Model 15 Teletype

Technical Description

+ Keyboard Layout

+ 5 Unit Baudot Code

+ Technical Description

+ Included CD

- **. General information**
- **. History**
- **. Pictures**

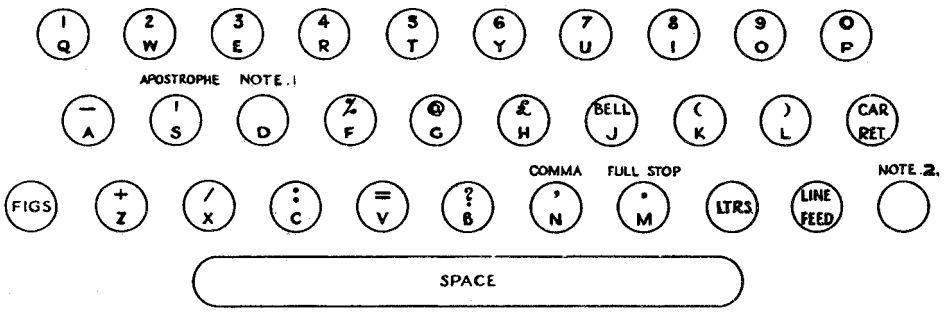
2 It is interesting to note that, from the time telegraph signalling was first proposed, efforts have been directed towards the development of a system whereby the messages are mechanically coded for transmission, then translated and made available as printed characters without the necessity of human effort, apart from operating the keyboard and removing and checking the finished messages which are received in a manner suitable for immediate use or delivery.

The successful achievement of this objective has reduced the fatigue associated with manual telegraph signalling and has reduced the time involved in transmitting a message. In this respect, it is possible for an operator to send approximately 150 characters per minute by manual Morse, but, with machine sending and receiving, approximately 270-300 characters can be sent in the same time. With an average of 6 letters per word, these speeds correspond to 25 words and 45-50 words per minute, respectively. Although the actual speed for short periods will exceed these values, time must be allowed for checking messages and other activities which reduce the speed to the averages stated.

A further advantage has been the possibility of providing telegraph service for commercial organisations in a simple and convenient form comparable to the telephone services, without the necessity of employing highly skilled operators.

3 The printing machine telegraph system can be compared to the manual system in the following respects -

(i) The keyboard transmitter is a device which has a keyboard similar in appearance to the typewriter keyboard (see Page 2 and Fig. 1).



A.P.O. START-STOP MACHINE KEYBOARD.

Notes.

1. Where "Answer Back" facility is provided this should operate on the "Figs. D" combination; otherwise upper case D type pallet and keytop should be left blank.
2. Position of the blank key (signal 32) if fitted.

FIG. 1.

FIVE UNIT CODE.

3.1 The Morse code, described in Paper No. 1, was designed to be readily identifiable when heard on a sounder. This has been achieved by making the characters of different time duration, for example, the shortest character, E, is four elements long, while the longest character in common use, the figure 0, is 22 elements long. This time includes the space between the characters. Early printing telegraph machines used the Morse code but, because of the varying length code, their design was extremely complex. However, the development of a code of uniform length for every character has simplified the design of the machines. (It is interesting, at this stage, to recall that in 1605, Bacon used a code based on similar principles for recording information in cyphered form.)

A.P.O START STOP MACHINE ALPHABET

No OF SIGNAL	LOWER CASE	UPPER CASE	NUMBER OF IMPULSES						
			START	1.	2.	3.	4.	5.	STOP
1.	A	—	S	M	M	S	S	S	M
2.	B	?	S	M	S	S	M	M	M
3.	C	:	S	S	M	M	M	S	M
4.	D	NOTE 1	S	M	S	S	M	S	M
5.	E	3	S	M	S	S	S	S	M
6.	F	%	S	M	S	M	M	S	M
7.	G	@	S	S	M	S	M	M	M
8.	H	£	S	S	S	M	S	M	M
9.	I	8	S	S	M	M	S	S	M
10.	J	BELL	S	M	M	S	M	S	M
11.	K	(	S	M	M	M	M	S	M
12.	L	)	S	S	M	S	S	M	M
13.	M	.	S	S	S	M	M	M	M
14	N	,	S	S	S	M	M	S	M
15.	O	9	S	S	S	S	M	M	M
16.	P	0	S	S	M	M	S	M	M
17.	Q	1	S	M	M	M	S	M	M
18.	R	4	S	S	M	S	M	S	M
19.	S	'	S	M	S	M	S	S	M
20.	T	5	S	S	S	S	S	M	M
21.	U	7	S	M	M	M	S	S	M
22.	V	=	S	S	M	M	M	M	M
23.	W	2	S	M	M	S	S	M	M
24.	X	/	S	M	S	M	M	M	M
25.	Y	6	S	M	S	M	S	M	M
26.	Z	+	S	M	S	S	S	M	M
27.	CARRIAGE RETURN		S	S	S	S	M	S	M
28.	LINE FEED		S	S	M	S	S	S	M
29.	LETTERS		S	M	M	M	M	M	M
30.	FIGURES		S	M	M	S	M	M	M
31.	SPACE		S	S	S	M	S	S	M
32.	BLANK		S	S	S	S	S	S	M

NOTE : M = MARKING SIGNAL
S = SPACING SIGNAL

A.P.O. START-STOP MACHINE ALPHABET
(FIVE UNIT CODE).

Note 1.
"Answer Back" facility, if fitted.

FIG. 2.

3.2 The code, as used in most printing machine telegraph equipment, is the Five Unit Code. In this code there are five intelligence conveying elements, which are either marking or spacing, arranged in different combinations, of which it is possible to obtain 32.

For the alphabet, 26 of these combinations are used; the remaining 6 combinations are used to control "functions" in the machines (described in paragraph 4).

Fig. 2 shows the five unit code which is generally used in Australia. It is in conformity with the International Telegraph Alphabet No. 2, and each group of five intelligence conveying impulses is preceded by a spacing start impulse and followed by a marking stop impulse. These additional two impulses are necessary for the correct functioning of the machine and are described later.

/ 4.

COURSE OF TECHNICAL INSTRUCTION.

TELEGRAPHY I. PAPER NO. 9.

PAGE PRINTING TELETYPE (MODEL 15). PAGE 1.

CONTENTS.

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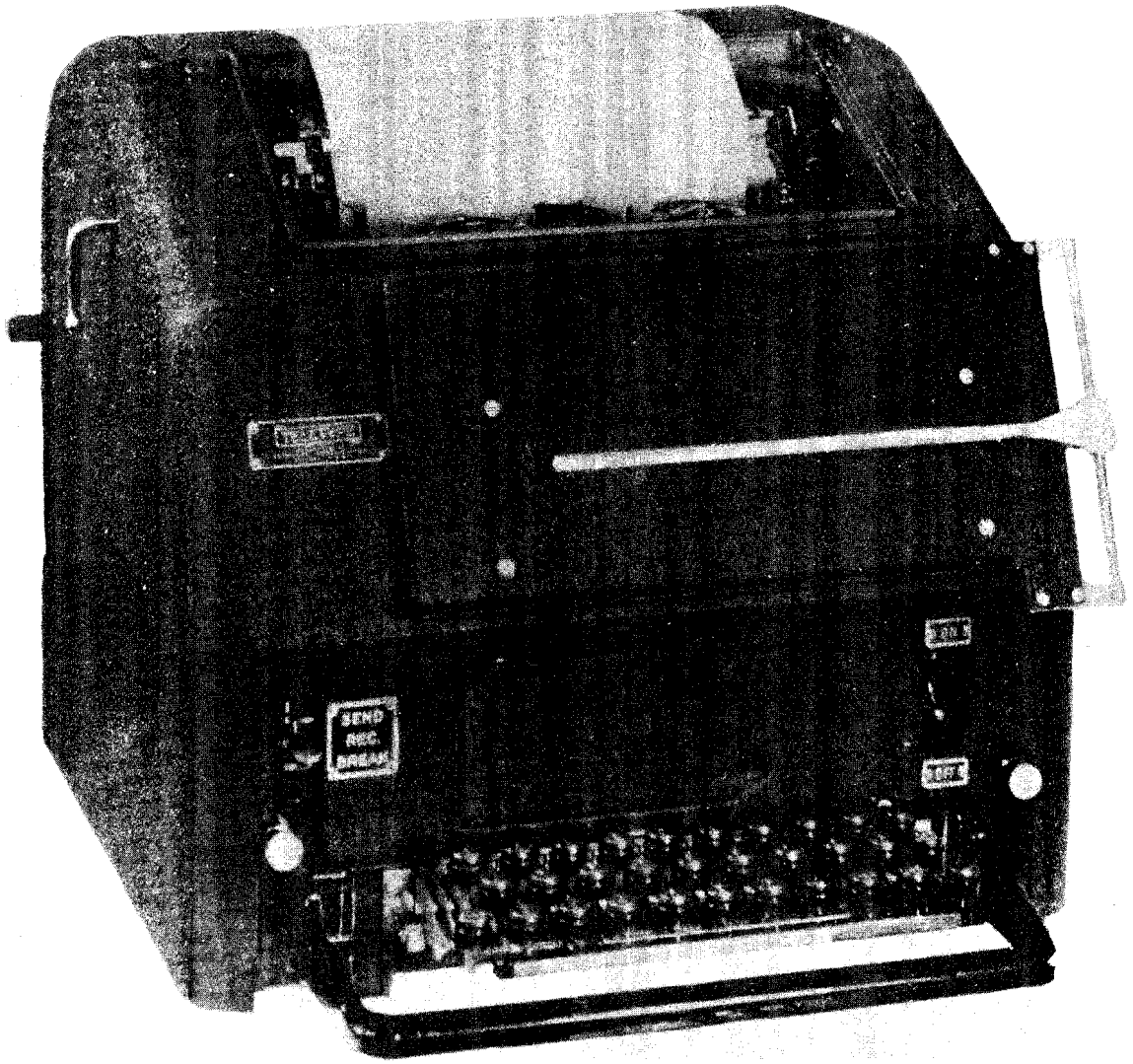
1. GENERAL.

1.1 The Model 15 Teletype Page Printer is a machine (made in U.S.A.) for interchanging telegraph messages between two or more points. A Sending-Receiving machine consists of a keyboard transmitter and a printer or typing unit, while for a Receiving-Only machine the keyboard is omitted; in other respects the machines are identical.

The keyboard transmitter sends signals in accordance with the five unit code to the receiving mechanism of the typing units at all stations connected to the circuit. These received signals are translated by the selector unit and cause the typing unit to print a copy of the message sent from the keyboard at the sending station.

1.2 Signalling Code. The signalling code is the "Start-stop" five unit code consisting of five code impulses which may be either "Marking" or "Spacing", preceded by a spacing start impulse, and followed by a marking stop impulse to maintain synchronism between the selector units at all stations on the circuit, as already explained in Paper No. 7. Single current signals are used and impulses which energise the selector magnets are known as marking and those which do not are known as spacing.

1.3 The signalling circuits for connecting these machines to each other are described in Paper No. 10.



TELETYPE - PAGE PRINTER MODEL 15.

1.4 For ease of maintenance, the machine is made in three major units which are interchangeable between machines. Electrical connections between the units are made by means of jacks, so arranged that when a unit is removed from the machine the signalling circuit is not interrupted and other stations on the circuit may communicate with each other. Mechanical connections between the units are usually in the form of gears. The major units are the Keyboard, the Typing Unit and the Base, and each unit is described in the following Sections.

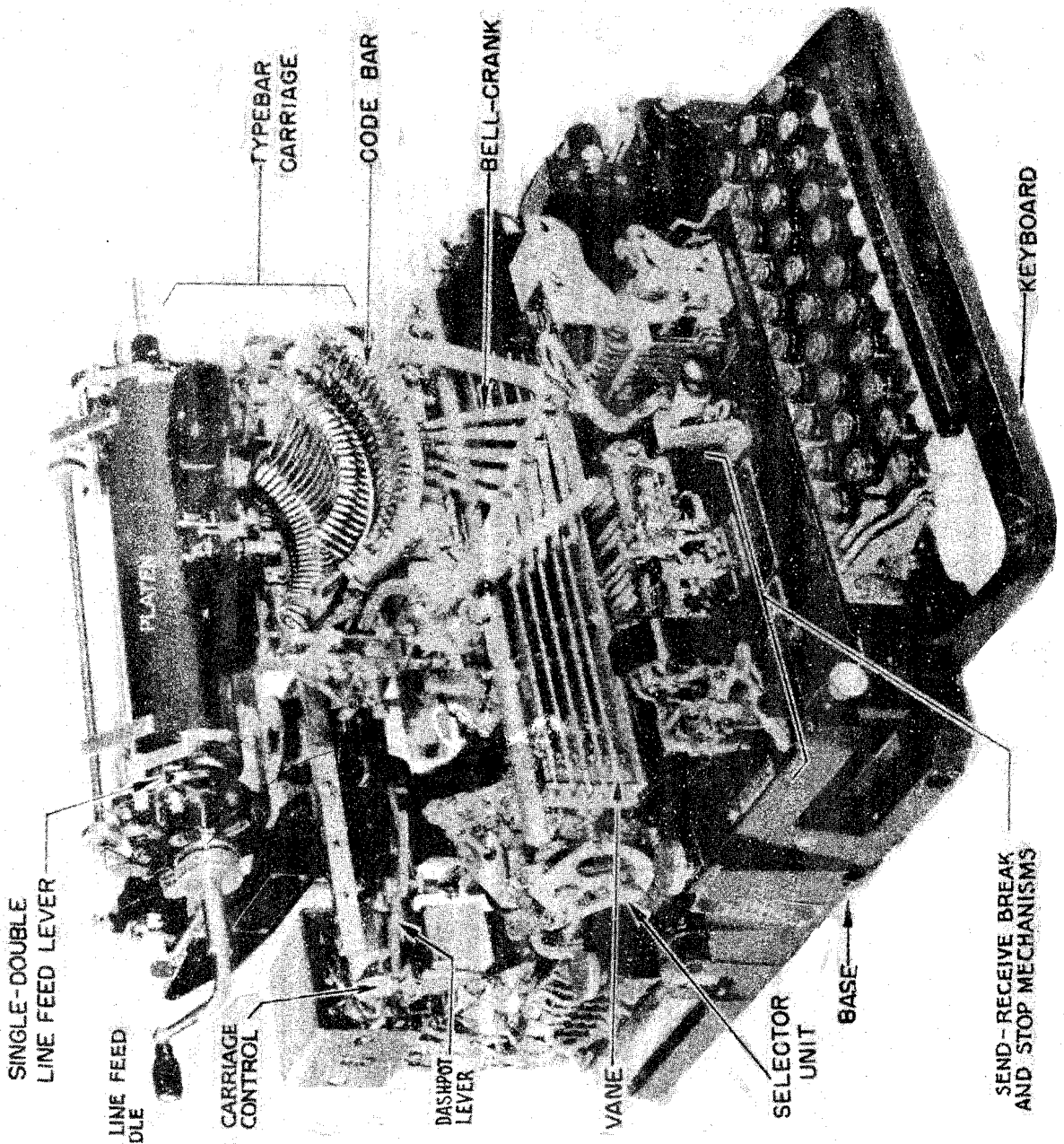
2. KEYBOARD UNIT.

2.1 The keyboard (as shown in Figs. 1 and 2) consists of a set of keys, key-levers, a bank of six sending contacts in parallel, operating cams, clutch and gear. This gear engages with the transmitting shaft driving gear on the main shaft. The sending cams are normally held stationary because the clutch on the driving shaft is held apart by the clutch throw-out lever. When a key is depressed, the driven member of the clutch is permitted to move into mesh with the driving member, causing the cam sleeve to revolve. At the end of the revolution, the driven member of the clutch is disengaged by the clutch throw-out lever and the cam sleeve is brought to rest until the next key is depressed (Fig. 3).

2.2 Beneath the key-levers are five selector bars and a universal bar extending across the width of the keyboard. The universal bar (Fig. 3) is connected to the trip-off pawl for controlling the starting and stopping of the cam sleeve and is pivoted at its two ends in such a way that the depression of any key moves it downwards causing the trip-off pawl to move towards the left in Fig. 3. The tip of the trip-off pawl engages the intermediate pawl causing it to rotate slightly in a clockwise direction. The right-hand extension of the intermediate pawl bears down on the clutch throw-out lever causing this lever to move its upper end away from the throw-out cam. This allows the driven clutch member to move along the shaft, under the tension of the spring, and to engage the driving clutch member, thus coupling the motor via the gear trains to the cam sleeve which commences to revolve.

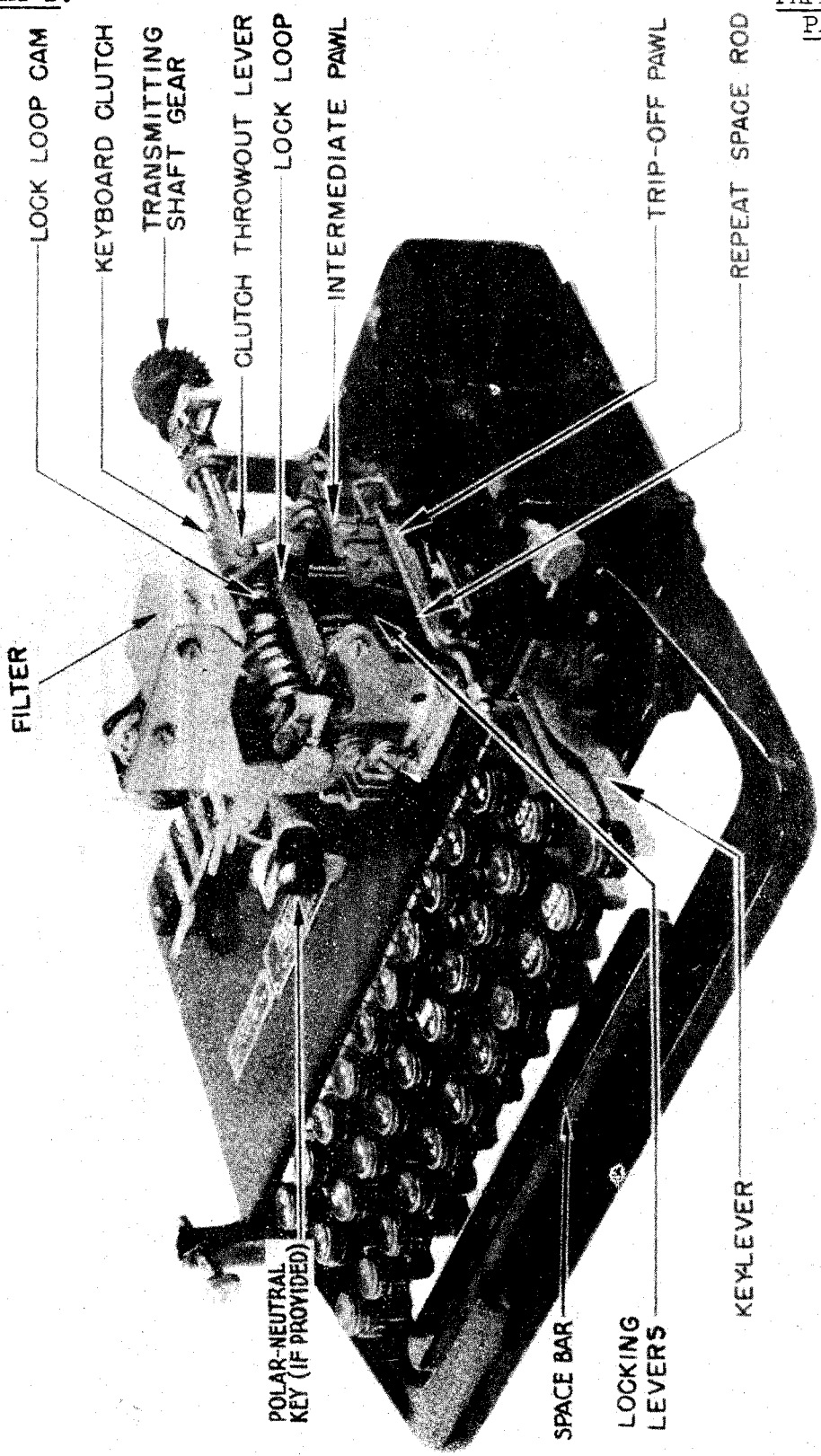
The selector bars are provided with saw-tooth shaped notches (as shown in Fig. 4) according to the requirements of the signalling code. These bars rest on rollers and are guided at each end so that they may be easily moved endways.

/ Fig. 1.



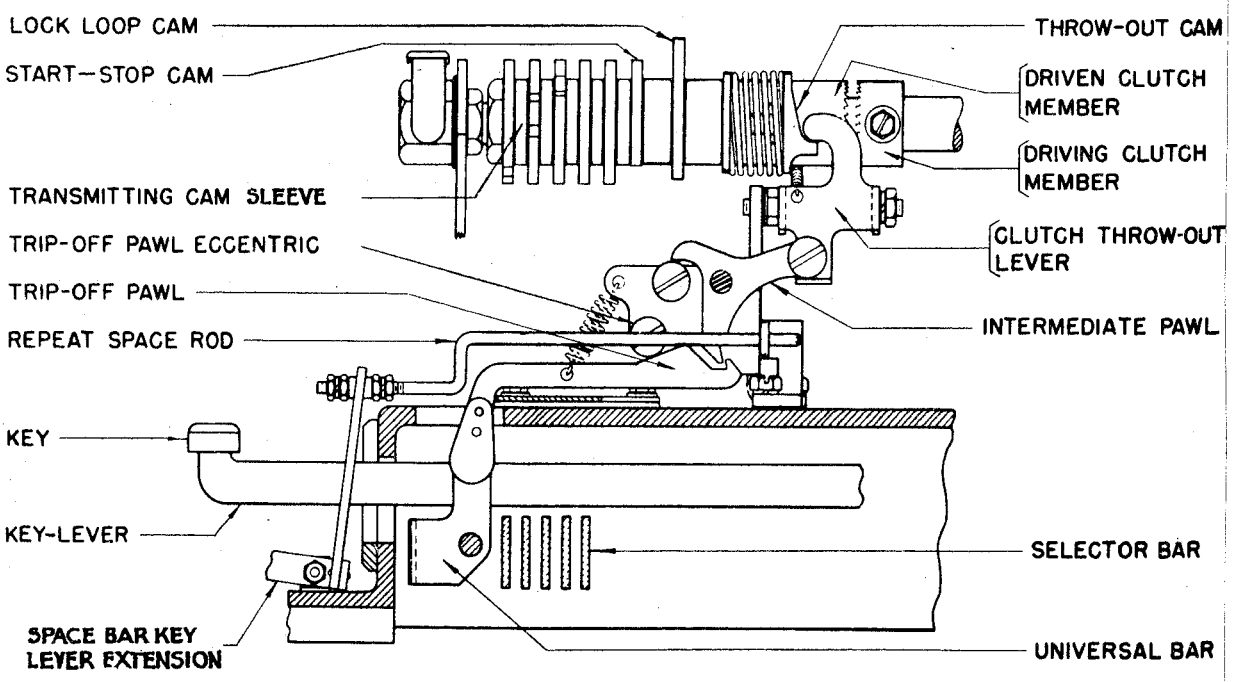
TELETYPE (MODEL 15).

FIG. 1.



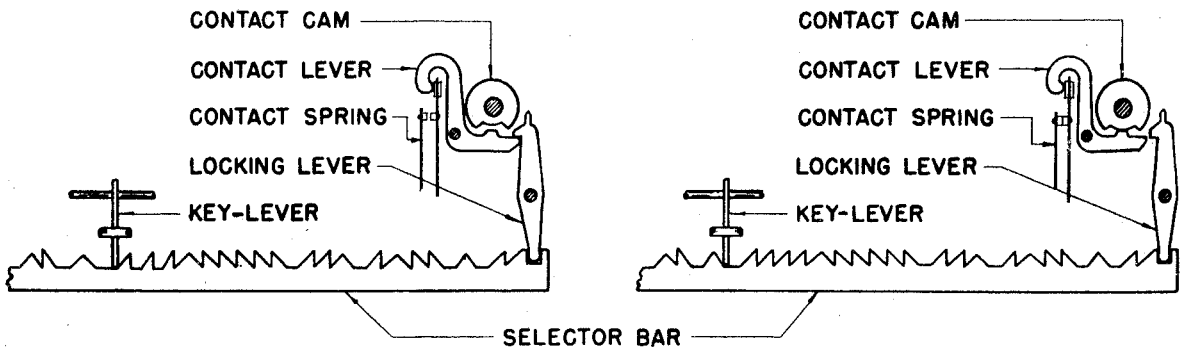
KEYBOARD.

FIG. 2.



OPERATION OF KEYBOARD CLUTCH.

FIG. 3.



(a) Spacing. (b) Marking.

OPERATION OF SELECTOR BARS.

FIG. 4.

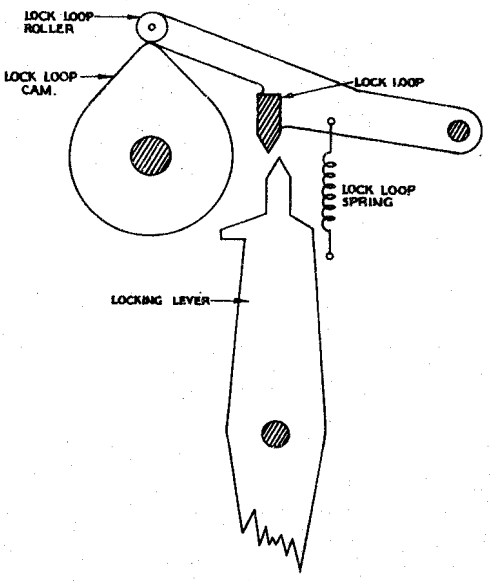
When a key is depressed, the key-lever strikes the slanting sides of these notches moving the bars either to the right for spacing impulses or left for marking impulses. Each selector bar (Fig. 4) engages a locking lever at its right-hand extremity and positions it to correspond with the signal impulses to be transmitted. Each locking lever controls the motion of a contact lever by either allowing the contact lever to close its contact when the cams revolve or restricting the motion of the contact lever. If the upper end of the locking lever is positioned to the left, corresponding to a spacing impulse (Fig. 4a), it engages the contact lever and prevents it from rising into the indent of the cam as it rotates, thus holding the circuit open for that impulse. If the locking lever is positioned to the right (Fig. 4b), corresponding to a marking impulse, it does not interfere with the movement of the contact lever. As the cam revolves, the contact lever rides on the cam surface and rises into an indent thereby allowing its contact to close, sending out a marking impulse. As the cams rotate, the impulses, either marking or spacing, are transmitted in succession.

2.3 The start-stop cam (shown in Fig. 3) controls an additional contact lever which in turn actuates the start-stop contacts. These contacts are opened at the beginning of each revolution of the cam shaft to transmit the start impulse (spacing) and remain open during the transmission of the five impulses. After the fifth impulse has been transmitted, the start-stop contacts close, sending the stop impulse (marking) to line. These contacts will remain closed until the next key-lever is depressed. At the end of the revolution, the clutch driven member is cammed out of mesh with the driving member by the ramp on the throw-out cam engaging the clutch throw-out lever and prevents the cam sleeve from rotating further until the next key is depressed.

2.4 The lock loop (see Figs. 5 and 6) which is raised by the lock loop cam at the end of each revolution, to allow the next combination to be set up in its down position, prevents a change in the selection set up while the signals are being sent out. This is done by holding the locking levers in their set positions and engaging on the projections on the tops of the locking levers. This arrangement also makes it impossible to depress another key until the signal for the previous character has been transmitted.

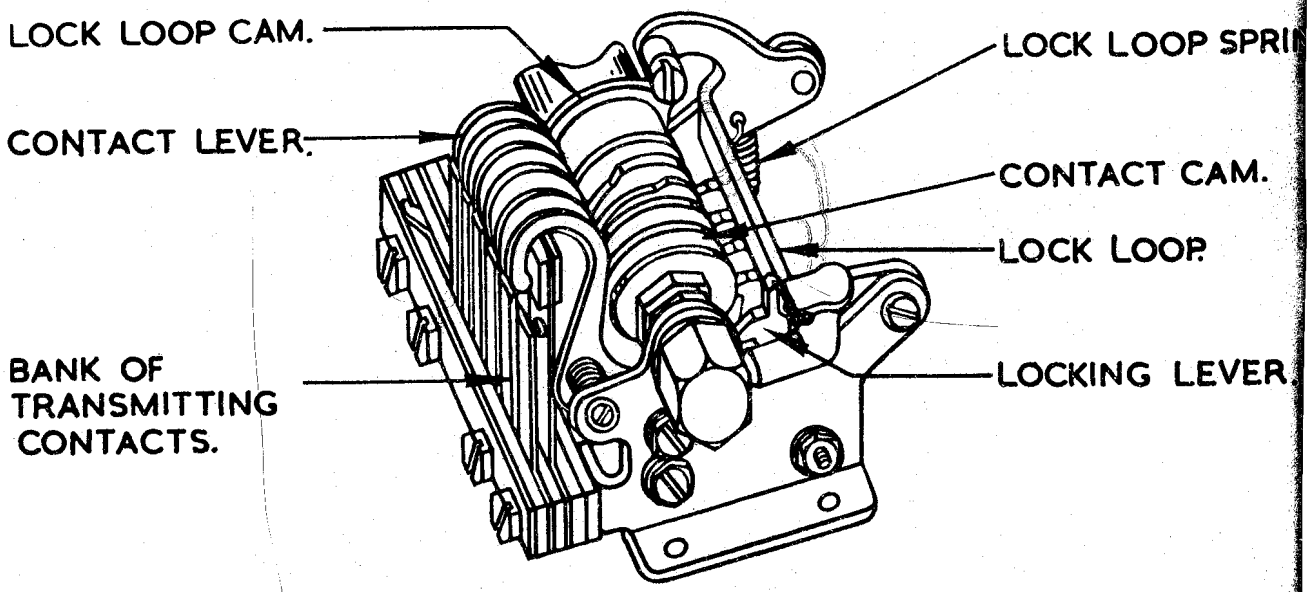
2.5 The keyboard, as shown in Figs. 2 and 3, is equipped with a space bar repeat device which permits the transmission of continuous train of impulses for spacing the carriage without printing any character. When the space bar is depressed, the space repeat rod attached to the key-lever extension will rotate the intermediate pawl, in turn holding the clutch throw-out lever out of engagement with the projection on the driven clutch. The transmitter cam sleeve revolves continuously until the space key-lever is released. The normal key-lever portion of the space bar positions the selector bars in accordance with the code to be transmitted in the usual manner.

/ Fig. 5.



OPERATION OF LOCK LOOP.

FIG. 5.



ASSEMBLY OF TRANSMITTER MECHANISM.

FIG. 6.

2.6 Polar-Neutral Key. Mounted on the keyboard (to the left of the transmitting contact assembly) is the "Polar-neutral" key (Fig. 2). This key performs no function in Model 15 Teletype as used by the Department and has been omitted from many machines.

3. TYPING UNIT.

3.1 The type bar carriage of the Model 15 Typing Unit (Printer) consists of type bars similar to those of a typewriter together with other associated parts. The type bars are mechanically thrown against a platen over which the paper passes, causing characters to be printed. The type bar to be selected is determined by the setting of five code bars which are actuated by signals through the medium of the selector mechanism. The code bars are so arranged that the notches on their upper sides will be lined up to permit the selected pull bar to move down into the path of the pull bar bail. This bail moves the pull bar forward causing the type bar to which it is connected to strike the platen. Fig. 1 shows the typing unit mounted on the base with a keyboard.

The various functions - Line Feed, Carriage Return, Space, Figure Shift, Letter Shift, etc. - are also done mechanically. A motor drives the main shaft assembly of the typing unit which supplies power to all mechanically operated parts.

3.2 Main Shaft Assembly (Fig. 7). The main shaft gear is located near the right end of the shaft and meshes with the motor pinion. The main shaft revolves continuously. The keyboard cam shaft is driven through the transmitting shaft driving gear mounted on the main shaft.

The main shaft spacing gear meshes with the spacing shaft gear to provide the spacing action at the required time. The spacing escapement ratchet, sleeve and friction discs are associated with the spacing mechanism and are described under "Spacing" (paragraph 3.8). The function bail cam and the printing bail cam operate their respective bails. The main shaft clutch is used in conjunction with the selector to provide power to operate the printing and function bails immediately after the selection has been completed. The selector cam sleeve is fitted over the left end of the main shaft and is driven through the medium of a friction clutch.

/ Fig. 7.

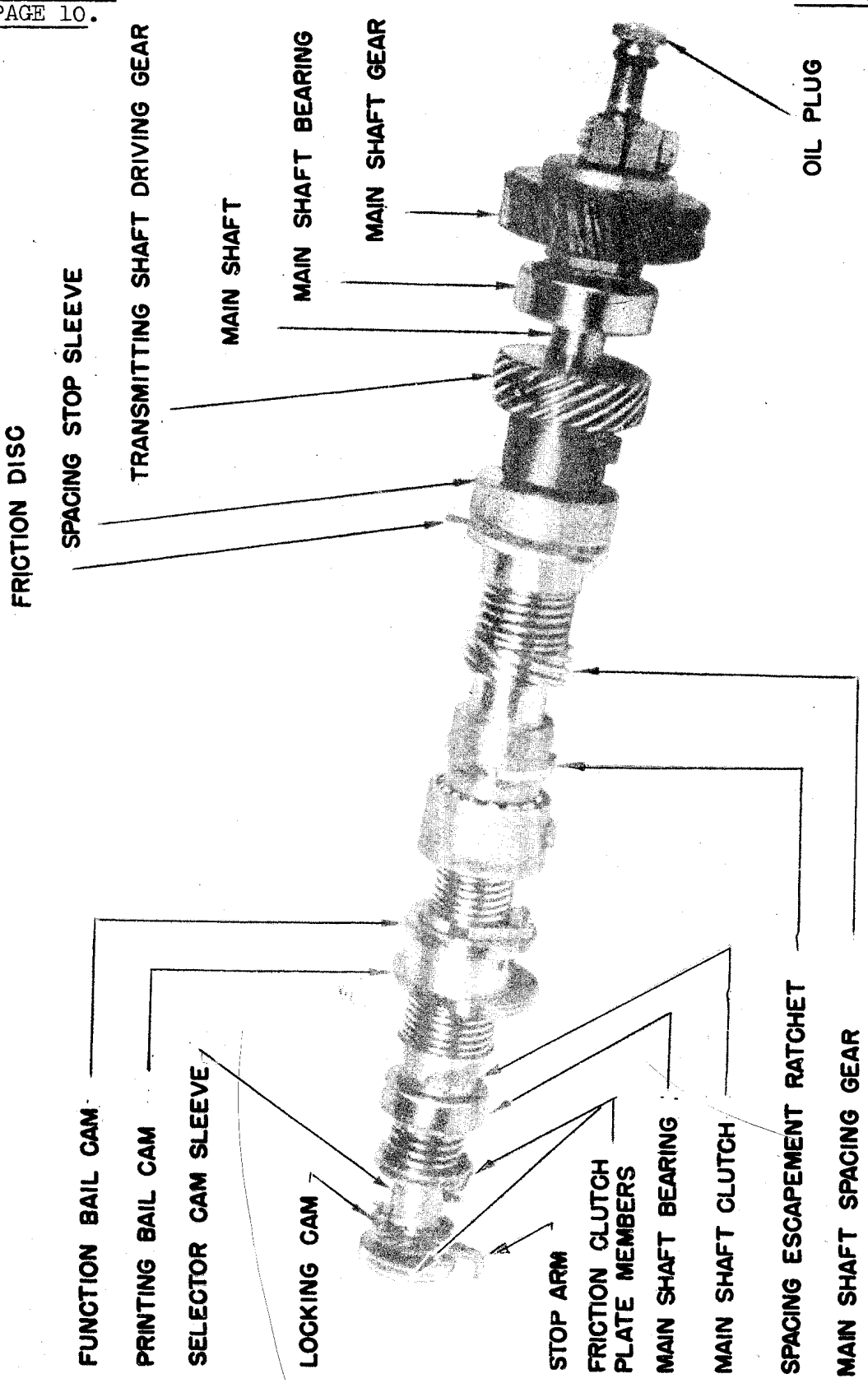


FIG. 7. MAIN SHAFT ASSEMBLY.

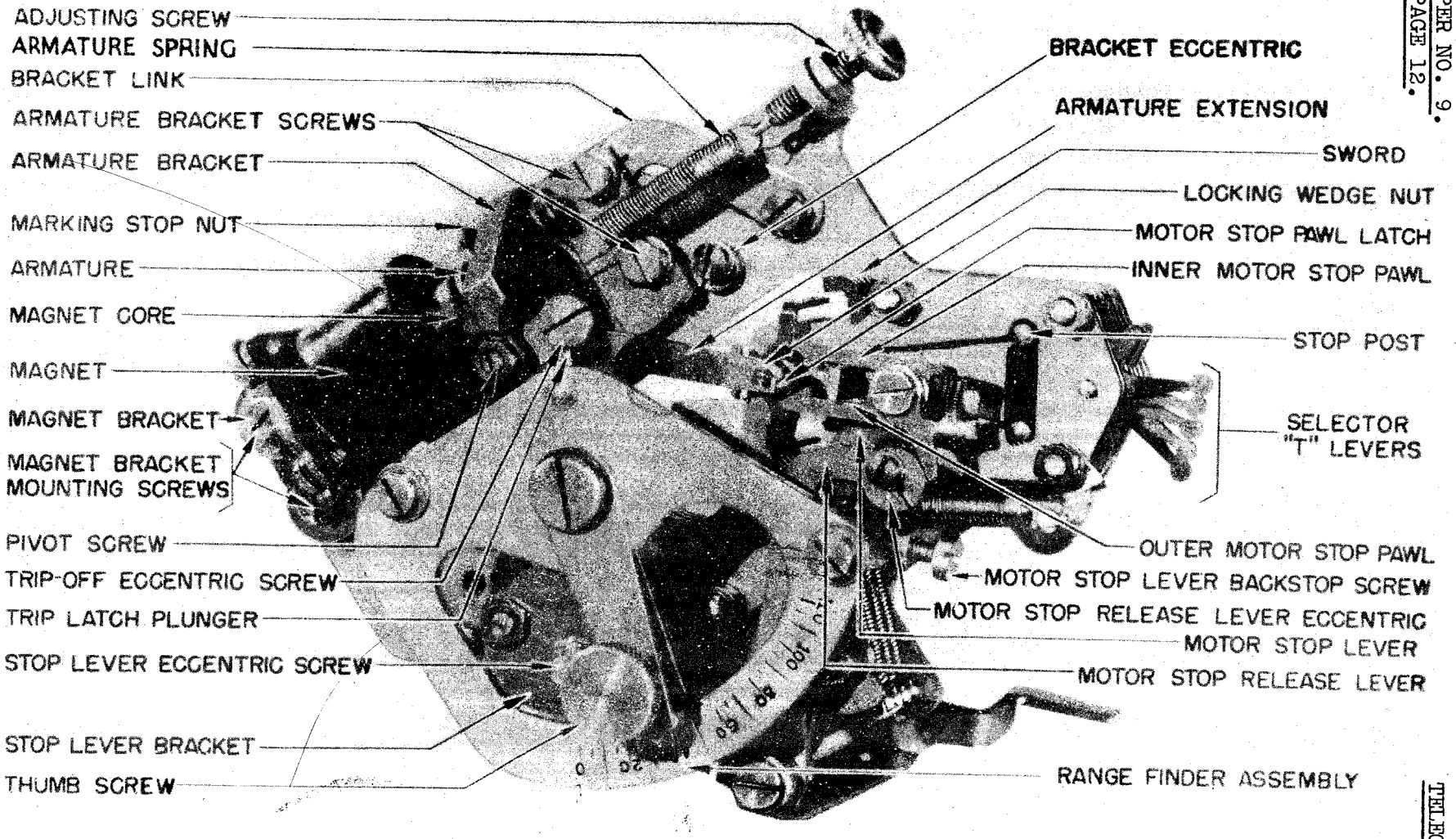
3.3 Selector Unit. (Figs. 8 and 9).) The purpose of the selector unit is to receive the signals and distribute them mechanically, thereby setting up various combinations on vanes. These combinations will determine the character to be printed or the function to be performed. The selector mechanism is controlled by the magnet which responds to the code impulses. At rest, the armature of the magnet is energised and the stop arm is against the stop lever which in turn is held by the trip latch. Because the stop arm which is a part of the selector cam sleeve is engaged with the stop lever, the cam sleeve is prevented from revolving. When the start impulse, which is spacing (a period of no current), is received, the armature is released and pulled away from the magnet pole pieces by the armature spring. The trip-off eccentric screw, which is part of the armature, depresses the trip latch plunger and operates the bell-crank which moves the trip latch out of engagement with the stop lever, thereby releasing the stop arm and allowing the selector cam sleeve to revolve with the main shaft.

Each vane, as shown in Fig. 10, is operated by a projection on the selector cam sleeve through a "T" lever, a sword and a selector lever. For instance, suppose that the code for the letter "E" is received. Upon the reception of the start impulse (a no current impulse), the armature moves away from the magnet, imparting motion first to the trip latch plunger (Fig. 9), which, in turn, causes the bell-crank to move the trip latch out of engagement with the stop lever releasing the stop arm, as explained previously. The selector cam sleeve starts to revolve.

The first impulse of the letter "E" (marking or current impulse) is received by the magnet and the magnet armature is attracted, bringing the upper end of the armature extension into the path of the upper sword arm. When the number 1 cam engages the number 1 selector lever, this lever is rotated counter-clockwise, carrying with it the sword which strikes the upper end of the armature extension and is in turn rotated clockwise about its pivot, point "A" in Fig. 10. This positions the sword so that when the number 1 cam clears the selector lever, the selector lever spring moves the sword against the "T" lever and brings the front edge of the number 1 vane down.

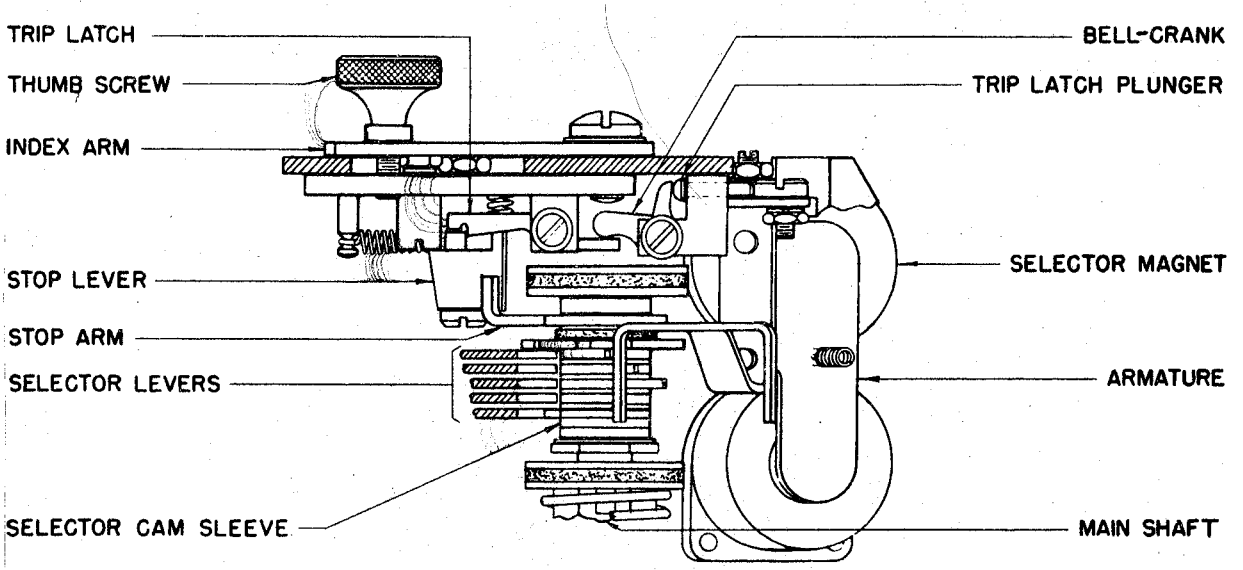
As no current is received by the magnet while number 2, 3, 4 and 5 cams are passing their selector levers, the magnet armature is released and the armature extension moves down so that the lower end of the armature extension is in the path of the lower sword arm. As the number 2, 3, 4 and 5 cams pass the number 2, 3, 4 and 5 selector levers, the number 2, 3, 4 and 5 swords are positioned so that the number 2, 3, 4 and 5 vanes are moved with their front edges up. When the front edges of the vanes are in the upper position, the corresponding code bars (Fig. 1) will be moved to the right through the medium of the bell-cranks. When the front edges of the vanes are in the lower position, the corresponding code bars will be moved to the left.

/ Fig. 8.



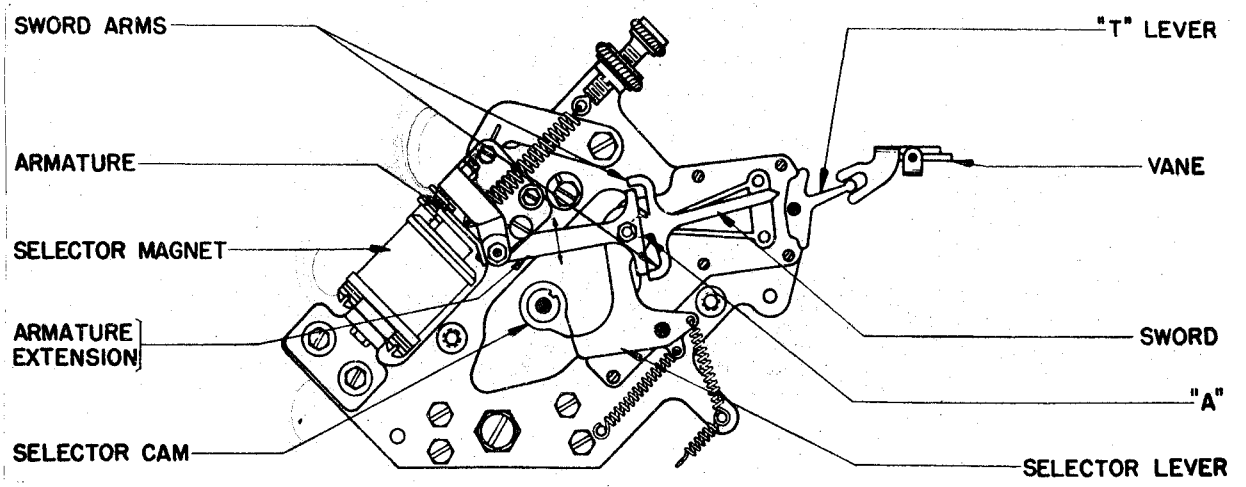
SELECTOR UNIT.

FIG. 8.



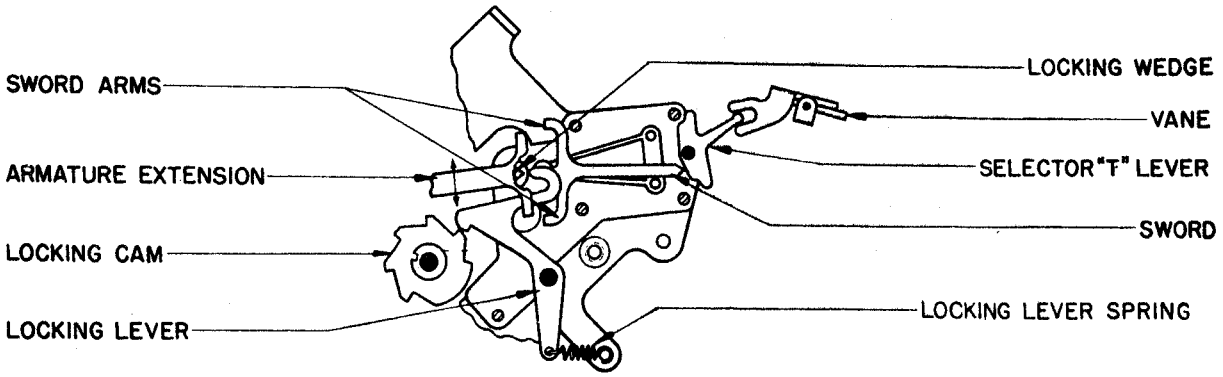
ANOTHER VIEW OF THE SELECTOR UNIT.

FIG. 9.



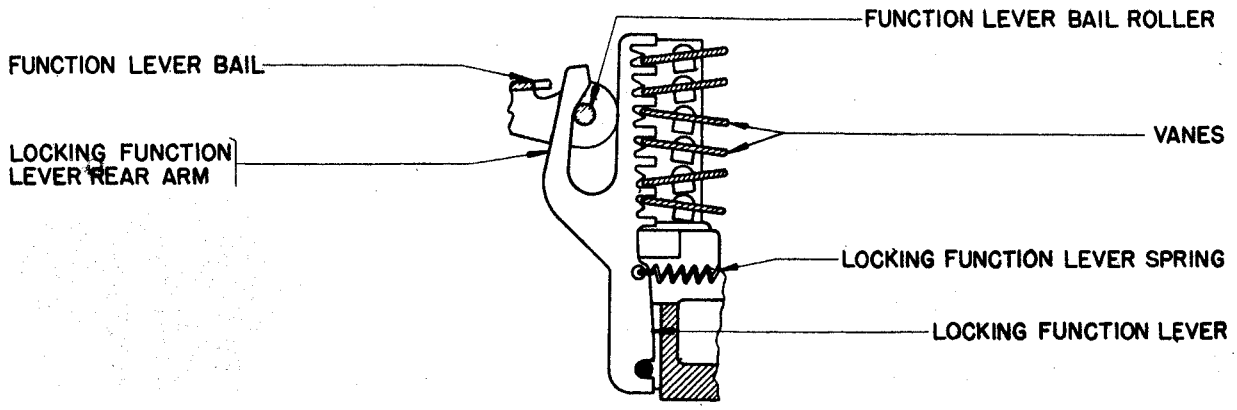
OPERATION OF VANES BY SELECTOR UNIT.

FIG. 10.



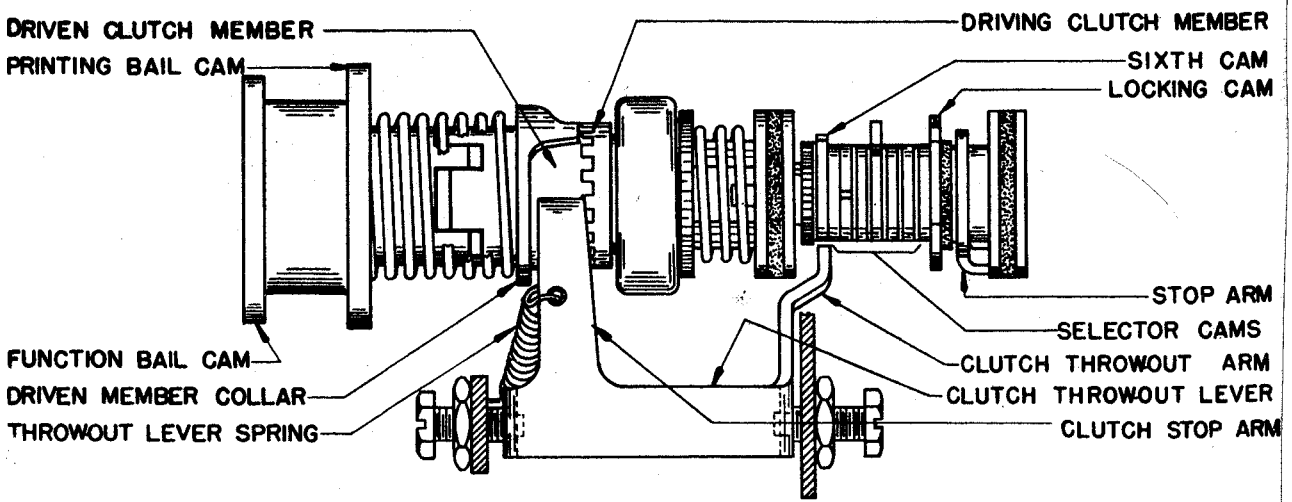
LOCKING LEVER.

FIG. 11.



LOCKING FUNCTION LEVER.

FIG. 12.



PART OF MAIN SHAFT AND CLUTCH THROW-OUT LEVER.

FIG. 13.

When the number 1 code bar is to the left and number 2, 3, 4 and 5 code bars are to the right, there is a notch in each code bar under the "E" pull bar.

The sixth cam releases the main shaft clutch allowing the printing and function bail to make one complete revolution (Fig. 13). The printing bail cam will permit the printing bail to be pulled forward by its spring. The "E" pull bar will be pulled down by its spring into the path set up by the code bars and the pull bar bail, actuated by the printing bail, will carry the pull bar forward causing the type bar to strike the platen printing the letter "E" (Fig. 14).

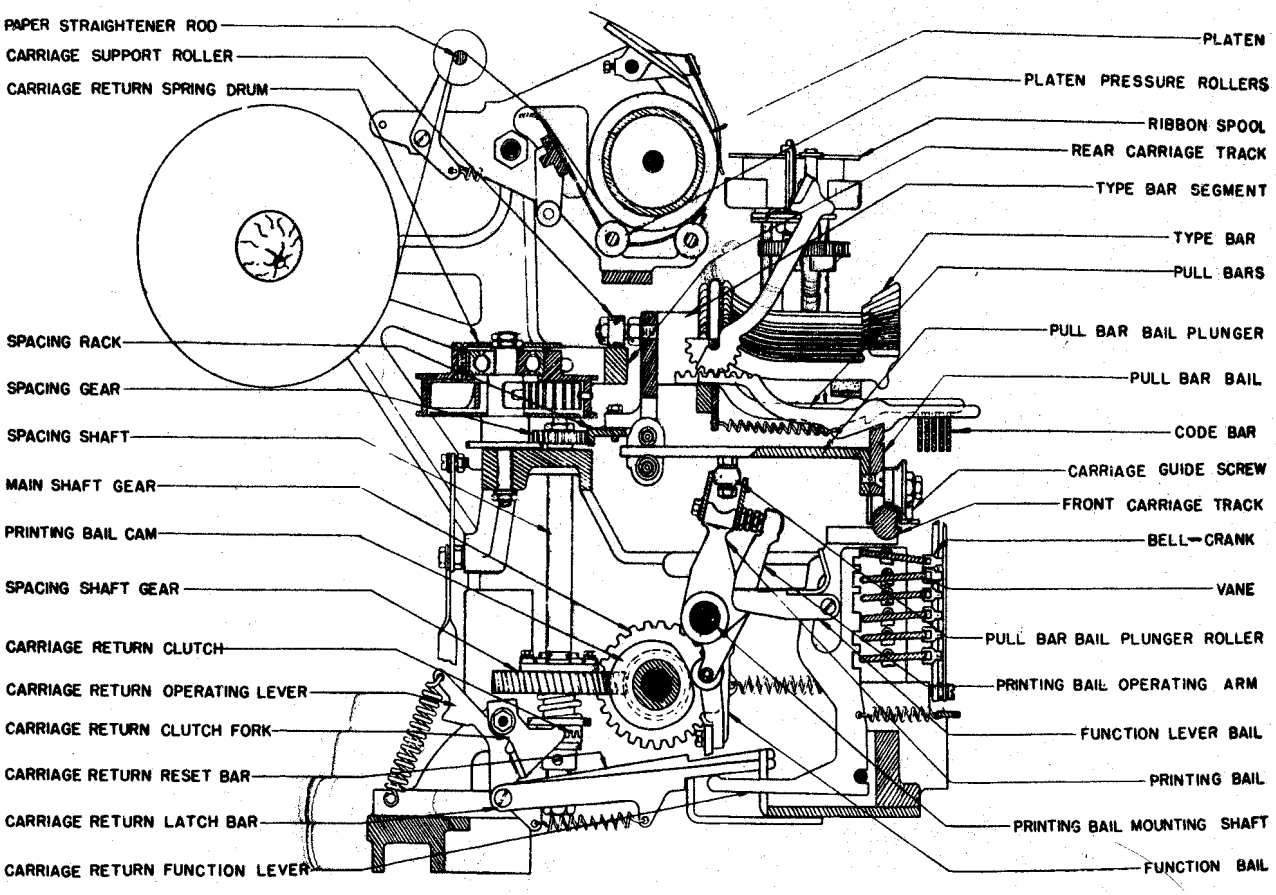
3.4 Locking Cam. The locking cam has five low and five high portions on its periphery against which the locking lever is held by its spring (Fig. 11). During the part of each impulse when the swords are set by striking against the armature extension (at the time the peak of any selector cam is operating the corresponding selector lever), a low portion of the locking cam is opposite the locking lever. The armature will now be held firmly in position by the "U" shaped extension of the locking lever engaging the locking wedge on the armature extension. When the locking lever is riding on the high portion of the locking cam, the locking lever extension will be held away from the locking wedge and the armature will be free to move in response to the next impulse.

3.5 Locking Function Lever. The vanes are held in their selected positions until the printing of the character has taken place. This is accomplished by means of the locking function lever. The locking function lever is the first on the right of the function levers, which are located immediately behind the vanes (Fig. 12). When the printing bail is in its rear position, the function lever bail, mounted on the printing bail casting, is holding the locking function lever away from the vanes. When the printing bail is permitted to move forward, the function lever bail roller moves down, allowing the function lever spring to pull the lever against the rear edges of the vanes. The locking function lever will engage each vane, whether its rear edge be raised by a marking impulse or brought down by a spacing impulse, locking the vanes in their selected positions.

The operation of the other function levers is dealt with under "Functions" (paragraphs 3.14 to 3.20).

3.6 Main Shaft Clutch Throw-Out Lever. As previously described, the sixth cam on the selector cam sleeve releases the main shaft clutch allowing the printing and function bail cams to make one complete revolution (Fig. 13). At the end of each revolution of the printing and function bail cams, the clutch stop arm engages with the projection on the driven clutch member and cams it out of mesh with the driving clutch member.

/ Fig. 14.



CROSS-SECTION TYPING UNIT.

FIG. 14.

Immediately after the fifth impulse has been received, the peak of the sixth cam strikes the clutch throw-out lever cam arm moving the lever stop arm out of engagement with the projection on the driven clutch member. This will permit the spring to move the driven clutch member into mesh with the driving member. Thus, it may be seen that immediately after the completion of the selection of any character or function, the printing and function bail cams will be permitted to revolve one revolution, which will affect the printing of that character or the operation of that function. Any character or function may be selected while the printing of the previous selection is taking place.

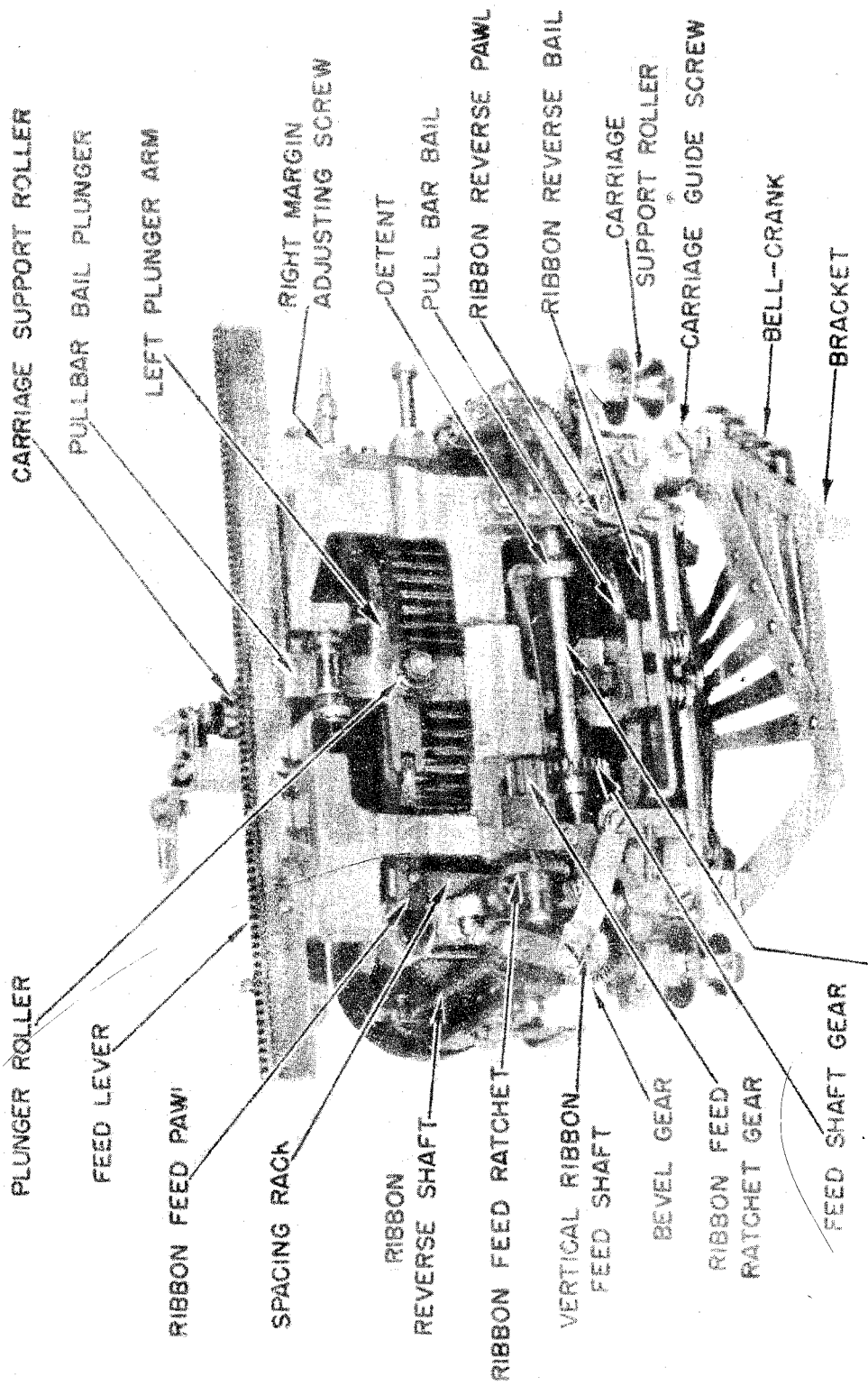
3.7 Printing. The printing bail operating arm is mounted on the bail mounting shaft. Also mounted on the mounting shaft are the printing bail, function bail and spacing escapement pawls. The printing bail spring attached to the right-hand end of the printing bail casting holds the printing bail against the upper end of the operating bail arm and the operating arm roller against the printing bail cam on the main shaft. Thus, it will be seen that the printing bail cam will determine the position of the printing bail at all times (Fig. 14).

The actual printing of any character is not caused directly by the printing bail, but by the pull bar bail which it controls. The pull bar bail is attached to the pull bar bail plunger, on the lower surface of which is attached the plunger roller (Fig. 15). This roller (when the type bar carriage is in place) is located between the printing bail blades (Fig. 14). This arrangement will permit the carriage to move from left to right and also allow the pull bar bail to be moved backwards and forwards by the printing bail, regardless of the position of the type bar carriage.

At the end of each revolution of the printing bail cam, the printing bail operating arm roller will be on the high portion of its cam. The printing bail will be in its rearmost position, carried there against the tension of its spring.

As the printing bail cam revolves, the roller on the printing bail operating arm will move against the low portion of the cam. The printing bail will follow the upper end of the operating arm, being pulled forward by its spring, and will move the pull bar bail forward. The forward motion of the pull bar bail will first allow all of the pull bars to be pulled down against the code bars by their respective springs, the selected pull bar being pulled down further than the rest, into the path set up for it in the code bars. As the pull bar bail continues on its forward stroke, it will engage the notch in the selected pull bar only (the remaining ones being too high for their notches to engage) and carry the pull bar forward, throwing the type bar which is geared to it against the platen, printing the character. Fig. 14 is a cross-section of the typing unit, and a type bar being thrown against the platen.

/ Fig. 15.



TYPE BAR CARRIAGE (BOTTOM VIEW).

FIG. 15.

The operating arm roller will again ride up on to the high portion of the printing bail cam as it completes its revolution. Thus, the operating arm brings the printing bail back to its rearmost position and in turn the pull bar bail which is engaged in it. When the pull bar bail is in its rear position, all the pull bars are moved sufficiently high to clear the code bars and, thus, they are free to move in either direction. The combination for the succeeding letter then takes its place in the code bars and the printing operation is repeated, as described in the foregoing.

3.8 Spacing. On Model 15 Printer, the type bar carriage is moved to accomplish the spacing. The type bar carriage is supported on two tracks. The upper track is a rectangular rod and is located to the rear. The lower track is a circular rod and is located above the vanes (Figs. 14 and 17). The type bar carriage is moved by the spacing gear which is meshed with the spacing rack and is facilitated by three carriage support rollers, two of which operate on the front track and one on the rear track. The front track is slotted throughout its length, so that the heads of two carriage guide screws, located at either side of the carriage casting, will be guided therein.

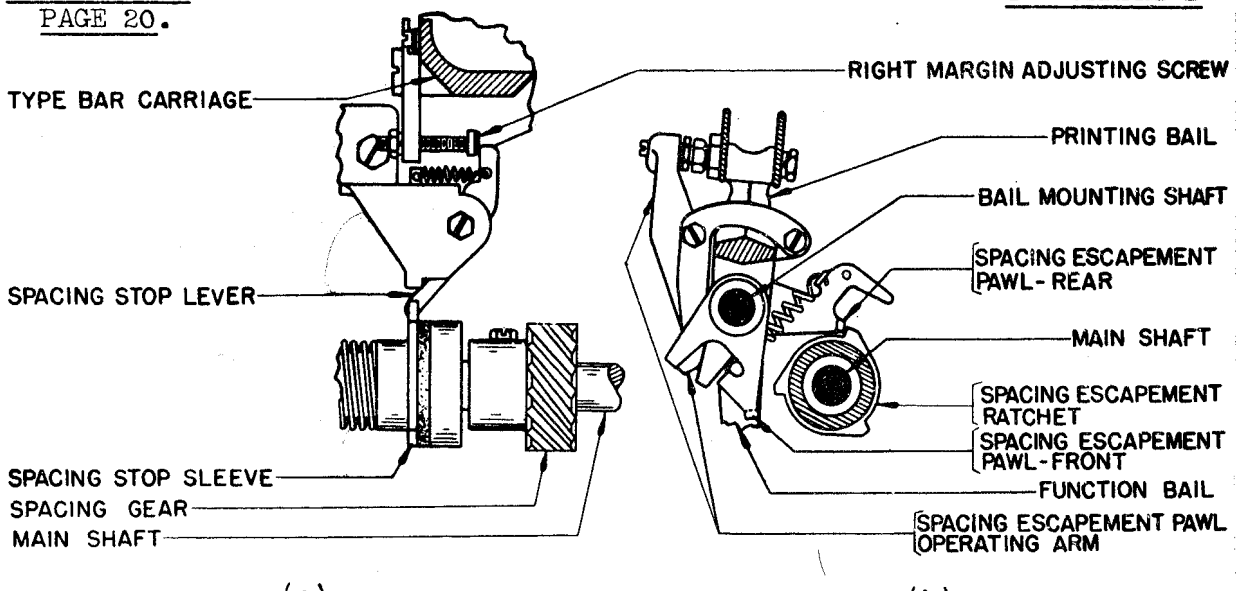
The spacing rack is mounted on the rear of the type bar carriage casting and meshes with the spacing gear which is fastened to the upper end of the spacing shaft (see Fig. 20). The spacing shaft gear is located at the lower end of the spacing shaft and meshes with the main shaft spacing gear. The lower half of the carriage return clutch is fastened to the spacing shaft (Fig. 14). The upper half of the clutch forms a sleeve on the spacing shaft to which the spacing shaft gear is attached. The carriage return clutch members are in engagement at all times, except when the carriage is returning from the end of a line. The function of this clutch is described under "Carriage Return".

The main shaft spacing gear (see Fig. 7) is a part of the sleeve of a friction clutch assembly. It consists of the spacing ball-bearing screwed to the shaft, a spacing escapement ratchet, a friction disc and felt washer, a spacing stop sleeve and a clutch spring. The main shaft spacing gear will revolve with the main shaft unless stopped by holding either the spacing stop sleeve or the spacing escapement ratchet.

When the type bar carriage reaches the end of its travel at the right end of the printer, the right margin adjusting screw (Fig. 16a) moves the spacing stop lever into the path of a projection on the spacing stop sleeve. This prevents spacing at the end of the carriage travel.

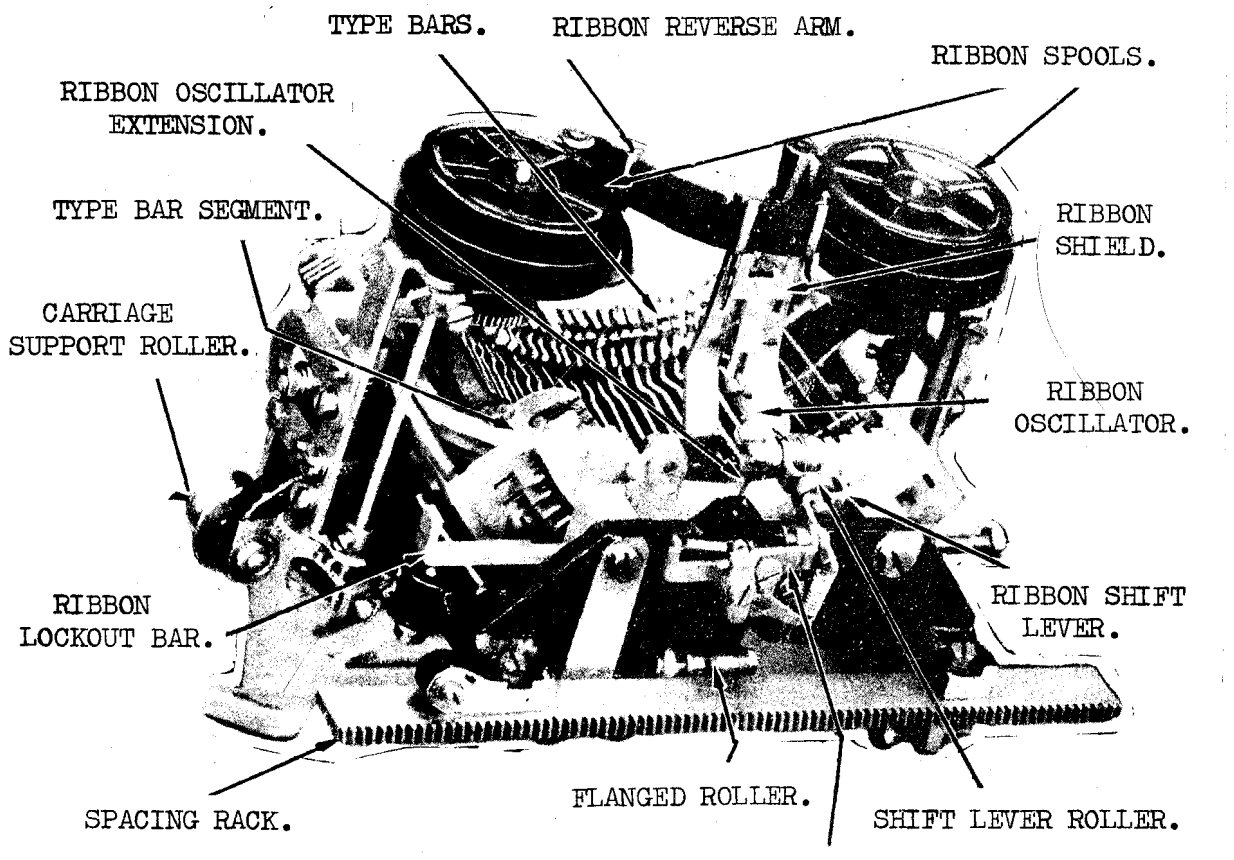
The spacing escapement ratchet is regulated by the front and rear escapement pawls which are mounted on the bail mounting shaft.

/ Fig. 16.



RIGHT MARGIN ADJUSTING SCREW AND SPACING MECHANISM.

FIG. 16.



REAR VIEW TYPE BAR CARRIAGE.

FIG. 17.

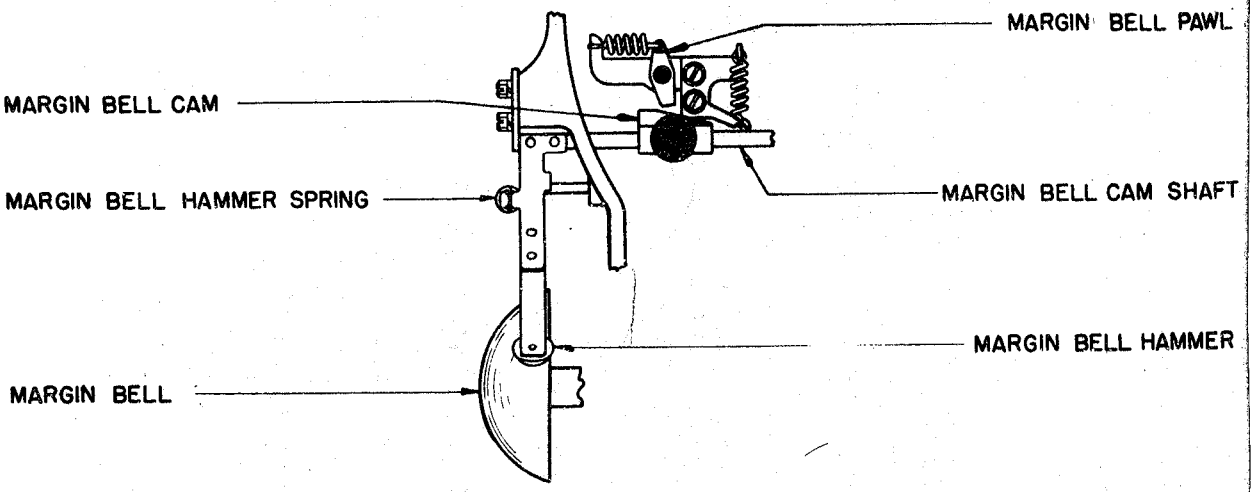
With the printing bail in its rear position, the rear escapement pawl is engaged in one of the teeth on the spacing escapement ratchet, holding the spacing gear sleeve (Fig. 16b). As the printing bail starts to move forward, the operating arm strikes the lower end of the rear pawl, moving it out of engagement with the tooth on the escapement ratchet, at the same time the front escapement pawl moves down against the escapement ratchet into the path of another tooth which it will engage after having travelled one-sixth of a space. The printing operation then takes place. Near the end of the return stroke of the printing bail, the escapement pawl operating arm lifts the front escapement pawl out of engagement with the escapement ratchet and at the same time the rear pawl moves against the ratchet. This will allow the spacing gear to revolve and complete the remaining portion of the space at the end of which time the rear escapement pawl will engage a tooth on the ratchet.

Spacing other than that accompanied by printing (such as spacing between words, etc.) is done in the same manner, except that there is no pull bar to be selected.

3.9 Margin Signal Bell. Before the type bar carriage reaches the end of its travel, it operates the margin bell as a warning to the operator that the end of the line is near (Figs. 18 and 20). The margin bell pawl on the type bar carriage will depress the margin bell cam, tipping it, moving the bell hammer away from the bell against the tension of its spring. When the type bar carriage bell pawl has been spaced beyond the cam, the bell hammer will be released and its spring will pull the hammer against the bell.

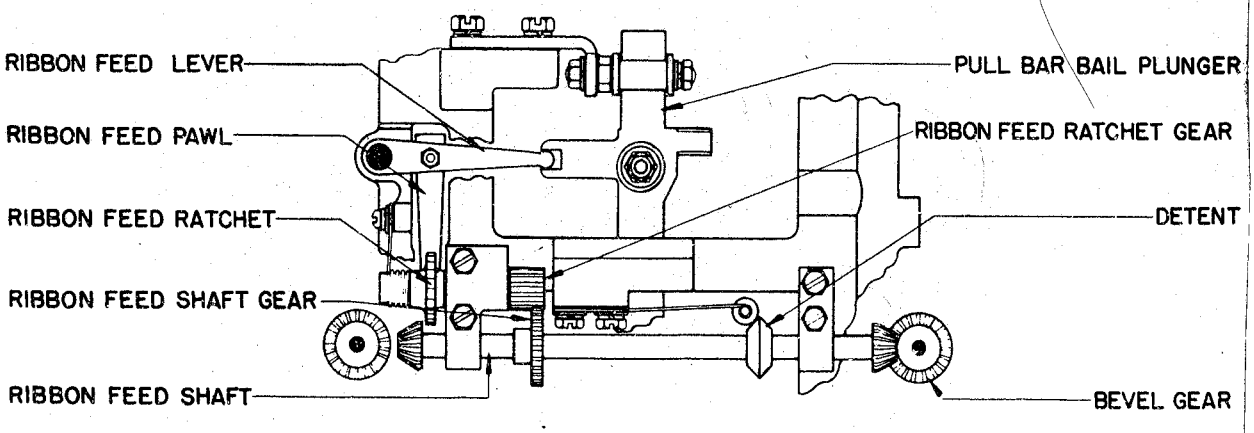
3.10 Ribbon Feeding. The end of the ribbon feed lever engages with the notched extension on the pull bar bail plunger (Fig. 19). The ribbon feed pawl, which actuates the feed ratchet, is attached to the ribbon feed lever. With each operation of the pull bar bail plunger, the ribbon feed ratchet and the ribbon feed ratchet gear, which is attached to a common shaft, is advanced one tooth. This motion is carried through a train of gears and shafts, causing one of the ribbon spools to be revolved.

3.11 Ribbon Reverse. Assuming that the ribbon is being wound on the right-hand spool and is almost unwound from the left-hand spool, an eyelet which is fastened to the ribbon will engage and move the left-hand ribbon reverse arm. This arm moves the left-hand ribbon reverse pawl into the path of the ribbon reverse bail (Fig. 21). As the bail moves toward the rear, it engages the pawl, moving the ribbon feed shaft to the left. This will disengage the right-hand ribbon feed shaft gears and engage the left-hand gears. The ribbon will then be wound on the left-hand spool. The reversing operation takes place in a similar manner on the right side of the assembly when the eyelet near the right end of the ribbon engages with the right-hand ribbon reverse arm. / Fig. 18.



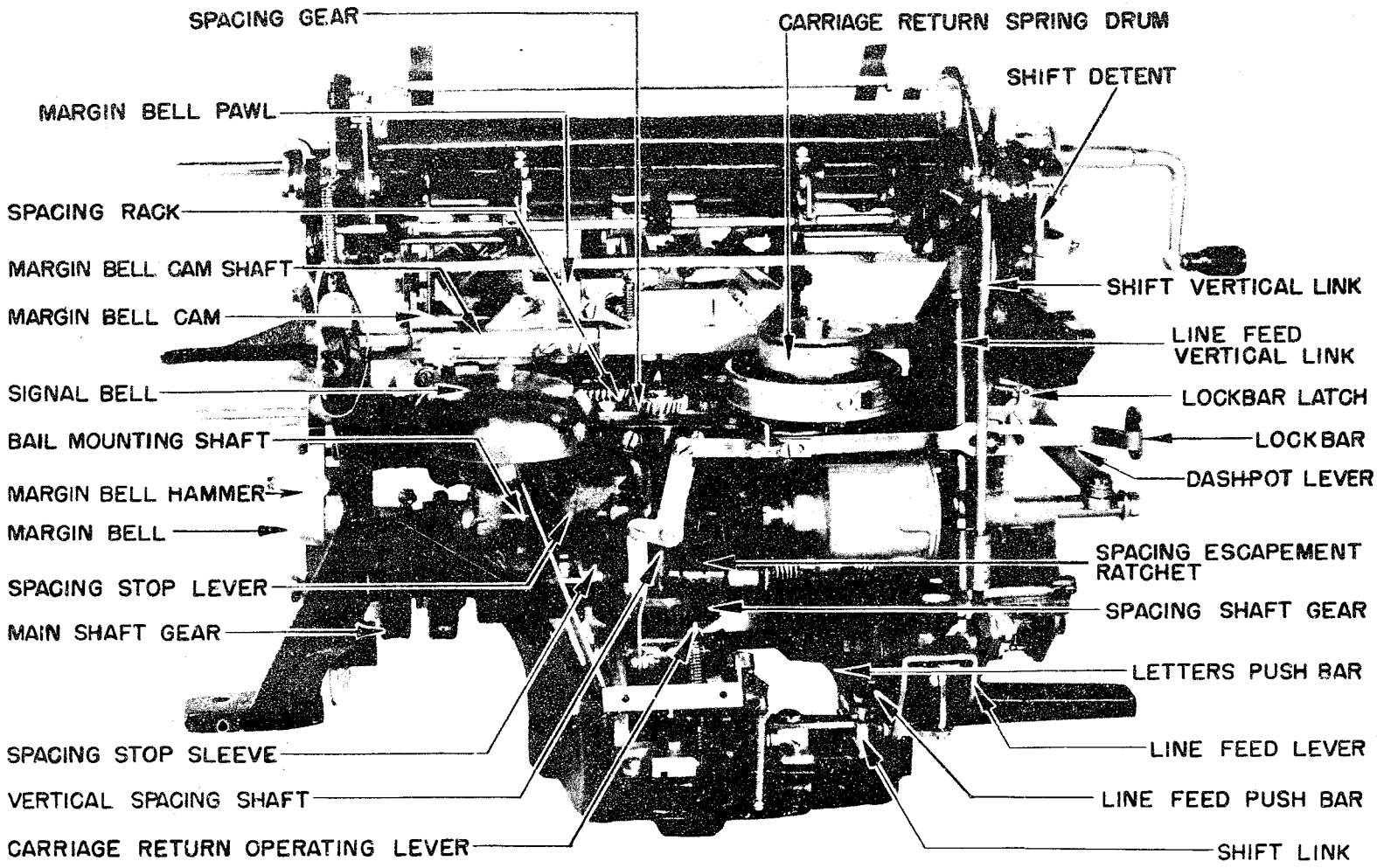
MARGIN SIGNAL BELL.

FIG. 18.



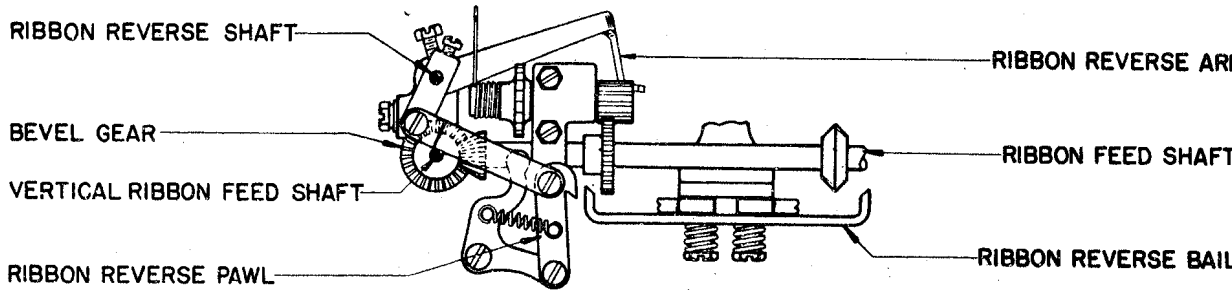
RIBBON FEED.

FIG. 19.



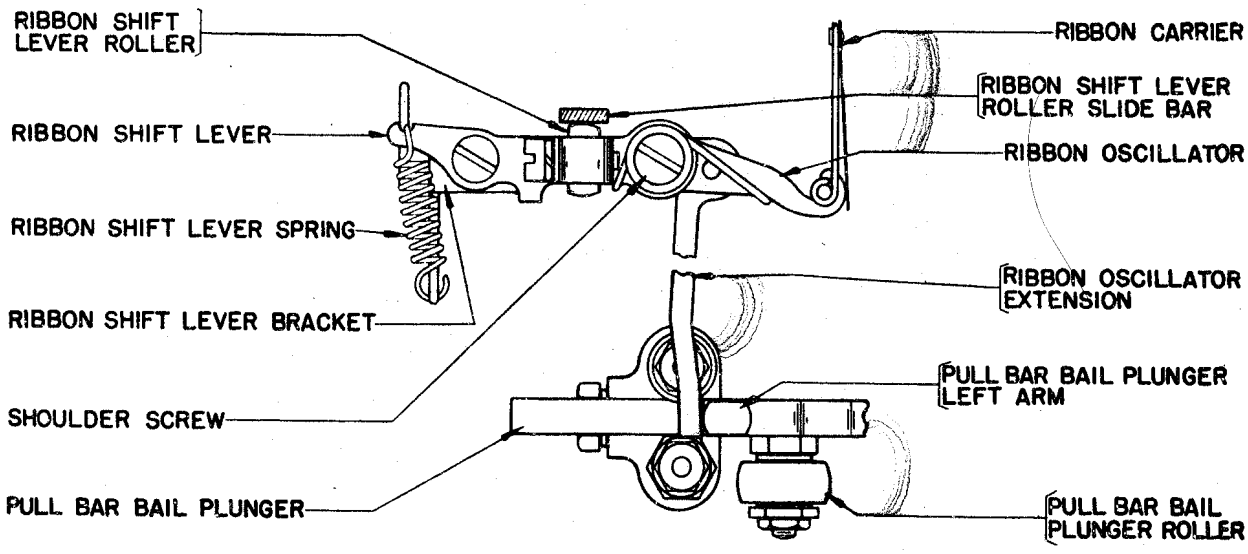
TYPING UNIT (REAR VIEW).

FIG. 20.



RIBBON REVERSE.

FIG. 21.



RIBBON OSCILLATOR.

FIG. 22.

3.12 Ribbon Oscillation. To allow the character to be seen, the ribbon is moved below the printing line after it has been printed. This is done by the ribbon oscillator which is actuated by the movement of the pull bar bail plunger (Fig. 22). Normally, the ribbon is held below the printing line by the pull bar bail plunger when in its rear position. The forward movement of the pull bar bail plunger will permit the oscillator spiral spring to move the ribbon shield upward carrying the ribbon into the path of the type bars.

The height to which the ribbon oscillator will raise the ribbon is determined by the position of the shift lever roller. Both the oscillator and the extension are pivoted on the ribbon shift lever. The shift lever spring holds the shift lever roller against the slide bar, which is mounted on the platen assembly. When the platen shifts to the "figures" position, the shift lever roller moves up with the slide bar and allows the shift lever spring to pull the ribbon oscillator assembly and ribbon to the higher printing line.

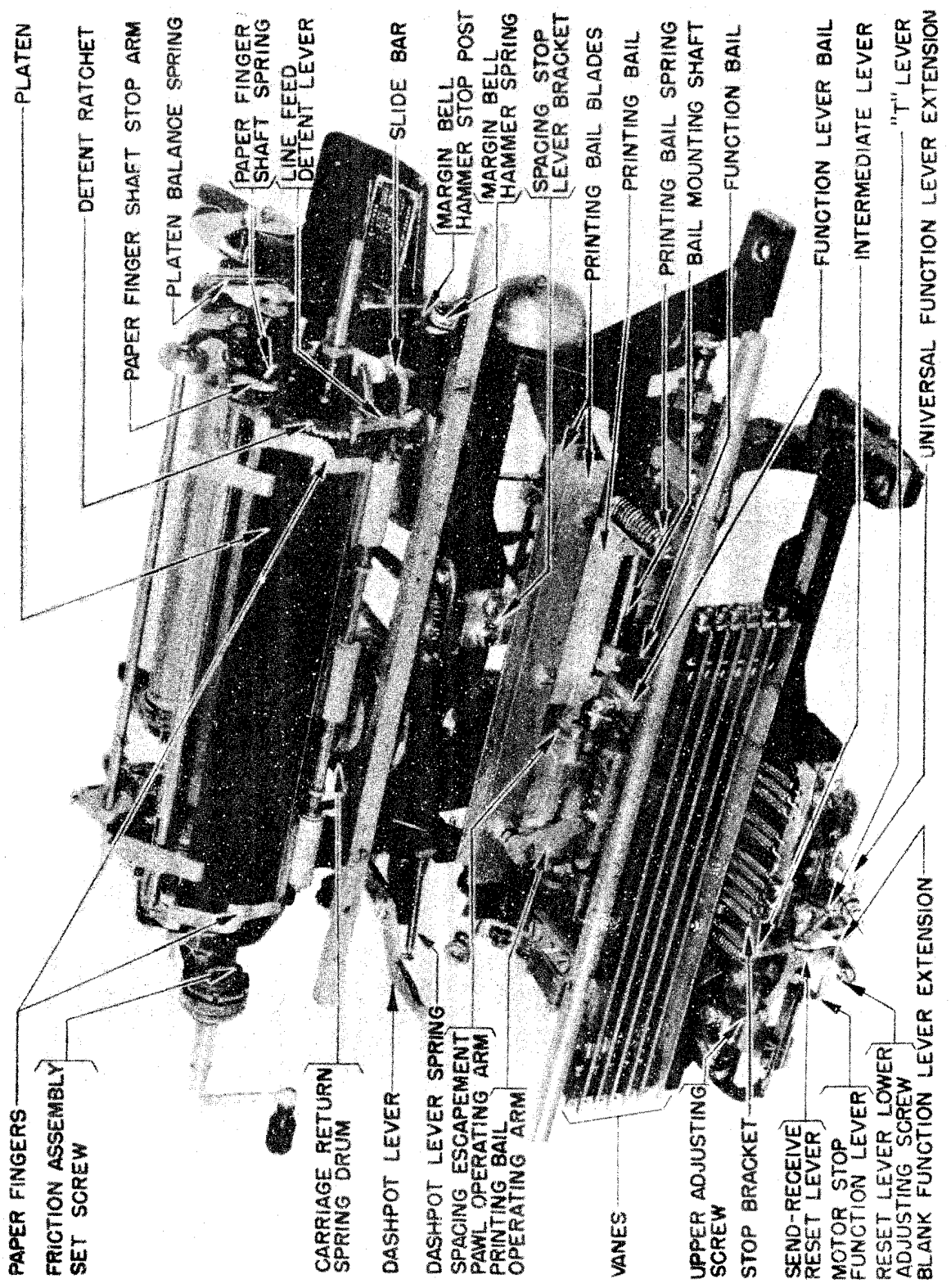
3.13 Ribbon Lockout. The ribbon lockout bar is provided for the purpose of locking the ribbon below the printing line when stencils are being made (Fig. 17). When the ribbon lockout bar is moved inward manually, it engages the oscillator extension, holding the oscillator assembly in the lower position, with the ribbon below the printing line.

3.14 Functions. There are two types of operations which can be performed by the typing unit. The first embodies those mechanical actions which are directly necessary to the actual printing of a character. The second type of operation, which embodies mechanical action supplementary to the printing of a character, or which alters the position of various mechanisms, is known as a function. The functions are - Carriage Return, Line Feed, Figures, Letters, Bell, Keyboard Locking, Motor Stop.

The operation of functions is accomplished through the medium of function levers. These function levers and others are shown in Fig. 24. When the printing bail is in its rear or normal position, the function lever bail, which is attached to the printing bail, holds the function levers away from the vanes. As the printing bail moves forward, the function lever bail roller will move down off the high portions of the function lever rear arms, permitting the function lever springs to pull their respective levers against the vanes. The forward arms of the function levers are notched so that when a function combination is set up on the vanes, the selected function lever will move forward further than the other function levers (Fig. 25).

When in the selected position, the carriage return, line feed, figures, letters, bell, motor stop and spacing suppression on blank function levers will be in the path of one of the blocking extensions on the function lever bail.

/ Fig. 23.



TYPING UNIT (FRONT VIEW).

FIG. 23.

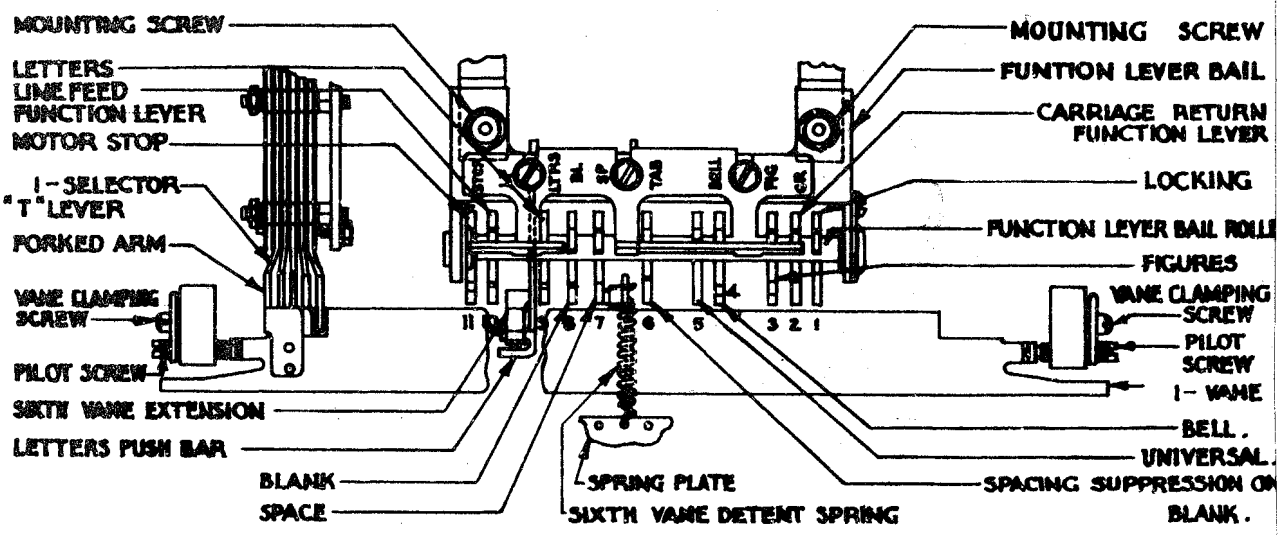
This will prevent the printing bail from moving forward far enough to allow the type bar carriage to space. However, the locking, universal, space or blank function levers do not block the printing bail.

The function bail, mounted on the bail mounting shaft, is used to operate some of the functions and is actuated by the function bail cam. The function bail spring holds the function bail cam roller against the cam at all times. After the printing bail and the function lever bail move forward sufficiently to release the function levers, the function bail roller starts to ride up the high part of its cam. This moves the function bail blade toward the rear, engaging and operating any function push bar that may have been moved in its path by a selected function lever. The function bail roller will then ride down to the low portion of the function bail cam, the bail blade returning to its forward position in readiness for the next function.

Sixth Vane. The lower end of the spring attached to the sixth vane fits into the notch in the forward end of the letters push bar (Fig. 31). When the platen is in the figures position, the letters push bar is in its forward position and the rear edge of the sixth vane is moved down. When the platen is in the letters position, the rear edge of the sixth vane will be in its upper position. When the letter "J" or "H" is selected and the platen is in the letters position, the bell and motor stop function levers will be inoperative because the sixth vane prevents their selection. With the platen in the figures position, the sixth vane will not prevent the selection of the bell or motor stop function (see "Motor Stop Function" and "Signal Bell Function").

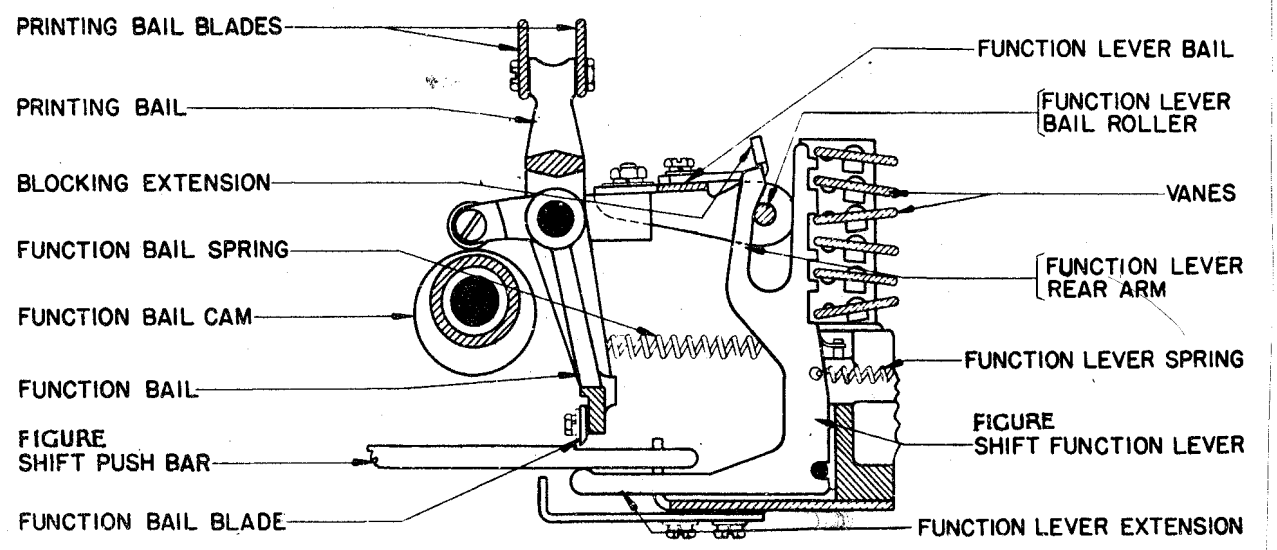
3.15 Carriage Return. When the carriage return function lever (second from the right in Fig. 24) moves into engagement with the vanes, the function lever extension moves the carriage return latch bar upwards out of engagement with its latch. This releases the carriage return operating lever, which actuated by its spring moves the carriage return clutch fork upwards, disengaging the upper carriage return clutch member from the lower member. The spacing shaft is then free to turn in its sleeve so that the type bar carriage may be pulled back to its extreme left-hand position by the carriage return spring, as shown in Fig. 23, (within the carriage return drum) through the medium of the draw strap. The notch on the reset bar will then be engaged by the function bail and moved to the rear. As the reset bar and the carriage return latch bar are both pivoted on the same screw, the latch bar will be reset into engagement with its latch (Fig. 26). In the meantime, the function lever bail will have been returned to its upper position and the carriage return function lever extension will have been moved down below the carriage return latch bar.

/ Fig. 24.



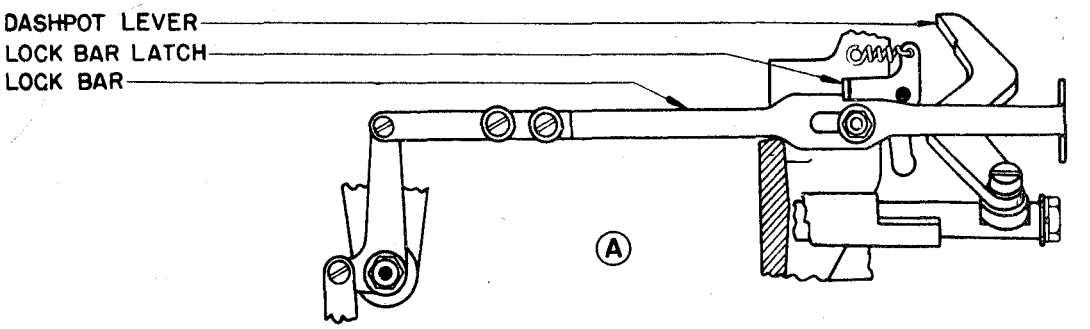
FUNCTION LEVERS.

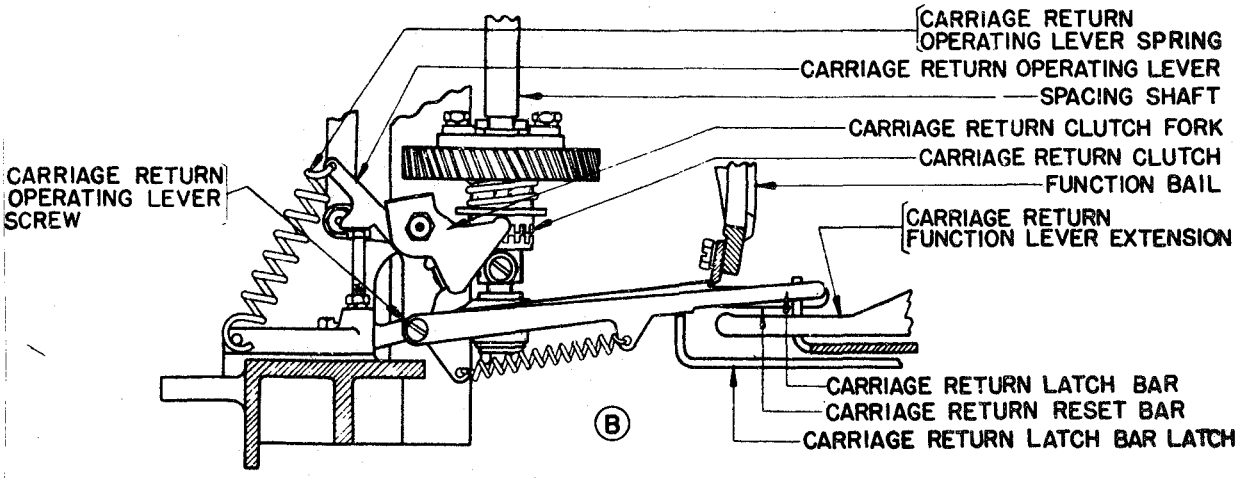
FIG. 24.



OPERATION OF FUNCTION LEVER.

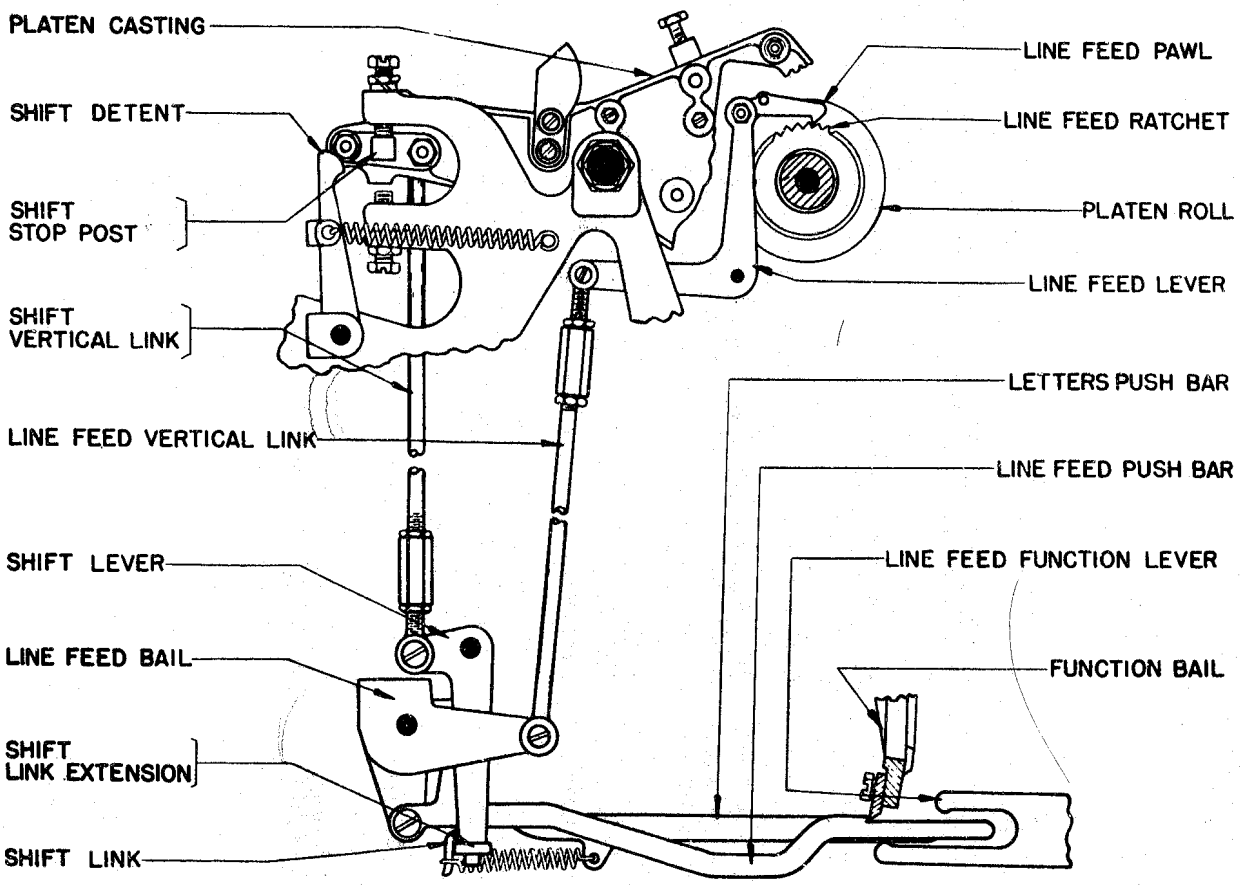
FIG. 25.





CARRIAGE RETURN.

FIG. 26.



"FIGURE" SHIFT AND LINE FEED.

FIG. 27.

During the time that the carriage return operating lever was being operated by its spring, the lock bar was moved through a series of levers until its notch engaged with the lock bar latch (Fig. 26). This held the carriage return clutch members disengaged to ensure a complete return of the carriage.

One end of the dash-pot lever is attached to the dash-pot plunger and the other end projects into the path of the type bar carriage. Just before the type bar carriage has returned to the beginning of the line, the left-hand margin adjusting screw (attached to the carriage) strikes the end of the dash-pot lever driving the plunger into the dash-pot air chamber absorbing the shock (see Fig. 1).

The carriage return lock bar extends beyond its latch so that it may be operated manually.

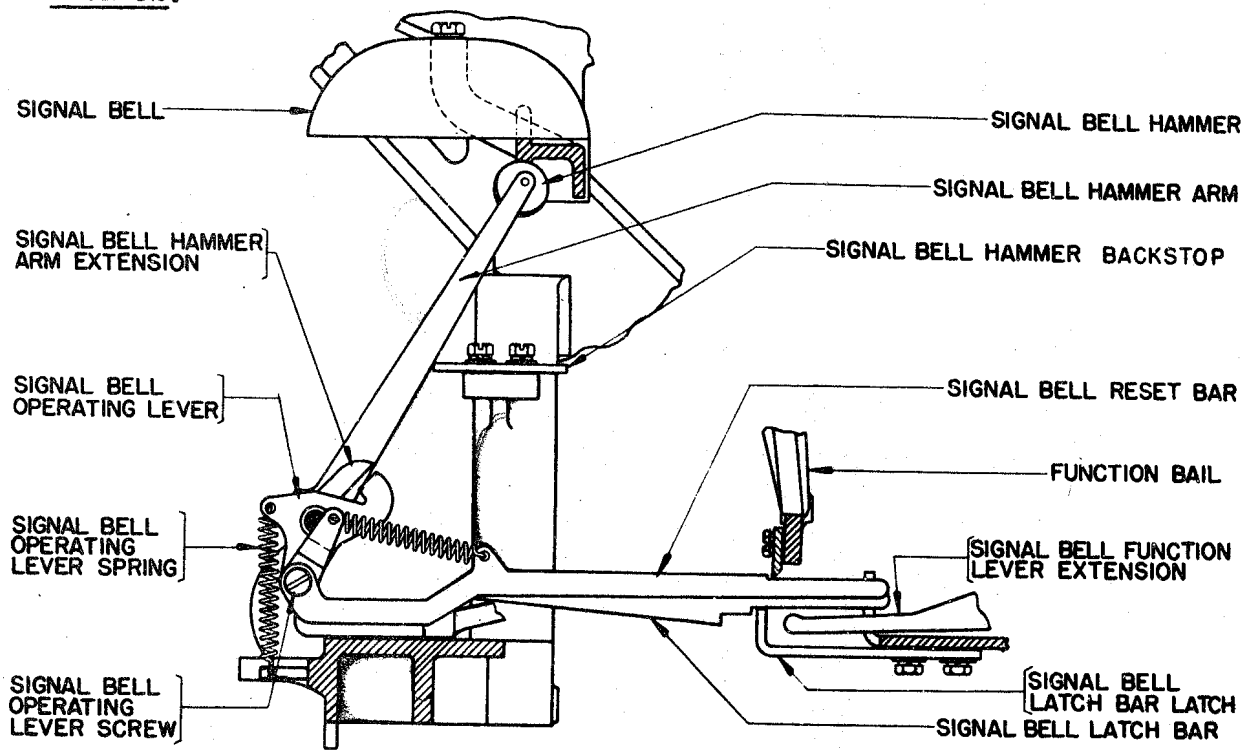
3.16 Line Feed Function. When the line feed function lever, tenth from the right, is selected, its lower extension raises the line feed push bar into the path of the function bail blade (Fig. 27). When the bail moves towards the rear of the printer, the line feed push bar rotates the line feed bell-crank, pulling the line feed vertical link downwards. This will operate the line feed lever which, in turn, will move the line feed pawl into engagement with the line feed ratchet and rotate the platen one line space. When the line feed function lever is returned to its normal position by the function lever bail, the upper function lever extension moves the line feed push bar down below the path of the function bail and holds it there until a line feed is again selected.

After each line feed operation, the detent roller locates itself between two teeth on the ratchet, thus holding the platen firmly in position during each line of printing (Fig. 23). The detent ratchet is attached to the right-hand end of the platen.

The single-double line feed lever in its lower position will allow the line feed pawl to engage two teeth, thereby causing the platen to rotate a double line space (Fig. 1). When the single-double line feed lever is in its upper position, the line feed pawl will be permitted to engage and operate only one tooth on the line feed ratchet which will cause the platen to rotate a single line space.

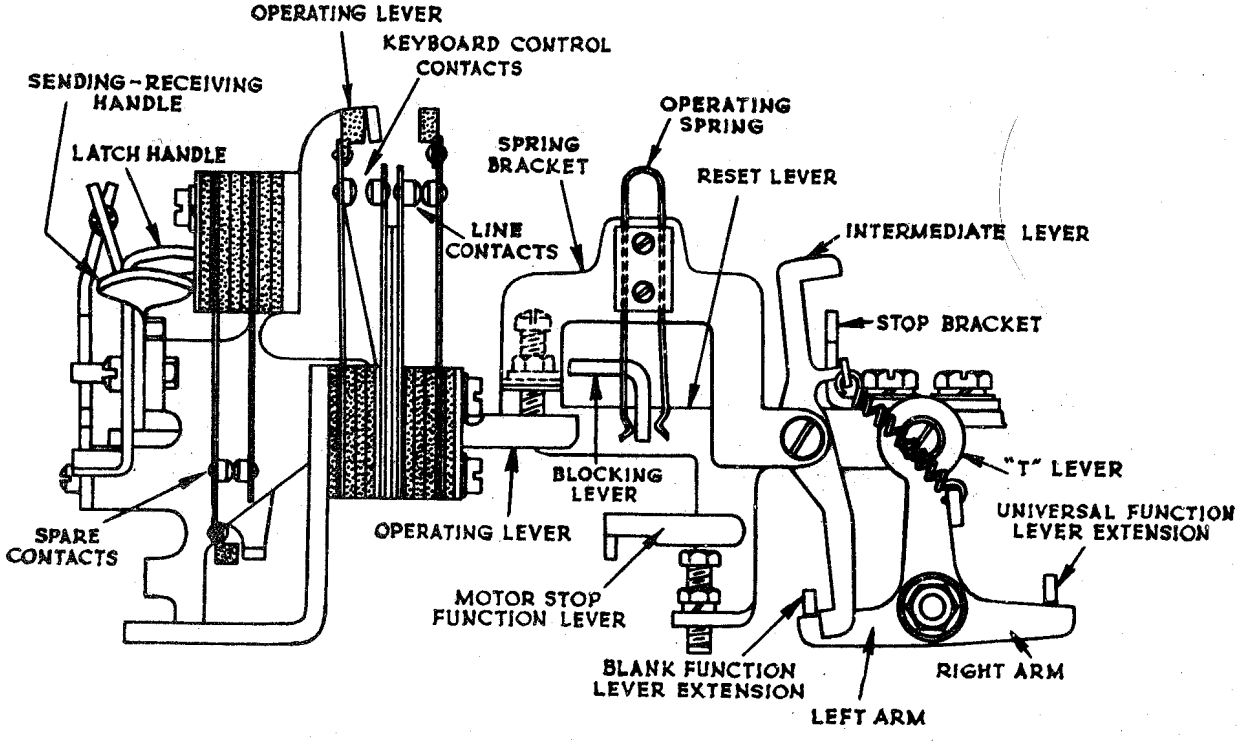
In order to facilitate paper feeding, the paper straightener rod and a series of platen pressure rollers are provided (Fig. 14). The paper straightener rod is used to guide the paper as it is unwound from the roll. It is also used as a slack rod to prevent the paper from tearing. The pressure rollers hold the paper firmly against the platen to prevent slippage while line feeding.

/ Fig. 28.



SIGNAL BELL.

FIG. 28.



KEYBOARD LOCKING MECHANISM.

FIG. 29.

3.17 Figure Shift and Letter Shift. The figure shift function lever, third from the right (Fig. 24), when selected, will move the figure shift push bar up to bring its notch into the path of the function bail. This push bar when moved by the function bail will turn the right end of the shift link, to which it is connected, towards the rear of the printer and the left end of the link towards the front of the printer (Figs. 20 and 27). The shift lever which is engaged in the left end of the link is thus moved to pull the rear end of the platen assembly downwards through the shift vertical link. The platen roll will be brought to its upper or figures position.

The letters push bar is connected to the left-hand side of the shift link. When the letters push bar is operated by the function bail, after the letters function lever (ninth from right) has been selected, the action on the platen assembly will be reversed, bringing the platen down to the letters position.

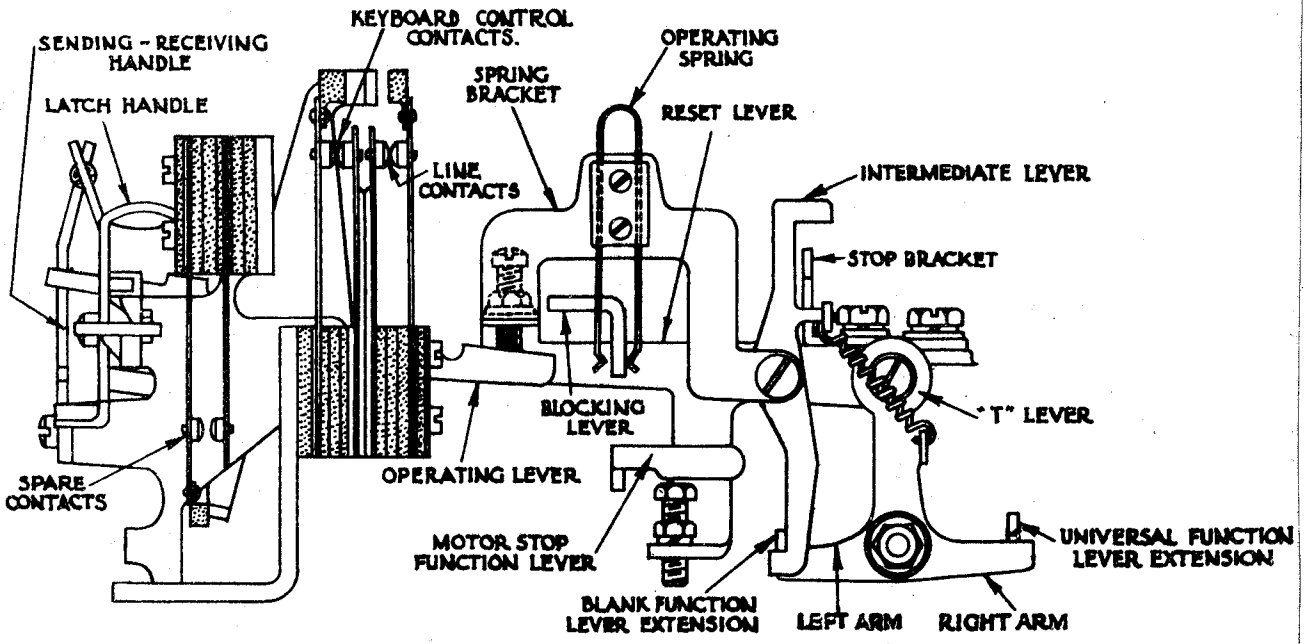
The shift detent is provided to hold the platen assembly firmly in either the shifted or letters position.

3.18 Signal Bell Function. When the bell combination (figures "J") is received, the bell function lever (fourth from the right in Fig. 24) will be selected. The extension on this lever will raise the bell latch bar out of engagement with the bell latch bar latch. This releases the bell operating lever so that its spring may in turn rotate it, permitting the lever to strike the bell hammer arm extension throwing the bell hammer against the signal bell (Fig. 28). The notch of the bell reset bar being in the path of the function bail blade will reset the bell latch bar when the function bail moves to the rear. The bell reset bail and the bell latch bar move together, because they are both pivoted on the bell operating lever screw.

3.19 Keyboard Locking Mechanism. (Figs. 29 and 30.) When the blank key on a keyboard is depressed twice, or the line is opened, for example, at the break contacts, for a time equivalent to two revolutions of the receiving cam, the keyboard control contacts will be closed, short-circuiting the keyboard transmitting contacts (Fig. 30). At the same time, the sending-receiving handle will move to its lower or receive only position. All keyboards on the circuit will be locked out until the sending-receiving handle is manually restored to its upper or sending and receiving position.

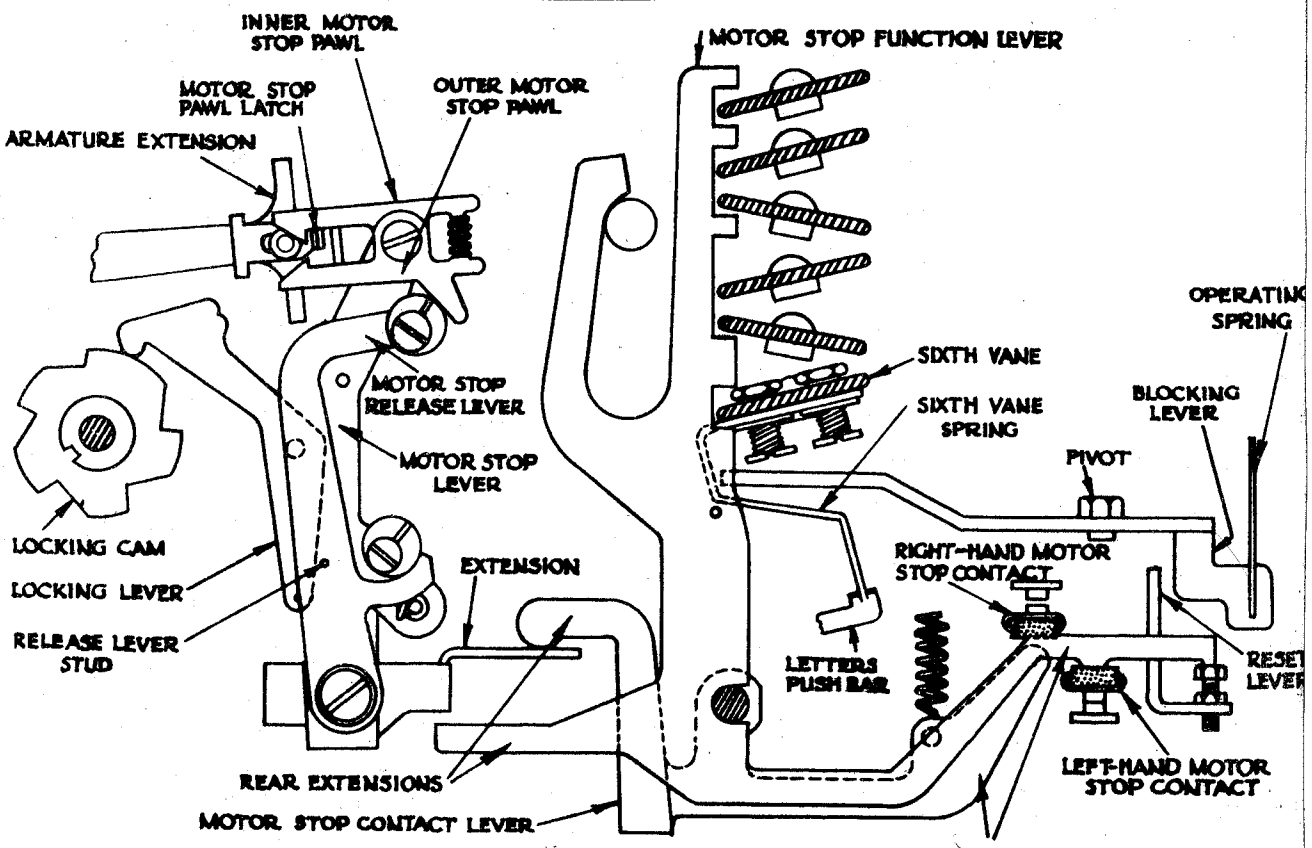
The universal function lever (fifth from the right in Fig. 24) is permitted to move forward by the function lever bail roller with each operation that involves spacing of the carriage. Its extension is positioned above the right arm of the "T" lever (Fig. 29), so that with each movement of the universal function lever, the right arm of the "T" lever will be pushed downwards, and the top of the "T" lever and the pivot of the intermediate lever will be moved to the right. This will keep the lower end of the intermediate lever out of the path of the blank function lever extension.

When a blank combination is received, two function levers, one sixth and the other eighth from the right are selected. The



KEYBOARD LOCKING MECHANISM.

FIG. 30.



MECHANICAL MOTOR STOP MECHANISM.

FIG. 31.

eighth from the right is used to operate the keyboard lock out mechanism and in the preliminary selection of the motor stop combination (see paragraph 3.20). However, because the blocking extension on the function lever bail (Fig. 25) does not extend above this function lever, its selection does not block the function lever bail and so prevent the spacing of the carriage. The "spacing suppression on blank" function lever, sixth from the right, does, however, block the bail and prevents the spacing of the carriage, and with it, the operation of the universal function lever (fifth from the right in Fig. 24).

With the selection of the blank function lever (eighth from right) its extension moves downwards moving the left of the "T" lever downwards, also. The upper part of the "T" lever and the pivot of the intermediate lever will, therefore, be moved to the left, allowing the lower end of the intermediate lever to move against the side of the blank lever extension when the blank lever is in its lower position. When the blank lever extension moves upwards at the end of the operating cycle, it will permit the lower end of the intermediate lever to swing beneath the blank function lever. If another blank selection is now made, the intermediate lever will be pulled downwards moving the reset lever against the operating lever which will release the operating pawl. The spring on the operating pawl will move its extension against the contact springs which will close the keyboard control contacts and move the sending-receiving handle to the lower position (Fig. 30). At the same time as the operating pawl closes the keyboard control contacts, it also opens a second pair of contacts which perform no function in machines used by the Department.

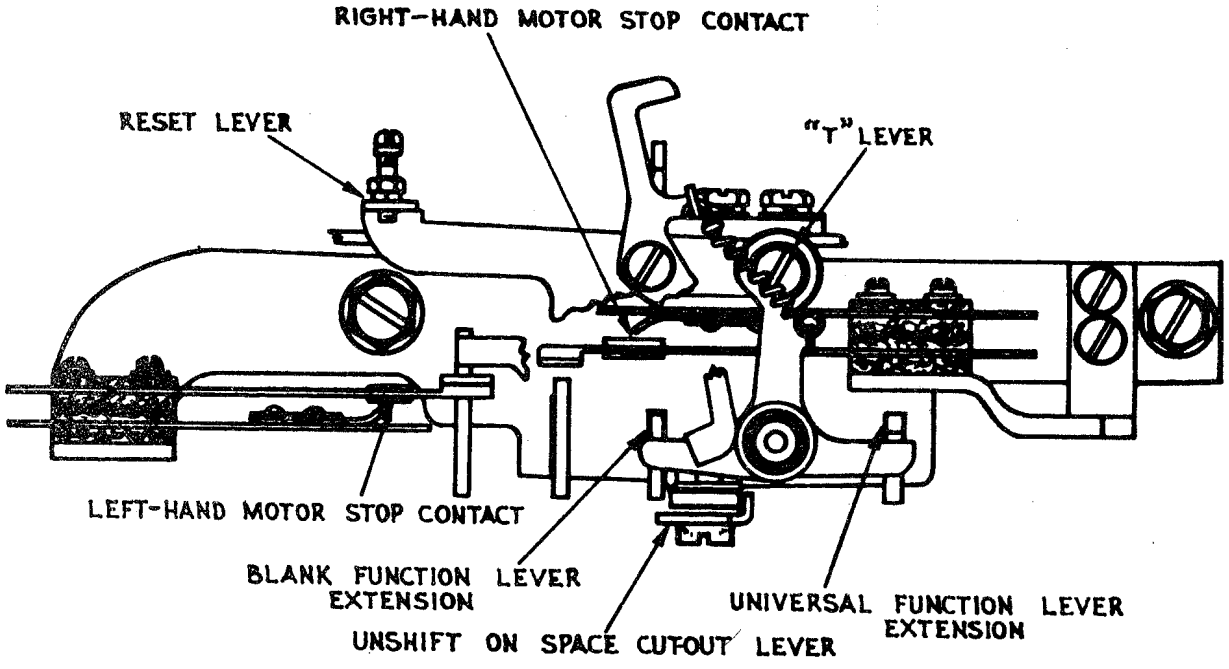
If only one blank signal is received, followed by a carriage spacing character, the keyboard will not be locked out because the intermediate lever will be moved out of the path of the blank function lever extension by the universal lever extension. Therefore, for the keyboard to be locked out, two blank combinations must be received, either consecutively or separated by non-spacing functions which prevent the universal function lever operating, and restoring the "T" lever.

3.20 Motor Stop Function. If a single blank combination is immediately followed by the "H" combination when the platens are in the figure position, the motors of all machines on the circuit will be automatically stopped.

After the receipt of the single blank combination, the reset lever (Fig. 32) is moved to the left, carrying with it the spring bracket as well as the intermediate lever (see previous paragraph).

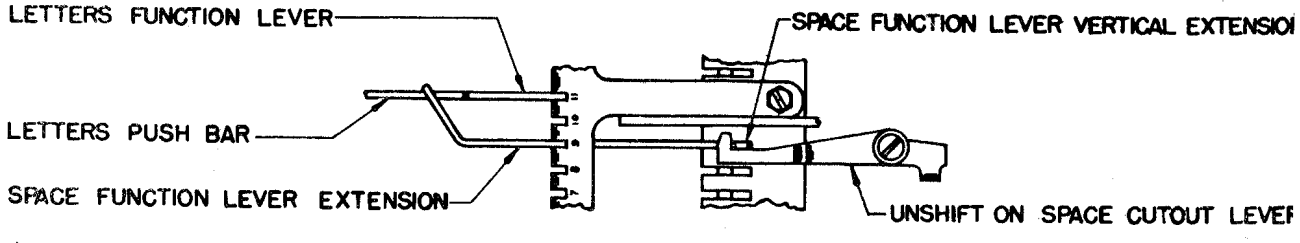
The right-hand side of the spring carried by the spring bracket bears on one end of the blocking lever and moves it so that its other end moves to the right, clear of the motor stop function lever.

/ Fig. 32.



MOTOR STOP.

FIG. 32.



UNSHIFT ON SPACE CUT-OUT LEVER.

FIG. 33.

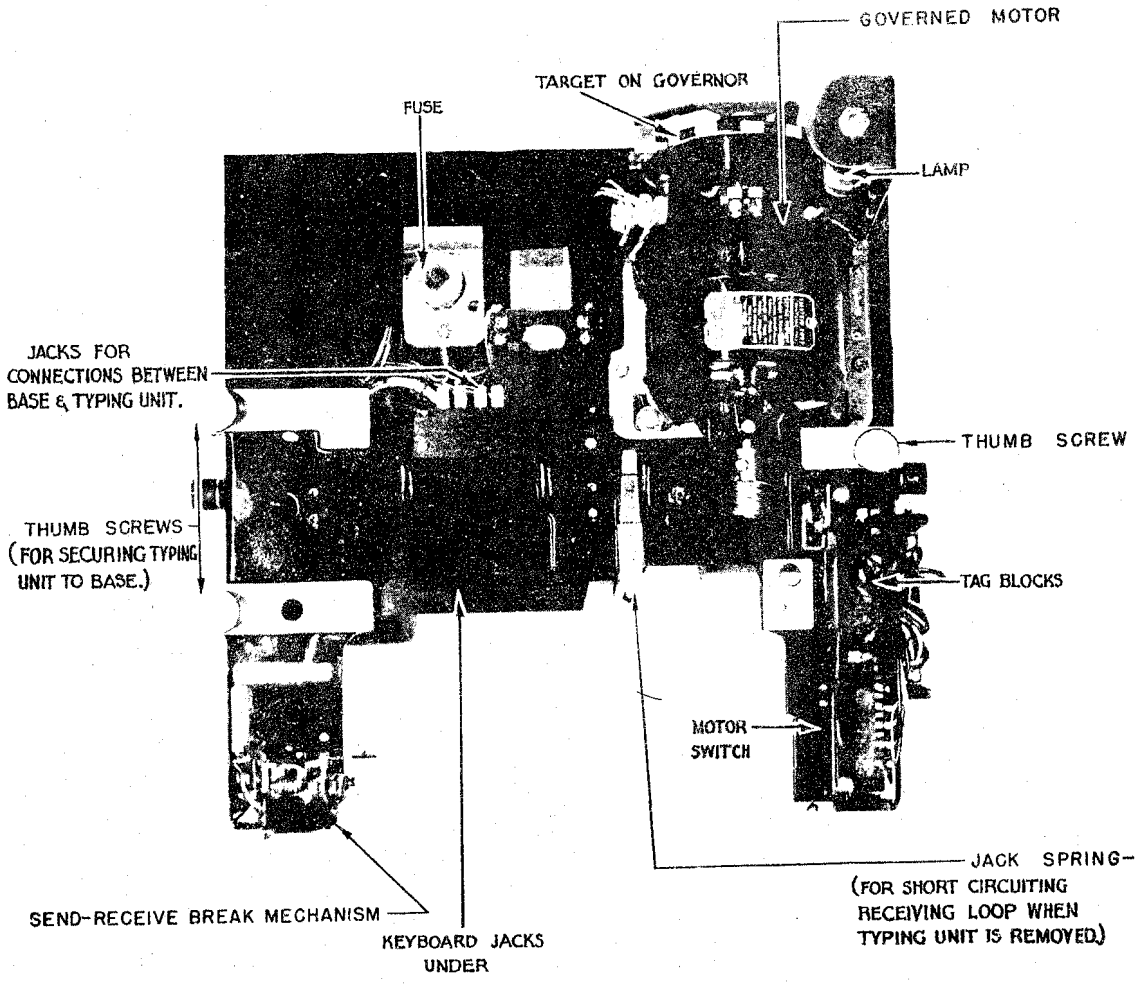
If the "H" combination is received, the motor stop function lever (eleventh from the right) will be selected and its lower rear extension will raise the lower part of the motor stop lever, moving the inner motor stop pawl, so that it latches at the thick portion of the motor stop pawl latch on the armature extension (Fig. 31). At the same time, the front extension of the motor stop function lever closes the left-hand motor contacts. Simultaneously, with the closing of the left-hand contacts, the motor stop contact lever rear extension is moved up by the extension of the motor stop lever, and the front extension moves down against the tension of its spring. This allows the right-hand motor stop contacts to open. Both pairs of contacts are wired in parallel so that the motor will not stop until the motor stop function lever is restored to its normal position, at which time its front extension will move upwards, permitting the left-hand contacts to open. The purpose of the left-hand contacts is to hold the motor circuit closed until the receiving cam sleeve comes to rest. This will ensure the disengagement of the main shaft clutch before the motor stops (Fig. 32).

To start the motors again, the line must be opened for a short interval by depressing the latch handle (above and to the rear of the send-receive handle). This will move the upper operating lever extension against the line break contact insulator, opening the line (Fig. 30). The opening of the line allows the selector armature extension to be moved downwards by the armature spring. After the upper end of the motor stop lever has moved forward a slight amount, it is again stopped by the outer stop pawl catching on the cut-away portion of the motor stop pawl latch (Fig. 31).

When the line is closed again, the armature will move to its operated position, which will disengage the armature extension latch from the outer motor stop pawl, permitting the motor stop lever to return to its normal position. The extension on the lower portion of the motor stop lever, which has been holding the motor stop contact lever away from the right-hand motor stop contacts, will now permit the spring to move the front extension of the motor stop lever upwards, closing the motor stop contacts. It should be noted that when the motor control function is operated, the keyboard control contacts are closed, locking out the keyboard transmission. This is accomplished by the forward end of the motor stop function lever moving downwards against the lower screw on the reset lever. The reset lever in turn moves the contact operating lever as previously described in paragraph 3.19.

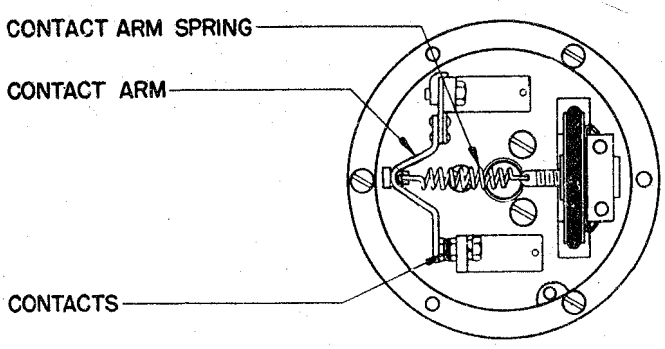
The motor stop release lever is provided to eliminate the possibility of the selector cam sleeve coming to rest with the armature locking lever in a low part of its cam (Fig. 31).

/ Fig. 34.



BASE WITH MOTOR (TOP VIEW).

FIG. 34.



CONTROL GOVERNOR.

FIG. 35.

For example, immediately after the motor stop combination has been sent and before the motor has stopped, should the line accidentally open, releasing the magnet armature, the selector cam sleeve would revolve beyond the stopping point and it is possible that the armature locking lever might come to rest in an indent in its cam. It can be seen that if the cam were to stop in this position, the armature extension would not be free to respond to the next open line interval, thus making it impossible to operate the mechanical motor control.

The motor stop release lever is provided to prevent such a condition by making it impossible for the motor stop pawl latch to be engaged by the pawl. When the locking lever falls into an indent in its cam, its spring brings its lower extension against the stud on the release lever. This shifts the upper end of the motor stop release lever and holds its eccentric against the lower part of the outer motor stop pawl, preventing it from latching under the motor stop pawl latch. Thus, the motor stop will not be permitted to function and the motor will continue to rotate.

If the "H" combination, necessary to complete the motor stop function, had not been immediately preceded by the blank combination, the blocking lever would have been in engagement with the front of the motor stop function lever and would have prevented it from moving forward into the vanes.

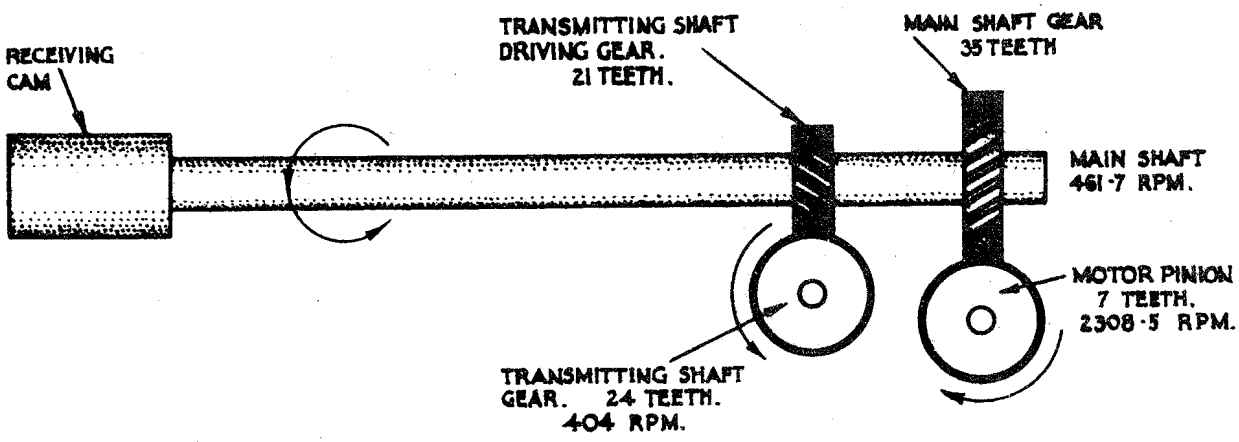
If the platen is in the letters position when the blank - H combination - is received, the sixth vane will be in such a position as to prevent the motor stop function lever moving forward.

In either of the above cases, the "H" pull bar will be selected and the secondary character (£) or primary character (H) will be printed in the normal manner.

3.21 Unshift on Space Function. This feature is not normally used by the Department, but, if desired, the printer may be arranged to shift the platen to the letters position on both the space and letters combinations. This is accomplished by means of the space function lever (seventh from right, Fig. 24).

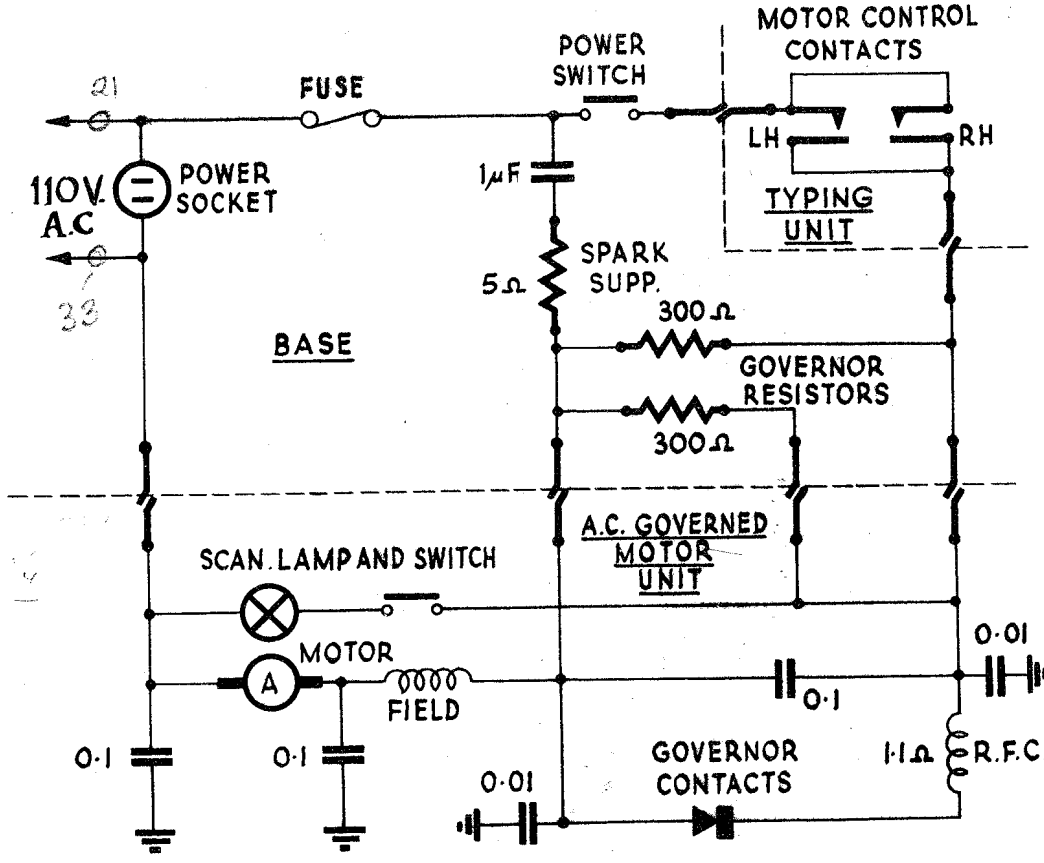
When the unshift on space feature is not required, the unshift on space cut-out lever is moved into engagement with the space function lever making it inoperative.

/ Fig. 36.



TELETYPE SHAFT SPEEDS AND GEAR RATIOS.

FIG. 36.



TELETYPE MOTOR CIRCUIT.

FIG. 37.

If the unshift on space cut-out lever is moved out of engagement with the space function lever, the space function lever extension will move upwards on a space combination and raise the letters shift push bar into the path of the function bail (Fig. 33). The platen will then be shifted to its letters position as previously described under Figure Shift and Letter Shift.

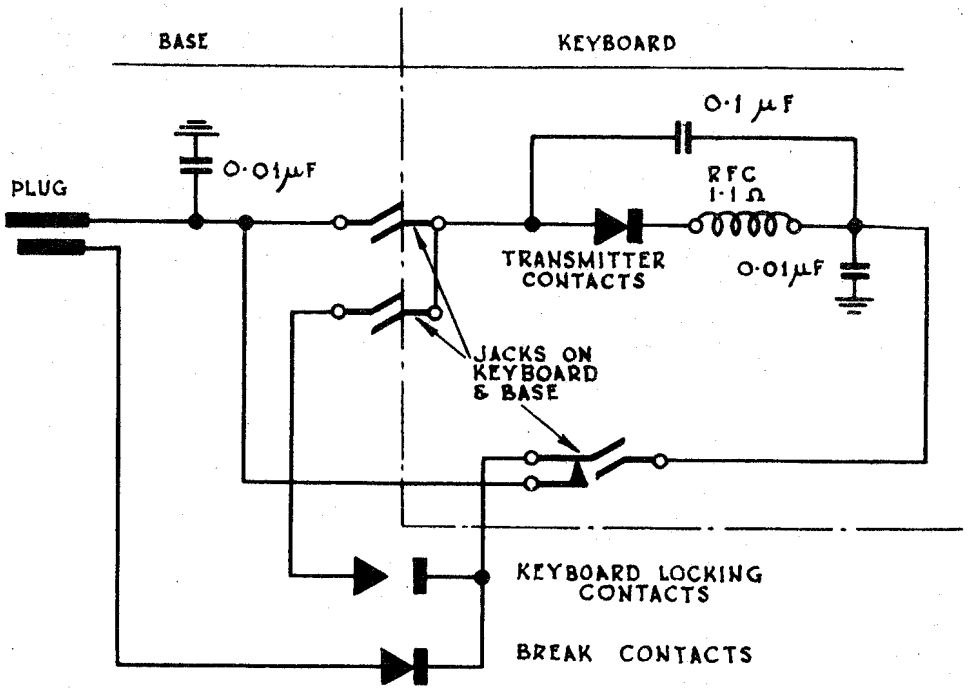
3.22 Orientation. In order to properly operate the selector mechanism, it is necessary to place the starting point of the selector cam sleeve in the most favourable position. This is done by means of the Range Finding Mechanism which is used to orient or take a range.

Mounted on the stop lever plate (which is a part of the range finding mechanism) are the stop pawl latch and the stop pawl which may be rotated thereby varying the relation between the start of the selector cam sleeve and the time the selector cams operate the selector levers. A graduated scale indicates the setting of the stop mechanism and the clamping plate screw holds it in place after having been set (see Figs. 8 and 9).

The movements of the stop lever and trip latch (Fig. 9), which are mounted on the stop lever plate, vary the degree of relationship between the start of the selector cam sleeve and the time the selector cams operate the selector levers. The setting of this stop mechanism is indicated on a graduated scale by an index arm held, when set, by a thumb screw.

The range is determined, while receiving the letters R and Y alternately on the receiving unit, by moving the range finder index arm in one direction until errors appear and then moving it back slowly until the errors disappear, noting the position on the scale. In a similar manner, the opposite limit of the range is located by moving the index arm toward the opposite end of the scale. The proper setting is midway between these two limits.

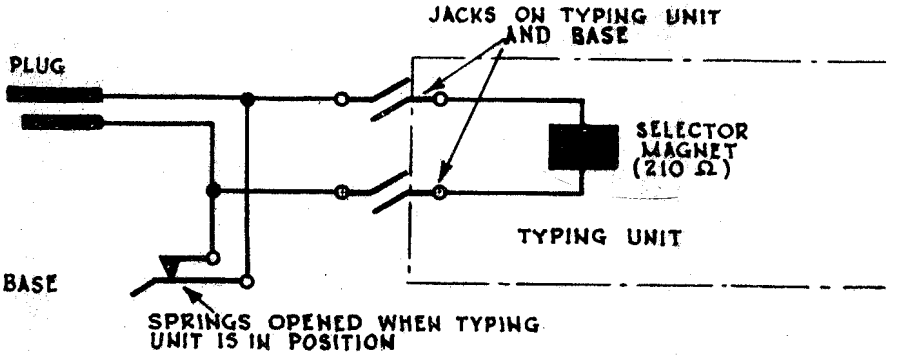
/ Fig. 38.



TELETYPE KEYBOARD TRANSMITTER CIRCUIT.

(Note. Keyboard Not Inserted In Jacks.)

FIG. 38.



TELETYPE SELECTOR MAGNET CIRCUIT.

FIG. 39.

4. BASE UNIT.

4.1 The base provides facilities for mounting the typing, keyboard and motor units together with the necessary accessories such as mounting blocks, condenser, slip connections, terminals, etc. (see Fig. 34).

4.2 Motor Speed Control. In order to maintain the transmitting and receiving stations at the proper speed, the driving motor is equipped with a governor attached to one end of the motor shaft (Fig. 35).

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

A target of alternate black and white spots is painted around the outer rim of the governor and is used with a speed indicator (stroboscope) to check the motor speed visually. When viewed through the shutters of the speed indicator, the spots on the target should appear stationary, provided the spring tension has been adjusted properly.

On the right rear corner of the motor base, mounted on a bracket, is a lamp with a switch, which provides illumination for the speed target.

4.3 The speed of the various shafts and the gear ratios are shown diagrammatically in Fig. 36.

4.4 Control Relay. Some machines are equipped with a relay which may be used for control of the motor. However, this feature is not used on Departmental machines and has been omitted from many machines.

4.5 Line Relay. Provision is made for a line relay to repeat the signals to the selector magnet, which then operates in a local circuit. However, as the Departmental method of operation uses the selector magnet directly in the line circuit, the relay and associated apparatus has been omitted from many machines.

/ 5.

5. SCHEMATIC CIRCUIT.

5.1 The schematic circuit in Fig. 37 shows the schematic wiring of a Model 15 printer, equipped with 110 volt A.C. governed motor. The undesignated capacitors and radio frequency choke are the radio interference suppression network.

5.2 Figs. 38 and 39 show the signalling circuits. It will be noticed that the jacking arrangements are such that both the sending circuit and the receiving circuit are maintained intact when the keyboard or typing unit is removed from the machine.

The radio frequency interference suppression networks consist of the undesignated capacitors and radio frequency choke.

END OF PAPER.