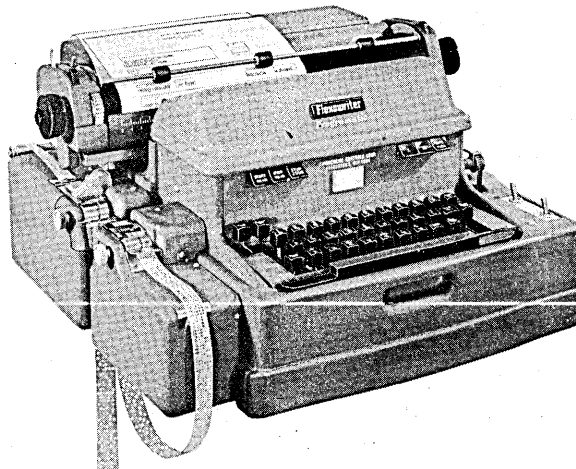


Technical Manual

Friden



Flexowriter®
automatic writing machines

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THE FRIDEN FLEXOWRITER automatic writing machine is essentially a page printer with built-in auxiliary units for providing various kinds of automatic operations associated with the creation of a printed document.

The characters are printed one at a time with the Flexowriter in the same manner as an electric typewriter, and the control of the Flexowriter can be either by manual keyboard operation, or it can be controlled automatically in response to coded impulses. These impulses can be supplied by an external machine or from a punched tape reader on the Flexowriter. Regardless of how the Flexowriter is operated, it can be arranged to automatically select coded impulses for controlling an external machine, or for controlling a tape punch on the Flexowriter.

These facilities can be built into the Flexowriter in different combinations and capacities as required by various applications.

The Writing Machine

In its simplest form, the Flexowriter is essentially a heavy-duty, electric writing machine. The Flexowriter is not intended for use solely as an electric typewriter because the special features and extremely rugged construction of the printing mechanism are not required in the ordinary use of an electric typewriter. However, every Flexowriter will have the printing mechanism as its base or foundation, and from there on, units may be added in various combinations to automatically perform many other functions incidental to page printing. The printing mechanism is built within or around the base or frame assembly, which houses the operating mechanism for whatever auxiliary units may be applied to the Flexowriter. The printing mechanism can type a maximum of 86 different characters from 43 type bars shiftable to type from either of two characters on each bar.

The Flexowriter is constructed the same as most correspondence typewriters in the respect that the carriage is moved for the letter spacing, while the printing mechanism is stationary. In this type of machine, a power-operated carriage return indexes the platen for line spacing incidentally to the return of the carriage. The Flexowriter shifts between two different positions to select between printing of upper case and lower case characters.

In the Flexowriter, all operations of the machine, whether it be to print a character or to perform some other function of the writing machine, must be originated by an operation of a keylever. Each keylever in the Flexowriter controls the operation of a cam which receives its power from a continuously rotating power roll. This cam

is connected to type bars through intermediate bell crank connections to operate each type bar individually to the printing position. In order to obtain good quality printing, various different forces must be applied to various different characters, and for this reason, the cams are made adjustable in order to obtain the exact printing force required for each particular character. A coarse adjustment for the blow for each type bar is provided by selecting one of several different bell cranks for each type bar. The same general type of cam under control of a keylever is provided for each of the functions of the Flexowriter. Thus, the entire operation of the writing machine portion of the Flexowriter is under control of the various keylevers, and in each instance the keylever performs no other function than to trip the cam for operation by the power roll, thereby providing that all keylevers require the same force to cause their operation.

AUTOMATIC FEATURES OF THE FLEXOWRITERS

In addition to the writing machine, the Flexowriter is usually provided with one or more of the following built-in auxiliary units to perform other functions incidental to writing a document.

Code Selector

This unit is located at the lower rear portion of the Flexowriter and is for the purpose of selecting a binary code which is different for each of the printed characters and other functions of the Flexowriter. The Code Selector mechanism is designed to operate with any code involving up to 12 bits. The selector operates to establish a binary code wherein each bit of the code is represented by an open or closed position of an electrical contact.

The Code Selector comprises an assembly of sliding members, which are mechanically connected to the cams of the writing machine so that each cam causes a sliding movement of one particular selector slide only. All these selector slides are positioned to operate a group of transverse bails, there being one bail for each bit of the code being used, plus a common bail which is always operated by every selector slide.

Thus, for a 6-bit code there would be seven transverse bails, and each bail is adapted to operate a normally open electrical contact. A portion on each of the selector slides forms a cam for operating each code bail, and each selector slide is distinctively coded by removing this cam portion associated with certain of the code bails so that a different combination of bails is operated by each selector slide. Accordingly, whenever any one of the cams is operated to print a character or cause a functional operation of the Flexowriter,

an associated selector slide is also operated to selectively close one or more of the code contacts in a pattern which is distinctive for that particular cam.

The Code Selector mechanism is one of the elements contributing to the extreme flexibility in adapting the Flexowriter to perform different applications. In other words, a code involving up to 12 bits may be selected by the Code Selector and any combination of any code may be used with any slide. Also, the Flexowriter may be so arranged that certain keylevers will operate to print or perform some other machine function without selecting a code merely by omitting a selector slide at this position or by removing all of the cam portions on this particular slide.

On the other hand, certain keys on the Flexowriter may be arranged to operate cams to, in turn, move selector slides which will select a particular code but will perform no other function on the Flexowriter. Thus, for any key position, the Flexowriter may be arranged to print or cause operation of a function only, to select a code only, or to select a code and type or to cause a functional operation.

The binary code set up by distinctively operating the code contacts on the Flexowriter in various combinations may then be used to control any device which can be operated by electrically coded circuits. This may be another Flexowriter, a tape punch or any similar device to which the circuits controlled by these contacts may be wired.

Auxiliary Bridge Contact Assembly

This assembly is available on all models of the Flexowriter. Each assembly consists of one type A, B or C contact for every third key lever. Every contact is operated by its associated selector slide only and the contact operating time is substantially the same duration as the Selector Code Contacts.

Code Translator

This unit is located at the lower front portion of the Flexowriter and is for mechanically selecting and operating keylevers of the Flexowriter in response to coded electrical impulses. The unit includes a code magnet for each bit of the binary code plus a magnet for operating a single-revolution mechanical clutch.

Translator magnets are available at 90 or 48 volts DC and are wound for 1500 ohms and 800 ohms respectively. The 1500 ohm magnet is wound with 10,000 turns of No. 40 wire. The 800 ohm magnets are wound with 7,000 turns of No. 40 wire; both magnets require a minimum pulse duration of 20 milliseconds.

By cable-connecting two Flexowriters, the code contacts of the

Code Selector of one machine can control the code magnets of the Code Translator of the other machine to operate it automatically. These same code magnets in the Translator may be controlled by code contacts in any other device which is arranged to select distinctive binary codes in the same manner as the Code Selector.

The Code Translator may be arranged to operate in response to any code involving up to 12 bits. The Translator is designed to operate up to 52 keylevers, and a 6-bit code is most commonly used in the control of the Flexowriter. However, the Translator may be arranged to operate in response to a 5-bit code in the same manner as the communications teletypewriting machines, or in response to 7-bit, 8-bit or any other code desired.

Tape Punch

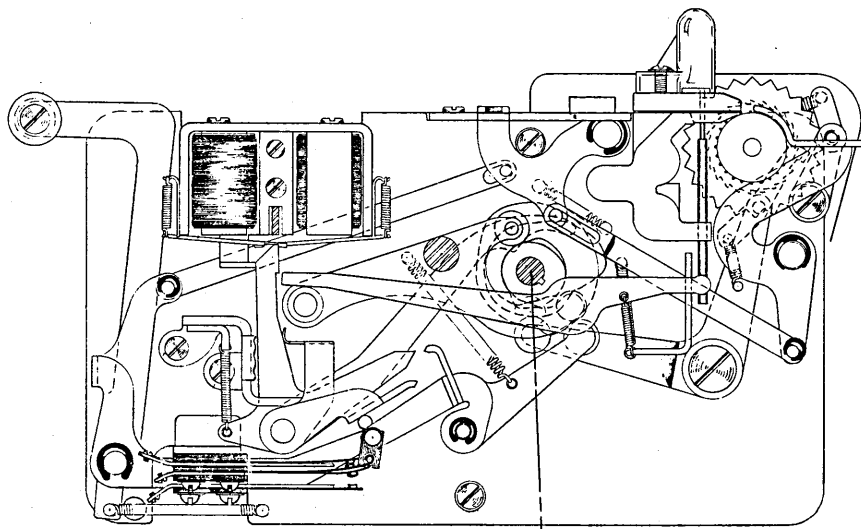
Whenever it is desired to store or record information typed on a Flexowriter for use at some later time to automatically operate the same or a different Flexowriter or any other device, a Tape Punch is used to perforate a binary code in a narrow paper tape. The Tape Punch is a unit mounted on the left rear side of the Flexowriter and is mechanically operated by a single-revolution, magnetically-operated clutch and has a code magnet for each unit of a binary code. These code and clutch magnets are usually controlled from the Code Selector of the Flexowriter, but may be controlled from any other source capable of selecting code combinations in the form of electrical impulses.

Punch code magnets are available at 90 or 48 volts DC and are wound with 850 or 600 ohms respectively. A minimum pulse duration of 15 milliseconds is required to operate these magnets.

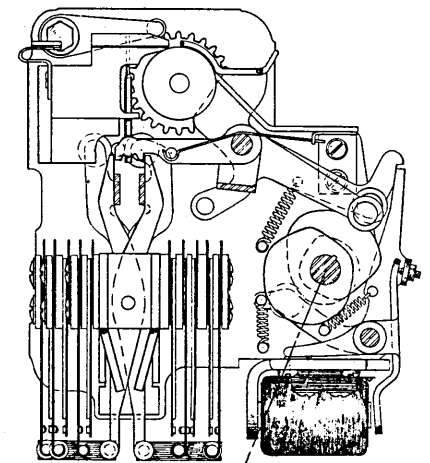
Punch clutch magnets consist of two series wound coils of 1000 or 450 ohms total and are operated on 90 or 48 volts DC respectively. To operate either the 90 or the 48 volt clutch requires a minimum pulse duration of 15 milliseconds.

The Tape Punch can be arranged to perforate any code involving up to 8 bits or code holes. The code holes are punched in a transverse row across the paper tape which usually varies in width according to the number of bits of the binary code involved. A smaller feed hole is always punched near the center of the tape for the purpose of intermittently feeding the tape past the punches, and also for feeding the tape in reading the code holes. Erroneously perforated codes can be voided by overpunching with a delete code.

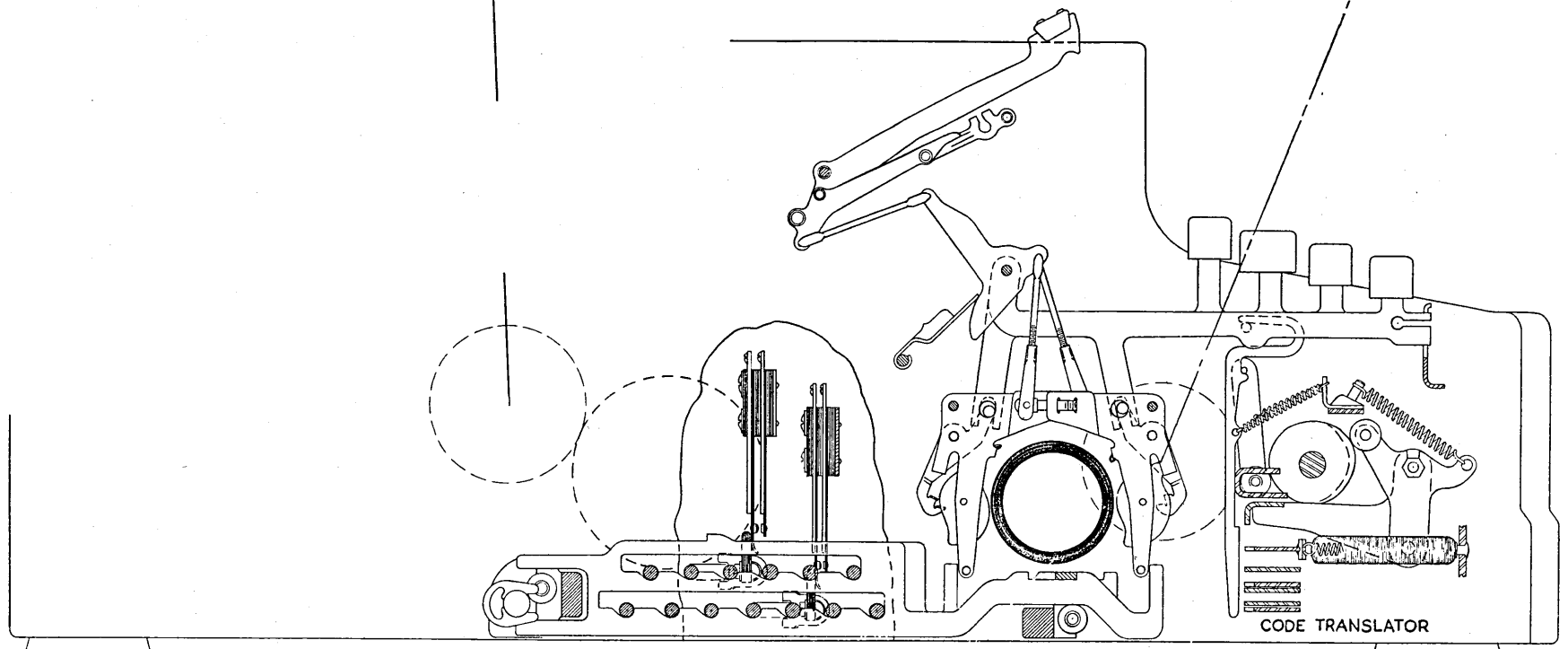
A magnetically operated tape back spacing mechanism can be added to the Tap Punch when required. This operates in response to each impulse supplied to the operating magnet to back space the tape one space without punching. This operating magnet can be con-



TAPE PUNCH



TAPE READER



CODE SELECTOR

CODE TRANSLATOR

trolled by a panel switch or by a keylever operation such as the Back Space key to provide for back spacing of the tape and the carriage simultaneously. A delete punch cycle operation would then follow this tape back spacing operation.

Parity Check Contacts

A contact assembly operated directly by the punch pins can be provided for checking accuracy of punching when self-checking codes are used of the odd-even type. This assembly can be wired to open a circuit only when an even number of holes are punched. A different wiring permits closing one circuit when an even number of holes are punched and closing another circuit when an odd number of holes are punched.

Tape Reader

This unit is for sensing code holes in a perforated tape and for accordingly operating electrical contacts. The unit is mounted on the left hand side of the Flexowriter directly in front of the Tape Punch. The Tape Reader is mechanically operated from the motor of the Flexowriter and its operation is usually controlled by manually operated switches mounted above the Flexowriter keyboard.

In reading a binary code punched into the paper tape, normally open contacts for each bit of the binary code are closed whenever a hole is sensed in the tape for that unit of the code. In addition, a common contact is ordinarily provided on the Tape Reader which closes for each code sensed by the Reader. A tape contact is also provided which is operated when the Reader is not in position to properly feed and read a tape.

The tape reading mechanism is so designed that several different contacts may be provided for each bit of the code. This multiple contact arrangement permits certain codes to be detected directly at the reading unit without requiring any external translating mechanism. This is particularly useful in the automatic operation of the Flexowriter in that certain codes, such as carriage return, tab, back space and stop codes, may be detected by the Reader unit and the automatic operation of the Reader may be stopped immediately.

The code contacts of the Tape Reader are ordinarily used on the Flexowriter to control operation of the Code Translator unit. However, these code contacts of the Reader may be used in other special applications to control any other external device which can respond to a binary code in the form of electrical impulses for providing some function similar to that of the Code Translator.

In using the Tape Reader with the Code Translator of the Flexowriter, the code contacts of the Reader are each connected to the

corresponding code magnets of the Translator, and the common contacts of the Reader are connected to the electromagnet of the Translator clutch. In controlling any device such as the Code Translator, the speed of operation of the reader shaft is the determining factor in the speed of operation of the control device. For this reason, the apparatus to be controlled by the Reader should have an operating speed slightly in excess of that of the Tape Reader in order to insure that the controlled device is always in step with the Reader.

The operating cam shaft of the Tape Reader is usually driven continuously by the motor of the Flexowriter, and a read control magnet RM in this case controls reading operation by allowing cam followers to operate only when this control magnet is energized. Usually this magnet is continuously energized to cause the reader to read tape continuously at its set speed of operation. However, this arrangement does not allow the reader to be impulsed or stepped to start operation at any accurate time after each impulse to the control magnet because of the continuous operation of its cam shaft.

Edge Card Punch and Reader

These units are available on all 5 or 8 channel Programatic Flexowriters. Units are capable of punching and reading information along either edge of a 3" x 7" card or tape. The cards are furnished in a continuous or pre-cut fanfold stack. If cards are furnished in a continuous stack, they can be cut to any desired length after punching. Information is punched at 10 codes to the inch and are read at normal Flexowriter printing speeds.

COMBINATIONS AVAILABLE

A great many different combinations of these auxiliary units with the writing machine are possible. The table illustrated shows the combinations which are most commonly required.

Flexowriter Specifications And Special Equipment

The following are the more commonly used features and variations in the Flexowriter. No standard model includes all the features listed, but all these features and variations are available in special machines in substantially any combination. The prices of all special machines will, of course, be determined by the amount of special equipment to be included. In nearly every instance, the special features must be built into the machines at the time of manufacture at the factory.

Keyboard

Substantially any arrangement of keys can be provided in the Flexowriter. The accompanying chart shows the maximum number of keylevers that can be provided and a typical arrangement of characters. The chart designates keylever and switch positions by letters and numerals which will be referred to in this discussion. Usually no change is ever made in the illustrated standard arrangement of alphabet keys, but various different characters can be assigned to any of the other printing keys. This applies to keylevers in positions 1 thru 43, which normally are the only keys in the keyboard which print. However, any of these keylevers can be arranged to control cams for the sole purpose of selecting coded impulses in the Code Selector without printing.

When the Flexowriter is provided for both upper and lower case printing, shift keys are provided in the positions shown on the chart. In this instance, the lower case shift keylever in position Z operates a shift cam and is interconnected by a bail to another lower case shift keylever in position Q which does not operate a cam. Likewise, the upper case shift keylever in position R operates a shift cam and is interconnected to another upper case shift lever in position Y which does not operate a cam. The Flexowriter can also be constructed for single case printing only and in this instance keylevers in position R and Z are available for special non-printing purposes such as the selection of a functional or control code.

The following keylevers are also available for special non-printing functions such as the selection of a code in instances where their normally used function is not required:

Keylever in position S normally used for TAB.

Keylever in position W normally used for BACK SPACE.

Keylever in position U normally used for three unit space in proportional spacing models.

The illustrated keyboard has four transverse rows of keys and is commonly referred to as a four-bank keyboard. However, the Flexowriter can be provided with a three-bank keyboard arrangement such as is generally used on communications machines used with 5-bit codes. If the top or figures row in the illustrated arrangement is omitted and the figures are combined with the top row of letters, the shift mechanism is then used to select between the printing of letters and figures.

Special arrangements of keyboards are also available on the Flexowriter for use with a 5-bit code which employ all four banks of keys. These special arrangements employ different keylevers for letters and figures with an interlock preventing operation of the figures keys when shifted to print letters and preventing operation of

the letters keys when shifted to print figures.

A mechanical keylever interlock is normally provided in the Flexowriter which is effective to prevent simultaneous operation of more than one keylever at a time. This is usually effective on all keylevers except the shift keylevers in positions Q and Y because these keylevers are interconnected mechanically to work simultaneously with their companion keylevers in positions Z and R. However, any of the other keylevers can be notched so that it is not affected by the interlock. Also, the entire interlock can be removed at any time from the Flexowriter.

A special mechanism can be provided for mechanically latching any one of the keylevers in a depressed position preventing depression of any other keylever. This mechanical latch is released by an impulse to a keylever release magnet allowing the keylever to restore to normal position. A holding circuit is provided on this keylever release magnet so that it will still release the latched keylever in the event the keylever is manually held down longer than the normal duration of the impulse to the release magnet. This latching arrangement can provide a reliable check on the accuracy and speed of any device controlled as a result of keyboard operation, and is also useful in verifying and code checking systems.

Normally, all keys are dark blue in color with white engraved characters. However, any of these keys can be gray or maroon in color in cases where it is desired to distinguish certain keys from others in the keyboard. Also, the engraved characters in the keys can be colored other than white for purposes of distinction.

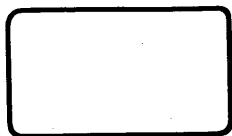
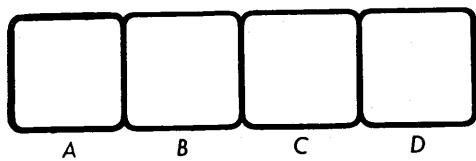
Case Shift

In double case Flexowriters, the type basket is shifted relative to the platen by two cams controlled by keylevers shown in the keyboard chart. This arrangement requires a key operation for shifting to one position and a different key operation for shifting to the other position.

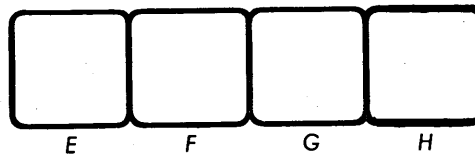
A special shift arrangement similar to that used on communications printers can be provided on the Flexowriter. This arrangement causes the machine to shift to letters position whenever the space bar is operated in figures shift position.

Back Space

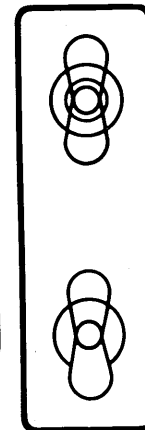
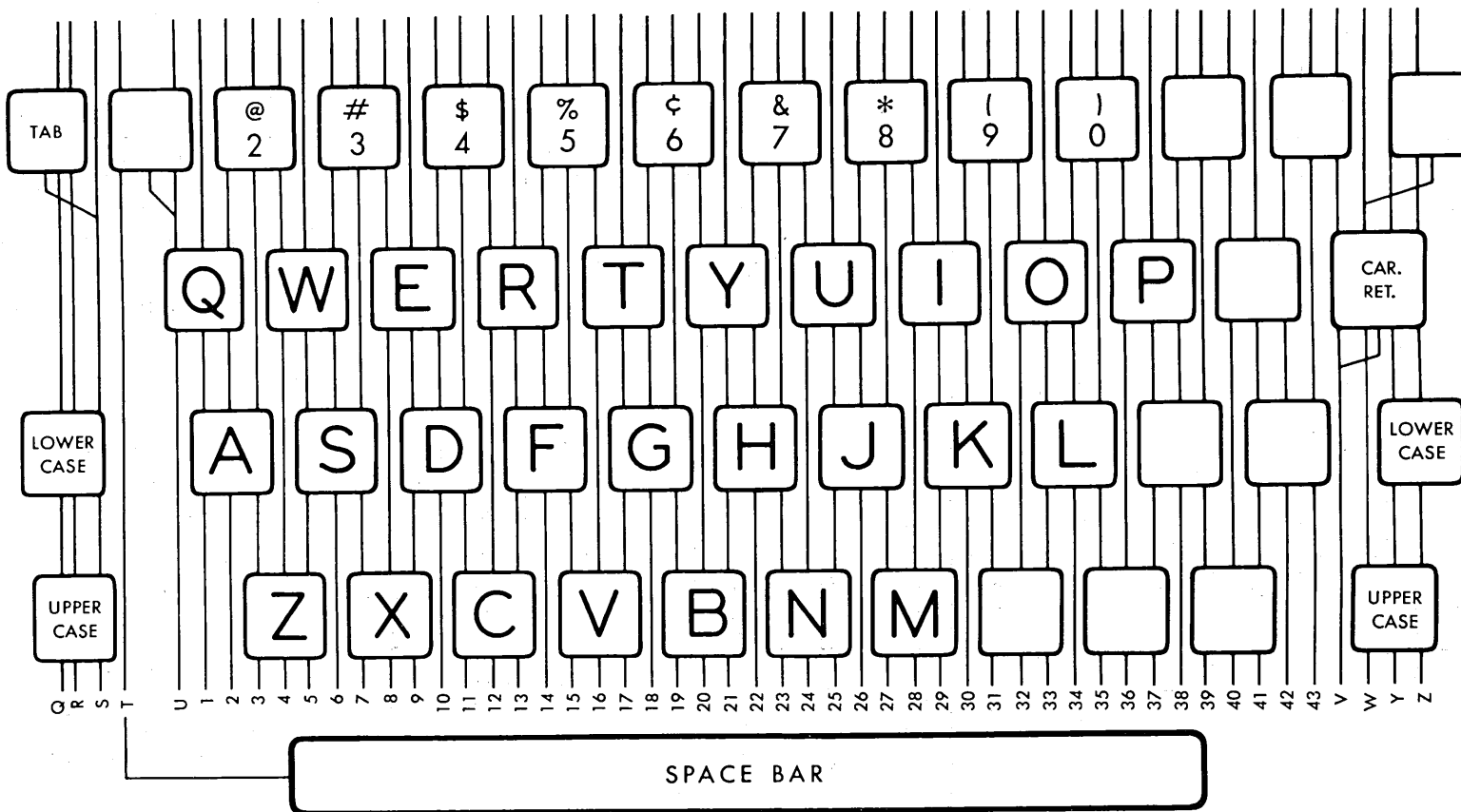
A back spacing mechanism is usually provided in the Flexowriter for moving the carriage one letter space to the right. This is a cam-operated mechanism under control of a keylever in position W. In proportional models, the back space will move the carriage one unit to the right.



INDICATING
LIGHT



8A



FLEXOWRITER
COMBINATIONS
AVAILABLE

EQUIPPED WITH

CAPABLE OF PERFORMING THE FOLLOWING

	TYPING UNIT	CODE SELECTOR	TAPE PUNCH	TAPE READER	CODE TRANSLATOR	2 TAPE READERS	CABLE CONNECTED	Typing Automatically	Selecting Code	Punching Tape	Reading Tape	Translating Code	Transmitting To Remote Machine	Receiving From Remote Machine	Reading From Two Tapes Alternately	Duplicating Tape
Flexowriter Transmitter	X	X					X		X				X			
Flexowriter Receiver	X				X		X					X		X		
Flexowriter Transmitter-Receiver	X	X			X		X		X			X	X	X		
Flexowriter Recorder	X	X	X						X	X						
Flexowriter Recorder-Transmitter	X	X	X				X		X	X			X			
Flexowriter Recorder Transmitter-Receiver	X	X	X		X		X		X	X		X	X	X		
Flexowriter Reproducer	X			X	X			X			X	X				
Flexowriter Reproducer-Receiver	X			X	X		X	X			X	X		X		
Flexowriter Reproducer Transmitter-Receiver	X	X		X	X		X	X	X		X	X	X	X		
Flexowriter Recorder-Reproducer	X	X	X	X	X			X	X	X	X	X				X
Flexowriter Recorder-Reproducer Transmitter-Receiver	X	X	X	X	X		X	X	X	X	X	X	X	X		X
Flexowriter Duplex Reproducer	X				X	X		X			X	X			X	
Flexowriter Duplex Reproducer Receiver	X				X	X	X	X			X	X		X	X	
Flexowriter Duplex Reproducer Transmitter-Receiver	X	X			X	X	X	X	X		X	X	X	X	X	
Flexowriter Recorder Tape Transmitter	X	X	X	X			X		X	X	X		X			

Carriage Return

The carriage is returned in the Flexowriter by power through a friction clutch controlled by a keylever. Indexing or rotation of the platen for line spacing is incidental to the carriage return operation and cannot be separated from it.

The left hand margin in printing is determined by the position to which the carriage is returned. This position is manually adjustable in increments of one letter space on machines spacing at ten or twelve characters to the inch, two letter spaces on machines spacing at 16 characters to the inch, and on proportional spacing machines, the margin is adjustable in increments of four units of spacing.

A special arrangement can be provided for initiating a return of the carriage automatically after the carriage has been spaced past an adjustable predetermined point. Another special arrangement can be provided which will automatically select a line feed code following a carriage return code selection. This is useful only when the Flexowriter is to be used in some combination with a communications page printer.

Tabulation

A carriage tabulating mechanism is usually provided in the Flexowriter and is controlled by a keylever in position S. The tab positions of the carriage are determined by individual stops which are manually positioned at variable increments of two letter spaces in machines spacing ten, twelve or sixteen characters to the inch, and at increments of four units of spacing in proportional spacing machines.

A special tab arrangement is available for three-bank keyboards operating on a 5-bit code. In this instance the code assigned to the tab is one of the letters codes in figures shift position, and the operation of this letter key will electrically cause operation of the regular tab keylever in position S providing the machine is in figures shift position.

Repeat Space Key

Normally all keylevers control cams which make only one operation regardless of how long the keylever is held down. However it is sometimes desirable to provide a repeating space key which will provide continuous spacing of the carriage as long as the key is held down. For this purpose a special keylever is provided in position U which operates a special repeating cam. The normal space bar is retained which provides single spacing for each operation.

Front Control Panel

A control panel is provided directly above the keyboard of the Flexowriter, and can be equipped with up to eight manually operated switches (A through H) some of which are used for machine control, plus an indicating light. The indicating light is placed in the center of the panel when used, and the switches are grouped each side of the light. Each switch includes an operating lever which is engraved to show the function of the switch.

Each switch may be the locking type or the self-restoring type. In the locking type the lever remains in its operated or depressed position until it is manually restored, while in the self-restoring the lever returns to normal position as soon as the manual operating pressure is removed. Each of the switch levers can operate a Class A (normally open) contact, or a Class B (normally closed) contact, or a Class C (transfer contact).

Line Length Indicator

A special contact operating mechanism can be provided on the carriage which will light the indicating light on the front panel when the carriage has reached an adjustable predetermined position and will stay on for a fixed extent of carriage travel. This position is manually adjustable in letter spacing increments.

Side Control Switches

Toggle switches can be provided at the right hand side of the keyboard for the control of the Flexowriter. The most common arrangement is only a single power switch which is provided to turn the power off and on for the entire machine. However, this side control switch arrangement can include either one or two toggle switches I and J and a plate over these switches can be engraved to indicate their function. Each switch can be either the two-position or the three-position type where the center position is off. Also each switch can be either a single pole type (one circuit only) or a double pole type (two circuits).

Type Styles

Flexowriters are available in a large variety of type styles and sizes either proportionally spaced or uniformly spaced. In case shift machines the shift motion is .265 of an inch, and any type style adapted to this shift motion and to the following spacing variations can be used. In monospacing machines, type can be used which is spaced ten characters to the inch (Pica), 12 characters to the inch (Elite), 16 characters to the inch, or $6 \frac{2}{5}$ characters to the inch. In proportional spacing machines, type can be used which has a unit

spacing value in inches of one thirty-second (twelve point), one thirty-sixth (ten point), or one forty-eighth (eight point).

Carriage Sizes

The standard Flexowriter is equipped with a 12 inch carriage which will accept an 11 inch wide sheet and has a $9\frac{1}{2}$ inch writing line. In addition, 16 inch and 20 inch carriages are available on all machines except 8 point and 10 point proportional spacing models. The 16 inch carriage will accept a 15 inch wide sheet and has a $13\frac{1}{2}$ inch writing line. The 20 inch carriage will accept a 19 inch wide sheet and has a $17\frac{1}{2}$ inch writing line.

Standard Platens

Various platens are available to obtain the desired printing quality for different applications. The following hardness and sizes are available.

- No. 1. For general typewriting applications, stencil writing, etc.
- No. 2. For general typewriting applications, but slightly harder than No. 1.
- No. 3. Hard platen of same diameter as No. 1 for small number of carbon copies requiring sharp impression. (Normally unsatisfactory for use with less than four or five carbon copies.)
- No. 4. Hard platen, one thirty-second of an inch undersize for large number of carbon copies.
- No. 7. Hard platen, one-sixteenth of an inch undersize for maximum number of carbon copies.
- No. 8. For typewriter applications requiring a platen harder than No. 2 but not as hard as No. 3.
- No. 9. For stencil writing exclusively, flexlastic platens will be furnished as standard equipment at no additional charge. This platen is not recommended for use on correspondence where more than two carbon copies are required.

Pin Feed Platens

A special pinfeed platen in various sizes is available. It has a single piece platen cover and must be ordered to fit the size paper used. The mechanism also includes the necessary paper fingers and paper guide rods. The platen ratchet is fixed to the platen shaft and no platen release is provided. The platen covers are available in three grades of hardness — No. 1 — soft, No. 2 — medium, and No. 3 — hard. The illustrated chart shows pin-feed platen specifications and form dimensions.

Platen Ratchets

The available ratchets shown in the accompanying chart provide different extents of line spacing.

Ribbon

A fabric ribbon with an automatic reversing feed mechanism is provided as standard equipment on Flexowriters. A special carbon paper ribbon feed mechanism is also available which feeds a narrow ribbon from a supply spool across the machine to a rewind spool. This mechanism permits the standard fabric ribbon to be used when the carbon paper ribbon is not being used.

Ribbon Shift

A manually operated ribbon shift is provided on all Flexowriters which selects between the use of two different fields of a fabric ribbon. An automatic ribbon shift can be provided which operates from a single code received by the Code Translator to change the field used in the ribbon. This mechanism uses a keylever in position 43 and is effective to change the color of printing when a two-color ribbon is used. A different ribbon shift mechanism is also available which is operated by an electromagnet. This magnetic ribbon shift does not require a keylever and simply operates to select one field of the ribbon when the electromagnet is energized and the other fields when deenergized.

Carriage Position Switch

A special mechanism is available on the Flexowriter for operating from one to four Class C or transfer contacts in any combination at selected predetermined positions of the carriage. This includes a rack mounted on the carriage having slots at every second letter space each capable of holding a manually inserted tab. The tab has four vertically spaced switch-operating projections, each of which can operate an associated one of four vertically spaced switches on the frame of the machine. Any of the projections on the tabs can be removed so that a particular tab can be placed in any slot in the rack to operate any one or any combination of the four switches at the corresponding position only of the carriage.

These switches in any required number up to four can be used to control relays which turn on and off either one or more devices such as the tape punch according to the carriage position.

Automatic Punch Selection From Tape

Special keylevers and selector contacts can be provided for punching distinctive codes in a tape so that when this tape is placed in the

PIN FEED PLATEN SPECIFICATIONS
Number of Spaces in One Inch of Form

Count the number of spaces in 10 inch 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	Upper Index Pawl Stop	Detent Arm Assembly	Index Pawl Carrier
304769	33	6.00	3.00	2.00		1000325	1076864	1073401
304771	44		4.00	2.66	2.00	1000325	1076864	1073401
1096910	55		5.00	3.33	2.50	1002272	1076886	1076862
1098579	66		6.00	4.00	3.00	1002273	1076884	1076862

12A

FORM DIMENSIONS - PIN FEED PLATENS

Over All Form Width	Pin to Pin	Over All Form Width	Pin to Pin	Over All Form Width	Pin to Pin
5-3/4	5-1/4	9-7/8	9-3/8	13-5/8	13-1/8
6-1/2	6	10-3/8	9-7/8	14-7/8	14-3/8
8	7-1/2	10-5/8	10-1/8	16	15-1/2
8-1/2	8	11-3/4	11-1/4	16-3/4	16-1/4
9-7/8	9-3/8	13-5/8	13-1/8	17-27/32	17-11/32
10-3/8	9-7/8				

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		5.91	3.94	2.96				
1002266	66		6.00	4.00	3.00		1002273	1076884	1076862

Tape Reader, these special keylevers will be operated by these codes to automatically turn the Tape Punch on and off. For the control of the punch on the Flexowriter, a "Punch On" key is used which controls operation of a special make contact in the Code Selector to energize a punch control relay which is held energized through a special break contact in the Code Selector which opens in response to operation of a "Punch Off" key.

Code Translator Auxiliary Contacts

A special cam-operated contact assembly can be provided in any Flexowriter Code Translator which does not involve greater than an 8-bit code. Any number up to three cams can be mounted on the Code Translator shaft and each cam can control a Class C or transfer contact. Each cam is adjustable to any radial position on the shaft and cams are available having various extents of operating duration.

Functional Contacts

Auxiliary contacts can be provided at various points in the Flexowriter to operate in accordance with the normal functional operations of the machine. Any number up to eight Class C or transfer contacts can be provided to operate according to the case shift position of the type basket. A single Class B (break) or a single Class A (make) contact can be provided to operate during the back spacing operation of the Flexowriter. Also contacts can be provided to operate at the start of both the carriage return and the tabulating operation and to remain operated until the completion of these operations. These contacts can involve up to four springs providing two Class A or two Class B assemblies.

Cable Connections

One or two cable connectors can be provided at the right rear side of the Flexowriter for the purpose of connecting the internal wiring of the machine to an external device. A.N. style connectors are used and one connector up to size 24 can be provided and if a second connector is required it can be up to size 22.

Motor

The standard motor used in the Flexowriter operates on 115 volts, 60 cycle and is rated at 35 M.H.P. It is an induction motor having a rated speed of 1725 R.P.M. This same motor is used on 115 volts, 50 cycle with changes in drive ratio to compensate for its reduced speed in this instance. When the Flexowriter is to be used with higher voltages between 120 and 260 volts, 50 or 60 cycle, an external transformer is provided and the same motor is used. A

special motor and a different ratio drive can be provided for 115 volts, 25 cycle applications of the Flexowriter. Another special motor is also available for 115 volts direct current applications. A rheostat is built into the Flexowriter with this D.C. application for adjusting the speed of the motor.

Direct Current Power Supply

The Flexowriter usually has a built-in, full wave rectifier supplying approximately 90 volts D.C. rated at 1 amp. In this case the rectifier is connected directly to the A.C. supply line and the D.C. power is not isolated from the line. Flexowriters are also available with a built-in D.C. supply at approximately 48 volts rated at 2 amps. This uses a transformer which isolates the D.C. power from the A.C. supply line.

Relay Capacity

The upper rear portion of the Flexowriter provides a space for mounting a number of relays usually required for the control of the machine. This space is sufficient for mounting a maximum of seven large telephone type relays. A greater number of relays of the medium size can be used on this space. If no carriage position switches are provided, a maximum of 22 medium size relays can be used, and if these switches are required a maximum of 18 medium size relays can be used.

Tape Used

Both the Tape Punch and the Tape Reader used on the Flexowriter can use any standard tape between .687 and 1.000 inch wide. Three width tapes are most commonly used in this range, eleven-sixteenths of an inch for a maximum of five code channels, seven-eighths of an inch for a maximum of seven code channels, and one inch for a maximum of eight code channels. All tapes have code holes which are .072 inch in diameter and feed or sprocket holes .046 inch in diameter.

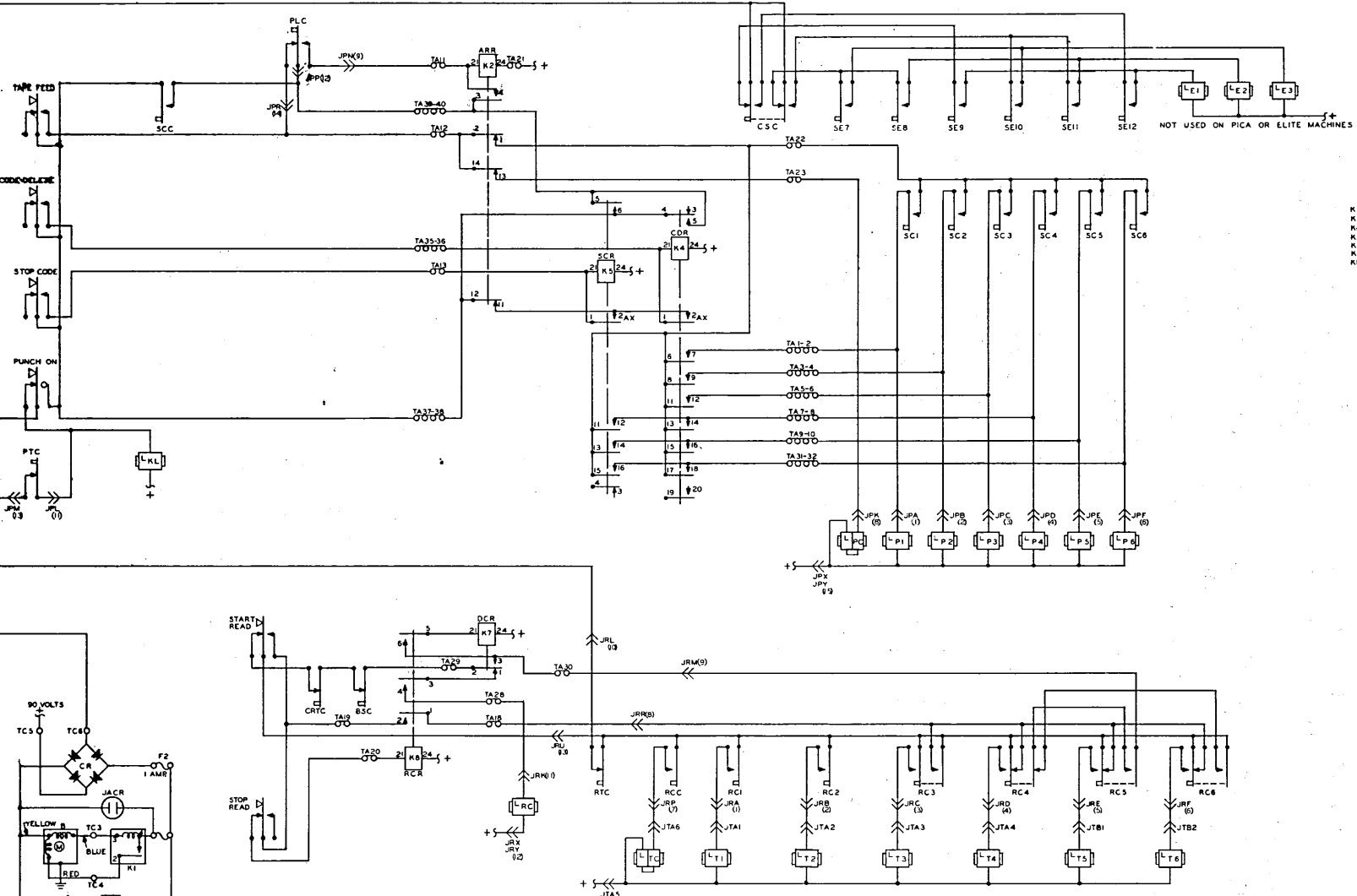
All holes are spaced .100 inch both longitudinally and transversely. The Tape Punch is normally constructed to punch the feed holes in line with the code holes transversely of the tape, but specially constructed tape punches are available which punch these feed holes .013 in advance of the code holes. The Tape Reader is adjustable to either of these two feed hole positions. Both the Tape Punch and the Tape Reader are normally constructed for use with tape having the center line of the feed holes spaced .394 inch from the inside or guiding edge of the tape, but specially constructed punches and readers can be provided for use with tape having the center line of

the feed holes spaced .4375 from this guiding edge.

Operating Speeds

The maximum operating speed of the Flexowriter is determined by the rate at which reliable repeat printing of a single character can be obtained.

Roughly this is about ten characters per second, and to provide a workable margin of safety, the Tape Reader is set to automatically operate the Flexowriter at a nominal speed of 571 characters per minute. Although the drive mechanism for the Code Translator operates at 588 R.P.M., it is not recommended that codes be supplied to it for automatic operation of the Flexowriter at a rate higher than 571 per minute. In operating the Flexowriter automatically from external control circuits supplying coded impulses to the Code Translator, provision must be made for the extra long functional operating times required for carriage return, tab, and back space operation. The mechanical drive for the Tape Punch operates at 853 R.P.M. to provide for manual keyboarding speed, and still higher speed drive is available which operates the punch at 1000 R.P.M. for applications where this speed is required.



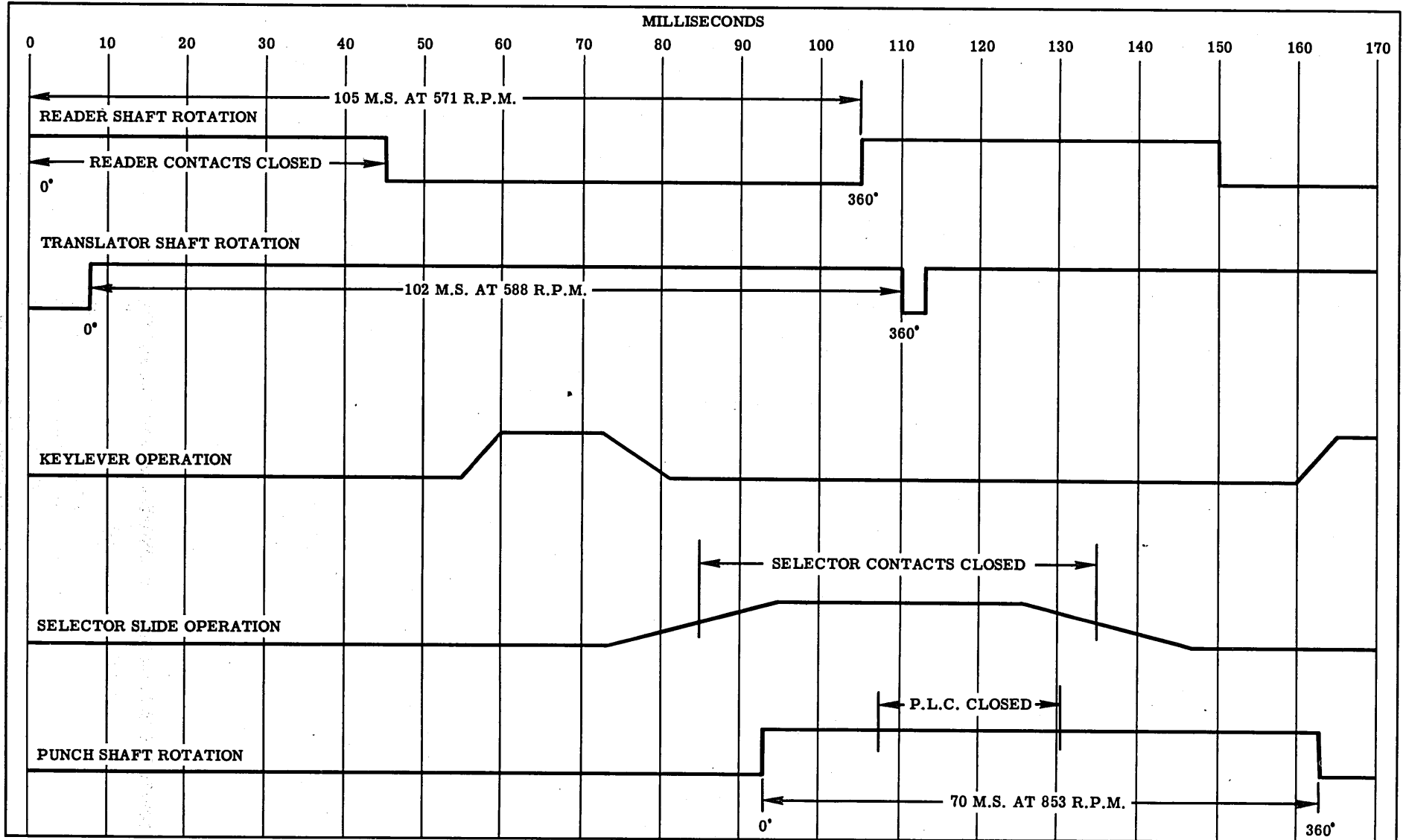
- K2 ARR 1053747
- K3 CDR 1057519
- K4 CDR 1053297
- K5 SCR 1053297
- K6 DCR 1053729
- K8 RCR 1053728

BACK SPACE CODE - 156
 TAB CODE - 236
 CARR. RET CODE - 356
 STOP CODE - 456

MATERIAL SPECIFICATIONS		TOLERANCE UNLESS OTHERWISE NOTED		ALIGNMENT WITHIN		TYP. HOLE POSITION		COMMERCIAL CONTROLS CORP.	
CASE DIMS		DECIMALS & .000		CONCENTRIC WITHIN		TYP. HOLE POSITION		Name FLEXOWRITER REC. REP.	
HARDWARE		FRACTIONS & 1/64		FLAT WITHIN		TYP. HOLE POSITION		Name SCHEMATIC WIRING	
SURFACE FINISH		ANGLES & 30°		PARALLEL WITHIN		TYP. HOLE POSITION		Name DIAGRAM	
ELECT. INSULATION		CONVEX & 1/16"		STRAIGHT WITHIN		TYP. HOLE POSITION		Name I.A.T. 17-252	
MAY BE BROKEN		INSIDE		SQUARE WITHIN		INCHES		Name	

SCHEMATIC WIRING DIAGRAM OF FLEXOWRITER FL, RECORDER REPRODUCER

FLEXOWRITER TIMING CHART



PART I

FLEXOWRITER - GENERAL

Section 1	General Description
Section 2	Combinations
Section 3	Models
Section 4	Installations
Section 5	Special Features

DESCRIPTION AND GENERAL INFORMATION

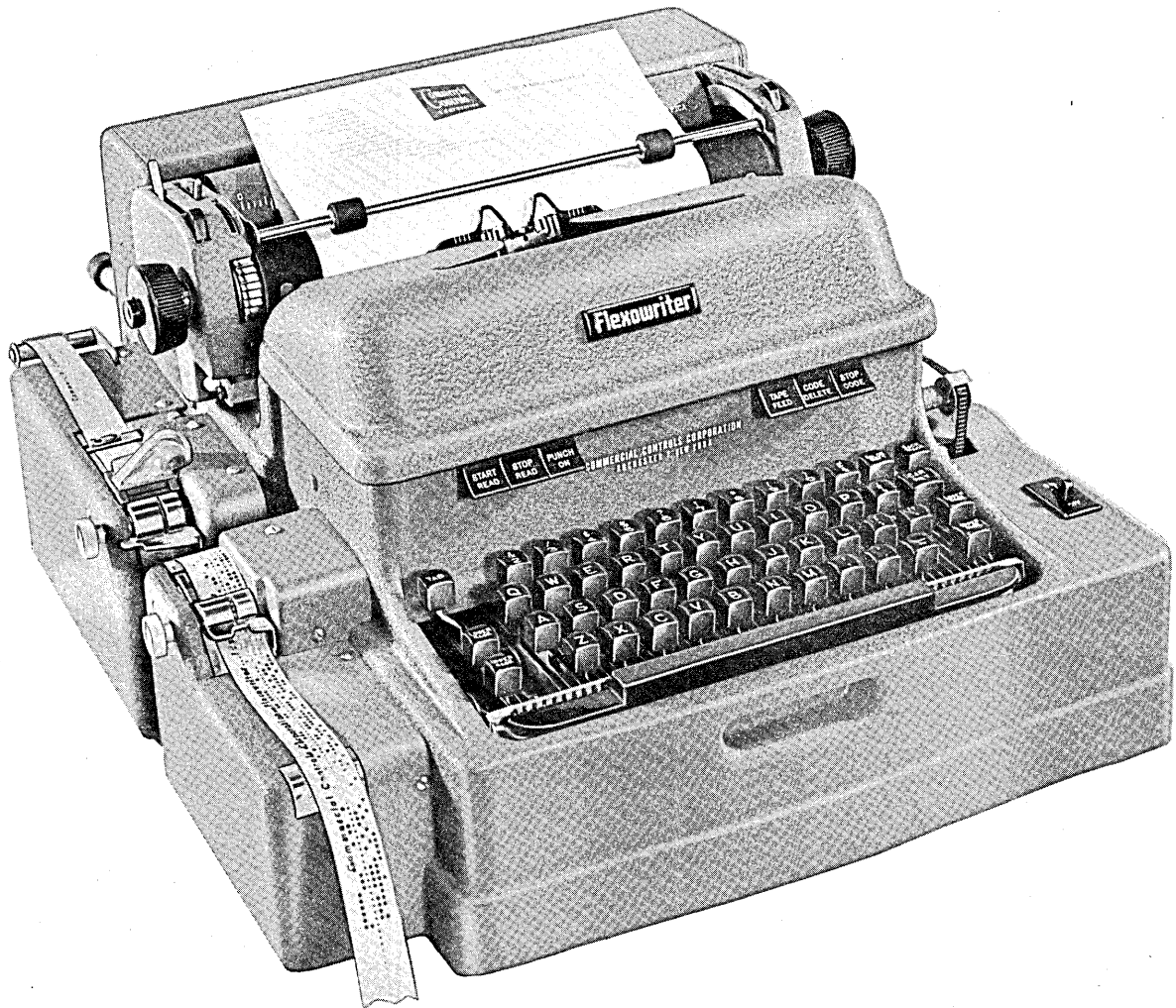


Figure 1-1 The Flexowriter

DESCRIPTION

The name "Flexowriter" is used by Commercial Controls Corporation to apply to all its writing machines except those having special facilities for justifying lines. The latter machines for justifying are called "Justowriter" (explained in Part VII).

The Flexowriter, in its simplest form, is essentially a heavy-duty electric writing machine with built-in auxiliary units for providing various kinds of automatic operations associated with the creation of a printed document.

Character operation takes place one at a time in the same manner as an electric typewriter. The control of the Flexowriter can be by manual

Description and General Information

keyboard operation, or, automatically in response to binary coded impulses. These impulses can be supplied by an external machine or from a punch tape reader mounted on the Flexowriter. It can also be arranged to automatically select binary coded impulses for controlling an external machine, or for controlling a tape punch mounted on the Flexowriter, regardless of how the Flexowriter is operated.

WRITING MACHINE

The Flexowriter, being basically a heavy-duty electric writing machine, is not intended for use solely as an electric typewriter. This is due to the extremely rugged construction and special features of the typing mechanism which are not required in the ordinary use of an electric typewriter.

Every Flexowriter will have the writing machine as its base or foundation and from there on, units may be added in various combinations to automatically perform many other functions incidental to typing. The typing mechanism is built around a base or frame assembly, which houses the operating mechanism for whatever auxiliary units may be applied to the Flexowriter. The writing machine can type a maximum of 86 different characters from 43 type bars. The type bars are shiftable with two characters on each bar.

The Flexowriter is constructed the same as most correspondence typewriters in the respect that the carriage is moved for the letter spacing while the typing mechanism is stationary. The Flexowriter shifts all type bars simultaneously between printing of upper case characters and

lower case characters. Also, line spacing on the Flexowriter is incidental to the power operated carriage return function.

There is a significant difference between the Flexowriter and certain other types of writing machines (principally used in the communications field). In these machines instead of the carriage moving for letter spacing, the typing mechanism moves. Also, the carriage return function does not move the platen, but only returns the typing mechanism to its position for starting a new line. The line spacing function is separate from this carriage return and operates only to index the platen for line spacing. The platen, in this type of machine, is usually shifted to select between upper and lower case typing.

In the communications type of machine, the carriage return and line space functions are separate in independence, while on the Flexowriter they are combined. This requires two separate operations on the communications type of machine at the end of each line, but provides the added flexibility wherein the line spacing mechanism may be operated without returning the carriage to the left margin. In the Flexowriter, however, a line spacing operation cannot be obtained without its being incidental to a carriage return operation.

All operations of a Flexowriter writing machine, whether typing a character or performing a functional operation, must be originated by an operation of a key lever. Each key lever in the Flexowriter controls the operation of a cam which receives its power from a continuously rotating power roll. This cam is connected to the type bars through intermediate bell crank connections

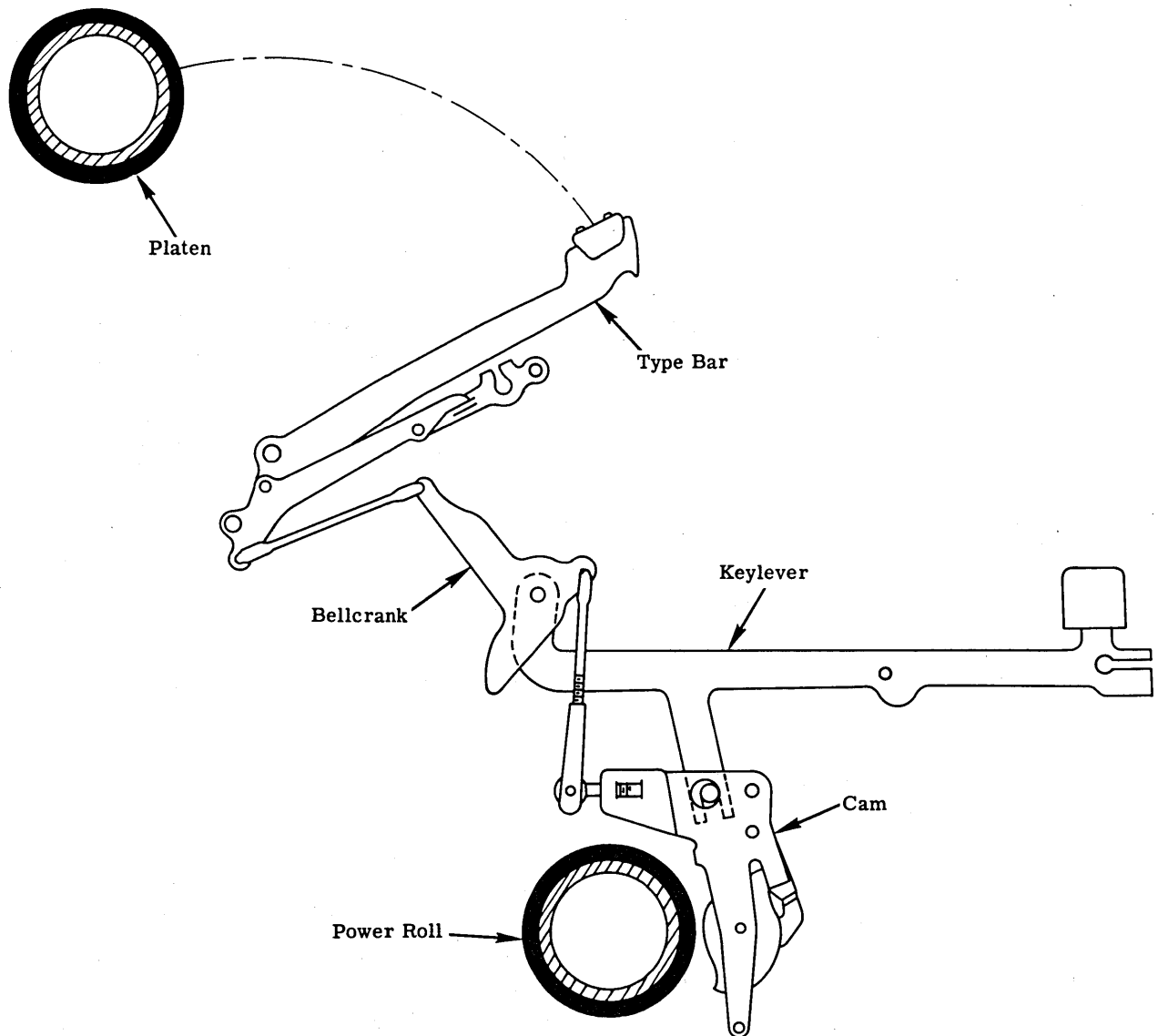


Figure 1-2 Keylever Operation

to operate each type bar individually to the printing position. (See Figure 1-2.)

In typing, the amount of force a character requires for proper impression, varies. The cams are made adjustable so that a fine impression adjustment may be obtained for each character. A coarse adjustment for the blow of each type bar is obtained by selecting one of several different bell cranks which are available for each

type bar position.

The same general type of cam, under control of a key lever, is provided for each of the functions of the Flexowriter. Thus, the entire operation of the typewriter portion (writing machine) of the Flexowriter is under control of the key levers. In each instance, the key lever performs no other function than to trip the cam for operation by the power roll. Therefore, all key levers require the

Description and General Information

same force to operate a cam.

AUTOMATIC FEATURES

In addition to the writing machine, the Flexowriter is usually provided with one or more built-in auxiliary units to perform other functions incidental to writing a document. These auxiliary units function on the binary coded principle. Therefore, a better understanding of the various uses and applications of the Flexowriter will be obtained by a general knowledge of the coding system used.

CODE SYSTEM

There are many different systems using codes to convey information, and the choice between these codes depend upon the type of apparatus used in connection with the code. With apparatus such as used in the Flexowriter, the various elements have only two significant positions. In other words, a mechanical device may be normal or in operated position, an electrical contact may be open or closed, a relay may be energized or de-energized, or a paper tape may be perforated or not perforated. This type of apparatus lends itself particularly to the use of a binary code, which is so called because two is used as a base. The binary code may be compared with the decimal system which is actually a code using ten as a base. Another example is a ternary code using three as a base.

In the binary code, each element of the code involves a choice or selection between only two conditions. These two conditions may be con-

veniently represented by the apparatus previously mentioned, while other code systems, such as the ternary or decimal, cannot be as conveniently handled or stored by these devices because they involve a choice of more than two conditions for each unit of the code.

The binary code system builds into combinations in the following manner: one unit code gives two combinations, two units of code gives four combinations, three units gives eight, four units sixteen and five units gives thirty-two, etc.

Figure 1-3 shows an example of the binary code system using a three unit code. In this case an electrical contact or group of contacts represent each unit of code. Each code contact has two conditions, either operate or non-operate. Thus, the number one code having one contact will have two conditions (or combinations). These two conditions of number one are connected to two separate contacts of the number two code. Each of the number two contacts has two conditions, thus the total conditions of number two code is four. The number three code has four separate contacts and each having two conditions will result in a maximum condition of eight. In other words, a three unit code will result in a maximum code combination of eight. The five unit binary code is the smallest that may be used to represent typographical characters. The five unit code, however, provides only thirty-two combinations and can only represent the twenty-six letters. Therefore, it is not sufficient to include the figures and punctuation ordinarily used in typography. This is why the figures are sometimes spelled and a period spelled "stop" in some telegrams.

A more convenient method of representing typog-

Description and General Information

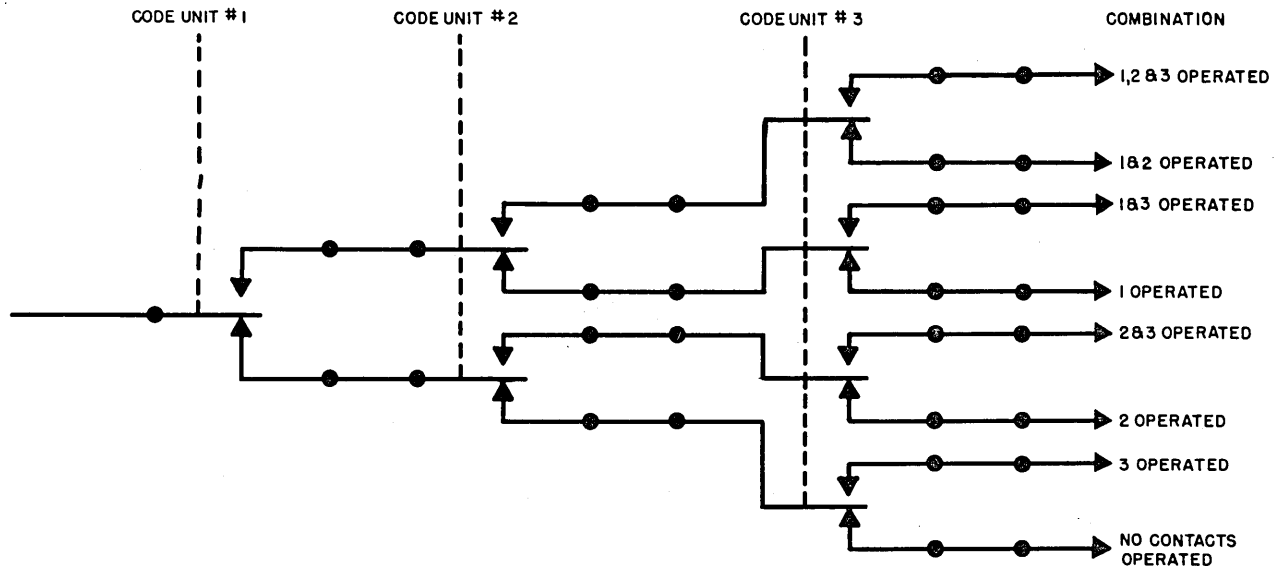


Figure 1-3 Example Binary Code System

graphical information with a five unit code is to use two codes out of the available thirty-two as "shift" codes. These shift codes are used to distinguish whether the remaining 30 codes represent letters, figures or punctuation. This, in effect, provides for the representation of 60 different characters or control functions through the use of a five unit code amplified by combining with two shift codes. This is the coded system used almost exclusively in the present age commercial tele-typewriting machines.

The above use of the five unit code with shift codes should not be confused with the case shift used on a correspondence typewriter. The shift function used with the five unit code distinguishes between letters and figures, but does not allow the use of capital and lower case letters. If capital and lower case letters, plus, figures and punctuation are to be designated by a binary code, it is more convenient to use a larger number of units

such as a six, or even more in certain systems. Binary codes are seldom above an eight unit range in ordinary information handling systems except in punch card accounting work where a twelve unit code is used.

The following table shows the maximum number of combinations available for the number of units in a binary code up to an eight unit code:

1 unit	-	2 combinations
2 units	-	4 combinations
3 units	-	8 combinations
4 units	-	16 combinations
5 units	-	32 combinations
6 units	-	64 combinations
7 units	-	128 combinations
8 units	-	256 combinations

The following paragraphs discuss the auxiliary units mentioned which are mounted on or within the main frame of the Flexowriter as shown in Figure 1-4.

Description and General Information

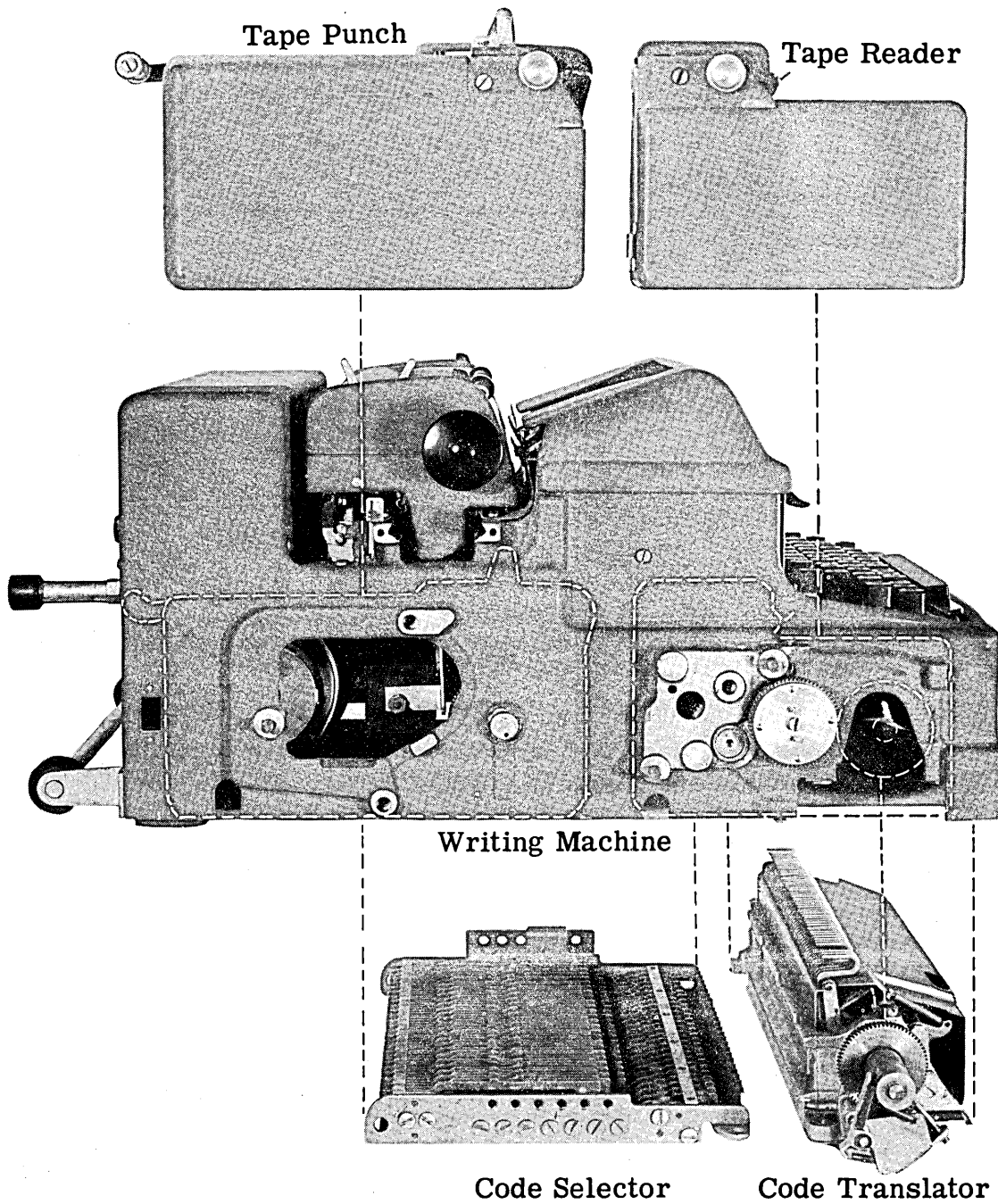


Figure 1-4 Flexowriter Units

Description and General Information

CODE SELECTOR

This unit is for the purpose of selecting a different binary code for each individual character and functions of the Flexowriter. This mechanism is designed to select any combination of units in a code up to a maximum of twelve units. The twelve unit code is used for punch card accounting work.

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 key lever position.

The code selector design enables the Flexowriter to be arranged so that certain key levers will operate to type or perform some other machine function without selecting a code. This

is accomplished by merely omitting a selector slide at this position or by removing all the cam surfaces on this particular slide. The Flexowriter may also be arranged to have the cams operate the selector slides which in turn will operate the code contacts but will not perform any other function on the writing machine.

Therefore, it is apparent, for any keylever position the Flexowriter may be arranged to:

1. Type or operate a function only.
2. Select a code only.
3. Select a code and type or cause a functional operation.

The electrical impulses, which are the result of closing the code contacts, may be used to control any device which will respond to a binary code. This may be another Flexowriter, a tape punch, or any similar device to which the circuits controlled by these contacts may be wired.

The PSM Flexowriters and Justowriters use six upper bails and the contacts are wired to three escapement magnets for proportional spacing operation.

TAPE PUNCH

The tape punch is used to store or record information typed on a Flexowriter for use at some later time to automatically operate the same or a different Flexowriter or any device which will respond to a binary code.

The tape punch is a separate unit mounted on the rear left side of the Flexowriter. It is mechanically operated by a single revolution, magnetically operated clutch and has a code punch magnet for each unit of a binary code. These code and clutch magnets may be controlled from the

Description and General Information

code selector of the Flexowriter or from any other source capable of selecting code combinations in the form of electrical impulses.

The tape punch is designed so that it can be arranged to perforate any code involving up to eight units. The code holes are punched in a transverse row across the paper tape which usually varies in width according to the number of units of the binary code involved. A feed hole, which is smaller than the code hole, is punched near the center of the tape for the purpose of intermittently feeding the tape past the punch positions and also for feeding the tape when reading the code holes.

TAPE READER

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

The reader is mounted on the front left hand side of the Flexowriter with one stud and one dowel. It may be removed easily from the base by unplugging a fifteen point Jones plug, removing the cover and loosening the mounting stud.

Mechanical power is supplied from the power drive of the writing machine through a four hole coupling.

The tape reader is under control for its operation by manually operated switches mounted above the Flexowriter keyboard. The reader is designed to handle from 11/16 to one inch wide tape. This

permits the reader to sense up to eight code units in a one inch wide tape.

The reader is normally adjusted for tape with the feed holes in line with the code holes, but a slight readjustment can enable it to operate on tape having the feed holes slightly advanced with relation to the code holes. The reader is also designed to operate with chadless tape.

When reading a binary code in a tape, a normally open contact for each unit of the code is closed whenever a hole is sensed in the tape for that unit of the code.

Besides the normally open contact mentioned, several other contacts may be added to each unit of the binary code. This multiple contact arrangement permits certain codes to be detected directly at the reading unit without requiring any external translating mechanism. This arrangement is used in the automatic operation of the Flexowriter so that certain codes such as carriage return, tab, back space and stop codes may be sensed by the reader and immediately stop the automatic operation of the reader.

As stated previously, the code contacts of the reader are used on the Flexowriters to control the operation of the translator. However, these code contacts of the reader may be used in other special applications to control any other external device which can respond to a binary code in the form of electrical impulses for providing some function similar to that of the code translator.

In using the tape reader with the code translator, the six code contacts of the reader, associated with a six unit binary code, are each connected to the corresponding code magnet of the translator. Also, the common contacts of the reader are con-

nected to the electromagnet of the translator clutch.

When controlling any device, such as the code translator, the speed of the reader shaft is the determining factor in the speed of operation of the control device. For this reason, the apparatus to be controlled by the reader should have an operating speed slightly in excess of the reader speed. This is to insure that the controlled device is always in step with the reader.

CODE TRANSLATOR

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

If the code magnets of the code translator are each connected to the code contact of a code selector on another Flexowriter, operation of the code selector will cause simultaneous operation of the second Flexowriter through the code translator. These same code magnets may be controlled by code contacts in any other device which is arranged to form distinctive binary codes in the same manner as the code selector.

The code translator may be arranged to operate in response to any code involving up to twelve units. It is designed to operate up to fifty-two key levers. A six unit code is most commonly used in the control of a Flexowriter. However, the translator may be arranged to operate in response to a five unit code in the same manner as the communications teletypewriting machines wherein the previously described figures and letters shift arrangement is used.

FLEXOWRITER COMBINATIONS

A great many combinations of the four units (described in Section 1) with the typewriting mechanism (writing machine) for the Flexowriter may be obtained, but the following are the combinations which are most commonly required.

FLEXOWRITER - RECORDER (Figure 2-1)

This is a combination of the writing machine with a code selector and tape punch. This arrangement is only capable of recording in the form of a perforated paper tape, the binary code selected by the code selector during manual operation of the writing machine keyboard.

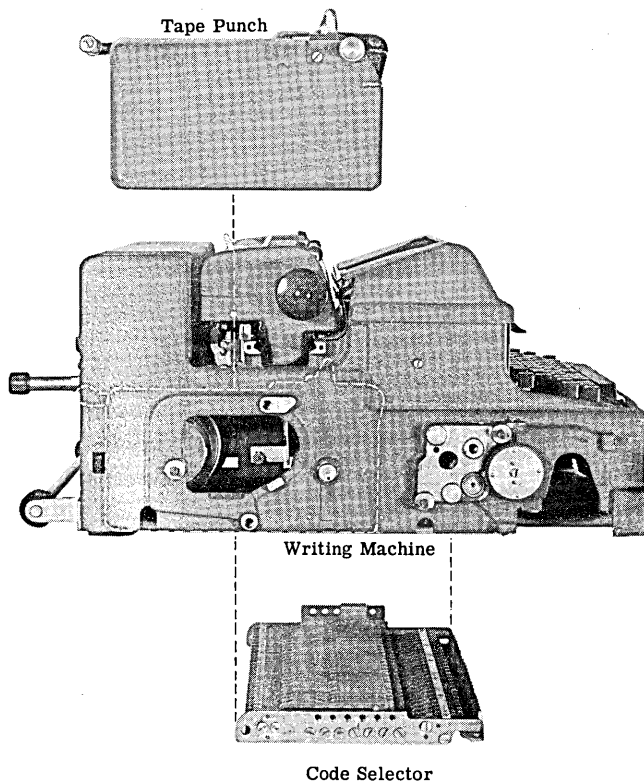


Figure 2-1 Flexowriter - Recorder

FLEXOWRITER - REPRODUCER (Figure 2-2)

The tape reader and code translator is used in this combination with the writing machine. This arrangement is able to automatically reproduce typing on the Flexowriter by reading a coded tape produced on another Flexowriter of the same model. It is also obviously capable of being operated as an ordinary electric typewriter from manual operation of the keyboard.

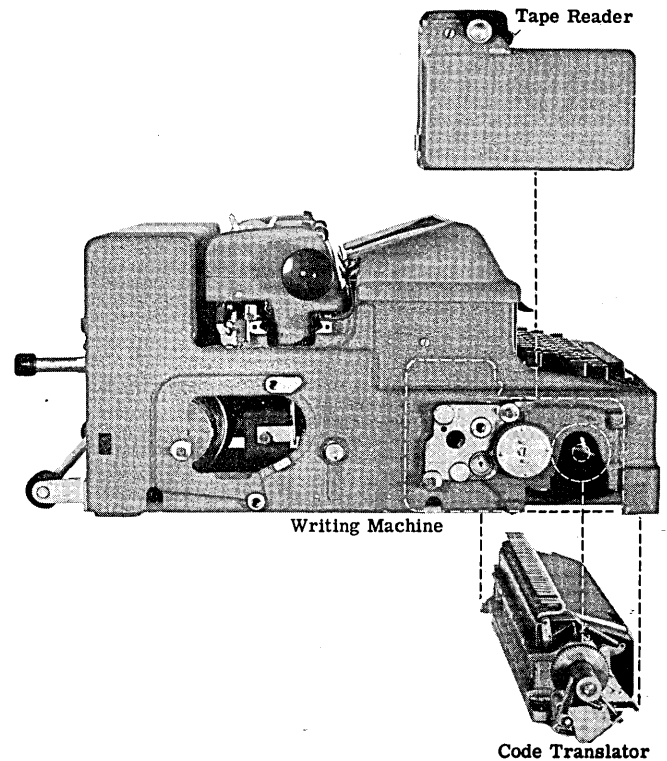


Figure 2-2 Flexowriter - Reproducer

FLEXOWRITER RECORDER - REPRODUCER (Figure 2-3)

This arrangement includes the writing machine,

Flexowriter Combination

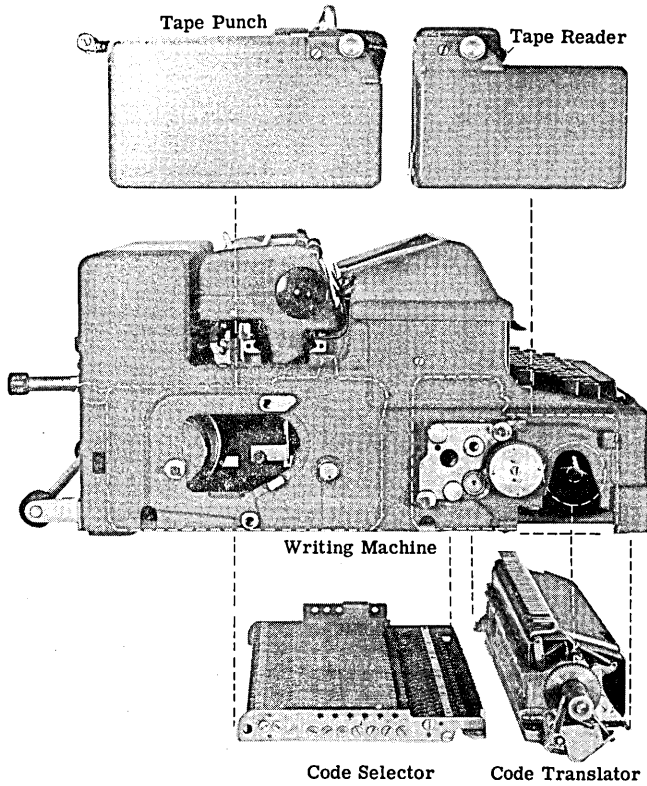


Figure 2-3 Flexowriter Recorder - Reproducer

plus the code selector, tape punch, tape reader and code translator. It has the combined capabilities of the Flexowriter Recorder and the Flexowriter Reproducer. Also, with this arrangement, during automatic operation of the Flexowriter from a punched tape, a new tape may be simultaneously punched when desired.

FLEXOWRITER - TRANSMITTER (Figure 2-4)

This machine requires only a code selector with the writing machine. The contacts of the code selector will, in this case, be connected through an external cable to another device, causing this device to operate automatically in response to the selector contact operation. (The

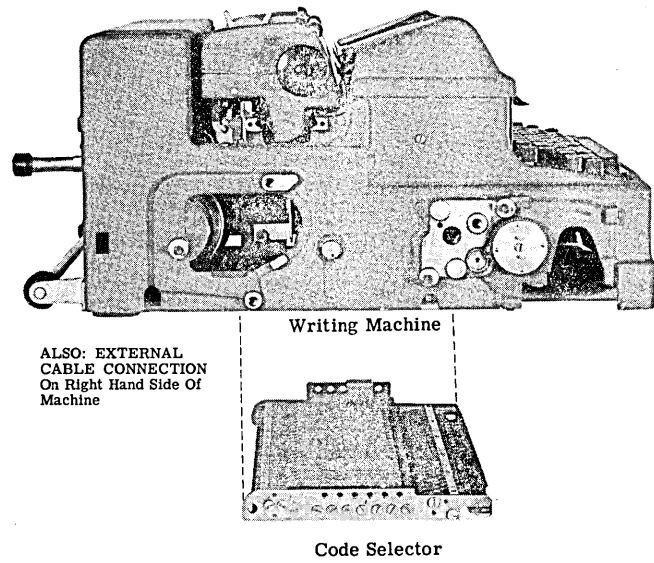


Figure 2-4 Flexowriter - Transmitter

device controlled by a Flexowriter - Transmitter would, for instance, be a Flexowriter - Receiver.)

FLEXOWRITER RECEIVER (Figure 2-5)

This would be a Flexowriter writing machine equipped with a code translator only. The magnets of the code translator would be connected through

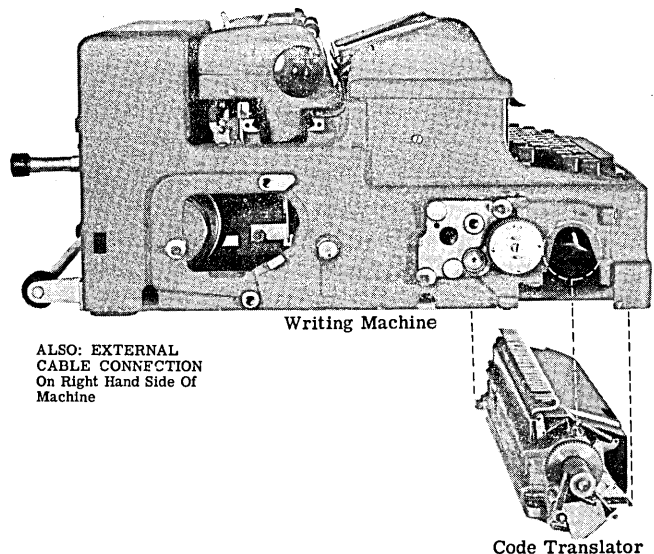


Figure 2-5 Flexowriter Receiver

an external cable to another device for providing binary coded electrical impulses for operating the code translator. (An example of the device for controlling the Flexowriter Receiver is the previously described Flexowriter - Transmitter.)

FLEXOWRITER - TRANSMITTER - RECEIVER
(Figure 2-6)

This is a combination of the two previously described machines and includes the writing machine equipped with both a code selector and a code translator. Such a machine is capable of transmitting coded impulses for the automatic control of another device, such as a Flexowriter Receiver or Flexowriter Transmitter - Receiver. It is also capable of being controlled by an external device, such as a Flexowriter Transmitter or a Flexowriter Transmitter - Receiver. In this machine a manual control switch is ordinarily provided to determine whether the

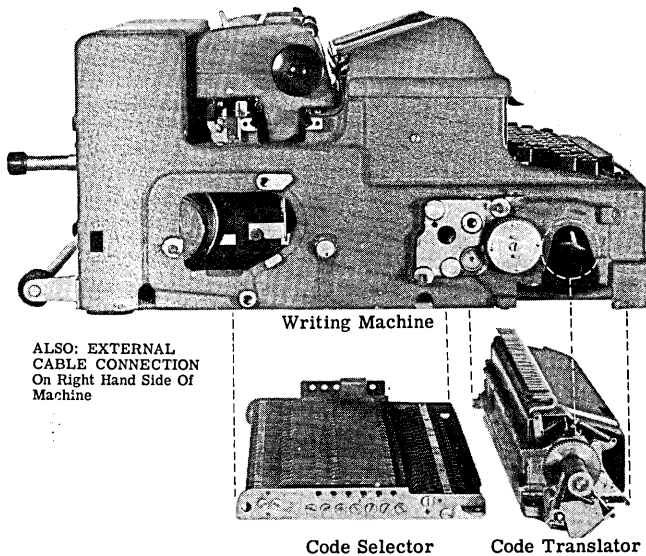


Figure 2-6

Flexowriter - Transmitter - Receiver

Flexowriter Transmitter - Receiver is to be used for the purposes of transmission or reception. This switch is usually of the three position type, permitting the machine to be used merely as a typewriter without either transmitting or receiving.

FLEXOWRITER RECORDER - TRANSMITTER
(Figure 2-7)

This is substantially the same machine as the Flexowriter Recorder except that the code contacts of the code selector are arranged for connection to an external cable. This permits an external device to be controlled by the code selector, either causing or without causing simultaneous operation of the tape punch. A suitable

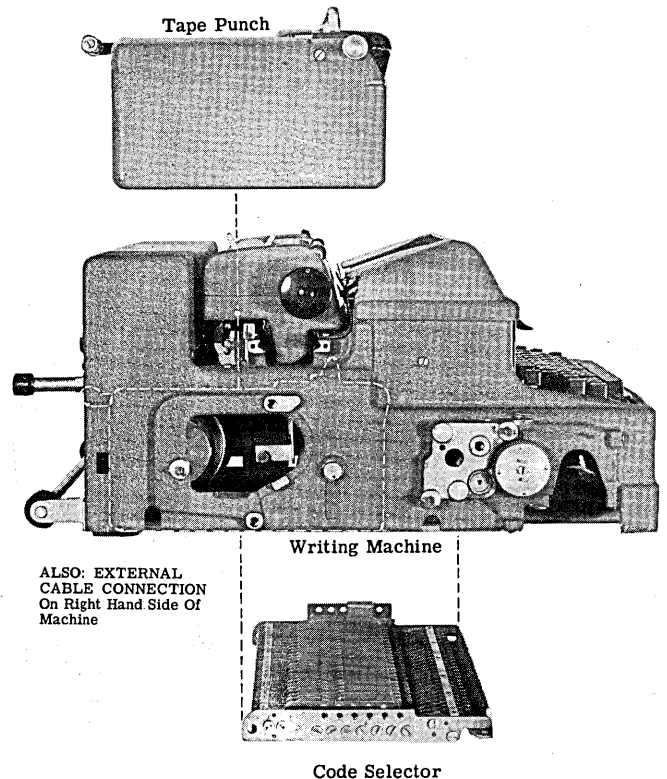


Figure 2-7 Flexowriter Recorder - Transmitter

Flexowriter Combination

manual switch can be provided allowing the machine to be used as an electric typewriter or merely as a recorder by operating a tape punch only.

FLEXOWRITER RECORDER - TRANSMITTER - RECEIVER (Figure 2-8)

This is a combination of a writing machine having a code selector, tape punch and code translator. This arrangement is able to produce a record tape by recording manual operations of the keyboard. Also, it is able to receive incoming coded signals into the code translator, thereby automatically operating the Flexowriter to type, and when desired, to punch a tape.

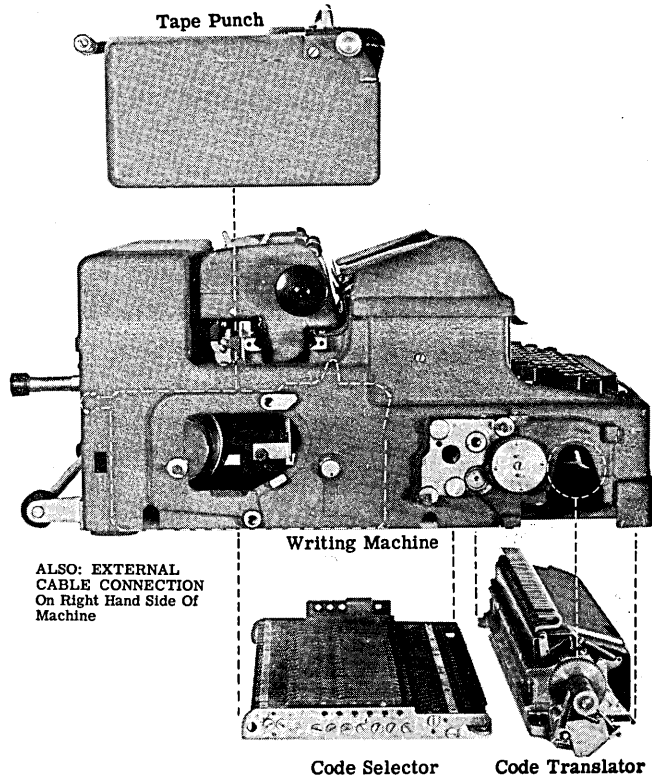


Figure 2-8

Flexowriter Recorder - Transmitter - Receiver

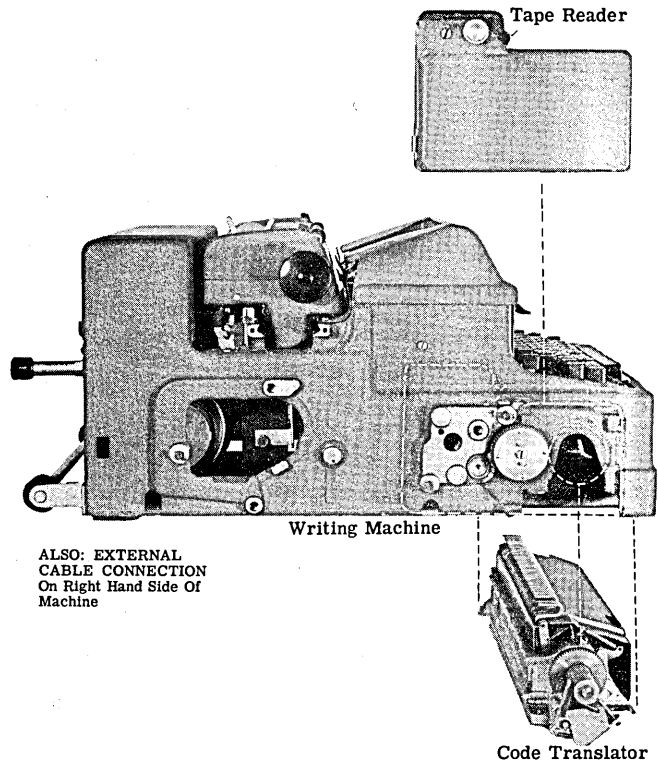


Figure 2-9 Flexowriter Reproducer - Receiver

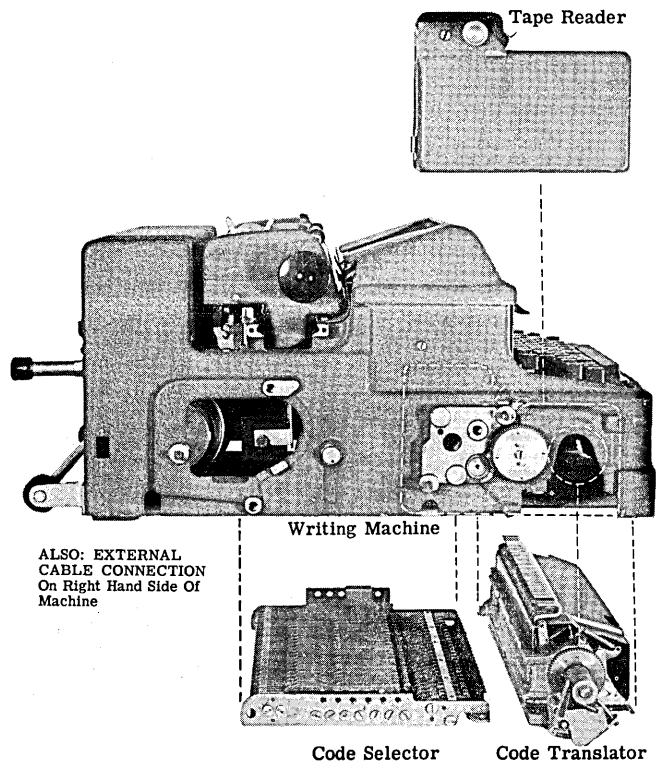


Figure 2-10

Flexowriter Reproducer - Transmitter - Receiver

FLEXOWRITER REPRODUCER - RECEIVER (Figure 2-9)

This is the same combination of units described in connection with the reproducer, but also includes means for connecting the code magnets of the code translator to an external control over a cable. It is capable of reproducing typing from a record tape, or to be operated automatically from the remote source such as a Flexowriter transmitter over its cable connection. A manually operated switch is necessary to select between these two sources of automatic operation of the machine.

FLEXOWRITER REPRODUCER - TRANSMITTER - RECEIVER (Figure 2-10)

This arrangement involves the writing machine, plus a code selector, tape reader and code translator. It is capable of automatically operating the Flexowriter by reading a tape prepared on another machine and at the same time a remote machine may be simultaneously operated in the same manner. The code translator is connected to the external cable connection by a suitable switching arrangement so that this machine may receive controls for its automatic operation over the cable connection when desired.

FLEXOWRITER RECORDER - REPRODUCER - TRANSMITTER - RECEIVER (Figure 2-11)

This is the same arrangement of parts as the Recorder - Reproducer except with switching

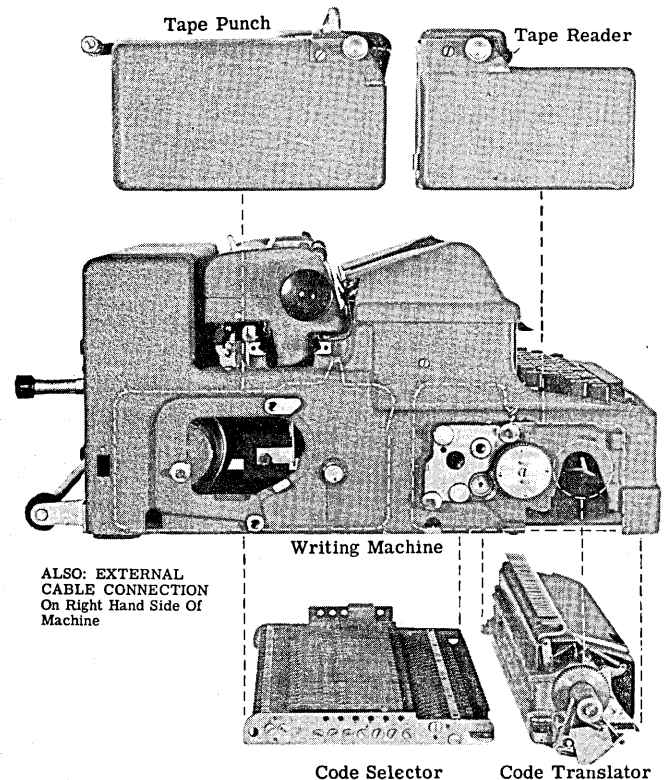


Figure 2-11

Flexowriter Recorder - Reproducer - Transmitter - Receiver

circuits arranged to either connect the code selector or the code translator to an external cable. This arrangement is capable of everything which may be done with the Recorder - Reproducer, and in addition is able to transmit messages to a remote machine either during manual operation of the keyboard or from automatic operation of the Flexowriter by reading a punched tape. It is also capable of being automatically operated from signals over the remote cable connection from another Flexowriter during which time the tape can be punched when desired. Another capability is that the manual operation of the keyboard may be arranged to punch a tape at the same time that the signals are being

Flexowriter Combination

transmitted to automatically control another Flexowriter.

FLEXOWRITER DUPLEX REPRODUCER (Figure 2-12)

This is an arrangement of two tape readers on the writing machine along with a code translator. The tape punch cannot be used on the Duplex Reproducer because the second reader is mounted in the space ordinarily occupied by the punch. Controls are usually provided for automatically operating the Flexowriter by a tape in either of the two readers. Both readers may be turned on so that they will alternate in their control of the automatic operation of the typing mechanism. The Duplex Reproducer may be arranged to operate in either of two different

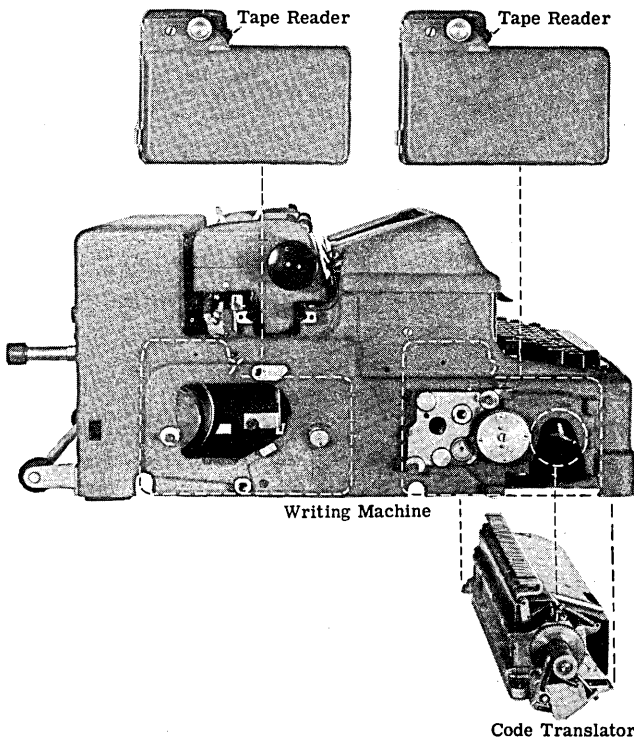


Figure 2-12 Flexowriter Duplex Reproducer

manners. In one form, the two readers alternate in a fixed cycle and the machine then stops automatically. In the other form, the two readers operate indefinitely in an alternate fashion in the control of the Flexowriter.

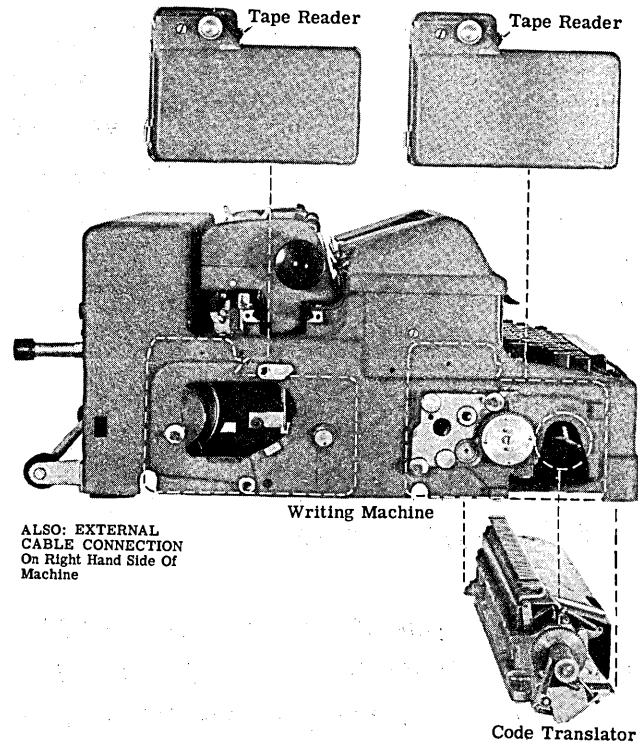


Figure 2-13 Duplex Reproducer - Receiver

DUPLEX REPRODUCER - RECEIVER (Figure 2-13)

This is the same arrangement as provided in the Duplex Reproducer, except that the code translator would be arranged for connection to an external cable when the code translator is not being controlled by either of the two readers. It is capable of the same operation as the Duplex Reproducer and in addition can be operated automatically over the cable circuits from an external Flexowriter Transmitter or similar code transmitting device.

DUPLEX REPRODUCER - TRANSMITTER - RECEIVER (Figure 2-14)

This is the same arrangement as the Duplex Reproducer - Receiver but with a code selector added. It is capable of all the above described functions in connection with the Duplex Reproducer - Receiver. In additon it is capable of transmitting coded controls over the cable connection to any external device.

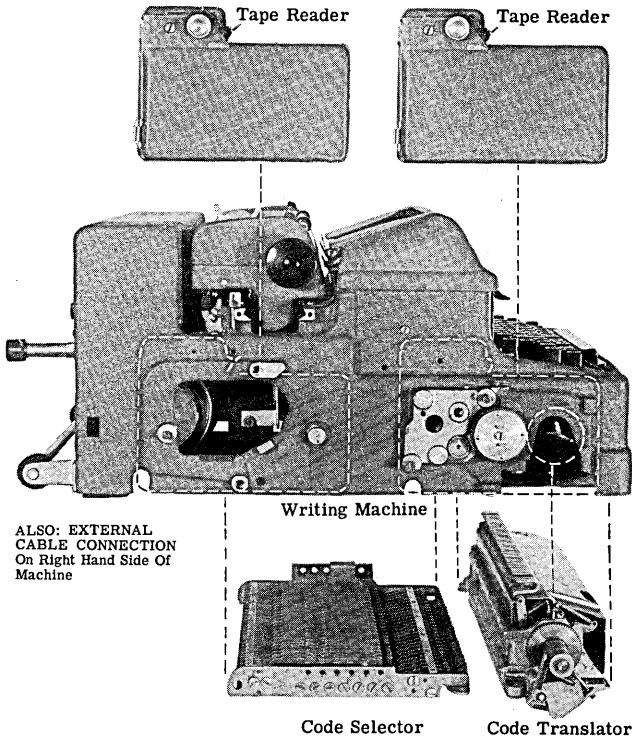


Figure 2-14

Duplex Reproducer - Transmitter - Receiver

FLEXOWRITER RECORDER TAPE TRANSMITTER (Figure 2-15)

This is an arrangement of the writing machine with a code selector, tape punch and tape reader. It is capable of all the functions of the Flexowriter

Recorder. The tape produced by the punch may be fed directly into the tape reader which has its contacts connected to the external cable connection. After the tape has been punched on this machine it can be read by the tape reader without handling by the operator for the purpose of controlling an external device such as a Flexowriter Receiver. In this arrangement, the tape reader may be operated for controlling this external machine at the same time that the keyboard is being operated for punching additional tape.

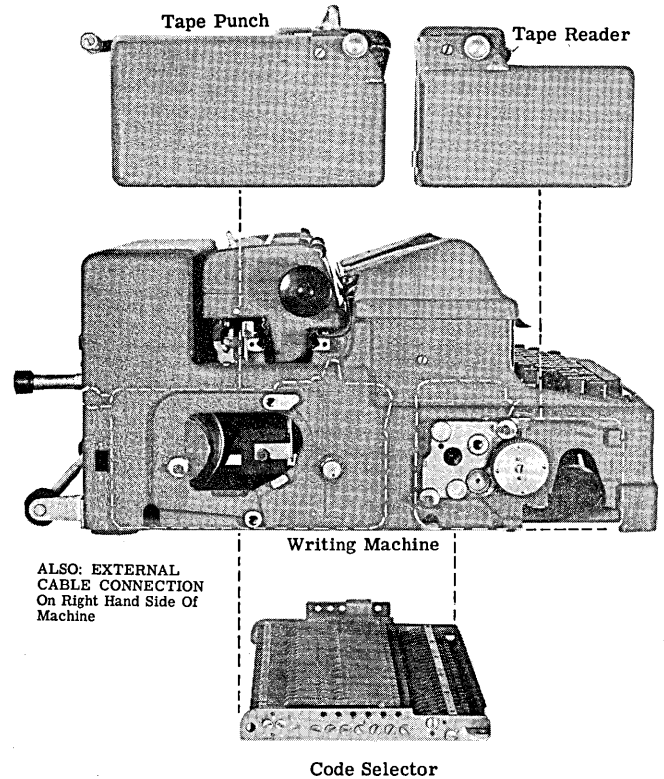


Figure 2-15

Flexowriter Recorder Tape Transmitter

The chart in Figure 2-16 gives a quick reference for all the Flexowriter combinations discussed including, the units the machine is equipped with, plus the operation the machine is capable of performing.

Flexowriter Combination

FLEXOWRITER COMBINATIONS AVAILABLE	EQUIPPED WITH							CAPABLE OF PERFORMING THE FOLLOWING								
	TYPING UNIT	CODE SELECTOR	TAPE PUNCH	TAPE READER	CODE TRANSLATOR	2 TAPE READERS	CABLE CONNECTED	Typing Automatically	Selecting Code	Punching Tape	Reading Tape	Translating Code	Transmitting To Remote Machine	Receiving From Remote Machine	Reading From Two Tapes Alternately	Duplicating Tape
Flexowriter Transmitter	X	X					X		X				X			
Flexowriter Receiver	X				X		X					X		X		
Flexowriter Transmitter-Receiver	X	X			X		X		X			X	X	X		
Flexowriter Recorder	X	X	X						X	X						
Flexowriter Recorder-Transmitter	X	X	X				X		X	X			X			
Flexowriter Recorder Transmitter-Receiver	X	X	X		X		X		X	X		X	X	X		
Flexowriter Reproducer	X			X	X			X			X	X				
Flexowriter Reproducer-Receiver	X			X	X		X	X			X	X		X		
Flexowriter Reproducer Transmitter-Receiver	X	X		X	X		X	X	X		X	X	X	X		
Flexowriter Recorder-Reproducer	X	X	X	X	X			X	X	X	X	X				X
Flexowriter Recorder-Reproducer Transmitter-Receiver	X	X	X	X	X		X	X	X	X	X	X	X	X		X
Flexowriter Duplex Reproducer	X				X	X		X			X	X			X	
Flexowriter Duplex Reproducer Receiver	X				X	X	X	X			X	X		X	X	
Flexowriter Duplex Reproducer Transmitter-Receiver	X	X			X	X	X	X	X		X	X	X	X	X	
Flexowriter Recorder Tape Transmitter	X	X	X	X			X		X	X	X		X			

Figure 2-16 Flexowriter Combination Chart 1

FLEXOWRITER MODELS

The Flexowriter combinations discussed in Part I, Section 2 are available in different models. The primary difference between the following Flexowriter models is the specific physical arrangement of the tape which is punched or read and the binary code used.

MODEL FL

This model is called a "Flexowriter Letterwriter", and has been designed expressly to type repetitive information automatically as a by-product of routine typing. It uses a six-unit binary code which is suitable for the automatic control of this particular model. Therefore, the perforated tape from this model is not interchangeable with the tape used on other models.

The Model FL is discussed in detail in Part II of this manual.

MODEL FC

The "Flexowriter Communication" machine was designed for use in communication systems. It uses a standard five unit binary code which is the same as used in commercial printing telegraph systems. A standard three bank keyboard is used, thus, its typing facilities are necessarily limited to capital letters only. The shift mechanism is designed to select between the printing of the letters (lower case) or figures (upper case).

The Model FC is discussed in detail in Part III of this manual.

MODEL FG

The "Flexowriter Graphotype" machine is designed to perforate a six unit binary coded tape required for operating the Automatic Graphotype machine.

There are several different models of the Flexowriter Graphotype machine which are designed specifically to perforate a tape to control a particular Automatic Graphotype model.

The tape perforated in any one particular Model FG is not necessarily interchangeable with another Model FG. Also, a perforated tape from any of the various Model FG's cannot be interchanged with other Flexowriter models.

The different Model FG machines are discussed in detail in Part IV of this manual.

MODEL FTM

The "Flexowriter Teletypewriter" Multiple circuit machine is used exclusively for teletypewriting applications involving the transmission and reception of messages to and from remote locations. The tape used on the Model FTM is physically the same as that used on the Model FL, but the codes assigned to certain characters are different than in the Model FL because it is particularly adapted to teletypewriting systems.

The Model FTM is discussed in detail in Part V of this manual.

MODEL FPC

Flexowriter Models

The "Flexowriter Punched Card" machine is designed to produce a record tape while an original document is being typed. The record tape may then be used to automatically punch cards for use in a tabulating system.

There are three models available, namely; Model FPC-8 and 8-A, and Model FPC-5. The

Model FPC-8 and 8-A uses an eight unit binary code, while the Model FPC-5 uses a five unit binary code. These models are not interchangeable, therefore, it is impossible to punch an eight unit code on the Model FPC-5 and vice versa.

The Model FPC is discussed in detail in Part VI of this manual.

INSTALLATION

This section contains the necessary information for a Customer Engineer to properly install a Flexowriter or Justowriter.

PACKAGING

A great deal of careful study was involved before the present packaging procedure of machines was adopted. This was necessary to insure that the many adjustments would be maintained through all conditions of shipment. To aid the Customer Engineer in the initial installation of a machine or when shipping a machine is necessary, it would be well to understand the packaging procedure described here.

Carriage end plugs (Figure 4-1) must be inserted between the carriage ways and rails to prevent damage to the escapement mechanism during shipment. The manual release levers should be locked down by inserting a paper plug before the carriage plugs are locked in place.

The feet of the machine must be replaced with rubber shock mounts. The feet must then be packaged and tied to the machine.

The motor belt must be disconnected from the motor pulley and the motor mounting should be drawn up tight against the base of the machine (by turning motor adjusting screw).

The machine must be fastened securely to the wood pallet with four large hex nuts.

The top cover, tape spool holder and margin release levers must be held in place with masking tape.

The padded cleats and sling must be installed as shown in Figure 4-1.

The cover must be installed and the machine placed in a fibreboard carton (the fibreboard carton is used on machines with 12" and 16" carriages, a wooden box is used to package 20" carriage machines). Two liners must be inserted in the carton and the covers must be glued.

MACHINE INSTALLATION

The procedure for initial machine installation is as follows:

1. Note condition of package and record on shipping tag (Form Number 330R) any noticeable damage.
2. Unpack and note general appearance of machine.
3. Note if operators instructions, machine specifications, ribbon, tape, dust cover and type cleaning brush are packed with machine.
4. Untie carriage. Connect motor belt and adjust.
5. Turn motor belt by hand in direction of rotation of motor, until all cams are restored to normal. (It may be necessary to return type bars to rest manually as motor belt is turned.)
6. Feed tape into the punch. Then, with no tape in the reader, turn machine and start reader operation.

All pins of reader should operate causing

Installation

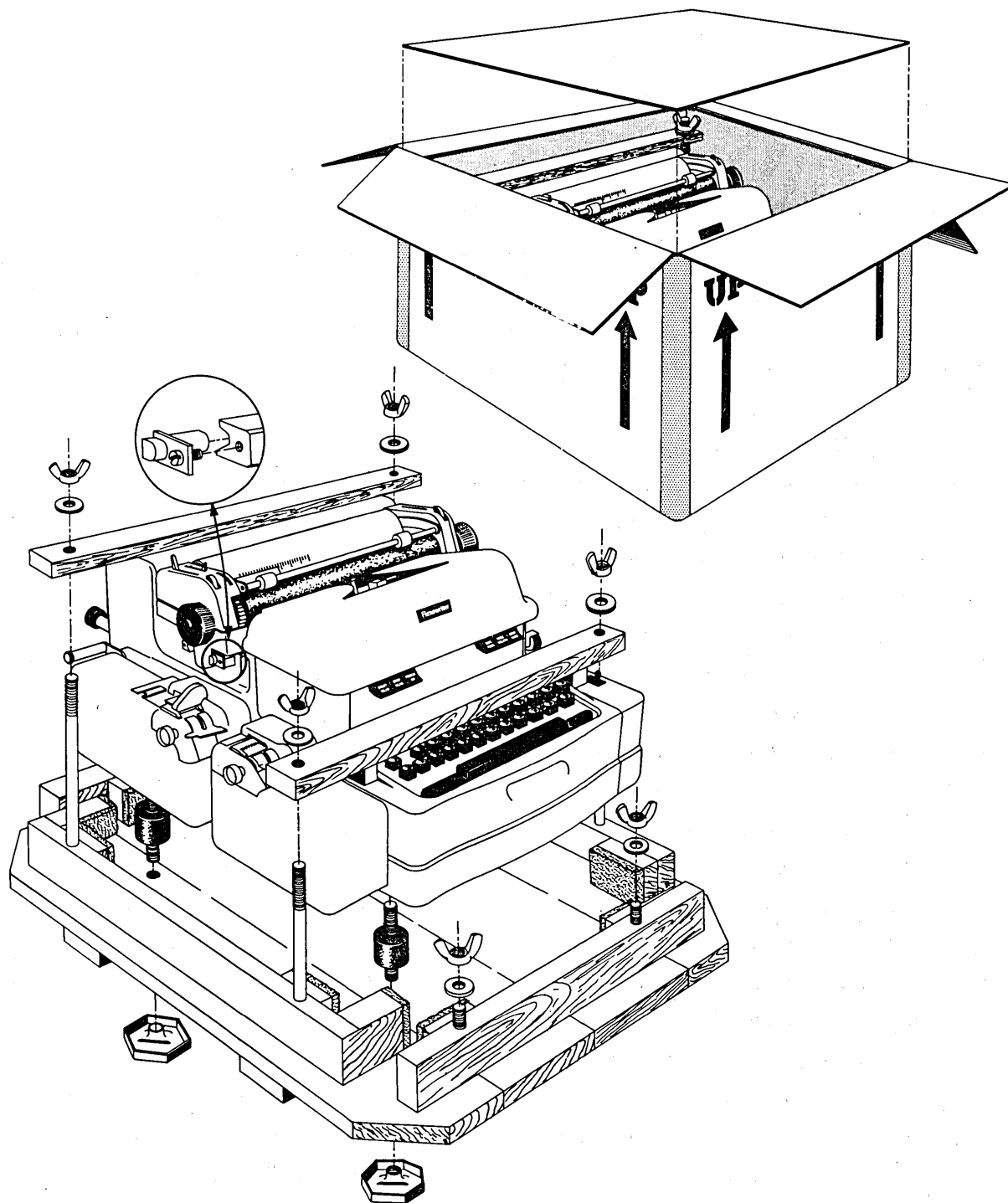


Figure 4-1 Packaging Procedure

translator clutch operation. However, no translator seeker operation should take place (this is the same as reading a code delete).

7. Place a piece of blank tape in the reader to prevent pins from operating and again start reader. The translator should operate without seeker operation.
8. Manually operate the keyboard without punching a tape, checking every character and function key for proper operation.
9. Manually operate the keyboard with the punch on being sure to operate every character and function key.
10. Without removing the tape from the punch, insert beginning of tape in the reader and run automatically with punch on. Continue this automatic operation until several reproductions of the original tape have been completed.

Form 518AR should be filled out completely during installation procedure described above.

90 DAY INSPECTION REPORT

On all service calls within the ninety day guarantee period, make an extra copy of the service report. Ninety days (last day of 90 day guarantee) after machine has been installed, complete the 90 day inspection and return the 90 day report (Form 518BR), completely filled out, to the Service Department at Rochester. Include the extra copies of the service reports, if any, stapled to the upper left hand corner of this report.

Check the machine for cleanliness, lubrication and operation. If any malfunctions are noted,

Thoroughly Examine The Machine Before Making Any Adjustments.

GUARANTEE POLICY

The free service guarantee on Flexowriter and Justowriter equipment is for a period of 90 calendar days after installation. If the equipment is outside the fifteen mile radius, it is subject to a transportation charge, at our cost, plus the cost of travel time at our current hourly service rate. All service calls made after that time are charge calls.

Flexowriter and Justowriter equipment has a one year guarantee covering defective parts or factory workmanship only. If after the 90 day guarantee expires it becomes necessary to install a part because it has proven defective this part will be replaced in the customer's machine without charge, but Commercial Controls will charge the customer our regular service charge to include service time, travel time and transportation. The defective parts must be returned to the General Service Department in Rochester.

INSPECTION AGREEMENTS

The Commercial Controls Inspection Agreement is sound insurance and will prolong the life of equipment. It is imperative that equipment be kept in the peak of operating efficiency through regular periodic attention by a factory-trained Customer Service Engineer who will clean, oil, adjust and inspect our machines under an agreement. Agreements are for a period of one year and will be carried out according to our

Installation

price schedule on a thirty, sixty, ninety and one hundred and twenty day basis.

The following sequence may be used as a definite guide to follow when making a Flexowriter or Justowriter inspection:

I. Remove following units if attached:

- a. Reader
- b. Punch
- c. Translator
- d. Selector
- e. Power Roll

II. Power Drive

- a. Remove "V" belt from pulley and inspect. Replace if necessary.
- b. Remove power drive shaft.
- c. Remove power roll drive and carriage return clutch shaft.
- d. Remove intermediate gear.
- e. Clean, inspect and lubricate Oilite bearings.
- f. Replace complete power Drive and lubricate when assembling.

III. Power Frame

- a. Clean, inspect and lubricate.
- b. Check mounting screws.
- c. Replace power roll and adjust motor belt.
- d. Check cam to power roll clearance, both lobes.
- e. Check keylever trip adjustment and adjust if necessary.
- f. Check ribbon feed and ribbon reverse operation.
- g. Check keylever locking for operation.

IV. Carriage Check

- a. Remove both carriage tension and carriage return tapes.

- b. Check carriage for binds and looseness. Carriage should run free but not be loose.
- c. Replace both carriage tapes. Adjust carriage tension.
- d. Check complete tab and carriage return adjustments.
- e. Check and adjust back space.
- f. Check color change operation and adjust.
- g. Check carbon ribbon feed mechanism and adjust.

V. Escapement

- a. Check escapement wheels for excessive looseness and adjust.
- b. Check "U" bar operation. Adjust trip link and operate with type bars to check trip.
- c. PSM - check electrical trip coils and armatures. Adjust links if necessary.

VI. Selector

- a. Clean and check for worn parts.
- b. Lubricate all pivot points.
- c. Install selector on machine.
- d. Clean and adjust selector contacts. Check wire connections.

VII. Punch

- a. Clean and check for any worn parts.
- b. Check armatures for wear.
- c. Clean and adjust contacts.
- d. Remove clutch - clean, lubricate and re-adjust.
- e. Mount punch on machine.
- f. Perforate tape - check feeding and tape registration.
- g. Check operation of keylock from tight tape or broken tape.

h. Lubricate as specified.

VIII. Reader

- a. Clean and check for any worn parts.
- b. Clean all contacts.
- c. Rotate reader drive and check for proper latching.
- d. Mount reader on machine.
- e. Insert paper over pins and adjust to open adjustment. Remove paper and check all break contacts and make contacts.
- f. Check operation of feeding after mounting translator.
- g. Lubricate as specified.

IX. Translator

- a. Clean and check for any worn parts.
- b. Check armatures for wear.
- c. Check all screws.
- d. Remove clutch - clean, lubricate and re-adjust.
- e. Lubricate as specified.

f. Mount translator on machine. Adjust gear mesh.

g. Check seeker to keylever adjustment.

h. Insert test tape in reader and check out.

X. Machine Complete

- a. Run repeat character test of entire keyboard.
- b. Test tab, carriage return, line space and back space operation from tape.
- c. Reproduce all test tapes.
- d. Check alignment of copy.

Note: On Justowriters add following -

1. Computer adjustment complete
2. Hole counter adjustment complete

XI. Relays

- a. Check operation of all relays on machines for proper operation.

Note: All special attachments to be checked for operation.

SPECIAL FEATURES

This section contains the more commonly used features and variations in the Flexowriter. No standard model, as described in this manual, includes all the features listed, but all these features and variations are available in special machines in substantially any combination. In nearly all cases, the special features must be built into the machines at the factory.

with practically any arrangement of keys. Figure 5-1 shows the maximum number of keylevers that can be provided and a typical arrangement of characters.

Usually no change is ever made in the illustrated standard arrangement of alphabet keys, but various different characters can be assigned to any of the other printing keys. This applies to keylevers in positions 1 thru 43 (as shown on the chart in figure 5-1,) which normally are the only keys in the keyboard which print. However, any of these keylevers can be arranged to control cams for

KEYBOARD

The keyboard on a Flexowriter can be provided

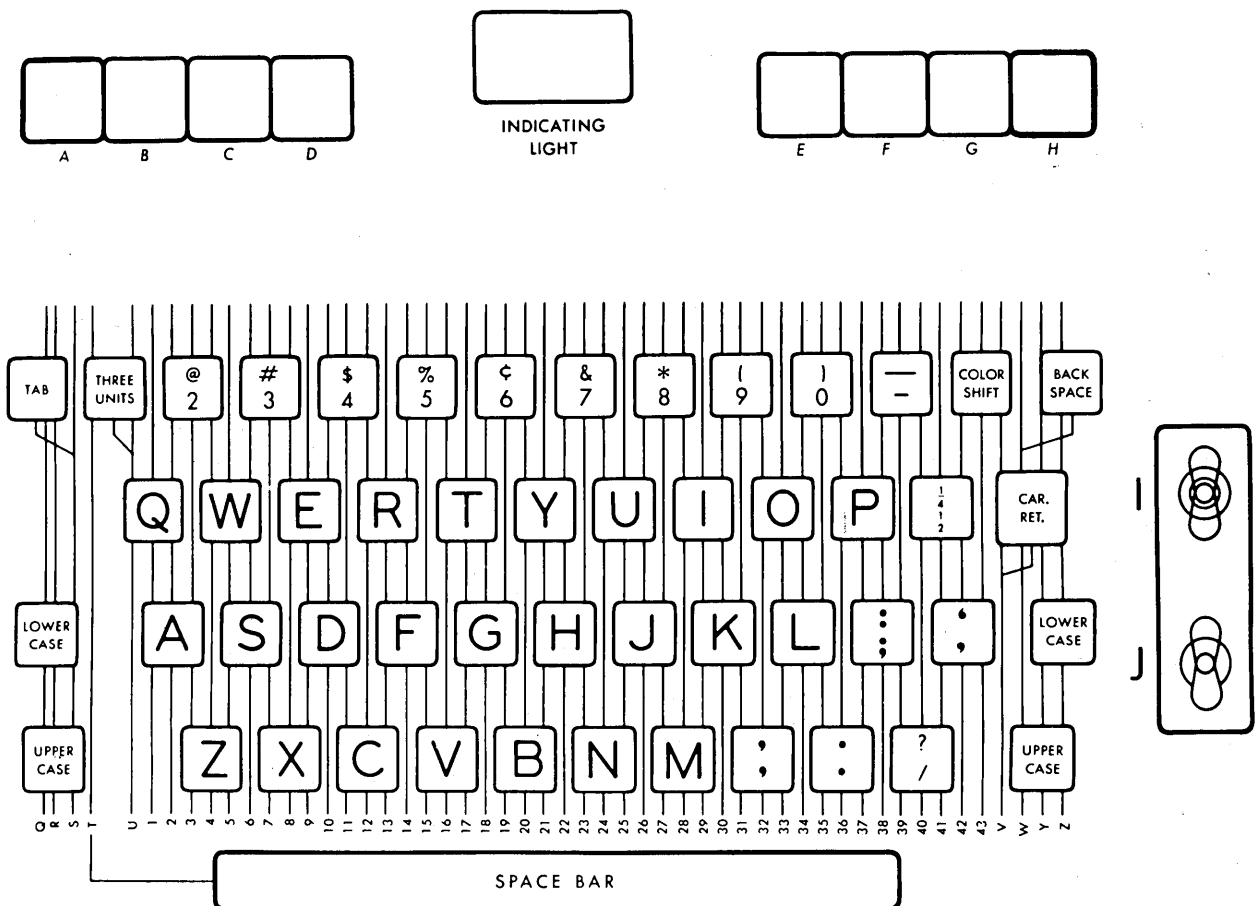


Figure 5-1 Example Keyboard Chart

Special Features

the sole purpose of selecting coded impulses in the Code Selector without printing.

When the Flexowriter is provided for both upper and lower case printing (typing), shift keys are provided in the positions shown (Figure 5-1). In this instance, the lower case shift keylever in position "Z" operates a shift cam and is interconnected by a bail to another lower case shift keylever in position "Q" which does not operate a cam. Likewise, the upper case shift keylever in position "R" operates a shift cam and is interconnected by a bail to another upper case shift keylever in position "Y" which does not operate a cam. The Flexowriter can also be constructed for single case typing only and in this instance keylevers in position "R" and "Z" are available for special non-printing purposes such as the selection of a functional or control code.

The following keylevers are also available for special non-printing functions such as the selection of a code in instances where their normally used function is not required:

Keylever in position "S" normally used for TAB.

Keylever in position "W" normally used for BACK SPACE.

Keylever in position "U" normally used for three unit space in proportional spacing models. This keylever, however, will always cause carriage spacing.

The keyboard shown in figure 5-1 has four transverse rows of keys and is commonly called a four-bank keyboard. However, the Flexowriter can be provided with a three-bank keyboard arrangement such as is generally used on communications machines used with a 5 unit binary

code. If the top or figures row in figure 5-1 is omitted and the figures are combined with the top row of letters, the shift mechanism is then used to select between the typing of letters and figures.

Special arrangements of keyboards are also available on the Flexowriter for use with a 5 unit code which employs all four banks of keys. These special arrangements employ different keylevers for letters and figures with an interlock preventing operation of the figures keys when shifted to type letters and preventing operation of the letters keys when shifted to print figures.

Normally all keys are dark blue in color with white engraved characters. However, any of these keys can be gray or maroon in color in cases where it is desired to distinguish certain keys from others in the keyboard. Also, the engraved characters in the keys can be colored other than white for purposes of distinction.

KEYBOARD INTERLOCK

A mechanical keylever interlock is normally provided on all Flexowriters and Justowriters. The purpose of this interlock is to allow only one keylever to be depressed at one time, thus preventing collision of type bars and mispunching of codes in the tape. The interlock is normally effective on all keylevers except the shift keylevers in position "Q" and "Y". These two keylever positions, through an equalizing rod, work simultaneously with their companion keylevers in position "Z" and "R". However, any of the other keylevers can be notched so that it is not affected by the interlock.

Figure 5-2 shows a sample of an interlock in

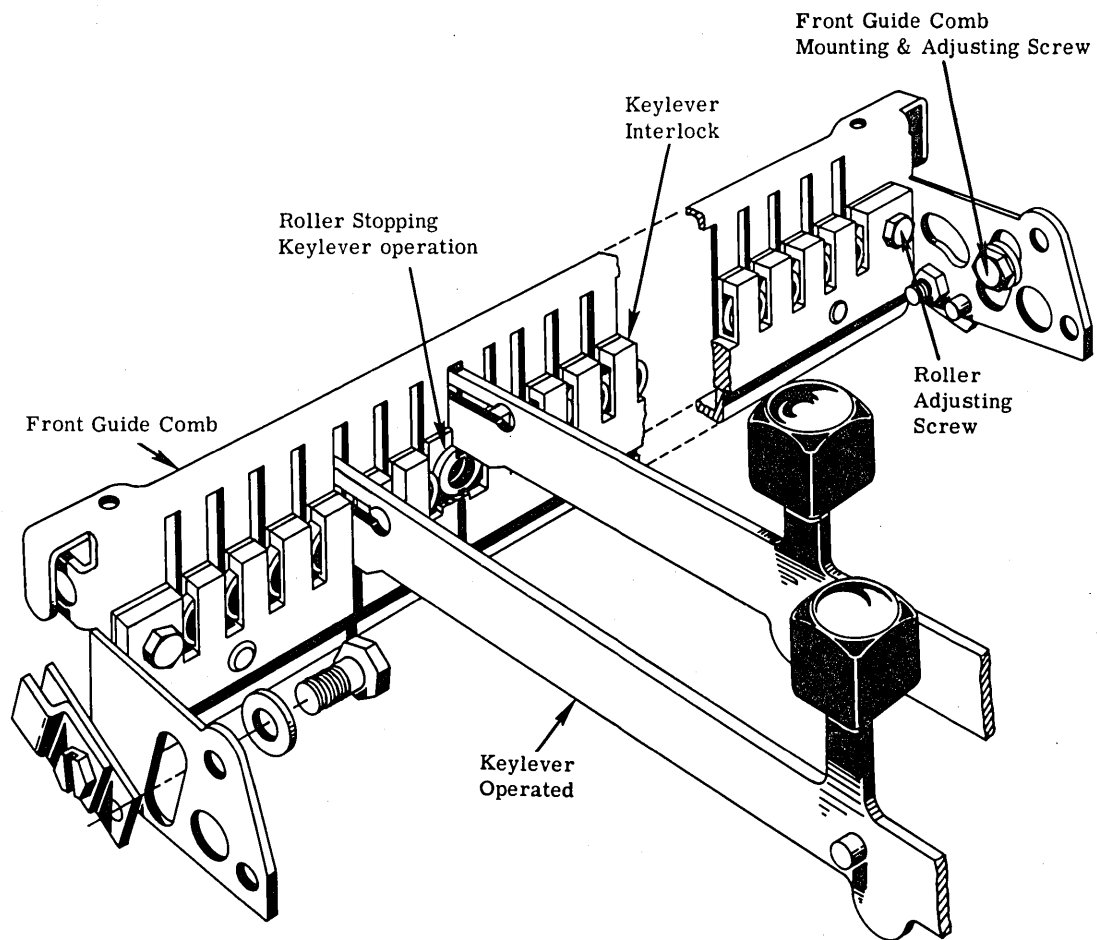


Figure 5-2 Keylever Interlock

operation. The interlock consist of one less roller than there are keylevers, consequently, when one keylever is depressed, the rollers move along the channel and prevent another simultaneous keylever operation.

If it is necessary to remove and replace a keyboard interlock use the following procedure:

1. Remove the reader cover
2. Remove the translator
3. Remove the keylock bar operating link. Remove the keylock bar by removing the right hand mounting screw and bracket.
4. Remove the interlock mounting screws and

remove the interlock.

NOTE: If an interlock is being initially installed on a machine, the front guide comb will have to be removed and replaced with a new one. To do this remove the upper and lower case equalizing rods. Also, the lower section of the L.H. lower case and R.H. upper case keylevers will have to be removed.

5. Using the .190 - .210 trip gage, check the keylever trip across the keyboard. Raise the guide comb if the majority of keylevers trip on the .190" side of the gage.

Special Features

Lower the guide comb if the majority of the keylevers do not trip at .210". This adjustment should be made so that the distance of travel of the keylevers is equal on both sides of the keyboard. (Try to get this adjustment without changing the bifurcation on the end of the keylevers.)

6. When the trip adjustment is correct secure the guide comb mounting screws and recheck .190" - .210" adjustment.
NOTE: Install upper and lower case equalizing rods if removed.
7. Install interlock with three mounting screws (do not tighten mounting screws). Be sure that slots in interlock align with slots in guide comb correctly.
8. With a keylever (about 9th from left hand side) held down, set right hand end of interlock so that the keylevers on the right hand side have about 3/64" play between the top of its interlock roller and the top of the slot in the guide comb.
9. Depress a keylever on the right hand side (about 9th) and adjust the interlock so that the keylevers on the left side have about 3/64" play between the top of its interlock roller and the top of the slot in the comb. Be sure the slots of the interlock align with the slots in the guide comb, then secure the interlock mounting screws.
10. With a center keylever held down check each keylever for approximately 3/64" play. If some keylevers are less than 3/64", close the bifurcation to get proper clearance. It may be necessary to disregard the .210" adjustment.

NOTE: The movement of the rollers is controlled by a stop at each end of the bracket. If more or less travel is necessary, loosen and move the roller adjusting screws (figure 5-2). Be sure and check the keylevers for proper locking after moving these screws.
CAUTION: DO NOT OIL INTERLOCK.

11. Install keylock bar. With machine off, set keylock bar to clear bottom of keylevers by approximately 1/32". Install keylock bar operating link.
12. Install space bar, translator and reader cover.

CASE SHIFT

In double case Flexowriter, the type basket is shifted relative to the platen by two cams controlled by keylevers (figure 5-1). This arrangement requires a key operation for shifting to one position and a different key operation for shifting to the other position.

A special shift arrangement similar to that used on communications printers can be provided on the Flexowriter. This arrangement causes the machine to shift to letters position whenever the space bar is operated in figures shift position, (see Special Feature Shift On Space, page 5-17).

BACK SPACE

A back spacing mechanism is usually provided in the Flexowriter for moving the carriage one letter space to the right. This is a cam-operated mechanism under control of a keylever in position "W". In proportional spacing models, the back

space will move the carriage one unit to the right.

CARRIAGE RETURN

The carriage is returned in the Flexowriter by power through a friction clutch, controlled by a keylever. Indexing or rotation of the platen for line spacing is incidental to the carriage return operation and cannot be separated from it.

The left hand margin in typing is determined by the position to which the carriage is returned. This position is manually adjustable in increments of one letter space on machine spacing at ten or twelve characters to the inch, two letter spaces on machines spacing at 16 characters to the inch, and on proportional spacing machines the margin is adjustable in increments of four units of spacing.

A special arrangement can be provided for initialing a return of the carriage automatically after the carriage has been spaced past an adjustable predetermined point. Another special arrangement can be provided which will automatically select a line feed code following a carriage return code selection. (See Special Feature - Automatic Line Feed, page 5-15).

TABULATION

A carriage tabulating mechanism is usually provided in the Flexowriter and is controlled by a keylever in position "S". The tab positions of the carriage are determined by individual stops which are manually positioned at variable increments of two letter spaces in machines spacing ten, twelve

and sixteen characters to the inch, and at increments of four units of spacing in proportional spacing machines.

A special tab arrangement is available for three-bank keyboards operating on a 5 unit code. In this instance the code assigned to the tab is one of the letters codes in figures shift position. Thus, the operation of this letter key will electrically cause operation of the regular tab keylever in position "S", providing the machine is in figures shift position. (See Special Feature - Model FC Tab Mechanism, page 5-19).

REPEAT CAM

Normally all keylevers control cams which make only one operation regardless of how long the keylever is held down. However, in some instances it is desirable to have a cam which will operate continuously for as long as the keylever is held down. This is accomplished by removing one lug on the release lever of a cam (see figure 5-3).

A repeat operation will usually only be found necessary for either space, back space or underline.

In the case of repeat space and repeat underline it is necessary to retain the normal single operating cam.

A special keylever is provided in position "U" for repeat space operation. If repeat underline is used, another key position will have to be given up.

Due to the delay control circuit in automatic back space operation it is not necessary to have a special keylever position for repeat back space.

Special Features

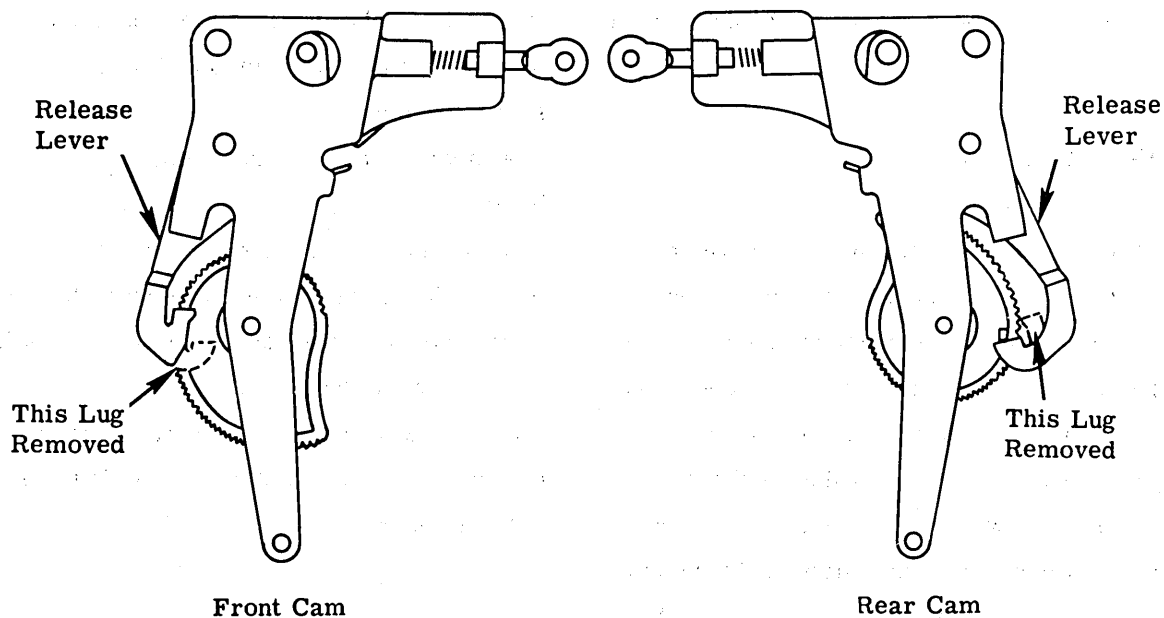


Figure 5-3 Repeat Cam

FRONT CONTROL PANEL

A control panel is provided directly above the keyboard of the Flexowriter and can be equipped with up to eight manually operated switches. (A through H - Figure 5-1), some of which are used for machine control plus an indicating light. The light is placed in the center of the panel when it is used, and the switches are grouped on each side of the light. Each switch includes an operating lever which is engraved to show the function of the switch.

The switches may be of the locking or self-restoring type. In the locking type, the lever remains in its operated or depressed position until it is manually restored. The self-restoring switch lever returns to normal position as soon as the manual operating pressure is removed. Each of the switch levers can operate a Class A (normally

open) contact, or a Class B (normally closed) contact, or a Class C (Transfer) contact.

SIDE CONTROL SWITCHES

Toggle switches can be provided at the right hand side of the keyboard for control of the Flexowriter. The most common arrangement is only a single power switch which is provided to turn the power off and on for the entire machine. However, this side control switch arrangement can include either one or two toggle switches "I" and "J" (Figure 5-1) and a plate over these switches can be engraved to indicate their function. Each switch can be either the two position or the three position type where the center position is off. Also each switch can be either a single pole type (one circuit only) or a double pole type (two circuits).

TYPE STYLES

Flexowriter are available in a large variety of type styles and sizes either proportionally spaced or uniformly spaced. In case shift machines, the shift motion is .265 of an inch, and any type style adapted to this shift motion and to the following spacing variations can be used. In monospacing machines, type can be used which is spaced 10 characters to the inch (Pica), 12 characters to the inch (Elite), 16 characters to the inch, or 6-2/5 characters to the inch. In proportional spacing machines, type can be used which has a unit spacing value in inches of one thirty-second (approximately twelve point) one thirty-sixth (ten point) or one forty-eighth (eight point).

CARRIAGE SIZES

The standard Flexowriter is equipped with a 12 inch carriage which will accept an 11 inch wide sheet and has a 9½ inch writing line. In addition, 16 inch and 20 inch carriages are available on all machines except 8 point and 10 point proportional spacing models. The 16 inch carriage will accept a 15 inch wide sheet and has a 13½ inch writing line. The 20 inch carriage will accept a 19 inch wide sheet and has a 17½ inch writing line.

PLATEN AND RATCHETS

See Platens and Ratchets – Part II, Section 2, page 2-56.

RIBBON

A fabric ribbon with an automatic reversing feed mechanism is provided as standard equipment on Flexowriters. A special carbon paper ribbon feed mechanism is also available which feeds a narrow ribbon from a supply spool across the machine to a rewind spool, (see Special Features-Carbon Ribbon Mechanism). This mechanism permits the standard fabric ribbon to be used when the carbon paper ribbon is not being used.

RIBBON SHIFT

A manually operated ribbon shift is provided on all Flexowriters which selects between the use of two different fields of a fabric ribbon. An automatic ribbon shift can be provided which operates from a single code received by the code translator to change the field used in the ribbon. This mechanism uses a keylever in position 43 and is effective to change the color of printing when a two-color ribbon is used. A different ribbon shift mechanism is also available which is operated by an electromagnet.

This magnetic ribbon shift operates to select one field of the ribbon when the electromagnet is energized and the other field when de-energized.

CODE TRANSLATOR AUXILIARY CONTACTS

A special cam-operated contact assembly can be provided in any Flexowriter Code Translator which does not involve greater than an 8 unit

Special Features

code. Any number up to three cams can be mounted on the Code Translator shaft and each cam can control a Class C (Transfer) contact. Each cam is adjustable to any radial position on the shaft and cams are available having various extents of operating duration.

FUNCTIONAL CONTACTS

Auxiliary contacts can be provided at various points in the Flexowriter to operate in accordance with the normal functional operations of the machine. The case shift contacts (CSC), controlled by the movement of the type basket, may have up to eight Class C (transfer) contacts. A single Class B (Break) or a single Class A (Make) contact can be provided to operate during the back spacing operation of the Flexowriter. Also, contacts can be provided to operate at the start of both the carriage return and tabulating operation and to remain operated until the completion of these operations. These contacts can involve up to four springs providing two Class A or two Class B assemblies.

CABLE CONNECTIONS

One or two cable connectors can be provided at the right rear side of the Flexowriter for the purpose of connecting the internal wiring of the machine to an external device. A.N. style connectors are used and one connector up to size 24 can be provided and if a second connector is required it can be up to size 22.

MOTOR

The standard motor used in the Flexowriter operates on 115 volts, 60 cycle and is rated at 35 M. H. P. It is an induction motor having a rated speed of 1725 R. P. M. This same motor is used on 115 volts, 50 cycle with changes in the drive ratio to compensate for its reduced speed. When the Flexowriter is to be used with higher voltages between 120 and 260 volts, 50 or 60 cycle, an external transformer is provided and the same motor is used. A special motor is available for 115 volts direct current applications. A rheostat is built into the Flexowriter with this D.C.

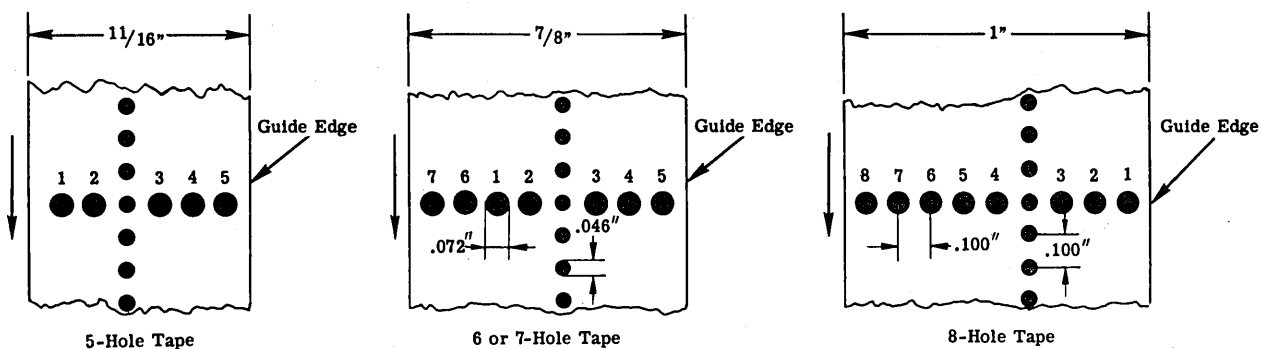


Figure 5-4 Tapes Used

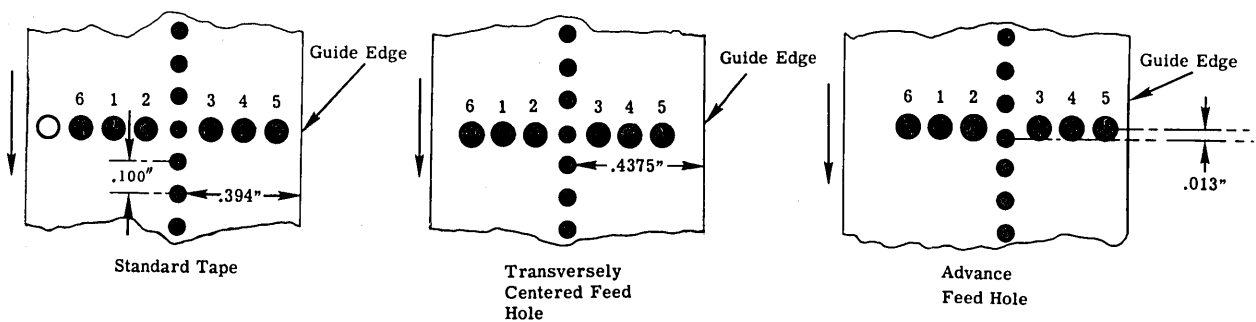


Figure 5-5 Special Tapes

application for adjusting the speed of the motor.

TAPE USED

DIRECT CURRENT POWER SUPPLY

The Flexowriter usually has a built-in, full wave rectifier supplying approximately 90 volts D.C. rated at 1 amp. In this case the rectifier is connected directly to the A.C. supply line and the D.C. power is not isolated from the line. Flexowriters are also available with a built-in D.C. supply at approximately 48 volts rated at 2 amps. This uses a transformer which isolates the D.C. power from the A.C. supply line.

RELAY CAPACITY

The upper rear portion of the Flexowriter provides space for mounting a number of relays usually required for the control of the machine.

This space is sufficient for mounting a maximum of seven large telephone type relays. A greater number of relays of the medium size can be used in this space. If no carriage position switches are required a maximum of 18 medium size relays can be used, and if these switches are required, a maximum of 15 medium size relays can be used.

The Tape Punch and the Tape Reader used on the Flexowriter can use any standard tape between .687 and 1.000 inch wide. Three width tapes are most commonly used in this range, eleven-sixteenths of an inch for a maximum of five code channels, seven-eighths of an inch for a maximum of seven code channels and one inch for a maximum of eight code channels. All tapes have code holes which are $.072$ inch in diameter and feed holes $.046$ inch in diameter. (See figure 5-4.)

All holes are spaced $.100$ inch both longitudinally and transversely. The tape punch is normally constructed to punch feed holes in line with the code holes transversely of the tape, but specially constructed tape punches are available which punch these feed holes $.013$ in advance of the code holes, (See Figure 5-5.) The tape reader is adjustable to either of these two feed hole positions. Both the tape punch and the tape reader are normally constructed for use with tape having the center line of the feed holes spaced $.394$ inch from the inside or guiding edge of the tape, but specially constructed punches and readers can be provided for use with tape having the center

Special Features

line of the feed holes spaced .4375 from this guiding edge.

OPERATING SPEEDS

The maximum operating speed of the Flexowriter is determined by the rate at which reliable repeat printing of a single character can be obtained.

Roughly this is about 10 characters per second, and to provide a workable margin of safety, the Tape Reader is set to automatically operate the Flexowriter at a nominal speed of 571

characters per minute. Although the drive mechanism for the Code Translator operates at 588 R.P.M., it is not recommended that codes be supplied to it for automatic operation at a rate higher than 571 per minute. The mechanical drive for the tape punch operates at 853 R.P.M. to provide for maximum manual keyboarding speed.

PIN FEED PLATENS (See Figure 5-6)

Pin feed platens are available in various sizes which provide a means of feeding multiple-

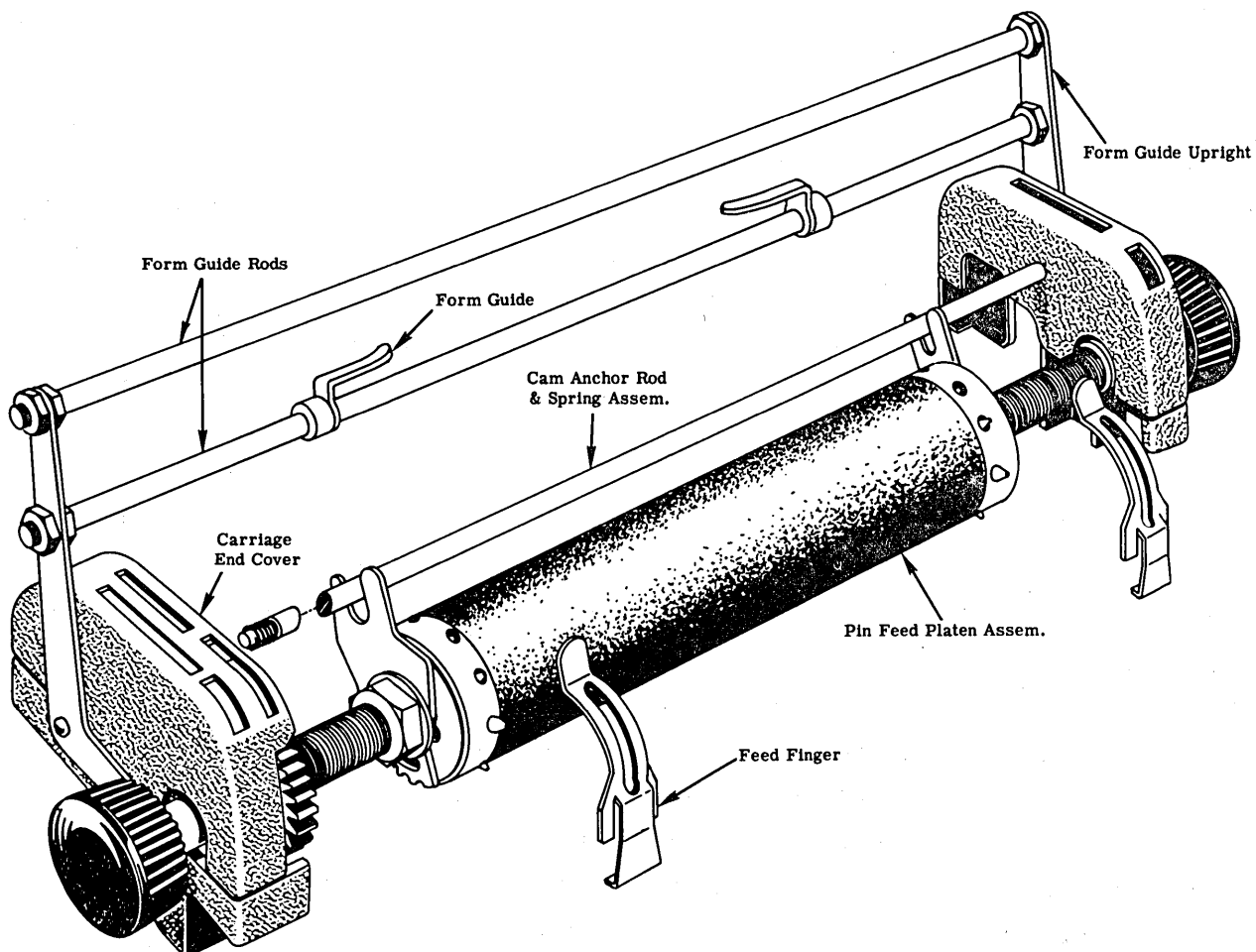


Figure 5-6 Pin Feed Platen Assembly

FORM DIMENSIONS - PIN FEED PLATENS

Over All Form Width	Pin to Pin	Over All Form Width	Pin to Pin	Over All Form Width	Pin to Pin
5-3/4	5-1/4	9-7/8	9-3/8	13-5/8	13-1/8
6-1/2	6	10-3/8	9-7/8	14-7/8	14-3/8
8	7-1/2	10-5/8	10-1/8	16	15-1/2
8-1/2	8	11-3/4	11-1/4	16-3/4	16-1/4
9-7/8	9-3/8	13-5/8	13-1/8	17-27/32	17-11/32
10-3/8	9-7/8				

Figure 5-7 Platen Chart (Pin Feed)

copy forms, with interleaved carbon, through the machine and maintaining register between the copies. Perforations along the edges of the form permit retractable pins in the rims of the platen to pull the form with the indexing (rotation) of the platen. Feed fingers are provided which spring into place on the front paper scale to hold the forms against the platen rims, thus keeping the perforations on the pins. Guide rods are also provided to keep the forms feeding into the platen evenly. During operation, the feed roll release lever is held forward in the released position because the feed rolls are not required to feed the paper.

Platen cylinders are available in three grades of hardness, No. 1 - soft, No. 2 - medium and No. 3 - hard. Each of these grades of hardness are available in different lengths, measured between the pins. The chart in Figure 5-7 shows the various lengths available.

The platen cylinder may be replaced by removing the right-hand platen knob, platen bushing and the hex nut against the right-hand pin wheel assembly, (Figure 5-8). The right-hand pin wheel assembly may then be removed from the shaft. The two hex nuts lock the cylinder on the shaft

in any position desired with regard to center.

The platen ratchet is fixed to the platen shaft and no platen release is provided. The ratchets available for pin feed platens are shown in Figure 5-9.

The indexing mechanism should be adjusted in the same manner as for a standard platen (See Part II, Section 2, page 2-36.) If after adjusting the indexing mechanism (pawl, stop, detent, etc.), and the registration of the form is off, loosen the ratchet set screws, hold the ratchet and turn the platen to the desired position. Be sure and tighten the ratchet set screws securely.

The pin position may be adjusted, if necessary, by loosening the roundhead screw in the slotted opening of the locating plate and rotating the plate until the pins begin to protrude as they reach the top of the front paper scale and begin to retract just before leaving the slot in the feed finger. Rotate the platen backward to insure that the pins do not catch on the top of the front paper scale.

CARBON PAPER RIBBON MECHANISM

This mechanism provides for the use of carbon paper ribbon but does not interfere with the use

Special Features

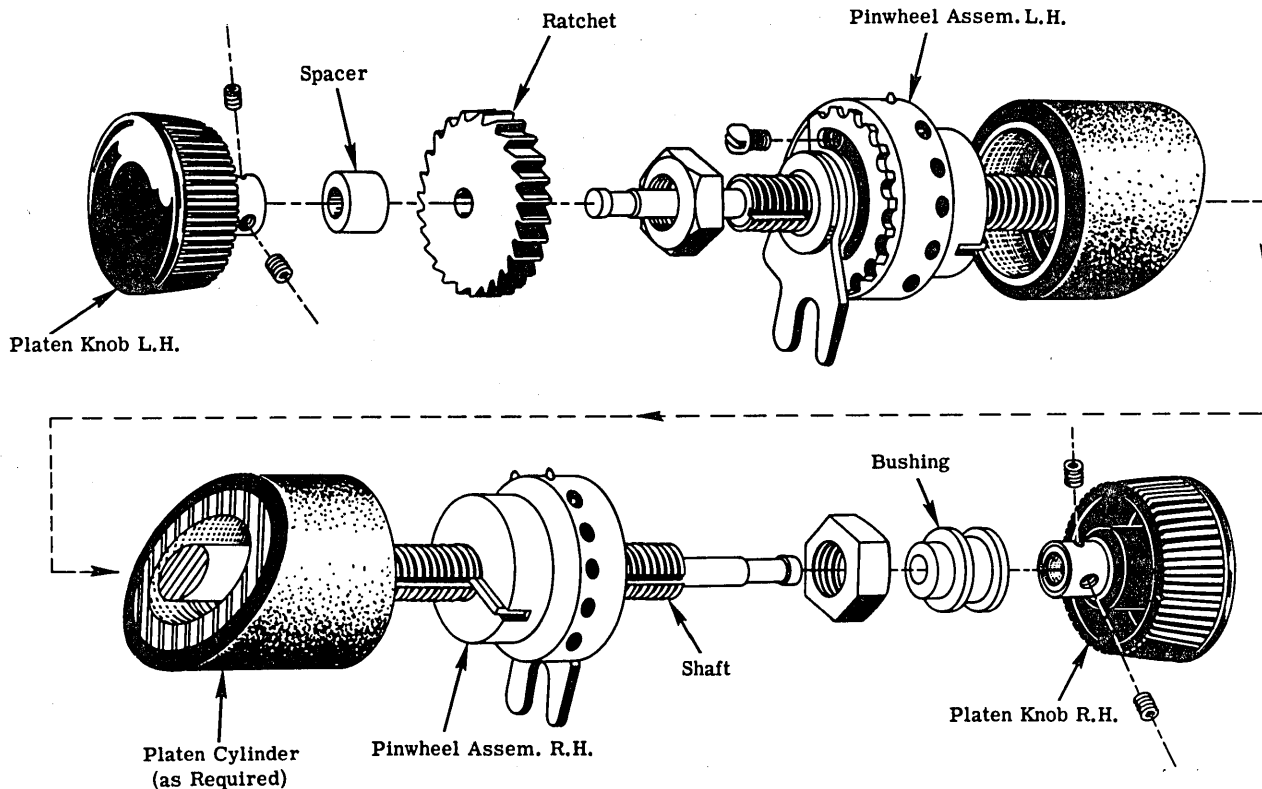


Figure 5-8 Pin Feed Platen Disassembled

of fabric ribbon (all Flexowriters are equipped for a fabric ribbon.)

A 4" diameter (645 ft.) roll of carbon ribbon (9/32" in width) is unwound from a right hand spool and is fed across the machine and rewound on a left hand spool. The ribbon is moved after each operation of a type bar.

This is accomplished by meshing a gear with the escapement mechanism (See Figure 5-10), which will cause the ribbon to move the correct amount of space so that the characters will not over-strike on the ribbon.

AUTOMATIC PUNCH CONTROL FROM KEYBOARD

A Flexowriter can be arranged to automatically

control the punch through keyboard operation. With this device the tape punch can be turned on and off from the keyboard.

An example circuit of punch control from the keyboard is shown in Figure 5-11. The "Punch On" switch is a non-locking switch, which when depressed will energize the "Punch On" relay (K3), causing all information typed to be punched in the tape. Note in figure 5-11, that the K3 relay holding circuit is through a normally closed contact on the K4 (Punch Off) relay. Therefore, if K4 becomes energized the K3 will de-energize stopping punching operation.

The selector slides for positions K and L are coded to operate additional contacts. The L position operates SC7 and the K position operates SC8. Therefore, if the basket is in Figures posi-

PIN FEED PLATEN SPECIFICATIONS
Number of Spaces in One Inch of Form

Count the number of spaces in 10 inch 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	Upper Index Pawl Stop	Detent Arm Assembly	Index Pawl Carrier
304769	33	6.00	3.00	2.00		1000325	1076864	1073401
304771	44		4.00	2.66	2.00	1000325	1076864	1073401
1096910	55		5.00	3.33	2.50	1002272	1076886	1076862
1098579	66		6.00	4.00	3.00	1002273	1076884	1076862

Figure 5-9 Ratchet Chart (Pin Feed)

tion and the K keylever (open parenthesis) is depressed a DC circuit is completed to the K3 (Punch On) relay as follows: from -DC, TC6, SC8, CSC 8 and 7 contacts, K3 coil, TC5, to +DC. With K3 energized all keylever operations will be recorded in the tape until the "L" position keylever is depressed (figures position-closed parenthesis). The "L" position operation will complete a circuit to the K4 (Punch Off) relay as follows: from -DC, TC6, SC7, CSC 4 and 3 contact, K4 coil, TC5, to +DC. Thus, with K4 energized, the holding circuit to K3 is broken when K4 - 1 and 2 contacts break.

Additions to the above example arrangement may be provided such as adding on additional "common" contact operated by the K slide only. This contact would break the circuit to the punch magnets preventing the K code from being recorded in the tape when in figures position. This would allow the punch to be turned on without punching the K code in the tape. Another contact may be added with the same results for Punch Off operation (L in figures position).

AUTOMATIC PUNCH CONTROL BY CARRIAGE POSITION

This feature controls the Tape Punch so that the material typed in predetermined vertical columns only will be recorded in the tape. This mechanism is designed so that the punch can be turned on or off automatically at as many different points in the carriage travel as may be desired.

The mechanism is operated by adjustable tabs mounted in a rack on the carriage. This rack is located behind the margin and tab racks. Each tab has a projection which either turns on the punch or turns it off. There is a maximum of four projections to a tab and they are normally arranged so that the projection in control position 1 turns the punch on and control position number 2 turns the punch off. Projections in control position 3 and 4 may be used for controlling a remote machine or other purposes such as operating a light on the control panel.

Figure 5-12 shows an example circuit arrangement for carriage position control of the punch.

Special Features

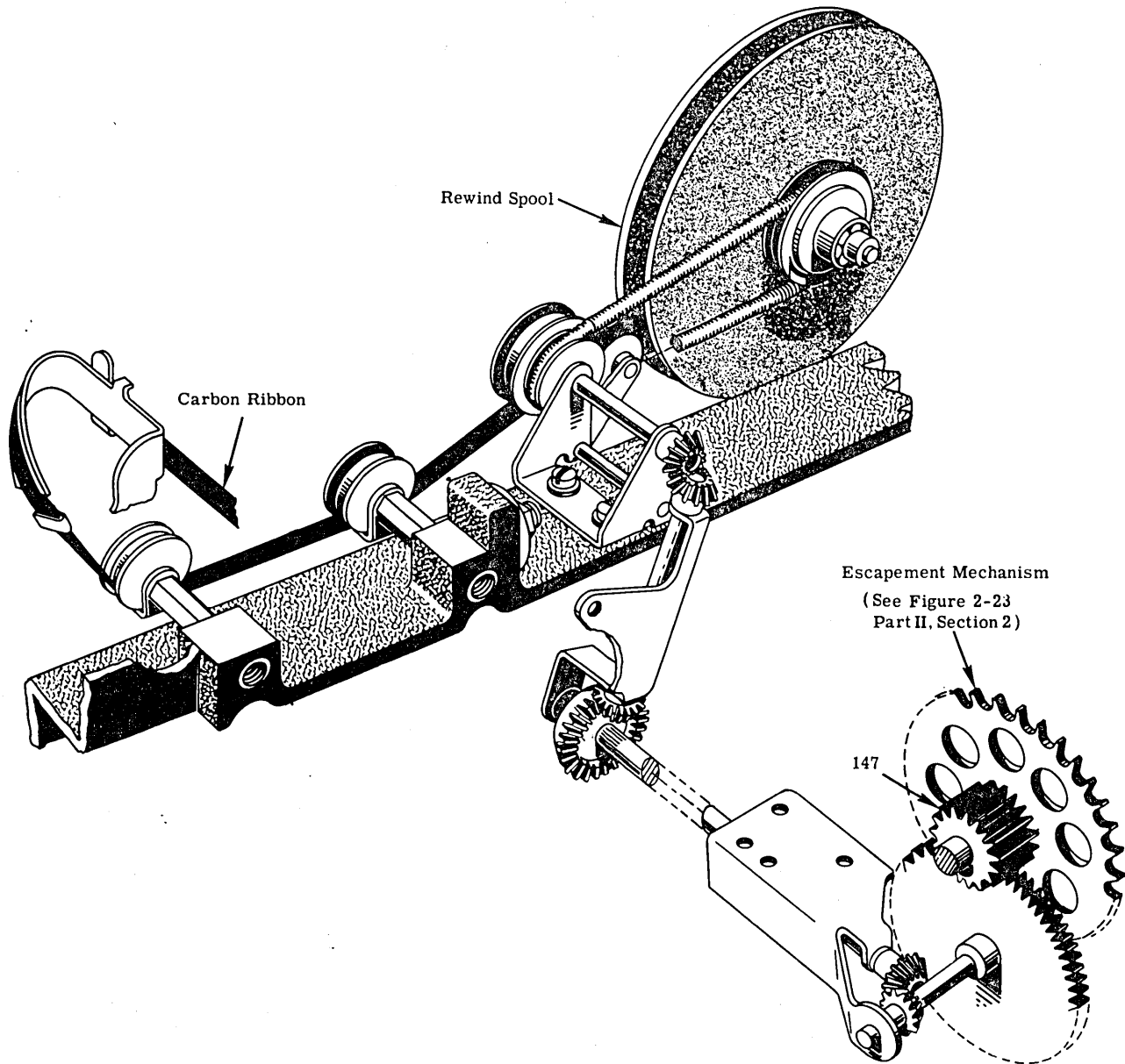


Figure 5-10 Carbon Ribbon Mechanism

To make the punch operative for carriage position control, the Punch On switch (on the control panel) must be in the "ON" position. When the carriage reaches a tab with a projection in the control position 1, the Punch On micro switch (carriage operated) will close energizing the K3 Punch Control relay. When the K3 relay picks up, a holding

circuit is completed through the normally closed Punch Off micro switch, through the K3 - 1 and 2 contacts to the K3 coil. The K3 - 11 and 12 contacts, when closed, will put a negative D.C. potential on the stationary strap of the selector common contact (SCC). Therefore, SCC Operation (caused by keylever operation) will complete cir-

cuits to the punch magnets and punch clutch magnets. When the carriage reaches a tab stop with a projection in control position 2, the Punch Off micro switch (carriage operated) will open, breaking the holding circuit to the K3 Punch Control relay. The K3 - 11 and 12 contact will open breaking the circuit to the punch magnets and clutch magnet, preventing punch operation.

A Punch All switch, located on the control panel, may be used to by-pass the carriage operated micro switches so that all information typed will be recorded in the tape regardless of carriage position. The Punch All switch has no function unless the Punch On switch (on control panel is also depressed.)

AUTOMATIC LINE FEED OPERATION

In communications equipment, the line feed (platen indexing) is not incidental to carriage return operation as is the case on the Flexowriter. Therefore, it is necessary to automatically punch a line feed code (2) after a carriage return code (4) when making a communication tape on a Flexowriter.

To punch the line feed code automatically after a carriage return code, an additional contact is operated by the carriage return selector slide. This contact is shown as SC7 in figure 5-13 and is operated by the carriage return selector slide only (SC7 operation is in addition to the

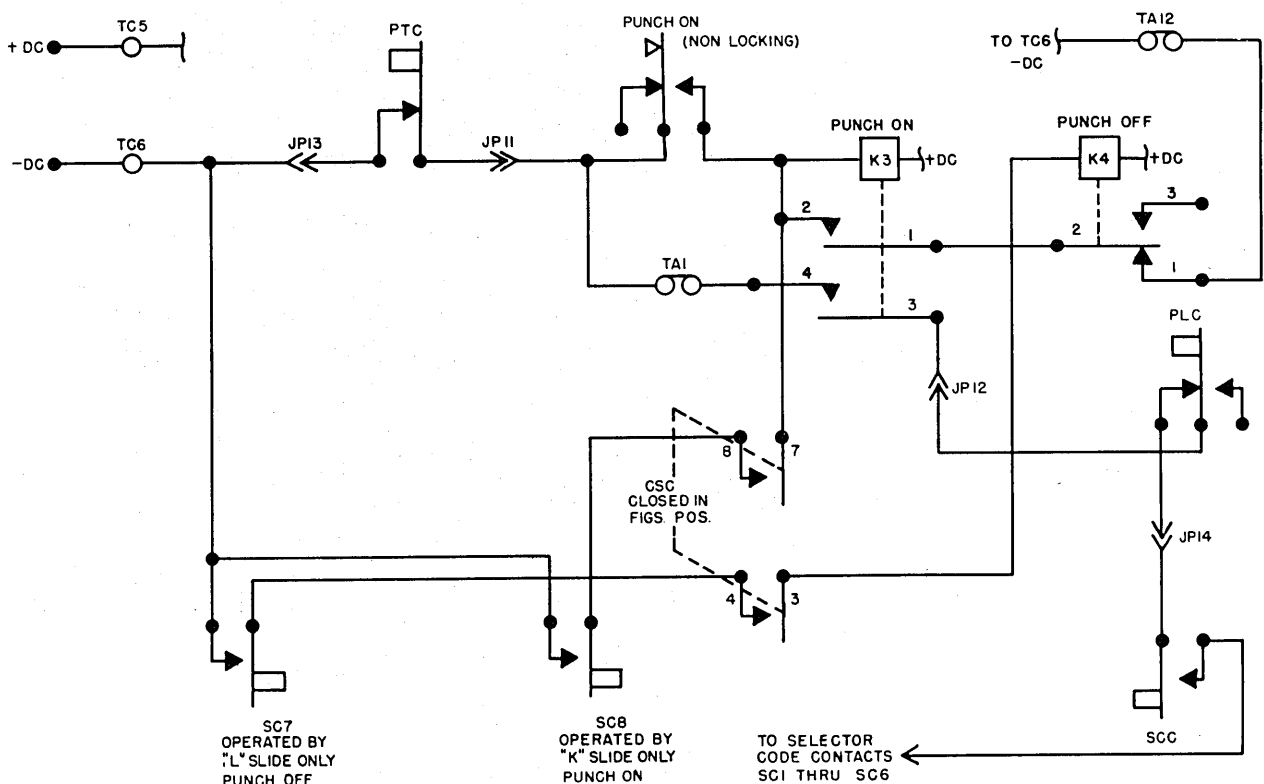


Figure 5-11 Keyboard Control of Punch

INSTRUCTION REFERENCE

Date: October 26, 1954
 Reference: FC-Flexowriter - Alcoa
 Subject: Schematic Wiring Diagram - 1268-137
 Purpose: To eliminate field Service problems.
 Information:

The following explanations on the circuits involved on subject machines will enable you to eliminate these field problems.

1. Automatic Line Feed

- a. The circuit explanation for automatic line feed code after carriage return code is explained in detail in the service manual in Part I, Section 5, page 5-15.
- b. The adjustment of the selector code contacts are the same as a standard machine with the exception of the SC7 & SCC contacts. It is important to have the SC7 contact close after the SC1 through SC6 code contacts, but before the SCC contact closes.

SC1 through SC6 - .020" approx.
 SC7 .025" approx.
 SCC .030" approx.

NOTE: If the selector contacts are not adjusted as above, the following troubles could occur:

TROUBLE	REASON
Punching 24 code after 4 code instead of 2 code.	SC7 closing too soon.
Feed hole instead of 2 code.	SC7 not closing before SCC

2. Tabulation Over Character G

- a. The operation of tabulation over character G is explained in detail in the service manual in Part I, Section 5, page 5-19 (Model FC Tab Mechanism).
- b. The case shift contact referred to in the service manual is contact straps 1 & 2, on schematic 1268-137. The adjustment of this contact should be as follows:

In letters case position, should have a gap of .020".
 In figures case position, the contacts should be made with an appreciable movement of the stationary strap (approx. .005").

NOTE: If the CSC 1 & 2 contact is not adjusted properly the following troubles could occur:

TROUBLE	REASON
Machine stops after reading 245 (Upper Case)	Tab operation did not take place. CSC 1 & 2 probably did not close soon enough.

3. Stop Code - Non Reproducing

- a. The stop code in this machine is 35 (figures position). When this code is read by the reader and the shift basket is in figures position, the holding circuit through CSC 7 & 8 and RC 3 & 5 to the RCR (K8) relay is broken.

An additional case shift contact (3 & 4) is used in series with a normally open RCC contact to complete a circuit to the No. 7 translator magnet (LT7) when the basket is in figures position. Therefore, when the reader senses a 35 code when the basket is in figures position, the H keylever will not operate due to the No. 7 permutation bar coding (there is only one projection on this bar).

- b. The case shift contacts 3 & 4 should be adjusted to open as soon as possible when shifting from figures to letters position. The contacts should make with a maximum follow of .005" when shifting from letters to figures position.

NOTE: If CSC 3 & 4 contact is not adjusted properly the following troubles could occur:

TROUBLE	REASON
Stop Code reproducing	CSC 3 & 4 not closing soon enough.
Char. H not printing	CSC 3 & 4 not opening soon enough.

The case shift contacts 7 & 8 should be adjusted for not more than .020" gap in figures position. Also, the CSC operating cam should be adjusted for the quickest closing time (of CSC 7 & 8) as possible. (Note - if an adjustment of the CSC operating cam is made it will be necessary to recheck all other CSC adjustments.)

NOTE: If CSC 7 & 8 contact is not adjusted properly the following troubles could occur:

TROUBLE	REASON
Stop after printing Char. H	CSC 7 & 8 not closing soon enough.
Machine does not stop after reading 35 code.	CSC 7 & 8 not opening soon enough.

Special Features

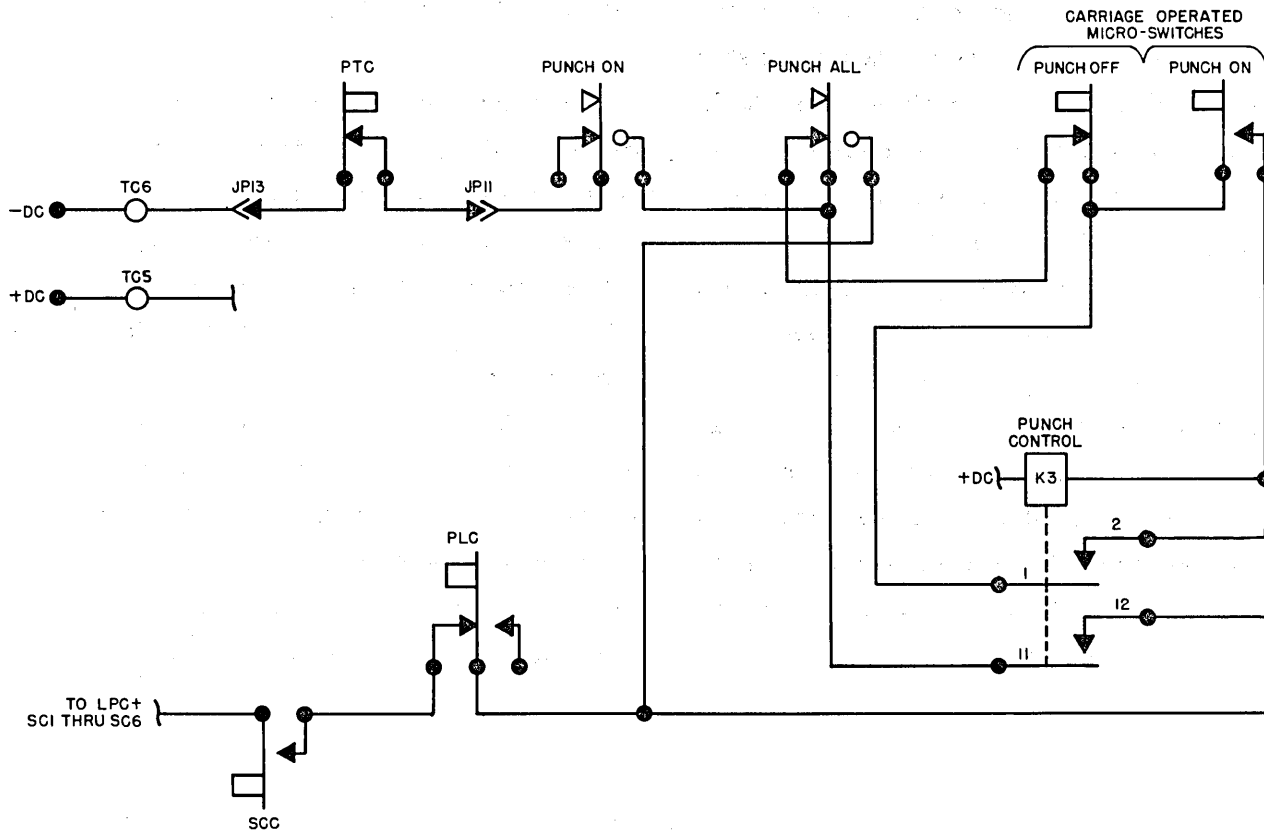


Figure 5-12 Carriage Position Control of Punch

SC4 and SCC contact operation for energizing the number four punch magnet and the clutch magnet.)

Figure 5-13 shows an example circuit arrangement for automatic line feed operation. Using this circuit as a reference, when the carriage return keylever is depressed, the carriage return code (4) and line feed code (2) are punched in the tape in the following sequence: The carriage return cam operates causing selector slide and consequently SCC, SC4 and SC7 contacts to close. The number four punch magnet and the clutch magnet are energized causing the punch to rotate. Also, due to the SC7 contact closing, a D.C. circuit is completed to the line feed relay No. 2 (K4). The rotation of the punch will cause the transferring

of the PLC contact, which will complete a D.C. circuit to the anti-repeat relay, (K2). K2 - 17 and 18 contact, when closed, will complete a circuit to the line feed relay No. 1 (K3).

NOTE: The K4 relay is still energized. Both K3 and K4 are slow drop-out relays. The relays are slugged and remain in the operated position for approximately 30 milliseconds after the coil circuit is broken.

The Punch completes its cycle punching the 4 code and feeding the tape. The PLC contact returns to normal and the anti-repeat relay (K2) drops-out. K2 - 5 and 6 contact makes, completing a circuit to the No. 2 punch magnet and the clutch magnet as follows: from -DC, TC6, JP13, PTC, JP11, Punch On N/O contact,

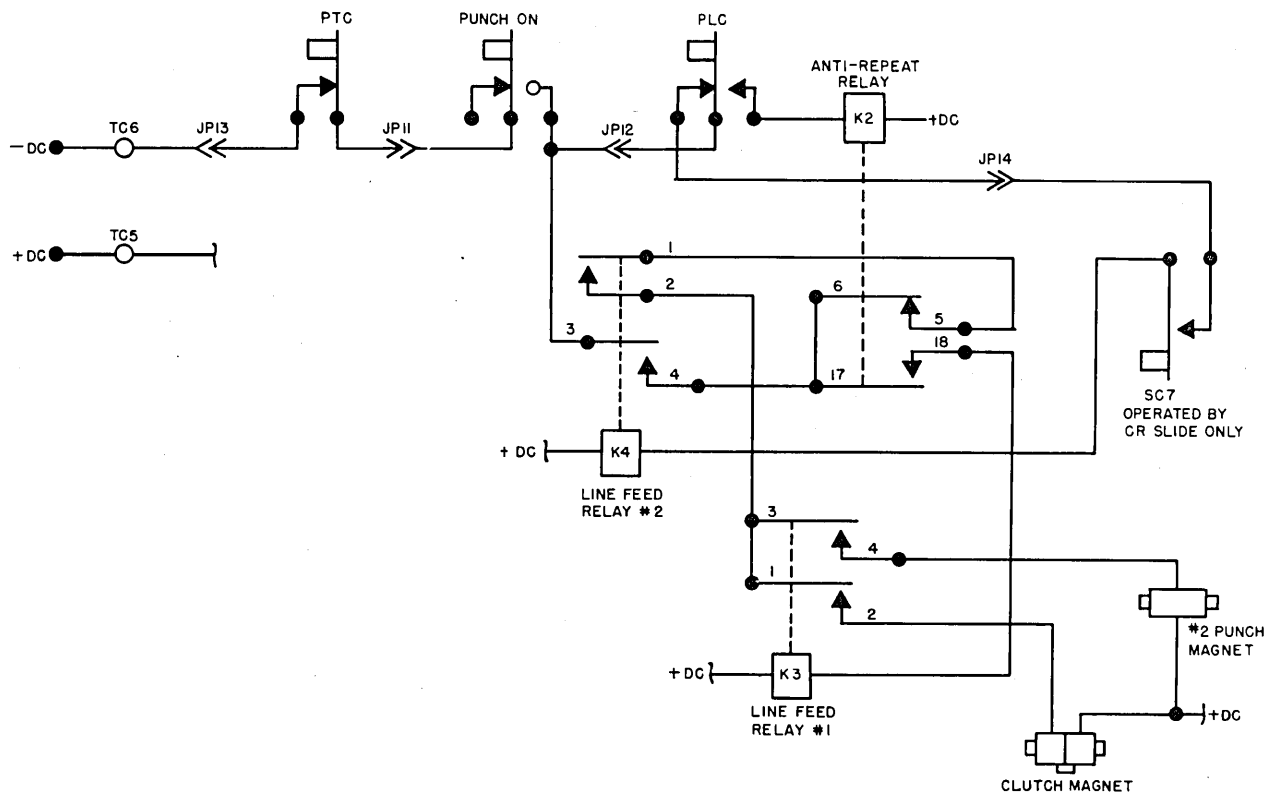


Figure 5-13 Automatic Line Feed Circuit

K4 - 3 and 4, K2 - 6 and 5, K4 - 1 and 2, K3 - 3 and 4 - 1 and 2, No. 2 punch magnet and punch clutch magnet, TC5, to +DC. Therefore, the punch makes another cycle of operation, punching the 2 code in the tape.

SHIFT ON SPACE

This is a special arrangement of the space keylever, letters keylever (lower case), letters cam and letters selector slide. The regular letters shift cam furnishes the power for shifting but does not operate a code selector slide (see figure 5-14). The regular letters shift cam is controlled by a dummy keylever which in turn is controlled by either the space bar or a second letters

shift keylever (with keybutton). Thus, when the space bar is operated the dummy letters keylever is also operated through the pivoting of the shift equalizing rod. This causes the regular space cam to operate and space the carriage plus select the space code, and in addition operates the regular letters shift cam to shift the basket without selecting the letters code.

The letters shift keylever (with keybutton) is arranged to operate both shift cams causing shifting to letters position and selecting the letters shift code.

The results of this feature correspond to an optional feature on communications equipment. It insures that the machines will be shifted to lower case (letters) upon operation of the space

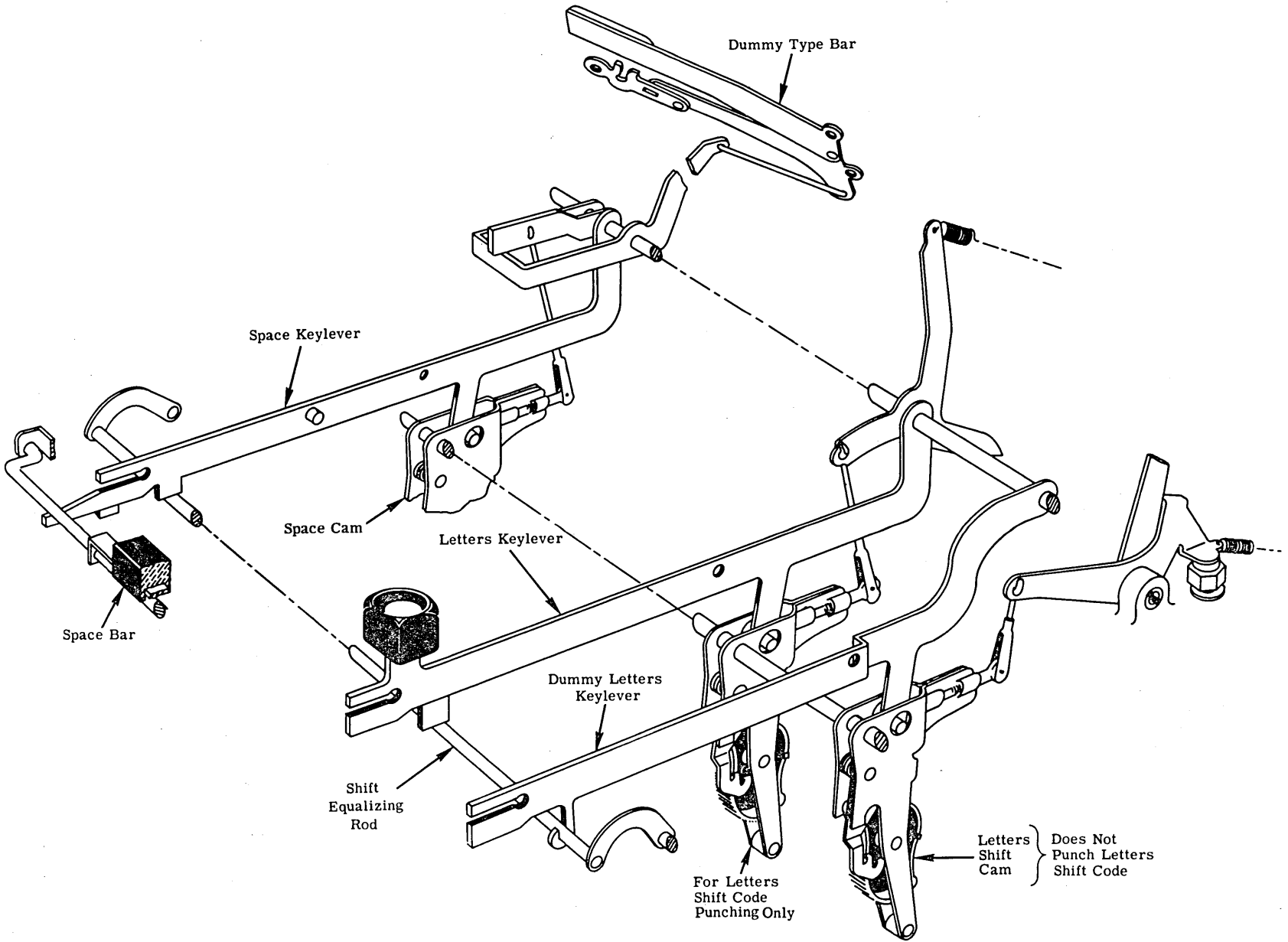


Figure 5-14 Shift On Space

bar because it is seldom that two figures will be separated by a space.

MODEL FC TAB MECHANISM

Machines using a five unit code system have no code combination available for operating the tab mechanism. Therefore, it is necessary to use one of the character codes such as the letter "G" in the figures shift position to actuate the tab mechanism. This is accomplished by adding an extra selector bail operated only by the "G" position cam, and the contacts controlled by this extra bail is in series with a case shift contact (controlled by the shift equalizing shaft movement). The shift contact is closed when the basket is in figures (upper case) position, thus, when both contacts are closed, a circuit is completed to the number six translator magnet and through a blocking rectifier to the translator clutch magnet. The number six permutation bar is released and the translator shaft rotates causing the regular tab mechanism to operate. The key-lever used to operate the tab cam is not provided with a key button and is not intended to be operated manually.

The number six permutation bar used has only one projection which blocks out the tab position seeker at all times except when the bar moves on a figures "G" operation.

This tab operation will occur either in response to manual operation of the "G" keylever in figures position or in response to reading a "G" code by the tape reader when the machine is in figures position.

COMBINATION CODE KEYBOARD

This is a special arrangement of keys in four banks which enables either a five-unit or a six-unit code tape to be punched. It includes a communications style, three bank keyboard with all these keys selecting a five-unit code. An additional bank of keys in keylever row number one all select codes involving the six-unit. The key buttons on this first row can be different in color, and carry numerals in letters position with extra symbols and signs in the figures position. The first row also includes tab and back space keylevers. A shield is provided for covering these first-row keylevers when a five-unit code is being punched.

This combination keyboard is used were it is occasionally necessary to punch a five-unit communications code, but otherwise the machine can be used with a six-unit code, to provide greater keyboard capacity and faster operation due to the elimination of the shift between letters and figures. It provides for the typing of capital case letters only.

LINE LENGTH INDICATOR

This feature is used wherever lines should not be typed beyond a maximum length. The operation is such that when the light goes on it indicates to the operator that the maximum length of the line is approaching. The light will remain on for seven spaces (seven character spaces on a mono-spacing machine), after which time the light will go off, indicating the maximum length of the line has been reached.

Special Features

The light is mounted above the keyboard (in the middle of the control panel) and is controlled by a carriage operated contact. The length of line is adjustable by the operator in the same manner as the margin stop. The adjustable contact operator is located on a rack behind the margin and tab racks and is set by pressing down on the left end and sliding the operator along the rack.

TAPE PUNCH INDICATOR

This feature can be used whenever it is particularly desirable to warn the operator of the condition of the tape punch.

The light is mounted above the keyboard (providing the Flexowriter is not using a light for some other purpose) and may be wired to light only when the punch is turned on (controlled by the Punch On switch on the control panel), or it may be wired to indicate when the supply of tape is exhausted or has excessive tension (circuit controlled by the PTC contact in the punch).

TAPE FEED HOLE REPUNCHING

This feature is required in certain special applications where it is necessary to reproduce the entire tape including feed holes (that portion of the tape with feed holes only).

To provide for this feature a dummy keylever is used in place of a standard keylever position. This keylever will operate a cam and selector slide only (no type bar operation). The selector slide is coded to close the selector common contact (SCC) only, thus completing a circuit to the punch clutch magnet only.

The translator is arranged so that the seeker for the above mentioned dummy keylever will operate only when none of the permutation bars have been operated. In other words, when a feed hole is "read" by the reader, the reader common contact (RCC) closes, completing a circuit to the translator clutch magnet causing translator shaft rotation. And since no permutation bars were released, the feed hole seeker will operate the dummy keylever (the permutation bar projections in this position are removed). The keylever operation will trip its cam, operate the selector slide, close the SCC contact, energize the punch clutch magnet, start punch shaft rotation, resulting in the feed hole only being punched in the tape.

TAPE TENSION ATTACHMENT

This arrangement is used on a Reproducer where tape is fed out of another punching device (not on the Flexowriter) directly into the reader. Its functional purpose is to stop the Flexowriter reader operation if for some reason the reader has caught up to the supply of punched tape.

The attachment consists of an arm and roller assembly mounted on the outside of a cover. The inside of the cover houses a micro-switch which is controlled by the arm and roller assembly. The complete attachment is located at the rear left side of the machine (in the location normally used by the tape punch). The tape rides over the roller before reaching the reader. Thus, if the tape becomes taut for some reason, the arm will pivot, open the micro-switch and break the circuit to the reader magnet, stopping reader operation.

PART II

FLEXOWRITER MODEL FL

Section 1	.....	Description
Section 2	.....	Writing Machine
Section 3	.....	Code Selector
Section 4	.....	Clutch Mechanism
Section 5	.....	Tape Punch
Section 6	.....	Tape Reader
Section 7	.....	Code Translator
Section 8	.....	Circuit Description

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

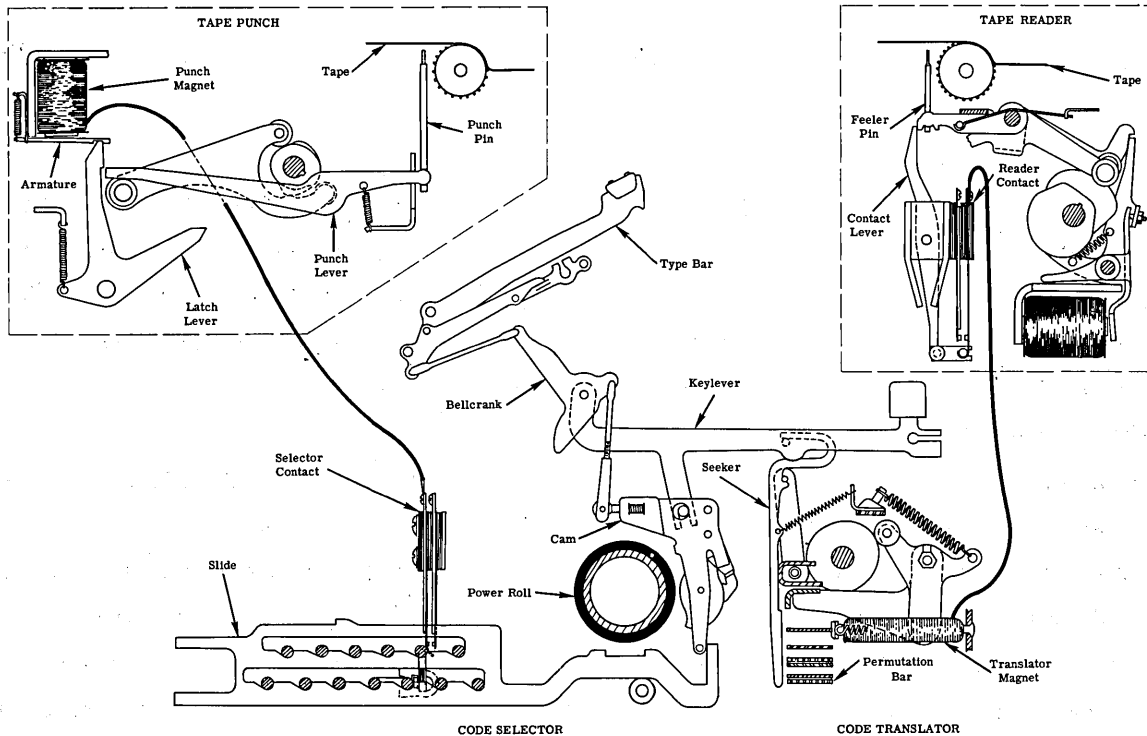


Figure 1-2 Functional Principles

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

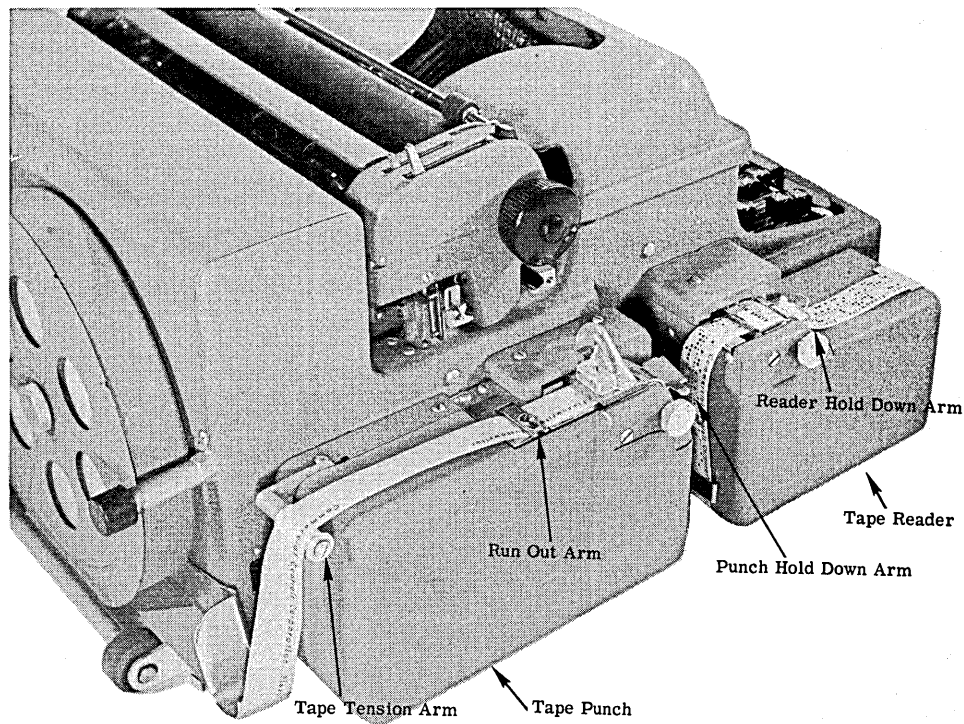


Figure 1-3 Punch and Reader Tape Installation

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

Description

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.

RECORDER-REPRODUCER

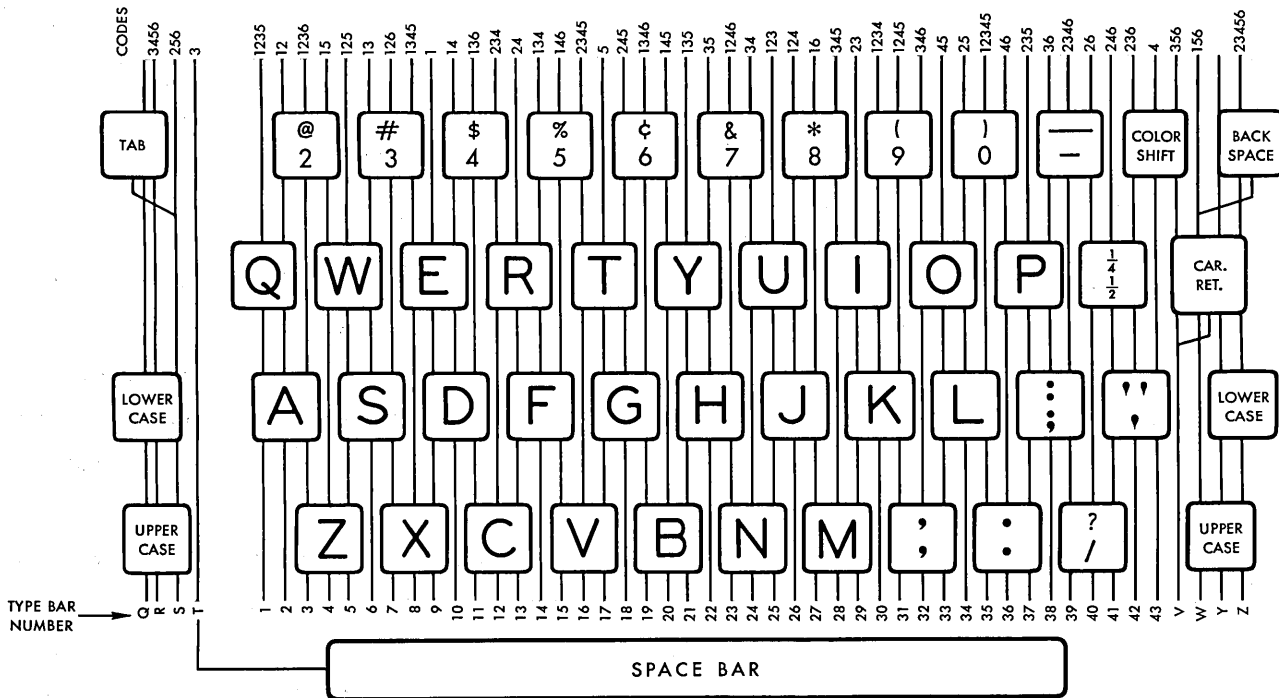


Figure 1-4 Standard Keyboard

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.

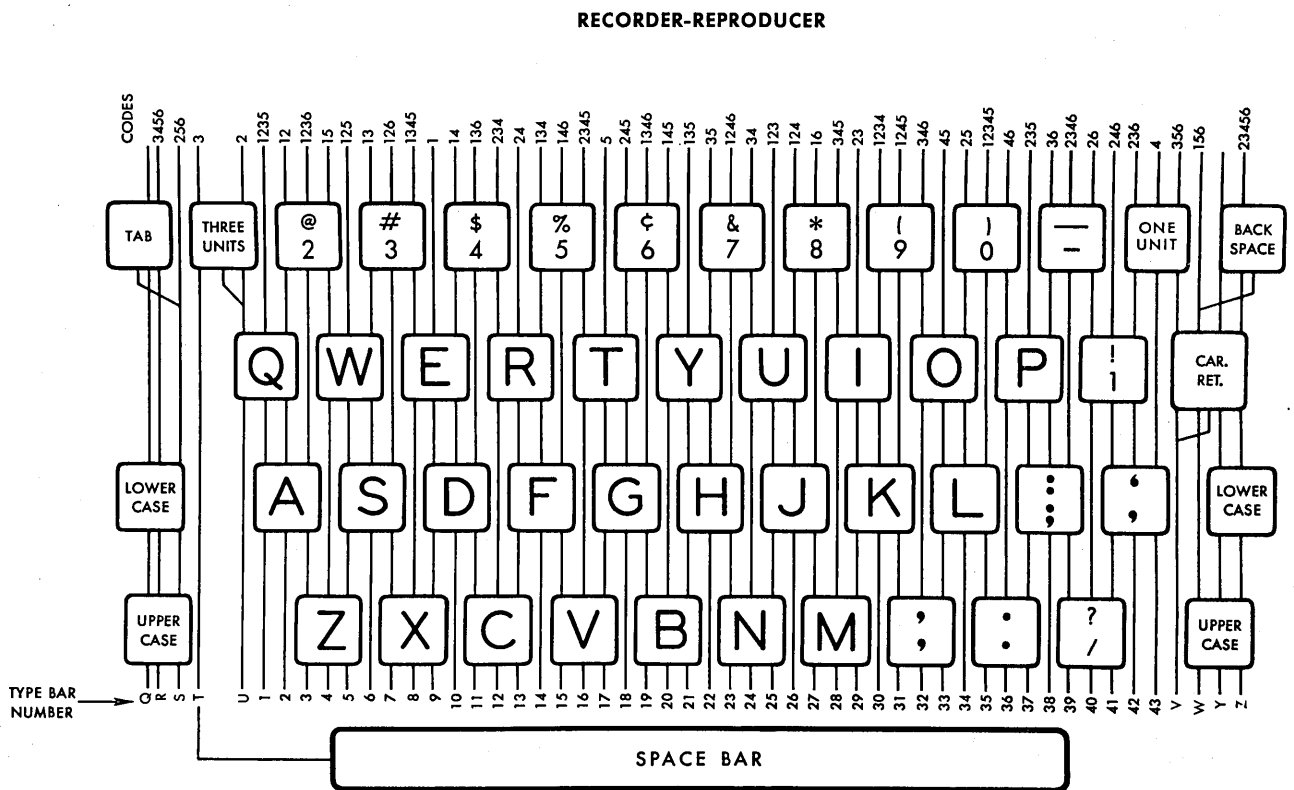


Figure 1-5 President Keyboard

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

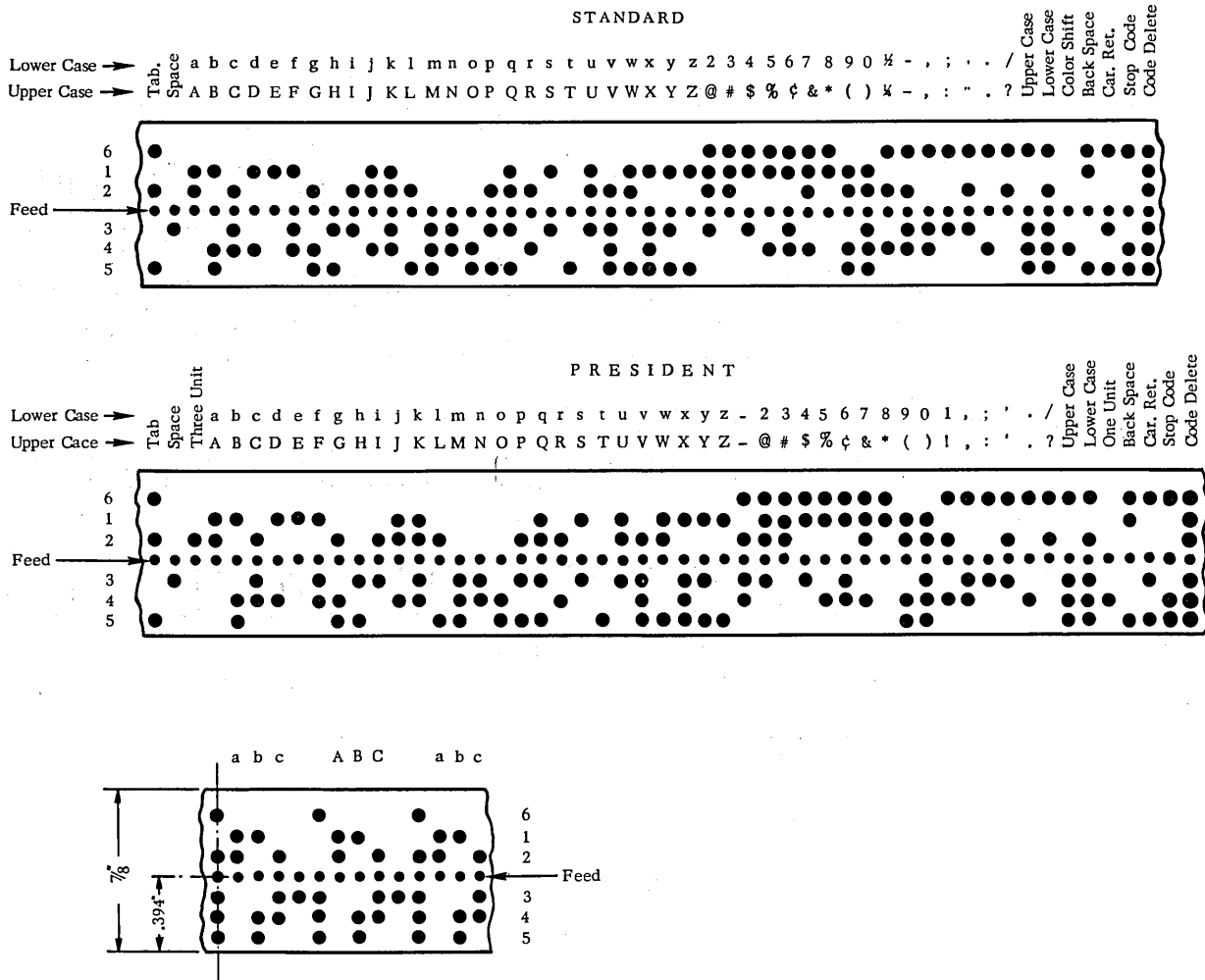


Figure 1-6 Sample Coded Tapes

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.

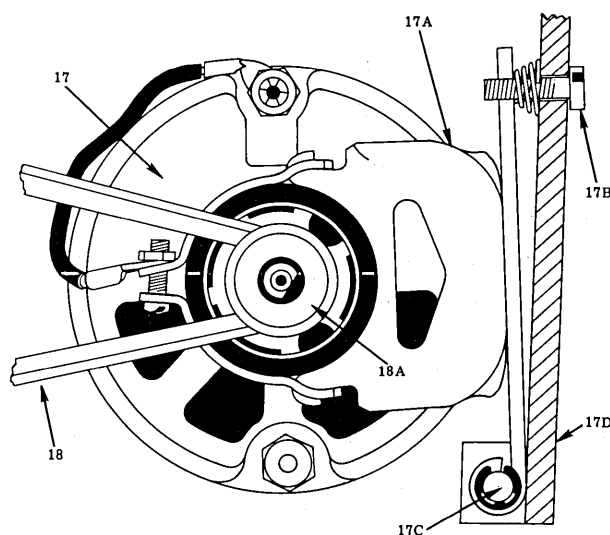


Figure 2-1 Motor Mounting

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.

Writing Machine

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.

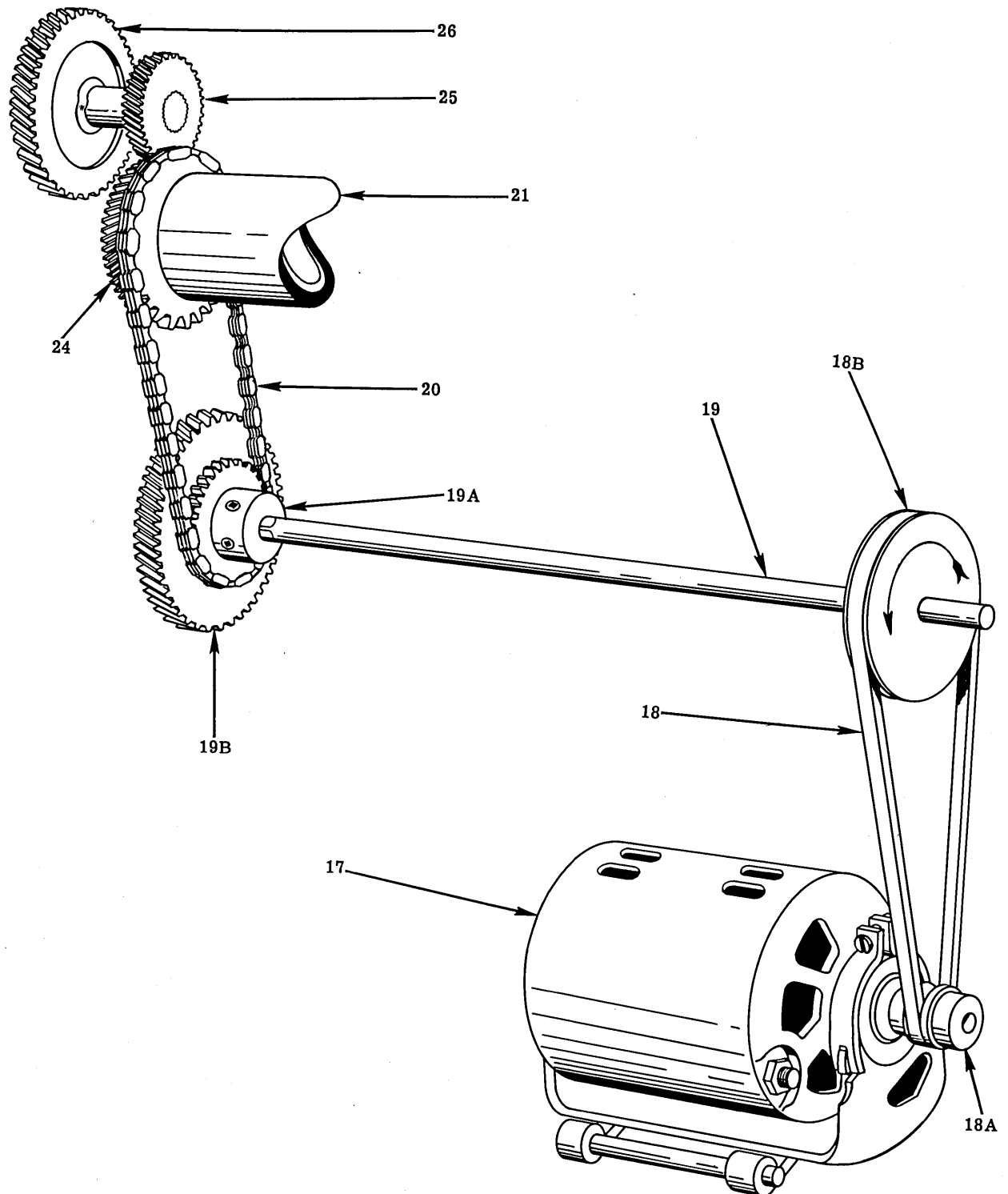
Operation - When the power switch is turned on, the motor (17) revolves at approximately 1750 R.P.M. Power is transmitted through the V-belt (18), riding over motor pulley (18A) and right hand power shaft pulley (18B) to turn the power shaft (19) at a speed of approximately 700 R.P.M. Mounted on the 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).



Writing Machine

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.

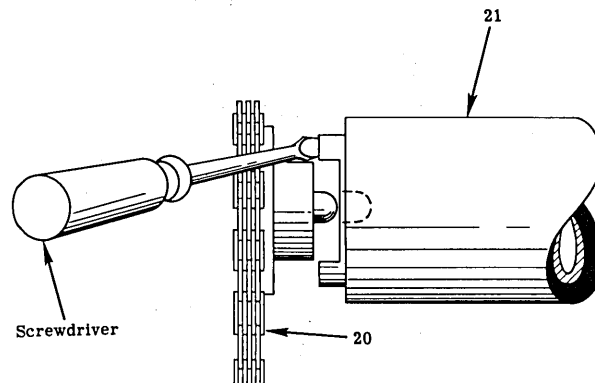


Figure 2-3 Power Roll Removal

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.

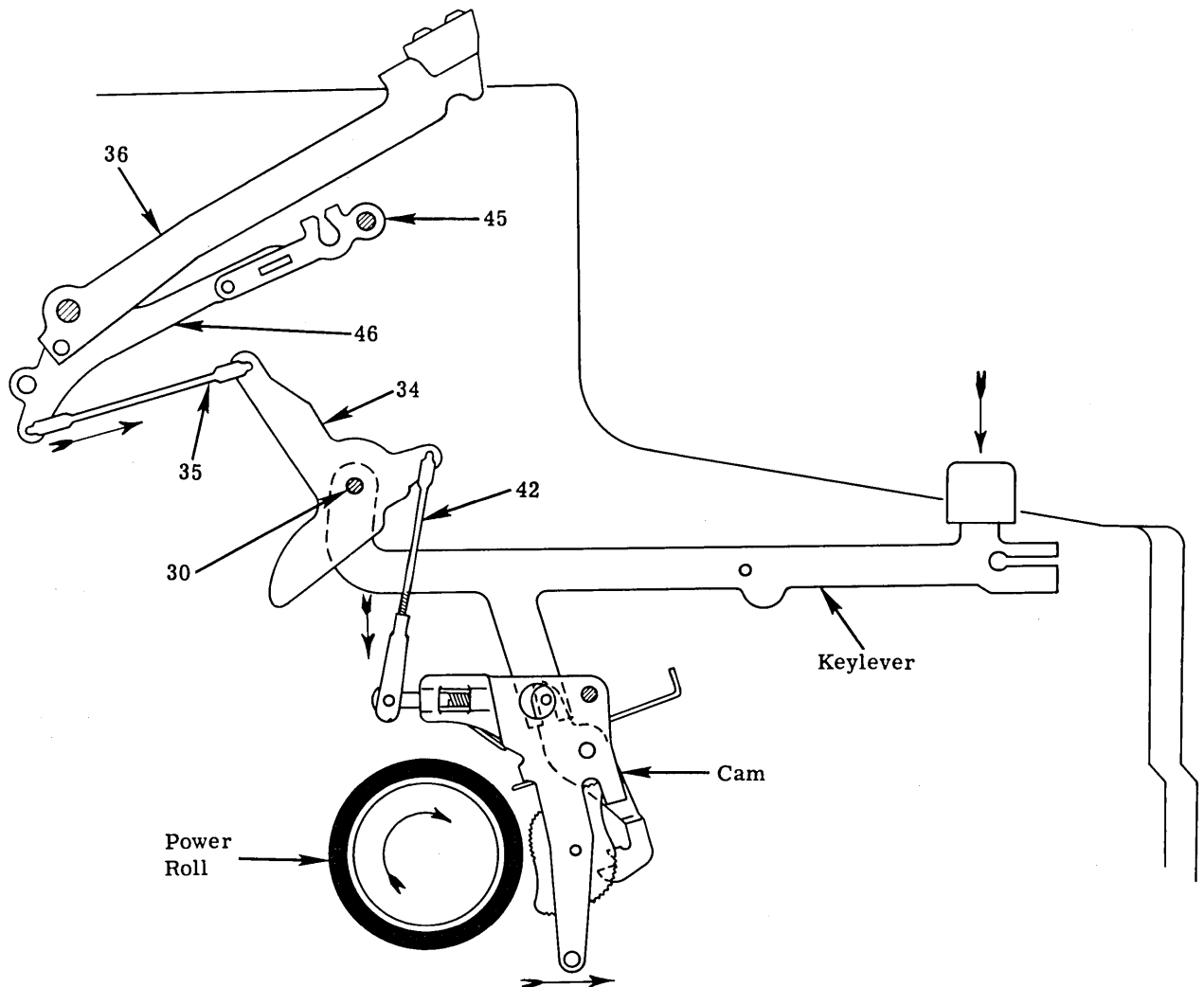


Figure 2-4 Keylever, Cam, Bellcrank and Typebar

Writing Machine

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.

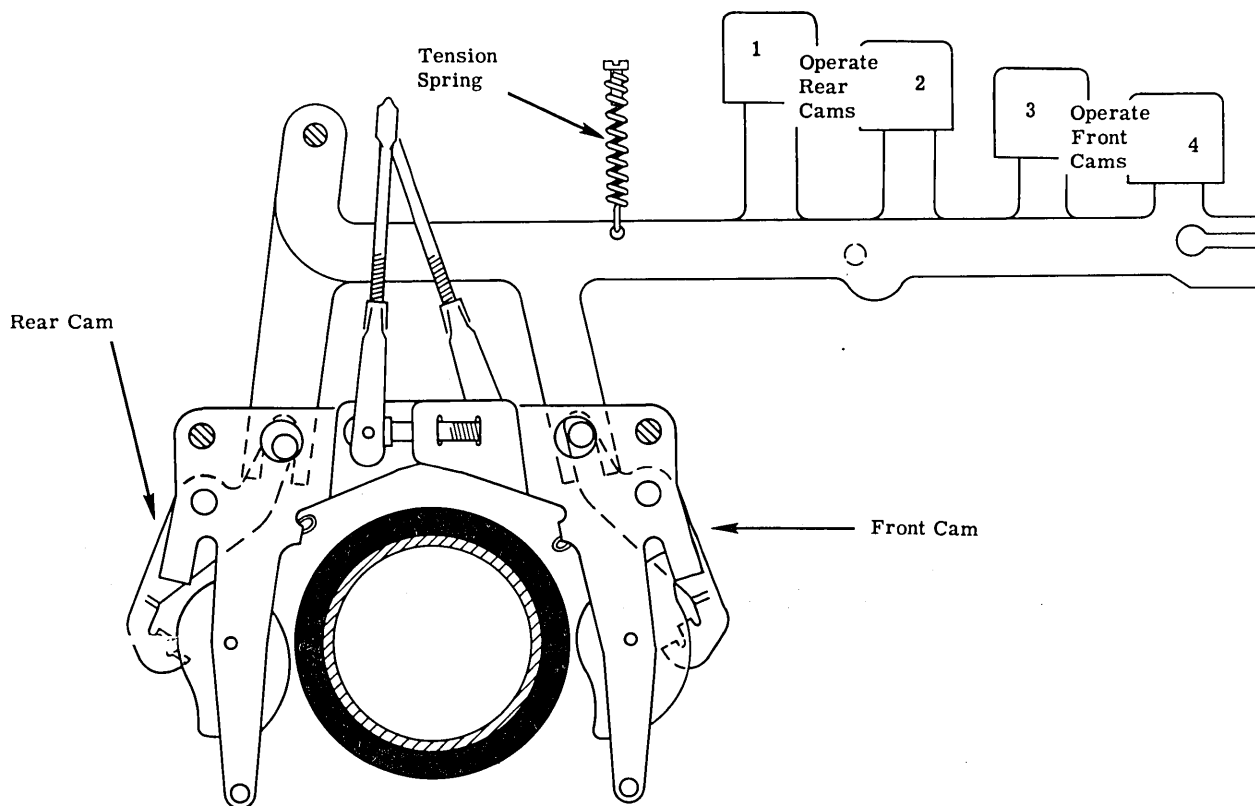


Figure 2-5 Keylever Position

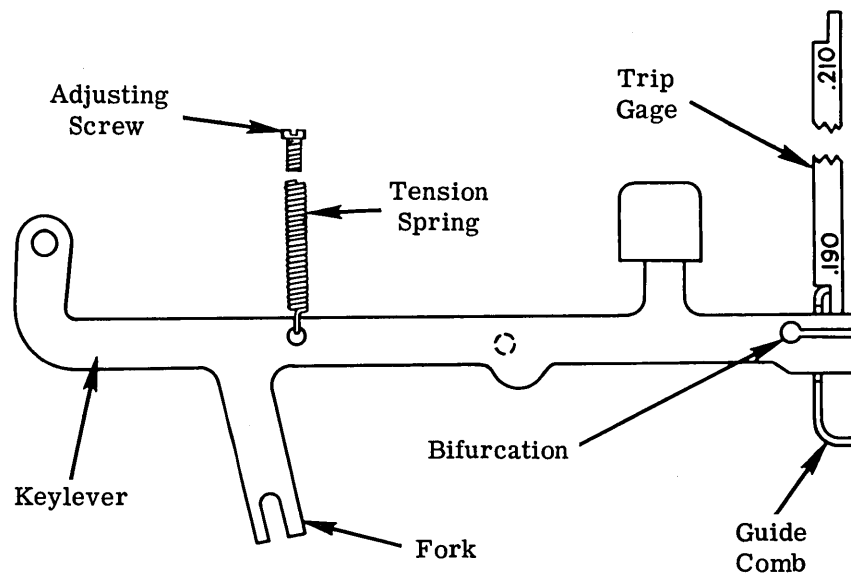


Figure 2-6 Keylever Adjustment

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

Writing Machine

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.

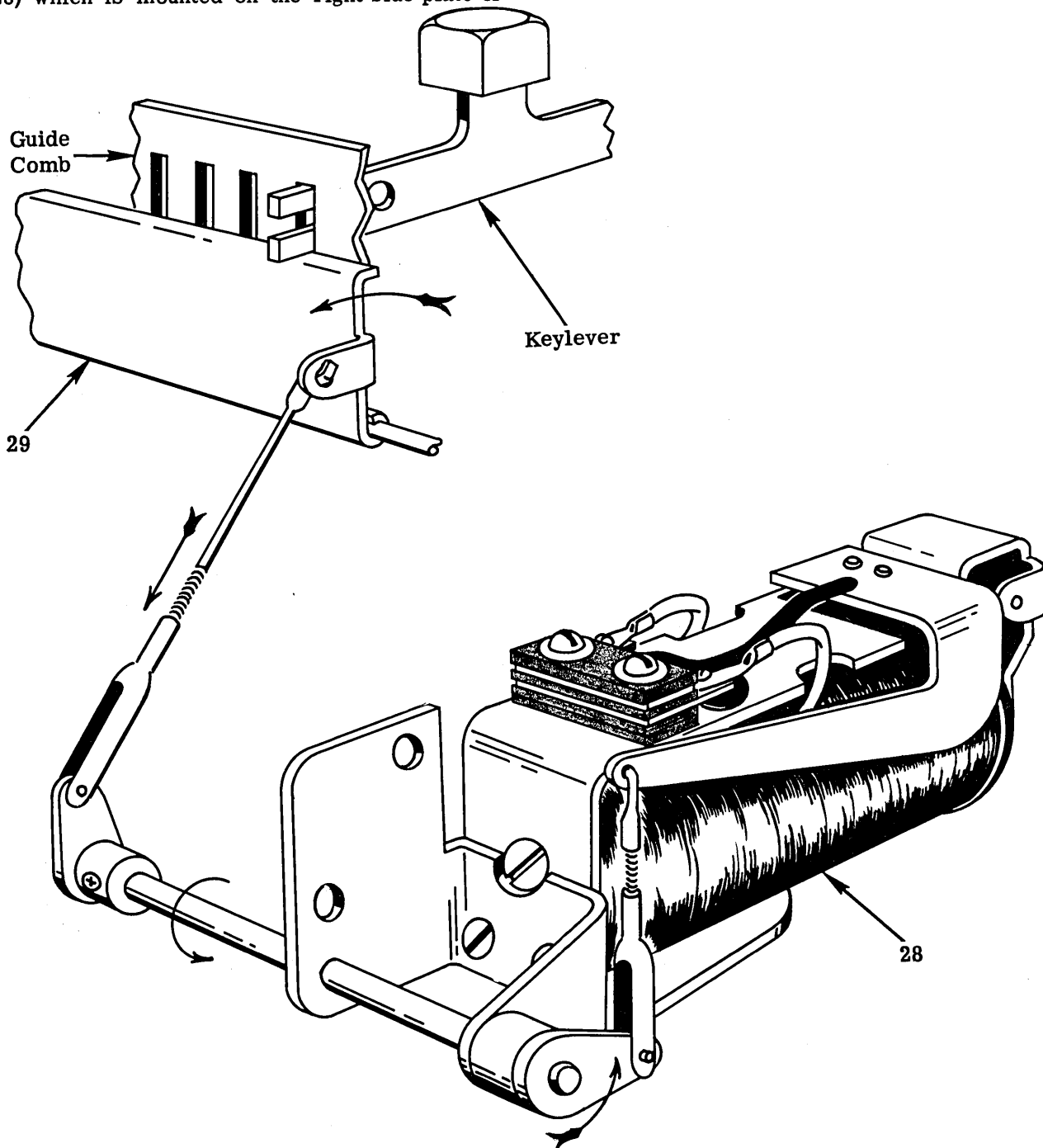


Figure 2-7 Keylever Lock Mechanism

MANUAL ADDENDUM

#21

DATE: July 23, 1959

REFERENCE: To be inserted in Part II, Section 2, between Pages 2-8 and 2-9

SUBJECT: Keylock Contacts for Systems Machines

PURPOSE: To prevent dropping codes after carriage return and tab operation

INFORMATION:

It is possible, when reading out of an Auxiliary Reader, that the Keylock Magnet will not pick fast enough after tab and carriage return operations, and the following code will be dropped.

The new keylock magnet has a set of contacts wired in series with this reader clutch circuit. These contacts are made when the keylock magnet is energized and break on carriage return and tab operation. This will insure the Keylock Bail being clear of the keylevers before another code is read.

Adjustments:

1. The keylock magnet armature gap should be .023; this adjustment is obtained by forming Lip 1, Fig. 1.

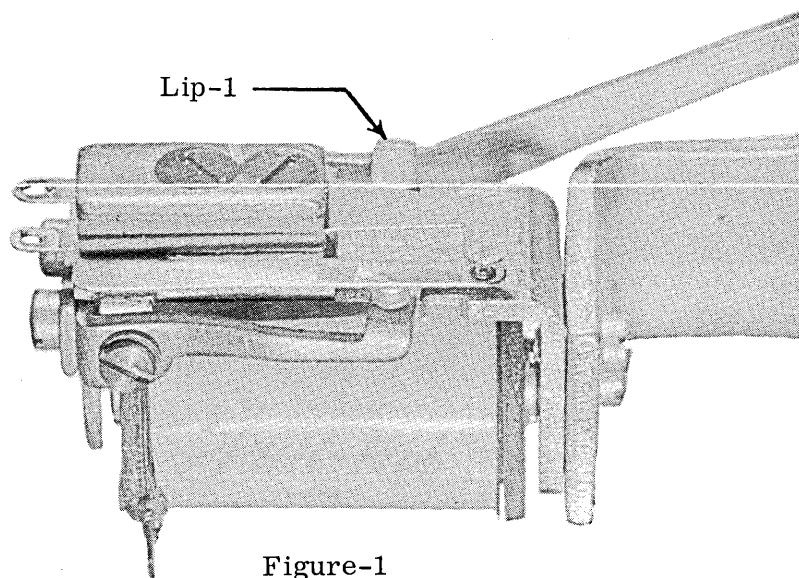


Figure-1

2. With the linkage disconnected, adjust the spring on the keylock bail to hold the bail against the guide comb with a minimum amount of tension.
3. With keylock magnet de-energized, adjust the clevis on the link so the top of the elongated slot in the clevis just clears the keylock shaft and does not pull the keylock bail away from the guide comb. This will give approximately .050 to .060 clearance between the keylock bail and the longest keylever when the magnet is energized.
4. With the keylock magnet energized, the keylock magnet stationary contact should have .010 to .015 follow.

Installation:

For the correct wiring of Keylock Magnet, Part 1047096, refer to the following wiring diagram:

SFD - #1045583 R2

SPS - #1046285 R1

SPD - #1046290 R1

Distribution: 38, 38A, 38B

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, per-

forms 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).

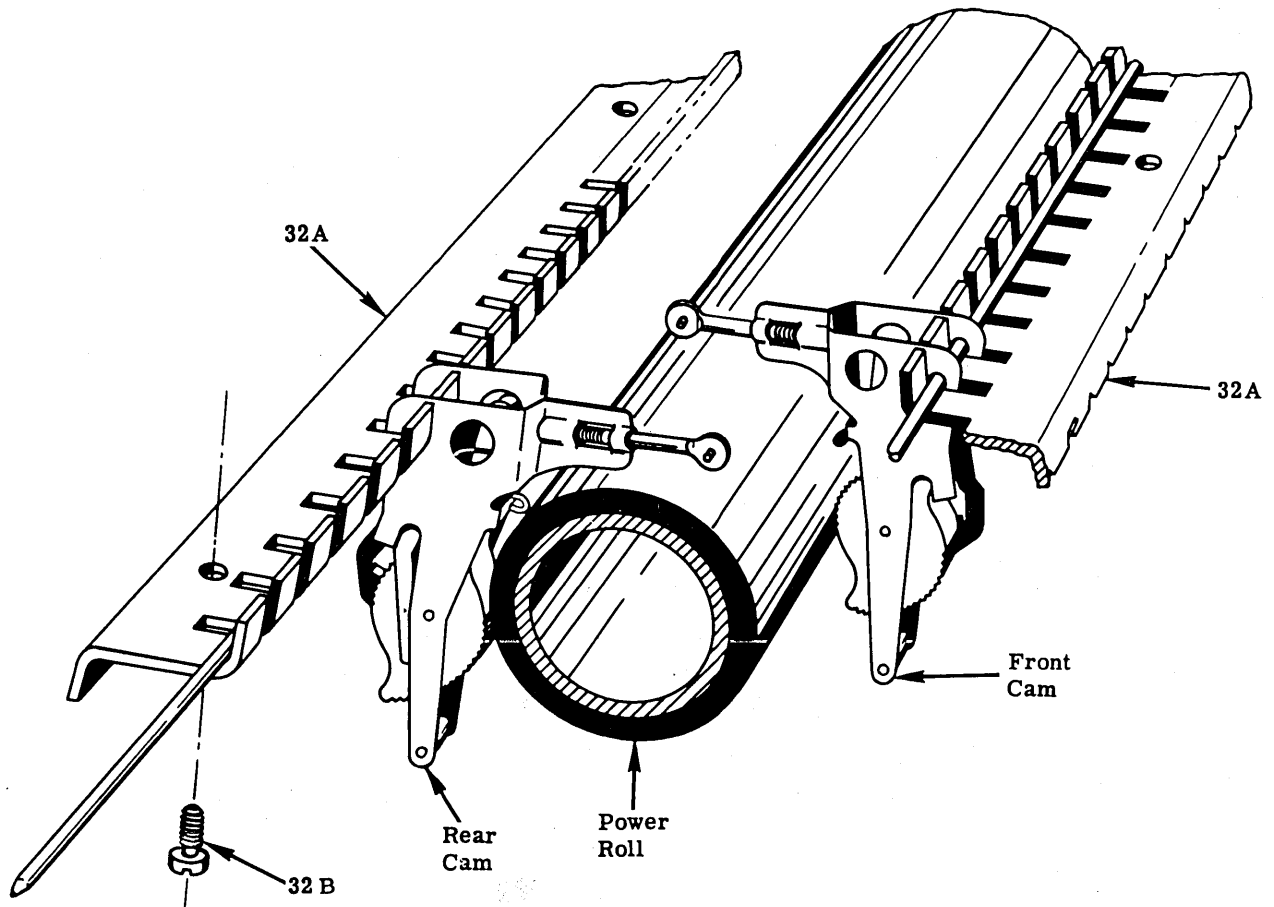


Figure 2-8 Front and Rear Cams

Writing Machine

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.

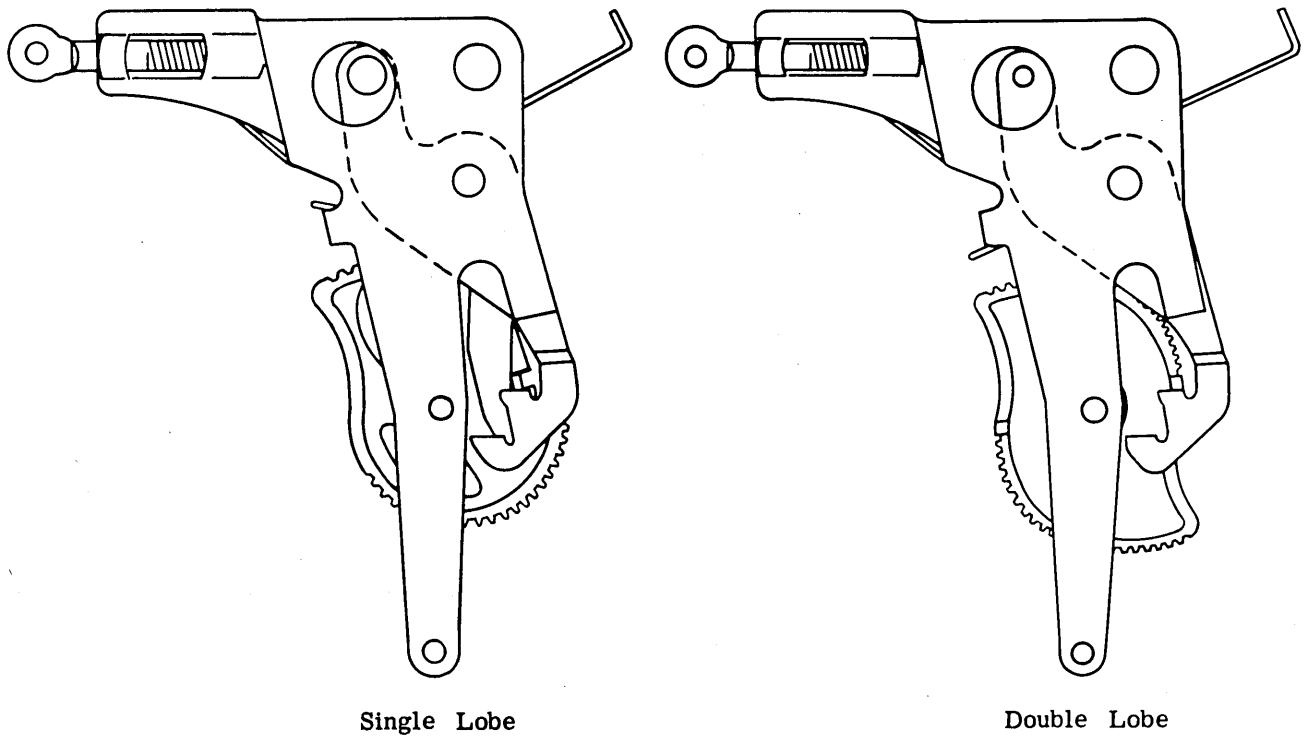


Figure 2-9 Single and Double Lobe Cams

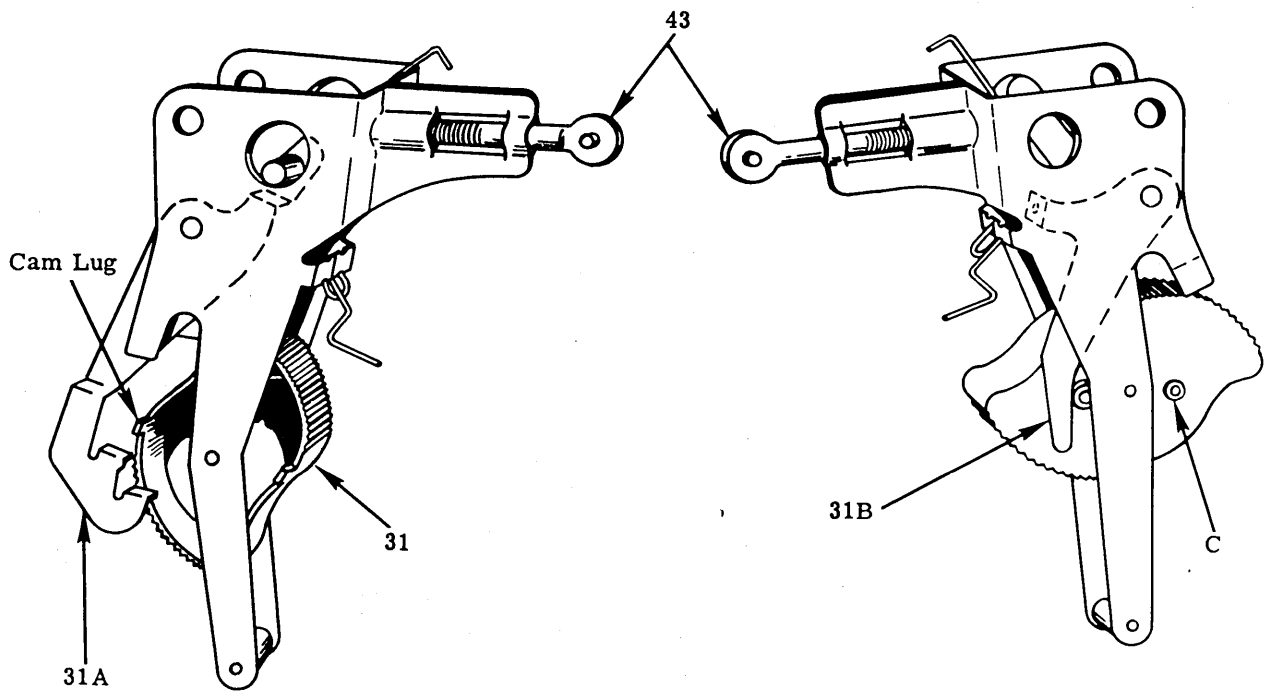


Figure 2-10 Cam Parts

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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.

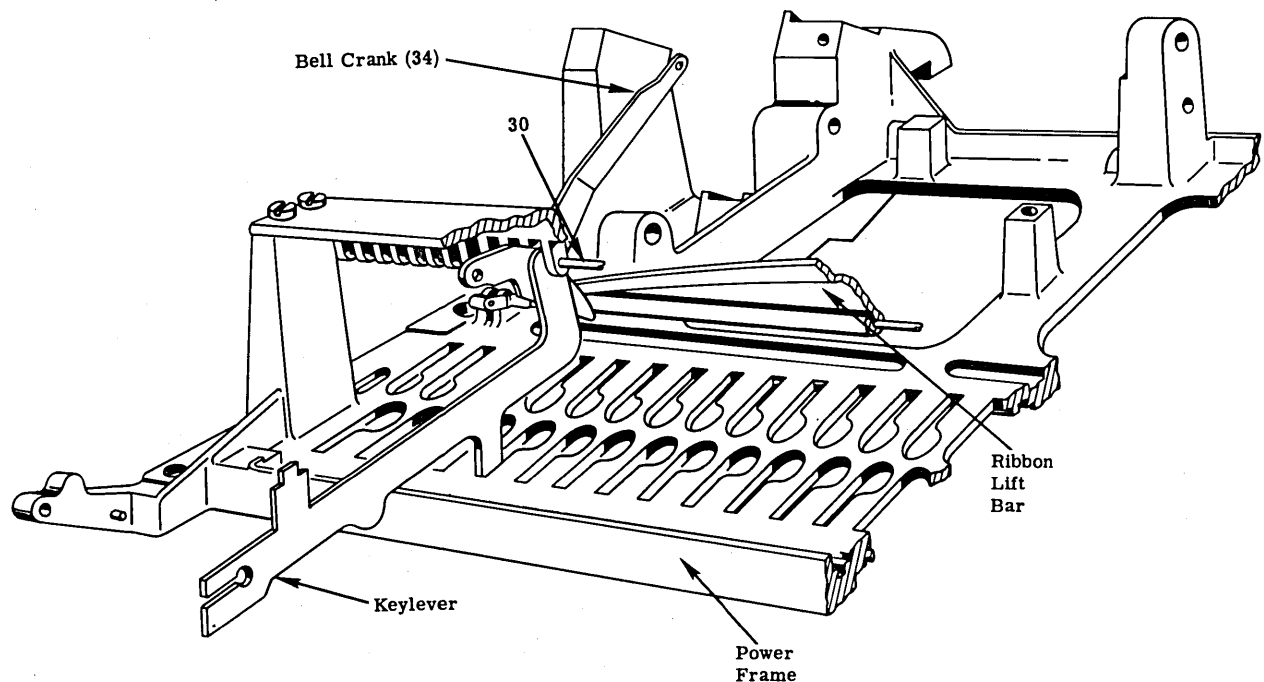


Figure 2-11 Bell Crank Location

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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.

crum wire (38) which provides a pivot point for them. The segment is slotted, which provides a lower guiding surface for each type bar.

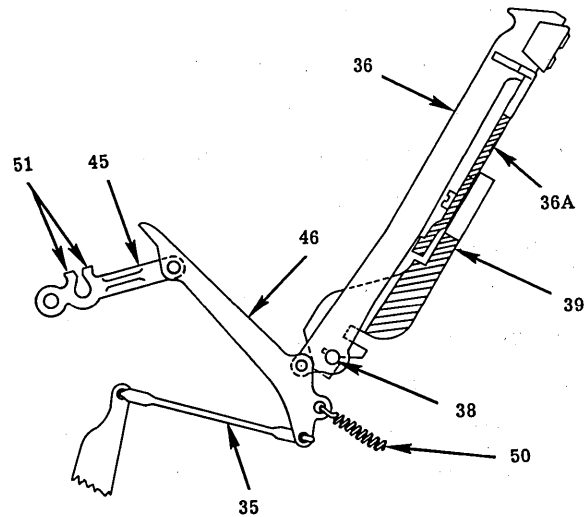


Figure 2-12 Type Bar in Guide

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 ful-

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.

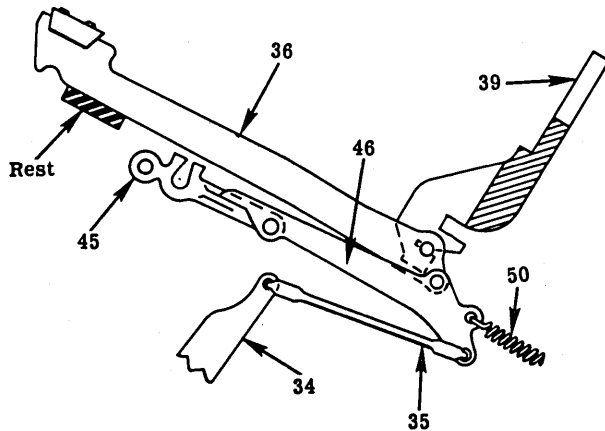


Figure 2-13 Type Bar in Rest Position

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 escape 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.

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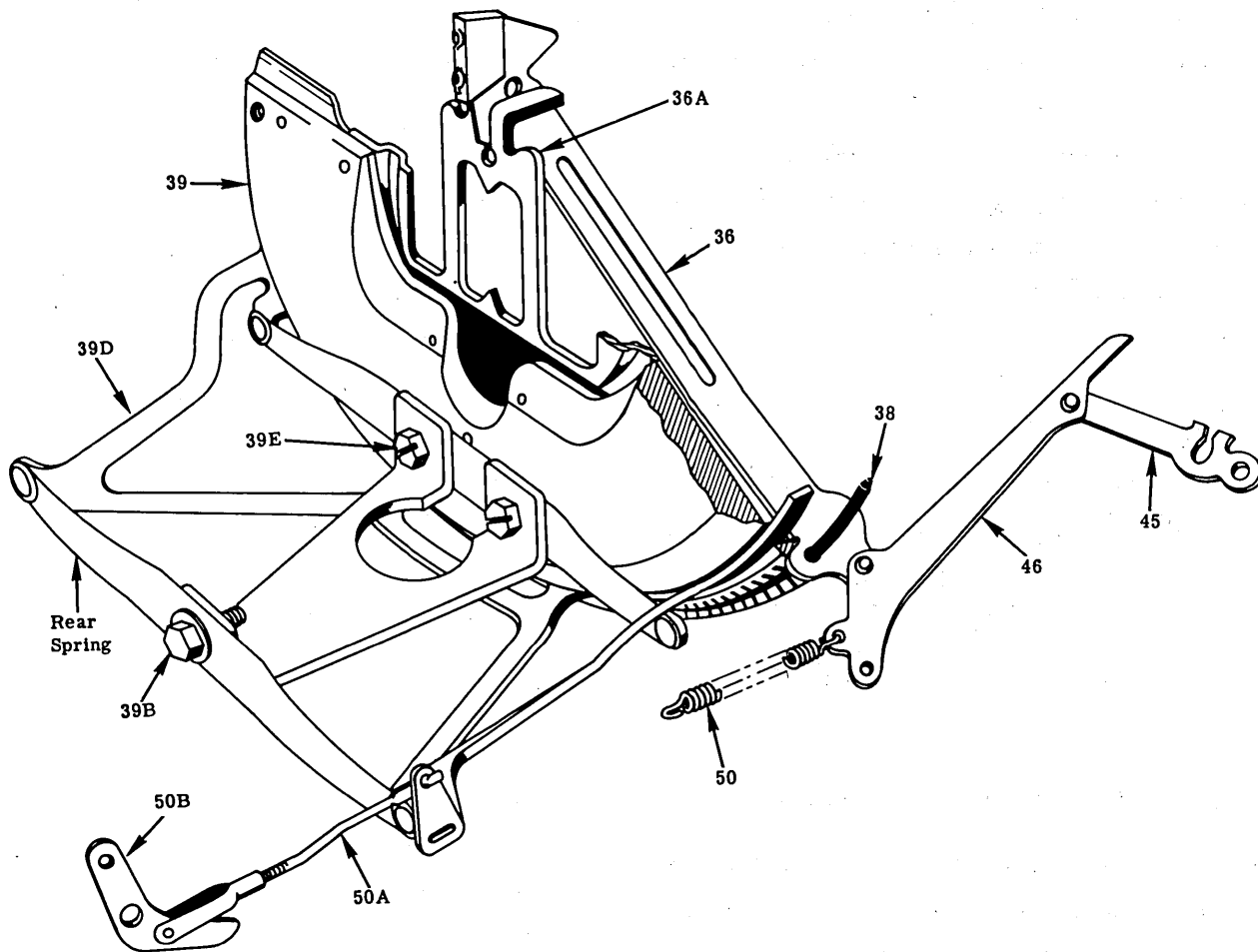


Figure 2-14 Universal Bar Mechanism

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.

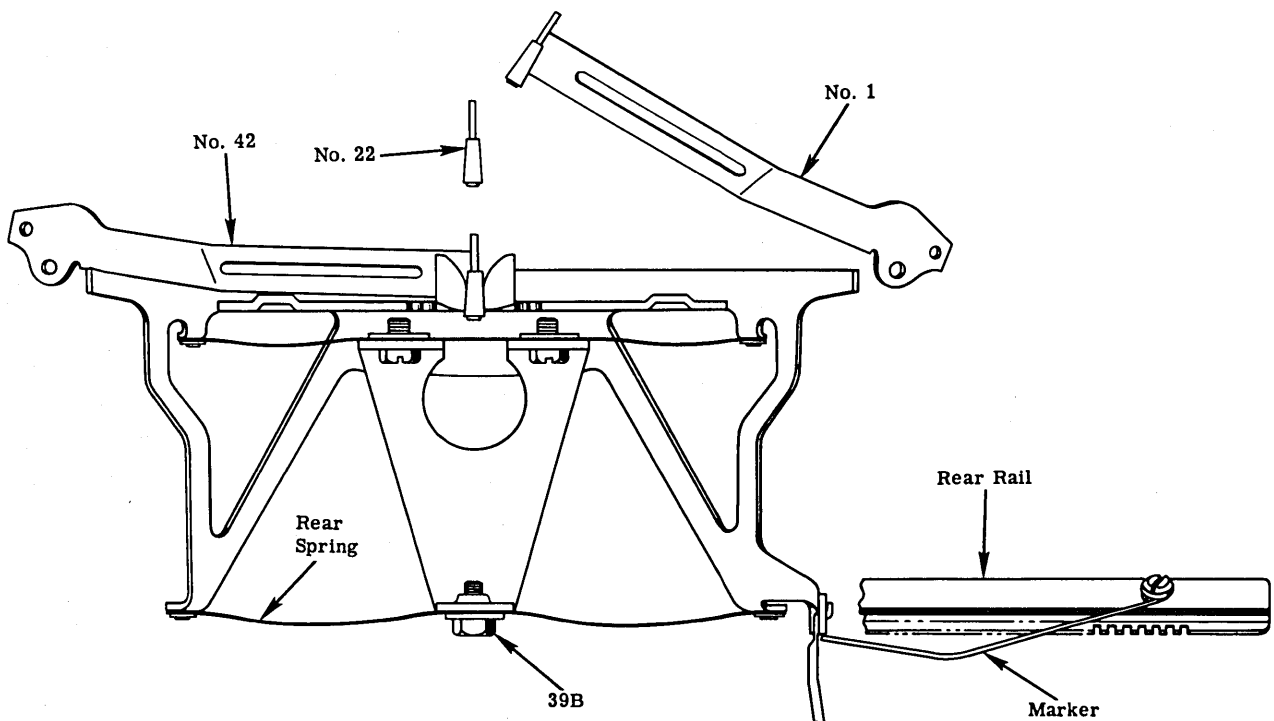


Figure 2-15 Universal Bar Adjustment

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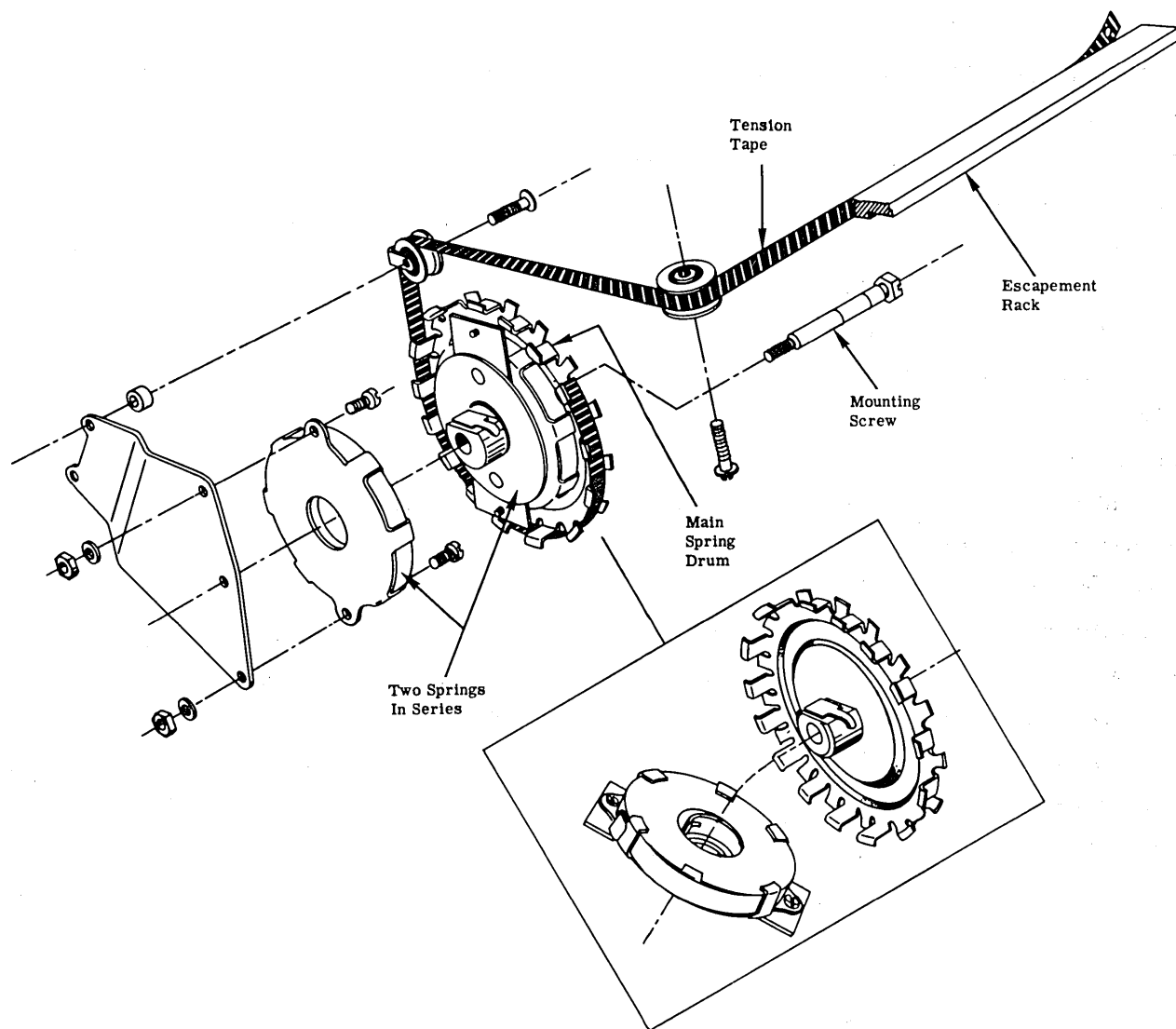


Figure 2-16 Main Spring and Holder

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.

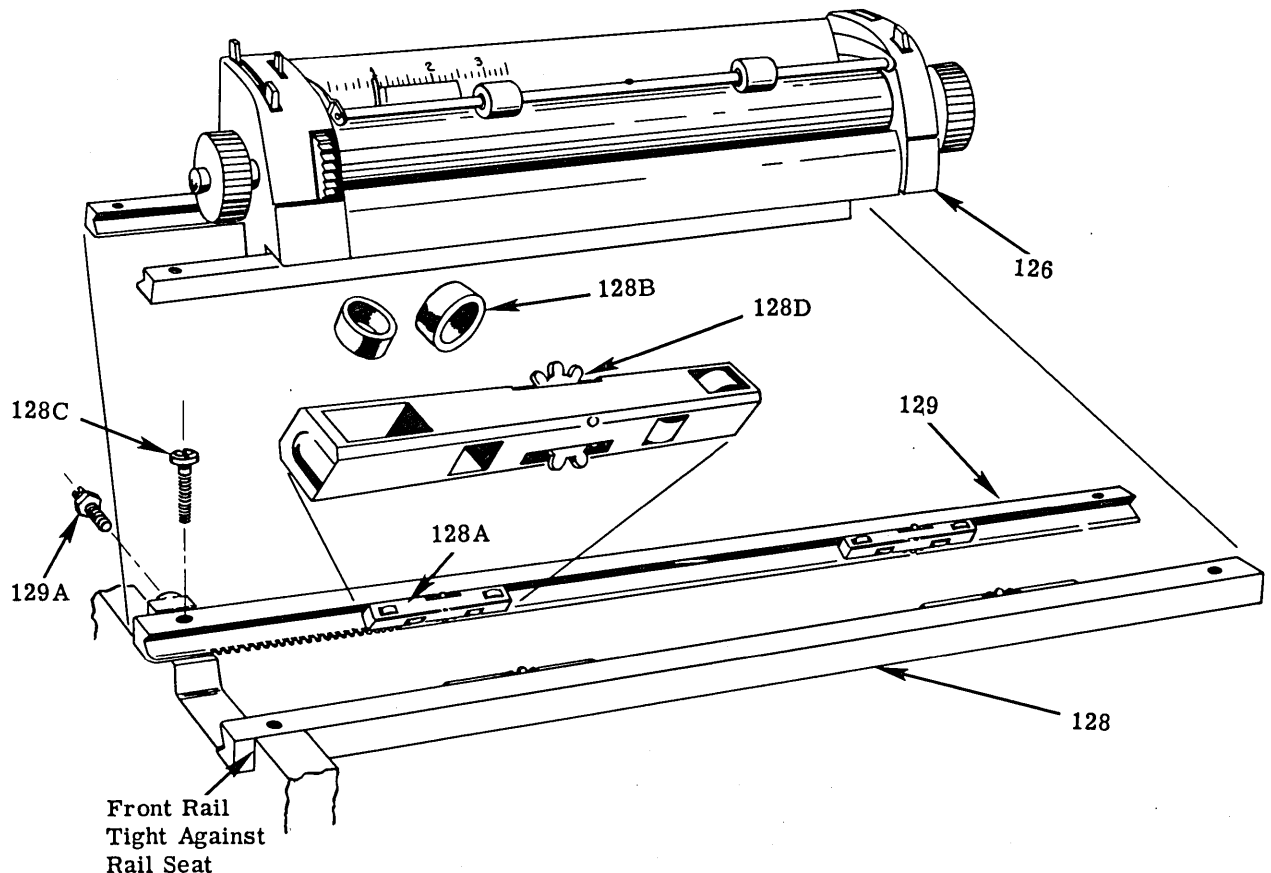


Figure 2-17 Carriage and Rails

Writing Machine

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

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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-

Writing Machine

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.

STANDARD SPACING	PROPORTIONAL SPACING	UNIT WIDTH
i	i	2 units
o	o	3 units
w	w	4 units
m	m	5 units

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).

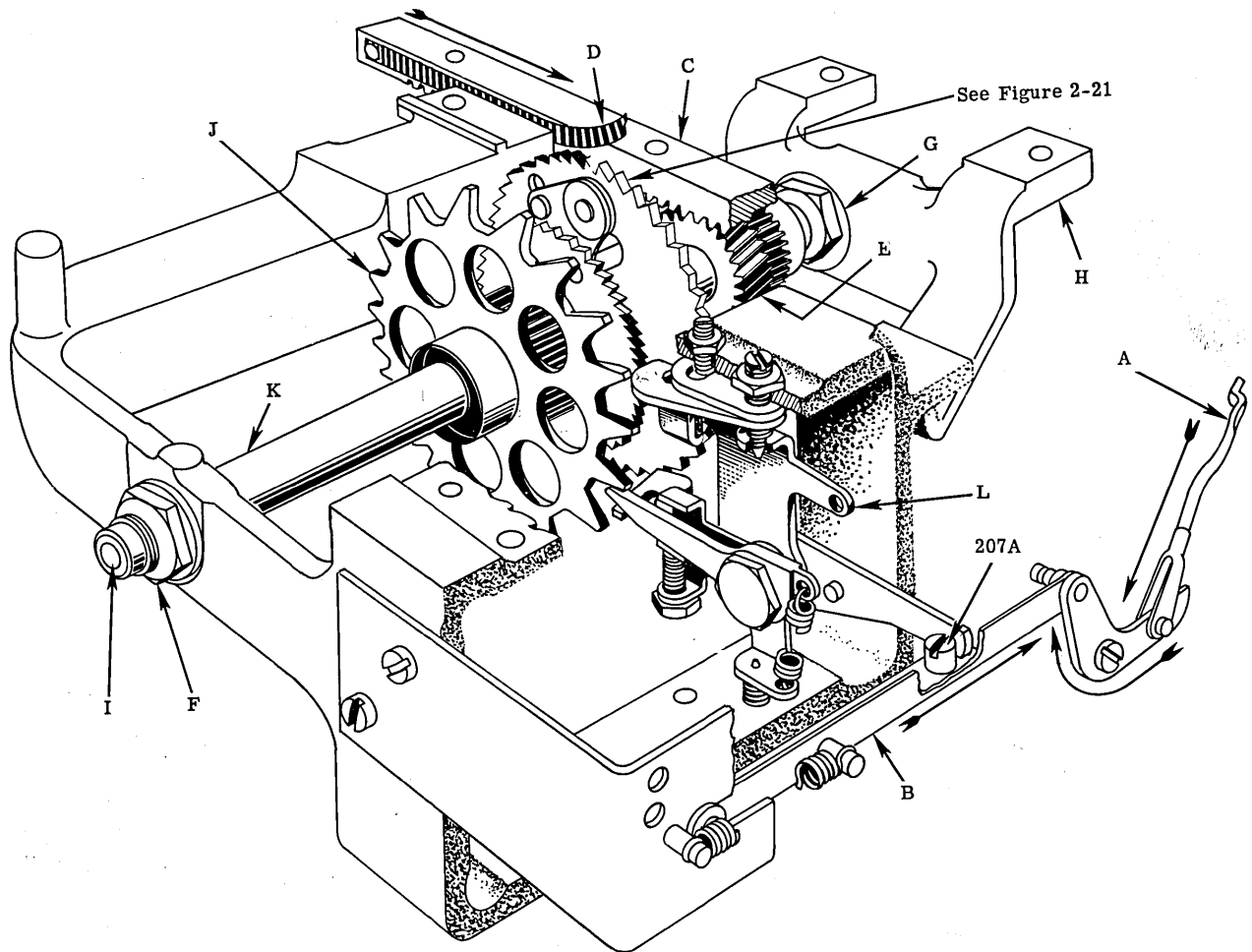


Figure 2-20 Mono-Spacing Escapement

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

Writing Machine

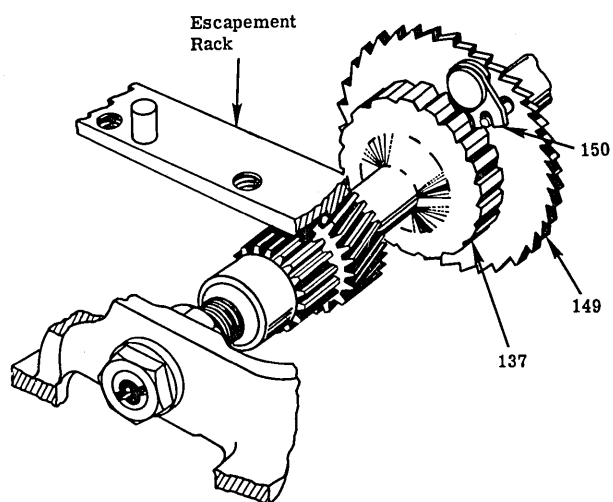


Figure 2-21 Carriage Return Pawl and Ratchet

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).

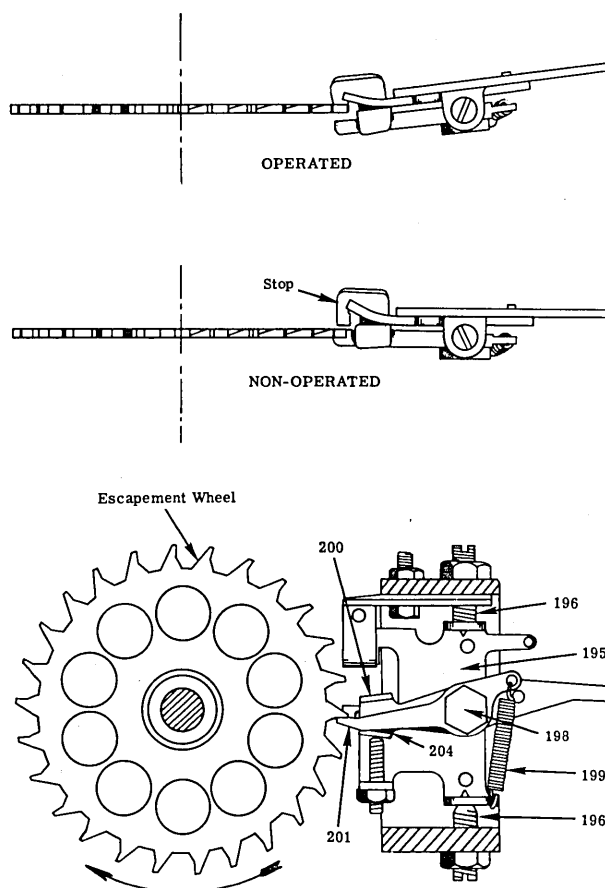


Figure 2-22 Pawl Carrier

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).

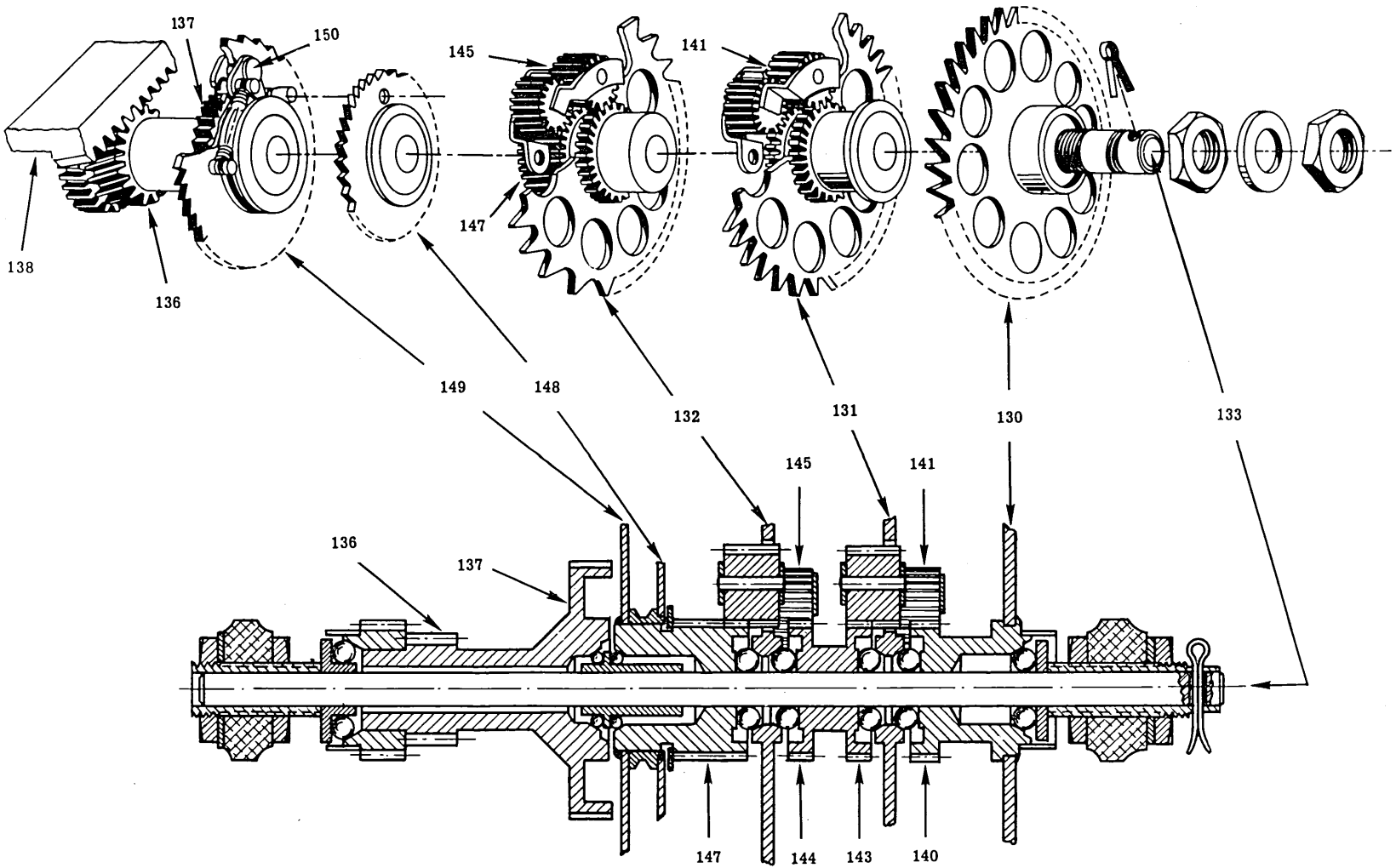


Figure 2-23 PSM Escapement

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 $1/54$ th 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 $1/27$ th 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 $1/18$ th 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.)

Writing Machine

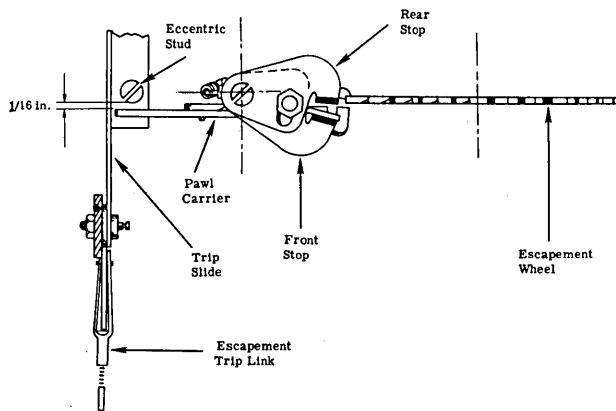


Figure 2-24 Front Stop Adjustment

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)

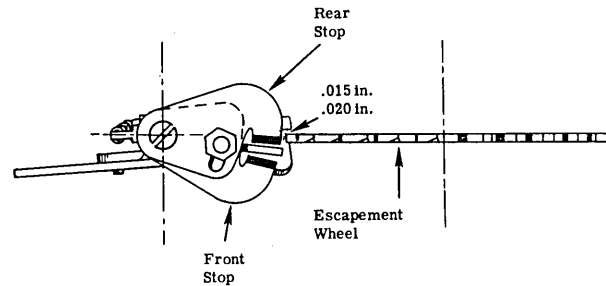


Figure 2-26 Pawl Clearance Adjustment

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)

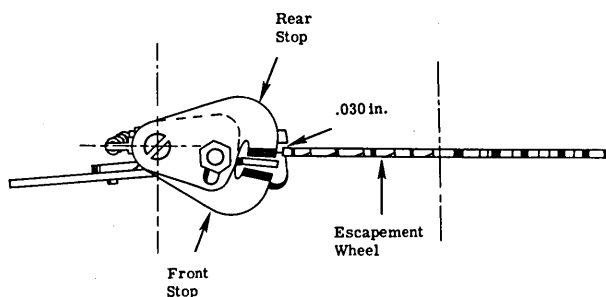


Figure 2-25 Rear Stop Adjustment

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

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

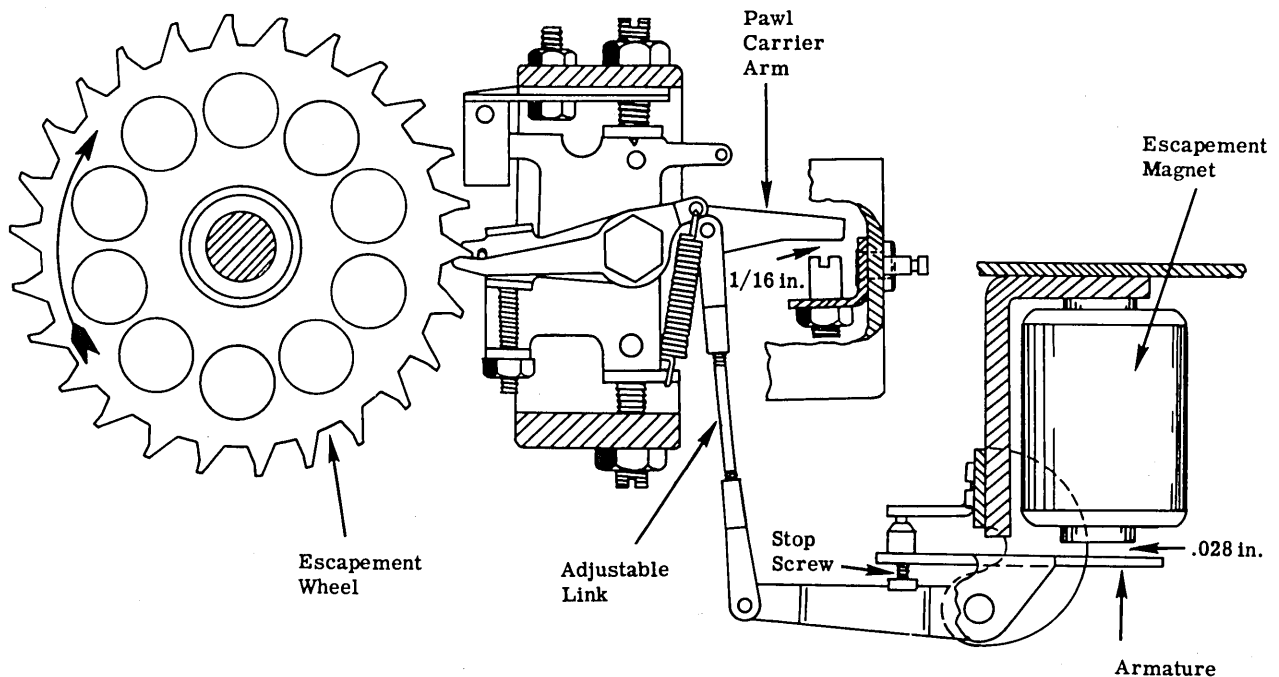


Figure 2-27 Magnet Armature Gap and Arm Adjustment

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

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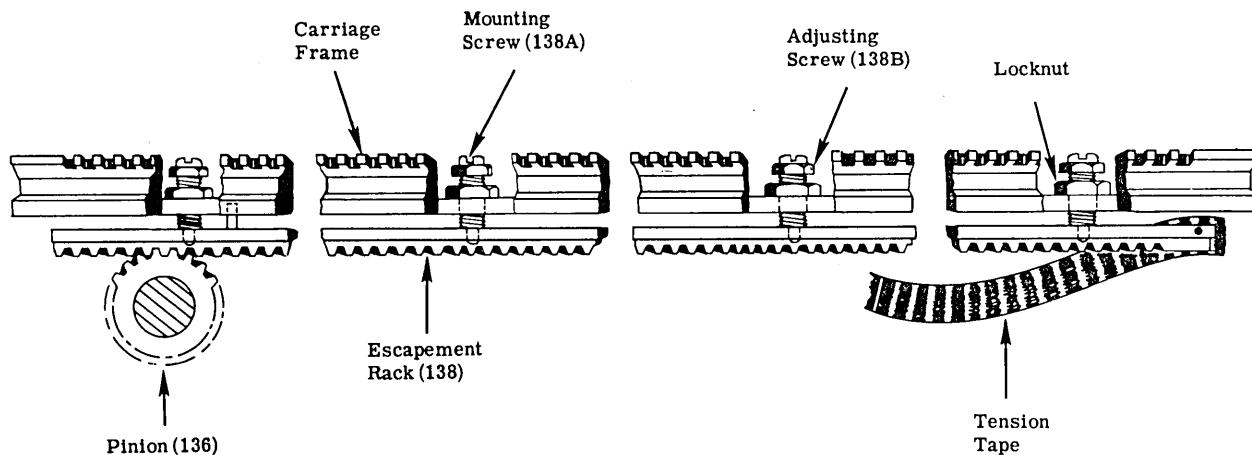


Figure 2-28 Escapement Rack

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.

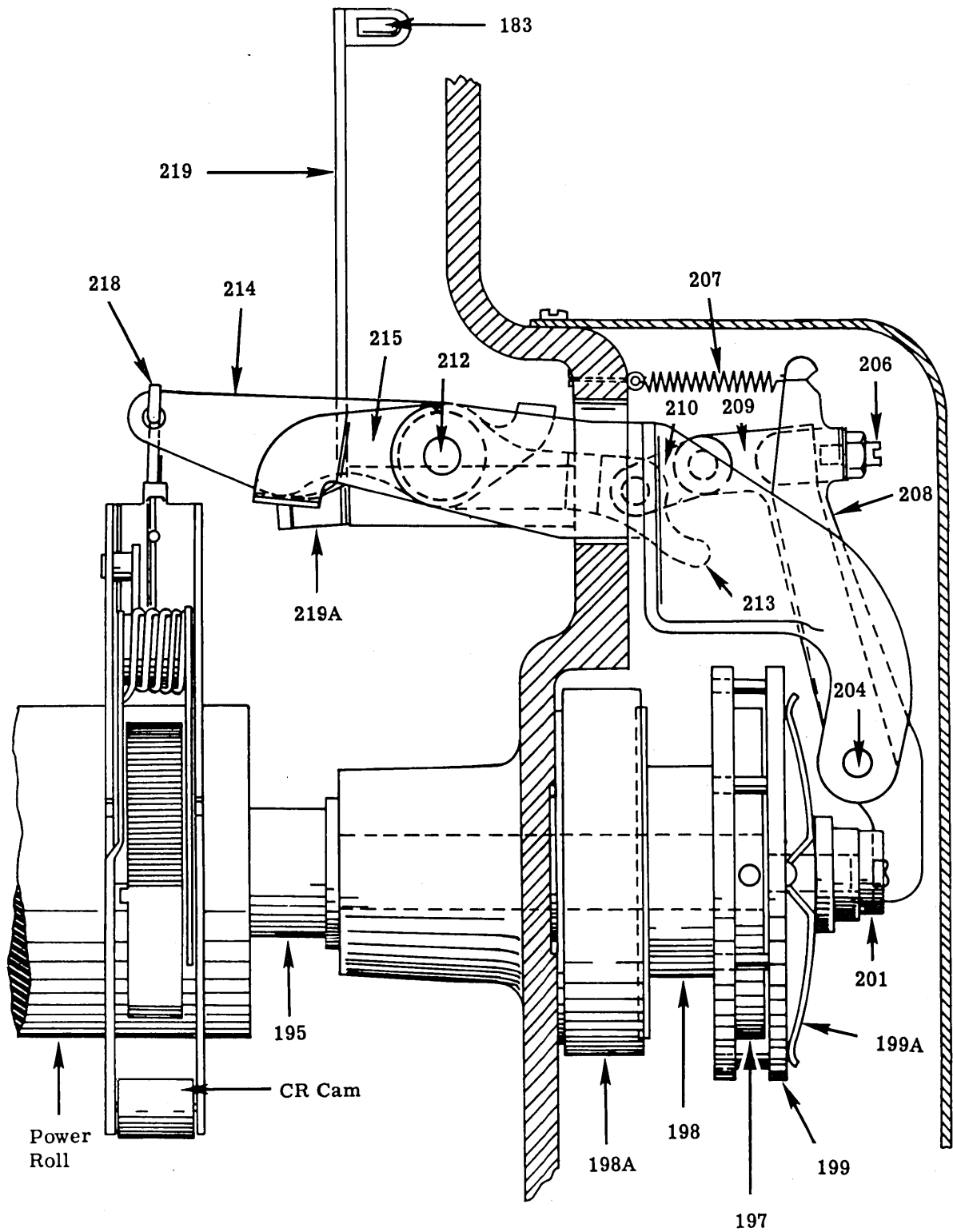


Figure 2-29 Carriage Return Clutch

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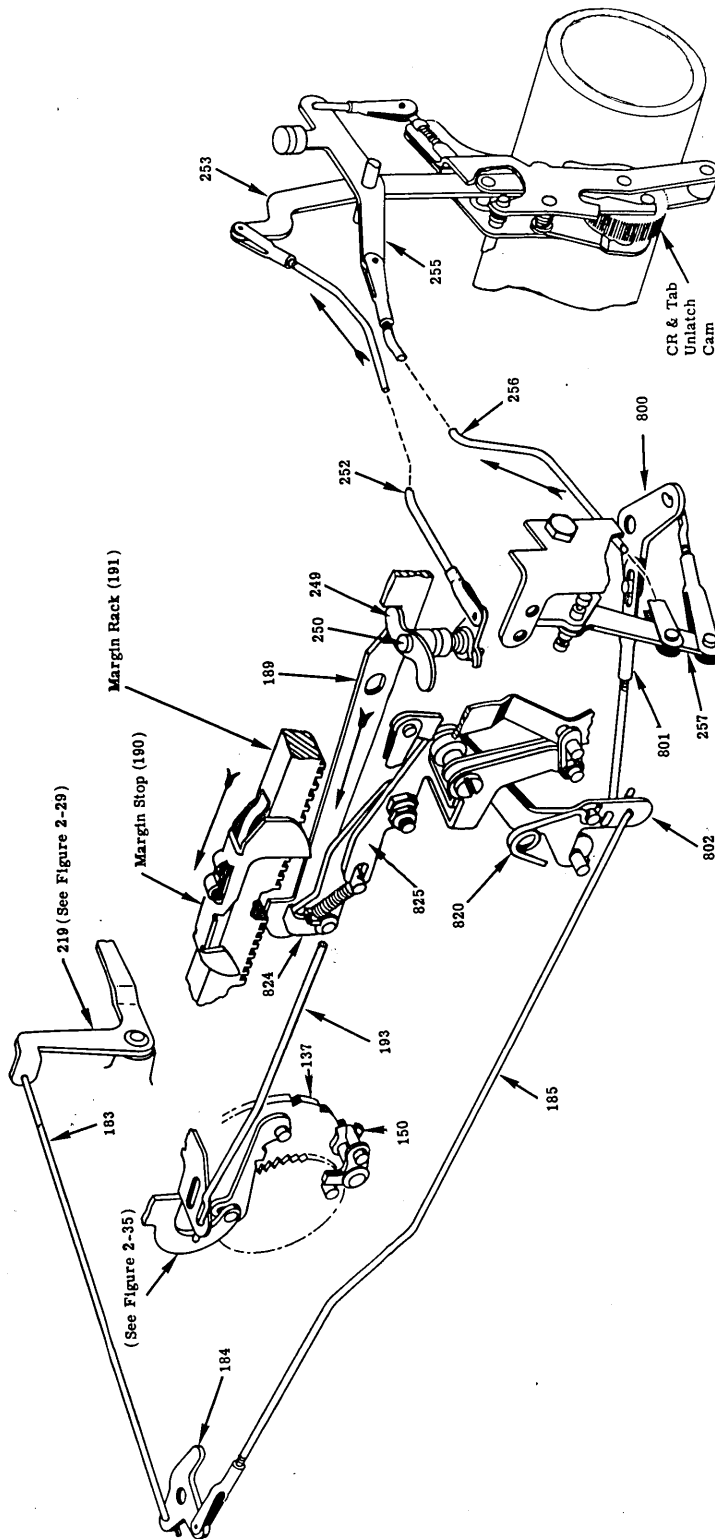


Figure 2-30 CR Linkage

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.

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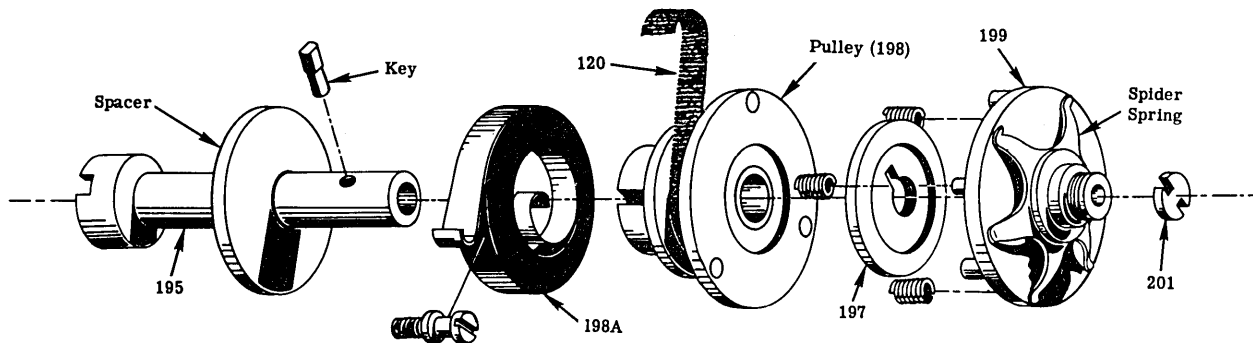


Figure 2-31 CR Clutch Parts

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.

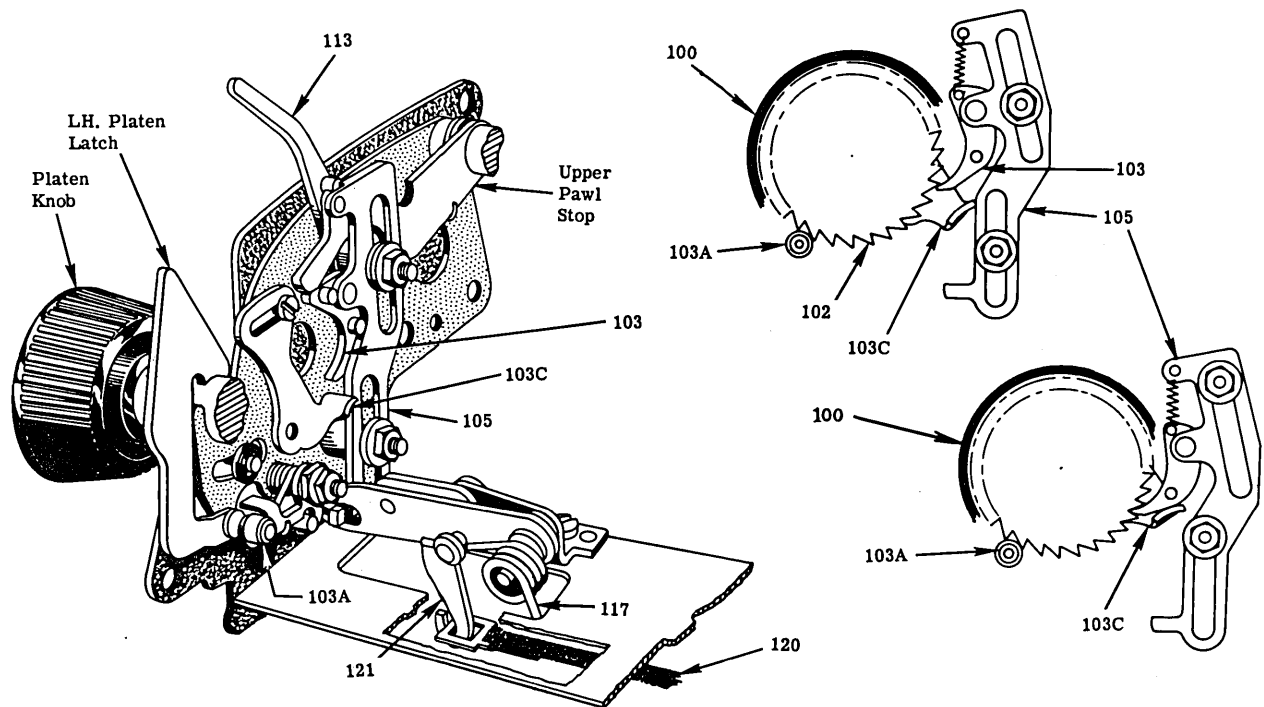


Figure 2-32 Line Space Mechanism

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 ad-

justed 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

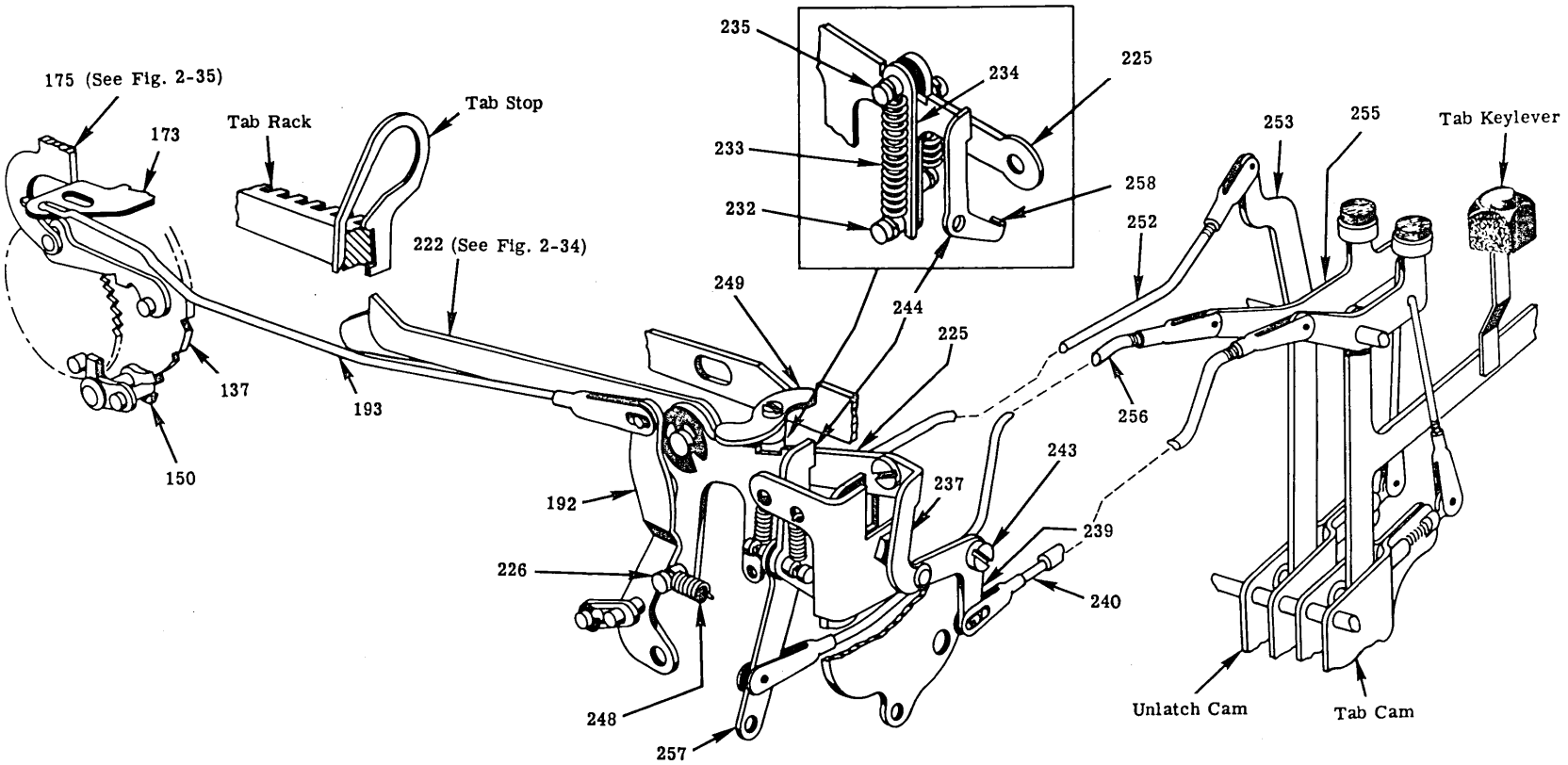


Figure 2-33 Tabular Cam Linkage

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

Writing Machine

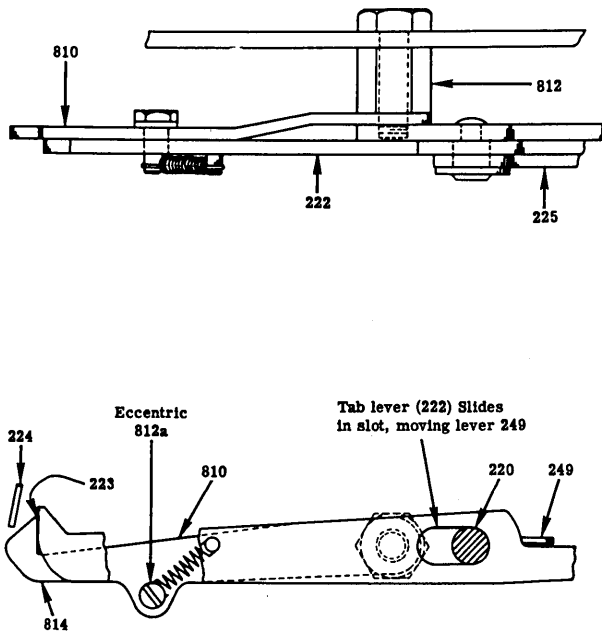


Figure 2-34 Tabular Lever and Rebound Check

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 knock-out 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

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''

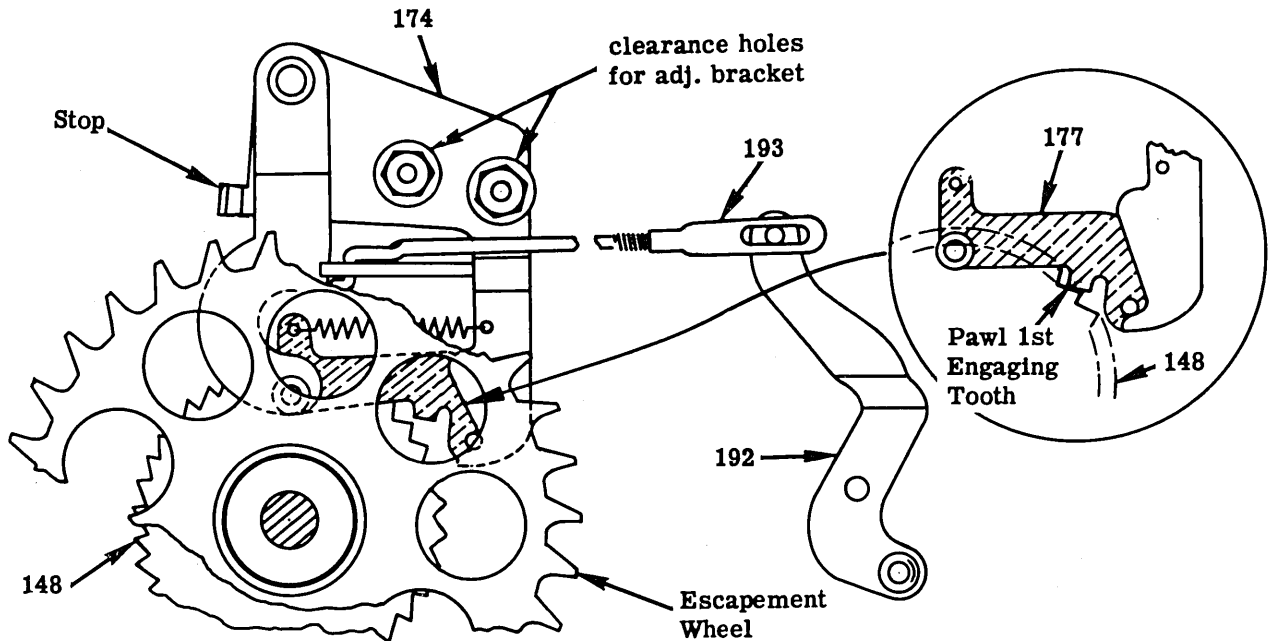


Figure 2-35 Carriage Return Pawl - Operating Mechanism

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

Writing Machine

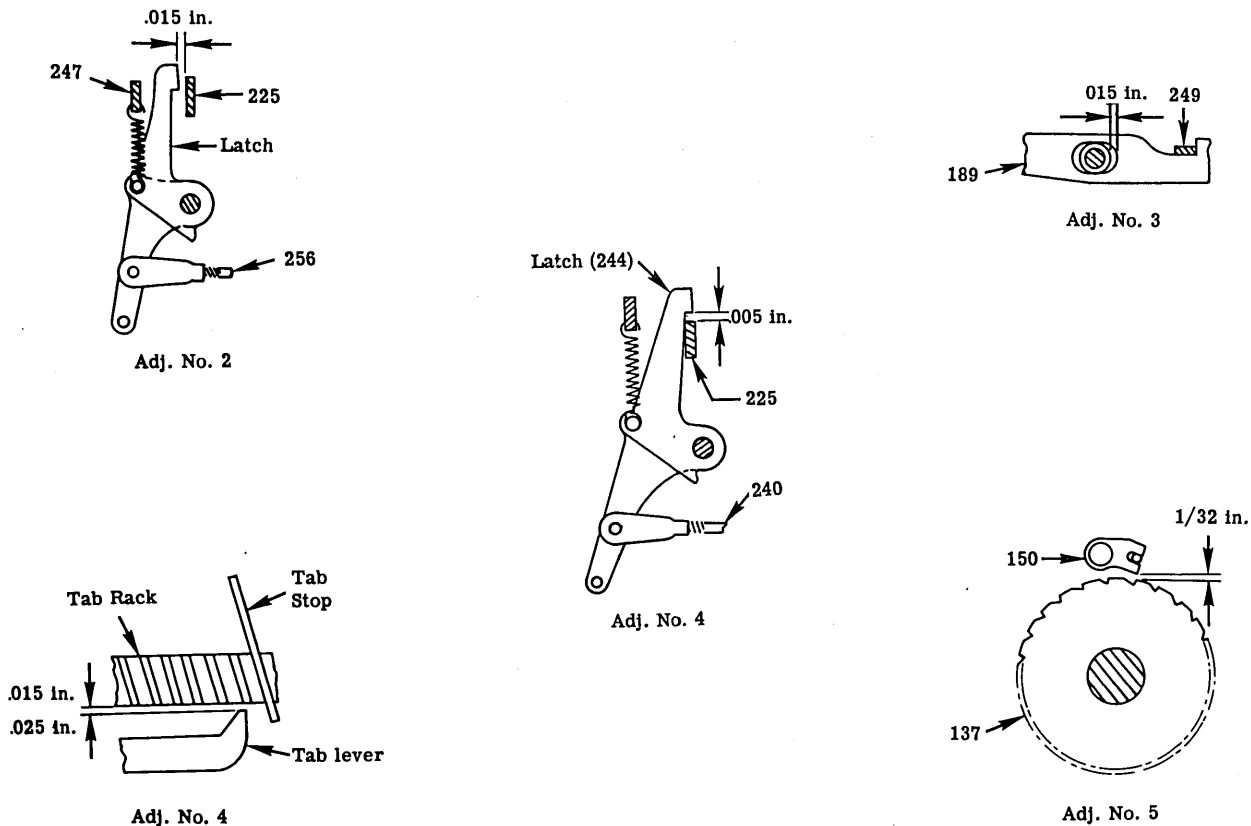


Figure 2-36 CR and Tab Adjustments

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

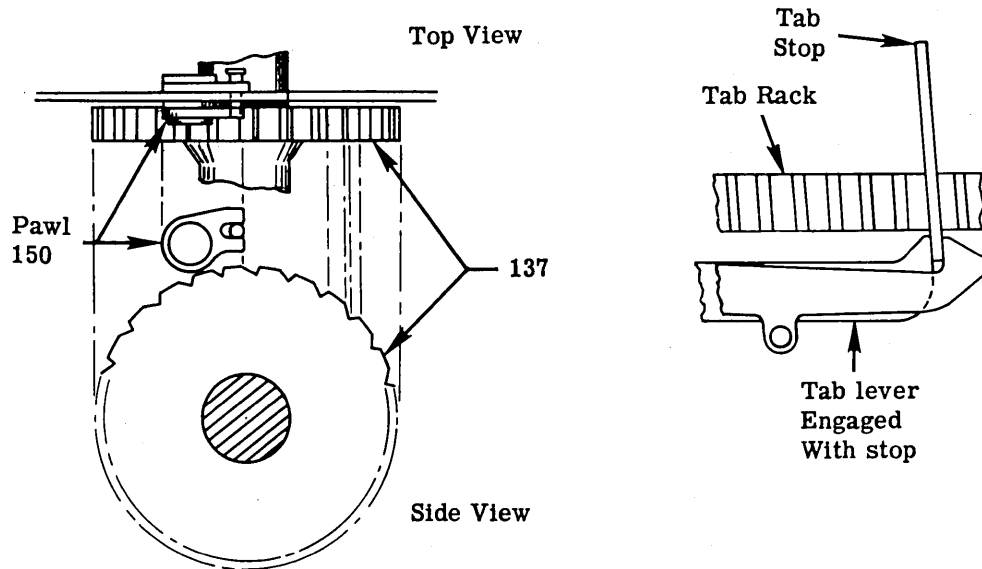


Figure 2-37 C R Pawl - Tab Rack Adjustment

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.

Writing Machine

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.

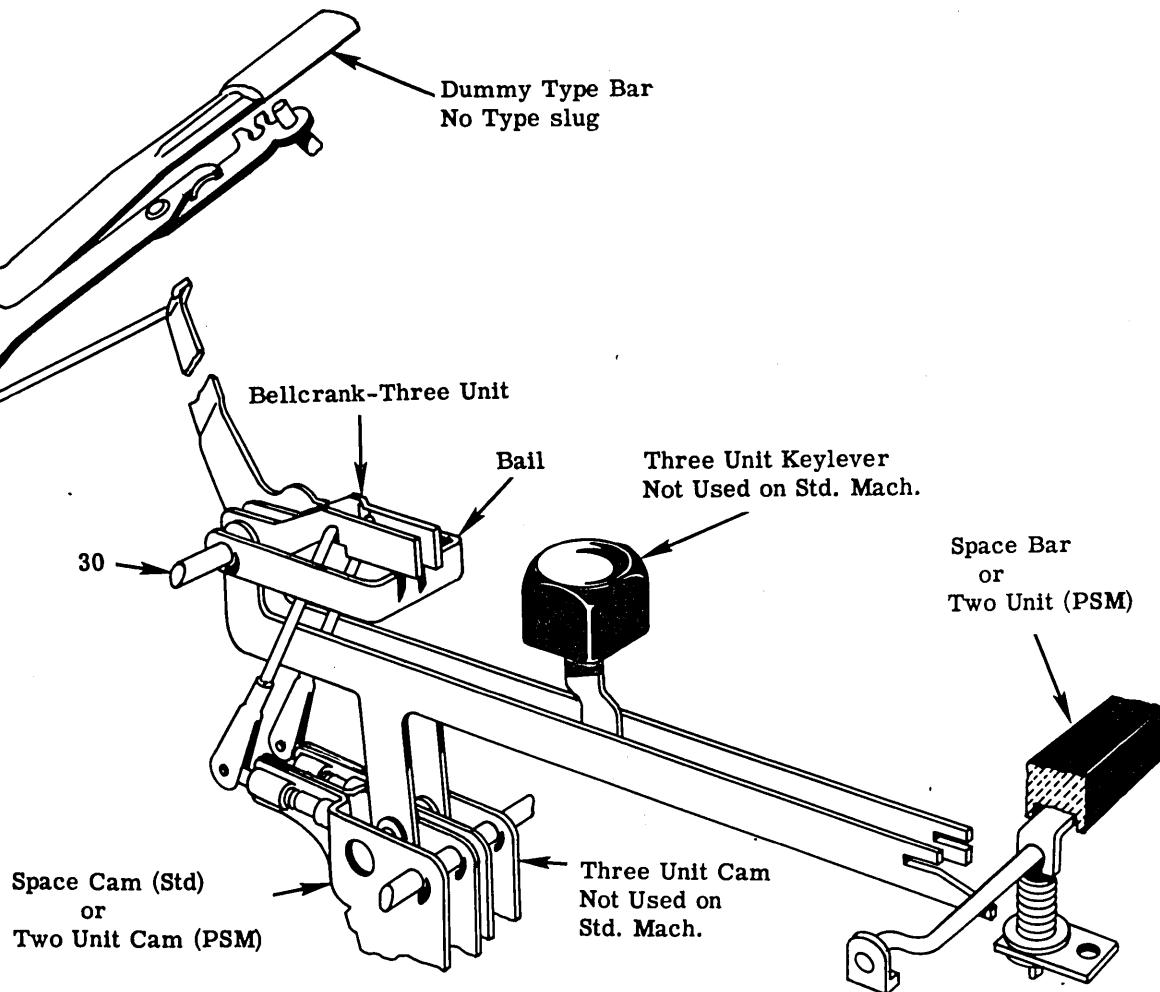


Figure 2-38 Space Bar Mechanism

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

Writing Machine

- 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.
- 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.
 - 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.

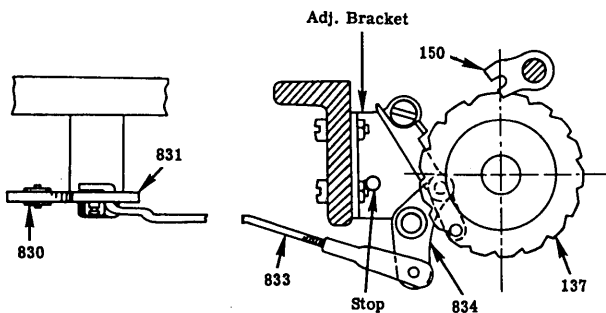


Figure 2-39 Back Space Assembly

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.

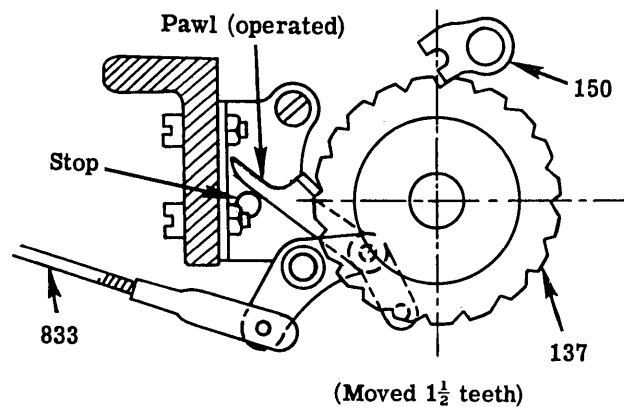


Figure 2-40 CR Pawl Engaging $\frac{1}{2}$ Tooth

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

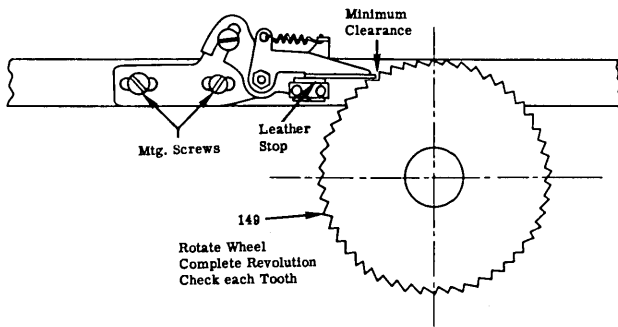


Figure 2-41 Detent Pawl (Single)

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.

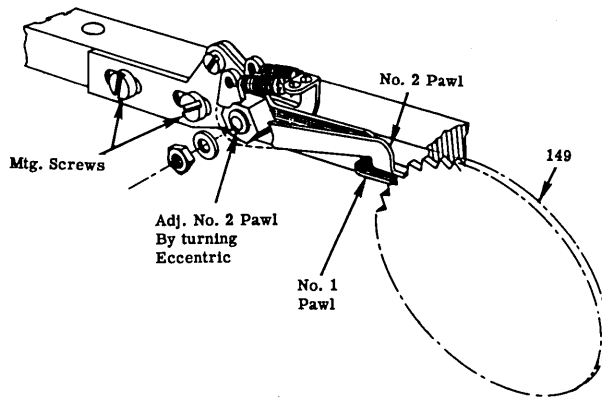


Figure 2-42 Detent Pawl (Double)

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

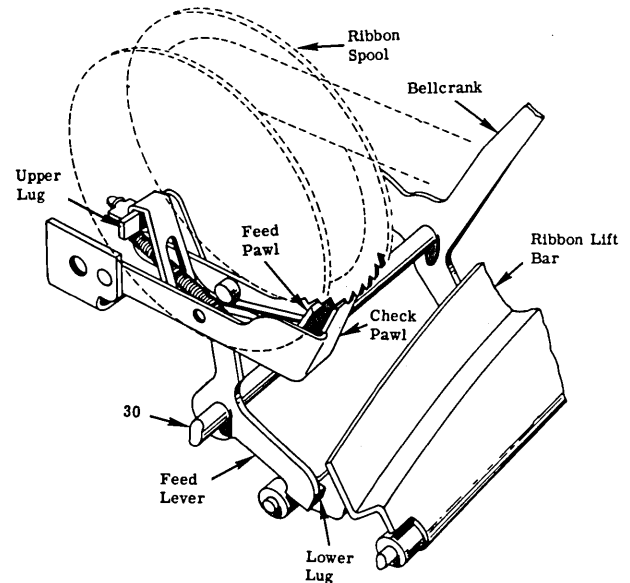


Figure 2-43 Ribbon Feed and Check Pawls

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

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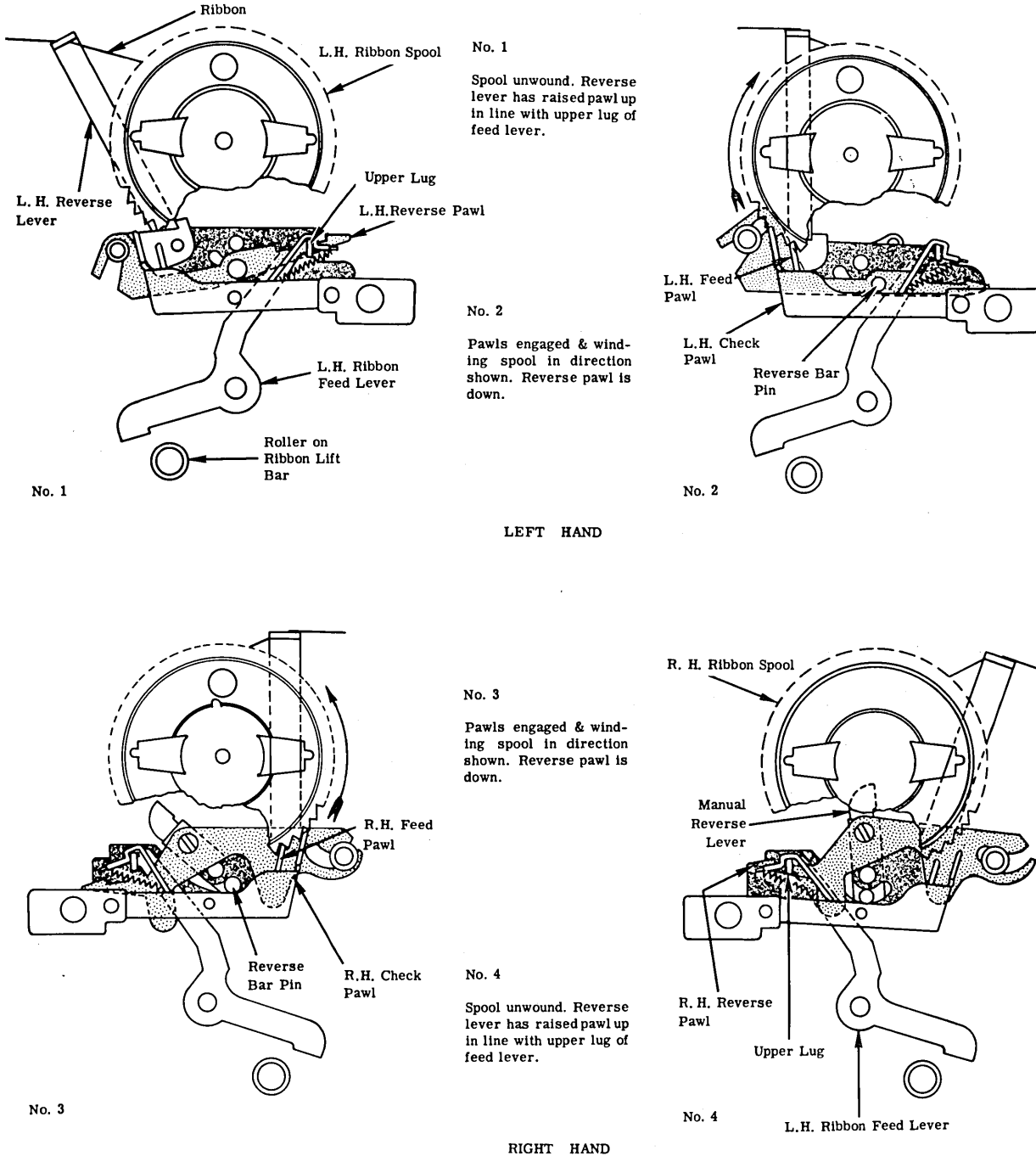


Figure 2-44 Ribbon Reverse Mechanism

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

Writing Machine

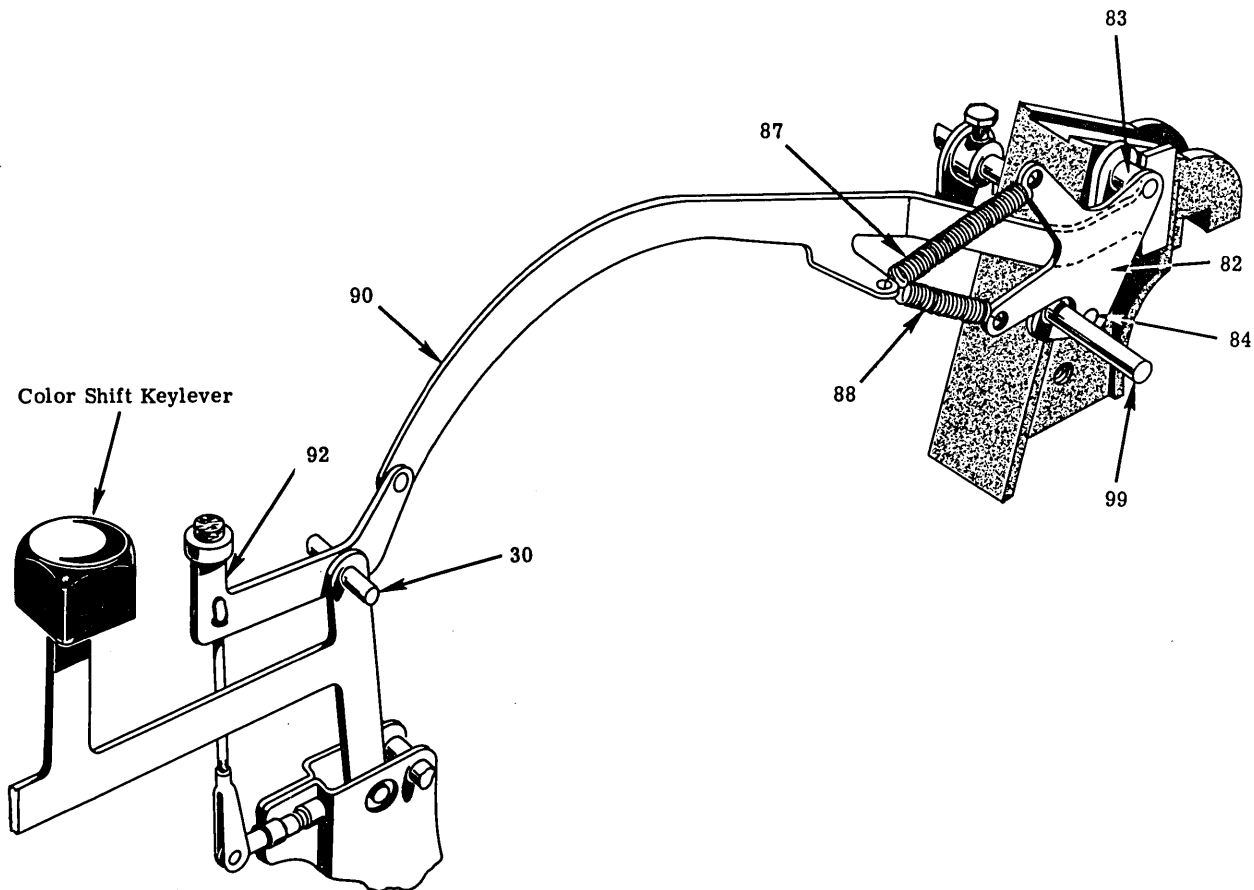


Figure 2-45 Color Control Linkage From Cam

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

Writing Machine

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 side 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.

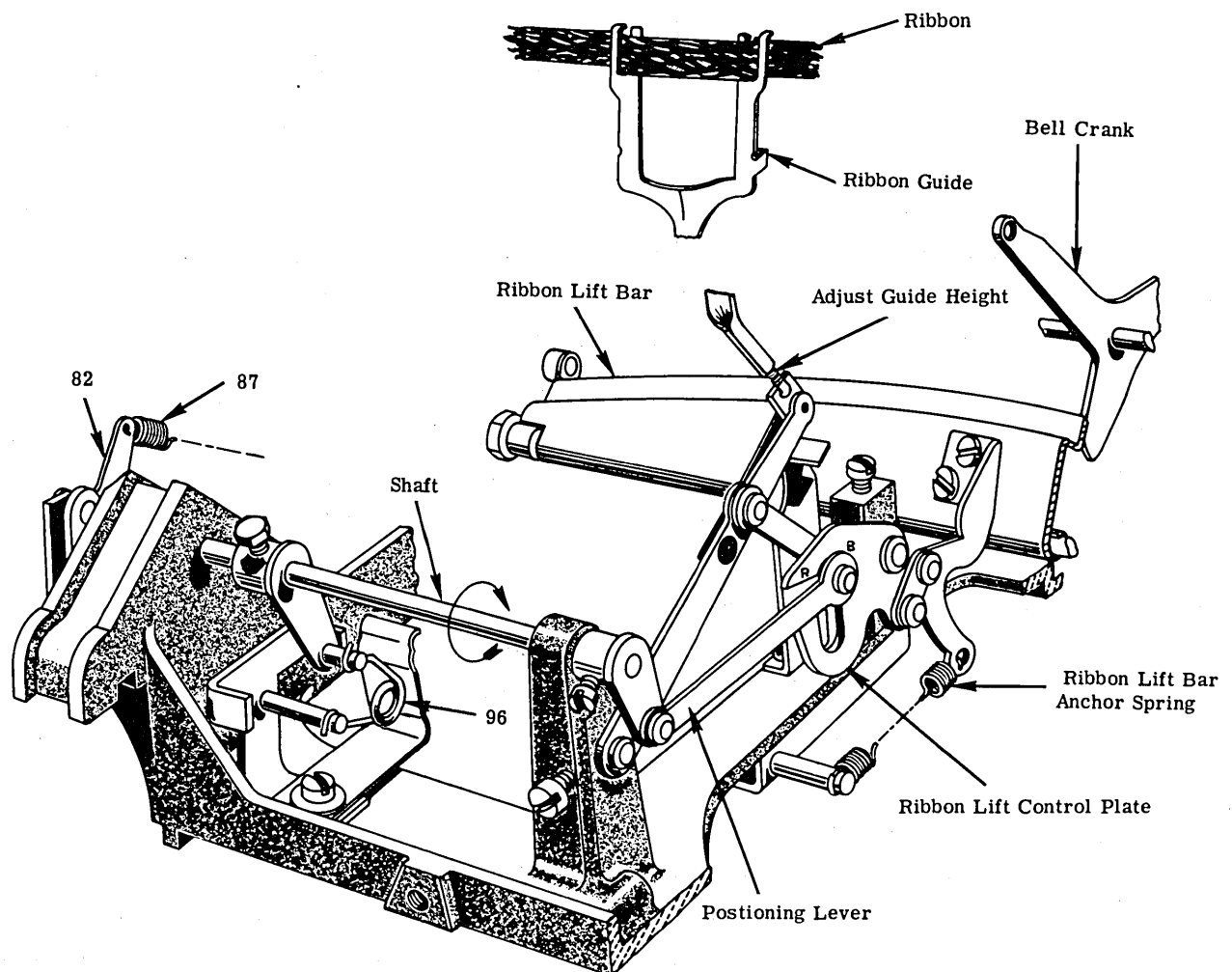


Figure 2-46 Color Control - Ribbon Lift Operation

Writing Machine

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

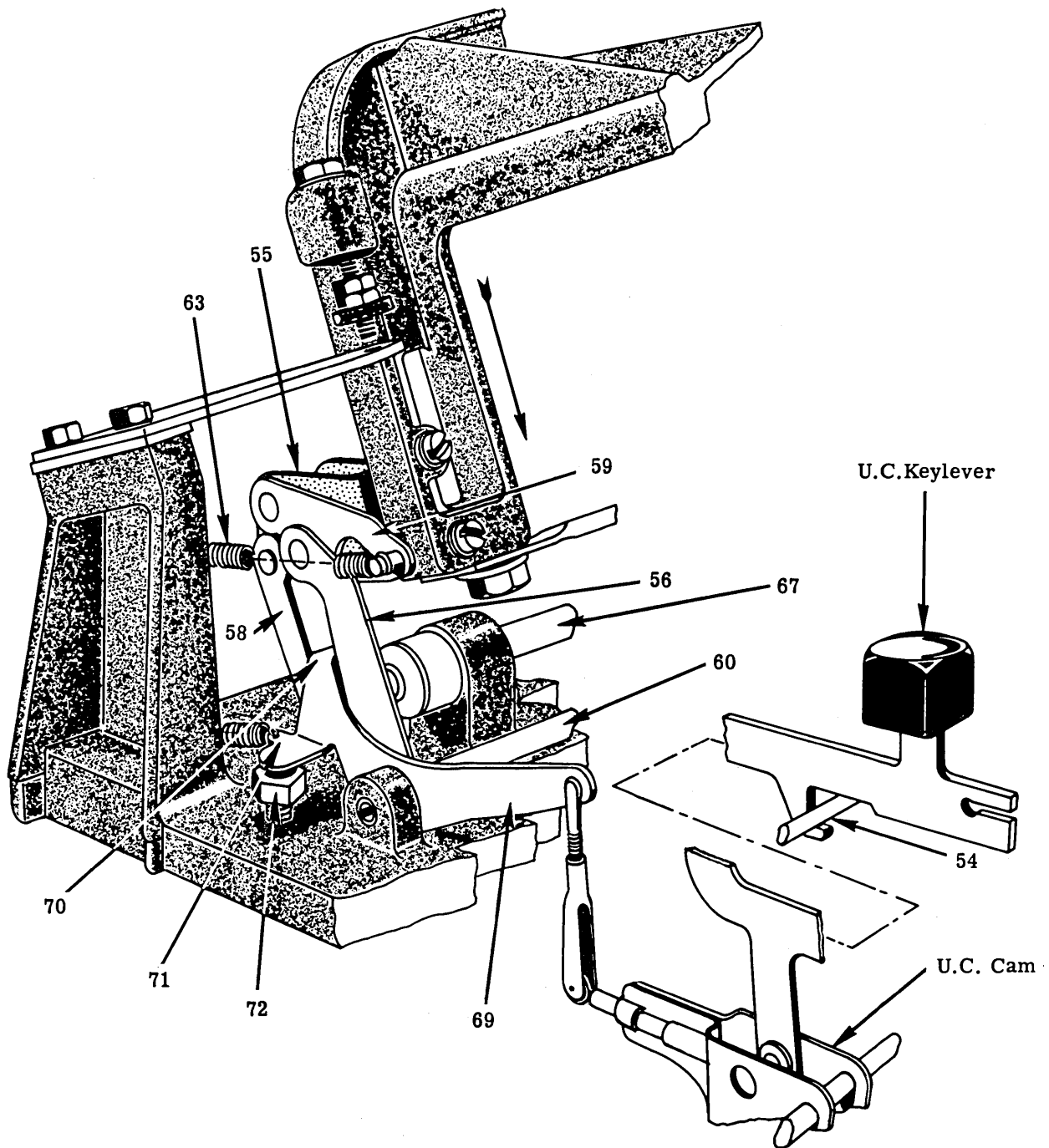


Figure 2-47 Shift L. H. View (L.C. Position)

Writing Machine

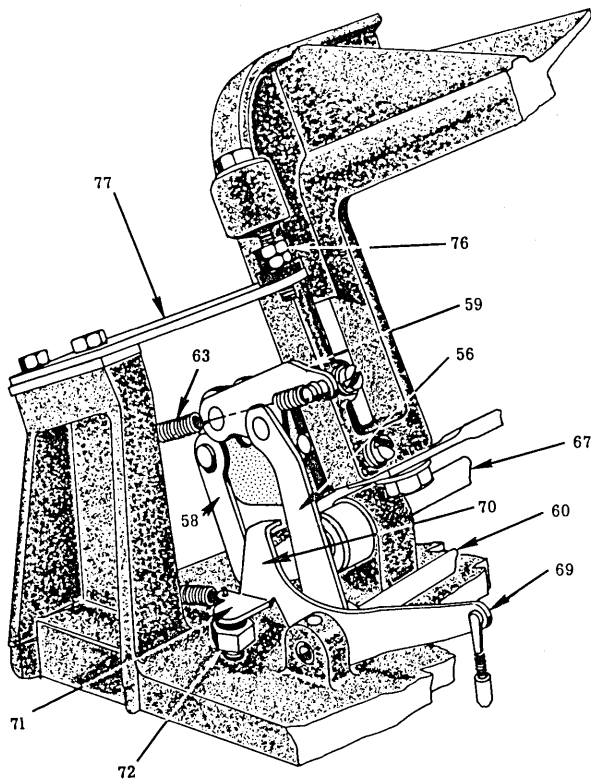


Figure 2-48 Shift L. H. View (U.C. Position)

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.

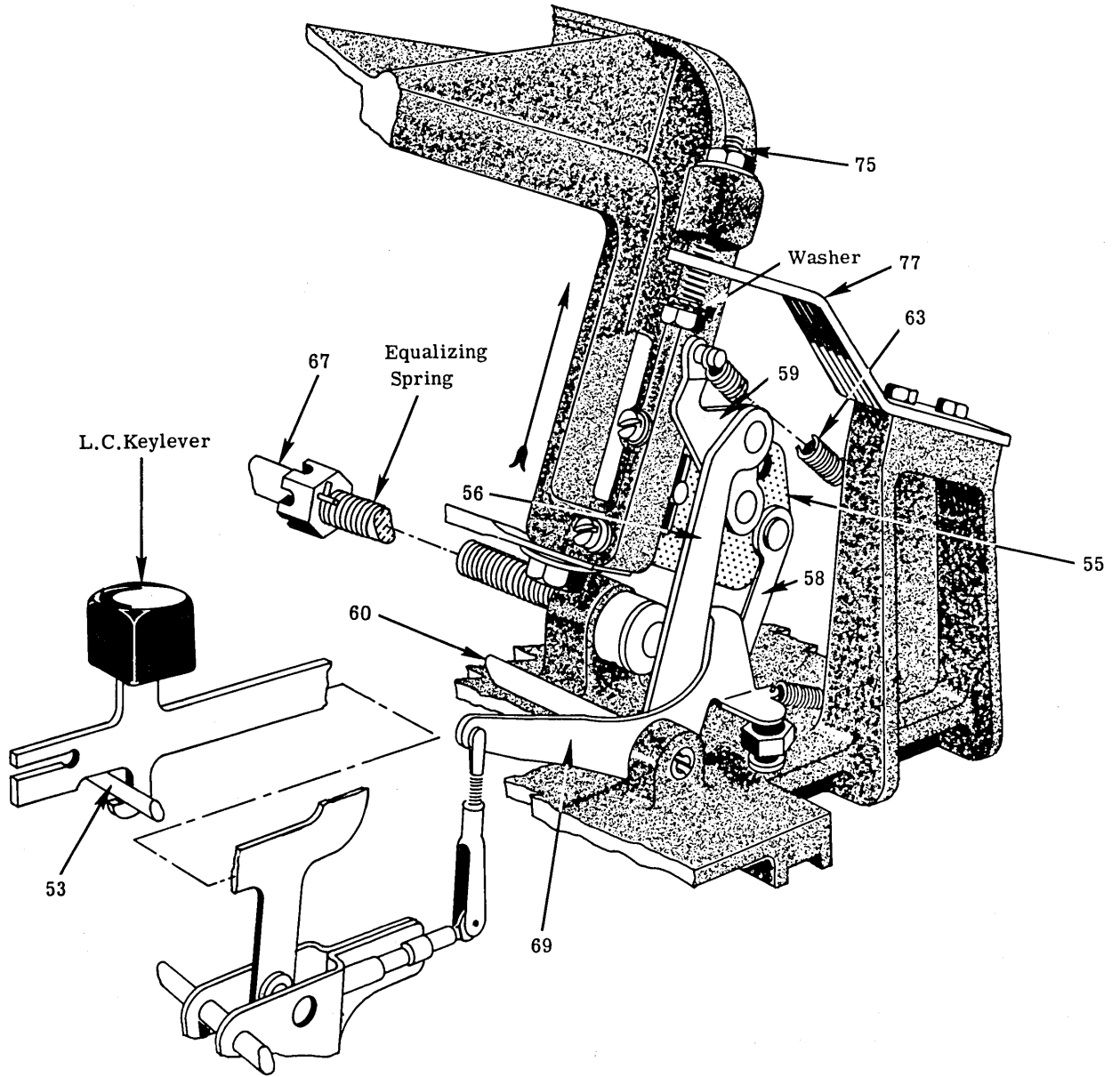


Figure 2-49 Shift R. H. (U.C. Position)

Writing Machine

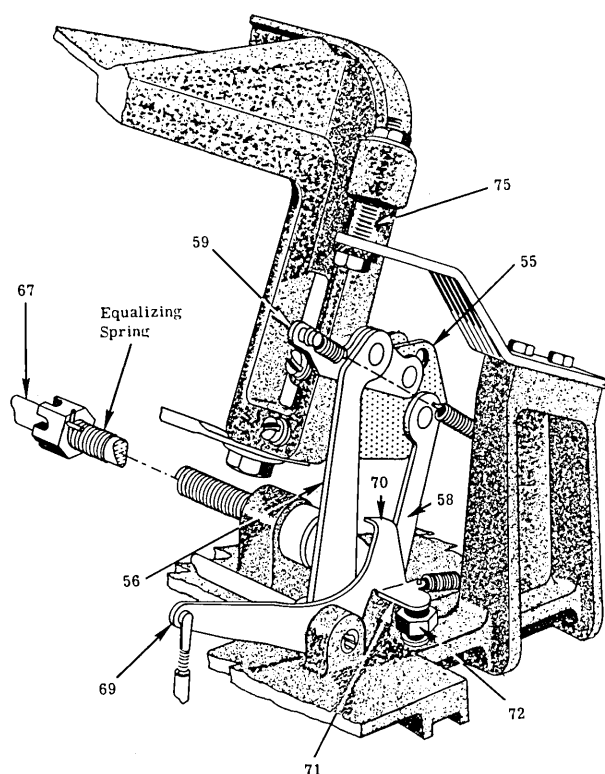


Figure 2-50 Shift R. H. (L. C. Position)

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

Writing Machine

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

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-

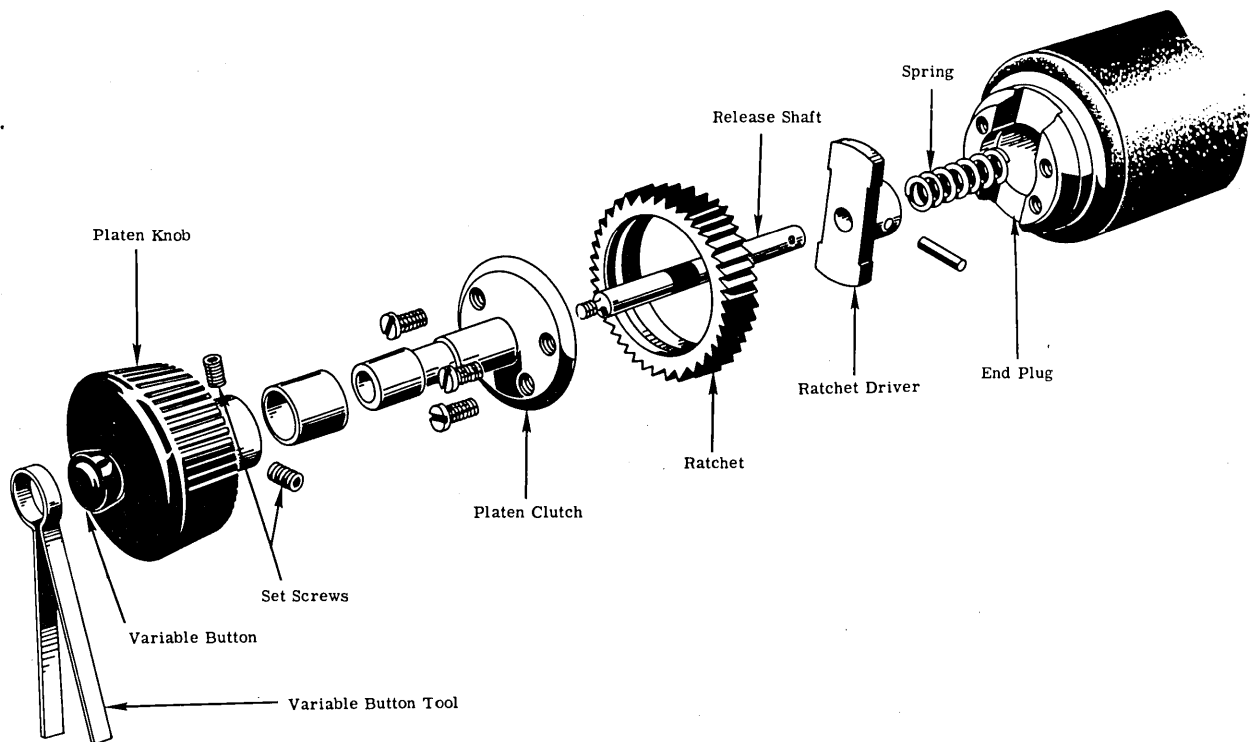


Figure 2-52 Platen and Ratchet

Writing Machine

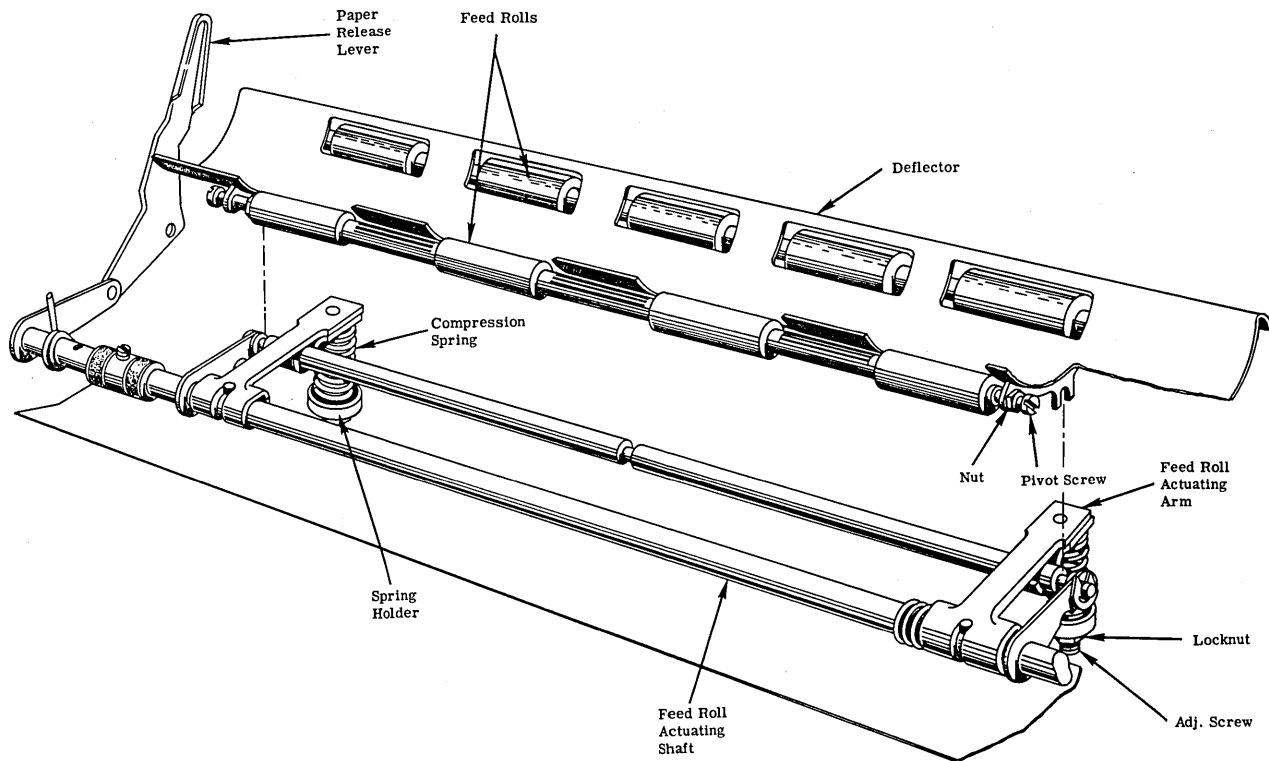


Figure 2-53 Paper Feed Mechanism

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.

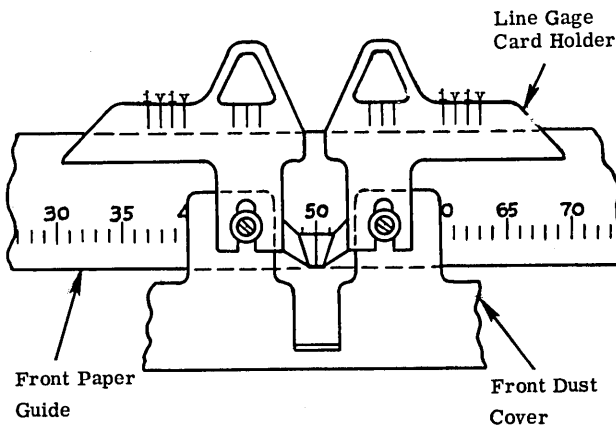


Figure 2-54 Card Holder (Standard)

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 care-

fully checked. The power roll speed must be properly adjusted to a speed of approximately 290 R.P.M. (permissible 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).

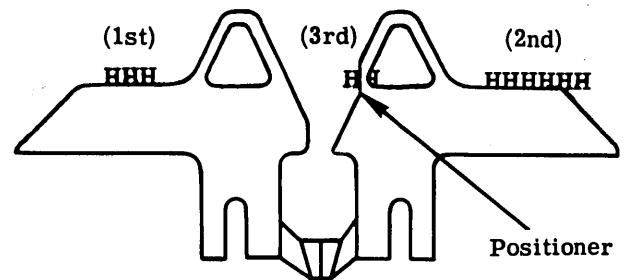


Figure 2-55 Card Holder (PSM)

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

Writing Machine

NnNnNnNnNnNnNnNnNnNnNnNnNnNnNnNnNnNn
 NANBNCNDNEFNHNGNHNHNJNKNLNMMNONPNQ
 nanbnrndnenfngnhninjnknlnmnonpnq
 NRNSNTNUNVNWVXNYNZN&N/N&N&N&NIN*
 nrsntnuvnvwnvxnyzn&n/n&n&n&nin*
 N(N)N&N&N N:~N,N,N
 n9n0n1n&n' n;n-n n,n
 AMARANTH SASSESUS ORONOCO SECEDES
 amaranth sascesosus 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 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

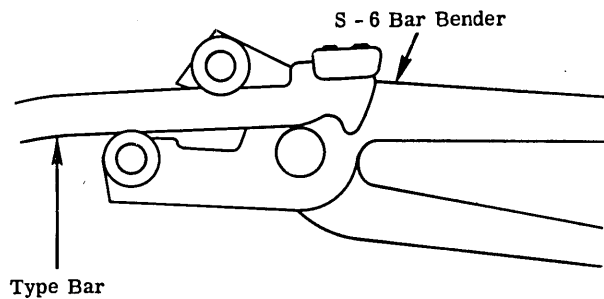


Figure 2-58 Bending Bar Toward Platen

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.

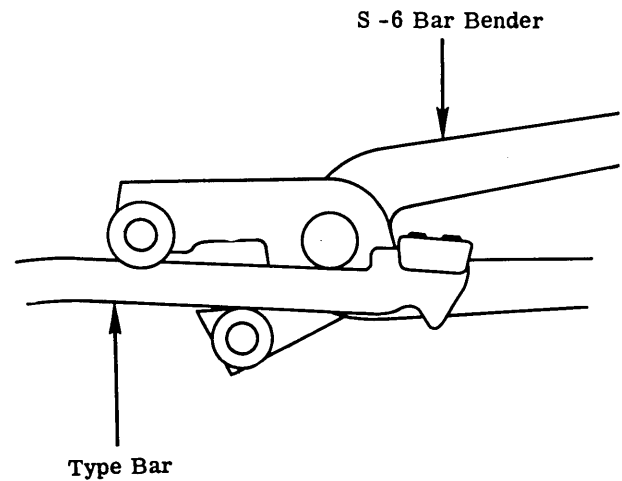


Figure 2-59 Bending Bar Away From Platen

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.

- 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

Writing Machine

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.

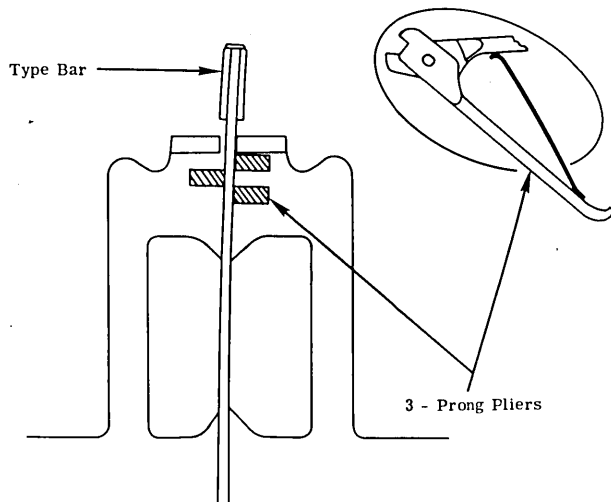


Figure 2-60 Type Bar Bent at Throat

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).

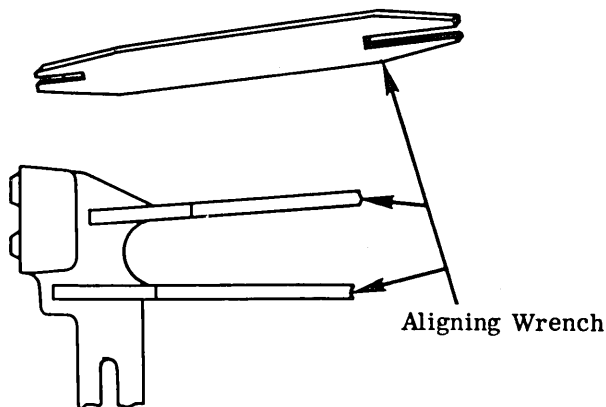


Figure 2-61 Two Type Aligning Wrenches

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).

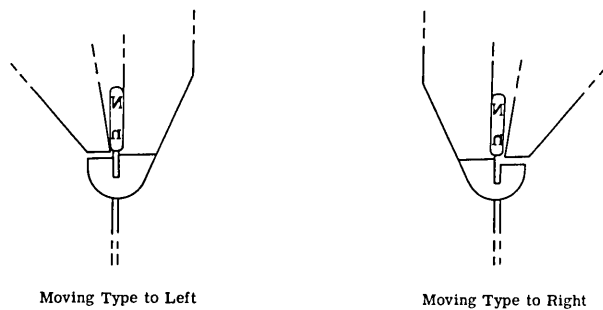


Figure 2-62 Use of Knock-Over Pliers

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).

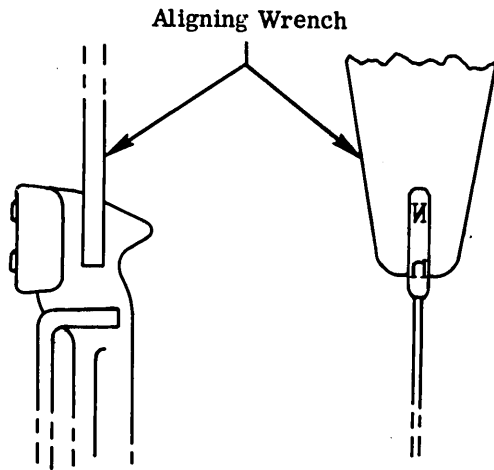


Figure 2-63 Straightening Upper Case

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

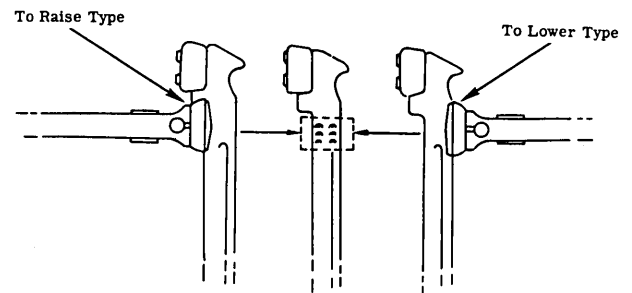


Figure 2-64 Peening Type

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

Writing Machine

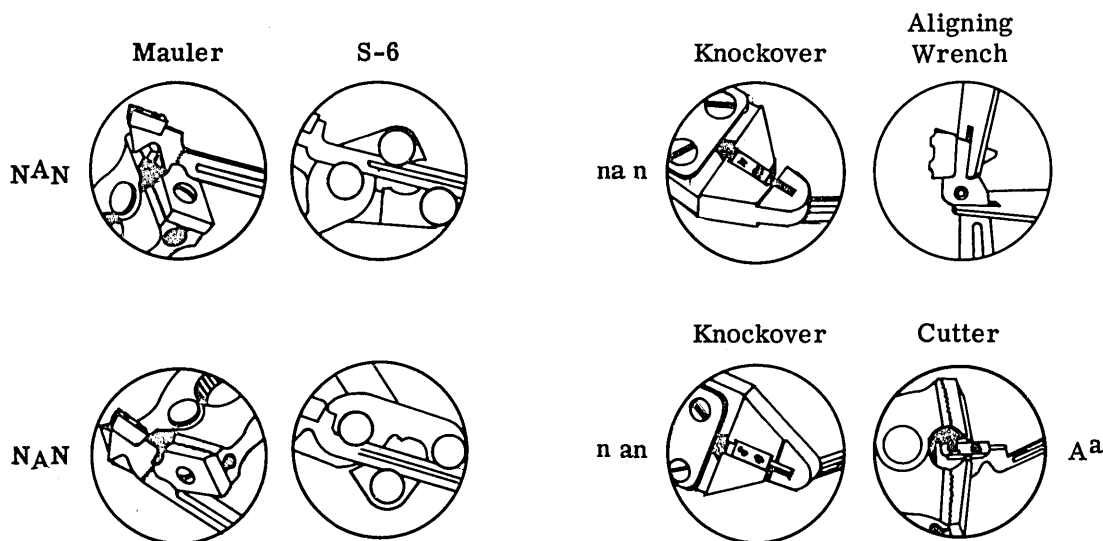


Figure 2-65 Use of Aligning Tools

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.

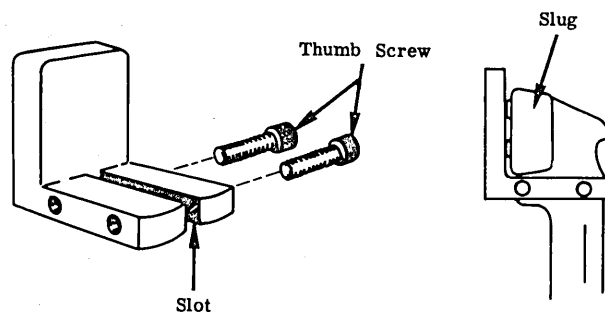


Figure 2-66 Soldering Fixture

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 be 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

Writing Machine

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 conditions, 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

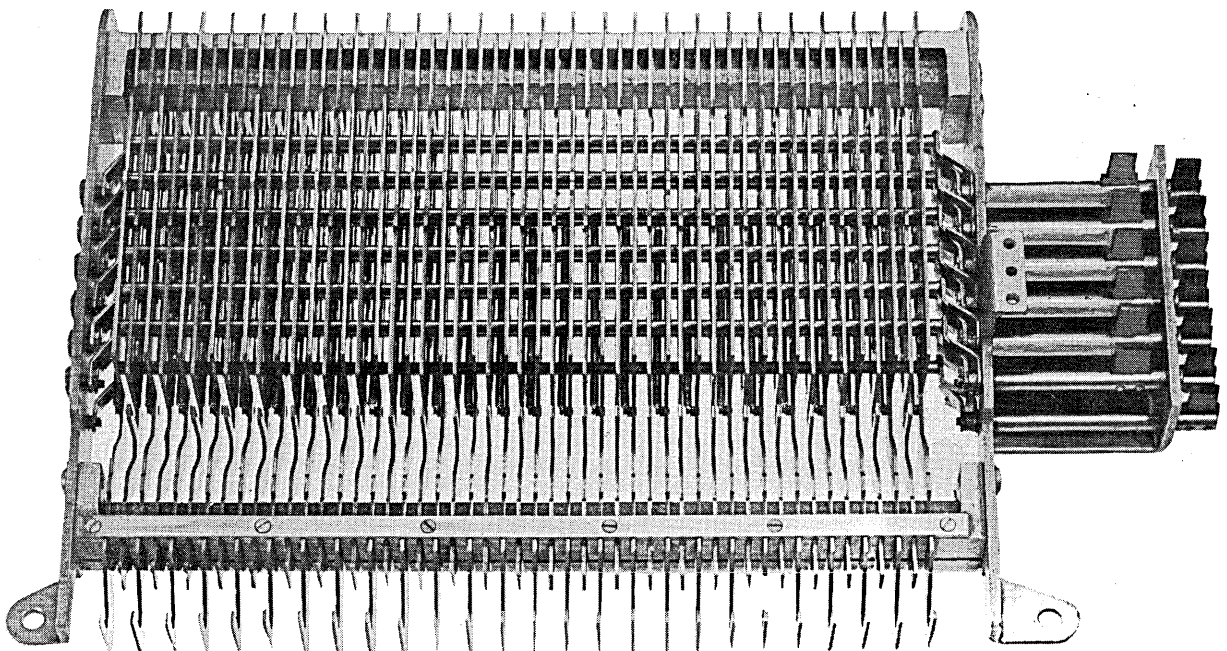


Figure 3-1 Code Selector

Code Selector

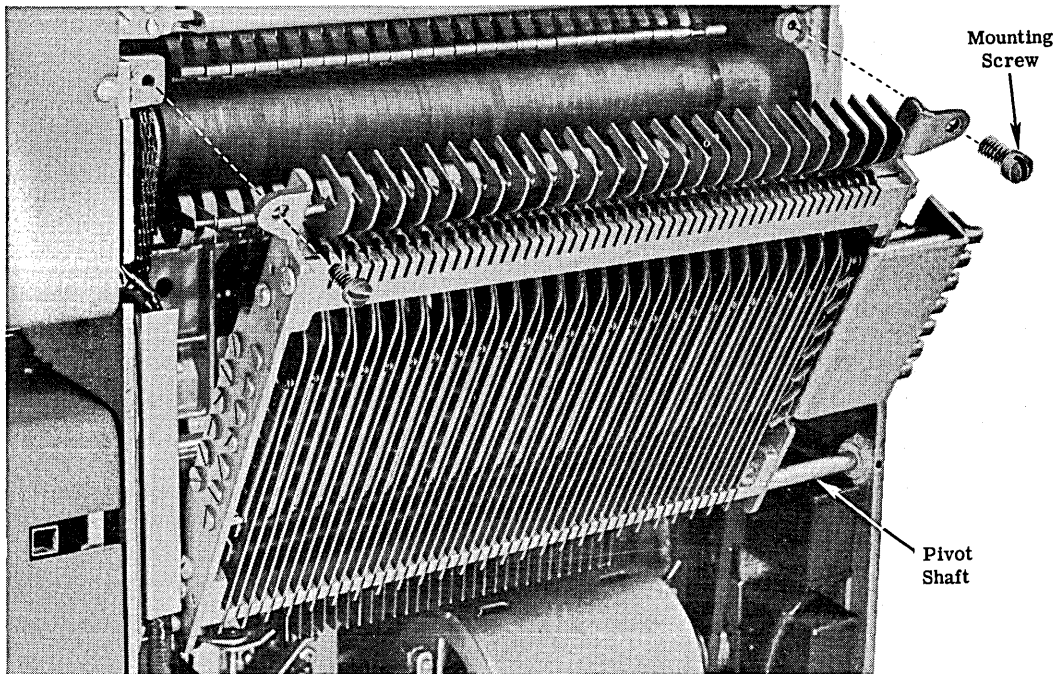


Figure 3-2 Selector-Pivoted on Shaft

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.

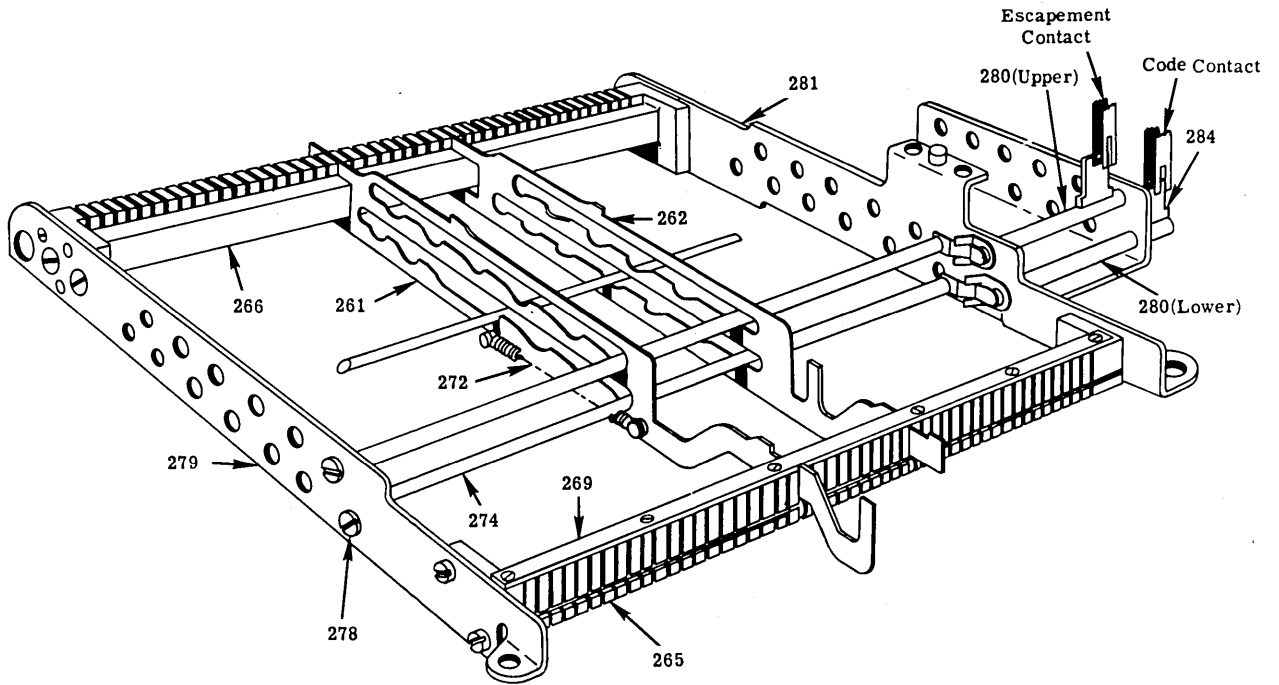


Figure 3-3 Selector Construction

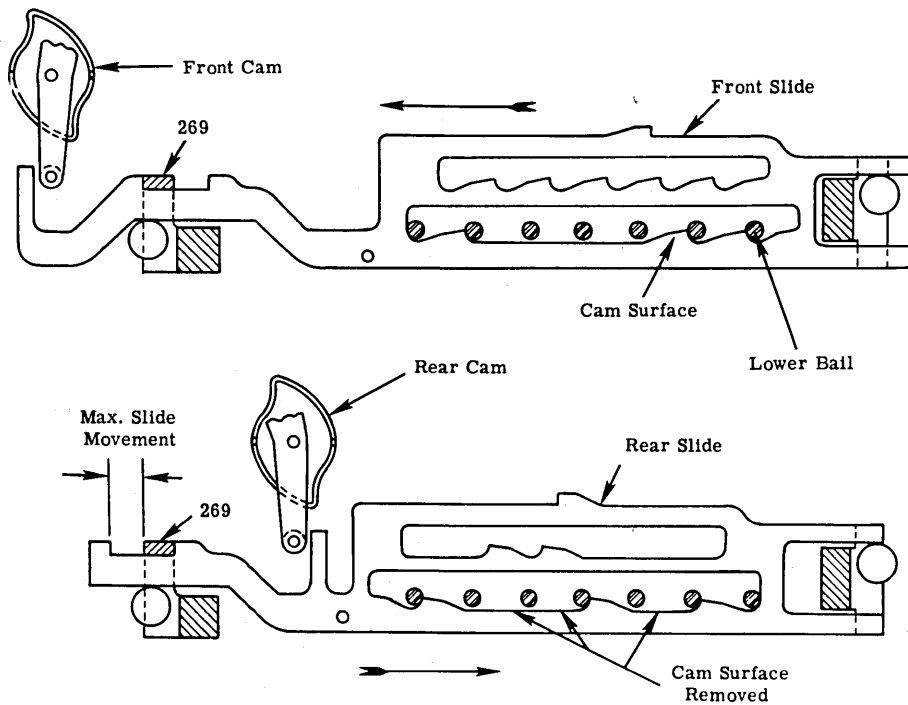


Figure 3-4 Front & Rear Slides

Code Selector

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,

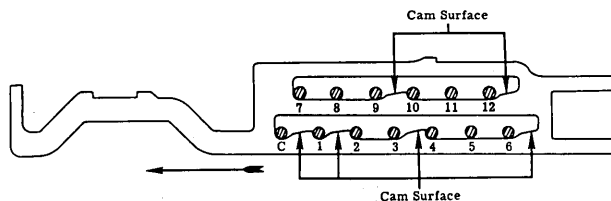


Figure 3-5 Front Slide-Side View

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.

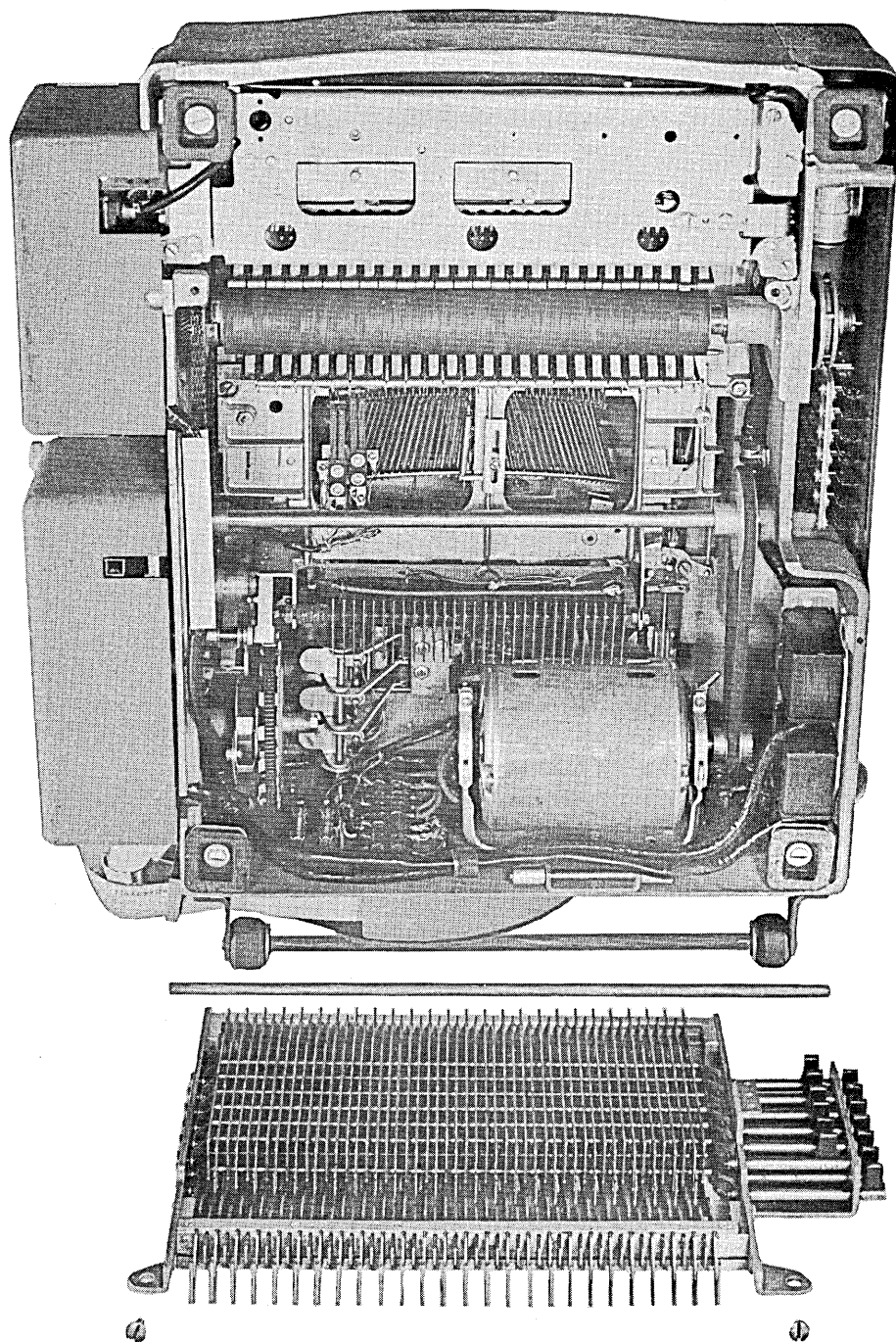


Figure 3-6 Selector Removed

Code Selector

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).

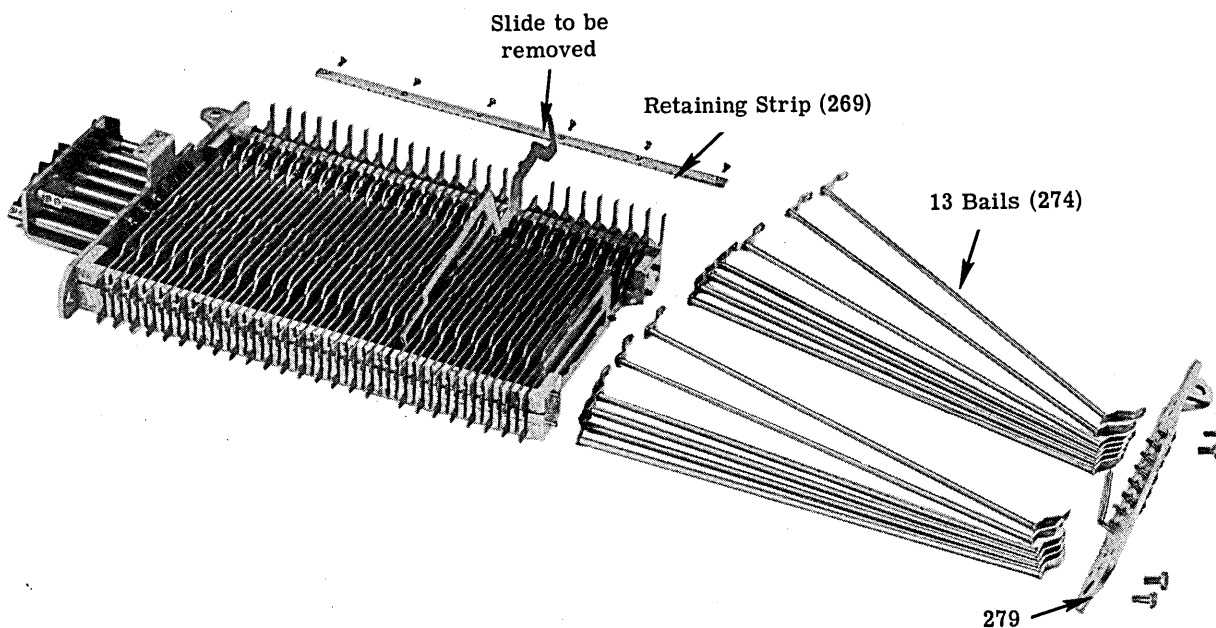
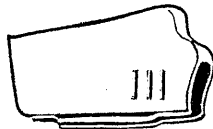


Figure 3-7 Selector Disassembled

Date: May 9, 1959
Reference: To be inserted in Part II, Section 3, between Pages 3-6 and 3-7.
Subject: Selector Code Adjustments
Purpose: Adjustments for new style common cam.
Information:

SELECTOR ASSEMBLY

All Flexowriter and Justowriters are now being manufactured with a new style common cam, part number 1046284. This cam was designed to shorten the closure time of the common contacts in order to reduce the pulse time to output units. This was particularly necessary with a TCPC connected to an SPS or SPD where the pick-up and drop-out time of code conversion relays were a factor. The new cam can be readily identified by the three vertical lines stamped on its side.



The complete adjustments for the selector with the new cam are as follows:

1. Mount Selector Assembly in writing machine. Tighten the Selector Pivot Shaft Set Screw and the Selector Assembly Mounting Screws. 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. Operate each type bar to the printing position and check to see that the slide does not choke off. (Form the operating extension of the slide if necessary). On machines with Electrical Trip Mechanism, this adjustment may have to be held to the minimum to assure proper escapement.

WITH THE MACHINE RESTING ON ITS FEET

2. Adjust the Contact Mounting Plate on the Base Casting to obtain the best average condition on Selector Contacts. Movable contacts must be against the fiber operator so that when the fiber operator is moved away from the movable contact, that the contact will follow the fiber operator a maximum of .010".
3. Individually adjust each contact assembly that is not against its contact fiber operator. If necessary, form the movable contact stiffener to allow the movable contact to be against its fiber operator.

SELECTOR CODE CONTACT ADJUSTMENTS

1. Adjust each set of code contacts to a gap of .020 to .024.
On PSM machines adjust each set of escapement contacts to a gap of .016 to .020.

COMMON CONTACT ADJUSTMENT MODELS SPS - SPD

1. Adjust SCC to .040 gap plus .006 or minus .003. The normal or starting setting should be .040. Next check the keyboard with the contact tester T-18164 connected across the common contact. If the majority of keys operated light both lights on the tester the SCC should be opened towards its maximum of .046. If the majority of keys operated light neither or one light the SCC should be closed towards its minimum of .037. Some slides will have to be bent to bring the pulse length into the desired range.

2. A minimum of .010 follow on the SCC is to be maintained on all type bars. Each type bar when operated manually should operate the punch when it is at least 1 inch from the platen.

3. These adjustments should give the desired pulse length with a minimum amount of individual slides being bent. If we keep as much follow as possible and still have the machine pass the contact tester we will insure that the majority of keys are giving a pulse near the 36 millisecond limit on the tester.

NOTE: CAUTION SHOULD BE USED WHEN CHECKING WITH THE CONTACT TESTER AS THERE SHOULD NEVER BE LESS THAN .010 FOLLOW OF THE STATIONARY COMMON CONTACT.

SELECTOR SLIDE OPERATIONAL CHECK AND ADJUSTMENT

1. Full operation of any type bar should move its mating cam and selector slide to give at least .010 movement of the stationary contact spring.

2. All code contacts must close before the common contact closes and open after the common contact opens.

3. If any slide fails to punch, it must be brought closer to the cam, but must not choke off on the cam. If it still fails, the common contact gap is to be closed, but not below the minimum specified above.

4. Slides that cause the punch error relay to pick up must be adjusted away from the cam.

5. If the common contact is set toward the minimum gap, and some slides still tend to operate the punch error relay, the common contact should be opened toward its maximum gap.

(See gap settings for various applications as listed above)

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.

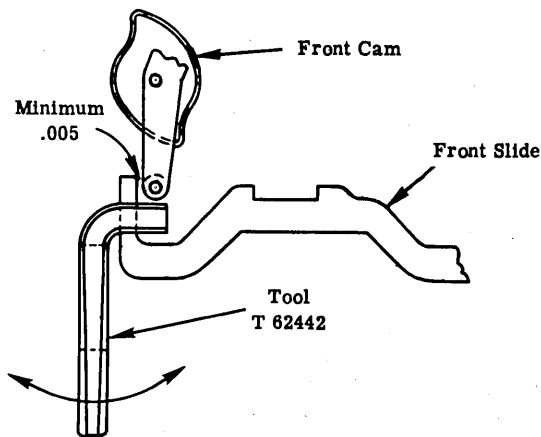


Figure 3-8 Cam & Slide Clearance - Nonoperate

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

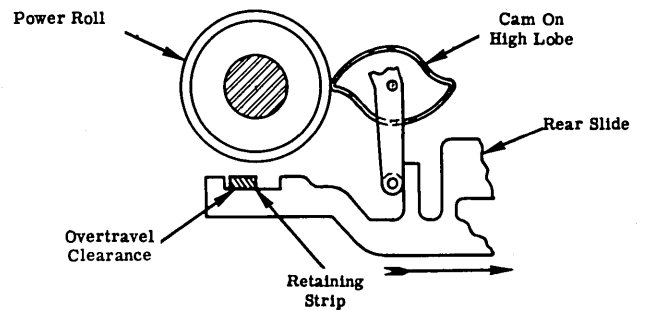


Figure 3-9 Cam & Slide Clearance - Operate

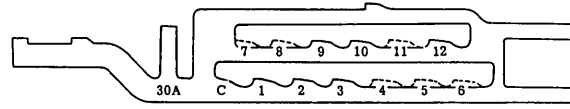
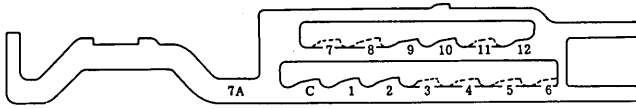
contacts close, and open after the common contacts open. Check to see that a full operation of a selector slide closes the common contact points with at least an appreciable movement of the stationary contact spring away from its stop strip.

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

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		Character Code	Escapement Code		Escapement Magnets Operated		Unit Width	
LC	UC		LC	UC	LC	UC	LC	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
!	!	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

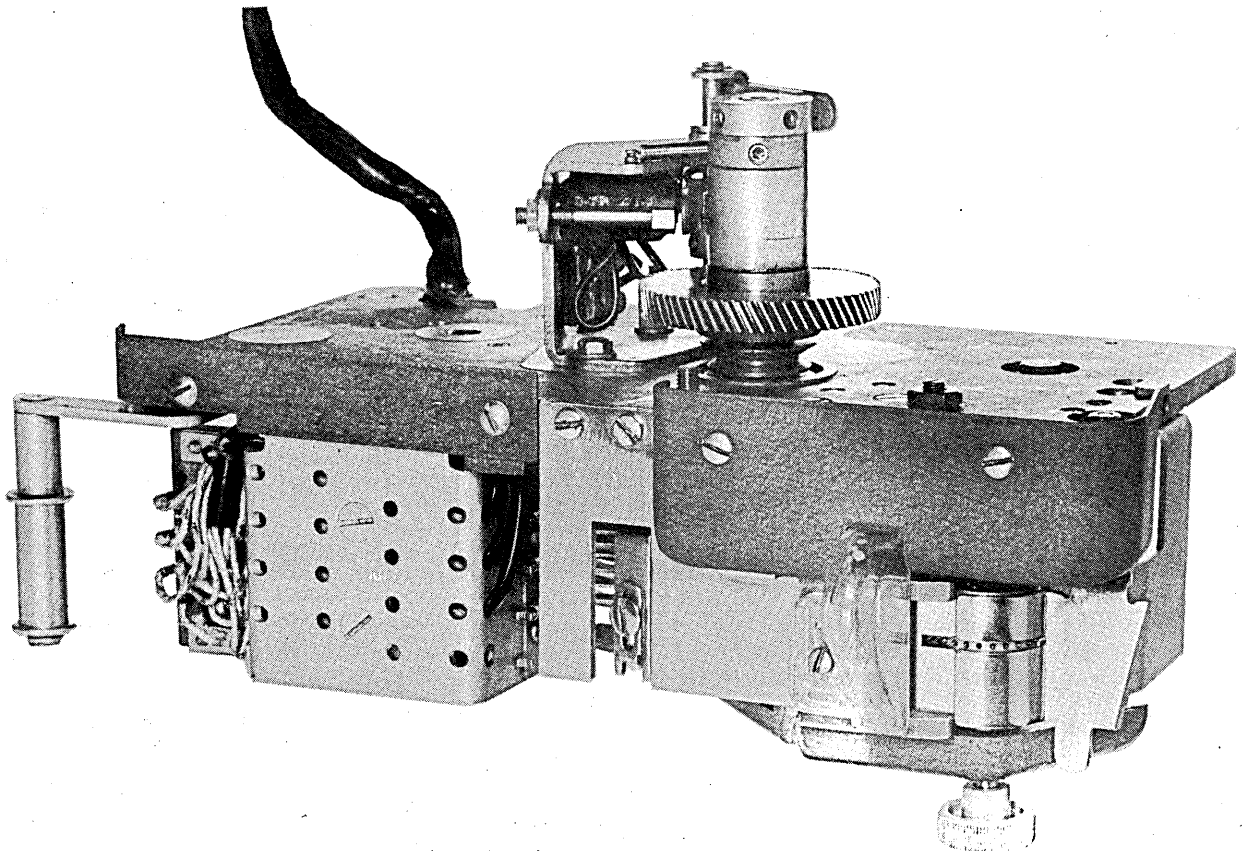


Figure 4-1 Punch Clutch Mechanism

Clutch Mechanism

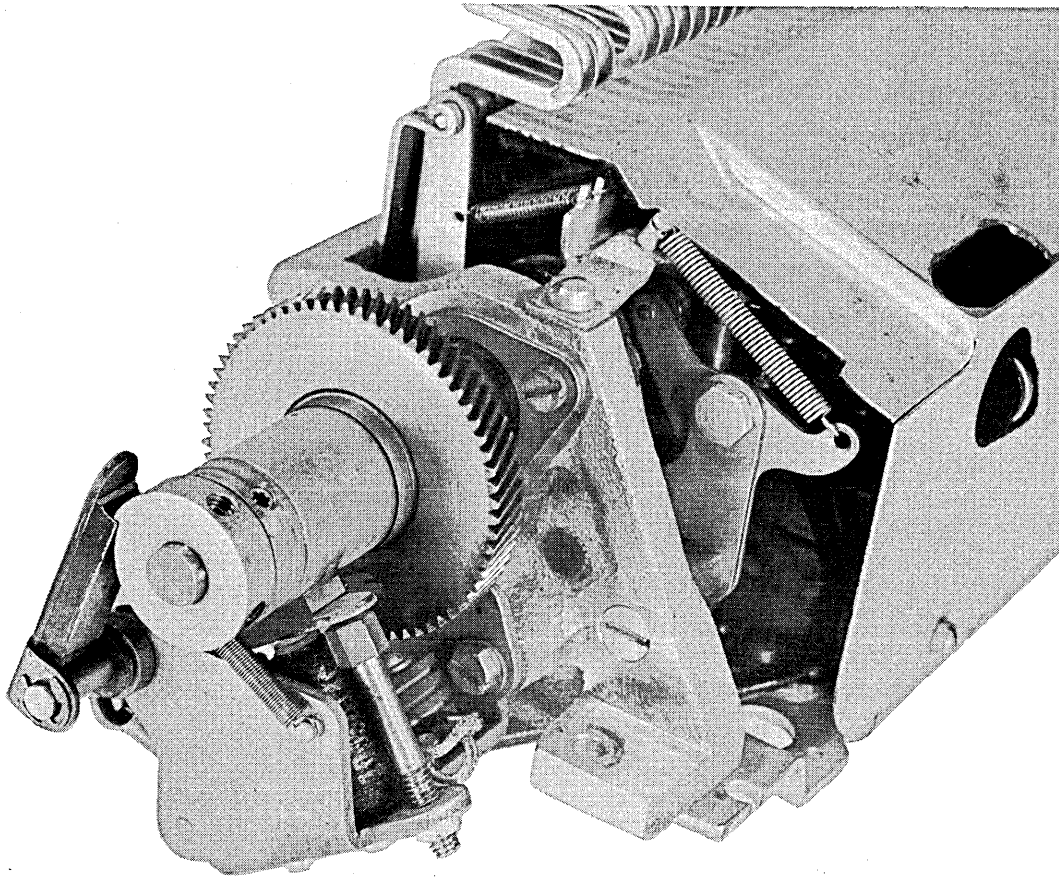


Figure 4-2 Translator Clutch Mechanism

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

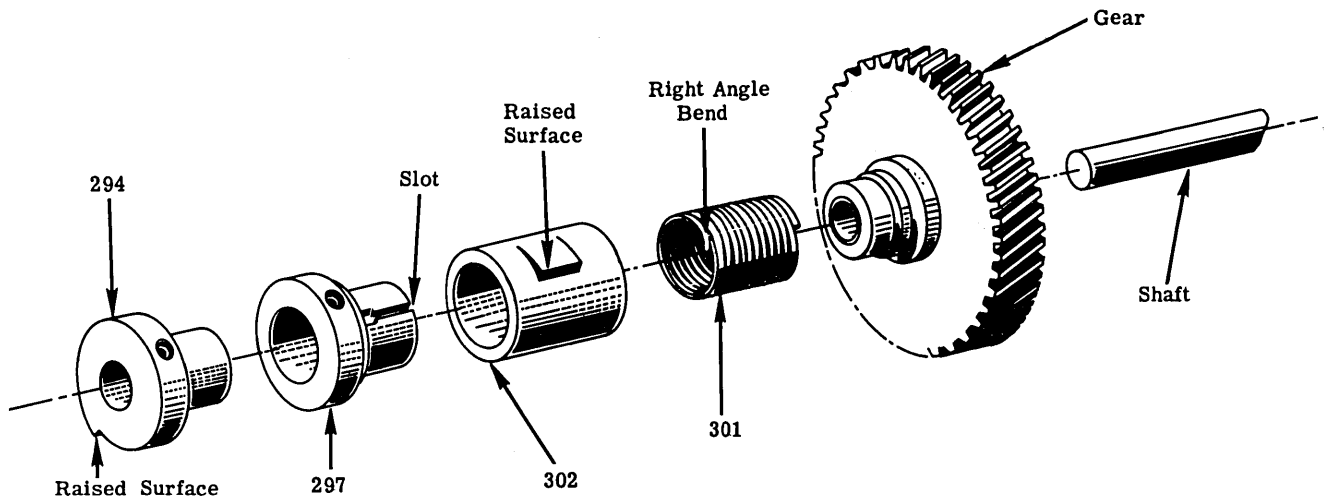


Figure 4-3 Clutch Mechanism Disassembled

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.

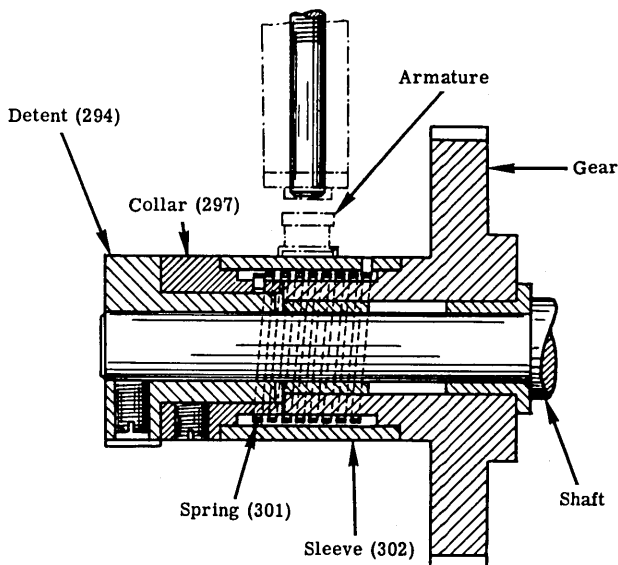


Figure 4-4 Cut-away Side View

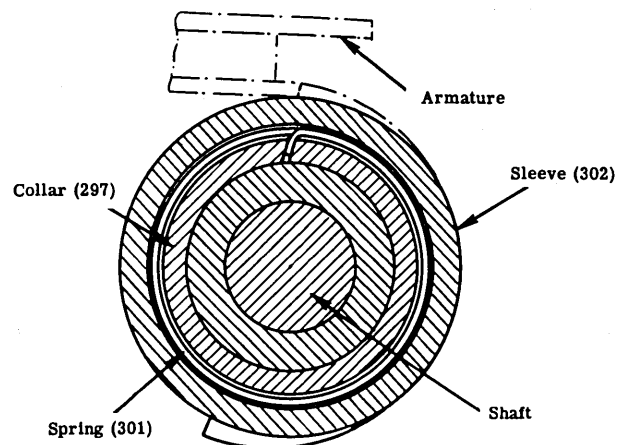


Figure 4-5 Cut-away End View

TAPE PUNCH

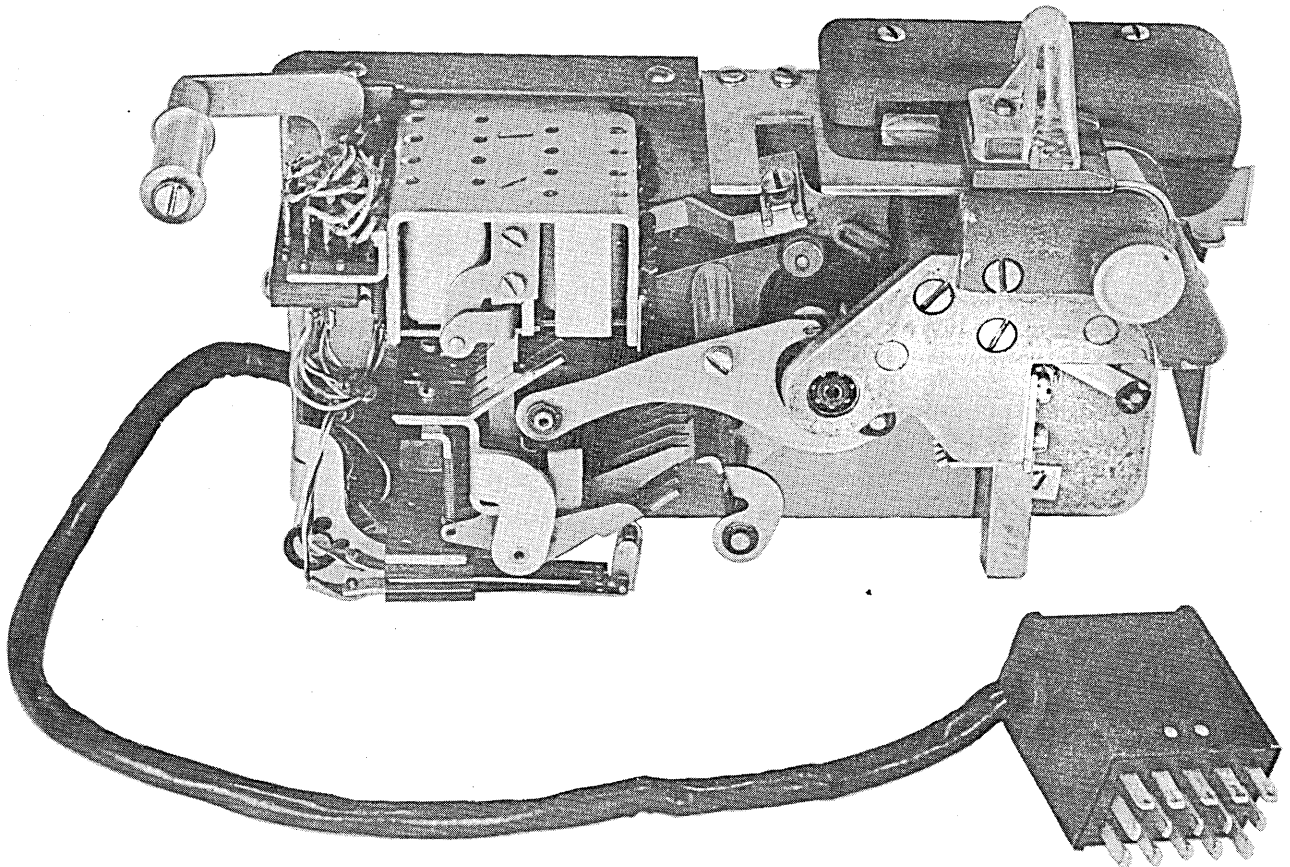


Figure 5-1 Tape Punch

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

Tape Punch

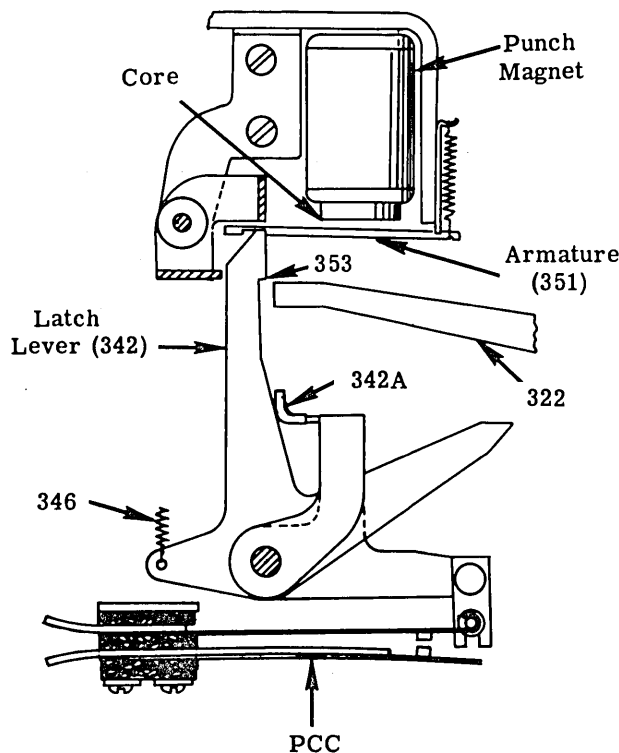


Figure 5-2 Punch Magnet and Latch Lever

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

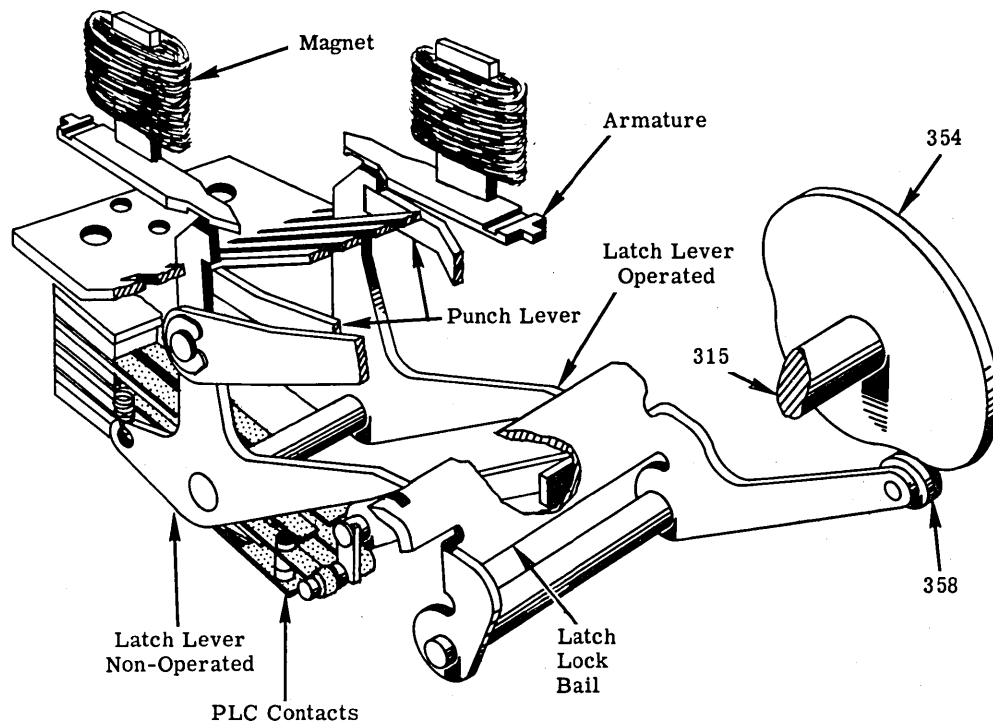


Figure 5-3 Latch Lock Bail

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 knock-off 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

Tape Punch

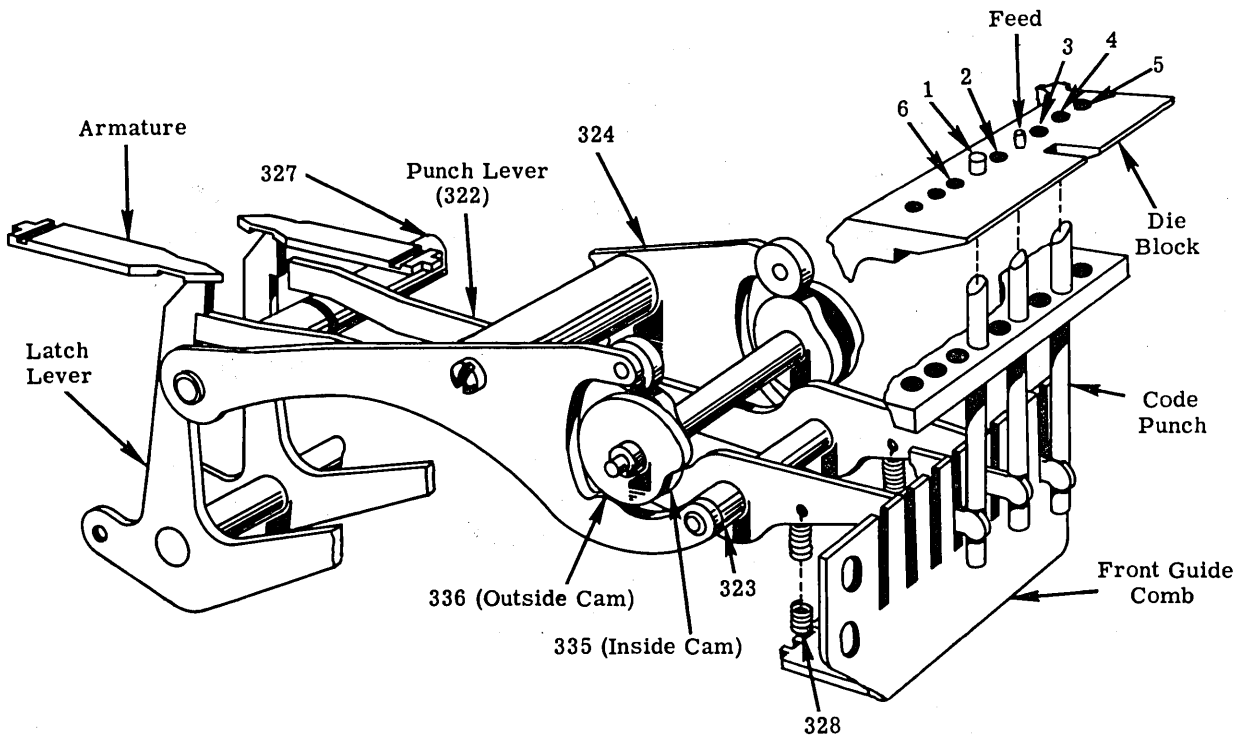


Figure 5-4 Latch, Operating Lever and Punch

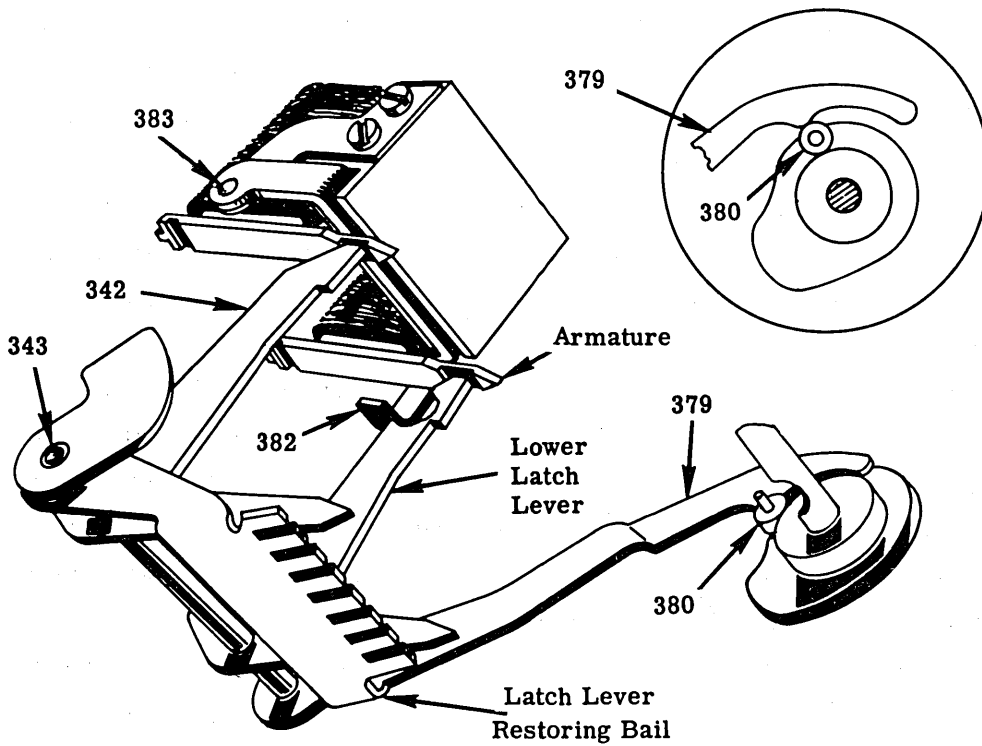


Figure 5-5 Latch Lever Restoring

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.

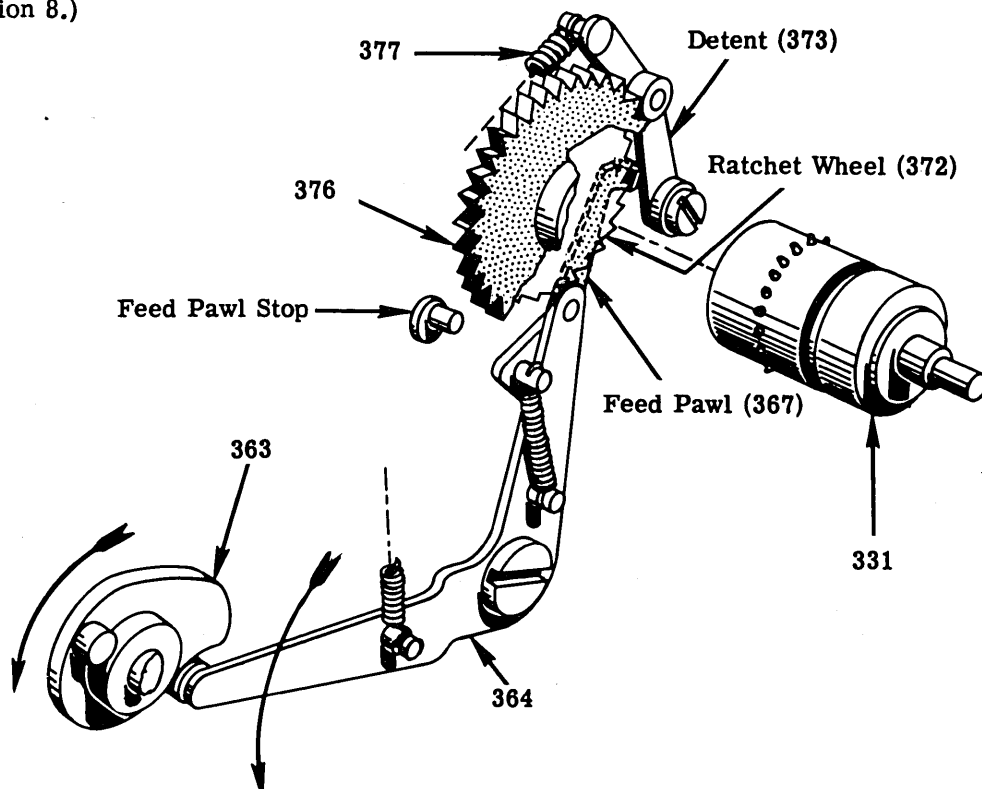


Figure 5-6 Tape Feed Mechanism

Tape Punch

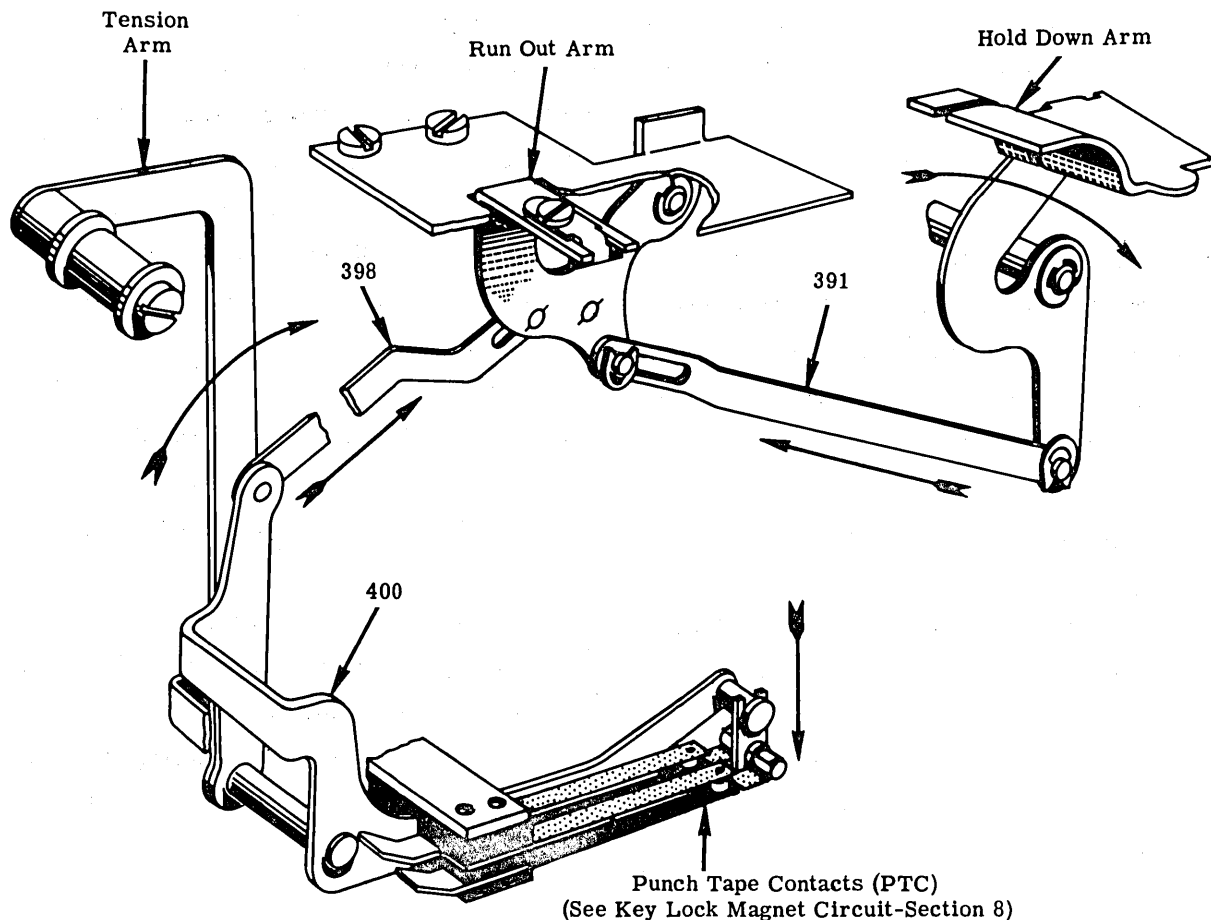


Figure 5-7 Punch Tape Contact Mechanism

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,

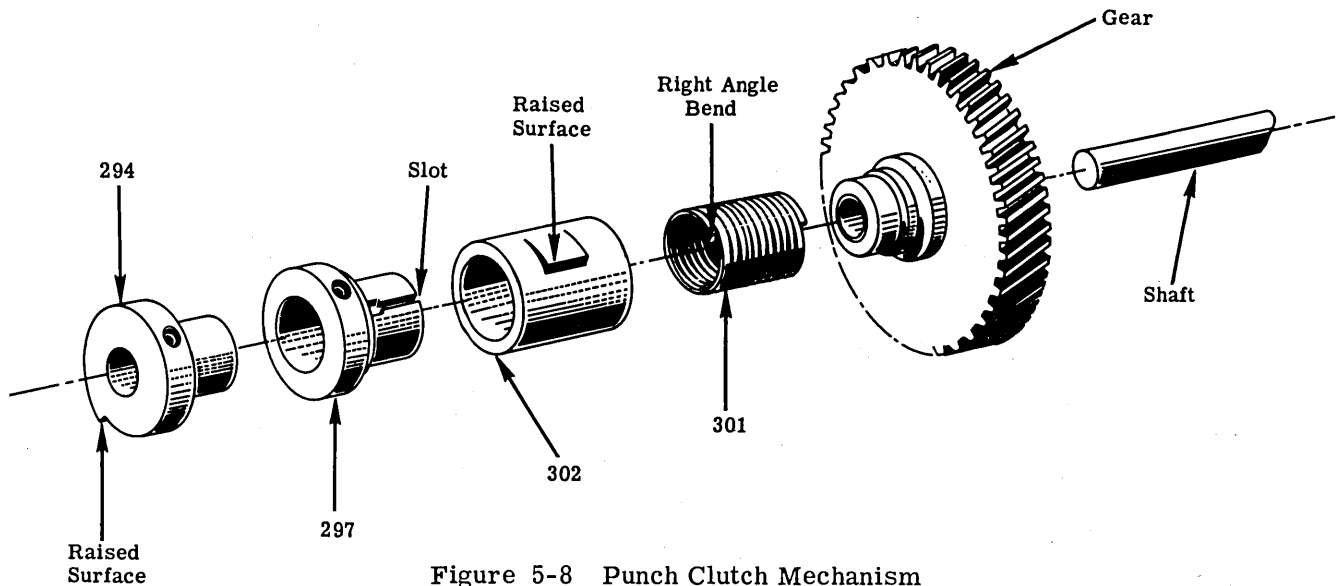


Figure 5-8 Punch Clutch Mechanism

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

Tape Punch

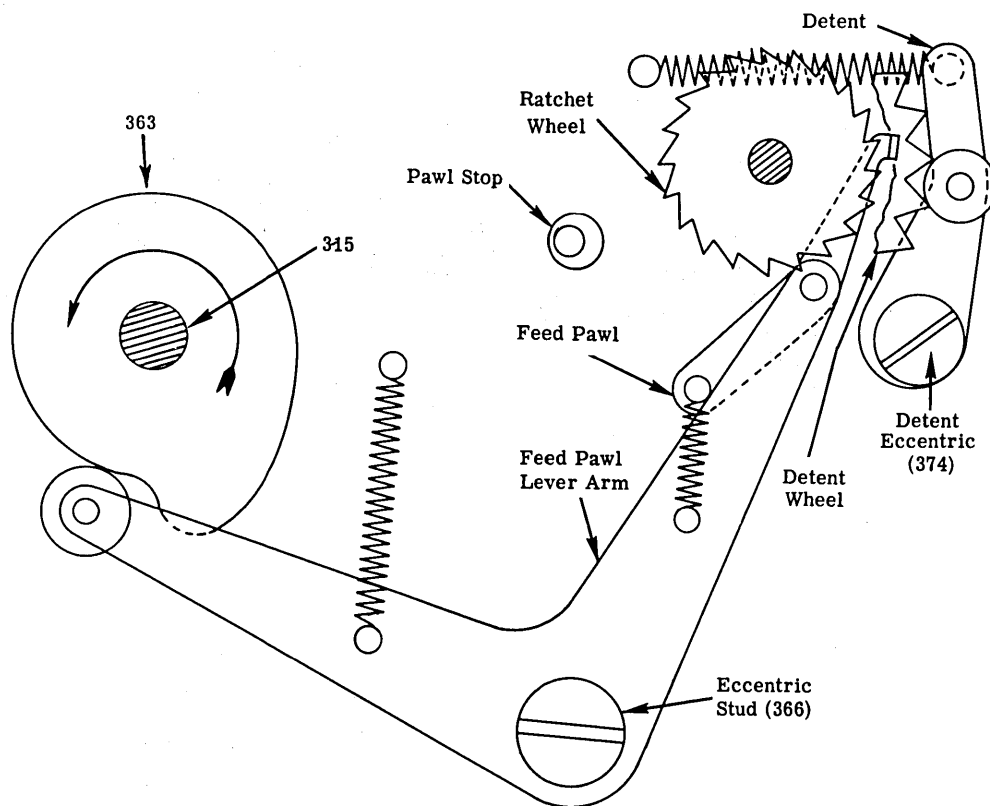


Figure 5-9 Feed Lever Position

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-

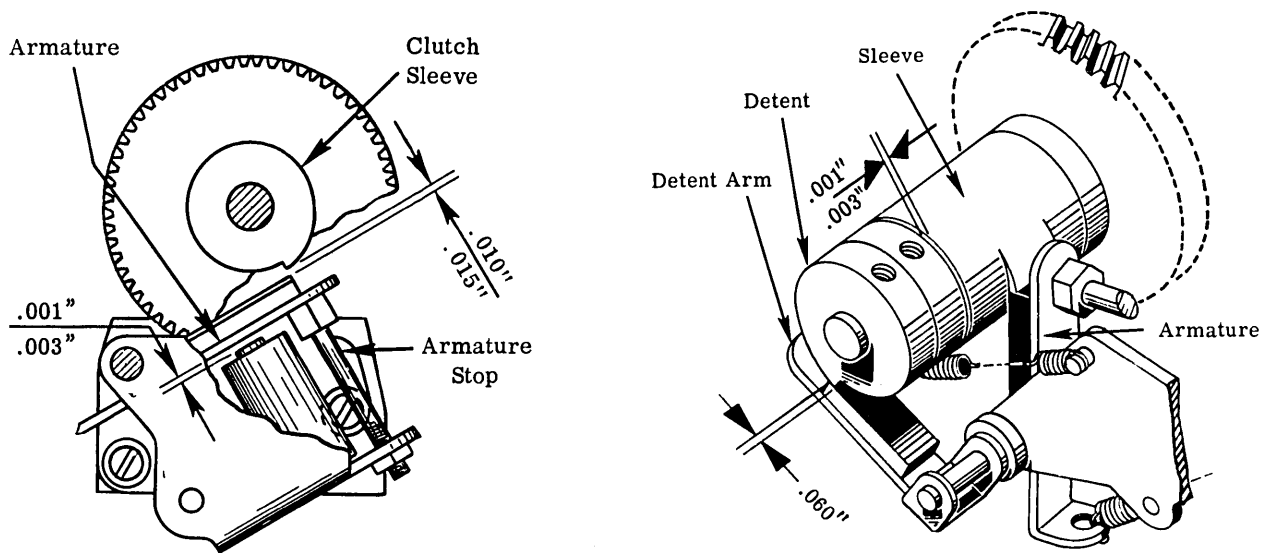


Figure 5-10 Clutch Magnet Yoke Adjustment

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

Tape Punch

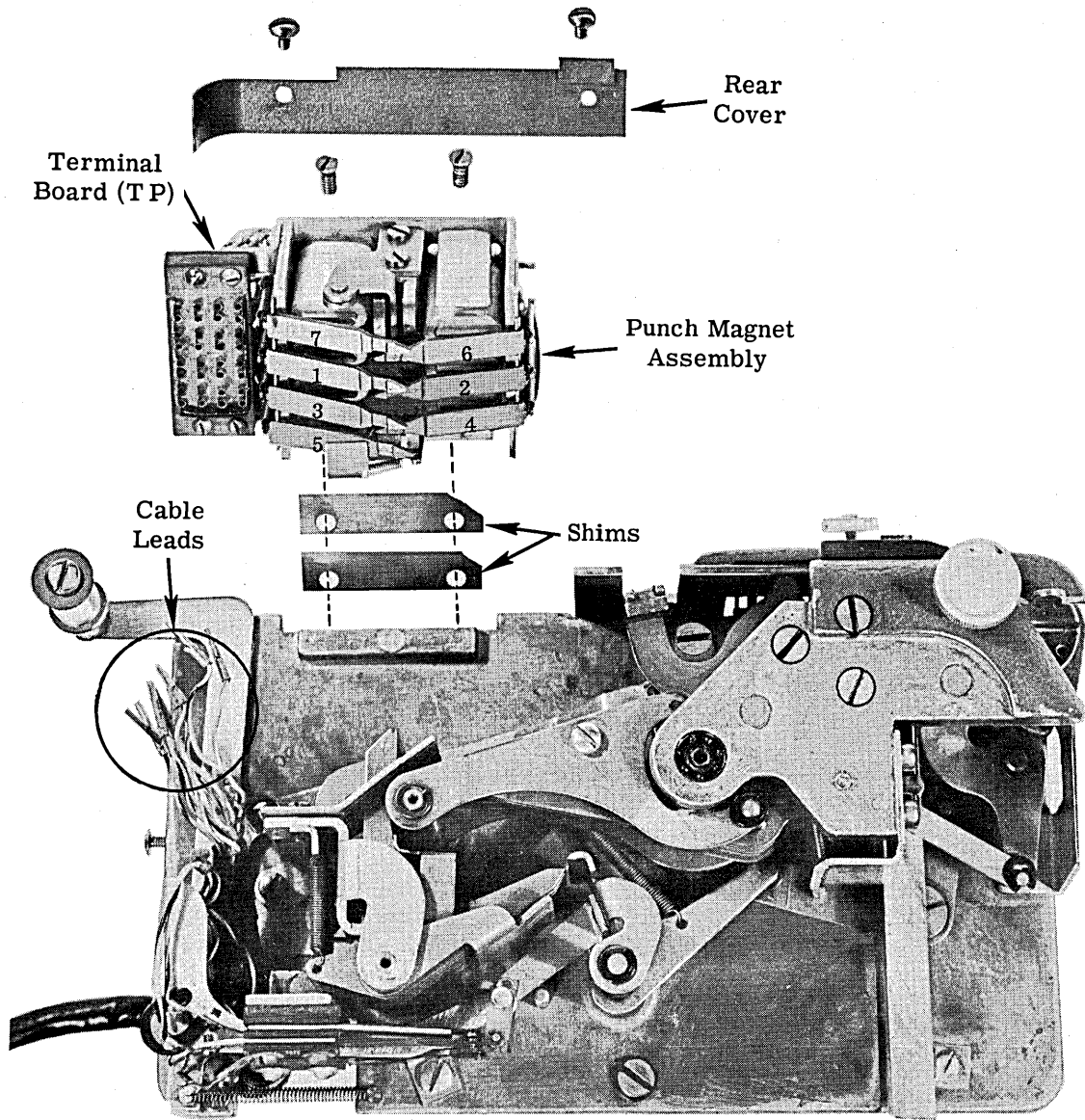


Figure 5-11 Removal of Punch Magnet Assembly

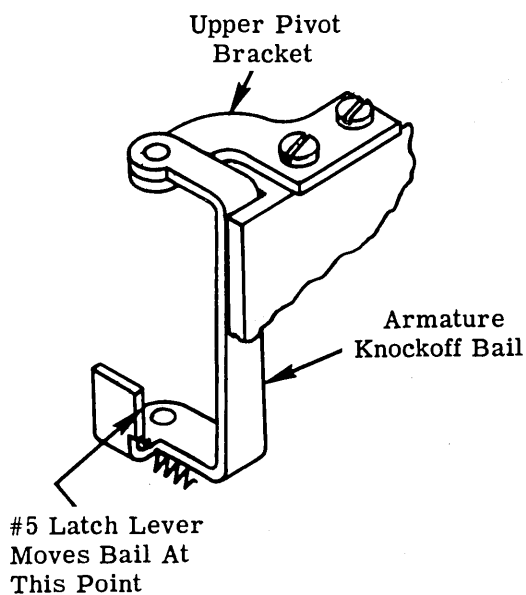
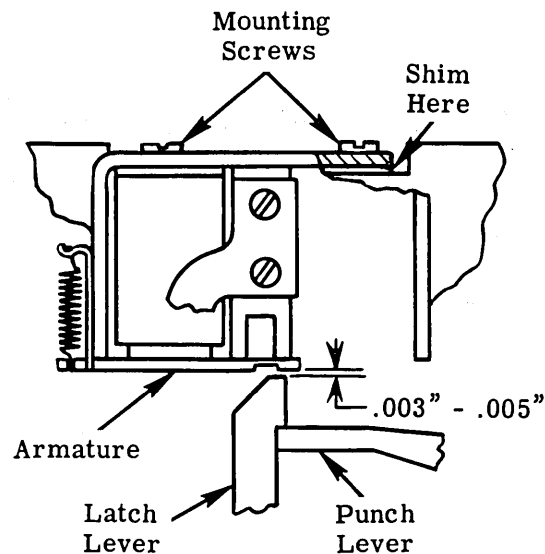


Figure 5-12 Adjustment of Knockoff Bail

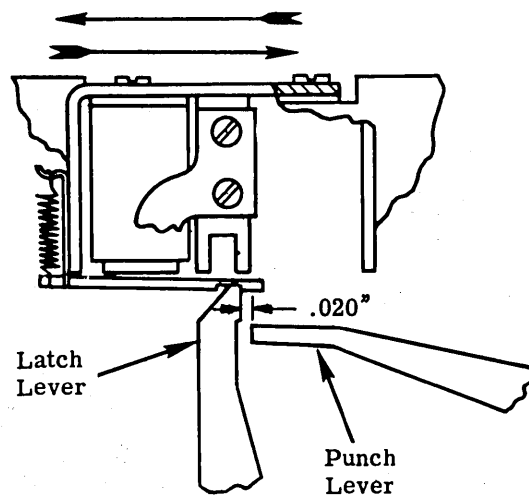
Figure 5-13
Shimming of Punch Magnet Assembly

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.

Tape Punch

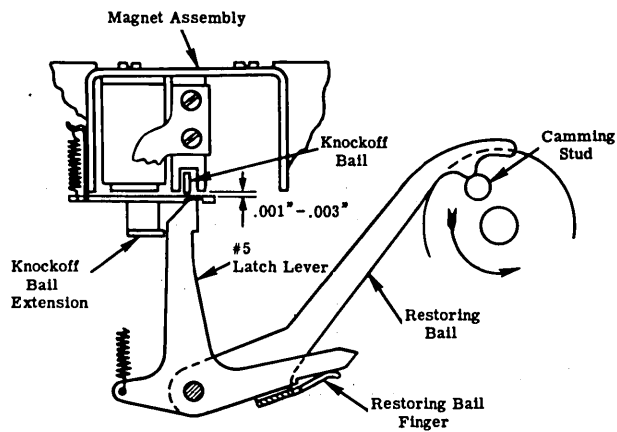


Figure 5-15 Knockoff Adjustment

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

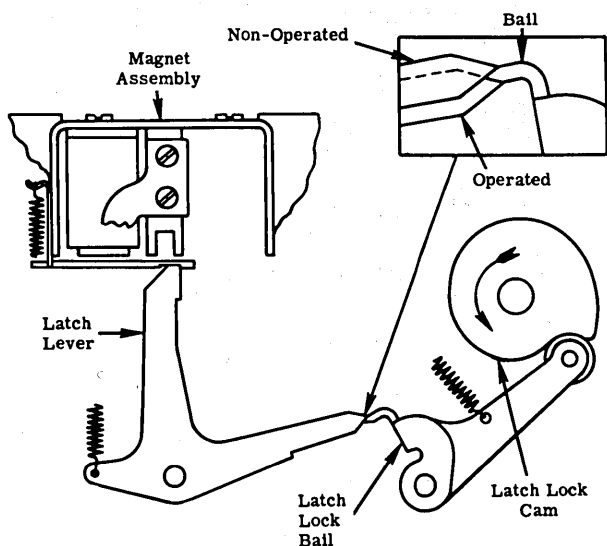


Figure 5-16 Latch Lock Adjustment

then refer to the following:

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

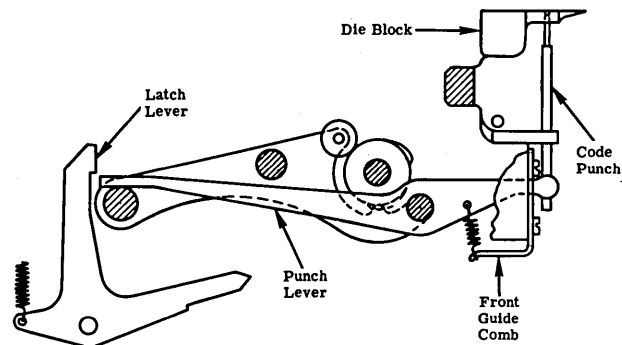


Figure 5-17 Guide Comb Adjustment

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.

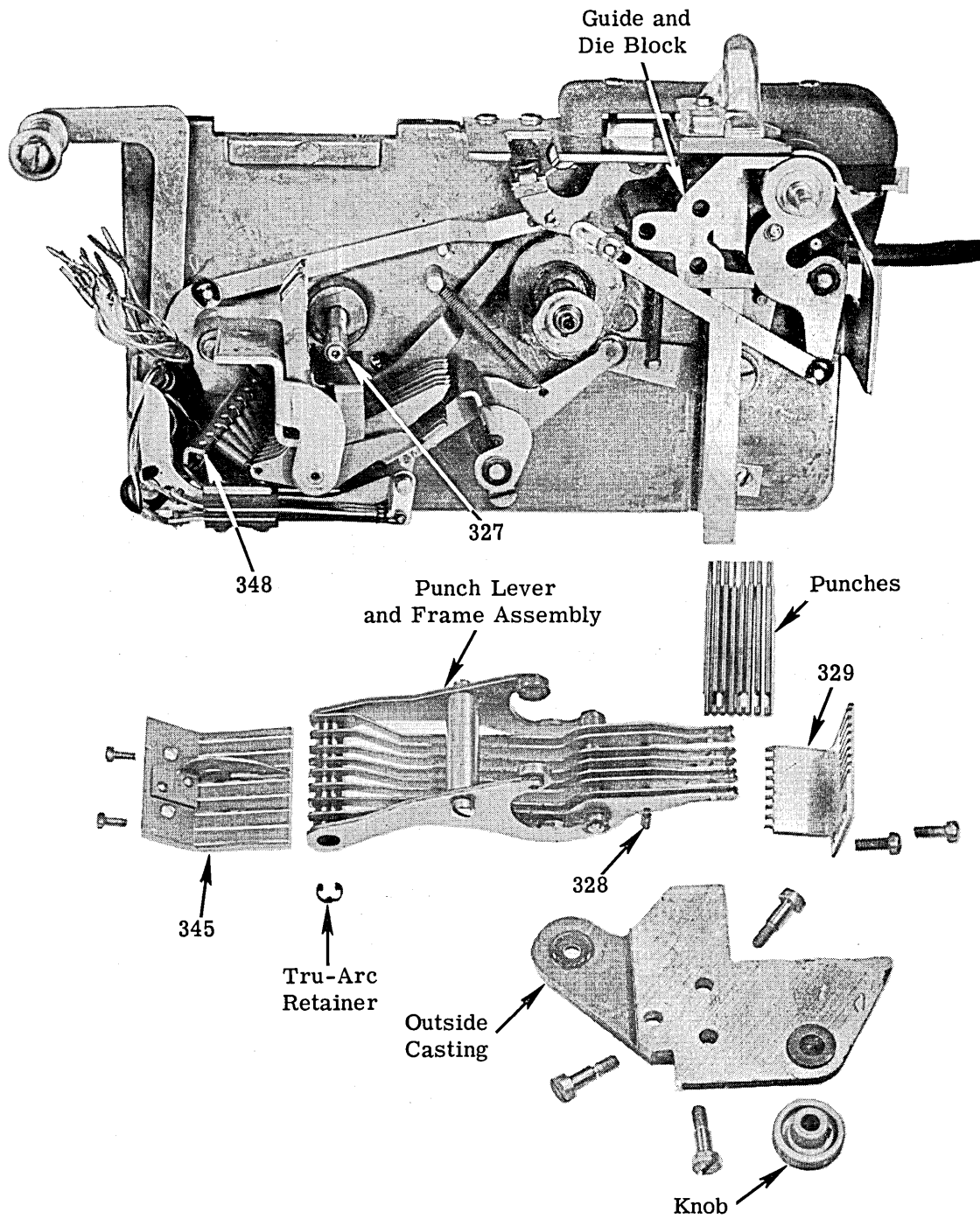


Figure 5-18 Removal of Punch Lever and Frame Assembly

Tape Punch

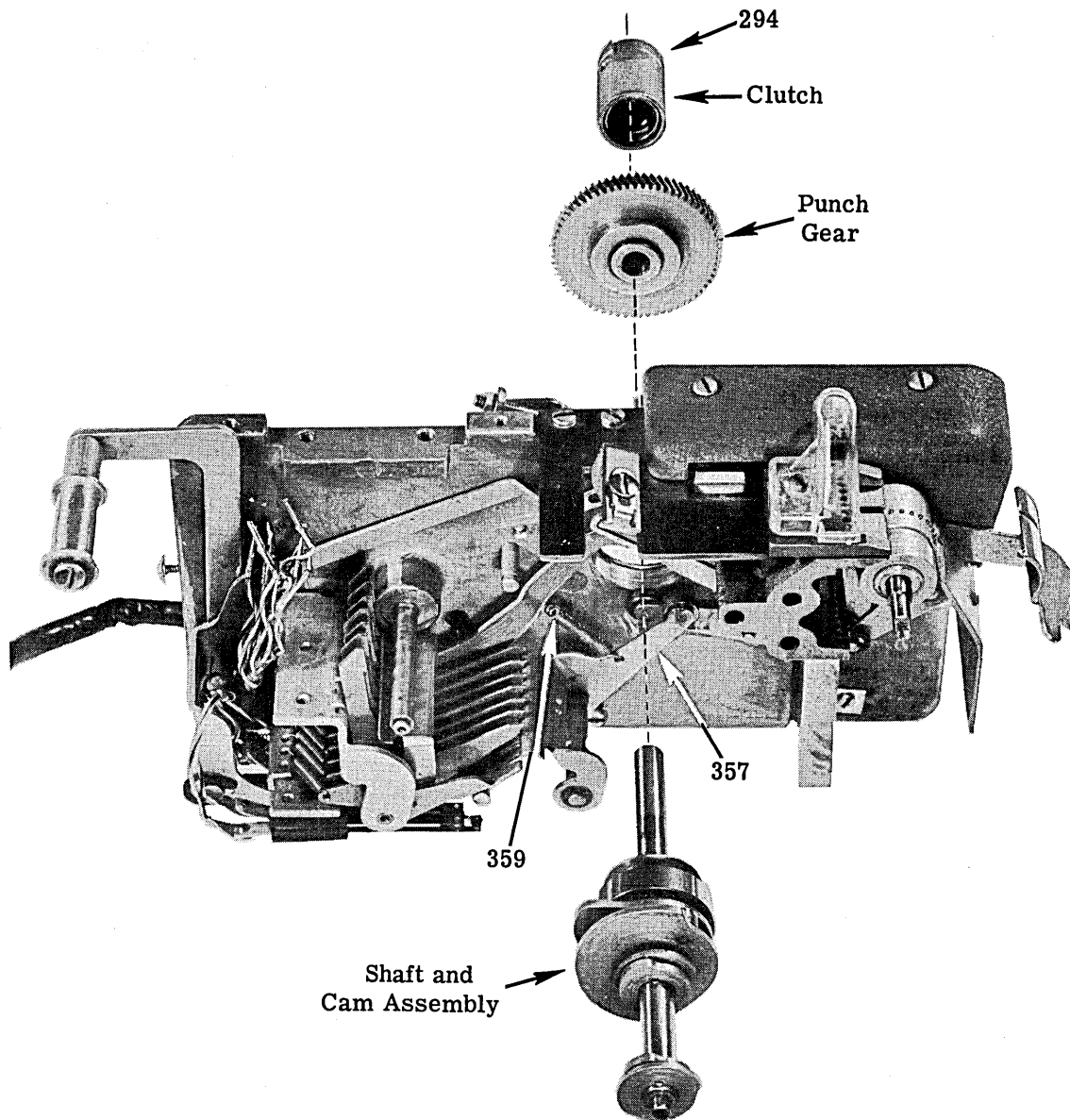


Figure 5-19 Removal of Punch Shaft and Cams

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.

Tape Punch

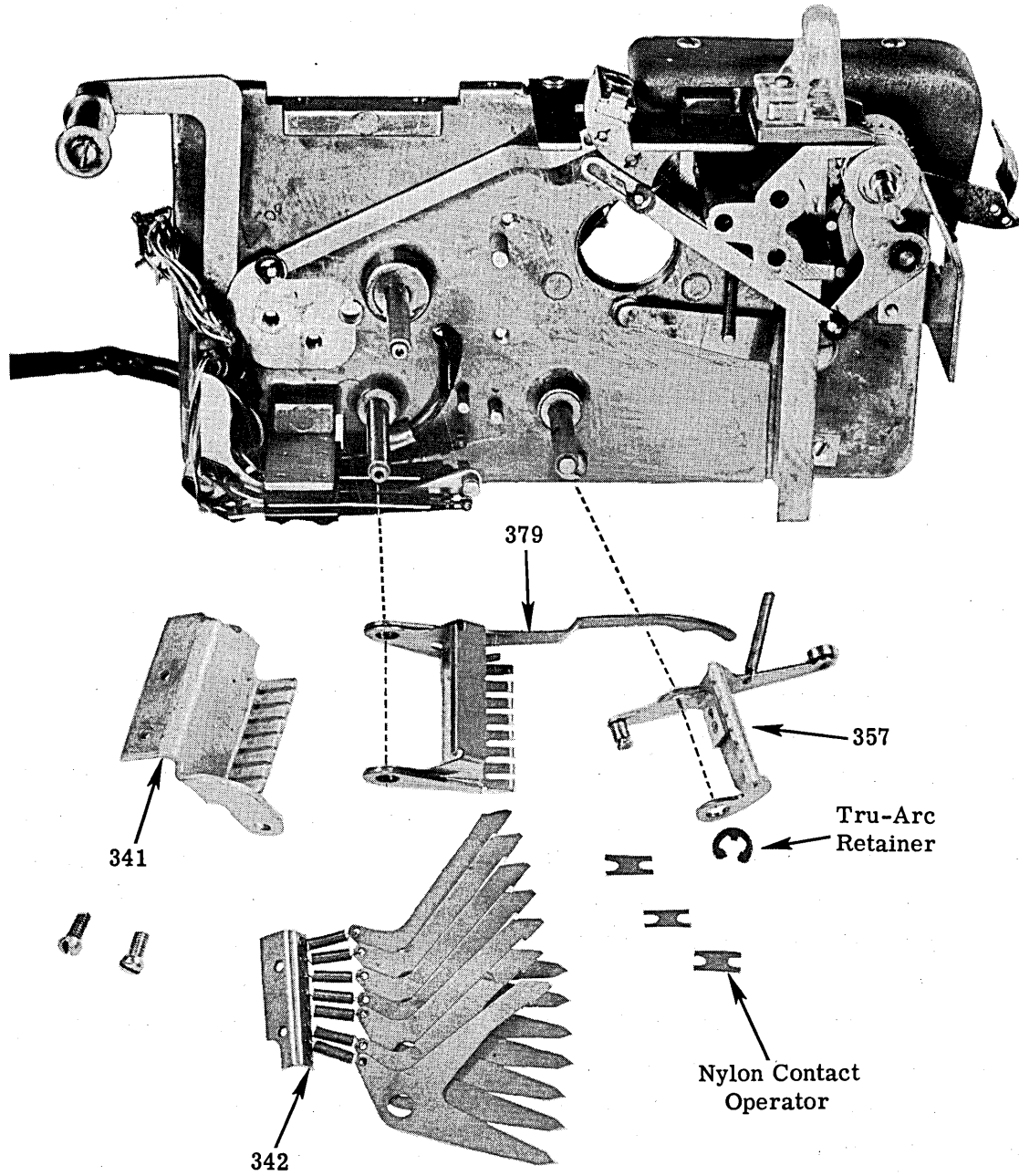


Figure 5-20 Removal of Latch Lever and Bail Assembly

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 mecha-

nism, 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" \pm .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

Tape Punch

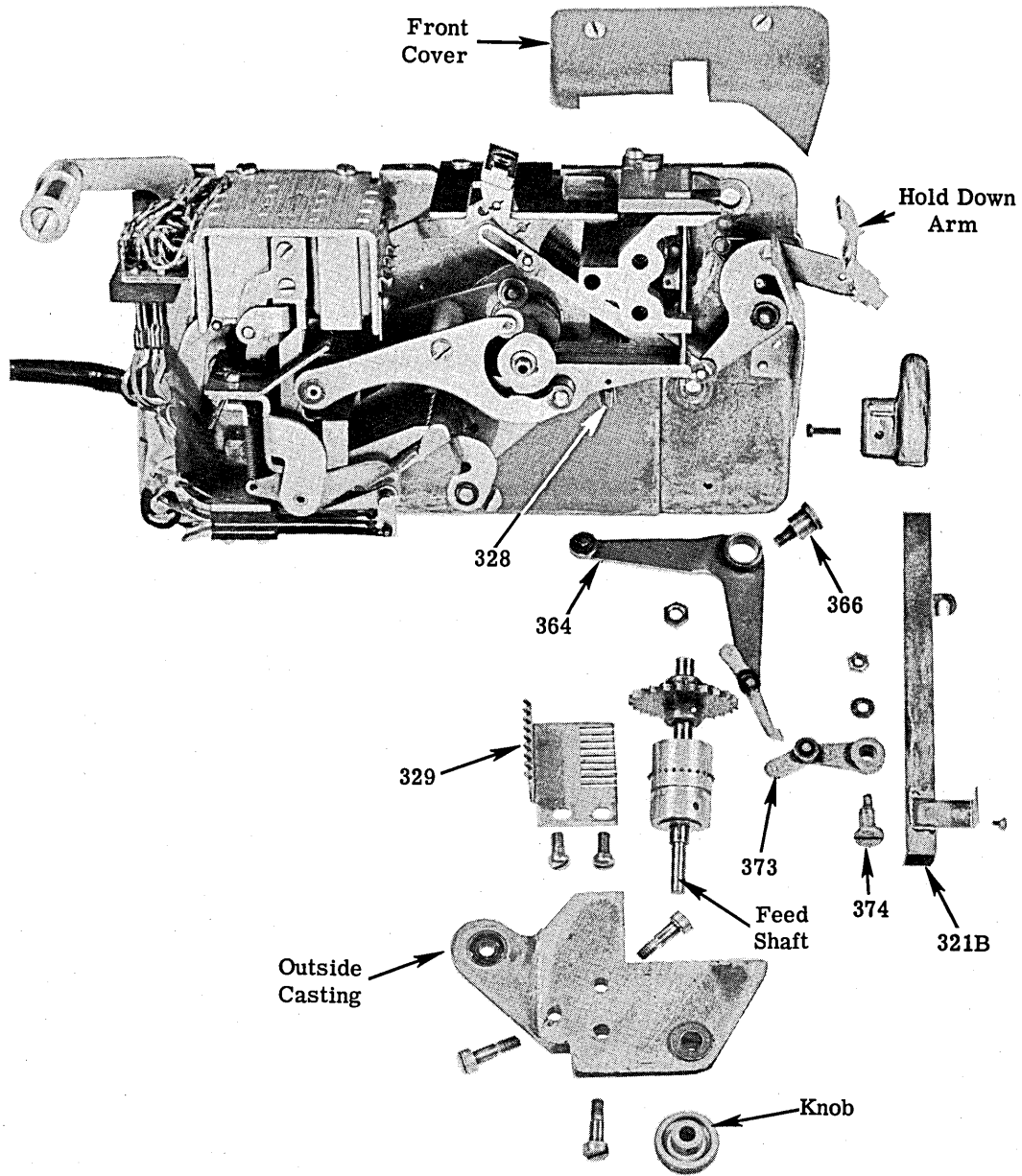


Figure 5-21 Removal of Tape Feed Mechanism

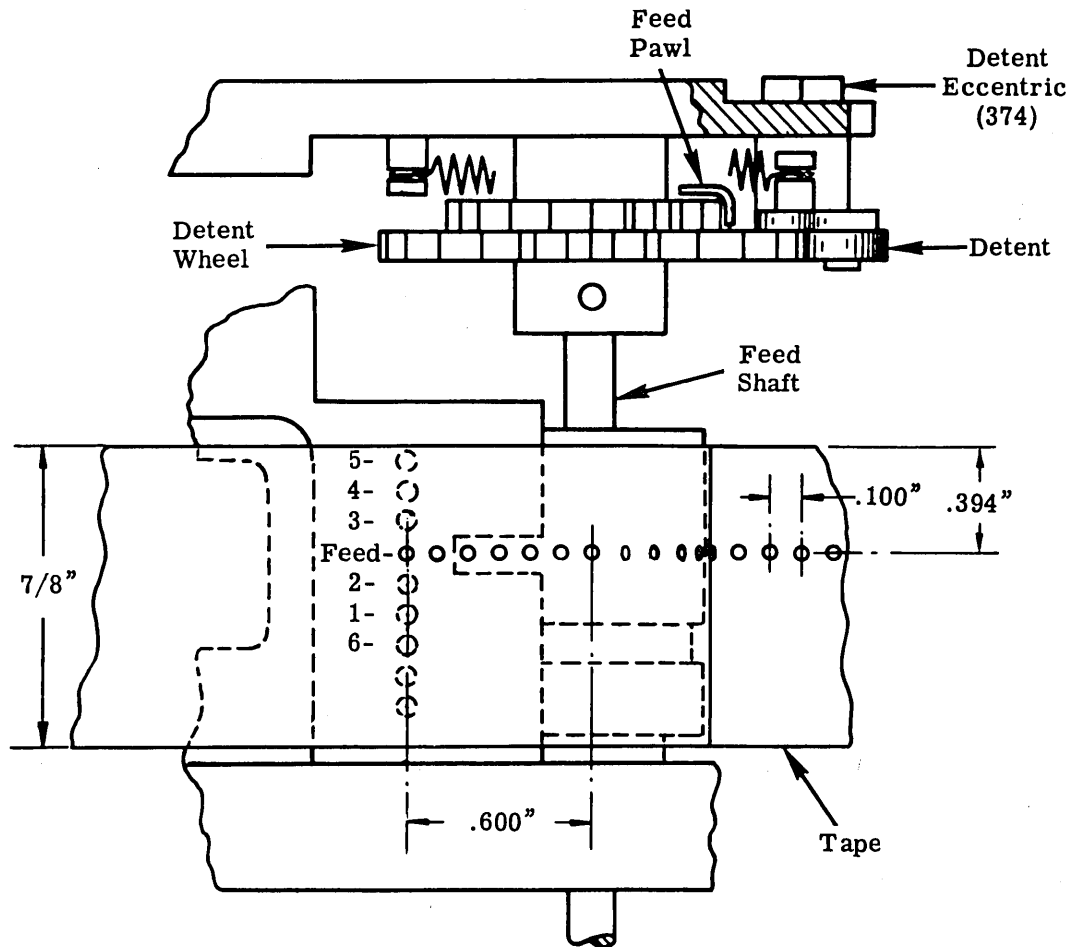


Figure 5-22 Tape Registration

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

Tape Punch

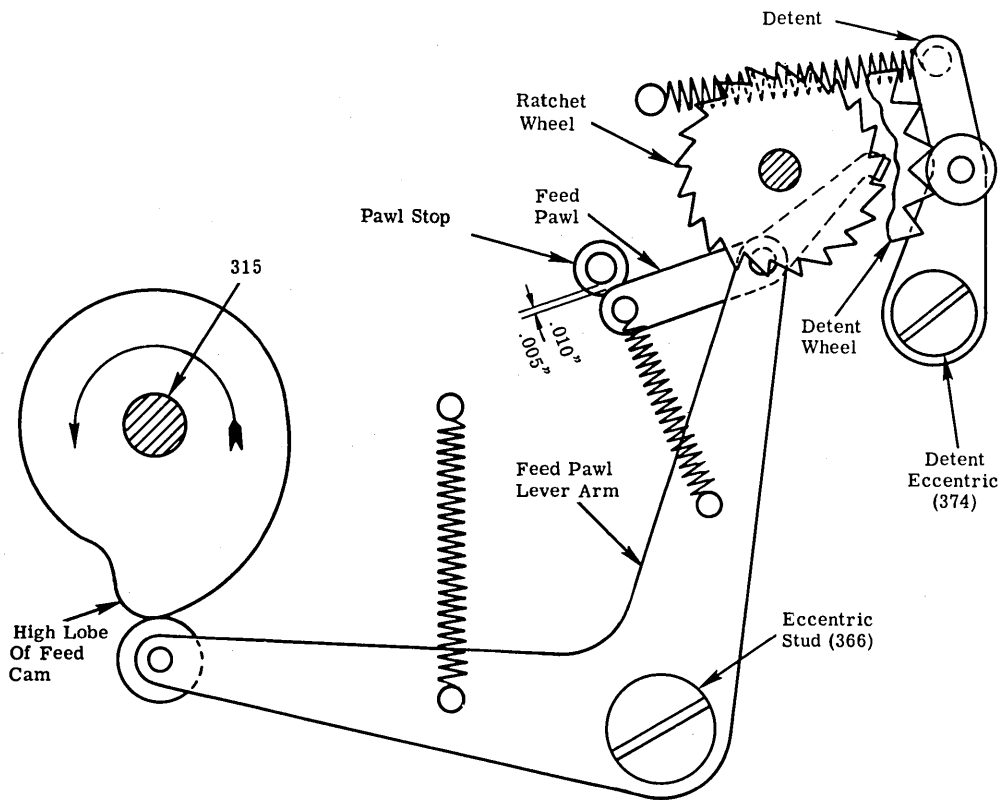


Figure 5-23 Feed Pawl Adjustment

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.

The logo for Friden, consisting of the word "Friden" in a white serif font on a black rectangular background.

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 holddown 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" \pm .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.

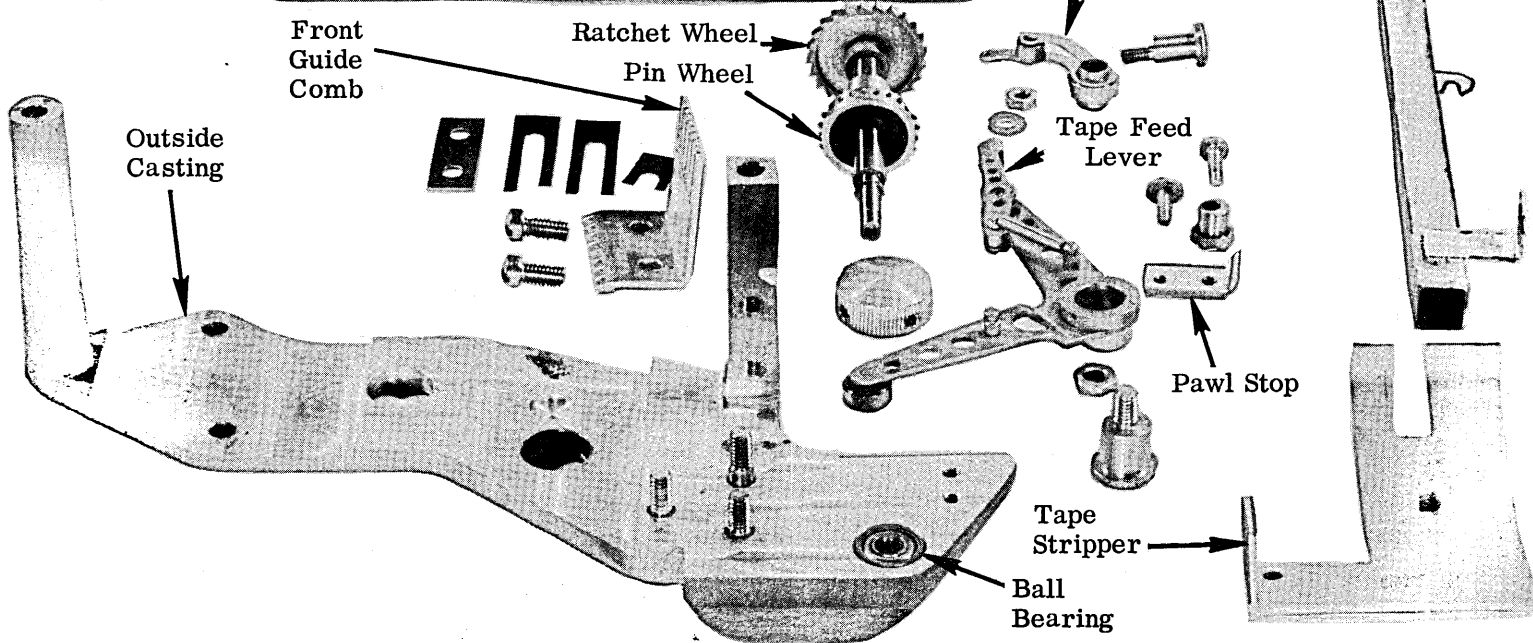
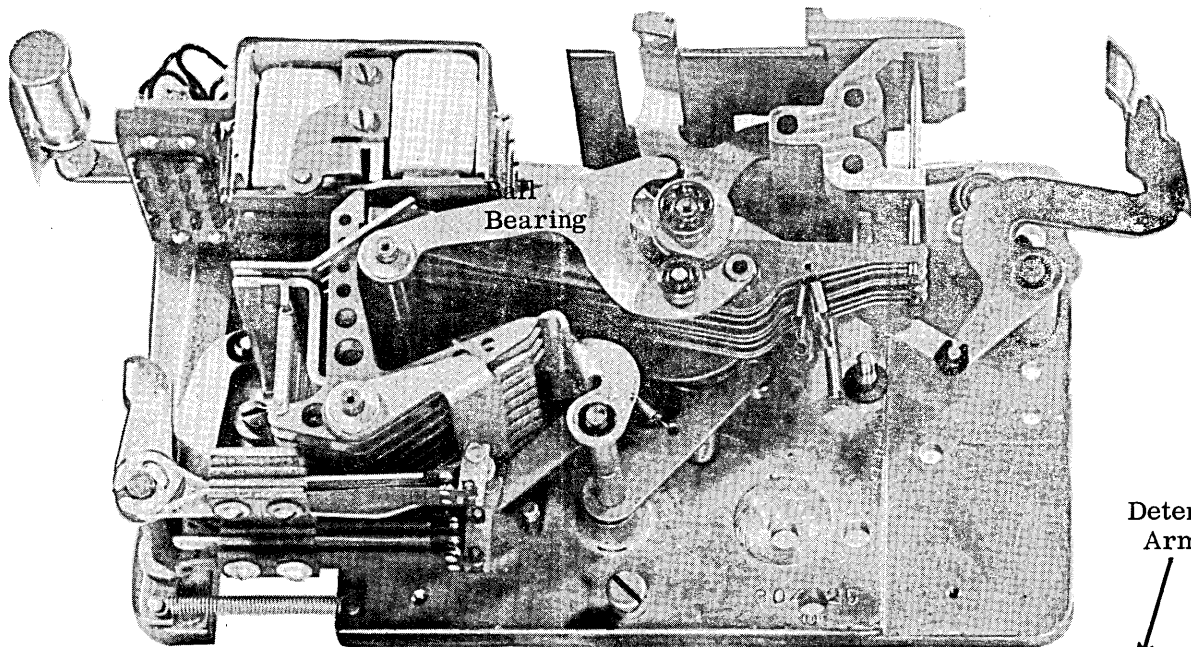
Punch Clutch Mechanism - The clutch parts have been altered and an additional roller has been added to obtain more positive control at higher speeds. The adjustments are as follows:

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 ($\mp 1^\circ$) 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).



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.

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.

#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.

MANUAL ADDENDUM

#16

Date: August 15, 1958

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

Subject: Model 2 Tape Punch

Purpose: Adjustment Procedure - Model Clutch

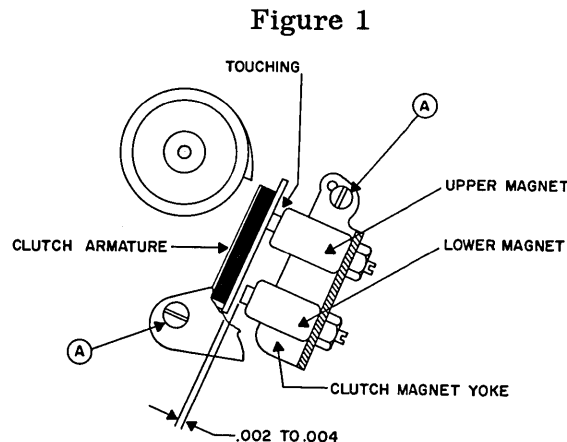
Information:

For the complete adjustments and general description of the Model 2 Punch, refer to Manual Addendum #6, date June 1, 1955, in Part II, Section 5.

ADJUSTMENTS

1. Clutch Magnet Yoke (Figure 1). The Clutch Magnet Yoke Assembly, should be positioned on the Punch Frame (Inner) casting, so that the Clutch Armature, in the attracted position, lies flat, on the Core of the Upper Magnet Coil, and has .002" to .004" clearance to the lower Magnet Core.

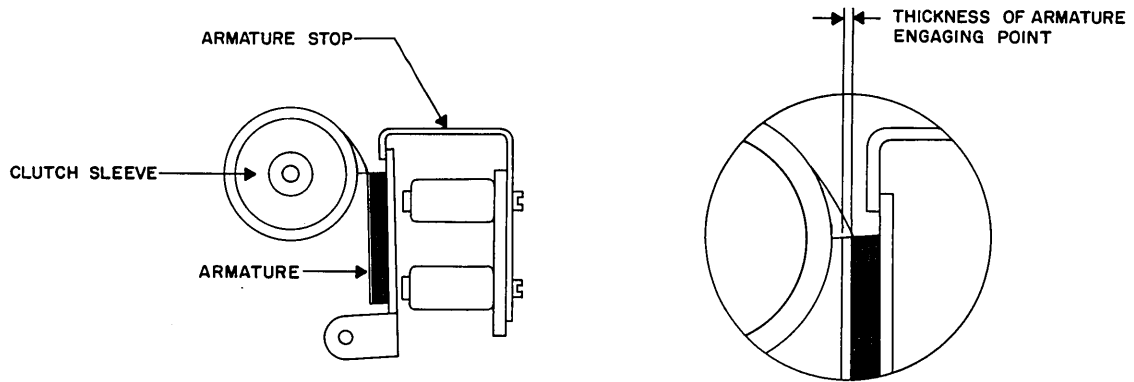
To adjust, loosen Screws A, and move in either direction, until the proper clearance is obtained.



2. Armature Stop (Figure 2). With the Clutch Armature in latched position, the Lip on the Clutch Sleeve, should engage the Armature no more than the thickness of the Armature engaging surface.

To adjust, reform the Armature stop, and then check to be sure there is clearance between the Clutch Sleeve and the Armature, when it is in the attracted position.

Figure 2



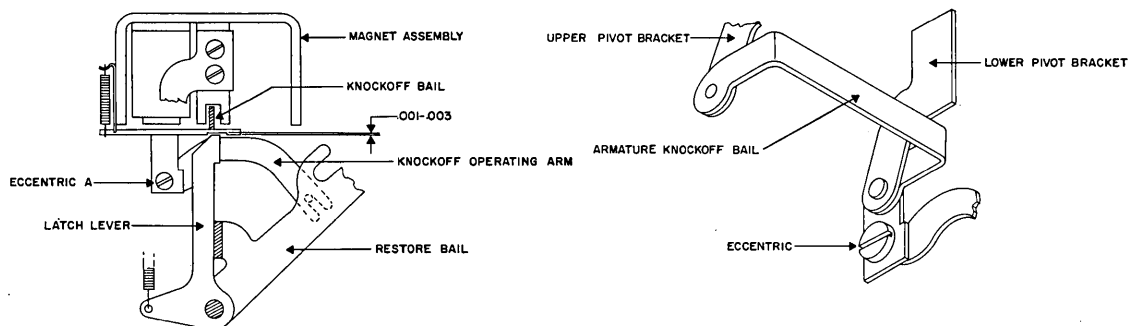
3. Armature Knockoff Bail (Figure 3). The Armature Knockoff Bail, should move all Punch Magnet Armatures simultaneously.

To adjust, move the upper and lower Pivot Bracket.

When the Armature Knockoff Bail is in its fully operated position, there should be .001'' to .003'' clearance between the Punch Magnet Armatures, and the Latch Levers.

To adjust, turn Eccentric Stud A, until the proper clearance is obtained.

Figure 3



TAPE READER

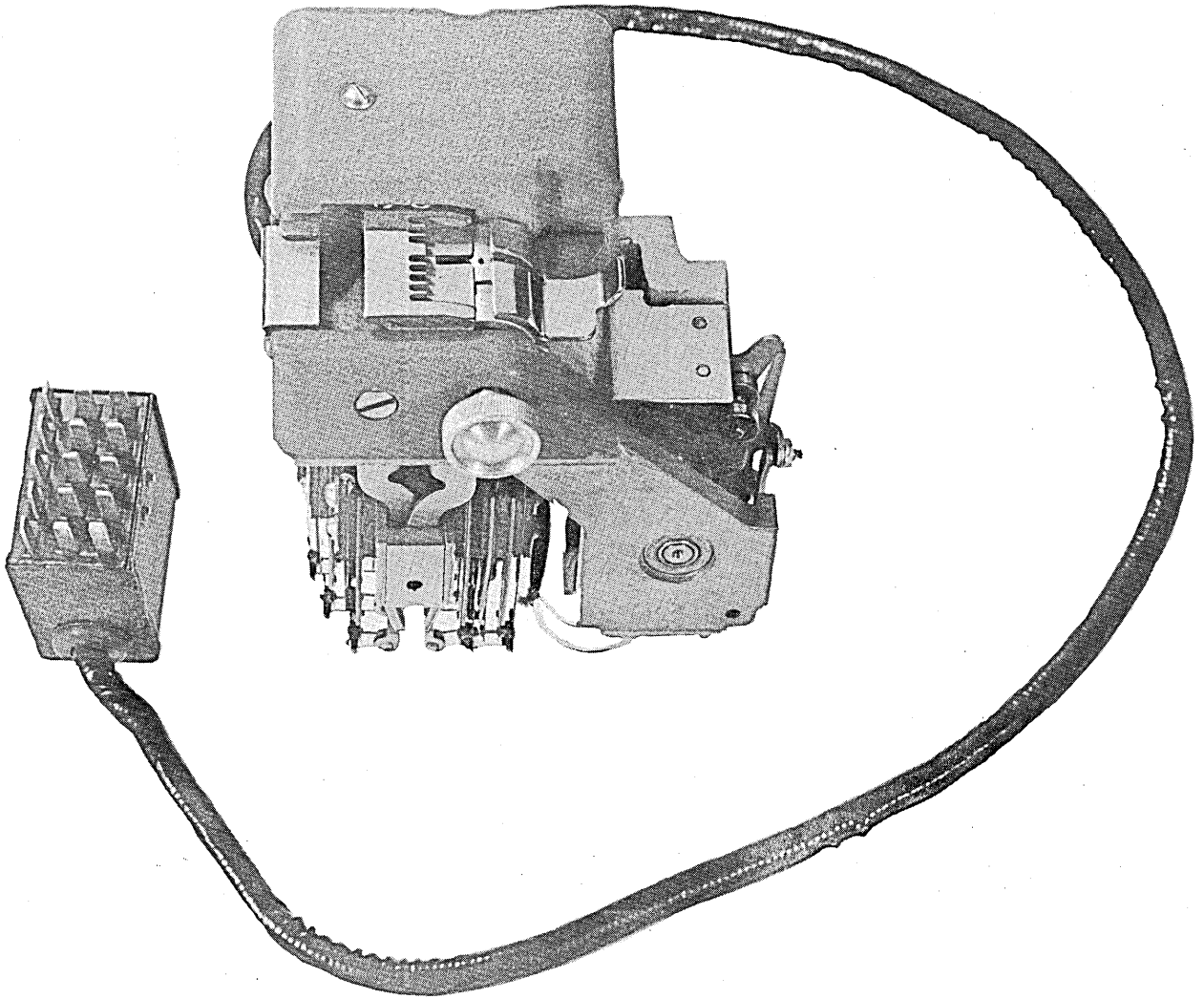


Figure 6-1 Tape Reader

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,

Tape Reader

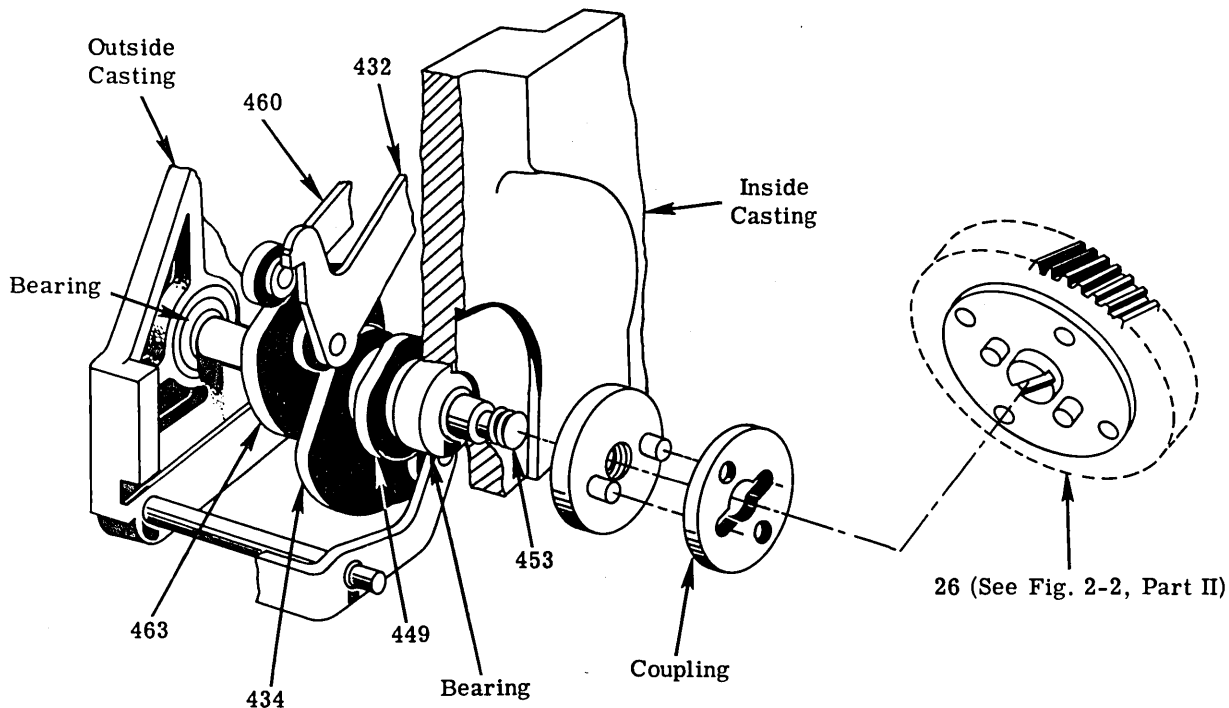


Figure 6-2 Reader Shaft and Cams

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 cast-

ings 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).

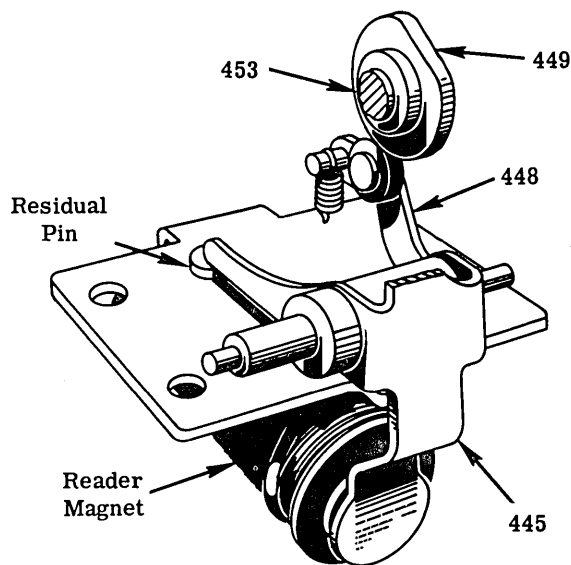


Figure 6-3 Magnet Armature Control

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

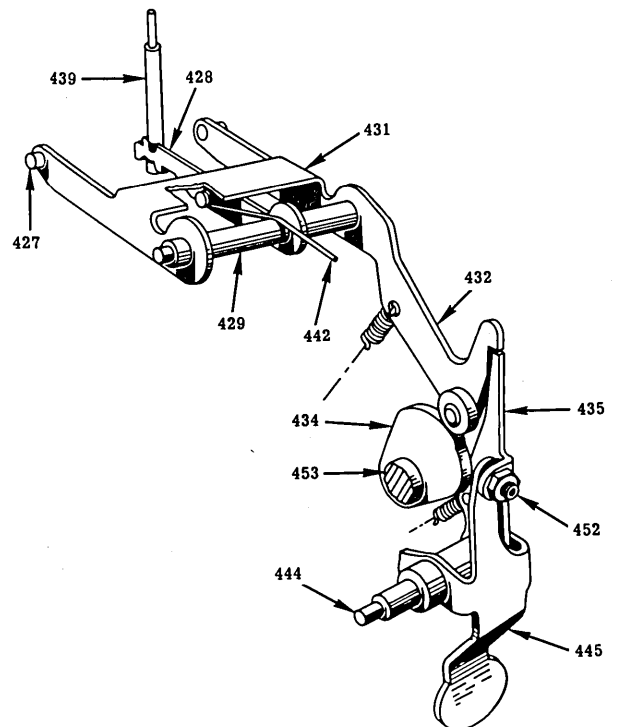


Figure 6-4 Interposer Bail Operation

Tape Reader

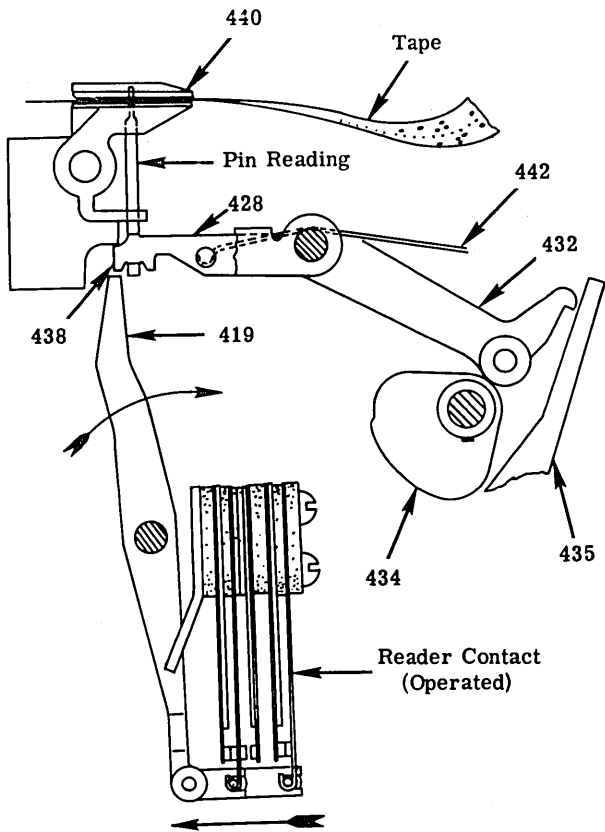


Figure 6-5 Feeler Pin Reading Code

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

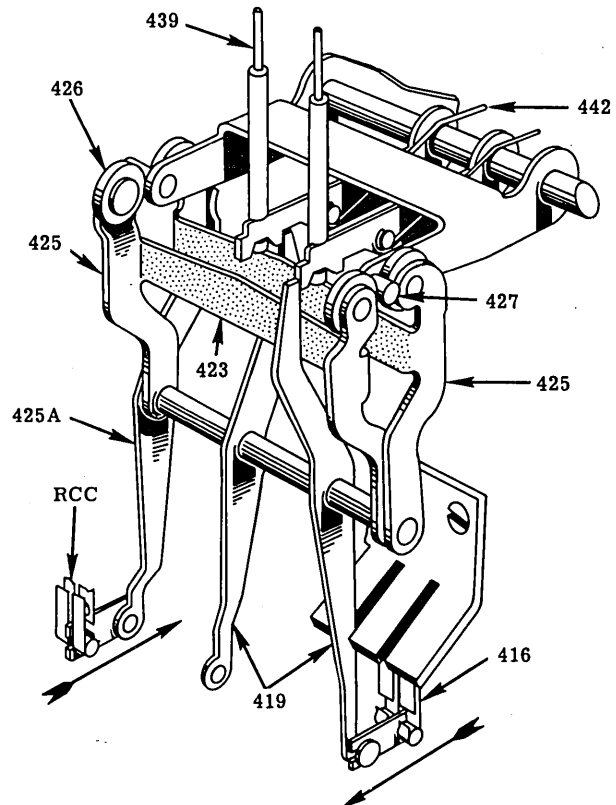


Figure 6-6 Feeler Pin and Contact Operation

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.

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).

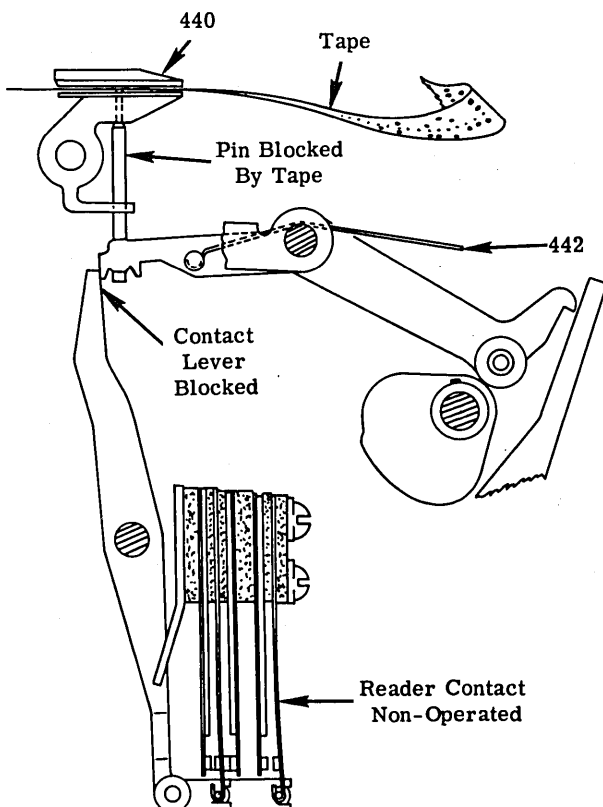


Figure 6-7 Feeler Pin Stopped by Tape

Tape Reader

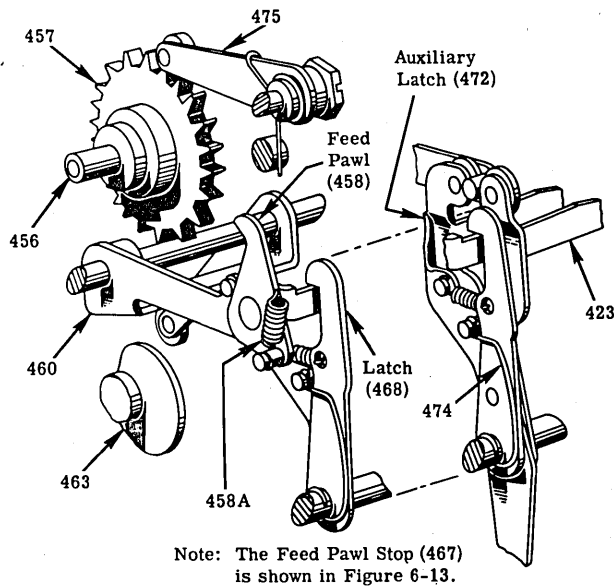


Figure 6-8 Tape Feed Mechanism

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

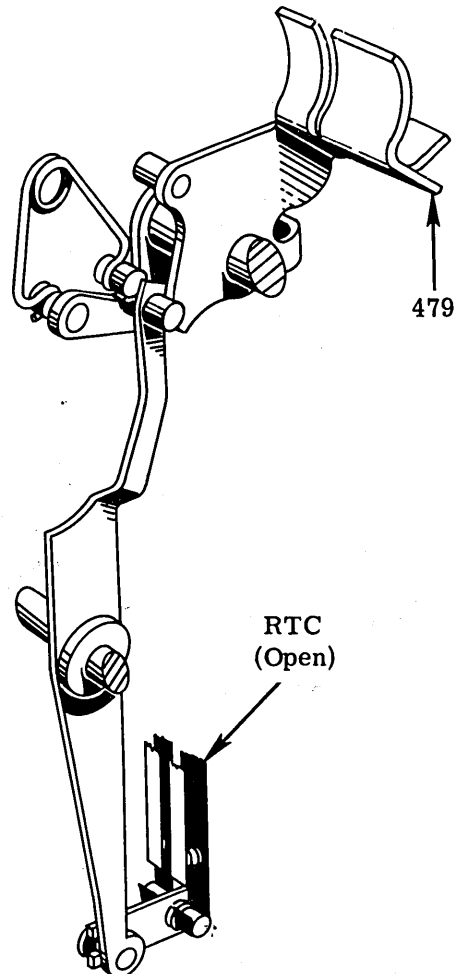


Figure 6-9 Tape Hold Down Lever

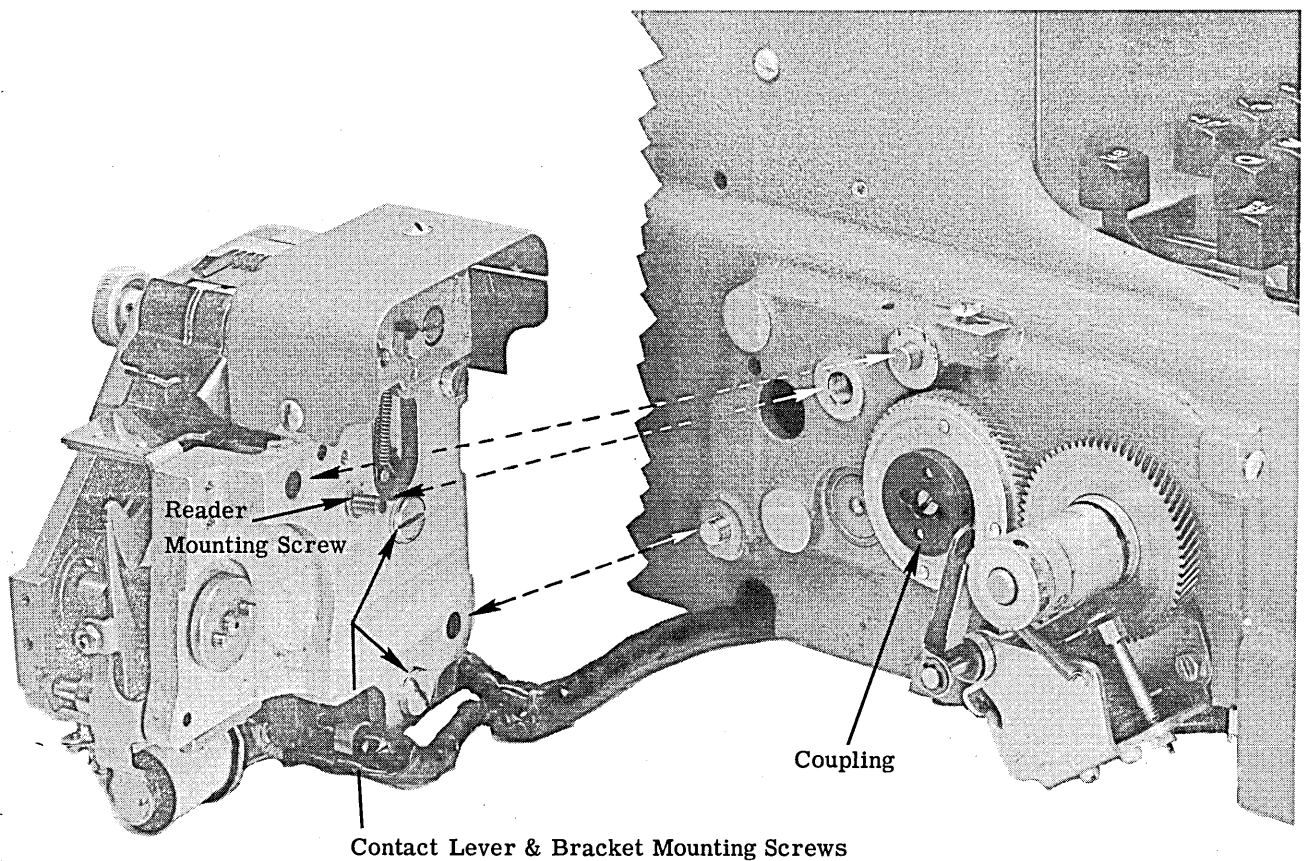


Figure 6-10 Reader Removal

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

Tape Reader

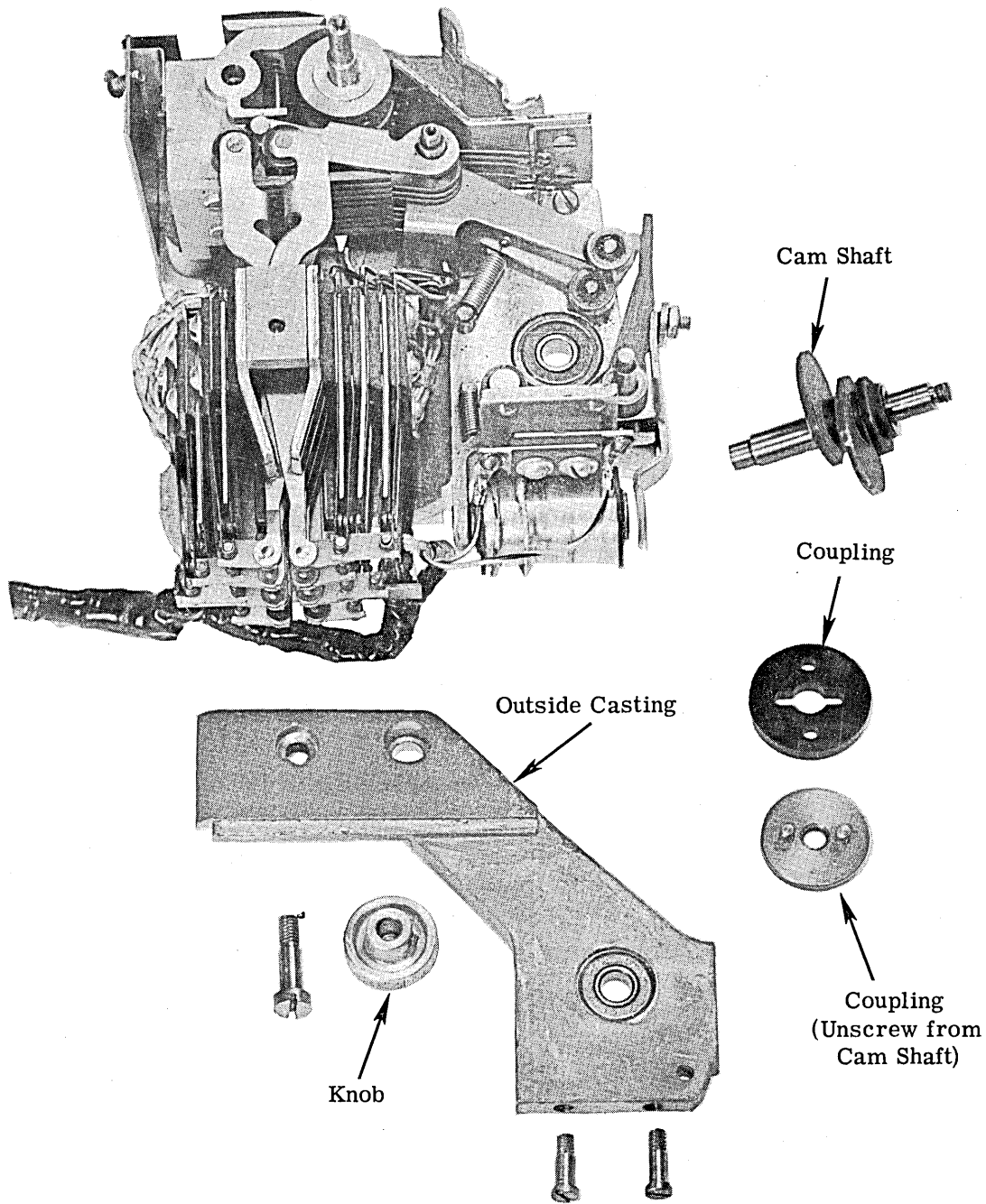


Figure 6-11 Removal of Operating Cams

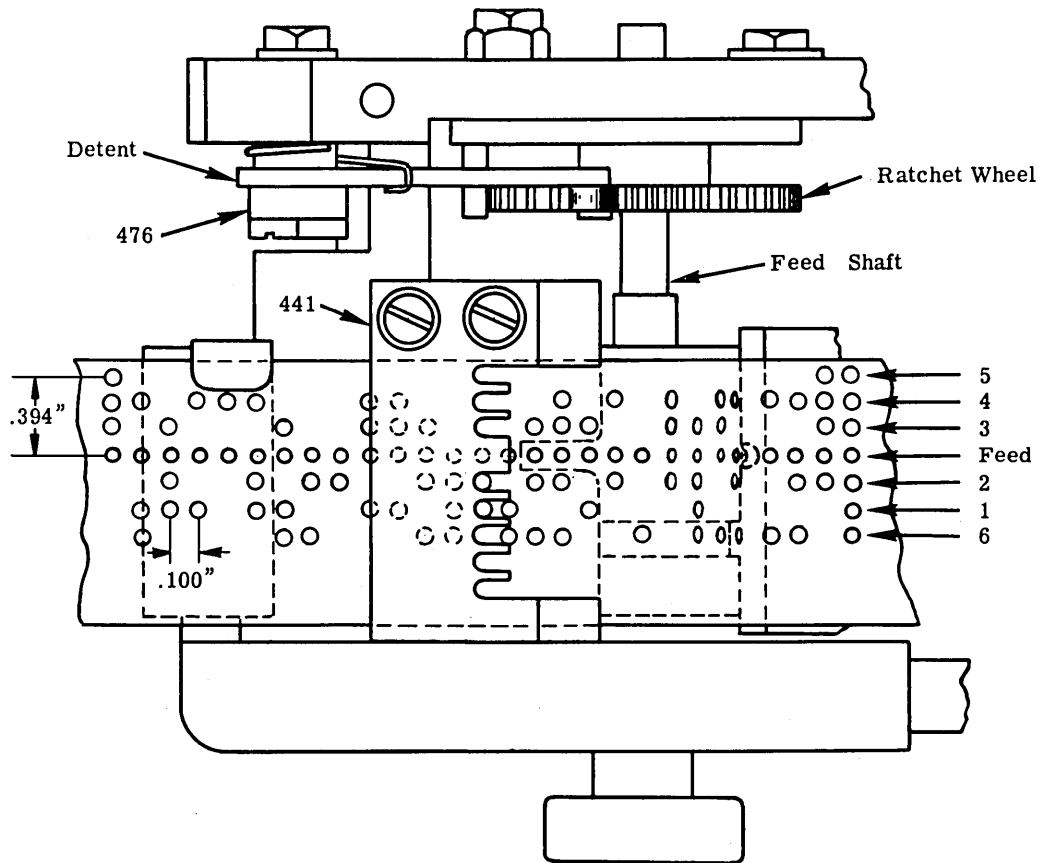


Figure 6-12 Tape Registration

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

Tape Reader

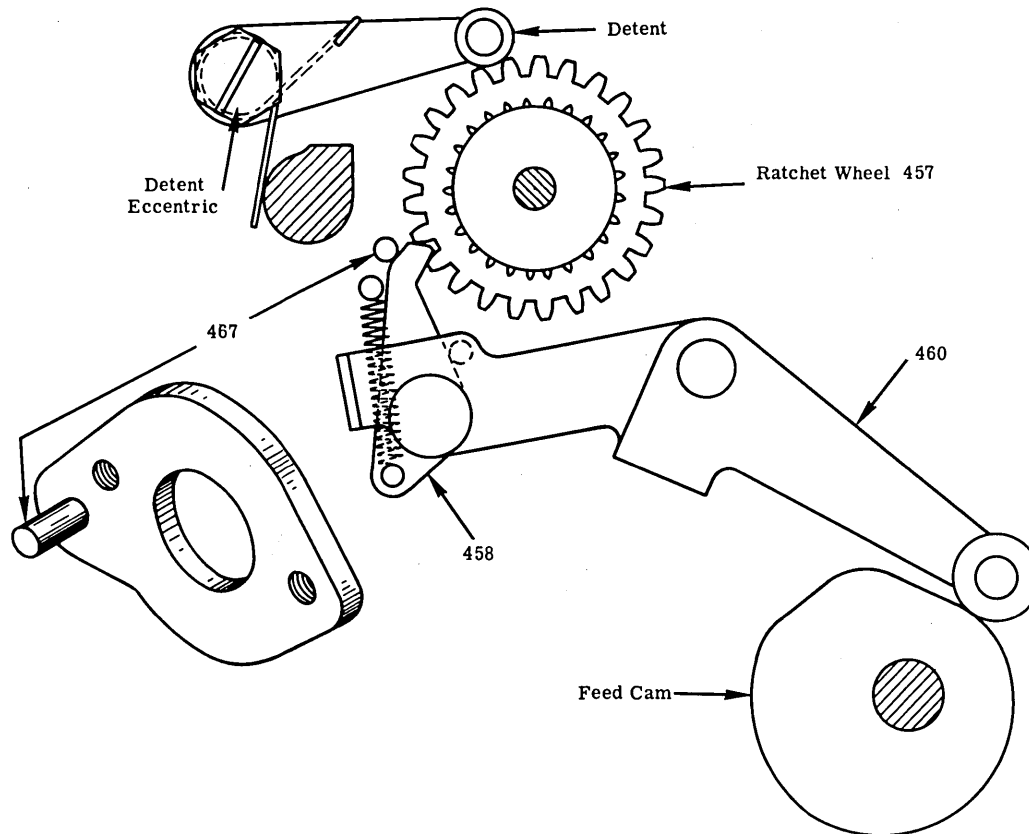


Figure 6-13 Adjustment of Feed Mechanism

(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.)

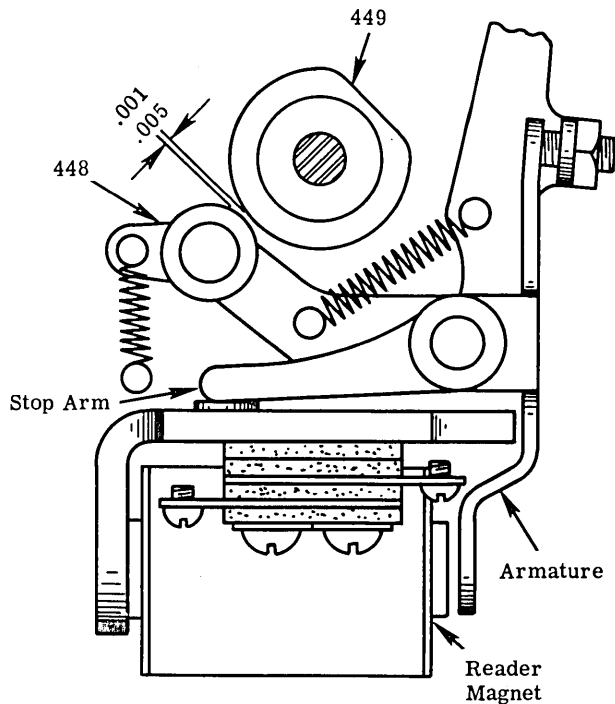


Figure 6-14 Magnet Armature Adjustment

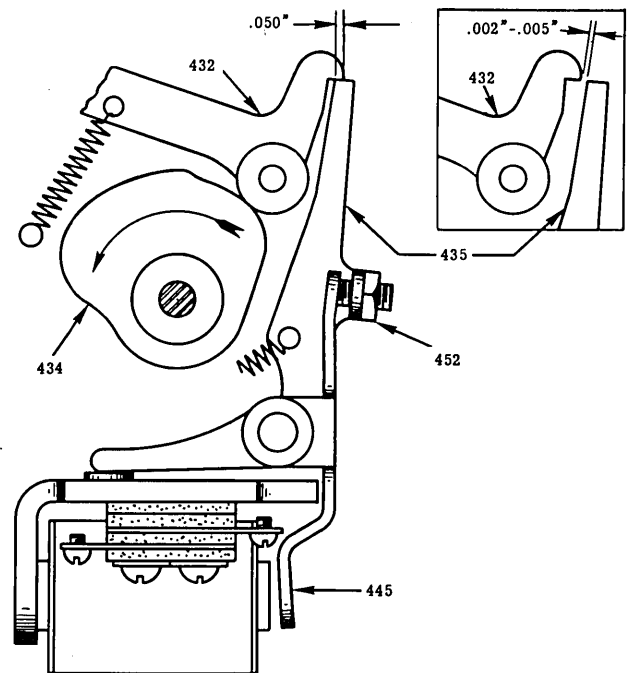


Figure 6-15 Control Arm Adjustments

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

Tape Reader

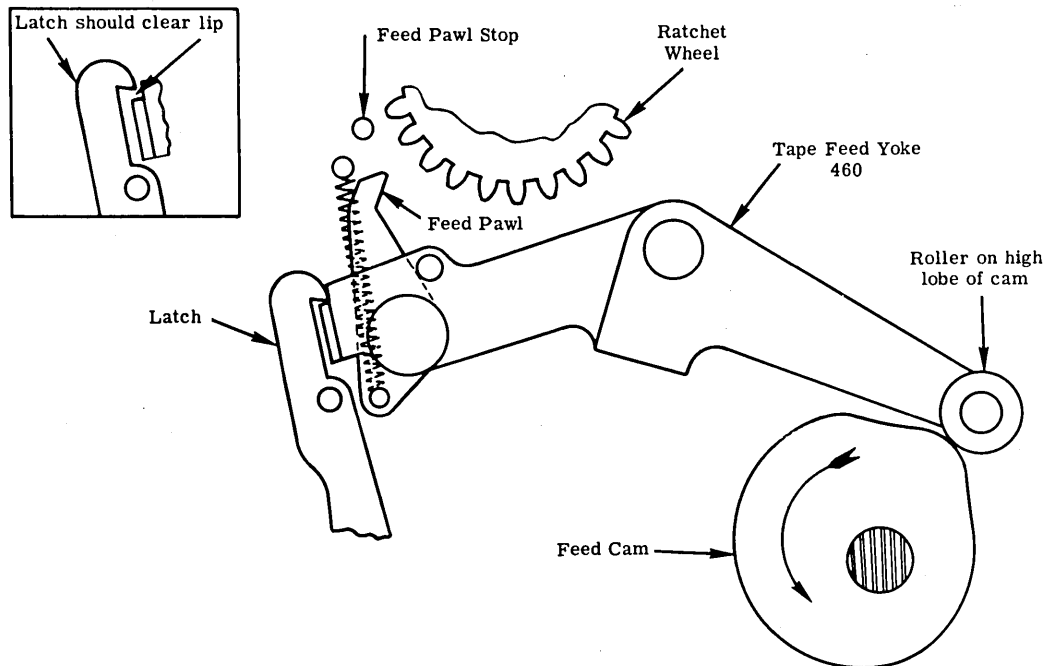


Figure 6-16 Feed Yoke Arm Adjustment

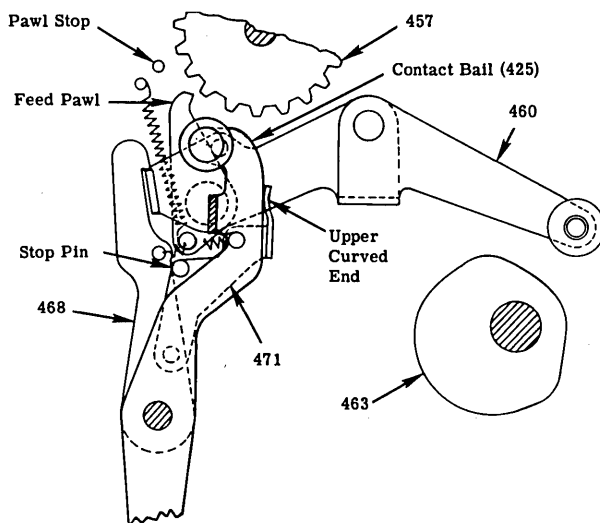


Figure 6-17 Latch Lever Adjustment

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 ball. 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.

#8 A.

MANUAL ADDENDUM

Date: July 17, 1959

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

Subject: Tape/Edge Card Reader

Purpose: Adjustment Procedure

Information: Remove and destroy Manual Addendum #8, dated Aug. 29, 1955

The Tape/Edge Card Reader is basically the same as the Tape Reader, which is explained in Part II, Section 6 of this manual. The principle difference between the two readers is, that while the Tape Reader is designed to accept only tape, the Tape/Edge Card Reader is designed to accept either tape or edge cards.

The complete adjustments of the Tape/Edge Card Reader are as follows:

Speed Adjustment

The reader shaft speed should be between 561 and 581 RPM, with the motor operating on rated voltage. The speed of the reader can be changed only by adjusting the split pulley on the motor shaft. It should be remembered, however, that by adjusting the split pulley, the speeds of the power roll, translator, and punch will also be changed.

Interposer Guide Adjustment

The interposer guide should be centered over the interposer so that the reader pins and interposer can operate freely with no drag on the guide.

Cam Shaft Adjustment

There can be no more than .002" end play on the cam shaft. Shims should be used as needed.

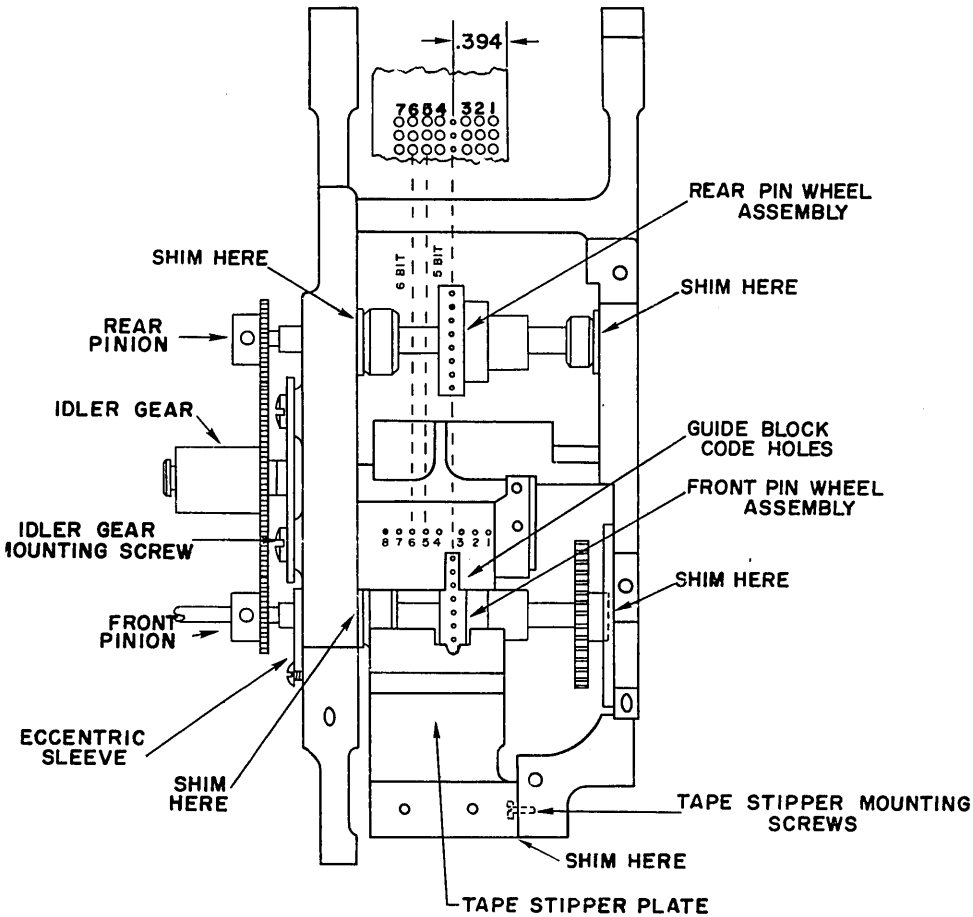


FIGURE 1

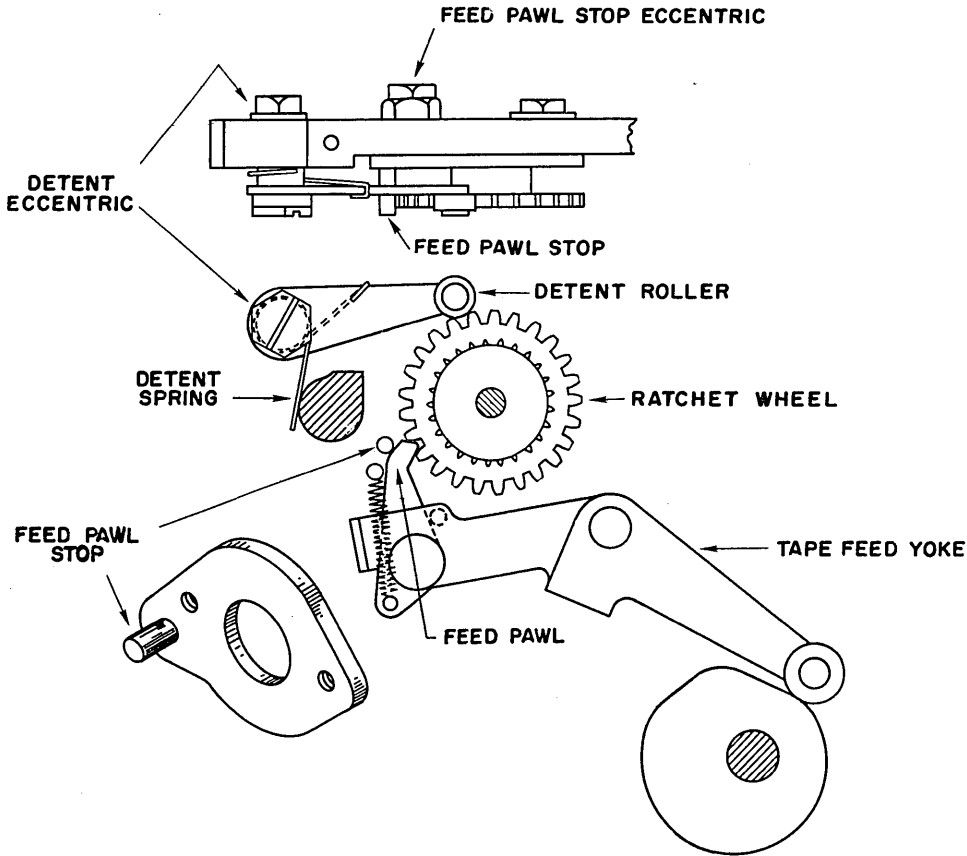


FIGURE 2

Tape and Edge Card Registration Adjustments (Figs. 1 & 2)

1. Loosen the pinion on the rear pin wheel assembly and the idler gear mounting screws (Fig. 1).
2. Place a punched tape in the reader for the remaining adjustments. The feed holes in the tape must be .394" from the guide edge if the proper adjustments are be made.
3. If necessary, align the pin wheel assemblies so that the rear pin wheel and the front pin wheel will be perpendicular to an imaginary horizontal line drawn through the center of the code holes in the guide block. At the same time, be sure that the code holes, punched in the tape, line up vertically with their corresponding code holes in the guide block (Fig. 1).
4. Adjust the detent eccentric (shown in Fig. 2) to horizontally position the code holes in the tape to their corresponding code holes in the guide block. (The tension on the detent spring should be between 1 and 1 1/4 lbs.).

Note: If steps 3 and 4 have been done correctly, the code holes in the tape above the code holes in the guide block will be concentric.

5. Reset the rear pinion and idler gear. The rear pinion should be set so that the rear pin wheel and the front pin wheel both engage the feed holes in the tape without either bowing or stretching the tape between them. At the same time, the idler gear is to be adjusted to give a minimum backlash between the idler gear and the two pinions. This adjustment may be made by using the clearance on the idler gear assembly mounting screws. Now check the pin wheels to make sure they are free to rotate with no drag. To feel for drag manually disengage the detent roller from the ratchet wheel (see Fig. 2) and turn the feed knob. Also, check the end play of the front and rear pin wheel assemblies. If there is more than .002" end play in either assembly it will have to be shimmed (Fig. 1).
6. Adjust the feed pawl stop to stop the feed pawl's motion just as the detent roller is fully seated between two teeth of the ratchet wheel. To make this adjustment, use the feed pawl stop eccentric shown in Figure 2.
7. Adjust the tape stripper plate so that its groove will be centered on the pins of the front pin wheel (shim as shown if necessary) and as near as possible to, but not touching, the front pin wheel assembly. To make this adjustment use the tape stripper plate mounting screws (Fig. 1).

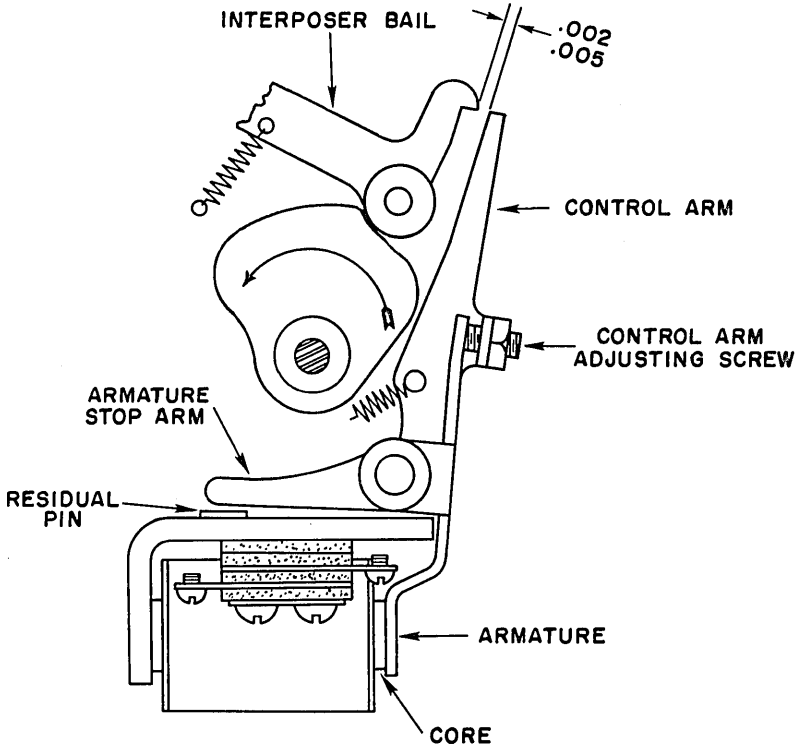


FIGURE 3

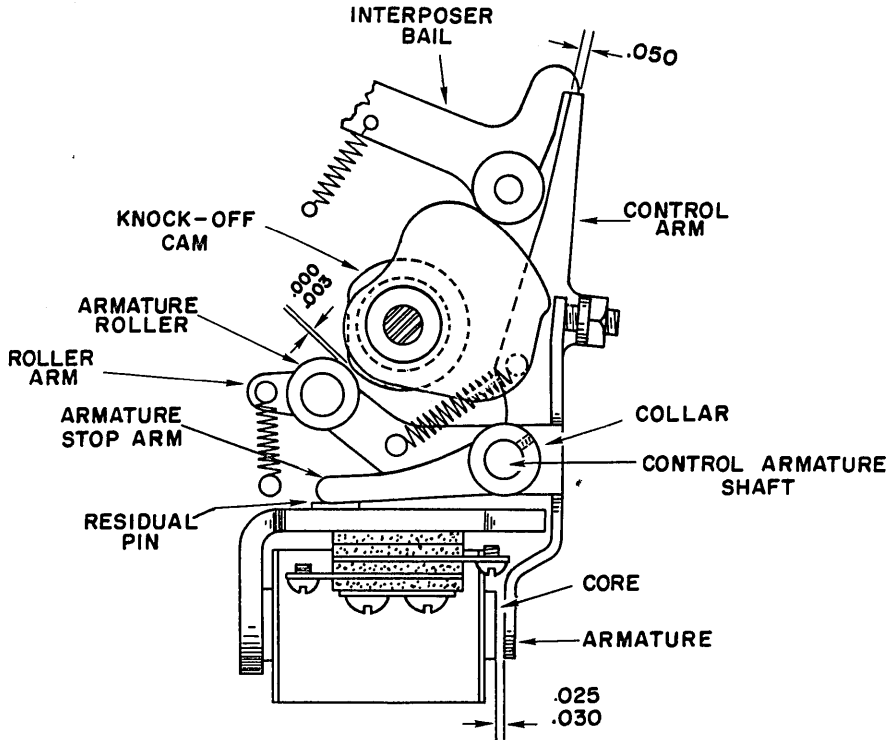


FIGURE 4

Control Armature Adjustments (Figs. 3 & 4)

1. Adjust the armature to lie flat against the core when the armature is fully attracted (Fig. 3). The armature may be formed, if necessary, to obtain this adjustment.
2. With the armature stop arm against the residual pin, the armature roller should clear the high dwell of the knock-off cam by $.000''$ to $.003''$. At the same time there should be an Air Gap of $.025''$ to $.030''$ between the magnet core and the armature. If necessary, bend the stop arm relative to the roller arm to obtain this adjustment (Fig. 4).
3. With the armature fully attracted to the core, adjust the screw on the control arm so that the control arm will clear the latch point of the interposer bail by $.002''$ to $.005''$ (Fig. 3). With the armature released from the core, the interposer bail latching surface should overlap the control arm by at least $.050''$ (Fig. 4).
4. The armature side to side end play at the interposer bail latching point should be between $.002''$ to $.005''$. To obtain this adjustment use the collar on the control armature shaft (Fig. 4).

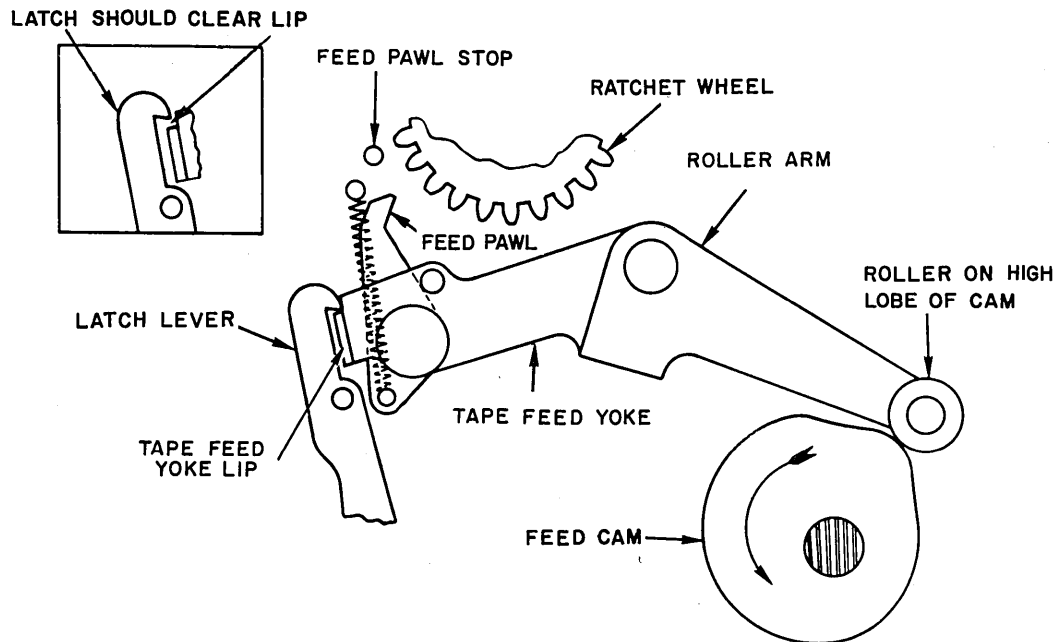


FIGURE 5

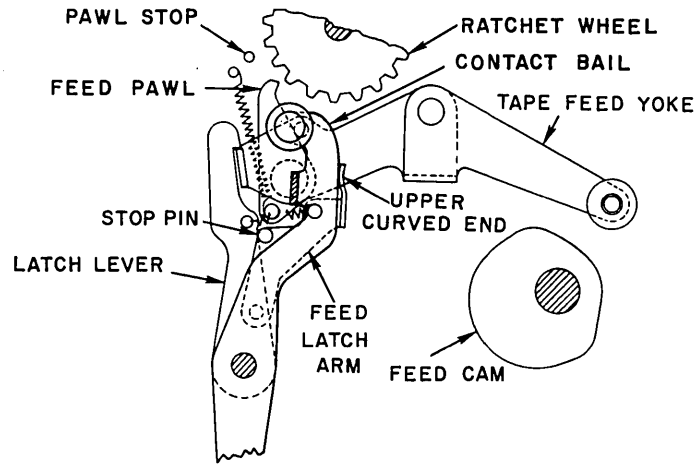


FIGURE 6

Feed Control Adjustments (Figs. 5 & 6)

1. The maximum operated position of the tape feed yoke should allow the latching lever to move freely over the lip of the tape feed yoke. The roller arm of the tape feed yoke may be reformed to obtain this adjustment (Fig. 5).
2. With the contact bail in normal position (pins withdrawn from the tape), the hook of the latch lever should have a full bite on the lip of the tape 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 should just engage the front contact bail. The upper curved end of the feed latch arm may be formed, if necessary, to obtain this adjustment (Fig. 6).

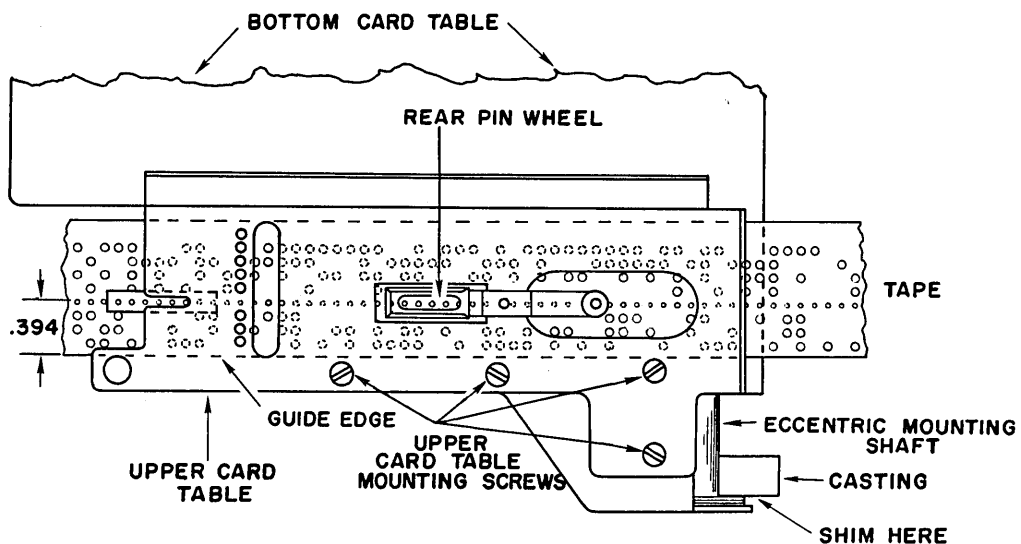


FIGURE 7

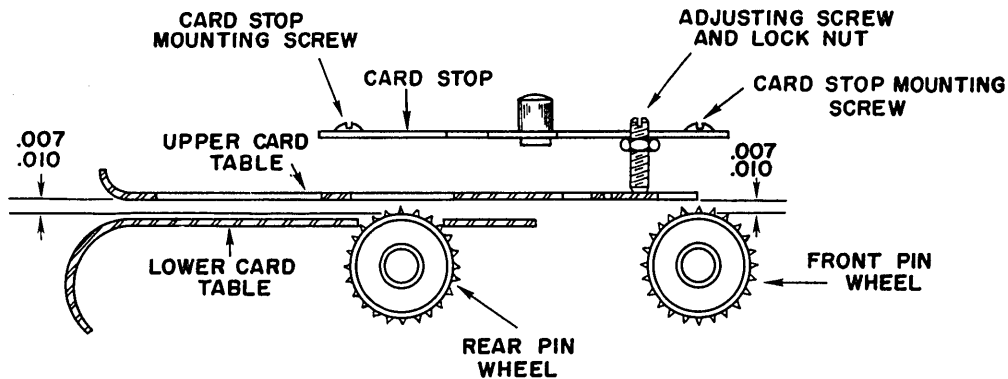


FIGURE 8

Tape and Edge Card Guide Table Adjustments (Figs. 1, 7 & 8)

1. The opening in the bottom card table must be centered over the rear pin wheel, both longitudinally and latitudinally. This centering adjustment may be obtained by the use of shims and the eccentric mounting shaft on which the rear of the card table is mounted (Fig. 7).
2. Adjust the upper card table so that the guide edge underneath the upper card table, is $.394''$ plus $.000''$ minus $.005''$ from the center of the rear pin wheel and so that the code holes in the table are as near concentric as possible with the code holes in the guide block. Use the upper card table mounting screws for this adjustment.
3. There should be $.007''$ to $.010''$ clearance between the upper card table and the front pin wheel. This clearance may be obtained by adjusting the eccentric sleeve in the outer casting around the front pin wheel shaft. This eccentric sleeve (shown in Fig. 1) protrudes above the outer casting and thus the bottom card table (Fig. 8) will rest on it when the card tables are "down" in the read position.

Note: Check the clearance between the upper tape table and the rear pin wheel. This clearance should be $.007''$ to $.010''$ and is obtained through adjustments 1 and 3 above.

4. Adjust the card stop so that when the card tables are in the "up" position and an edge card is resting on the stop, the edge card will drop into proper registration when the card tables are put "down" into a reading position. An edge card must be used for this adjustment. This adjustment is made by using the card stop mounting screws (Fig. 8).

5. The adjusting screw and lock nut are to be adjusted to allow a minimum of drag when a partially read card is removed from the reader (Fig. 8).

Contact Adjustments

1. Check the contact assemblies to see that all springs are assembled in proper sidewise registration in each stack.
2. Check the movable contact springs to see that they all have sufficient tension to follow their contact levers to their extreme inward position without lost motion in the nylon operators.
3. Place an unpunched piece of tape in the reader, to block all the reader pins, and turn the cam shaft until the interposer bail roller engages the low dwell of the cam. Adjust standard reader normally open contacts to a gap of .020" to .025". Adjust systems reader normally open contacts to a gap of .015" to .020".
4. Remove the tape from the reader and adjust all standard reader normally closed contacts to a gap of .020" to .025". Adjust systems reader normally closed contacts to a gap of .015" to .020". Check all the normally open contacts 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 straps.
5. Replace the unpunched tape in the reader. With the interposer bail roller against the low dwell of the cam, check all the normally closed contacts to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop straps.
6. Common Contact: Turn the power shaft of the Flexowriter until all the normally open contacts on a standard reader have a .020" to .025" air gap, then holding the power shaft at this point, adjust the standard reader common contact to the same gap of .020" to .025". Turn the power shaft of the Flexowriter until all the normally open contacts on a systems reader have a .015" to .020" air gap, then holding the power shaft at this point, adjust the systems reader common contact to the same gap of .015" to .020".

Note: 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.

MANUAL ADDENDUM

No. 17 R2

DATE: February 5, 1959

REFERENCE: To be inserted in Part II, Section 6, after Page 6-13. Remove and destroy Addendum No 17 R1 dated December 23, 1958.

SUBJECT: Tab Card Reader.

PURPOSE: Adjustment Procedure.

INFORMATION:

The Tab Card Reader utilizes the friction feed principle. This type of feed differs from that used in our Edge Card or Tape Reader in that there are no Feed Holes in the Tab Card. Therefore, the Tab Card Reader is not equipped with a Feed Pin Wheel Assembly.

Feeding of the IBM Tab Card is accomplished thru a set of Pressure and Feed Rollers. The upper or Pressure Rollers are free floating (not driven), and serve the purpose of exerting a downward pressure on the face of the Tab Card.

The Feed Rollers, which furnish the motion for indexing the Tab Card into the reading position are locked on the shaft, which is directly connected to the Feed Ratchet Wheel. As the Feed Ratchet is rotated by the action of the Feed Pawl, the Feed Rollers are rotated in a clockwise direction, an amount sufficient to advance the Tab Card into the next reading or column position.

Pressure Feed (Fig. 1)

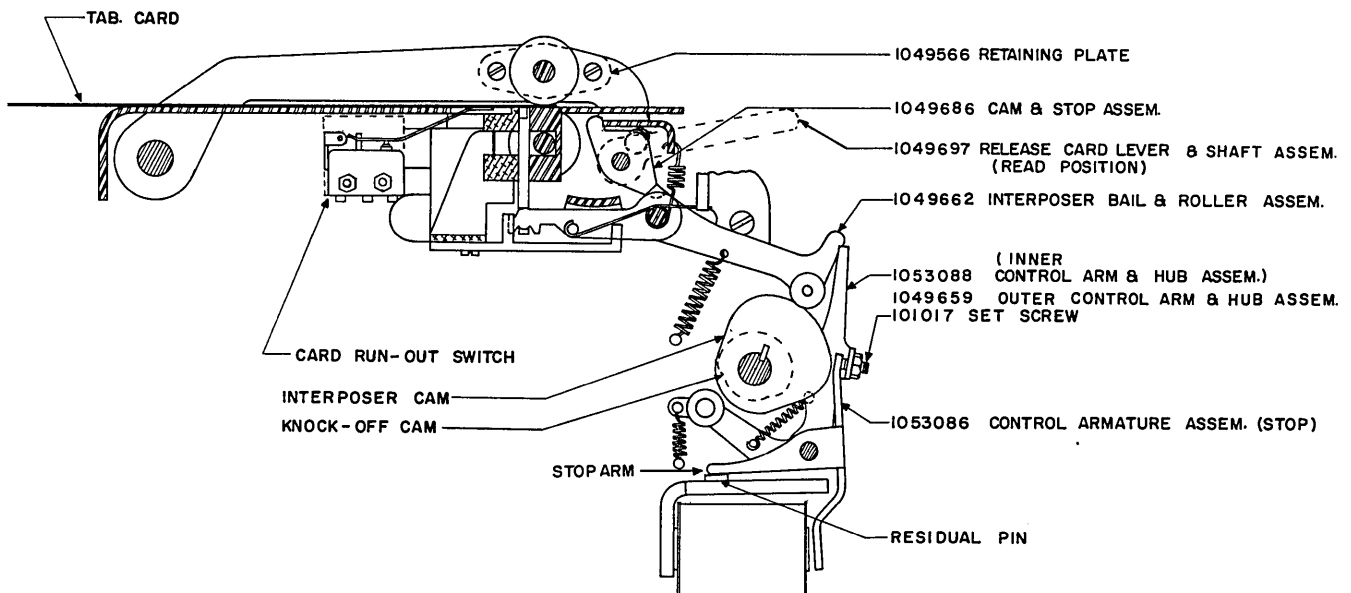
These adjustments must be made with a blank card between the Pressure Feed Rollers.

1. Adjust cam and stop assembly (1049686) to position the card. Release shaft assembly (1049697) so the end of the release lever is in line with the top of card table. This adjustment is to be made in read position.
2. Adjust pressure roller shaft retaining plate (1049566) downward to give maximum pressure of pressure rollers on feed rollers. Release lever must be up when this adjustment is made.

Control Armature (Fig. 1)

1. With the armature stop arm (1049665) 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 two screws (101017) on control arms (1053088 & 1049659) 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 arms 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.



CONTROL ARMATURE & PRESSURE FEED FIG. 1

Card Stop (Fig. 2-1, 2-2, 2-3)

1. Adjust the card stop so that the tab card will rest against the card stop when the code pins are centered on the first row of code holes (Fig. 2-1).
2. With card between the feed rollers adjust the card stops to be flush to .010 (max) below the card table with the release lever in the read position. To obtain this adjustment very carefully bend the card stops (with the card table raised) until the correct adjustment is obtained. With the card release lever up adjust the card stiffener springs so that the lower portion of the springs are below the top edge of the card stops but not touching the card and will not allow the card to pass over the card stops. The stiffener should be adjusted to allow the spring to move upward for easy removal of tab card.

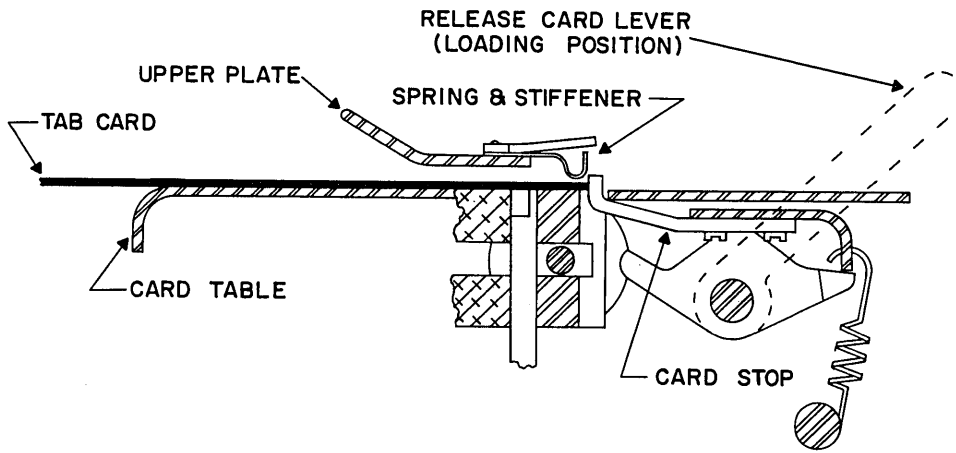


FIG. 2-1

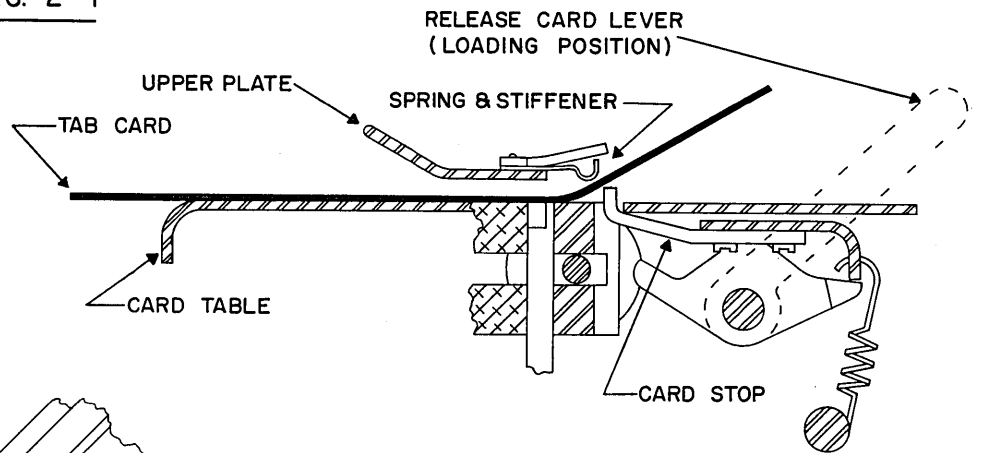


FIG. 2-2

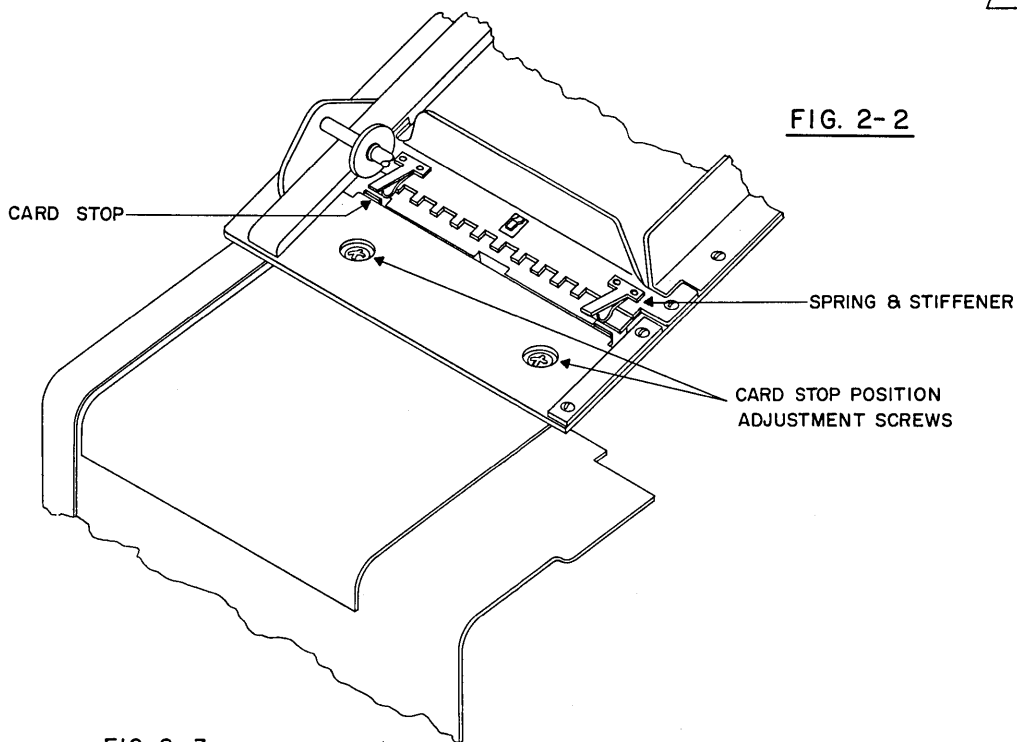
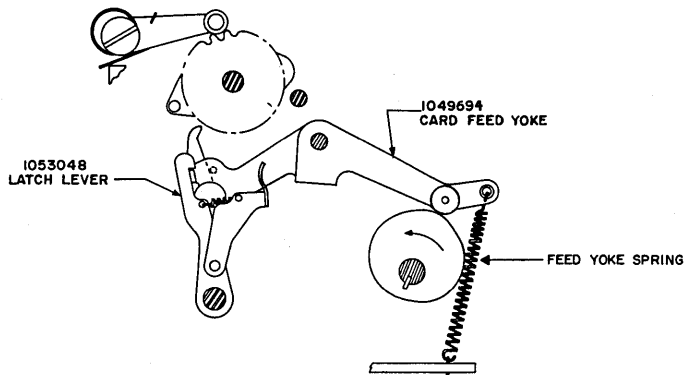


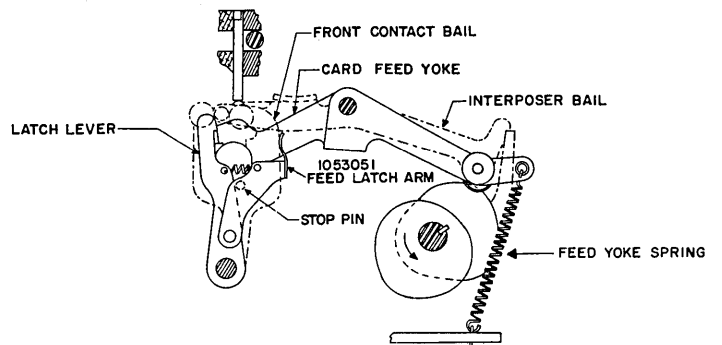
FIG. 2-3

Feed Control (Fig. 3 and 4)

1. The maximum operating position of the card feed yoke (1049694) 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 withdrawn 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).



FEED CONTROL FIG. 3



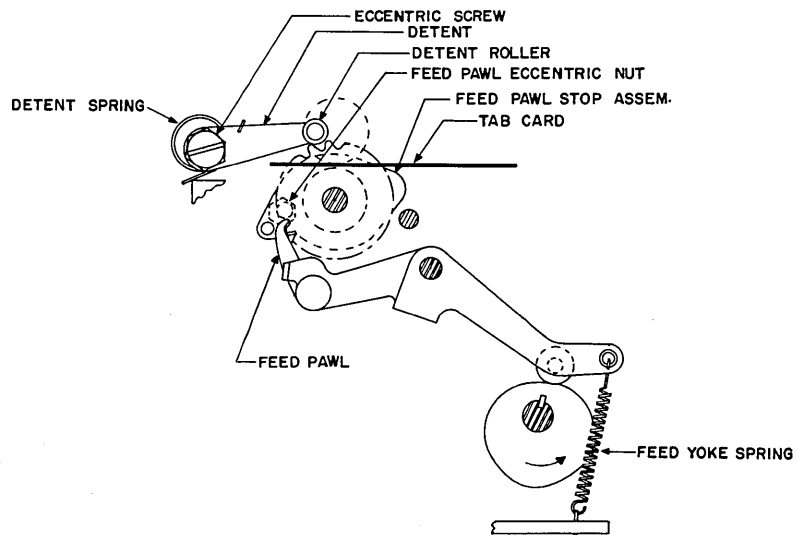
----- DENOTES INTERPOSER BAIL & CONTACT BAILS

FEED CONTROL FIG. 4

Longitudinal Registration (Fig. 5).

1. Rotate reader cam shaft to low dwell of cam (full upward feed pawl movement), and remove springs for both the detent arm and feed yoke arm. Adjust eccentric nut for the feed pawl stop to insure full cam action of the feed pawl between stop and ratchet tooth, leaving .001 to .003 clearance between roller and low dwell of cam. If this clearance is too great underfeeding will result. Restore feed yoke spring.

2. Replace detent spring and move feed pawl to its maximum upward position. Adjust the detent roller (by movement of eccentric screw) between the ratchet teeth, allowing no movement of ratchet wheel as feed pawl is returned.
3. Adjust detent spring to 1/2 to 3/4 lb. tension. If this tension is too great, overfeeding will result.
4. Check for registration over entire card length. Readjust card stops if necessary.



LONGITUDINAL REGISTRATION FIG. 5

Lateral Registration (Figs. 6-1, 6-2)

1. Adjust the outer card guide (1049572) 90° to the lead edge of the pin openings in the guide block, and adjust so that the inner edge of the card code holes line up with inner edge of pin openings in guide block.
2. Adjust the inner guide, so that the outer edge of the card code holes line up with the outer edge of the pin openings in the guide block.

By making the above adjustments, sufficient clearance will be allowed for normal expansion of cards.

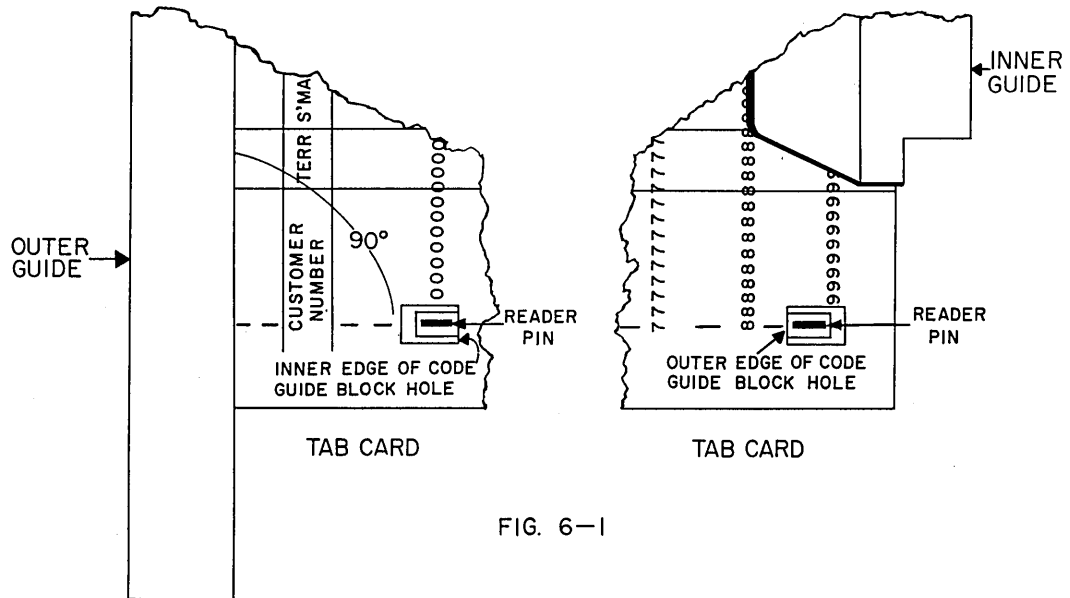
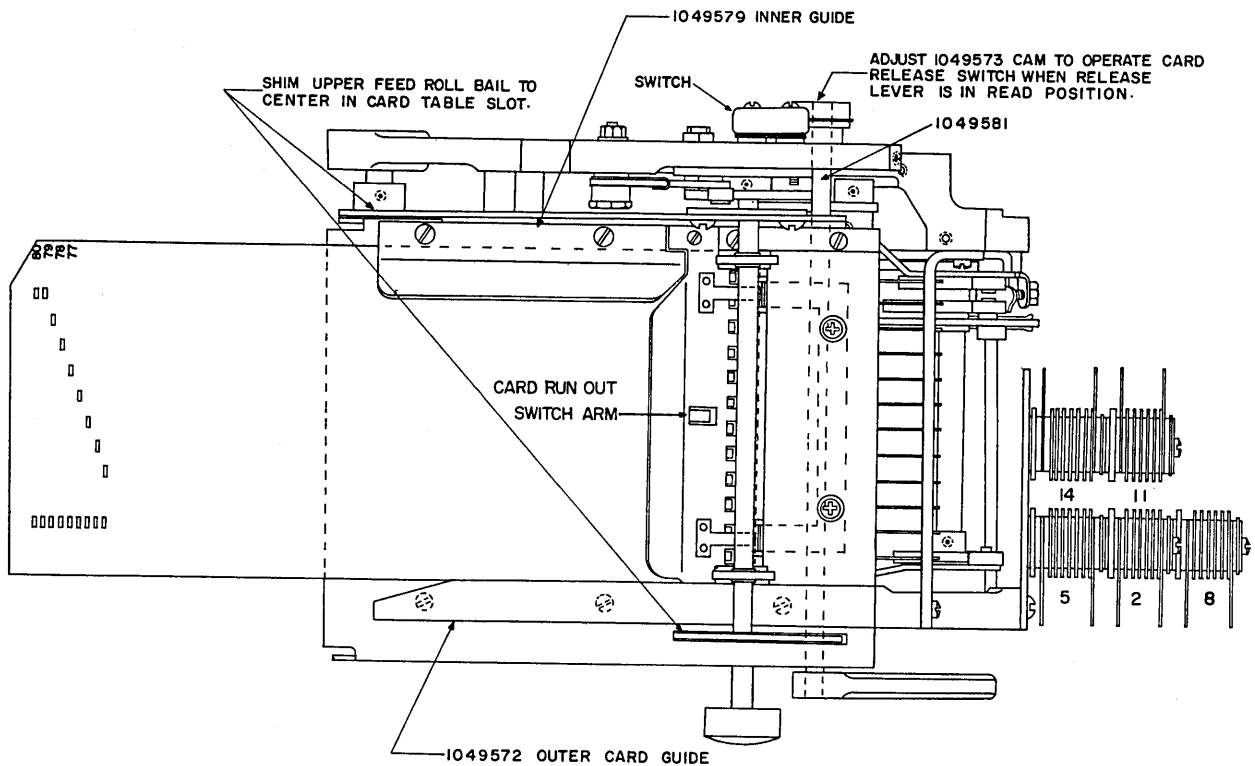


FIG. 6-1



LATERAL REGISTRATION FIG. 6-2

Card Release Lever Switch (Fig. 6-2)

1. Adjust cam (1049573) on card release (1049697) so that when card release is raised the release lever switch will open just before cam reaches its high point. Check for additional overthrow of contact switch operating arm. Adjust micro switch if necessary to obtain adjustment.
2. Check for contact making when card release lever is lowered (read position) with additional play of the switch operating arm between cam and contact button.

Card Run-Out Switch (Fig. 1)

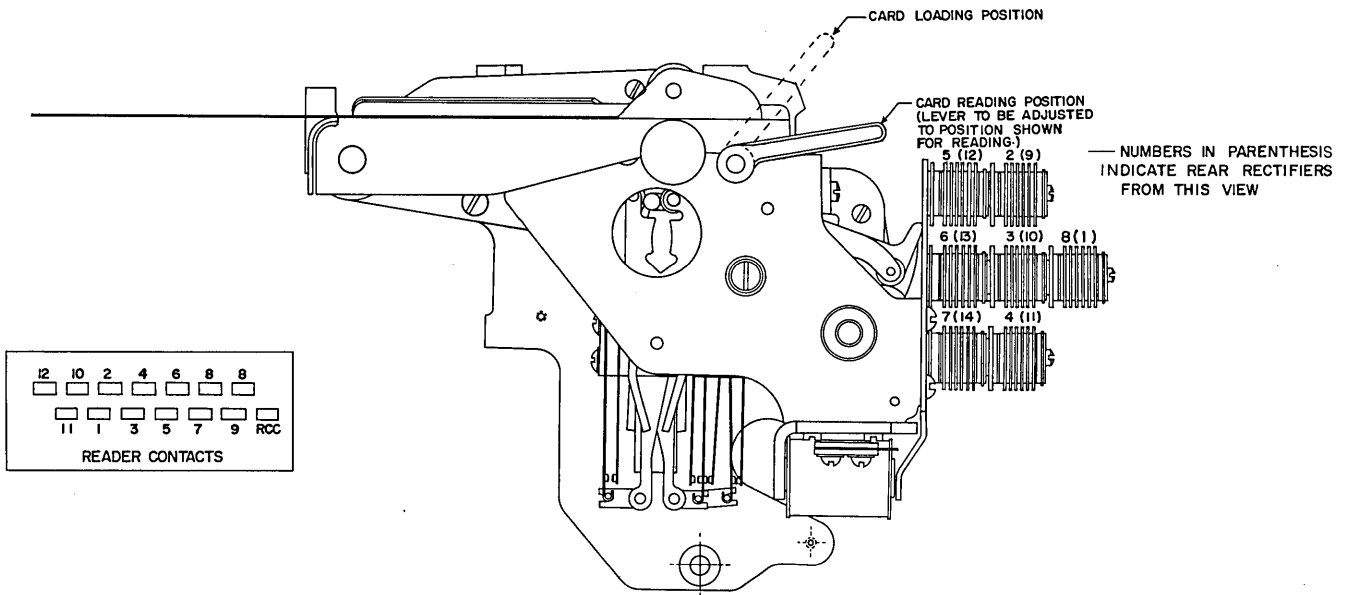
1. Adjust card run-out switch so that it will actuate when the card starts to leave its 80th position.
2. Check to see that contact operating arm (in operated position) does not choke off before going below top of card table.

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 movable 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 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 .025.
2. Common contact adjustment - leaving card in; turn cam shaft until interposer bail roller engages low dwell of cam. #1 and #2 contacts must be closed with .010 to .015 movement of the stationary contacts. #3 and #4 contacts are to be adjusted to make at the same time as the normally open code contacts. With the interposer bail on the low dwell of cam; adjust clearance contact gap of #6 and #7 to .015. With interposer bail latched up; adjust #5 and #6 to .015 gap to insure make before break action on #5, #6, and #7.
3. Remove card from reader; with interposer bail on low dwell of cam, adjust all normally closed contacts, except common, to a gap of .015 to .025.
4. Rotate cam shaft until common contacts #1 and #2 are just ready to make; check to see that all normally open contacts are made with an appreciable amount of follow and that all normally closed contacts except #7 & 8 on SR8 and 3 & 4, 5 & 6 on SR3 are broken. Adjust 7 & 8 on SR8 and 3 & 4, 5 & 6 on SR3 to break at the same time contacts 1 & 2 on common contact make.

5. Replace card in reader to block all reader pins, with interposer bail on low dwell of cam, check all normally closed contacts to be sure that they are all made with an appreciable amount of follow.



CONTACT STACK UP FIG. 7

INSTRUCTIONS FOR INSERTING TAB CARDS
(Tab Card Reader)

Step Number One (See Figure 1)

Have the Tab Card Release Lever in the Raised position, and power on. Grasp the Tab Card with the left hand, and slide the card from left to right into the Tab Card Reader Inner Flared Guide.

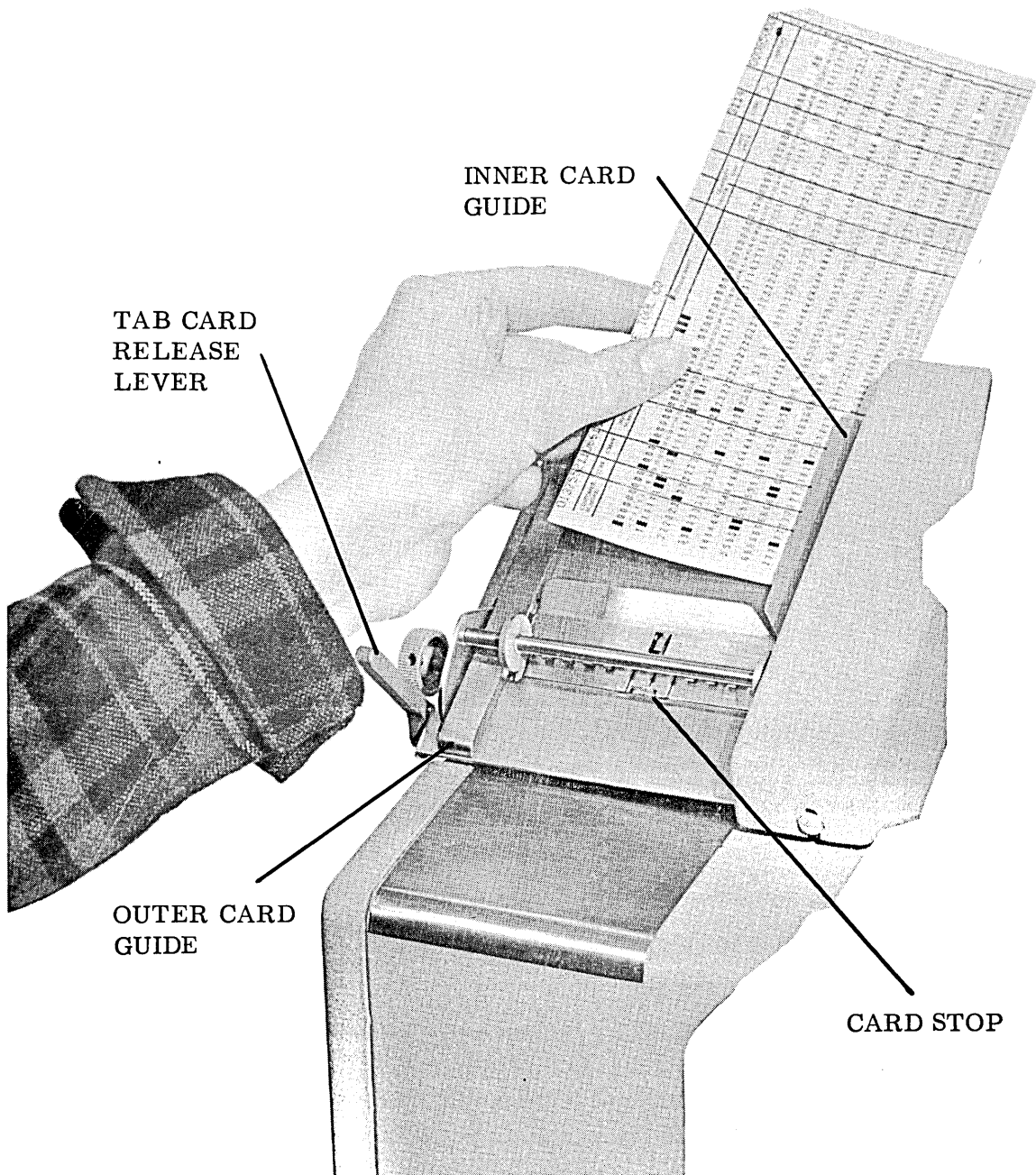


FIGURE 1

Step Number Two (See Figure 2)

Using the three fingers of your left hand, slide the Tab Card down into the Tab Card Reader so that the leading edge of the Tab Card is against the Card Stops.

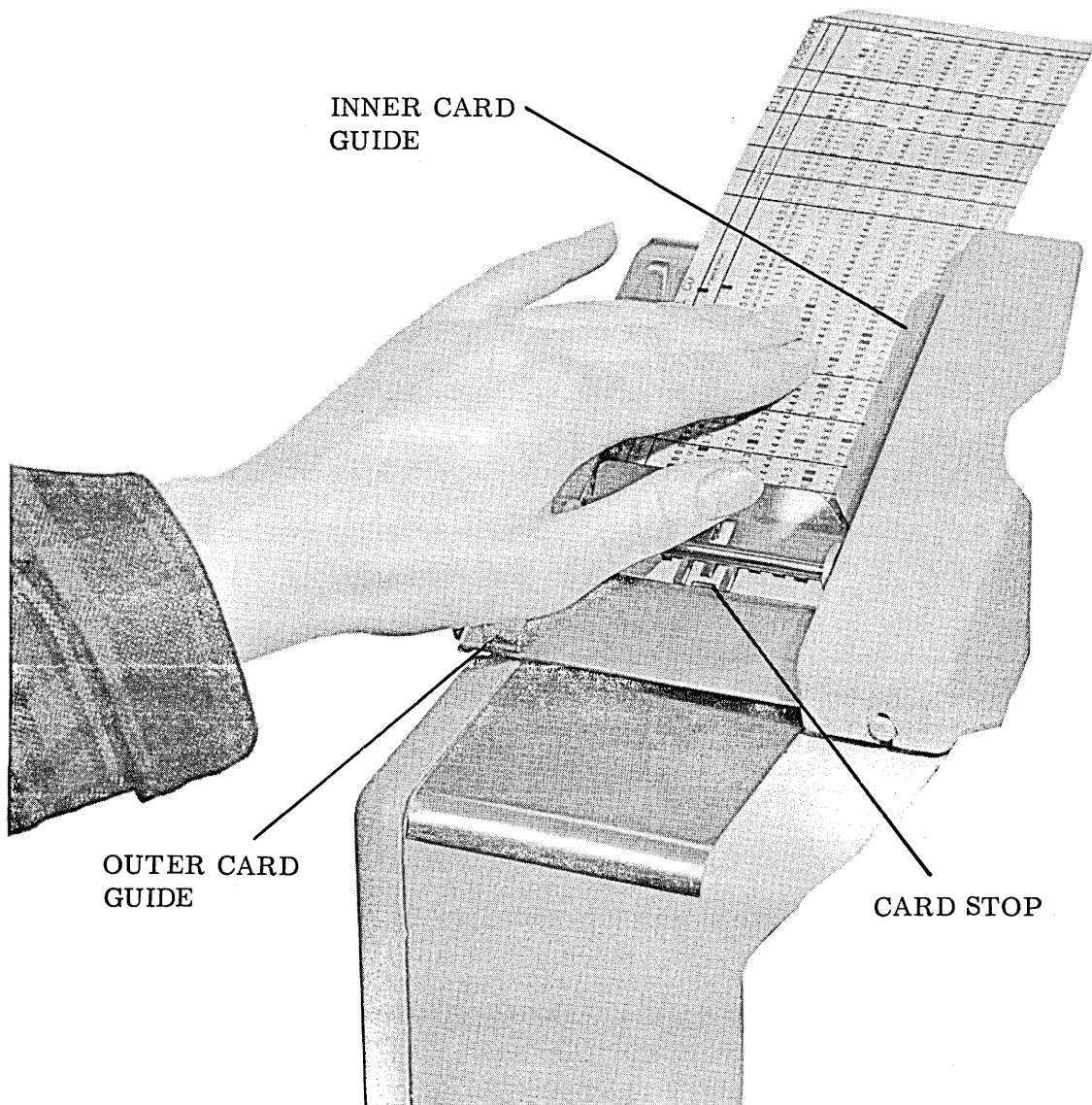


FIGURE 2

Step Number Three (See Figure 3)

Remove your left hand from the Tab Card and grasp the Tab Card Release Lever with the thumb and forefinger of your left hand and gently press the Lever downward.

The Tab Card is now in the correct reading position, and reading will start upon depressing the Start Read Switch.

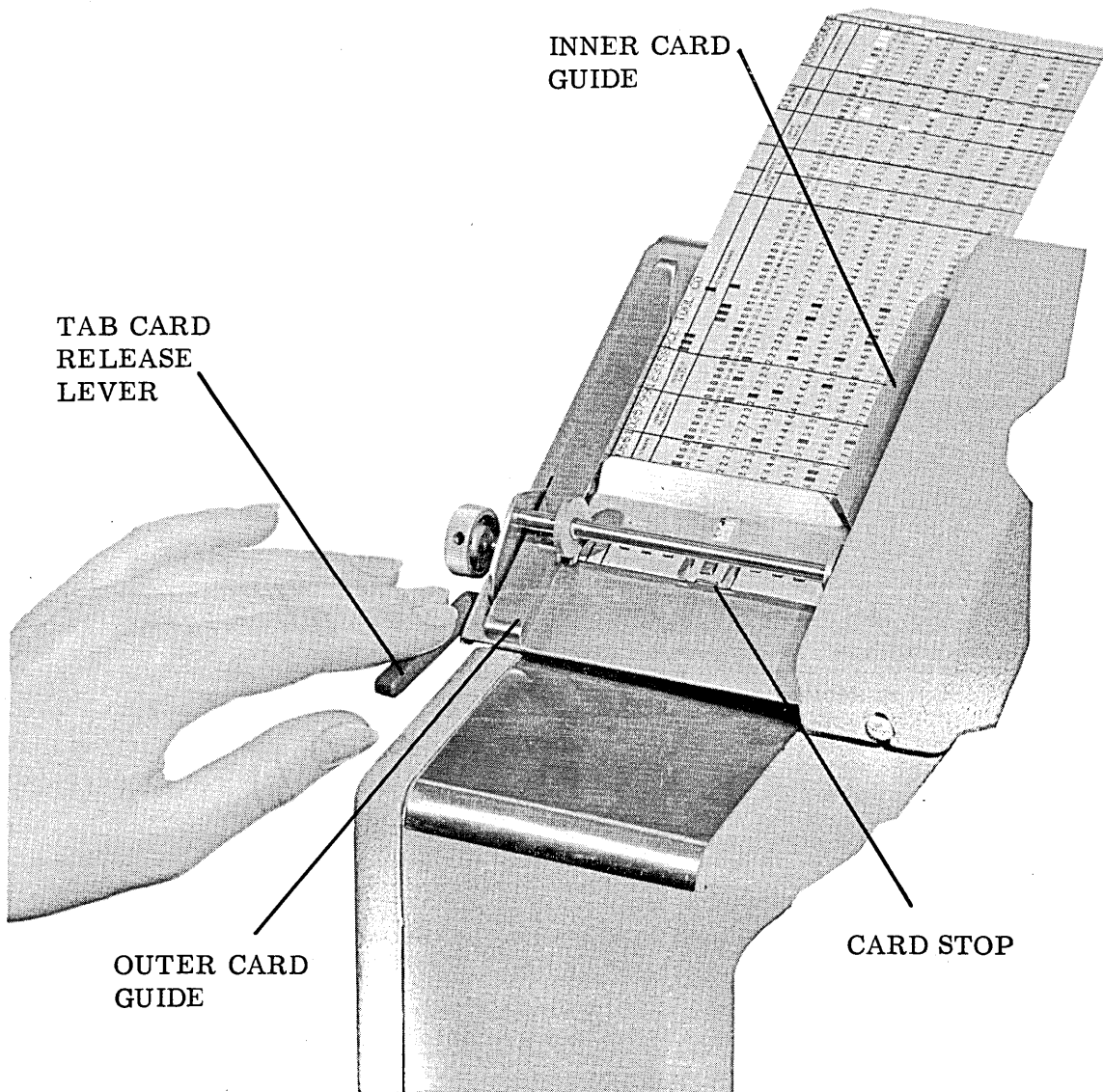


FIGURE 3

CODE TRANSLATOR

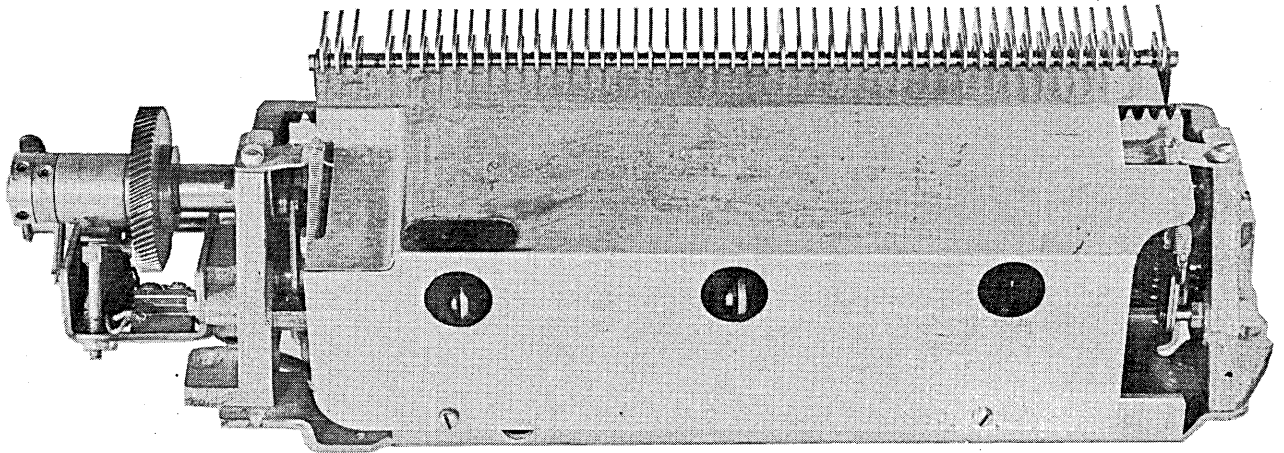


Figure 7-1 Code Translator

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

Code Translator

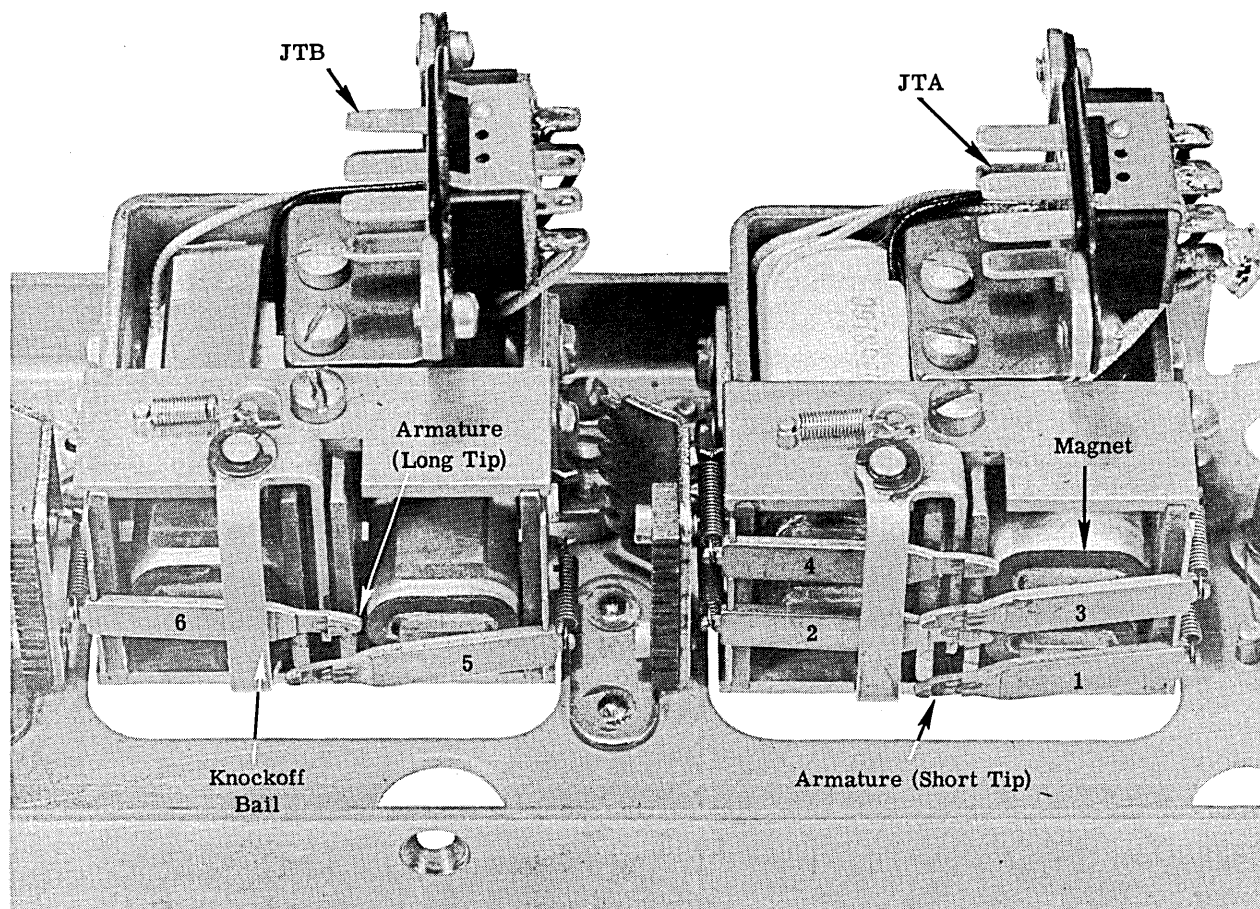


Figure 7-2 Magnet Positions

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

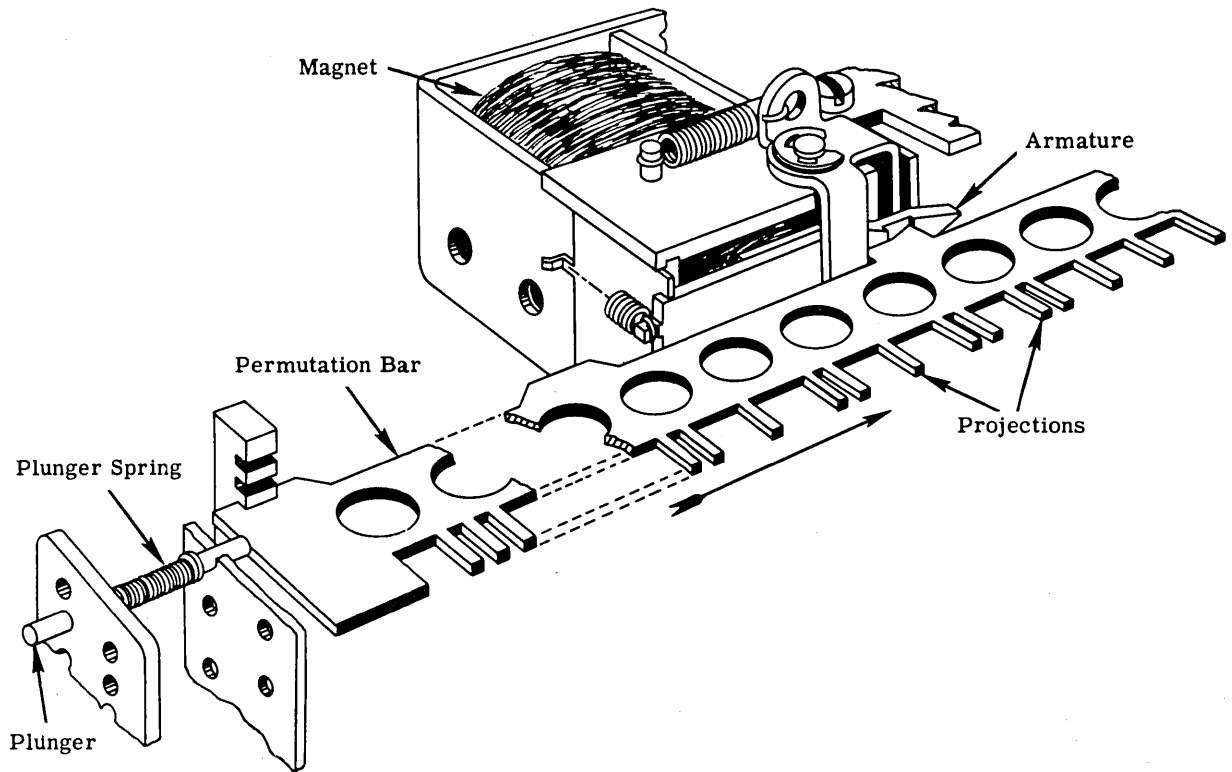


Figure 7-3 Permutation Bar Latched

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

Code Translator

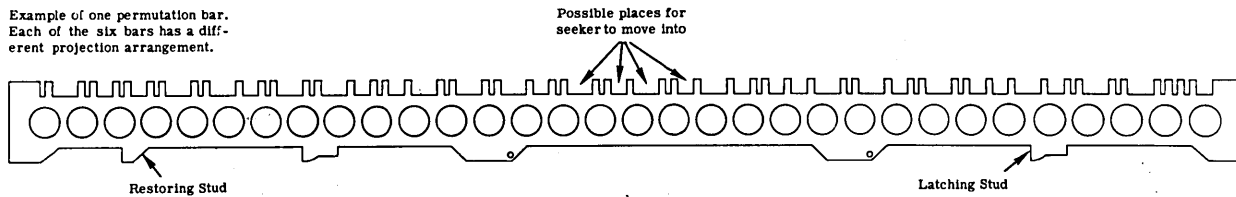


Figure 7-4 Sample Permutation Bar

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

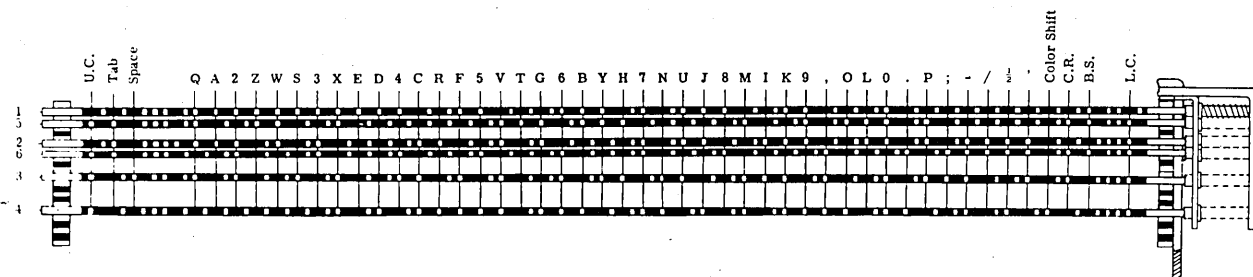


Figure 7-5 Bar Coding Arrangement

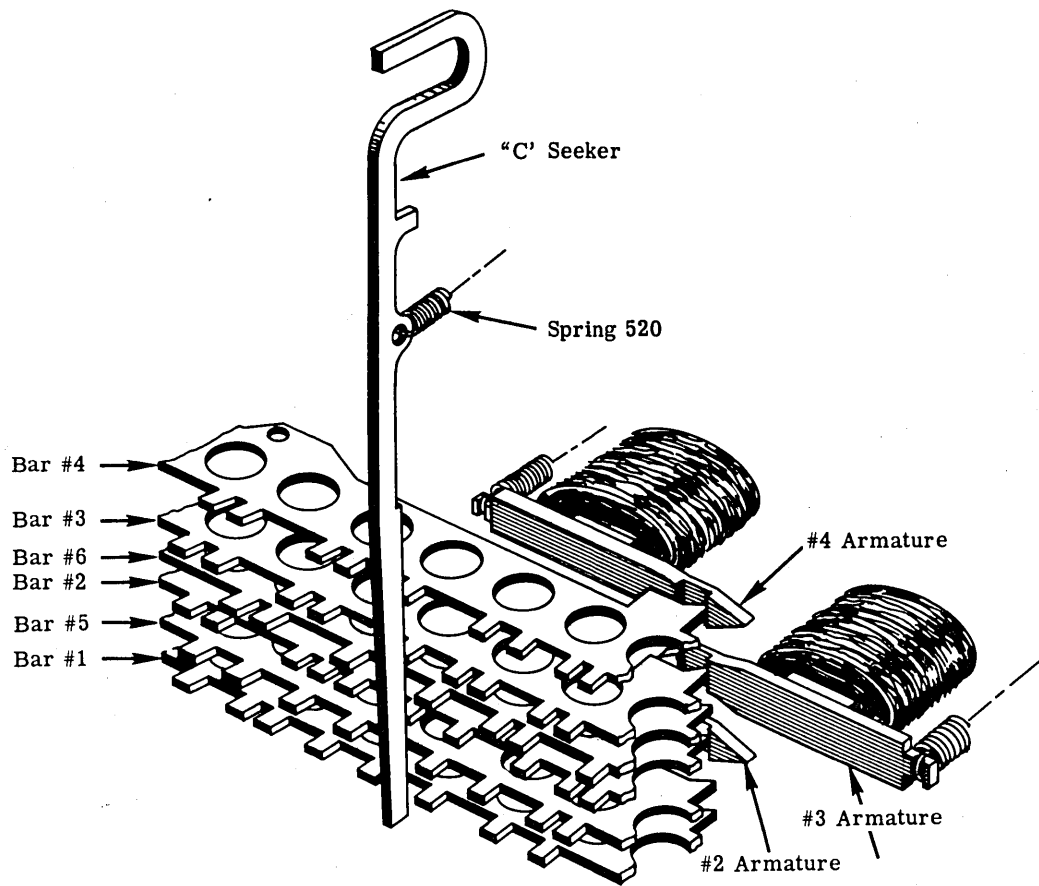


Figure 7-6 Bars - Non Operated

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

Code Translator

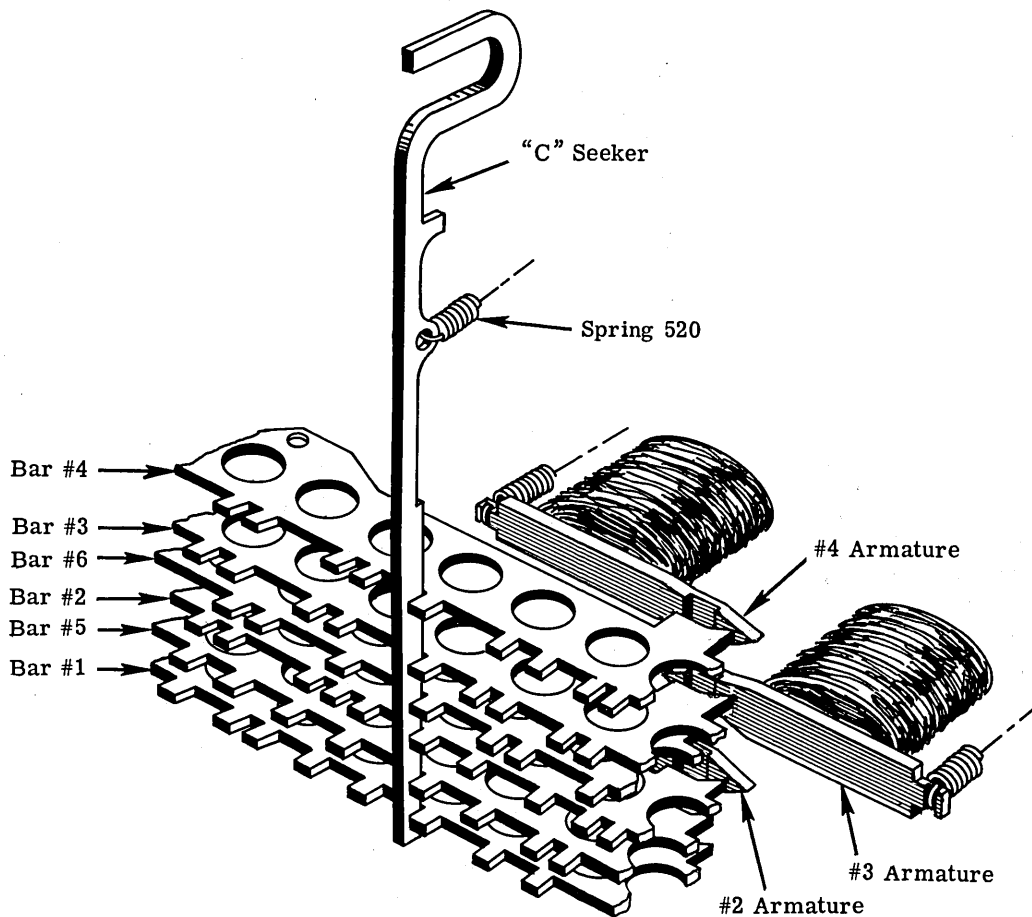


Figure 7-7 Bars - Operated

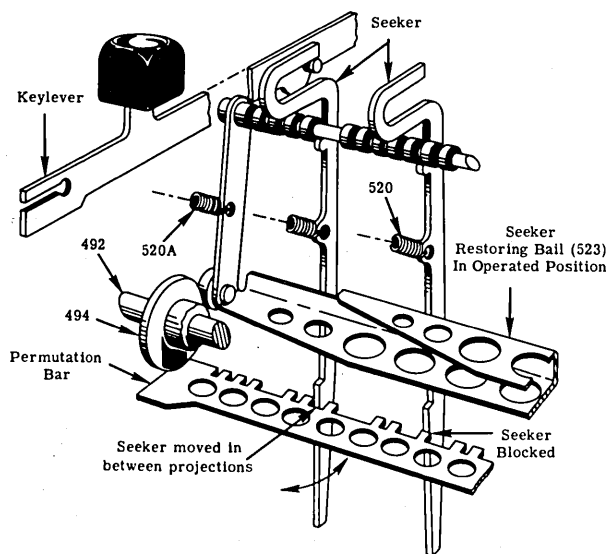


Figure 7-8 Seeker Restoring Bail

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.)

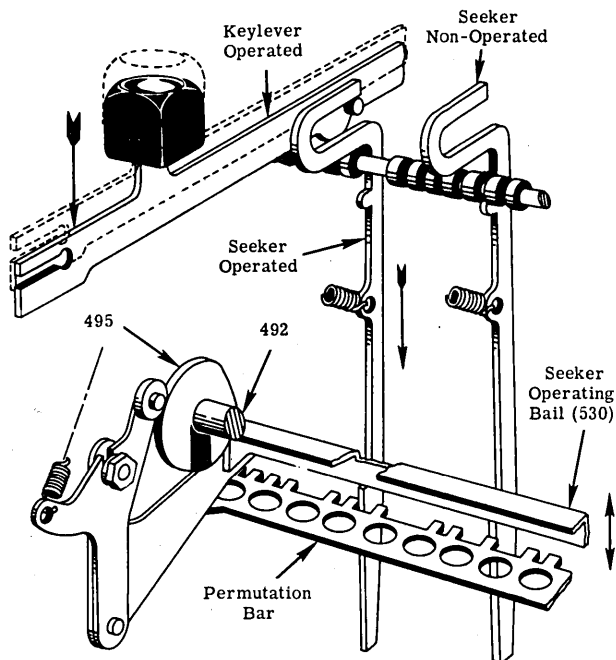


Figure 7-9 Seeker Operating Bail

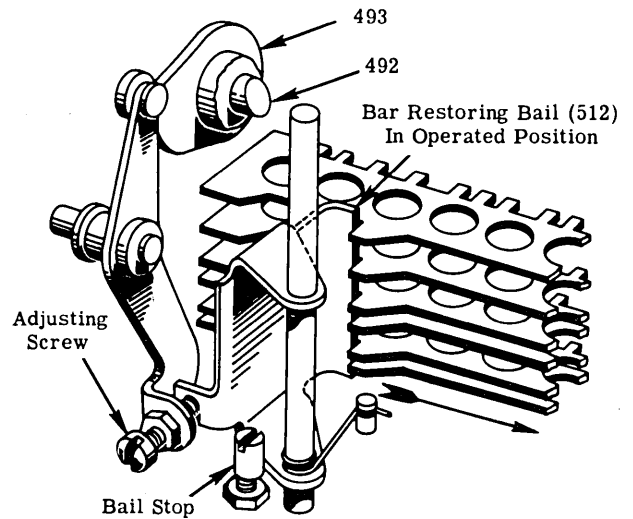


Figure 7-10 Bar Restoring Bail

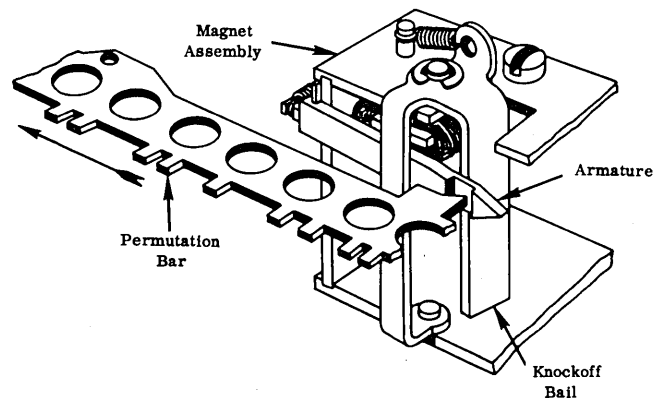


Figure 7-11 Armature Knockoff

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" side-wise 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.)

Code Translator

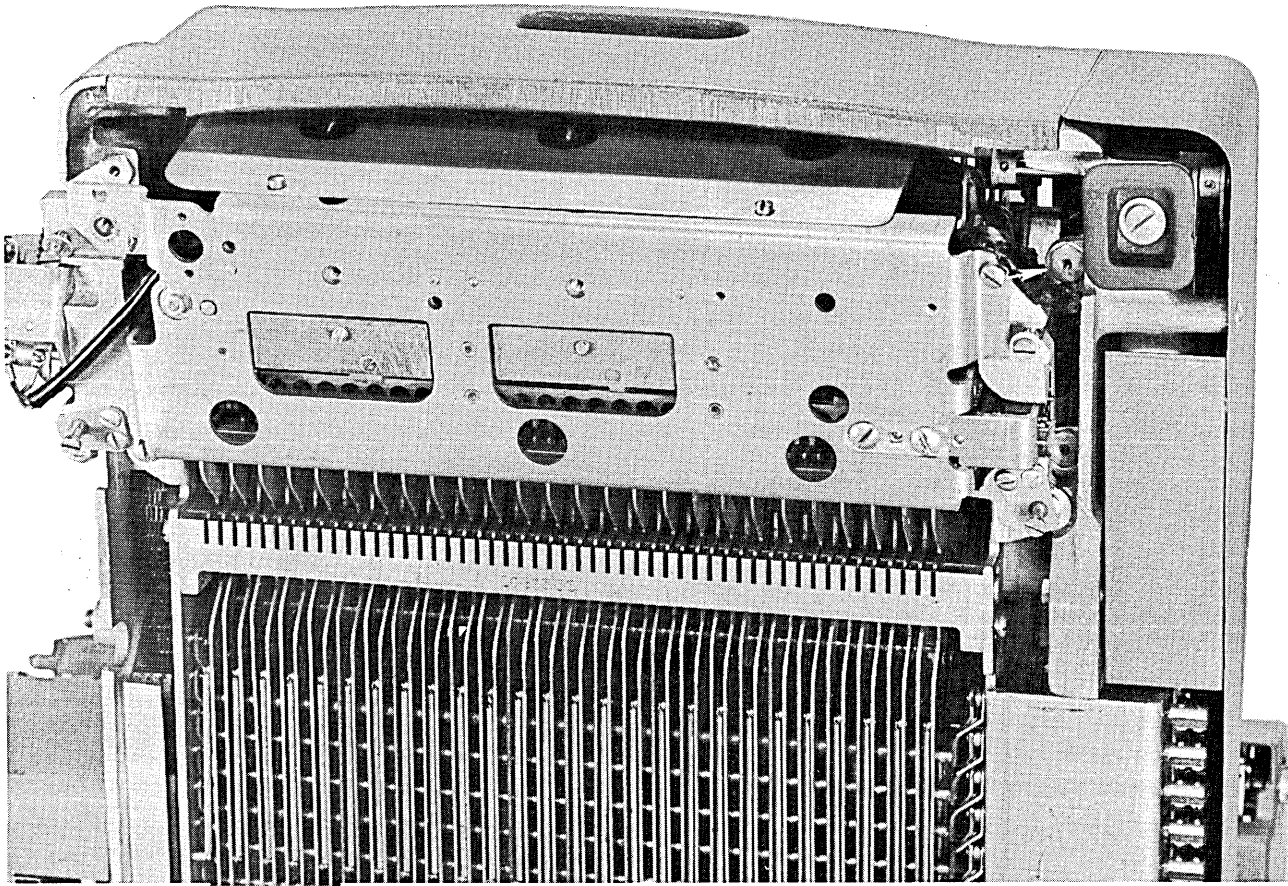


Figure 7-12 Translator Removal

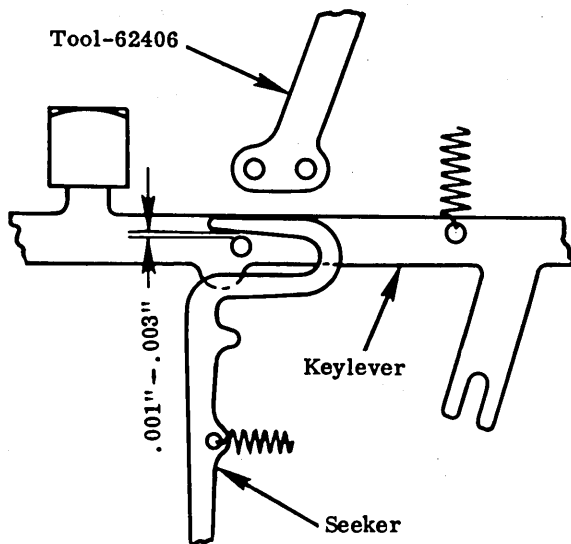


Figure 7-13 Seeker Adjustment

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

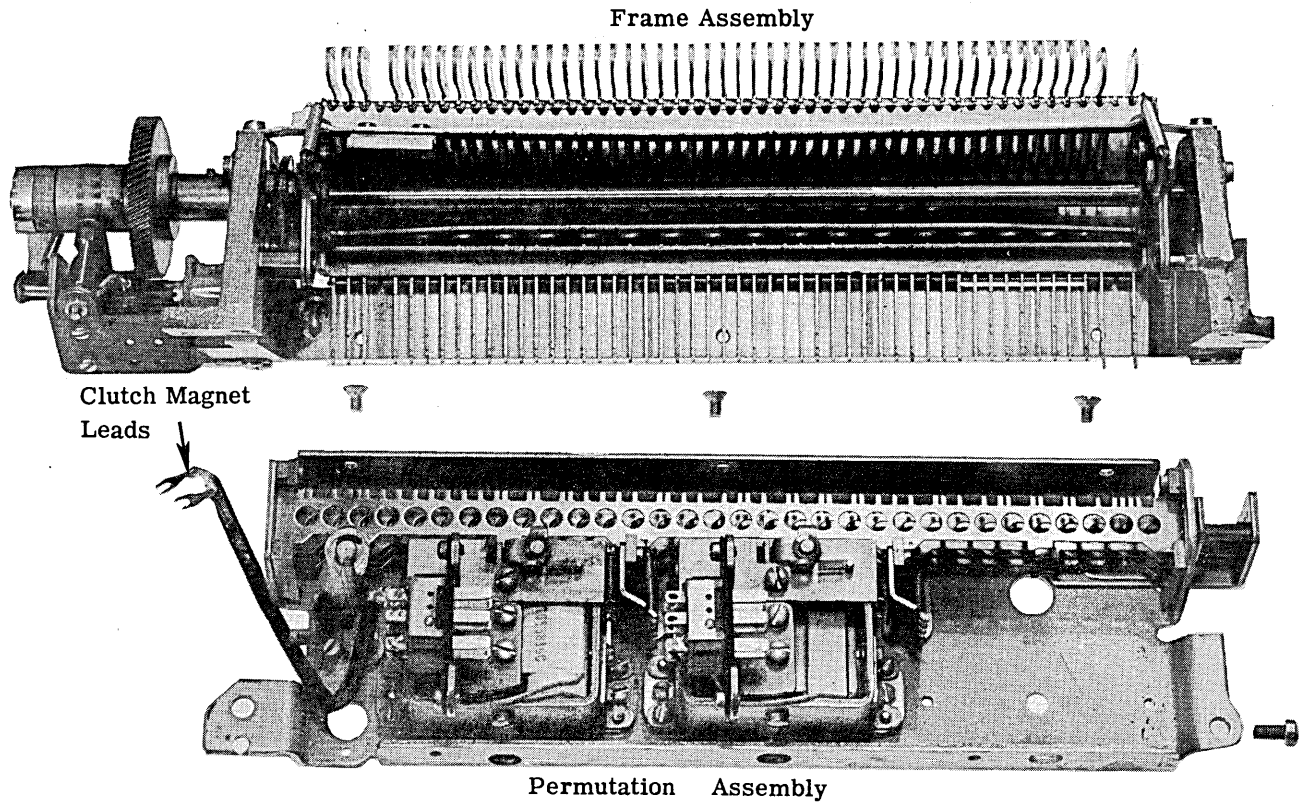


Figure 7-14 Translator Disassembly

- 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.)

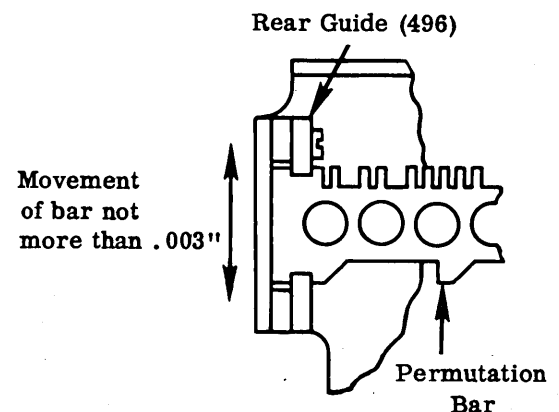


Figure 7-15 Rear Guide Block Adjustment

Code Translator

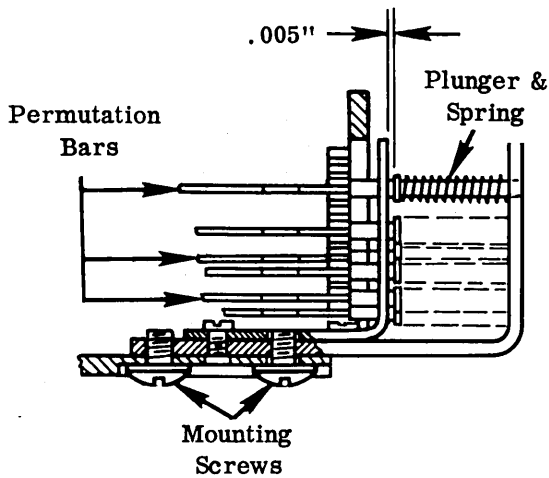


Figure 7-16 Plunger Bracket Adjustment

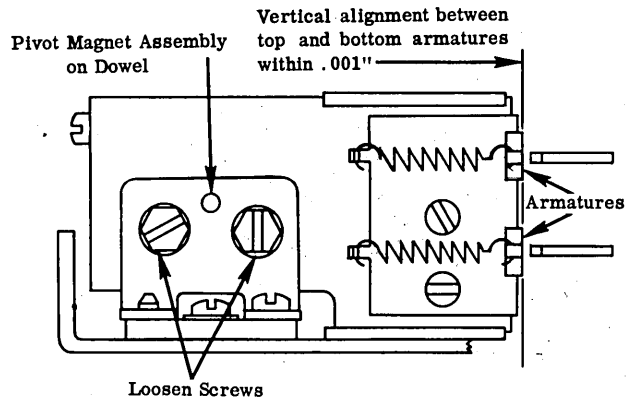


Figure 7-17

Top and Bottom Armature Adjustment

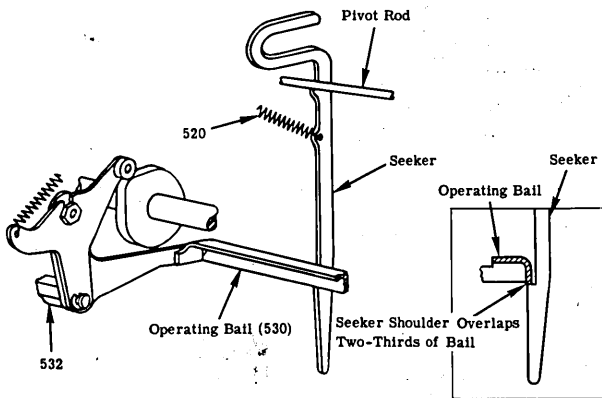


Figure 7-18 Operating Bail Adjustment

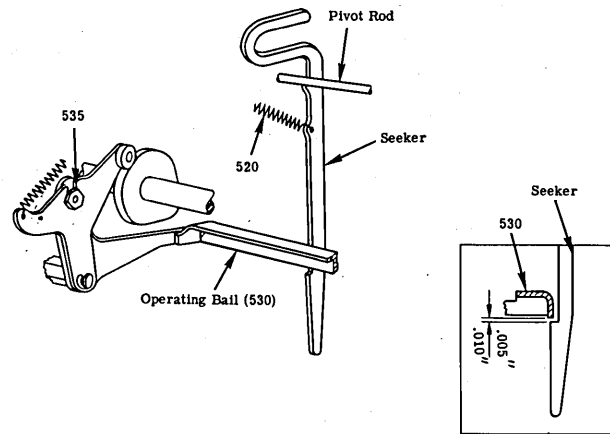


Figure 7-19 Operating Bail Adjustment

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

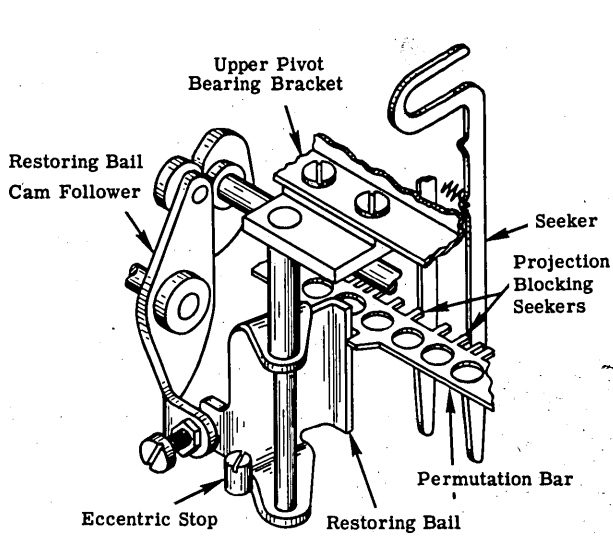


Figure 7-20 Restoring Bail Eccentric

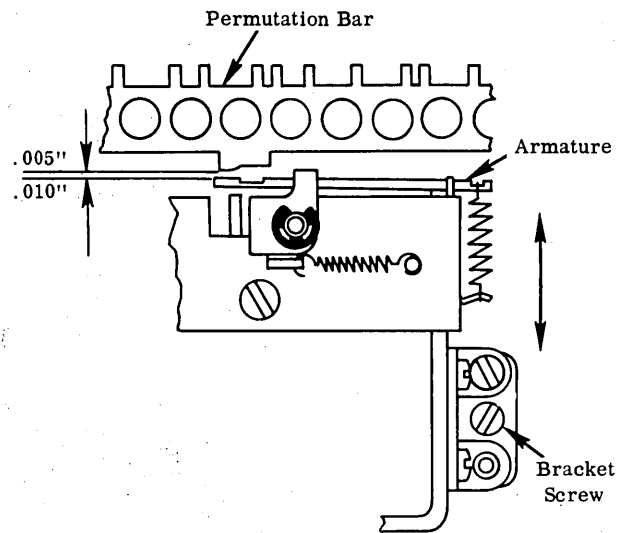


Figure 7-21 Magnet Assembly Adjustment

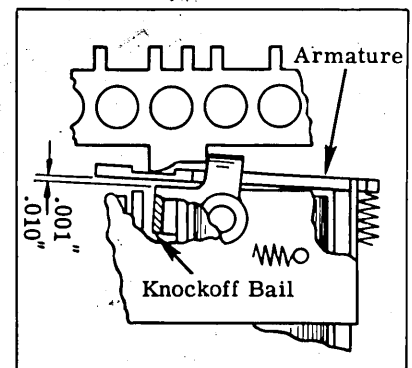
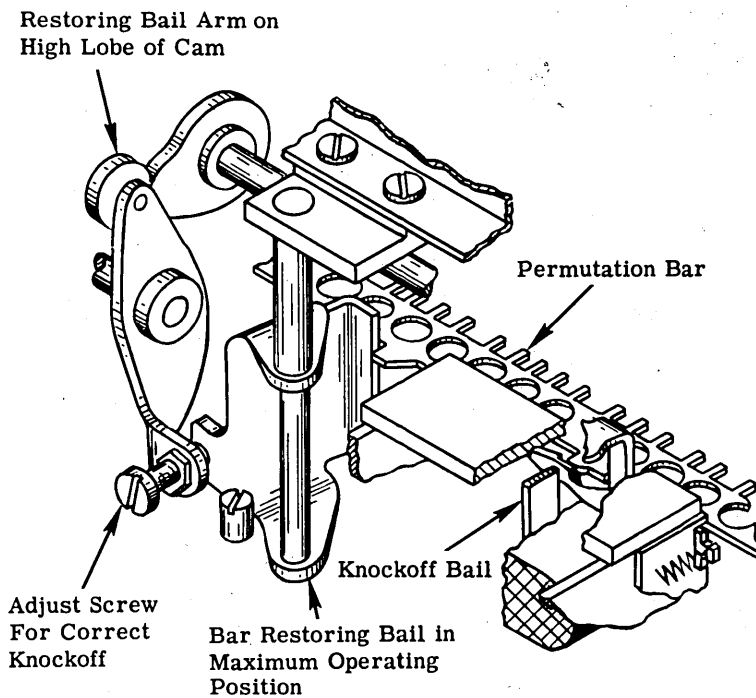


Figure 7-22 Restoring Bail Adjusting Screw

Code Translator

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.

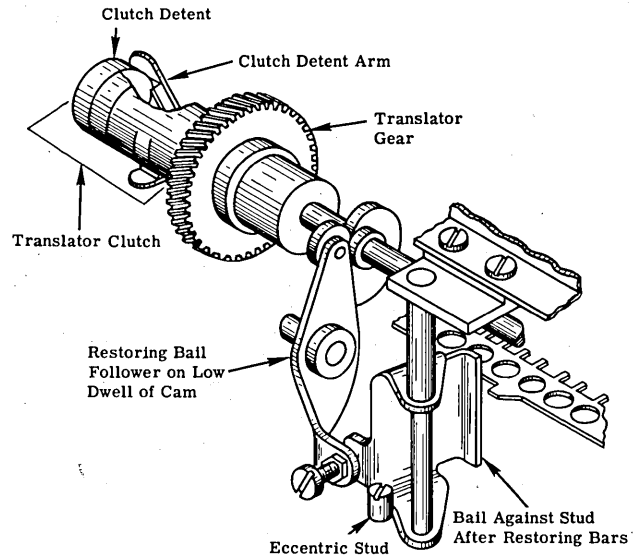


Figure 7-23 Clutch Adjustment

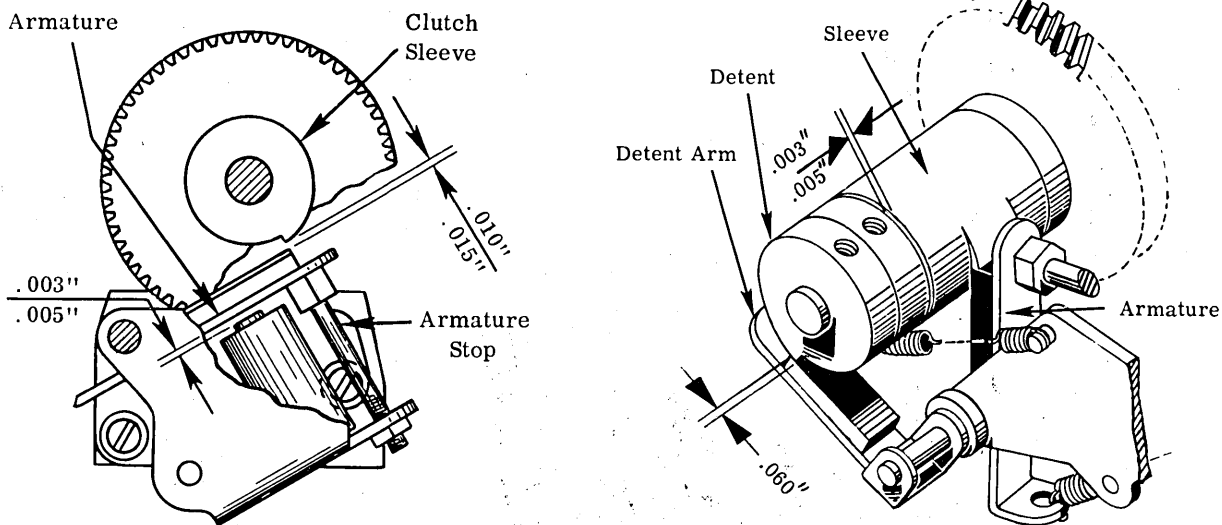


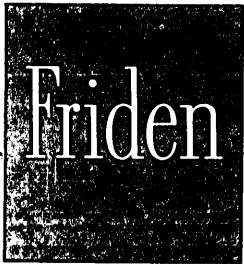
Figure 7-24 Clutch Magnet Adjustment

- 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 -

- 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.



MANUAL ADDENDUM

No. 19

DATE: January 13, 1959

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

SUBJECT: Translator Clutch Adjustments.

PURPOSE: Adjustment Change.

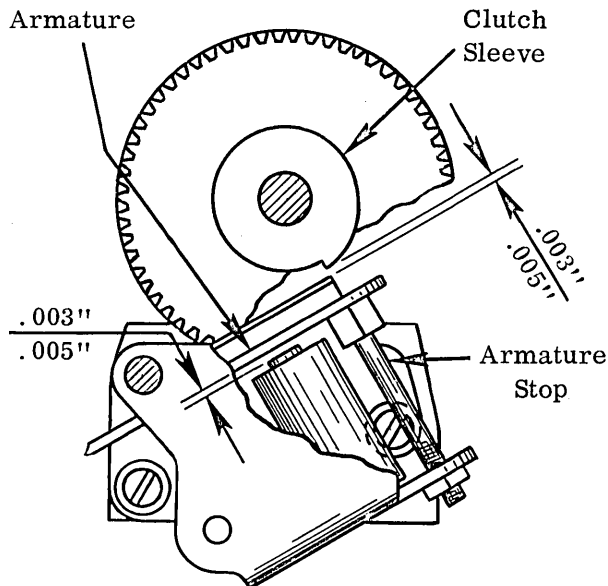
INFORMATION:

Page 7-12 and 7-13 Adjustments

1. Unchanged.
2. Changed as follows:

Delete present adjustment No. 2 in its entirety, and add the following:

Adjust the Armature Stop so that the Armature just engages the Brass Stop with .003 to .005 clearance between the Armature and the 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 .003 to .005. (see figure below)



3. Unchanged.

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

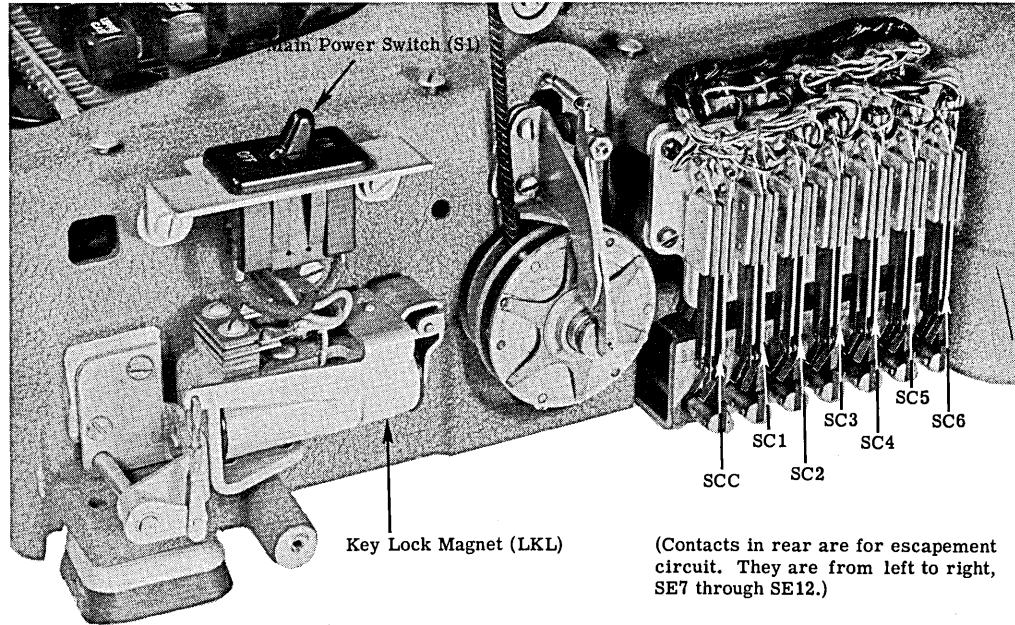


Figure 8-1 S1, LKL and Selector Contacts

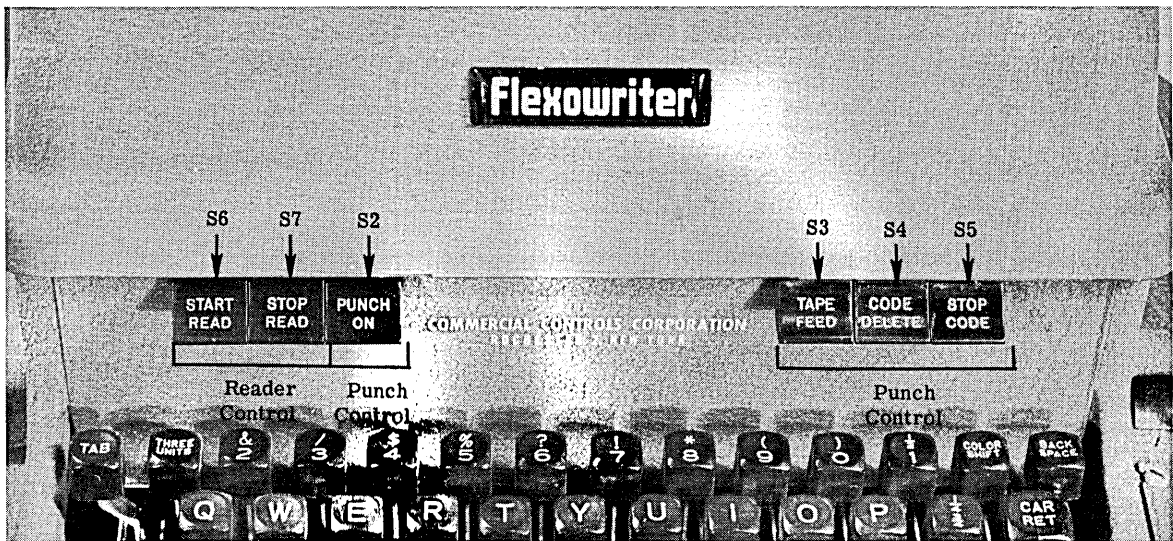


Figure 8-2 Control Panel

Circuit Description

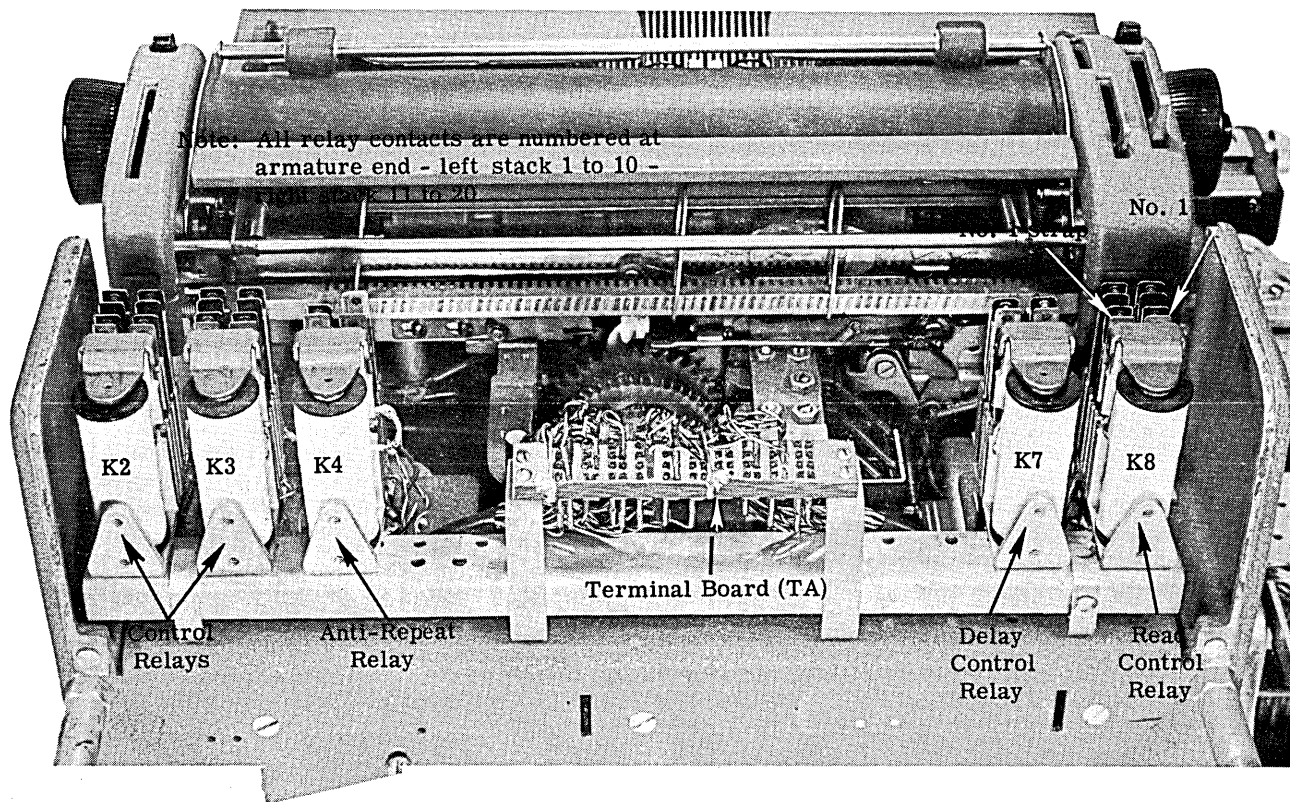


Figure 8-3 Relay and Plugboard

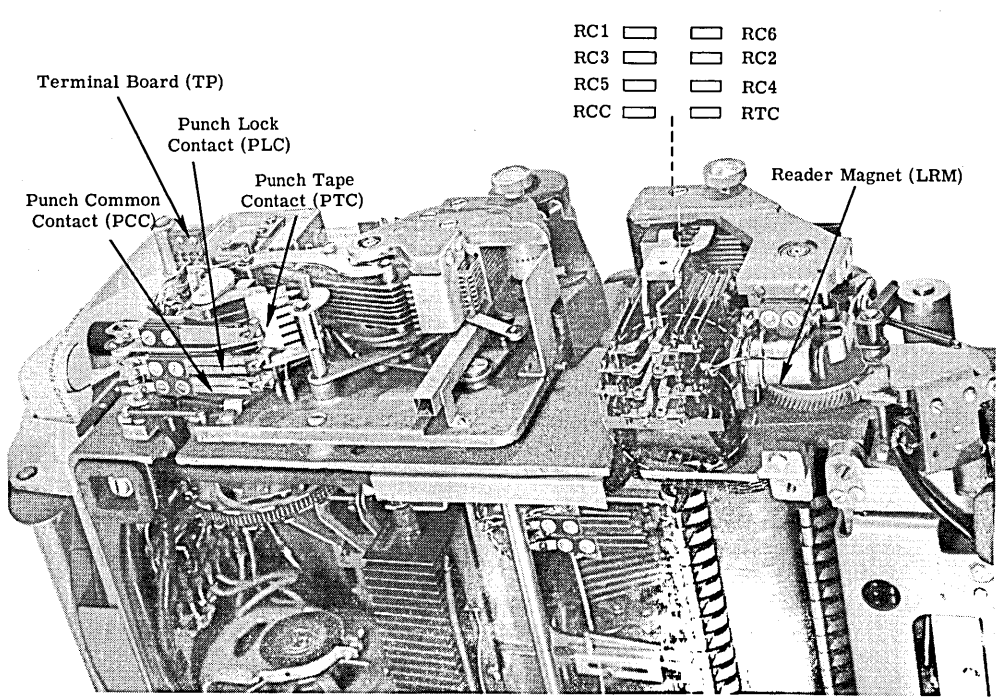


Figure 8-4 Reader and Punch Contacts

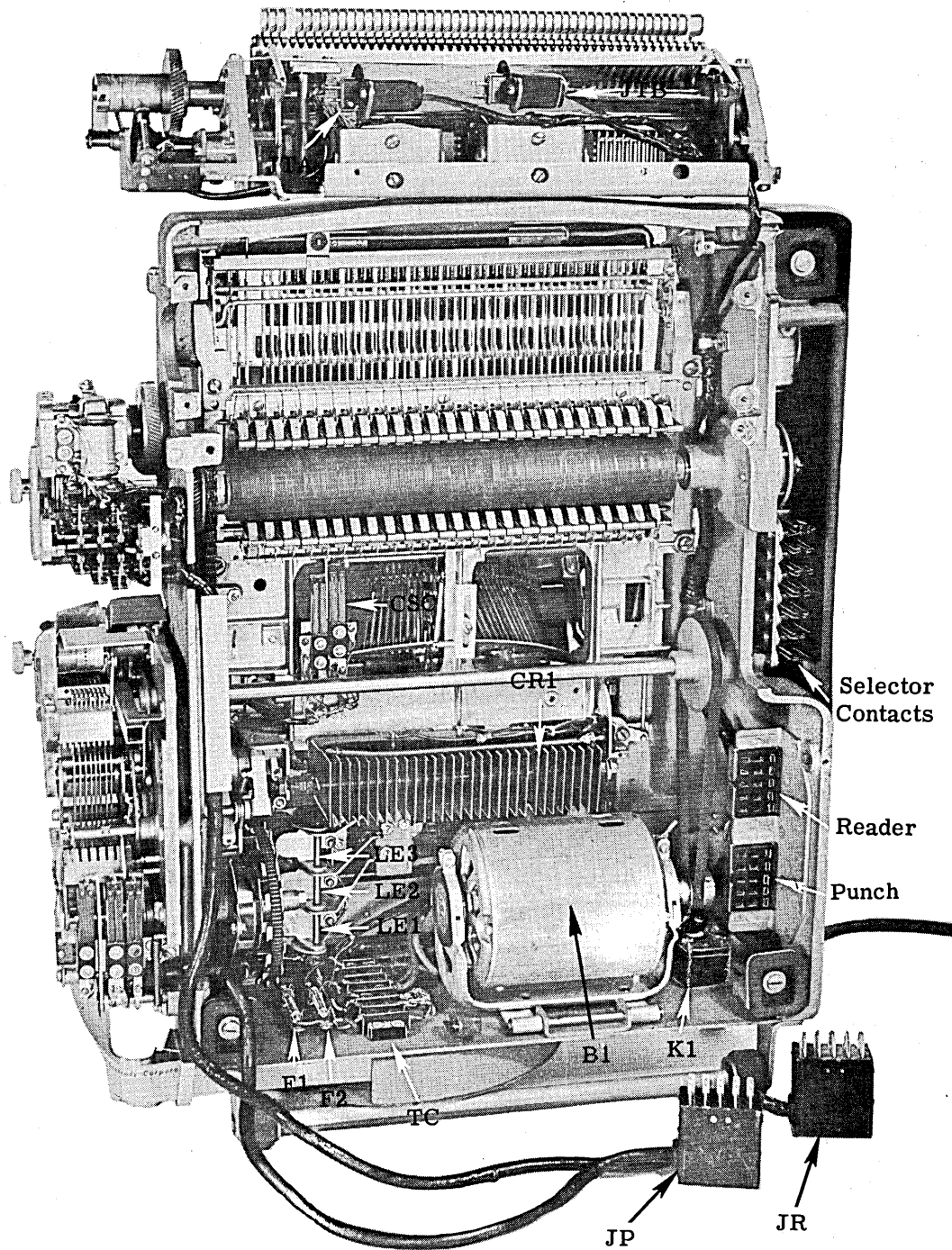


Figure 8-5 Electrical Component Locations

Circuit Description

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 milli-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

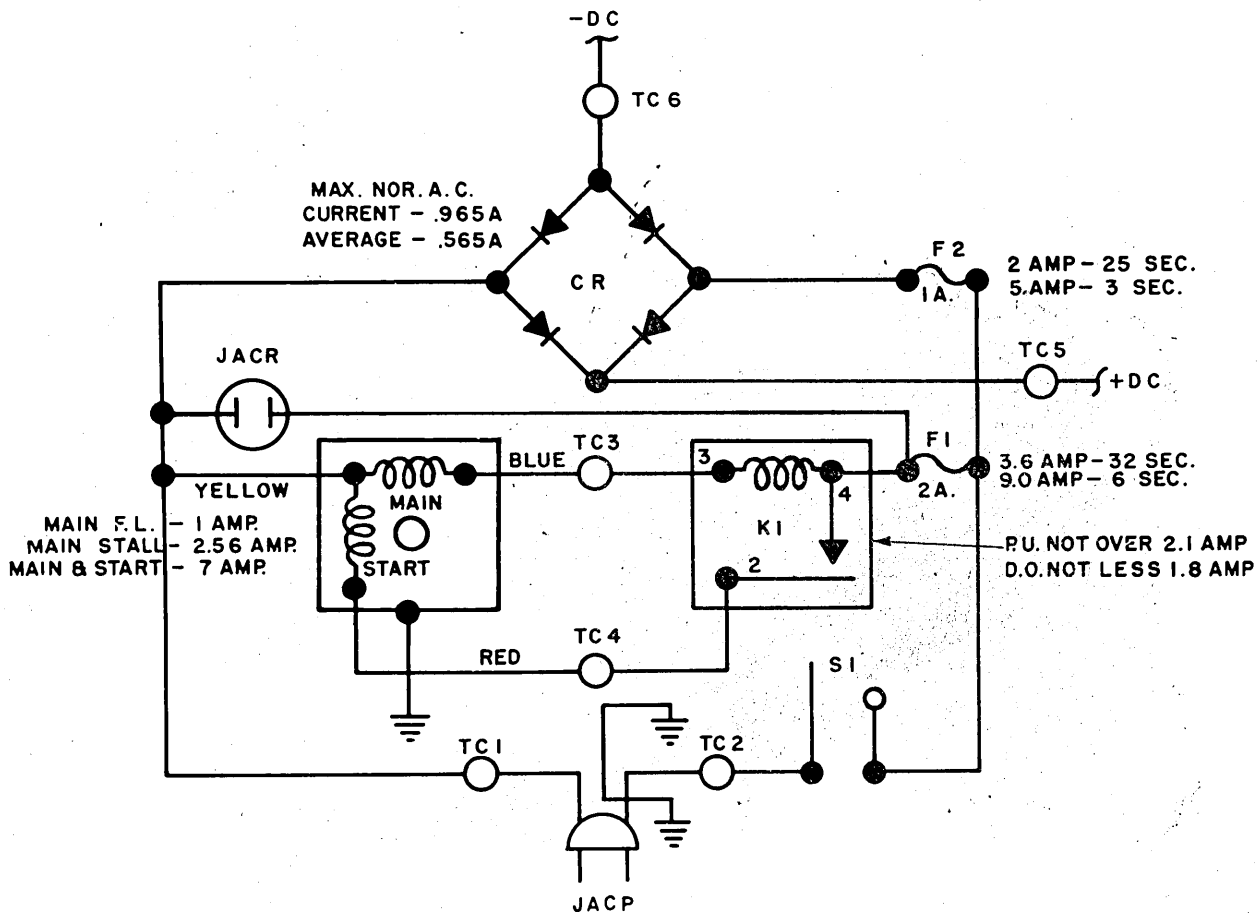


Figure 8-6 Power Circuit - AC Machine

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 VAC 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.

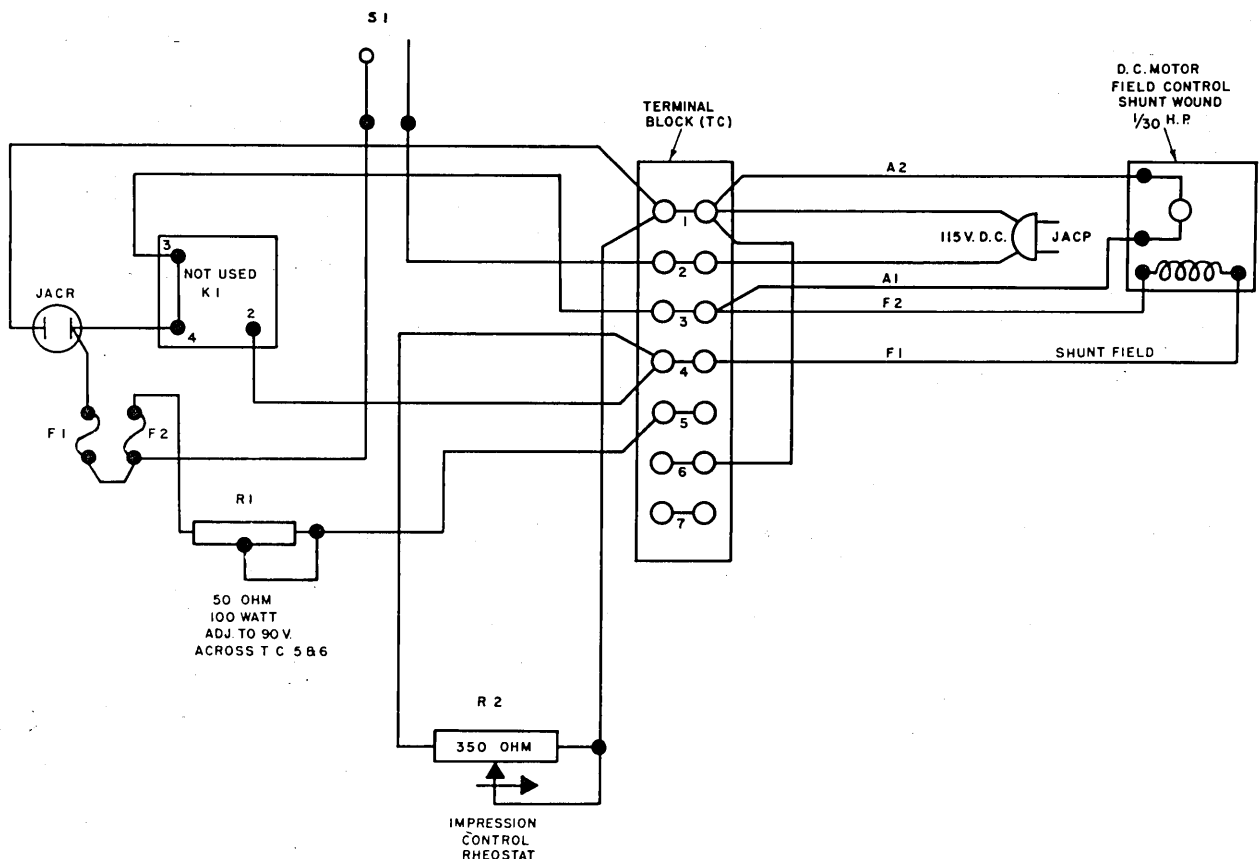


Figure 8-7 Power Circuit - DC Machine

Circuit Description

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.

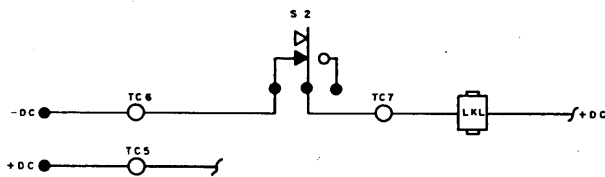


Figure 8-8 Key Lock Magnet - S2 Off

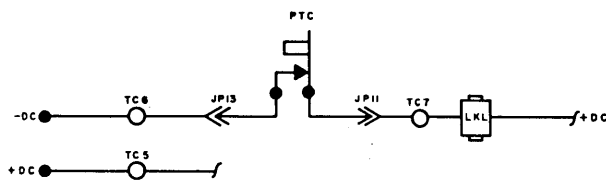


Figure 8-9 Key Lock Magnet - S2 On

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.

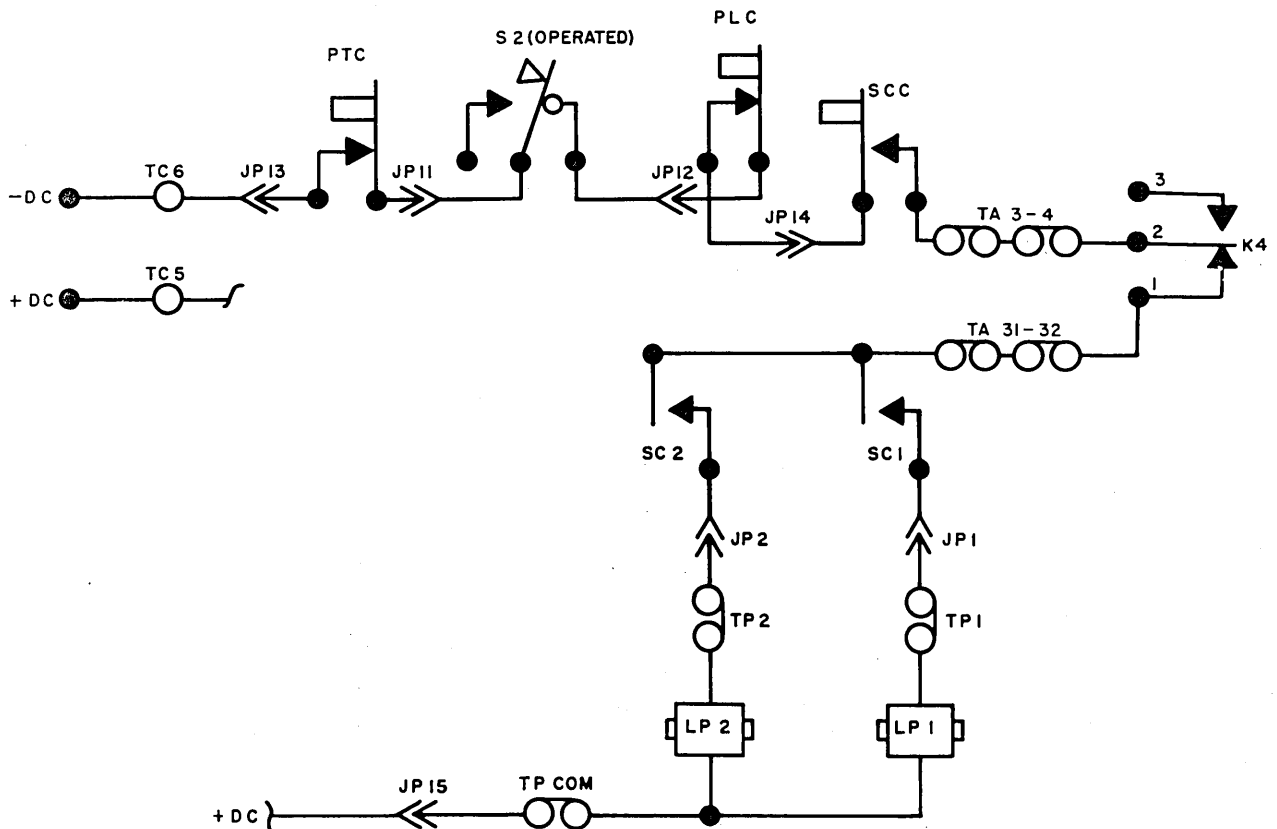


Figure 8-10 Punch Magnet Circuit

Circuit Description

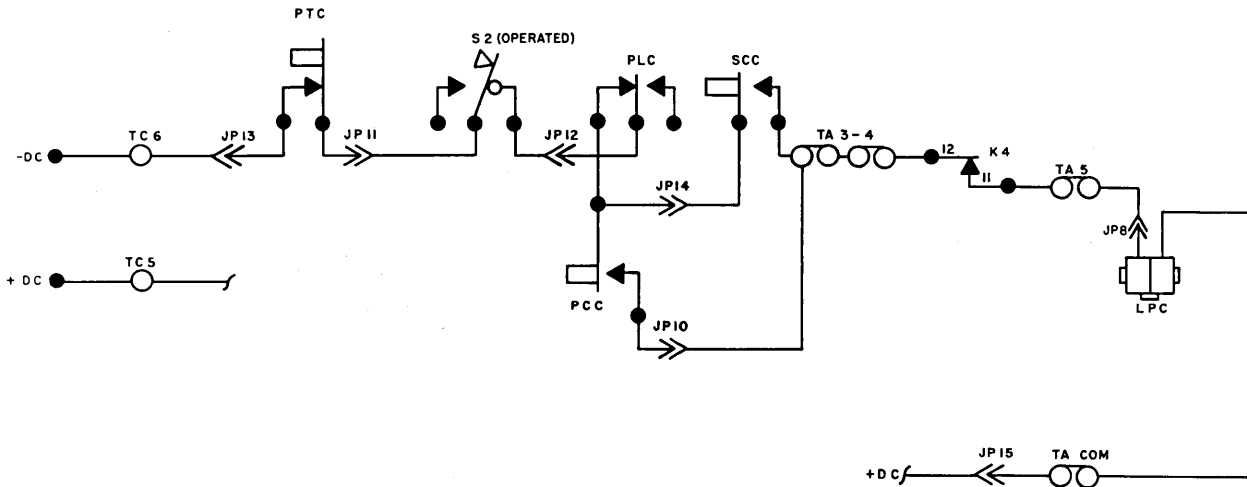


Figure 8-11 Punch Clutch Magnet Circuit

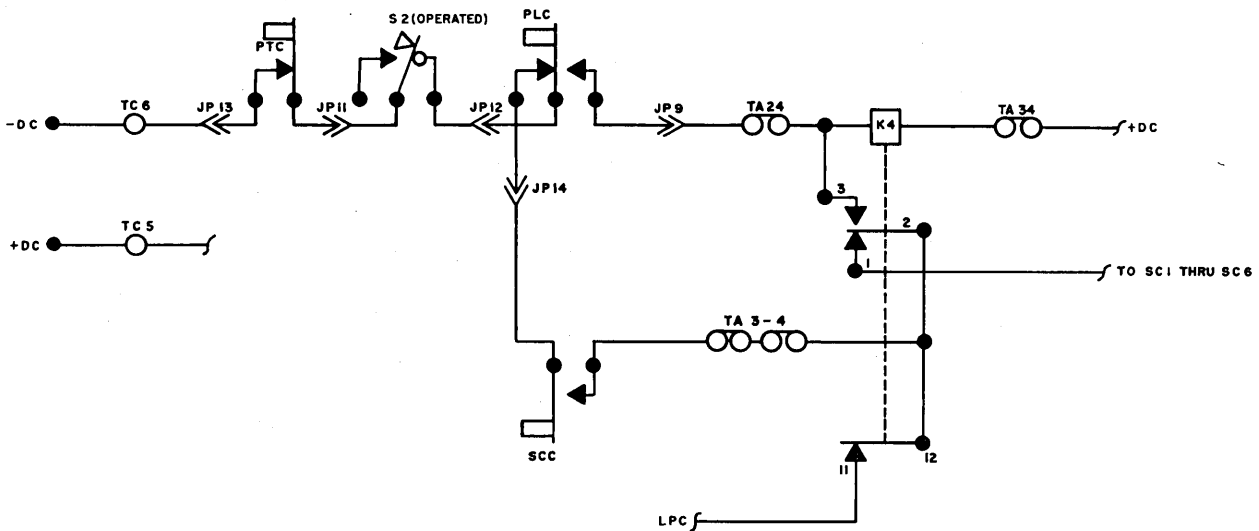


Figure 8-12 Anti-Repeat Circuit

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,

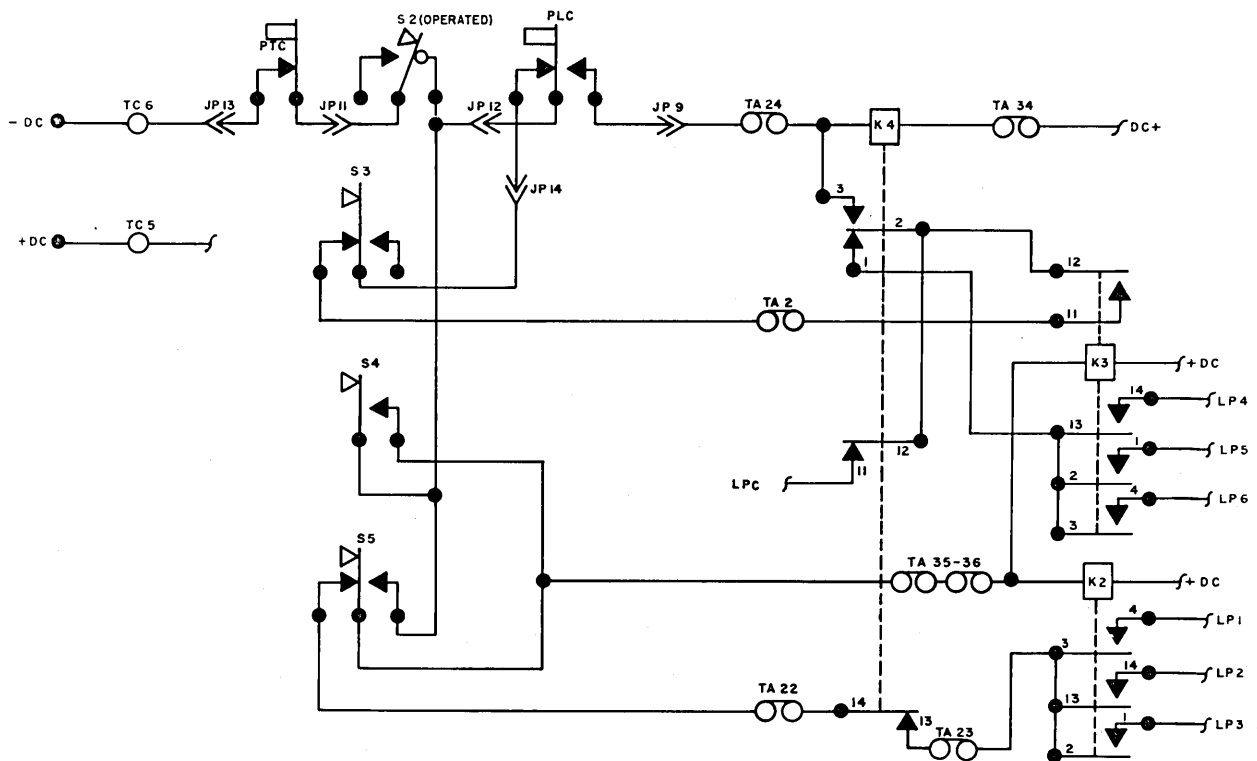


Figure 8-13 Stop Code and Code Delete

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

Circuit Description

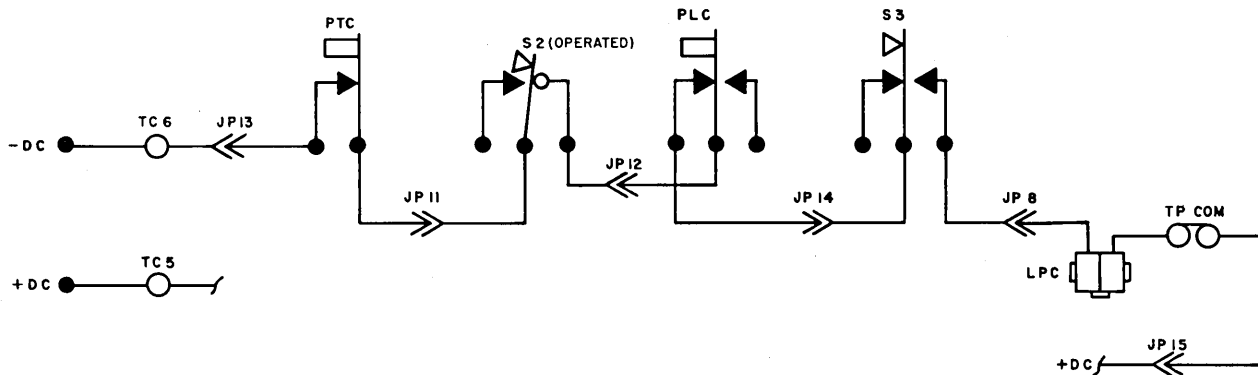


Figure 8-14 Tape Feed Circuit

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

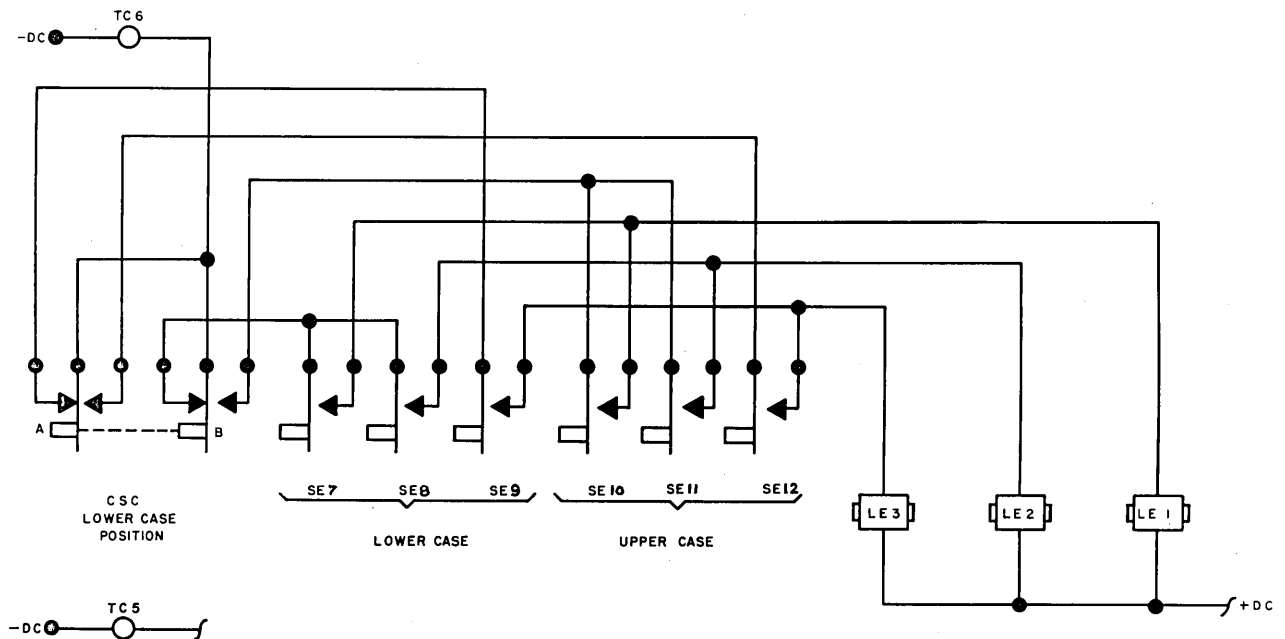


Figure 8-15 Escapement Magnet Circuit

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

Circuit Description

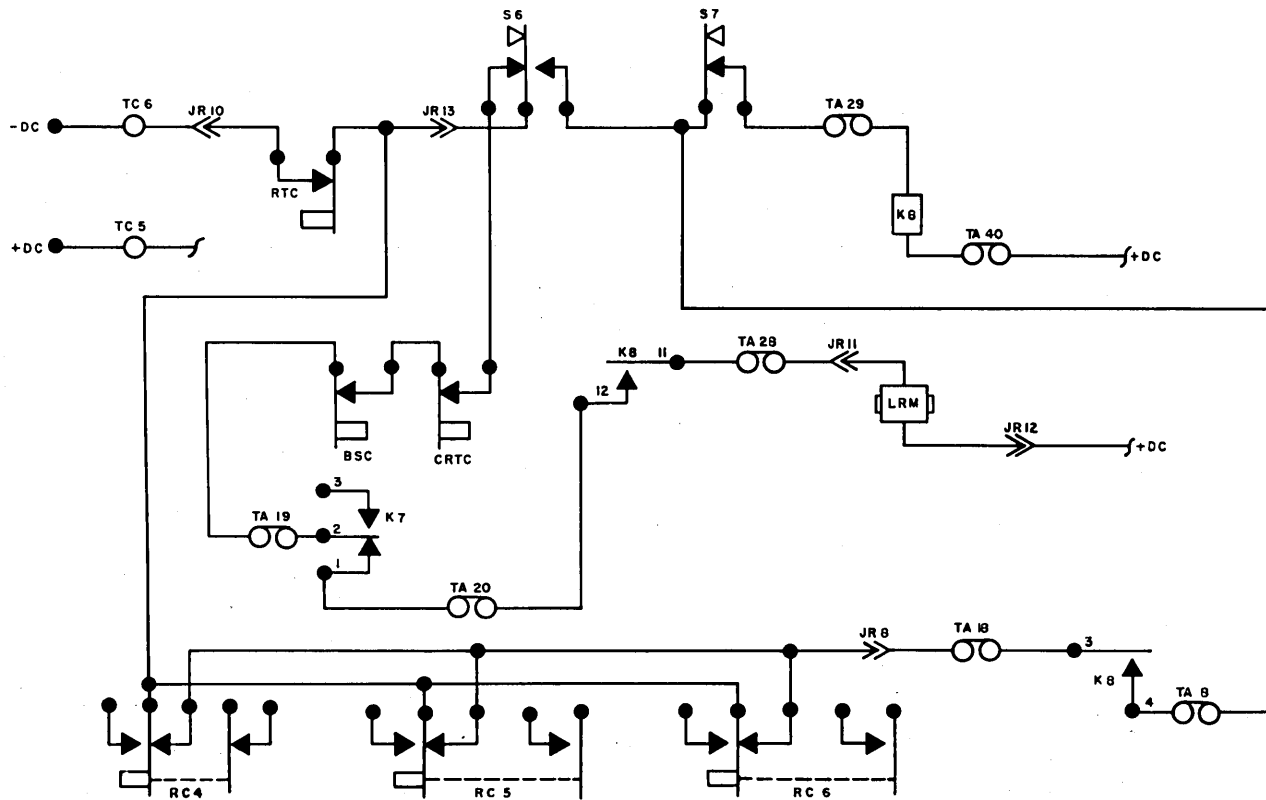


Figure 8-16 Start and Stop Circuits

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

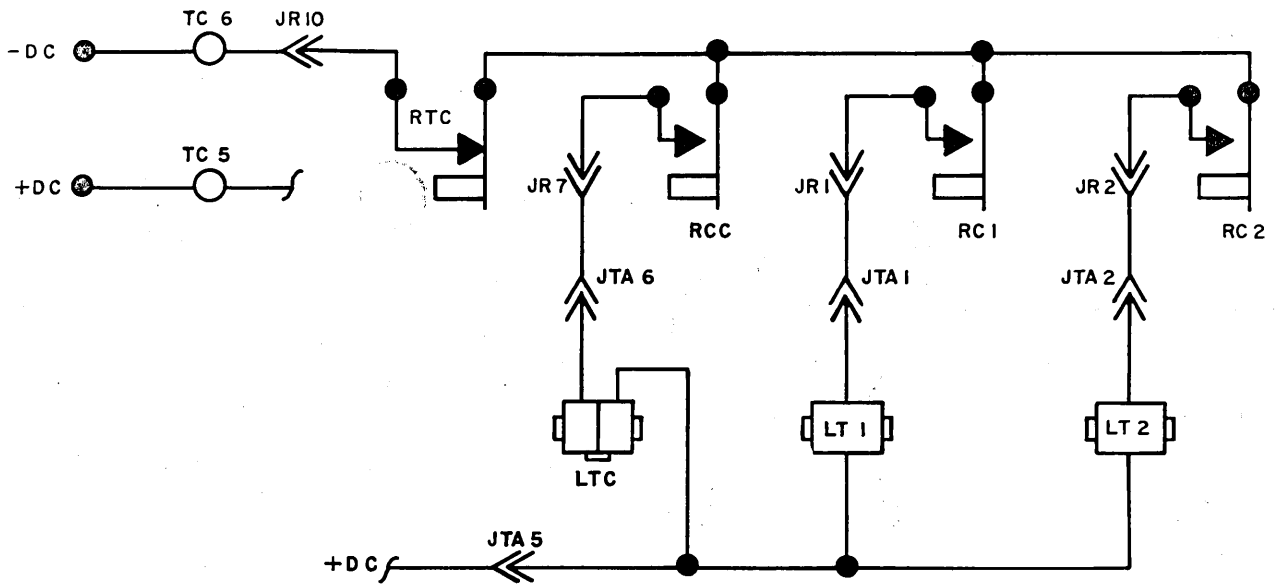


Figure 8-17 Translator Magnet Circuits

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)

Circuit Description

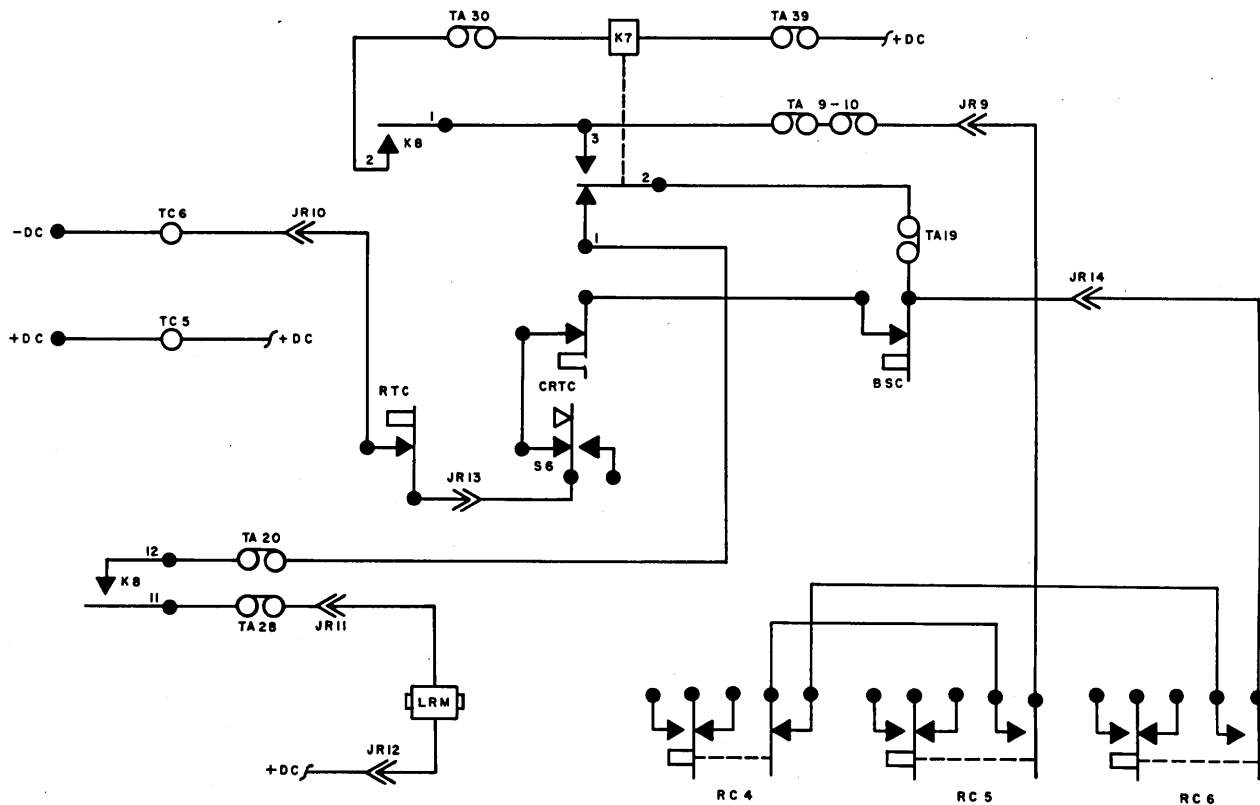


Figure 8-18 Delay Control Circuit

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.

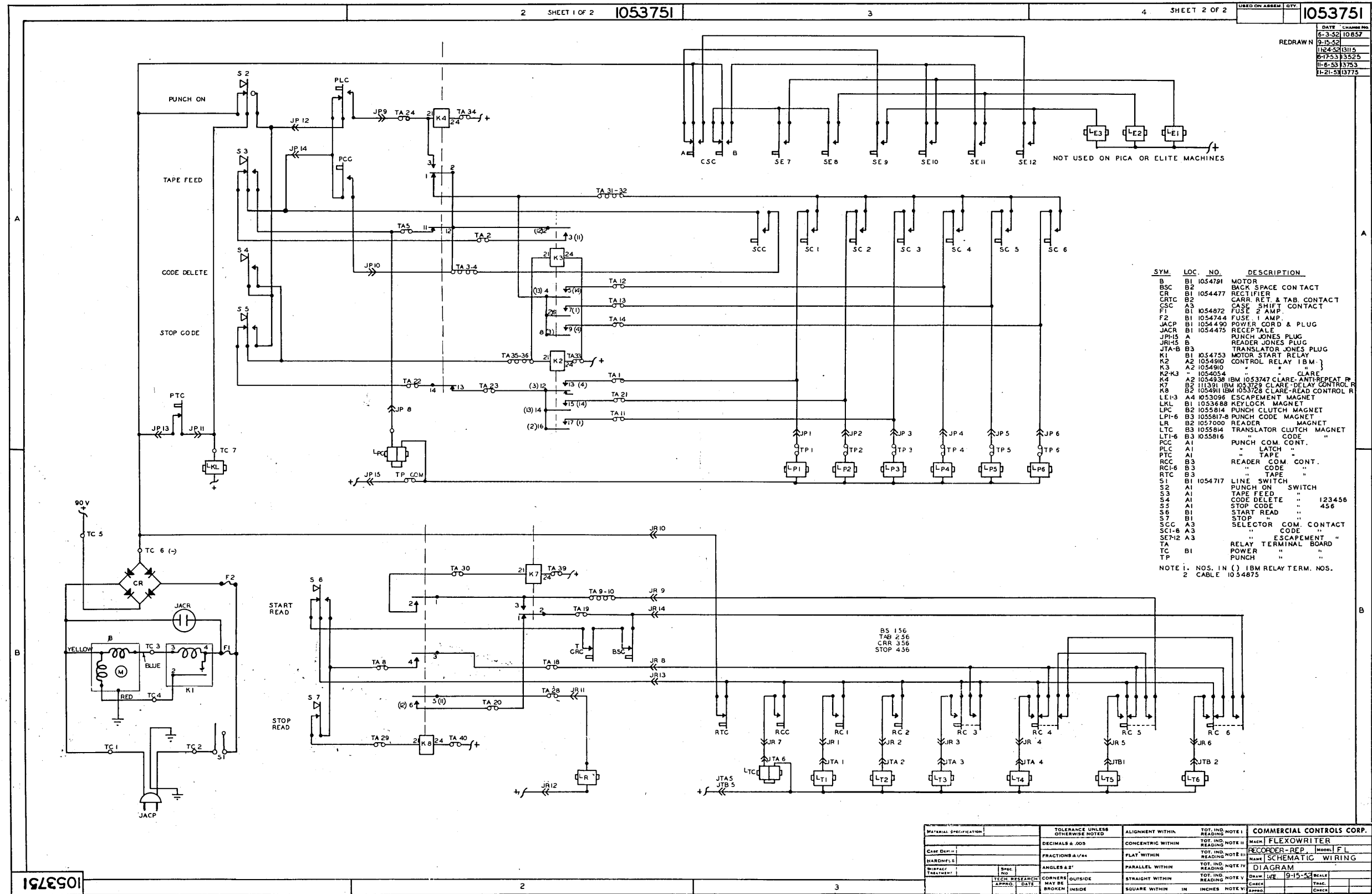


Figure 8-19 Flexowriter Wiring Diagram

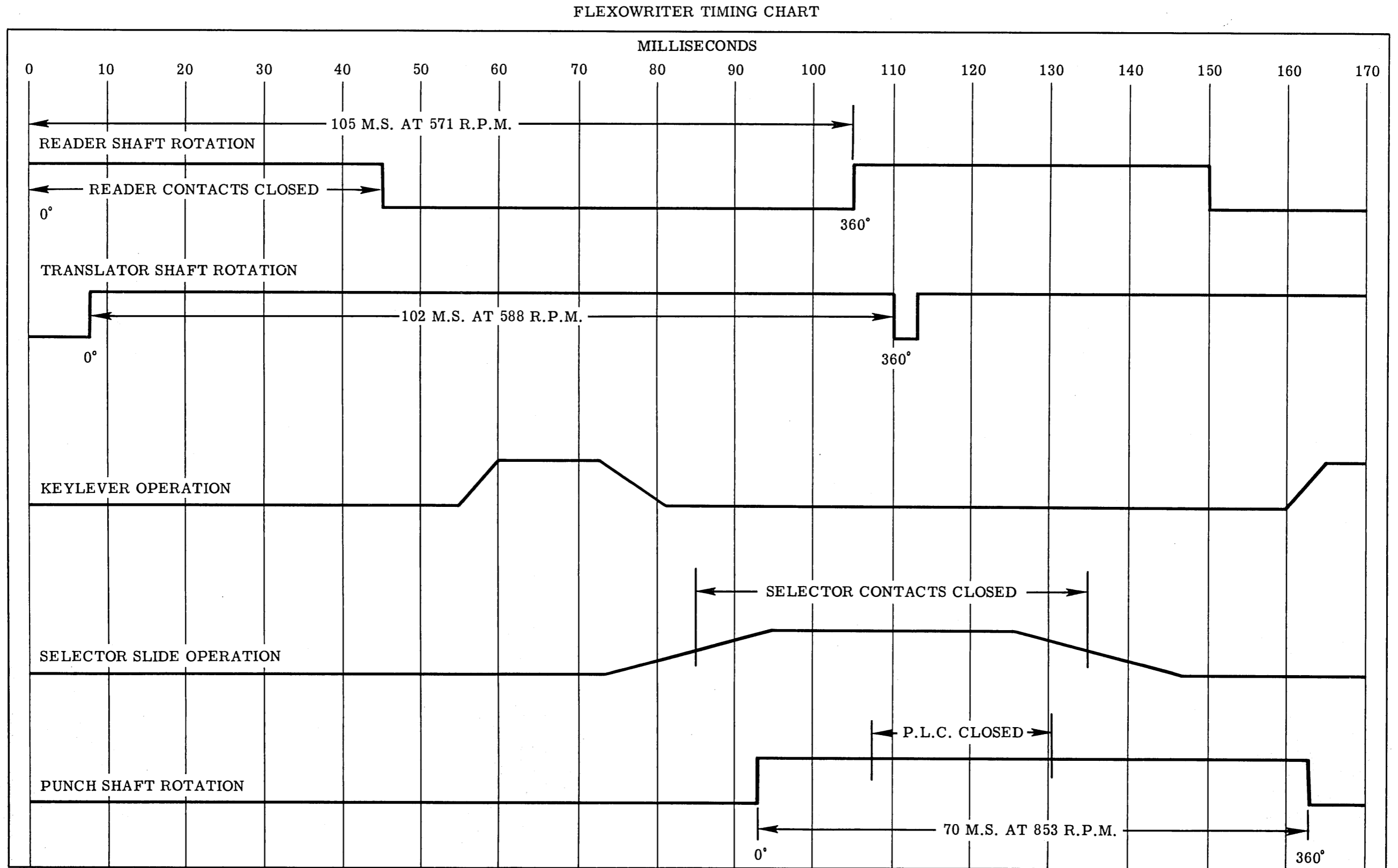


Figure 8-20 Flexowriter Timing Chart



Friden

12

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.

ENGINEERING STANDARDS

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.

ENGINEERING STANDARDS

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.

ENGINEERING STANDARDS

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

ENGINEERING STANDARDS

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).

ENGINEERING STANDARDS

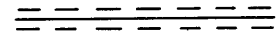
WIRE SYMBOLS

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.

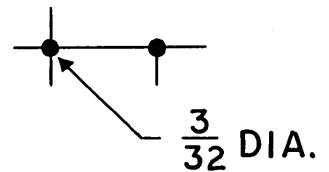
Shielded Wire



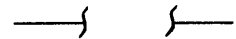
Crossed Wires, Not Connected



Wires Connected

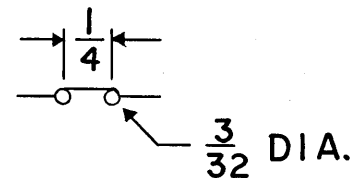


Break In Wire Symbol

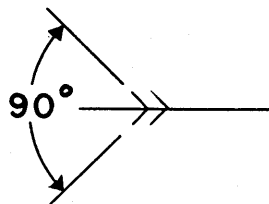


TERMINALS

Plug Hub



Plug Connector

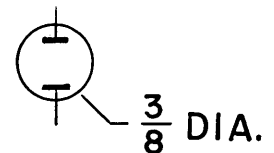
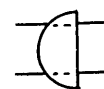


Power Plugs and Receptacles

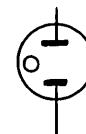
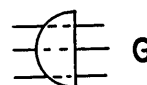
Plugs

Receptacles

Two Wire, Non-Polarized



Three Wire, Polarized, Grounding



ENGINEERING STANDARDS

MANUAL SWITCHES

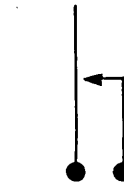
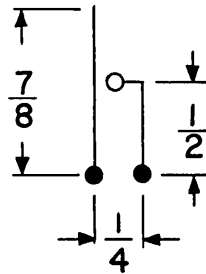
LEVER TYPE

LOCKING

NON-LOCKING

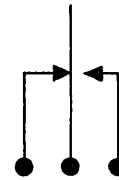
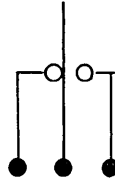
S.P.S.T

Single Pole
Single Throw



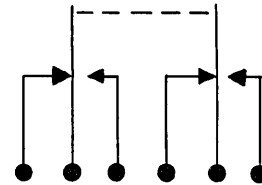
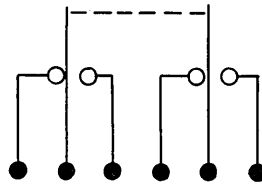
S.P.D.T.

Single Pole
Double Throw

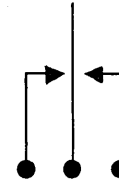
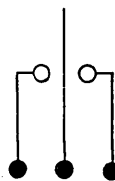


D.P.D.T.

Double Pole
Double Throw



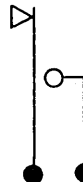
Center Off



PUSH TYPE

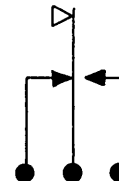
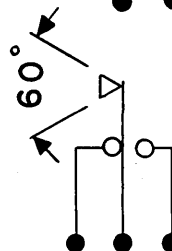
S.P.S.T.

Single Pole
Single Throw



S.P.D.T.

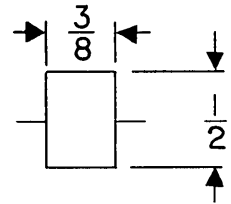
Single Pole
Double Throw



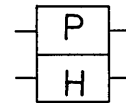
ENGINEERING STANDARDS

RELAY COILS

Standard Single Winding



Double Winding

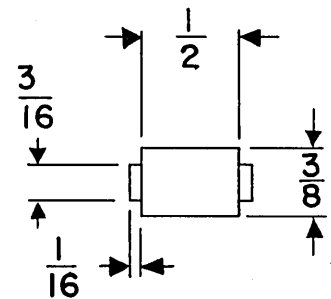


Special Feature Designations

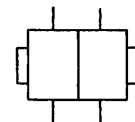
AC	-	Alternating Current
EP	-	Electrically Polarized
FO	-	Fast Operating
FR	-	Fast Releasing
H	-	Holding Winding
P	-	Pick-up Winding
MP	-	Magnetically polarized
SO	-	Slow Operating
SR	-	Slow Releasing
SA	-	Slow Acting

ELECTROMAGNET OR SOLENOID COIL

Single Winding



Double Winding



ENGINEERING STANDARDS

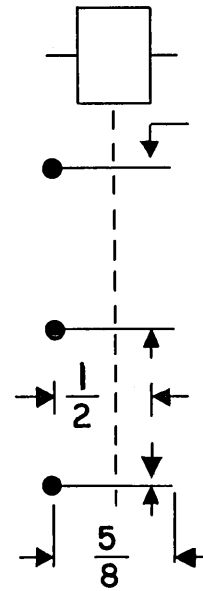
RELAY CONTACTS

Coil

Form A or Make or Normally Open

Form B or Break or Normally Closed

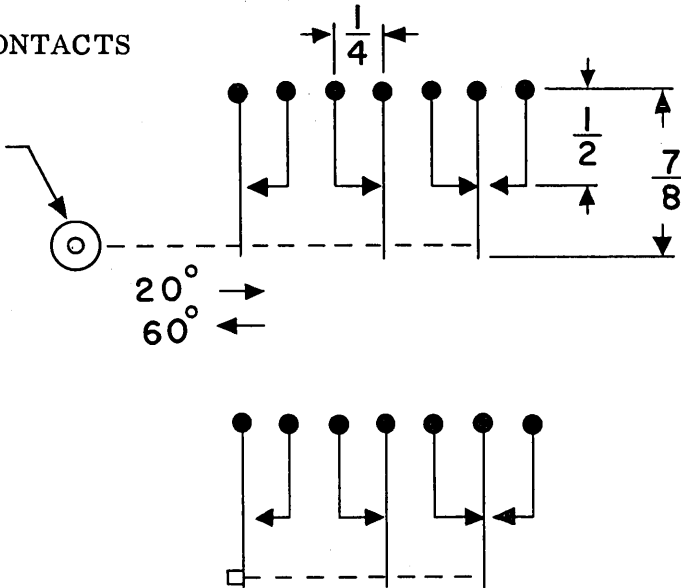
Form C or Transfer



MECHANICALLY-OPERATED CONTACTS

Cam-Operated $\frac{1}{4}$ DIA.

Lever-Operated

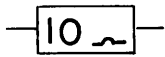


These symbols may be drawn with Terminals either top or bottom.

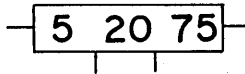
ENGINEERING STANDARDS

RESISTORS

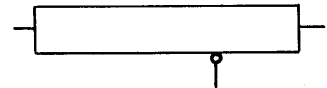
Fixed



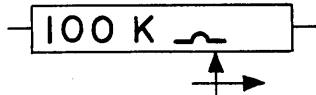
With Fixed Taps



Adjustable (Clamp)



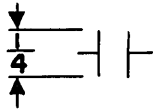
Rheostat or Potentiometer



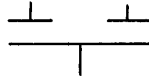
Arrow indicates clockwise rotation.

CAPACITORS

Fixed



Double (Common Tap)

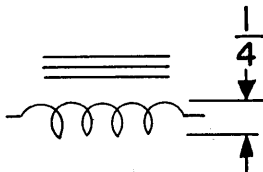


Variable



INDUCTORS

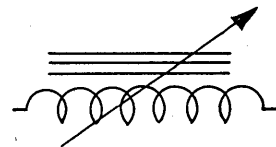
Fixed



Tapped

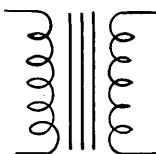


Variable

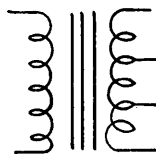


TRANSFORMERS

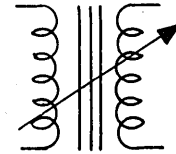
Fixed



Tapped



Variable



Omit core symbol on Air Core Units

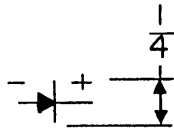
ENGINEERING STANDARDS

BATTERY (Indicate Volage)

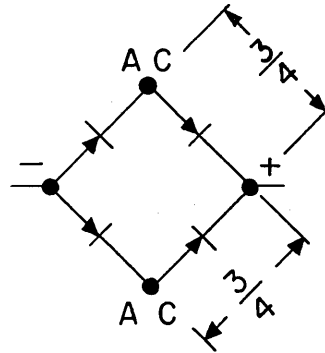


DRY RECTIFIER

Half Wave



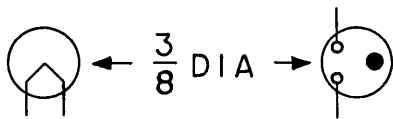
Bridge



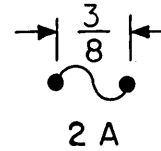
LAMPS

Filament

Neon



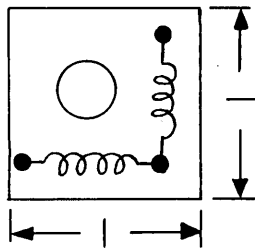
Fuse (Show Amp. Rating)



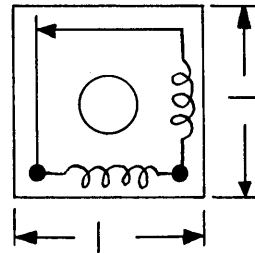
MOTORS

A. C. Single Phase

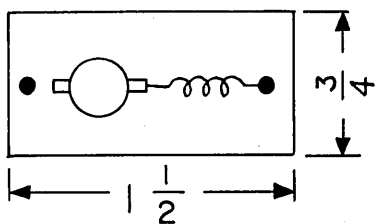
External Start Control



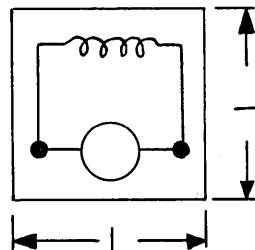
Internal Start Control



D. C. Series



D. C. Shunt



PART III

FLEXOWRITER MODEL FC

Section 1	Description
Section 2	Maintenance of Units
Section 3	Circuit Description

DESCRIPTION

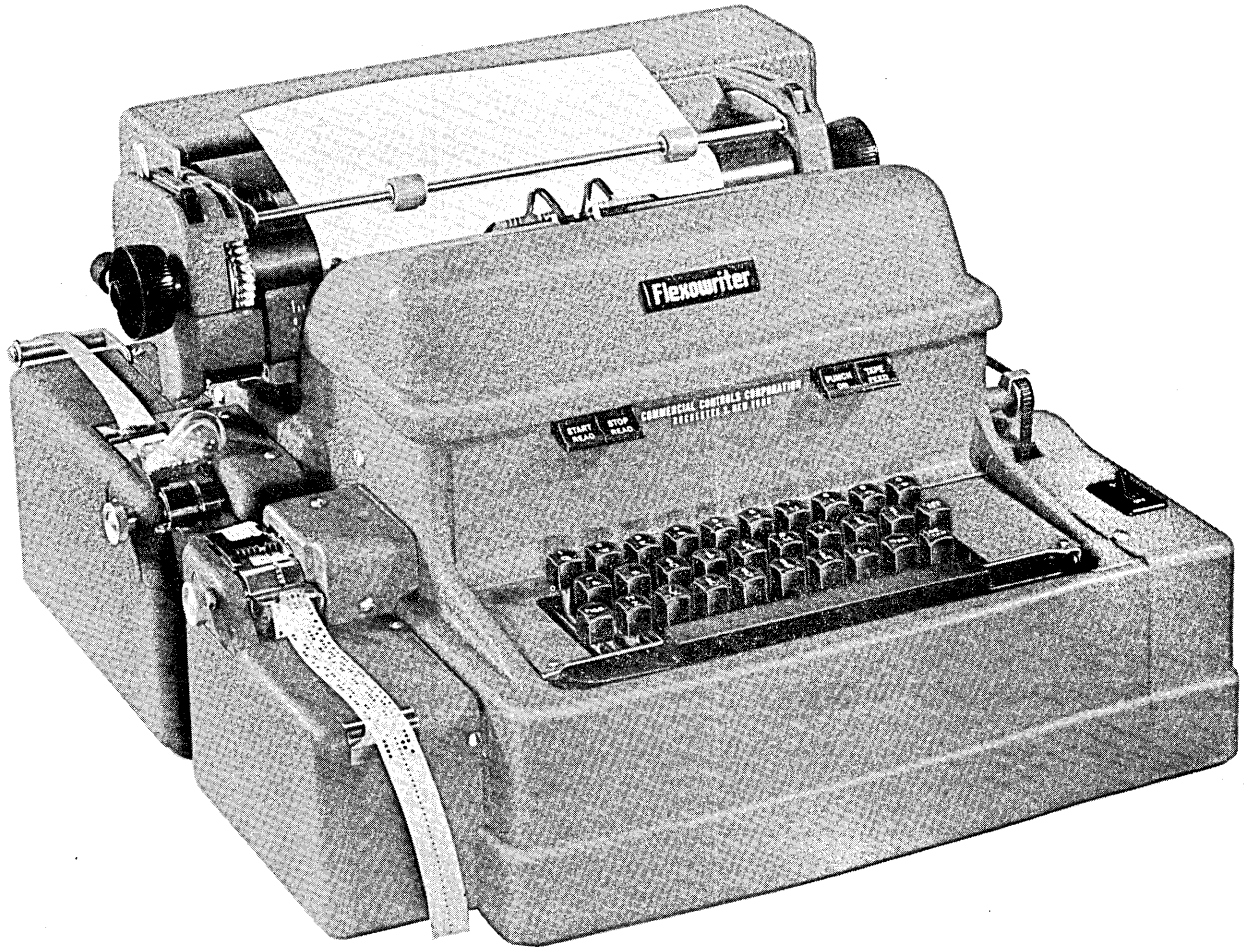


Figure 1-1 Flexowriter Model FC

The Flexowriter Model FC was designed to type a message with the required number of carbon copies and, as a by-product of typing, to perforate a communications tape with only the message to be wire transmitted. Also, the perforated tape can be used later to reproduce additional copies if needed, to cut a stencil, to make a direct image plate or other duplicating masters.

The Model FC is available in three combinations; Recorder, Reproducer, and Recorder-Re-

producer. The latter is a combination of the Recorder and Reproducer and can perform the combined functions of the two such as, messages can be typed, a communications tape punched, tape can be read to operate the Flexowriter automatically. Also, duplicate, revised or corrected tapes can be made.

The Model FC Recorder-Reproducer consists of a writing machine, code selector, tape punch, tape reader and code translator.

Description

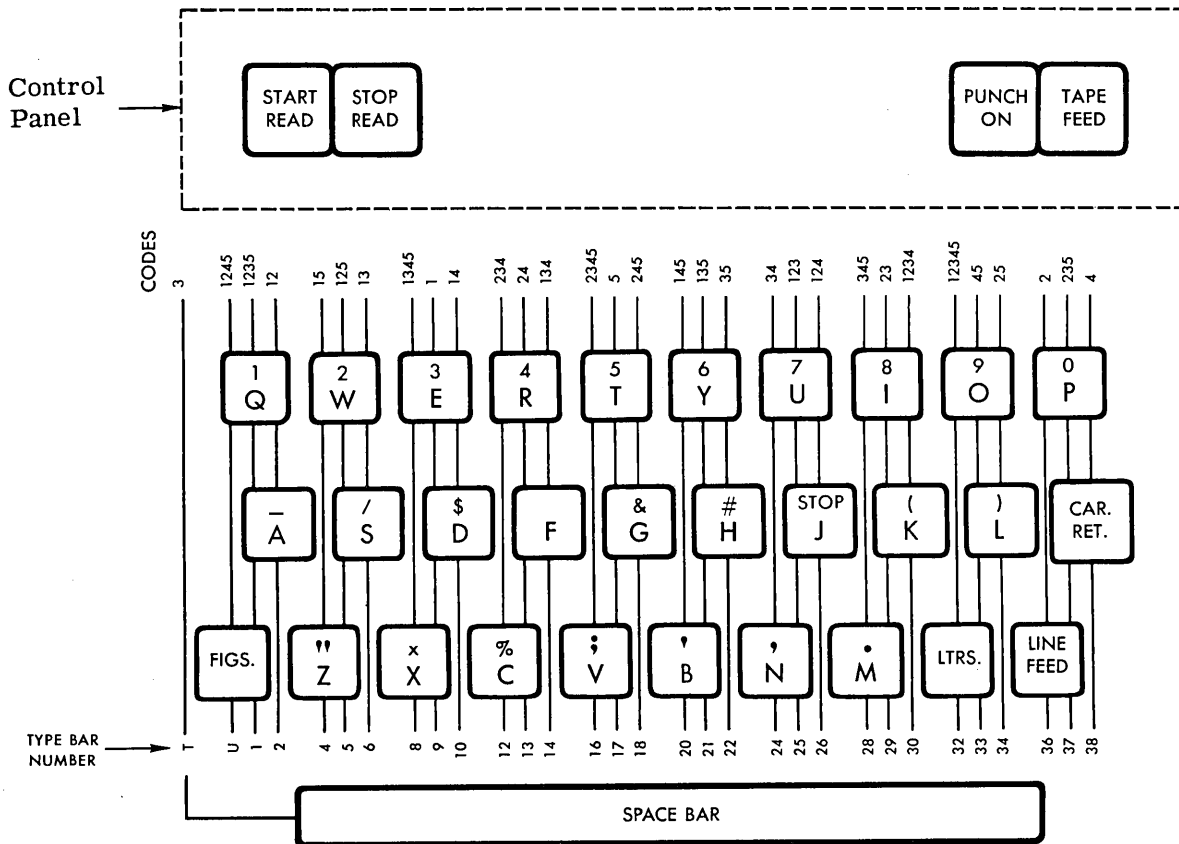


Figure 1-2 Model FC Keyboard

BASIC FUNCTIONAL PRINCIPLES

The basic functional principles of operation of the Model FC are the same as the Model FL explained in Part II, Section 1, with the exception that the Model FC uses a standard three-bank communications keyboard and a five unit binary code system. This means that only five code contacts (plus the common contact) are operated by the code selector and there are only five punch magnets and five reader contacts controlling five translator magnets.

Also, on the Model FC Recorder-Reproducer there are only two switches controlling the tape punch operation and they are the punch on switch and the tape feed switch. Both these switches

perform the same function in the Model FC as in the Model FL. The start read and stop read switches control the tape reader in the same manner as in the Model FL.

KEYBOARD

The Model FC keyboard is a standard three-bank communications keyboard, a sample of which is shown in Figure 1-2. It uses a total of 31 key-lever positions, 26 of which are used for character operation. Four of the remaining five positions are used for functional operation including carriage return, figures shift, letters shift and space. The operation of a keylever in the number 36 position (line feed) results in a number two code

perforated in the tape only. This keylever does not perform any function on the writing machine. The line feed function on the Flexowriter is incidental to carriage return operation.

Since there are only three rows of keylevers, they serve a dual purpose and are controlled by either the letter shift key (lower case) or the figure shift key (upper case).

Depression of the letters shift key will cause each succeeding key depression to print a letter on a document (except position numbers 36 and 38). Depression of the figures shift key will cause each succeeding key depression to print either a diget or a special character, with the exception of keylever position numbers 26, 36 and 38.

With the type basket in the upper case position (Figures) and the Jkeylever automatically operated, no character will be printed and the machine will automatically stop.

CODE SYSTEM

The Model FC Flexowriter uses a five unit binary code which provides 32 possible code combinations. As shown on the keyboard chart in Figure 1-2 and the tapes in Figure 1-3, 26 of these code combinations are used for characters while five others are used for functions such as,

carriage return, letters shift, space and line feed (the line feed keylever operation just perforates a 2 code in the tape).

Eleven-sixteenth inch wide paper tape is used and the code holes are numbered 1-2-3-4-5 facing the leading edge of the tape (Figure 1-3). The feed hole is between the 2 and 3 code hole and is .394 inch from the right edge with its center line even with the center line of the code holes.

CONTROL PANEL

The Model FC Recorder-Reproducer control panel is shown in Figure 1-2 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.

Start Read - When this switch is depressed and released, the tape reader automatically starts

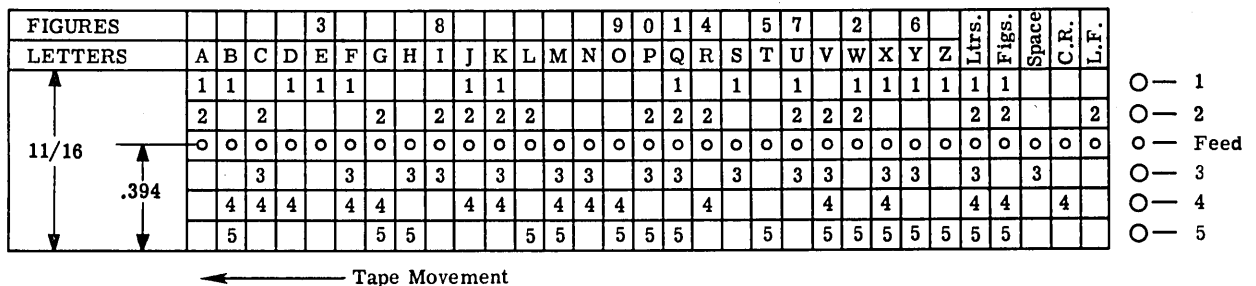


Figure 1-3 Model FC Code Chart

Description

operation. By stepping (depressing and releasing rapidly) this switch, the tape may be moved one code position at a time.

Stop Read - When the stop read switch is depressed during automatic operation, the reader will stop operation, thus stopping automatic typing operation. In order to resume automatic operation, the start read switch must be depressed.

SPECIFICATIONS

Power Supply - The Model FC may be specified with one of the following power supplies.

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

Recorder - Reproducer - 85 lbs.

Recorder - 74 lbs.

Reproducer - 78 lbs.

Type Style - The standard type style on the Model FC is Pica Gothic which will print ten characters to the inch.

Keyboard - The Model FC may be equipped with any standard three-bank communications keyboard.

Carriage - The Model FC 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 - See Part II, Section 2, Page 2-56, for available platens and ratchets.

Tabulation - The Standard Model FC does not provide a tab mechanism.

Back Space - The Standard Model FC does not provide a back space mechanism.

Case Shift - The type basket shifts to select between the printing of letters and figures, with duplicate shift keys on each side of the keyboard.

Carriage Return - The Model FC has a power operated carriage return with line spacing incidental to carriage return operation. An extra line space key (position 36) is provided for punching the line feed code (2) in the tape. The left hand margin can be adjusted in increments of one letter space.

Operating Speed - The operating speed of the tape punch is approximately 850 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.

MAINTENANCE OF UNITS

The Model FC Recorder- Reproducer consists of five major units, namely; writing machine, code selector, tape punch, tape reader and code translator. These units are all basically the same as the units described in Part II, Sections 2 through 7. Therefore, the maintenance procedures and adjustments will be the same for each, with the exception of the following:

WRITING MACHINE

The Model FC has a standard communications three-bank keyboard, therefore, there are only 31 keylevers, 32 cams, 26 character bellcranks and 26 character typebars.

This model may be specified with either Pica Gothic or Elite Gothic type, therefore, the machine will be equipped with a monospacing escapement only.

The standard Model FC does not have a tabular mechanism or a back space mechanism.

This model is not equipped with a color shift keylever mechanism. However, a manual color change lever protrudes through the left side of the base, permitting ribbon color change by hand.

All of the writing machine component adjustments and maintenance procedures may be found in Part II, Section 2.

CODE SELECTOR

The Model FC code selector is the same as the code selector described in Part II, Section 3, except that:

1. It has only 31 selector slides.
2. It has only five code contact operating bails (plus one common bail).

The selector coding arrangement is shown in Figure 2-1. The adjustments and maintenance procedures are the same as described in Part II, Section 3.

TAPE PUNCH

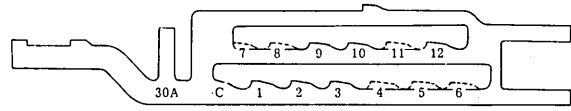
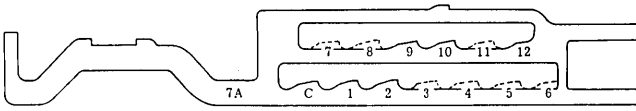
The Model FC tape punch has the same adjustments and maintenance procedure as the tape punch explained in Part II, Section 5.

TAPE READER

The Model FC tape reader is the same as the tape reader explained in Part II, Section 6, except for the following:

1. It is only capable of reading a five unit binary code, thus, it has only five reader pin contacts (plus the reader common and tape contacts).

Maintenance of Units



FRONT SLIDE

REAR SLIDE

Position Number	Cam Surface
1B	8-11
	C-1-2-4-5
3A	8-11
	C-3
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
39A	8-10-12
	C-2-5
41C	7-8-9-10-11-12
	C-2
43	Dummy
49C	C-4
51B	C-1-2-3-4-5

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

Figure 2-1 Selector Code Chart

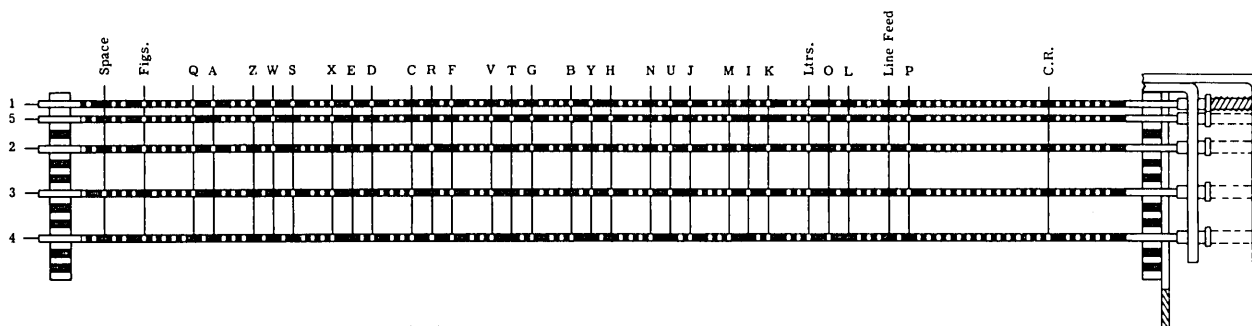


Figure 2-2 Permutation Bar Coding Arrangement

2. The contact stackup arrangement is as follows:

RC1 - 1 break, 1 transfer (or 1B, 1C)
 RC2 - 1 break, 1 transfer (or 1B, 1C)
 RC3 - 2 make, 1 break (or 2A, 1B)
 RC4 - 1 make, 1 transfer (or 1A, 1C)
 RC5 - 1 make, 1 transfer (or 1A, 1C)

3. Contact Adjustment:

a. Place a piece of tape (without code holes) in the reader to block all feeler pins. Turn the cam shaft (453) until the interposer bail roller engages the low dwell of cam (434). This should allow the pins to move up against the tape. With the pins in this position, adjust all the normally open contact points to a gap of .020" to .025" except the normally open RC4 contact which should be set at .030"

b. Remove the tape from the reader and adjust all normally closed contact points to a gap of .020" to .025". Check the 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.

c. Replace the tape in the reader and check for additional motion of the normally closed contacts away from their stop strips after make.

d. Adjust the RTC contacts to have a gap of .020" to .025" also, check to see that there is additional motion of the stationary strap away from the backing strap after the contact makes.

CODE TRANSLATOR

The Model FC code translator is the same as the code translator explained in Part II, Section 7, except for the following:

1. There are only 31 seekers to operate the 31 keylevers.
2. There are only five permutation slides, armatures and magnets used corresponding to each unit of the five unit binary code.

The permutation bar coding arrangement is shown in Figure 2-2. The Model FC translator should be adjusted the same as explained in Part II, Section 7.

CIRCUIT DESCRIPTION

The following circuit descriptions for the Model FC Recorder-Reproducer are based on wiring diagram 1055640. (See Figure 3-5.)

POWER CIRCUIT

This circuit is the same as explained in Part II, Section 8, Page 8-5.

PUNCH CIRCUITS

Key Lock Magnet - This circuit is the same as explained in Part II, Section 8, Page 8-6.

Punch Magnet Circuit - This circuit is the same as explained in Part II, Section 8, Page 8-6, except the Model FC only uses five selector code contacts.

Clutch Magnet Circuit - This circuit is the same

as explained in Part II, Section 8, Page 8-6.

Anti-Repeat Circuit - This circuit is the same as explained in Part II, Section 8, Page 8-7.

Tape Feed Circuit - This circuit is the same as the tape feed circuit explained in Part II, Section 8, Page 8-10.

READER AND TRANSLATOR CIRCUITS

Manual Start and Stop Circuits - The start read switch (S6), when depressed and released, will energize the reader magnet (LRM) and start a reader cycle of operation. In order to energize the reader magnet when the start read switch is depressed, a circuit is first completed to the reader control relay (K8) as follows: (Figure 3-1) from -DC, TC6, JR10, RTC, JR13, N/OS6, N/CS7, TA29, K8 coil, TA40, TC5, to +DC. The K8 relay is energized, closing all three of its

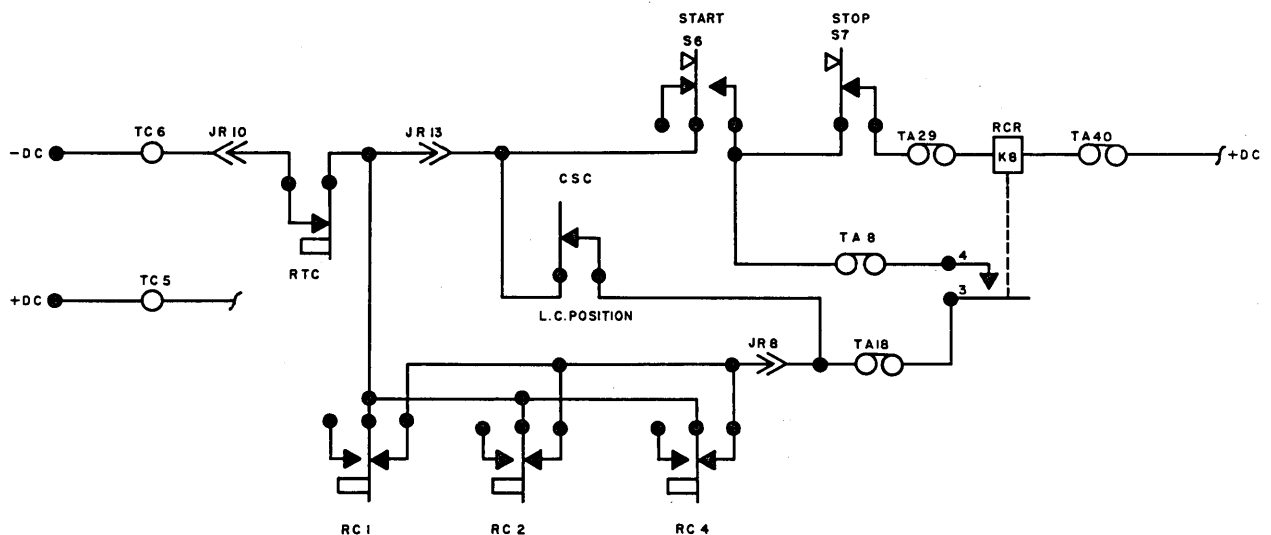


Figure 3-1 K8 Pick Up and Hold Circuit

Circuit Description

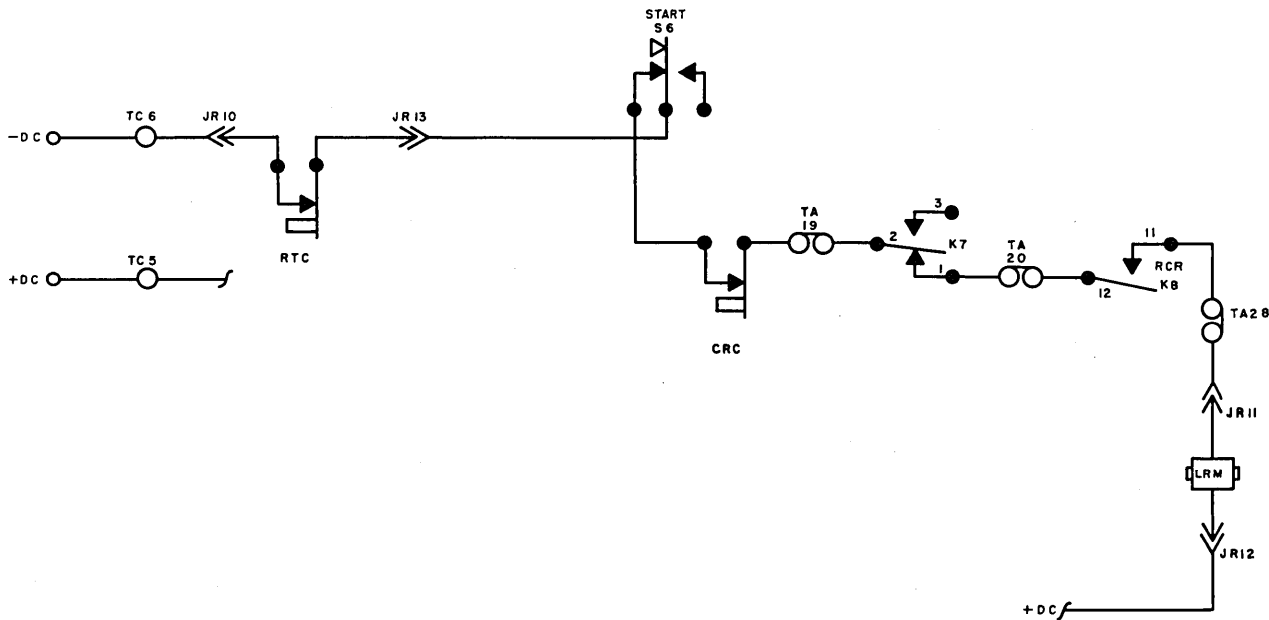


Figure 3-2 Reader Magnet Circuit

normally open contacts. When K8 contacts 3 and 4 close, a holding circuit to K8 is completed as follows: from -DC, TC6, JR10, RTC, N/CRC1, N/CRC2 and N/CRC4, JR8, TA18, K8 - 3 and 4, TA8, N/CS7, TA29, K8 coil, TA40, TC5, to +DC. There is also another contact in the K8 holding circuit called the case shift contact (CSC). These contacts are normally closed when the type basket is in the lower case position (see Stop Code Circuit).

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/CS6, CRC, TA19, K7 - 2 and 1, TA20, K8 - 12 and 11, TA28, JR11, LRM, JR12, TC5, to +DC. (See Figure 3-2).

Once the circuit to the reader magnet (LRM) is established, it 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 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 5 and 6 open, the reader magnet is de-energized, stopping the reader operation.

Translator Magnet Circuits - 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. (See Figure 3-3.)

The reader common contact (RCC) closes during each reader cycle of operation, completing a circuit to the translator clutch magnet as follows:

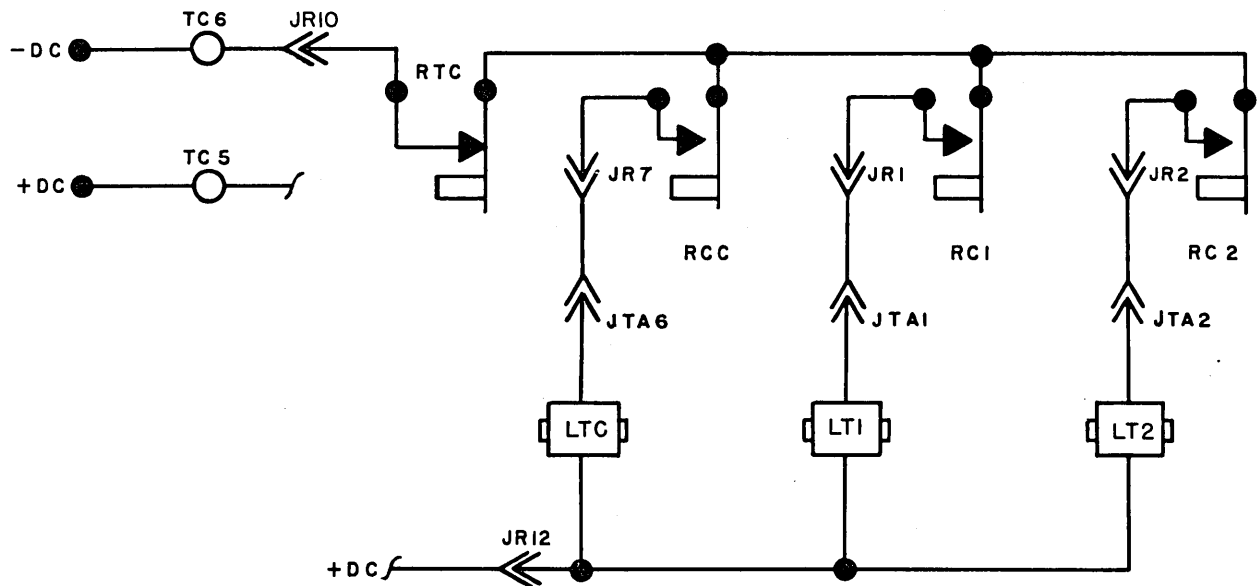


Figure 3-3 Example Translator Magnet Circuit

from -DC, TC6, JR10, RTC, RCC, JR7, JTA6, LTC, JTA5, TC5, to +DC.

Delay Control Circuit - It is essential to have an automatic delay control circuit incorporated in the Model FC in order to delay the operation of the tape reader until the carriage return function has been completed in the writing machine.

The carriage return code, which is a 4 code, when read in the reader, will operate the RC4 contacts. The operation of the RC4 contacts will energize the delay control relay (K7) as follows: (Figure 3-4) from -DC, TC6, JR10, RTC, RC5, RC3, RC1, RC2, RC4, JR9, TA9 and 10, K8 - 1 and 2, TA30, K7 coil, TA40, TA39, TC5, to +DC. When the delay control relay is energized, contact strap 2 breaks with contact 1 and makes with contact 3. The energizing circuit to the reader magnet (LRM) is broken, thus de-energizing the 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 the RC4 contacts return to normal).

At the same time the above mentioned circuit is completed to K7, a circuit is also completed to the translator magnet LT4 and translator clutch LTC. This will cause the translator to operate, resulting in a carriage return function. The operation of the carriage return mechanism will open the CRC contacts, thus breaking the holding circuit to K7.

The K7 contacts return to normal position, but the circuit to the reader clutch magnet will not be complete until the carriage returns to the left hand margin and the clutch toggle unlocks. When this happens, the CRC contact closes, completing the energizing circuit to the reader magnet, starting the reader operation again.

Stop Code Circuit - When the type basket is in

Circuit Description

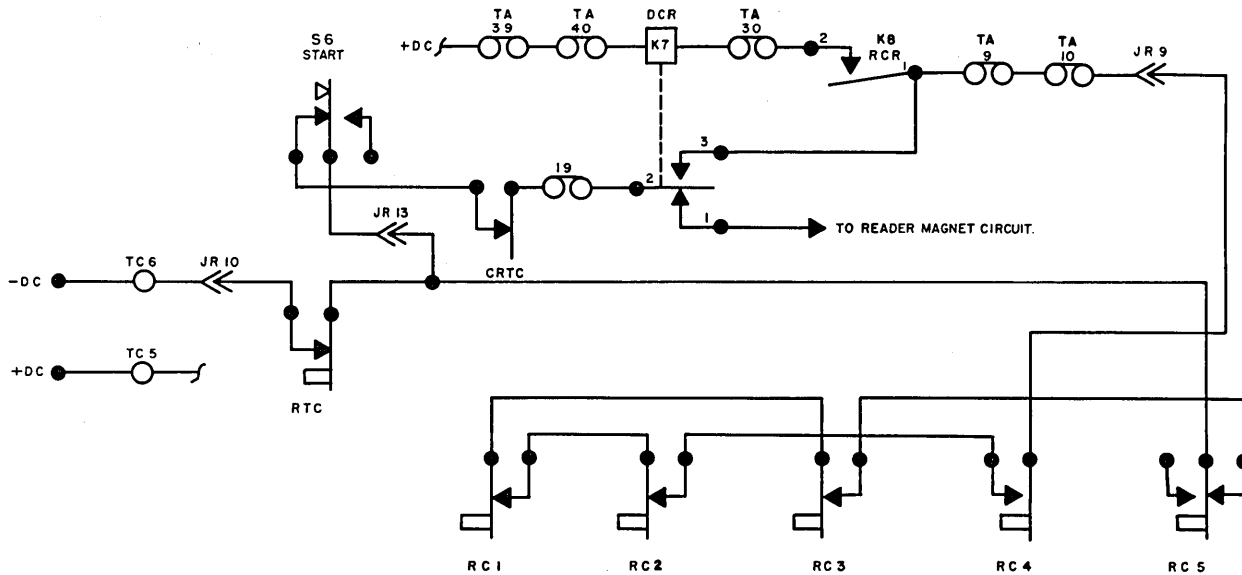


Figure 3-4 Delay Control Circuit

the upper case position and a 1-2-4 code is read by the reader, the holding circuit for the reader control relay (K8) will be broken, thus de-energizing the reader magnet and stopping the reader operation. This is a result of the K8 holding circuit being through normally closed contacts of RC1, RC2 and RC4, plus the case shift contacts (CSC). Therefore, when the type basket is in the

upper case, the CSC contacts are open, and the reading of the 1-2-4 code will operate the RC1, RC2 and RC4 reader contacts, thus breaking the K8 holding circuit, de-energizing the reader magnet and stopping the reader operation. (See Figure 3-1.)

In order to resume automatic operation, the start read switch must be depressed and released.

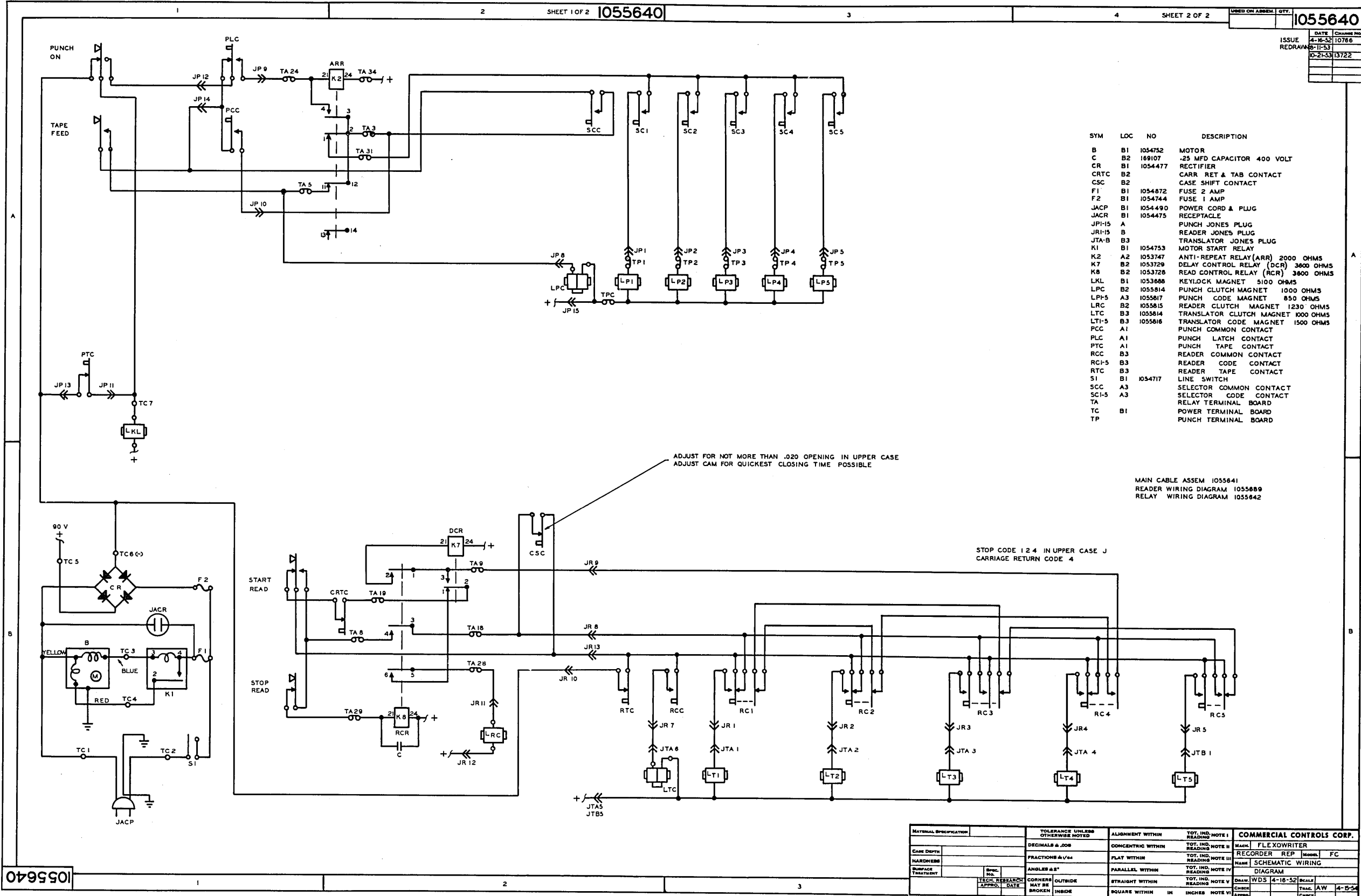


Figure 3-5 Model FC Wiring Diagram

MATERIAL SPECIFICATION	TOLERANCE UNLESS OTHERWISE NOTED	ALIGNMENT WITHIN	TOT. IND. NOTE I	COMMERCIAL CONTROLS CORP.
CASE DEPTH	DECIMALS & JOES	CONCENTRIC WITHIN	TOT. IND. NOTE II	Model FLEXOWRITER
HARDNESS	FRACTIONS 1/64	FLAT WITHIN	TOT. IND. NOTE III	RECORDER REP Model FC
SURFACE TREATMENT	ANGLES & 8°	PARALLEL WITHIN	TOT. IND. NOTE IV	NAME SCHEMATIC WIRING
TECH. RESEARCH APPROV. DATE	CORNERS MAY BE BROKEN	OUTSIDE INSIDE	TOT. IND. NOTE V	DIAGRAM
		STRAIGHT WITHIN	TOT. IND. NOTE VI	Drawn WDS 4-16-52
		SQUARE WITHIN IN INCHES NOTE VI	Check	Scale AW 4-5-54

PART IV

FLEXOWRITER MODEL FG

Section 1	Description
Section 2	Maintenance of Units
Section 3	Circuit Description

DESCRIPTION

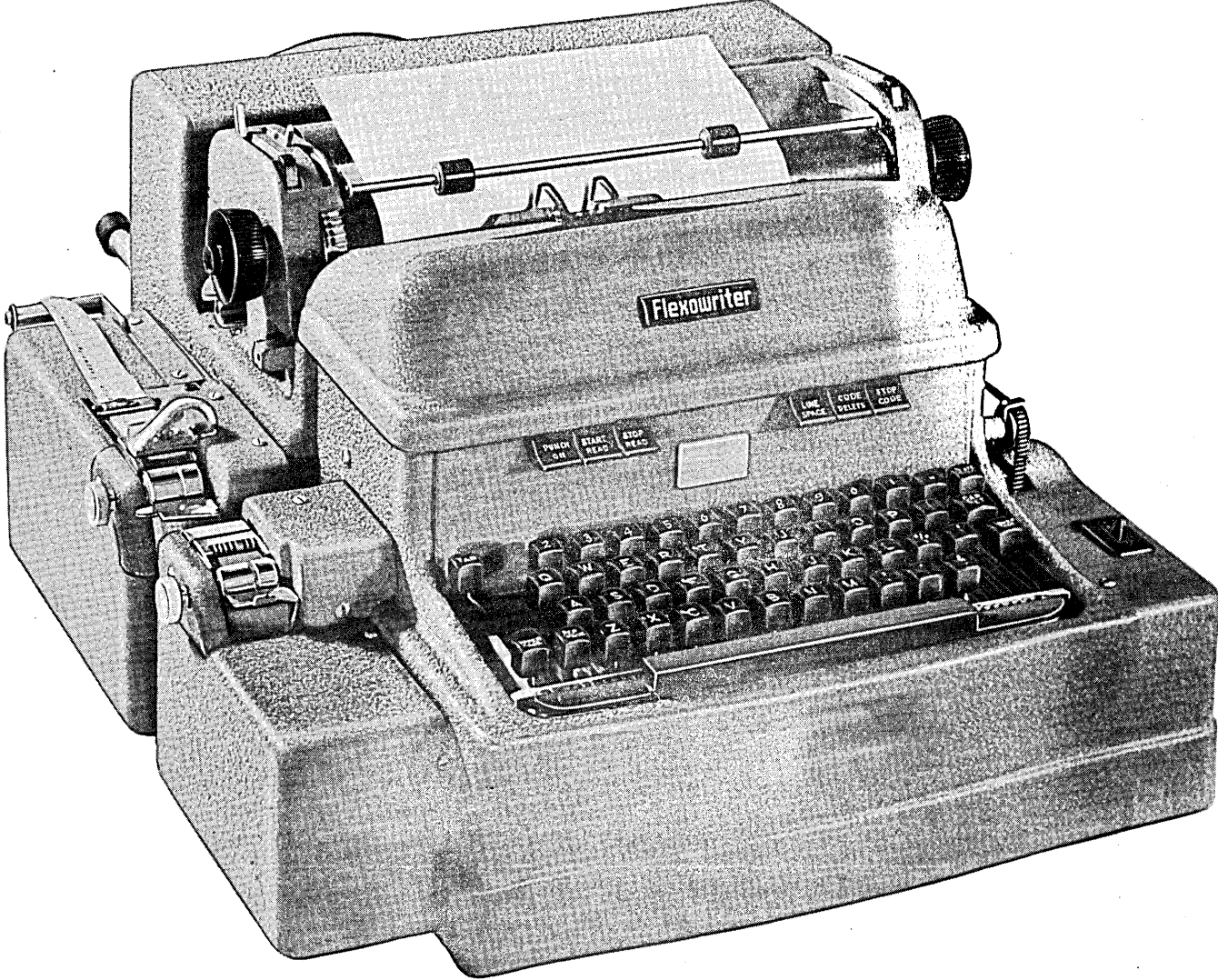


Figure 1-1 Model FG-40

Description

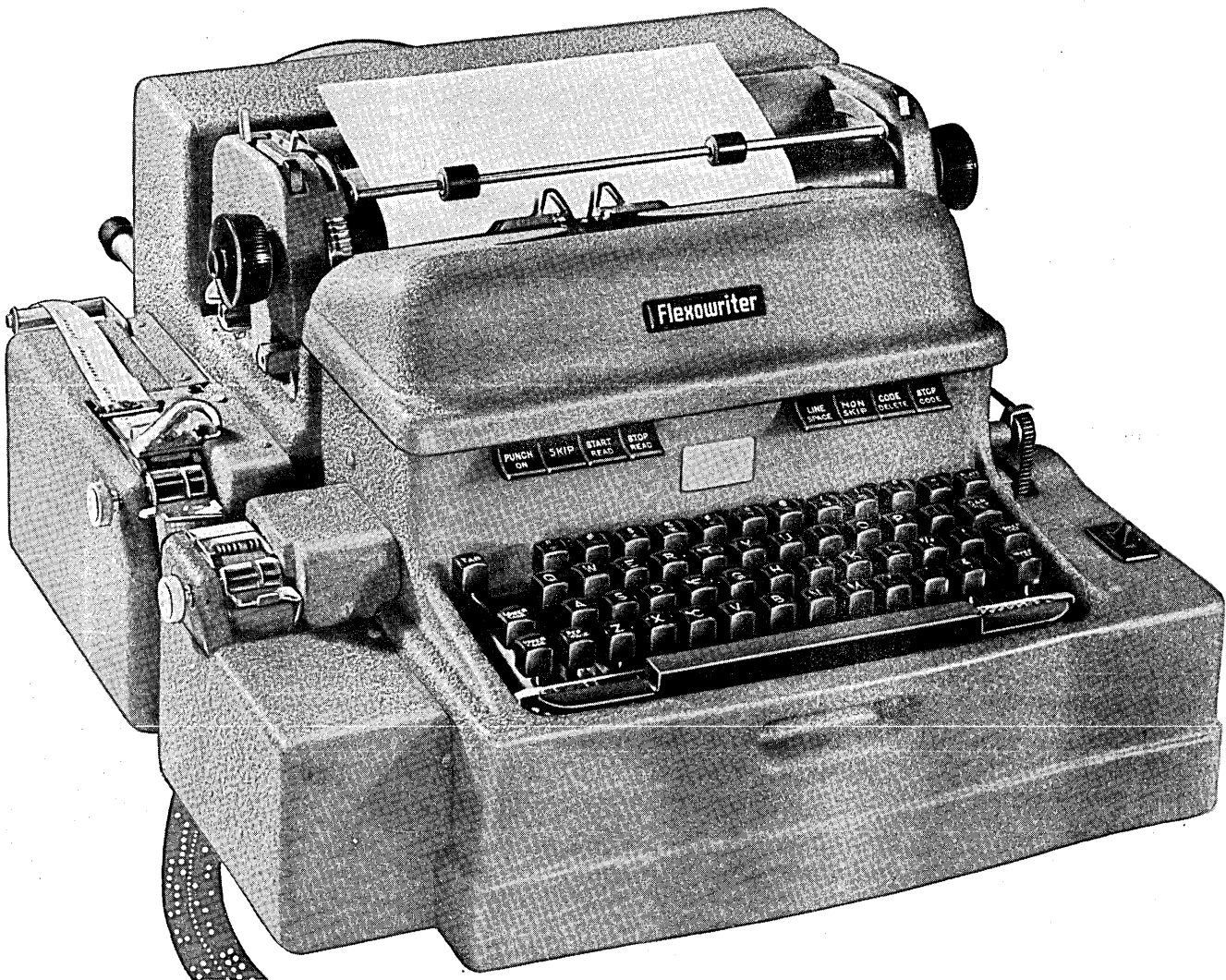


Figure 1-2 Model FG-80

The Model FG Flexowriter was specifically designed for preparing tape for operating the Automatic Graphotype machine. This model uses a six unit binary code which is specially adapted to this application and the tapes prepared on the Model FG are not interchangeable with tapes prepared on other model Flexowriters.

There are several Model FG Flexowriters available which are designed to be used with specific Graphotype models.

The two Model FG's that will be discussed in this manual are the Model FG-40 (Figure 1-1) and the Model FG-80 (Figure 1-2).

The Model FG-40 is used with Graphotype Models 6740 and 6741. It is equipped to print capital letters only, plus figures, special characters and punctuation marks.

The Model FG-80 is used with the Graphotype Model 6781 and is equipped to print both upper and lower case characters.

There are three available combinations of both the Model FG-40 and Model FG-80, namely; Recorder, Reproducer, and Recorder—Reproducer. The latter combination 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. It consists of a writing machine, code selector, tape punch, tape reader and code translator.

BASIC FUNCTIONAL PRINCIPLES

The functional principles of the Model FG writing machine, code selector, tape punch, tape reader and code translator are the same as the Model FL explained in Part II, Section 1, with the exception of the following:

Model FG-40 - This model does not have a case shift operation, thus it prints capital case letters only. There are four switches controlling punch operation, namely; punch on, code delete, stop code and line space. The start read and stop read switches control the tape reader operation.

Model FG-80 - This model is equipped with a case shift mechanism. It has six switches controlling tape punch operation including; punch on, code delete, stop code, skip, non-skip and line space. The start read and stop read switches control the tape reader operation.

Both models have a line length indicating light which indicates to an operator the amount of characters in a line during tape recording.

KEYBOARD

The Model FG-40 keyboard is a specially arranged four-bank keyboard with the shift keys omitted. This keyboard is shown in Figure 1-3. It uses a total of 50 keylever positions, 43 of which are used for character operation. Four of the remaining seven keylevers are used for functional operation such as, carriage return, space, repeat space and tabulation. The remaining three keylever positions are used to perforate special codes in the tape. These keylevers are, plate discharge, non-skip and skip, and do not perform any function of the writing machine.

The Model FG-80 keyboard is a four-bank keyboard with both upper and lower case shift operation and is shown in Figure 1-4. It uses a total of 52 keylever positions, 43 of which are used for character operation. Eight of the remaining nine positions are used for functions such

Description

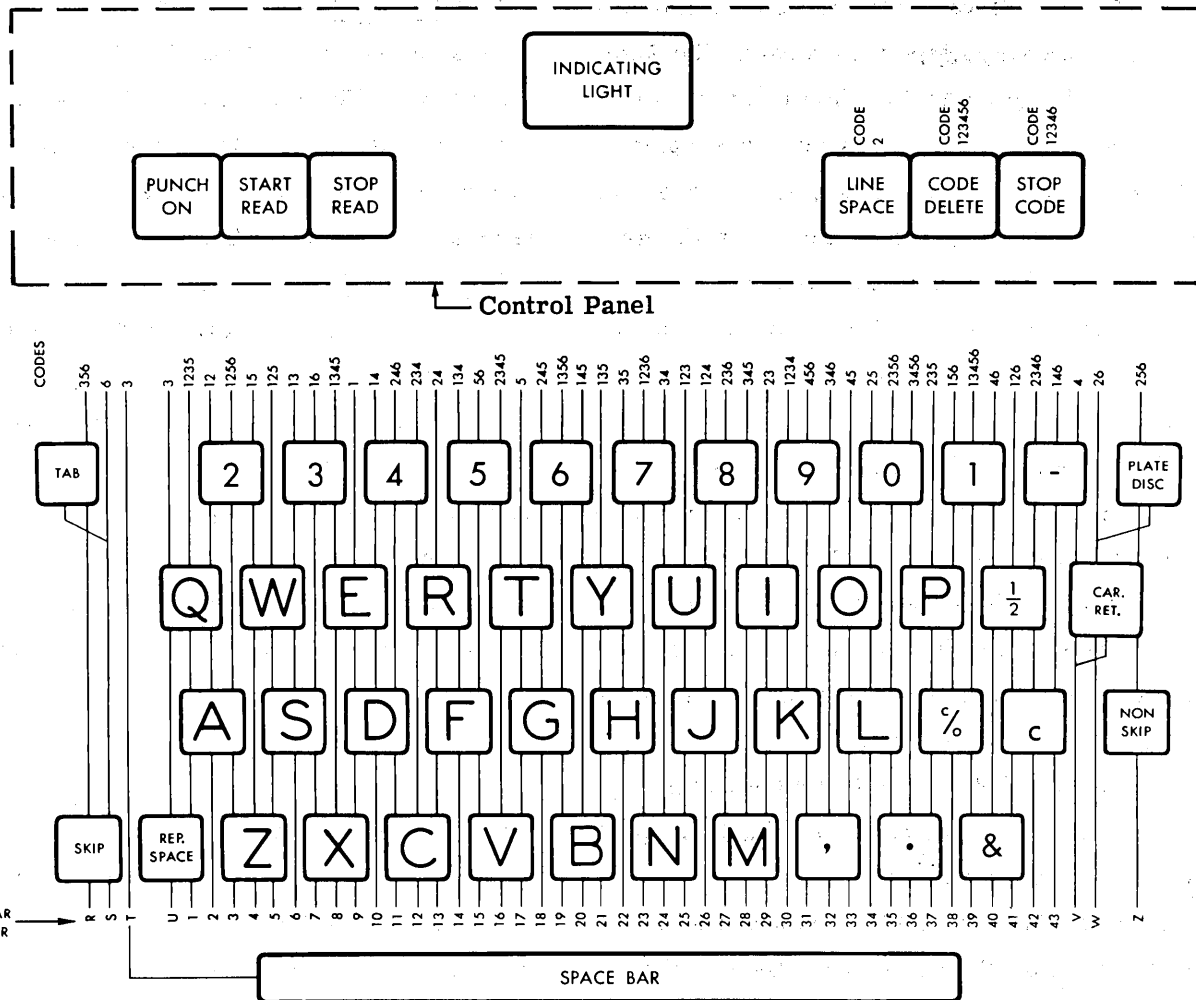


Figure 1-3 Keyboard Chart - Model FG-40

as upper and lower case shift, carriage return, repeat space, space and tabulation. The W position is used for a plate discharge code and does not cause writing machine operation.

CODE SYSTEM

The Model FG uses a six unit binary code system which provides a maximum of 64 possible code combinations. As can be seen from the keyboard chart in Figure 1-3 and Figure 1-4, 43 of these combinations are used for character codes

in both the Model FG-40 and Model FG-80.

Figure 1-5 shows the character and function codes in a tape.

A seven-eighth inch wide tape is used for both Model FG's and is shown in Figure 1-5. The code holes are numbered 6-1-2-3-4-5 facing the leading edge of the tape. The feed hole is between the 2 and 3 code holes and is .4375 inch from the right edge of the tape. The feed hole is advanced .013 inch with respect to the code holes in order to conform with the feed mechanism on the Automatic Graphotype.

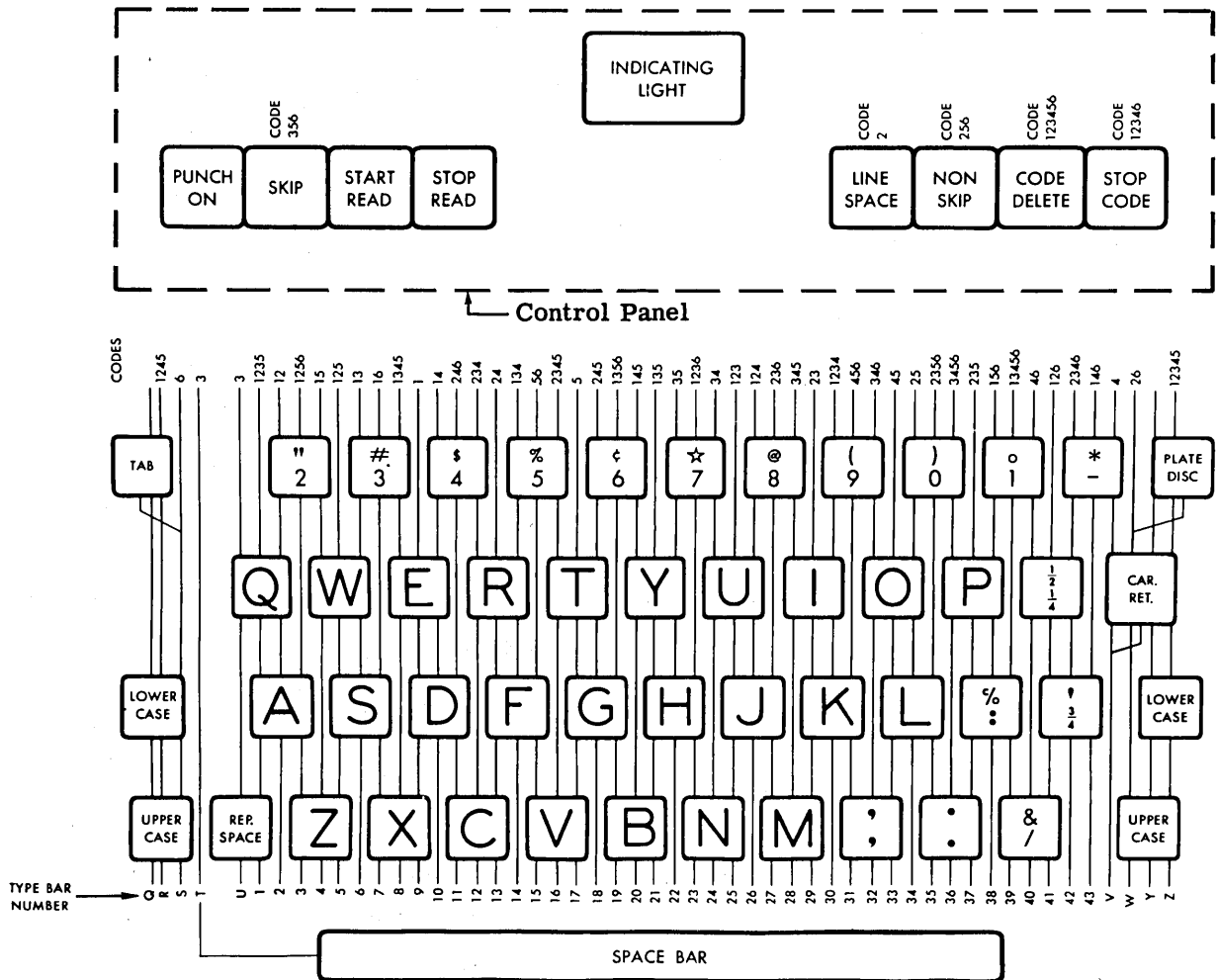


Figure 1-4 Keyboard Chart - Model FG-80

The plate discharge, skip, non-skip keylevers on the Model FG-40 do not perform a Flexowriter function other than perforate individual codes in the tape. When these codes are read by the Graphotype, they will automatically cause various functional operations necessary when embossing an Addressograph plate.

The above applies to the plate discharge key-lever on the Model FG-80 also.

The repeat space key spaces the carriage and perforates a consecutive series of space codes (3) in the tape as long as it is depressed.

CONTROL PANEL - MODEL FG-40

The Model FG-40 Recorder-Reproducer control panel is shown in Figure 1-3 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.

Code Delete - When this switch is held de-

1. Perforate a series of space codes (by depressing the repeat space key) to obtain a tape lead of approximately 12 to 13 inches.
2. Perforate a plate discharge code (by depressing the plate discharge key), then a carriage return code and begin typing the name.
3. After the last letter of the first line is typed, use the carriage return key which returns the carriage and simultaneously line spaces.
4. The second line is again followed by a carriage return code.
5. At the end of the last character in the third line, make a plate discharge code.
6. Perforate a carriage return code and proceed to type the first line of the next plate.
7. When the tape is to be ended, instead of making a plate discharge code followed by a carriage return code, make four plate discharge codes and feed out the tape by making about 30 consecutive delete codes, plus a stop code. Tear off the tape.

SPECIFICATIONS

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

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 FG is 17½", the depth is 20" and the height is 10".

The shipping weight of all 12 inch carriage Flexowriters is approximately 115 pounds, while the unpacked weights of the two Model FG combinations are as follows:

Recorder-Reproducer - 85 lbs.

Recorder - 74 lbs.

Type Style - The standard type style on the Model FG is as follows:

Pica - 10 characters to the inch.

Elite - 12 characters to the inch.

Keyboard - The Model FG-40 is equipped with a specially arranged four-bank keyboard with the shift keys omitted.

The Model FG-80 has a four-bank keyboard with more special characters available than the Model FG-40 due to the use of the case shift.

Carriage - The Model FG 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 - See Part II, Section 2, Page 2-56 for available platens and ratchets.

Tabulation - This Model FG is equipped with a standard tab mechanism. The tab code is 6.

Repeat Space Key - A repeat space key is provided in addition to the regular space bar. The space bar operation allows the carriage to move only one letter space per operation, while the repeat space key will cause successive letter spacing movement of the carriage as long as the key is held down.

Back Space - There is no back space mechanism on the Model FG.

Description

Case Shift - The Model FG-40 is not equipped with case shift movement and the type basket is locked in the lower position.

The Model FG-80 provides a type basket shift to select between printing of upper and lower case characters.

Line Length Indicator - An indicating light located on the control panel is provided to show when a line of predetermined length has been typed. It is adjustable by the operator and remains on for seven letter spaces of carriage movement.

Carriage Return - The Model FG has a power operated carriage return with line spacing operation incidental to the carriage return operation. The line space function can be a separate function

on the Graphotype and accordingly a separate line space switch has been provided which punches a code in the tape but does not otherwise operate the Flexowriter.

Record Tape - The Model FG uses a seven-eighth inch wide tape with the feed hole .013 inch advanced with respect to the code holes.

Operating Speed - The operating speed of the tape punch is approximately 850 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.

MAINTENANCE OF UNITS

All Model FG Recorder-Reproducers consist of five major units, namely: writing machine, code selector, tape punch, tape reader and codetranslator. These units are all basically the same as the units described in Part II, Sections 2 through 7. Therefore, the maintenance procedures and adjustments will be the same for each, with the exception of the following:

WRITING MACHINE

Model FG-40 — This model has a fourbank keyboard, but does not use a shift mechanism. The

type basket is locked in lower case position with the type having capital characters only.

The R, W, and Z keylever positions do not cause a character or functional operation of the writing machine. These positions are used to perforate a code in the tape only. The repeat space keylever (position U), when held operated, will cause continuous spacing of the carriage. This is accomplished by using a double lobe cam having one lug removed on the release lever. Therefore, when the keylever is held depressed, there is nothing to prevent repeat operation of the

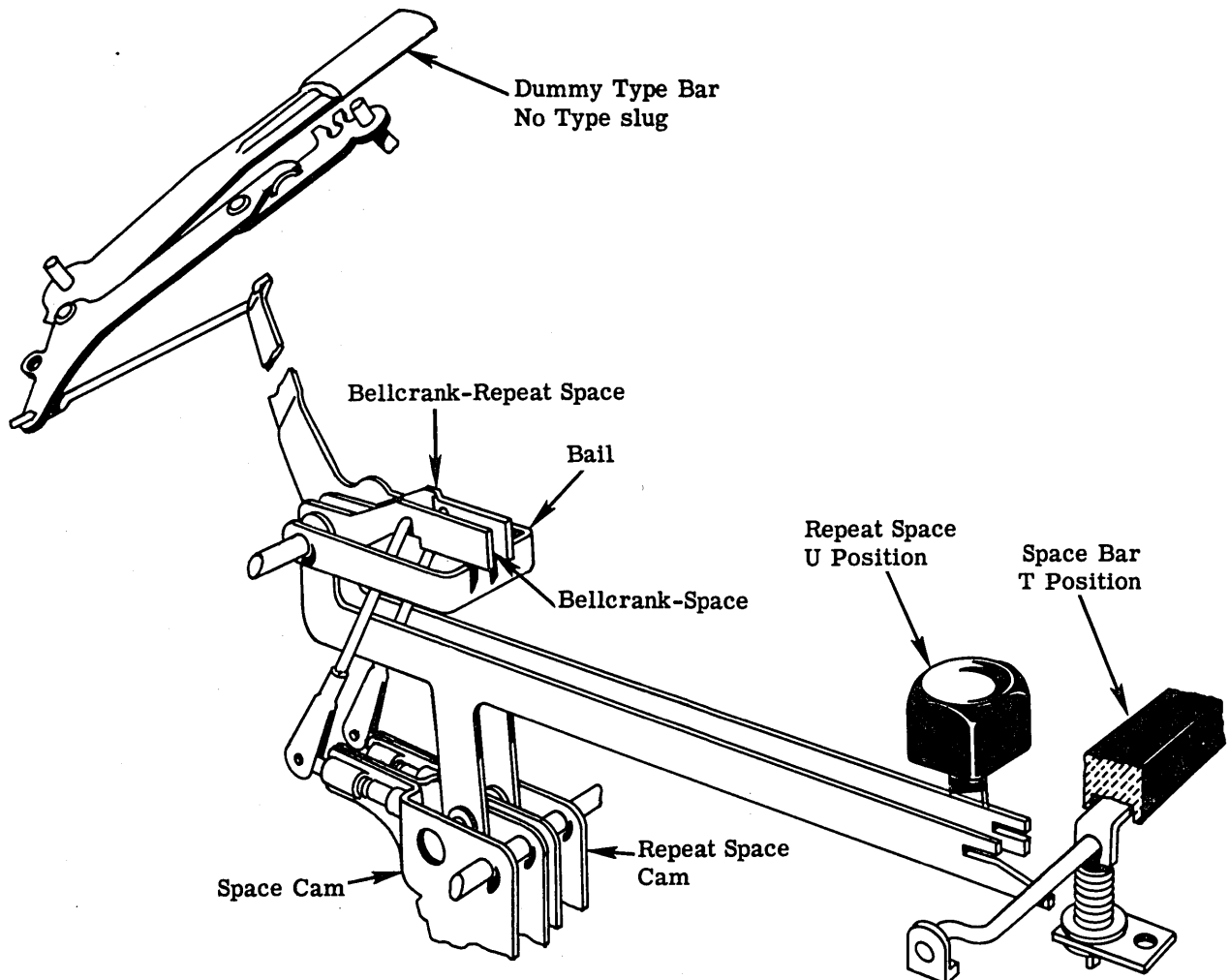
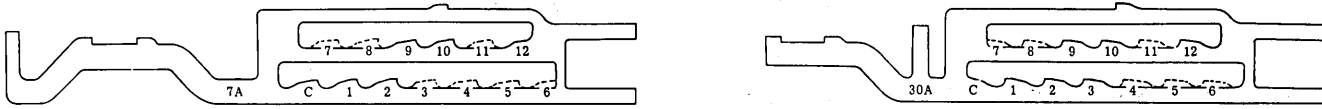


Figure 2-1 Standard & Repeat Space Mechanism

Maintenance of Units



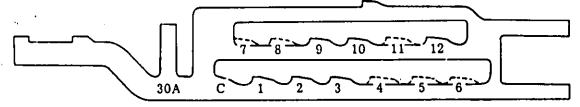
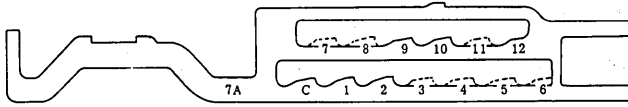
FRONT SLIDE

REAR SLIDE

Position Number	Cam Surface
1(49A)	C-3-5-6
3A	8-11
	C-3
5(3A)	8-11
	C-3
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
41(1A)	
	C-3-4-5-6
43C	7-8-9-10-11-12
	C-1-5-6
45(41A)	8-11
	C-4-6
47C	7-8-9-10-11-12
	C-2-3-4-6
49C	
	C-4
51(45C)	7-8-9-10-11-12
	C-2-5-6

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

Figure 2-2 Selector Coding - Model FG-40



FRONT SLIDE

REAR SLIDE

Position Number	Cam Surface
1B	8-11
	C-1-2-4-5
3A	8-11
	C-3
5(3A)	8-11
	C-3
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
41(1A)	
	C-3-4-5-6
43C	7-8-9-10-11-12
	C-1-5-6
45(41A)	8-11
	C-4-6
47C	7-8-9-10-11-12
	C-2-3-4-6
49C	
	C-4
51B	
	C-1-2-3-4-5

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

Figure 2-3 Selector Coding - Model FG-80

Maintenance of Units

cam. The repeat space cam operates the same dummy type bar as the space bar in position T. See Figure 2-1.

There is no back space or color shift mechanism on the Model FG-40. A ribbon color change lever protrudes through the right side of the base, permitting ribbon color change by hand.

Model FG-80 — This model has a fourbank keyboard and uses a shift mechanism. Operation of the keylever in position W does not cause a character or functional operation in the writing machine. A repeat space key in position U is the same as explained for Model FG-40.

There is no back space or color shift mechanism used in the Model FG-80.

The Model FG-40 and FG-80 are equipped with a line length indicating light. This light is controlled by an adjustable stop to light after a line has been typed to a predetermined length. The light remains on for seven spaces of carriage travel or until the carriage is returned. The stop is located on a rack behind the margin and tab racks and is set by pressing down on the left end and sliding the stop along the rack.

The Model FG machines use a mono-spacing escapement.

Note: Other Model FG machines are used having a three-bank communications keyboard. These models are: Model FG-51, Model FG-53, Model FG-54 and Model FG-55. All of the writing machine component adjustments and maintenance procedures may be found in Part II, Section 2.

CODE SELECTOR

The Model FG code selectors are basically the same as the code selector described in Part

II, Section 3, for the coding arrangement. This is explained in the charts in Figures 2-2 and 2-3.

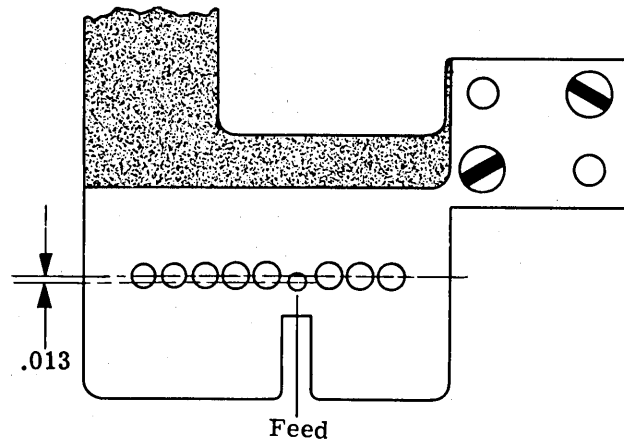


Figure 2-4 Punch Die Block

TAPE PUNCH

The tape punch used in the Model FG machines uses a die block having the feed punch position .013" advance in relation to the code punch positions. (See Figure 2-4.) Also, the feed hole is located in the transverse center of the tape. (See Figure 2-5.) Thus, with a seven-eighth inch wide tape, the center line of the feed holes is located .4375" from the edge of the tape (edge nearest number five code position).

With the exception of the above, the FG tape

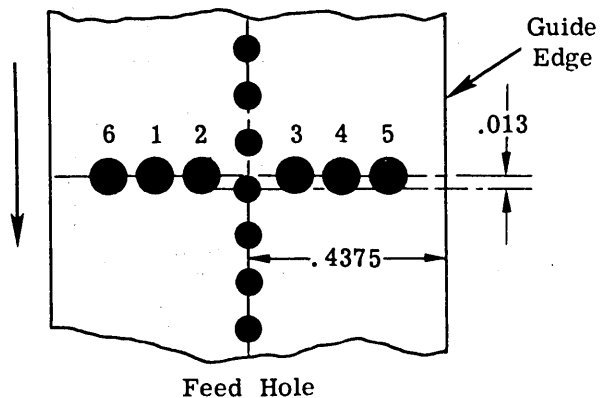


Figure 2-5 Transverse Centered Feed Hole

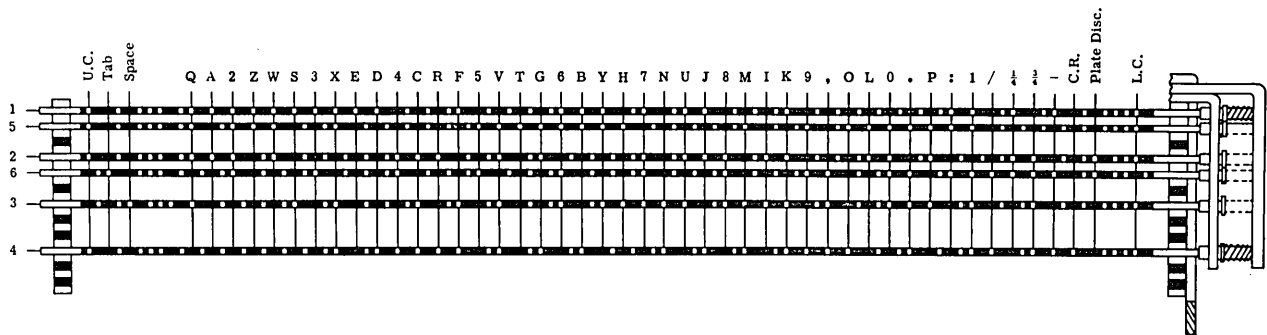


Figure 2-6 Permutation Bar Coding Arrangement

punch has the same adjustments and maintenance procedure as explained in Part II, Section 5.

TAPE READER

The FG tape reader is the same as the reader explained in Part II, Section 6 except for the following:

1. It is adjusted to accept the transversely centered, advance feed hole tape.
2. The contact stackup for the Model FG-40 and FG-80 is as follows:

RC1 - 1 break, 1 transfer (or 1B, 1C)

RC2 - 1 break, 1 transfer (or 1B, 1C)

RC3 - 1 break, 1 transfer (or 1B, 1C)

RC4 - 2 transfer (2C)

RC5 - 1 make, 1 transfer (1A, 1C)

RC6 - 2 transfer (2C)

CODE TRANSLATOR

The Model FG translators are basically the same in operation and adjustment as explained in Part II, Section 7.

The coding of the permutation bars (Figure 2-6) however, is different.

CIRCUIT DESCRIPTION

The following circuit description is for the Model FG-80 Recorder-Reproducer and is based on wiring diagram 1055255. (See Figure 3-9.) The Model FG-40 circuits are basically the same as the Model FG-80 and the wiring diagram (1055283) is shown in Figure 3-10.

POWER CIRCUITS

These circuits are the same as explained in Part II, Section 8, Page 8-5.

PUNCH CIRCUITS

Keylock Magnet – Same as described in Part II, Section 8, Page 8-6.

Punch Magnet Circuit – Same as described in Part II, Section 8, Page 8-6.

Clutch Magnet Circuit – Same as described in Part II, Section 8, Page 8-6.

Anti-Repeat Circuit – Same as described in Part II, Section 8, Page 8-7.

Stop Code Circuit – (Figure 3-1) When the stop

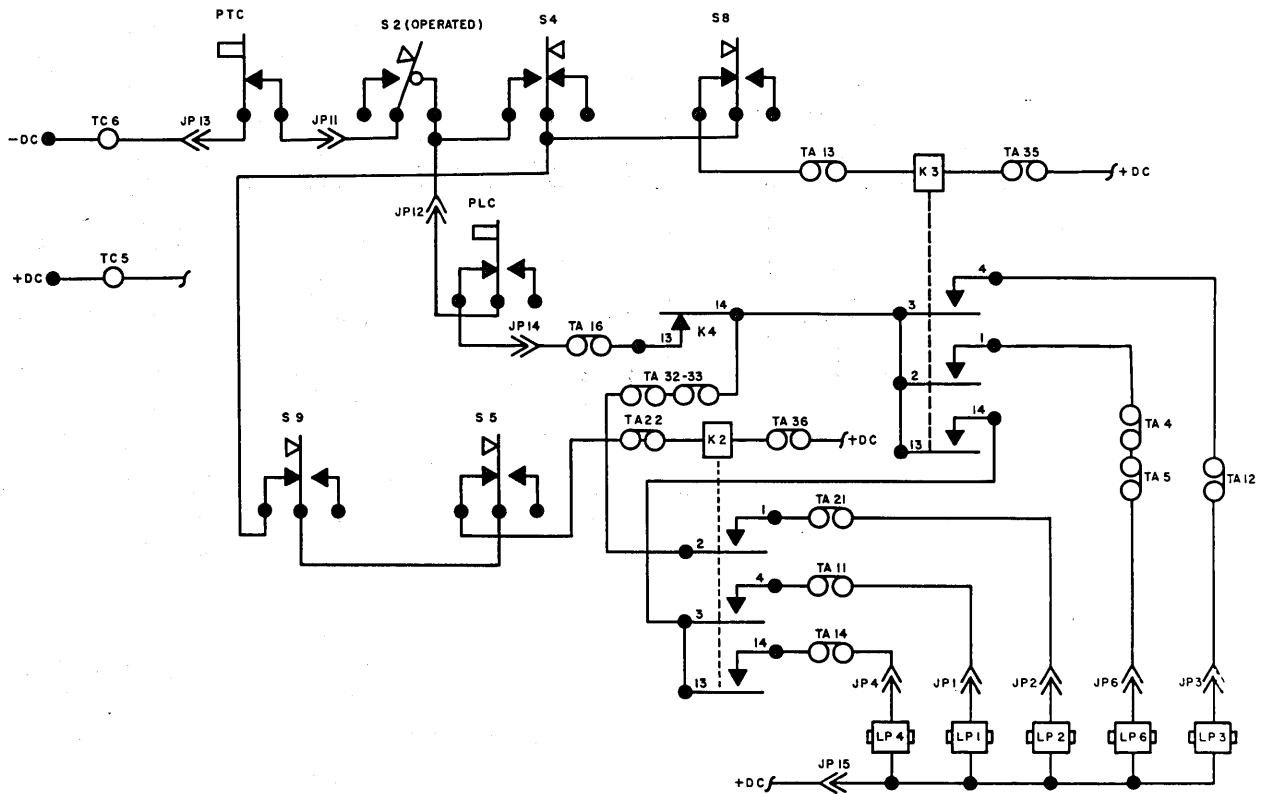


Figure 3-1 Stop Code Circuit

Circuit Description

code switch S4 is depressed, the code 1-2-3-4-6 is perforated in the tape. This code, when sensed by the reader, will automatically stop reader operation.

The K2 and K3 relays will pick up when S4 is depressed resulting in LP1, LP2, LP3, LP4, LP6 and LPC being energized.

The circuit to K2 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, N/O S4, N/C S9, N/C S5, TA22, K2 coil, TA36, TC5, to +DC. With K2 energized, a DC circuit is completed to LP2 as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, TA - 33 and 32, K2 - 2 and 1, TA21, JP2, LP2, JP15, TC5, to +DC.

With K3 - 13 and 14 contact closed, a circuit is complete to LP1 and LP4 as follows: from -DC,

TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, K3 - 13 and 14, K2 - 3 and 4 - 13 and 14, TA11 and TA 14, JP1 and JP4, LP1 and LP4, JP15, TC5, to DC.

The circuit to K3 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, N/O S4, N/C S8, TA13, K3 coil, TA35, TC5, to +DC.

The circuit to LP3 and LP6 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, K3 - 3 and 4 - 2 and 1, TA12 and TA4 - 5, JP3 and JP6, LP3 and LP6, JP15, TC5, to +DC.

The circuit to the clutch magnet (LPC) is completed at the same time as the above mentioned circuits to the punch magnets. The clutch magnet circuit is as follows: (Figure 3-2) from -DC, TC6, JP13, PTC, JP11, N/O S2, N/C S3, TA6 and 7, K3 - 12 and 11 and K2 - 12 and 11, K4 - 12 and 11,

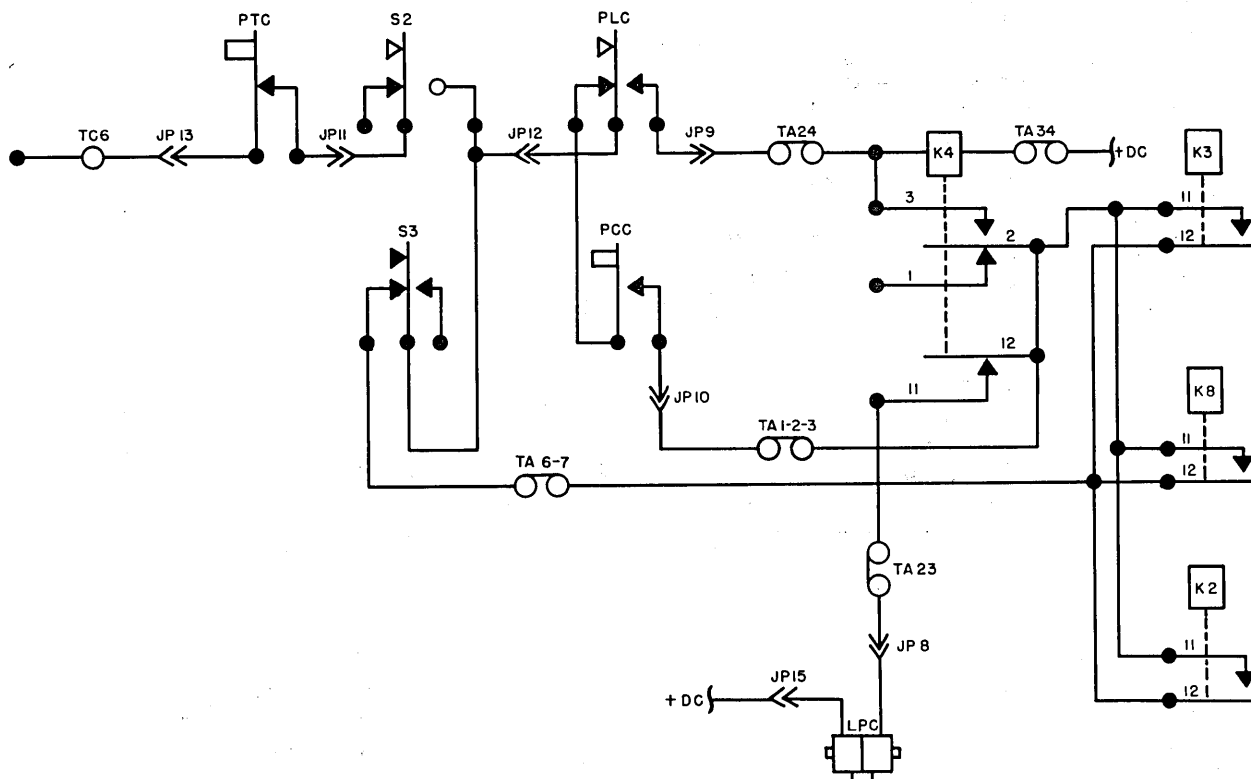


Figure 3-2 Anti-Repeat Circuit

TA23, JP8, LPC, JP15, TC5, to +DC.

Due to an anti-repeat circuit, the stop code will be punched only once in the tape for each operation of the stop code switch S4. This circuit is explained in the following paragraph.

Anti-Repeat Circuit — (Figure 3-2) When any one of the S4, S5, S8 or S9 switches are operated, the punch will complete one cycle of operation for as long as the particular switch is held depressed. This is due to a holding circuit to the anti-repeat relay (K4) which, when energized, will break the circuits to the six punch magnets and the clutch magnet (the punch magnet circuits are broken by contact K4 - 13 and 14 while the clutch magnet circuit is broken by K4 - 11 and 12 contact).

The anti-repeat relay (K4) is energized during the punch cycle (when the punch lock contacts (PLC) transfer). Thus, if any one of the control

relays K2, K3 or K8 remain energized after the punch cycle has been completed and the S3 is not operated, the K4 remains energized through the following holding circuit: from -DC, TC6, JP13, PTC, N/O S2, N/C S3, TA6 and 7, K2 - K3 or K8 - 11 and 12 contacts, K4 - 2 and 3, K4 coil, TA34, TC5, to +DC. Note that the circuit is through the normally closed portion of the code delete switch (S3). Therefore, if this switch is operated the holding circuit to K4 will not be complete (see Code Delete Circuit).

Skip Code Circuit — When the skip code switch S5 is operated, a 3-5-6 code is perforated in the tape. This is due to the K3 and K8 relays being energized and completing circuits to punch magnets L3, L5 and L6. The circuit to K8 is as follows: (Figure 3-3) from -DC, TC6, JP13, PTC, JP11, N/O S2, N/O S5, N/C S9, N/C S4, TA25, K8 coil, TA37, TC5, to +DC. With K8 energized, the circuit

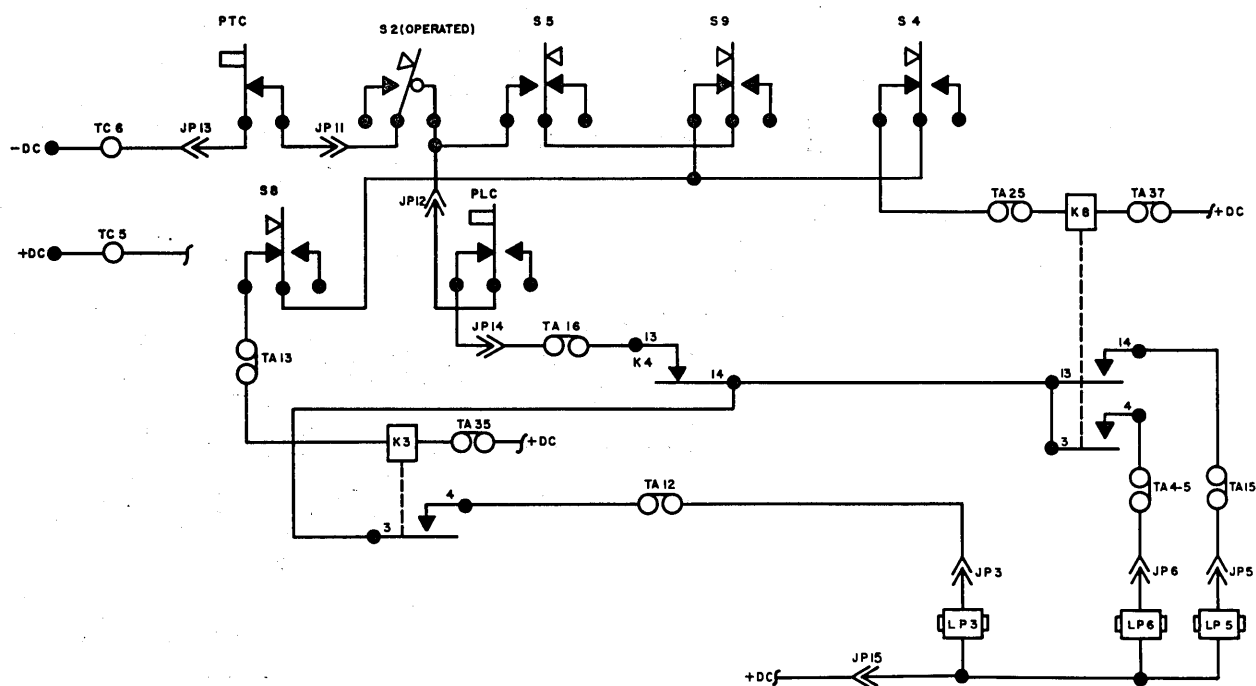


Figure 3-3 Skip Code Circuit

Circuit Description

to LP5 and LP6 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, K8 - 13 and 14 - 3 and 4, TA - 4 and 5 - TA15, JP5 and JP6, LP5 and LP6, JP15, TC5, to +DC.

The K3 relay is energized as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, N/O S5, N/C S9, N/C S8, TA13, K3 coil, TA35, TC5, to +DC. With K3 relay energized, the circuit to LP3 is as follows: from -DC, TC6, JP13, PLC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, K3 - 3 and 4, TA12, JP3, LP3, JP15, TC5, to +DC.

The circuit to the clutch magnet, causing punch operation, is the same as explained in Stop Code Circuit.

Non-Skip Code Circuit - (Figure 3-4) When the S8 switch is operated, a 2-5-6 code is perforated in the tape. This is due to the K2 and K8 relays

being energized and completing circuits to LP2, LP5 and LP6. The circuit to K2 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, N/O S8, N/C S5, TA22, K2 coil, TA36, TC5, to +DC. With K2 energized, the circuit to LP2 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, TA32 and 33, K2 - 2 and 1, TA21, JP2, LP2, JP15, TC5, to +DC.

The circuit to K8 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, N/O S8, N/C S4, TA25, K8 coil, TA37, TC5, to +DC. With K8 energized, the circuit to LP5 and LP6 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, K8 - 13 and 14 - 3 and 4, TA15, TA4 and 5, JP5 and JP6, LP5 and LP6, JP15, TC5, to +DC.

The circuit to the clutch magnet, causing punch operation, is the same as explained in Stop Code

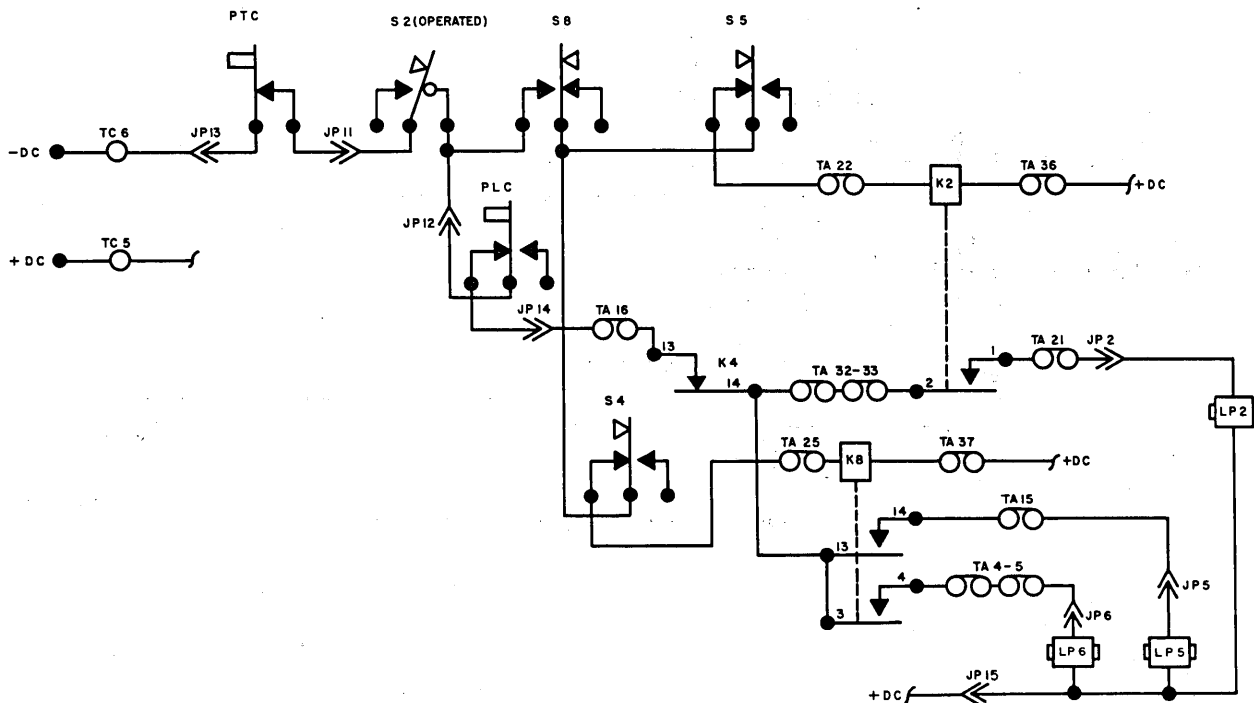


Figure 3-4 Non Skip Code Circuit

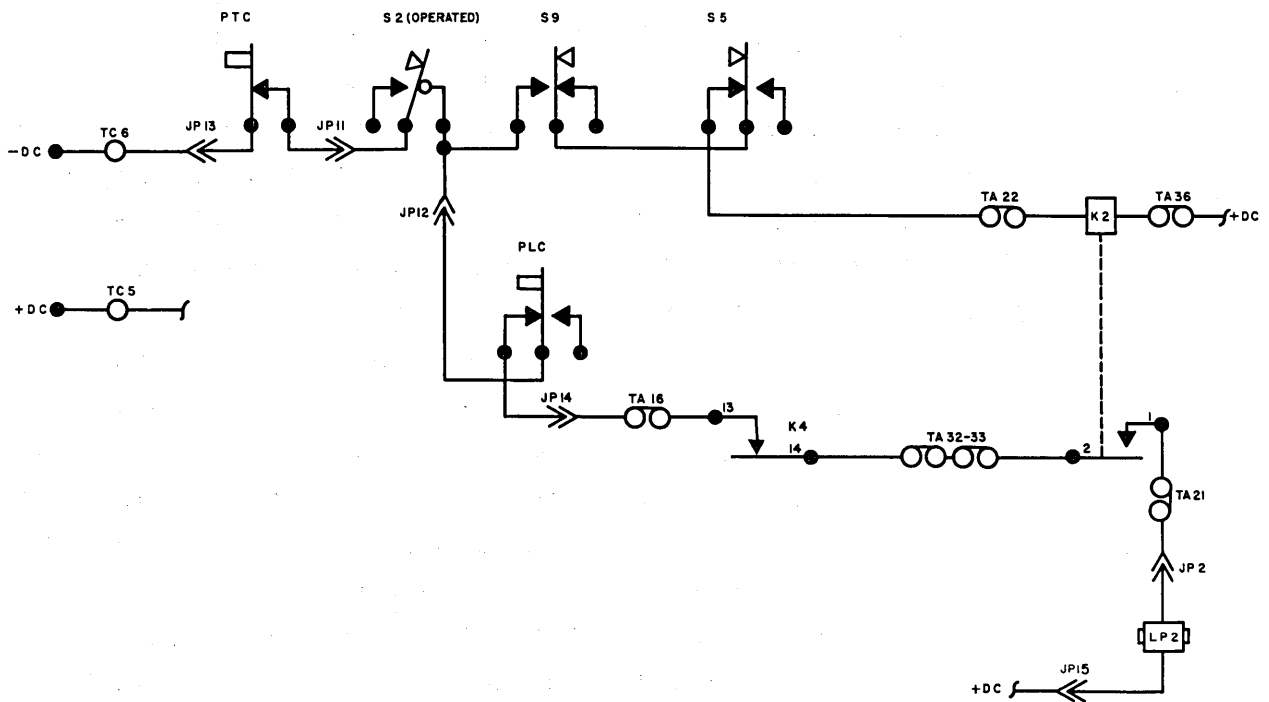


Figure 3-5 Line Space Code Circuit

Circuit.

Line Space Code Circuit — (Figure 3-5) When the line space switch (S9) is operated, a 2 code is perforated in the tape. This is due to the K2 relay being energized, completing a circuit to LP2. The circuit to K2 is as follows: from -DC, TC6, PTC, JP11, N/O S2, N/O S9, N/C S5, TA22, K2 coil, TA36, TC5, to +DC. With K2 energized, the circuit to LP2 is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, PLC, JP14, TA16, K4 - 13 and 14, TA32 and 33, K2 - 2 and 1, TA21, JP2, LP2, JP15, TC5, to +DC.

The circuit to the clutch magnet, causing punch operation, is the same as explained in Stop Code Circuit.

Code Delete Circuit — When the code delete switch S3 is operated, the K2, K3, and K8 relays are energized, completing circuits to all six punch magnets and the clutch magnet. The circuits

to the K2, K3 and K8 relays are similar to the circuits previously explained (Stop Code, Skip Code, etc.).

With the S3 switch operated, the clutch magnet circuit is complete when the PCC (punch common contacts) close. Also, due to S3 being operated, there will not be an anti-repeat circuit (holding circuit to K4 relay — see Figure 3-2). Therefore, as long as the S3 switch is held operated, the punch will continue to perforate the code 1-2-3-4-5-6.

READER AND TRANSLATOR CIRCUITS

Start and Stop Circuits — (Figure 3-6) The start read switch (S6), when depressed and released, will energize the reader magnet (LRM) and start a reader cycle of operation. In order to energize the reader magnet, a circuit is first completed to the reader control relay (K7) as follows:

Circuit Description

from -DC, TC6, JR10, RTC, JR13, N/O S6, N/C S7, TA29, K7 coil, TA37, TC5 to +DC. The K7 relay is energized, closing all three of its normally open contacts. When K7 contacts 3 and 4 close, a holding circuit to K7 is completed as follows: from -DC, TC6, JR10, RTC, the normally closed transfer contacts of RC1-RC2-RC3-RC4 and RC6, JR8, TA18, K7 - 3 and 4, TA8, N/C S7, TA29, K7 coil, TA37, TC5, to +DC.

When the S6 switch is released, the reader magnet is energized as follows: from -DC, TC6, JR10, RTC, JR13, N/C S6, CRTC, TA19, K6 - 12 and 11, TA20, K7 - 12 and 11, TA28, JR11, LRM, JR12, TC5, to +DC. Once the circuit to the reader magnet is established it will remain energized and the reader will operate continuously until either; the reader magnet circuit is broken auto-

matically (explained under Delay Control and Stop Code Circuits) or, the stop read switch S7 is manually depressed.

When the stop read switch S7 is depressed, the holding circuit to the K7 relay is broken. Thus, when the K7 contacts 11 and 12 open, the reader magnet is de-energized, stopping reader operation.

Translator Magnet Circuits - 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: (Figure 3-7) from -DC, TC6, JR10, RTC, RC1 and RC2, JR1 and JR2, JTA1 and JTA2, LT1 and

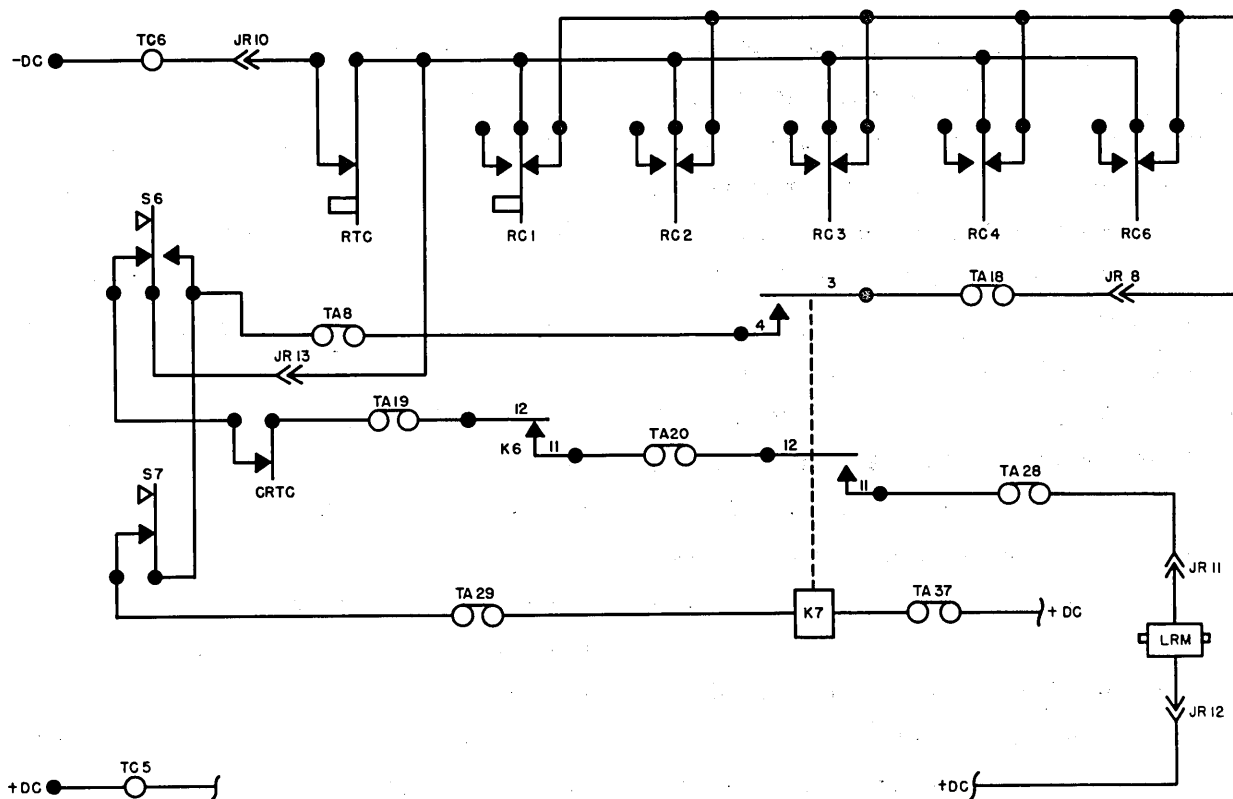


Figure 3-6 Start and Stop Circuit

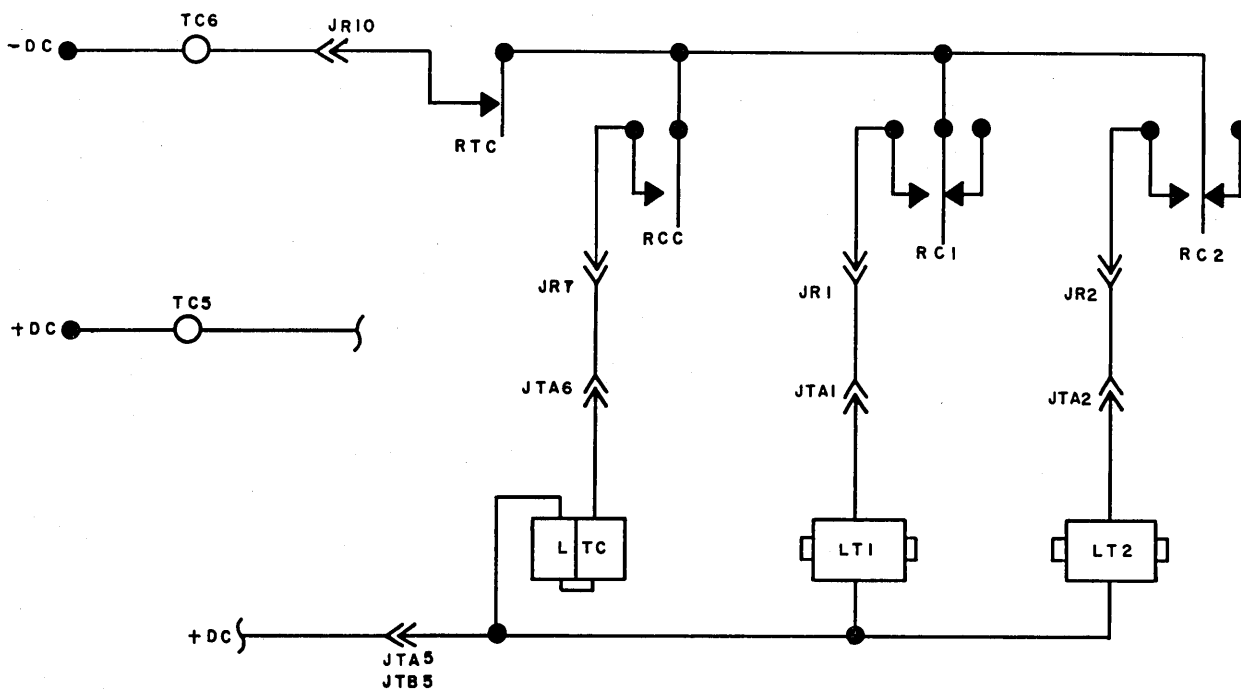


Figure 3-7 Example Translator Magnet Circuit

LT2, JTA5, TC5, 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, JTB5, TC5, to +DC.

Delay Control Circuit (Figure 3-8) An automatic delay control circuit is used in the Model FG machine in order to delay the operation of the tape reader until the carriage return or tab function has been completed in the writing machine. The code for carriage return is 4, while the tab code is 6. Thus, when either RC4 or RC6 contacts operate, a circuit is completed to the delay control relay (K6), breaking the circuit to the reader magnet and stopping reader operation.

For an example operation, assume that a carriage return code 4 is read by the tape reader. A circuit would be completed to the K6 relay as follows: from -DC, TC6, JR10, RTC, RC5, RC3, RC1, RC2, RC4, RC6, JR9, TA9 and 10, K7 - 1

and 2, TA30, K6 coil, TA36, to +DC. When K6 is energized, K6 contact transfers (12 strap breaks with 11 strap and makes with 13 strap) thus breaking the energizing circuit to the reader magnet, stopping reader operation. Also, when K6-12 and 13 makes, a holding circuit to K6 coil is completed.

At the same time the above circuit is completed to K6, a circuit is also completed to the LT4, and the translator clutch magnet LTC. Thus, translator operation takes place, causing carriage return operation. As a result of the carriage return function, the CRTC contact breaks, thus breaking the holding circuit to K6. The K6 contacts 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 reader

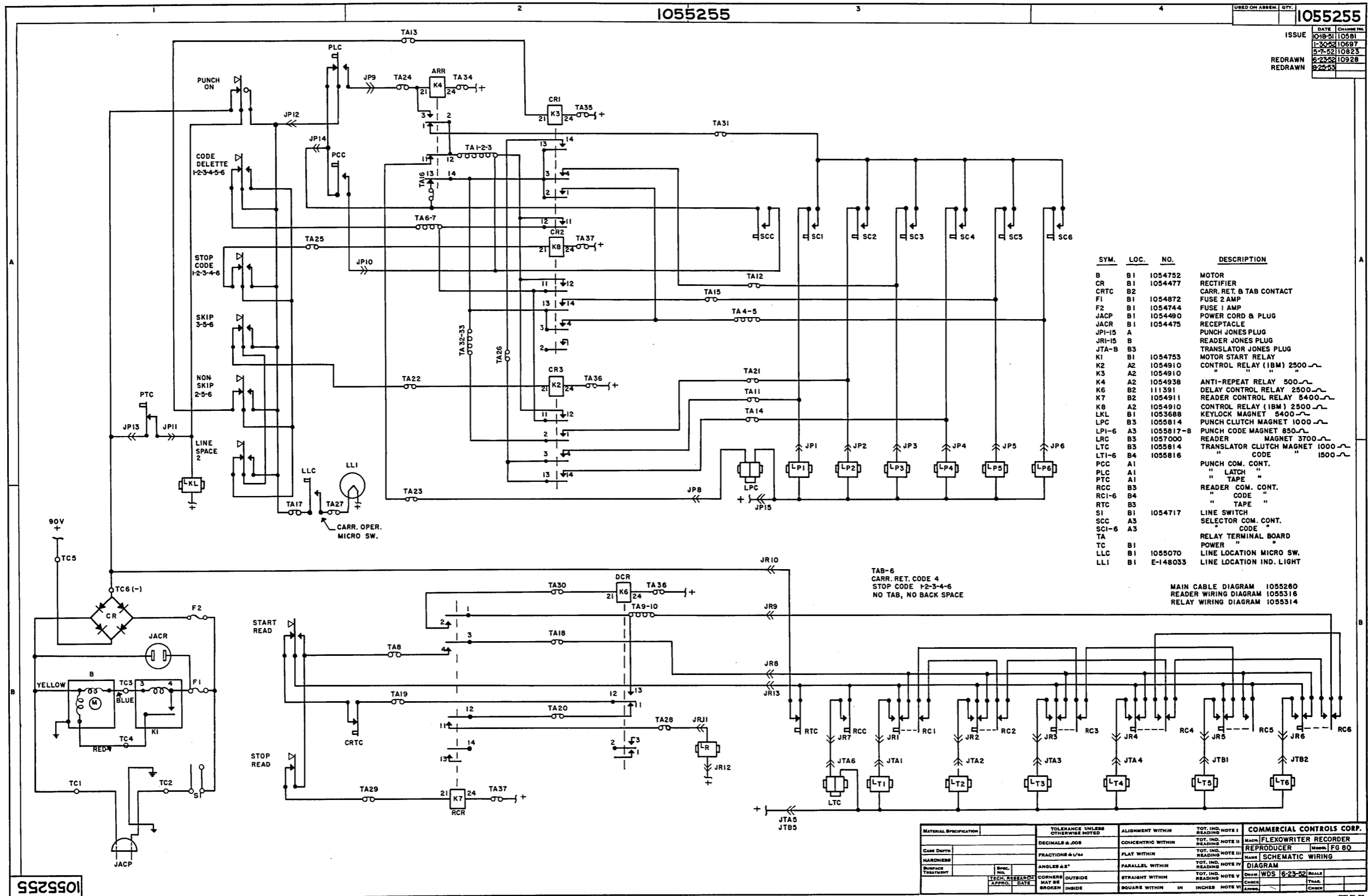


Figure 3-9 Model FG-80 Wiring Diagram

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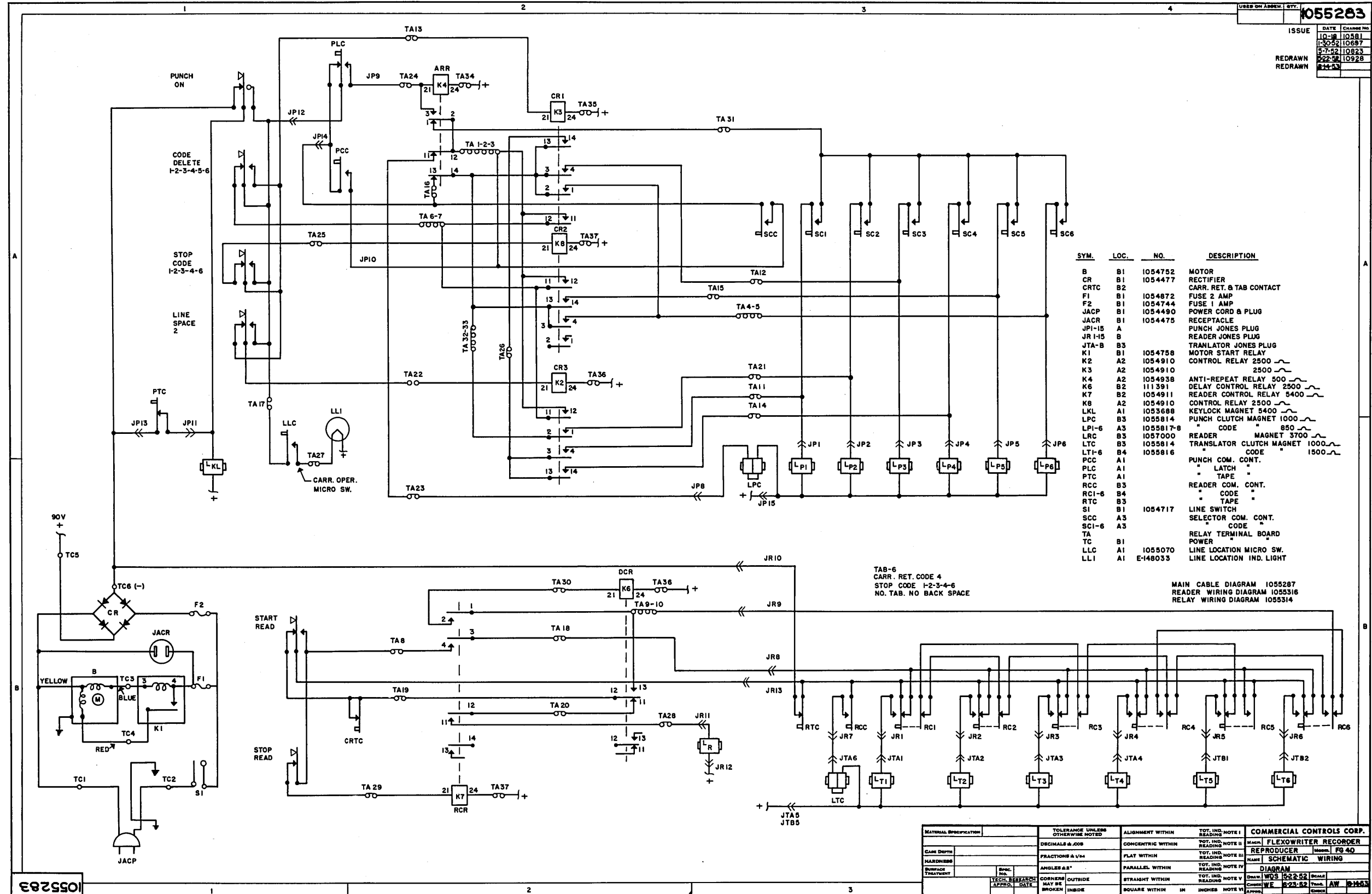


Figure 3-10 Model FG-40 Wiring Diagram

PART V

FLEXOWRITER MODEL FTM

Section 1	Description
Section 2	Maintenance of Units
Section 3	Circuit Description

DESCRIPTION

PURPOSE

The Flexowriter Model FTM was designed to speed inter-office communications. It has been expressly adapted to meet the demand for an electric typing machine which can rapidly transmit messages to and receive messages from another remote typing machine. Also, the Model FTM will punch and read a seven-eighth inch wide paper tape to provide for automatic typing.

COMBINATIONS

The Flexowriter Model FTM can be equipped with or without tape punching and reading facilities.

Due to the fact that the code selector transmits and the code translator receives, tape punching and reading facilities are optional.

The chart in Figure 1-1 shows the combinations that may be provided according to application of a Model FTM.

The Flexowriter FTM** (shown in Figure 1-1) which provides for typing, transmitting, punching tape, reading tape, and receiving, includes the following in one unit:

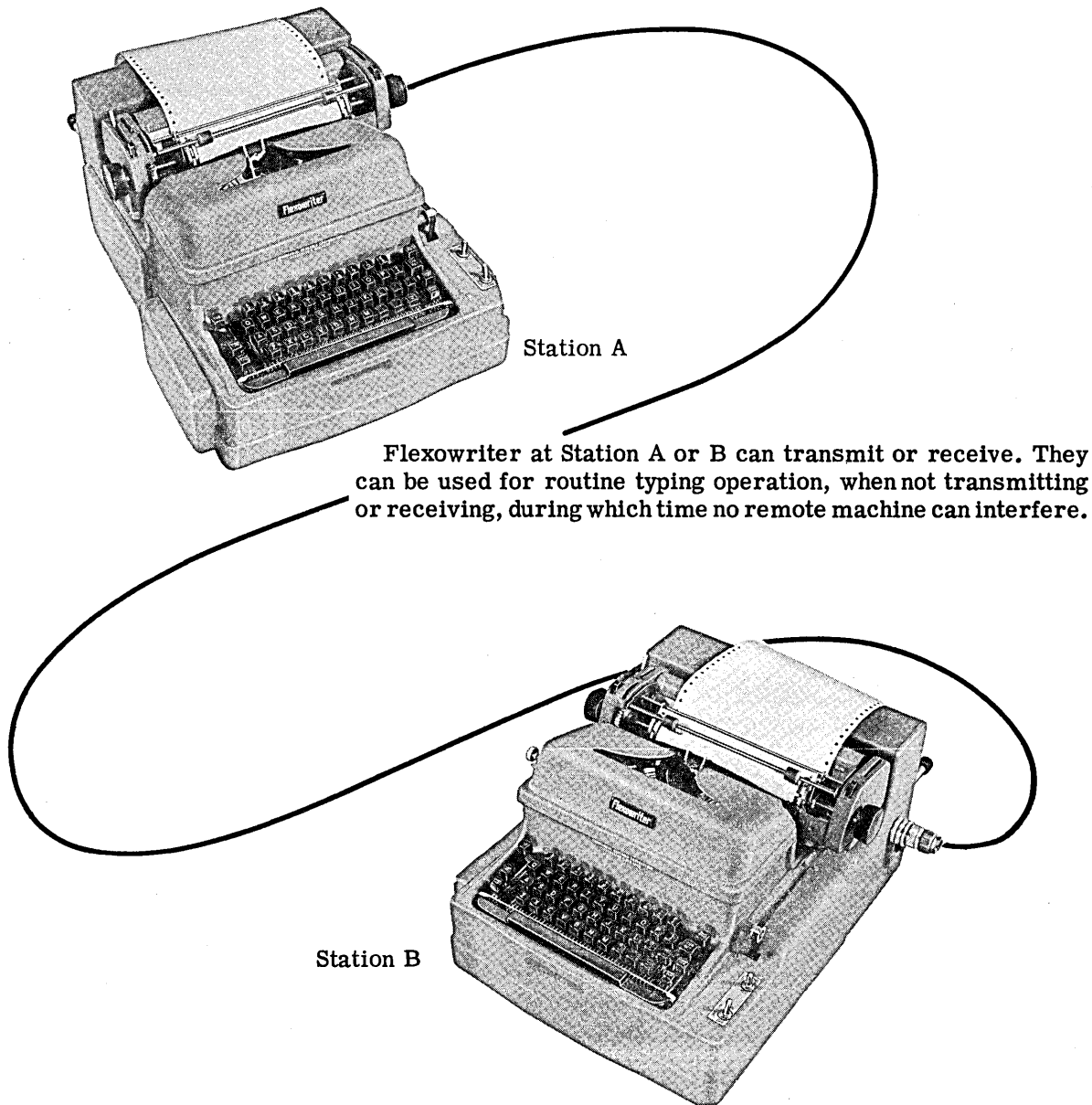
Writing Machine – This is a heavy-duty electric typing machine with a standard keyboard. It provides for manual or automatic typing.

Code Selector – This unit is operated in response to depressing a keylever. The resultant

Combination	Equipped With					Capable Of				
	Writing Machine	Code Selector	Tape Punch	Tape Reader	Code Translator	Typing	Transmitting	Punching Tape	Reading Tape	Receiving
Flexowriter FTM Transmitter	X	X				X	X			
Flexowriter FTM Receiver	X				X	X				X
Flexowriter FTM Transmitter-Receiver	X	X			X	X	X			X
Flexowriter FTM Recorder-Reproducer Transmitter-Receiver **	X	X	X	X	X	X	X	X	X	X
Flexowriter FTM Recorder-Transmitter	X	X	X			X	X	X		
Flexowriter FTM Reproducer-Receiver	X			X	X	X			X	X

Figure 1-1 Combination Chart

Description

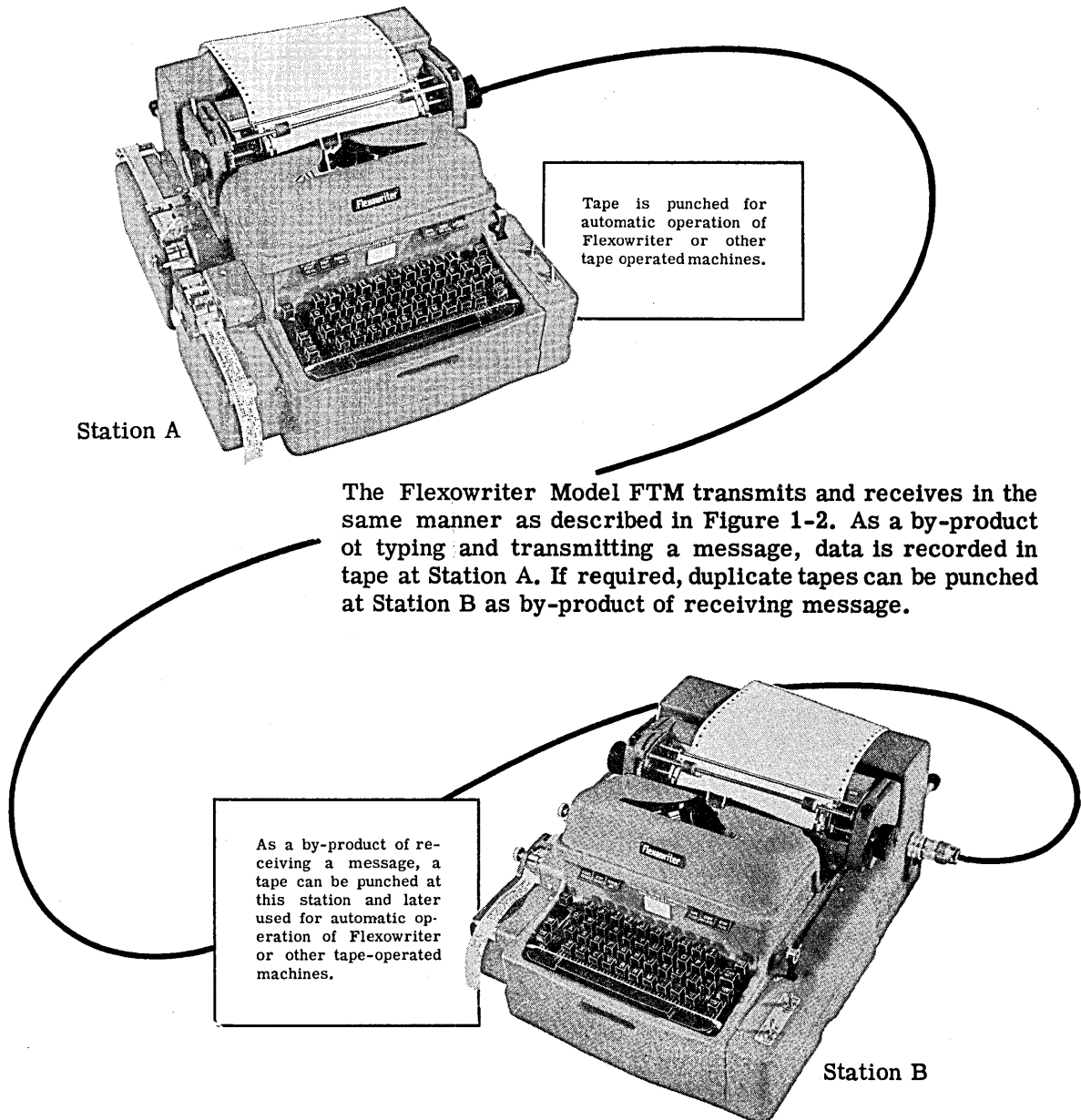


Operator at Station A places the line switch in the transmitting (send) position.

This automatically signals Flexowriter at Station B. If B is not in use and the line switch is in receive position an indicating light on both machines will turn on indicating a connection. However, if Station B is in use, (line switch not in receive position) a buzzer will sound in both machines, indicating no connection.

When Stations A & B are connected, Station A operator types and as a by-product of typing message, impulses are received at Station B which actuate type bars and types received message.

Figure 1-2 Model FTM Transmitter-Receiver



A previously punched tape can actuate a tape reader and transmit a message as a by-product of automatic typing.

(The Flexowriter can be used as a Flexowriter Model FL affording all of the features of punching, reading and duplicating tape and typing without transmitting.)

Figure 1-3 Model FTM Recorder-Reproducer Transmitter-Receiver

Description

selector operation selects a code for that particular keylever position and transmits that code over a cable to actuate another Model FTM automatically and/or it (the code) can be stored in a tape for future use.

Tape Punch — The punch is also operated by the code selector and it perforates the proper code holes in a tape corresponding to the code selected.

Tape Reader — This unit reads the codes in the tape to automatically operate the writing machine through the code translator, and operate the tape punch through the operation of the code selector.

Code Translator — The translator is actuated through the tape reader or from a remote Model FTM to automatically operate the writing machine.

BASIC FUNCTIONAL PRINCIPLES

The operation of a keylever in the Model FTM has the same results as described in Part II, Section 1, except the code selectors in the Model FTM may be connected by cable to a remote Flexowriter. Also, the Model FTM code translator may be actuated by impulses received from another Flexowriter code selector.

The example installation in Figure 1-2 shows two Flexowriter Model FTM Transmitter-Receiver connected by a cable. These two machines are identical. The Flexowriter at Station A or B can transmit or receive. They can be used for routine typing operation (line switch in local position), when not transmitting or receiving.

The other example installation in Figure 1-3 shows two Flexowriter Model FTM Recorder-Reproducer Transmitter-Receiver connected by cable. These two machines are identical.

KEYBOARD

The Model FTM keyboard is shown in Figure 1-4. It uses a total of 51 keylever positions, 43 of which are used for character operation. The remaining eight positions are used for functional operation including; back space, carriage return, tab, space, upper case and lower case.

CODE SYSTEM

The Model FTM uses a six unit binary code which provides for 64 possible code combinations. As shown in the keyboard chart (Figure 1-4) and the coded tape (Figure 1-5), 43 of these code combinations are used for characters. Six more combinations are used for functional operations which were described as; carriage return, back space, space, tabulation, lower case shift and upper case shift. The code combination 1-2-3-4-5-6 is used for a code delete operation and the 1-2-4-5-6 is used for a stop code. A seven-eighth inch wide paper tape is used and the code holes are numbered 612345 facing the leading edge of the tape. (See Figure 1-5.) 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.

CONTROL PANEL

The Model FTM switches are the same as described in Part II, Section I, except for the following: (See Figure 1-4.)

Stop Code — The operation of this switch will

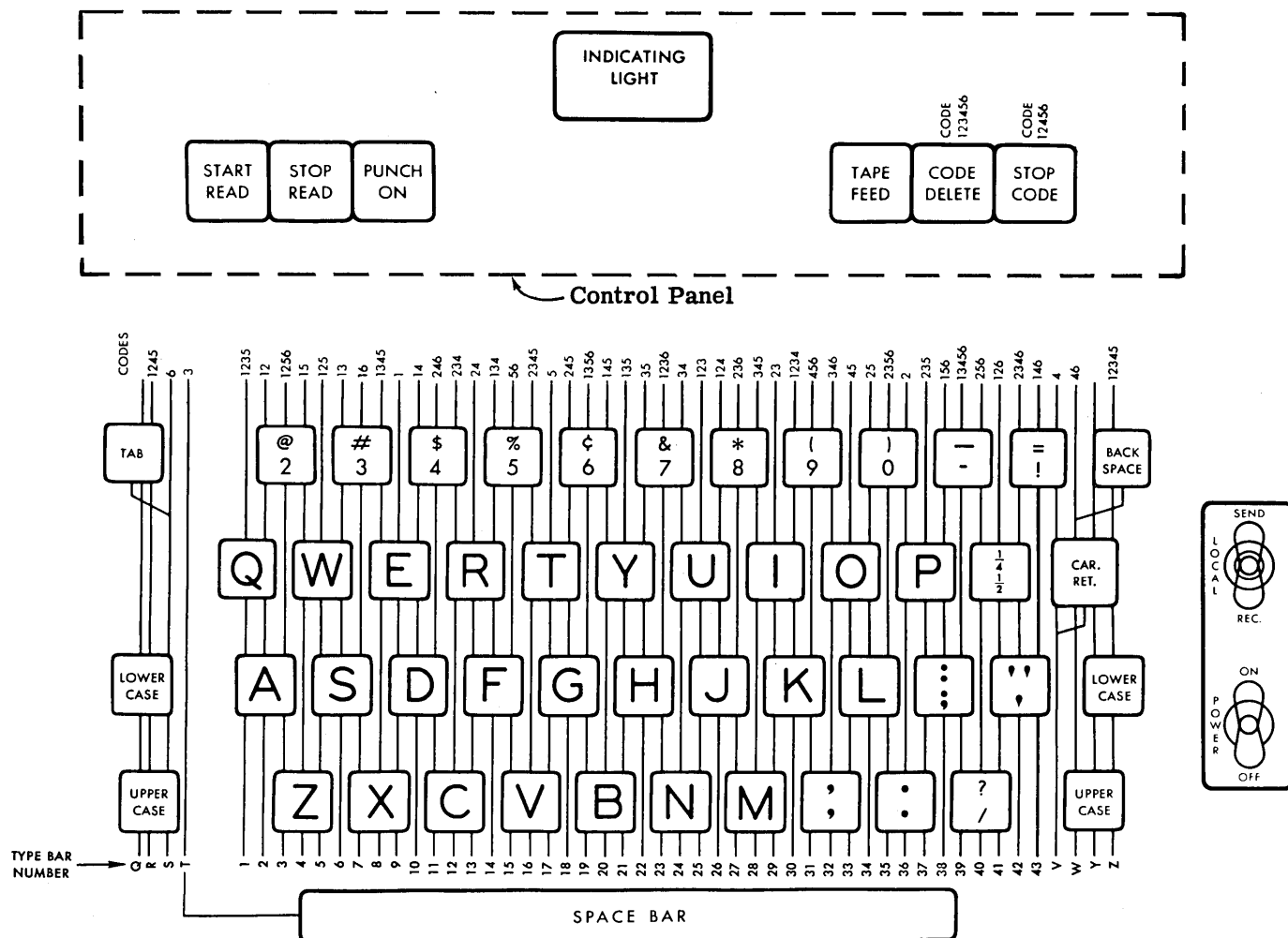


Figure 1-4 Model FTM Keyboard

cause a 1-2-4-5-6 code to be perforated in the tape.

Indicating Light — When two Model FTM's are connected, one in the "send" position and one in the "receive" position, the indicating light will be on.

Note: A buzzer is provided and wired to operate when one machine is trying to send a message but the local machine is not in condition to receive. The buzzer in the sending machine also operates under these conditions.

Line Switch — The line switch located on the right side of the machine has three positions, namely; Local, Send and Receive. (This switch is not used on a Model FTM Transmitter or Receiver.)

Local Position — When the line switch is in the local position, the machine may be used as a Flexowriter Model FL thus having all the features of punching, reading and duplicating tape and typing without transmitting.

Send Position — When the line switch is in send

Flexowriter Transmitter - 75 lbs.

Flexowriter Receiver - 75 lbs.

Flexowriter Transmitter-Receiver - 80 lbs.

Flexowriter Recorder-Reproducer

Transmitter - Receiver - 90 lbs.

Type Style — The Model FTM may be equipped with any of the type faces having a .265" motion as shown in Commercial Controls Type Available Catalog.

Carriage — The Model FTM may be equipped with a 12", 16" or 20" carriage, the carriage

lengths on Flexowriters transmitting and receiving messages should be the same length.

Transmitting Distance — The effective transmitting distance is dependent upon the characteristics of the wire used in the cable. Each single wire (within cable) must be capable of carrying 150 milliamps with a voltage drop less than 8 volts. Two common power wires (on plugs JLH and JLJ) must each be capable of carrying the combined loads of the single wires (approximately 450 milliamps).

MAINTENANCE OF UNITS

The Model FTM Recorder-Reproducer-Transmitter-Receiver consists of five major units, namely; writing machine, code selector, tape punch, tape reader, and code translator. These units are all basically the same as the units described in Part II, Sections 2 through 7. Therefore, the maintenance procedures and adjustments will be the same with the exception of the following:

WRITING MACHINE

The power drive mechanism on a Model FTM uses a cog belt drive from the motor to the drive shaft. The use of a cog belt insures uniform speed of send and receive machines or in installations having multiple machine operation. The tension of the belt is obtained by turning the adjusting screw located on the rear base plate of the machine.

All of the writing machine component adjustments and maintenance procedures may be found in Part II, Section 2.

CODE SELECTOR

The Model FTM code selector is the same

as the selector explained in Part II, Section 3 with the exception of the selector slide coding. The selector slide coding arrangement is shown in the chart in Figure 2-1.

TAPE PUNCH

The Model FTM tape punch has the same description and sequence of operation as the punch explained in Part II, Section 5. The punch magnet coils, however, have a rating for 48 volt D. C. operation (coils are 800 Ohms).

TAPE READER

The operation and basic description of the Model FTM tape reader is basically the same as the reader described in Part II, Section 6, with the exception of the following:

The contact stackup arrangement

RC1 - 1 break, 1 transfer (1B, 1C)

RC2 - 1 break, 1 transfer (1B, 1C)

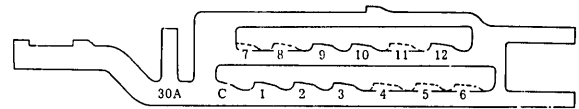
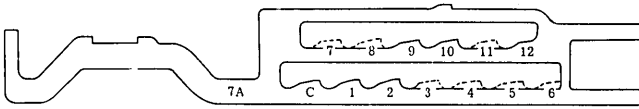
RC3 - 1 make, 1 transfer (1A, 1C)

RC4 - 1 make, 1 transfer (1A, 1C)

RC5 - 1 break, 1 transfer (1B, 1C)

RC6 - 1 make, 1 transfer (1A, 1C)

Maintenance of Units



FRONT SLIDE

REAR SLIDE

Position Number	Cam Surface
1B	8-11
	C-1-2-4-5
3A	8-11
	C-3
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
41C	7-8-9-10-11-12
	C-2
43C	7-8-9-10-11-12
	C-1-5-6
45C	7-8-9-10-11-12
	C-2-5-6
47C	7-8-9-10-11-12
	C-2-3-4-6
49C	
	C-4
51B	
	C-1-2-3-4-5

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

Figure 2-1 Selector Slide Coding

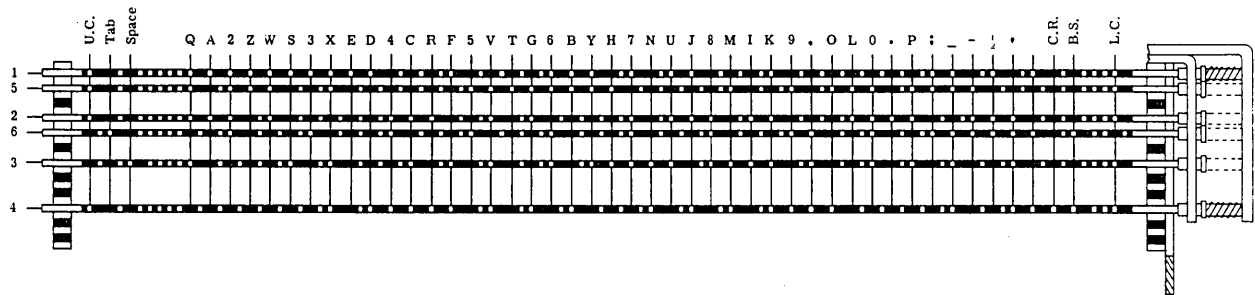


Figure 2-2 Permutation Bar Coding

Contact Adjustment:

1 - With a piece of blank tape in the reader and the pins resting against the tape, adjust all open contacts to .020" to .025" gap except the make contact of RC4 and RC6 (contacts in delay control circuit). These two contacts should be set at approximately .030".

2 - Remove tape and adjust normally closed contacts to .020" to .025".

3 - Adjust RTC to .020" to .025".

4 - Check for positive make with additional overtravel on all contacts.

CODE TRANSLATOR

The Model FTM code translator is basically the same as the translator described in Part II, Section 7, except for the permutation bar coding arrangement (Figure 2-2) and the translator magnet coil ratings (800 Ohms for 48 volt D.C. operation).

CIRCUIT DESCRIPTION

The individual circuits discussed in this section are based on wiring diagram number 1055939 for the Flexowriter Model FTM Recorder-Reproducer Transmitter-Receiver. (See Figure 3-14.)

POWER CIRCUITS

The power circuit is controlled by the S1 power switch when the S2 line switch is in either "local" or "send" position. When the S2 switch is in "receive" position, the power circuit is controlled by the switch contacts on the K8 relay (also can be controlled by S1 switch).

When the power switch (S1) is in the on position, a 110 V A.C. circuit is complete to the 35 milihorse power motor (B) as follows: from JACP, TC4, S1, F1, K1 coil, main motor winding, TC3, to JACP. The initial surge of current through the circuit just described builds up a flux in the K1 coil which is strong enough to close the K1 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 the starting relay, 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 where the coil will no longer hold the K1 contacts closed. Thus, the motor, once it reaches its running speed, will operate by the circuit through its main winding.

Connected across A. C. supply terminal TC5 and TC6 is the primary winding of a stepdown transformer (T).

The secondary winding of this transformer is connected to a full wave selenium rectifier (CR1) through terminals TC7 and TC9. The secondary center tap is connected to terminal TC2 (-DC). The approximate voltages are as follows:

Across TC7 and TC9 - 115 Volts A. C.

Across TC5 and TC6 - 115 Volts A.C.

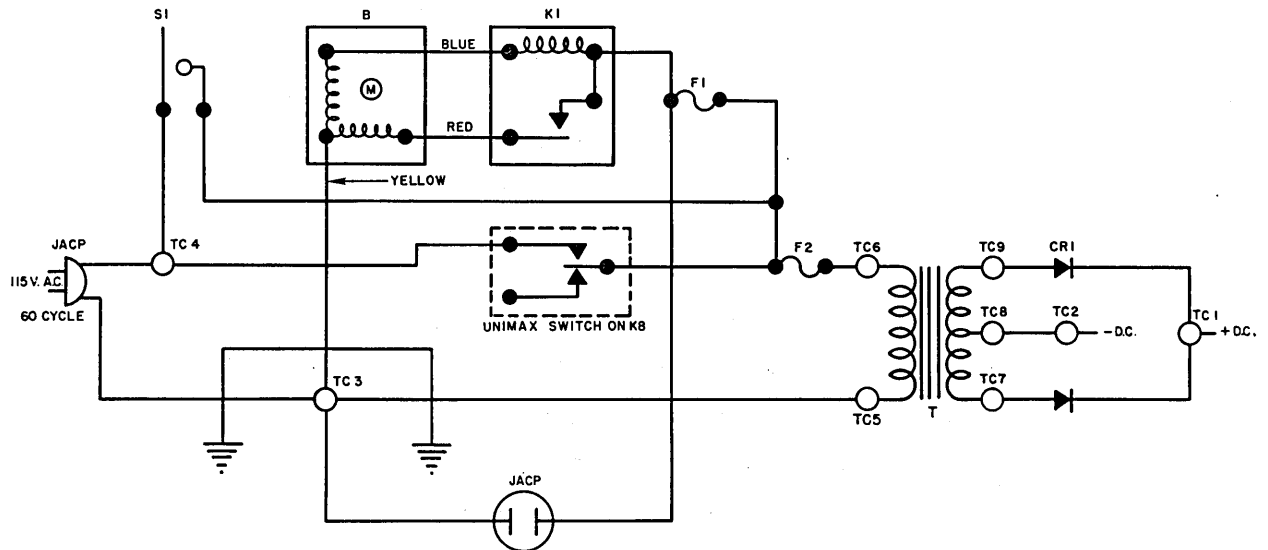


Figure 3-1 Power Circuit

Circuit Description

Across TC7 and TC9 - 115 Volts A.C.

Across TC7 and TC8 - 57.5 Volts A.C.

Across TC8 and TC9 - 57.5 Volts A.C.

Across TC1 and TC2 - 48 Volts D.C.

The D.C. output of CR1 (terminals TC1 and TC2) supplies the power necessary to operate the various relay coils and magnets in the machine.

The A.C. and D.C. supply circuits are protected by a 2.0 amp Slo-Blo fuse (F1-A.C. and F2-D.C.).

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

The power relay (K8), when energized will close the switch contacts and complete the same circuits just described. This relay (K8) will be energized when the S2 switch is in receive position. (The energizing circuit for K8 is received from a remote machine. See Figure 3-10.)

(LKL) is energized as follows: from -DC, TC2, N/C S2, LKL, TC1, to +DC. (See Figure 3-3.)

When the S3 switch is in the "On" position, the key lock magnet (LKL) is energized as follows: from -DC, TC2, JP13, PTC, JP11, LKL, TC1, to +DC. In this circuit, the PTC contact controls the circuit to the key lock magnet, 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 keyboard.

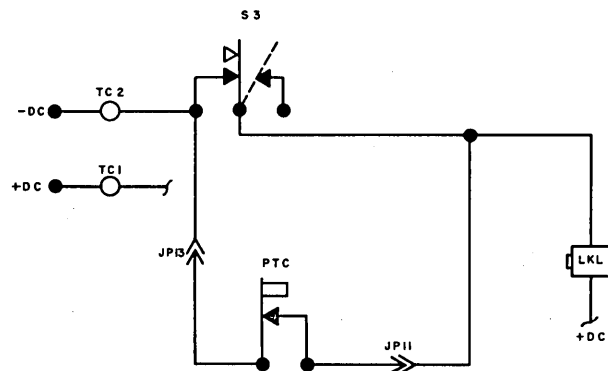


Figure 3-3 Key Lock Magnet Circuit

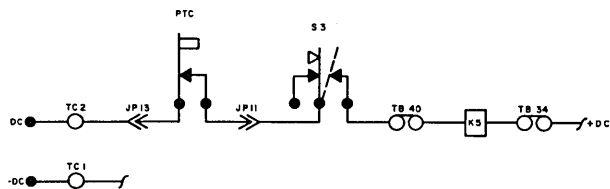


Figure 3-2 Punch Control Relay Circuit

RECORDING CIRCUITS

Punch Control Relay (K5) Circuit — When the punch on switch S3 is in the "On" position, a circuit is complete to the K5 relay as follows: from -DC, TC2, JP13, PTC, JP11, N/O S3, TB40, K5 coil, TB34, TC1, to +DC (See Figure 3-2.)

Key Lock Magnet — When the punch on switch (S3) is in the "Off" position, the key lock magnet

Punch Magnet Circuit — 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 DC circuit will be completed to the LP1 and LP2 (No. 1 and No.2 punch magnets) as follows: (Figure 3-4) (S3 "On" and K5 energized): from -DC, TC2, JP13, PTC, JP11, N/O S3, TB40, K5 - 7R and 8R, K7 -

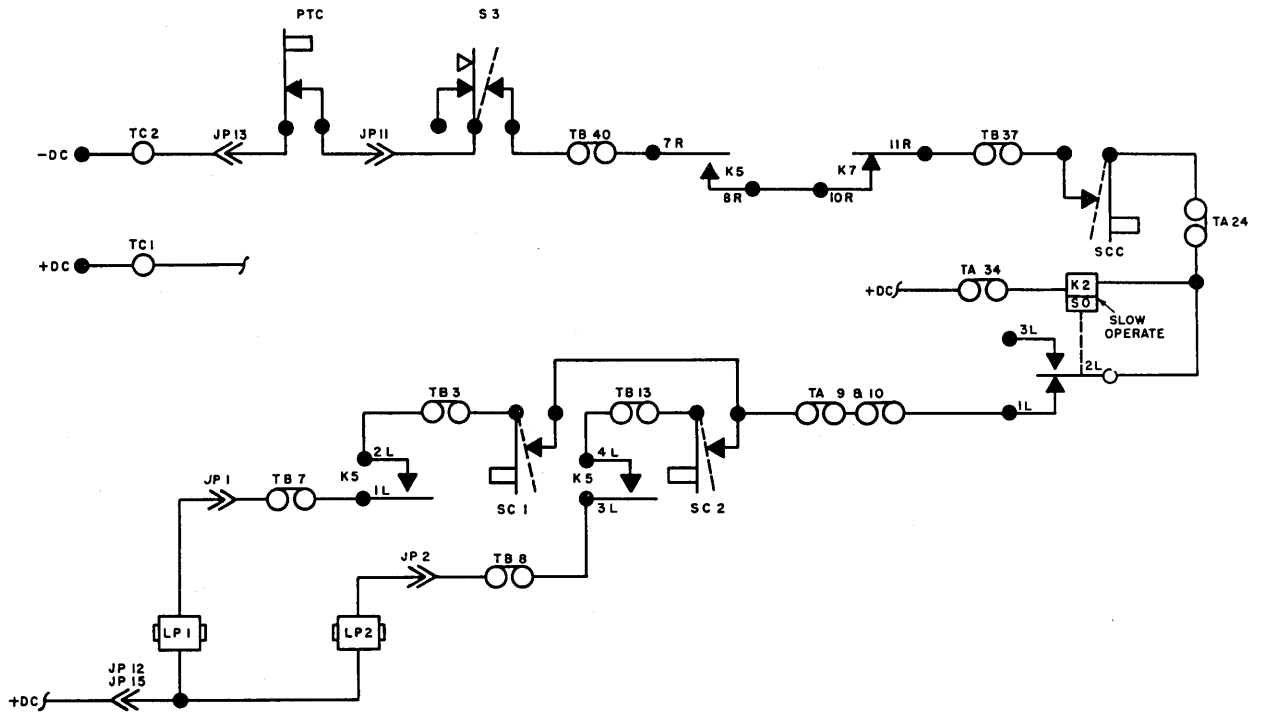


Figure 3-4 Example Punch Magnet Circuit

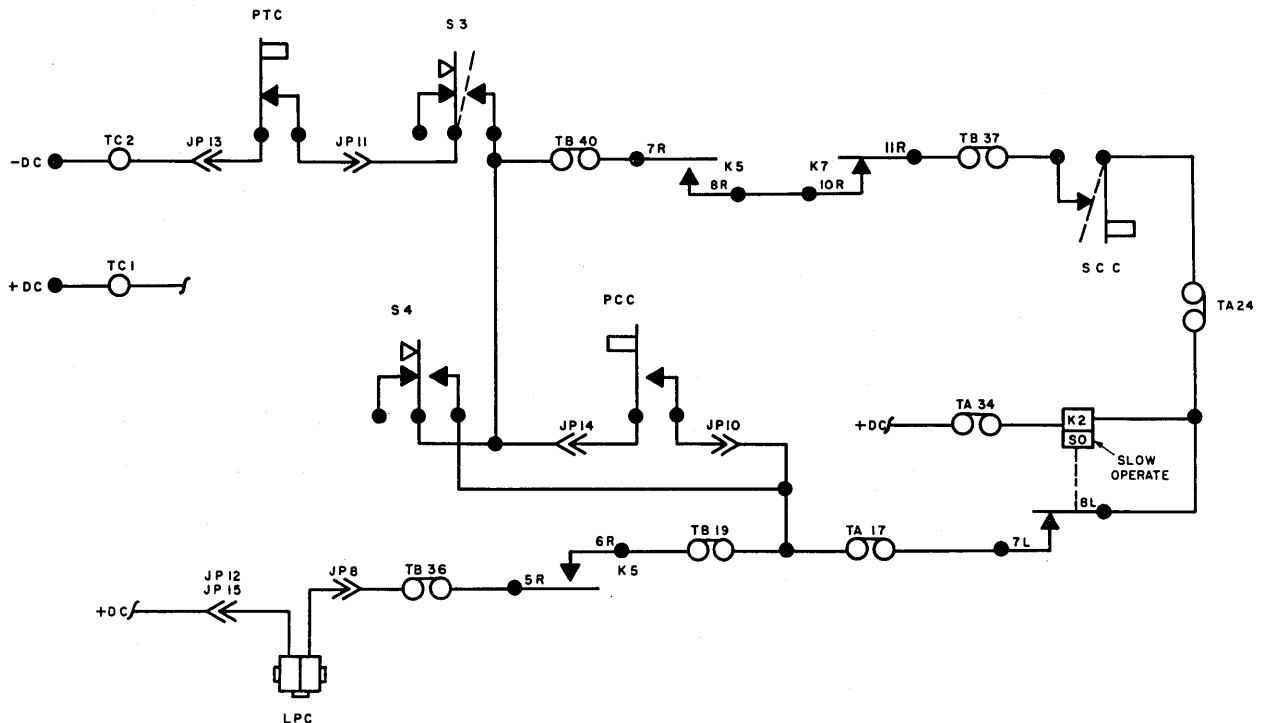


Figure 3-5 Clutch Magnet Circuit

Circuit Description

10R and 11R, TB37, SCC, TA24, K2 - 2L and 1L, TA9 and 10, SC1 - SC2, TB3 - TB13, K5 - 2L and 1L - 4L and 3L, TB7 - TB8, JP1 - JP2, LP1 - LP2, JP12, and 15, TC1, to +DC. Therefore, the 1-2 code will be punched in the tape during the punch cycle of operation.

Clutch Magnet Circuit (Figure 3-5) - The clutch magnet (LPC) is energized after each initial operation of a keylever through the following circuit: from -DC, TC2, JP13, PTC, JP11, N/O S3, TB40, K5 - 7R and 8R, K7 - 10R and 11R, TB37, SCC, TA24, K2 - 8L and 7L, TA17, TB19, K5 - 6R and 5R, TB36, JP8, LPC, JP12 and JP15, TC1, to +DC. 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 are 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.

When it is necessary to "feed out" the tape with feed holes only, the tape feed switch (S4) may be depressed. This switch operation will

complete a circuit direct to the clutch magnet.

Anti-Repeat Circuit - It is possible during punching operation for the punch to finish a cycle of operation before the selector common contact (SCC) opens. This would cause a repeat operation in the punch. To prevent this, an anti-repeat circuit is used in the following manner: the same energizing circuit used for the punch magnets and clutch magnet is also used to energize the anti-repeat relay (see Figures 3-4 and 3-5). The K2 relay, however, has a slow operate coil. The pick up time of this relay is approximately 60 mili-seconds, thus allowing circuits to be completed to the punch and clutch magnets before K2 - 1L and 2L and K2 - 7L and 8L contacts break. Therefore, when K2 does pick up, the above contacts will be broken preventing a repeat cycle of the punch.

Code Delete Circuit (Figure 3-6) - The delete code is 1-2-3-4-5-6 and when it is necessary to punch this code in the tape, the S5 switch is depressed. When S5 switch is depressed, the K6 relay is energized as follows: from -DC, TC2, JP13, PTC, JP11, N/O S3, S5, TB27, K6 coil, TB34, TC1, to +DC. When K6 is energized all seven of the K6 contacts make, completing a circuit to the six punch magnets (LP1 through LP6). The circuit to LP1, LP2, LP4, LP5 and LP6 is as follows: from -DC, TC2, JP13, PTC, JP11, N/O S3, N/C S4, TB28, K6 - 6R and 5R, TB30, TA24, K2 - 2L and 1L, TA9 and 10, TB39, K6 - 2L and 1L-4L and 3L - 8L and 7L - 2R and 1R - 4R and 3R, TB3 - 13 - 33 - 6 - 16, K5 - 2L and 1L - 4L and 3L - 8L and 7L - 2R and 1R - 4R and 3R, TB7 - 8 - 10 - 17 - 18, JP1 - 2 - 4 - 5 - 6, LP1 - 2 - 4 - 5 - 6, JP12, - 15, TC1, to +DC. The circuit to LP3 is

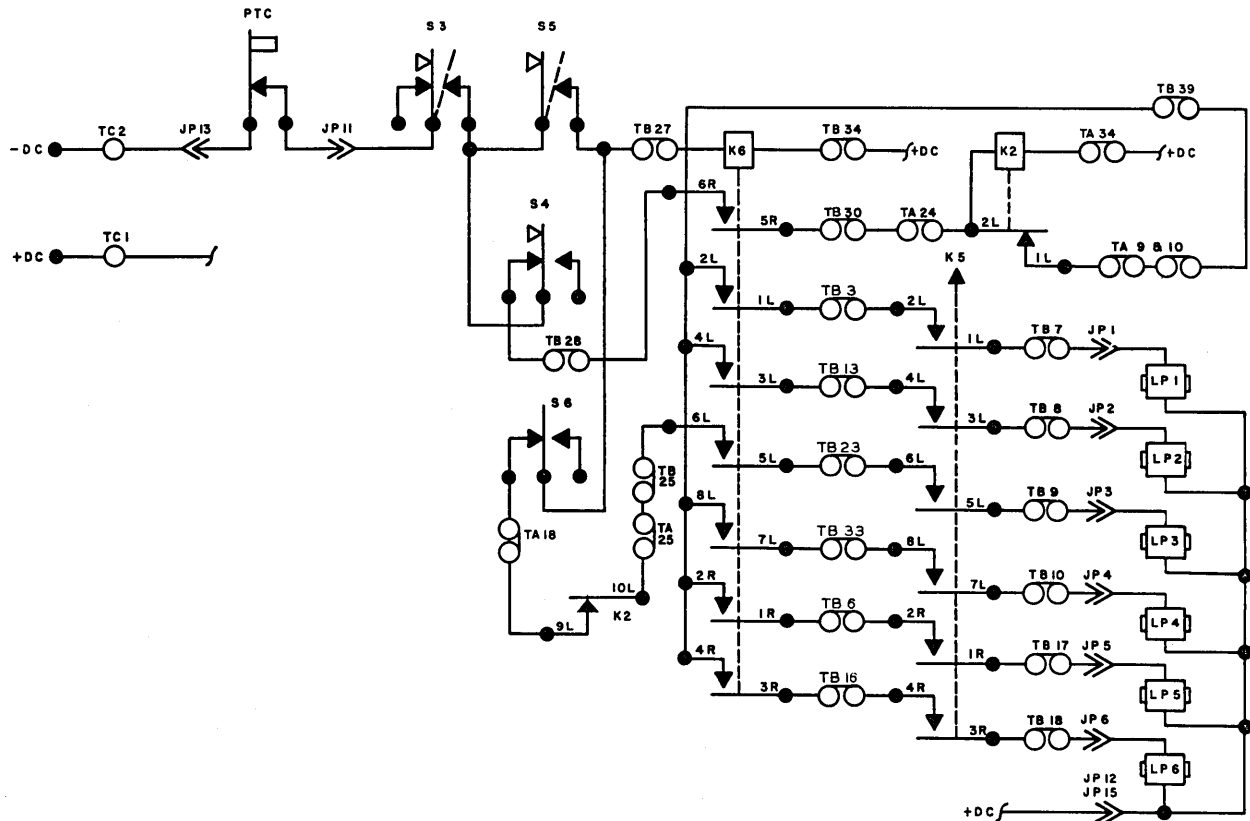


Figure 3-6 Code Delete & Stop Code Circuits

as follows: from -DC, TC2, JP13, PTC, JP11, N/O S3, S5, N/C S6, TA18, K2 - 9L and 10L, TA25, TB25, K6 - 6L and 5L, TB23, K5 - 6L and 5L, TB9, JP3, LP3, JP12 and 15, TC1, to +DC.

The clutch magnet will also be energized, thus releasing the clutch, rotating the punch shaft and punching the delete code (1-2-3-4-5-6) in the tape.

As long as the S5 switch is held depressed, the K2 (anti-repeat) relay will be held energized preventing a repeat of the delete code as follows: the S5 switch held depressed would hold K6 energized, thus holding K6 - 5R and 6R closed, which in turn keep K2 energized.

Stop Code Circuit (Figure 3-6) — The stop code is 1-2-4-5-6 and when it is necessary to punch

this code in the tape the S6 switch is depressed. When the S6 switch is depressed, the K6 relay, the LP1, LP2, LP4, LP5 and LP6 punch magnets are all energized in the same manner as explained in the Code Delete Circuit. The LP3, however, is not energized due to the fact that its circuit is broken when the S6 normally closed contacts break when the switch is depressed.

REPRODUCING CIRCUITS (READER AND TRANSLATOR)

Manual Start and Stop Circuits (Figure 3-7)— A tape may be reproduced by inserting it in the reader and manually depressing the start read switch (S7). This will cause the reader to read

read switch (S8) is manually depressed.

When the stop read switch (S8) is depressed, the holding circuit to the read control relay (K4) is broken. Thus, when the reader finishes the cycle of operation (RCC open), the K4 relay drops out breaking K4 - 11R and 12R, and stopping reader operation.

Translator Magnet Circuits — 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.

Each of the six reader contacts are individually connected to an open contact on the K4 read control relay. Therefore, it is obvious the K4 relay must be energized before a circuit can be established to a translator magnet.

For an example circuit, assume that a 1 code is read in the reader tape. The translator magnet

LT1 and the translator clutch LTC will be energized as follows (the clutch magnet is energized with the same pulse as the code magnet) (Figure 3-8): from -DC, TC2, JR10, RTC, N/O RC1, JR1, TA3, K4 - 3L and 2L, TA1, JTA1, LT1, JTA5, TC1, to +DC. This same pulse passes through a blocking rectifier and energizes the LTC. Thus, translator operation takes place causing character E to be typed.

Note: See Automatic Send and Receive Circuits on page 3-12.

Delay Control Circuit (Figure 3-9) — It is essential to have an automatic delay control circuit incorporated in the Model FTM 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: carriage return (4), tabular (6), and back space (4-6).

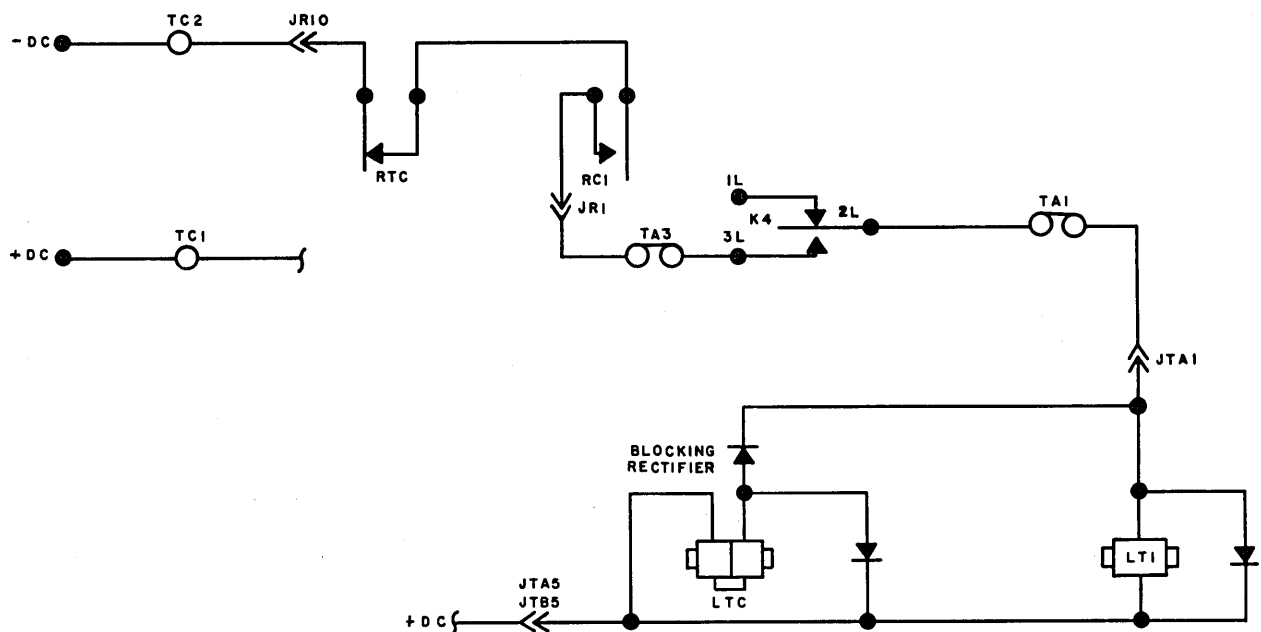


Figure 3-8 Example Translator Magnet Circuit

Circuit Description

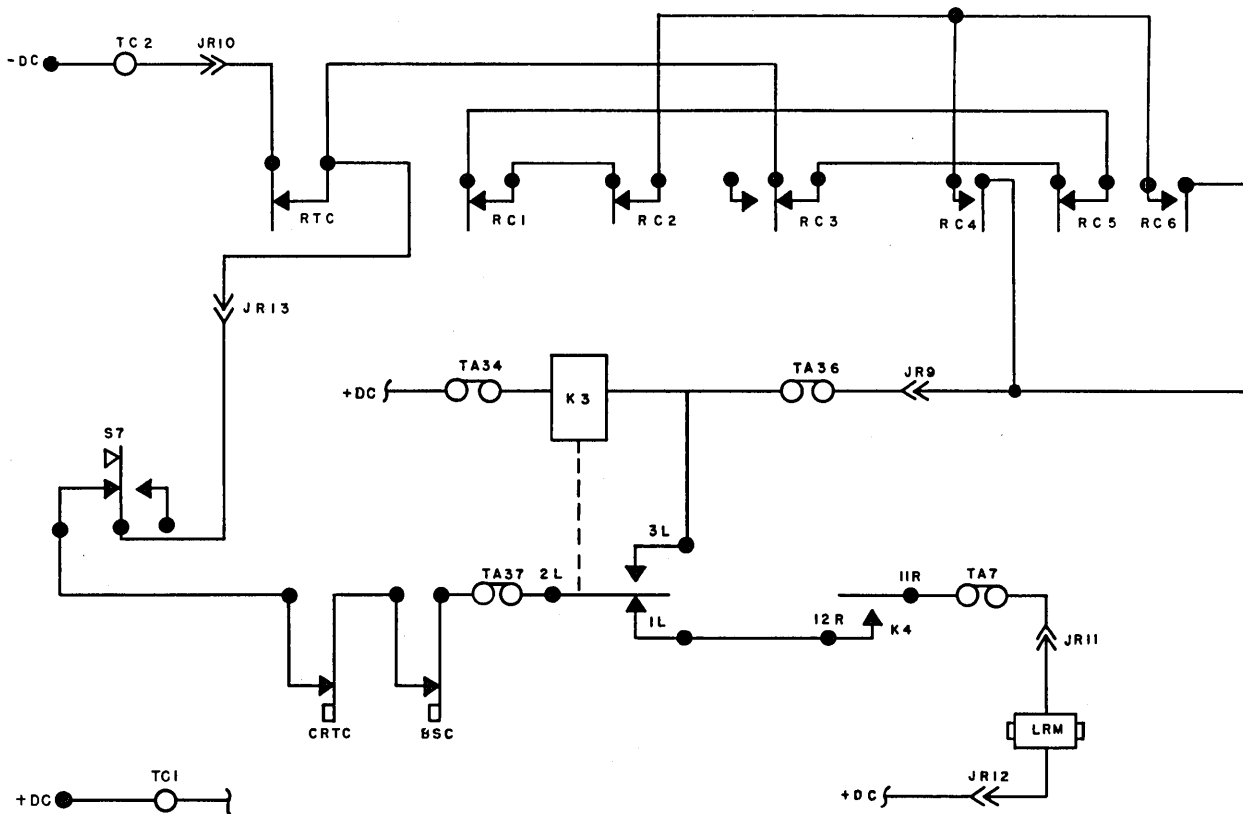


Figure 3-9 Delay Control Circuit

A transfer contact is used on a delay control relay K3 which breaks the circuit to the reader magnet when any of the above codes are read. This will stop the reader operation for the time required of the functional operations mentioned.

The K3 (delay control relay) is energized by operating either the RC4 or RC6 contacts, or operating these two reader contacts simultaneously. If a 4 code (CR) is read by the reader for example, the following circuit to K3 would be completed: from -DC, TC2, JR10, RTC, RC3 - N/C transfer, RC5 - break contact, RC1 - break contact, RC2 - break contact, RC4 - make contact, JR9, TA36, K3 coil, TA34, TC1, to +DC.

At the same time the above circuit is complete to the K3, a circuit would also be completed to

translator magnet LT4 and translator clutch magnet LTC. Translator operation would take place, causing carriage return operation. The operation of the carriage return mechanism would open contacts CRTC.

When K3 picks up, its contacts transfer (strap 2L breaks with 1L and makes with 3L), breaking the reader magnet circuit and providing a holding to K3. Thus, when CRTC contact opens, the holding circuit to K3 is broken. The K3 contacts 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 takes place, the CRTC contact closes, completing the energizing circuit to the reader magnet, starting the

reader operation again.

Stop Code Circuit — When a stop code 1-2-4-5-6 is read by the reader, the holding circuit for the K4 relay (read control relay) will be broken, thus de-energizing the reader magnet and stopping the reader operation. A normally closed contact on RC1, RC2, RC4, RC5 and RC6 completes the holding circuit through K4 - 8R and 9R to the K4 coil. If all five of the contacts (RC1, RC2, RC4 and RC6) were to open simultaneously, the K4 relay would drop out, opening contacts K4 - 11R and 12R, thus breaking the circuit to LRM. The start read switch (S7) would have to be depressed to start the reader operation again. (See Figure 3-7.)

When a code delete (1-2-3-4-5-6) is read in the reader, a normally open contact on RC3

maintains the holding circuit to K3.

A .25 mfd. capacitor is placed across the K4 (read control relay) to delay the drop-out time momentarily. This is necessary to insure that all six translator magnets and clutch magnet are energized before the K4 relay contacts transfer.

SEND AND RECEIVE CIRCUITS

The following circuits are used when the line switch S2 is placed in the "send" position on the "local" machine and the S2 switch on the "receive" machine is placed in the "receive" position.

Power Relay (K8) Circuit — The power relay in the "receive" machine is energized (due to the above position of the S2 switch). This relay, when energized, will condition the power circuit

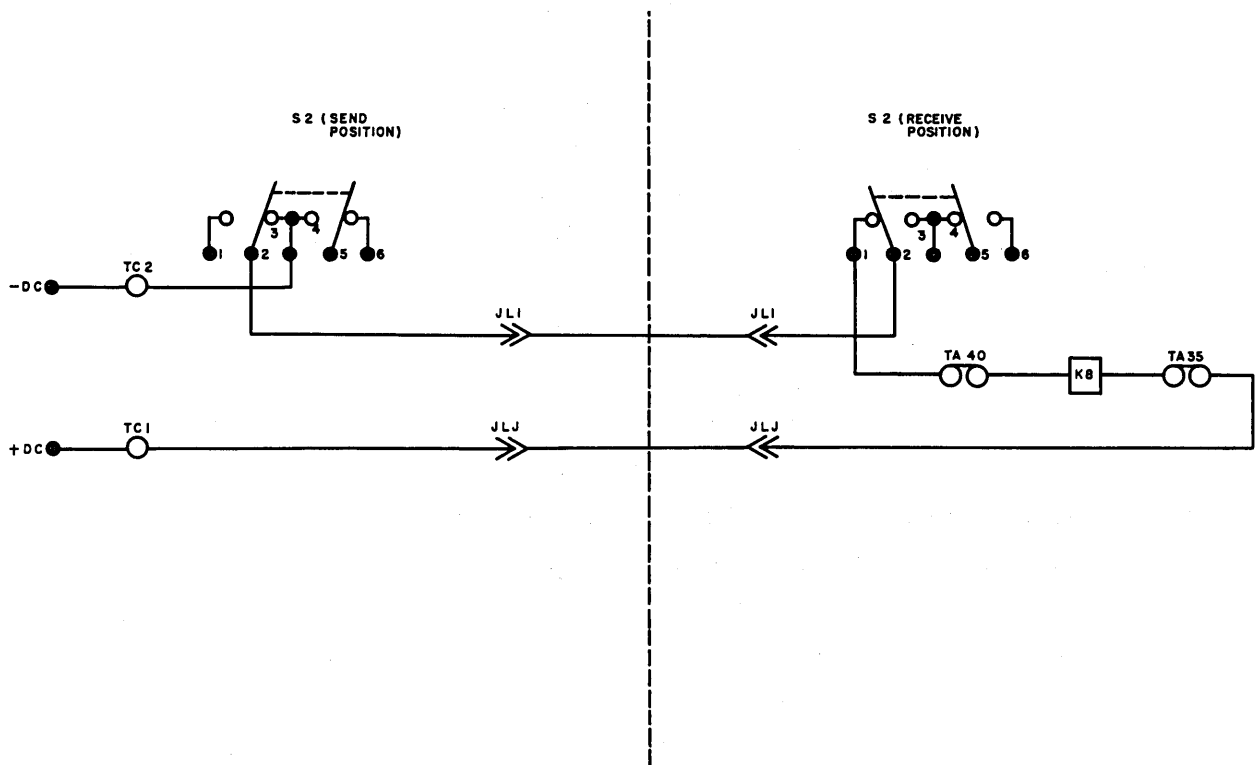


Figure 3-10 Power Relay (K8) Circuit

Circuit Description

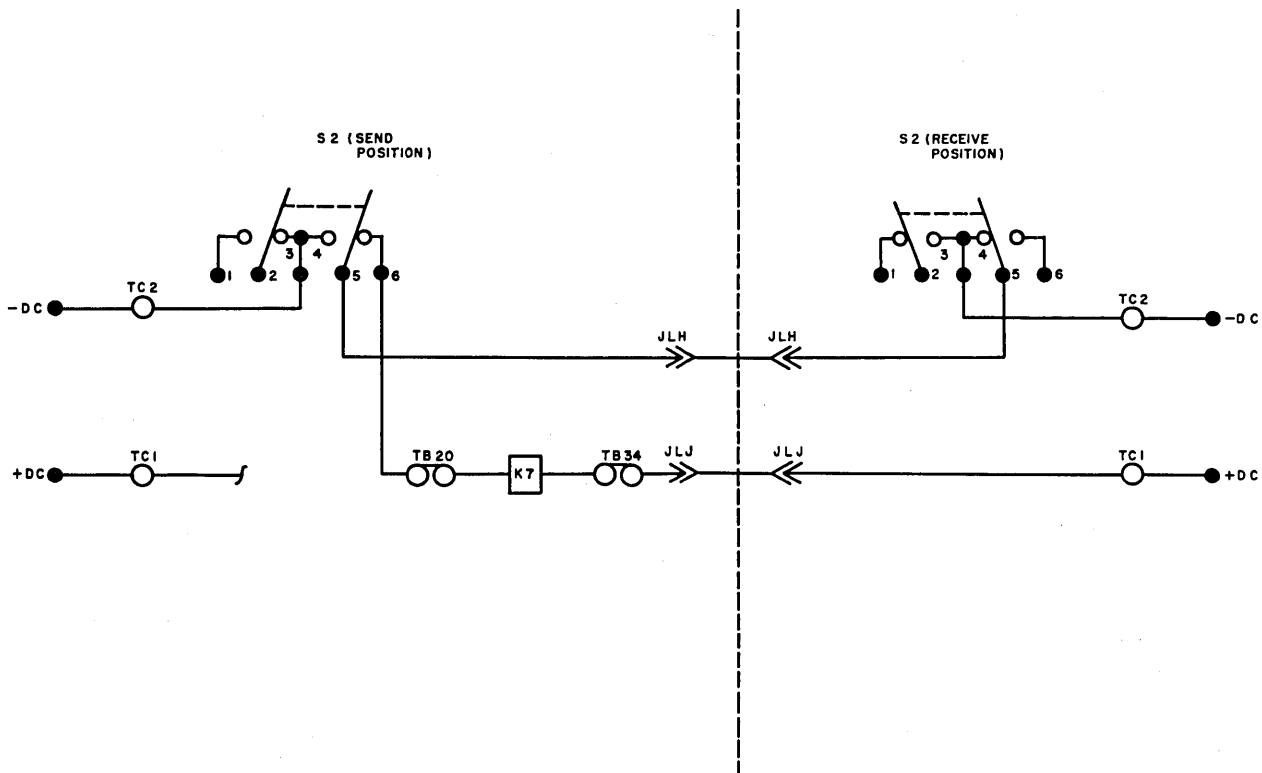


Figure 3-11 Send Relay (K7) Circuit

in the receive machine (see Power Circuit). Also, a circuit to the indicating light (I) will be made and the buzzer (LB) circuit will be broken.

The circuit to K8 is as follows: from -DC (Send) to TC2, S2 - 3 and 2, JLI (Send), JLI (Receive), S2 - 2 and 1, TA40, K8 coil TA35, JLJ (Receive), JLJ (Send), TC1, to +DC. (See Figure 3-10.)

Send Relay (K7) Circuit — The send (K7) relay, when energized, conditions the sending machine to transmit the electrical code impulses originating at the selector contacts to the receive machine.

The circuit to K7 is as follows: from -DC (Receive), TC2, S2 - 5 and 4, JLH (Receive), JLH (Send), S2 - 5 and 6, TB20, K7 coil, TB34, JLJ (Send), JLJ (Receive), TC1, to +DC. (See Figure 3-11.)

Indicating Light and Buzzer Circuits — In the

send machine, the indicating light will operate and the buzzer will not operate when the K7 relay is energized. This is due to K7 contact strap 8R breaking with 7R and making with 9R (See Figure 3-12.)

The indicating light will operate and the buzzer will not operate in the receive machine. This is due to the K8 relay being energized, making contact straps 3L and 4L and breaking straps 1L and 2L (See Figure 3-12.)

Send and Receive Signal Circuit — The electrical impulses originating at the selector contacts (on the send machine) are transmitted to the corresponding translator magnets in the receive machine. These translator magnets are therefore energized causing a character or functional operation.

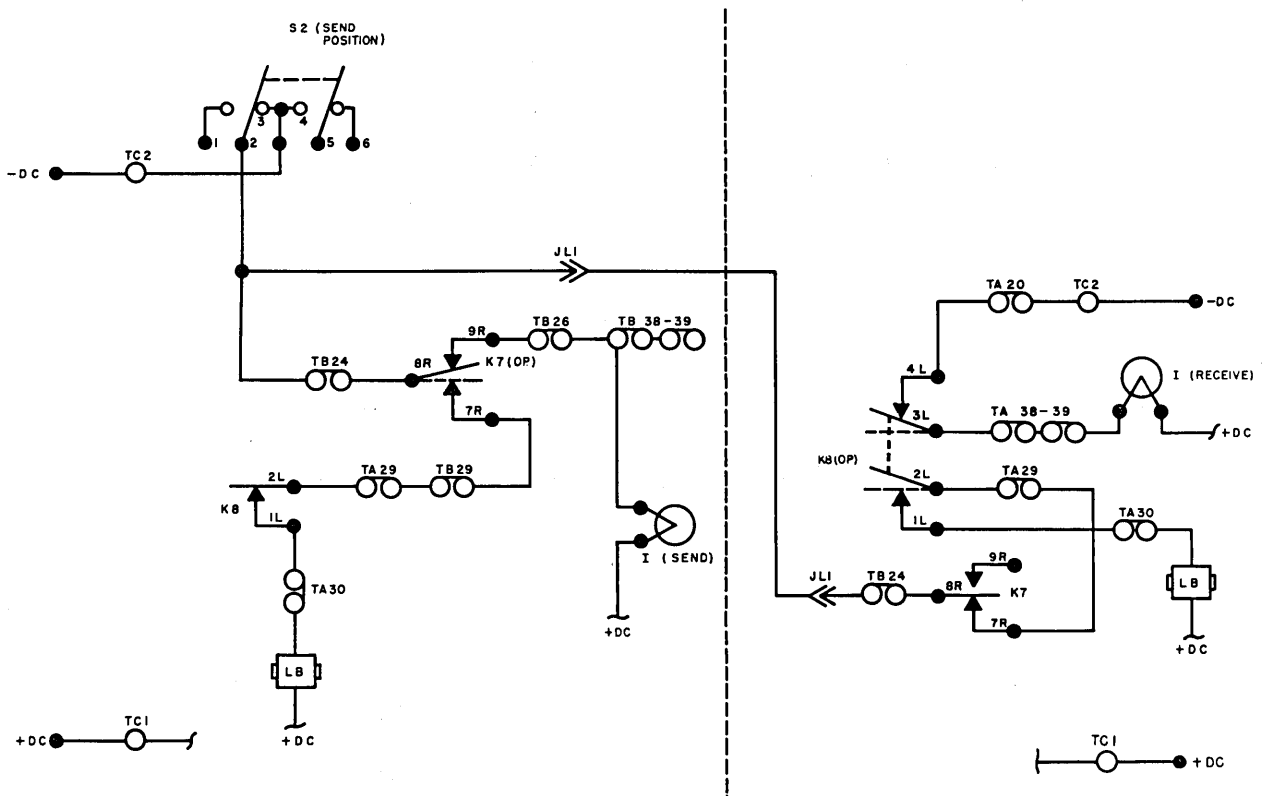


Figure 3-12 Indicating Light & Buzzer Circuits

For an example operation, assume that the "E" keylever was depressed in the send machine. This would close the SC1 contact (on code selector), completing a DC circuit to the LT1 translator magnet in the receive machine as follows: from -DC (Receive), TC2, S2 - 4 and 5 (Receive), JLH (Receive), JLH (Send), S2 - 5 and 6 (Send), TB20, K7 - 12R and 11R, TB37, SCC, TA24, K2 - 2L and 1L, TA9 and 10, SC1, TB3, K7 - 3L and 2L, TB1, JLA (Send), JLA (Receive), TB1, K7 - 2L and 1L, TB2, TA2, K4 - 1L and 2L, TA1, JTA1, LT1, JTA5, TC1, to +DC (Receive).

The same code pulse which energized the LT1 translator magnet is also used to energize the translator clutch magnet (LTC). A blocking rectifier (CR2) is used to prevent the code pulse

from energizing the other five translator magnets (a blocking rectifier is used in each of the six code pulse circuits).

The suppressors (CR3), shown across the magnets in Figure 3-13, prevent excessive arc-in of the selector common contacts (SCC) in the send machine when a multiple circuit is used.

The result of the above example operation will be the printing of the character "E" on the receive machine. It is also possible, with this type of machine (Model FTM Recorder-Reproducer Transmitter-Receiver), to turn on the S3 (Punch On) switch in both machines and punch the character "E" code (1) in the punch tapes. This circuit is described on page 3-2, Punch Magnet Circuit. It should be noted however, the DC supply is from the receive machine. This

Circuit Description

is due to the K7 relay being energized, thus having the K7 - 11R contact strap making with K7 - 12R strap.

Automatic Send and Receive Signal Circuits -
When reproducing copy in a local machine, it is

possible to transmit this information to a remote machine at the same time. The circuits involved in this arrangement are the same as explained for "Reproducing Circuits" on page 3-5 combined with "Send and Receive Circuits" on page 3-9 .

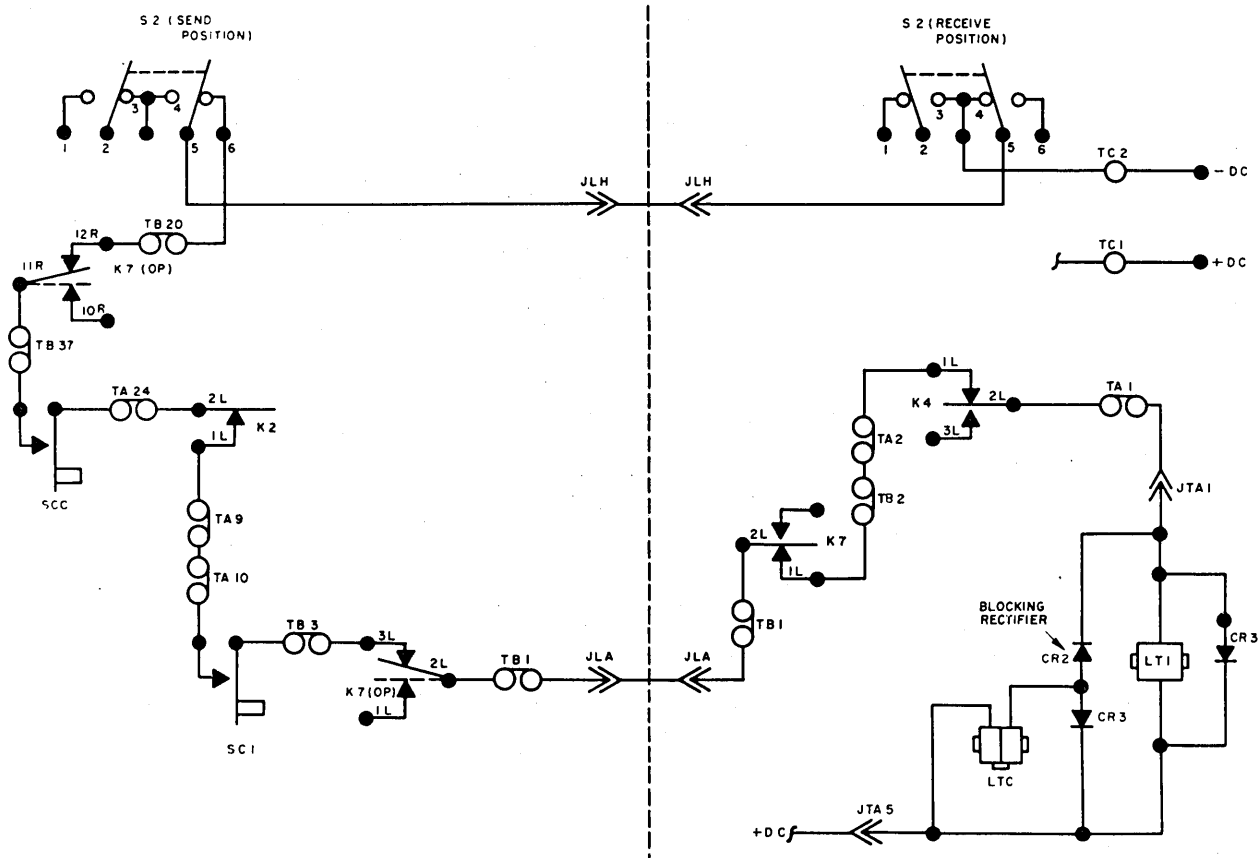


Figure 3-13 Send & Receive Signal Circuit

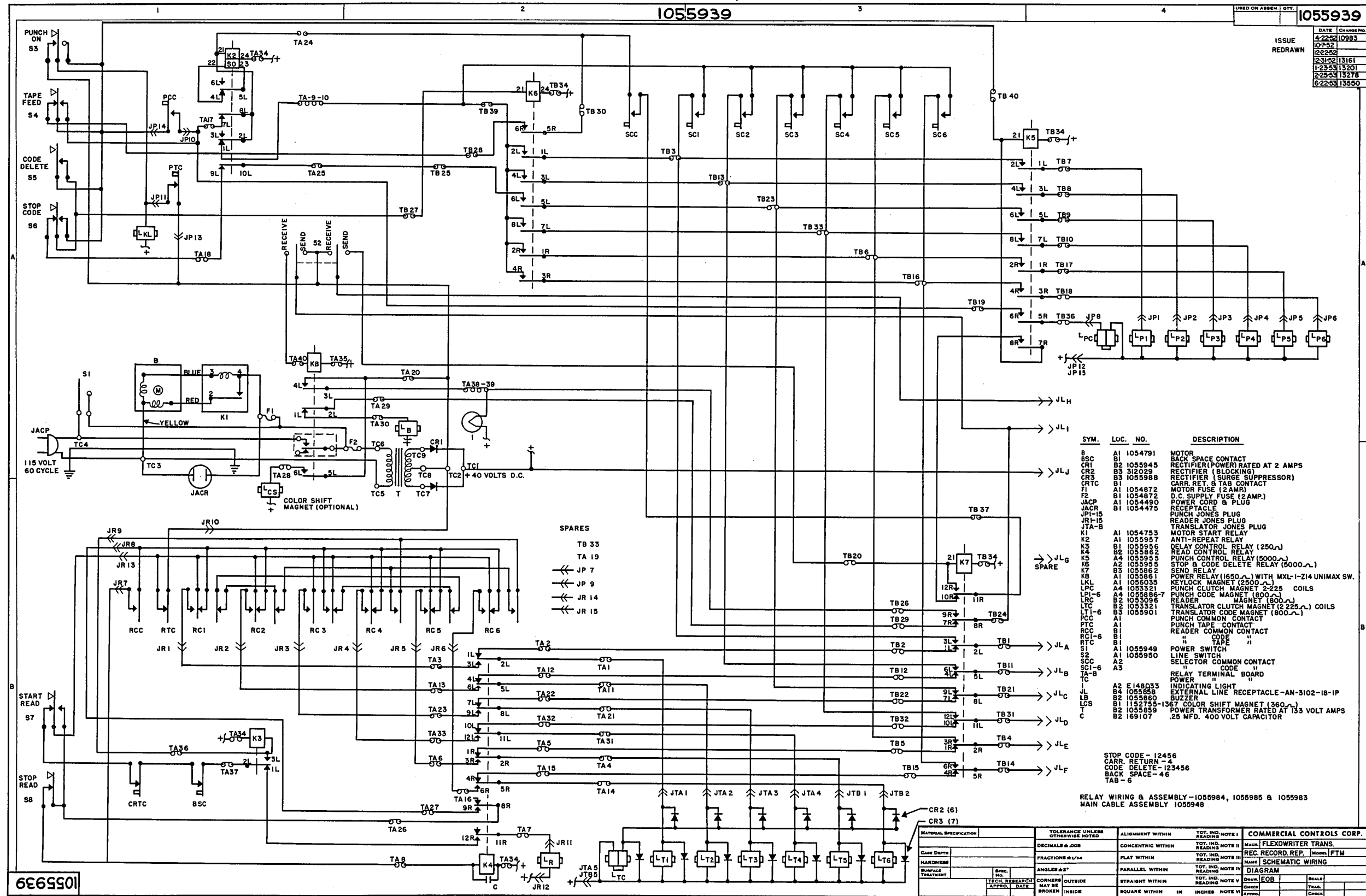


Figure 3-14 Model FTM - Recorder Reproducer - Transmitter Receiver Wiring Diagram

PART VI

FLEXOWRITER MODEL FPC

Section 1	Description
Section 2	Maintenance
Section 3 . Non Programatic - Circuit Description FPC-8	
Section 4 . Programatic-Circuit Description FPC5-4 Bank	
Section 5 . Programatic-Circuit Description FPC8. (S.C.)	

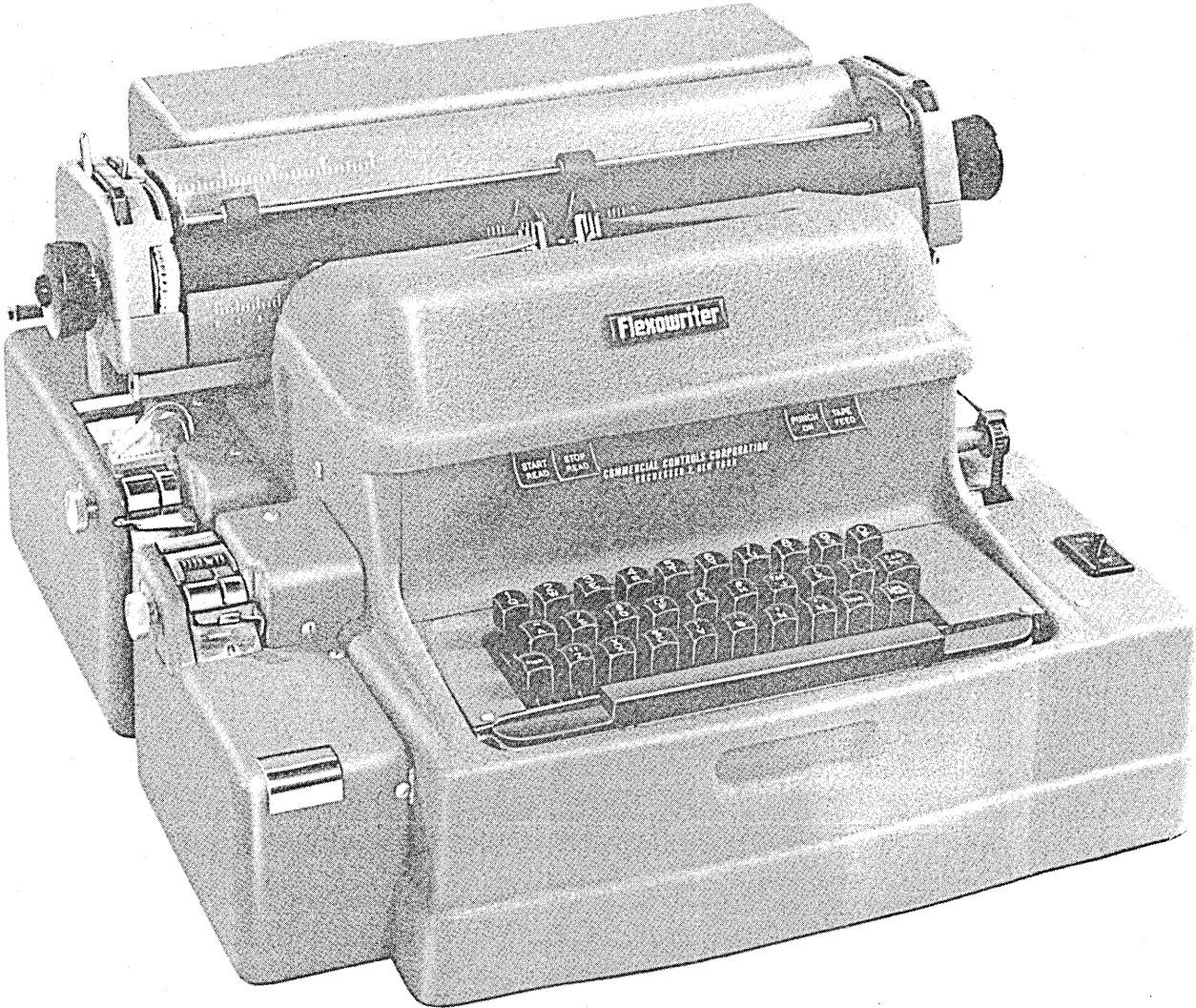


Figure 1-1 FPC-5, Non Programatic, 3 Bank, D.C.

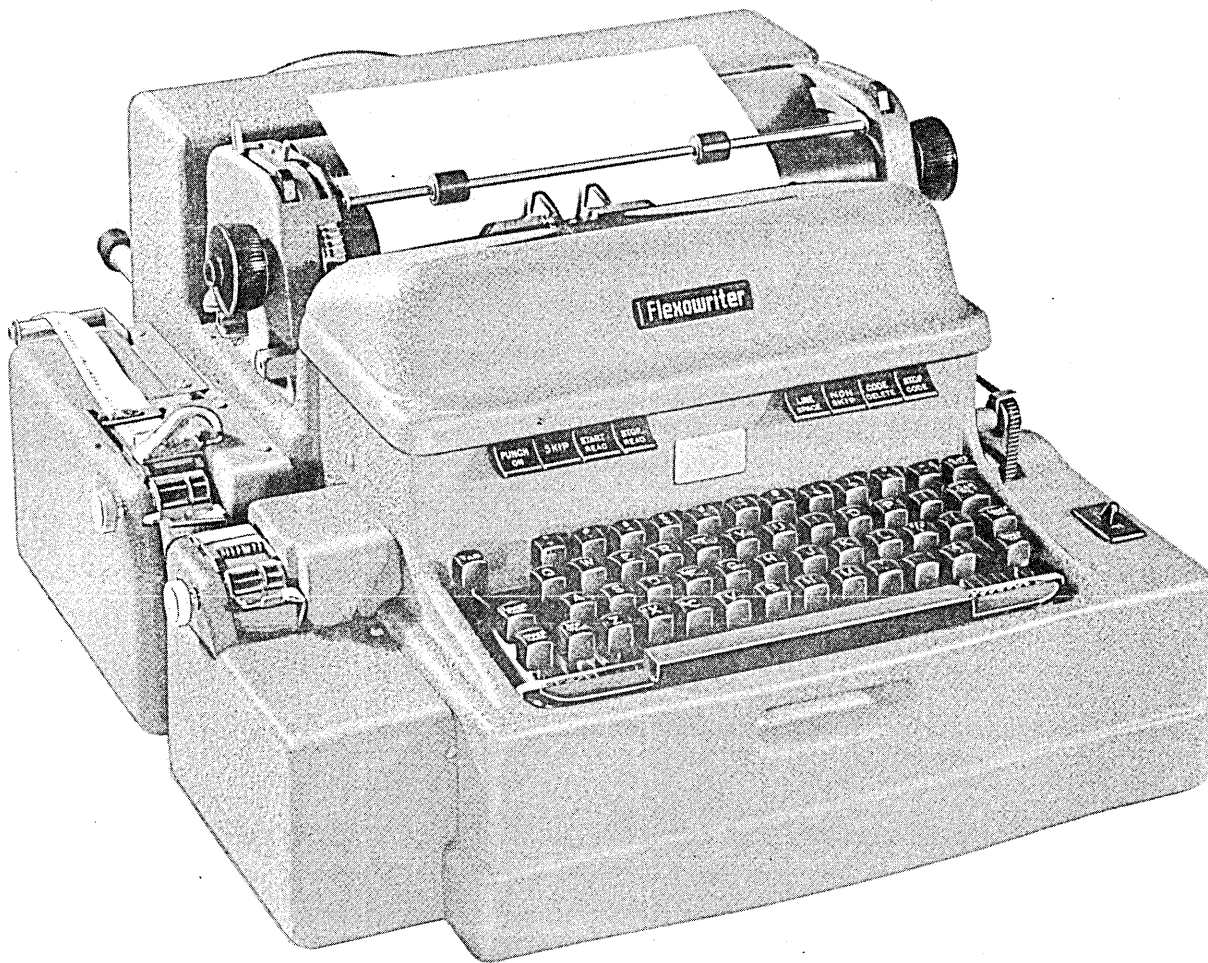


Figure 1-2 FPC-8, Non Programatic, 4 Bank, S.C.

PURPOSE

The Flexowriter Model FPC was designed to prepare tape to punch tabulating cards automatically as a by-product of document writing.

There are two Model FPC Flexowriters, namely: Model FPC5 and Model FPC8.

(Figures 1-1 & 1-2.)

The Model FPC5 was designed to

punch a five unit binary code in a tape eleven-sixteenths of an inch in width. This tape is used to actuate a card punch machine for automatically punching tabulating cards. This tape may also be used for wire transmission purposes, because the codes are assigned to the same manner to all letters, figures and typing functions as they are in the Flexowriter Model FC (see Part III).

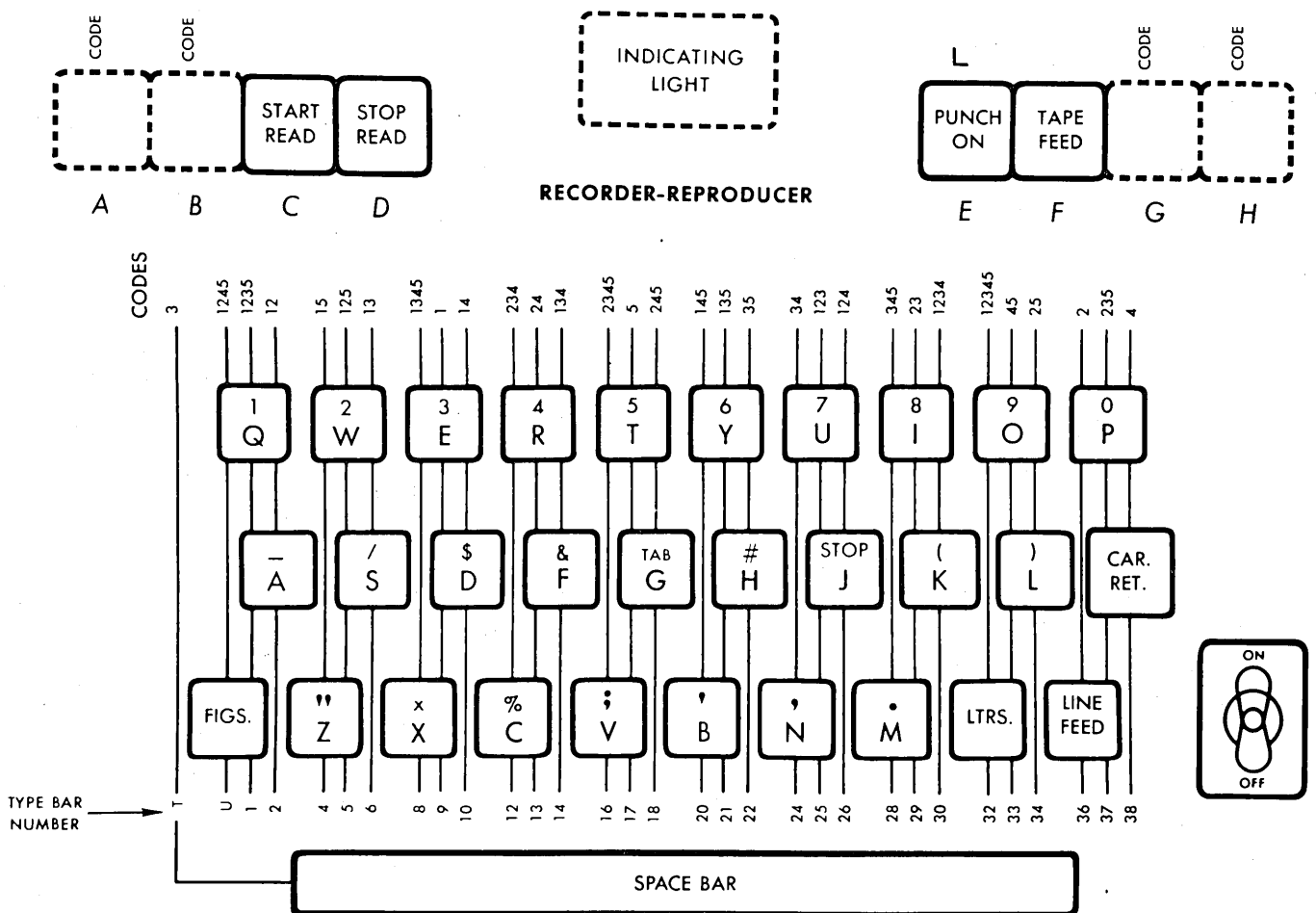


Figure 1-3 Keyboard Chart - Model FPC5

The Model FPC8 was designed to punch an eight unit binary code in a tape one inch in width. This tape is used to actuate a tape controlled card punch for automatically punching tabulating cards.

The above machines are available in three combinations, namely: Recorder, Reproducer or Recorder-Reproducer. (See Part I, Section 2, Flexowriter Combinations.)

BASIC FUNCTIONAL PRINCIPLES

The operation of a keylever in the Model FPC has the same operational results as described in Part II, Section 1. The major differences between the two Model FPC machines are as follows:

MODEL FPC5

This model is the same as the Model FC described in Part III except for the following: The number fourteenkeylever position (Figures) is used for a card eject code on the older Model FPC5's. (The new style keyboard for the Model FPC5 is shown in Figure 1-3.) Thus, the F key in figures position will punch a code in the tape which will cause the card ejection in the card punch machine, but will not return the carriage on the Flexowriter. This arrangement is necessary because it may require two or more lines of typing on the Flexowriter to complete one tabulating card, therefore, it is not always desired to eject a card at each carriage return.

The "letters" shift key, besides its

normal function of shifting the type basket to the letters position, is used also as a code delete key on the Model FPC5. As on nearly all Flexowriters, the delete code consists of a hole punched in every code position, therefore, because of the limited number of code combinations (five unit code-32 combinations), the letters shift code is the code having all five code positions punched.

When using the letters shift key for deleting an error, it is important to remember that the LTRS key always returns the type basket to LTRS position. Therefore, when deleting figures or special characters, the basket should be shifted back to Figs position to continue typing.

The number eighteenkeylever position (Figures) is normally used for tab operation on the Model FPC-5. (See Part I, Section 5, Special Features, pp. 5-19.) Therefore, if numerical information is being typed, it is necessary after deleting a code to depress the figures key.

MODEL FPC8

There are two keyboard arrangements available in this model, single and double case. Both are used to produce a paper tape as a by-product of typing and this tape is used to automatically operate a card punch machine.

SINGLE CASE MACHINE

The keyboard chart for the single case machine is shown in Figure 1-4. The A-Z characters and 0-9 numerals

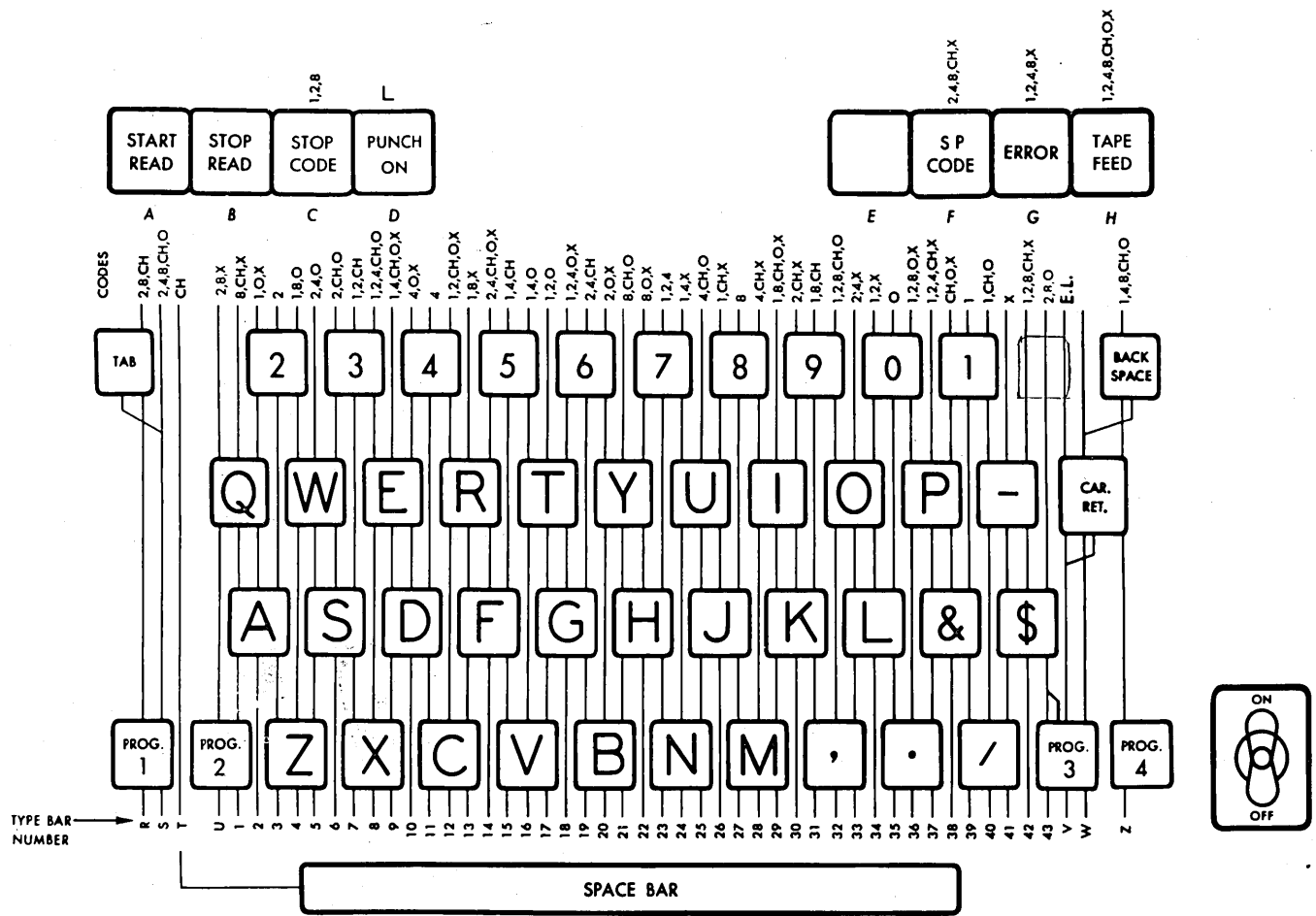


Figure 1-4 Keyboard Chart - Model FPC8 - S.C.

are arranged as on any standard keyboard. Depression of a keylever prints a character on a document and simultaneously punches a corresponding code into the tape. On this particular keyboard, characters are capital letters only.

Six key positions (Positions 32, 36, 38, 40, 41, and 42) are used for printing, punctuation and special characters. The period, comma, diagonal, ampersand, dollar, and dash are standard; however, these characters may be substituted with others

depending upon application requirement.

The carriage return, tab and space key positions all perform their respective functional operations of the writing machine, plus punching a corresponding code in the tape. Backspace is an uncoded function.

PROGRAM CODES

Four key positions (R, U, 43 and Z) are primarily to punch a code in the tape for the purpose of automatically controlling the card punch machine. These keylever operations do not cause any functional or

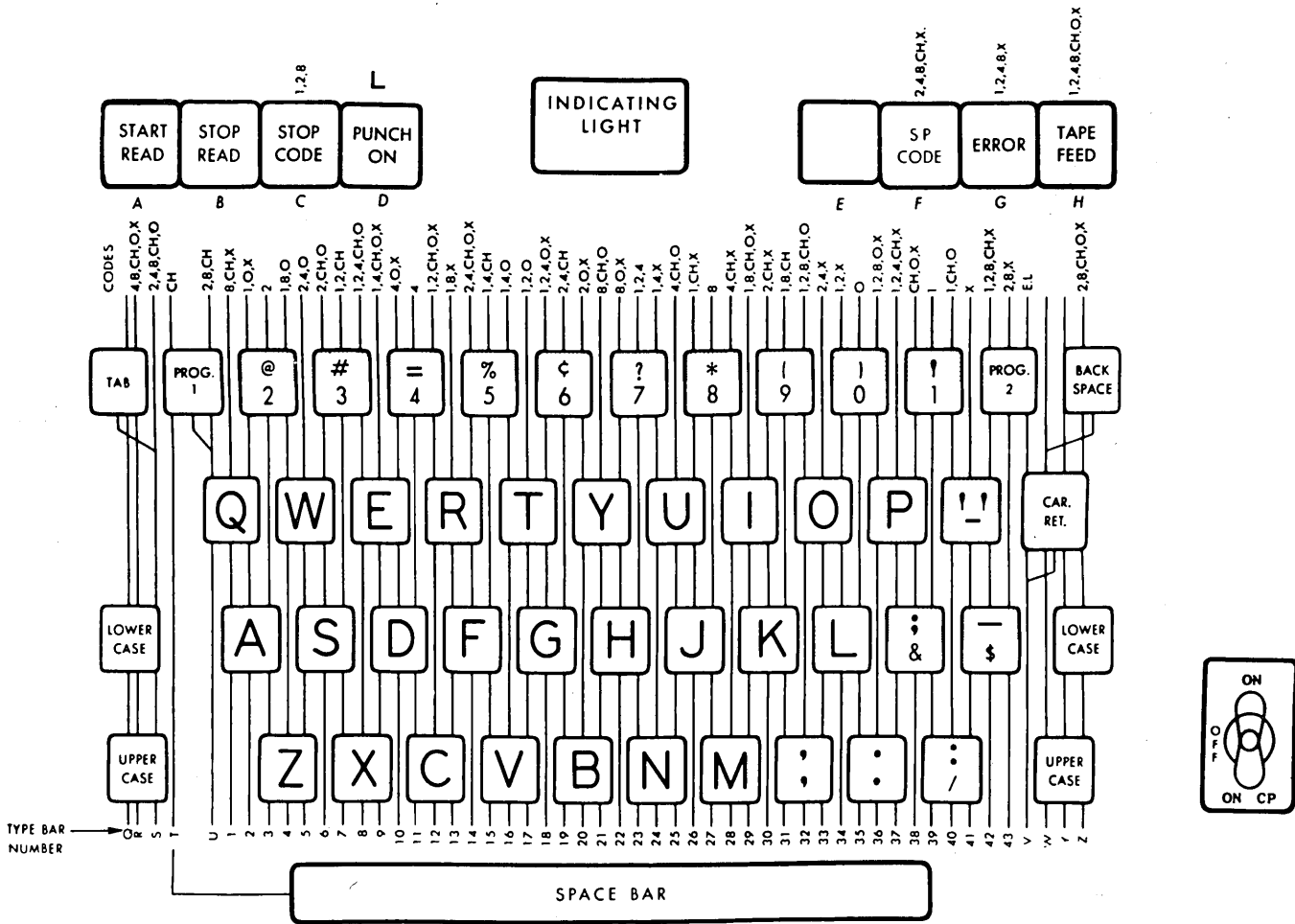


Figure 1-5 Keyboard Chart - Model FPC8 - D.C.

character operation of the writing machine.

There are seven switches located on the control panel, one of which (S P code) is used for card punch control codes.

Error Code - This switch, when depressed, will punch a code in the tape for the purpose of conditioning the card punch machine to ignore the card codes.

Start and Stop Read - The start and stop read switches on the control panel are used to control the tape reader operation.

The Punch On, Tape Feed and Stop Code switches are used for controlling punch operation.

DOUBLE CASE MACHINE

The keyboard chart for the Model FPC8 double case machine is shown in Figure 1-5. The A-Z characters and 0-9 numerals are arranged as on any standard keyboard.

Various signs and symbols may be used in the upper case position on keys

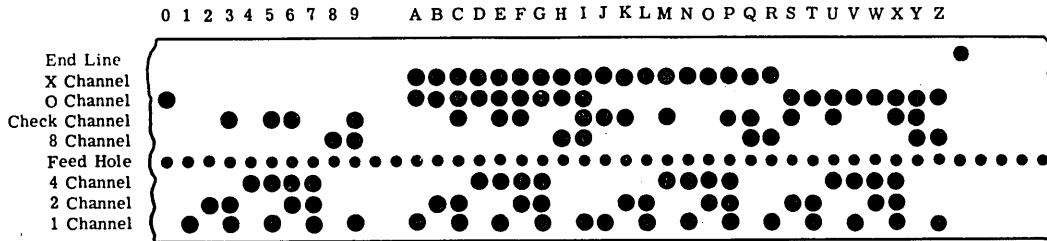


Figure 1-7 Standard Character Codes

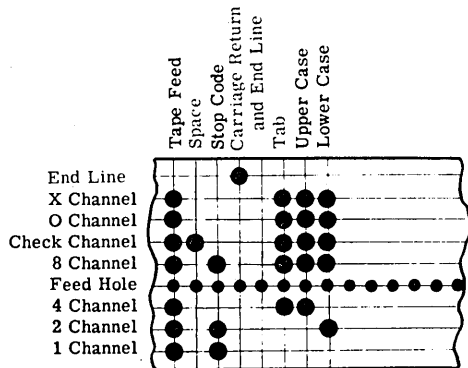


Figure 1-8 Punctuation and Special Character Codes

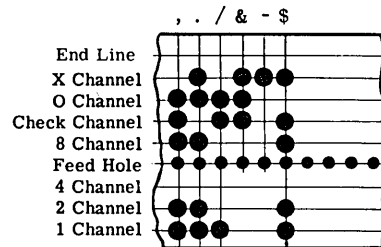


Figure 1-9 Control Codes - Flexowriter Operation

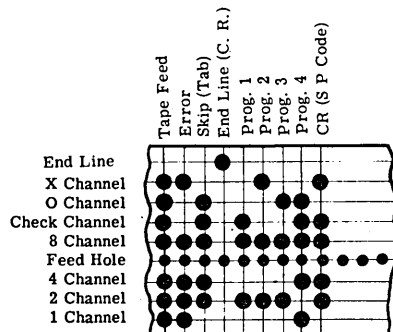


Figure 1-10 Control Codes - Card Punch

card punch. Note the coding arrangement used for the standard character codes as shown in Figures 1-4, 1-5, & 1-7. This is a simplified arrangement designed for ease of reading codes in tape or cards. The numerals, for example, use those particular channels whose sum equal the numeral value, i.e., the code for numeral 7 is 1, 2, 4.

The check channel is automatically punched in the tape with an even number of code bits, i.e., the code for numeral 9 is 1, 8, therefore, the check channel is added to make this an odd code (it is necessary to

have odd codes for proper operation of the card punch machine). The alphabet codes are arranged in the same manner as the numerals, except the O, X channels are used to distinguish between the first 9 letters and the next 9, etc. For example, the first letter of the alphabet is A, which has a code of 1, O, X. The second letter of the alphabet is B, which has a code of 2, O, X. The tenth letter is J and in this case the code is 1, Ch, (the 1, X code would be an even number, therefore, the check channel is used).

MAINTENANCE OF UNITS

The Model FPC machines (Recorder-Reproducers) consist of five major units, namely: writing machine, code selector, tape punch, tape reader and code translator. These units are all basically the same as the units described in Part II, Sections 2 through 7 with addendums. Therefore, the maintenance procedures and adjustments will be the same for each, with the exception of the following:

WRITING MACHINE

Model FPC5 - This Model is the same

as the Model FC (Part III) except for key-lever position 14. This key position, when the basket is in figures position, is designated as the card eject key.

Model FPC8 - The single case machine does not use a shift mechanism. Key positions R and Z are used for code punching operation only (Program 1 code and Program 4 code). The Program 4 code punching mechanism is shown in Figure 2-1.

The Program 3 keylever (Program 2 - Double Case) is shown in Figure 2-2. The

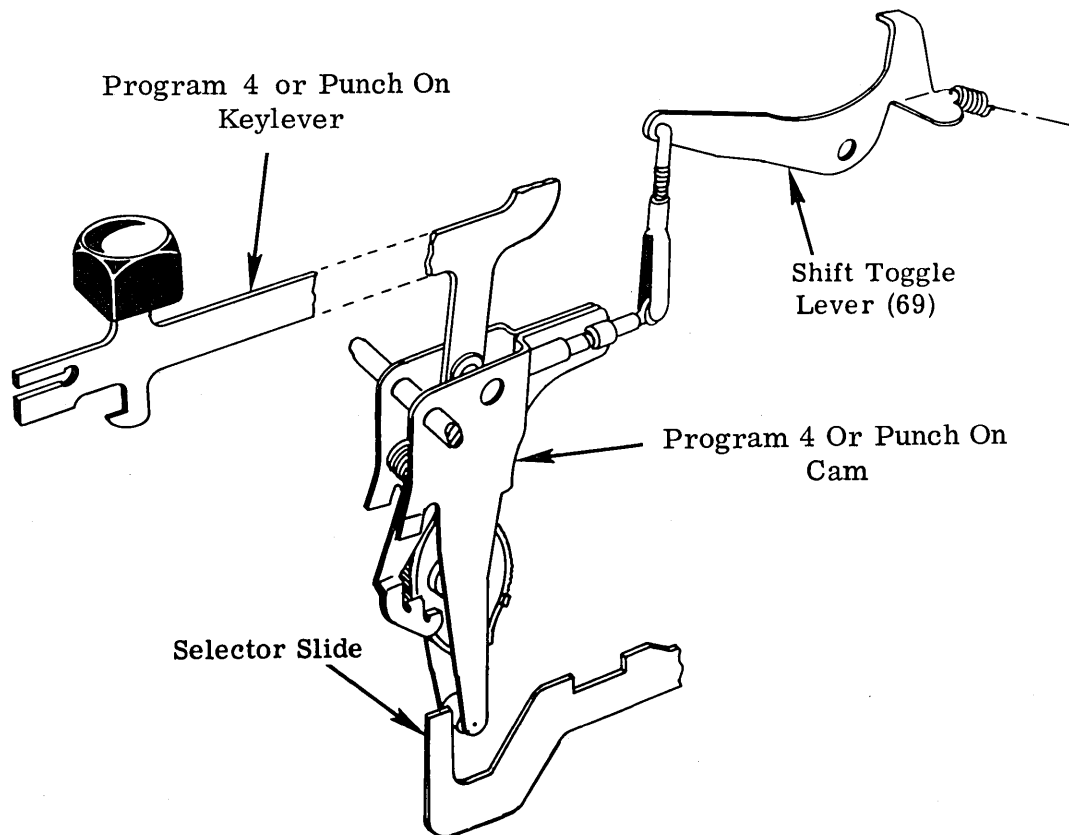


Figure 2-1 Program 4 Code Punching Mechanism

keylever, cam and bellcrank function in the same manner as in standard operation. Notice, however, the type bar and toggle assembly is not used. Also, a spring is attached to the upper leg of the bell-crank for the purpose of loading the cam for good positive operation.

The Program 2 keylever (Program 1 - Double Case) mechanism is shown in Figure 2 - 3. Note that the bellcrank for the "U" position has two pivot holes for the cam

to bellcrank connecting link. Note also, this link being in this position will not allow enough movement of the typebar to release the escapement mechanism.

All of the Model FPC writing machine component adjustments and maintenance procedures may be found in Part II, Section 2.

CODE SELECTOR

The code selectors for the Model FPC machines are basically the same as the

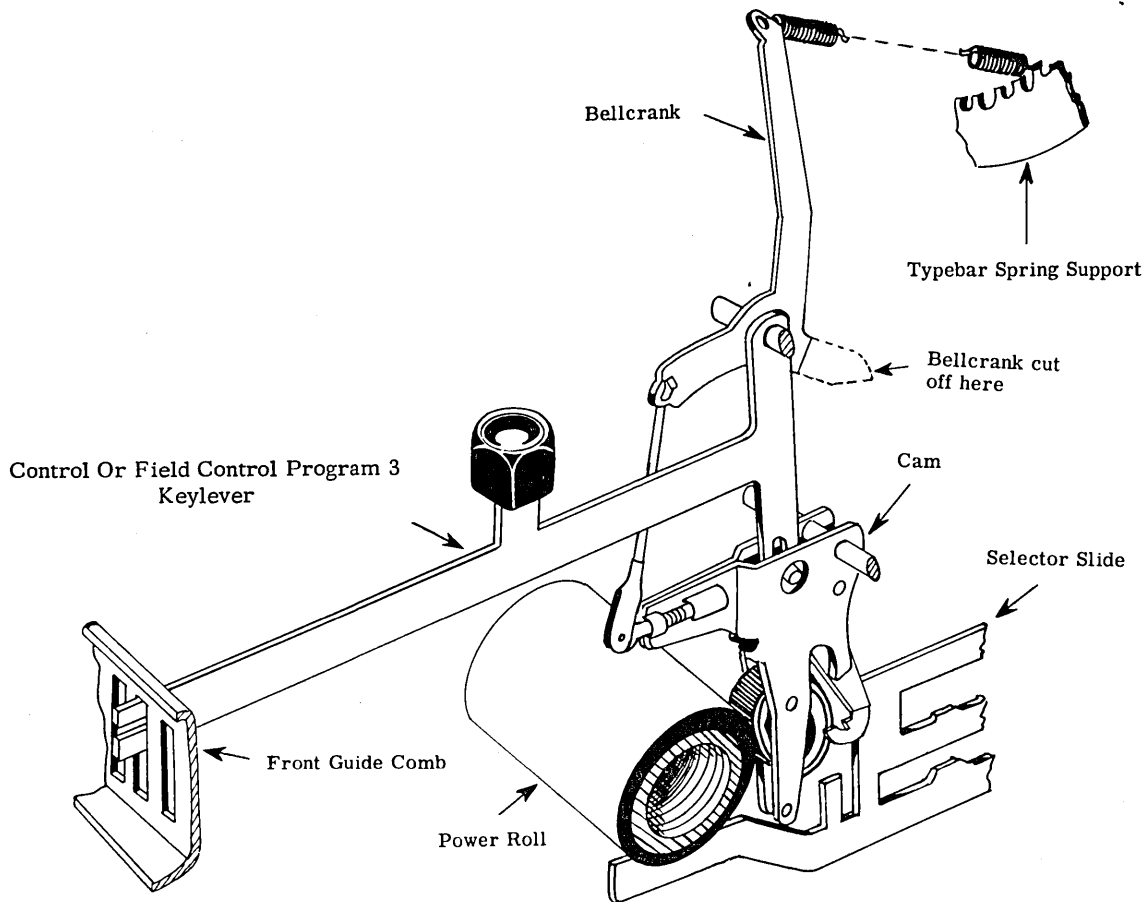


Figure 2-2 Program 3 Code Punching Mechanism

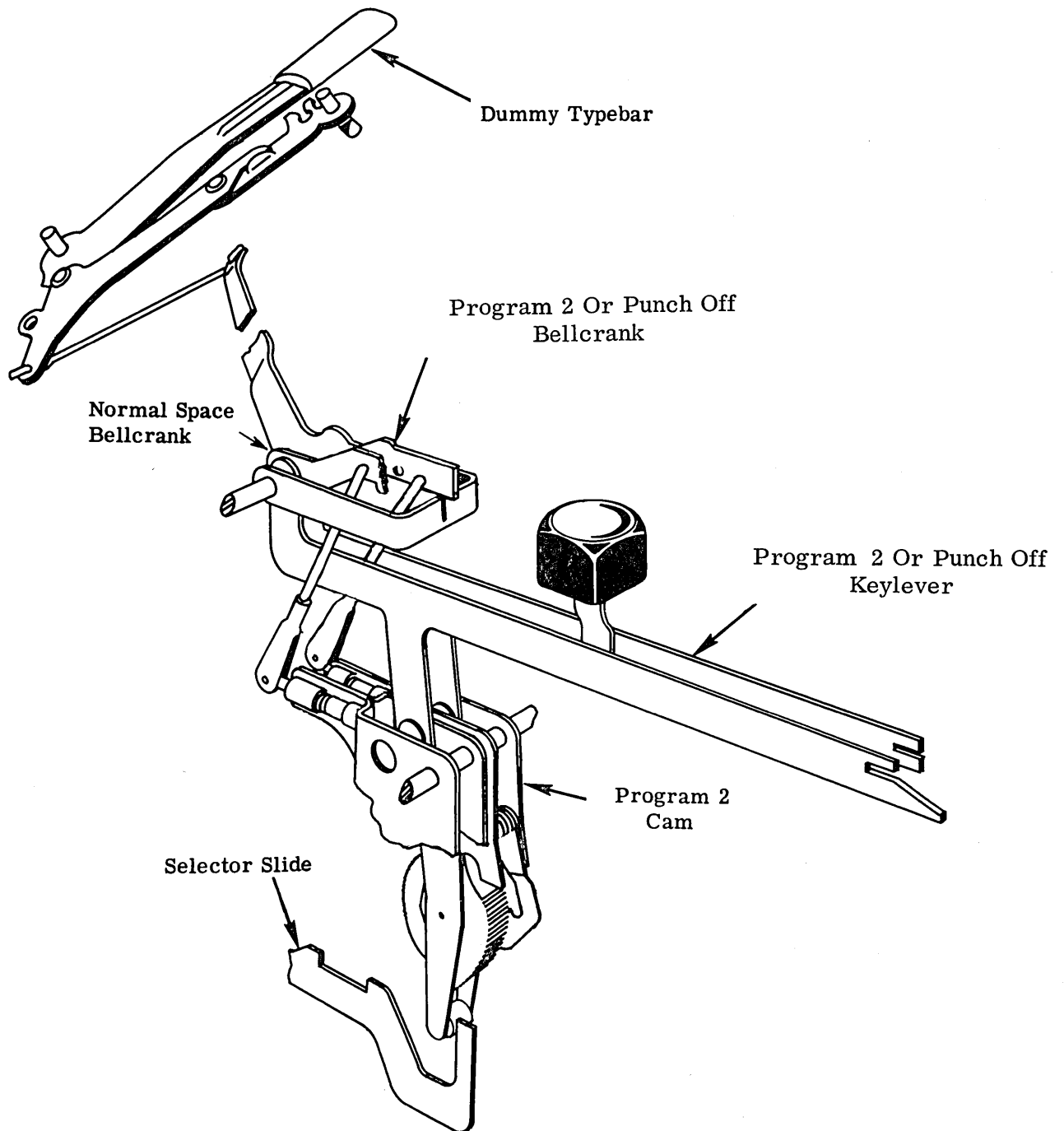


Figure 2-3 Program 2 Code Punching Mechanism

Maintenance

FRONT SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
1	1G	8-9 C-3-4-5	4-8-CH-0-X
3	3C	C-5	CH
5	25C	C-2-4-5	2-8-CH
7	31D	8-9 C-1	1-0-X
9	17G	8- C-1-4	1-8-0
11	33G	8 C-2-5	2-CH-0
13	37D	8 C-1-2-3-5	1-2-4-CH-0
15	33C	8-9 C-3	4-0-X
17	17H	8-9 C-1-2-5	1-2-CH-0-X
19	19G	8-9 C-2-3-5	2-4-CH-0-X
21	21E	8 C-1-3	1-4-0
23	23E	8-9 C-1-2-3	1-2-4-0-X
25	35C	8-9 C-2	2-0-X
27	27G	8-9 C-4	8-0-X
29	23C	9 C-1-3	1-4-X
31	15D	9 C-1-5	1-CH-X
33	33H	9 C-3-5	4-CH-X
35	19D	9 C-2-5	2-CH-X
37	37K	8 C-1-2-4-5	1-2-8-CH-0
39	39G	9 C-1-2	1-2-X
41	51C	8-9 C-1-2-4	1-2-8-0-X
43	35G	7-8-9 5	CH-0-X
45	45L	7-8 1-5	1-CH-0
47	47D	7-9 1-2-4-5	1-2-8-CH-X
49	21C	10 C	E.L.
51	13E	8-9 C-2-4-5	2-8-CH-0-X

REAR SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
2	10F	8 C-2-3-4-5	2-4-8-CH-0
4		Dummy	
6	8B	9 C-4-5	8-CH-X
8	8G	7 2	2
10	10E	8 C-2-3	2-4-0
12	44D	7 1-2-5	1-2-CH
14	14H	8-9 C-1-3-5	1-4-CH-0-X
16	16F	7 3	4
18	18G	9 C-1-4	1-8-X
20	28D	7 1-3-5	1-4-CH
22	34C	8 C-1-2	1-2-0
24	26E	7 2-3-5	2-4-CH
26	46D	8 C-4-5	8-CH-0
28	40F	7 1-2-3	1-2-4
30	30D	8 C-3-5	4-CH-0
32	32J	7 4	8
34	34G	8-9 C-1-4-5	1-8-CH-0-X
36	36H	7 1-4-5	1-8-CH
38	24J	9 C-2-3	2-4-X
40	40H	7-8	0
42	42H	9 C-1-2-3-5	1-2-4-CH-X
44	14E	7 1	1
46	34E	7-9 C-2-3-4	X
48	34K	9 C-2-4	2-8-X
50		DUMMY	

Figure 2-4 Selector Coding Model FPC8 - D.C.

selector explained in Part II, Section 3 with the exception of the selector slide coding and contact adjustment. The selector slide coding for the two FPC8 machines are shown in Figure 2 - 4 and 2 - 5.

Selector Slide and SCC Contact Adjustment. The selector slides and selector contacts are adjusted to give a satisfactory pulse to the code and clutch magnets, but when adjusting, it should be remembered that too long a make time of the SCC will cause the punch error relay to pick up, thus locking the keyboard.

1. Adjust the SCC to .050", plus .008", minus .002". The normal or start setting should be .050". If any keylever fails to punch, the selector slide must be brought closer to (but not choke off) the cam. If the keylever still fails to punch, the SCC is to be closed but not below the minimum of .048".

2. Any selector slides that cause the punch error relay to pick up must be adjusted away from the cam.

3. If it was not necessary to bring SCC closer than .050", and many slides tend to operate the punch error relay, the SCC should be opened toward its maximum of .058".

The adjustment of SCC between a minimum of .048" and a maximum of .058" should eliminate as much individual slide adjustment as possible.

TAPE PUNCH

The tape punch for the Model FPC

machines have the same description and sequence of operation as the Model II punch explained in Part II, Section 5, with addendums. However, the Model FPC5 uses a five code unit punch and the Model FPC8 uses an eight code unit punch. Also, the PLC contacts are a break-before make and should be adjusted to have a .005" to .010" follow on the make contact.

TAPE READER

The operation, description and maintenance of the Model FPC tape readers are basically the same as the reader described in Part II, Section 6 with the exception of the following:

Model FPC5 - Same as tape reader in Part III, Section 2.

Model FPC8 - The contact stack-up arrangement on the single and double case machines is as follows:

- RC1 - 1 break (1B), 1 transfer (1C)
- RC2 - 1 make 1 transfer (1A, 1C)
- RC3 - 3 make (3A)
- RC4 - 1 make, 1 transfer (1A, 1C)
- RC5 - 1 make (1A)
- RC6 - 3 make (3A)
- RC7 - 1 break, 2 make (1B, 2A)
- RC8 - 2 make (2A)

The contact adjustment for the Model FPC8 readers is as follows:

1. Place a piece of blank tape in the reader. Rotate the cam shaft until the pins touch the bottom of the tape. Adjust all normally open contact points to a gap of .020" to .025".

Maintenance

FRONT SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
1	25C	C-2-4-5	2-8-CH
3	3C	C5	CH
5	23D	9 C-2-4	2-8-X
7	31D	8-9 C-1	1-0-X
9	17G	8 C-1-4	1-8-0
11	33G	8 C-2-5	2-CH-0
13	37D	8 C-1-2-3-5	1-2-4-CH-0
15	33C	8-9 C-3	4-0-X
17	17H	8-9 C-1-2-5	1-2-CH-0-X
19	19G	8-9 C-2-3-5	2-4-CH-0-X
21	21E	8 C-1-3	1-4-0
23	23E	8-9 C-1-2-3	1-2-4-0-X
25	35C	8-9 C-2	2-0-X
27	27G	8-9 C-4	8-0-X
29	23C	9 C-1-3	1-4-X
31	15D	9 C-1-5	1-CH-X
33	33H	9 C-3-5	4-CH-X
35	19D	9 C-2-5	2-CH-X
37	37K	8 C-1-2-4-5	1-2-8-CH-0
39	39G	9 C-1-2	1-2-X
41	51C	8-9 C-1-2-4	1-2-8-0-X
43	43L	8-9 C-5	CH-0-X
45	15F	8 C-1-5	1-CH-0
47	51H	9 C-1-2-4-5	1-2-8-CH-X
49	21C	10 C	E.L.
51	41D	8 C-1-3-4-5	1-4-8-CH-0

REAR SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
2	10F	8 C-2-3-4-5	2-4-8-CH-0
4		Dummy	
6	8B	9 C-4-5	8-CH-X
8	22F	C-2	2
10	10E	8 C-2-3	2-4-0
12	38C	C-1-2-5	1-2-CH
14	14H	8-9 C-1-3-5	1-4-CH-0-X
16	28A	C-3	4
18	18G	9 C-1-4	1-8-X
20	48D	C-1-3-5	1-4-CH
22	34C	8 C-1-2	1-2-0
24	32F	C-2-3-5	2-4-CH
26	46D	8 C-4-5	8-CH-0
28	28H	C-1-2-3	1-2-4
30	30D	8 C-3-5	4-CH-0
32	14D	C-4	8
34	34G	8-9 C-1-4-5	1-8-CH-0-X
36	36F	C-1-4-5	1-8-CH
38	24J	9 C-2-3	2-4-X
40	48E	8 C	0
42	42H	9 C-1-2-3-5	1-2-4-CH-X
44	18D	C-1	1
46	30E	9 C	X
48	42E	8 C-2-4	2-8-0
50		Dummy	

Figure 2-5 Selector Coding Model FPC8 - S.C.

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

3. Adjust the reader common contact (RCC) to close at approximately the same time as the code contacts. This is accomplished by allowing the pins to move up slowly and at the point of closing of the make contacts, adjust the common contact to close also.

4. Adjust the reader tape contact

(RTC) to a gap of .020" to .025".

5. Check to see that the two contact points on each strap engage their mating contact points simultaneously.

CODE TRANSLATOR

The Model FPC code translator is basically the same as the translator described in Part II, Section 7, except for the permutation bar coding arrangement. Figure 2-6 shows the coding arrangement for a Model FPC8 D.C. translator.

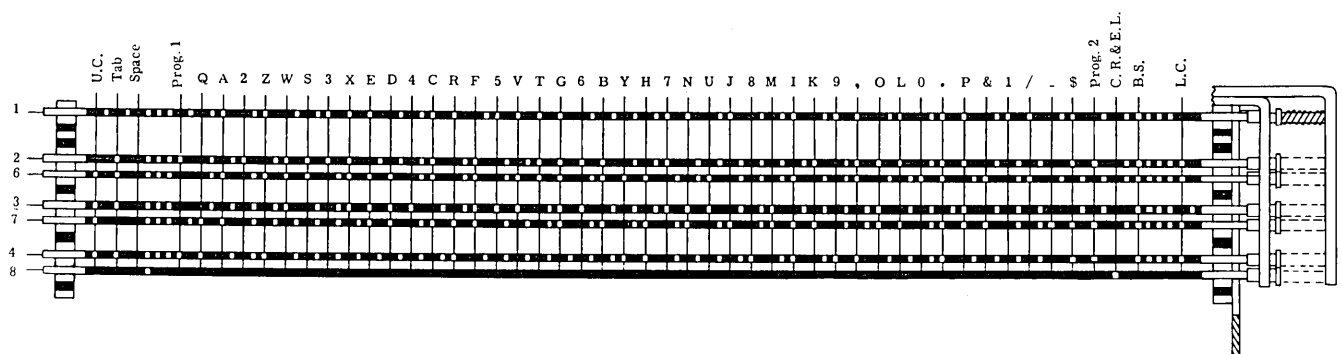


Figure 2-6 Translator Coding

CIRCUIT DESCRIPTION

The following circuit description is for the Model FPC-8 (Double Case). The Model FPC-5 uses the same wiring diagram as the Model FC (Part III, Section 3). The Model FPC-8 (Single Case) is essentially the same as the Model FPC-8 Double Case machine.

The wiring diagram used in this description is for the Model FPC-8 1041201 (shown in Figure 3 - 1 Part VI).

The Power Circuits for both Model FPC machines are the same as explained in Part II, Section 8, Page 8 - 5.

PUNCH CIRCUITS

Key Lock Magnet Circuit - The key lock magnet (LKL) is controlled by the punch tape contact (PTC) when the punch on Switch (S6) is in the ON position as is the case in other machines. Thus, if the PTC contact should open the keyboard would lock, even though negative input to the punch would not be broken.

Punch Checking Circuit - To prevent the possibility of obtaining a typed character without its corresponding code being punched in the tape a punch checking circuit is used. This circuit causes the keyboard to become locked when the anti-repeat relay remains energized for too long a period of time. Conditions that would cause the anti-repeat relay to remain energized would be, sticking selector slides, malformed slides, excessive manual keyboard speed (improper keyboard operation), etc.

When the SCC closes in response to keyboard operation, a circuit will be complete to the punch clutch: - DC, TC6, S6 (operate), SCC, TA39 - 40, JPP, PLC, JPR, TA12, K2, 14 and 13, K3 - 1 and 2, TA35 - 36, JPK, LPC, JPX - JPY, TC5, to + DC. The punch lock contacts (PLC) transfer during punch operation and complete a circuit to the anti-repeat relay K2 and break the punch magnet and clutch circuits. When the PLC returns to normal, if the selector common contact (SCC) is still closed, K2 is held energized by its own make contacts 17 and 18. K2 will pick up in 8 - 12 milliseconds after PLC closes, K3 (punch error relay) will pick-up in 11 milliseconds after K2 has been energized. Thus, if the anti-repeat holding circuit is maintained by the SCC for more than 11 milliseconds, the K3 will become energized and open the key lock magnet circuit. The punch error relay K3 is picked up: DC, TC6, S6, SCC, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 15 and 16, K7 - 4 and 3, K6 - 4 and 3, K5 - 4 and 3, K3 coil, TC5 to + DC.

The holding circuit for K3: - DC, TC6, S6, TA23, K4 - 4 and 3, K3 - 13 and 14, K3 coil, TC5 to + DC.

The key lock magnet (LKL) de-energizes when K3 - 3 and 4 contacts open. Also, K3 contacts 5 and 6 will open the holding circuit to K2.

In order to de-energize the K3 relay, it is necessary to depress the tape feed switch S10. This will cause K4 contacts

Circuit Description

3 and 4 and breaking the holding circuit to K3.

PLC is a break - before - make contact so that K2 will not have an over-long pick up. It would otherwise be possible for SCC to open, breaking the K2 holding circuit, and yet have the pick up circuit through PLC still in force.

See Section 2, "Selector Contact Adjustment".

C.P. Tape Circuit - The S1 switch located on the right hand side frame is normally used as the power switch on most machines. However, on the Model FPC-8, this switch is used for both the power supply and the "card punch" tape circuit. The S1 switch is a DPDT, center off type of switch.

When the punch on switch S6 is in the "on" position, any typing on the keyboard will be recorded in the tape. However, if the S1 switch is placed in the "on C.P." position (with S6 on), and the type basket is in upper case position, the operation of the numerals, dash, diagonal, ampersand or dollar key-levers will not cause the punch to record their respective codes in the tape.

To accomplish the above condition the numerals, dash, diagonal, ampersand and dollar selector slides are coded with a number seven (7) position cam surface, but do not have a common (SCC) cam surface. Therefore, due to the fact that the SC7 contact is in series with the CSC (case

shift contact), when the CSC is open (basket in upper case), there is no circuit to the punch magnets.

For example, the numeral 7 keylever position selector slide is coded 1 - 2 - 3 - 7 and the code for this position is 124. If the type basket is in the upper case position, the CSC contact will be open, breaking the circuit to the LP1, LP2 and LP3 punch magnets. However, if the type basket is in the lower case position, the CSC contact will be closed and the circuit to the LP1, LP2 and LP3 punch magnets is as follows: from - D.C., TC6, S6, CSC, SC7, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 13 and 14, K3 - 1 and 2, TA35 - 36, SC1 - SC2, SC3, JPA - JPB - JPC, LP1 - LP2 - LP3, TC5, + DC. Also, the clutch magnet (LPC) is energized by the same circuit up to TA35 - 36, at which point it goes through JPK, LPC, TC5, to + DC.

A C.P. Tape indicating light is located on the front control panel which turns on when the S1 switch is in the "on C.P." position.

Tape Feed Circuit - When the code delete switch S10 is depressed, the code 1 - 2 - 4 - 8 - Ch - 0 - X is punched in the tape continuously for as long as the S10 switch is held depressed. This is accomplished by energizing the K4 relay, which in turn will complete circuits to the LP1 through LP7 punch magnets, plus the clutch magnet LPC. The circuit to the K4 relay is as follows: from - DC, TC6, S6, N/O

S10, TA13, K2 - 1 and 2, K4 coil, TC5, to + DC.

A sensitive make contact (K4 - 1 and 2) is used to insure that the K4 relay will be held energized until after the punch cycle starts. This is necessary for positive energizing of all seven punch magnets no matter how short the impulse to the K4 relay might be (i.e. the operator just flicking the tape feed switch S10). This holding circuit is as follows: from - DC, TC6, S6, TA23, K2 - 11 - 12, K4 - 1 and 2, K4 coil, TC5, to + DC. The holding circuit to K4 is broken during the punch cycle when the ARR contacts operate.

The circuits to the seven punch magnets (LP1 through LP7) is as follows: from - DC, TC6, S6, TA23, K4 - 4 and 5, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 13 and 14, K3 - 1 and 2, K4 - 6 and 7, 8 and 9, 11 and 12, 13 and 14, 15 and 16, 17 and 18, 19 and 20, TA1 - 2, TA3 - 4, TA5 - 6, TA7 - 8, TA9 - 10, TA31 - 32, TA33 - 34, JPA, JPB, JPC, JPD, JPE, JPF, JPH, LP1 - LP2 - LP3 - LP4 - LP5 - LP6 - LP7 -, JPX/JPY, TC5 to + DC.

The tape feed switch when held depressed will give continuous operation of the punch. The clutch magnet is energized each cycle of the punch through the same circuit.

Stop Code Circuit - When the stop code switch (S5) is depressed, the code 128 is punched in the tape. This is ac-

complished by energizing the K7 relay, which in turn will complete circuits to the LP1, LP2 and LP4 punch magnets. The circuit to the K7 relay is as follows: from - DC., TC6, S6 N/O S5, TA18, K7, coil, TC5, to + DC.

The circuit to the LP1, LP2 and LP4 punch magnets are as follows: from - DC, TC6, S6, TA23, K7 - 6 and 5, TA39 - 40, JPP, N/C transfer PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, K7 - 11 and 12 - 13 and 14 - 15 and 16, TA1 and 2 - 3 and 4 - 7 and 8, JPA - JPB - JPD, LP1 - LP2 - LP4, JPX JPY, TC5, to +DC.

The clutch magnet circuit is as follows: from - DC, TC6, S6, TA23, K7 - 6 and 5, TA39 - 40, JPP, N/C transfer PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, TA35 and 36, JPK, LPC, JPX - JPY, TC5, to +DC.

There will be only one stop code (128) punched for each operation of the stop code switch S8. This is due to the anti-repeat circuit as described under the Error Code Circuit.

Error Code Circuit - When the error switch (S9) is depressed, the code 1248X is punched in the tape. This is accomplished by energizing the K6 relay, which in turn will complete circuits to the LP1, LP2, LP3, LP4, and LP7, punch magnets. The circuit to the K6 relay is as follows: from - DC, TC6, S6, S9, TA17, K6 coil, TC5, to +DC.

The circuits to the punch magnets are as follows: from - DC, TC6, S6, TA23,

Circuit Description

K6 - 7 and 6, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, K6 - 11 and 12 - 13 and 14 - 15 and 16 - 17 and 18 - 19 and 20, TA - 1 and 2 - 3 and 4 - 5 and 6 - 7 and 8 - 33 and 34, JPA - JPB - JPC - JPD - JPH, LP1 - LP2 - LP3 - LP4 - LP7, JPX - JPY, TC5, to +DC.

The clutch magnet circuit is as follows: from - DC, TC6, TA23, K6 - 7 and 6, TA39 - 40 - JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, TA35 and 36, JPK, LPC, JPX - JPY, TC5, to + DC.

There will be only one error code (1248X) punched for each operation of the S9 switch. This is due to the anti-repeat circuit, wherein the anti-repeat relay (K2) picks up during the punch cycle, breaking the circuits to the punch magnets and the clutch magnet (K2 - 13 and 14). The K2 is held energized, through the following circuit: from - DC, TC6, S6, TA23, K6 - 7 and 6, K3 - 5 and 6, K2 - 17 and 18, K2 coil, TA21, TC5, to + DC. Therefore, as long as S9 is held depressed K6 will remain energized, maintaining a holding circuit to K2.

Note that K3 (punch error relay) will not pick up because K6 - 3 and 4 will be open.

SP Code Circuit - When the (Special) code switch S8 is depressed, the code 248CHX is punched in the tape. This is accomplished by energizing the K5 relay, which in turn, will complete circuits to the LP2, LP3, LP4, LP5, and LP7 punch magnets.

The K5 relay circuit is as follows: from - DC, TC6, S6, S8, TA14, K5 coil, TC5, to + DC.

The punch magnet circuits are as follows: from - DC, TC6, S6, TA23, K5 - 7 and 6, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, K5 - 11 and 12 - 13 and 14 - 15 and 16 - 17 and 18 - 19 and 20, TA3 and 4 - 5 and 6 - 7 and 8 - 9 and 10 - 33 and 34, JPB - JPC - JPD - JPE - JPH, LP2 - LP3 - LP4 - LP5 - LP7, JPX - JPY, TC5, to + DC.

The clutch magnet circuit is as follows: from - DC, TC6, S6, TA23, K5 - 7 and 6, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, TA35 and 36, JPK, LPC, JPX - JPY, TC5, to + DC.

There will be only one SP code (248CHX) punched for each operation of the SP code switch S8. This is due to the anti-repeat circuit as described under the Error Code Circuit.

READER AND TRANSLATOR CIRCUITS

Start and Stop Code Circuit - When the S3 start read switch is depressed, a circuit is completed to the K23 read control relay as follows: from - DC, TC6, JRL, RTC, the N/C transfer of RC1 - RC2 and RC4, JRR, S3, TA19, K3 - 11 and 12, K23 coil, TC5 to + DC. When K3 picks-up, a holding circuit is established as follows: from - DC, TC6, JRL, RTC, the N/C transfer of RC1 - RC2 and RC4, JRR, S4, TA20, K23 - 1 and 2, K3 - 11 and 12, K23 coil.

TC5, to + DC. Thus, with K23 held energized, when the S3 switch is released a circuit is completed to the reader magnet (LR) as follows: from - DC, TC6, JRL, RTC, the N/C transfer of RC1 - RC2 and RC4, JRR, S3, CRTC, TA29, K22 - 2 and 1, K23 - 6 and 5, TA28, JRK, LR, JRX - JRY, TC5, to + DC. When the reader magnet is energized, reader operation takes place. The reader magnet will remain energized until the stop read switch (S4) depressed, the start read switch (S3) is depressed, or a stop code (1 - 2 - 8) is read.

When a stop code is read, reader contacts RC1, RC2 and RC4 operate, breaking the holding circuit to the K23 relay. Thus, with the K23 de-energized, the reader magnet circuit is broken. To resume operation after reading a stop code, it is necessary to depress and release the start read switch S3.

A normally open contact on RC3, RC6, RC7, also used in the K23 holding circuit is order utilize as many code combinations as possible. For example, if the 1 - 2 - 8 code units are to be used, as long as one of code units 4, 0 or X is used, the K23 relay will not drop out.

Delay Control Circuit - It is essential to have an automatic delay control circuit incorporated in the reproducing operation in order to delay the operation of the tape reader until a function in the Writing Machine has been completed. There are two functions which require more operating time

than the regular characters. These functions are: carriage return (EL Code) and tabular (2 - 4 - 8 - Ch - O Code). When the EL code is read by the reader a circuit is completed to the delay control relay (K22) as follows: from - DC, TC6, JRL, RTC, RC1, RC8, JRM, TA30, K23 - 3 and 4, K22 coil, TC5, to + DC.

When K22 is energized, strap 2 breaks with strap 1 and makes with strap 3. Thus, the energizing circuit to the reader magnet (LR) is broken, de-energizing the reader magnet and stopping reader operation. Also, due to K22 - 2 and 3 making, a holding circuit to K22 coil is established (the original pick-up circuit to K22 will be open when RC8 contact returns to normal).

If we assume the CR code EL was read in the reader, then, at the same time the above mentioned circuit was complete to K22, a circuit would also be complete to the translator magnet LT8, and the translator clutch magnet LTC. Therefore, translator operation would take place, pulling down the CR keylever and starting a carriage return function. The operation of the carriage return mechanism would open contacts CRTC, thus breaking the holding circuit to K22. The K22 contact (straps 1, 2 and 3) would return to its 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

Circuit Description

CRTC contact closes completing the energizing circuit to the reader magnet, starting reader operation again.

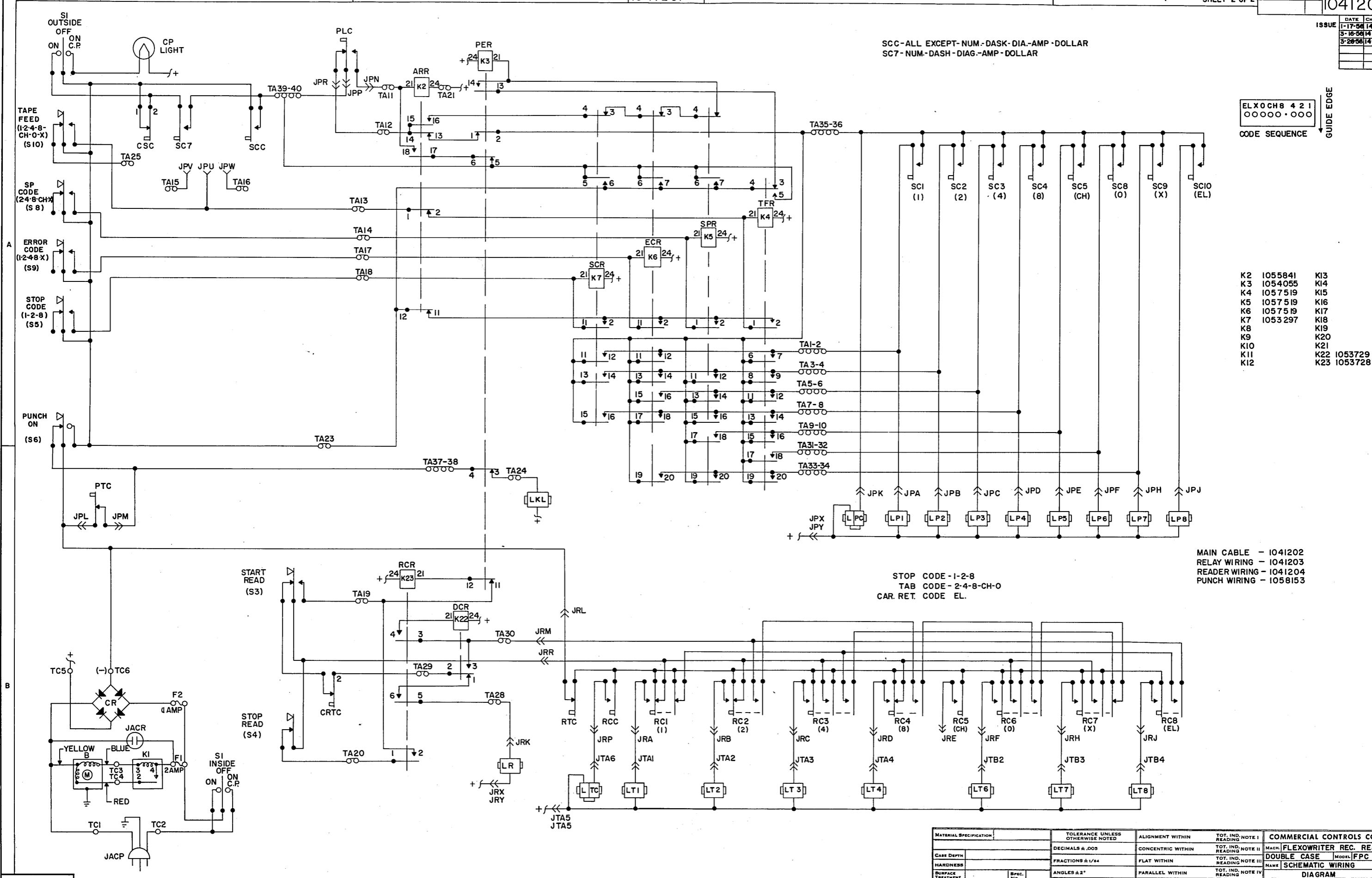
When the tab code 2 - 4 - 8 - Ch - O) is read by the reader the delay control relay (K22) is energized as follows: from -

DC, TC6, JRL, RTC, RC1, RC3, RC7, RC6, RC4, RC2, JRM, TA30, K23 - 3 and 4, K22 coil, TC5 to + DC. Thus, when K22 is energized, the same delaying action of the reader takes place as explained for carriage return.

ISSUE	DATE	CHANGE
1-17-56	1486	
3-16-56	1486	
3-28-56	1486	

SCC-ALL EXCEPT-NUM-DASK-DIA-AMP-DOLLAR
 SC7-NUM-DASH-DIAG-AMP-DOLLAR

ELXCH8 4 2 1
 OOOO · OOO
 CODE SEQUENCE



- K2 1055841
- K3 1054055
- K4 1057519
- K5 1057519
- K6 1057519
- K7 1053297
- K8
- K9
- K10
- K11
- K12
- K13
- K14
- K15
- K16
- K17
- K18
- K19
- K20
- K21
- K22 1053729
- K23 1053728

MAIN CABLE - 1041202
 RELAY WIRING - 1041203
 READER WIRING - 1041204
 PUNCH WIRING - 1058153

STOP CODE - 1-2-8
 TAB CODE - 2-4-8-CH-0
 CAR. RET. CODE EL.

MATERIAL SPECIFICATION		TOLERANCE UNLESS OTHERWISE NOTED		ALIGNMENT WITHIN		TOT. IND. READING NOTE I		COMMERCIAL CONTROLS CORP.	
CASE DEPTH		DECIMALS ± .003		CONCENTRIC WITHIN		TOT. IND. READING NOTE II		MACH. FLEXOWRITER REC. REP.	
HARDNESS		FRACTIONS ± 1/64		FLAT WITHIN		TOT. IND. READING NOTE III		DOUBLE CASE MODEL FPC 8	
SURFACE TREATMENT		ANGLES ± 2°		PARALLEL WITHIN		TOT. IND. READING NOTE IV		NAME SCHEMATIC WIRING	
		CORNERS MAY BE BROKEN INSIDE		STRAIGHT WITHIN		TOT. IND. READING NOTE V		DRAW. RED 1-17-56 SCALE	
				SQUARE WITHIN		TOT. IND. READING NOTE VI		CHECK WE 1-17-56 TRAC.	

CIRCUIT DESCRIPTION

The following circuit description is for the Flexowriter Edge-Card Programatic Model FPC-5, 4 bank, and based on schematic wiring diagram 1041120, (Figure 4-1).

The Power Circuit is the same as explained in Part II, Section 8, Page 8-5.

PUNCH CIRCUITS

Key Lock Magnet

When the power switch (S1) is in the "On" position, the key lock magnet (LKL) is energized as follows: -DC, TC6, JL11, JL12, JPL, PTC, JPM, TA16, K3-3 and 4, TA15, LKL magnet coil, TC5, to DC +. Notice that this circuit is through a normally closed contact of the punch error relay (K3 - 3 and 4). If the K3 (Punch Error) relay is energized the Key Lock Magnet circuit is broken, and the keyboard will lock.

PUNCH CONTROL CIRCUITS

Punch All

With the punch switch (S2) in the ALL position, the Flexowriter is conditioned to record all codes in the tape. When the punch control relay (K9) is energized, circuits to the punch magnets and to the punch clutch may be completed simultaneously. K9 is energized as follows: -DC, TC6, S2 (inside-ALL). JL22, JL21, TB33, K9 coil, TC5, +DC. A DC circuit is complete to the punch

on indicating light when K9 is energized: -DC, TC6, TA26, K9- 1 and 2, TB36, Lamp I, TC5, + DC.

Punch Magnet Circuit

When a keylever, other than On 1-On 2, or Punch OFF is depressed, one or more of the selector code contacts will close, followed by the selector common contact (SCC), energizing the punch magnets and clutch.

For an example circuit, assume that the "E" character keylever was depressed. A DC circuit would be completed to the LP1 magnet: -DC, TC6, SCC, TA24, K10-4 and 5, K4- 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3 - 2 and 1, TA1, SC1, TA2, K10-7 and 8, K9- 5 and 6, TB2, JPA, LP1, JPX/JPY, TC5, +DC.

The circuit to the punch clutch is in parallel with that to the code magnets: -DC to K9- 3 and 4, TB1, JPK, LPC, JPX/JPY, TC5, +DC.

Note: Selector contact SC7 is the "common" contact for punching On 1 - On 2, and Punch Off codes.

Punch Select

With the punch switch (S2) in the SEL position the Flexowriter is conditioned to type only, until the On 1 keylever is depressed. In SEL (basket in Figs. position), On 1 turns on the Flexowriter punch but

does not record the code in the tape. Succeeding keylever operations will be recorded, however, until Punch Off is depressed.

When On 1 is depressed the punch select relay (K16) is energized: -DC, TC6, SC6 (operate strap transferred), CSC 22 and 23 (basket in Figs. position), TB34, K16 coil, TC5, +DC. The holding circuit for K16 relay: -DC, TC6, S2 (inside - SEL), punch off contacts (POC) 1 and 2, TB35, K16 - 4 and 5, K16 coil, TC, +DC. With K16 energized a circuit will be complete to the punch control relay, K9: -DC, TC6, POC- 4 and 3, TB40, K16- 15 and 14, TB31, JL22, JL21, TB33, K9 coil, TC5, +DC.

When it is necessary to turn the punch off, the Punch Off keylever is depressed, breaking the holding circuit to the K16 relay at contacts POC- 1 and 2. The holding circuit for the punch control relay (K9) will be broken when K16- 14 and 15 open.

ANTI-REPEAT CIRCUIT

*See Punch Checking Circuit

Punch Checking Circuit

Sticking selector slides, malformed slides and excessive manual keyboard speed (improper Keyboard operation) make it possible to obtain a typed character without its corresponding code if the selector common contacts (SCC) remain closed too long. To prevent this, a punch checking circuit be-

comes operative if the anti-repeat relay (2) is held energized.

When the K2 relay is energized and the PLC contacts have returned to normal, a circuit will be complete to the punch error relay (K3): -DC, TC6, SCC, TA24, K10- 4 and 5, K4- 13 and 14, TA17, JPP, PLC, JPR, JL14, JL5, TA14, K2- 15 and 16, K10- 2 and 1, K8- 3 and 4, K7- 3 and 4, K6- 3 and 4, K3 coil, TC5, +DC. The holding circuit for K3: -DC, TC6, TA26, K5-4 and 3, K4-7 and 6, K3- 15 and 16, K3 coil, TC5, +DC. Contacts 5 and 6 of the K3 relay break the K2 holding circuit: contacts 1 and 2 break the punch circuits: contacts 3 and 4 open the circuit to the keylock magnet (LKL) and the keyboard becomes inoperative. Tape Feed operation is required to drop out K3 and unlock the keyboard.

It should be noted, that because a long operator is used to operate the SCC contacts, the pulse to the anti-repeat relay may not be long enough to actually pickup the anti-repeat relay. However, it is not essential that the anti-repeat relay actually picks-up on each operation, because as stated, if there is a long pulse to the anti-repeat relay, then a circuit will be complete to the punch error relay, thus locking up the keyboard.

Tape Feed - Card Feed Circuit

Depression of the Tape Feed panel switch

(S10) will punch a five channel LTRS (or delete) code when tape is in the punch. With a card in the punch, depression and release of the Tape Feed switch will allow the card to feed through the punch automatically (with a blank code only) until the control hole in the next card permits the card feed micro-switch to restore.

When the S10 switch is depressed with tape in the punch, the tape feed relay (K5) is energized: -DC, TC6, operated S10, JPU/JPV (jumpered on non card punches), TA22, K4- 4 and 3, K2- 2 and 1, K5 coil, TC5, +DC.

The tape feed relay (K5) is held: -DC, TC6, TA26, K2- 12 and 11, K5- 1 and 2, K5 coil, +DC. With K5 energized, circuits will be complete to the punch clutch magnet and to the punch magnets: -DC, TC6, TA26, K5- 4 and 5, K10- 4 and 5, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3- 2 and 1, K5- 11 and 12 - 13 and 14 - 15 and 16 - 17 and 18 - 19 and 20, K10- 7 and 8 - 11 and 12 - 14 and 15 - 17 and 18, K11- 1 and 2, K9- 5 and 6 - 7 and 8 - 9 and 10 - 11 and 12 - 13 and 14, TB2 - 3 - 4 - 5 - 6, LP1 - 2 - 3 - 4 - 5, JPX/JPY, TC5, +DC. LPC is energized: from -DC, to K3- 2 and 1, K9- 3 and 4, TB1, JPK, LPC, TC5, +DC. The holding circuit provided for K5 insures that all code magnets will be energized regardless

of when the Tape Feed switch is released. When K2 is energized, its contact 11 and 12 will open, breaking the K5 holding circuit K2 will have a holding circuit, however, through its contact 17 and 18 only until K5 drops out opening its contact 5 and 4.

With a card in the punch, the operate strap of the card feed micro-switch will be transferred, so that when the S10 switch is depressed the card feed relay (K4) will be energized: -DC, TC6, N/0 S10, JPU, card feed micro-switch, JPW, TA21 K4 coil, TC5 +DC. K4 is held: (a), -DC TC6, TA26, K2- 12 and 11, K4- 18 and 19, K4 coil, TC5 +DC, and (b), -DC, TC6, TA26, K4- 16 and 17, TA25, JPU, card feed micro-switch, JPW, TA21, K4 coil, TC, DC. When the S10 switch is released a circuit will be made to LPC: -DC, TC6, N/C S10, TA23, K4- 15 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3- 2 and 1, K9 - 3 and 4, TB1, JPK, LPC, TC5, +DC. The punch clutch will continue to cycle the card through the punch until either the end of a card or the control hole in the next attached card allows the card feed switch to restore. Contacts 18 and 19 of K4 allow one more punch cycle to occur after the card feed switch has restored, and thus the new card is driven to the proper punching position.

Print Restore Code Circuit

The print restore code (1-2-3-4) is

perforated in the tape when the S8 panel switch is depressed (basket in Figures). This code, when read by the reader, will restore the Flexowriter to normal printing condition only when non-print operation was initiated either by Non-Print code in the tape, or by depression of the Tape Skip panel switch.

With the S8 panel switch depressed (in Figs) the print restore code relay is energized: -DC, TC6, CSC-1 and 2, operated S8 switch, TA32, K6 coil, TC5, +DC. The K6 relay is held through contact 11 and 12 of K2. Negative DC now comes from the rectifier, TC6, TA26, K6-7 and 6, K10-4 and 5, K4-13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2-14 and 13, K3-2 and 1, to K6 make contacts and to the punch clutch and code magnets. The anti-repeat (K2) having been picked up when the PLC operate strap transferred is energized as long as the S8 panel switch is held depressed, -DC, TC6, TA26, K6-7 and 6, K10-4 and 5, K3-5 and 6, K2-17 and 18, K2 coil, TC5, +DC. Contact 3 and 4 breaks when K6 is energized and prevents the pick-up of the punch error relay regardless of how long the print restore code relay and the anti-repeat relay is energized.

Error Code Circuit

This circuit is used to punch a 1-2-4 code in the tape (basket in Figures) which,

when read, will not cause any operation of the Flexowriter. Operation of the Error Code panel switch (S9) will energize the error code relay (K7): -DC, TC6, CSC 1 and 2 (Figs.), N/O S9, TA33, K7 coil, TC5, +DC. K7 is held: -DC, TC6, TA26, K2- 12 and 11, K7-1 and 2, K7 coil, TC5, +DC. Punching operation of the error code, anti-repeat operation, etc., corresponds with the print restore code punching operation explained above.

Stop Code Circuit

When the stop Code Panel switch (S7) is depressed, a feed hole only will be perforated in the tape, which, when read in the reader, will automatically stop reader operation. Operation of the S7 switch energizes the stop code relay (K8): -DC, TC6, Operated S7 switch, TA34, K8 coil, TC5 +DC. When the K8 relay is energized negative power is applied to the punch clutch in the same manner as explained in the Tape Feed circuit.

READER AND TRANSLATOR CIRCUITS

Manual Start and Stop Circuits

The Start Read Switch (S3), when depressed and released will energize the tape reader magnet (LR) and start a cycle of reader operation. To energize the reader magnet, when the S3 switch is depressed, a circuit is first completed to the reader control relay (K23): -DC, TC6, JRL (JRL con-

nected to JRV; RTC contact not in Card Reader), RTC, N/C RCC, JRR, TA9, K3-11 and 12, TA10, operated S3, TA39, K23 coil, TC5, +DC. When K23 contacts 1 and 2 close a holding circuit for K23 is maintained: -DC, TC6, JRL, RTC, N/C RCC, JRR, TA9, K3- 11 and 12, TA10, S4 switch, TA28, K23-1 and 2, K23 coil, TC5, +DC. When the S3 Switch is allowed to return to its normally closed position, the reader magnet is energized: -DC, TC6, JRL, RTC, N/C RCC, JRR, TA9, K3-11 and 12, TA10, S3 switch, S5 switch, S6 switch, CRTC, TA19, K23-4 and 3, K21- 2 and 1, K20- 2 and 1, TA29, JRK, LR, JRX/JRY, TC5, +DC.

The reader will operate continuously until either the reader magnet circuit is broken automatically (explained under Delay Control Circuit) or manually, by depressing the Stop Read switch (S4).

When the S4 switch is depressed, the holding circuit to the reader control relay (K23) is broken. Thus, when K23 contact 4 and 3 open, the reader magnet is de-energized and the reader will stop.

Translator Magnet Circuits

When a reader pin senses a code in the tape, a corresponding reader contact closes, and completes a circuit to the related translator magnet.

For an example circuit, assume that a 1-2 code is read in the reader tape. The trans-

lator magnets LT1 and LT2 will be energized: -DC, TC6, RTC (RTC omitted in Card Reader - JRL is connected to JRU circuit), JRU, TB20, K11- 11 and 12, TB19, JRT, RC1 and RC2, JRA and JRB, JTA1 and JTA2, JTA5 and JTA6, JTA5 and JTB5, TC5, to +DC. Also, the reader common contact (RCC) closes and completes a circuit to the translator clutch: -DC, TC6, RTC, RCC, JRP, JTH6, LTC, JTA5 and JTB5, TC5, to +DC.

Delay Control Circuit

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. Two functions which require more operating time than the regular characters are carriage return (4 code) and tabular (14 code UC).

When the tab code 14 (basket in upper case) is read in the reader a circuit is completed to the delay control relay #1 (K21): -DC, TC6, RTC, RC5, RC4, RC3, RC2, JRS, CSC - 13 and 14, TB18, K12 - 11 and 12, K22 - 11 and 12, K11 - 14 and 15, K21 coil, TC5, to +DC.

At the same time the above is complete to K21, (when reading tab code), a circuit would also be complete to the translator magnets LT1, LT4 and LTC. The translator would operate, pull down the tab keylever

and initiate a tabular function. The operation of the tab mechanism would open CRTC and break the holding circuit to K21. The K21 contacts would return to their normal position, but the circuit to the reader magnet would not be complete until the carriage tab-stop struck the tab lever and unlatched the tab mechanism. When this occurs, the CRTC contact closes and completes the energizing circuit to the reader magnet, starting reader operation again.

If a Carriage Return Code (4) is read, K21 will again be energized until the opening of CRTC drops out the K21 holding circuit. In this instance, K21 is energized by operation of RC4: -DC, TC6, RTC, RC5, RC4, RC3, RC2, RC1, JRM, TA20, K11 - 14 and 15, K21 coil, TC5, to + DC.

Therefore, when a tab or CR code is read by the reader, reader operation will automatically stop and will not start again until the particular function is complete.

Stop Code Circuit

When a stop code (feed hole) is read by the reader, the holding circuit for the K23 relay (read control) will be broken, thus, de-energizing the reader magnet and stopping reader operation. Normally closed contacts of RCC complete the holding circuit through K23 contact 1 and 2, to the K23 coil. Therefore, whenever a feed hole only is read by the reader, the RCC contacts

operate and break the K23 holding circuit, stopping the reader.

Because RCC contacts operate on each reading cycle, normally open contacts on RC1 through RC5 provide alternate holding circuits to K23, thereby preventing K23 from de-energizing when one or more codes are read.

Tape Skip Circuit

The tape skip switch (S6) allows sections of tape to pass through the reader preventing all keylever operations with the exception of CR Letters and Figures shift. Tape cycles through the reader only until a Print Restore Code (1234 - basket in Figures) is read, which restores normal printing and punching operation automatically without stopping the reader. If carriage return codes are read during Tape Skip operation, the carriage will return and line space the form. The same applies when reading the Figures or Letters shift codes; the basket will shift when either shift code is read.

When the Flexowriter punch or Motorized punch (if connected) is on at the time of pressing the tape skip switch, only the CR Letters and Figures codes will be punched.

Operation of the Tape Skip switch (S6) will energize the reader magnet (LR) and start a cycle of reader operation. When the S6 switch is depressed, the K22 relay is energized: -DC, TC6, JRL, RTC, RCC, JRR,

TA9, K3 - 11 and 12, TA10, S3, S5, operated S6, TA18, K22 coil, TC5 to +DC. K22 is held energized: -DC, TC6, JRL, RTC, JRU, TB20, K14 - 5 and 6, K22-5 and 6, K22 coil, TC5, to +DC.

With K22 energized and the S6 switch released, the reader magnet (LR) is energized: -DC, TC6, JRL, RTC, RCC, JRR, TA9, K3-11 and 12, TA10, S3, S5, S6, CRTC, TA19, K22- 3 and 4, K21- 2 and 1, K20-2 and 1, TA29, JRK, LR, JRX and JRY, TC5 to +DC.

As the reader cycles, the reader common contact (RCC) will close and energize translator magnet 7 (LT7) and the translator clutch (LTC). Also, LT6 is energized if the basket is in Figures position.

When LT7 is energized, a permutation bar will be released in the translator and prevent the selection of any keylever except CR, Figs. and Letters shift. The circuit to LT7 is: -DC, TC6, JRL, RTC, operated RCC, JRP, TB28, K22- 16 and 15, TA40, JTB3, LT7, JTA5 and JTB5, TC5, to +DC. Also, the clutch coil circuit is: from -DC, TC6, JRL, RTC, operated RCC, JRP, TB28, JTA6, LTC, JTA5 and JTB5, TC5, to +DC.

Assuming that a carriage return code (4) is read in the reader (during Tape Skip), LTC and LT4 will be energized, and in addition LT7: -DC, TC6, JRL, RTC, JRU, TB20, K11- 11 and 12, TB19, JRT, RC4, JRD, TA4 LT4, JTA5 and JTB5, TC5, to +DC.

To delay reader operation until the carriage return function is complete, the delay control relay K21 will also be energized. This circuit is the same as explained under Delay Control Circuit with the exception of the K21 holding circuit. Contacts 3 and 4 of K22 complete the K21 holding circuit when CR code is read during tape skip.

Tape skipping operation will continue in the reader until a Print Restore code (1234) is read (basket in Figures). When this code is read, it will cause the print restore relay (K14) to pickup, dropping out the tape skip relay (K22) and energize the read control relay (K23) for further reader operation.

When the 1234 is read, the print restore relay (K14) is energized: -DC, TC6, JRL, RTC, RC5 N/C, RC4 N/0, RC3 N/0, RC2 N/0, RC1 N/0, JRW, CSC - 5 and 6, TB10, K12- 3 and 4, K15- 1 and 2, K14 coil, TC5, to +DC. K14 has no holding circuit in this instance and will drop out when the reader contacts restore. When contact 5 and 6 of K14 opened, the holding circuit to K22 was broken and the tape skip relay dropped out. At the same time, however, negative was being applied to the read control relay (K23): -DC, TC6, JRL, RTC, JRU, TB20, K14 - 13 and 14, K23 coil, TC5, to +DC. K23 is again held through its 1 and 2 contact. The circuit to LR is still complete: -DC, TC6, JRL, RTC,

RCC, JRR, TA9, K3- 11 and 12, TA10, S3, S5, S6, CRTC, TA19, K23- 4 and 3, K21- 2 and 1, K20- 2 and 1, TA29, TRK, LR, JRX and JRY, TC5, to +DC.

Since the tape skip relay is no longer energized, its open contact 15 and 16 no longer energize LT7, therefore, all characters are allowed to print and all functions allowed to operate.

Manual Non-Print Circuit

The non-print switch (S5) will also allow sections of tape to pass through the reader without causing any operation of the Flexowriter.

Tape cycles through the reader only until a stop code (feed hole) is read, for the stop code is the only code recognized during this operation. The stop code is first reproduced automatically before stopping the reader. Non-Print operation can be terminated at any time by pressing the Stop Read switch. Although, by-passed codes in the tape cause no operation of the Flexowriter, these codes can be reproduced by the Flexowriter punch or the motorized punch.

Manual operation of the Non-Print switch (S5) will energize the Non-Print relays and the read control relay: -DC, TC6, JRL, RTC, RCC, JRR, TA9, K3- 11 and 12, TA10, S3, operated S5, TB29, K15 coil of the manual non-print relay. TC5 to +DC. Also, with K15 picked up, the same circuit will be

through K15- 12 and 13, coils of K10 and K11, TC5, to +DC.

When R11 picks up, the same negative that picked up K11 will energize K23 (RCR), through K11 - 10 and 9, K14 - 12 and 11, K23 coil, TC5, to +DC. Thus, with K23 energized, a holding circuit will be complete to the read control relay and to the non-print relays: -DC, TC6, JRL, RTC, RCC, JRR, TA9, K3- 11 and 12, TA10, S4, TA28, K23- 1 and 2, K23 coil.

When the non-print switch is released, the above holding circuit will keep K23, K15, K10, and K11 relays energized until a stop code (feed hole) is read, or the stop read switch is depressed. The releasing of the S5 switch will also complete a circuit to the reader magnet (LR).

As can be seen on print 1041120, when K10 and K11 non-print relays are energized, circuits to the translator magnets LT1 -LT5 can be energized, but keylever operation is prevented by operation of LT - 8 in NP.

If punching tape is required on manual non-print operation, the punch control relay (K9) will be energized and the DC potential on the reader contacts will come from the punch. Assuming that the reader is in operation (Non-Print) and that the character "E" is read, the punch magnet #1 and the clutch magnet will be energized as follows: -DC, TC6, JRL, RTC, RCC, JRP, TB28,

K10- 6 and 5, K4- 13 and 14, TA17, JPP, PTC, JPL, JL14, JL15, TA14, K2- 14 and 13, K3- 2 and 1, K11- 13 and 12, TB19, JRT, operated RC1, JRA, TB23, K10- 13 and 12, K9- 5 and 6, TB2, JPA, LP1, JPX and JPY, TC5, to +DC. Also, from contact 1 and 2 of K3, K9- 3 and 4, TB1, JPK, LPC, JPX and JPY, TC5, to +DC.

Tape duplication will occur until a stop code is read in the reader, at which time the read control and non-print relays will be dropped out. When the reader reads the feed hole (stop code), the N/C RCC opens, breaking the holding circuit to K23. As the RCC breaks the K23 holding circuit, a second RCC N/0 contact makes, establishing a temporary second holding circuit to the non-print relays (through different coils). This temporary holding of the non-print relays allows enough time for the stop code to be punched. The holding circuit is as follows: -DC, TC6, JRL, RTC, operated RCC, JRN, TB27, K11-7 and 8, K11 coil, K10 coil, also, K15- 4 and 5, K15 coil, TC5, to +DC.

When the reader pins return to non-operated position, the non-print relays will drop out.

During manual non-print operation, break contact 1 and 2 on K15 prevents the print restore relay (K14) from becoming energized, in the event the print restore code

(1234 UC) is read.

If the reader has been started by Manual Non-Print operation, it may be stopped by depressing the Stop Read switch (S4). In this instance, the holding circuit for K23 will be broken at the transfer strap of S4. This is a make-before-break contact and the non-print relays will again be held (after the read control relay has dropped out) until the last code sensed by the reader has been punched and the S4 switch released.

Automatic Non-Print Circuit.

A non-print operation on the Flexowriter can be initiated automatically by a non-print code in the tape. By-passed codes will be punched if the Flexowriter punch or the motorized punch is on at the time the NP code is read. Automatic non-print operation is restored to normal printing by a PR code which does not stop the reader. This differs from the manual operation of the non-print switch which is stopped by a stop code.

Assume that the reader is in normal operation and that a non-print code (234 Figures) in the tape is read. Delay control relay #2 (K20) will be energized: -DC, TC6, JRL, RTC, RC5, RC4, RC3, RC2, RC1, JRV, CSC- 11 and 12, TB17, K12- 5 and 6, K22- 2 and 1, K20 coil, TC5, to +DC. The holding circuit for K20 is: -DC, TC6, JRL, RTC, JRU, TB20, K11- 5 and 4, K20- 4 and

3, K20 coil, TC5, to +DC.

When K20 is energized, the circuit to the reader magnet (LR) is momentarily broken (open contact K20- 1 and 2).

As the delay control relay #2 (K20) was being energized, the non-print code 234 (Figs.) was also effecting translator operation, tripping the NP keylever, and closing selector contact SC9. The automatic non-print relay (K13) will now pick-up: -DC, TC6, SC9, TA8, K23- 6 and 5, K13 coil, TC5, to +DC.

K13 is held energized through; -DC, TA26, K14- 1 and 2, K13- 1 and 2, K13 coil, TC5, to +DC.

The non-print relays are now energized: -DC, TA26, K13- 4 and 3, K14- 4 and 3, K10 and K11 coils, TC5, to +DC. Note that the manual non-print relay (K15) is not energized.

The reader magnet will again be energized when K11- 5 and 6 contacts open and drop out DCR #2 (K20).

With the non-print relays energized, the circuit to the translator magnets LT1 - LT5 can be energized but LT -8 prevents keyboard operation when in NP.

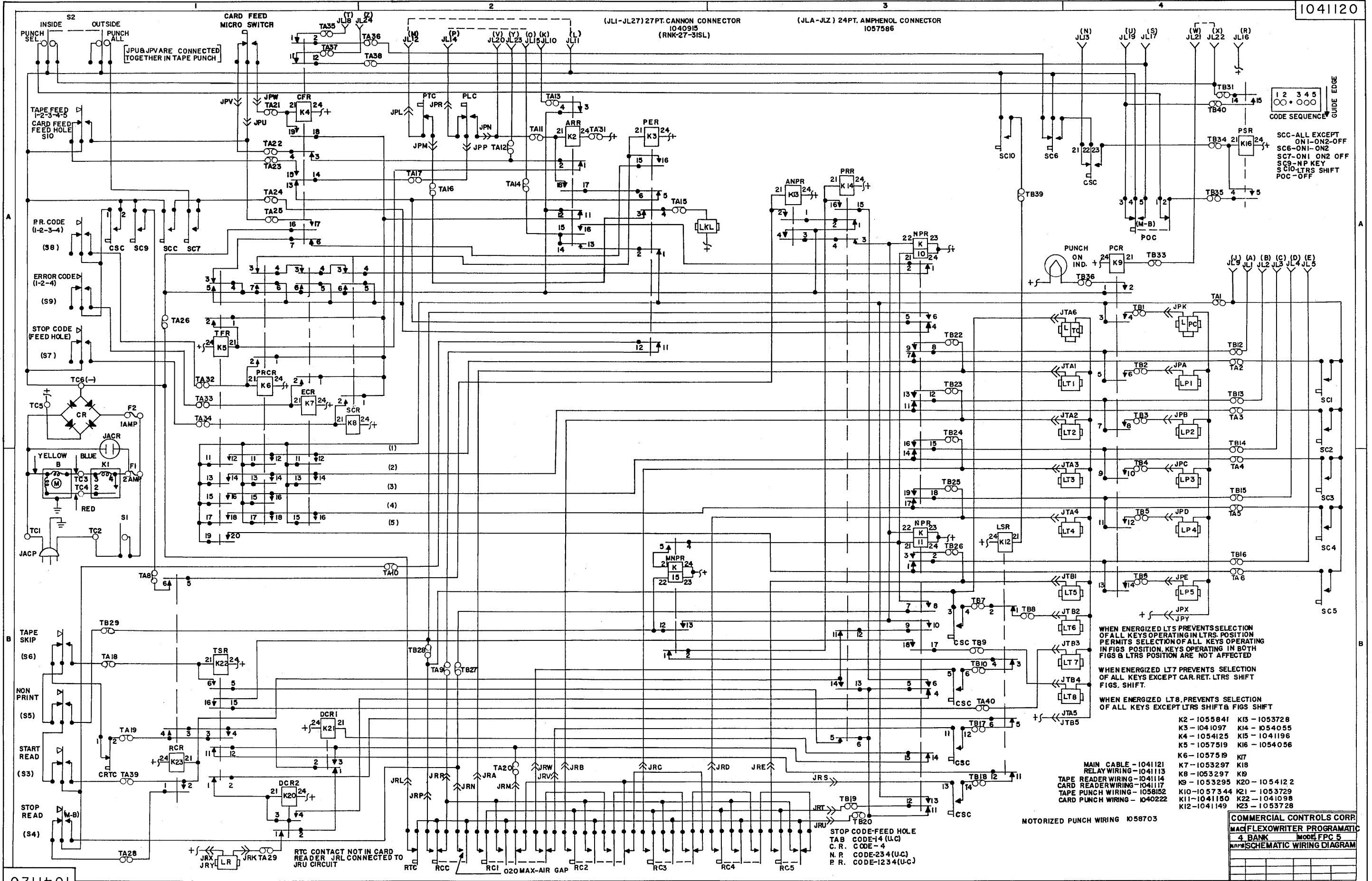
When reading a stop code, the K23 relay does not drop out as was the case in the

Manual Non-Print operation. The holding circuit for K10 and K11 also holds K23.

Non-printing continues until the reader senses the 1-2-3-4 (Figures) print restore code, which operation energizes the print restore relay: -DC, TC6, JRL, RTC, RC5, RC4, RC3, RC2, RC1, JRW, CSC - 5 and 6, TB10, K12- 3 and 4, K15- 1 and 2, K14 coil, TC5, to +DC. K14 is held energized: -DC, TC6, JRL, RTC, TC20, K11- 5 and 6, K14- 15 and 16, K14 coil, TC5, to +DC.

With K14 operated, its contacts 1 and 2 open, dropping out K13. Also, K14- 3 and 4 contacts open breaking the original circuit to K10 and K11, however a temporary holding circuit to different coils of K10 and K11 will be established through a normally open contact of RCC. This circuit will be in effect until the reading pins return to non-operate position after reading print restore code.

The K23 read control relay will not drop out when the K14 relay picks-up due to the closing of K14- 13 and 14 contact. Even though K14 drops out at the completion of the reader cycle (RCC opens, K10 and K11 drops out, K11- 5 and 6 breaks holding circuit to K14), K23 will remain energized through its own contact 1 and 2. Thus, normal reading and printing will be restored.



1 2 3 4 5
O O O O O
CODE SEQUENCE GUIDE EDGE

SCC-ALL EXCEPT ON1-ON2-OFF
SC6-ON1-ON2
SC7-ON1 ON2 OFF
SC9-NP KEY
SC10-LTRS SHIFT
POC-OFF

WHEN ENERGIZED LT5 PREVENTS SELECTION OF ALL KEYS OPERATING IN LTRS. POSITION PERMITS SELECTION OF ALL KEYS OPERATING IN FIGS POSITION, KEYS OPERATING IN BOTH FIGS & LTRS POSITION ARE NOT AFFECTED

WHEN ENERGIZED LT7 PREVENTS SELECTION OF ALL KEYS EXCEPT CAR. RET. LTRS SHIFT FIGS. SHIFT.

WHEN ENERGIZED LT8 PREVENTS SELECTION OF ALL KEYS EXCEPT LTRS SHIFT & FIGS SHIFT

- K2 - 1055841 K3 - 1053728
- K3 - 1041097 K4 - 1054055
- K4 - 1054125 K5 - 1041196
- K5 - 1057519 K6 - 1054056
- K6 - 1057519 K7
- K7 - 1053297 K8
- K8 - 1053297 K9
- K9 - 1053295 K20 - 1054122
- K10 - 1057344 K21 - 1053729
- K11 - 1041150 K22 - 1041098
- K12 - 1041149 K23 - 1053728

MOTORIZED PUNCH WIRING 1058703

STOP CODE-FEED HOLE
TAB CODE-14 (U.C)
C. R. CODE-4
N. P. CODE-234 (U.C)
P. R. CODE-1234 (U.C)

COMMERCIAL CONTROLS CORP.
MACFLEXOWRITER PROGRAMATIC
4 BANK MODEL FPC 5
SCHEMATIC WIRING DIAGRAM

CIRCUIT DESCRIPTION

The following circuit description is for the Flexowriter Edge-Card Programatic Model FPC-8, single case, and is based on schematic wiring diagram 1041109. (Figure 5-1)

The Power Circuit is the same as explained in Part II, Section 8, Page 8-5.

PUNCH CIRCUITS

Key Lock Magnet

When the power switch (S1) is in the On position, the key lock magnet (LKL) is energized as follows: -DC, TC6, JL11, JL12, JPL, PTC, JPM, TA16, K3 - 3 and 4, TA15, LKL, TC5, +DC. Notice that this circuit is through a normally closed contact of the punch error relay (K3- 3 and 4). If the K3 relay is energized, the Key Lock Magnet circuit is broken, locking the keyboard. See Punch Checking Circuit on page 5-2.

PUNCH CONTROL CIRCUITS

Punch All

With the punch switch (S2) in the ALL position, the Flexowriter is conditioned to record all codes in the tape. When the punch control relay (K9) is energized, circuits to the punch magnets and to the punch clutch may be completed simultaneously. K9 is energized as follows: -DC, TC6, S2 (inside),

JL22, JL21, TB33, K9 Coil, TC5, +DC. A D.C. Circuit is complete to the punch on indicating light when K9 is energized: -DC, TC6, TB19, K9 - 1 and 2, TB36, Lamp I, TC5, +DC.

Punch Magnet Circuit

When a keylever, other than On 1, On 2, or Off is depressed, one or more of the selector code contacts will close, followed by the selector common contact (SCC), energizing the punch magnets and clutch magnet.

For an example circuit, assume that the "1" character keylever was depressed. A D.C. circuit would be completed to the LP1 magnet: -DC, TC6, SCC, TA24, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2 - 14 and 13, K3 - 2 and 1, TA1, SC1, TA2, K9 - 5 and 6, TB2, JPA, LP1, JPX/JPY, TC5, +DC.

The circuit to the punch clutch is in parallel with that to the code magnets: -DC to K9 - 3 and 4, TB1, JPK, LPC, JPX/JPY, TC5, +DC.

Selector contact SC7 is the "common" contact for punching On 1, On 2 and Off codes.

Punch Select

With the punch switch (S2) in the SEL position the Flexowriter is conditioned to type only, until the On 1 keylever is de-

pressed. On 1 turns on the Flexowriter punch but does not record the code in the tape. Succeeding keylever operations will be recorded, however, until Punch Off is depressed.

When On 1 is depressed, the punch select relay (K16) is energized: -DC, TC6, SC8, TB34, K16 Coil, TC5, +DC. The holding circuit for K16 relay: -DC, TC6, S2 (inside), punch off contacts (POC) 1 and 2, TB 35, K16 - 4 and 5, K16, TC5, +DC. With K16 energized, a circuit will be complete to the punch control relay, K9: -DC, TC6, POC 4 and 3, TB40, K16 - 14 and 15, TB 31, JL22, JL21, TB33, K9 coil, TC5, +DC.

When it is necessary to turn the punch off, the Punch Off keylever is depressed breaking the holding circuit to the punch select relay (K16) at the contacts POC 1 and 2. The holding circuit for the punch control relay (K9) will be broken when K16 - 14 and 15 open.

Anti-Repeat Circuit.

See Punch Checking Circuit

Punch Checking Circuit

Sticking selector slides, malformed slides and excessive manual keyboard speed (improper keyboard operation) make it possible to obtain a typed character without its corresponding code if the selector common contacts (SCC) remain closed too long. To prevent this, a punch checking

circuit becomes operative if the anti-repeat relay (K2) is held energized.

When the K2 relay is energized and the PLC contacts have returned to normal, a circuit will be complete to the punch error relay (K3): -DC, TC6, SCC, TA24, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2 - 15 and 16, K10 - 2 and 1, K8 - 3 and 4, K7 - 3 and 4, K6 - 3 and 4, K3 coil, TC5, +DC. The holding circuit for K3: -DC, TC6, TB19, K5 - 3 and 4, K4 - 6 and 7, K3 - 15 and 16, K3 coil, TC5, +DC. Contacts 5 and 6 of the K3 relay break the K2 holding circuit; contacts 1 and 2 break the punch circuits; contacts 3 and 4 open the circuit to the key lock magnet (LKL) and the keyboard becomes inoperative. Tape Feed operation is required to drop out K3 and unlock the keyboard.

It should be noted, that because a long operator is used to operate the SCC contacts, the pulse to the anti-repeat relay may not be long enough to actually pick-up the anti-repeat relay. However, it is not essential that the anti-repeat relay actually picks-up on each operation, because as stated, if there is a long pulse to the anti-repeat relay, then a circuit will be complete to the punch error relay, thus locking up the keyboard.

Tape Feed - Card Feed Circuit

Depression of the Tape Feed panel switch (S10) will punch a seven channel delete

code when tape is in the punch. With a card in the punch, depression and release of the Tape Feed switch will allow the card to feed through the punch automatically (with a blank code only) until the hole in the next card permits the card feed micro-switch to restore.

When the S10 switch is depressed with tape in the punch, the tape feed relay (K5) is energized: -DC, TC6, N/O S10, JPU, N/C card feed switch, JPV, TA22, K4 - 4 and 3, K2 - 2 and 1, K5 coil, TC5, +DC. With K5 energized circuits will be complete to the punch clutch magnet and to the punch magnets (except LP8): -DC, TC6, TB19, K5 - 4 and 5, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2 - 14 and 13, K3 - 2 and 1, K9 - 3 and 4, TB1, JPK, LPC, JPX/JPY, TC5, +DC and from K3 - 2 and 1, K5 - 6 and 7, 8 and 9, 11 and 12, 13 and 14, 15 and 16, 17 and 18, 19 and 20, K9 - 5 and 6, 7 and 8, 9 and 10, 11 and 12, 13 and 14, 15 and 16, 17 and 18, TB 2 - 3 - 4 - 5 - 6 - 7 - 8, LP1 - 2 - 3 - 4 - 5 - 6 - 7, JPX/JPY, TC5, +DC. A holding circuit is provided for K5 to insure that all code magnets will be energized regardless of when the Tape Feed switch is released: -DC, TC6, TB19, K2 - 12 and 11, K5 - 1 and 2, K5, TC5, +DC. When K2 is energized, its contact 11 and 12 will open breaking the K5 holding circuit. K2 will have a holding circuit, however, through its contact 18 and

17 only until K5 drops out opening its contacts 5 and 4.

With a card in the punch, the operate strap of the card feed micro-switch will be transferred, so that when the S10 switch is depressed the card feed relay (K4) will be energized: -DC, TC6, N/O S10, JPU, C.F. Micro Switch, JPW, TA21, K4 coil, TC5, +DC. K4 is held: -DC, TC6, TB19, K4 - 16 and 17, TA 25, JPU, card feed switch, JPW, TA 21, K4, TC5 + DC. When the S10 switch is released a circuit will be made to LPC: -DC, TC6, N/C S10, TA23, K4 - 15 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3 - 2 and 1, K9 - 3 and 4, TB1, JPK, LPC, JPX/JPY, TC5 + DC. The punch clutch will continue to cycle the card through the punch until either the end of a card or the hole in the next card allows the card feed switch to restore. Contacts 18 and 19 of K4 provide that the relay will be held long enough to energize the clutch and drive the card to the proper punching position.

Error Code Circuit

This circuit is used to punch a 1-2-4-8-X code in the tape which, when read, will not cause any operation of the Flexowriter. Operation of the Error Code panel switch (S9) will energize the error code relay (K6): -DC, TC6, N/O S9), TA32, K6 coil, TC5, +DC. With K6 energized circuits will be complete to LP1, LP2, LP3, LP4, and LP7

and the punch clutch in the same manner as explained in the Tape Feed Circuit.

As long as the S9 switch is held depressed, only one cycle of the punch can occur because the anti-repeat relay (K2) has been energized. The K2 relay will remain energized through its contacts 18 and 17, K6 - 7 and 6, and N/O S9 until the error code switch is released. The break contacts 3 and 4 of K6 prevent the punch error relay (K3) from locking the keyboard during this operation.

Print Restore Code Circuit

The print restore code (4-8-0) is perforated in the tape when the S8 panel switch is depressed. This code, when read by the reader, will restore the Flexowriter to normal printing condition only when non-print operation was initiated by a Non-Print code in the tape, or by depression of the Tape Skip panel switch.

With the S8 panel switch depressed the print restore code relay is energized: -DC, TC6, N/O, S8, TA33, K7 Coil, TC5, +DC. Punch and anti-repeat circuits correspond with the error code circuits previously explained.

Stop Code Circuit

When the Stop Code panel switch (S7) is depressed, a 1-2-8 code will be perforated in the tape, which, when read in the reader, will automatically stop reader operation. Operation of the S7 switch energizes

the stop code relay (K8): - DC, TC6, N/O, S7, TA34, K8 coil, TC5, +DC. When the K8 relay is energized, the LP1, LP2 and LP4 punch magnets and clutch magnet are energized in the same manner as explained in the Error Code Circuit.

READER AND TRANSLATOR CIRCUITS

Manual Start and Stop Circuits

The Start Read switch (S3), when depressed and released will energize the tape reader magnet (LR) and start a cycle of reader operation. To energize the reader magnet, when the S3 switch is depressed, a circuit is first completed to the reader control relay (K23): -DC, TC6, JRL (JRL connected to JRV; RTC contact not in card reader), RTC, RC 1 N/C -RC2 N/C -RC4 N/C, JRR, TA10, K3-11 and 12, TA20, N/O S3, TA39, K23 coil, TC5, +DC. When K23 contacts 1 and 2 close a holding circuit for K23 is maintained: -DC, TC6, JRL, RTC, RC1-2-4 (N/C), JRR, TA10, K3-11 and 12, TA20, S4 N/C, TA28, K23-1 and, K23 coil, TC5, +DC. When the S3 switch is allowed to return to its normally closed position, the reader magnet is energized: -DC, TC6, JRL, RTC, RC1-2-4 (N/C), TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC-1 and 2, TA19, K23-4 and 3, K21-2 and 1, K20-1 and 2, TA29, JRK, LR, JRX/JRY, TC5, +DC.

The reader will operate continuously

until either the reader magnet circuit is broken automatically (explained under Delay Control Circuit) or manually, by depressing the Stop Read switch (S4).

When the S4 switch is depressed, the holding circuit to the reader control relay (K23) is broken. Thus, when K23 contacts 4 and 3 open, the reader magnet is de-energized and the reader will stop.

Translator Magnet Circuits

When a reader pin senses a code in the tape, a corresponding reader contact closes and completes a circuit to the relative translator magnet.

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: -DC, TC6, RTC (RTC omitted in Card Reader - JRL is connected to JRU circuit), JRV, TB20, K12-17 and 18, TB30, JRT, RC1 and RC2, JRA and JRB, TB22 and TB23, K10-12 and 11, K10-15 and 14, TB12 and TB13, JTA1 and JTA2, LT1 and LT2, TC5, +DC. With pin operation the reader common contact (RCC) closed and completes a circuit to the translator clutch: -DC, TC6, RTC, RCC, JRP, TB21, K10-5 and 4, TB11, JTA6, LTC, TC5, +DC.

Delay Control Circuit

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. Two functions which require more operating time than the regular characters are carriage return (EL code) and tabular (2-4-8-CH-O) code. The back space mechanism is for manual operation only (uncoded).

When Tab 2-4-8-CH-O is read in the reader a circuit is completed to the delay control relay #1 (K21): -DC, TC6, RTC, RC1, RC3, RC4, RC7, RC6, RC5, JRS, TA30, K22-11 and 12, K12-11 and 12, K21 coil, TC5, +DC. When K21 is energized, contact strap 2 breaks with 1 and makes with 3. The energizing circuit to the reader magnet (LR) is broken, thus LR drops out and the reader stops. Since the read control relay (K23) remains energized, K21 will have a holding circuit: -DC, TC6, RTC, RC1, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC 1 and 2, TA19, K23-4 and 3, K21-2 and 3, K12-11 and 12, K21, TC5, +DC.

Assuming that Tab code, 2-4-8-CH-O, was read, then, at the same time the above circuit was complete to K21, a circuit would also be complete to the translator magnets LT2, LT3, LT4, LT5, LT6 and LTC. The translator would operate, pull down the tab keylever and initiate a tabular function. The operation of the tab mechanism would open CRTC and break the holding circuit to K21. The K21 contacts would return to their normal position, but the circuit to the reader magnet would not be complete until

the carriage tab stop struck the tab lever and unlatched the tab mechanism. When this occurs, the CRTC contact closes and completes the energizing circuit to the reader magnet, starting reader operation again.

Should the reader read the CR code, EL, K21 will again be energized until the opening of CRTC drops out K21's holding circuit. In this instance, K21 is energized by operation of RC8: -DC, TC6, RTC, RC8, RC2, JRM, TB10, K12-11 and 12, K21 coil, TC5, +DC.

Therefore, when a Tab or CR code is read by the reader, reader operation will automatically stop and will not start again until the particular function is complete.

Stop Code Circuit

When a stop code 1-2-8 is read by the reader, the holding circuit for the K23 relay (read control) will be broken, thus, de-energizing the reader magnet and stopping reader operation. Normally closed contacts on RC1, RC2 and RC4 complete the holding circuit through K23 contact 1 and 2 to the K23 coil. If all three contacts (RC1, RC2 and RC4) were to open simultaneously, the K23 relay would de-energize, open contact K23-4 and 3, and break the circuit to LR. The start read switch (S3) would have to be depressed to start the reader operation again.

Normally open contacts on RC3, RC6 and RC7 provide alternate holding circuits for

K23 when 1-2-8 is used in combination with other code units.

Tape Skip Circuit

The Tape Skip switch (S6) allows sections of tape to pass through the reader without operating the Flexowriter. Tape cycles through the reader only until a Print Restore Code (4-8-0) is read, which restores normal printing and punching operation automatically without stopping the reader. If carriage return codes are read during tape skip operation, the carriage will return and line space the form. When the Flexowriter punch or the motorized punch is on at the time of pressing the tape skip switch, only the carriage return code will be punched.

Operation of the Tape Skip switch (S6) will energize the reader magnet (LR) and start a cycle of reader operation. LR is energized: -DC, TC6, JRL, RTC, RC1-RC2-RC4 (N/C), JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, operated S6, TA18, K22 coil (tape skip relay), TC5, +DC. K22 relay is held energized: -DC, TC6, JRL, RTC, JRU, TB20, K14-5 and 6, K22-5 and 6, K22 coil, TC5, +DC. When the S6 switch is allowed to return to its normally closed position, the reader magnet is energized: -DC, TC6, JRL, RTC, RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC, TA19, K22-3 and 4, K21-2 and 1, K20-2 and 1, TA29, JRK,

LR, JRX/JRY, TC5, +DC.

As the reader cycles, the reader common contact (RCC) will close and energize translator magnet 5 (LT5) and the translator clutch (LTC). When LT5 is energized, a permutation bar will be released in the translator and prevent the selection of any keylevers except carriage return. Negative power to LT5 and LTC: -DC, TC6, JRL, RTC, operated RCC, JRP, TB21, K22-16 and 15, TA40, JTB1, LT5 coil, JTA5/JTB5, TC5, +DC. Also, from -DC, TC6, JRL, RTC, operated RCC, JRP, TB21, K10-5 and 4, TB11, JTA6, LTC coil, JTA5/JTB5, TC5, +DC.

Assuming that a Carriage Return code (EL) is read in the reader, LTC and LT5 will be energized, and in addition LT8: -DC, TC6, JRL, RTC, JRU, TB20, K12-18 and 17, TB30, JRT, operated RC8, JRJ, TB29, K12-15 and 14, TB18, JTB4, LT8 coil, TC5, +DC. To delay reader operation until the carriage return function is complete, the delay control relay (K21) will also be energized: -DC, TC6, JRL, RTC, operated RC8, N/C RC2, JRM, TB10, K12-11 and 12, K21 coil, TC5, +DC. When K21 picks up it will be held: -DC, TC6, JRL, RTC, RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC, TA19, K22-3 and 4, K21-2 and 3, K12-11 and 12, K21 coil, TC5, +DC. When the carriage return clutch toggle locks up, CRTC will open and drop

out K21. When the carriage return function is complete CRTC will close and LR will again be energized.

Tape skipping operation will continue in the reader until a P. R. code 4-8-0, which when read, will cause the print restore relay to pick up, drop out the tape skip relay and energize the read control relay for further reader operation.

When 4-8-0 is read, the print restore relay (K14) is energized: -DC, TC6, JRL, RTC, N/C contact RC1, operated RC3, RC4, N/C RC7, operated RC6, N/C RC5, JRW, TB38, K15-1- and 2, K14 coil, TC5, +DC. K14 has no holding circuit in this instance and will drop out when the reader contacts restore. When contact 5 and 6 of K14 opened, the holding circuit to K22 was broken and the tape skip relay dropped out. At the same time, however, negative was being applied to the read control relay (K23): -DC, TC6, JRL, RTC, JRU, TB20, K14-13 and 14, K23 coil, TC5, +DC. K23 is again held through its 1 and 2 contact. The circuit to LR is still complete: -DC, TC6, JRL, RTC, RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC, TA19, K23-4 and 3, K21-2 and 1, K20-2 and 1, TA29, JRK, LR, JRX/JRY, TC5, +DC. Since the tape skip relay (K22) is no longer energized its open contact 15 and 16 no longer energize LT5, therefore, all characters are allowed to print.

Manual Non-Print Circuit

The non-print switch (S5) will also allow sections of tape to pass through the reader without causing any operation of the Flexowriter. Tape cycles through the reader only until a stop code (1-2-8) is read, for the stop code is the only code recognized during this operation. The stop code is first reproduced automatically before stopping the reader. Non-Print operation can be terminated at any time by pressing the Stop Read switch. Although by-passed codes in the tape cause no operation of the Flexowriter, these codes can be reproduced by the Flexowriter punch or the motorized punch.

Manual operation of the Non-Print switch (S5) will energize the non-print relays and the read control relay: -DC, TC6, JRL, RTC, N/C RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, operated S5, TB37, K15 coil of manual non-print relay, K15-13 and 12 (now closed), coils of K10, K11, K12, TC5, +DC. When K12 picks up, voltage will be on its contact 5 and 6, K14-11 and 12 and K23 will be energized. With K23 energized a holding circuit will be complete to the read control relay and to the non-print relays: -DC, TC6, JRL, RTC, N/C RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S4, TA28, K23-1 and 2, K23 coil, TC5, +DC. When the non-print switch is released negative from K23-1 and 2 will be in parallel

to K14-11 and 12, K12-5 and 6, K12, K11, K10 coils, TC5, DC. The manual non-print relay (K15) and LR will be energized when K23-1 and 2 close. The energized non-print relays now prevent negative from reaching the translator, hence no printing occurs.

If punching tape is required on manual non-print operation, the punch control relay (K9) will be energized and the DC potential on the reader contacts will come from the punch. Assuming that the reader is in operation and that the character "1" is read, the punch magnets and clutch will be energized as follows: -DC, TC6, JRL, RTC, RCC, JRP, TB21, K10-5 and 6, K4-13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2-14 and 13, K3-2 and 1, K12-18 and 19, TB30, JRT, operated RC1, JRA, TB22, K10-12 and 13, K9-5 and 6, TB2, JPA, LP1, JPX/JPY, TC5, +DC. Also, from contact 1 and 2 of K3, K9-3 and 4, TB1, JPK, LPC, JPX and JPY, TC5, +DC.

Tape duplication will occur until a stop code is read in the reader, at which time the read control and non-print relays will be dropped out. When the reader reads 1-2-8 the N/C RC1, RC2, RC4 contacts open and break the holding circuit to K23. As RC1-2-4 break, however, a contact on RCC makes and negative power is allowed to maintain the non-print relays (through different coils) until the Stop Code has

been punched. From -DC, TC6, JRL, RTC, operated RCC contact, JRN, TB39, K12-2 and 3, K12 - K11 - K10 coils, also K15 - 4 and 5, K15 coil, TC5, + DC. When the reader pins reset these relays will drop out. Break contact 1 and 2 on K15 prevented picking up the print restore relay (K14) in the event a P. R. code was non-printed.

If the reader has been started by Manual non-print operation, it may be stopped by depressing stop read. In this instance, the holding circuit for K23 will be broken at the transfer strap of S4. This is a make-before-break contact and the non-print relays and K15 will again be held (after the read control relay has dropped out) until the last code sensed by the reader has been punched and the S4 switch released.

Automatic Non-Print Circuit

A non-print operation on the Flexowriter can be initiated automatically by a non-print code in the tape. By-passed codes will be punched if the Flexowriter punch or the motorized punch is on at the time the N.P. code is read. Automatic non-print operation is restored to normal printing by a P.R. code which does not stop the reader. This differs from the manual operation of the non-print switch which is stopped by a stop code.

Assume that the reader is in normal operation and that a non-print code (4-8-CH) in the tape is read. Delay control

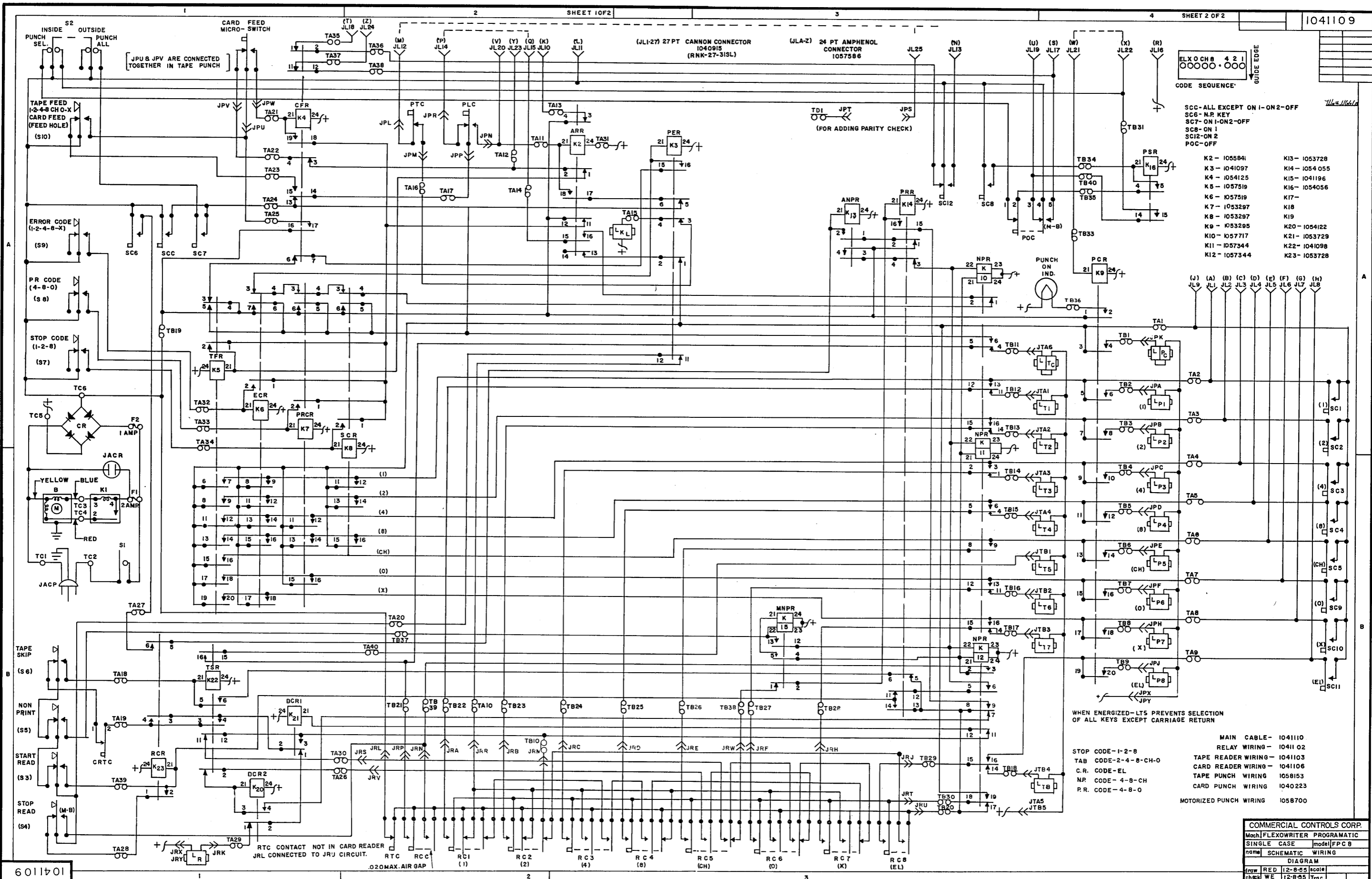
relay #2 will be energized: -DC, TC6, JRL, RTC, N/C RC1, operated RC3, operated RC4, N/C RC7, N/C RC6, operated RC5, JRV, TA26, K22-1 and 2, K20 coil, TC5, + DC. K20 will be held: -DC, TC6, JRL, RTC, JRU, TB20, K12-8 and 7, K20-3 and 4, K20 coil, TC5, + DC. The circuit to LR will now be broken by the open contact K20-1 and 2, and the reader will momentarily stop.

As delay control relay #2 was being energized, the non-print code 4-8-CH was also effecting translator operation, tripping the N.P. keylever, and closing selector contact SC6. The automatic non-print relay (K13) will now pick up: -DC, TC6, SC6, TA27, K23-6 and 5 (only the reader magnet has dropped out), K13 coil, TC5, + DC. K13 remains locked up: -DC, TC6, TB19, K14-1 and 2, K13-1 and 2, K13 coil, TC5, + DC. The non-print relays are now energized: -DC, TC6, TB19, K13-4 and 3, K14-4 and 3, K10, K11, K12 coils, TC5, + DC. Holding circuits for these relays will be complete when K12-5 and 6 close. Note that the manual non-print relay is not energized. The reader magnet will again be energized when K12 contacts 7 and 8 open and drop out DCR #2 (K20).

Non-printing continues until the reader senses the 4-8-0 print restore code, which operation energizes the print restore relay: -DC, TC6, JRL, TRC, RC1 N/C, operated

RC3, operated RC4, N/C RC7, operated RC6, JRW, TB38, K15-1 and 2, K14 coil, TC5, +DC. K14 is held: -DC, TC6, JRL, RTC, JRU, TB20, K12-8 and 9, K14-15 and 16, K14 coil, TC5, +DC. With K14 operated its contact 1 and 2 opens dropping out K13;

contacts 3 and 4, open dropping out K10, K11 and K12. When contact 8 and 9 of K12 open the holding circuit for K14 is broken, but the read control relay has been held energized and normal reading and printing is now restored.



ELX O CH 8 4 2 1
 ○○○○ ○○○
 GUIDE EDGE

CODE SEQUENCE
 SCC-ALL EXCEPT ON 1-ON 2-OFF
 SC6-N.R. KEY
 SC7-ON 1-ON 2-OFF
 SC8-ON 1
 SC12-ON 2
 POC-OFF

- K2 - 1055841
- K3 - 1041097
- K4 - 1054125
- K5 - 1057519
- K6 - 1057519
- K7 - 1053297
- K8 - 1053297
- K9 - 1053295
- K10 - 1057717
- K11 - 1057344
- K12 - 1057344
- K13 - 1053728
- K14 - 1054055
- K15 - 1041196
- K16 - 1054056
- K17 -
- K18 -
- K19 -
- K20 - 1054122
- K21 - 1053729
- K22 - 1041098
- K23 - 1053728

(J) JL9 (A) JL1 (B) JL2 (C) JL3 (D) JL4 (E) JL5 (F) JL6 (G) JL7 (H) JL8

WHEN ENERGIZED-LTS PREVENTS SELECTION OF ALL KEYS EXCEPT CARRIAGE RETURN

- STOP CODE-1-2-8
- TAB CODE-2-4-8-CH-0
- C.R. CODE-EL
- NP. CODE-4-8-CH
- P.R. CODE-4-8-0
- MAIN CABLE- 104110
- RELAY WIRING- 1041102
- TAPE READER WIRING- 1041103
- CARD READER WIRING- 1041106
- TAPE PUNCH WIRING- 1058153
- CARD PUNCH WIRING- 1040223
- MOTORIZED PUNCH WIRING- 1058700

COMMERCIAL CONTROLS CORP.			
Mach	FLEXWRITER	PROGRAMATIC	
SINGLE CASE	model	FPC 8	
name	SCHEMATIC WIRING		
DIAGRAM			
Drawn	RED	12-8-55	scd/c
check	WE	12-8-55	Tr/c
DATE			

MANUAL ADDENDUM

Date: March 26, 1958

Reference: To be inserted in Part VI, after Section 5

Subject: F P C - 8 Programatic Duplex

Purpose: Circuit Description (Wiring Diagram 1043042)

Information:

NON-DUPLEX OPERATION (Switching Codes Ignored)

Start Read - This operation can be initiated in either reader, independently, by depressing the respective start read switch. Negative will be applied to the start read switch 1: TC7, TA26, K3 - 12 and 11, JRL, STT, SRT (#2 reader), TB10, start read switch. Depression of the switch will cause RR1 (K22) to be energized but not held. RRC1 (K3) is now energized: TB10 (-), TA32, K22 - 3 and 4, K3. RRC (K2) is also energized through K22 - 1 and 2. With K2 picked up K3 will have a holding circuit through its contacts 16 and 15 and K2 - 4 and 3. K2 is held through K2-2 and 1 and the N/C Duplex Clear Switch.

When the Start Read 1 Switch is released, RDC2 (K16) is energized. Its contacts close and the reader magnet (LR) picks up; tape is read in #1 reader.

If a C.R. or Tab code is read RCD 1 (K17) will pick up and hold, drop K16 and LR and delay reader. SCRT will drop K17 when open. Termination of function will allow K16 and LR to re-energize.

Stop Read - If Stop Read switch is fully operated while the reader is operating, RSC (K18) will energize and hold, breaking the circuit to LR. Operation of either Start Read 1 or Start Read 2 switches will allow the stopped reader to continue by dropping out K18. K16 also drops out until the Start Read switch is restored. The same circuit would apply if the reader read a stop code.

Start Read 2 - If the #1 reader is reading and stopped and it is desired to read from the #2 reader, the Duplex Clear switch must first be operated and then the Start Read 2 switch. Duplex Clear switch will cause K3 and K2 in the above Start Read operation to drop out. Pressing

Start Read 2 will energize RR2 (K21) which will allow RRC2 (K4) and K2 to energize. Both relays will hold, K16 and LRC will then energize; the indicating lamp will be on.

Auto Non-Print - When a N.P. code is read SS6 closes and RANP (K7) picks up and is held. Negative on K7-15 and 16 will pick up RNP (K5, K10, K11). RDC 1 (K17) also picks up and delays the reader by dropping K16 and LR. When K5 is energized, K16 is re-energized and LR picks up again. The closure of SRC contacts provide negative through K5-3 and 2 to the reader contacts and the punch magnets.

Reading of the PR code (4, 8, 0) restores the reader to normal reader operation by energizing RPR (K8) which holds until K7 drops out. Secondary SRC contacts hold the NP relays long enough to punch the PR code.

Manual Non-Print - This operation is initiated by first operating and holding the Start Read Switch for the desired reader, then operating the Non-Print Switch, and releasing both together.

1. Press Start Read: Energize RR1, RRC1, RRC. K3 and K2 hold.
2. Press Non-Print: Energize RMNP (K6) and K5, K10, K11. NP relays will be held through K6- 4 and 5.

When both switches are released, K16 will pick up and energize LR.

The Non-Print operation will continue until the reading of a Stop Code or operation of the Stop Read Switch. If a Stop Code is read, RSC (K18) will pick up, hold, and drop out LR. K18 - 11 and 12 will also drop out the NP relays. The SRC secondary again supports the RNP's while K18 breaks their hold circuit. The Stop Code is punched. Depression of either Start Read Switch or Non-Print will drop K18 and allow reading or non-printing to continue. If, at this time, the other reader is desired, the Duplex Clear Switch must be operated first, the desired reader selected, and the Non-Print switch operated.

Skip Operations - The Flexowriter may be wired for four different skip operations.

1. Tape Skip (Connections 1 and 5) restores to normal reading on Print Restore Code. All operations are ignored except Carriage Return. Operation is initiated by depressing Start Read Switch,

the Skip Switch and allowing both to restore. Start Read Switch 1 energizes K22, K3, K2. Skip Switch energizes RS (K9) and it is held through Connection 1. Start Read Switch restored allows K16 to pick up and energize LR. Operation of LT5 allows translator selection of C.R. only. Open K9- 14 and 15 contacts prevent energizing K17 on a NP or Tab Code in Tape Skip.

Print Restore Code restores operation to normal: K8 picks up, not held, but drops K9. LT5 no longer operates and Flexowriter prints.

2. Line Skip 1 (Connections 2 and 5) restores to normal reading on Carriage Return Code. Only On 1, On 2, Off, C.R., Ltrs. and Figs. keys are selected. Operation is initiated as in Tape Skip. K9 is held through Connection 2. When a C.R. code is read K17 will pick up, delay reader and drop out K9. SCRT will drop K17 and allow normal operation to continue.
3. Line Skip 2 (Connections 2, 4 and 5) stops Flexowriter on a C.R. Code. LT5 allows key selection as in Line Skip 1. Operation is initiated as in Tape Skip. K9 is energized and held through Connection 2. When a C.R. Code is read K17 will pick up and drop out K9. In addition (through connection 4) RSC (K18) will be energized and held through the Start Read Switch. SCRT will drop out K17, but LR will be de-energized until depression of the Start Read Switch drops out K18.
4. Special Skip (Connections 3 and 6) restores to normal reading on Skip Restore Code (1-4-8). LT5 prevents selection of all keys. Operation is initiated as in Tape skip. K9 is energized and held through Connection 3. When a Skip Restore Code is read K10 will pick up and drop out K9. LT5 will no longer operate and normal operation will continue. Connection 6 allows normal delay operation on Carriage Return.

Duplex Operation (Switching Codes Recognized)

All operations are the same in Duplex as in non-Duplex except that the switching codes will be recognized and the readers will switch in the normal reading operation. The switching codes will not be recognized in Manual and Automatic Non-Print or Skip. The switching code is 1-4-8-CH-0 (5 over Z).

With negative from SRT (#2 reader) and the Duplex Switch operated

RD (K23) will be energized. Start Read operation may then be initiated in either reader.

If tape is being read in the Flexowriter Reader, read control relays K3 and K2 will be energized. When the reader reads a switch code K23- 2 and 1 will allow RS2 (K19) to pick up. K19 - 4 and 3 will then pick up K4, which will drop K3. Open K4 - 5 and 6 will also drop LR, and the Flexowriter Reader will stop. K3 - 3 and 4 will hold K4. Since K19 has no holding circuit a circuit will now be complete to the Motorized Reader (#2) clutch magnet: - DC, SRT, K2-5 and 6, K19- 2 and 1, K4 - 14 and 13, K3 - 5 and 6, K18 - 1 and 2, K16 - 3 and 4, STC, LRC, plus DC.

A switch code now read in #2 reader will energize RS 1 (K20), which will in turn energize K3. K3 will drop K4 and establish a holding circuit through K4- 4 and 3. K3 - 5 and 6 will drop LRC, but LR will be re-energized: -DC, SRT (#2), K2- 5 and 6, K20 - 1 and 2, K3 - 14 and 13, K4- 6 and 5, LR, plus DC.

General

Switch Reader Tape - In the Non Duplex condition, either reader can operate without having tape in the other reader. The SRT contacts are spring-loaded and will open without tape in the reader. Reading operation can only occur in the reader with tape.

For example, with tape in the #2 reader only, and the Start Read #2 depressed K4 and K2 would be energized and held: -DC, TC7, TA29, K3-11 and 12, TA33, SRT (#2 reader), N/C Start Read 1 Switch, operated Start Read #2 switch, K21 coil, plus DC. K4 and K2 are energized and held. Holding circuit for K2: -DC, TC7, TA29, K3-12 and 11, TA33, SRT (#2 reader) TB10, N/C Duplex Clear Switch, K2- 2 and 1, K2 coil, plus DC.

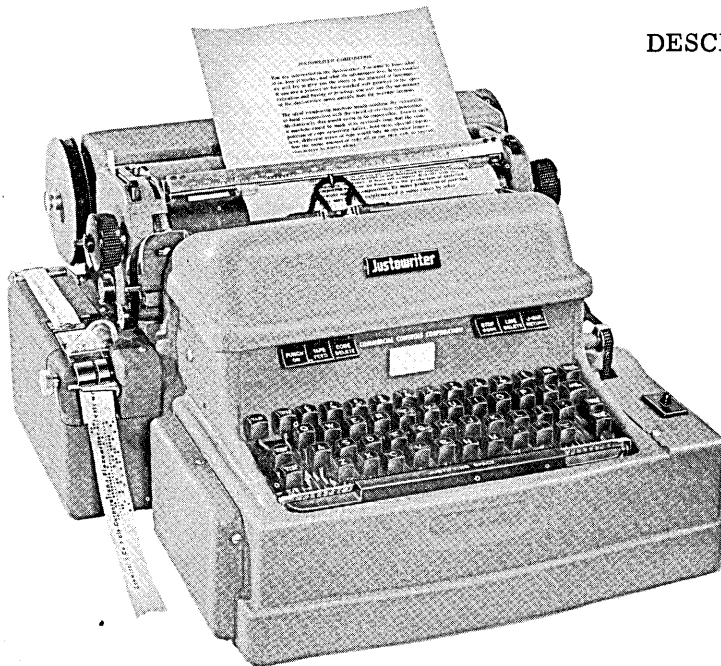
In the Duplex condition, when a switching code switches to a reader that does not have tape in it, all operations will stop. In the above, if a switching code was read in the #2 reader K4 would drop out, but K3 and K2 could not be held. However, if the Flexowriter Reader is Edge Card, switching to it when there is no tape or card in it will not stop the operation.

PART VII

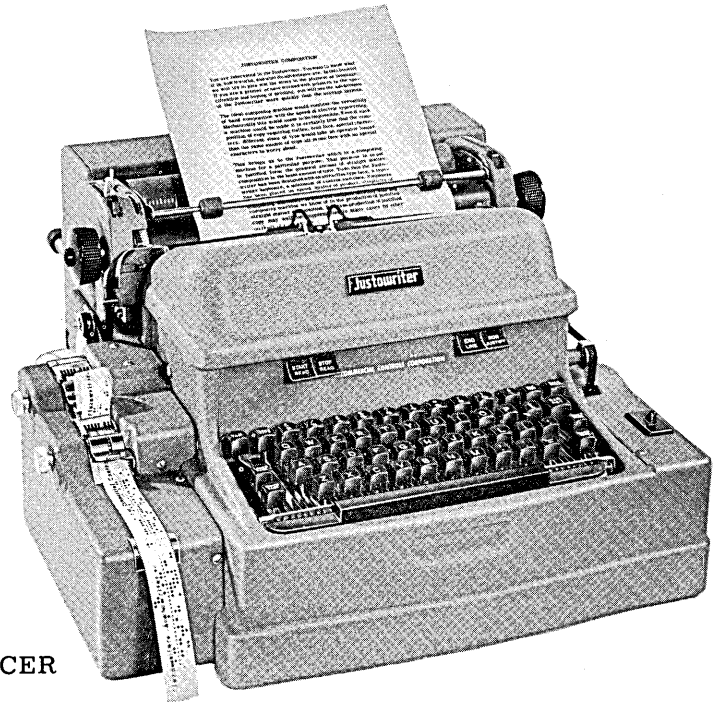
JUSTOWRITER

Section 1	Description
Section 2	Maintenance
Section 3	Recorder Circuit Description
Section 4	Reproducer Circuit Description
Section 5	Rec-Rep Circuit Description

DESCRIPTION



RECORDER



REPRODUCER

Figure 1-1 The Justowriter

GENERAL

The Justowriter is a proportional spacing, automatic justifying, typewriter composing machine which requires only one manual typing. The second, or justification typing, is accomplished by means of a perforated tape.

The Justowriter consists of two machines which are called: Recorder unit and Reproducer unit. Each is basically a proportional spacing, electrically powered typewriter with a standard keyboard. The Recorder unit is provided with a punch which records in a narrow tape the code for each letter and function. The Reproducer has a reader (double reader) which interprets the tape and

automatically types and justifies in page or galley form.

The product is a clear, opaque justified page or galley in 12, 10 or 8 point type face of various styles especially suited to offset reproduction. The impression of each letter is obtained by using a one-time carbon ribbon. The characters are proportionally spaced to their natural widths from $2/32$ inches to $5/32$ inches in increments of $1/32$ inches.

The Recorder unit is operated manually, in the same manner as any conventional typewriter, to print a trial copy to determine the normal length of a typed line. At the same time that a character is being printed or a function operated, a code is

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perforated in a paper tape in the tape punch. When each line is completed, justifying information is also punched in the tape. This justifying information enables a line to be expanded or contracted to the desired length when it is retyped. This retyping is produced automatically on the Reproducer unit, and the justifying information in the tape automatically sets up apparatus to alter the spacing between words as required for justification of each line.

The word spacing in both the Recorder and Reproducer is accomplished by means of a variable escapement mechanism that is used for proportional letter spacing. The normal word spacing, as a result of operating the justifying space bar on the Recorder, is two units. When justifying in the Reproducer, the word spacing may be one, two, three, four or five units as required. (One unit is 1/32", 1/36" or 1/48".)

The expansion and contraction of word spacing in a line is accomplished in multiples of one unit spacing. Also, the maximum number of word spaces that can be expanded or contracted is eight. Thus, if a line has more than eight word spaces, the ninth, tenth, etc. word spaces will be a normal two units.

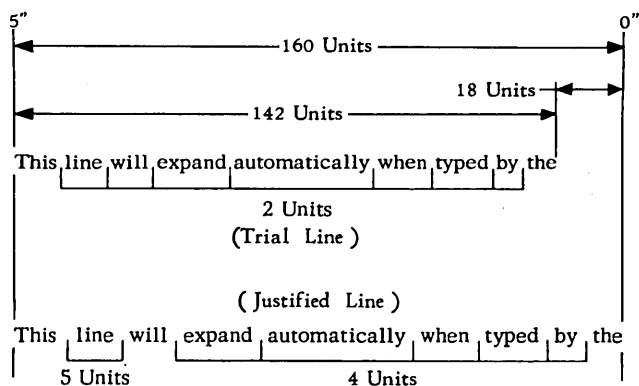


Figure 1-2 Trial and Justified Line

Figure 1-2 illustrates a line typed on the Recorder and the justification of the same line when automatically typed by the Reproducer. This line has eight word spaces and the trial line is 18 units short of zero for a five inch line (five inch line is 160 units - 32 units to the inch). The line is automatically expanded 18 units in the Reproducer by adding 3 units to the first two word spaces and 2 units to each of the remaining word spaces. Therefore, the total units in each word space is; five units in the first two, and four units in the remaining six word spaces.

All this is accomplished automatically by apparatus in the Recorder which selects a particular justification control code to be punched in the tape. Also, when the tape is read in the Reproducer, apparatus conditions this control code to automatically select the proper number of word spacing units at the start of the line and the point, if any, where this word spacing value decreases or steps down one unit.

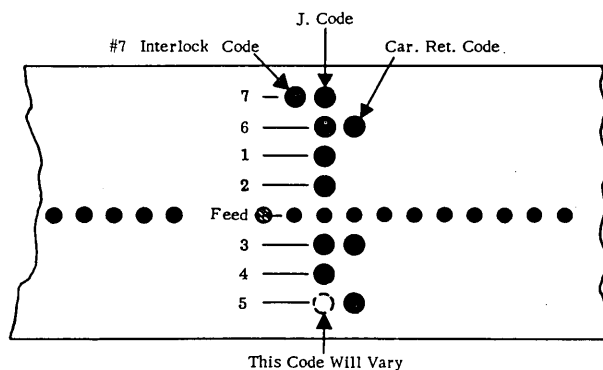


Figure 1-3 Justification Code In Tape

CODE SYSTEM

The same codes are used in the Justowriter tape for the characters and most of the functions

as are used in the Flexowriter tape explained in Part II Section 1 of this manual. In addition to the character and function codes, a justification code is used at the end of each line. This justification code actually consists of three distinct codes. (See Figure 1-3.) The first code will always be a number seven. The second code will always contain the 6-7 plus any combination (a maximum of 30 combinations) of 1 through 5. The last justification code will always contain a carriage return code which is 3-5-6.

The above three codes are perforated in the tape automatically when the operator reaches the end of a line and depresses the J-Carriage Return switch.

The number seven code is used as an interlocking code for the two reading heads of the Reproducer double reader.

The front reader is called the print reader while the back reader is called the J-reader or justifying reader. Each line in a tape is always fed through the J-reader before feeding through the print reader. Therefore, the number seven code in each line insures that the justification code will always be read first, thus conditioning the Reproducer for proper justification before any codes in that line are read by the print reader. This interlock holds true no matter how the lines vary in length.

UNITS OF JUST.	CODE 1 W.S.	CODE 2 W.S.	CODE 3 W.S.	CODE 4 W.S.	CODE 5 W.S.	CODE 6 W.S.	CODE 7 W.S.	CODE 8 W.S.
- 7								367
- 6							367	3467
- 5						367	3467	467
- 4					367	3467	467	4567
- 3				367	3467	467	4567	567
- 2			367	3467	467	4567	567	3567
- 1		367	3467	467	4567	567	3567	34567
0	67	67	67	67	67	67	67	67
+ 1	1367	1367	1367	1367	1367	1367	1367	1367
+ 2	2367	13467	13467	13467	13467	13467	13467	13467
+ 3	12367	2367	1467	1467	1467	1467	1467	1467
+ 4		23467	2367	14567	14567	14567	14567	14567
+ 5		12367	23467	2367	1567	1567	1567	1567
+ 6		123467	2467	23467	2367	13567	13567	13567
+ 7			12367	2467	23467	2367	134567	134567
+ 8			123467	24567	2467	23467	2367	167
+ 9			12467	12367	24567	2467	23467	2367
+ 10				123467	2567	24567	2467	23467
+ 11				12467	12367	2567	24567	2467
+ 12				124567	123467	23567	2567	24567
+ 13					12467	12367	23567	2567
+ 14					124567	123467	234567	23567
+ 15					12567	12467	12367	234567
+ 16						124567	123467	267
+ 17						12567	12467	12367
+ 18						123567	124567	123467
+ 19							12567	12467
+ 20							123567	124567
+ 21								12567
+ 22								123567

Figure 1-4 Justification Code Chart

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The second code contains the necessary justification information for conditioning the Reproducer to expand or contract a line the necessary number of units. As stated previously, the 6-7 code is always perforated in this position and is recognized by the J-reader only (the print reader will ignore this code). The 6-7 code, when read by the J-reader will start print reader operation, also, the 1 through 5 code units will condition the Reproducer to justify the line. There are thirty different binary code combinations that may be used from the 1 through 5 code units of justification code. These are shown in the chart in figure 1-4.

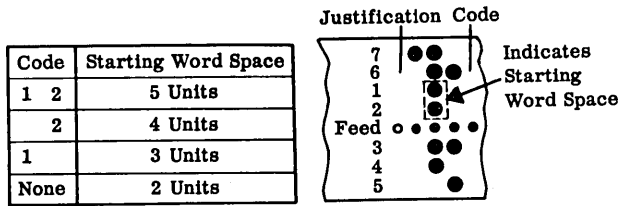


Figure 1-5 Starting W. S. Codes

This second position justification code can be broken down into two more groups (the 6-7 control code has already been explained). The 1 and 2 code units determine what the first or starting word space will be in a line. (See Figure 1-5.) Because there are two code units involved, there are four possible combinations of these code units. These four combinations correspond to the four possible units of escapement for a starting word space. They are as follows: if a 1-2 code is in the tape, the starting word space will be five units. With a 2 code in the tape, the starting word space will be four units. A 1 code in the tape will give a starting word space of three units. With neither the 1 or 2 code in the

tape, a normal spacing of two units will be the starting word space.

The 3, 4, and 5 code units of this code position determine when the units of word spacing will decrease. (See Figure 1-6.) Or, in other words, these codes condition the Reproducer to automatically decrease the starting word space by one unit somewhere after the first word space and before the eighth word space.

These three units of code provide eight code combinations. The chart in figure 1-6 shows these eight combinations plus the results of each. For an example, if a 3-4 code was read in the J-reader, the Reproducer would be conditioned to decrease the starting word space by one unit after the second word space operation for that particular line.

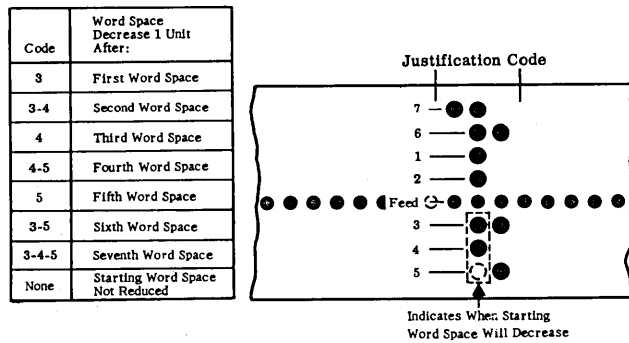


Figure 1-6 Word Space Reduction Codes

The third position of the justification code always contains a 3-5-6 carriage return code which, when read by the print reader in the Reproducer, will return the carriage and index the platen for the next line.

RECORDER

The Recorder consists of a writing machine (typing mechanism) which is basically similar to

a Flexowriter with a proportional spacing mechanism (explained in Part II, Section 2 of this manual). The tape punch in the Recorder is identical to the tape punch explained in Part II, Section 5. Also, the code selector is similar in operation to the code selector explained in Part II, Section 3. It is apparent, then, that the same sequence of operation takes place when a keylever is depressed. That is, the operation of a keylever will trip its related cam. The cam operation causes a type bar to print a character plus operate a selector slide. The selector slide operation closes contacts which in turn causes a punch cycle of operation, thus perforating a code in a paper tape.

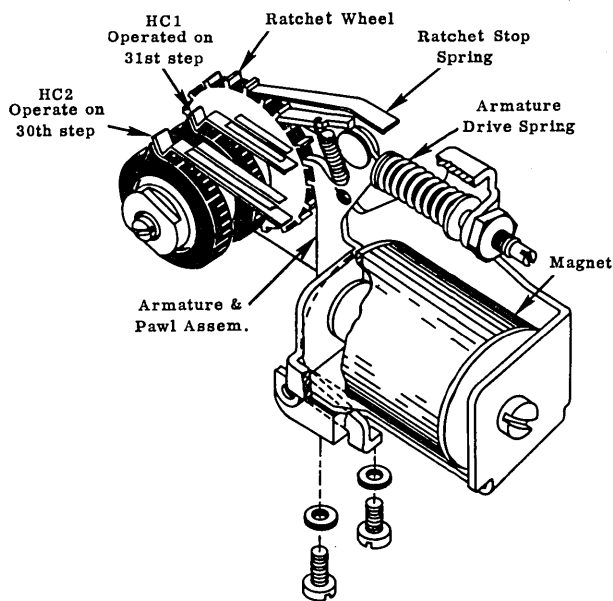


Figure 1-7 Hole Counter

Hole Counter (Figure 1-7) - As each line is typed on the Justowriter Recorder, the first 30 codes punched in the tape are counted by a mechanism called the tape hole counter. The

tape hole counter is provided to insure that the distance between each justification code is at least three inches. This is necessary for proper operation of the J-reader and print reader in the Reproducer (the distance between the two reading stations is three inches). The hole counter is essentially a stepping switch mechanism using a magnet (HCM) to index a rotary shaft through a pawl and ratchet mechanism. The shaft is rotated one ratchet position when the magnet is de-energized. The ratchet wheel has 33 teeth and is fastened to the shaft. Also located on the shaft are two cams each having one lobe. The lobes are the distance of one ratchet tooth apart. The lobe on the right hand cam (viewed from armature end) operates its corresponding contacts on the 30th step of the ratchet and restores them on the 31st step. The lobe on the left hand cam operates its corresponding contacts on the 31st step of the ratchet and restores them on the 32nd step.

As stated previously, the first 30 holes perforated in the tape are counted by the hole counter. After the 30th step, the transferring of the right hand contacts prevent further stepping operation until the J-Carriage Return switch is depressed (see Circuit Description, Part VII, Section 3). When the J-Carriage Return switch is depressed, the 31st, 32nd and 33rd steps take place automatically. These last three steps perforate the 7, 6-7 (plus any combination of 1 through 5) and the 3-5-6 justification code in the tape.

Computer and Code Bar Assembly - The code computer mechanism is a device which operates to select one of 30 different justification control codes (Figure 1-4) which corresponds to the number of units a trial line is shorter or longer

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than the desired justified length. This code selected also corresponds to the number of word spaces in the line.

The code computer is mounted as a unit to the left rear base frame at the rear of the carriage to work in conjunction with a computer code bar assembly which is mounted on the carriage (Figure 1-8).

The justification control information is in the form of a five unit code and accordingly there are five sets of contacts, JC1, JC2, JC3, JC4, and JC5, on the computer. Each set of contacts has an associated vertical contact arm (637) on which is pivoted a horizontal seeker (638). The tension of the movable contact springs of each set of contacts is formed in a direction which tends to close the contacts. The contacts are prevented from closing, however, by a contact arm bail (641) which extends across the five contact arms and normally holds the contacts open against the force of the springs. (See Figure 1-9.) A justifying code magnet (JCM) controls the

operation of the contact arm bail. The magnet (JCM), however, does not become energized until the carriage has moved into the justifying zone. The maximum justification that can be obtained is plus 22 units to minus 7 units with at least eight word spaces in a line. This, then, would be the maximum limit for the justification zone. The minimum justification zone extends from plus 3 to plus 1 units from zero which results from a line with one word space only. Thus, the extent of the justification zone depends upon the number of word spaces in a line.

In view of the above, it is necessary to have the computer count and store the number of word spaces in each line. This is accomplished by a seeker bail (642) which is indexed from its normal or zero position upwardly to eight different positions by a justifying space magnet (JSM). (See Figure 1-10.) The justifying space magnet (JSM) is energized each time the justifying space bar is operated so that the seekers are elevated by the seeker bail, one position for each succeeding word

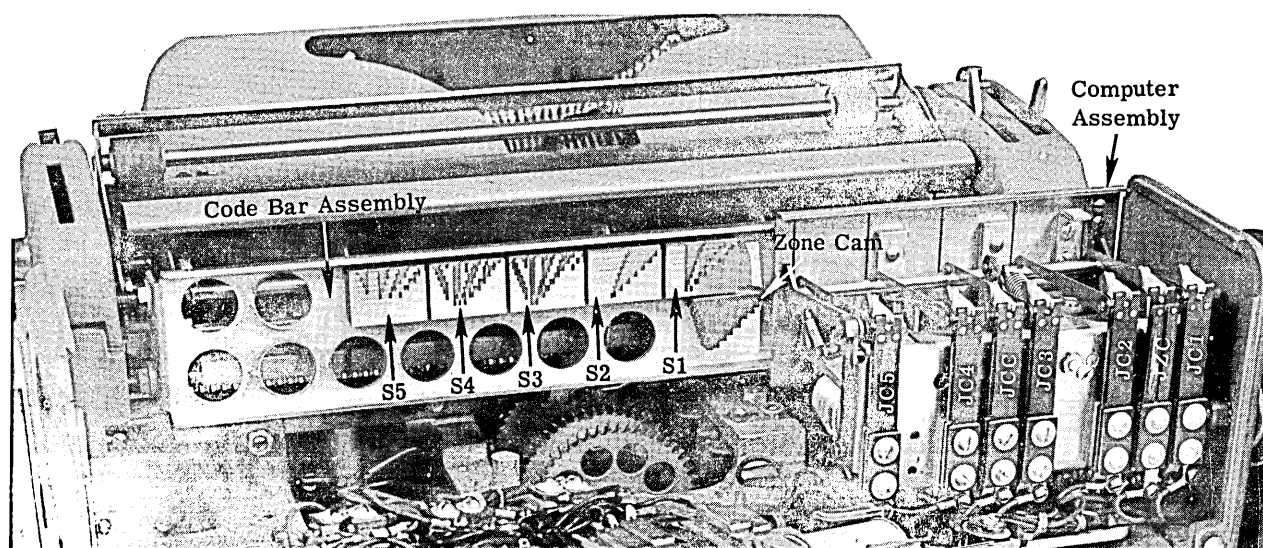


Figure 1-8 Computer and Code Bar Location

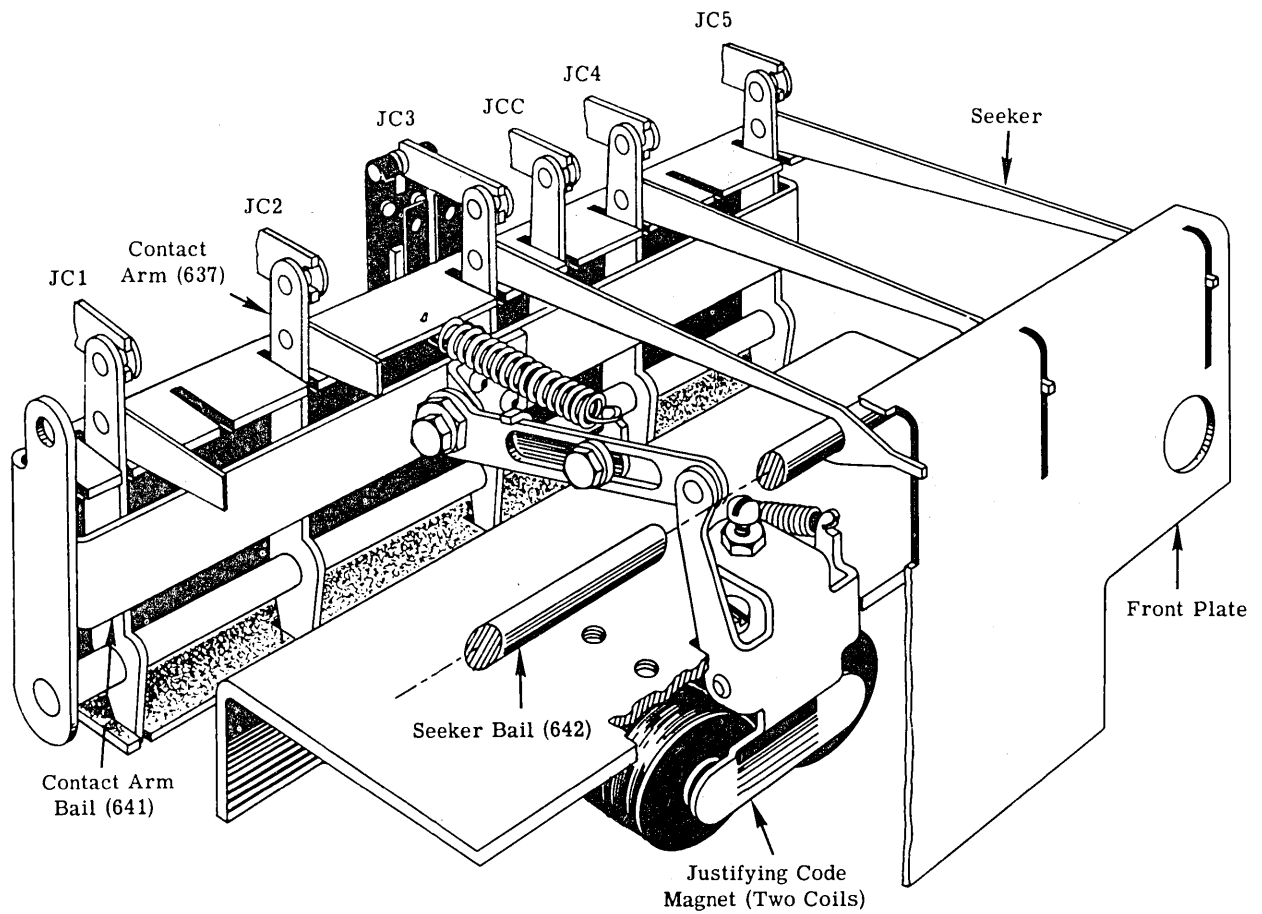


Figure 1-9 Seeker Operating Mechanism

space. The seeker bail not only determines the angular position of all five of the seekers with respect to their contact arms, but is designed to permit horizontal sliding movement of the seekers also.

The indexing mechanism functions through the movement of the JSM armature which, in turn, pivots the pawl operating arm (650) counter-clockwise. The indexing pawl (656), being pivotally connected to the pawl operating arm, is therefore rocked into contact with a tooth on the seeker bail operating arm segment. This movement, therefore, elevates the seekers the distance of one segment tooth each time the JSM is energized.

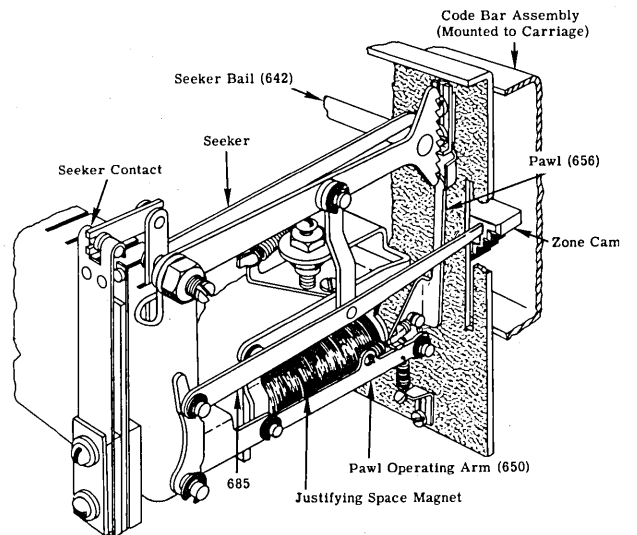


Figure 1-10 Indexing Mechanism

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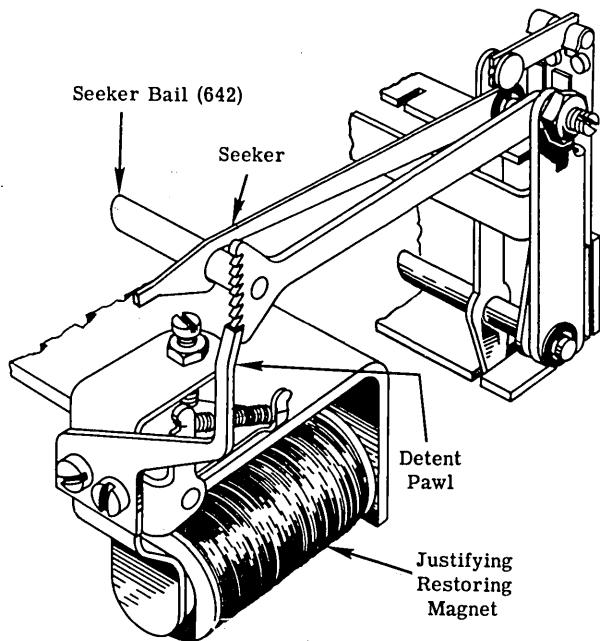


Figure 1-11 Detent Mechanism

A detent pawl engages a tooth of the right hand segment and holds the seekers in each elevated position. The detent pawl is disengaged from the segment each time the justifying restoring magnet (JRM) is energized, thus allowing the seekers to drop down to their normal position. (See Figure 1-11.)

A zone contact operating arm (685) follows the upward indexing movement of the seekers through a link (687) which is connected to the seeker bail operating arm. The front end or nose of the zone contact operating arm extends through a vertical slot in the front plate. The rear end of the operating arm is linked to the justifying zone contact (JZC). (See Figure 1-12.)

A justifying zone cam is mounted on the code bar assembly to move with the carriage. This cam works in conjunction with the nose of JZC operating arm to close the justifying zone contact during certain zones of movement of the carriage

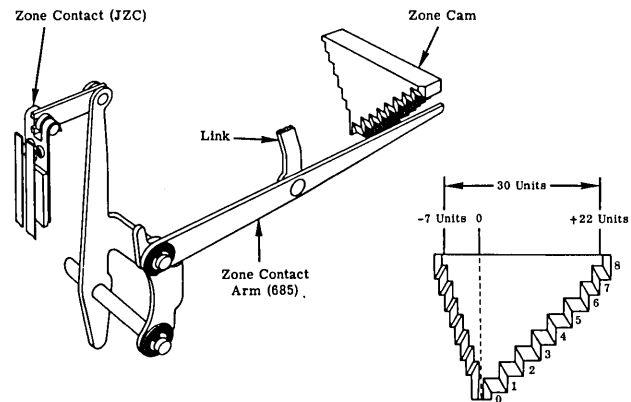


Figure 1-12 Zone Contact Linkage and Cam

depending on the number of word spaces in the line. As explained previously, the maximum justification that can be obtained is plus 22 units to minus 7 units with at least eight word spaces in a line. Therefore, the zone cam is arranged to hold the contact JZC closed through a maximum of 30 units of travel of the carriage when there are eight or more word spaces (seekers elevated to highest level). When there is only one word space in a line, the zone cam will hold the contact JZC closed through a maximum of four units of travel of the carriage. In other words, the greater the number of word spaces, the greater will be the range of positions of the carriage in which justification can be accomplished. The face surface of the zone cam presents an angular area which increases in width from bottom to top. Consequently, as the seeker operating arm is indexed upwardly as word spaces are put into the line being written, a wider surface of the cam will be presented to the nose of the zone contact operating arm. The closing of contact JZC energizes a lamp JZL and the contact remains closed during the time that the nose of the operating arm travels across the face of the cam. In

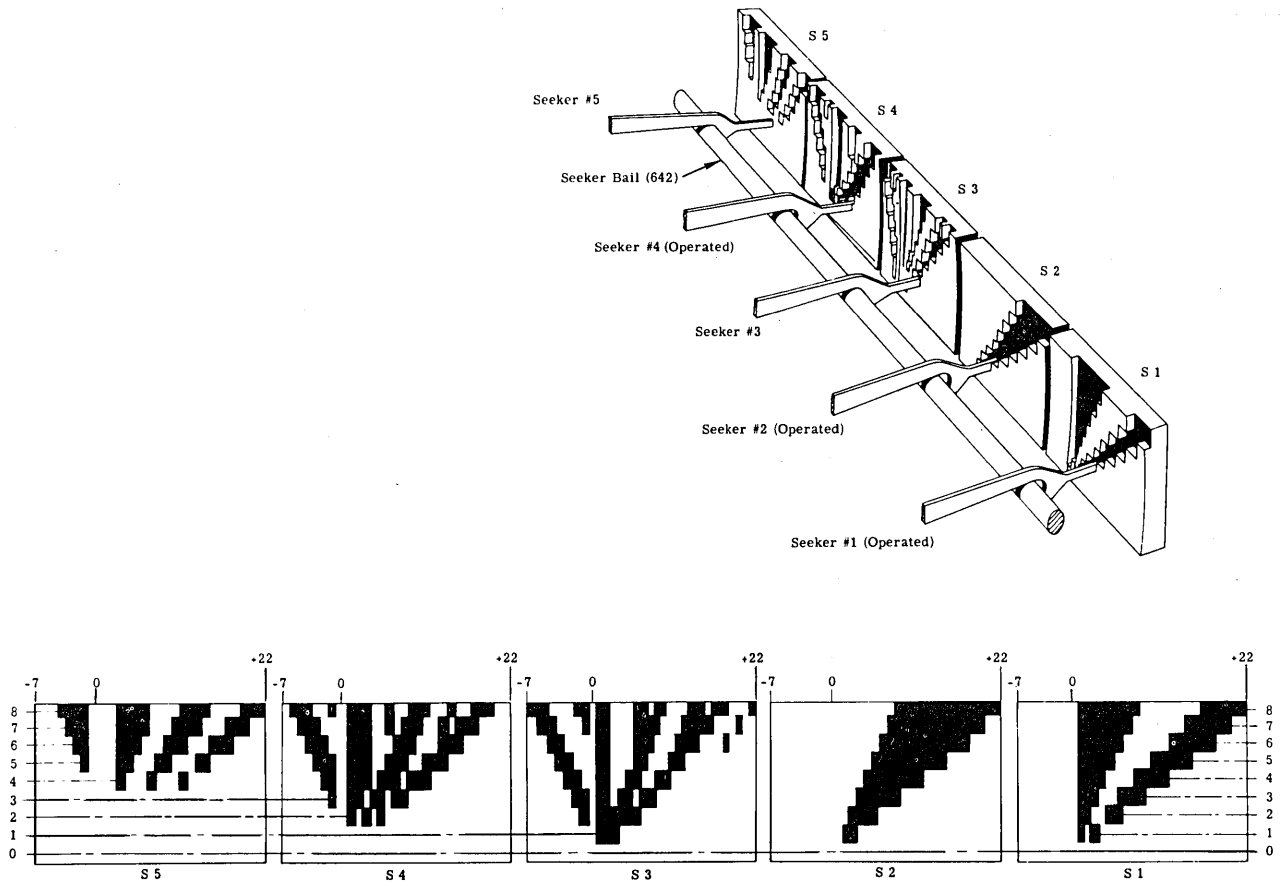


Figure 1-13 Code Bar Assembly

studying the code chart in Figure 1-4, it will be obvious the manner in which the zone cam derives its shape.

There are five individual sections mounted to the code bar assembly which are identified as S1, S2, S3, S4, and S5. Each section is approximately one inch in length and is associated with one of the five seekers. The seekers are horizontally spaced one inch apart also. The five sections of the code bar assembly have nine vertically spaced fields at levels corresponding to zero and the eight stepped positions of the seekers. Each level (except zero) of a section is notched at certain horizontal unit spaces to

allow forward movement of the seekers which are under tension of their individual contact springs. If a seeker does move into a notch in its related code bar section, the seeker movement will allow its contact to close. The remaining portions of the code bar sections which are not notched restrain forward movement of the seekers to prevent closing of the contact points. Thus each horizontal unit space of each section and level of the code bar is either notched or not, to control the operation of all five contacts (JC1 through JC5), according to the horizontal position of the carriage and the vertical position of the seekers. (See Figure 1-13.)

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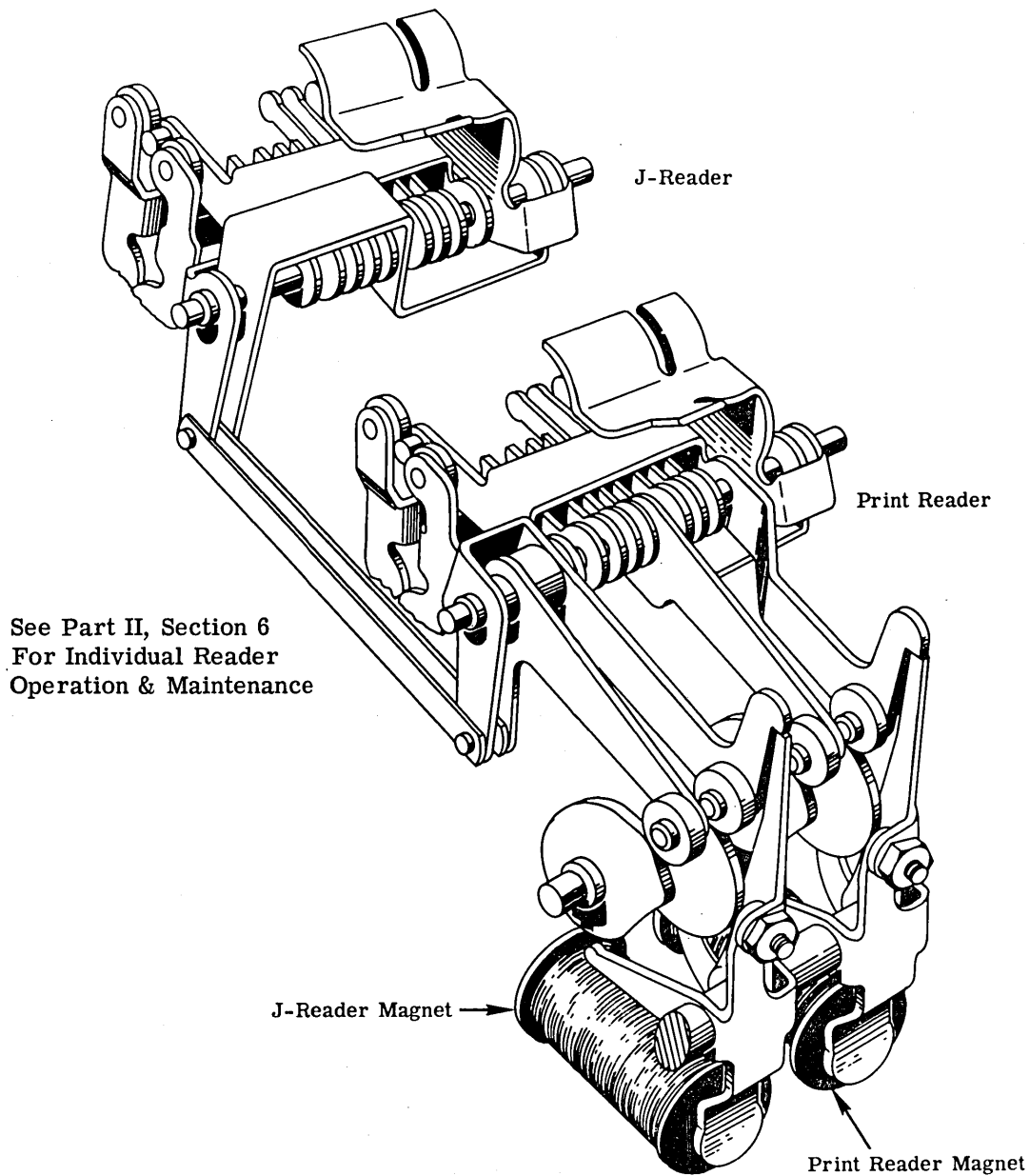


Figure 1-14 Double Reader

When a trial line is being typed, the seekers do not contact the code bar section and consequently do not interfere in any way with the carriage movement. This is because the previously mentioned contact arm bail normally holds the contacts open and the seekers out of the path of the code bar assembly. The bail is moved

at the end of a trial line due to the energization of the magnet JCM (the JCM is energized when the J-Carriage Return switch is depressed). Thus, the noses of the seekers are all allowed to move through their respective slots in the computer front plate and into contact with their related code bar sections, whereby, some seekers are

stopped and others move into notches allowing their contacts to close.

The code contacts (JC1 through JC5) are individually connected to punch magnets in the tape punch. Thus, when a contact closes, its respective punch magnet becomes energized, resulting in the code position being perforated in the tape.

From the above functional description, it can be seen that a code can be set up and perforated in a tape which represents the information necessary to condition the Reproducer to add or subtract units of word spacing in a line.

Line Delete - A line delete switch is provided on the Recorder, which, when depressed (with the J-Carriage switch), will perforate all seven code units in the justification code. This code, when read in the Reproducer, will condition the Reproducer to ignore all the codes in the preceding line, thus the line will be deleted. This is a very useful function in the event an operator makes a mistake.

Note: A complete Recorder Circuit Description is explained in Part VII, Section 3 of this manual.

REPRODUCER

The Reproducer consists of a writing machine (typing mechanism), a double reader, code selector and code translator: All of these mechanisms are similar in design and operation to those explained in Part II of this manual. The double reader, however, has two sets of single reader component parts resulting in two separate readers mounted on one base. (See Figure 1-14.)

Therefore, the double tape reader has two reading stations, rear and front which have

identical structure insofar as the number and control of reading pins are concerned. The rear reader is affected only by codes having a 7 hole and is referred to as the justification reader. The front reader is affected by the printing codes consisting of combinations of holes from 1 to 6 and is referred to as the print reader.

The tape prepared on the Recorder is placed into both reading stations of the double reader, and in order to start the reading operation, the tape hold-down arms of both reading stations must be against the pin wheels to allow the two tape contacts JRTC and PRTC to close. The tape is placed edgewise into both stations and it is not necessary to form a loop between the two stations. It is only necessary that the first printing code holes at the beginning of the line be back of the reader pins in the print reader. Also, the first line justification code should be in back of the reader pins in the J-reader.

In order to start automatic operation of the Reproducer, it is only required to press and release the start read switch. This starts operation of the justification reader only, and as this reader reads the printing codes in the tape, no controls are set up because the number 6 and 7 codes must be read simultaneously in order to complete circuits through the other contacts of the justification reader.

From the description of the Recorder operation it will be remembered that at the end of each line a number 7 code hole alone is first punched followed by a code including the number 7 and number 6 holes, plus a five unit code representing the justification control. Accordingly, as the justification section of the double reader reaches the end of the first line, it will first read a number 7 code

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hole alone. When the print reader is not operating, as is the case being explained, the reading of the number 7 code hole in the J-reader will not stop operation of the J-reader. It will stop operation of the J-reader, however, if the print reader is operating.

After reading the number 7 code hole, the next code to be read by the J-reader is the 7 and 6 code holes along with the five unit justification code. When the 7 and 6 code holes are read, the print reader will automatically start operation. At the same time, the five unit justification code is read along with the 6 and 7 code holes which will energize storage relays related to the holes in the justification code.

The operation of the print reader will read the six unit codes and accordingly control the translator and affect automatic operation of the Reproducer to print the line. The print reader, however, does not cause printing operation in response to any code employing the number 7 code hole because the circuits from the PRC contacts to the translator code magnets are controlled by a normally closed PRC7 contact.

The control circuits for the two readers are so interlocked that if the justifying reader reaches a number 7 code hole in the tape while the print reader is still operating, the justification section will be stopped until the printing section reaches a number 7 code hole. On the other hand, if the print reader finishes the line and reaches the number 7 code hole while the justifying reader is still operating, the print reader will be stopped until the justifying reader reaches the next number 7 code hole.

Non-Justify - Provision is made on the Reproducer for operating the machine to produce un-

justified lines. For this purpose, a non-justify switch is provided on the machine which, when pressed, is retained in its depressed position. When the non-justify switch is depressed and the tape in the print reader, only the print reader operates, reading and producing a non-justified line.

Line Delete - In the Recorder, it will be remembered that a line delete code 1-2-3-4-5-6-7 may be punched in the tape in place of the justification code to delete the entire line preceding this delete code. When this code is read by the J-reader, a relay (COR) is energized. When relay COR is energized, a normally closed contact on this relay opens, breaking the circuit which energizes the translator magnets through the PRC contacts. Thus, while the print reader is reading a line following the sensing of the line delete code by the J-reader, the translator code magnets do not become energized and, accordingly, that line is not printed.

End Line - In operating the Reproducer, it may sometimes be desirable to stop the machine for a long period of time and turn off the main power switch when a length of tape still remains in the readers. For example, this would occur when a length of tape still remained in the machine at the end of the day so that the power must be turned off before finishing the entire tape. As will be explained later, the justification controls set up by energization of the storage relays may be lost in the event the power switch is turned off while the print reader is operating to automatically type a line. For this reason, an end line switch is provided on the machine. The end line switch, when held depressed during the typing of the entire line, will stop the machine operation,

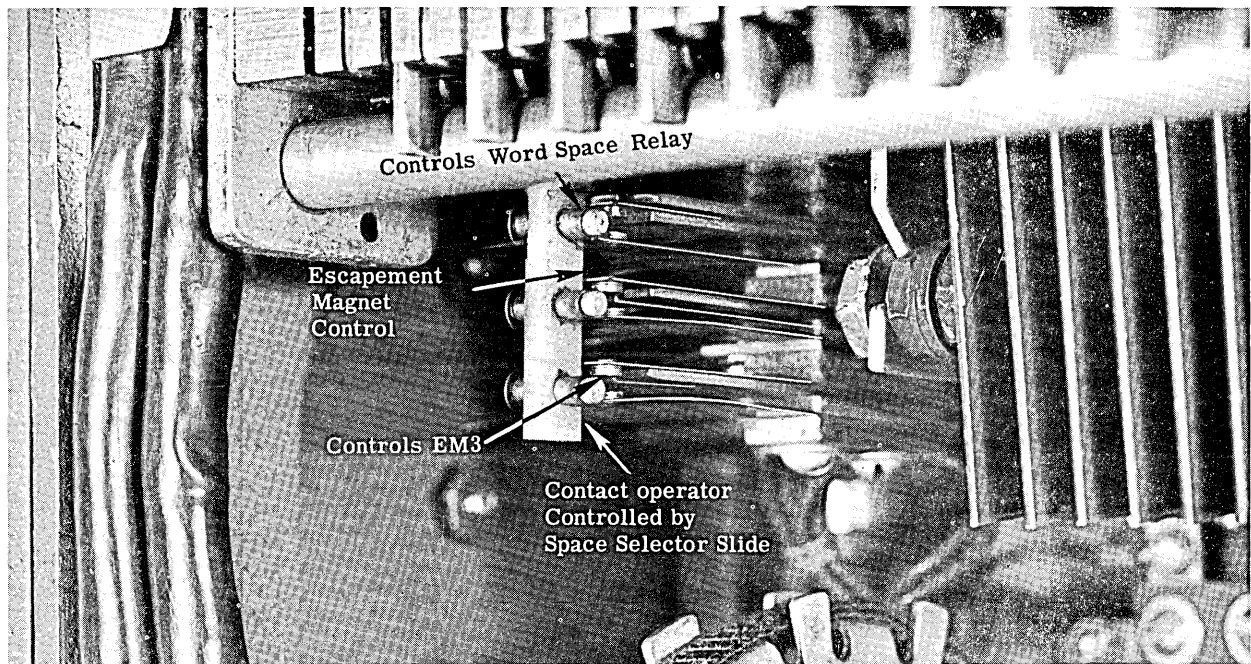


Figure 1-15 Word Space Contacts

whereupon the power switch may be turned off without danger of losing any justification controls set up in the machine.

The function of this end line switch is merely to open the circuit to the JRR relay so that when the printing section finishes a line, relay JRR will not become energized to start operation of the J-reader, and accordingly both readers will stop with no justification controls stored in the relays. Thus, the operator merely presses the end line switch and when both readers stop operations, the power switch may be turned off. Later, when it is desired to resume operation from the same tape, the power switch is merely turned on and the start read switch operated.

Word Space Control - When a number 3 code hole is read by the print reader in the Reproducer, the space bar key lever is automatically operated. The resultant selector slide operation does not

directly select the operation of the escapement magnets EM1, EM2, and EM3, but instead, controls three normally open contacts called word space contacts (WSC). (See Figure 1-15.) Two of the three contacts (WSC) control the circuits for energizing the escapement magnets, and the other controls a word space relay WSR. Therefore, the extent of spacing between words can be varied between one unit and five units to affect justification and is under the joint control of the two storage relays JR1 and JR2 and the stepdown relay SDR.

The chart in Figure 1-16 shows the different word space values (in units) which are affected upon operation of contacts WSC according to the different combinations set up by relays JR1, JR2 and SDR. As explained previously, the 1 and 2 justification code holes, when read by the J-reader, control the energizing of the JR1 and

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JR2 relays. Also, these two code positions determine the starting word space in a line. For example (refer to Figure 1-16), if a 1 and 2 justification code was read in the J-reader, the JR1 and JR2 relays would be operated. With these relays held energized, when the first number 3 word space code is read in the print reader, a circuit would be complete to the EM2 and EM3 escapement magnets, escaping the carriage 5 units for the first word space. If the relay SDR were to become energized along with relays JR1 and JR2 (this would happen only after the first word space and before the eighth word space), then the starting word space escapement would be decreased from five units to four units.

Code		Relays Operated			Escapement Magnets			Word Space In Units
		JR1	JR2	SDR	EM1	EM2	EM3	
1	2	X	X			X	X	5
1	2	X	X	X	X		X	4
	2		X		X		X	4
	2		X	X			X	3
1		X					X	3
1		X		X		X		2
						X		2
				X	X			1

X-Denotes Operated

Figure 1-16 Starting Word Space Chart

By studying the chart in Figure 1-16 it would be noted that when the stepdown relay SDR is energized, the word spacing is reduced by one unit for each of the four values of word spacing selected by the relays JR1 and JR2. Therefore, with relay SDR de-energized, the initial or starting word spacing in a line is always determined by relays JR1 and JR2, and the point at which the word spacing is reduced during typing of the line is determined by the energization of the step-down relay SDR.

It has been mentioned previously that the point at which the word spacing is reduced one unit by the energization of relay SDR is perforated in the tape in the form of a three unit code (justification code holes 3, 4 and 5). This code conditions the storage relays JR3, JR4 and JR5. This information stored in relays JR3, JR4 and JR5 together with three word space counting relays CR3, CR4, and CR5, determine after which word space in a line the SDR will be energized. The counting relays CR3, CR4, and CR5 operate in definite sequence for each line as follows:

1st word space operation - CR3 energized

2nd word space operation - CR3 and CR4 energized

3rd word space operation - CR4 energized

4th word space operation - CR4 and CR5 energized

5th word space operation - CR5 energized

6th word space operation - CR3 and CR5 energized

7th word space operation - CR3, CR4 and CR5 energized

8th word space operation - CR3, CR4 and CR5 energized

From the above information it can be seen that, when the condition of the counting relays CR3, CR4 and CR5 match or correspond respectively to the stored condition of relays JR3, JR4 and JR5, relay SDR becomes energized to reduce the value of the remaining word spaces in a line. For example, if the J-reader reads the justification code units 3 and 4, the JR3 and JR4 relays would become energized. During the second word space operation, the relays CR3 and CR4 are energized. After the second word space operation,

the SDR is energized due to the matching of CR3 and CR4 with JR3 and JR4.

The contacts of the word space relay WSR and contacts of a half-step relay CRP are used to set up conditions of relays CR3, CR4 and CR5 which correspond to the accumulated number of word spaces in typing a line. In addition, a final count relay CR8 is provided to de-energize relays JR1, JR2 and SDR after the eighth word space so that any additional word spaces will result in a normal two unit escapement of the carriage.

For a summary of manner in which justification is controlled in the Reproducer, the following example will be helpful (Figure 1-17): Suppose a line having six word spaces is eight units short of the desired length. It will, therefore, be necessary to add eight units between the words of this line in order to achieve complete justification of the line. By referring to the code chart in Figure 1-4, it will be noted that the code for the above condition consists of the 2, 3 and 4 codes. The 2 code will control the number of units by which the words will be spaced during the reproduction of the initial part of the line. The 2 code, according to the chart in Figure 1-16, will cause the magnets EM1 and EM3 to be energized during the first word space operation, thus causing four units escapement of the carriage. The 3 and 4 codes indicate after which word space the reduction in spacing units will take place. Therefore, according to the chart in Figure 1-6, the word spacing will reduce one unit (from four units to three units) after the second word space operation.

In the example, there are six word spaces having a total of twelve normal units of spacing between words. Since the first two word spaces will be four units or a total of eight units, and the

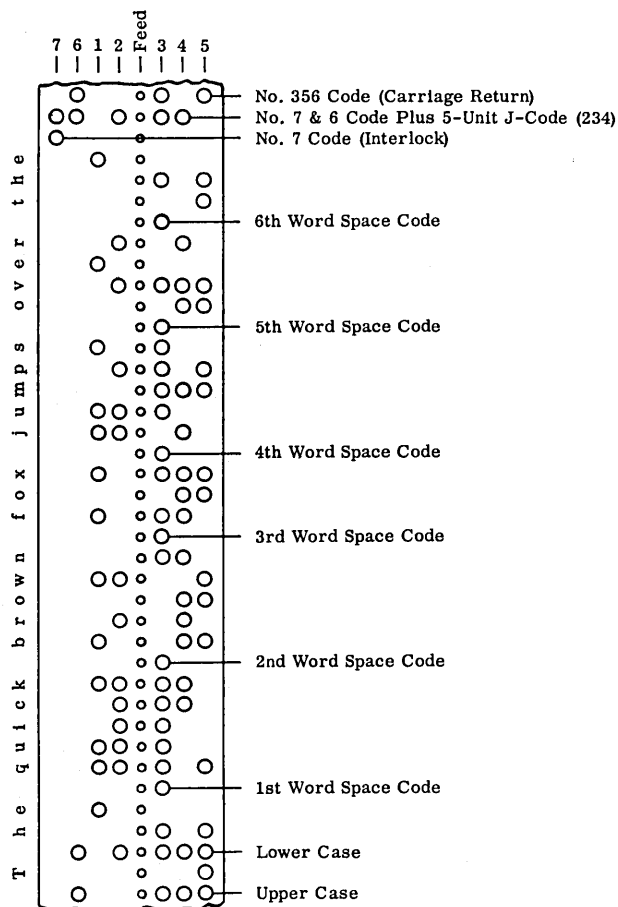


Figure 1-17 Example J-Code In Tape

next four word spaces will be three units or a total of twelve units, it follows that a total of twenty units will be provided in the six word spaces. The normal number of space units in the six word space line is twelve units, as noted above, therefore, the eight additional units have been provided to achieve complete justification of the line.

For a complete Reproducer Circuit Description, see Part VII, Section 4.

SPECIFICATIONS

Power Supply - The Justowriter Recorder and Reproducer may be specified with one of the following power supplies:

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 Justowriter Recorder and Reproducer is 18", the depth is 21" and the height is 10". The shipping weight of each is approximately 115 pounds while the unpacked weight of each is approximately 85 pounds.

Type Style - The Justowriter Recorder may be equipped with any of the type styles illustrated below except the Booktype and Newstype. The Reproducer may be equipped with any one of the 8, 10, 11 or 12 point type styles.

When a different type style is used on each unit, the Recorder should be equipped with a Carbon Ribbon Mechanism.

The following type illustrations are set in actual size as listed:

This entire manual is set in **BOLD FACE TYPE** and reduced to approximately 10 point.

12 point

***BOLD FACE ITALIC TYPE** is especially useful on a Recorder in combination with a Bold Face Reproducer. For headings, word emphasis and footnotes, Italic copy is stripped in.*

12 point

GALVIN TYPE is the result of a complete study of the Justowriter method of printing. The designer sought to produce a type which would print well and be attractive. Not an adaptation of any existing type face.

12 point

SECRETARIAL TYPE is a fine-line, feminine style type which is compact, legible and attractive. Excellent for making stencils.

12 point

ROGERS TYPE was specifically designed for the Justowriter by Bruce Rogers. Especially suited to actual size use in books and other reading matter.

11 point

DOCUMENTARY TYPE is distinctively styled for easy readability. Well suited for all offset or duplicator reproduction in actual or reduced size.

11 point

MODERN TYPE is a smart looking, well-rounded type face. Well suited to actual size reproduction for books, manuals, house organs and sales literature.

10 point

BOOKTYPE is a true 10 point face and because of this fact it is ideally suited for the composition of books, manuals and pamphlets without the necessity of photographic reduction.

10 point

NEWSTYPE is a condensed, 8 point type perfect for newspapers and house organs. Can be used on the Reproducer only, with any of the above type faces on the Recorder.

8 point

Each of the type styles are based on 1/32" spacing with the exception of the 8 point Newstype which has 1/48" spacing, and 10 point Booktype which has 1/36" spacing. The 1/36" and 1/48" escapement can be used on the Reproducer only.

Keyboard - The Justowriter keyboard is shown in Figure 1-18.

Carriage - The Justowriter Reproducer may be equipped with either a 12" or 16" carriage. The Recorder, however, can have only a 12" carriage.

Platens and Ratchets - The No. 2 platen is used with fabric ribbon, while the No. 8 platen is used when carbon ribbon, or both carbon and fabric

ribbon is used.

Ratchets: For 10-, 11-, 12-point type

- 44 - 4.0 lines per inch
- 50 - 4.55 lines per inch
- 55 - 5.0 lines per inch (standard)
- 62 - 5.64 lines per inch
- 66 - 6.0 lines per inch

For 8-point type

- 36 - 6.55 lines per inch
- 38 - 6.91 lines per inch
- 39 - 7.09 lines per inch
- 40 - 7.28 lines per inch
- 44 - 8.0 lines per inch

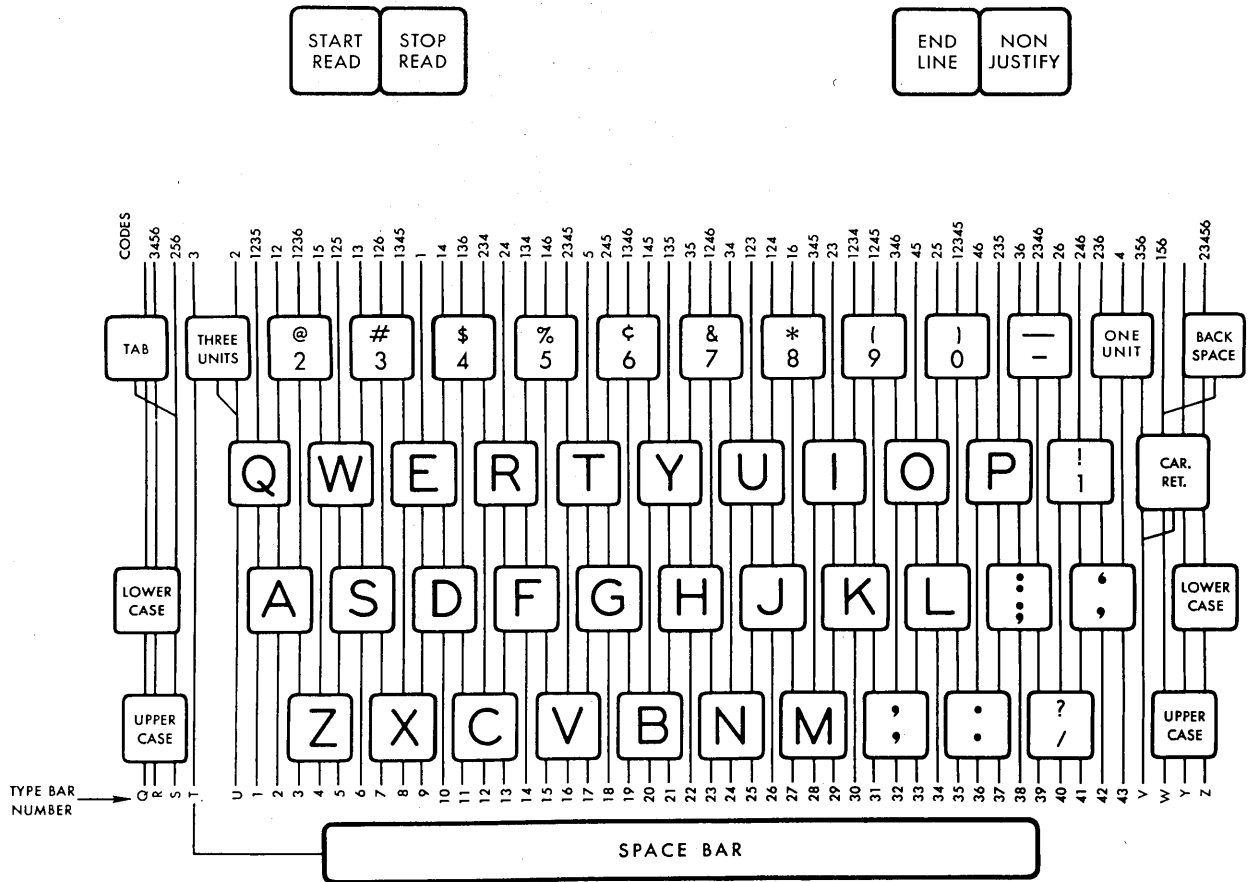


Figure 1-18 Keyboard

MAINTENANCE

RECORDER

Writing Machine - The writing machine in the Justowriter Recorder is basically the same as the unit described in Part II, Section 2 (President Model). There are, however, a few differences in parts and adjustments as follows:

A unit scale is provided in place of the paper bail. This scale is graduated for 8 point (top scale), 10 point (middle-in red), and 12 point (bottom scale). This unit scale may be used to convert from 12 point (Recorders have 1/32 inch escapement only - for 12 point) to 8 point or 10 point easily. The 8 point Reproducers have 1/48 inch escapement, while the 10 point Reproducers have 1/36 inch escapement. Therefore, if an 8 point 2 inch line is required, the Recorder margin stop would be set at 3 inches.

When setting for an 8 point line, the margin stop on the Recorder can be set on all graduation lines (on unit scale). The tab stops can be set on the long graduation lines only (on the unit scale). Referring to the margin rack, the margin stop can be set on all lines and dots. On the tab rack, however, the tab stops can be set in slots with horizontal lines only.

When setting for a 10 point line, the margin stop and tab stop on the Recorder can be set on all graduation lines of the unit scale. On the margin rack, the margin stop can be set on the dots only. On the tab rack, the tab stops can be set in slots having vertical lines only.

The tabular rack is numbered from right to left in inches. The tab stop slots are an eighth of

an inch apart (4 units). The margin rack is also numbered from right to left in inches, with the notches spaced an eighth of an inch. The front scale on the Recorder is not used.

Margin and Tab rack adjustments:

1. Adjust the unit scale midway in the screw slots.

2. Adjust the card holder as follows:

Move the carriage to the extreme left hand margin.

Type approximately ten lower case "n's" (three units of escapement). Space the carriage approximately fifteen spaces and type ten more "n's". Move the carriage back and type one "n" in about the mid-position of the two rows of "n's". Back space twelve times and adjust the vertical edge of the card holder to the right hand edge of the character "n". Adjust the top edge of the card holder to the bottom edge of the two typed rows of "n's". Tighten the card holder screws.

3. Move the carriage until the pointer on the card holder aligns with the "0" position on the unit scale. Adjust the unit scale if necessary to obtain exact alignment.

Note: The pointer should be the same distance from the bottom edge of the scale for the entire movement of the carriage.

4. With the carriage at the "0" position, escape the carriage one unit at a time and check to see that the carriage moves a least thirteen units past "0" before reaching the right hand final carriage stop.

5. Check the tab rebound check adjustments as

Maintenance

follows: lock up the tab lever and move the carriage to engage the tab lever with a tab stop. Adjust the horizontal eccentric to position the rebound check lever from .000" to .003" away from the tab stop. Adjust the vertical eccentric so the tip of the rebound check lever will be level to .010" below the tip of the tab lever. Check these adjustments in various positions. (Also, with the tab operated, check to see that the rebound check lever does not strike a tab stop on carriage return.)

6. Operate the escapement until the carriage return pawl (150) can be seen from the top. With the power off, depress the tab operating lever and allow the carriage to be held by the tab stop in the "0" position. Then, watching the carriage return pawl, trip the tabular latch and notice what part of the tooth (on pinion 137) the pawl engages. Adjust the rack so the operating end of the carriage return pawl will engage the tooth far enough back (approximately $\frac{1}{2}$ tooth maximum distance) to always drop safely into the same tooth.

Note: If a tab rack adjustment is made, it may be necessary to readjust the computer and code bar assembly. (See page 2-3 of this section.)

7. Loosen margin rack brace. Adjust the margin rack roughly so the threads on the right hand end extend flush to two threads outside the nut on the carriage end plate. Operate the escapement by hand until the carriage return pawl (150) can be seen from the top of the machine. Set the margin

stop at No. 1 position on the margin rack. Move the carriage to engage the margin stop. Move the carriage manually to the right causing the margin stop to move the margin release lever in its elongated slot. This movement or margin overthrow should be from "0" to $\frac{1}{32}$ " travel of the margin release lever. Move the margin rack to obtain this adjustment. (The above adjustment may also be checked by watching the carriage return pawl from the top of the machine. The pinion (137) should move to the right toward next tooth from 0 to $\frac{1}{4}$ tooth space.)

Note: Adjustments for 8 point machines should be $\frac{1}{2}$ tolerances given above.

8. Check to see that the margin release lever clears the bottom of the margin stop by approximately $\frac{1}{32}$ ".
9. Fasten the margin rack brace to the margin rack and check above adjustments by moving margin stop along rack in several positions. The adjustments should not vary over .005"
10. Check the setting between the tab and margin racks as follows:

Set the margin stop at No. 1 position, return the carriage to the margin stop and type the lower case "n".

Move the margin stop to the left hand end of the margin rack. Insert a tab stop in the No. 1 position. Move the carriage manually to the left hand margin.

Tab to the No. 1 position and type the lower case "n". The last "n" character typed should print over the first character typed. If an adjustment is necessary, move the tab rack

and repeat the above adjustment procedure.

Check the margin and tab rack relationship at several positions across the racks.

11. Check the final tab stop to be sure that it will unlatch the tab lever $1/8"$ to $1/4"$ before the carriage reaches the right hand carriage stop.

Code Selector - The code selector is basically the same as the selector described in Part II, Section 3 of this manual. The Recorder, having a proportional escapement mechanism, uses the six upper bails for controlling the three escapement magnets. Also, a contact operator is mounted to the space selector slide (number three slide) for the purpose of operating the word space contacts.

Tape Punch - The tape punch described in Part II, Section 5 is identical to the one used on the Justowriter Recorder. When this punch is used on the Justowriter Recorder, however, the number seven punching position is used.

Computer Mechanism - The computer is mounted to the rear left hand base of the machine, and works in conjunction with a computer code bar assembly which is mounted to the carriage.

If it is necessary to remove the computer or code bar assembly, the assembly and adjustment procedure is as follows: (the margin and tab rack adjustments must be correct before adjusting the computer.)

1. Assemble the computer code bar assembly to the carriage in the approximate vertical position and parallel to travel of the carriage.
2. Assemble the computer to the rear base with three mounting screws. Step the seekers

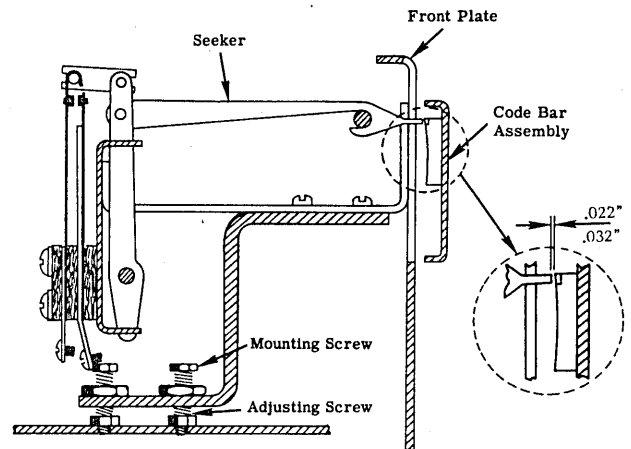


Figure 2-1 Computer Mounting Adjustment

up to the eighth position. Adjust the vertical position of the computer so that the top edge of seekers will be flush with the top edge of their respective code bar sections (S1, S2, S3, S4 and S5). This adjustment is obtained by the adjusting screws as shown in Figure 2-1.

3. Adjust the computer code bar assembly to provide $.022"$ to $.032"$ clearance between the computer code sections and the seekers (seekers in eighth position). (See Figure 2-1.)
4. After making the adjustment above, check to see that the pivot point of the seeker bail is aligned with the center of the arc of the code sections and zone cam. This may be checked by placing the carriage in the "O" position and moving the seeker bail from bottom to top position. If the zone contact arm does not remain stationary during this movement, it will be necessary to readjust the computer or code bar assembly.
5. Place the seekers in the lowermost position. Adjust the code bar assembly horizontally so

Maintenance

that at "O" position of the carriage the zone indicating contact is fully closed and will open one unit space each side of "O" position. Tab the carriage to the zero position to check this adjustment.

- Step the seekers up to the eighth position. Move the carriage to the "O" position. Unhook the seeker bail spring (701). Adjust the five seeker contacts to have .020" gap. Replace seeker bail spring. Move the seekers & check to see that the common contact does not make until all five seeker contacts make. Carriage must be moved away from code bar.

If it is necessary to make a complete adjustment of the computer, proceed as follows:

- Step the seekers up to the number four position. Unhook the bail spring (701). Hold the JCM armature against its core. Adjust the eccentric (699) so that the seekers extend $\frac{1}{8}$ " out from the front plate. (See Figure 2-2.)

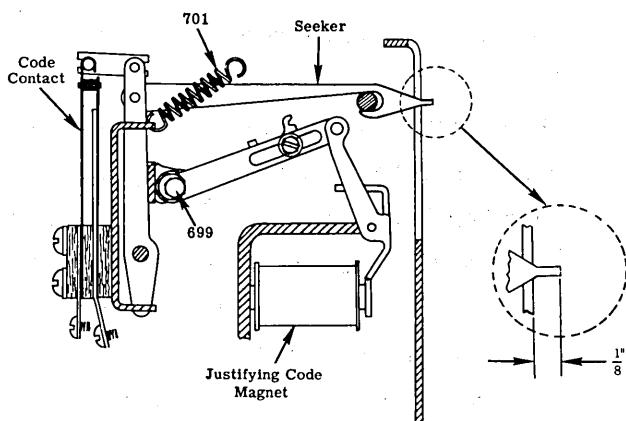


Figure 2-2 Seeker Adjustment

- Hook the bail spring (701). Place the seekers in the lowermost position. Adjust the contact arm bail stop screw (641a) so that the

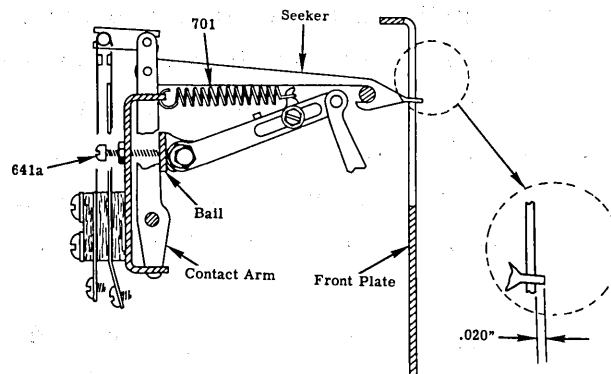


Figure 2-3 Seeker Adjustment

seekers extend .020" from the front plate. (See Figure 2-3.)

- Move the pawl stop (656a) to the uppermost position. Check to see that the full movement of the JSM armature (646) will raise seeker bail (642) .005" to .010" more than one tooth space (check this .005" to .010" between tip of detent pawl 668 and tooth). If necessary, reform the JSM operating arm (646) to obtain this adjustment. (See Figure 2-4.)

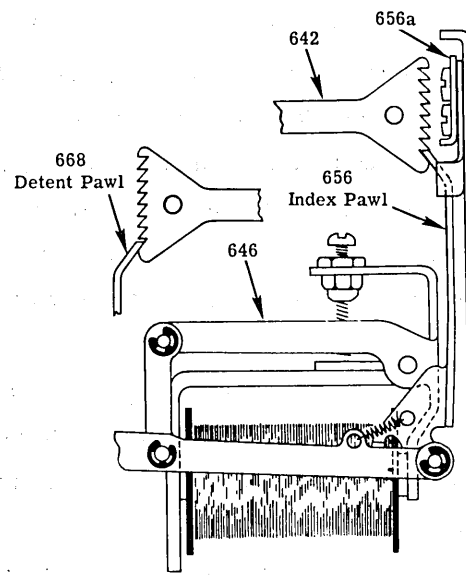


Figure 2-4 JSM Armature Arm Adjustment

4. Step the seekers up to the number one position. Adjust the JSM armature stop screw (646a) so that the pawl (656) will be opposite, or .005" above, the number three tooth. Check to see that the pawl (656) clears the tooth by .002" to .006". This clearance may be obtained by reforming the pawl (656). (See Figure 2-5.)

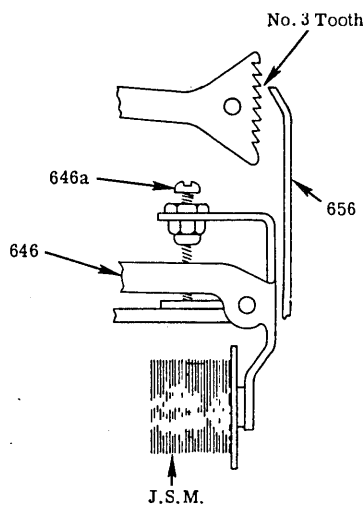


Figure 2-5 Index Pawl Adjustment

5. Place the seekers in the lowermost position. Adjust the lower bail stop (645) so that the pawl (656) will be opposite, or .005" above, the number two tooth. (See Figure 2-6.)
6. Adjust the pawl stop (656a) to allow .002" to .005" (check this between tip of detent pawl 668 and tooth) over travel of seeker bail when pawl is engaged in a tooth and JSM armature is fully operated.
7. Adjust the upper bail stop (645a) to allow .002" to .005" over travel of seeker bail when stepping to the eighth position. (See Figure 2-7.)
8. Adjust the spring bracket (677) so that the

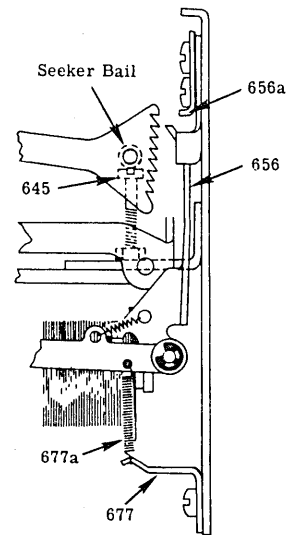


Figure 2-6 Lower Bail Stop Adjustment

mounting screw is located in approximate center of slot. This should give the pawl spring (677a) a slight amount of tension when the seekers are in their lowermost position. (See Figure 2-6.)

Hole Count Relay (Figure 2-8) - The hole count relay is provided to insure that the distance between each justification code is at least three inches. This is necessary for the proper operation of the J Reader and print reader in the Reproducer (the distance between the two reading stations is three inches).

The hole count relay is of the indirect drive type, i.e., the cam is advanced during release of the armature rather than during its operation. When the coil is magnetized, it attracts the armature (causing the pawl to move into engagement with the next ratchet tooth), compresses the driving spring so as to store mechanical energy. During operation of the armature, the ratchet wheel and cam assembly are held in position by

Maintenance

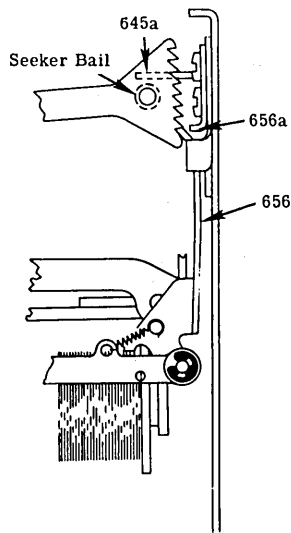


Figure 2-7 Upper Bail Stop Adjustment

a detent spring. Demagnetization of the coil allows the driving spring to exert force through the pawl on the ratchet tooth and thus move the cam assembly forward one step.

The following may be used as a guide for inspection and adjustment of the hole count relay:

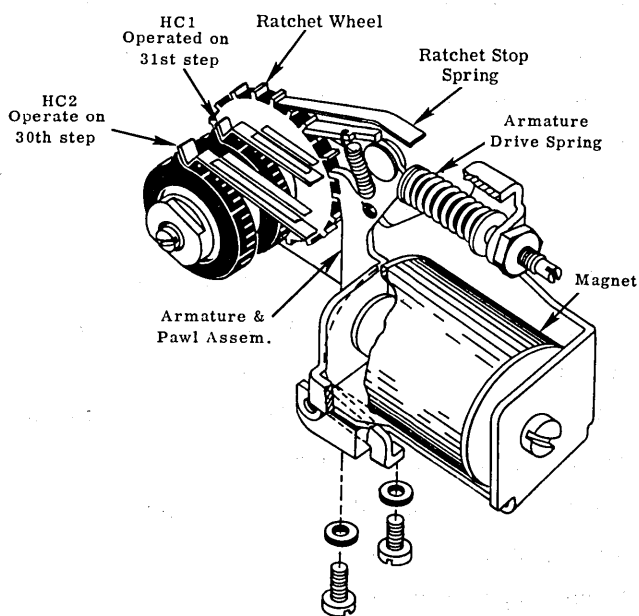


Figure 2-8 Hole Count Relay

Armature: The armature operation positions the pawl in the next tooth of the ratchet wheel. A spring restores the armature when the magnet is de-energized, rotating the cam one space, after which the stopping teeth on the armature engage the ratchet wheel teeth. For proper operation there must be no binds in the armature assembly.

1. The armature must be clear of the heel-piece. Also, in the operated position, a check with a .003" gage must be tight and a .0015" gage must be loose in the airline. The armature must be parallel to the heelpiece as gaged visually.
2. The edges of the pawl, along its length, must be parallel to the sides of the ratchet wheel. Also, the tip of the pawl must be parallel to the edge of the ratchet teeth as gaged by eye.
3. The armature stopping teeth must not project beyond either edge of the ratchet teeth by more than .010" in any position allowed by play in the armature bearings. The edge of the pawl shall project a minimum of 1/64", a maximum of 3/64" beyond the wiper side of the ratchet teeth in any position allowed by play in the armature and pawl bearings.

Ratchet Stopping Spring: The ratchet stopping spring is provided to hold the cam in place while the armature pawl is being prepared for the next step.

1. With the armature in the non-operated position, the ratchet stopping spring must clear the armature and pawl a minimum of 1/32".
2. With the play between the pawl and ratchet wheel taken up in the direction opposite to the cam rotation and the armature in the

- non-operated position, there must be .003" maximum clearance between the spring tip and the radial surface of the ratchet tooth.
3. The tip of the ratchet stopping spring must project a minimum of 1/64" beyond the cam side of the ratchet wheel and must be parallel to the edge of the ratchet teeth as gaged by eye.

Armature Driving Spring: A spring restores the armature when the magnet is de-energized, thus driving the cam. An adjusting screw and locknut are provided. This spring is adjusted to completely restore the armature from the operated position when retarded by hand and allowed to restore slowly by hand.

Contacts:

1. The contact assembly is adjusted approximately parallel to the surface of the relay frame to which the cam shaft is mounted.
2. The apex of the V of the operate (middle) strap must line up with the center line of the lobe of the cam. There must be a definite clearance between the V and the lobe at the step immediately before and after the operated position. The contact farthest from the ratchet transfers on the 31st step, while the one nearest the ratchet transfers on the 32nd step.
3. The apex of the V of the operate straps must be approximately parallel to the cam shaft.
4. There must be a definite clearance between the V form of the operate strap and the cam on steps 1 through 30.
5. The make and break contact strap must have a minimum of .008" gap.

REPRODUCER

The writing machine in the Justewriter Reproducer is basically the same as the unit described in Part II, Section 2 (President Model) and also the Justewriter Recorder. The following parts and adjustments are different in the Reproducer.

The margin and tab racks for the 12 and 11 point Reproducers are the same as the Justewriter Recorder.

The 8 and 10 point Reproducer margin and tab racks differ as follows:

8 point - The margin stop may be set on all lines and dots.

The tab stops may be inserted in all slots.

10 point - The margin stop may be set on the dots only.

The tab stops may be inserted in slots with vertical lines only.

The over-all adjustments for the margin and tab racks on the above machines are the same as described for the Justewriter Recorder.

A carbon ribbon mechanism is used on the Reproducer. The color control mechanism is locked in one position because the standard ribbon feed mechanism (for fabric ribbon) is not used and the parts are not assembled to the machine. This mechanism is shown in Figure 2-9. It is important that the carbon ribbon mechanism operate smoothly, free of binds, due to the fact that it operates off the escapement mechanism.

Code Selector - The code selector used in the Reproducer has the six upper bails only for escapement operation. Also, the number three slide

Maintenance

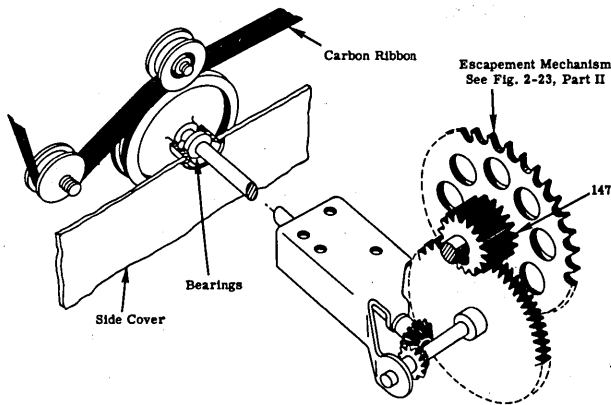


Figure 2-9 Carbon Ribbon Mechanism

(space) does not have cam surfaces and consequently does not operate the bails or contacts. This slide operates an individual set of word space contacts.

Double Reader - This reader has a double reading head and each head is basically the same as the single reader explained in Part II, Section 6 of this manual. The mechanical adjustments are the same as explained for the single reader.

The double reader contact adjustments are as follows:

Print Reader

1. Place a strip of tape (with feed holes only) in print reader and allow the pins to rest against the bottom of the tape.
2. Adjust all contacts to have a gap of .020"

except PRC5 and PRC6 make contacts (in delay control circuit). PRC5 and PRC6 contacts above should be adjusted to .030" gap.

3. Remove the tape and set the PRC3 break contact at .020", the PRC7 N/C transfer contact at .020" and the PRC4 break contact at .030".
4. With the tape removed, operate the contacts and check to see that the PRC4 break contact breaks before PRC5 and PRC6 make contacts close (delay control circuit). Also, check to see that the PRCC breaks before the PRC7 make contact closes.
5. Open the PRTC contacts (by moving the hold down arm back), and set to a .020" gap.
6. Check to see that all contacts have a .005" follow after make.

J-Reader

1. Insert a tape (feed holes only) set all the contacts to have a .020" gap.
2. Remove the tape and set the JRC7 N/C transfer contact to a .020" gap.
3. Open the JRTC contacts (by moving the hold down arm back) and set to a .020" gap.
4. Check to see that all contacts have .005" movement after make.

RECORDER CIRCUIT DESCRIPTION

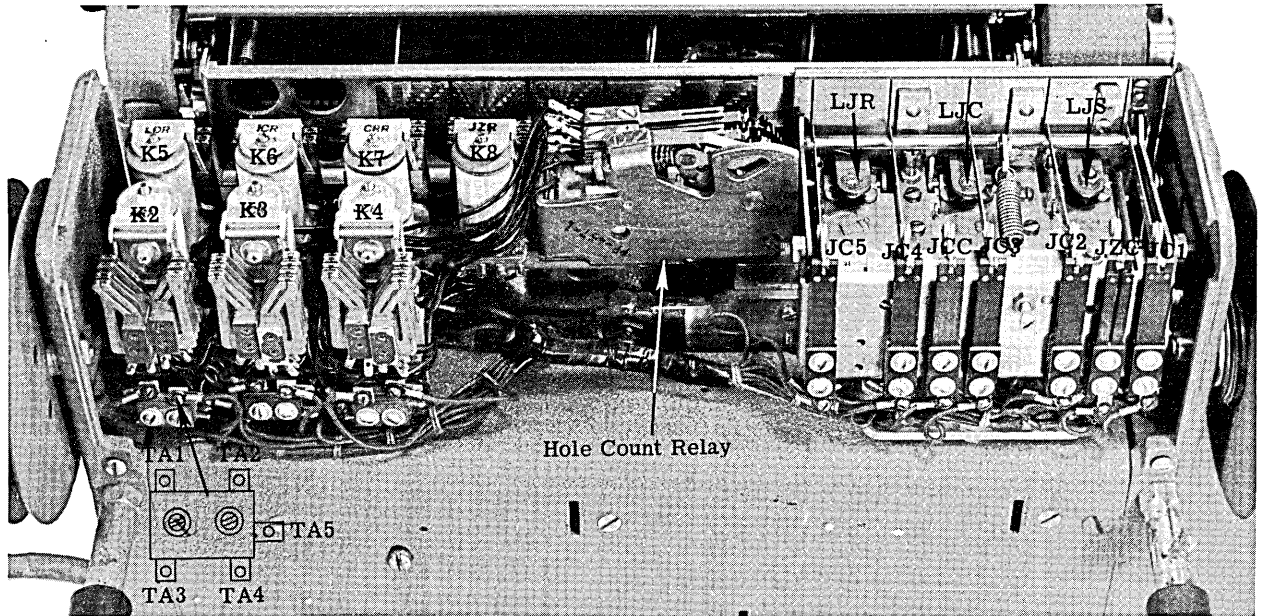


Figure 3-1 Relay Location

The following circuit descriptions are based on wiring diagram 1054058 (Figure 3-18).

Figures 3-1 thru 3-3 show the location of the various electrical components of the Recorder.

POWER CIRCUIT

The power circuit in the Recorder is identical to the power circuit described in Part II, Section 8 of this manual.

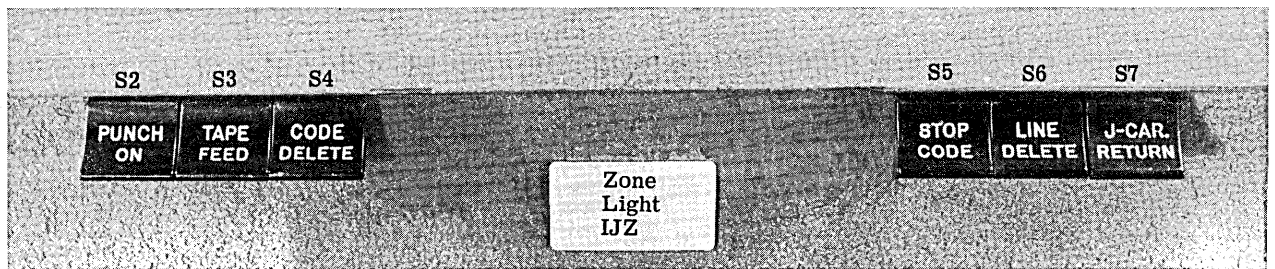


Figure 3-2 Control Panel

Recorder Circuit Description

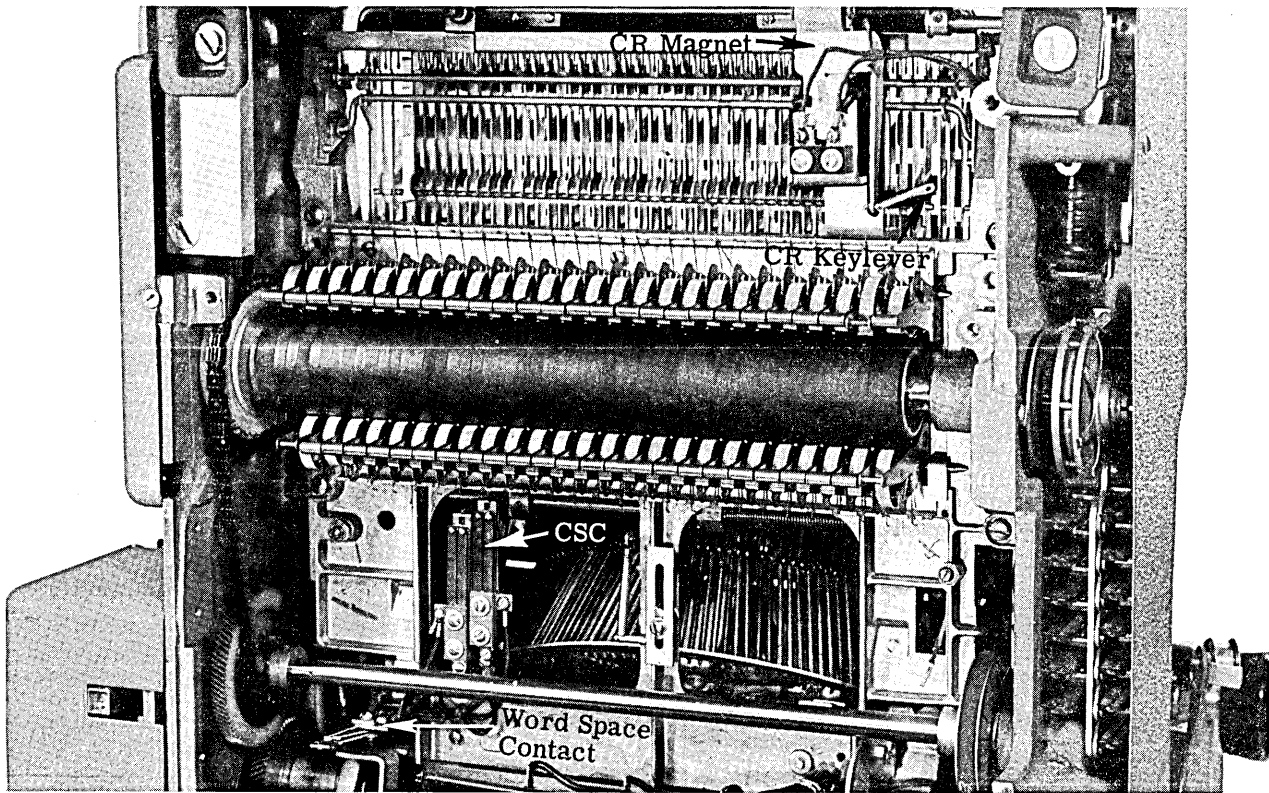


Figure 3-3 Space and Case Shift Contacts

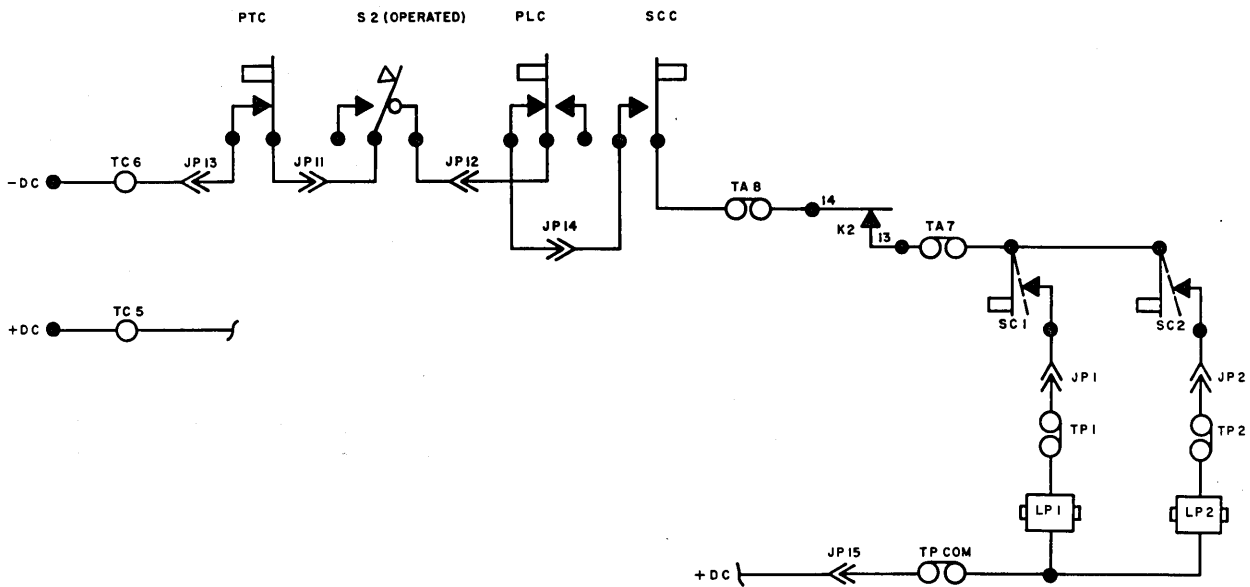


Figure 3-4 Punch Magnet Circuit

KEY LOCK MAGNET CIRCUIT

The Tape Punch used in the Justewriter Recorder is identical to the punch described in Part II of this manual, also, the Key Lock Magnet Circuit is the same.

PUNCH MAGNET CIRCUIT

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 (Figure 3-4). 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, TA8, K2 14 and 13, TA7, SC1 and SC2, JP1 and JP2, TP1 and TP2, LP1 and LP2, TP COM, JP15, TC5 to +DC. Therefore, the 1-2 code will be perforated in the tape during the punch cycle of operation.

PUNCH CLUTCH MAGNET CIRCUIT

When a key lever is depressed as described, a circuit is completed to the punch clutch magnet (LPC) also (Figure 3-5). This circuit is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, N/C PLC, JP14, SCC, TA8, K2 4 and 3, TA10, JP8, LPC, JP15, TC5, to +DC. Thus,

the clutch magnet circuit is completed at the same time as the punch magnet circuits, but due to the characteristics of the coils, the punch magnets will be energized and accordingly, the latch levers will engage the operating levers before the clutch magnet armature is attracted and the punch shaft starts its rotation.

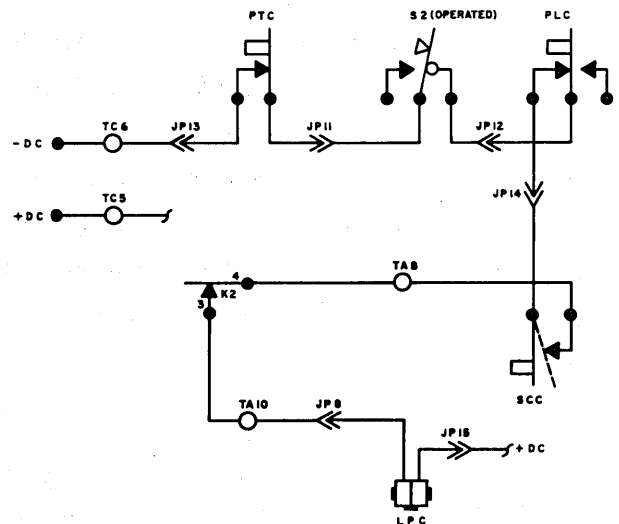


Figure 3-5 Punch Clutch Magnet Circuit

During the punch shaft rotation, the PLC (punch lock contact) transfers, thus completing a circuit to, and energizing the K2 (anti-repeat) relay. When K2 is operated, the circuits to the punch magnets (through contacts 13 and 14) and the clutch magnet (through contacts 3 and 4) are broken. If the SCC contact on the selector did not open before the punch completed its cycle, the K2 relay would remain energized through a holding circuit established by K2 15 and 16 contacts in series with the SCC contact. Thus, for one key-lever operation only one cycle of the punch will take place.

Recorder Circuit Description

HOLE COUNT RELAY MAGNET CIRCUIT

Each keylever operation, besides completing circuits to the punch and clutch magnets as just described, also completes a circuit to the hole count relay. However, this only takes place on the first 30 keylever operations after which, the hole count relay magnet circuit is broken until the J-carriage return switch S7 is depressed.

The operation of the hole count relay does not take place until after the magnet (LHC) is de-energized. That is, the armature movement indexes the pawl which engages a ratchet tooth, and when the magnet (LHC) is de-energized the pawl movement rotates the hole count shaft one tooth position. This ratchet tooth movement is re-

ferred to as a "step." The hole count relay will take 30 steps before the HC2 contacts will transfer, breaking the circuit to LHC.

The circuit which energizes the hole count magnet (LHC) when a keylever is depressed, is as follows: (Figure 3-6) from neg. D.C., TC6, JP13, PTC, JP11, N/0 S2, JP12, N/C PLC, JP14, SCC, TA8, K2-4 and 3, TA10, N/C S3, TA27, HC2 (11 and 12), TA13, K2-2 and 1, TA14, LHC, TA26, TC5, to pos. D.C. During the punch cycle, the PLC contact transfers, energizing K2. Thus, contacts 1 and 2 on K2 open, breaking the circuit to LHC causing the relay to step one position.

When the 30th relay step takes place, the high point of HC2 cam moves operate strap No. 12 to break with strap No. 11 and make with strap

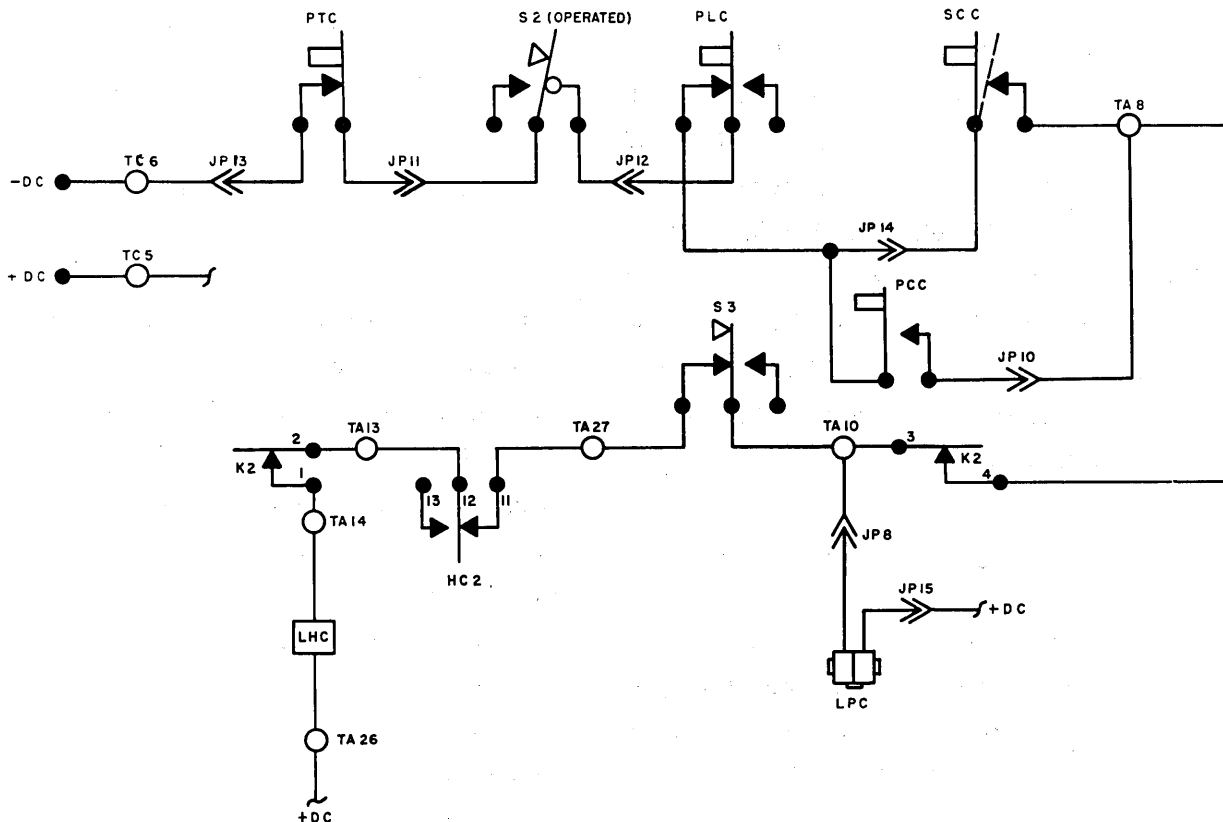


Figure 3-6 Hole Count Magnet Circuit

No. 13. Therefore, the circuit to LHC explained above, is no longer possible and additional key-lever operations will not step the hole count relay. A circuit will be complete to LHC, however, when the J-carriage return switch S7 is depressed.

J-CARRIAGE RETURN SWITCH CIRCUITS

When the S7 switch is depressed, the hole count relay automatically steps three positions (steps 31, 32 and 33) and the punch completes three additional cycles. This results in a justification code being perforated in the tape depending upon the number of word spaces in the line and the number

of units from zero that a line is ended. This justification code will include a number seven code only in the 31st position, a seven - six plus a combination of one through five code units in the 32nd position and in the 33rd position a three - five - six - carriage return code.

When an operator finishes a line and depresses the S7 switch, the following circuit sequence takes place, (hole count relay on 30th step with contact straps 12 and 13 made):

Energizing the No. 7 Punch Magnet - When the S7 switch is depressed the K6 relay is energized as follows: (Figure 3-7) from neg. D.C. TC6, JP13, PTC, JP11, N/0 S2, JZC, (JZC is closed,

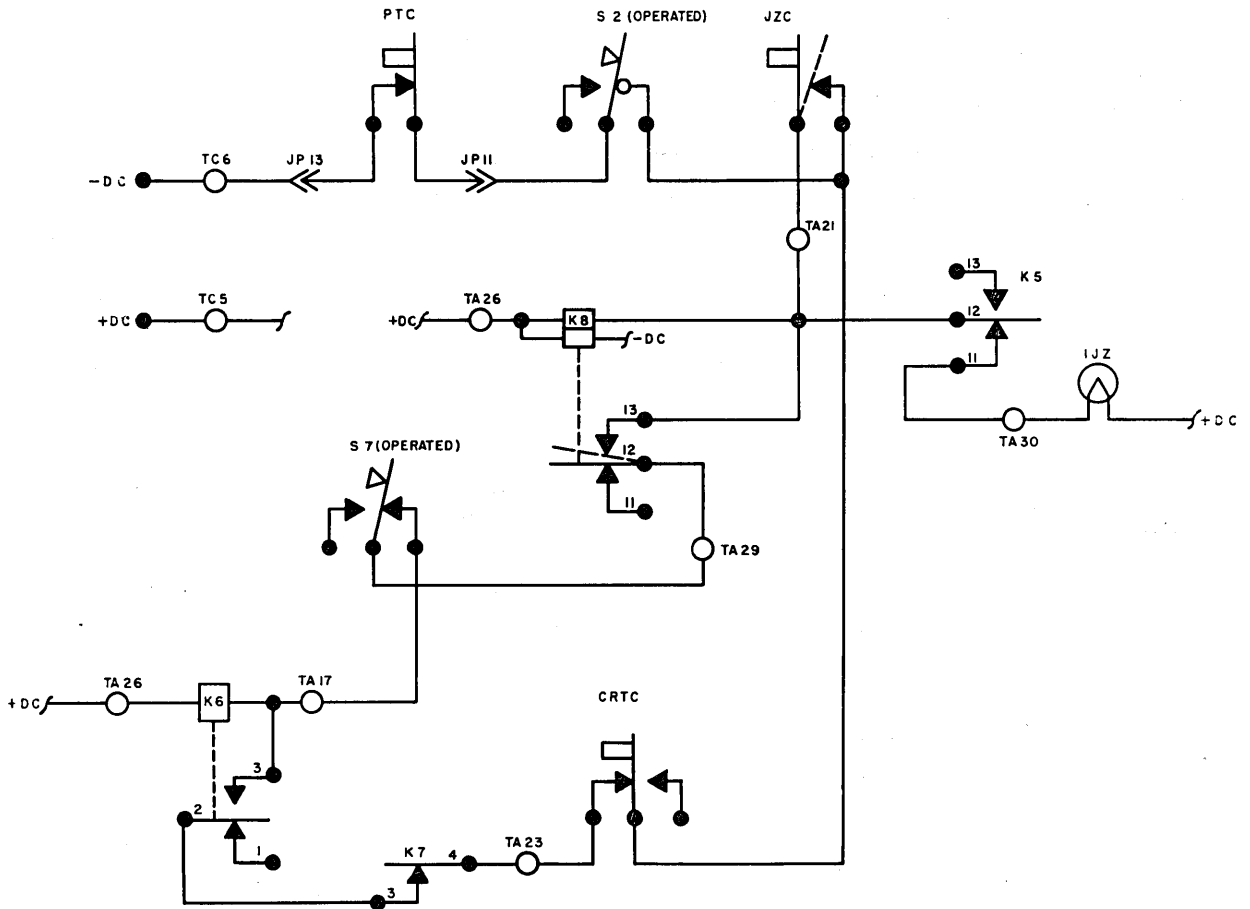


Figure 3-7 ICR (K6) Circuit

Recorder Circuit Description

thus energizing IJZ and K8), TA21, K8 13 and 12, TA29, N/0 S7, TA17, K6 coil, TA26, TC5, to pos. D.C. The interlock control relay (K6) is energized and a holding circuit is complete to it from neg. D.C., TC6, JP13, PTC, JP11, N/0 S2, CRTC, TA23, K7 4 and 3, K6-2 and 3, K6 coil, TA26, TC5, to pos. D.C. When the S7 switch is released, the S7 operate strap (which is connected to negative D.C. as described) makes with the S7 normal strap, thus a D.C. circuit is now complete to LP7 (Figure 3-8) through the normally closed S7, TA18, K6-5 and 4, K4-12 and 11, TA13, HC2 (12 and 13), TA25, JP7, TP7, LP7, TPC, JP15, TC5, to pos. D. C.

Note: A D.C. Circuit is also completed to the LHC through the K2-2 and 1, through TA14, LHC, TA26, to pos. D. C. (See Figure 3-6.) Thus, the hole count magnet is energized also.

The LP7 punch magnet being energized attracts the number seven punch magnet armature which

releases the number seven punch latch lever. The movement of the number seven latch lever in turn moves the punch common contact bail which closes the punch common contact (PCC). The operate strap of PCC is connected to negative D.C., therefore, a D.C. circuit is complete to the punch clutch magnet (LPC) from PCC, JP10, TA8, K2-4 and 3 TA10, JP8, LPC, JP15, TC5, to pos. D.C. (See Figure 3-6.) When the LPC becomes energized the punch shaft rotates, during which the PLC contacts transfer, completing a DC circuit to and energizing K2 (anti-repeat) relay. K2-1 and 2 contacts break, thus, the LHC circuit is open, de-energizing the hole count magnet. This results in the hole count relay stepping to the 31st position. Also, due to the rotation of the punch shaft, and the LP7 energized, the seven code will be perforated in the tape.

31st Step of Hole Count Relay - When the hole count relay steps to the 31st position, the high lobe of HC2 cam allows the No. 12 strap to break

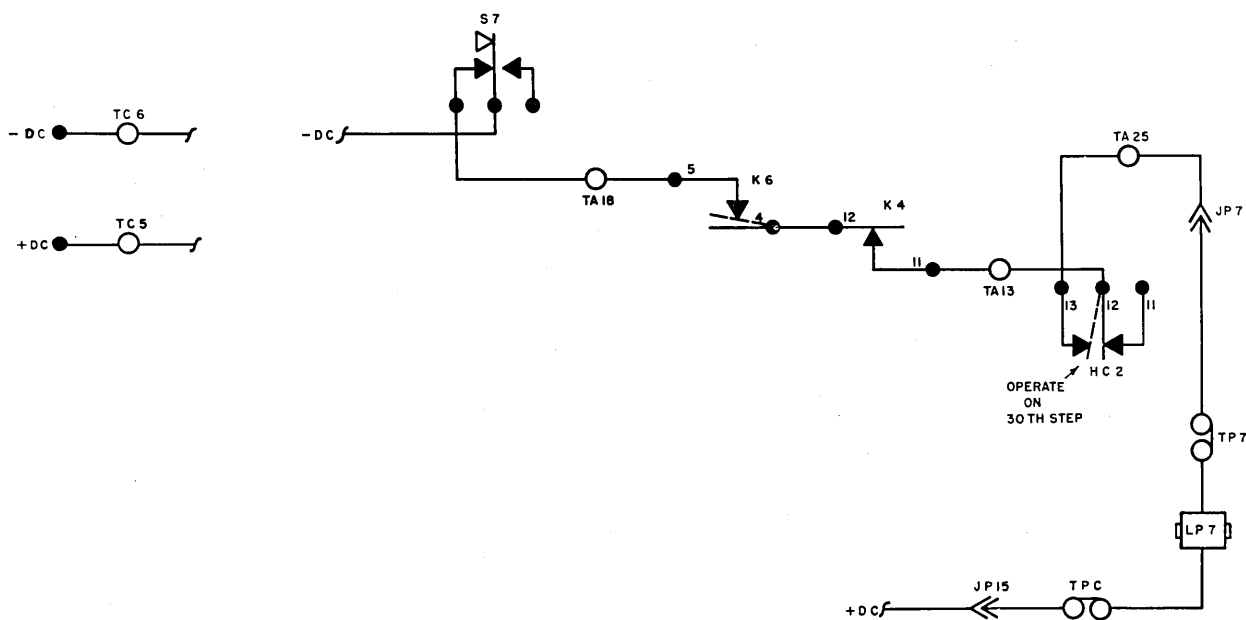


Figure 3-8 No. 7 (LP7) Punch Magnet Circuit

Recorder Circuit Description

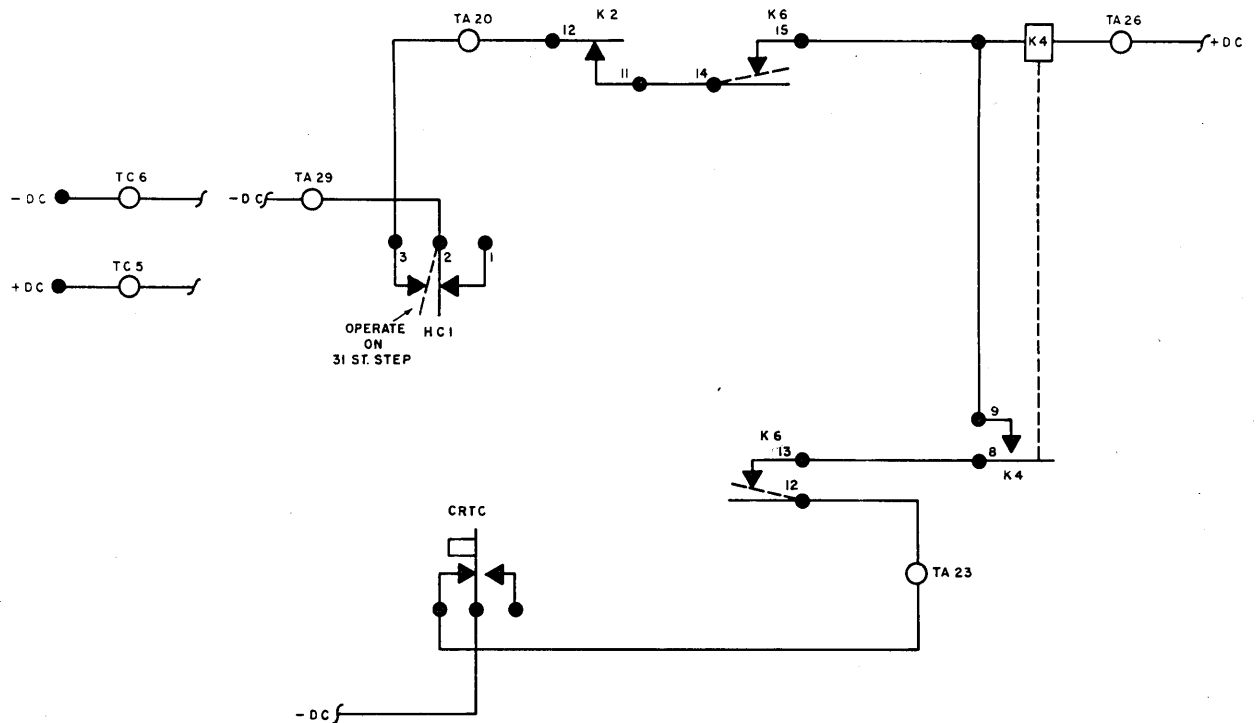


Figure 3-9 JCR (K4) Circuit

with No. 13 strap and make with the No. 11 strap. Also, the high lobe of HC1 cam moves the No. 2 strap to break with No. 1 and make with No. 3. It should be noted that HC 1 - No.2 strap is connected to negative D.C., therefore, a D.C. circuit is completed to and energizes the justification control relay (K4) as follows: (Figure 3-9) from HC1 - No. 2 and 3 straps, TA20, K2-12 and 11 (this contact closes near end of punch cycle when K2 relay drops out), K6 - 14 and 15, K4 coil, TA26, TC5, to pos. D.C. The K4 (JCR) relay is energized and a holding circuit is established as follows: from negative D.C. to CRTC contact, TA23, K6 - 12 and 13, K4 - 8 and 9, K4 coil, TA26, TC5, to pos. D.C.

The justifying code magnet (LJC), located on the computer, is energized at the same time as the K4 relay. This circuit is as follows: (Figure 3-10)

from negative D.C. on HC1 - 2 and 3 straps, TA20, K2 - 12 and 11, K6 - 14 and 15, K7 - 1 and 2, K5 - 2 and 1, K8 - 5 and 6, TA22, LJC, TC5, to pos. D.C. The operation of LJC allows the seekers to move to their respective cams on the computer code bar. Thus, a combination of JC1 through JC5 (plus JCC) contacts will close, depending upon the level of the seekers (number of word spaces in a line) and the number of units from zero that the line is ended. Therefore, due to the JCC and combination of JC1 through JC5 contacts closing a DC circuit will be completed to the LP7, LP6 and those punch magnets (LP1 through LP5) whose corresponding JC contacts have closed (Figure 3-11).

The circuit to LP6 is as follows: from neg. D.C., N/C S7, TA18, K4 - 2 and 3, K8 - 2 and 3, TA28, JCC, TA8, K2 - 14 and 13, K4 - 14 and 15, TA6,

JP6, TP6, LP6, TPC, JP15, TC5, Pos. D.C.

The circuit to LP7 is as follows: from neg. D.C., N/C S7, TA18, K4 - 2 and 3, K8 - 2 and 3, TA28, JCC, TA8, K2 - 14 and 13, K7 - 6 and 5, K4 - 16 and 17, TA25, JP7, TP7, LP7, TPC, JP15, TC5, to pos. D.C.

The circuits to LP1 through LP5 are as follows: from neg. D.C., N/C S7, TA18, K4 - 2 and 3, K8 - 2 and 3, TA28, JCC, TA8, K2 - 14 and 13, TA7, JC1 through JC5 (depending on which are closed), to LP1 through LP5, TPC, JP15, TC5 to pos. D.C.

The LHC and LPC are also energized when JCC closes, thus the punch shaft rotates, during which the K2 relay is energized (because PLC transfers), therefore, K2 - 1 and 2 contacts open, breaking the circuit to LHC, causing the hole count relay to step to the 32nd position. Also, during punch rotation, the seven - six plus a combination of one through five code units are perforated in the tape.

32nd Step of Hole Count Relay - When the hole count relay steps to the 32nd position, the high

lobe of the HC1 cam allows the No. 2 strap to break with No. 3 strap and make with the No. 1 strap. Because the No. 2 strap is connected to negative D.C. a circuit is complete to the K7 carriage return relay as follows: (Figure 3-12) from neg. D.C., HC1 straps 2 and 1, TA16, K2 - 17 and 18, K4 - 4 and 5, K7 coil, TA26, TC5, pos. D.C.

A holding circuit is complete to the K7 relay through the CRTC contact (normally closed), TA23 through K7 13 and 14, coil, TA26, TC5 to pos. D.C.

When the K7 relay picks up, K7 contacts 3 and 4 break, thus breaking the holding circuit to the K6 relay and the K6 relay drops out. This in turn, results in the K4 relay de-energizing because of K6 contacts 12 and 13 breaking. (See Figures 3-7 and 3-9.)

The result of this sequence of operations is a D.C. circuit to the carriage return magnet (LCR) as follows: (Figure 3-13) from negative D.C., N/C S7, TA18, K4 - 2 and 1, K7 - 15 and 16, TA24, LCR, TC5, pos. D.C. The carriage return magnet operation (LCR is located under the right

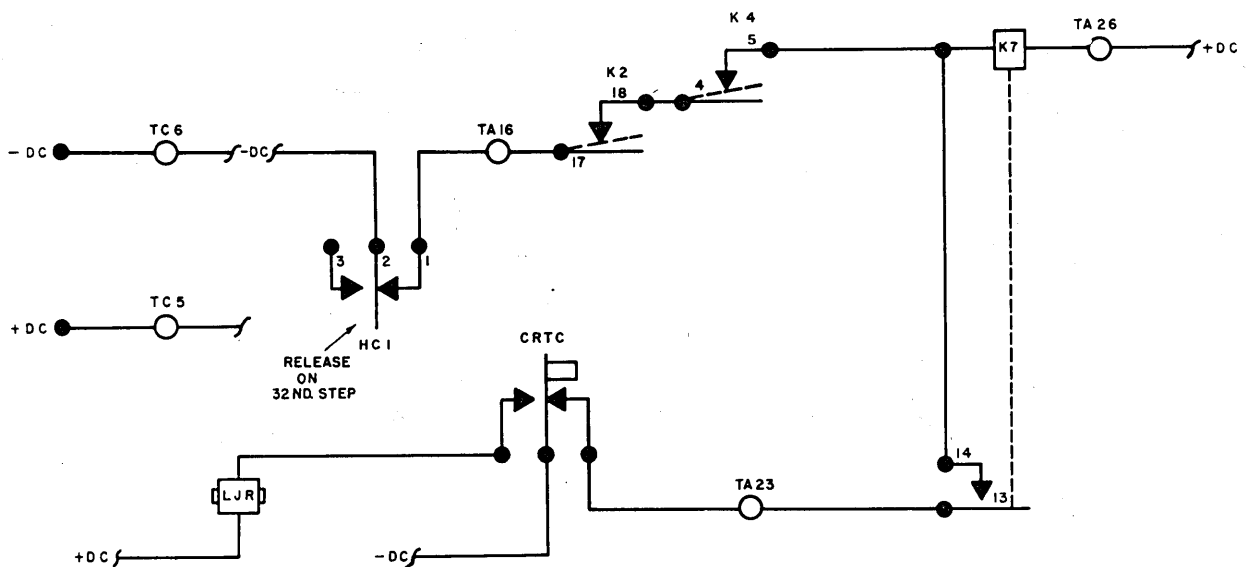


Figure 3-12 CRR (K7) Circuit

Recorder Circuit Description

hand end of the keyboard) pulls down the carriage return keylever and trips the CR cam. The CR cam operation causes carriage return operation, also CR selector slide operation. The mechanical CR linkage will transfer the CRTC contact, thus breaking the K7, K8 and IJZ holding circuits. Also, the CRTC operate and transfer straps, when made, complete a D.C. circuit to the justifying restoring magnet (LJR). (See Figure 3-12.) The LJR operation restores the seekers and the zone bail to the zero position (lowest position).

The CR selector slide operation closes SCC, SC3, SC5 and SC6 contacts, thereby completing circuits to and energizing the LP3, LP5 and LP6 punch magnets, also the LPC and LHC coils are energized. Due to LPC operation, the punch shaft rotates, during which the PLC contacts transfer,

causing the K2 to pick up. The K2 - 1 and 2 contacts break de-energizing the LHC and causing the hole count relay to step to the 33rd position. Also, during punch shaft rotation, the three - five - six code units are perforated in the tape. When the carriage returns to the left hand margin, the CRTC contacts return to the normal position and the LJR is de-energized.

S7 Circuit (Not in Zone)

The preceding circuit explanations function when the carriage is in the justifying zone (and JZC contacts are closed). If, however, the carriage is not in the zone and the J-carriage return switch S7 is operated, only the 7,6-7 and 3-5-6 codes will be perforated in the tape. In other

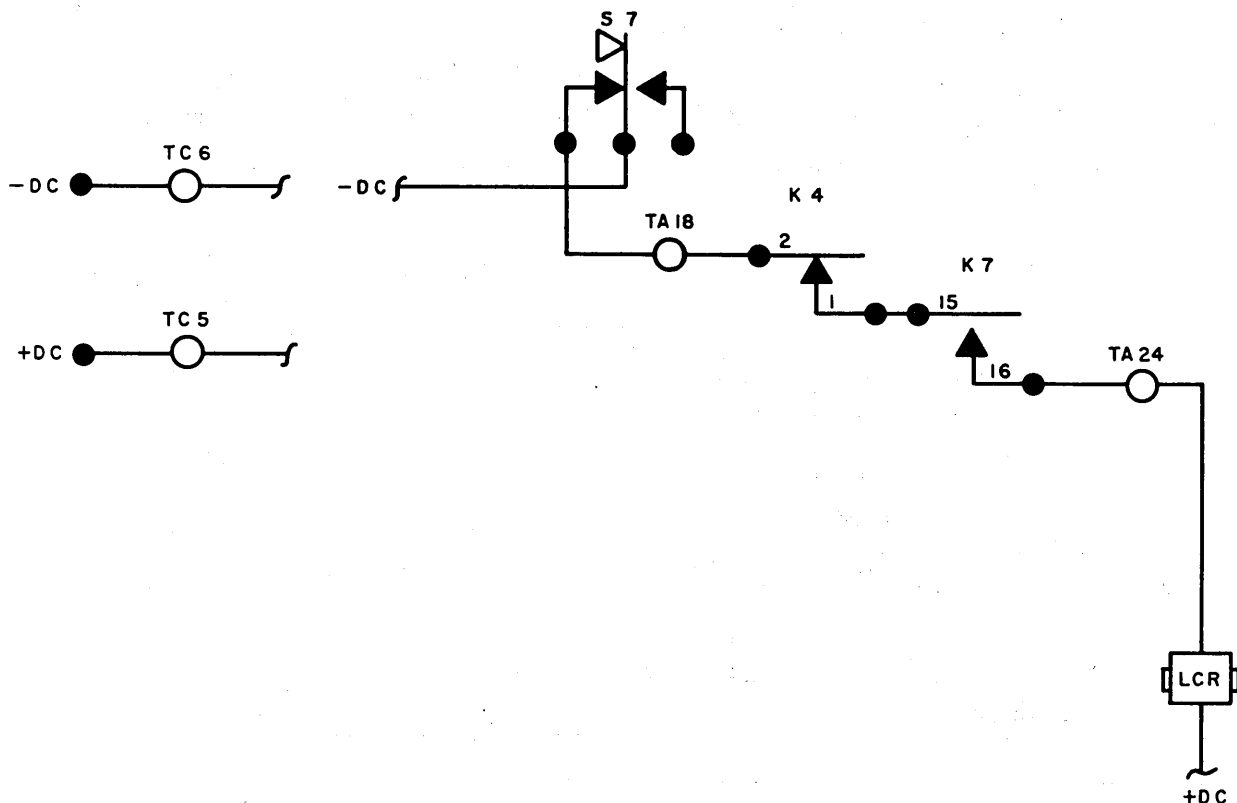


Figure 3-13 CR Magnet (JCR) Circuit

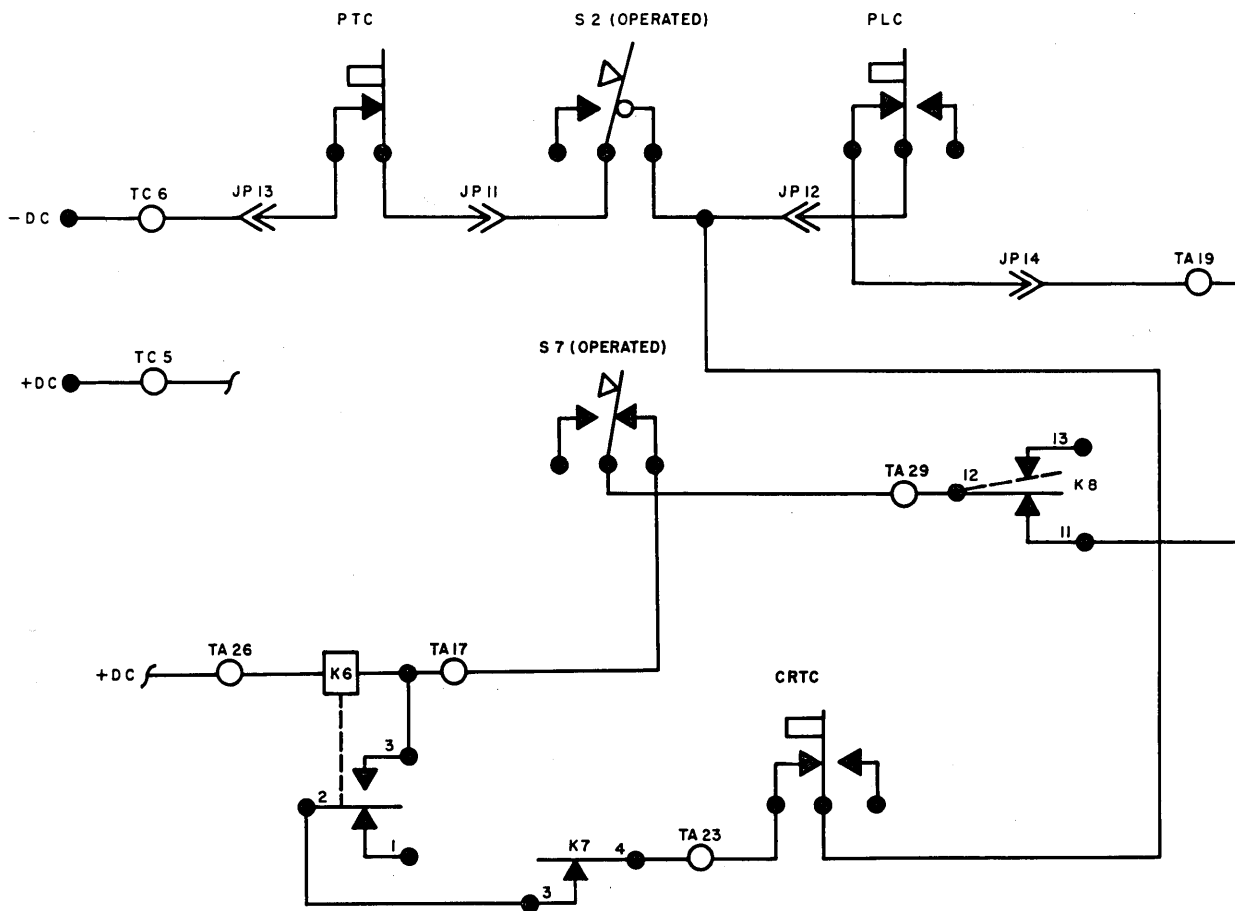


Figure 3-14 K-6 Circuit (not in zone)

words, the justifying zone magnet (LJC) does not become energized, thus, the seeker contacts will not close. The LJC can only be energized on the 31st step if the JZC contacts are closed and the justifying zone relay K8 is energized.

Also, when not in the zone (K8 not energized) the negative DC to the operate strap of the S7 switch is different than previously explained. This circuit is as follows: from -DC, TC6, JP13, PTC, JP11, N/O S2, JP12, N/C PLC, JP14, TA19, K8-11 and 12, TA29, to S7 operate strap. (See Figure 3-14.)

LINE DELETE CIRCUIT

When the line delete switch S6 and the J-carriage return switch S7 are depressed simultaneously, a line delete code (1-2-3-4-5-6-7) is perforated in the justification code, which when read in the reproducer will delete an entire line.

The same sequence of operation will take place as previously explained except for the circuits completed on the 31st step of the hole count relay. These circuits will differ because the line delete relay (K5) will be energized. This will result in the

Recorder Circuit Description

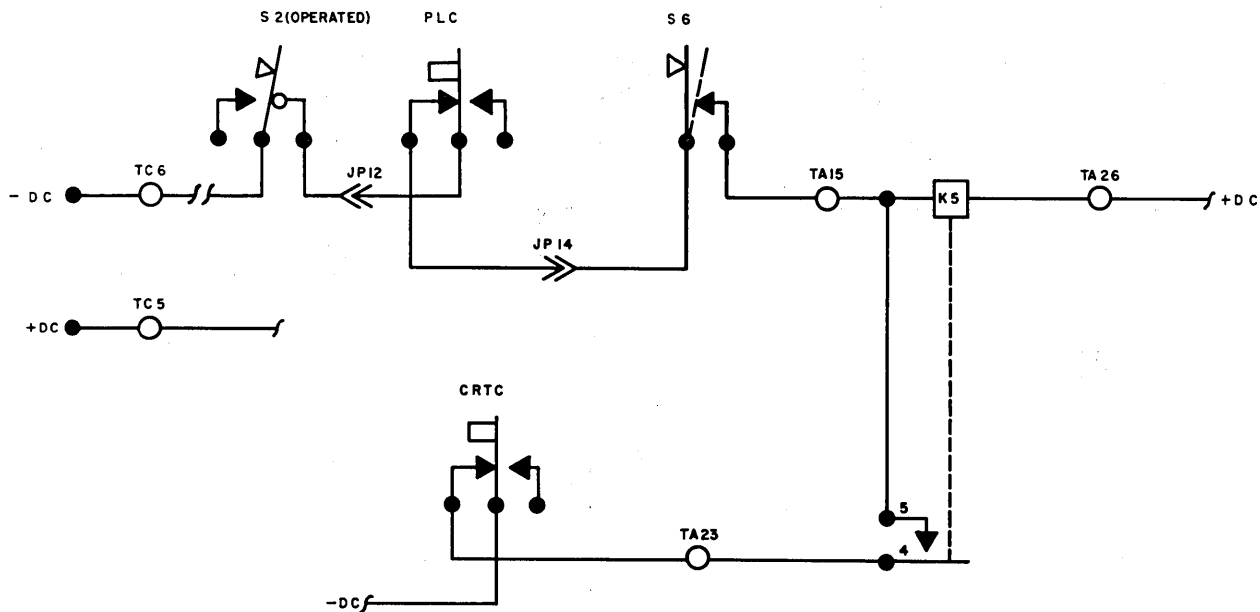


Figure 3-15 LDR (K5) Circuit

code relay (K3) picking up and completing a circuit to the LP1 through LP6 punch magnets (the LP7 is energized in the same manner as previously explained) instead of the LJC operation.

The line delete relay (K5) is energized by completing the following circuit: (Figure 3-15) from neg. D.C., TC6, N/0 S2, JP12, N/C PLC, JP14, N/0 S6, TA15, K5 coil, TA26, TC5, pos. D.C.

The holding circuit to K5 is from neg. D.C. to N/C CRTC, TA23, K5 - 4 and 5, K5 coil, TA26, TC5, to pos. D.C.

On the 31st step of the hole count relay the following circuit is complete to the K3 relay: (Figure 3-16) from neg. D.C., TC6, JP13, PTC, JP11, N/0 S2, JZC, TA21, K8 - 13 and 12, TA29, HC1 (2 and 3), TA20, K2 - 12 and 11, K6 - 14 and 15, K7 - 1 and 2, K5 - 2 and 3, K3 coil, TA26, TC5, to pos. D.C.

When the code relay (K3) is energized, the LP1 through LP3 punch magnets are energized as

follows: (Figure 3-17) from neg. D.C., through K5 - 2 and 3, TA11, N/C S5, TA12, K2 - 6 and 5, K3 - 2 and 3 - 4 and 5 - 6 and 7, TA1 - TA2 - TA3, JP1 - JP2 - JP3, TP1 - TP2 - TP3, LP1 - LP2 - LP3, TPC, JP15, TC5, to pos. D.C.

The LP4, LP5 and LP6 punch magnets are energized as follows: from neg. D.C., TC6, JP13, PTC, JP11, N/0 S2, JP12, PLC, JP14, TA19, K3 - 8 and 9, K2 - 14 and 13, K3 - 12 and 13 - 14 and 15 - 16 and 17, TA4 - TA5 - TA6, JP4 - JP5 - JP6, TP4 - TP5 - TP6, LP4 - LP5 - LP6, TPC, JP15, TC5, to pos. D.C.

The LP7 punch magnet is also energized with the other six magnets in the same manner as previously described.

The punch clutch magnet (LPC) and the hole count magnet (LHC) are energized also, which result in the line delete code (1-2-3-4-5-6-7) perforated in the tape and the hole count relay steps to the 32nd position.

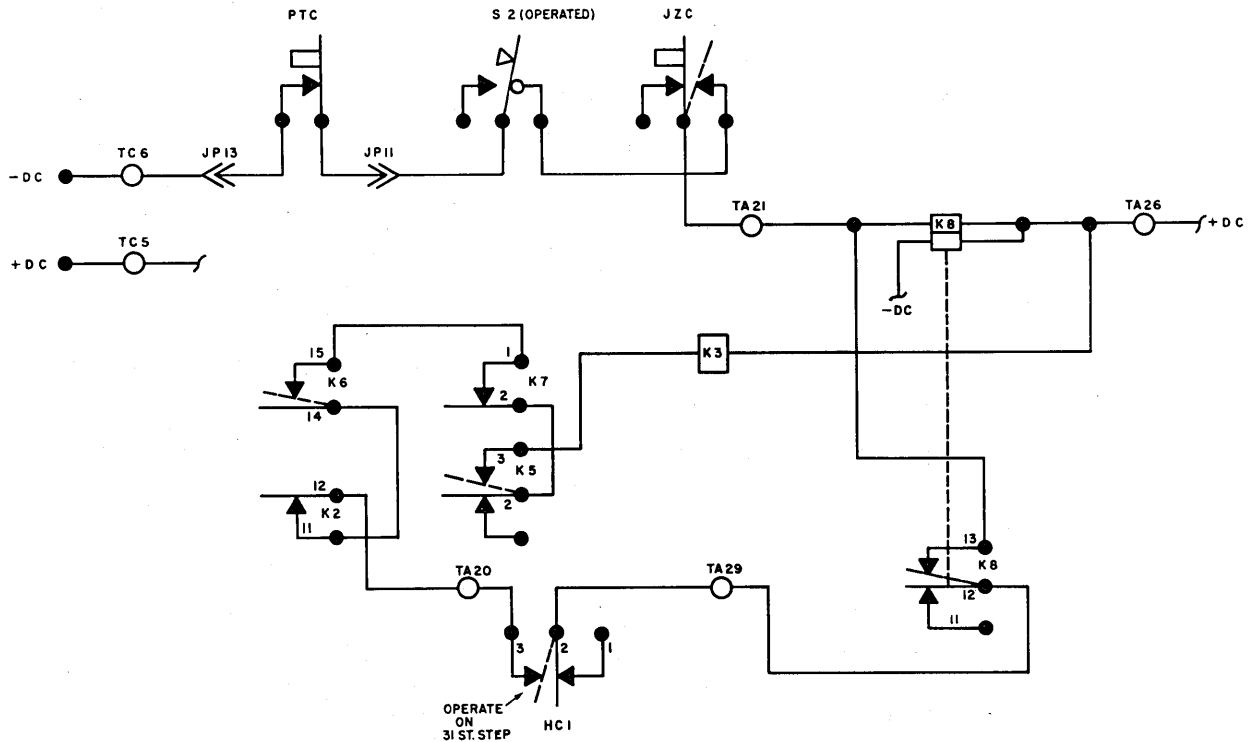


Figure 3-16 CR (K3) Circuit

TAPE FEED CIRCUIT

When the tape feed switch (S3) is depressed, the tape feeds out continuously with just feedhole perforations for as long as S3 is held depressed. This is accomplished because of the following circuit: from neg. D.C., TC6, JP13, PTC, JP11, N/0 S2, JP12, N/C PLC, JP14, N/0 S3, JP8, LPC, JP15, TC5, pos. D.C.

CODE DELETE CIRCUIT

The code delete switch (S4) when depressed, will result in the 1-2-3-4-5-6 code units perforated in the tape. This code, when read by the reproducer will not cause any function of the writing machine.

The code relay (K3) is energized when the S4 switch is depressed as follows: (Figure 3-18)

from neg. D.C., TC6, JP13, PTC, JP11, N/0 S2, JP12, PLC, JP14, N/0 S4, TA11, K3 coil, TA26, TC5, to pos. D.C.

There is a negative D.C. potential on the K3 - 8 strap, therefore, when K3 - 8 and 9 make, a circuit is complete to the LP4, LP5 and LP6 punch magnets as follows: neg. D.C., K3 - 8 and 9, K2 - 14 and 13, K3 - 12 and 13 - 14 and 15 - 16 and 17, TA4 - TA5 - TA6, JP4 - JP5 - JP6, TP4 - TP5 - TP6, LP4 - LP5 - LP6, TPC, JP15, TC5, pos. D.C. The LP1, LP2 and LP3 are energized at the same time as follows: from neg. D.C., N/0 S4, N/C S5, TA12, K2 - 6 and 5, K3 - 2 and 3 - 4 and 5 - 6 and 7, TA1 - TA2 - TA3, JP1 - JP2 - JP3, TP1 - TP2 - TP3, LP1 - LP2 - LP3, TPC, JP15, TC5, pos. D.C. Also, the punch clutch magnet (LPC) is energized which will cause punch shaft rotation, perforating the delete code

Recorder Circuit Description

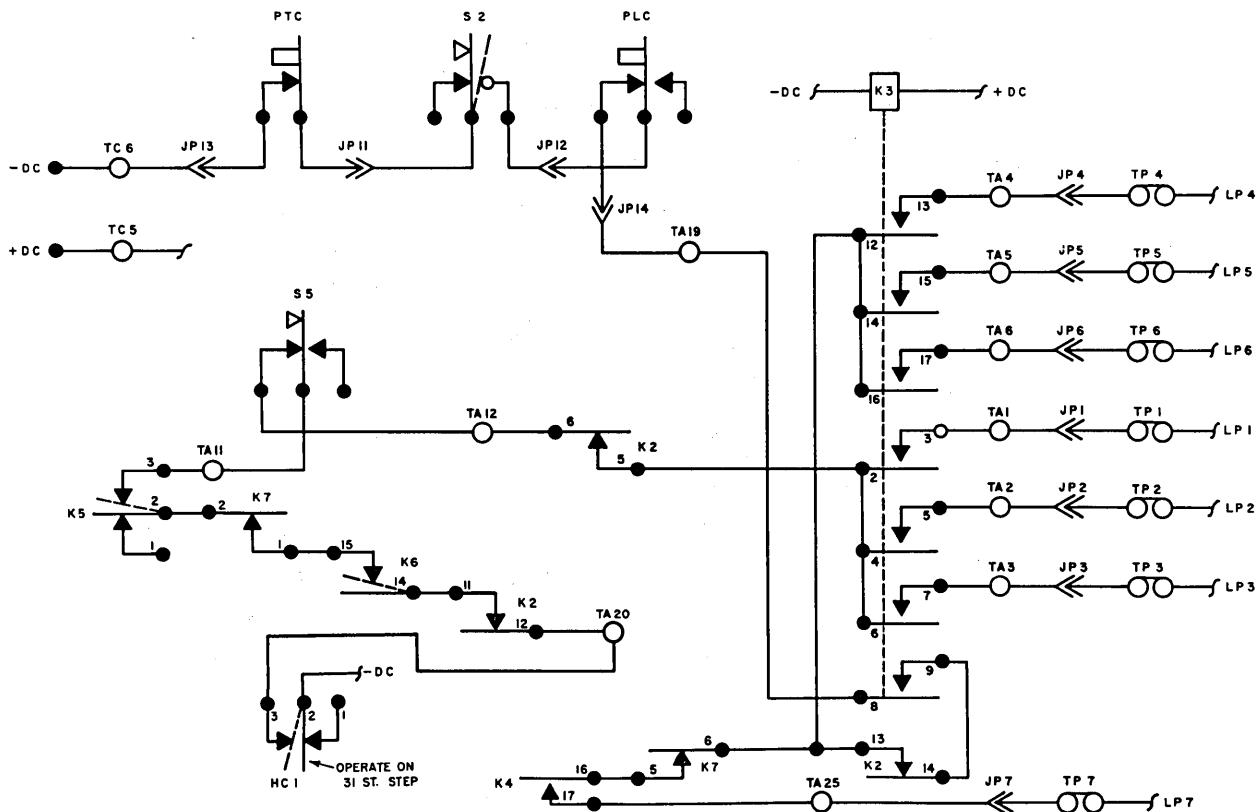


Figure 3-17 Line Delete Code Circuit

(1-2-3-4-5-6) in the tape.

The circuit is designed to allow only one code delete perforation for each depression of the S4 switch. This is accomplished through the use of an anti-repeat circuit which prevents more than one cycle of the punch even though the S4 switch is held depressed. The anti-repeat relay (K2) picks up during punch shaft rotation which results in the following:

K2 - 13 and 14 breaks - opens circuit to LP4, LP5 and LP6.

K2 - 3 and 4 breaks - opens circuit to LPC.

K2 - 5 and 6 breaks - opens circuit to LP1, LP2 and LP3.

K2 - 15 and 16 make - holds K2 energized as long as S4 is held depressed.

STOP CODE CIRCUIT

The stop code (4-5-6) is perforated in the tape when the S5 switch is depressed. This code when read by the reproducer will automatically stop reader operation.

Depressing the S5 switch will energize the K3 code relay and complete a circuit to LP4, LP5 and LP6 punch magnets as explained previously in the Code Delete Circuit description. However, the LP1, LP2 and LP3 punch magnets will not be energized because the circuit is broken to these magnets when the S5 switch is depressed. (See Figure 3-17.)

The anti-repeat circuit explained in the Code Delete Circuit description applies to stop code operation also.

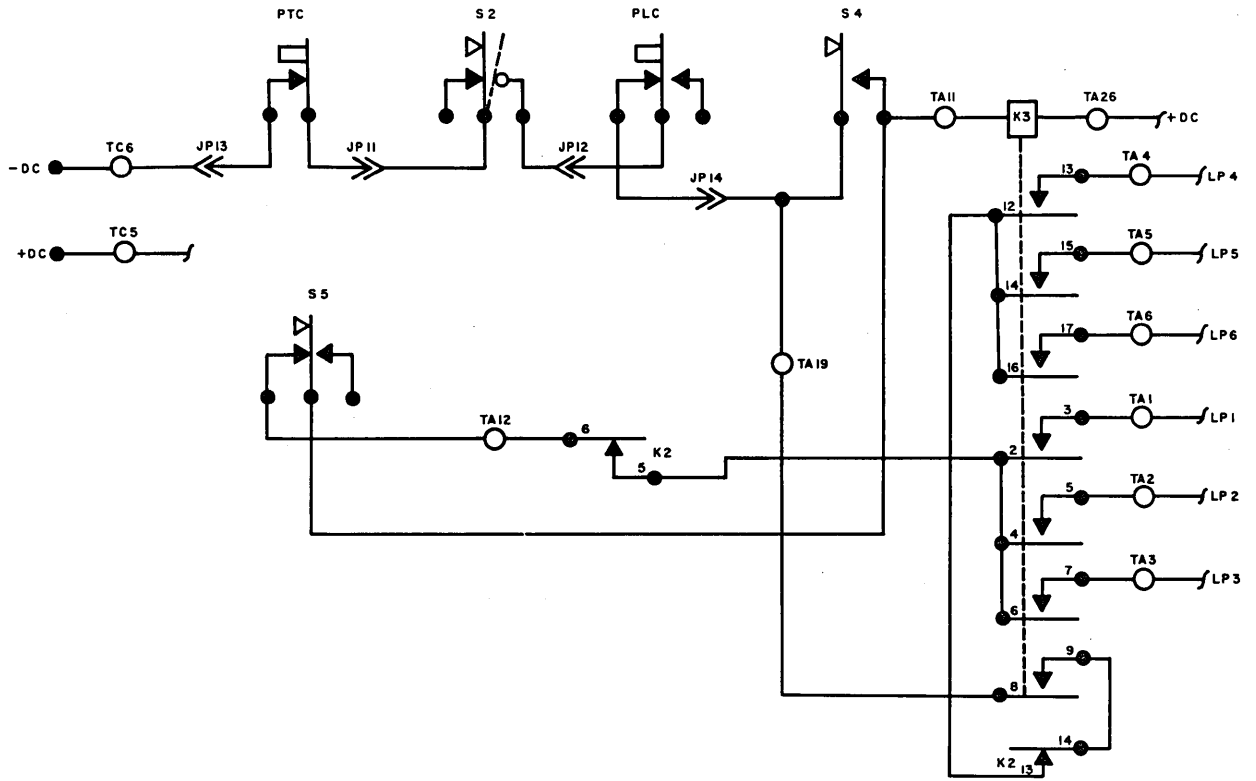


Figure 3-18 Code Delete and Stop Code Circuit

Recorder Circuit Description

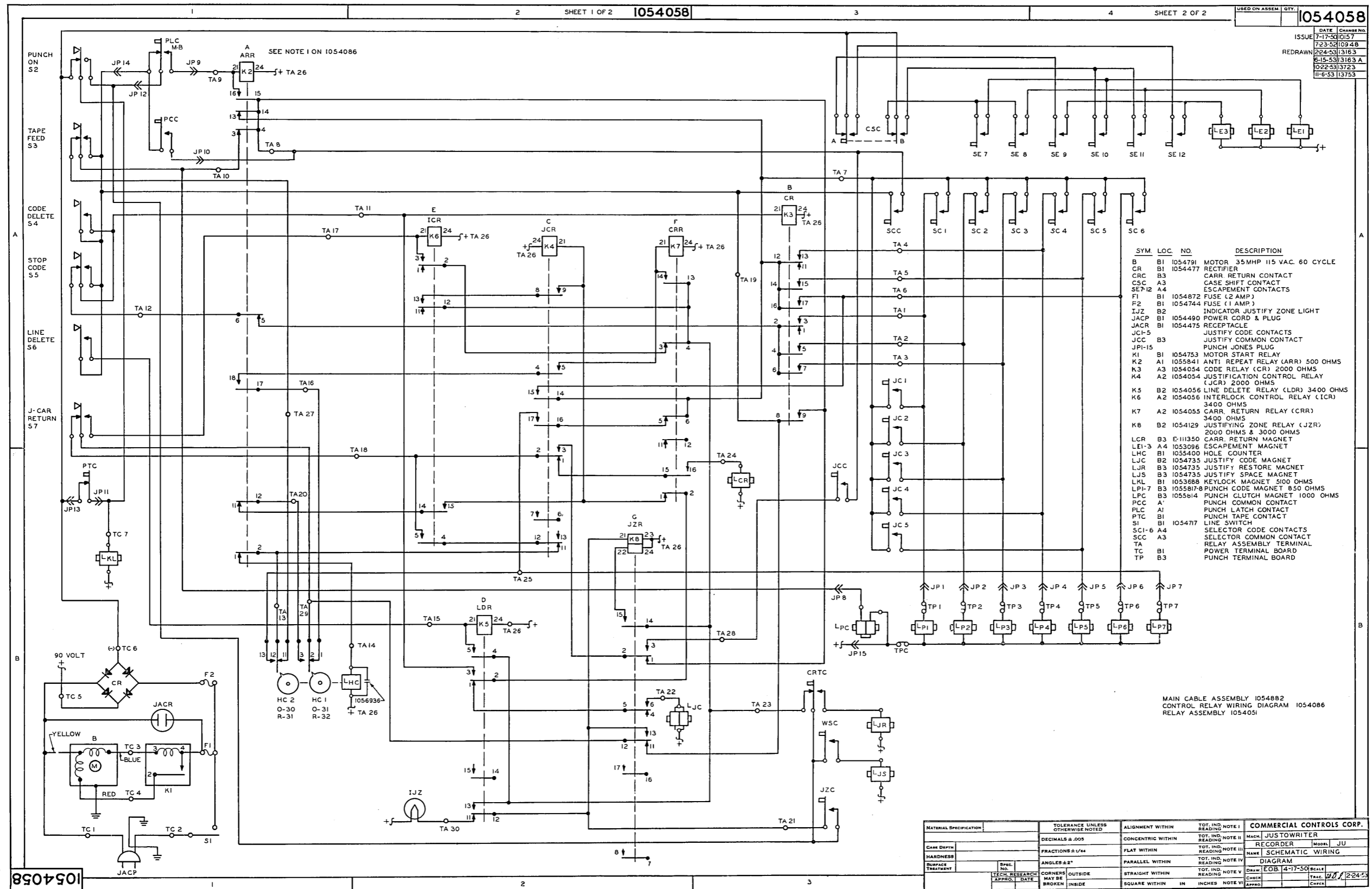


Figure 3-19 Justewriter Recorder Wiring Diagram

REPRODUCER CIRCUIT DESCRIPTION



Figure 4-1 Control Panel

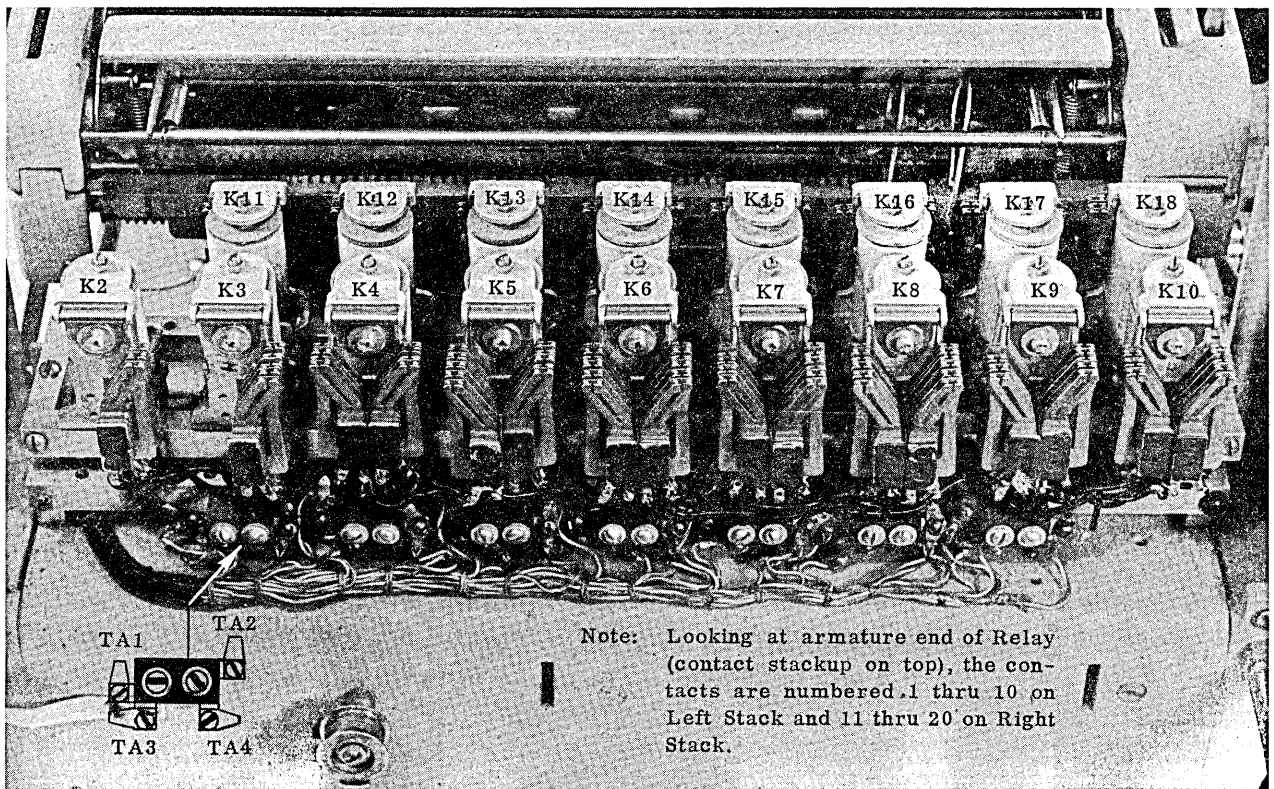


Figure 4-2 Relay Location

Reproducer Circuit Description

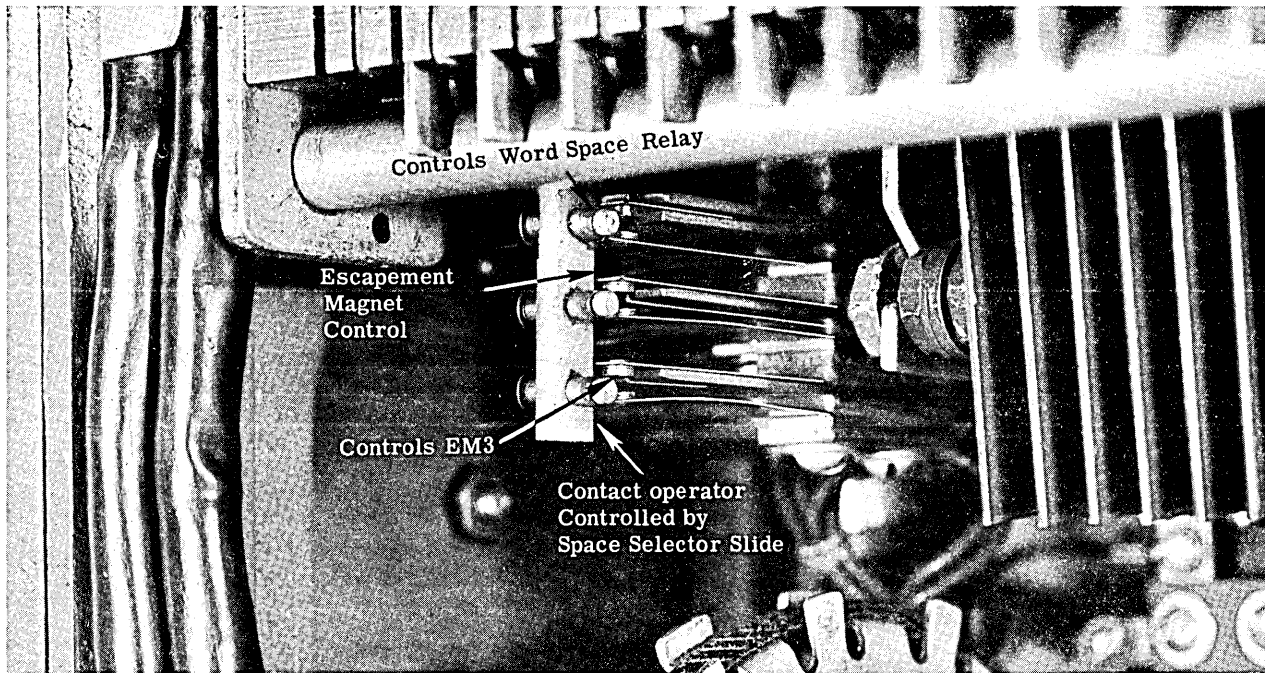


Figure 4-3 Word Space Contacts

The following circuit descriptions are based on wiring diagram 1054133. (See Figure 4-26.) Figures 4-1 through 4-3 show Reproducer component locations.

POWER CIRCUIT

The power circuit in the Reproducer is identical to the power circuit described in Part II, Section 8 of this manual.

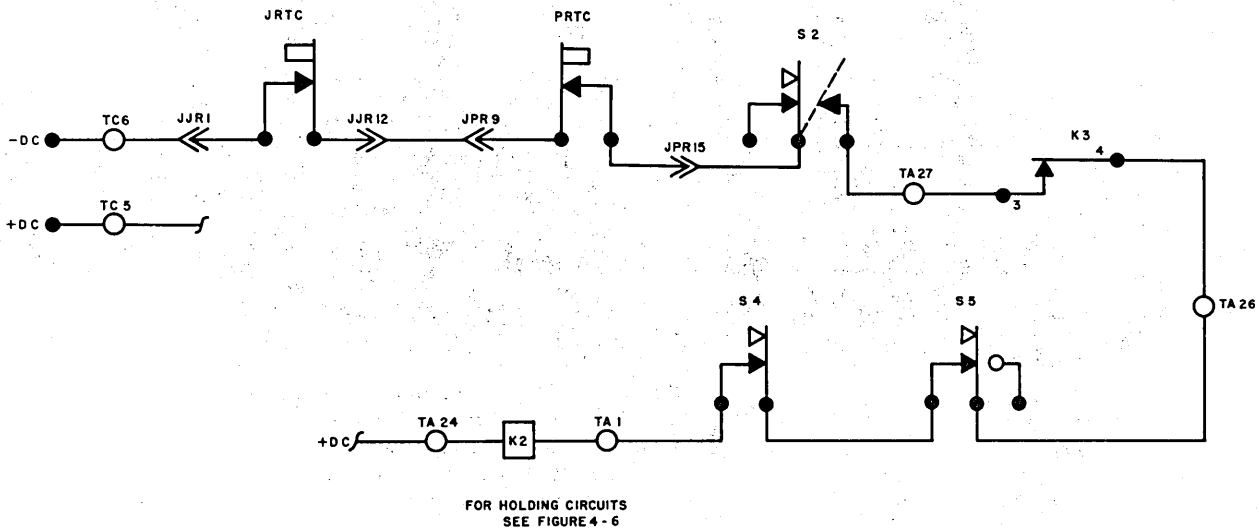


Figure 4-4 JRR (K2) Pick Up Circuit

START READ CIRCUIT (J-READER)

When the start read switch (S2) is depressed and released, the J-reader starts reading and feeding the tape. This function takes place due to the transferring of the S2 contacts which completes a D. C. circuit to the justify reader relay (K2) as follows: (Figure 4-4) from -DC, TC6, JJR1, JRTC, JJR12, JPR9, PRTC, JPR15, N/O S2, TA27, K3 - 3 and 4, TA26, N/C S5, N/C S4, TA1, K2 coil, TA24, TC5, to +DC.

With the K2 relay picked up and the S2 switch returned to normal position, the J-reader magnet (LJR) is energized by the following circuit: (See Figure 4-5) from -DC, N/C S2, TA6, K11 - 2 and 1, K2 - 3 and 4, TA7, JJR5, LJR, JJR11, TC5, to +DC. Therefore, with the J-reader magnet energized, the tape is fed through the J-reader (rear).

The J-reader relay (K2), once it is energized, is held energized by the following circuits:

K2 holding circuit No. 1: (Figure 4-6) from -DC, TC6, JJR1, JRTC, JJR12, JPR9, PRTC, JPR15, JJR15, N/C transfer JRC7, JJR3, TA5, K2 - 1 and 2, K2 coil, TA24, TC5, to +DC. The holding circuit just described is through a normally closed transfer contact of JRC7, therefore, when a seven code is read in the J-reader this holding circuit to K2 is broken.

K2 holding circuit No. 2: (Figure 4-6) Another holding circuit for K2 is through the normally closed 5 and 6 contacts of the print reader relay (K3), as follows: from -DC, TA9, K3 - 6 and 5, K2 - 5 and 6, TA26, N/C S5, N/C S4, TA1, K2 coil, TA24, TC5, to +DC. Thus, it is obvious, that when the K3 relay is energized, this 2nd holding circuit to K2 is broken.

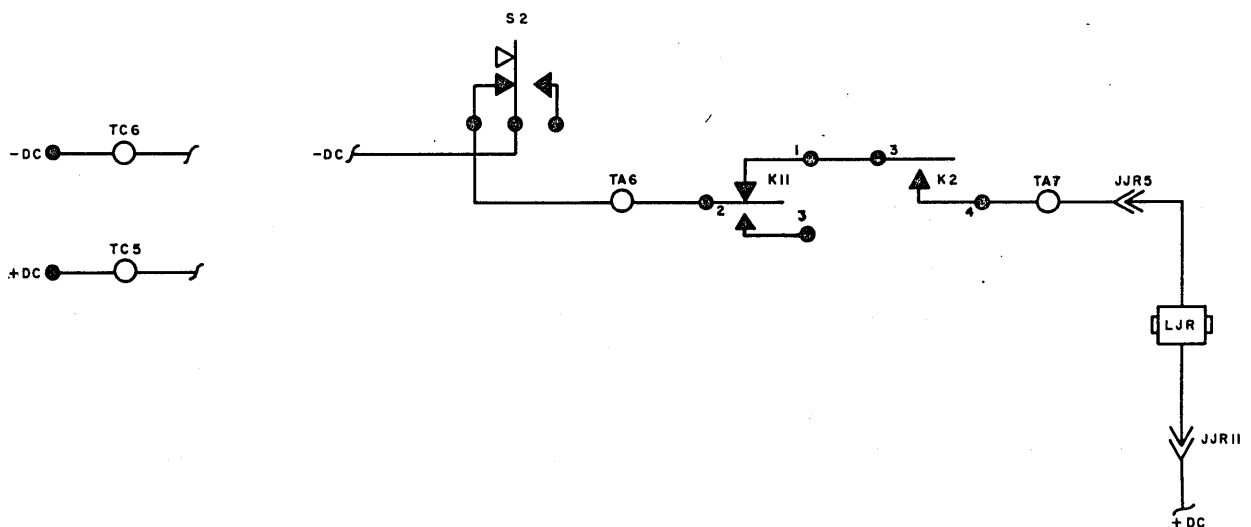


Figure 4-5 J-Reader Magnet (LJR) Circuit

Reproducer Circuit Description

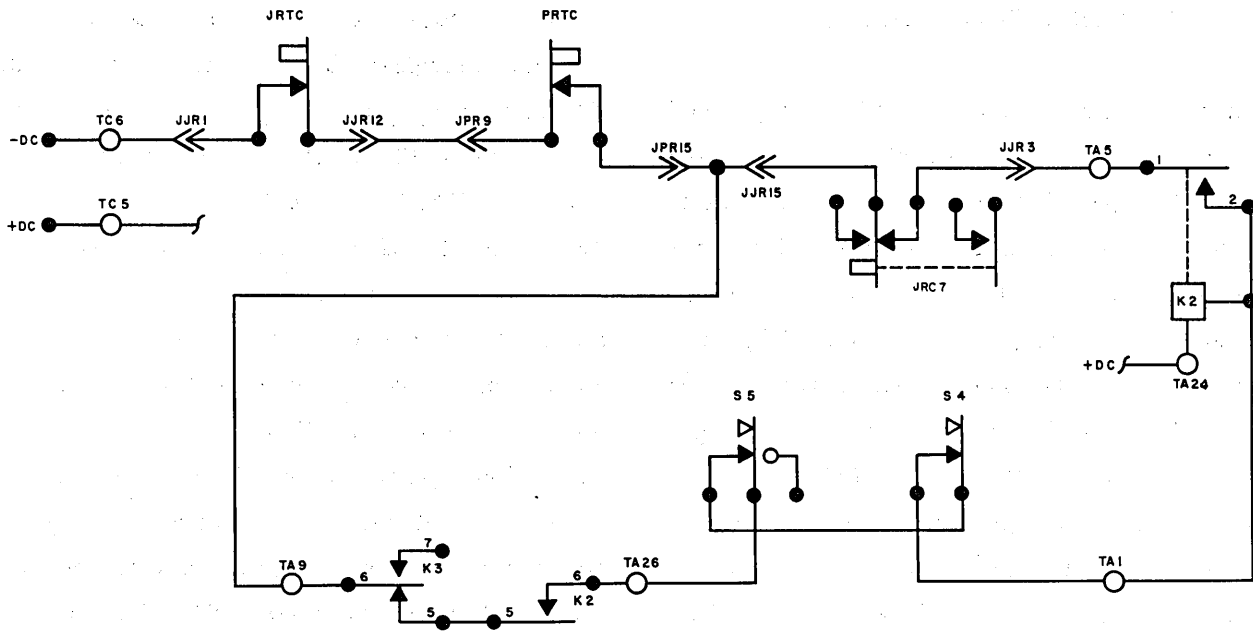


Figure 4-6 JRR (K2) Holding Circuit

JUSTIFYING RELAY PICK-UP CIRCUITS

There are five justifying relays (JR1 through JR5) mounted on the relay bank in the rear of the machine. These relays are used as storage relays to store the justification information of each line. The initial pick-up circuit to these relays can take place only when the 6-7 justification code is read in the tape. The JRC1 through JRC5 J-reader contacts are connected respectively to the JR1 through JR5 justifying relays. Thus, it follows that when a 6-7 plus a combination of the 1 through 5 code is read in the J-reader, the respective justifying relays will be energized.

For an example, assume that a 1-2-3-4-6-7 justification code was read by the J-reader. This would result in the JR1 (K9), JR2 (K10), JR3 (K14) and JR4 (K15) relays being energized. Thus, with these particular relays energized, the Reproducer has stored the following information:

the first and second word space operations will escape the carriage five units, and the next six word spaces will have a four unit escapement. If there are more than eight word spaces in a line, the remaining will have the normal two unit escapement.

The pick-up circuit to the JR relays in the example code would be complete when JRC6 and JRC7 operate simultaneously. This would put a DC potential on one strap of the other five JRC contacts. Therefore, when JRC1, JRC2, JRC3 and JRC4 contacts operate, JR1, JR2, JR3 and JR4 would pick-up. (See Figure 4-7.)

To hold these relays energized and store the information for the line, a holding circuit is complete through a contact on the print read relay (K3 contacts 6 and 7).

NOTE: The print read relay K3 picks up when the JRC 6 and 7 contacts close also.

The holding circuit to the JR1 (K9), JR2 (K10)

Reproducer Circuit Description

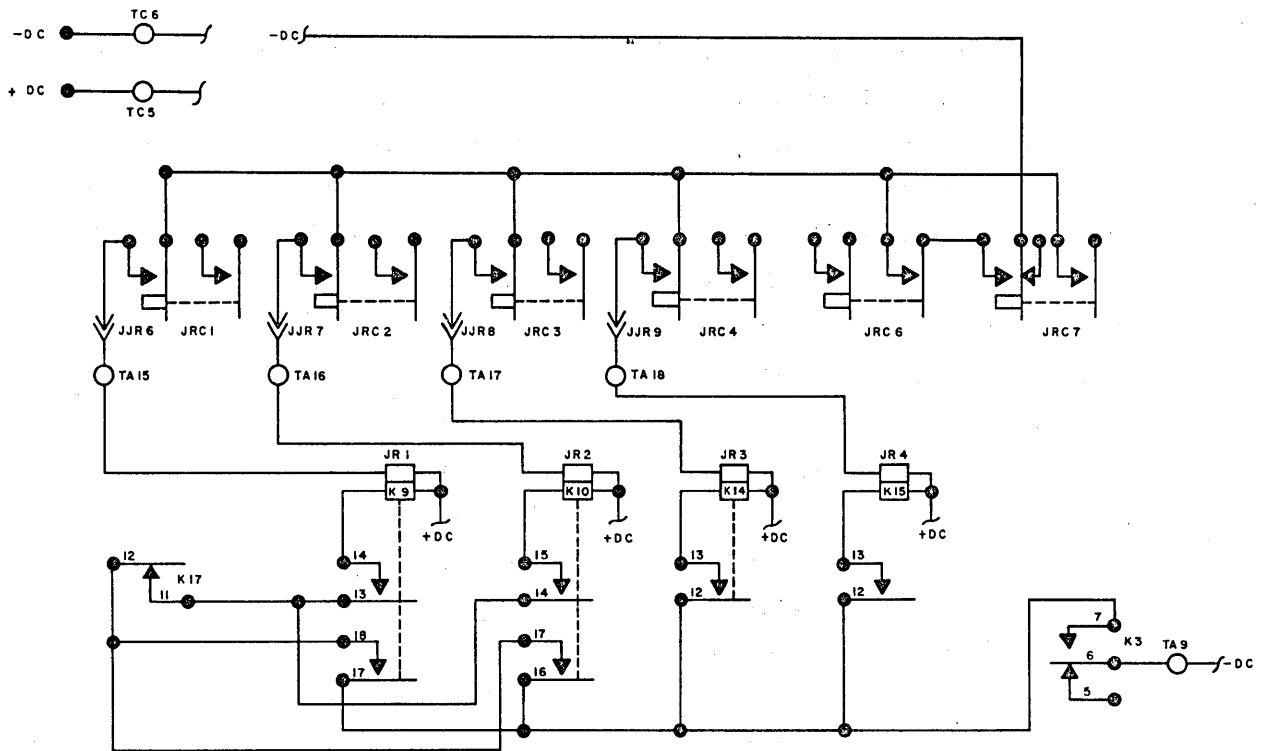


Figure 4-7 Justifying Relay P. U. and Hold Circuit

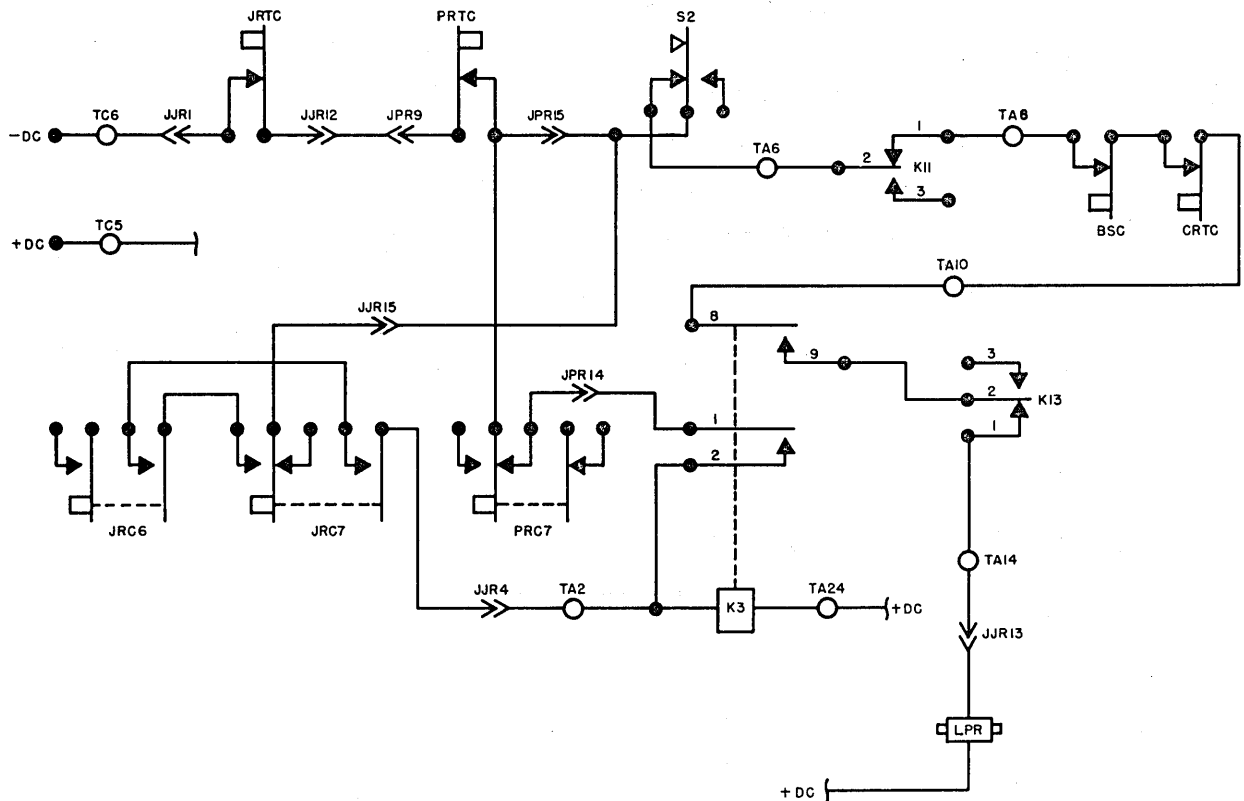


Figure 4-8 Print Reader Magnet (LPR) Circuit

Reproducer Circuit Description

and SDR (K18 - if energized) is through a normally closed contact on CR8 (K17 - 11 and 12 contacts). Thus, after the eighth word space operation, the JR1, JR2 and SDR relay will de-energize and cause two unit escapement operation for the remainder of word spaces in the line (if any). The JR3, JR4 and JR5 relays, however, will remain energized until the K3 - 6 and 7 contacts open (at the end of the line).

START READ CIRCUIT (P READER)

The print reader (front) starts reading and feeding tape when the 6-7 justification code is read by the J-reader. This operates JRC6 and JRC7 contacts completing a pick-up circuit to the print relay K3 as follows: from -DC to the operate strap of JRC7 transfer contact, through JRC6, JRC7 make contact, JJR4, TA2, K3 coil, TA24, TC5, to +DC. (See Figure 4-8.)

The K3 relay is held energized by a circuit through the normally closed transfer contacts of PRC7, through K3 - 1 and 2 to the K3 coil. Thus, if a 7 code is read by the print reader and

operates the PRC7 contacts, the holding circuit to the K3 relay will be broken.

With K3 energized, contacts K3 - 8 and 9 are closed completing a circuit to the print reader magnet as follows: (Figure 4-8) from -DC, N/C S2, TA6, K11 - 2 and 1, TA8, BSC, CRTC, TA10, K3 - 8 and 9, K13 - 2 and 1, TA14, JJR13, LPR, TC5, to +DC.

Thus, with the print reader magnet energized, print reader operation takes place, whereby the codes read will result in translator operation causing type bar and functional operation of the Reproducer.

WORD SPACE CONTACT CIRCUITS

When the number three code unit is read by the print reader, the correct escapement of the carriage takes place which depends on the word space contact (WSC) operation and the position of the contacts of K9, K10 and K18. Assuming that just the K9 relay was energized, the LE3 escapement magnet would be energized when the

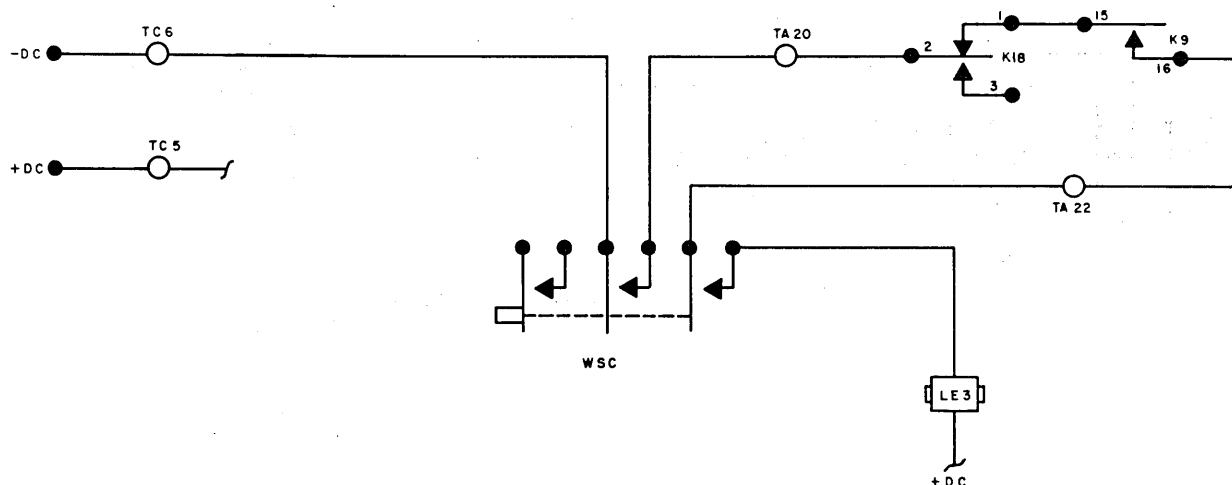


Figure 4-9 Circuit to LE3 (K9 Energized)

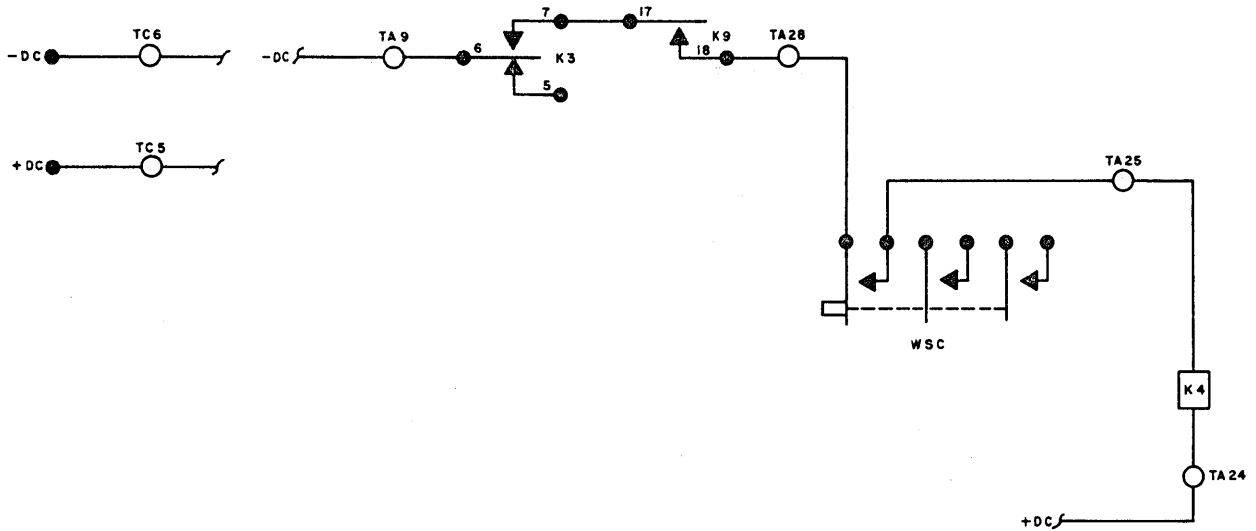


Figure 4-10 Example Word Space Relay (K4) Circuit

word space contacts operated. This circuit would be as follows: (Figure 4-9) from -DC, TC6, WSC, TA20, K18 - 2 and 1, K9 - 15 and 16, TA22, WSC, LE3, TC5, to +DC.

The operation of the word space contact would also energize the K4 word space relay provided one or more of the JR relays were energized (either K9, K10, K14, K15 or K16). If the K9 relay was energized, for example, the K4 relay would be energized as follows: (Figure 4-10) from -DC, TA9, K3 - 6 and 7, K9 - 17 and 18, TA28, WSC, TA25, K4 coil, TA24, TC5, to +DC.

The K4 relay would remain energized until the completion of the space cam cycle, at which time the WSC contacts would open, breaking the circuit to K4.

From the above, it is apparent that each word space code read in the print reader will result in the pick-up and drop-out of the K4 word space relay.

The contacts of the word space relay are used to control the circuits to the counting relays (K5, K6, K7, K8 and K17). These counting relays operate

in a definite sequence in each line and thus are a means of counting the number of word spaces in a line with an end result of determining when to energize the step down relay (K18) in a line.

SEQUENCE OPERATION OF RELAYS FOR JUSTIFICATION							
SEQUENCE OPERATION OF WS CONTACT IN ANY JUSTIFIED LINE	SEQUENCE OPERATION OF CR RELAYS IN ANY JUSTIFIED LINE	RELAY					
		WSR	CR-3	CR-4	CR-5	CRP	CR-8
FIRST	3	PU	PU				
		DO	U			PU	
SECOND	3-4	PU	U	PU		U	
		DO	U	U		DO	
THIRD	4	PU	DO	U			
		DO		U		PU	
FOURTH	4-5	PU		U	PU	U	
		DO		U	U	DO	
FIFTH	5	PU		DO	U		
		DO			U	PU	
SIXTH	3-5	PU	PU		U	U	
		DO	U		U	DO	
SEVENTH	3-4-5	PU	U	PU	U		
		DO	U	U	U	PU	
EIGHTH	3-4-5	PU	U	U	U	U	PU
		DO	U	U	U	DO	U

PU - PICK UP DO-DROP OUT U-HELD UP OR OPERATED

Figure 4-11 Counting Relay Operational Chart

Reproducer Circuit Description

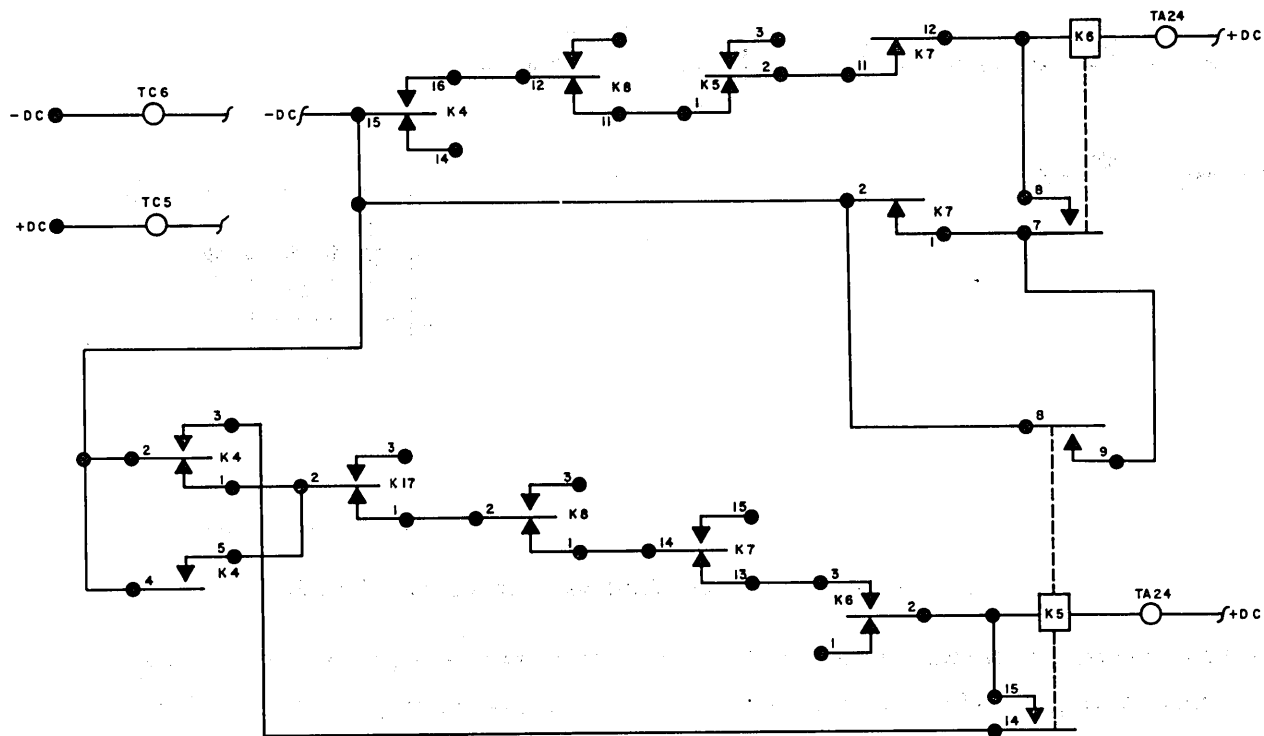


Figure 4-12 First Word Space CR Circuits

COUNTING RELAY CIRCUITS

As stated above, the counting relays pick-up and drop-out in a definite sequence in each line.

This sequence is shown in the chart in Figure 4-11 and the circuits are as follows:

First W. S. Relay (K4) Pick-Up - As shown in the chart, this first pick-up of K4 will energize the CR3 (K6) relay. K6 is energized as follows: from -DC, K4 - 15 and 16, K8 - 12 and 11, K5 - 1 and 2, K7 - 11 and 12, K6 coil, TA24, TC5, to +DC. (See Figure 4-12.)

First W. S. Relay (K4) Drop-Out - The K6 will remain energized and the CRP (K5) will pick-up. K6 holding circuit is as follows: from -DC, K7 - 2 and 1, K6 - 7 and 8, K6 coil, TC5, to +DC.

The K5 pick-up circuit is as follows: from -DC, K4 - 2 and 1, K17 - 2 and 1, K8 - 2 and 1, K7 - 14

and 13, K6 - 3 and 2, K5 coil, TA24, TC5, to +DC. With K5 energized, a holding circuit is established through K5 - 4 and 5 through the same circuit just mentioned.

Second W. S. Relay (K4) Pick-Up - The K5 and K6 will remain energized and the K7 will pick-up.

Because K7 will pick-up on this second W. S. operation, another holding circuit is necessary for K6 (original holding circuit was through K7 - 2 and 1). Since the K5 relay is energized, K5 - 8 and 9 complete a holding circuit to K6. (See Figure 4-13.)

The K7 relay pick-up is as follows: from -DC, K4 - 15 and 16, K8 - 12 and 11, K5 - 13 and 12, K6 - 19 and 20, K7 coil, TA24, TC5, to +DC.

K5 is held energized through K4 - 2 and 3 and K5 - 14 and 15.

Second W. S. Relay (K4) Drop-Out - The K6 and

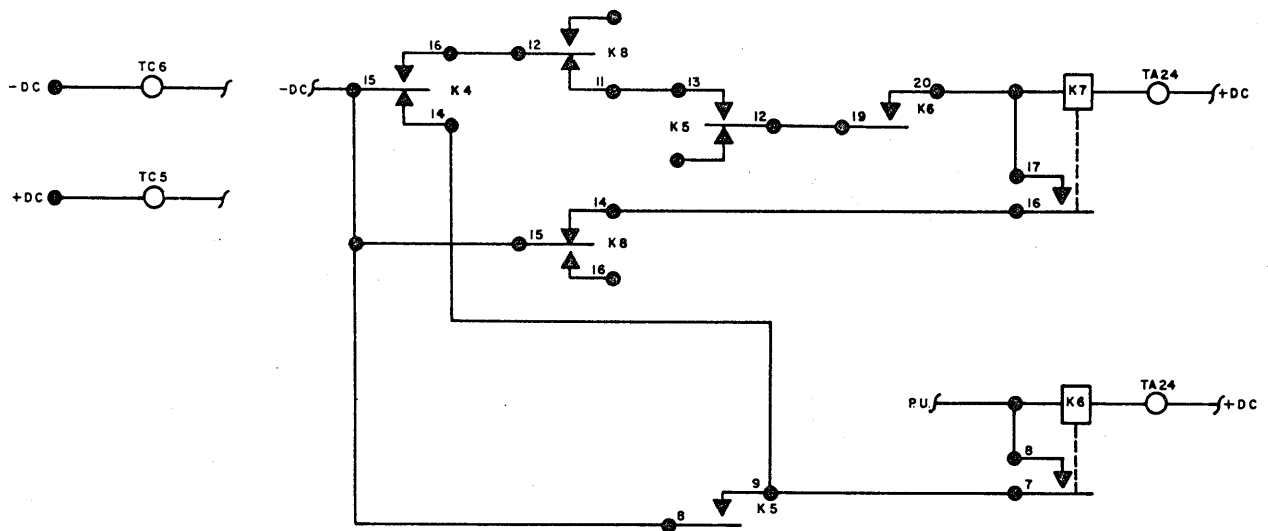


Figure 4-13 Second Word Space CR Circuits

K7 will remain energized and K5 will drop-out.

The holding circuit for K6 is through K4 - 15 and 14 and K6 - 7 and 8.

The holding circuit for K7 is through K8 - 15 and 14 and K7 - 16 and 17.

The K5 holding circuit is broken when K4-2 and 3 break.

Third W. S. Relay (K4) Pick-Up - The K6 drops-out and K7 remains energized.

When K4 - 14 and 15 break, the holding circuit to K6 is broken, thus K6 is de-energized.

The holding circuit for K7 is through K8 - 15 and 14 and K7 - 16 and 17.

Third W. S. Relay (K4) Drop-Out - The K7 relay remains energized and the K5 picks-up.

The K7 holding circuit is through K8 - 15 and 14 and K7 - 16 and 17. (See Figure 4-14.)

The K5 pick-up circuit is as follows: from -DC, K4 - 2 and 1, K17 - 2 and 1, K8 - 2 and 1, K7 - 14 and 15, K6 - 1 and 2, K5 coil, TA 24, TC5, to +DC.

Fourth W. S. Relay (K4) Pick-Up - The K5 and K7 remains energized and the K8 picks-up. (See

Figure 4-15.)

The K5 holding circuit is through K4 - 2 and 3 and K5 - 14 and 15.

The K7 holding circuit is through K5 - 6 and 7 and K7 - 16 and 17.

The K8 relay is energized as follows: from -DC, K4 - 12 and 13, K5 - 17 and 16, K7 - 18 and 19, K6 - 12 and 11, K8 coil, TA24, TC5, to +DC.

Fourth W. S. Relay (K4) Drop-Out - The K7 and K8 relays remain energized and the K5 drops out.

The K7 holding circuit is through K4 - 12 and 11 and K7 - 16 and 17.

The K8 holding circuit is through K8 - 17 and 18 (K8 once energized will not drop out until the end of the line).

The K5 holding circuit is broken when K4 - 2 and 3 break.

Fifth W. S. Relay (K4) Pick-Up - The K8 relay remains energized and the K7 relay drops out.

The K8 relay holding circuit is through K8 - 17 and 18.

Reproducer Circuit Description

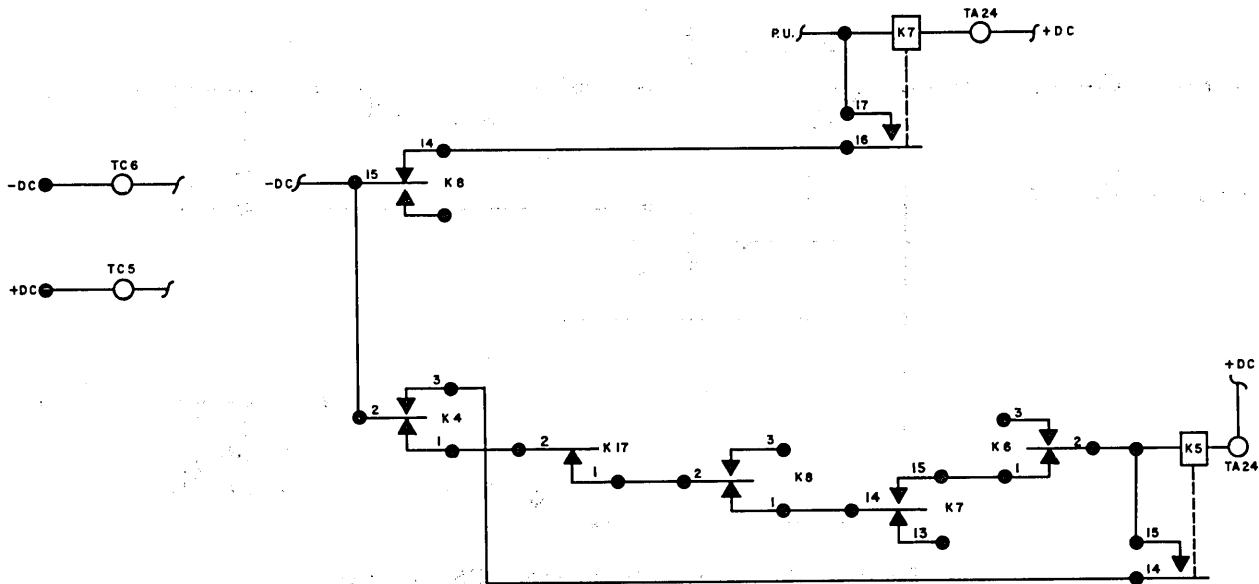


Figure 4-14 Third Word Space CR Circuits

The K7 relay drops out when K4 - 12 and 11 break.

Fifth W. S. Relay (K4) Drop-Out - The K8 relay remains energized and the K5 relay picks-up. (See Figure 4-16.)

The K8 holding circuit is through K8 - 17 and 18.

The K5 pick-up circuit is as follows: from -DC, K4 - 2 and 1, K17 - 2 and 1, K8 - 2 and 3, K7 - 4

and 3, K6 - 4 and 5, K5 coil, TA24, TC5, to +DC. Sixth W. S. Relay (K4) Pick-up - The K6 relay picks-up and the K5 and K8 relays remain energized.

The K8 relay holding circuit is through K8 - 17 and 18.

The K5 relay holding circuit is through K4 - 2 and 3 and K5 - 14 and 15.

The K6 relay pick-up circuit is as follows: from

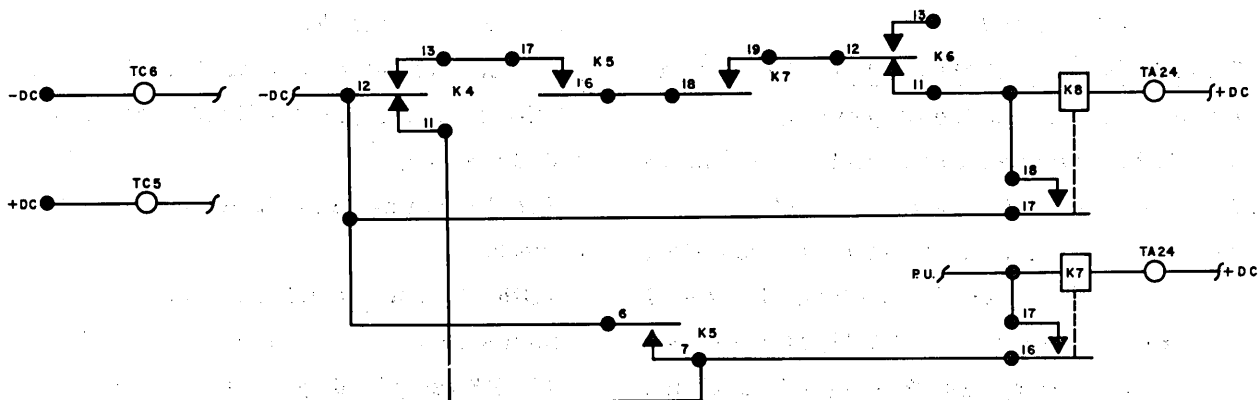


Figure 4-15 Fourth Word Space CR Circuits

Reproducer Circuit Description

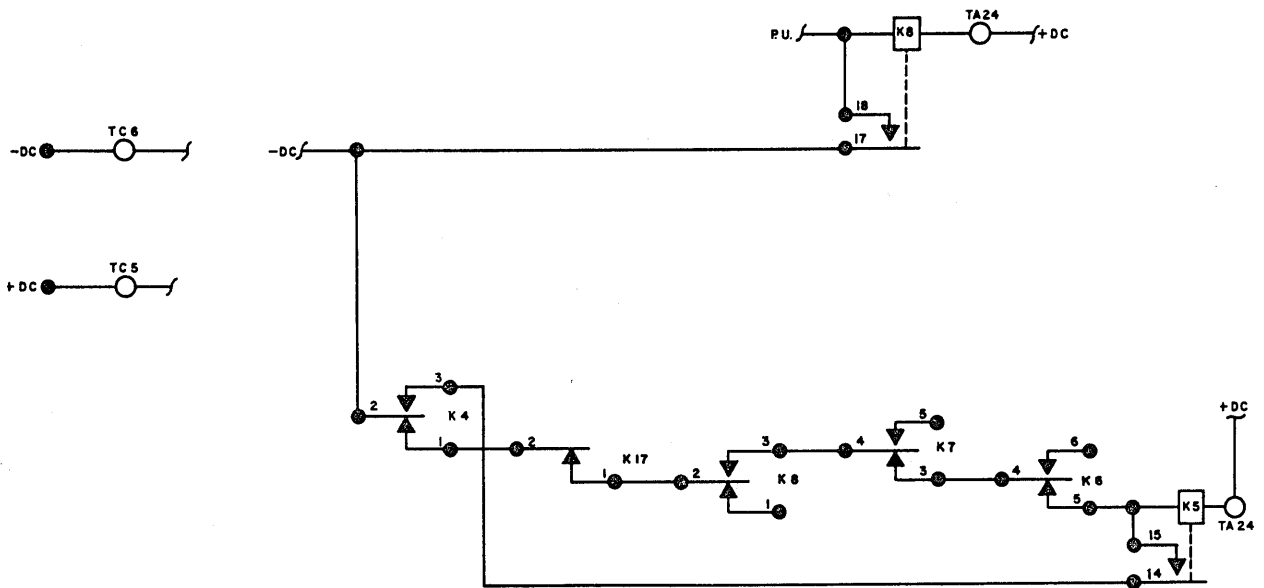


Figure 4-16 Fifth Word Space CR Circuits

-DC, K4 - 15 and 16, K8 - 12 and 13, K5 - 3 and 2, K7 - 11 and 12, K6 coil, TA24, TC5, to +DC. (See Figure 4-17.)

Sixth W. S. Relay (K4) Drop-Out - The K6 and K8 relays remain energized and K5 relay drops out.

The K6 relay holding circuit is through K8 - 15 and 16 and K6 - 7 and 8.

The K8 relay holding circuit is through K8 - 17 and 18.

The K5 relay holding circuit is broken when K4 - 2 and 3 break.

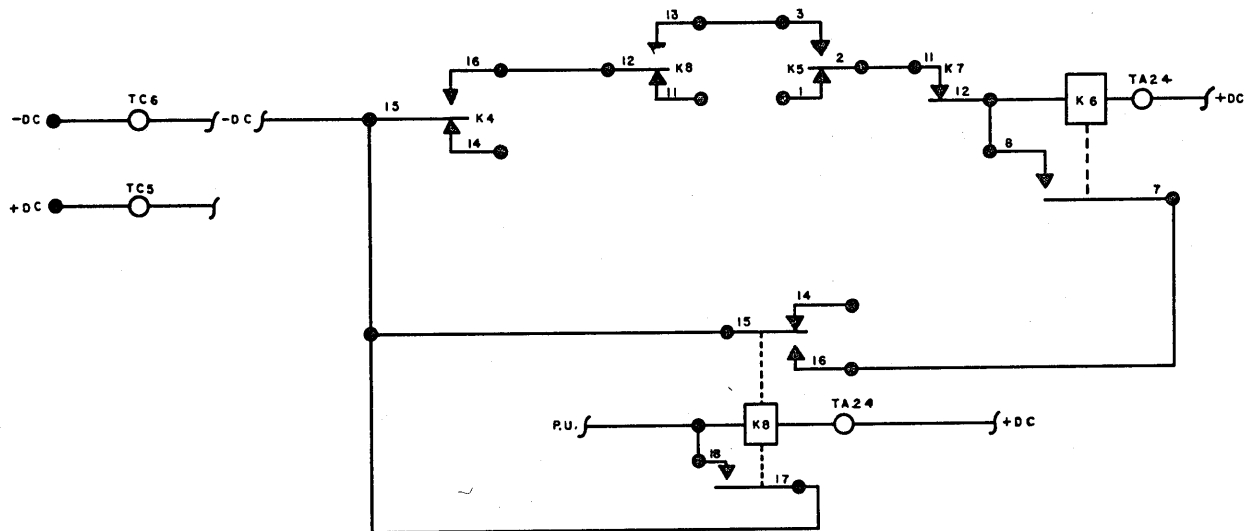


Figure 4-17 Sixth Word Space CR Circuits

Reproducer Circuit Description

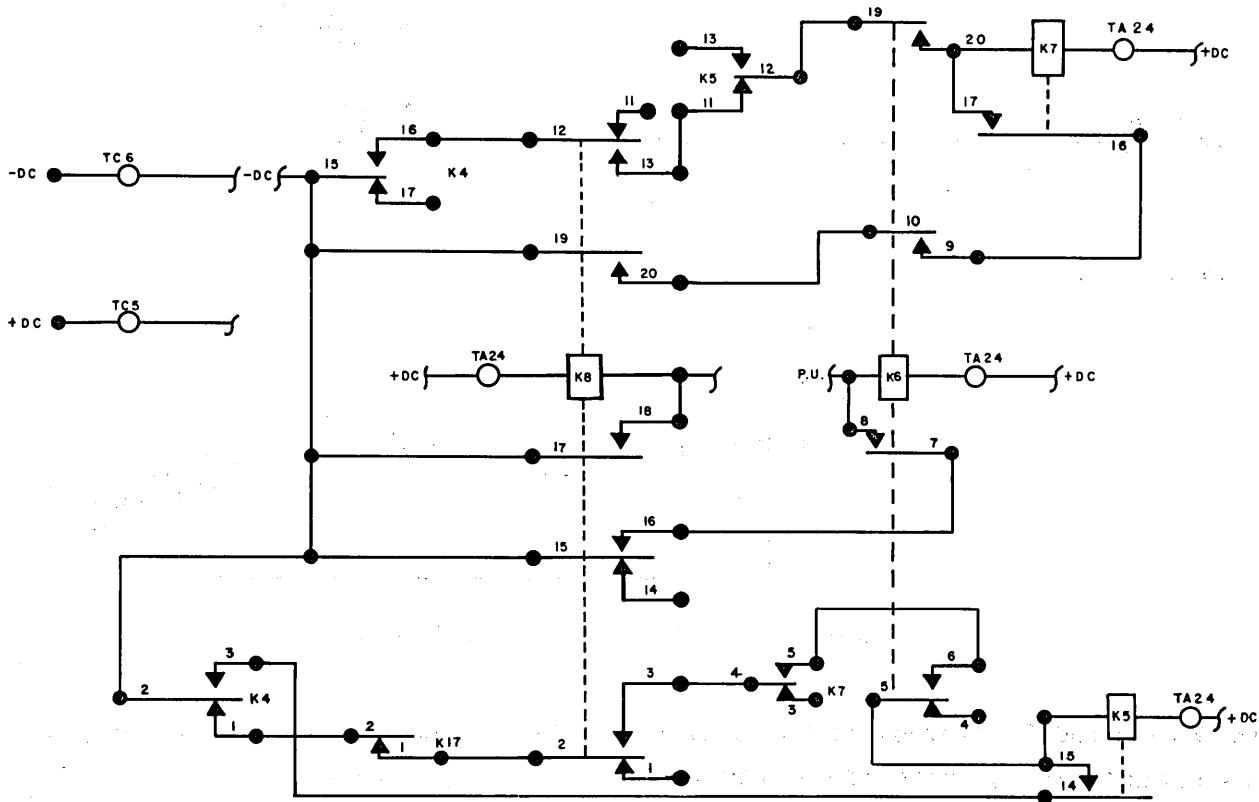


Figure 4-18 Seventh Word Space CR Circuits

Seventh W. S. Relay (K4) Pick-Up - The K6 and K8 relays remain energized and the K7 relay picks-up.

The K6 relay holding circuit is through K8 - 15 and 16 and K6 - 7 and 8.

The K8 relay holding circuit is through K8 - 17 and 18.

The K7 pick-up circuit is as follows: from -DC, K4 - 15 and 16, K8 - 12 and 13, K5 - 11 and 12, K6 - 19 and 20, K7 coil, TA24, TC5, to +DC. (See Figure 4-18.)

Seventh W. S. Relay (K4) Drop-Out - The K6, K7 and K8 relays remain energized and the K5 relay picks-up.

The K6 holding circuit is through K8 - 15 and 16 and K6 - 7 and 8.

The K7 holding circuit is through K8 - 19 and 20, K6 - 10 and 9 and K7 - 16 and 17.

The K8 holding circuit is through K8 - 17 and 18.

The K5 pick-up circuit is as follows: from -DC, K4 - 2 and 1, K17 - 2 and 1, K8 - 2 and 3, K7 - 4 and 5, K6 - 6 and 5, K5 coil, TA24, TC5, to +DC.

Eighth W. S. Relay (K4) Pick-Up - The K5, K6, K7 and K8 relays remain energized and the K17 relay picks-up. The K5 relay holding circuit is through K4 - 2 and 3 and K5 - 14 and 15.

The K6 relay holding circuit is through K8 - 15 and 16 and K6 - 7 and 8.

The K7 relay holding circuit is through K8 - 19 and 20, K6 - 10 and 9, and K7 - 16 and 17.

The K8 holding circuit is through K8 - 17 and 18.

Reproducer Circuit Description

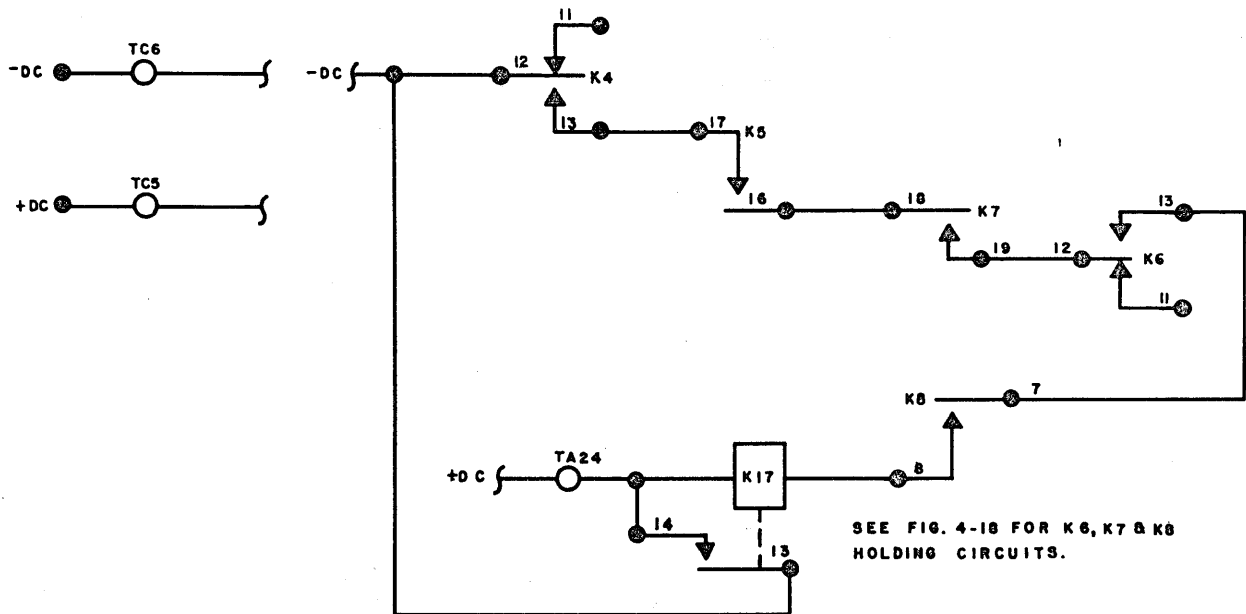


Figure 4-19 Eighth Word Space CR Circuits

The K17 pick-up circuit is as follows: from -DC, K4 - 12 and 13, K5 - 17 and 16, K7 - 18 and 19, K6 - 12 and 13, K8 - 7 and 8, K17 coil, TA24, TC5, to +DC. (See Figure 4-19.)

Eighth W. S. Relay (K4) Drop-Out - The K6, K7, K8 and K17 relays remain energized and the K5 relay drops out.

The K6 relay holding circuit is through K8 - 15 and 16 and K6 - 7 and 8.

The K7 relay holding circuit is through K8 - 19 and 20, K6 - 10 and 9 and K7 - 16 and 17.

The K8 holding circuit is through K8 - 17 and 18.

The K5 relay holding circuit is broken when K4 - 2 and 3 break.

The K17 relay holding circuit is through K17 - 13 and 14.

When CR8 (K17) is energized, K17 - 11 and 12 break, thus breaking the holding circuits to JR1 (K9) JR2 (K10) and SDR (K18). Therefore, if there

are more than eight word spaces in a line every space after the eight will be a normal two units.

STEP-DOWN RELAY (K18) PICK-UP CIRCUIT

The SDR (K18) contacts are in series with the contacts of JR1 (K9) and JR2 (K10) in providing a variable circuit to the escapement magnets (LE1, LE2, and LE3).

For an example, if the justification code was 1-2-3-4-6-7, then the JR1 (K9), JR2 (K10), JR3 (K6) and JR4 (K7) relays would be energized when this code was read in the J-reader.

The arrangement of the K9, K10 and K18 contacts would be such that for the first and second word space, the LE 2 and LE 3 escapement magnets would be energized, thus escaping the carriage five units. After the second word space operation, however, the SDR (K18) will energize, changing the circuit to energize LE1 and LE3,

Reproducer Circuit Description

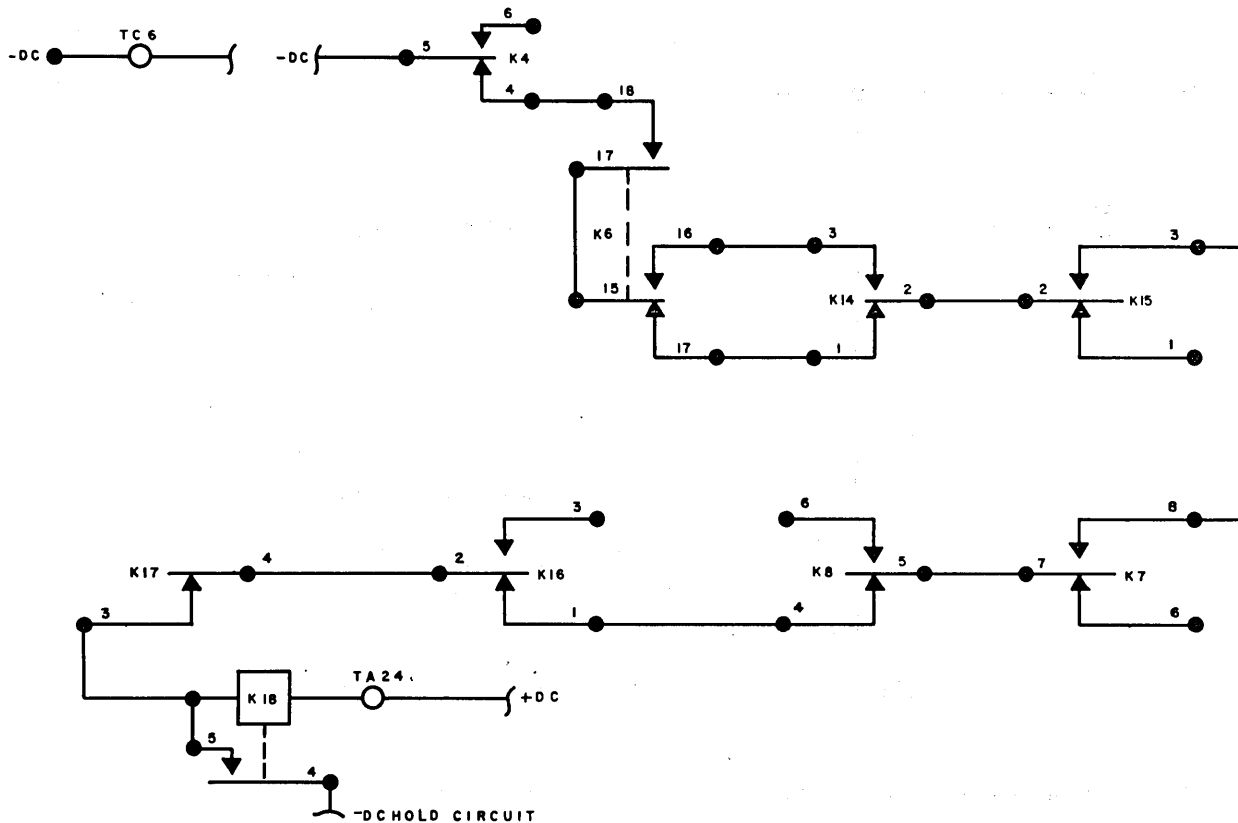


Figure 4-20 Example SDR (K18) Circuit

thus reducing the third word spacing (and all others up to the eighth) to four units.

The K18 is energized after the second word space (with the above code) because the counting relays CR3 (K6) and CR4 (K7) are energized, plus the fact that JR3 (K14) and JR4 (K15) are also energized. With these relays energized, their contacts are so arranged that a circuit is complete to the step-down relay (K18) as follows: from -DC, K4 - 5 and 4, K6 - 18 and 17, K6 - 15 and 16, K14 - 3 and 2, K15 - 2 and 3, K7 - 8 and 7, K8 - 5 and 4, K16 - 1 and 2, K17 - 4 and 3, K18 coil, TA24, TC5, to +DC. (See Figure 4-20.)

SEVEN CODE INTERLOCK CIRCUITS

The number seven code is used as an interlocking code for the two reading heads of the

Reproducer double reader.

With both the J-reader and print reader operating, if the J-reader reads a number seven code before the print reader finishes a line, the J-reader will automatically stop.

When the number seven code is read in the J-reader, the JRC7 contact operates. This breaks the holding circuit to the K2 coil (through K2 - 1 and 2), thus de-energizing K2. The K2 - 3 and 4 break, opening the circuit to the J-reader magnet and stopping the J-reader operation. (See Figures 4-21 and 4-24.)

When the print reader finishes printing the line and reads the number seven code, the PRC7 contact transfers breaking the holding circuit to the K3 coil (through K3 - 1 and 2), thus, de-energizing K3. The K3 - 8 and 9 break, opening

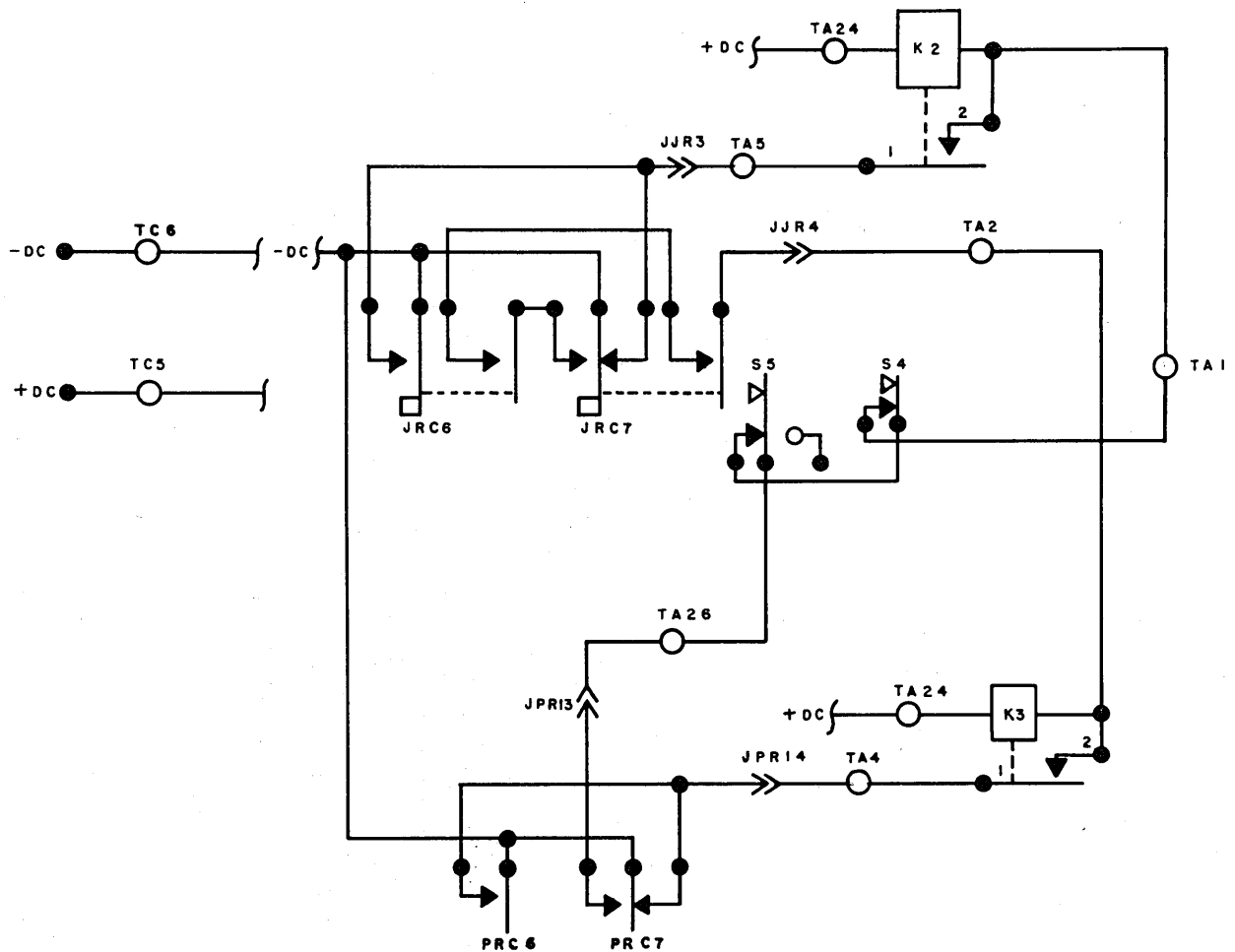


Figure 4-21 Seven Code Interlock Circuit

the circuit to the print reader magnet and stopping print reader operation. Also, the transferring of PRC7 contacts completes a pick-up circuit to the K2 relay, closing K2 - 3 and 4 and energizing the J-reader magnet. The J-reader reads the next line justification code (the 6-7 code units, plus combination of 1 through 5 code units), thus energizing the storage relays (K9, K10, K14, K15 or K16, depending on the code) and also completing a circuit to the K3 relay, starting print reader operation.

If a condition arises where the print reader

finishes reading and printing a line before the J-reader reaches the next justification code, then the print reader will stop operation when the PRC7 contacts operate.

Therefore, from the above, it can be seen that the number seven code will prevent the J-reader from reading the next justification code in a line while the print reader is still printing the preceding line. Also, the number seven code will prevent the print reader from printing a line before the J-reader has read the justification code for that line.

Reproducer Circuit Description

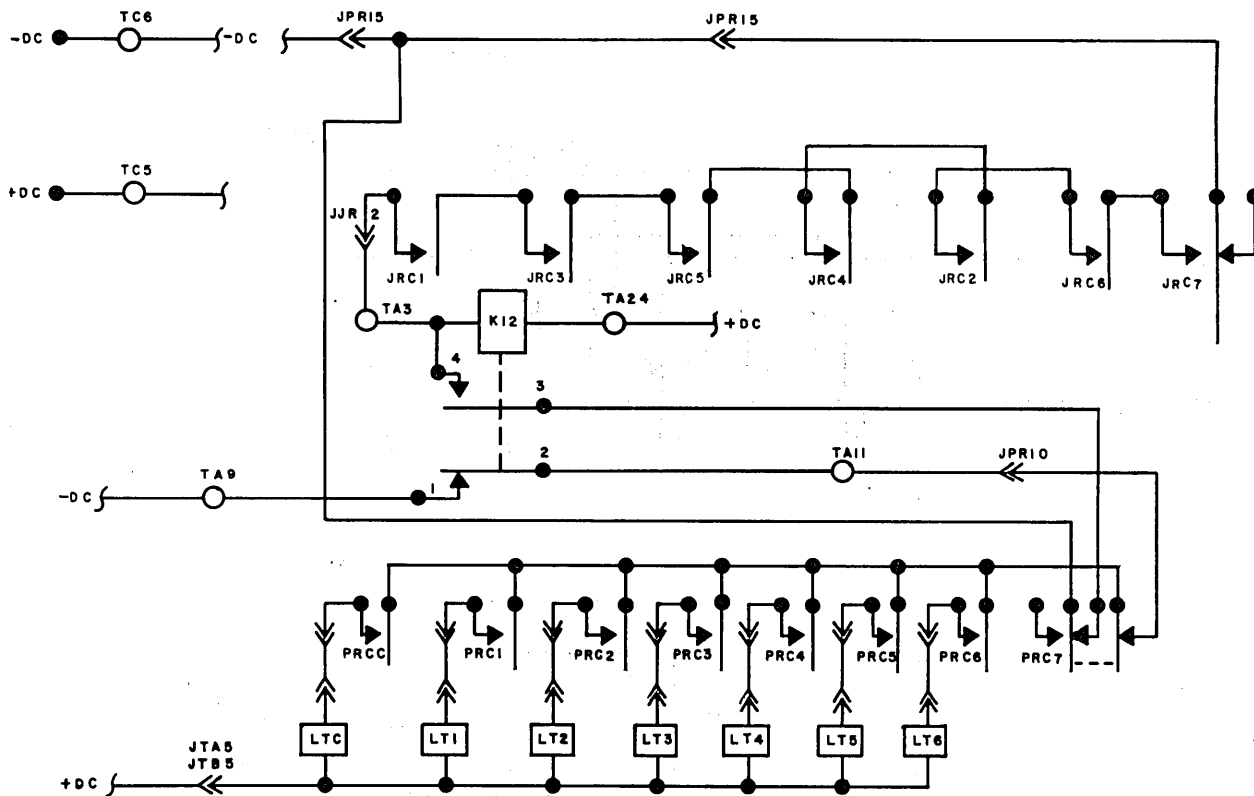


Figure 4-22 Line Delete Circuit

LINE DELETE CIRCUIT

When the line delete code (1-2-3-4-5-6-7) is read in the J-reader, a DC circuit is completed to the K12 cut-off relay as follows: from -DC, JRC7 transfer contact, JRC6, JRC2, JRC4, JRC5, JRC3, JRC1, JJR2, TA3, K12 coil, TA24, TC5, to +DC. (See Figure 4-22.) The above circuit energizes the K12 relay closing K12 - 3 and 4 and opening K12 - 1 and 2. When K12 - 3 and 4 close, a holding circuit is completed to K12 through a normally closed contact on PRC7. When K12 - 1 and 2 breaks, the negative DC potential is removed from the print reader contacts (PRC1 through PRC6 and PRCC), thus, when the print reader reads the character and function codes for that

line, the contacts operate, but the translator magnets do not become energized and no printing or functional operation of the writing machine takes place.

The K12 relay is de-energized when the print reader reads the next number seven code (at the end of the line), thus PRC7 contact operates and breaks the holding circuit through K12 - 3 and 4 to the K12 coil.

END LINE CIRCUIT

The purpose of the endline switch S4 is to allow an operator to stop the tape at the end of a line and turn off the main power switch at a point where both readers stop after reading a 7 code.

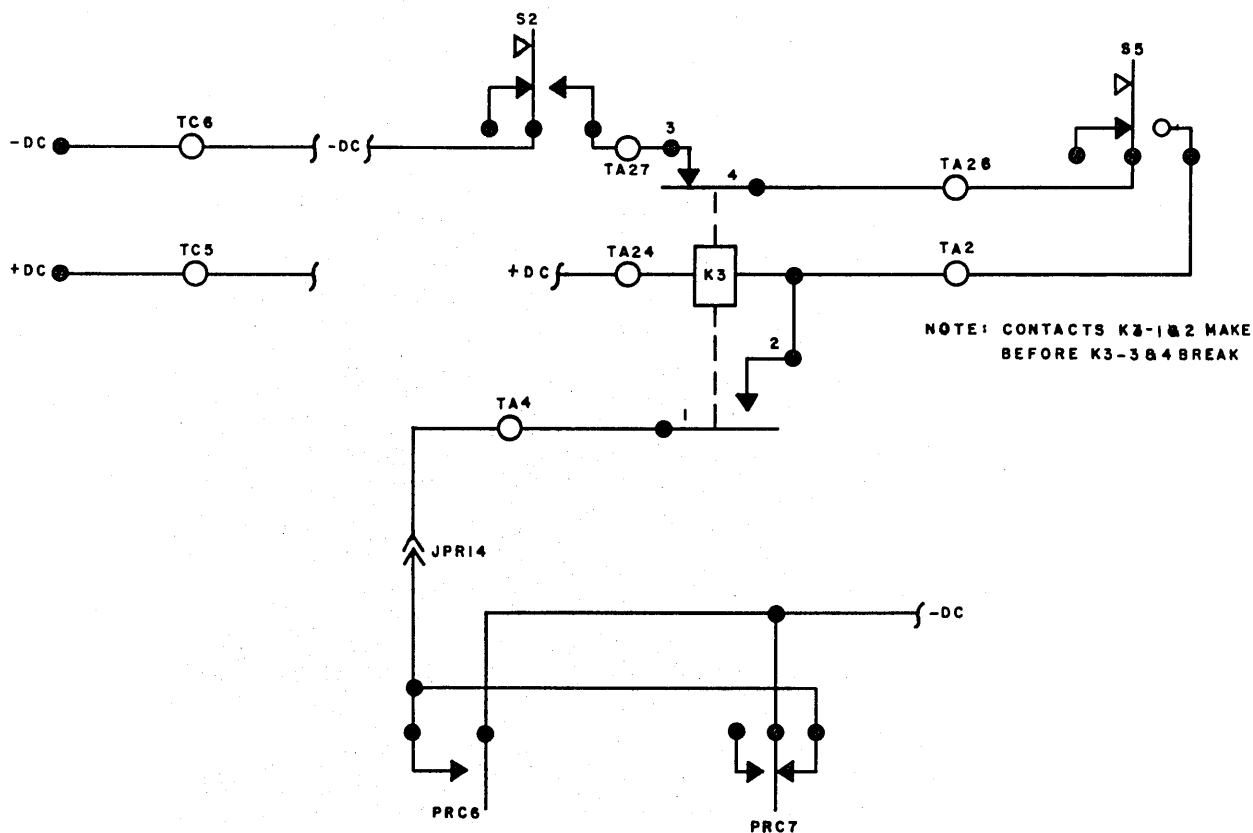


Figure 4-23 Non Justify Circuit

(See Figure 4-21.)

When the S4 switch is held depressed and the print reader reads a 7 code, the PRC7 contacts operate and break the holding circuit to K3, stopping print reader operation. Then when the J-reader reads a 7 code, the K2 holding circuit will be broken and the J-reader operation will stop. (Normally, when the print reader relay K3 is de-energized, the J-reader relay K2 will not drop out at this point. But due to the S4 switch being held in the operated position, the K2 holding circuit is broken.)

Thus, the S4 operation will cause both the J-reader magnet and the print reader magnet to be de-energized, stopping both reader operations.

When the readers resume operation, the first code read in each reader will be the 6-7 justification code.

NON-JUSTIFYING CIRCUIT

When the non-justify switch S5 is depressed, the K2 pick-up circuit is broken and the transferring of S5 contacts will complete a circuit to the K3 relay as follows: from -DC, S2 transfer, TA27, K3 - 3 and 4, TA 26, S5 transfer, TA2, K3 coil, TA24, to +DC. (See Figure 4-23.) The K3 - 1 and 2 contact will make before K3 - 3 and 4 break, consequently a holding circuit will be complete to the K3 coil before the pick-up circuit is broken.

Reproducer Circuit Description

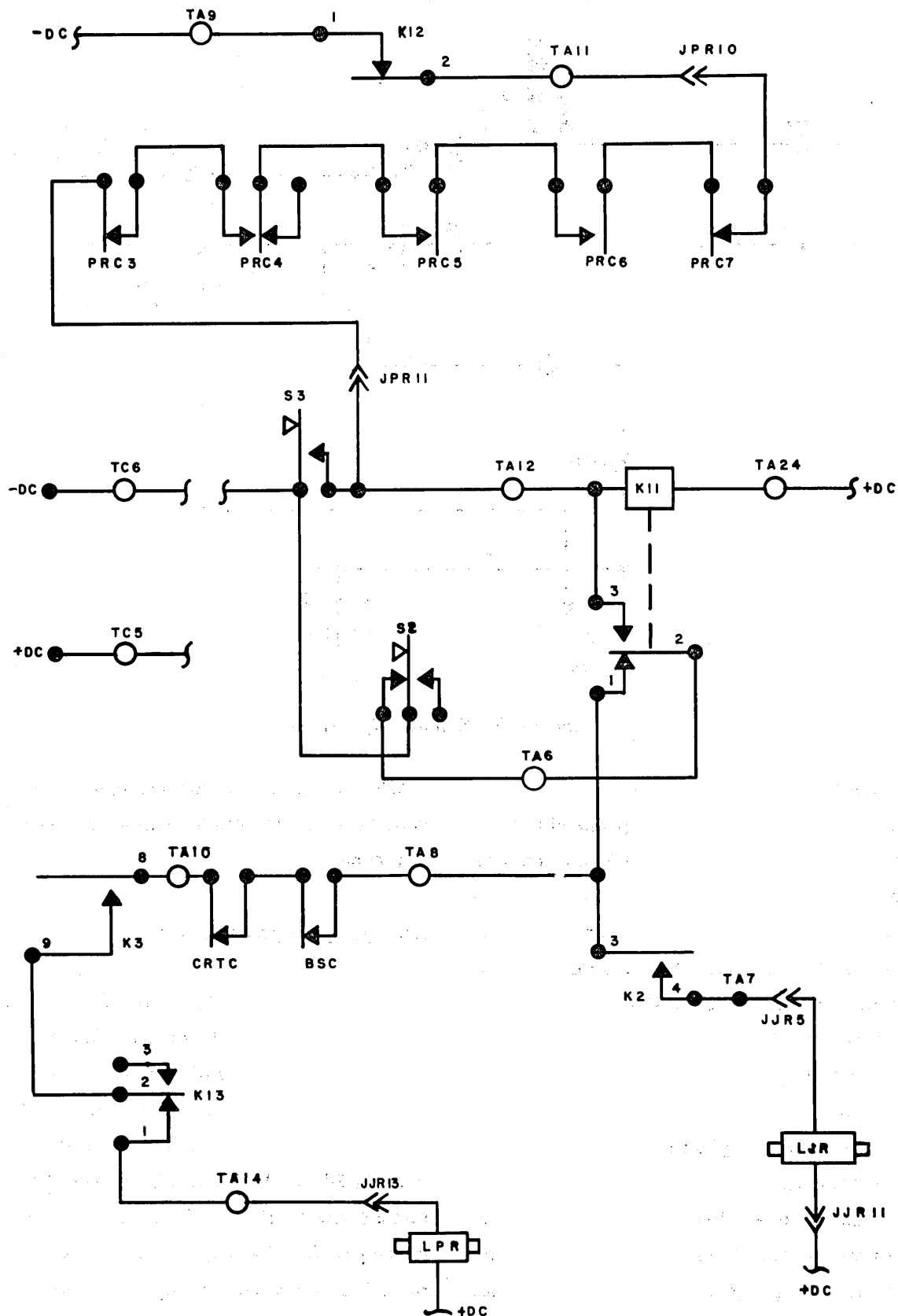


Figure 4-24 Manual and Automatic Stop Circuit

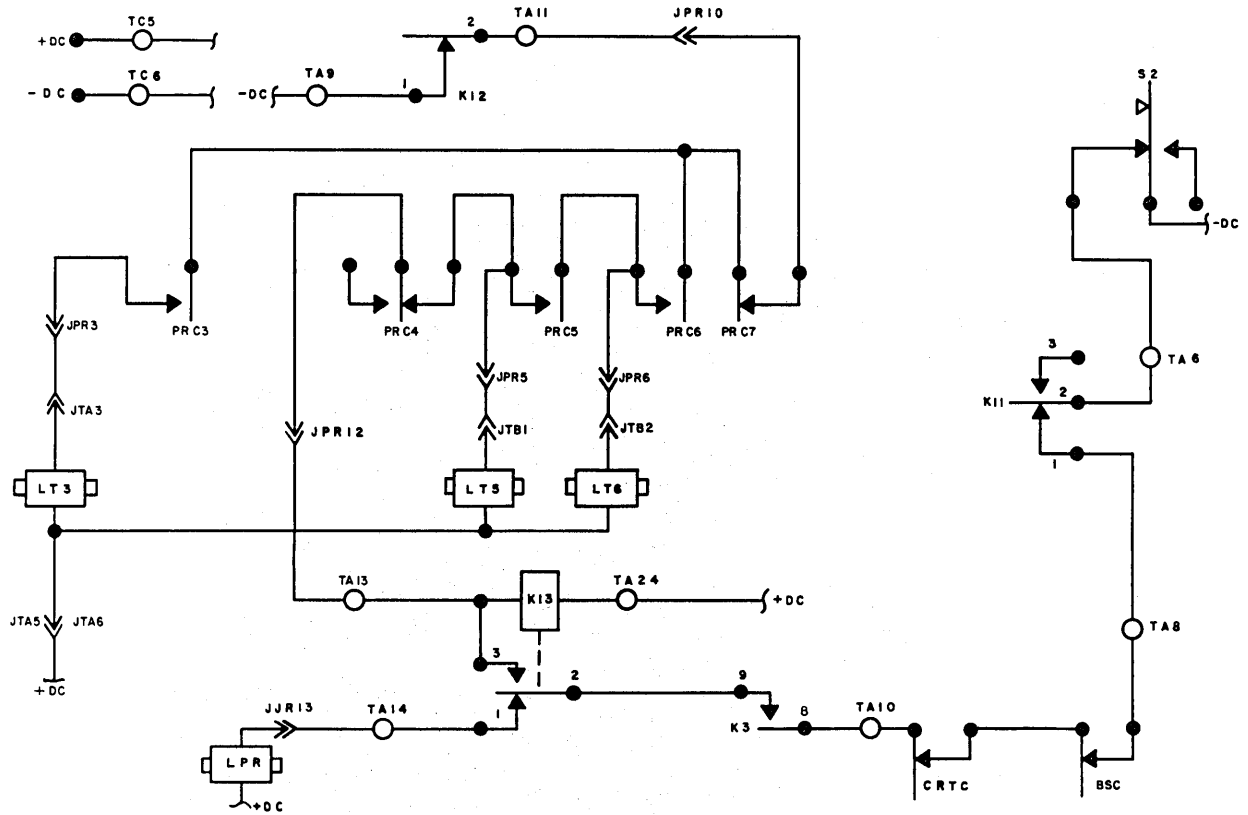


Figure 4-25 Delay Control Circuit

Therefore, the operation of the S5 switch will allow print reader operation only, and justification of lines will not take place.

MANUAL STOP CIRCUIT

When the stop read switch S3 is depressed, a circuit is completed to the stop for insert relay K11. This relay, when energized, will break the DC circuit to both reader magnets LJR and LPR, due to K11 - 1 and 2 breaking. K11 - 2 and 3 maintain a holding circuit to K11 coil, thus K11 will remain energized until the start read switch S2 is depressed. When S2 is operated, K11 drops out, K11 - 1 and 2 make and both readers resume

operation.

AUTOMATIC STOP CIRCUIT (Figure 4-24)

When a 4-5-6 stop code is read by the print reader, the K11 relay is energized breaking the circuit to both reader magnets LJR and LPR, thus stopping reader operation. This circuit is as follows: from -DC, PRC7 (break contact), PRC6, PRC5, PRC4, PRC3, JPR11, TA12, K11 coil, TA24, TC5, to +DC.

Once K11 coil is energized, its own contact (K11 - 2 and 3) completes a holding circuit to K11 coil until such time as the S2 switch is depressed. Depressing S2 will break K11 holding

Reproducer Circuit Description

circuit and the readers will again resume operation.

DELAY CONTROL CIRCUIT

It is necessary to have an automatic delay control circuit incorporated in the Reproducer in order to delay 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. Thus, PRC5 and PRC6 will operate when each of these codes are read. When PRC5 and PRC6 operate, without PRC4 operating, a circuit is completed to the delay control relay (K13) as follows: from -DC, PRC7 (break contact), PRC6, PRC5, PRC4, JPR12, TA13, K13 coil, TA24, TC5, to +DC. (See Figure 4-25.) When K13 is energized, K13 - 2 strap breaks with 1 strap and makes with 3 strap. The energizing circuit to the print reader magnet (LPR) is broken, thus stopping print reader operation. Also, when K13 - 2 and 3 make, a holding circuit to K13

is established (the original pick-up circuit to K13 will be open when contacts PRC5 and PRC6 return to normal).

Assume for the moment that the CR code 3-5-6 was read in the print reader, then at the same time the above mentioned circuit was complete to K13, a circuit would also be complete to the translator magnets LT3, LT5, LT6 and the translator clutch magnet LTC.

Translator operation would result, 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 K13. The K13 contacts would return to their normal position, but the circuit to the reader magnet would 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 print reader, the reader operation will automatically stop and will not start again until that particular function is complete.

Reproducer Circuit Description

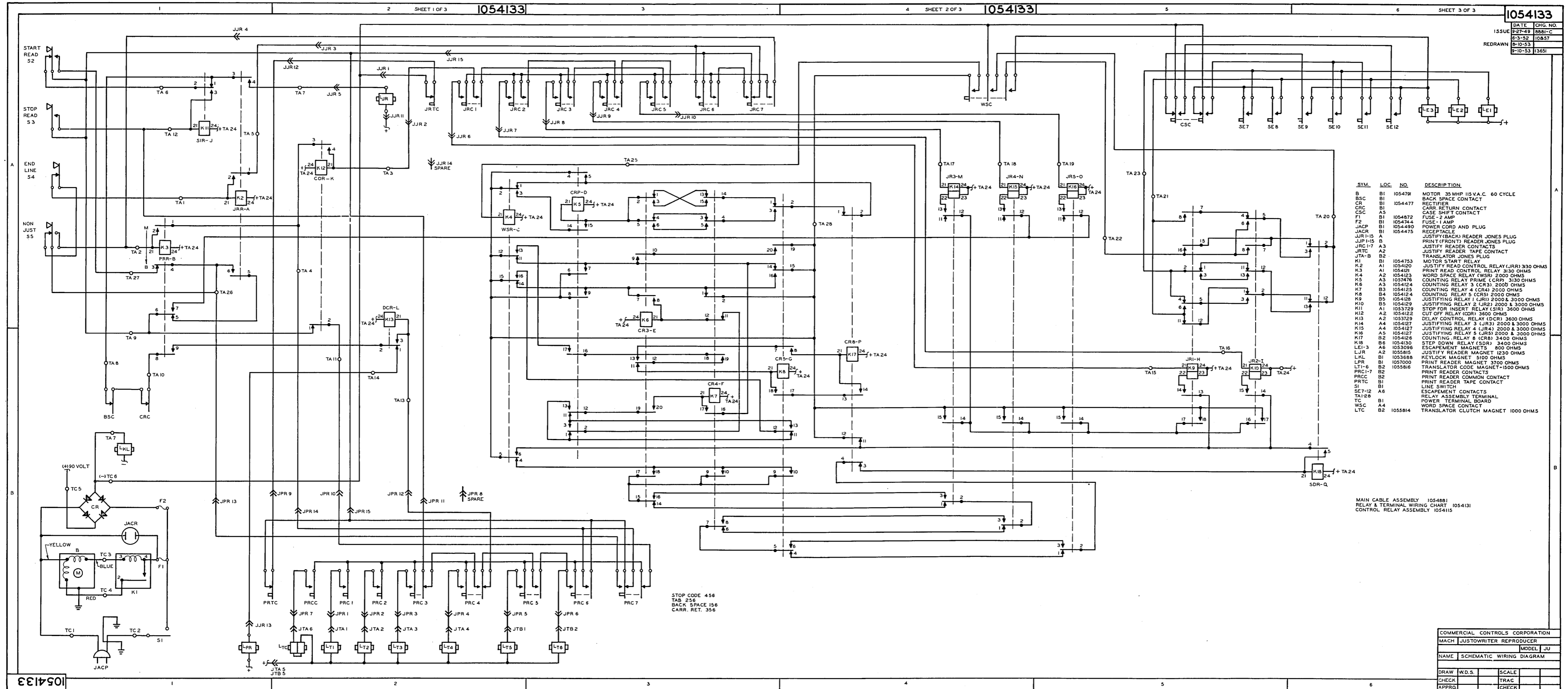


Figure 4-26 Justewriter Reproducer Wiring Diagram

RECORDER-REPRODUCER CIRCUIT DESCRIPTION

DESCRIPTION

The Justowriter Recorder-Reproducer is essentially the same as the Justowriter Recorder described in Part VII, Section 3. A single reader (described in Part II, Section 6) is added, which makes possible the re-perforation of Justowriter tape, thus, duplicate or revised tapes can be made easily. The only manual typing required to incorporate changes in a new tape is the typing of the change itself.

OPERATION

A start read and stop read switch has been provided to control the reader operation, otherwise, the operation is the same as a Justowriter Recorder.

When a Justowriter tape is read in a Recorder-Reproducer, the reader stops automatically at the end of the line. The J-carriage return switch must be depressed to punch the justification code in the new tape (same as Justowriter Recorder), or the line may be deleted by depressing both the line delete and J-carriage return switches. The reader is started again with the start read switch. The start read or stop read switch can be used to stop the reader at any time to make corrections or additions through the keyboard.

When the reader senses the justification code in the tape, no operation of the writing machine will take place. The reader will sense the 7, 6-7 and 3-5-6 justification code and then stop operation.

CIRCUIT DESCRIPTION

The following circuit descriptions are based on wiring diagram 1055402. Those circuits involving the Justowriter Recorder operation are the same as described in Part VII, Section 3 and will not be described in this section.

Start and Stop Read Circuit - When it is desired to start reader operation, the S8 start read switch is depressed and released resulting in the reader magnet being energized causing reader operation. When the S8 switch is depressed, a circuit is completed to the read control relay K10 as follows: From -DC, TC6, CRTC, BSC, JP10, RTC, JR14, N/O S8, S9, TA20, K10 coil, TA38, TC5, to +DC. With K10 energized, a holding circuit is completed to the K10 coil as follows: from -DC, TC6, TA26, K7 - 2 and 1, TA25, JR13, RC-RC5 and RC6, JR8, TA21, K10 - 3 and 4, TA19, S9, TA20, K10 coil, TA38, TC5, to DC. (See Figure 5-1.)

When the S8 switch is released, a circuit is completed to the reader magnet LRM as follows: from -DC, TC6, CRTC, BSC, JP10, RTC, JR14, N/C S8, TA18, K9 - 2 and 1, K10 - 2 and 1, TA22, LRM, JR12, TC5, to +DC.

If it is necessary to stop the reader operation, the S9 stop read switch may be depressed, thus breaking the holding circuit to K10. K10 - 1 and 2 contacts will open breaking the circuit to the reader magnet.

By depressing the S8 switch, the circuit to the reader magnet LRM will be broken, stopping reader operation, but not de-energizing the K10 relay.

Rec-Rep Circuit Description

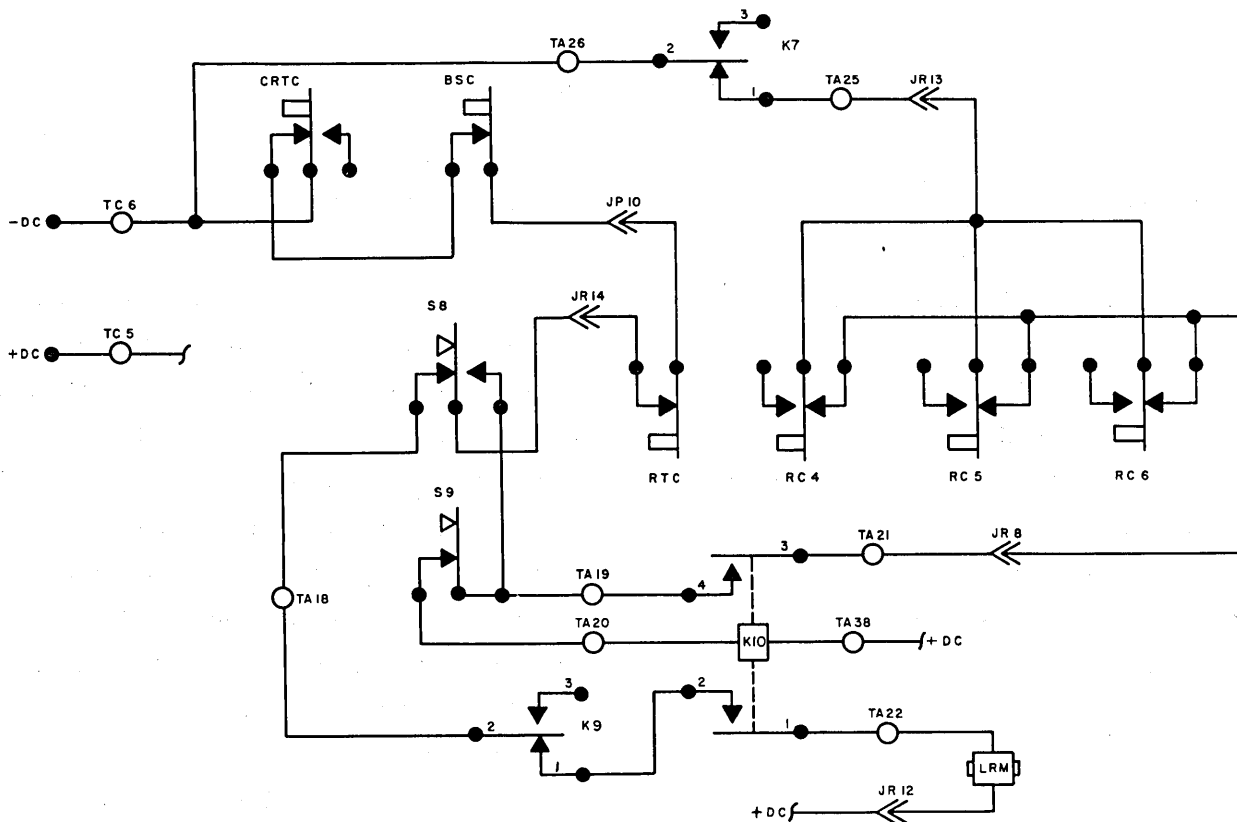


Figure 5-1 Start and Stop Read Circuits

The reader may be stopped at any point in the line automatically if the reader senses a stop code (4-5-6). When this code is read, RC4, RC5 and RC6 contacts will operate; breaking the holding circuit to the K10 relay. The S8 switch must be operated to start reader operation again.

Example Translator Magnet Circuit - When the reader senses the character and functional codes in the tape, the reader contacts operate, causing translator and writing machine operation.

For an example circuit, assume that a 1-2 code is read in the tape. Translator magnets LT1, LT2 and LTC would be energized as follows: from -DC, TC6, TA26, K7 - 2 and 1, TA25, JR13, RCC-RC1 and RC2, JR7-JR1 and JR2, JT6A-JT1A and JT2A, LTC-LT1 and LT2, JR12, TC5, to +DC. (See Figure 5-2.) Thus, the

"A" keylever would operate causing the "A" typebar operation.

Line Relay (K7) Pick Up and Hold Circuit - When the reader senses the number 7 code at the end of a line, a circuit is completed to the line relay (K7) as follows: from -DC, TC6, CRTC, BSC, JR10, RTC, RC7, JR15, TA23, K7 pick up coil, TA38, TC5, to +DC. When the K7 relay is energized, a holding circuit is complete to the pick-up coil of K7 as follows: from -DC, TC6, CRTC, BSC, JR10, RTC, JR14, N/C S8, TA18, K9 - 2 and 1, K7 - 5 and 6, K7 pick up coil, TA38, TC5, to +DC. (See Figure 5-3.)

With K7 energized, the K7 number 2 contact strap transfers, breaking with number 1 strap and making with number 3 strap. This contact operation will break the negative DC to the reader

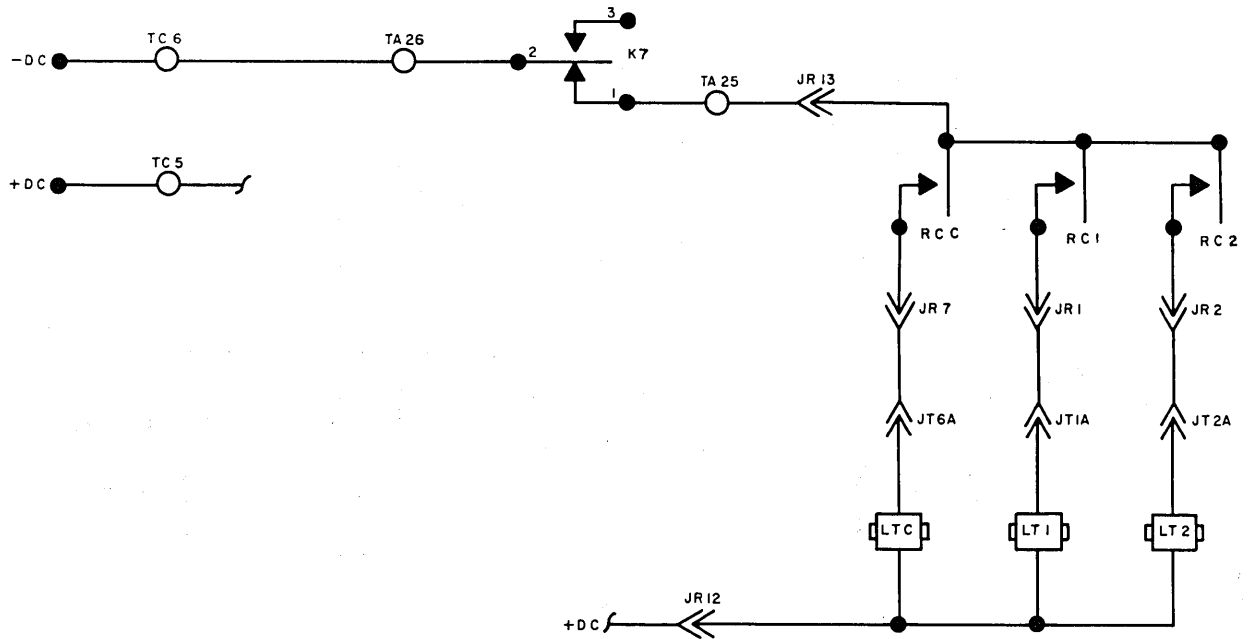


Figure 5-2 Example Translator Magnet Circuit

contacts. Thus, the holding circuit to the read control relay K10 is broken (through contacts RC4, RC5 and RC6 - Figure 5-1). The reader magnet however, will not de-energize when K10 drops out because of the make contacts K7 - 7 and 8. These contacts keep the reader magnet LRM energized allowing the reader to sense the 6-7 (plus combination of 1 through 5) code.

Due to the line relay K7 being energized and its contacts K7 - 2 strap broken with 1 strap, there is no negative DC on the reader contacts. Therefore, when the 6-7 code is read, the translator magnets will not become energized. The reader, then, will read and feed to the next code which is the 3-5-6 carriage return code.

Carriage Return J-Code Circuit - When the reader senses the 3-5-6 code at the end of a line,

a circuit is completed to the delay control relay K9 as follows: from -DC, TC6, CRTC, BSC, JR10, RTC, RC7 transfer, RC6 make, RC4 break, RC5 make, JR9, TA24, K9 coil, TA38, TC5, to +DC. (See Figure 5-4.)

Also, a circuit is completed to the hold coil of K7 through the same path described above, through K7 - 13 and 12 (K7 was held energized), K7 hold coil, TA38, TC5, to +DC.

When the delay control relay K9 is energized, the circuit to the reader magnet (LRM) is broken (K9 contacts 2 and 1 break), thus stopping reader operation.

K9 contacts 2 and 3, when made, will complete a holding circuit to the K9 coil and complete a holding circuit to the K7 hold coil through K7 - 13 and 12 contacts.

Rec-Rep Circuit Description

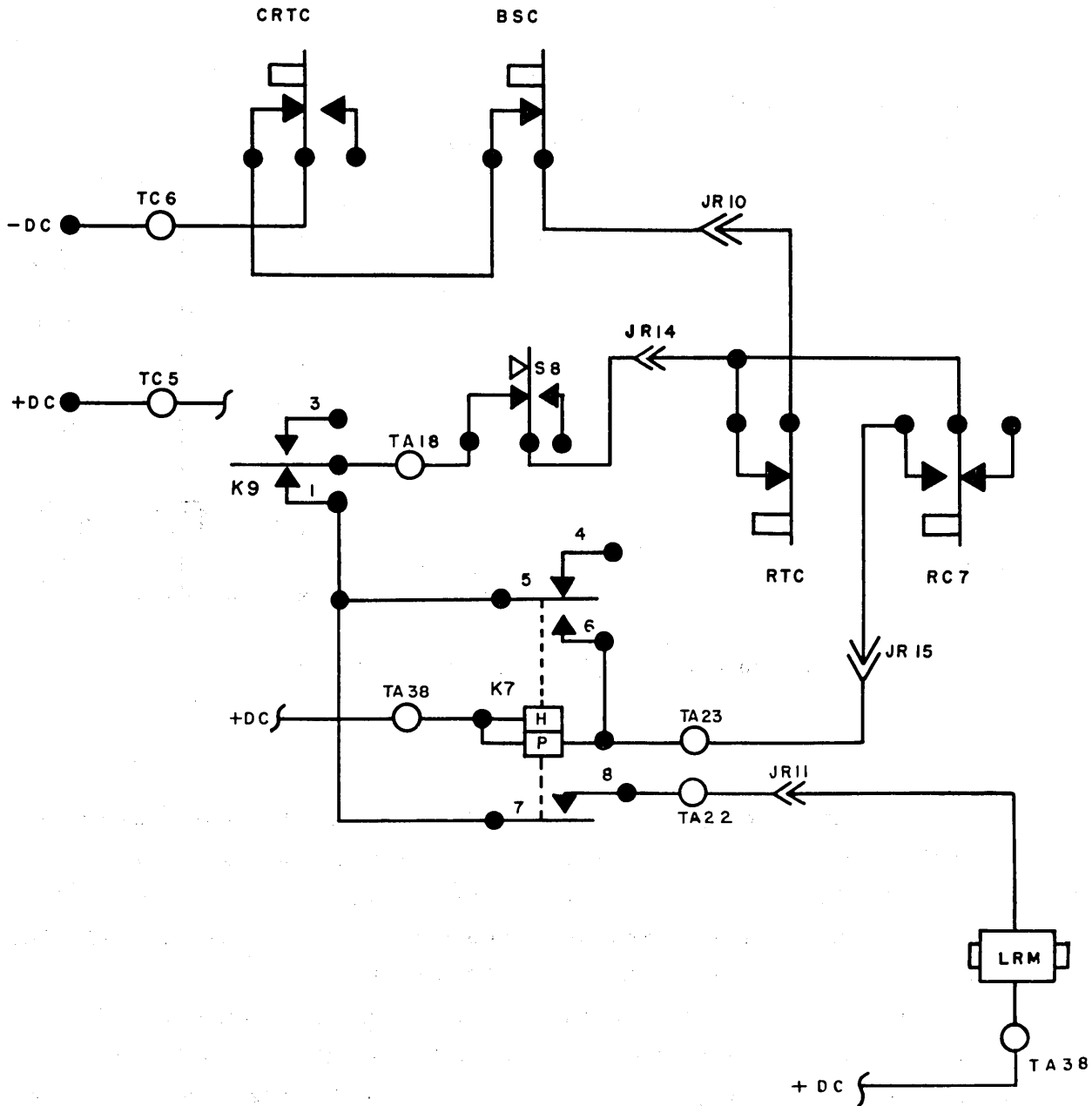


Figure 5-3 Line Relay Circuit

These two relays (K9 and K7) will remain energized until carriage return operation takes place and the CRTC contact transfers.

At this point the J-carriage return switch S7 must be depressed to punch the justification code in the new tape. The operation that takes place is the

same as described in Section 3, Part VII, except as explained in the following paragraphs.

Circuit to Translator Magnets L3, L5 and L6 -

When the J-carriage return switch S7 is depressed, a circuit is complete to the interlock control relay K6 and also the three translator magnets

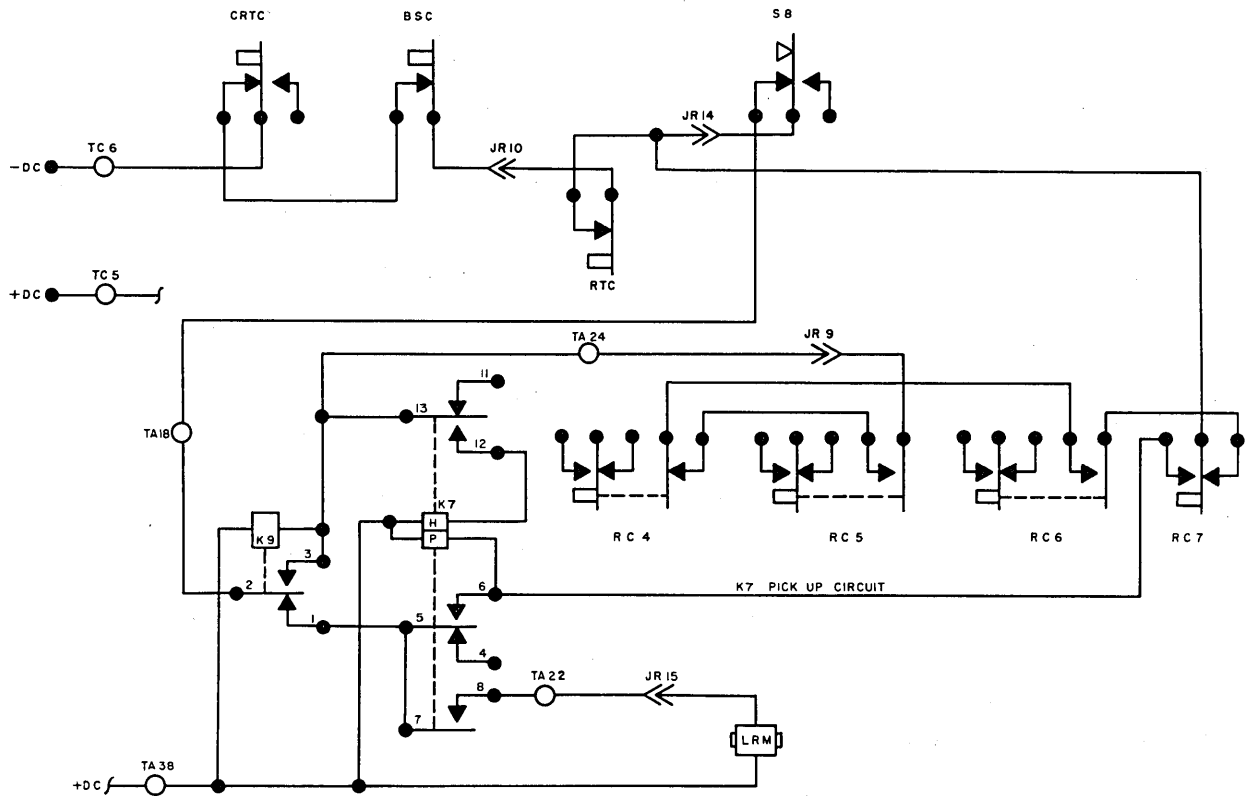


Figure 5-4 Carriage Return J-Code Circuits

L3, L5 and L6. This circuit is as follows: from -DC, TC6, JP13, PTC, N/O S2, JP12, PLC, JP14, TA31, K11 - 4 and 5, TA32, N/O S7, TA29, K6 - 4 and 5, 6 and 7, 8 and 9, TA16, TA15 and TA14, JT3A, JT5A and JT6A, LT3, LT5 and LT6, TA38, TC5, to +DC. (See Figure 5-5.)

Carriage return operation will not take place however, until the translator clutch magnet (LTC) is energized. The LTC will be energized when the CRR (K5) relay picks up on the 32nd step of the hole count relay.

Translator Clutch Magnet Circuit - The translator clutch magnet will be energized when the CRR (K5) relay is picked up and K5 contacts 9 and 10 make. The circuit to LTC is as follows:

from -DC, TC6, JP13, PTC, N/O S2, JZC (in zone), TA33, K11 - 6 and 5, TA32, N/C S7, TA30, K4 - 2 and 1, K5 - 9 and 10, TA17, JT6A, LTC, TA38, TC5 to +DC. (See Figure 5-6.) The L3, L5 and L6 translator magnets were energized when the S7 switch was depressed, therefore, when the clutch operates, the CR keylever will function, causing carriage return operation.

This circuit to the L3, L5, L6 and LTC magnets is necessary because there is no room to use a carriage return magnet (LCR) when a translator is installed. (The LCR is used to operate the CR keylever in a Justowriter Recorder - Section 3, Part VII.)

Rec-Rep Circuit Description

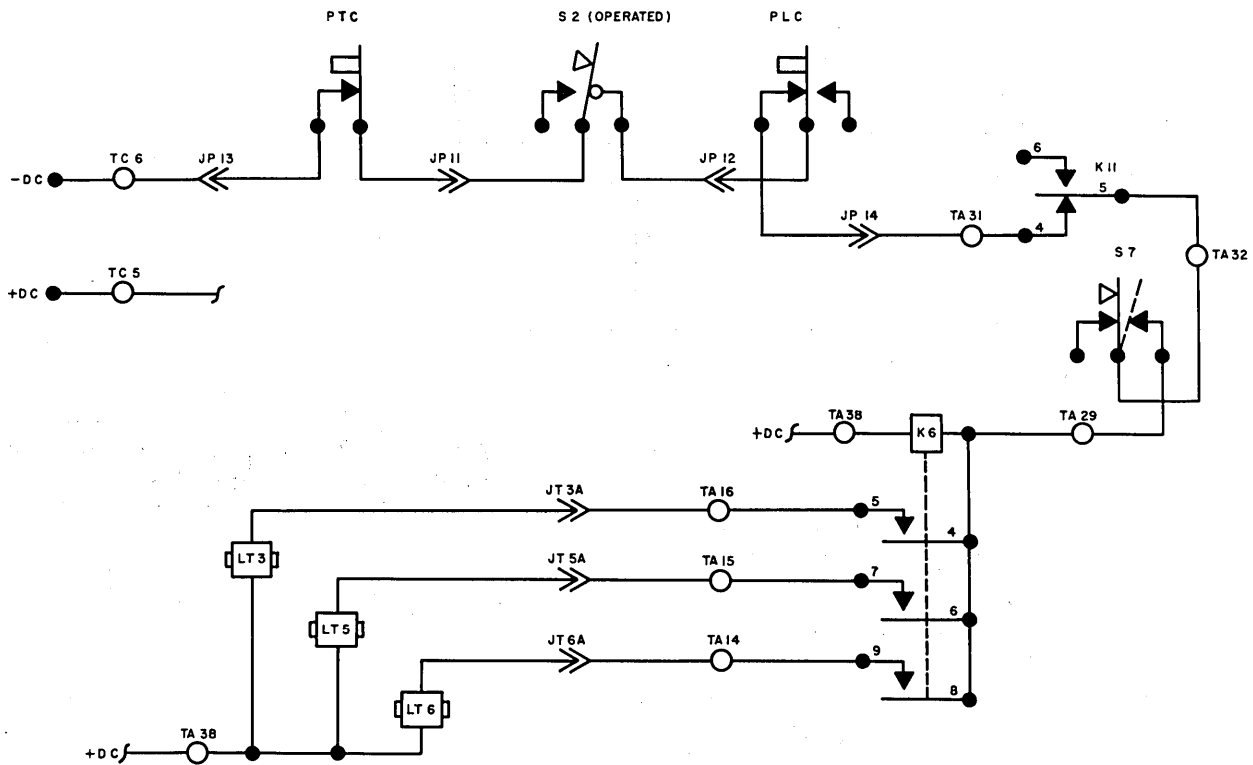


Figure 5-5 Circuit to Translator Magnets, L3, L5 and L6

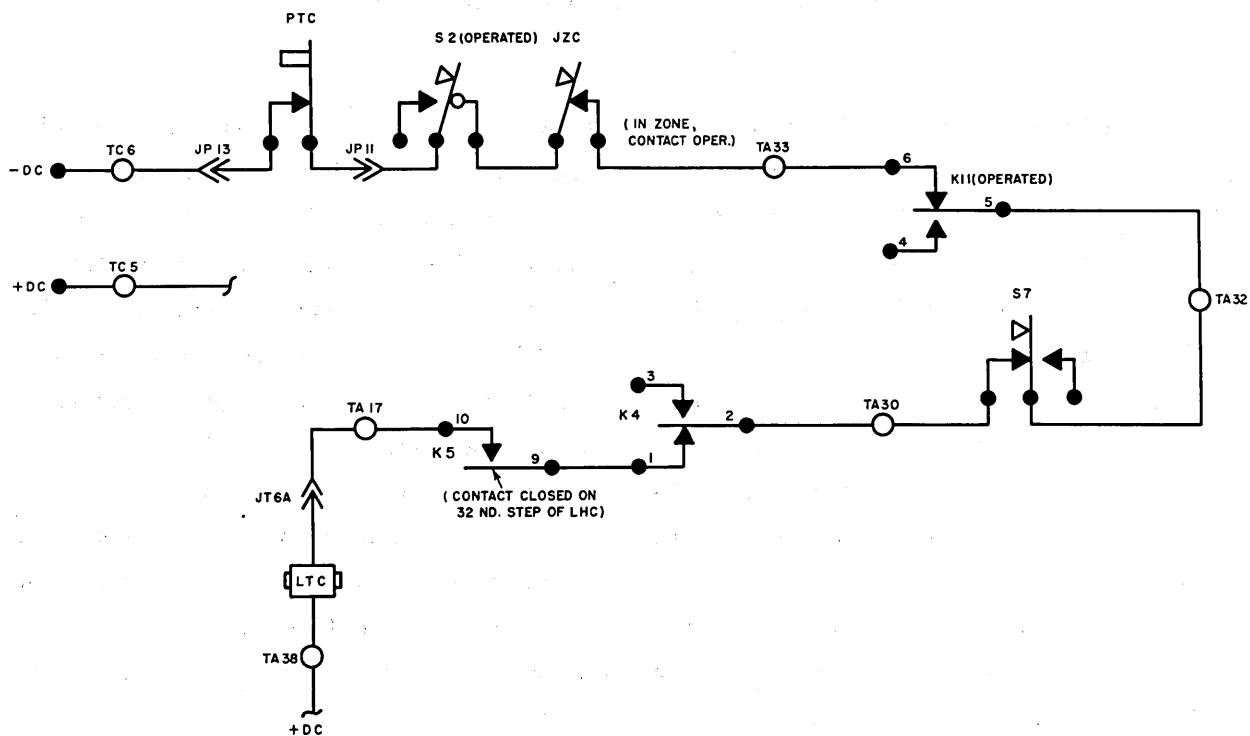


Figure 5-6 Translator Clutch Circuit

PART VIII
LUBRICATION

Section 1 Lubrication General
Section 2 Writing Machine
Section 3 Code Selector
Section 4 Tape Punch
Section 5 Single Reader
Section 6 Code Translator
Section 7 Double Reader
Section 8 Computer
Section 9 Hole Count Relay

LUBRICATION GENERAL

It is essential to keep Commercial Controls Flexowriters and Justowriters in the best operating condition for customer satisfaction. Therefore, to aid in reducing service calls, it is very important that all moving parts be properly lubricated at regular intervals.

The lubrication of machines involves the use of the correct lubricant applied in the proper amount, and at frequent enough intervals to prevent rust and excessive wear. Lubricants added in excess may flow or drip to parts which may be damaged by oil or grease. For example, if oil was allowed to drip on the writing machine power roll, the cams would most likely fail in operation and in time, the roll itself would become damaged.

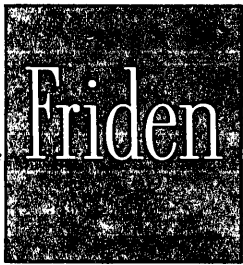
On the other hand, insufficient lubrication will result in excessive wear and machine failure. Incorrect lubricants will be ineffective and may actually damage some parts. An example of this is an oilite bronze bearing which is porous and may become clogged and run hot if the wrong lubricant is applied.

The following sections contain a detailed description of all points of lubrication on the various mechanisms of the Flexowriter and Justowriter. The numbers in each figure indicate the type of lubricant to use at a specific point. These numbers and their associated lubricants are listed below.

CC

<u>Lubricant Number</u>	<u>General Description</u>	<u>Approved Source</u>	<u>Lubricants Name</u>
1	A light oil which has good lubricating and rust preventative properties.	Shell Oil Co.	Shell Tellus Number 27
2	For all porous metal bearings.	Esso	WS - 1170
4	A light grease containing lithium. Good adherent properties.	Lubrication Inc.	Lubgrease L-2
6	A grease of light consistency which contains oxidation resistant additives and provides good lubrication without excessive channeling.	Shell Oil Co.	Retinax "T"

Note: CC No. 3 contains 2% colloidal graphite No. 1104 in Shell Vexilla L39 oil (See Figure 2-20)



#18

MANUAL ADDENDUM

Date: November 18, 1958

Reference: To be inserted in Part VIII, Section 1, after Page 1-1.

Subject: Lubrication General

Purpose: New Lubricant

Information:

Part VIII - Flexowriter - Justowriter Service Manual

Section 1 - Lubrication General

Lubricant Number	General Description	Lubricant Name
8	A light lubricant used on light mechanisms and gears	Molyube Alloy SM Oil #0

MANUAL ADDENDUM

Date: November 1, 1954
 Reference: To be inserted in Part VIII, Section I, after Page 1-1.
 Subject: Lubrication General
 Purpose: Changes and additions in lubrication.
 Information:

Part VIII - Flexowriter - Justowriter Service Manual

Section I - Lubrication General

The following is the up to date list of lubricants now being used on all Flexowriters and Justowriters:

CC Lubricant Number	General Description	Approved Source	Lubricants Name
1	A light oil which has good lubricating and rust preventative properties.	Shell Oil Co.	Shell Tellus Number 27
*2	For all porous metal bearings.	Socony Vacuum	Gargoyle DTE-797
4	A light grease containing lethium. Used on light mechanisms, where speed is a factor and loads are relatively low.	Lubrication, Ins.	Lubgrease L-2
**5	A light oil selected for specific application and should be used only for the application now specified.	Shell Oil Co.	SAE 20W
6	A grease of light consistency which contains oxidation resistant additives and provides good lubrication without excessive channeling.	Shell Oil Co.	Retinax "T"

Page Two

CC Lubricant Number	General Description	Approved Source	Lubricants Name
***7	A powdered graphite used wherever a dry lubrication is desirable.	Bel-Ray Co.	Molyube 16
*CC2	The former lubricant Esso WS1170 is being discontinued immediately. Branches and Agencies are requested to order the new CC No. 2 immediately.		
**CC5	This oil is specifically assigned for use on the drive chain only.		
***CC7	This lubricant is used for the keylever interlocks only. The interlocks should NOT be lubricated with any other type of lubricant.		

MANUAL ADDENDUM

Date: March 28, 1955

Reference: To be inserted in Part VIII, Section 1, after Page 1-1.

Subject: Lubrication General

Purpose: Change in lubrication - CC No. 4 and CC No. 6

Information:

Part VIII - Flexowriter - Justowriter Service Manual

Section 1 - Lubrication General

All lubrication points throughout Part VIII showing CC No. 4 are now being lubricated with CC No. 6.

Tests on CC No. 4 and CC No. 6 lubricants indicated both to have the same lubricating qualities. Therefore, to eliminate the use of two similar type lubricants, CC No. 4 was discontinued.

WRITING MACHINE

The writing machine lubrication information contained in this section includes the Final Assembly, Carriage and Rails and Power Frame.

Final Assembly — The lubrication points for the final assembly are shown on figures 2-1 through 2-4.

C. C. lubricant number 4 should be used on all gear teeth, spring ends, main spring drum shaft, forged ends of all links and link pivots.

C. C. lubricant number 2 should be used on all porous metal bearings.

C. C. lubricant number 1 should be used on all pivots, bearings or moving parts not otherwise shown in figures 2-1 through 2-4.

Carriage and Rails — The lubrication points for the carriage and rails are shown on figures 2-5 through 2-12.

C. C. lubricant number 4 (unless specially noted) should be used on the operating surfaces of the escapement wheels and dogs, escapement racks and gears, all escapement wheel bearings,

all forged link ends, index pawl carrier, tape hook spring, escapement trip slide, lost motion links, back space pawl and gear, latching points and all spring ends.

Note: On points where it indicates to use both C. C. No. 1 and C. C. No. 4, Lubricate first with C. C. No. 1 and then with C. C. No. 4.

C. C. lubricant number 1 should be used on all other moving parts, pivots or bearings not otherwise specified.

Power Frame — The lubrication points for the power frame are shown on figures 2-13 through 2-20.

C. C. lubricant number 4 should be used on all forged ends of all links, all spring ends, ribbon lift bar operating surface, keylever forks and keylever bearing support fulcrum.

C. C. lubricant number 1 should be used on the segment and type bars, combs, pivots, bearings and moving parts not otherwise shown.

Writing Machine

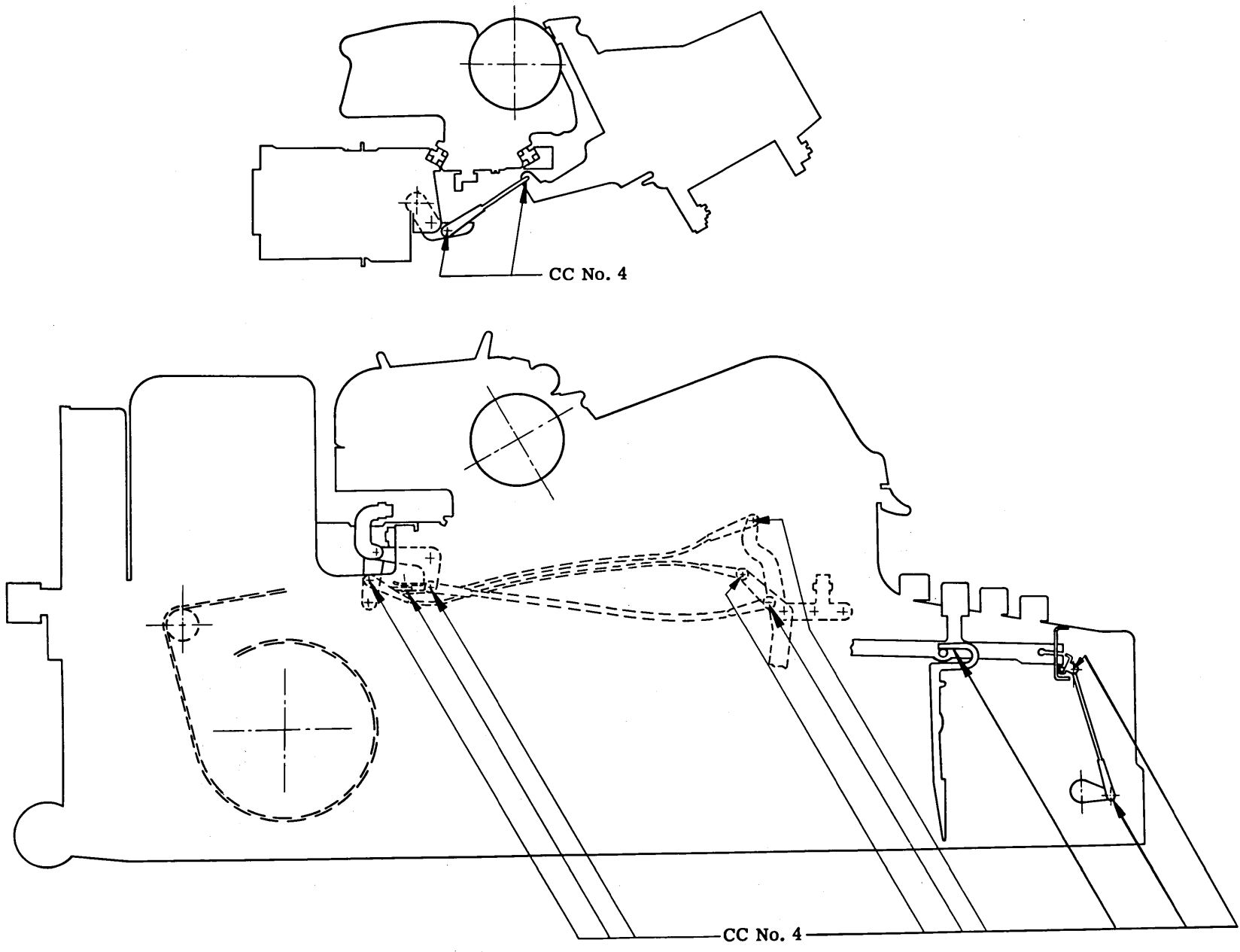


Figure 2-1 Final Assembly (Left side)

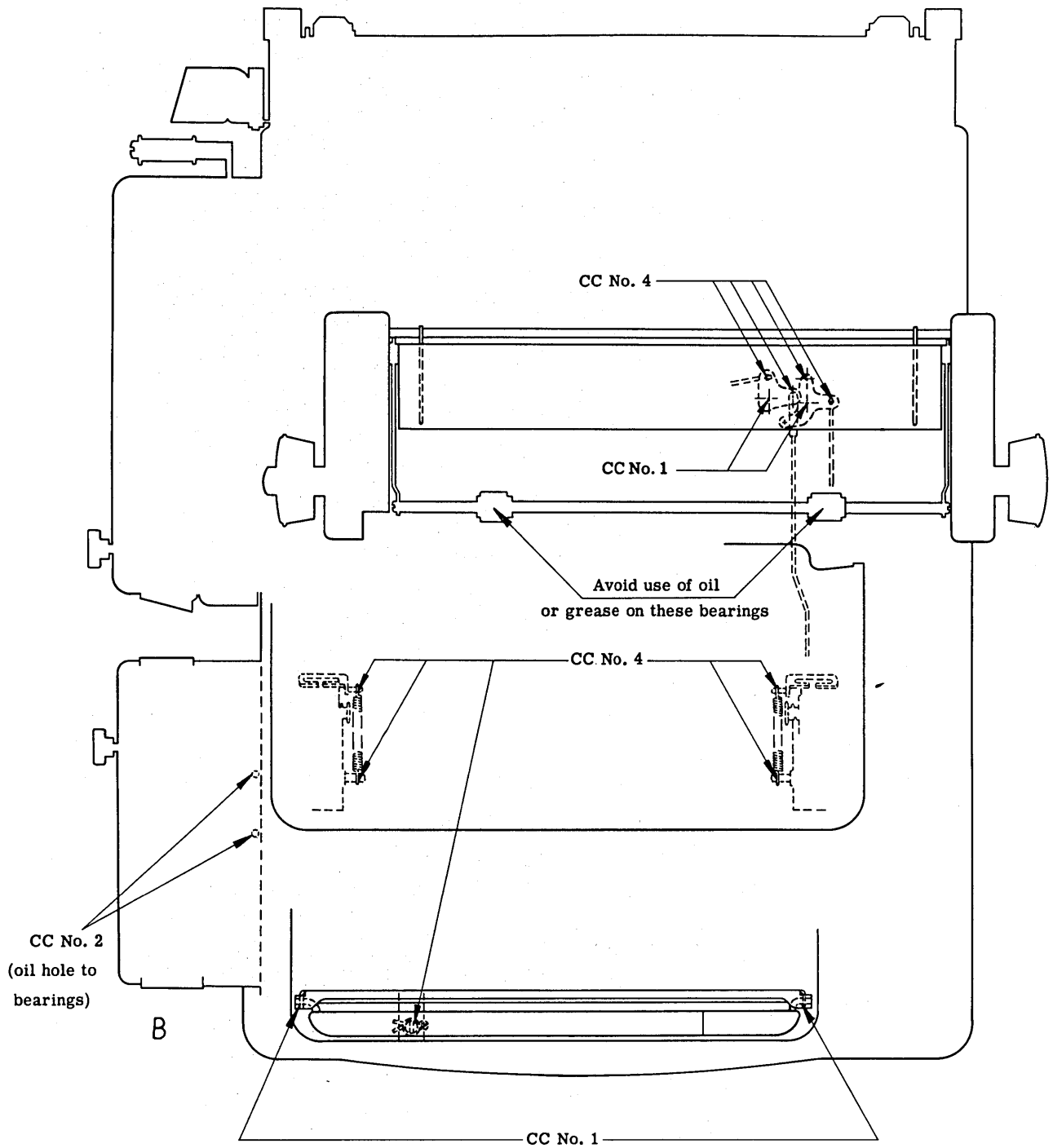


Figure 2-2 Final Assembly (Top)

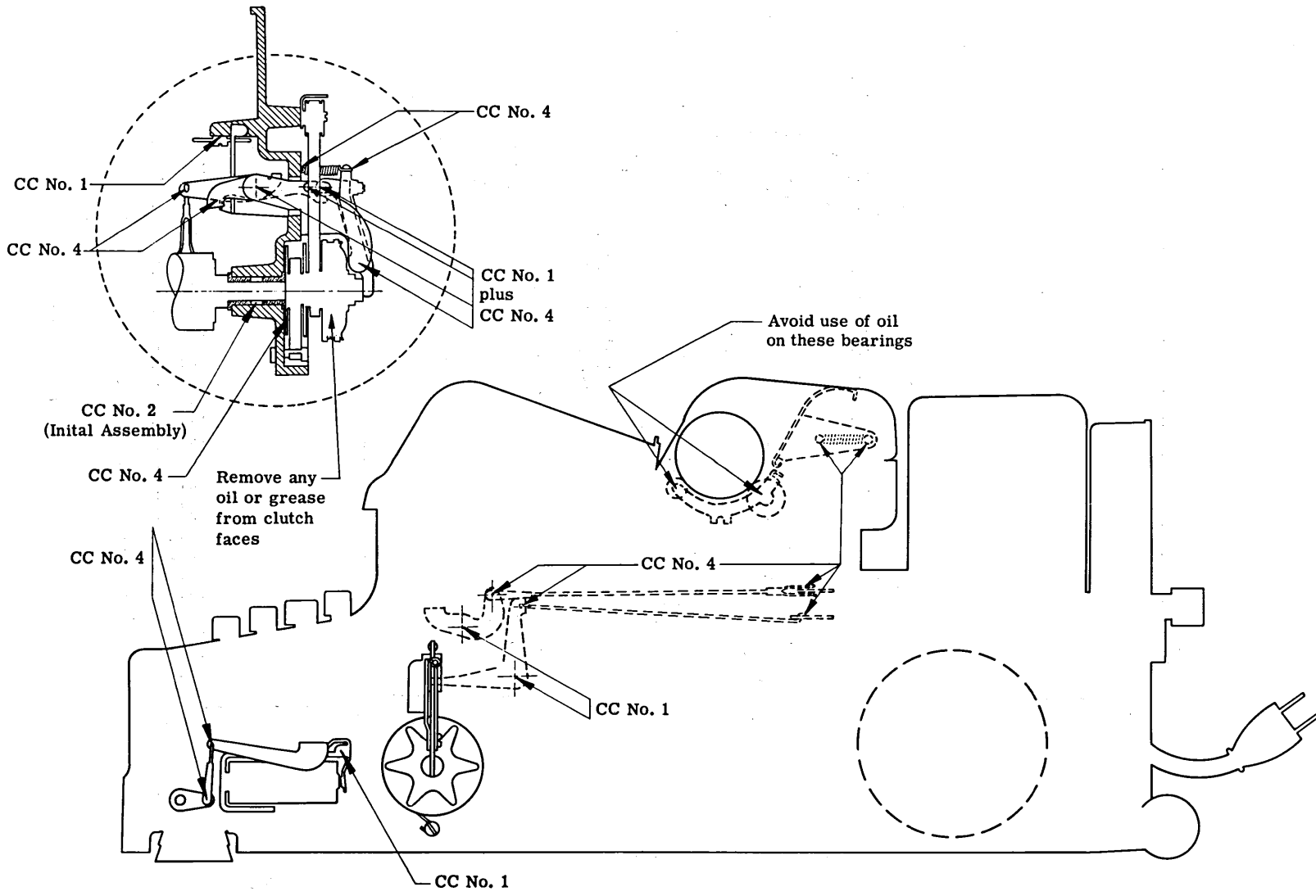


Figure 2-3 Final Assembly (Right Side)

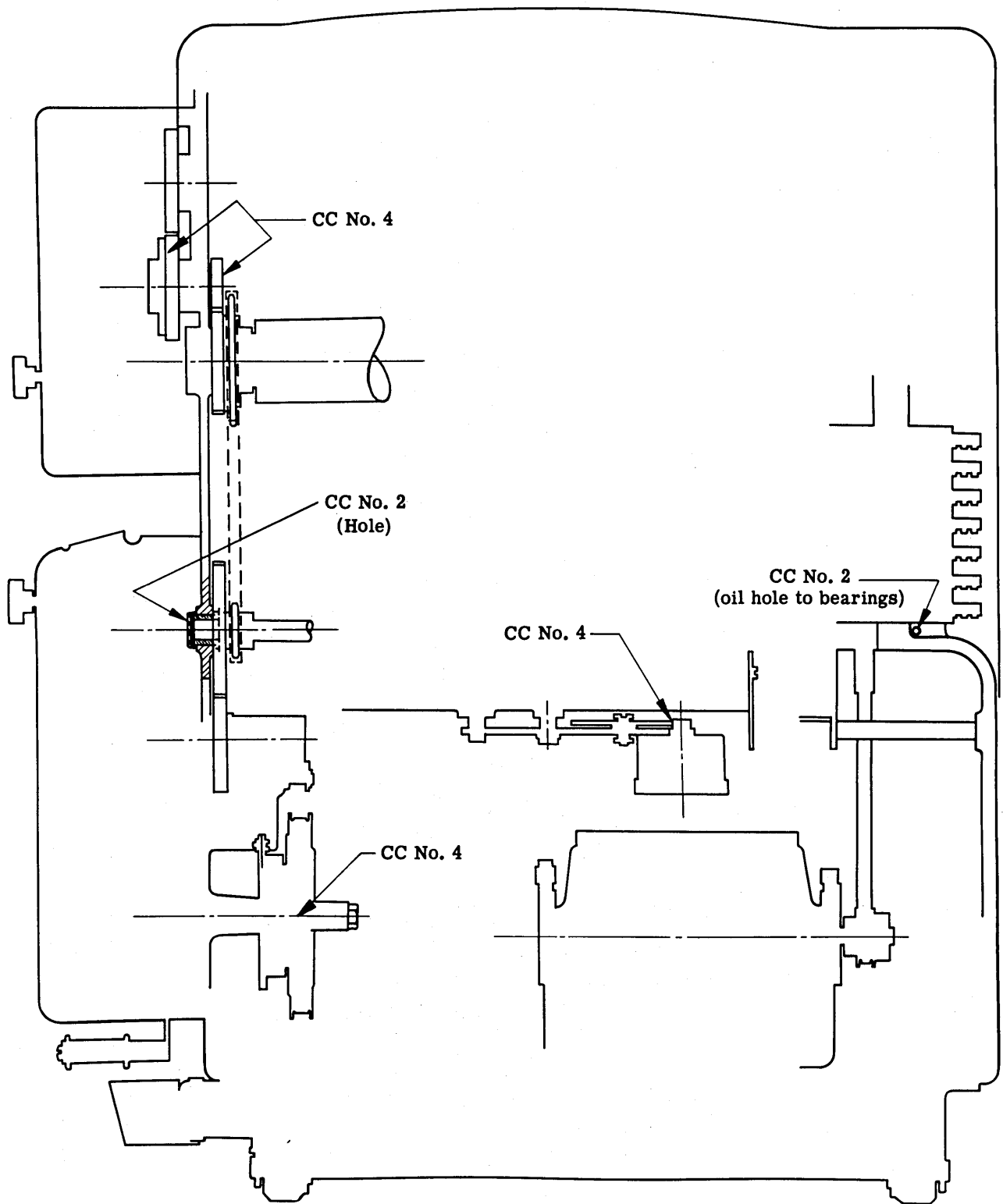


Figure 2-4 Final Assembly (Bottom)

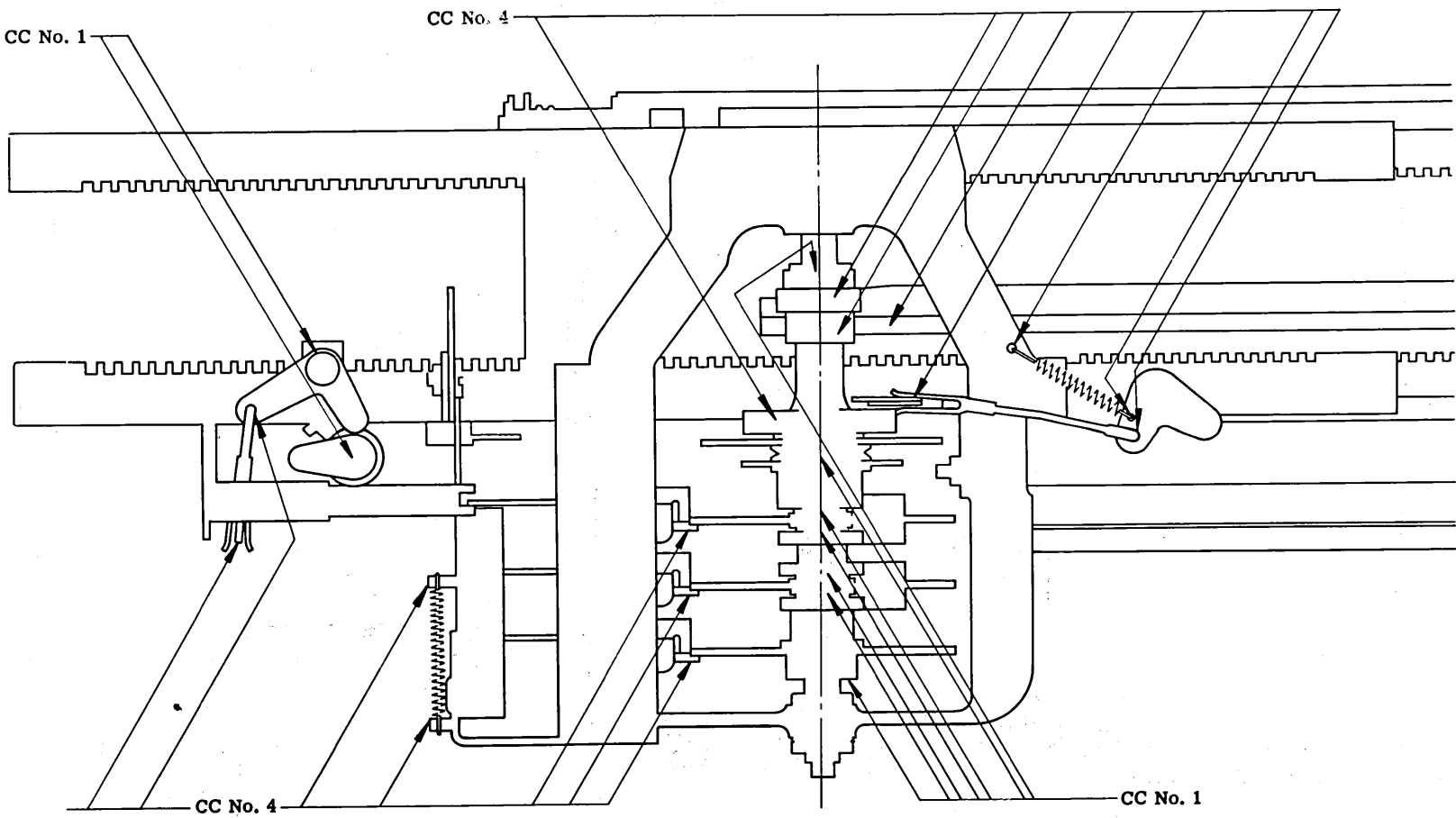


Figure 2-5 Carriage & Rails--Escapement

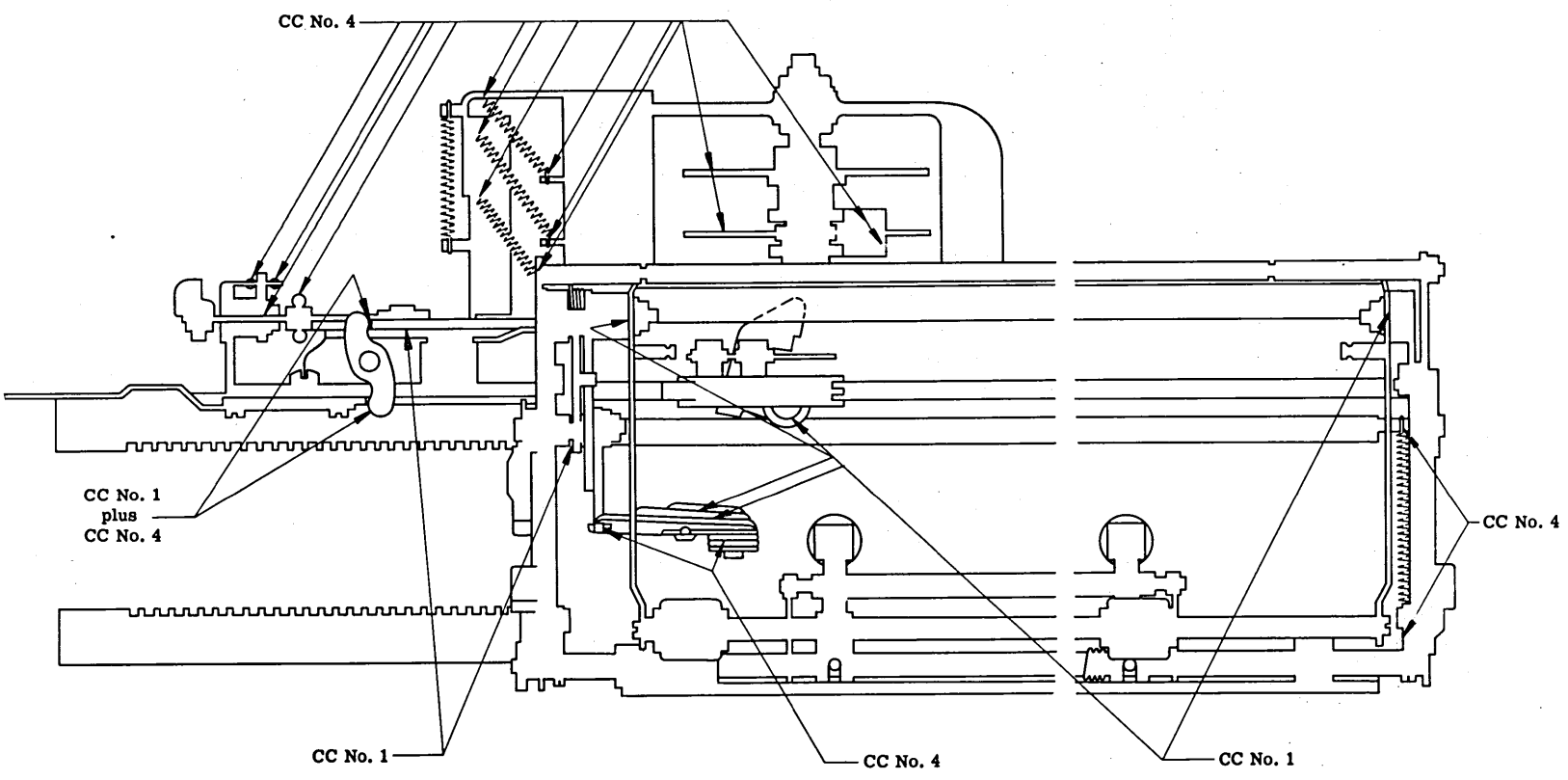


Figure-2-6 Carriage & Rails (Top)

Writing Machine

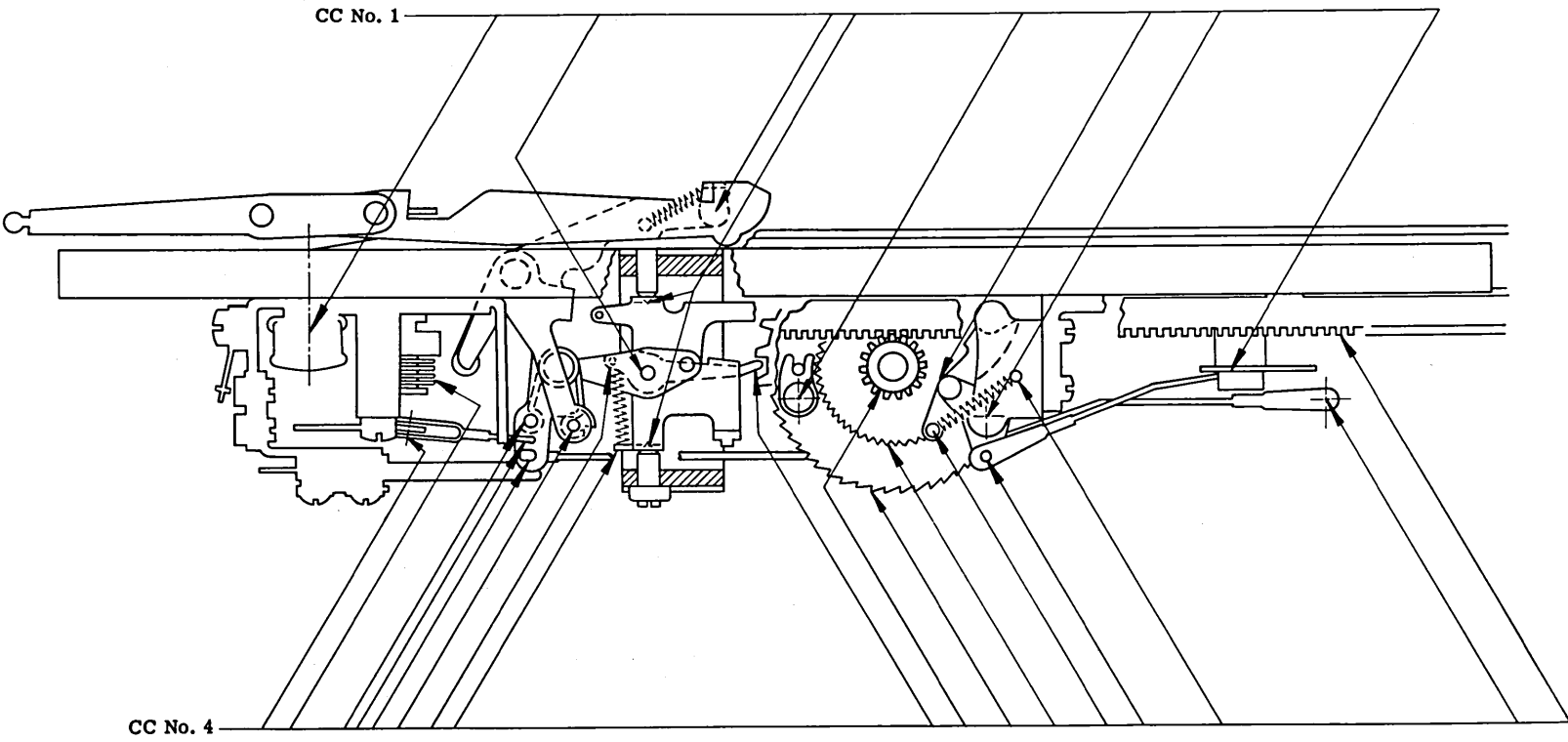


Figure 2-7 Rear Rail Assembly

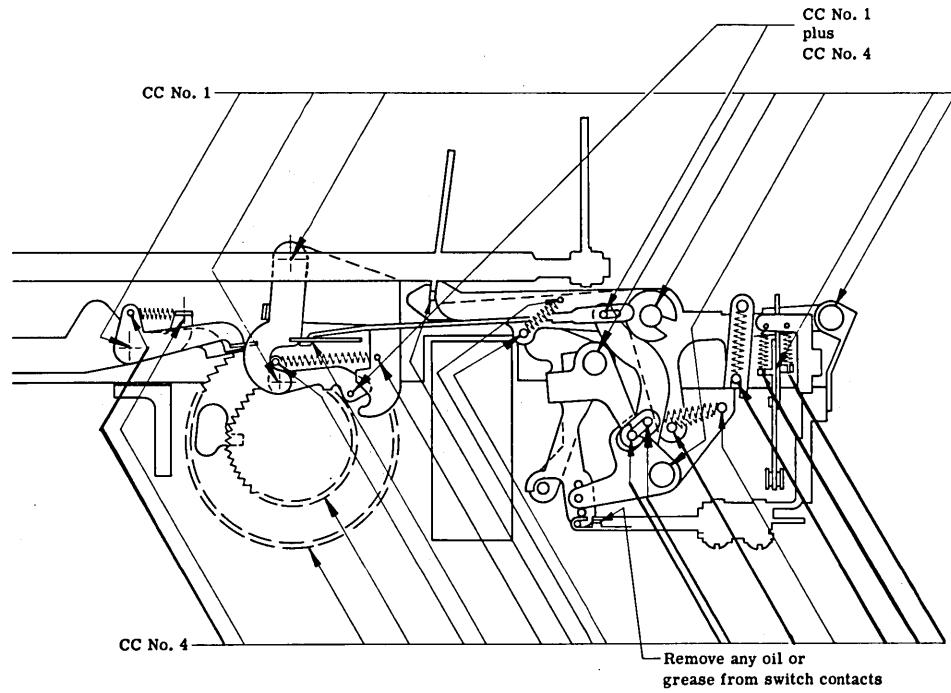


Figure 2-8 Carriage & Rails (Rear-Right)

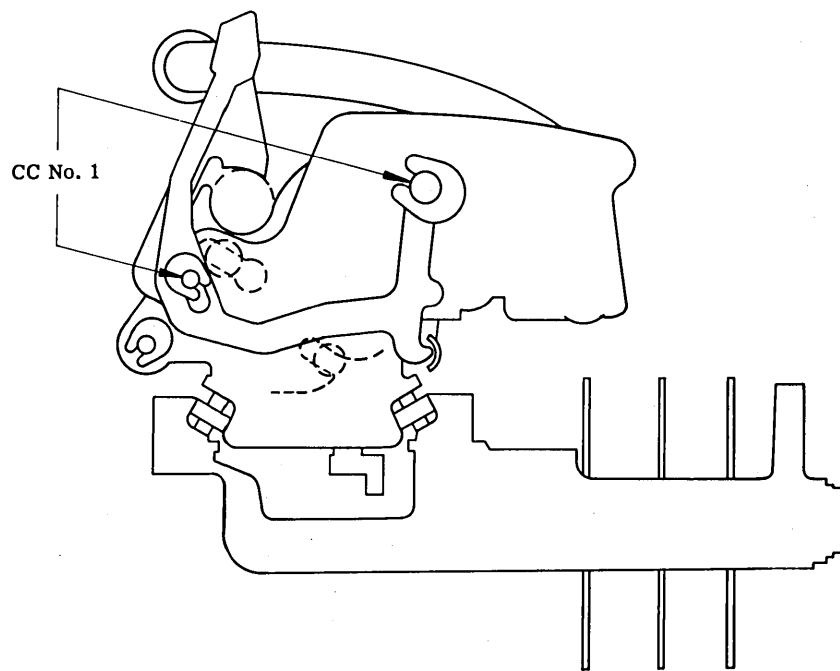


Figure 2-9 Carriage & Rails (Right Side)

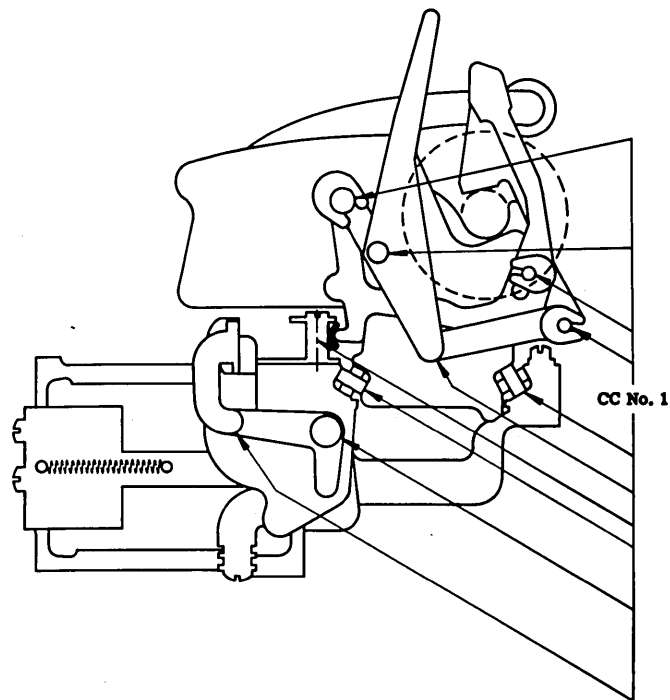


Figure 2-10 Carriage & Rails (Left Side)

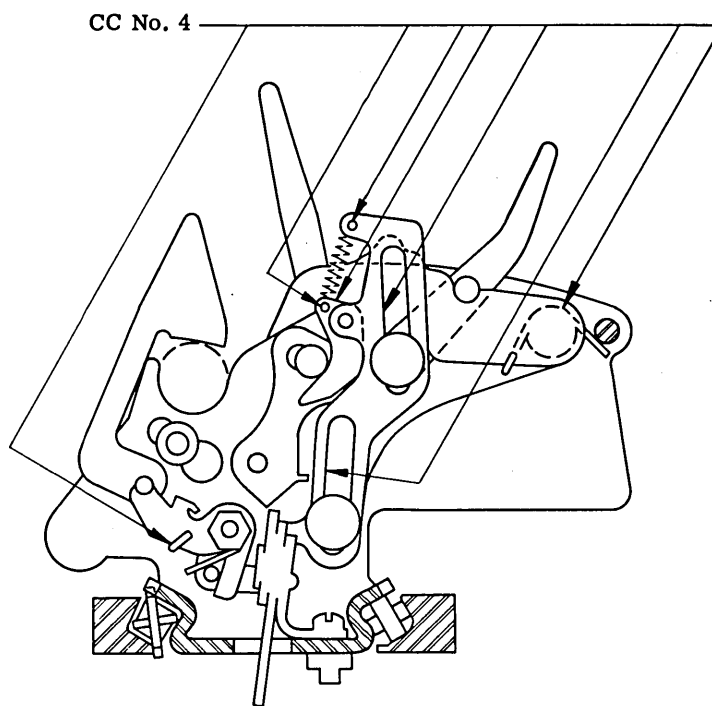


Figure 2-11 Carriage & Rails (L. H. Platen Yoke)

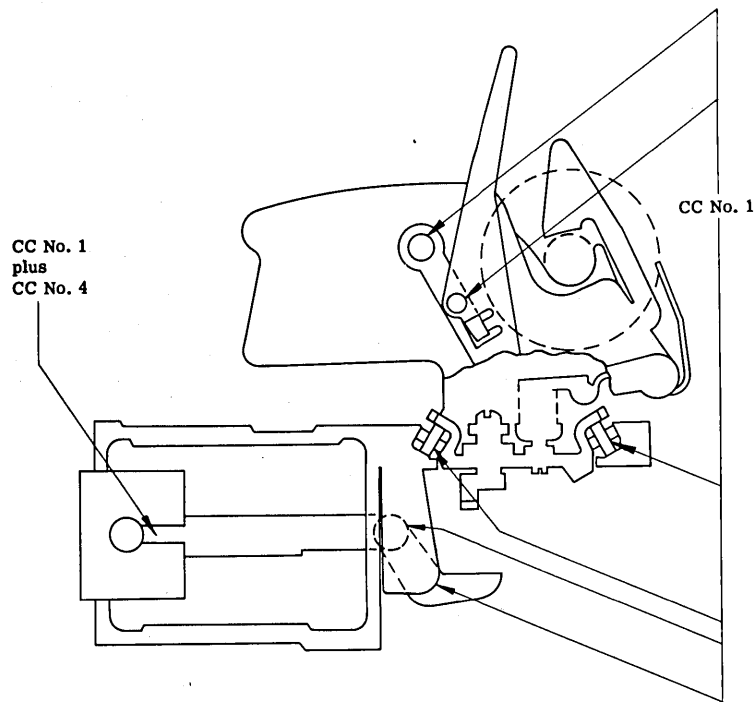


Figure 2-12 Carriage & Rails (Left Side)

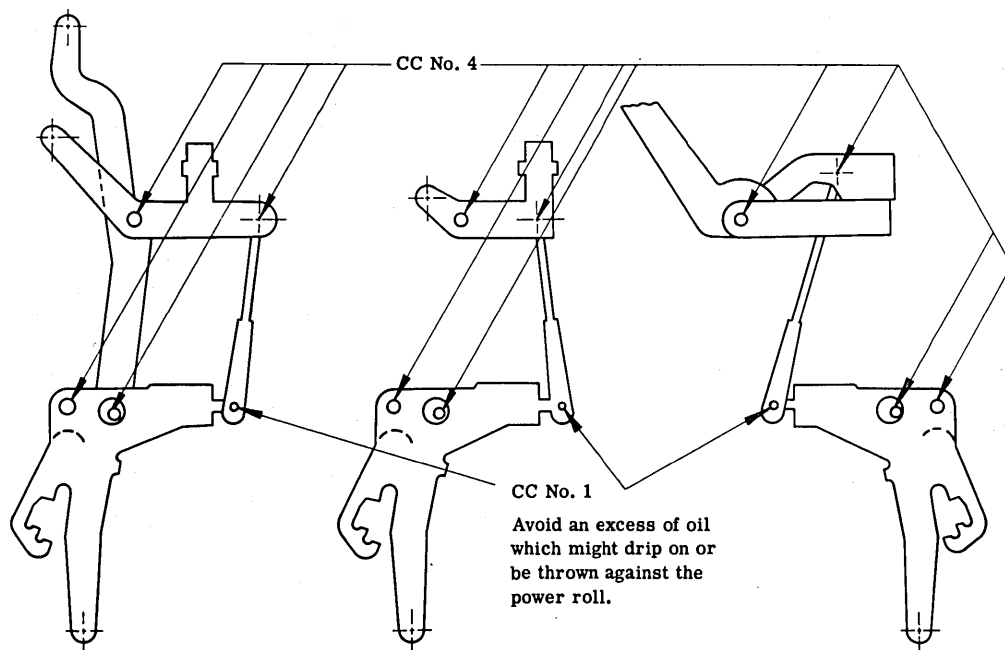


Figure 2-13 Cam & Linkage

Writing Machine

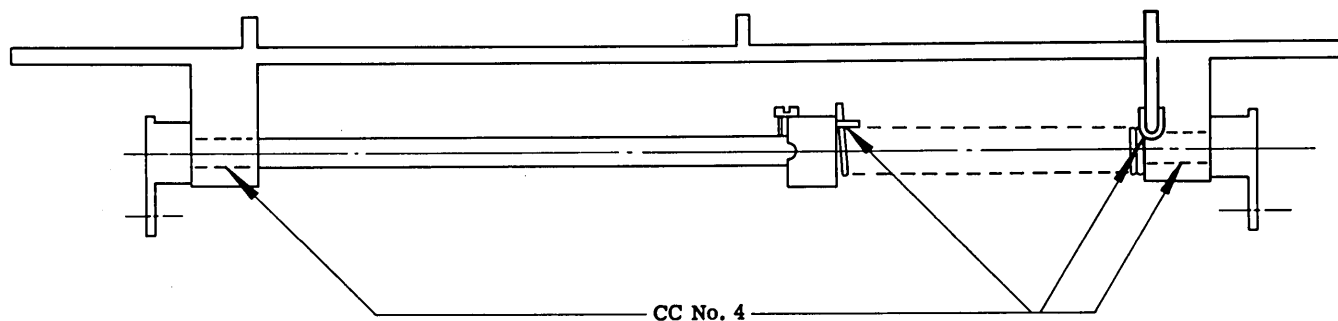


Figure 2-14 Shift Equalizing Shaft

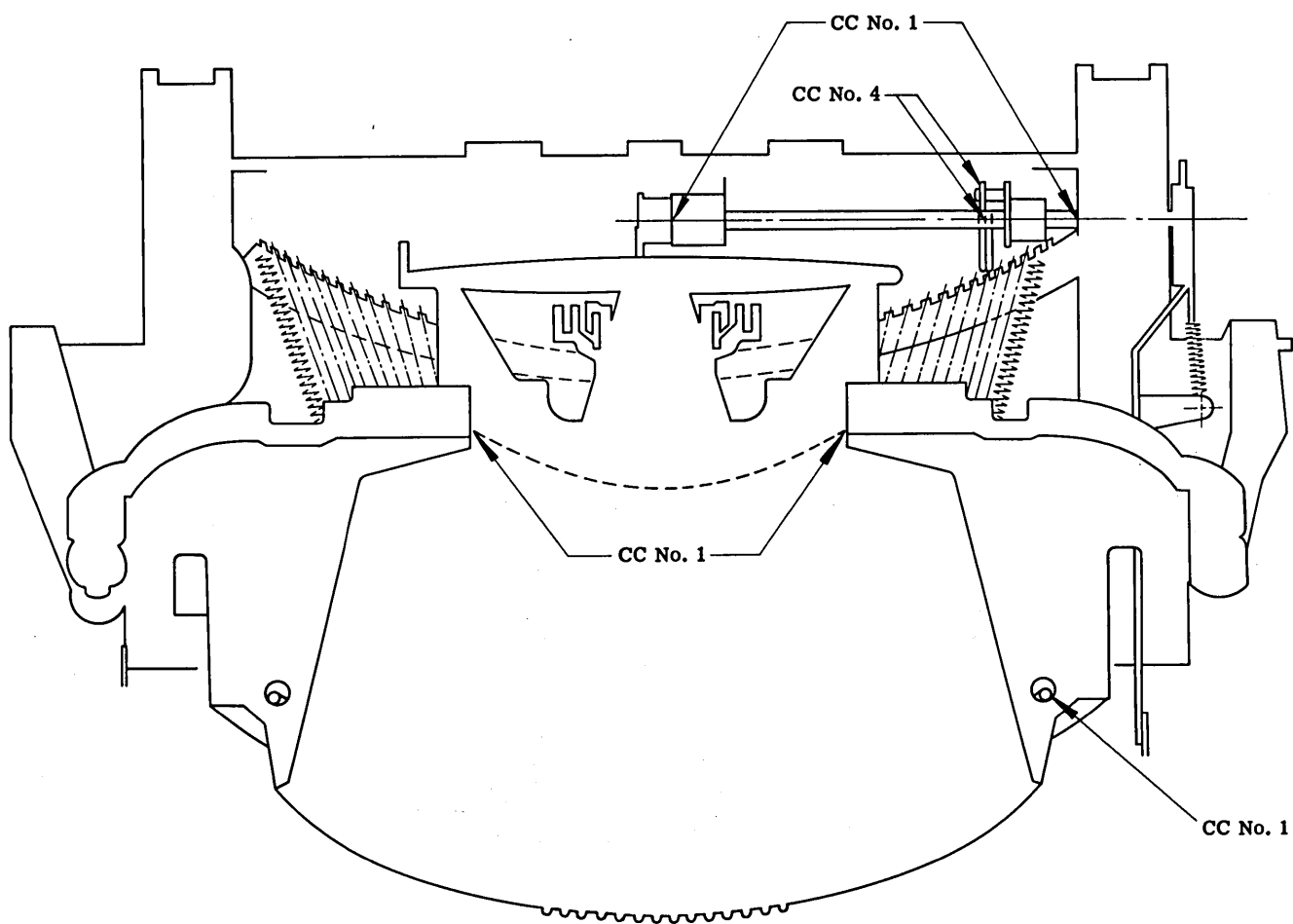


Figure 2-15 Power Frame (Top)

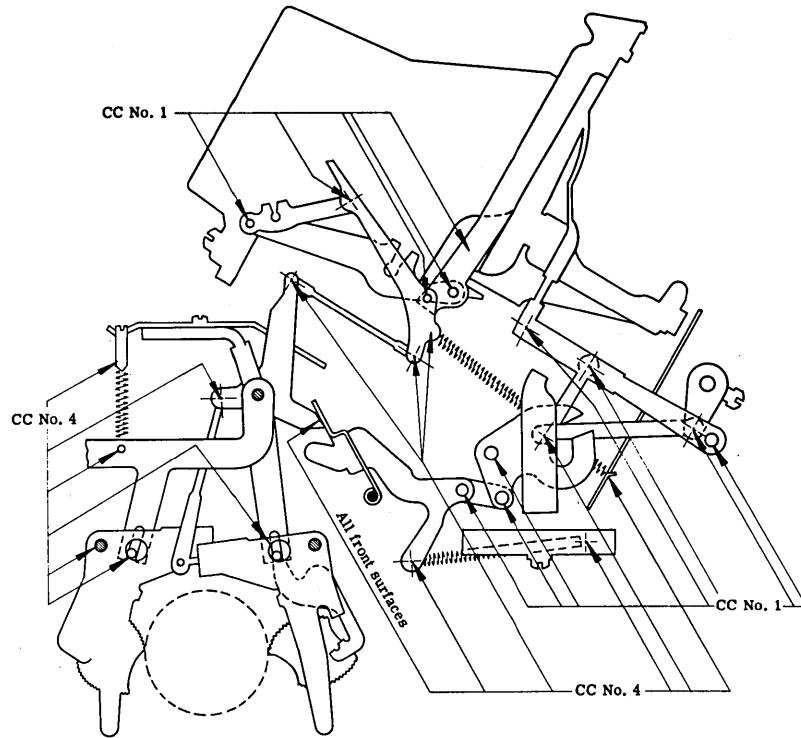


Figure 2-16 Power Frame (Cutaway-Right)

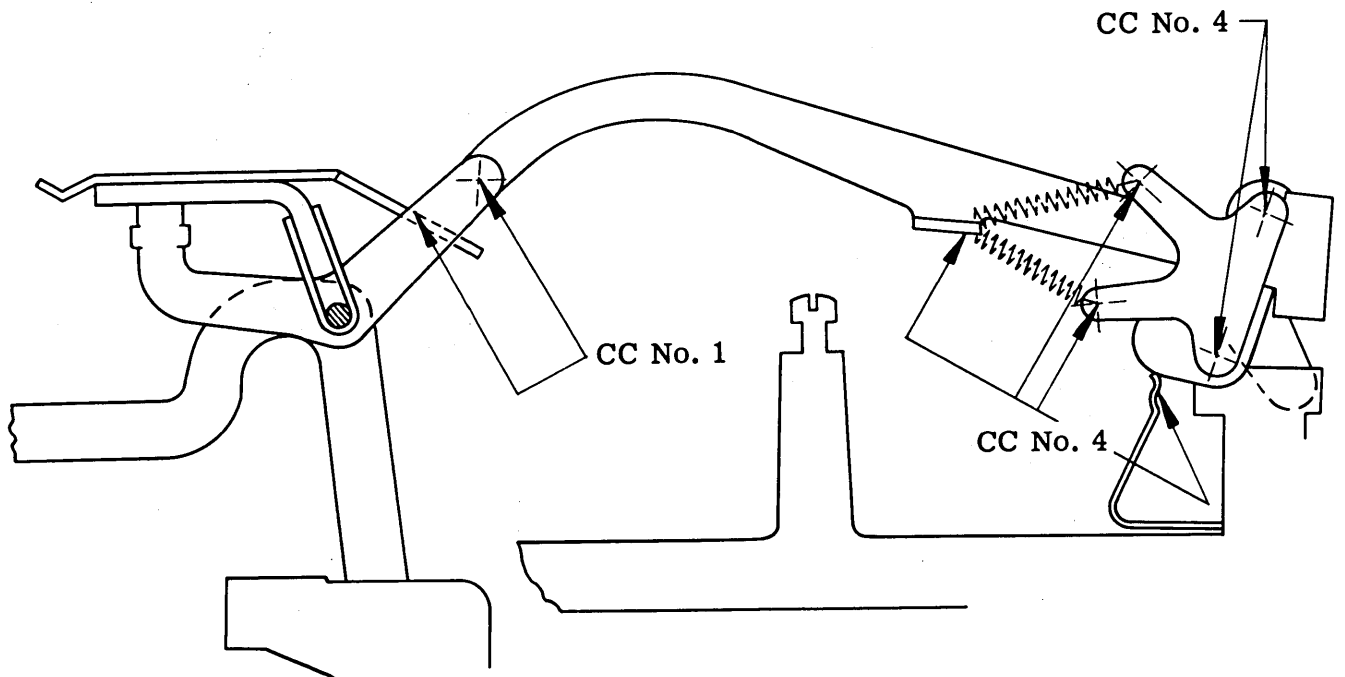


Figure 2-17 Color Control Linkage

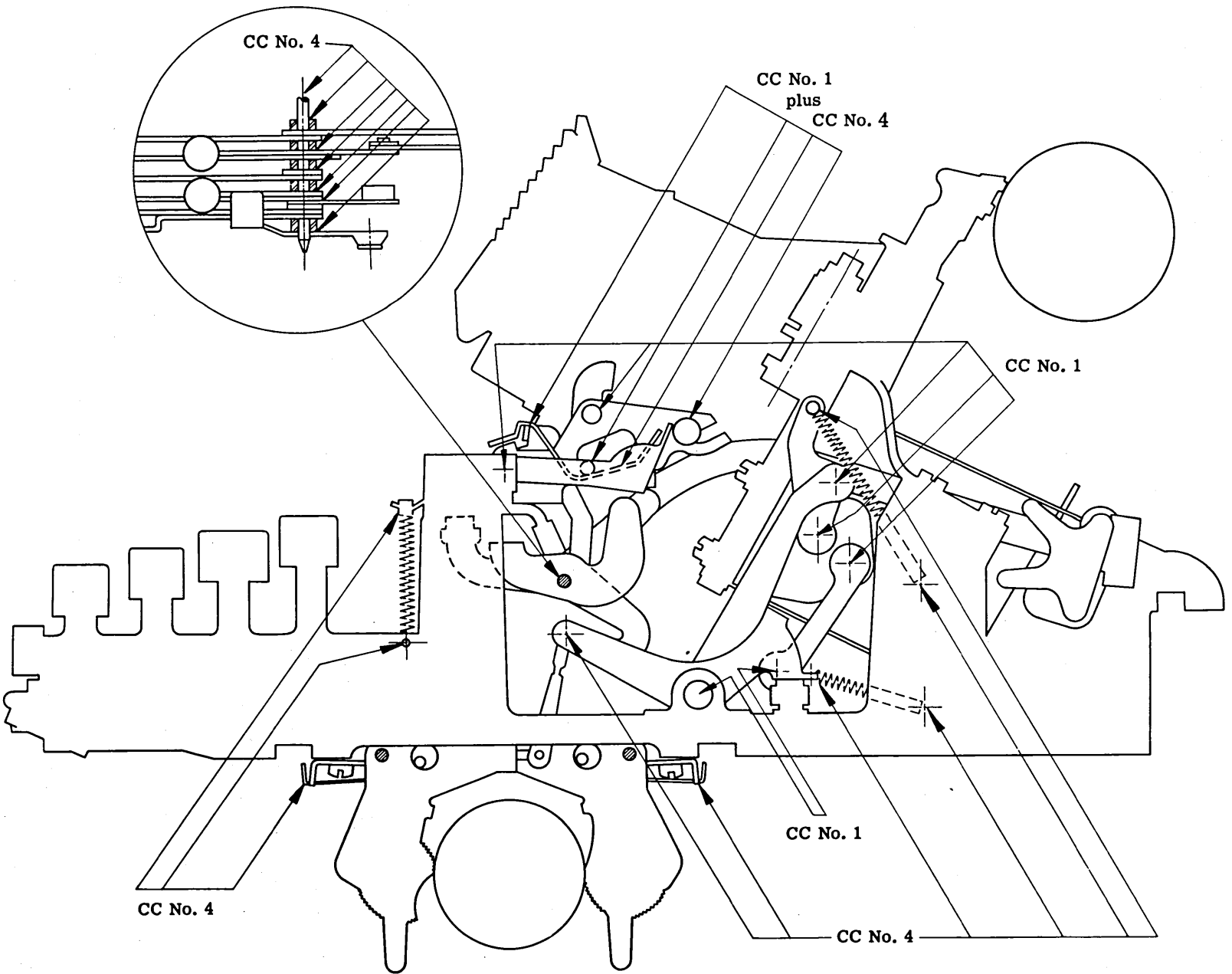


Figure 2-18 Power Frame (Right Side)

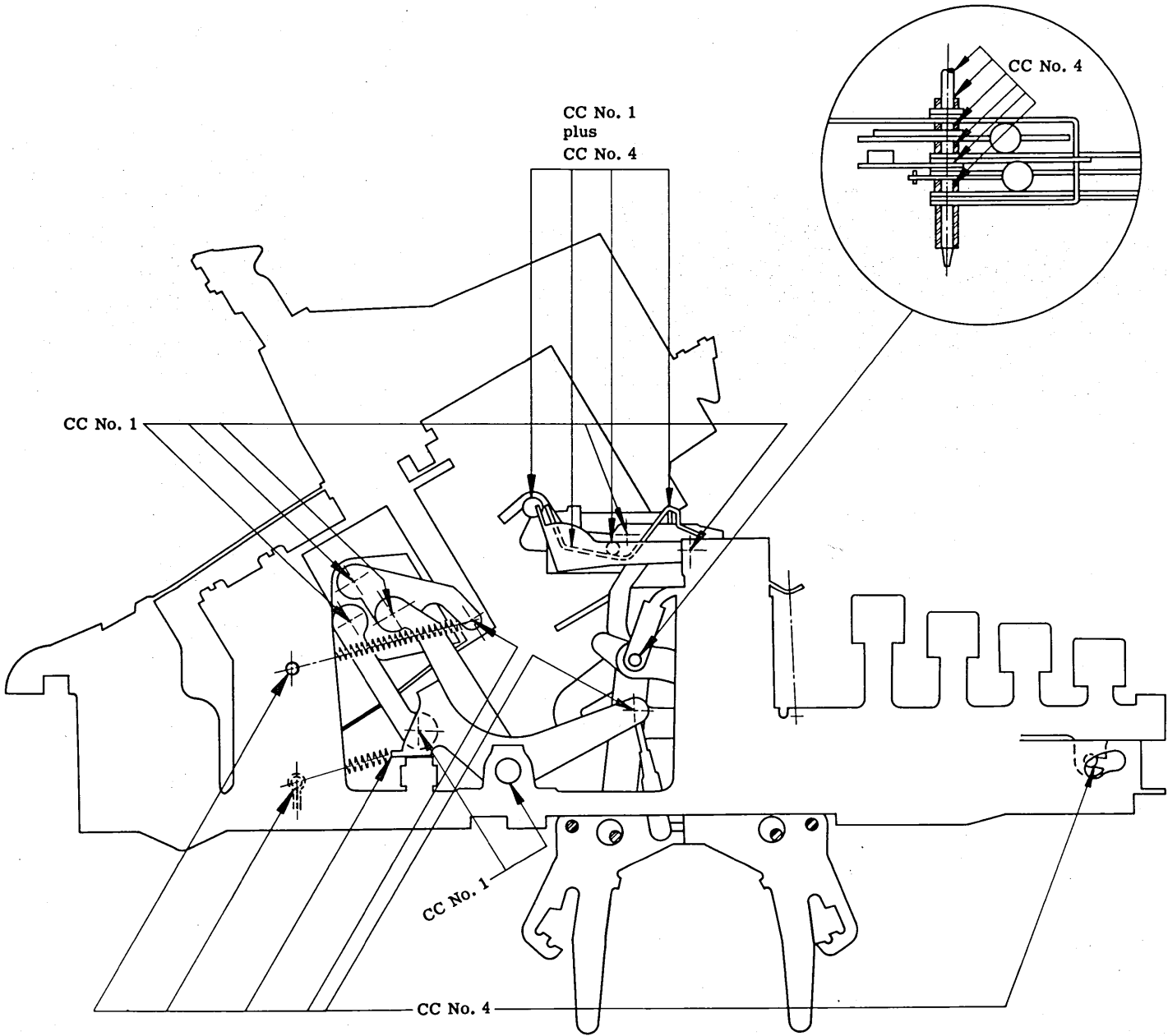


Figure 2-19 Power Frame (Left Side)

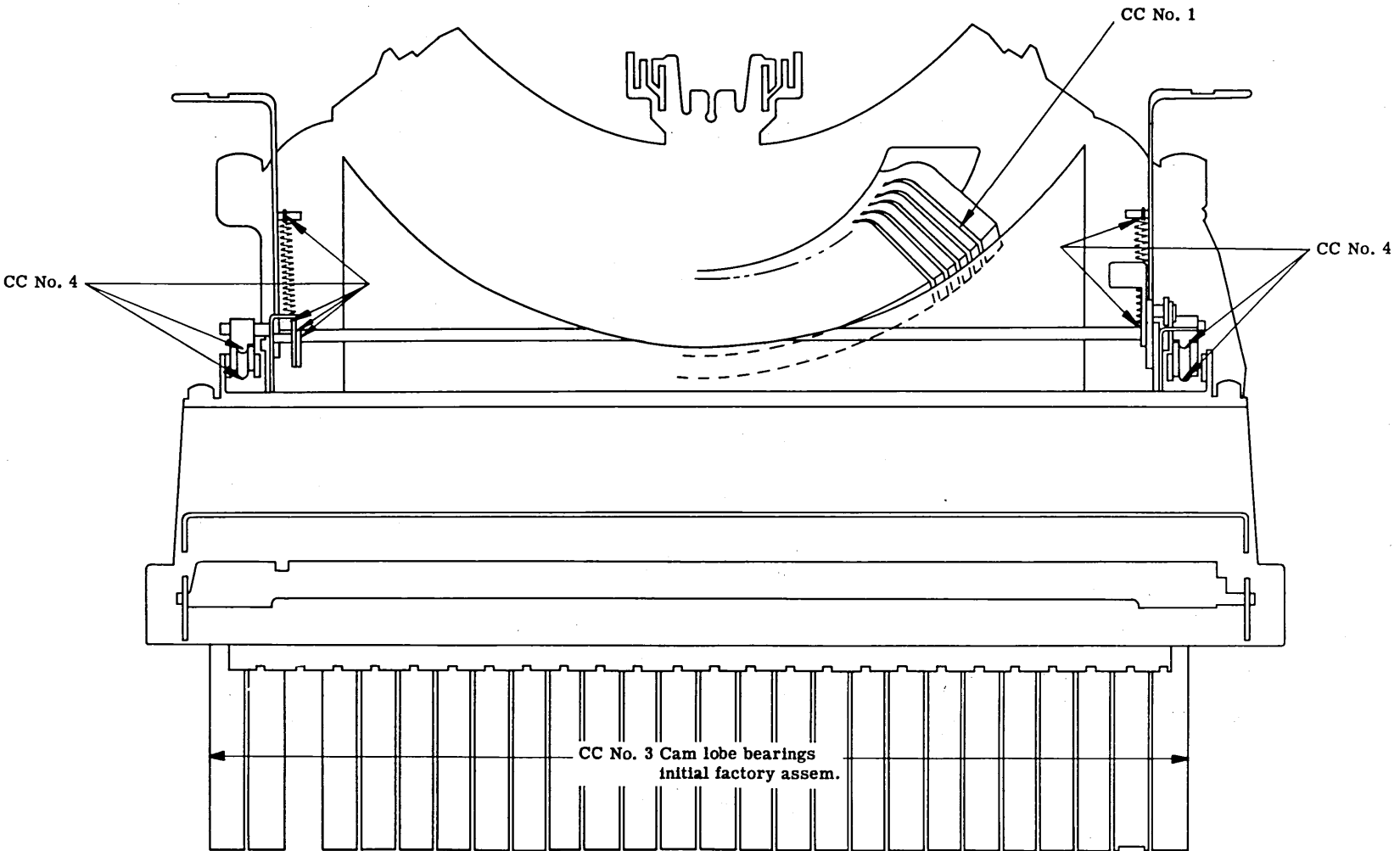


Figure 2-20 Power Frame (Front)

CODE SELECTOR

The two figures (Figures 3-1 and 3-2) in this section show the various points of lubrication necessary to maintain good operating condition of the code selector.

All slide cam surfaces and all spring ends should be lubricated with C. C. lubricant number 4.

All slides, where they ride in the combs all rollers, bearings and pivots should be lubricated with C. C. lubricant number 1.

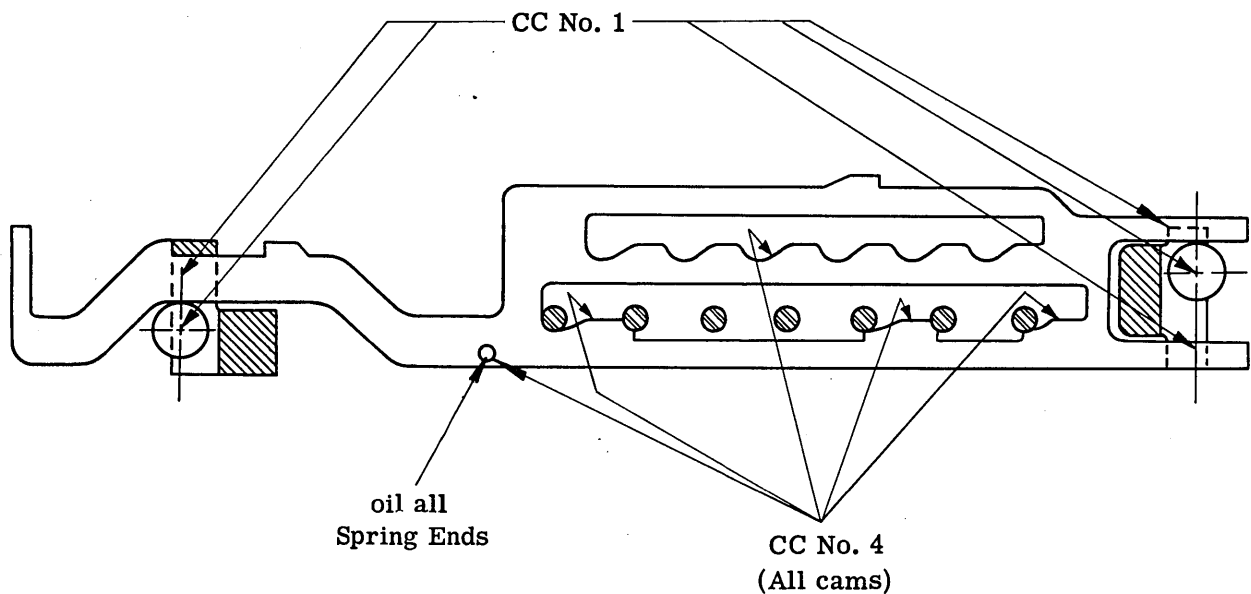


Figure 3-1 Selector Slide

Code Selector

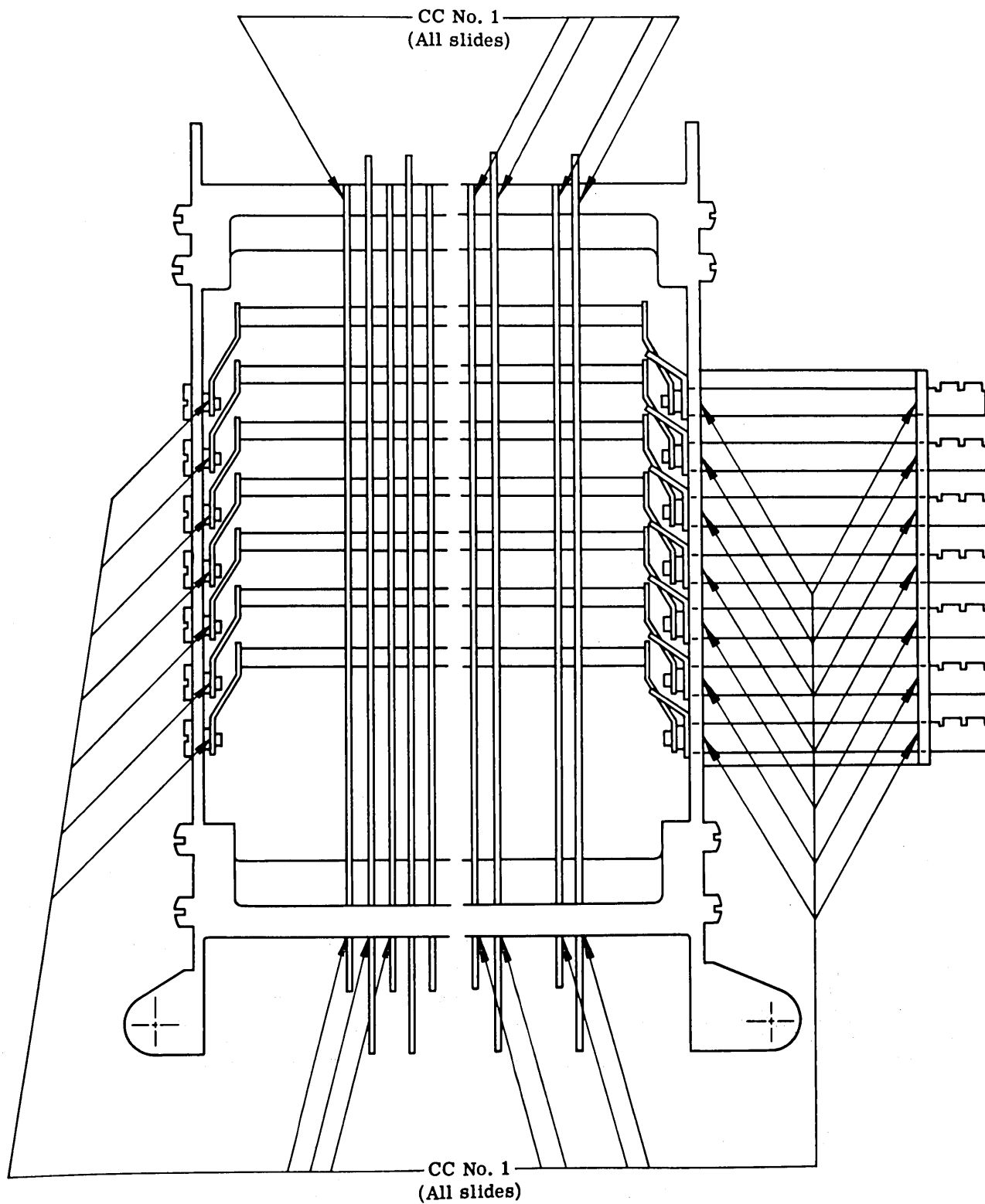


Figure 3-2 Code Selector

TAPE PUNCH

The lubrication points for the various components in the tape punch are shown on figures 4-1 through 4-7.

The following points should be lubricated with C. C. lubricant number 4: All latching surfaces, on armatures where knock-off bails contact, detent, cam surfaces, drive gear teeth, clutch sleeve and collar surfaces (where armatures contact),

restoring bail and spring ends.

The cam roller bearings should be lubricated with C. C. lubricant number 1 and then followed by C. C. lubricant number 4.

All other moving parts, pivots or bearings not otherwise shown should be lubricated with C. C. lubricant number 1

Lubricate clutch spring with CC No. 6.

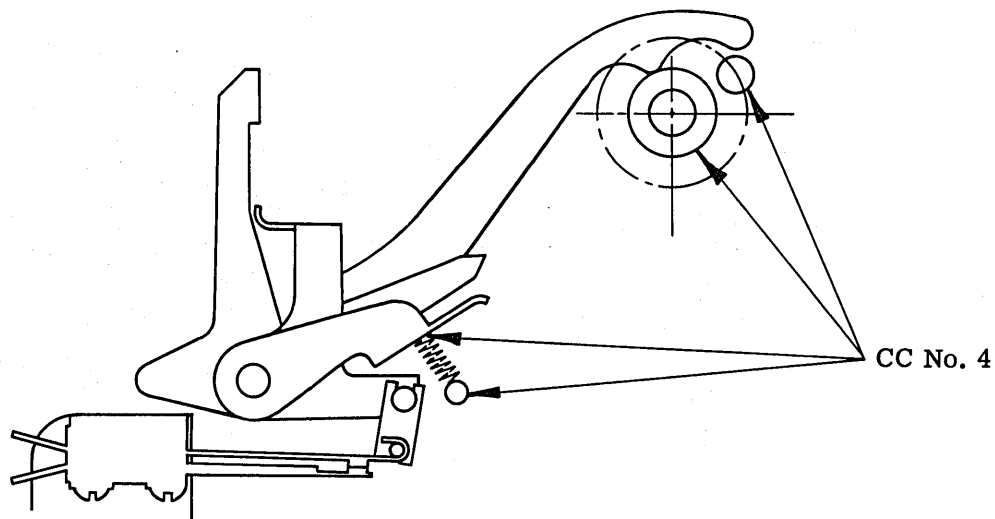


Figure 4-1 Latch Restoring Mechanism

Tape Punch

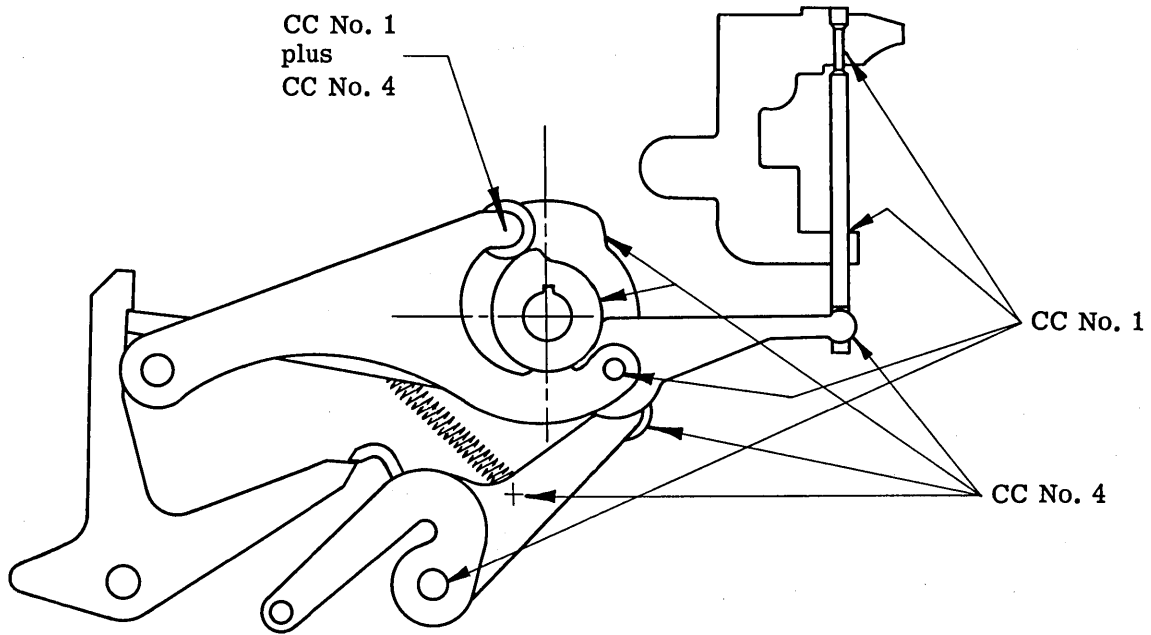


Figure 4-2 Latches, Operating Levers & Punch Pins

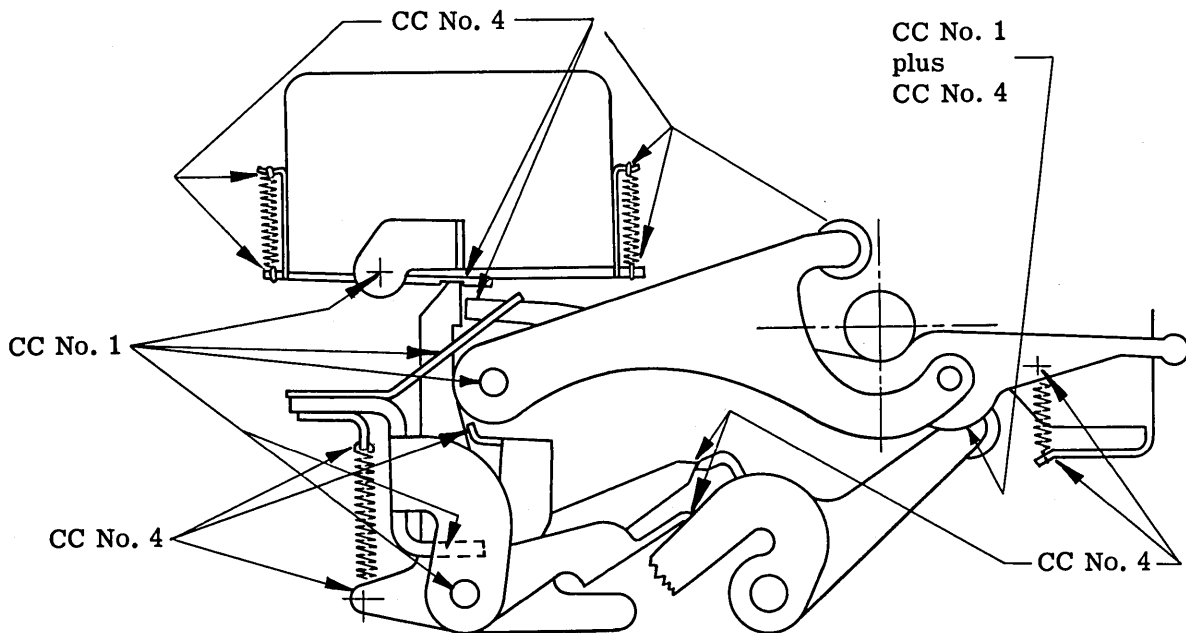


Figure 4-3 Armatures, Latches & Operating Levers

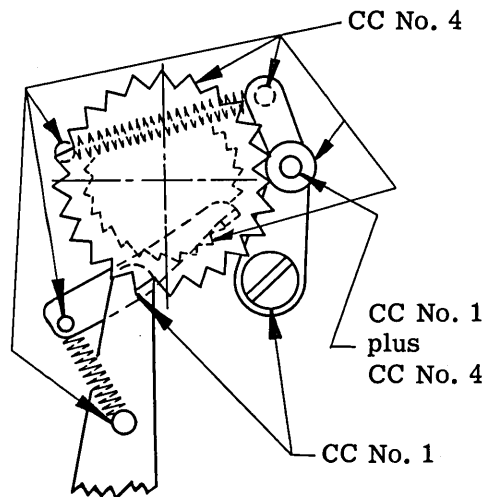


Figure 4-4 Feed Mechanism

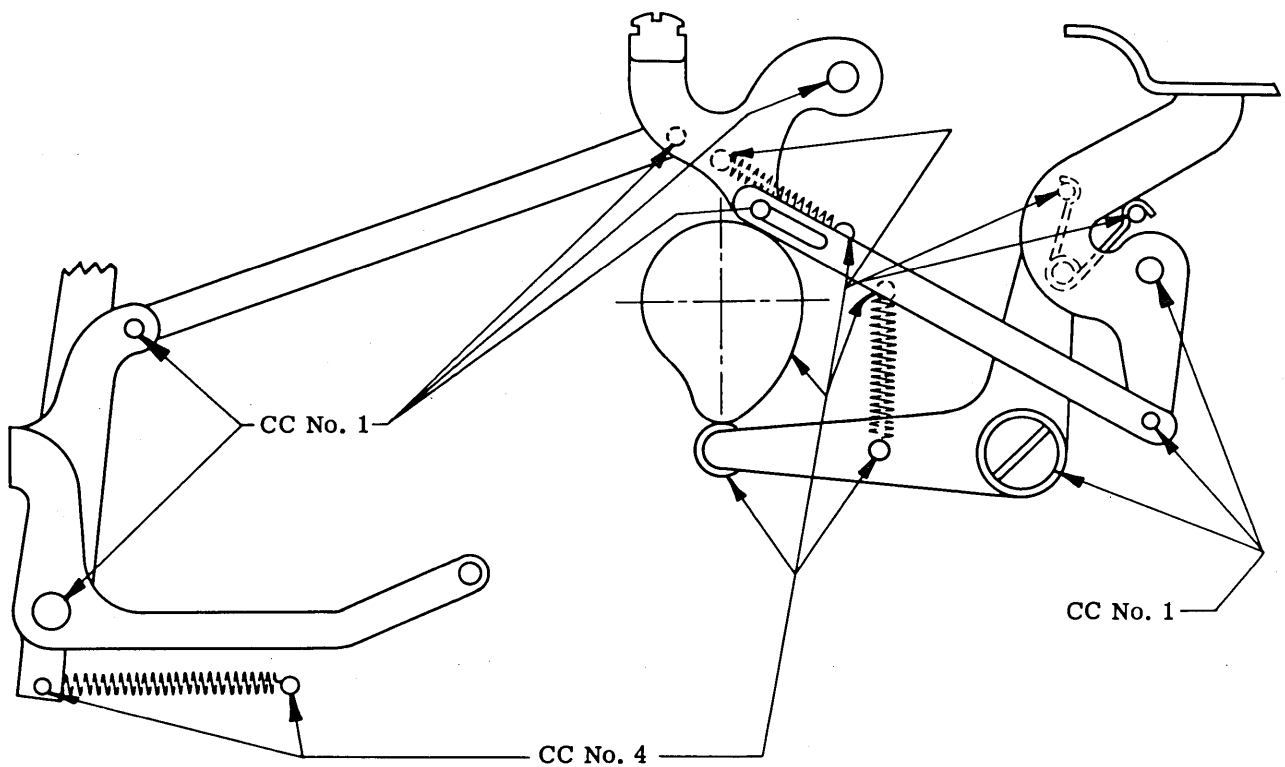


Figure 4-5 Tape Tension & Run-out Linkage

Tape Punch

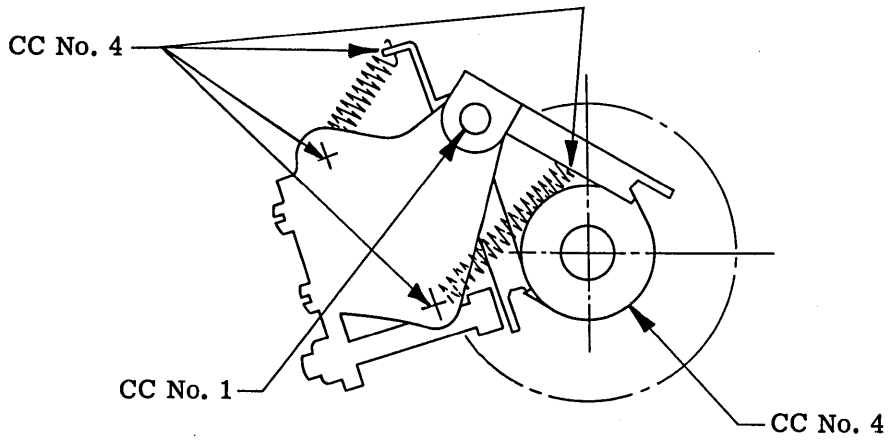


Figure 4-6 Clutch Mechanism

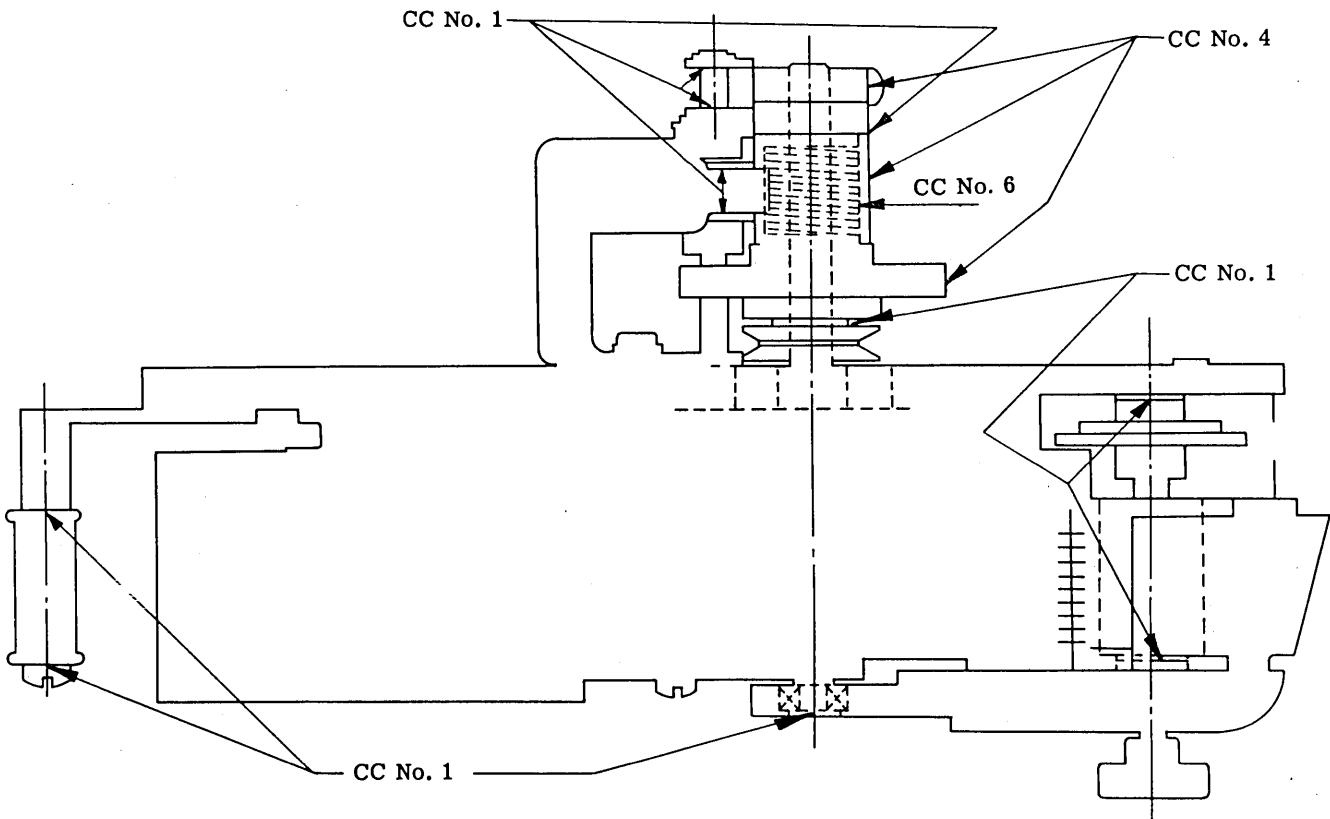


Figure 4-7 Tape Punch (Top)

SINGLE READER

The lubricating points for the various components of the tape reader are shown in figures 5-1 through 5-6

The following points should be lubricated with C. C. lubricant number 4: all cam surfaces, feed pawl, ratchet wheel, detent, surface of contact operating bails, spring ends and latching surfaces.

The cam roller bearings should be lubricated with C. C. lubricant number 1, then followed with C. C. lubricant number 4.

All other moving parts, pivots, bearings or combs not otherwise shown should be lubricated with C. C. lubricant number 1.

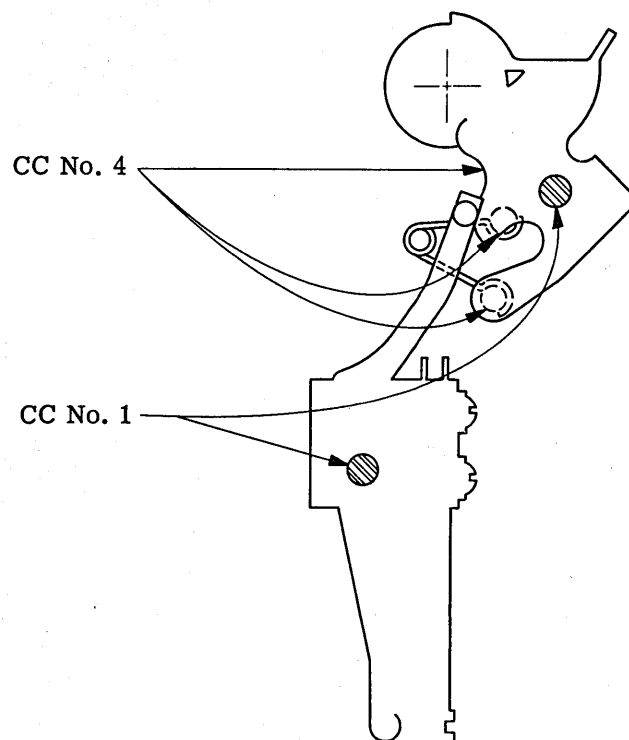


Figure 5-1 Tape Hold Down Linkage

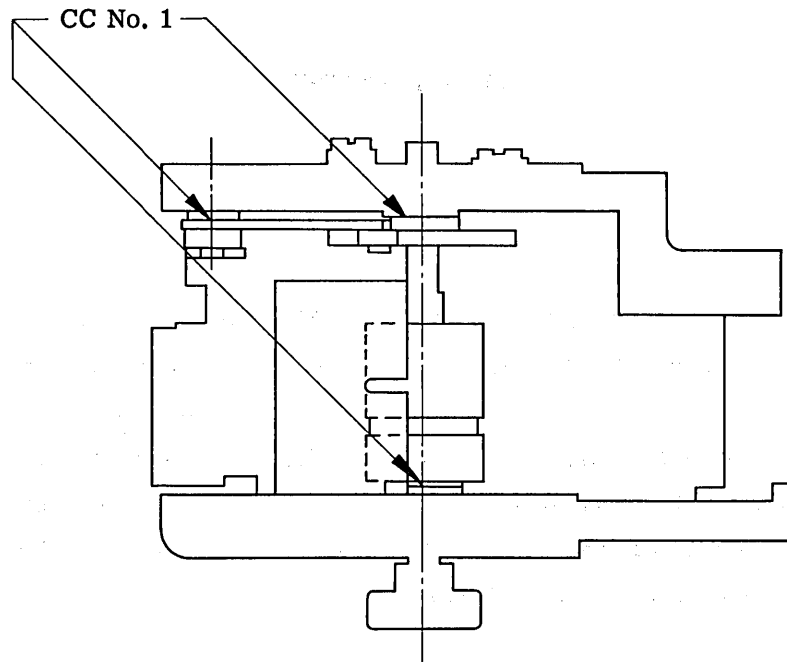


Figure 5-2 Tape Feed Shaft

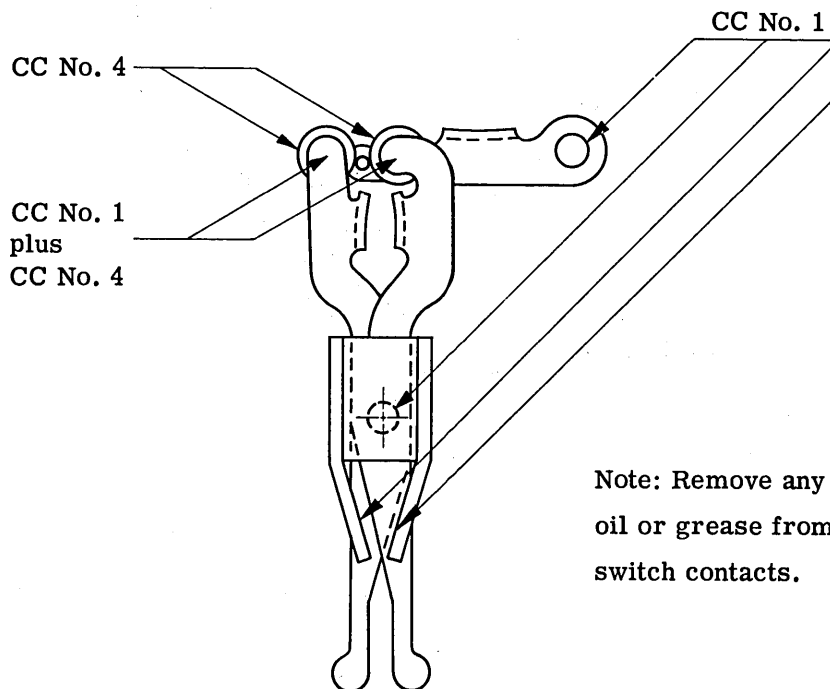


Figure 5-3 Contact Operating Bails

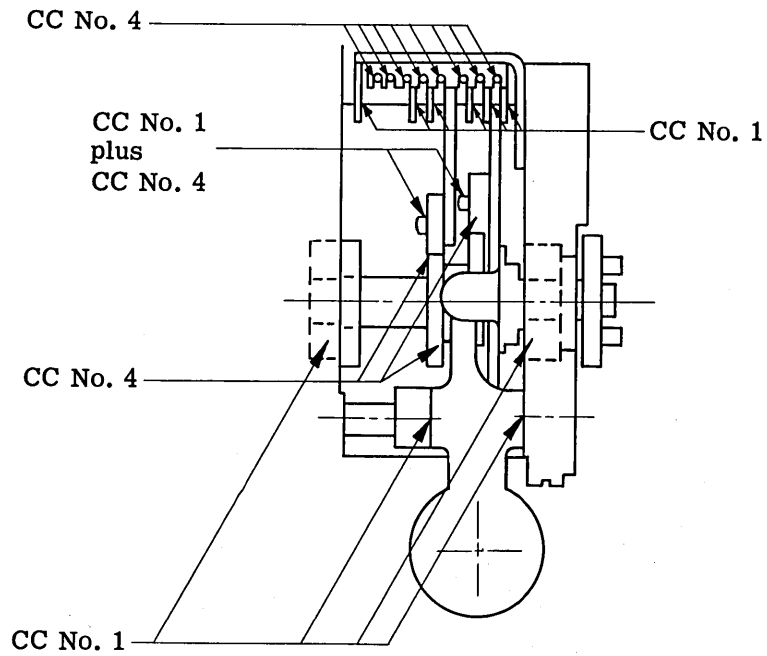


Figure 5-4 Armature, Cam Shaft & Springs

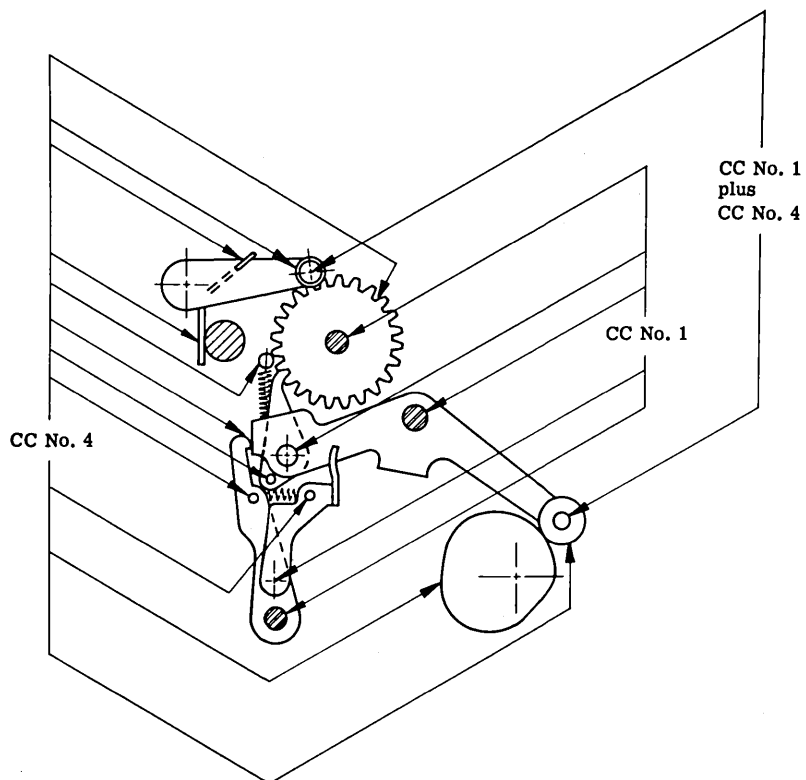


Figure 5-5 Tape Feed Mechanism

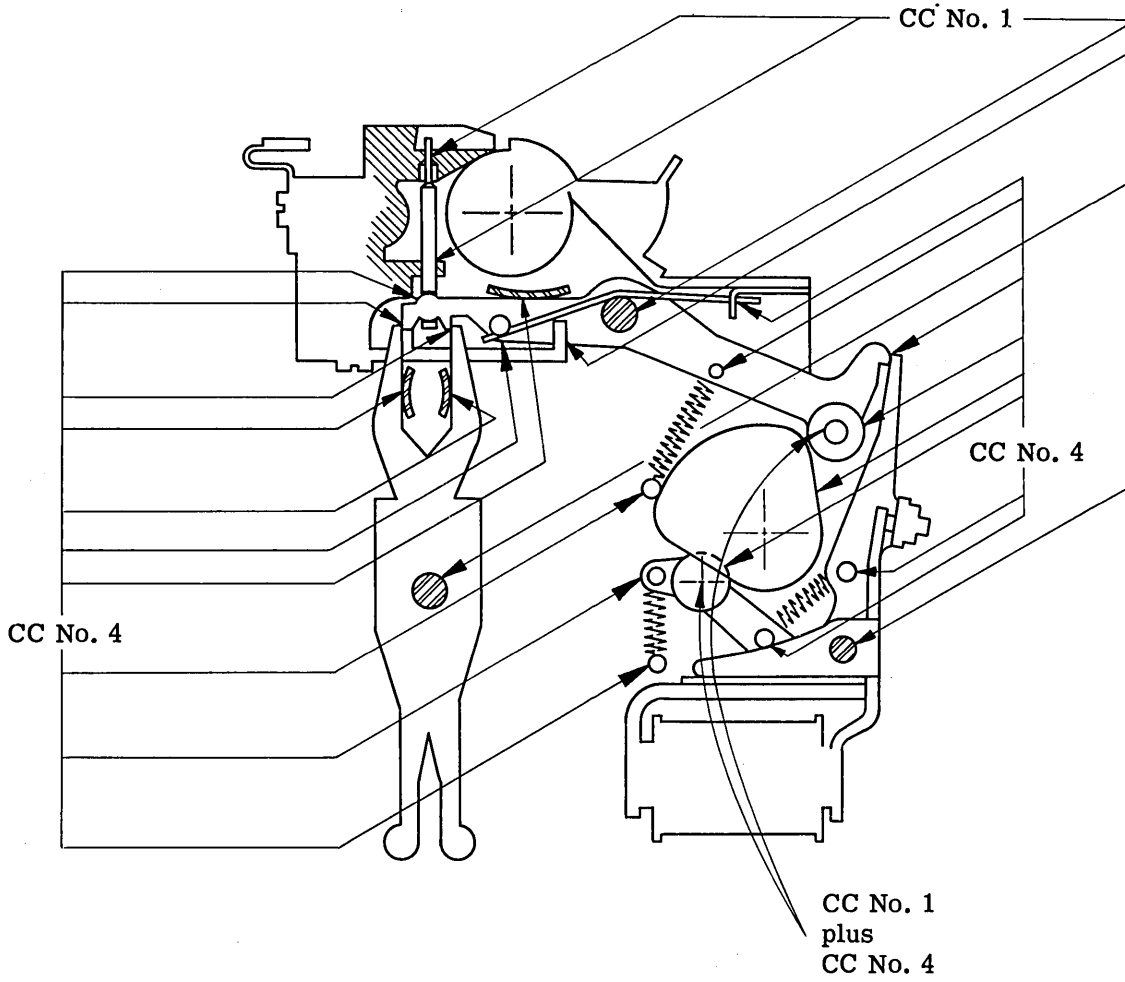


Figure 5-6 Pin & Contact Operating Mechanism

CODE TRANSLATOR

The lubricating points for the various components of the code translator are shown in figures 6-1 through 6-5.

The following points should be lubricated with C. C. lubricant number 4: latching points of permutation slides, surface of restoring bail, surface of cams, seeker ends (where they contact keylever pins), clutch sleeve and collar surfaces (where armatures contact), drive gear teeth

and restoring bail springs.

The cam roller bearings should be lubricated with C. C. lubricant number 1 then followed with C. C. lubricant number 4.

All other moving parts, pivots or bearings not otherwise shown should be lubricated with C. C. lubricant number 1.

Lubricate clutch spring with CC No. 6.

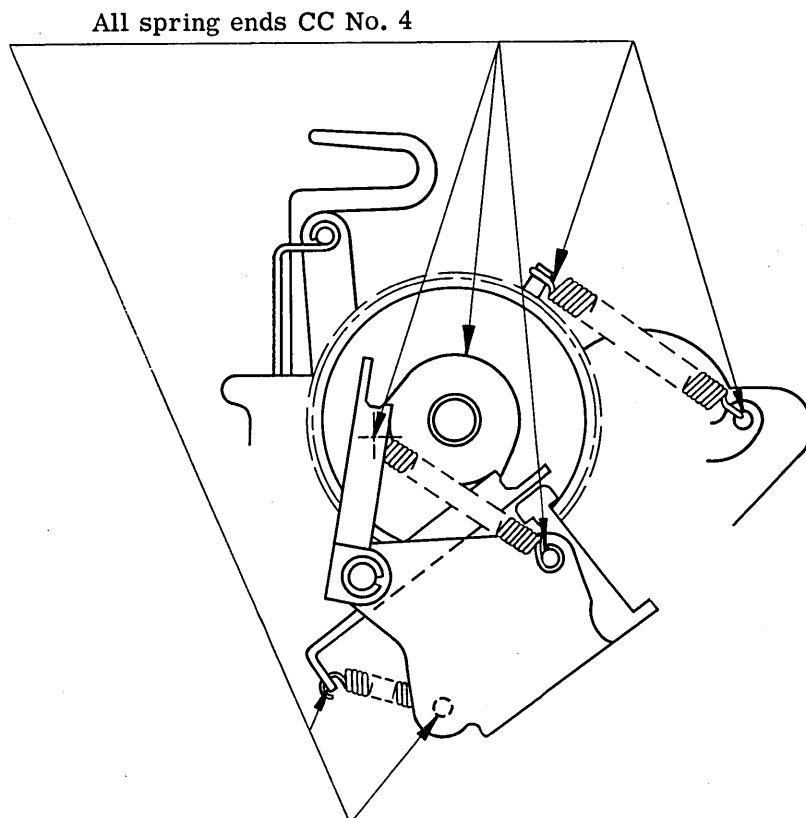


Figure 6-1 Code Translator (Left End)

Code Translator

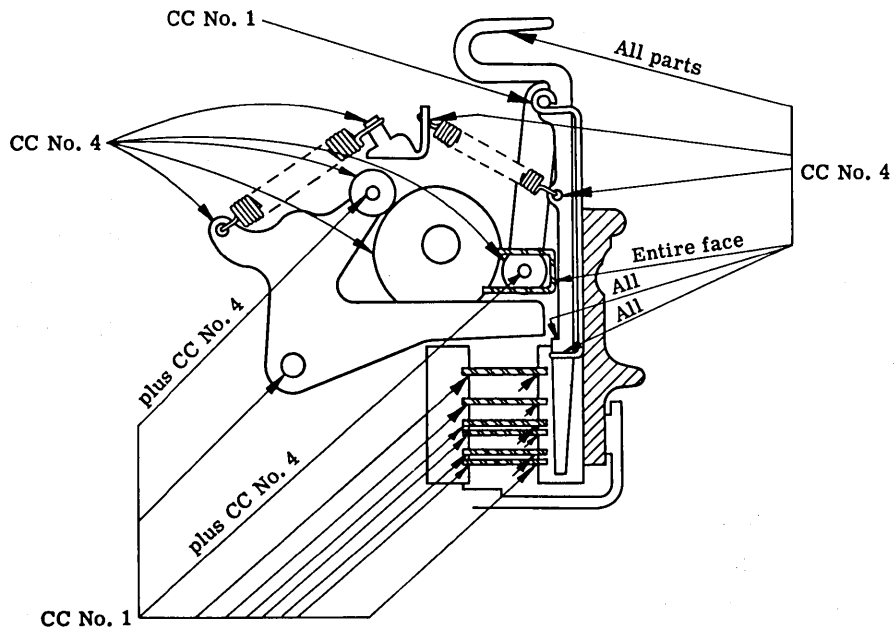


Figure 6-2 Code Translator (Cutaway—Right End)

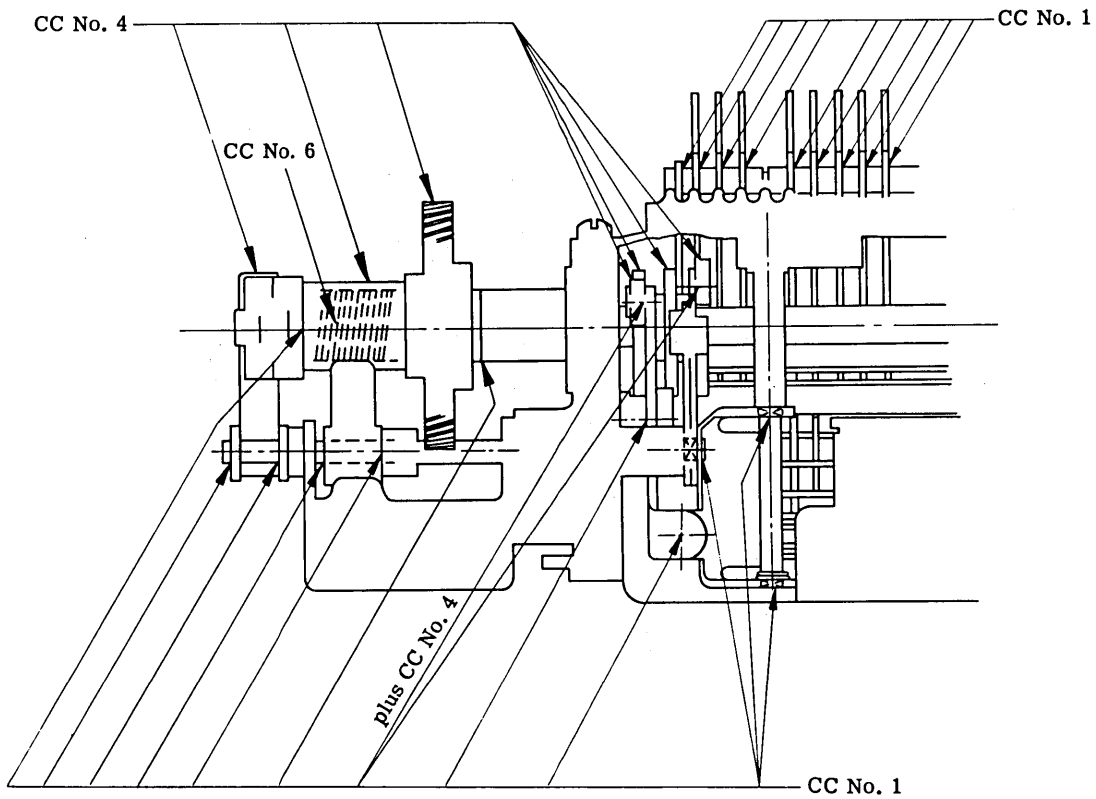


Figure 6-3 Clutch, Shaft, Cams & Seekers

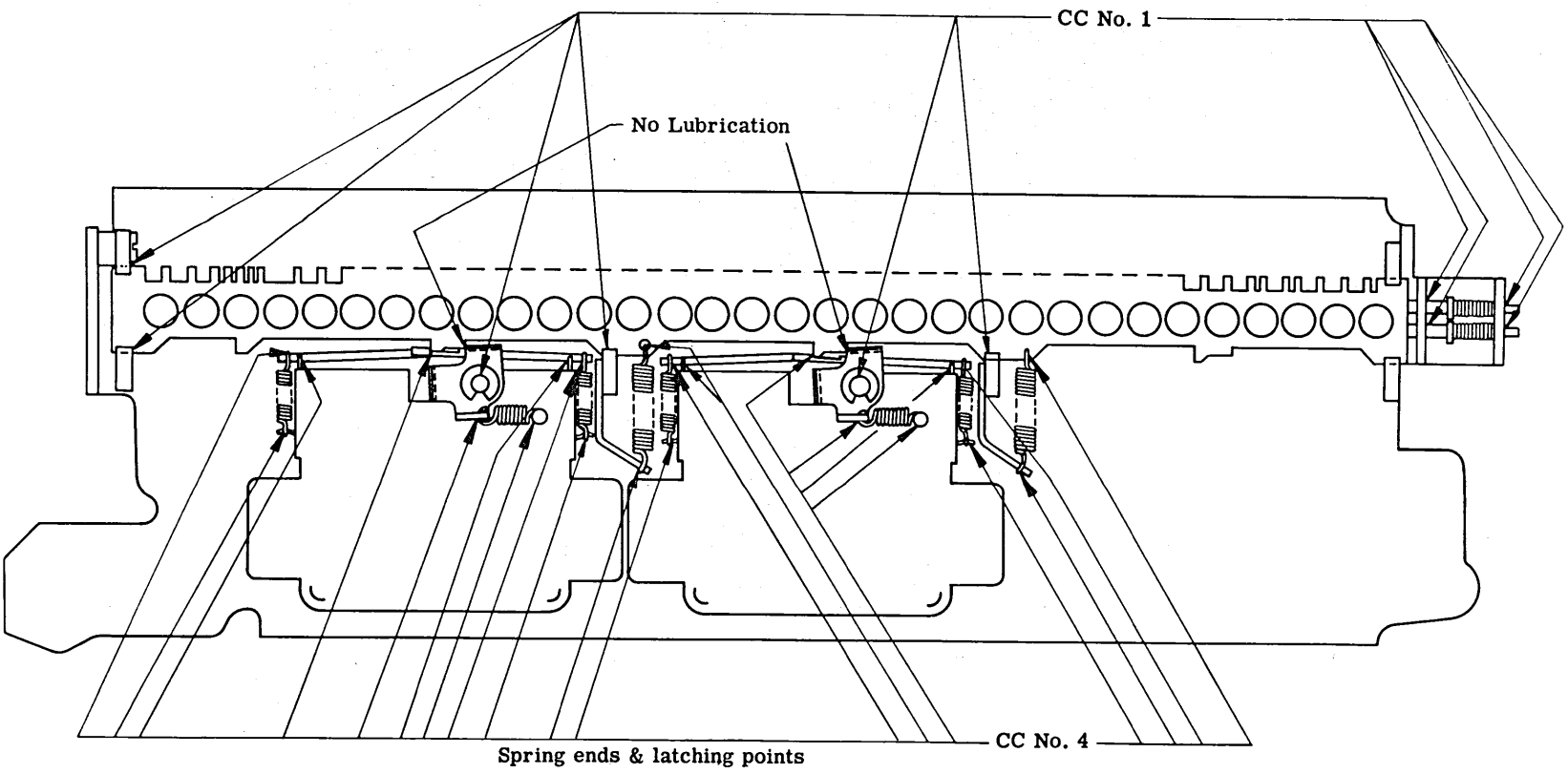


Figure 6-4 Magnet Assemblies, Slides & Plungers

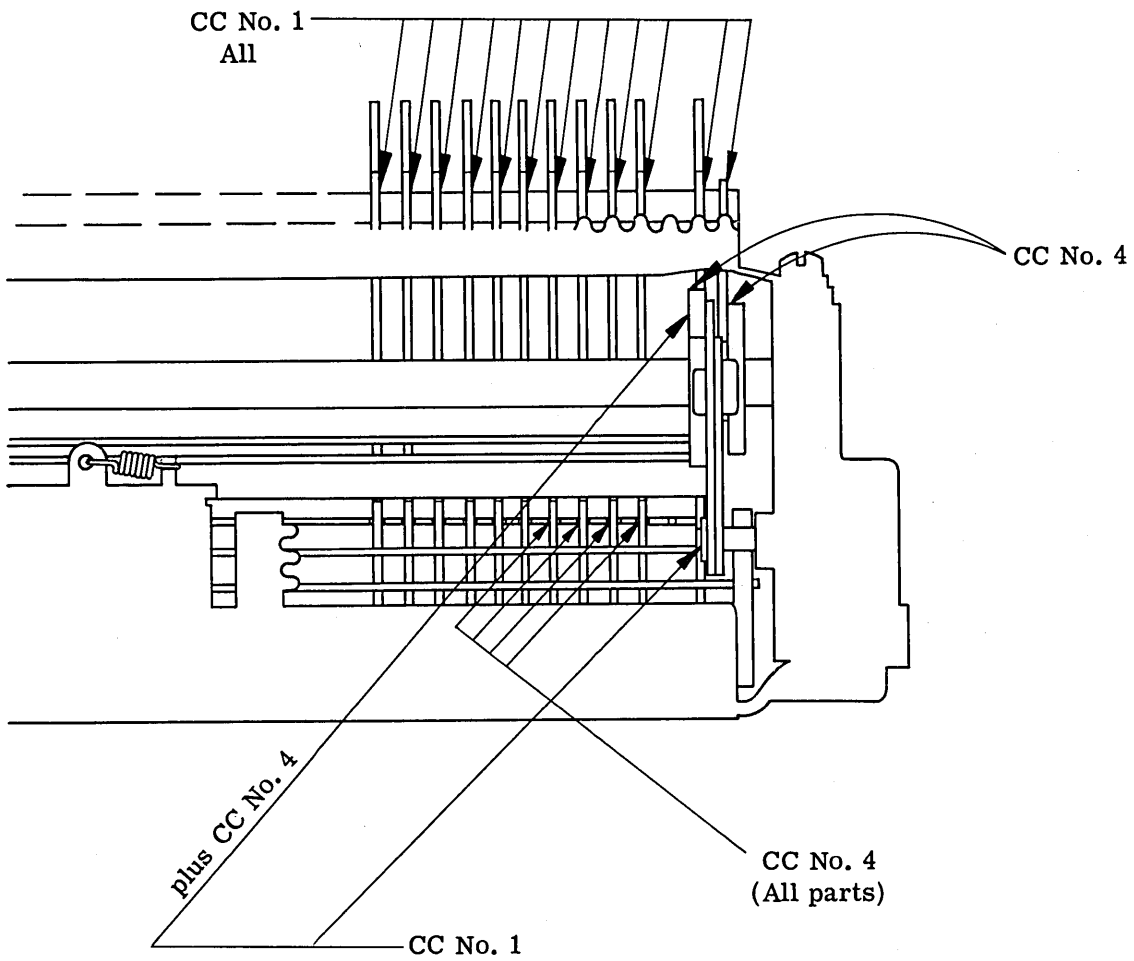


Figure 6-5 Permutation Slides, Cams & Seekers

DOUBLE READER

The lubrication points for the various component parts of the double reader (used on the Justewriter Reproducer) are shown on figures 7-1 through 7-6.

The following points should be lubricated with C. C. lubricant number 4: all cam surfaces, feed pawls, ratchet wheels, detents, operating bail contact surfaces, spring ends and latching surfaces.

The cam roller bearings should be lubricated with C. C. lubricant number 1, then followed with C. C. lubricant number 4.

All other moving parts pivots, bearings and combs not otherwise shown should be lubricated with C. C. lubricant number 1.

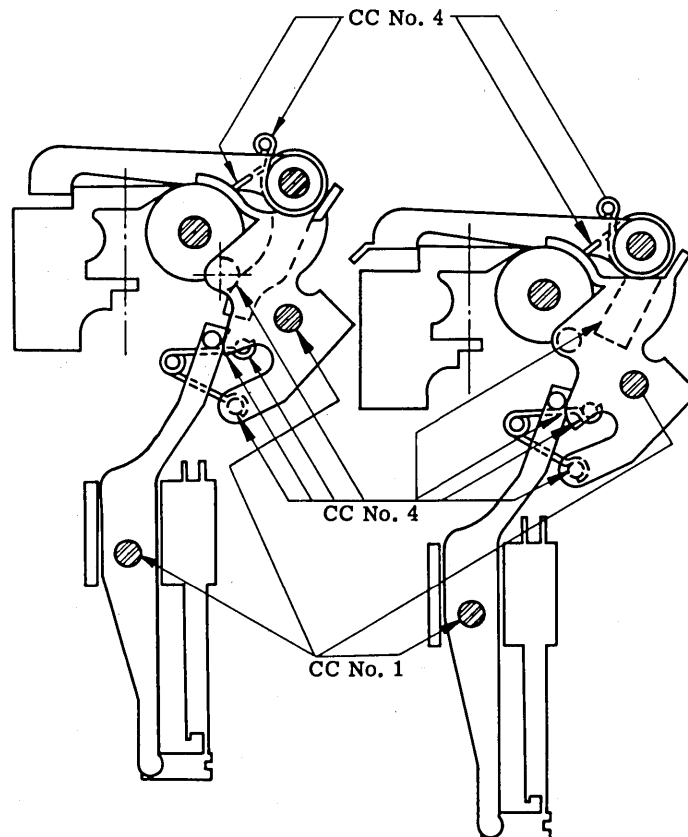


Figure 7-1 Tape Hold Down Mechanism

Double Reader

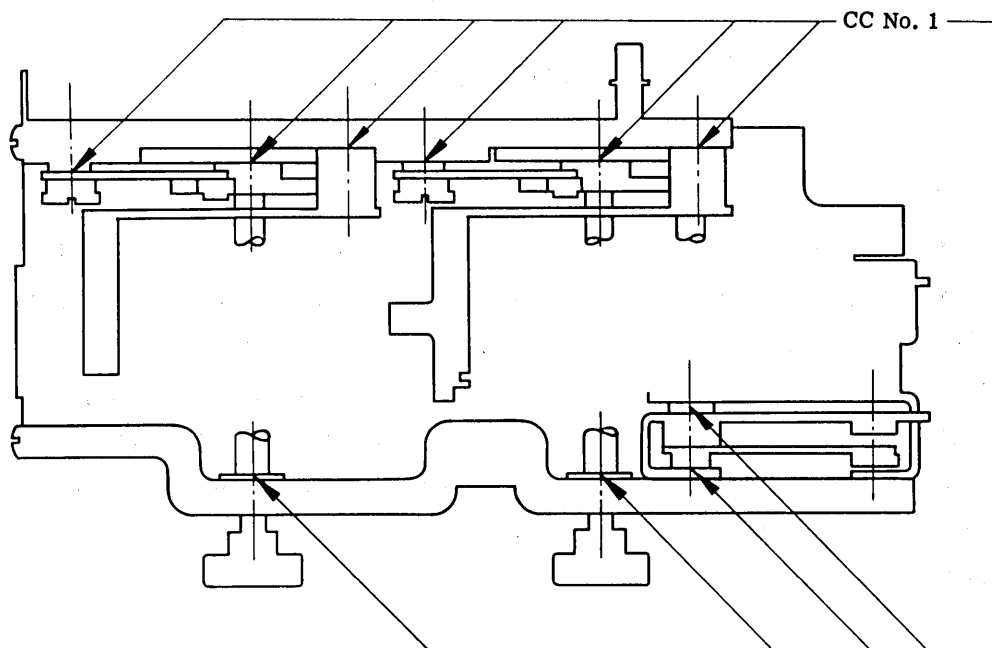
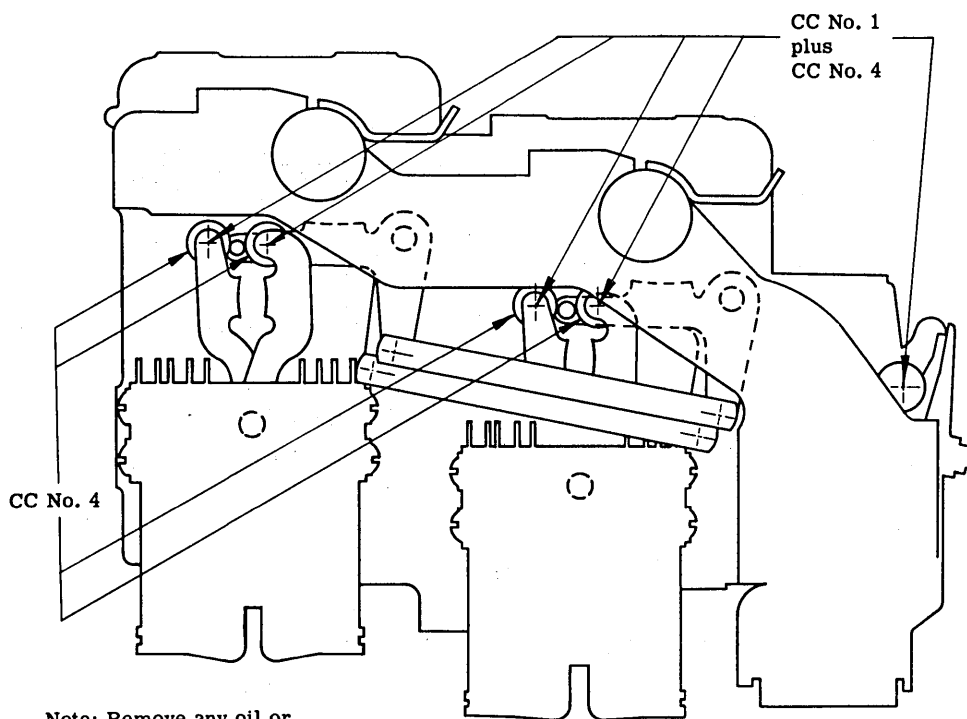


Figure 7-2 Double Reader (Top)



Note: Remove any oil or grease on switch contacts

Figure 7-3 Double Reader (Left Side)

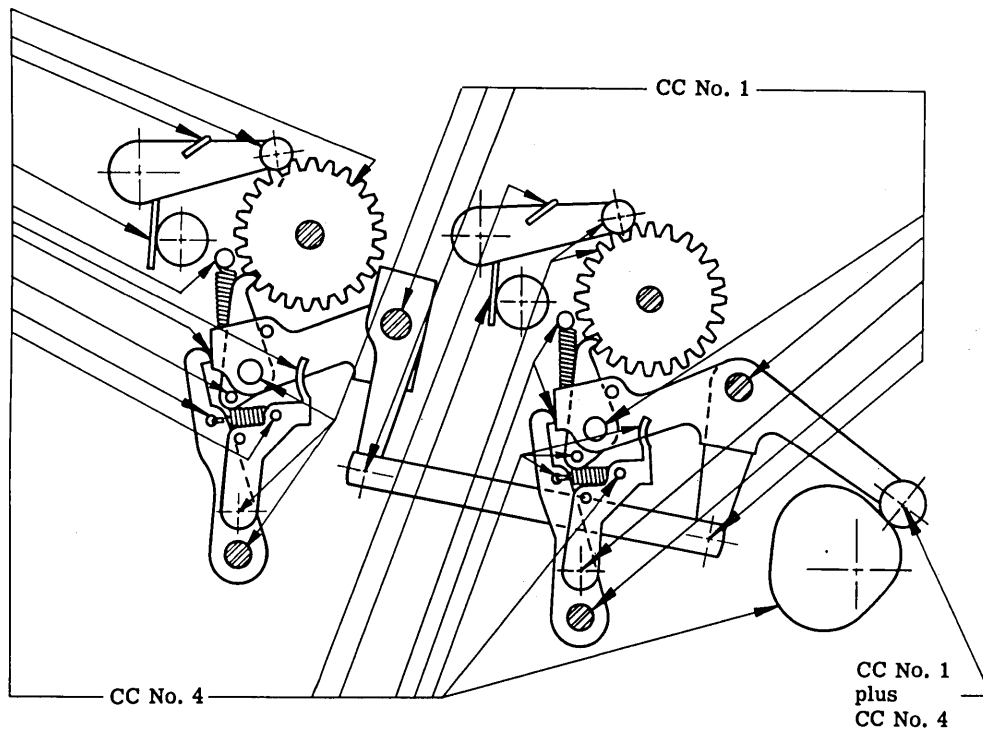


Figure 7-4 Tape Feed Mechanism

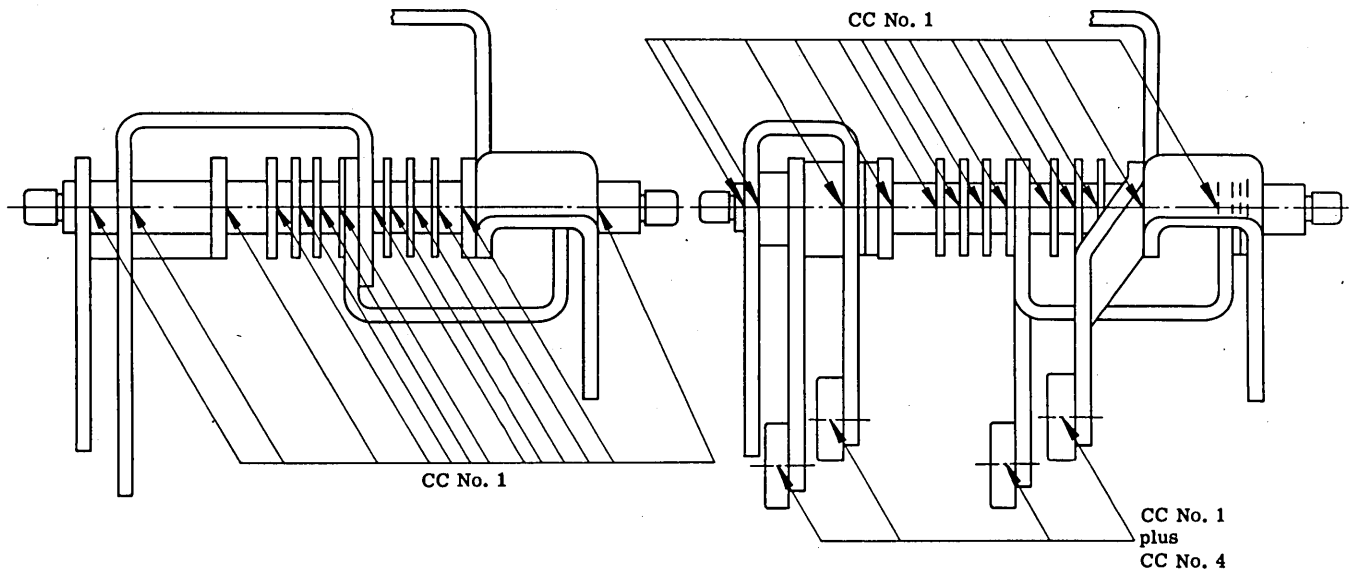


Figure 7-5 Interposer, Shaft & Operating Arms

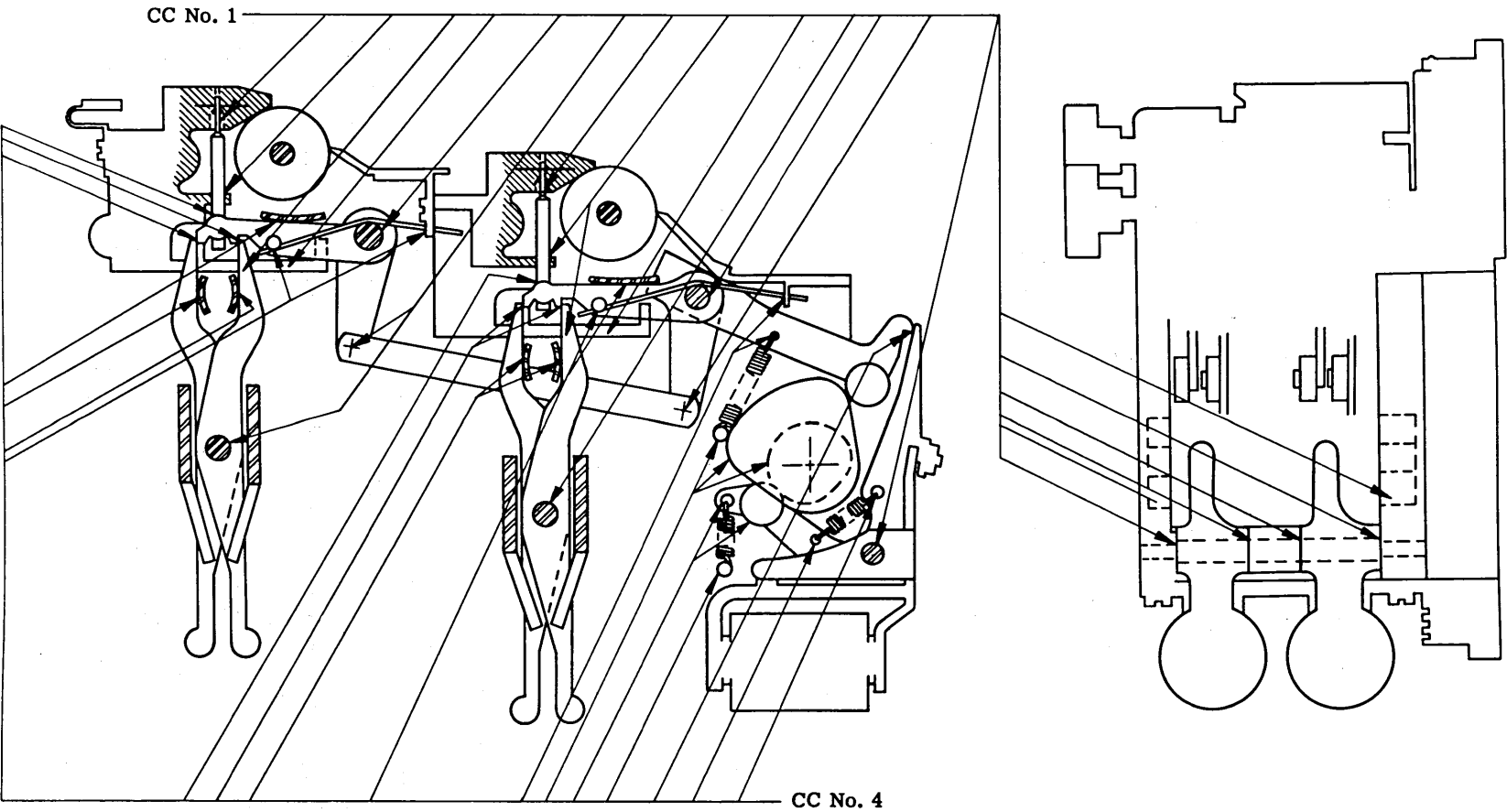


Figure 7-6 Pin & Contact Operating Mechanism

COMPUTER

The lubrication points for the various components of the computer (used on the Justewriter Recorder) are shown in figures 8-1 through 8-5.

The teeth on the seeker bail assembly, and all spring ends should be lubricated with C. C.

lubricant number 4.

All pivots, bearings and combs not otherwise shown should be lubricated with C. C. lubricant number 1.

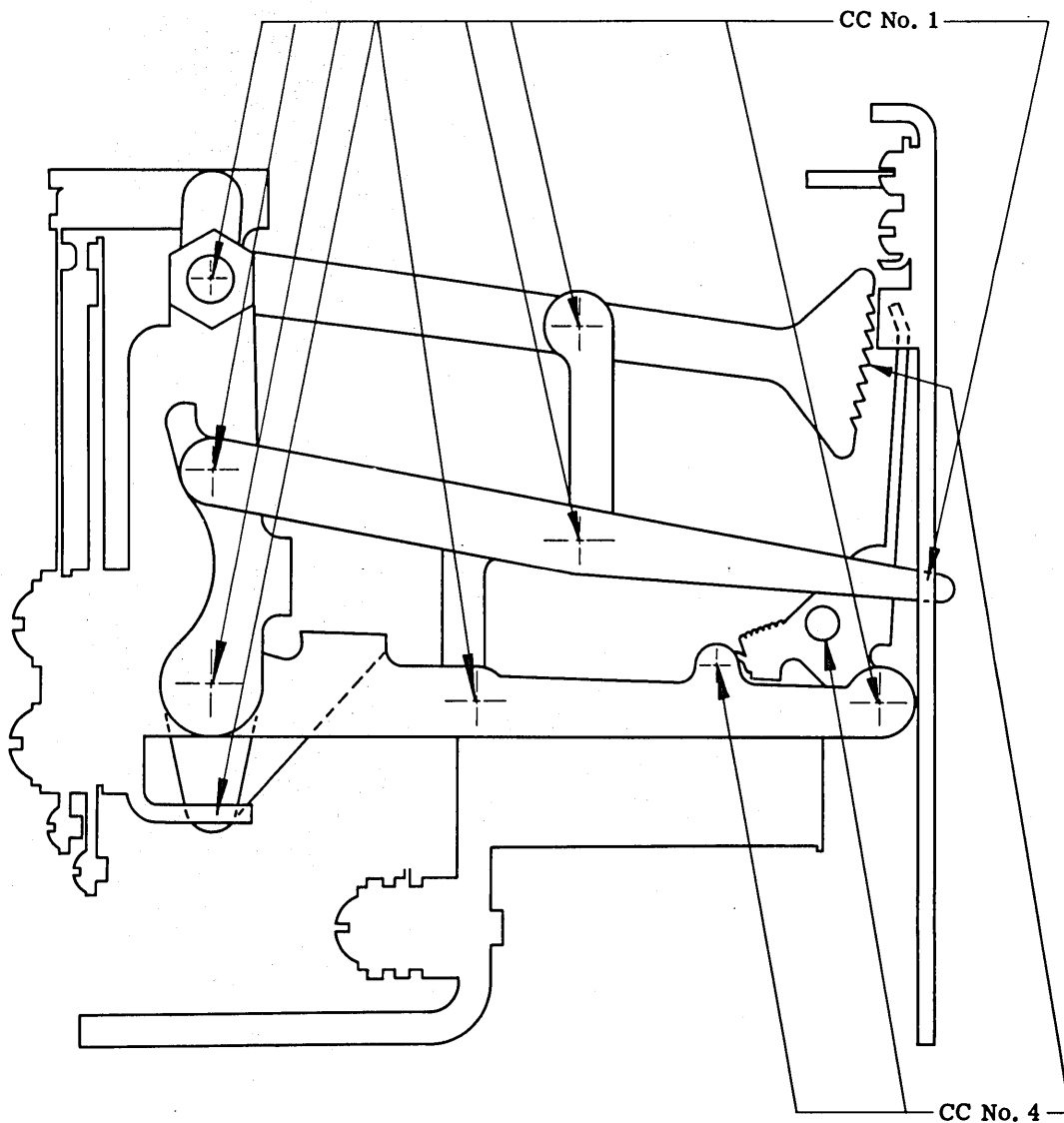


Figure 8-1 Computer (Left Side)

Computer

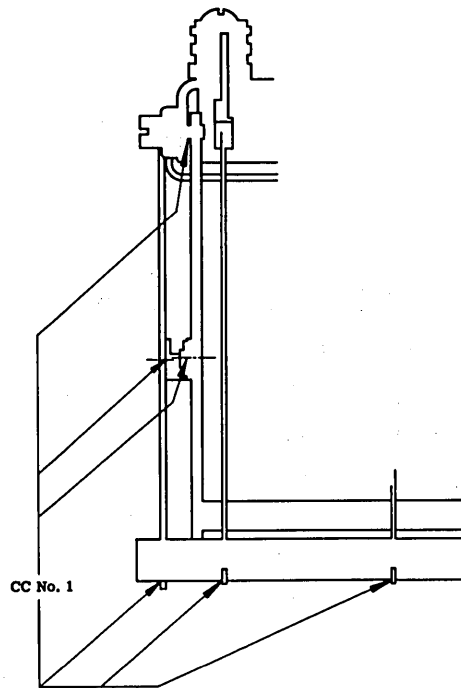


Figure 8-2 Seeker, Seeker Bail & Zone Arm

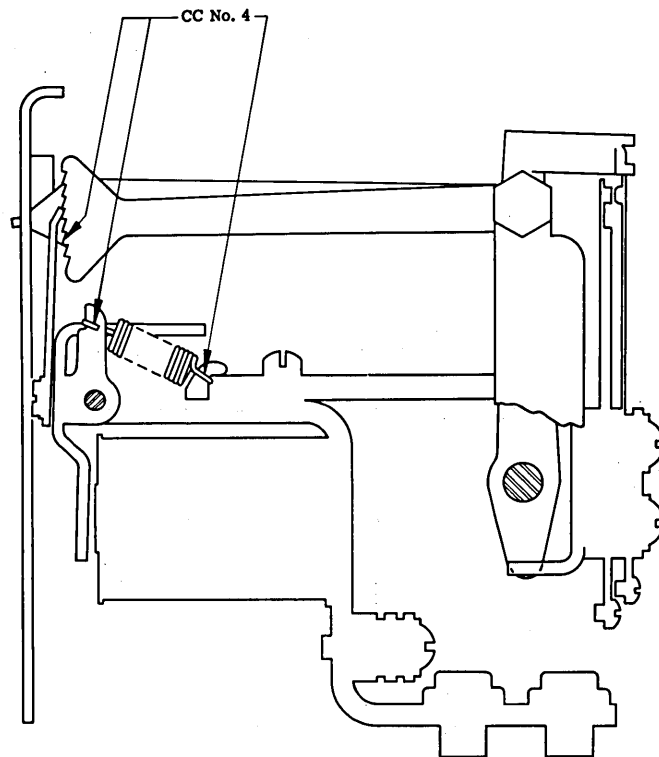


Figure 8-3 Computer (Right Side)

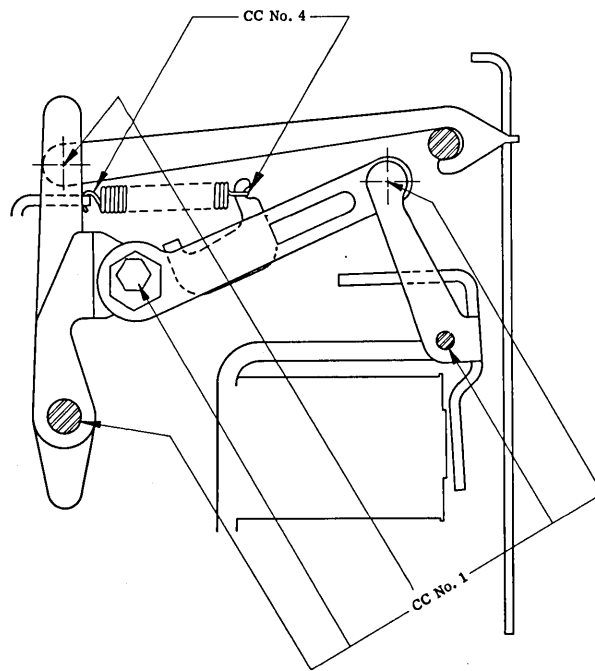


Figure 8-4 Computer (Cutaway-Left Side)

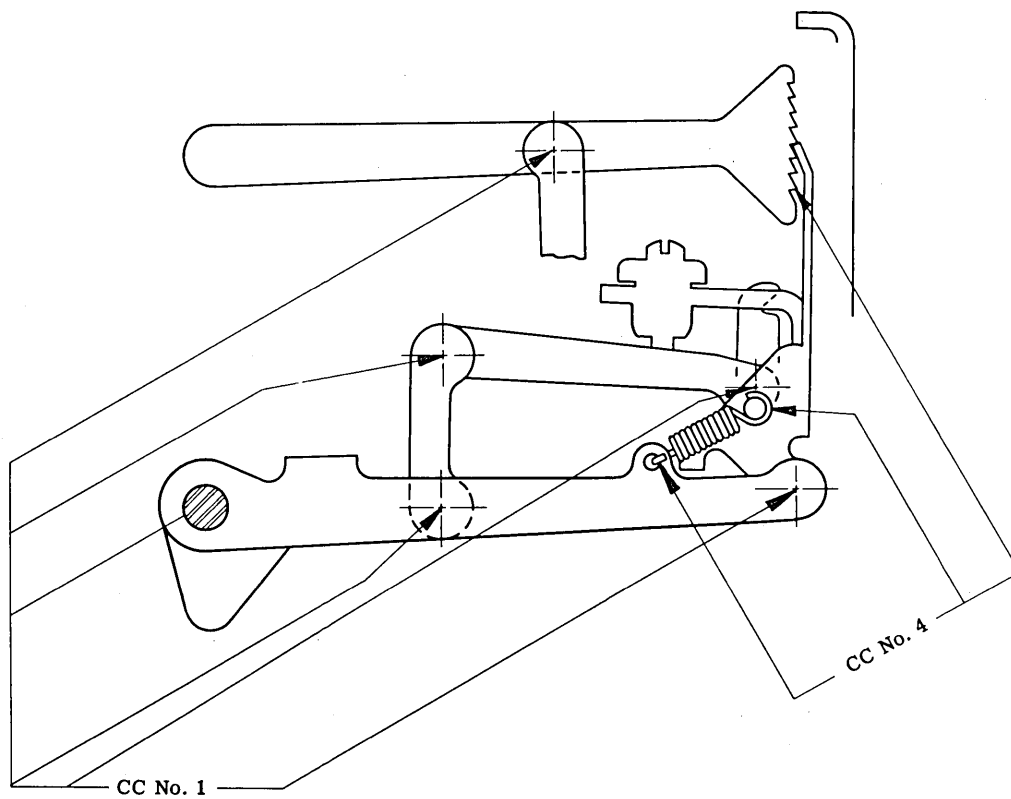
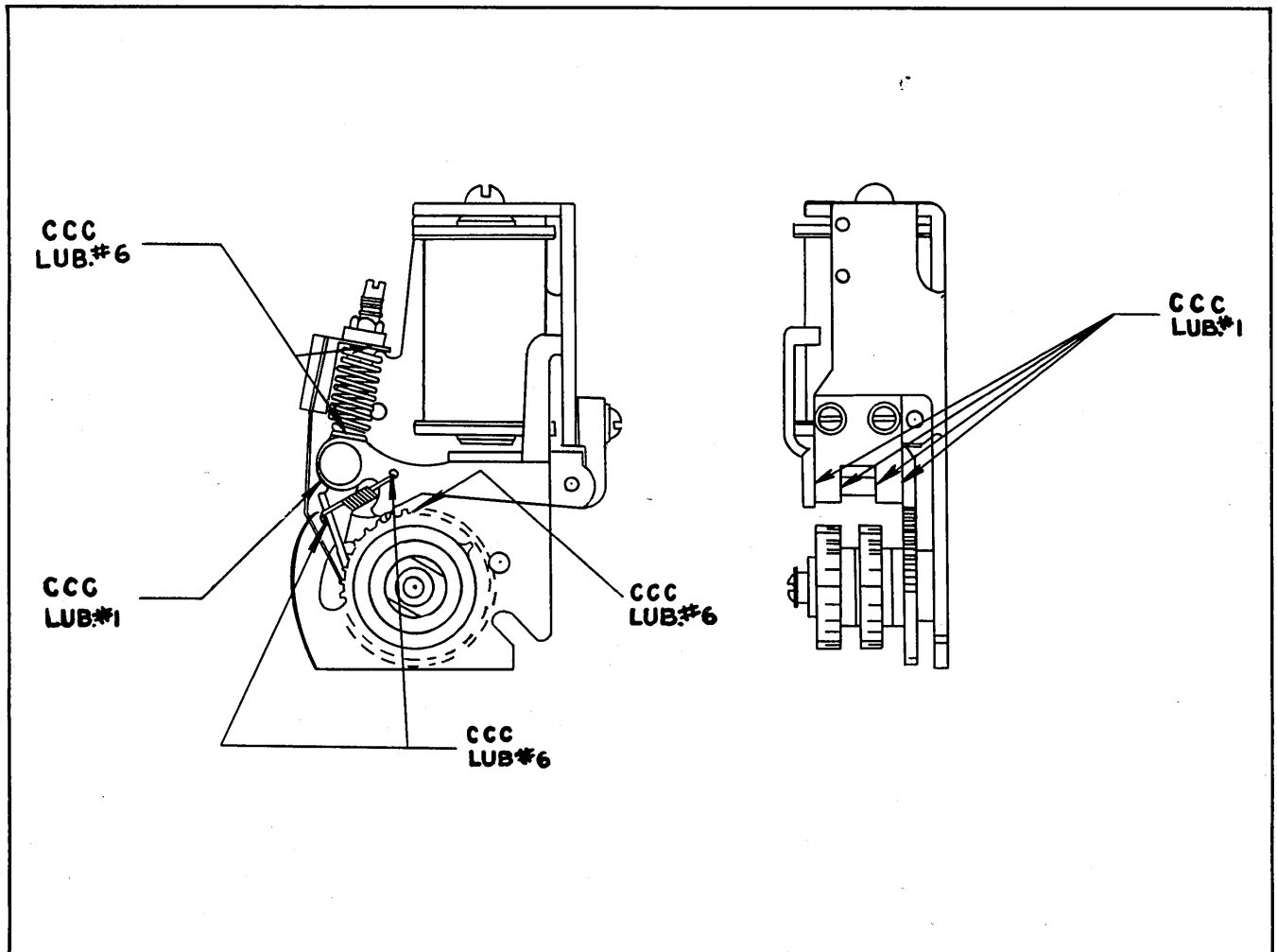


Figure 8-5 Indexing Mechanism

HOLE COUNT RELAY

The lubrication points for the various components of the hole count relay (used on the Justewriter Recorder and Recorder-Reproducer) are shown in Figures 9-1.

The pivot points of the Hole Count Relay armature and feed pawl should be lubricated with C.C. lubricant number 1. All other points shown should be lubricated with C.C. lubricant number 6.



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