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IBM 1443 PRINTER for 1620/1710 Systems

This publication describes the IBM 1443 Printer as an on-line output unit for the 1620 Data Processing Systems, Models 1 and 2, and for the 1710 Control System.

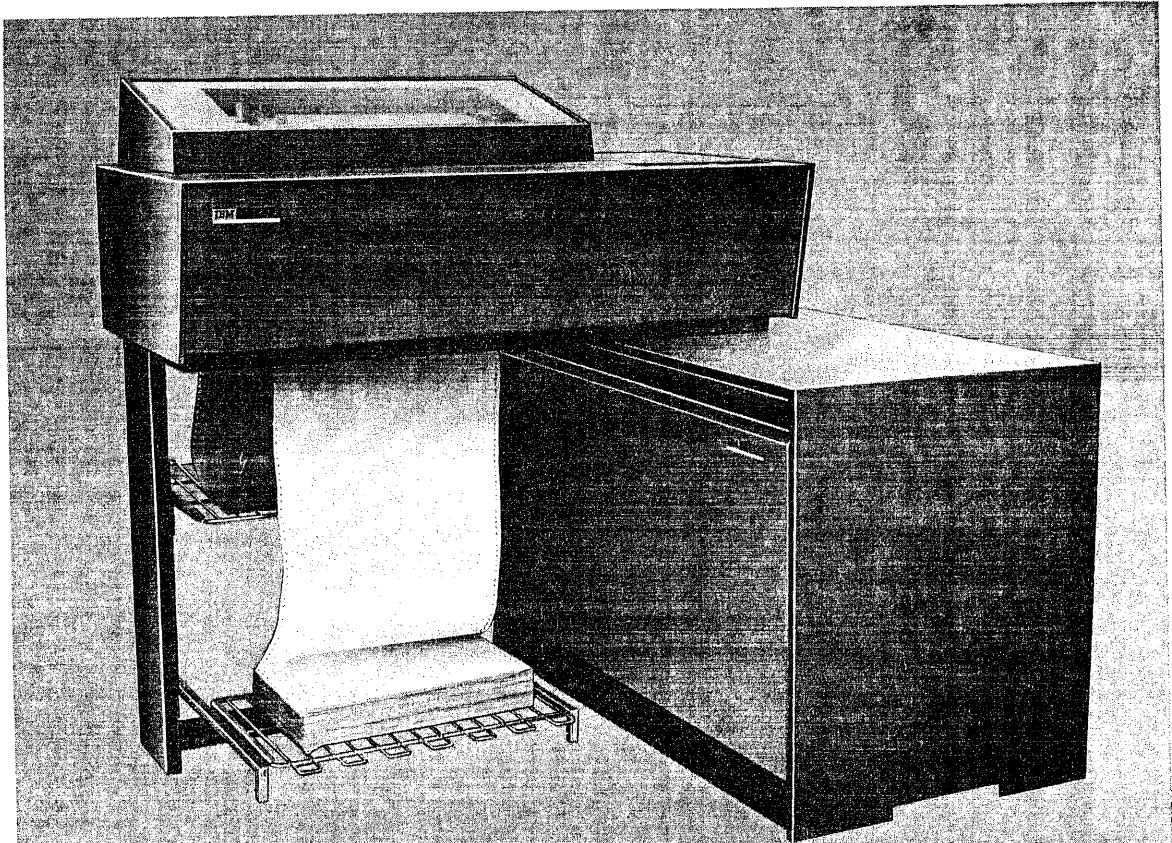
This is a reprint of an earlier publication; it incorporates the following Technical Newsletters:

Form No.	Pages	Dated
N26-0076	1, 2, 3, 3.1, 4, 5, and 6	6/16/64
N26-0118	3 and 3.1	4/1/65
N26-0124	2	4/30/65
N26-0142	3.1 and 4	11/2/65

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Introduction

The IBM 1443 Printer is an on-line output unit for both models of the 1620 Data Processing System and the 1710 Control System. Standard features include a tape-controlled carriage for transporting continuous paper forms, an interchangeable type bar, and buffer storage.

The easy interchangeability of the type bar enables the operator to select type-style and character-set for specific applications.

The printer buffer enables the computer to transfer core storage data to the buffer, and then continue processing during the relatively slow printing operation. Printing speed is from 150 to 600 lines a minute, depending on the 1443 Model and the character-set of the type bar in use. A print line consists of 120 characters. An additional 24 characters are available as a special feature for each line.

Printing Operation

The 1443 type bar can print the standard 1620 character set, i.e., each of the 120 or 144 print positions can print any one of 48 different characters: 26 alphabetic, 10 numeric, and 12 special characters.

.) + \$ * - / , (= @ ≠

Horizontal spacing is 10 characters to the inch. Vertical spacing of six or eight lines to the inch is manually selected by the operator. Selective spacing and skipping between printed lines are controlled by the 1620 program.

Several repetitions of the full character set are located on the thin metal type bar (Figure 1). There are 120 or 144 hammer magnets and print hammers, each of which has an individual print buffer position. Once the print buffer is loaded, individual characters are printed as quickly as they pass in front of the hammer that has the same character stored in its buffer position.

Printing Speeds

The 1443 Model 1 prints from 150 to 430 lines a minute; the Model 2, from 240 to 600 lines a minute. The determining factor for both models is the size of the type bar character set:

Character Set	Lines Per Minute	
	1443-1	1443-2
13	430	600
39	190	300
52	150	240

As shown above, it is the smaller character sets that provide the greatest speed. A smaller number of type characters allows more character set repetition on the type bar, and as a result, less type bar travel is necessary to pass all the characters in front of every print hammer. Less type bar travel, of course, enables greater printing speeds.

Print Control

Data to be printed must first be edited and arranged in core storage in exactly the format to be printed. The appropriate 1620 output instruction can then be executed to transfer the data to the print buffer.

The print buffer contains 197 positions even though the 1443 prints only 120 or 144 positions. The Printer Dump (PRD-35) instruction transfers a full buffer load of data, 197 characters, including group mark (≡) and record mark (≠) characters.

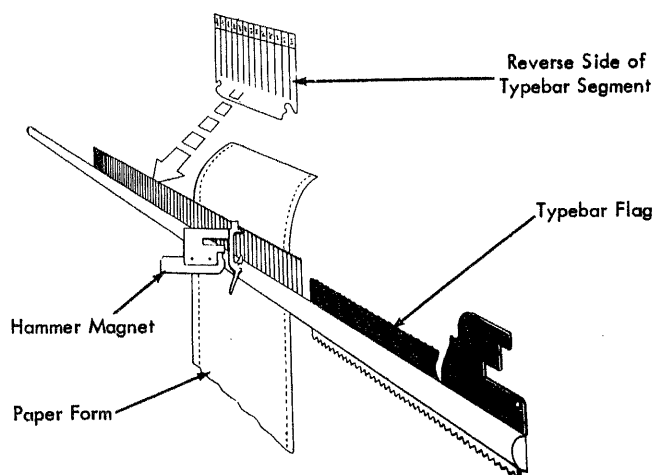


Figure 1. Printing Schematic

To perform a continuous core dump it is necessary to insert a Printer Dump instruction followed by: (1) an Add Immediate (AM-11) instruction to add 120 or 144 to the P address of the first instruction, and (2) a Branch (B-49) to position 00000.

The Print Numerically (PRN-38) and Print Alphanumerically (PRA-39) instructions, however, transfer a full buffer load only if neither character is detected. The detection of either character, a group mark or record mark, terminates data transfer and reduces the remaining buffer positions to blanks. Neither the terminating record mark nor group mark is transferred to the buffer.

When performing a Print Alphanumeric operation, a group mark or record mark should be placed in position 121 or 145 to prevent possible Printer Checks caused by the transmission of the unedited positions (121 through 197 or 145 through 197) to the print buffer.

A # may be printed by Print Alphanumerically (PRA-39) instructions on 1620 Model 1 serial number 10701 and above, and all 1620 Model 2's by the undefined character code 22. A 22 will not terminate data transfer and is not detected as a # for other operations.

The difference between the Print Numerically and Print Alphanumerically instructions is the type of data that each is designed to handle. The Print Numerically instruction encodes and transfers single digit characters. The Print Alphanumerically instruction changes two-digit characters into single digit characters before transferring them to the buffer. Table 1 shows both types of characters as they appear in core storage and buffer storage. Note also the relationship between the data and the output instruction (Printed Output column).

Print Instructions

All three instructions – Printer Dump, Print Numerically, and Print Alphanumerically – use an I/O code of 09 in Q_8Q_9 . The P address specifies the core storage address from which data transfer begins. The Q_{11} digit either initiates or suppresses a space-after-print: a 0 causes the space, a 1 suppresses the space (actually, the space occurs any time a 1-bit is absent from Q_{11}). The Q_7 and Q_{10} digits are not used.

Execution Times of Print Instructions

All three output instructions have the same execution times:

Computer Time: 1620 Model 1 – 8.1 ms.
1620 Model 2 – 2.1 ms.

Printing Time: 100 to 400 milliseconds, depending on 1443 Model and type bar character-set.

Tape-Controlled Carriage

The carriage is tape-controlled and advances the form as directed by the program. The vertical spacing is manually set by the operator to either 6 or 8 lines-to-

Table 1. Character Coding

Character	ALPHAMERIC DATA		Printer Output (Print Alphanumerically)
	Core Storage		
	Alpha.	Num.	
(Blank)	C	C	blank
. (period)	C	C 21	.
)	C	4)
+	1	C	+
\$	1	C 21	\$
*	1	4	*
- (hyphen or minus)	2	C	-
/	2	1	/
, (comma)	2	C 21	,
(2	4	(
=	C 21	C 21	=
@	C 21	4	@
A	4	1	A
:	:	:	:
I	4	C8 1	I
0 (-)	C 4 1	C	-
J	C 4 1	1	J
:	:	:	:
R	C 4 1	C8 1	R
S	C 42	2	S
:	:	:	:
Z	C 42	C8 1	Z
0	421	C	0
:	:	:	:
9	421	C8 1	9
#	C	C8 2	terminates
(undefined)	2	2	# ** does not terminate
#	C	C8421	terminates

** Note: Not applicable to 1620-1 prior to serial number 10701

Character	NUMERICAL DATA		
	Core Storage	Printer Output	
		Print Numerical	Printer Dump
0, 1, 2, ..., 9	C, ..., C18	0, ..., 9	0, ..., 9
numerical blank	C84	blank	@
record mark (#)	C82	terminates	#
group mark (#)	C8421	terminates	G
0̄, 1̄, ..., 9̄ (flagged)	F, CF1, ..., F18	-J, ..., R	-J, ..., R
numerical blank (flagged)	F84	blank	*
record mark (flagged)	F82	terminates	W
group mark (flagged)	F8421	terminates	X

the-inch. The carriage can be single, double, or triple spaced. These operations are planned in the program when variable spacing operations are required.

Space and Skip instructions may be executed at any point in the program prior to a Print instruction. Paper movement may be specified before printing or after printing. If no space or skip is programmed, a single space-after-print occurs automatically unless suppressed by the program.

All *spacing* operations are stopped mechanically, that is, the carriage moves one, two, or three spaces, depending on the instruction. *Skipping* operations, however, are stopped only by the sensing of a hole or punch in the carriage control tape. The computer can be programmed to continue processing while the skip operation is in progress.

Space and Skip Instructions

The 1620 Control instruction (K-34) is used to initiate carriage space and skip operations. As shown in Figure 2, the Q_8Q_9 digits specify the printer I/O code, 09, and the $Q_{10}Q_{11}$ digits determine whether the operation is spacing or skipping, and also, whether the space or skip is *immediate* (before print) or *delayed* (after print). The P address and the Q_7 digit are not used.

When a 1-bit in Q_{11} of succeeding print instructions prevents the execution of the control space instruction, the control code is stored until executed. In the following example, the Control instruction (34) uses the $Q_{10}Q_{11}$ digits 62 (delay double-space after print). This operation is executed after the first print operation that does not suppress spacing. In the case of a Control instruction where the $Q_{10}Q_{11}$ are 21 or 63 (delay single or triple space) the operation will be executed in the same manner. The normal space-after-print will not occur in addition to the spacing called for in the Control instruction.

PROGRAM	OP CODE	Q_{10} Q_{11}
① Control, Double space after print (SAP)	34	62
② Print Num., Suppress SAP	38	01
③ Print Num., SAP	38	00
④ Print Num., SAP	38	00

PRINT LINE NO.	FORMAT
1	Data printed by ② and ③
2	Blank resulting from ① and not suppressed by ③
3	Data printed by ④
4	Next line to be printed - result of ④

Once an immediate skip or delayed skip instruction has started the skip operation, a punch in the associated control tape channel is required to stop the operation. For example, a punch in channel 5 of the tape will stop both the immediate skip-to-5 and the delay skip-to-5.

The sensing of a 9 or 12 punch in the control tape turns on indicators 33 or 34, respectively. These indicators can be tested by the 1620 Branch Indicator and Branch No Indicator instructions.

If the printer carriage is in motion when the Control instruction is initiated, execution of the instruction is delayed until the carriage operation responsible for the motion is completed.

If more than one delayed skip or delayed space instruction precedes a print instruction, the last delayed skip or space instruction will be executed after the print instruction.

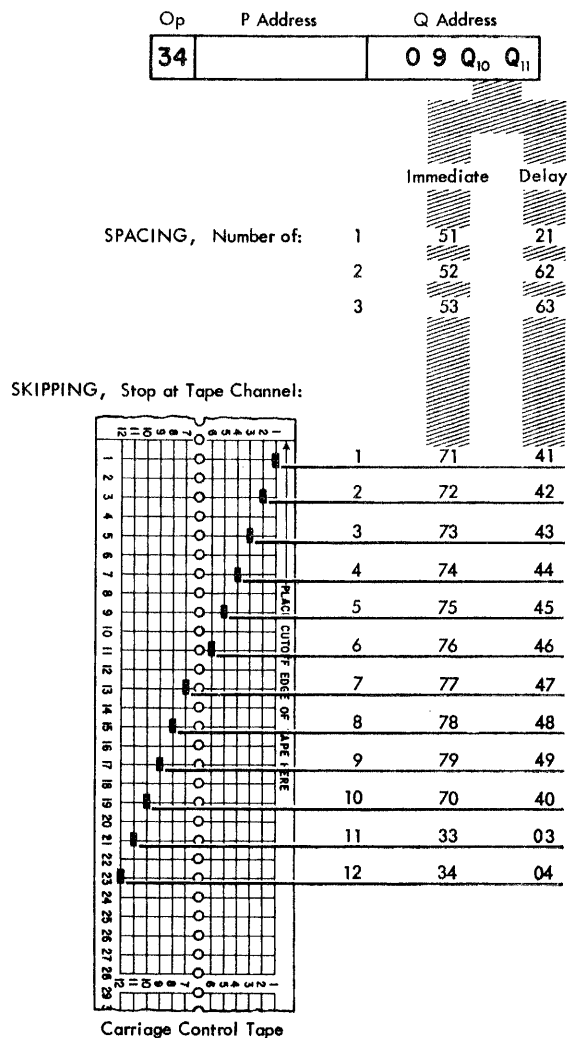


Figure 2. Instruction Coding — Printer Carriage Control

Execution Times of Space and Skip Instructions

Computer Time: 1620 Model 1 — 160 microseconds
1620 Model 2 — 60 microseconds

Printer Carriage Time:

Immediate Skip 45 ms (milliseconds) maximum for
and first line, plus 10 ms for each addi-
Immediate Space tional line

Delayed Skip First two lines included in print
and time; 10 ms for each additional
Delayed Space line

1443 Program Indicators

Four 1443 indicators can be interrogated by the 1620 Branch Indicator and Branch No Indicator instructions.

Channel 9 (Code 33). This indicator is turned on when a punched hole is detected in channel 9 of the

carriage control tape; it is turned off by program interrogation or depression of the 1620 Reset key, or by detection of a punched hole in channel 1 of the carriage control tape. Note: These methods of turning the indicator off may be ineffective if they are executed while a channel 9 is being sensed in the carriage control tape.

Channel 12 (Code 34). This indicator is turned on when a punched hole is detected in channel 12 of the carriage control tape; it is turned off in the same manner as indicator 33. (See above note also.) If program interrogation of indicator 33 or 34 occurs while the carriage is in motion, the program will be delayed until completion of the carriage operation. If interrogation occurs during a print operation, the program will not be delayed.

Printer Busy (Code 35). This indicator is on when the 1443 is printing and the buffer is unavailable for loading. The indicator is off when printing is complete and the buffer can accept data from core storage. The Print Busy indicator is not on during skipping or spacing. Program interrogation does not turn the Print Busy indicator off if it is on.

Printer Check (Code 25). This indicator and light are turned on by a parity error or a sync check in the 1443. The light is located above the RD CHK light on the 1620 console. Because the 1443 prints buffered data, either of these errors can occur at any time with respect to 1620 operation. The Any Check indicator (19) is turned on when the Printer Check indicator is turned on.

If the Printer Check indicator is turned on by a parity error, it may be turned off by program interrogation, or by pressing the 1620 Reset key or the 1443 Reset key.

If the Printer Check indicator is turned on by a 1443 sync check, the 1443 Reset key must be pressed to clear the sync check and turn off the Printer Check indicator; program interrogation will not turn the Printer Check indicator off.

If the I/O Check switch is set to STOP and a parity or sync check error occurs, the entire system stops after the line is printed. If the I/O Check switch is set to PROGRAM and a parity or sync check error occurs, the operation is completed and the program can branch to an error handling routine; however, even though the program continues processing, a sync check causes the 1443 to stop.

If the program is to remain in operation when a printer error occurs, then it is necessary to distinguish between a parity check and a sync check. The reason for this is that if *parity* errors occur, the program can accumulate a count of the errors that occur, and, if the count does not exceed a specified limit, *the program can continue processing*. However, if a sync check occurs, operator intervention is required *before another print instruction can be given*.

Distinguishing between a parity check and a sync check can be accomplished by testing the Printer Check indicator (25) twice after each Printer Write instruction. If the Printer Check indicator is on the second time it is tested, a sync check had caused the indicator to be turned on. (If a parity check had occurred, the *first* test would have turned off the indicator.)

IBM 1443 Printer Controls

Keys, Lights, and Switches (Figure 3)

Start Key. Pressing this key places the 1443 Printer in a ready status, provided the following conditions are met:

1. AC power ON
2. DC power ON
3. Forms in place
4. Typebar in position
5. Character-Set Selector switch positioned for the correct character-set
6. Carriage tape mounted
7. No error condition

Stop Key. Pressing this key removes the printer from ready status. The rest of the system is not affected unless the program selects the printer when the ready status has been interrupted; then the system is interlocked until the printer is ready.

Power On Light. This light indicates when DC power is applied to the printer control circuits.

Ready Light. This light indicates that the printer has been conditioned by the operator to accept instructions from this system. It is turned off if: the Stop key is pressed, the Typebar switch is turned off, a sync check error occurs, the Form Check light is on, the End of Form light is on, or the Carriage Interlock light is on.

Sync Check Light. This light is turned on when the typebar is not properly synchronized during a print operation. The Printer Check indicator and light are also turned on. When this error occurs, the Printer is removed from ready status. The Sync Check light and the Printer Check indicator and light (when they are turned on by a *sync* check) can be turned off only by pressing the 1443 Reset key.

Parity Check Light. This light is turned on when a parity error is detected by the error check circuits in the 1443. The Printer Check indicator and light are also turned on. The Parity light and the Printer Check indicator and light are turned off when the Printer Check indicator is tested by the program, or they can be turned off by pressing either the 1620 Reset key or the 1443 Reset key.

Form Check. This light indicates that forms are feeding improperly at the carriage tractors. There is a Form-Check switch located at the top of each forms tractor. When this light is on, the Ready light is off.

End-of-Form Light. This light is turned on when the last form passes the end-of-form switch lever. Printing will continue until a hole is sensed in control tape channel 1 and at this time the Ready light is turned off. In

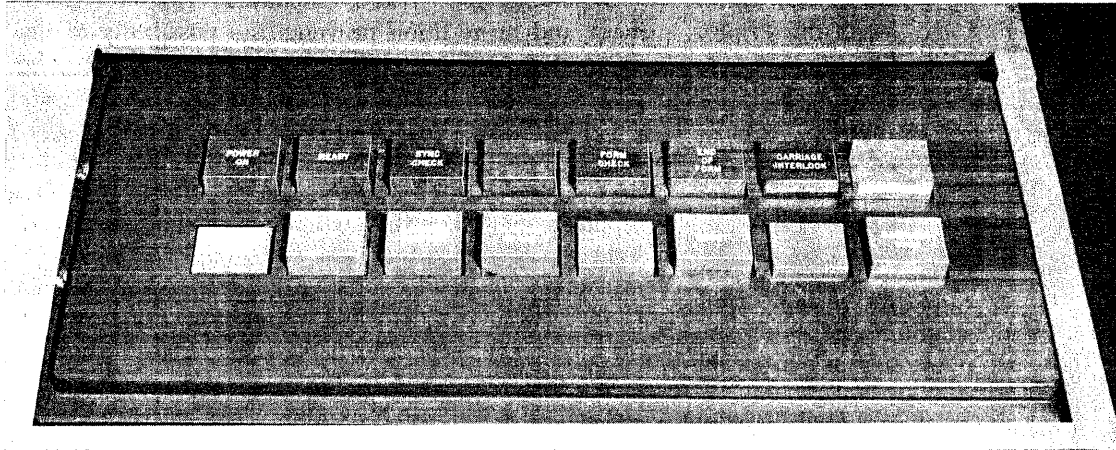


Figure 3. 1443 Keys, Lights, and Switches

the case where forms remain, pressing the Start key will allow printing to start and continue through a single form until tape channel 1 is again sensed. This operation can be repeated for a complete runout of forms.

Carriage Interlock. This light indicates that either the control-tape brush holder is in a raised position, or the protective cover for the 6 or 8 line spacing belt has been raised. When this light is on, the Ready light is off.

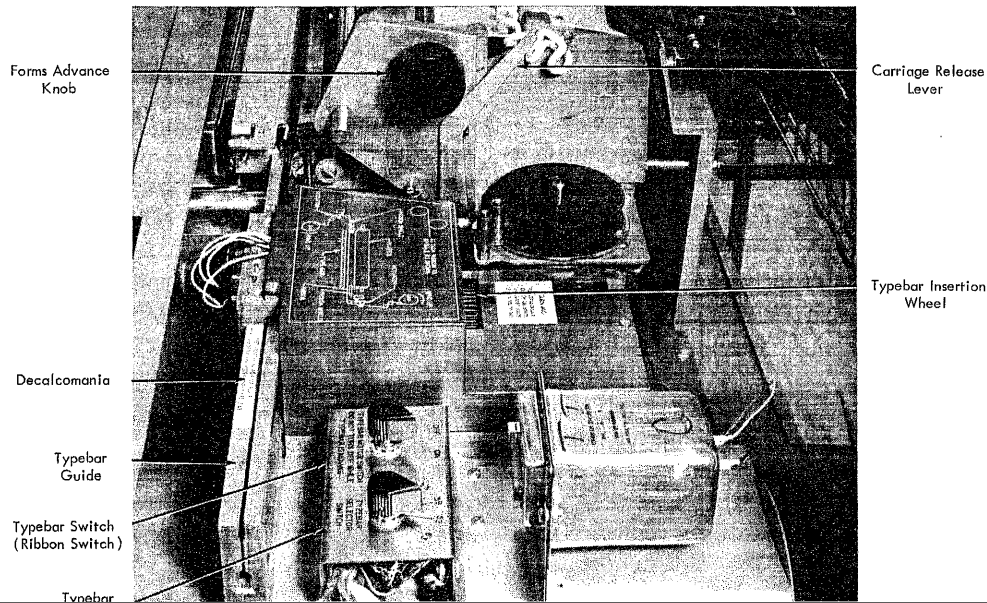
Carriage Restore Key. Pressing this key positions the

carriage at channel 1. If the Manual Clutch Knob is set to OUT, the form does not move. If it is set to IN, the form moves synchronously with the control tape.

NOTE: The Ready light must be off for this key to operate.

Carriage Space Key. Pressing this key causes the form to advance one space.

NOTE: The Ready light must be off for this key to operate.



Reset Key. Pressing this key turns off the Parity Check and Sync Check lights and resets the Printer Check indicator.

Carriage Stop Key. Pressing this key stops the carriage operation and should normally be used only in the event of a carriage run-a-way condition.

Manual Controls

Character-Set Selection Switch. This four-position switch must be set to either 13, 39, or 52 depending upon the character-set being used (Figure 4). If this switch is not set to the correct number, a sync check error will occur.

Typebar Insertion Wheel. This wheel is located to the right of the carriage and on the upper rear of the typebar drive unit. The typebar is positioned by manually rotating the wheel. It is used when inserting or removing a typebar in the printer. After power is turned off and the Typebar switch is turned off, the typebar is inserted from the right side of the printer as far as it will go in the typebar guide. The Typebar Insertion Wheel is then turned until the notch on the typebar flag of the 39 or 52 character typebar is aligned properly to the decal.

The aligning notch on the 13-character typebar-flag is difficult to see when the typebar is in the machine. Therefore, the right edge of the upper section of the flag can be used as a reference when inserting a 13-character typebar into operating position. Use care to avoid damage to the typebar.

Carriage Release Lever. When this lever is pulled forward, the printer carriage swings up and back, thereby permitting replacement of the printer platen.

Forms Advance Knob. This knob allows the forms to be manually advanced within the control carriage in increments of one space. No adjustment of the carriage — in relation to the typebar — is made.

After forms have been advanced manually and the manual clutch has been re-engaged, the Forms Advance knob should be rotated back and forth slightly to ensure that the detent has seated. Also, check the forms to ensure they are taut.

Typebar Switch (Ribbon Switch). This switch controls the typebar drive and the ribbon drive. In the OFF position it stops the ribbon and typebar-drive to permit replacement of the ribbon or to change the typebar. This switch is located on the right side of the printer under the cover.

Removing the typebar facilitates ribbon replacement and in addition prevents the possibility of machine damage if the ribbon is accidentally inserted between the type fingers. Damage can also be caused if ribbons are used after they have been worn through or frayed. The schematic diagram located to the right of the Typebar switch can be referred to during ribbon replacement. When this switch is turned off, the Ready light is off.

Manual Clutch Knob. (Figure 5.) The Manual Clutch knob controls the carriage-tape drive and the form-feeding mechanism. The Manual Clutch knob has two settings, OUT and IN. The OUT position disengages the clutch so that the form does not move with the carriage drive. The IN position engages the clutch so that the form is moved synchronously with the carriage control tape.

Horizontal Adjustment Knob. This knob is used for small adjustments of the printer carriage to the right or left in relation to the typebar.

Vertical Adjustment Knob. This knob is used for small up and down adjustments of the printer carriage in relation to the typebar.

Paper Brake. (Figure 6.) This control is located on the left side of the lower forms guide. It has six positions: 0 to 5. Rotating the adjusting control clockwise increases the amount of drag exerted on the form.

Excessive pressure can cause the forms to tear; too little pressure can cause wavy-line printing or unequal spacing.

When forms are inserted into the lower forms guide, the Paper Brake must be retracted fully by turning the control as far as possible in a counterclockwise direction and locking it.

Platen Positioning Knob. To compensate for the number of carbon copies used, the platen can be adjusted toward or away from the typebar by the Platen Positioning knob.

The adjustment is made through a knob on the lower left side of the carriage. Rotation of the control moves the platen forward or away from the typebar. The setting of the control at 3 is the standard position for the average one-part form of regular weight paper. The knob should be turned counterclockwise for increasing thicknesses of forms.

Sixteen positions are provided by the control. To insert a new form, the control must be turned fully counterclockwise (past position 15), then re-adjusted before printing is started.

Protective Cover for
line-spacing gears

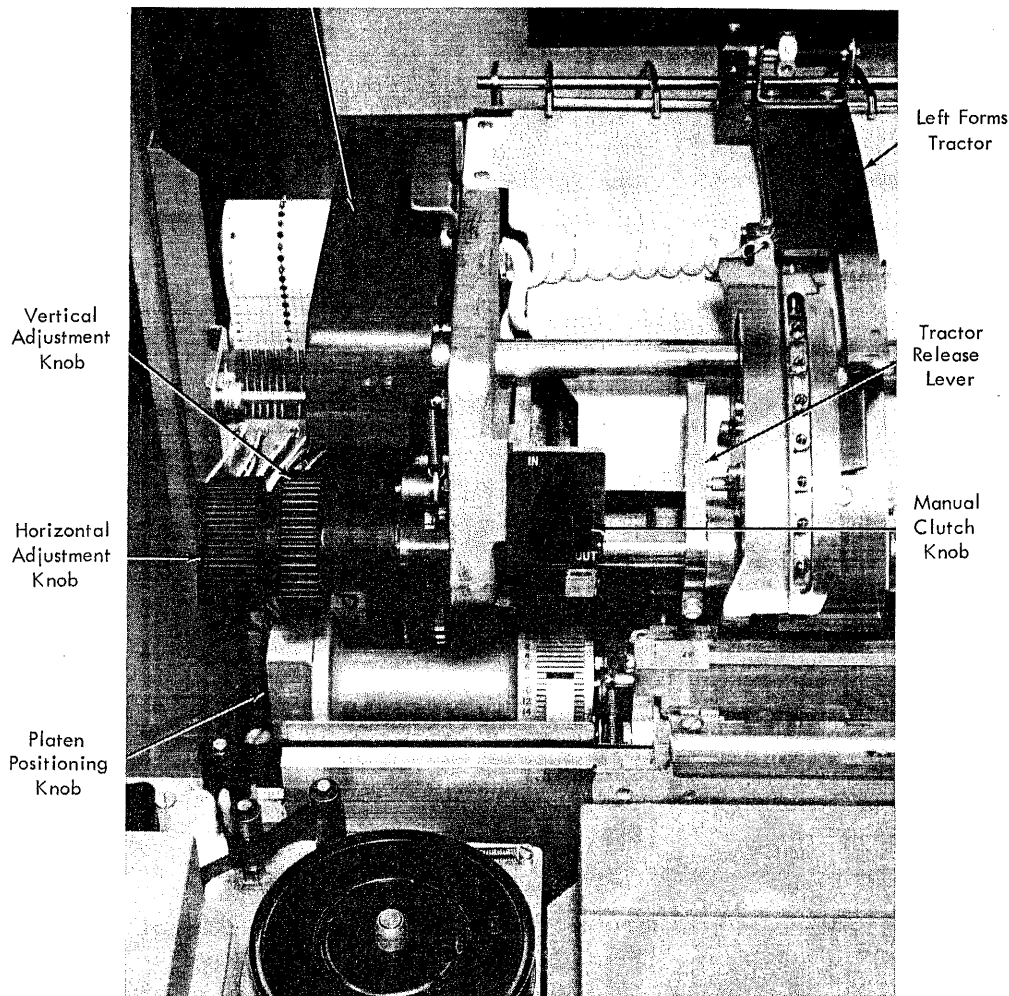


Figure 5. Manual Controls – Front-Left of 1443

Adjustment for 6 or 8 lines-to-the-inch Spacing

The following steps should be used to change the lines-to-the-inch spacing (refer to Figure 7).

1. Raise the protective cover.
2. Press the Tension Release lever towards the back of the machine.
3. Slide the rubber belt to the “inside” set of gears for 8 lines to-the-inch spacing or to the outside set of gears for 6 lines to-the-inch spacing.
4. Press the Tension Bar to apply tension to the belt.
5. Lower the protective cover into position.

Control Tape

The control tape (Figure 8) has 12 columnar positions indicated by vertical lines. These positions are called channels. Holes can be punched in each channel throughout the length of the tape. A maximum of 132 lines can be used to control a form, although for convenience, the blank tapes are slightly longer. Horizontal lines are spaced 6 to-the-inch for the entire length of the tape. Round holes in the center of the tape are prepunched so the pin feed drive will advance the tape to synchronize with the movement of the printed form

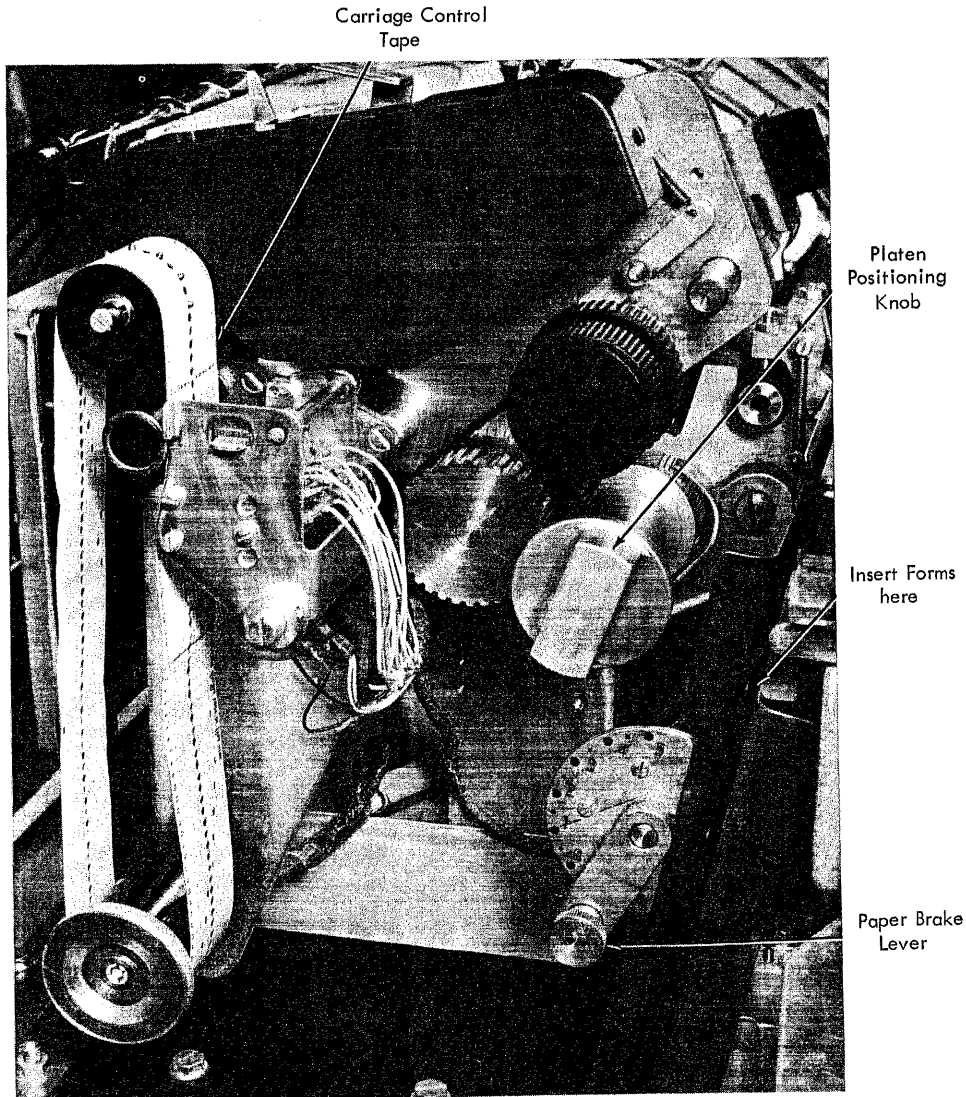


Figure 6. Manual Controls – Left Side of 1443

through the carriage. The effect is exactly the same as though the control holes were punched along the edge of each form.

Punching the Tape

A small compact punch (Figure 9) is provided for punching the tape. The tape is first marked in the channels in which the holes are to be punched. This can easily be done by laying the tape beside the left edge of the form it is to control, with the top line (immediately under the glue portion) even with the top edge of the form (refer to Figure 8). A mark is then

made in the first channel on the line that corresponds to the first printing line of the form. Additional marks are made in the appropriate channels for each of the other skip-stops and for the overflow signal required for the form.

The marking for one form should be repeated as many times as the usable length of the tape (22 inches) allows. (When the tape controls several forms in one revolution through the sensing mechanism, the life of the tape is increased.) Finally, the line corresponding to the bottom edge of the last form should be marked for cutting after the tape is punched.

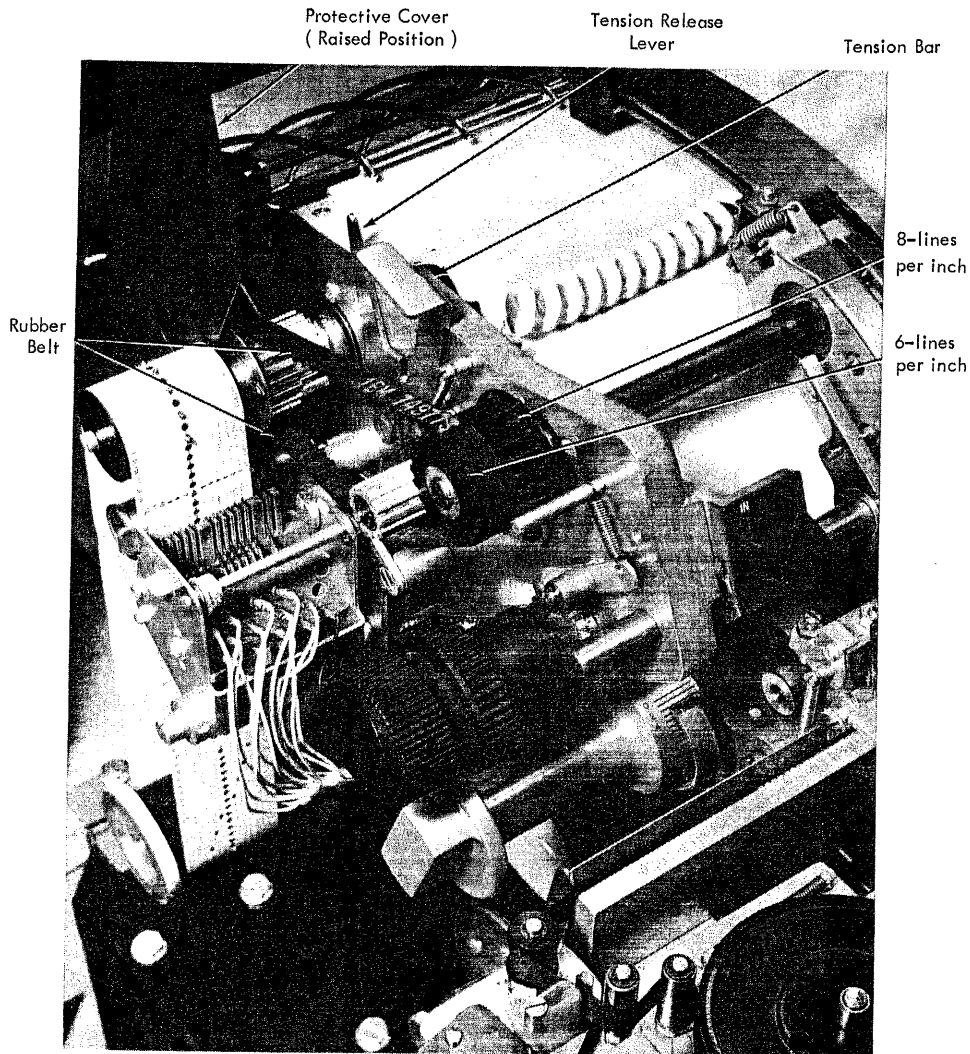
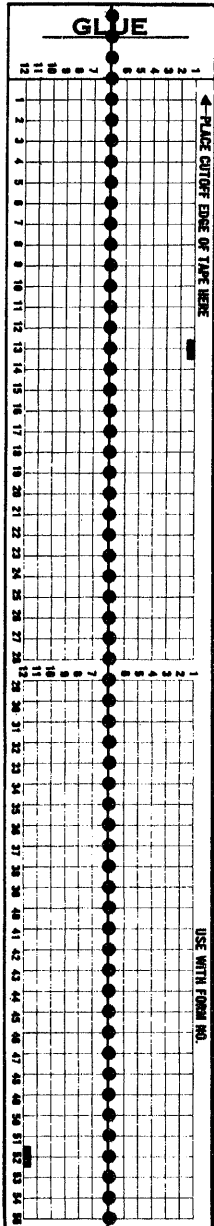


Figure 7. Line Spacing Mechanism

The tape is inserted in the punch by placing the line to be punched over a guide line on the base of the punch and placing the center feed holes of the tape over the pins projecting from the base. The dial is then turned until the arrow points to the number of the channel to be punched. Pressing on the top of the punch, toward the back, cuts a rectangular hole at the intersection of a vertical and horizontal line in the required channel of the tape. The tape should never be punched in more than one channel on the same line. After the tape is punched, it is cut and looped into a belt. The bottom end is glued to the top section, marked "glue," so the bottom line will coincide with

the first line. Before the tape is glued, the glaze on the tape should be removed by an ink eraser; if this is not done, the tape ends can come apart. The center feed holes should coincide when the two ends of the tape are glued together.

The last hole punched in the tape should be at least four lines from the cut edge, because approximately the last half inch of the tape overlaps the glue section when the two ends are spliced. If it is necessary to punch a hole lower than four lines up from the bottom of the form, the tape should be placed with the top line (immediately under the glue portion) four lines lower than the top edge of the form, before marking



EARTH WORK VOLUME AND AREA COMPUTATIONS.							
STATION NO.	PROFILE ELEVATION	STAKE OFFSET		CUT VOLUME	FILL VOLUME	LOSS	ACCUMULATED NET
		LEFT	RIGHT				
START				476372	384137	88352	C 3883
5325 + 00	313.13	136	142				C 3883
5326 + 00	310.46	136	146	21317			C 25200
5327 + 00	307.79	135	136	16511	21	5	C 41685
5328 + 00	305.12	144	88	7452	1457	364	C 47316
5329 + 00	302.45	136	97	7766	2183	546	C 52353
5330 + 00	299.78	132	107	11076	2227	557	C 60645
5331 + 00	297.20	93	111	4774	5761	1440	C 58218
5332 + 00	294.82	119	108	60	11527	2882	C 43869
5333 + 00	292.62	116	113		14382	3596	C 25891
5334 + 00	290.61	109	111		12958	3240	C 9693
5335 + 00	288.79	102	99	6830	5824	1456	C 9243
5336 + 00	287.16	103	108	9864	804	201	C 18102
5337 + 00	285.72	115	99	3034	6570	1643	C 12923
5338 + 00	284.47	116	112		13097	3274	C 3448
5339 + 00	283.41	113	117		14532	3633	C 21613
		TOTALS		565056	475480	111189	C 21613

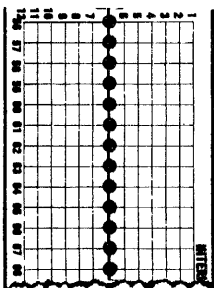


Figure 8. Control Tape and Form

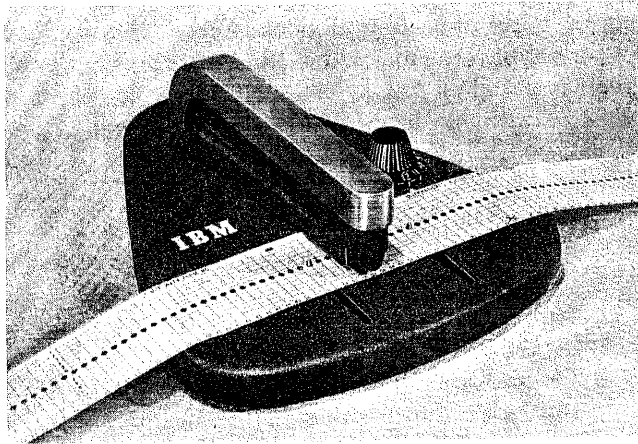


Figure 9. Tape Punch

the channels. To compensate for the loss, the tape should then be cut four lines lower than the bottom of the edge of the form.

Spacing for 8 Lines-per-inch

The control tape for 8 lines-per-inch spacing is punched as it would be for normal 6 lines-per-inch spacing. Each line on the tape always equals one line on the form, regardless of whether the latter is 6 or 8 lines-per-inch. In measuring a control tape for a document printed 8 lines to the inch on the form, every 1/8 inch on the form represents one line on the tape.

Inserting the Control Tape in the Carriage (Figure 10)

1. To gain access to the tape-reading mechanism, press up on the Cover Release latch and raise the counterbalanced cover of the printer.
2. Turn the Manual Clutch knob to disengage the clutch.

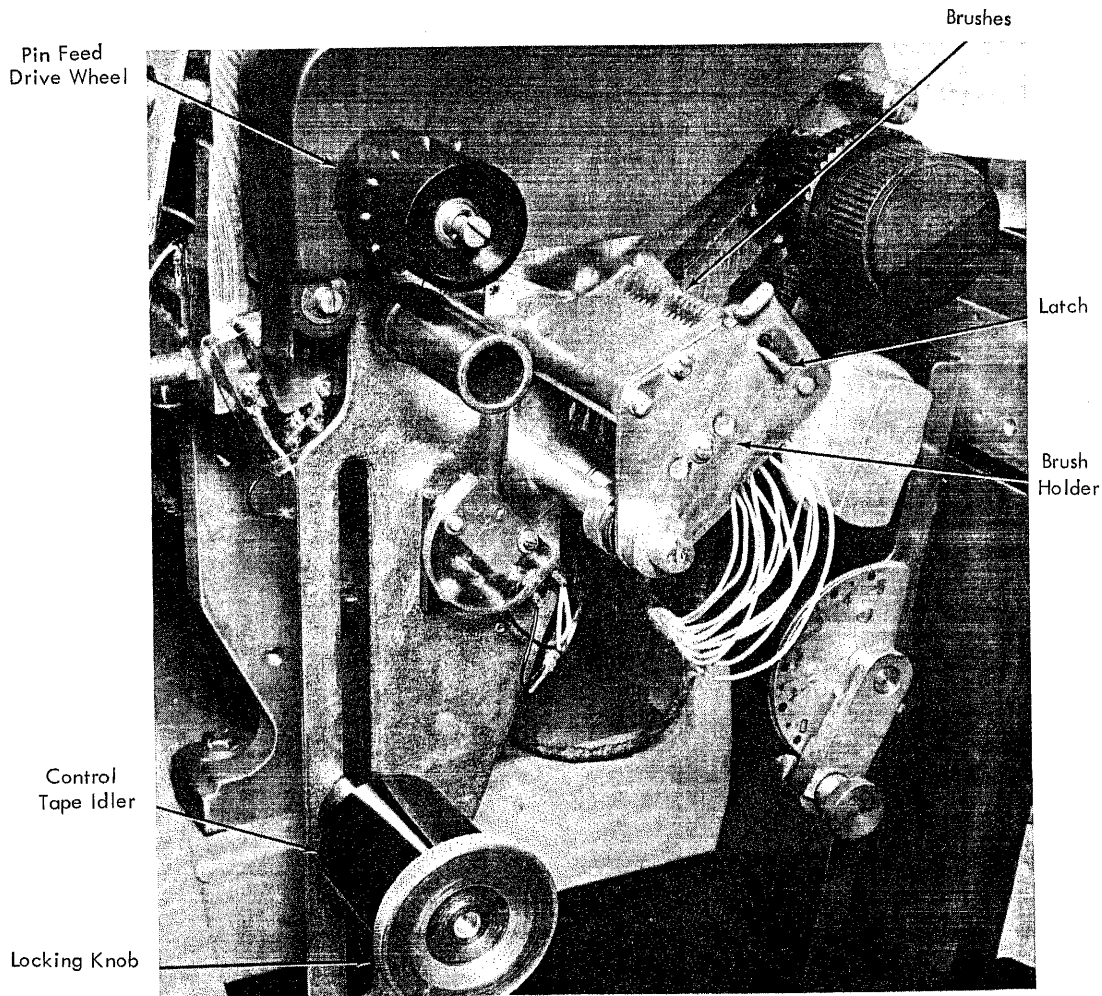


Figure 10. Control Tape Mechanism

3. Raise the brushes by lifting the latch located on the side of the brush holder.
4. Place one end of the tape loop — held so that the printed captions can be read — over the pin-feed drive wheel so that the pins engage the center drive holes.
5. Place the opposite end of the loop around the adjustable carriage control tape idler.
6. Remove the excess slack from the tape by loosening the Locking knob on the idler and moving the idler in its track. Tighten the knob when the desired tension is reached. The tape should be just tight enough so that it gives slightly when the middle portions of the loop are pressed together. If it fits too tightly, damage can occur to the pin-feed holes.
7. Press the brushes into operating position until they latch and close the printer cover when the tape is in position.
8. Press the Carriage Restore key to bring the tape to its home position and turn the Manual Clutch knob back to the engaged position. The carriage is now ready to operate.

Forms

The forms used on the IBM 1443 must be designed for use with a tractor feed (Figure 11). Therefore, the forms must be continuous with marginal punching on both sides. There is no provision for single-sheet feed-

ing or pressure-feeding of documents. The maximum paper width recommended is 16 $\frac{3}{4}$ inches and the minimum is 4 inches. For more detail on forms specifications, refer to *IBM 1403 and 1443 Printers Form Design Considerations* (Form A24-3041).

Forms Insertion (Figure 11)

1. Raise the cover of the printer to gain access to the print and forms area.
2. Turn the Manual Clutch knob to the out position.
3. Set the Platen Positioning knob to "16."
4. Set the Paper Brake lever just to the left of "0," and lock it into position.
5. Raise the Print-Line indicator.
6. Raise the upper and lower Tractor Pressure plates of both forms tractors.
7. Place the forms on the floor or a paper stand beneath the printer.
8. Raise the paper form up and to the left of the printer so that — after the form is inserted — about one or two pages would extend beyond the Print-Line indicator. Insert the form from the left side into the opening just in front of the Paper Brake lever (refer to Figure 6).
9. Press down on the top edge of both Tractor Release levers to permit the tractors to move freely.
10. Set the left Forms Tractor slightly to the left of the first printing position.
11. Insert the form on the pins and close the upper and lower pressure plates.

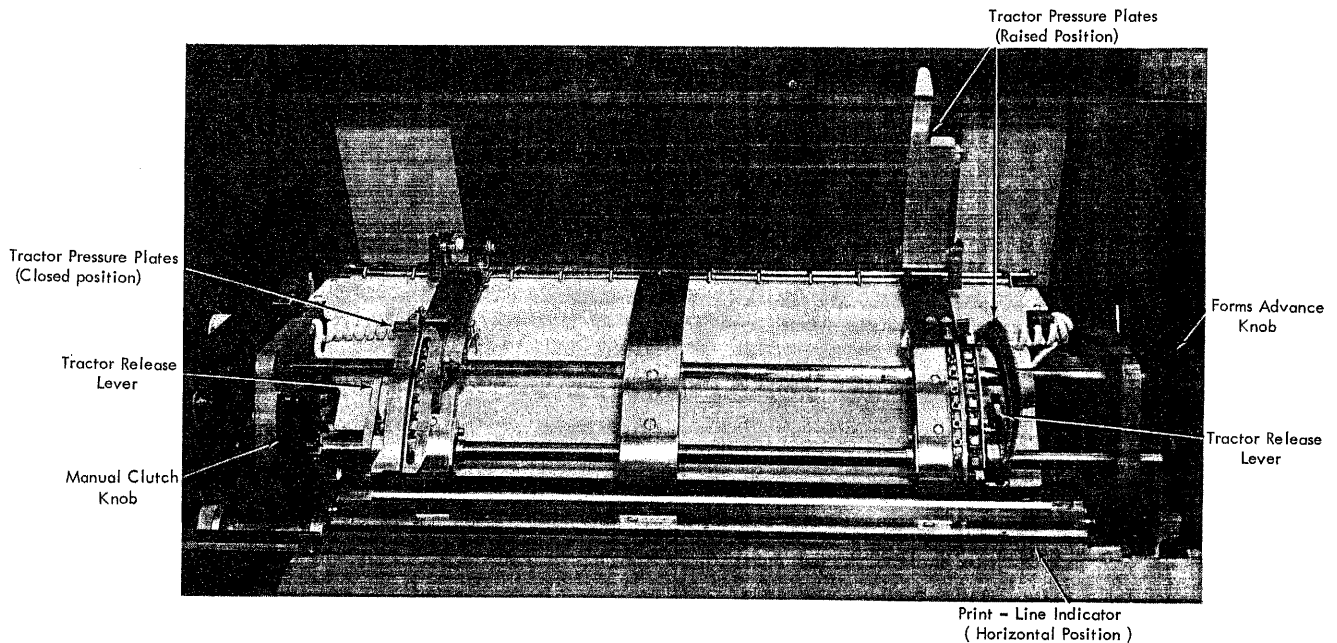


Figure 11. Inserting Forms

12. Move the right Forms Tractor to line up with the right side of the form.
13. Insert the form on the pins and close the upper and lower Tractor Pressure plates.
14. *Raise up* on the top edge of both Tractor Release levers thereby locking the Forms Tractors into position.
15. Lower the Print-Line indicator to the normal position.
16. Turn the Vertical and Horizontal Adjustment knobs to align the form exactly with the correct printing position.
17. Turn the Forms Advance knob to align the first printing line of the form with the printing positions of the print bar. This can be accomplished by setting the bottom of the first printing line of the form to a position just above the top of the Print-Line indicator; and then turning the Forms Advance knob *backward* for 10 lines.
18. Set the Platen Positioning knob according to the number of parts in the form.
19. Reposition the Paper Brake.
20. Turn the Manual Clutch knob to *IN*.
21. Close the cover.

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