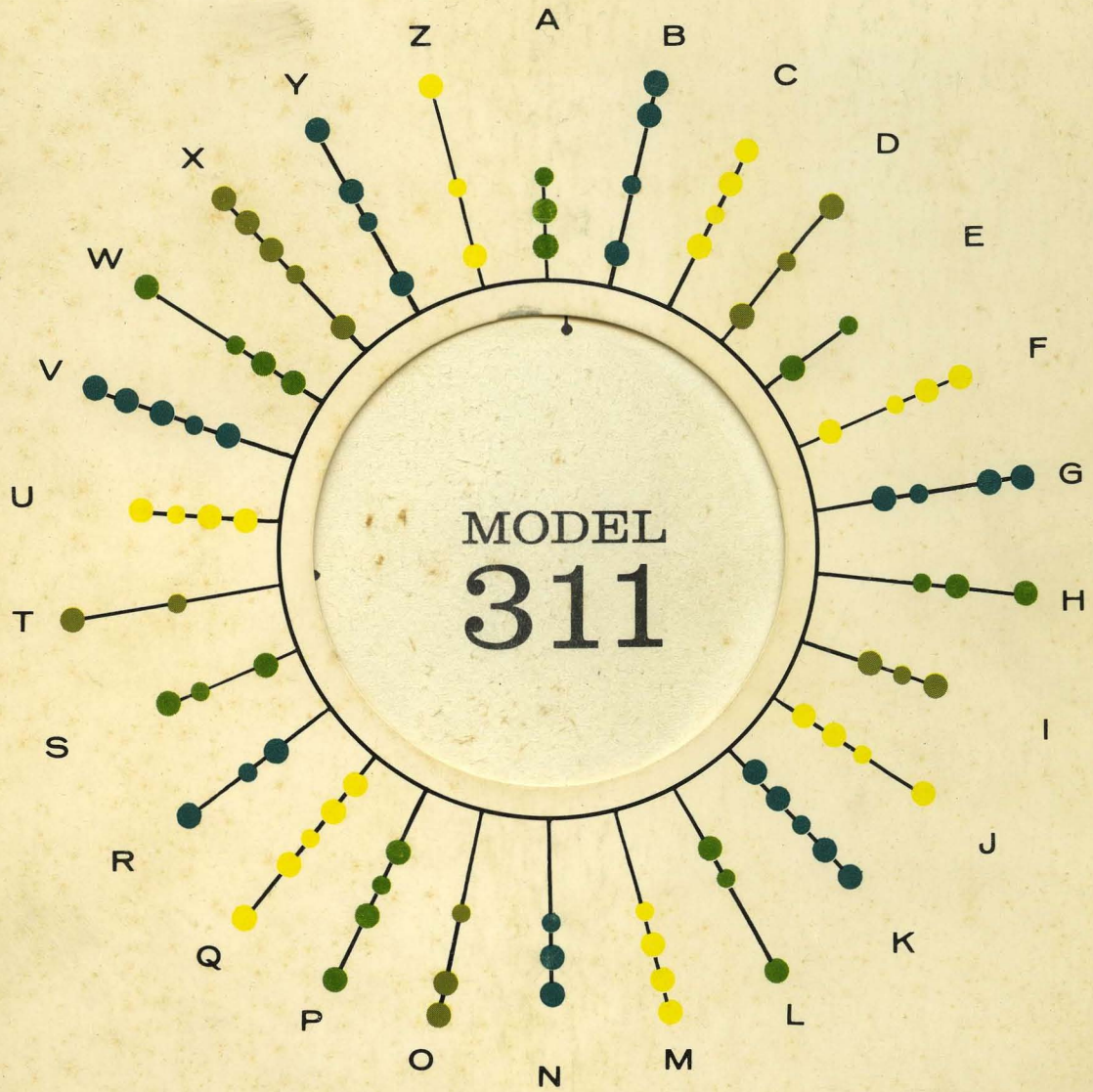
OPERATION AND MAINTENANCE MANUAL



SCM®

KLEINSCHMIDT
DIVISION OF SCM CORPORATION
DEERFIELD, ILLINOIS

E.S. 134

Operation and Maintenance Manual

MODEL 311

99129A-07

5-65

THIS MANUAL

This manual is published by the Technical Information Department, KLEINSCHMIDT Division of SCM Corporation, Deerfield, Illinois, for the information and guidance of all concerned with the installation, operation and maintenance of the Electronic Data Printer Model 311.

A plastic ring binding permits easy page replacement, or the addition of new pages. New pages will contain "T" binding slots for easy insertion in the manual.

The component chapters of the manual are listed below. Detailed indexes are listed at the start of each chapter.

Chapter 1. Installation and Operation

Chapter 2. Principles of Operation

Chapter 3. Keyboard Theory and Maintenance

Chapter 4. Printer Theory and Maintenance

All models of the 311 are basically alike, yet each model is adapted to the customer's particular needs, therefore, to make the manual as flexible as the Model 311, the following format is used: Chapters 1 and 2 are compatible with all models, whereas Chapters 3 and 4 describe entirely only the models built according to the Engineering Specifications (ES..) listed on the title page.

CHAPTER 1

INSTALLATION AND OPERATION

TABLE OF CONTENTS

CHAPTER 1

INSTALLATION AND OPERATION

LIST OF ILLUSTRATIONS

*Equipment with form-feed and vertical tab facilities only.

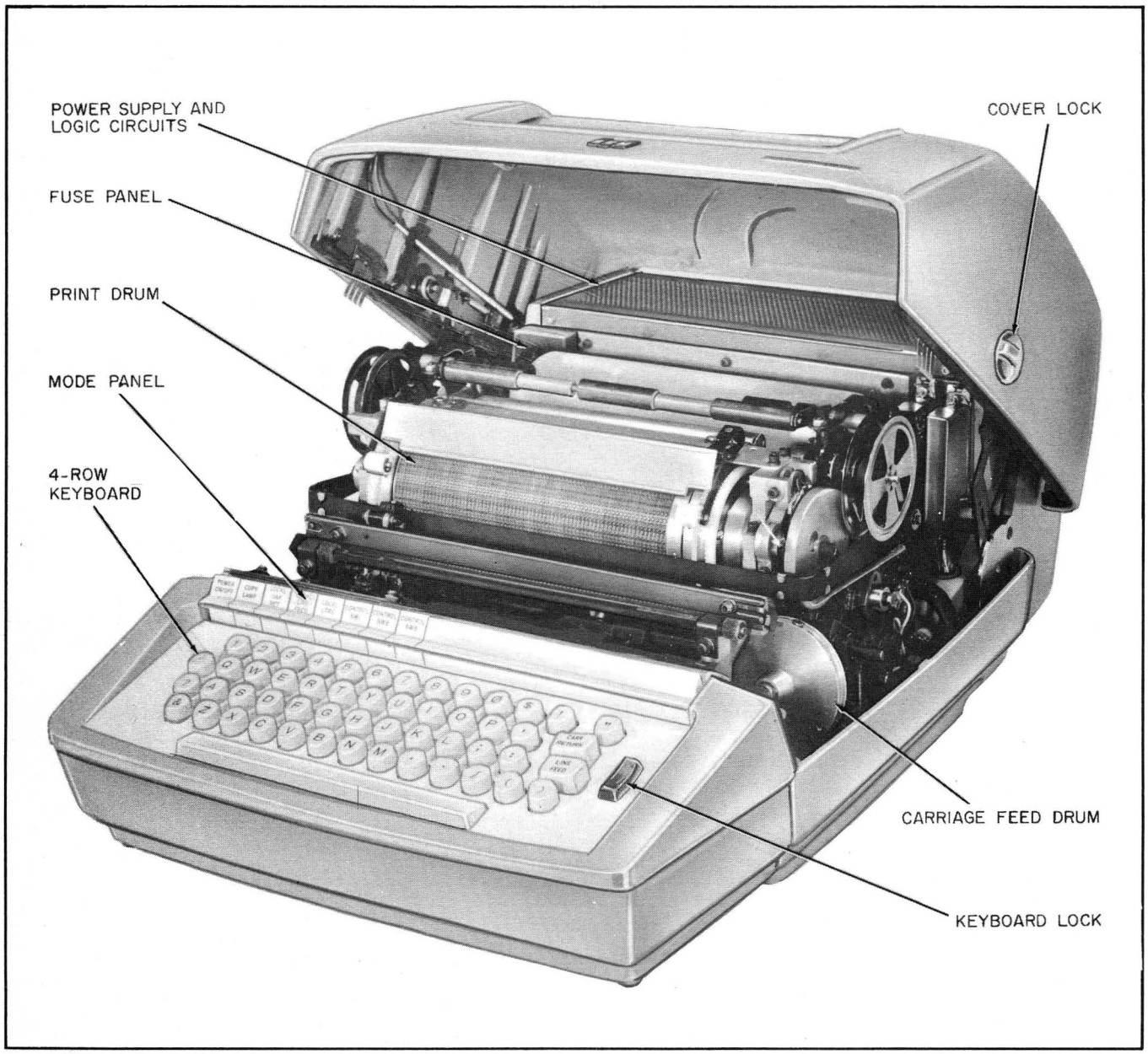


Figure 1A-1. Model 311 Electronic Data Printer.

CHAPTER 1

INSTALLATION AND OPERATION

Chapters 1 and 2 of this Manual are applicable to Model 311 Electronic Data Printers manufactured according to Engineering Specifications ES126 through ES141. Chapters 3 and 4 are unique to the models manufactured according to the Engineering Specifications listed on the title page (at the front of this manual).

Section A Description and Data

1A-1 PURPOSE AND USE

The Model 311 Electronic Data Printer in its basic form is a parallel-signaling page printer that can be adapted to a variety of serial and parallel systems. Figure 1A-1 shows a typical printer. The Model 311 can print at speeds up to 40 characters per second in parallel systems, and at speeds up to 300 bauds in serial systems. A keyboard is optional. The three systems shown in figure 1A-2 cover the main uses of the Model 311.

1A-2 TECHNICAL REFERENCE DATA

The technical characteristics listed below are applicable to all models. Additional technical characteristics are listed (as applicable to individual models) in paragraph 1A-5. Differences in mode panels are shown in figure 1C-1 (page 1C-7).

a. Type of Installation. Fixed station.

b. Type Style. Murray style.

c. Type of Characters. See Figure 1A-4.

d. Characters per Line.

Standard - - - -	72	10 characters per horizontal inch.
Weather - - - -	76	
Optional - - - -	80	

e. Format Characters. At least one carriage return code and one line feed code must be sent to the printer at the end of each line on 311's not equipped with carriage return switch S13, see figure 4G-1.

f. Paper Feed. Combined sprocket and friction feed. Six lines per vertical inch in single line feed position.

Paper Supply Location:
External for fanfold; internal for roll.

Roll: Up to 5 inches in diameter,
8-7/16 ± 3/64 inches wide,
340 feet long,
3 lbs. maximum.

Fanfold: 8-7/16 ± 3/64 inches wide.

Printed lines per roll: Approximately 24,000.

Duration: Paper will last about 1-1/2 hours at 40 characters per second or 6 hours at 100 wpm (75 bauds).

Number of fanfold copies: Original and three tissue carbon copies.

Number of roll copies: Original only.

g. Finish. Per MIL-E-15090 as required.

h. Electrical Characteristics.

Operating Voltage:
115 VAC ± 10%, 60 cycles ± 1/2 cycle
(± 3 cycles with phase compensator, see figure 4G-1).

Power Requirement: 150 watts nominal.

Signaling Voltage: See paragraph 1B-6.

Interface Characteristics. See paragraph 1B-6.

i. Approximate Dimensions: Overall dimensions of assembled Model 311 are shown in figure 1A-3.

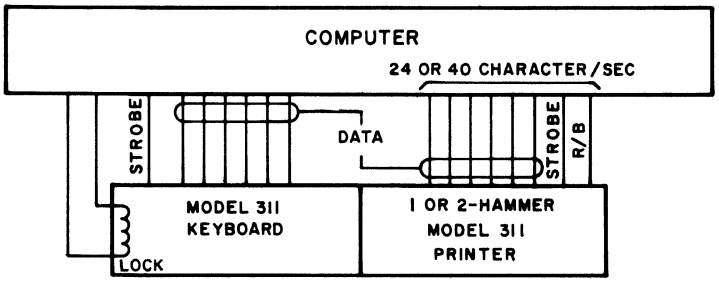
1A-3 COMPONENTS OF MODEL 311

a. Some of the sixteen combinations of the Model 311 are one-package models. The others (5-level and 6-level serial, send-receive 2-hammer printers) require a second package (fig. 1A-5) for electronics and logic power supply.

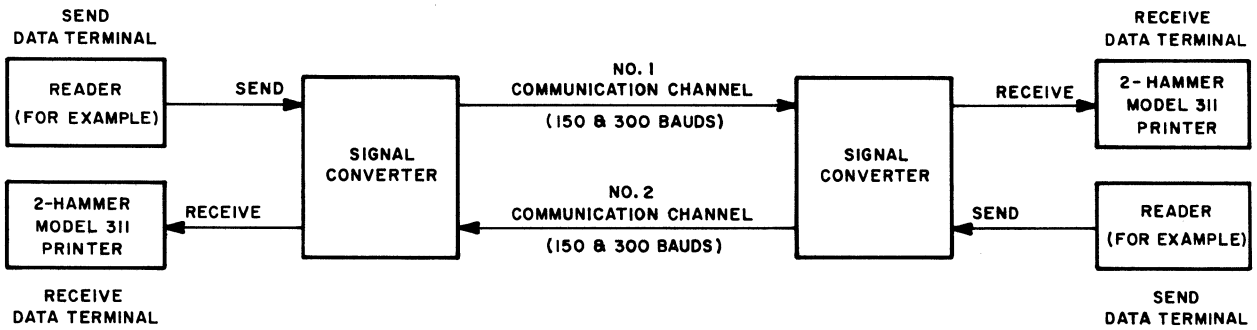
b. Additional equipment: Running spares, external electronics and power supply (if applicable, see par. 1A-5).

1A-4 RUNNING SPARES

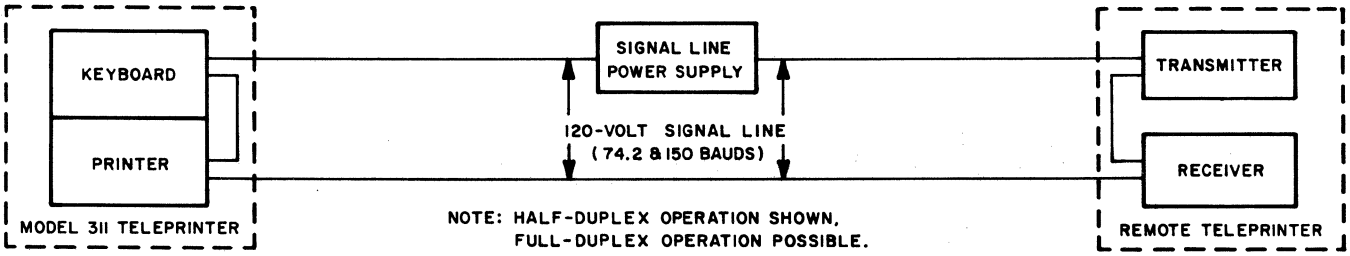
Quantity	Item
1	Paper roll spindle
3	Inking ribbon
10	Fuses
1	Terminating connector for signal line (if applicable)
1	Circuit-board extender
1	Circuit-board extractor



A. INPUT-OUTPUT APPLICATIONS, PARALLEL EQUIPMENT
(E.S. 128,129,132,133,136,137,140 & 141)



B. DATA TERMINAL APPLICATIONS, SERIAL EQUIPMENT
(E.S. 134,135,138 & 139)



C. TELEPRINTER APPLICATIONS, SERIAL EQUIPMENT
(E.S. 126,127,130 & 131)

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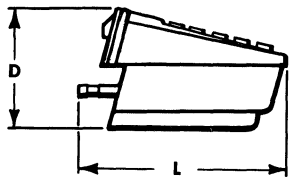
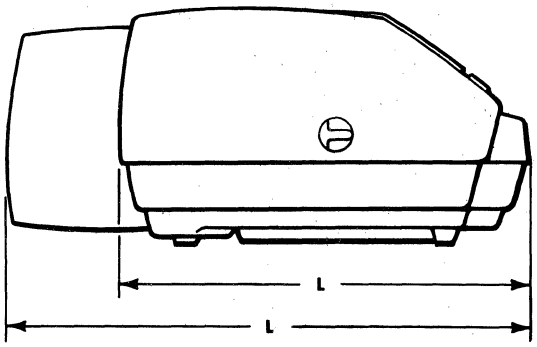
Figure 1A-2. System applications.

1A-5 DIFFERENCES IN MODELS

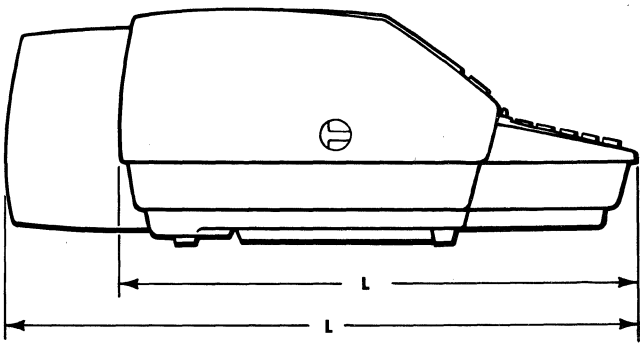
ENGINEERING SPECIFICATION NO.	SEND/RECEIVE (S/R) OR RECEIVE ONLY (R/O)	PRINTER (RECEIVER)						KEYBOARD (TRANSMITTER)				ELECTRONICS AND POWER SUPPLY	
		NUMBER OF HAMMERS	SERIAL (S) PARALLEL (P)	INFORMATION BITS	PARALLEL SPEED (R/B CHARACTERS PER SECOND)	RECEIVE BAUD RATE	TOTAL BITS PER CHARACTER	TYPE	NUMBER OF KEY ROWS	TRANSMIT BAUD RATE	TOTAL BITS PER CHARACTER	WITHIN PRINTER PACKAGE	IN EXTERNAL PACKAGE
126	S/R	1	S	5	-	74.2, 150	7.00	A	3	74.2, 150	7.00	X	
127	R/O	1	S	5	-	74.2, 150	7.00	-	-	-	-	X	
128	S/R	1	P	5	20	-	-	A	3	-	-	X	
129	R/O	1	P	5	20	-	-	-	-	-	-	X	
130	S/R	1	S	6	-	75, 150	8.00	E	4	75, 150	8.00	X	
131	R/O	1	S	6	-	75, 150	8.00	-	-	-	-	X	
132	S/R	1	P	6	20	-	-	E	4	-	-	X	
133	R/O	1	P	6	20	-	-	-	-	-	-	X	
134	S/R	2	S	5	-	150, 300	8.00	A	3	150, 300	8.00		X
135	R/O	2	S	5	-	150, 300	8.00	-	-	-	-	X	
136	S/R	2	P	5	40	-	-	A	3	-	-	X	
137	R/O	2	P	5	40	-	-	-	-	-	-	X	
138	S/R	2	S	6	-	150	9.00	E	4	150	9.00		X
139	R/O	2	S	6	-	150	9.00	-	-	-	-	X	
140	S/R	2	P	6	40	-	-	E	4	-	-	X	
141	R/O	2	P	6	40	-	-	-	-	-	-	As required	

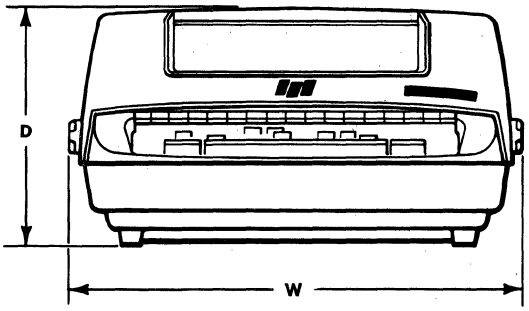


A. KEYBOARD



B. RECEIVE ONLY PRINTER





C. SEND-RECEIVE PRINTER

Item	Fig. 1A-3	Width (in.)	Length (in.)	Height (in.)	Weight (Without paper roll)
Keyboard 3-row	A	15-5/8	6-1/2	3-7/8	7 lbs. 12 oz.
Keyboard 4-row	A	15-5/8	6-1/2	3-7/8	8 lbs. 2 oz.
Printer:					
Without power supply *	B	17	15-1/4	9-5/16	43 lbs.
With internal power supply*	B	17	19-7/8	9-5/16	56 lbs.
With cover open	-	-	-	14-1/2	-
Send-Receive printer:					
With power supply	C	17	24	9-5/16	64 lbs.
Without power supply	C	17	19-5/8	9-5/16	52 lbs.
External Power Supply	Fig. 1A-5	17	17-1/2	6-1/2	28 lbs.
* See Paragraph 1A-5					

99129A-10

Figure 1A-3. Dimensions.

1A-6 GENERAL DESCRIPTION

a. General (fig. 1A-1). The Electronic Data Printer, Model 311 consists of either a page printer or a keyboard and page printer, mode panel, electronic circuit boards, and power supply. The keyboard is mounted in front of and below the dust cover; the mode panel is an integral part of the printer. The power supply and electronic circuit boards are housed in the printer module in most cases (par. 1A-5).

b. Serial Keyboard Description. (fig. 1A-4)

(1) Physically, the serial keyboard consists of a cover, typing mechanism, and keyboard base. The keyboard electronics are within the printer package behind the printing mechanism (fig. 1A-1) or in the electronic unit (fig. 1A-5).

(2) A depressed typing key causes the keyboard to generate sequentially the 7 or 8 mark and space signals that represent the character.

(3) The typing keys are arranged in three-row or four-row order, with typewriter spacing between the keys. One to five (or six) glass-enclosed reed switches close magnetically in response to the depression of a typing key, electrically encoding the corresponding character. A universal-bar reed switch closes for each depressed key to provide a start signal for the associated keyboard electronic circuits. The keyboard touch is like that of an electric typewriter, although there is no mechanical linkage between the typing mechanism and printer.

(4) Two character typing bursts that exceed the line rate are permissible; the second character is held in mechanical storage until the first character has been transmitted out of electronic storage. A keyboard lock mechanism prevents the typing of a third character until the first character is transmitted electrically.

(5) The keyboard electronics convert parallel electrical signals generated by the typing mechanism into serial electrical signals required by the signaling line. The electronics are contained on four printed circuit boards. For 120-volt teleprinter applications, an output keying relay is employed; it is located behind the printer mechanism.

c. Parallel Keyboard Description (fig. 1A-4).

(1) Physically, the parallel keyboard consists of a cover, typing mechanism, and keyboard base that are identical to the serial keyboard.

(2) A depressed typing key provides:

(a) 1 to 5 (or 6) code switch closures to represent the typed character in parallel 5-level or 6-level form, and:

(b) A universal-bar switch closure to indicate that a character has been typed.

(3) The typing keys are arranged in three-row or four-row order, with typewriter spacing between the keys. The keyboard touch is like that of an electric typewriter, although there is no mechanical linkage between the typing mechanism and printer. The glass-enclosed code switches and universal-bar switch close magnetically in response to the depression of a typing key.

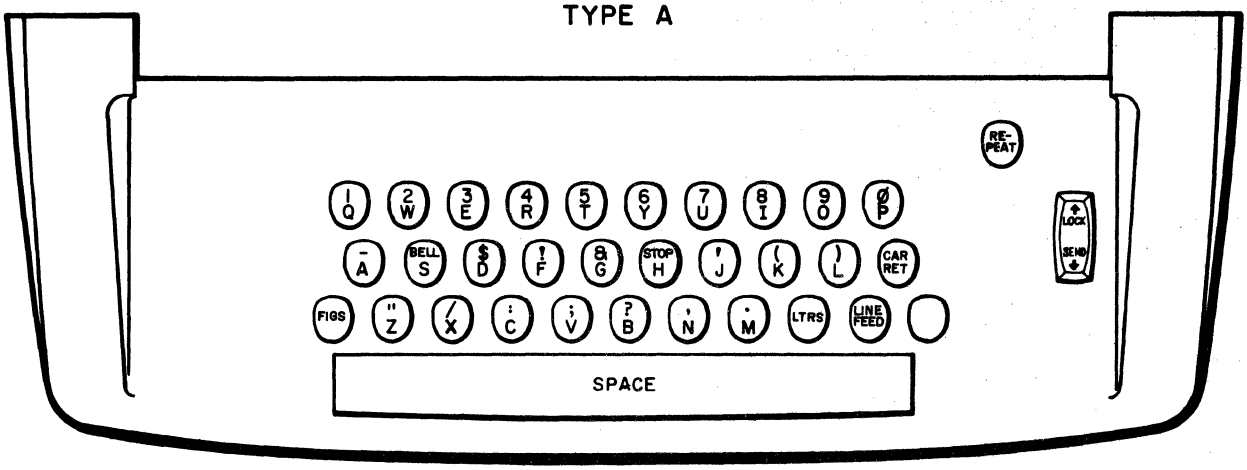
(4) A keyboard lock solenoid is provided. It can be energized once per character by the receiver to avoid mis-selection due to rocking of the code bails. It can also be used to prevent further typing.

d. One-Hammer Printer Description.

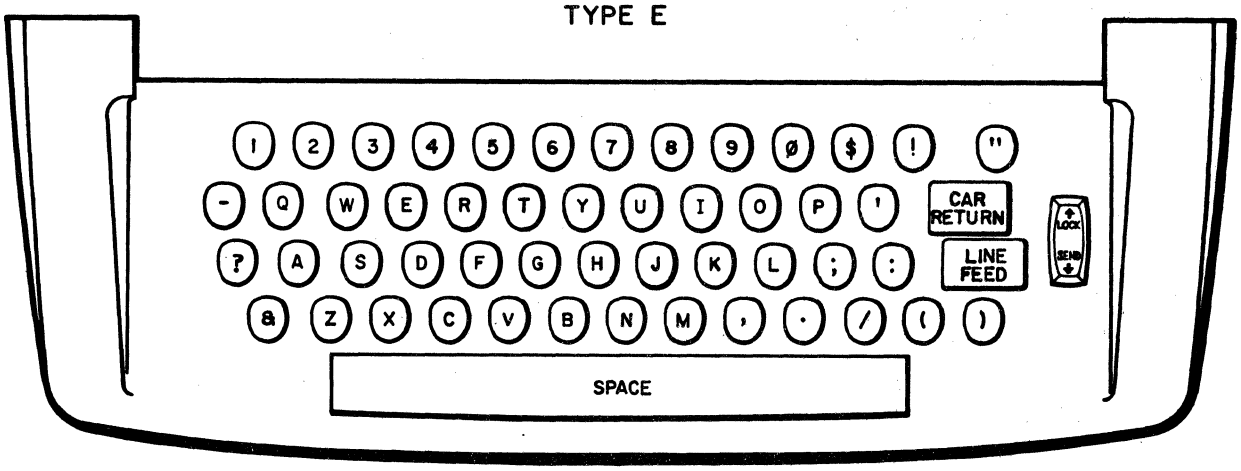
(1) Functionally, a one-hammer printer consists of a printing mechanism with a one-hammer carriage, a mode panel, electronics, and a power supply. The printer electronics are contained on printed circuit boards behind the printing mechanism.

(2) The printing mechanism employes a continuously rotating drum (fig. 1A-1) composed of 36, 38, or 40 typewheels, each typewheel having two identical rows of communication symbols embossed on it. A print hammer which is part of the carriage assembly is carried left to right in front of the drum. The hammer is triggered to press the ribbon against the paper and drum as the desired character appears in line with the hammer. Drum-position-monitor coils provide a series of pulses to the printer electronics to permit comparison of the characters passing the print hammer with the received character. Characters on each typewheel are in binary order according to the Baudot code, with letters on one-half of the typewheel and figures on the other half. Each character is assigned a position in a 64-count binary progression. The printer electronics employ a comparison circuit to compare the binary position of the incoming character with the position of a counter which is stepped continuously by the 64 pulses from the type drum monitor. For serial one-hammer printers, an electronic serial-to-parallel converter is employed between the signal line and the one-hammer parallel printer electronics.

TYPE A



TYPE E



Binary Position	Character	Binary Position	Character	Binary Position	Character	Binary Position	Character
0	∅ (Blank)	16	T	32	∅ (Blank)	48	5
1	E	17	Z	33	3	49	"
2	∅ (Line Feed)	18	L	34	∅ (Line Feed)	50	)
3	A	19	W	35	-	51	2
4	∅ (Space)	20	H	36	∅ (Space)	52	∅ (Stop)
5	S	21	Y	37	∅ (Bell)	53	6
6	I	22	P	38	8	54	Ø
7	U	23	Q	39	7	55	1
8	∅ (Car Ret)	24	O	40	∅ (Car Ret)	56	9
9	D	25	B	41	$	57	?
10	R	26	G	42	4	58	&
11	J	27	∅ (Figs.)	43	'	59	∅ (Figs.)
12	N	28	M	44	,	60	.
13	F	29	X	45	!	61	/
14	C	30	V	46	:	62	;
15	K	31	∅ (Ltrs.)	47	(	63	∅ (Ltrs.)
	∅ Non-Print						

Figure 1A-4. Keyboard and typewheel arrangements.

e. Two-Hammer Printer Description.

(1) Functionally, a two-hammer printer consists of a printing mechanism with a two-hammer carriage, a mode panel, electronics, and a power supply. The printer electronics are contained on printed circuit boards either behind the printing mechanism or in a separate package (par. 1A-5).

(2) The printing mechanism employs a continously rotating drum (fig. 1A-1) composed of 36, 38, or 40 typewheels, each typewheel having two identical rows of communication symbols embossed on it. Two print hammers which are part of the carriage assembly are carried left to right in front of the drum. Each hammer is triggered individually to press the ribbon against the paper and drum as the desired character appears in line with the hammer. Drum-position-monitor coils provide a series of pulses to the printer electronics to permit comparison of the characters passing both print hammers with two received characters. With a two-hammer printer, mechanical spacing of the carriage is required only half as often as with a one-hammer printer. Characters on each typewheel are in binary order according to the Baudot code, with letters on one-half of the typewheel and figures on the other half. Each character is assigned a position in a 64-count binary progression. The printer electronics employ two identical comparison circuits to compare the binary position of two incoming characters with the position of a counter which is stepped continuously by the 64 pulses from the type drum monitor. For serial two-hammer printers, an electronic serial-to-parallel converter and a 4-character buffer are employed between the signal line and the two-hammer parallel printer electronics.

f. Mode Panel Description (fig. 1C-1). The mode

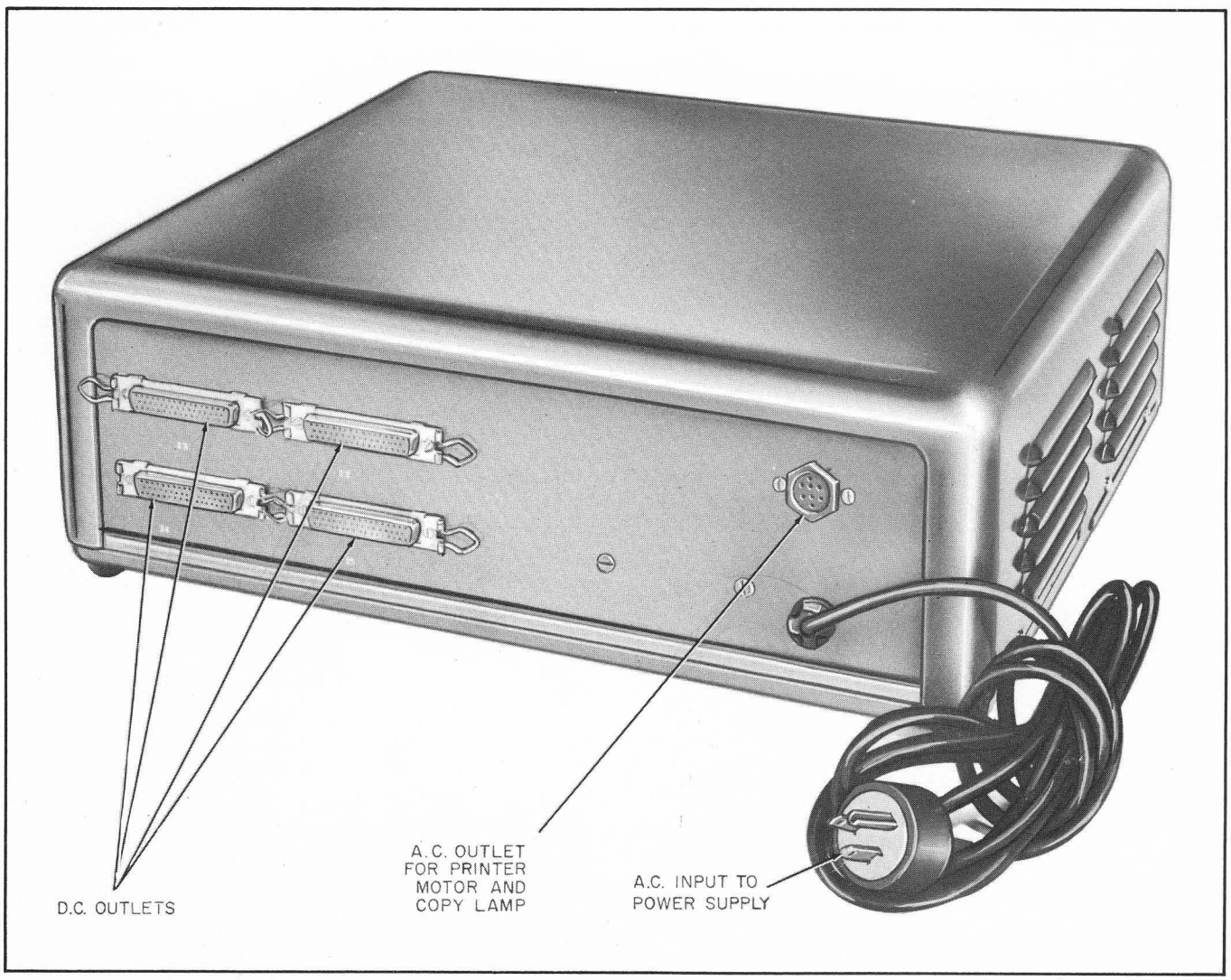


Figure 1A-5. Electronic unit.

panel comprises control switches and indicator lamps. Basic equipment on all Model 311 mode panels consists of:

POWER ON/OFF switch with indicator lamp.
COPY LAMP switch.
LOCAL C.R. switch and LOCAL L.F. switch.

In addition to the above, mode panels of certain models contain any or all of the following:

LINE BREAK switch, LOCAL LTRS switch, INTERLOCK lamp, REQ SEND switch, CLEAR SEND lamp. Additional control switches may be installed to meet customer requirements. A total of 17 positions are available on the mode panel.

g. Power Supply. The DC power supply accepts 115 volts alternating current and delivers low voltage direct currents to the electronic circuits and to the printer magnets. AC for printer motor and copy lamps is also fed through the power supply module. The DC power supply does not provide signal line current for 120-volt serial lines.

Section B Installation Instructions

1B-1 SITING

Select a location which provides the following:

a. Convenient access for operating and maintenance personnel.

b. Adequate illumination.

c. Unrestricted passage for flow of message traffic.

d. Access to power source outlet. The power cord is six feet long.

1B-2 UNPACKING (fig. 1B-1)

a. Packaging Data. When packed for domestic shipment, the Model 311 is mounted on a wooden shipping board with two machine screws, lockwashers, flat washers and nuts, and packed in a fiberboard carton which is then packed in a triple wall fiberboard shipping carton. Both cartons are sealed with adhesive tape.

b. Removing Contents.

CAUTION: Do not permit unpacking tools to penetrate or mutilate the package or its contents.

(1) With a sharp knife slit along the lower extremities (all four sides) of the package.

(2) Lift the triple wall fiberboard carton to remove.

(3) Carefully slit along the lower extremities (all four sides) of the fiberboard carton.

(4) Lift the fiberboard carton to remove.

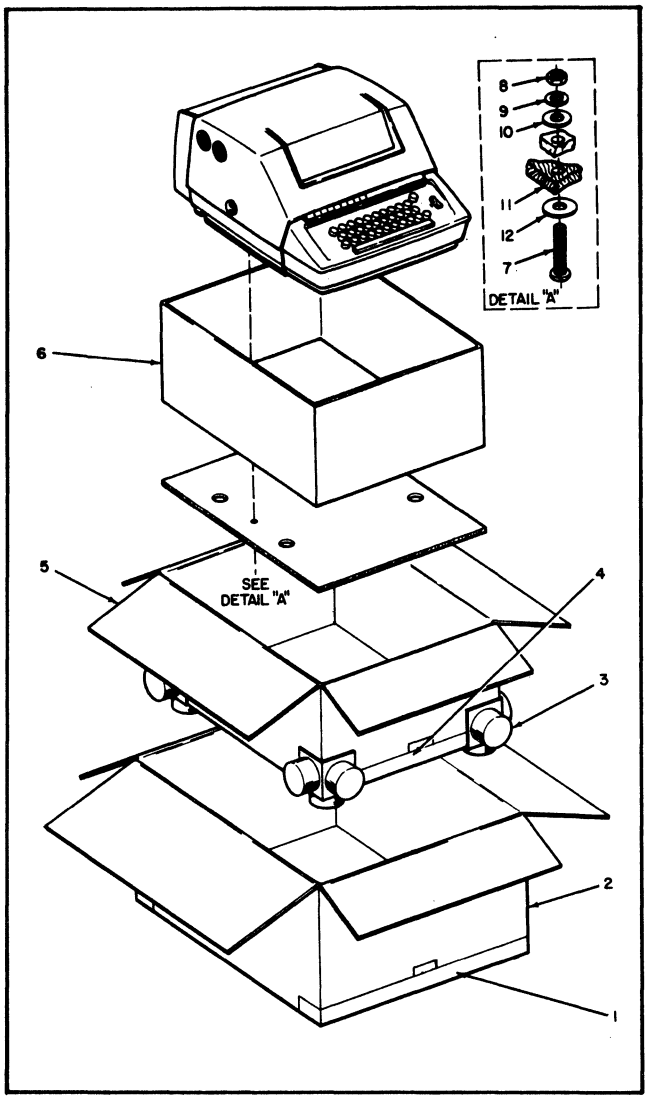


Figure 1B-1. Packaging for domestic shipment.

Legend for Figure 1B-1

Item	Quantity	Part Name	Part No.
1	As required	A/R Tape	30235
2	1	Shipping carton	31105
3	8	Corner pads	31104
4	As required	A/R Tape	30930
5	1	Carton	31103
6	1	Sleeve	31101
7	2	Machine screw	-
8	2	Nut	10544
9	2	Lockwasher	10427
10	2	Flat washer	10497
11	1	Shipping board	31102
12	2	Flat washer	-
		Running spares	See para. 1A-4

c. Checking Unpacked Equipment.

(1) Check the contents of the package.

(2) Examine the equipment for signs of damage in transit.

(3) Open the printer cover - by half-turning both cover locks and lifting the cover upwards, to access the mounting hardware. Remove the shipping board. Store the mounting hardware with the packaging materials for future use.

(4) Loosen (do not remove) the lock-down screws at the four corners of the printer until the entire weight of the printer is supported on the shock mounts.

(5) Close the printer cover.

1B-3 INSTALLATION AND SIGNAL LINE CONNECTIONS (fig. 1B-2)

a. Transfer the Model 311 to the operating site (par. 1B-1).

b. On one unit models (fig. 1B-2), remove the rear cover plate.

c. On teleprinter applications, connect the signal line wires to terminal strip TB1, as shown in figure 1B-3A, B, or C.

d. On data terminal applications, connect the signal line wires to the 50-pin connector plug (P34 if external package, P2 if internal).

e. On input-out applications, connect the signal cable to the 50-pin connector plug as shown in figure 1B-4.

f. Reinstall the rear cover plate if applicable (see b above).

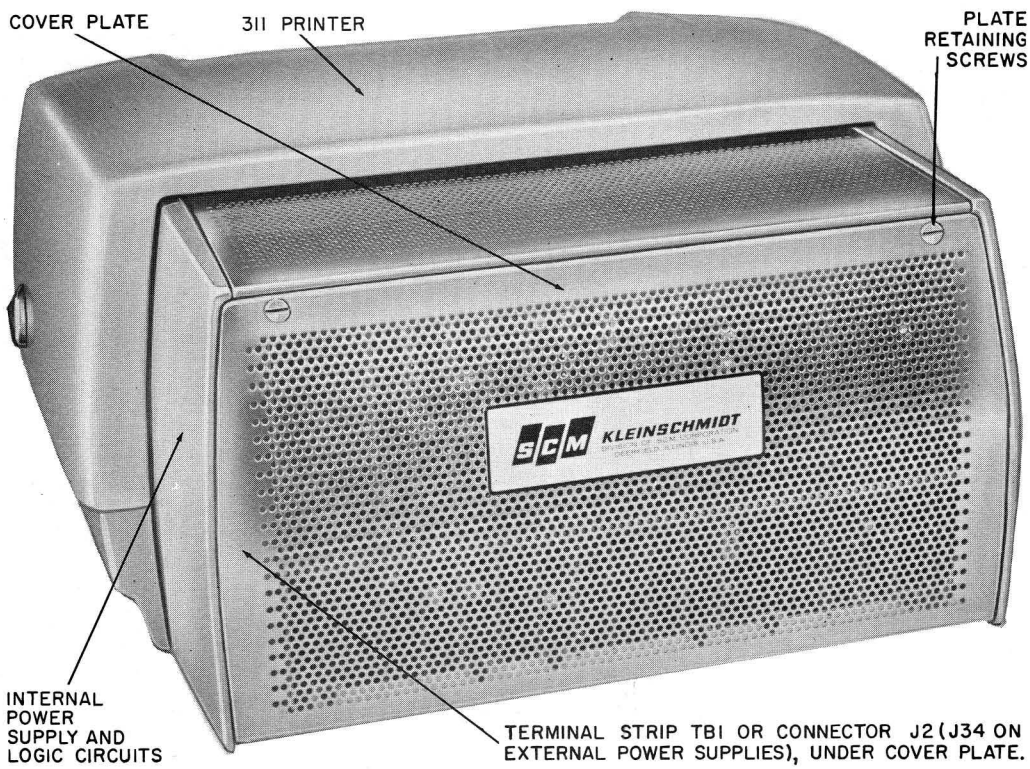


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Figure 1B-2. Rear view of 311, with internal power supply and logic circuits.

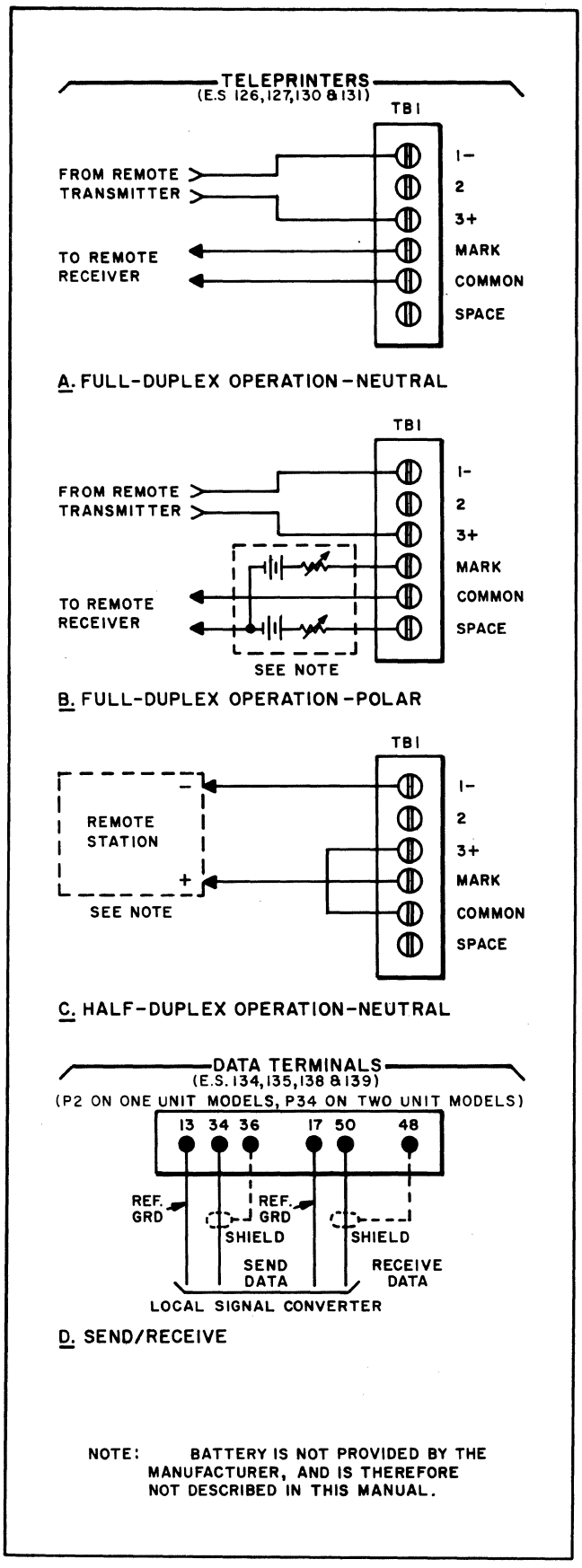

Figure 1B-3. Signal line terminal arrangements, serial signal models.

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g. Open the printer cover, by half-turning both cover locks.

(1) Check that carriage feed and return belts are in place.

(2) Make sure that all shipping ties are removed - from ribbon vibrator, carriage mechanism, etc.

(3) Install paper and ribbon as described in paragraphs 1C-4 and 1C-5.

(4) Close the printer cover.

(5) Connect the power cord plug to the ac supply (par. 1A-2h).

h. For data terminal applications, connect the signal cable to the 50-pin plug P34 that plugs into the electronic unit (fig. 1B-3D).

1B-4 FINAL TESTING, TELEPRINTERS

a. General.

(1) Depress the POWER ON/OFF switch and see that the switch becomes illuminated and that the motor runs.

(2) Depress the COPY LAMP switch and see that the copy lamps light.

Note: Light from the copy lamps may not be too obvious if the ambient light is excessive.

b. Send-Receive, Half-Duplex Equipments. References to keys imply keyboard controls, references to switches imply mode panel controls. All keys (keyboard controls) generate and transmit signal codes. Mode panel switches do not generate signal codes.

(1) Depress the CAR RETURN key to synchronize local and remote printer carriages.

(2) Depress the LINE FEED key to cause local and remote printers to line-feed.

(3) Depress the LTRS key.

(4) Depress "R" and "Y" keys alternately to print a complete line (72 characters); check that the margin bell rings on the 66th character. Depress the CAR RETURN key to synchronize local and remote printers. Depress the LINE FEED key to cause line feeding on local and remote printers.

(5) Depress the LOCAL LINE FEED switch and see that the paper advances. Depress the LOCAL LINE FEED switch past the notch and see that the paper advances continuously while the switch is held down.

(6) Depress FIGS key or LTRS key as applicable, and operate keys to print 10 or 12 characters. Depress the LOCAL CAR RET switch and see that the local carriage returns to the left margin. Depress the CAR RET key to return the carriage of the remote printer.

(7) Make sure that the printed characters are alined horizontally.

Note: The equipment is thus installed and is available for half-duplex operation. If full-duplex operation is required, the terminal strip (TB1) must be rewired as shown in figure 1B-3.

c. Receive-Only Equipments.

(1) If suitable distortion test equipment is available, it should be arranged according to its associated instruction manual to simulate the keyboard procedures described in b above. Operate the mode panel switches of the receive-only printer in conjunction with the test equipment.

(2) If suitable distortion test equipment is not available, arrange with the remote transmitter operator to transmit signals as described in b above.

1B-5 FINAL TESTING, INPUT-OUTPUT PRINTERS

a. General.

(1) Depress the POWER ON/OFF switch and check that the switch becomes illuminated and that the motor runs.

(2) Depress the COPY LAMP switch and see that the switch becomes illuminated and that the copy lamps light.

Note: Light from the copy lamps may not be too obvious if the ambient light is excessive.

b. Input-Output Equipments. Since input-output printers have no connection between keyboard and printer, a test program should be devised for the associated computer or other data processing device to provide output to the printer when input is provided by the keyboard.

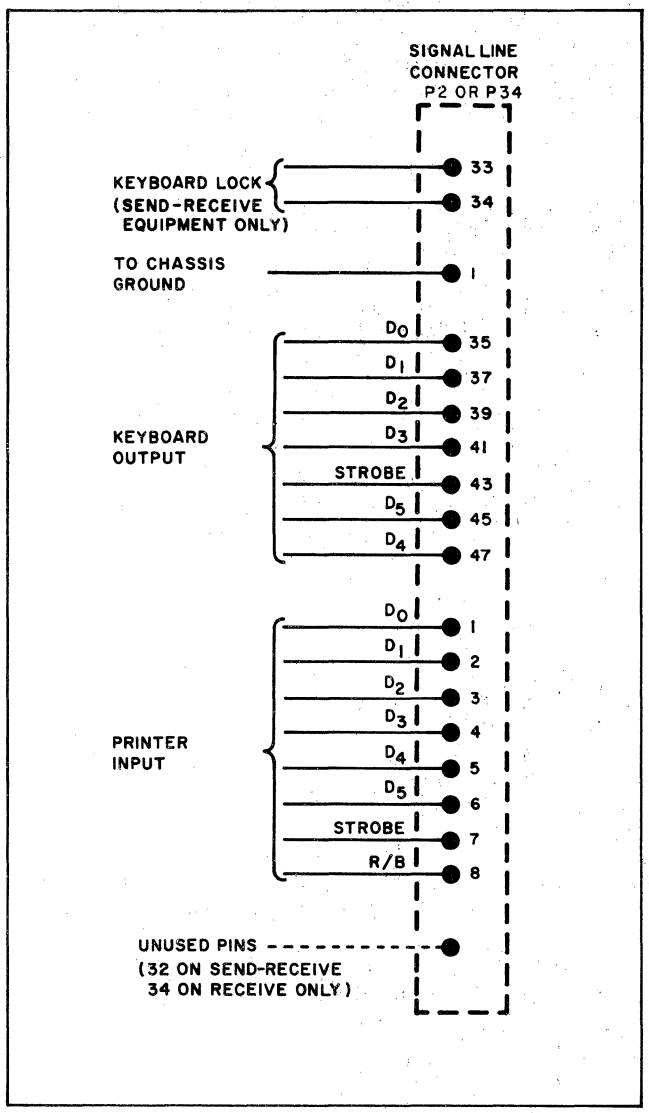

Figure 1B-4. Signal line terminal arrangements for parallel signal models (E.S. 128, 129, 132, 133, 136, 137, 140, 141).

1B-6 PRINTER ELECTRICAL INTERFACE
(Buyer Supplied Voltage on Data Lines)

a. Binary One: Minus 12 vdc nominal.

Voltage Range:
Minus 3 vdc to minus 20 vdc.

b. Binary Zero: Plus 6.8 vdc nominal.

Voltage Range:
Zero vdc to plus 20 vdc.

c. Impedance: 3.3K ohms minimum.

d. Signal Ground: Electrical ground for data and control leads.

e. Chassis Ground: Electrical ground of equipment frame.

f. Control and Mode Panel.

(1) Power ON/OFF: Locking switch with a lamp indicating power is ON.

(2) Copy Lamp: Locking switch controls copy lamps.

(3) Local Carriage Return: Momentary switch controls local carriage return.

(4) Local Line Feed: Momentary switch controls local line feed.

(5) Local Letters: Momentary switch that shifts the printer circuits from FIGURES to LETTERS.

(6) REQUEST TO SEND momentary switch initiates request to connecting signal converter.

(a) OFF (no request): Minus 12 vdc nominal.

Voltage Range:
Minus 10.8 vdc to minus 13.2 vdc.

(b) ON (request): Plus 6.8 vdc nominal.

Voltage Range:
Plus 4.0 vdc to plus 7.5 vdc.

(c) Allowable Current on Request-to-Send Line: 8 ma maximum.

(7) CLEAR TO SEND lamp indicates that signaling converter is ready to receive from keyboard.

Buyer Supplied Voltage on Clear-to-Send Line.

(a) OFF: Minus 12 vdc nominal.

Voltage Range:
Minus 3 vdc to minus 20 vdc.

(b) ON: Plus 7 vdc nominal.

Voltage Range:
Plus 3 vdc to plus 20 vdc.

(c) Printer Characteristics:

Impedance: 3300 ohms nominal between line terminal and ground.

Open Circuit Voltage through 50,300 ohms nominal measured between line terminal and ground.

Minus 12 vdc nominal.

(8) INTERLOCK lamp indicates that signaling converter is arranged for signaling on a communication channel. Interface characteristics are identical to clear-to-send line.

(9) Filler strip to cover remaining 9 mode positions.

1B-7 KEYBOARD ELECTRICAL INTERFACE
(Keyboard Supplied Output Voltage on Data Lines)

a. Binary One: Minus 12 vdc through 560 ohms.

Voltage Range:
Minus 10.8 vdc to minus 13.2 vdc.

b. Binary Zero: Plus 6.8 vdc through 2360 ohms.

Voltage Range:
Plus 7.3 vdc to plus 6.3 vdc.

c. Allowable Current on Data Lines:
8 ma maximum.

Section C Operating Instructions

1C-1 MODES OF OPERATION

a. First, the Model 311 can provide keyboard input and page copy output for a computer or other data processing device. See figure 1A-2, part A. In this input/output application, 5-level or 6-level parallel signaling is employed at short distances (up to 10 feet). Optional special interface circuits can extend the range to 300 feet. For printers with one print hammer, printing speeds up to 24 characters per second are possible on a ready-busy basis. Speeds up to 40 characters per second are attained by adding a second print hammer.

b. Second, the Model 311 acting as a data terminal can provide keyboard sending and page copy receiving over data communication channels (i.e. telephone lines). See figure 1A-2, part B. Signal converters are required on the communication channels to convert the dc printer signals into signals suitable for long distance transmission through telephone networks. At the sending end, the keyboard provides serial signaling at low voltage dc levels into a signal converter. At the receiving end, the printer accepts serial signals at low voltage dc levels from another signal converter. Two-hammer Model 311 printers designed for data terminal applications operate at 150 and 300 bauds with Baudot start-stop signaling. Signaling with 6 information bits also is possible.

c. Third, the Model 311 can function as a teleprinter at speeds up to 150 bauds on standard 120-volt dc telegraph lines. See figure 1A-2, part C. One-hammer Model 311 printers designed for teleprinter applications employ 7-bit Baudot characters (1 start, 5 information, 1 stop). Receive-only signaling at 300 bauds is possible with the Model 311 but such rates on 120-volt circuits are unusual.

1C-2 CONTROLS AND INDICATORS (figs. 1C-1 and 1A-4)

The following table lists and describes the function of each operating control of the printer.

a. Mode Panel.

Control	Function
POWER ON/OFF switch and lamp	When POWER switch is pushed for on, the printer motor starts and the logic power supply is energized. On models which have a motor-stop feature, if no signal arrives from the remote transmitter within two minutes the motor stops. Thereafter the first signal of a communique restarts the motor.
COPY LAMP switch	When the COPY LAMP switch is depressed, two copy lamps illuminate the printed copy.
LOCAL CAR RET switch	When this switch is depressed, the local carriage moves to the left margin.
LOCAL LINE FEED switch	When depressed, it causes the local printer to feed paper one or two lines at a time (depending on position of line-feed selector) if motor is running. Depression of line-feed switch past notch causes continuous paper feeding while the switch is held down.
LOCAL LTRS switch	Causes the local printer to print letters on receipt of appropriate code.
LINE BREAK switch	Opens serial telegraph line to start motors of teletypewriter equipment.
REQ SEND switch	By depressing the REQ SEND switch the local operator requests permission from the signal converter to operate the local transmitter.
CLEAR SEND lamp	When lit, indicates that the local transmitter may be operated.
INTERLOCK lamp	Indicates that the REQ SEND switch may be depressed.

b. Keyboard Controls.

Control	Function
LINE FEED key	Generates and transmits line feed code.
CAR RETURN key	Generates and transmits carriage return code.
BELL key (3-row only Upper case S)	Generates and transmits the bell code.
Alphanumeric keys	Generates and transmits code group for letter, or symbol, shown on key top.
Space bar	Generates and transmits spacing (non-printing) code.
Manual keyboard lock	Prevents depression of keys, except the repeat key.
Stop key (3-row only, upper case H)	Generates and transmits the stop code which turns the motor off.
FIGURES key (3-row only)	Generates and transmits the figures code to the printer case register.
LETTERS key (3-row only)	Generates and transmits the letters code to reset the printer case register.
REPEAT key (3-row only)	Continuously transmits any code while the repeat key and the selected key are depressed.

c. Printer Controls.

Control	Location	Function
Line feed selector knob	Right side frame.	Determines whether paper shall move one or two line spaces (not applicable on equipment with vertical tab and form feed).
Release bar	Top center of paper guide assembly.	When latched over mounting plate, pressure on paper is released.
Release knob	Top right side of paper guide assembly.	When in forward position, pressure on paper is released. In the rear position, holds paper against paper drive rollers.

d. Indicators and Their Uses.

Control	Location	Function
Margin and/or signal bell	Frame below the print drum.	(1) Rings after the 66th character to warn keyboard operator that printed line is almost complete. (2) Rings when bell code group is received by printer.

e. Paper Feed Control.

Control	Location	Function
Feed selector cam (Equipment containing retractable sprocket pins only).	One cam in each paper drive of print drum.	When the cam is in up position, feed pins are retracted. When cam is in down position, feed pins are extended.

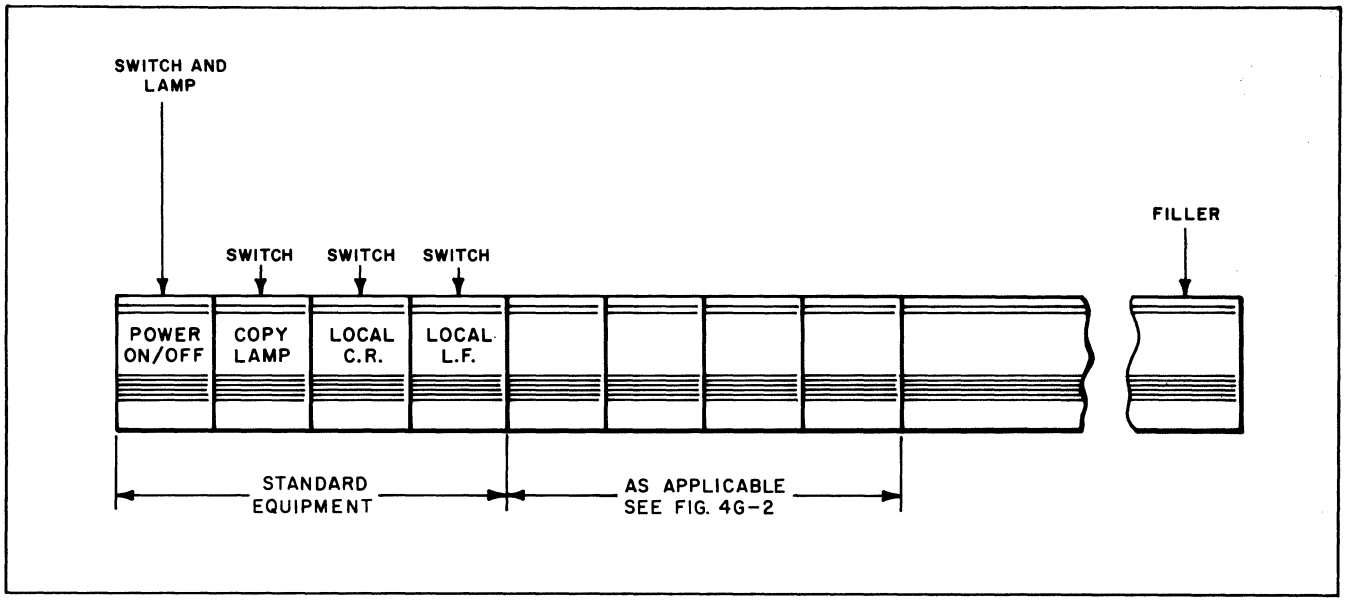

Figure 1C-1. Basic mode panel.

1C-3 PRELIMINARY CHECKS AND PREPARATION

a. Be sure the signal line and power cord are connected to their respective sockets.

b. Check the paper; if the supply is low, replenish it (par. 1C-4). A red stripe on the paper indicates that the paper supply is nearly exhausted. The appearance of the red line allows time to finish the message and obtain a new roll of paper. From the beginning of the red line there remains enough paper for about 900 single line feeds (12 to 15 feet).

c. Check the ribbon; if it is torn or frayed, replace it (par. 1C-5).

d. Position the line-feed selector (not applicable on equipment with vertical tab and form feed), as required, for either single or double-spacing of printed lines.

e. Depress the POWER ON/OFF switch and see that the switch lamp lights.

f. Depress the CAR RETURN key and LOCAL CAR RET switch to ensure that the carriages of local and remote printers are synchronized.

1C-4 INSTALLING PAPER (fig. 1C-2)

a. Rolled Paper. Install paper roll for friction feed operation as follows:

(1) Open the cover of the printer.

(2) Push down the mounting plate until it latches under the release bar. Pull the release knob toward its front position.

(3) Remove the paper shaft assembly.

(4) Remove and discard the old paper roll hub.

(5) Insert the paper shaft assembly in a new roll of paper.

(6) Be sure the feed selector cam is in the retracted (up) position.

(7) Install the paper shaft and roll in the printer so that the paper feeds from the underside of the roll.

(8) Unroll about twelve inches of paper from the roll.

(9) With the paper lying over the top of both paper rollers, insert the paper in the area between the print drum and paper guide.

(10) Depress the LOCAL LINE FEED switch on the mode panel, until about six inches of paper emerges at the front of the drum.

(11) Push the release bar toward the rear until the mounting plate is released.

(12) Make sure that the paper is alined correctly; push the release knob to its rear position. Roll paper is thus installed.

b. Fanfold Paper. Install paper for sprocket feed operation as follows:

(1) Open the cover of the printer.

(2) Push down the mounting plate until it latches under the release bar. Pull the release knob toward its front position.

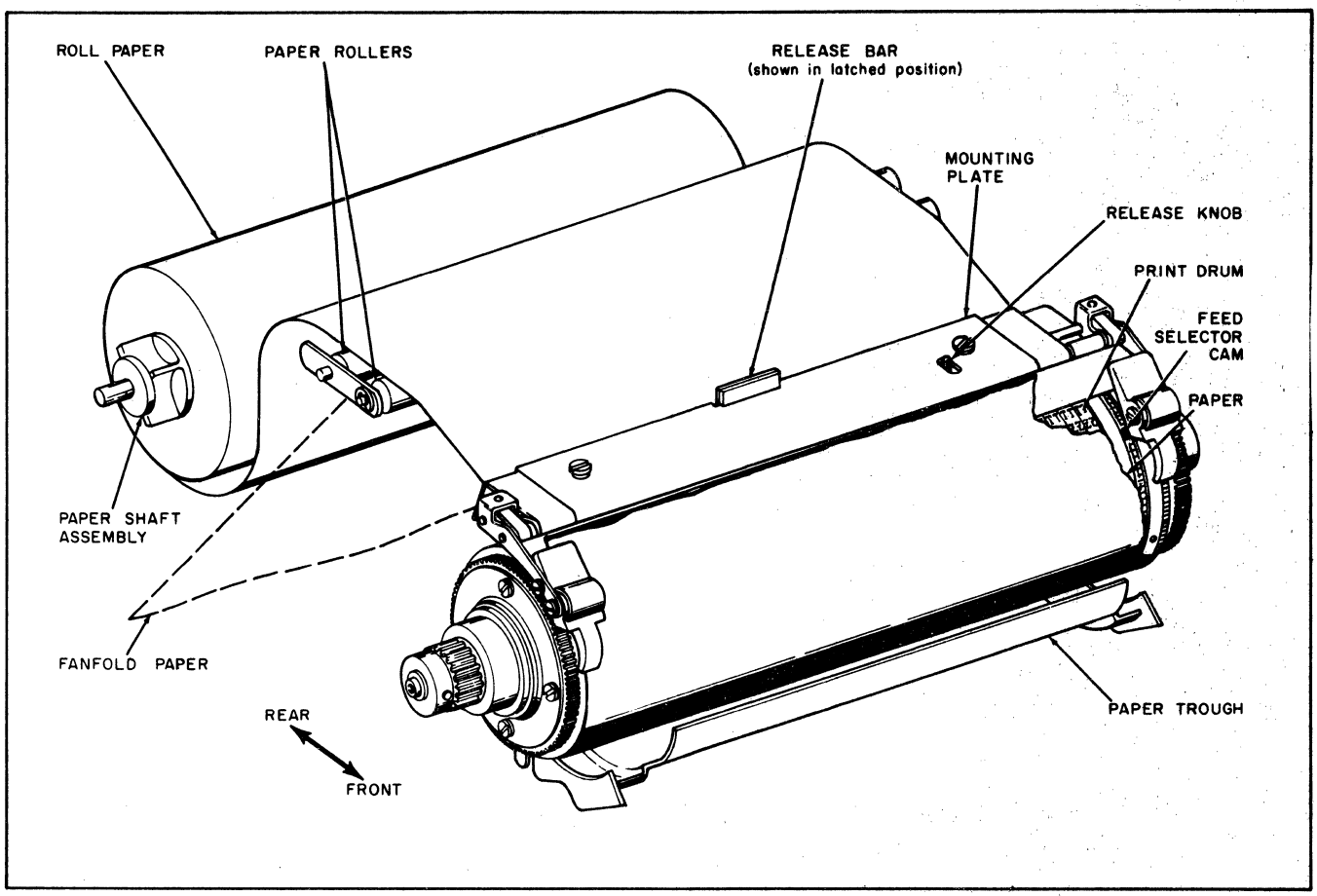

Figure 1C-2. Paper installation.

(3) Place the carton of fanfold paper directly behind the printer, in line with the print drum.

(4) Withdraw about 18-inches of paper from the carton.

(5) Place the feed selector cam in the pins retracted (up) position.

(6) Insert the paper in the slot in the rear of the cover.

(7) Feed the paper up between the two paper rollers. Carefully insert the paper down into the area at the back of the print drum, so that the leading edge of the paper is parallel with the print drum.

(8) Pull the paper through the paper trough (being careful to keep the leading edge of the paper parallel with the print drum) and aline the feed holes in the paper over the sprocket pin holes in the sprocket wheel assemblies.

(9) Push the release bar toward the rear until the mounting plate is released.

(10) Place the feed selector cam in the pins extended (down) position.

(11) Make sure the paper is alined correctly; push the release knob to its rear position. The fanfold paper is thus installed.

1C-5 INSTALLING OR CHANGING INKING RIBBON (fig. 1C-3)

a. Removing Ribbon.

(1) Turn off motor.

(2) Manually rotate the driven spool, until the other (free) spool is empty.

(3) Disengage the ribbon from the hub spear of the empty spool and from the sensing arm.

(4) Continue to wind gently the full ribbon spool until all the ribbon is wound on it.

(5) Move the spool lock until it is in line with the spool shaft and remove the spool from the shaft.

99129A-03

b. Installing Ribbon.

(1) Place the empty spool on the spool shaft which is engaged with the driving mechanism, so that the hub spear points toward the front of the printer, and move the spool lock to the locked position.

(2) Place the full spool on the free shaft so that the free end of the ribbon hangs down at the rear of the spool, and move the spool lock to the locked position.

(3) Pull the free end of ribbon to the front, up and over the top roller at the rear of the full spool.

(4) Insert the ribbon in the sensing arm slot, and pass the ribbon around the bottom roller and thread it through the ribbon guides and around to the other side of the printer.

(5) Pass the ribbon around the bottom roller, through the sensing arm slot, around the top roller, and impale the ribbon on the hub spear.

(6) Rotate the spool to wind a few turns of ribbon on the hub.

c. Checking Ribbon. After each ribbon installation, and at reasonable intervals thereafter, check the ribbon as follows:

(1) The ribbon should be firmly (not tightly) supported, and free from twists, holes and tears. It must lie flat in the ribbon guides.

(2) The ribbon spools should turn in opposite directions when the machine is printing.

(3) Both ribbon spools should be seated correctly and the ribbon spool locks should be set.

(4) Both ribbon spools should reverse direction when either spool empties.

1C-6 STOPPING PROCEDURE

To stop the Model 311 and close it to traffic, raise the POWER ON/OFF switch.

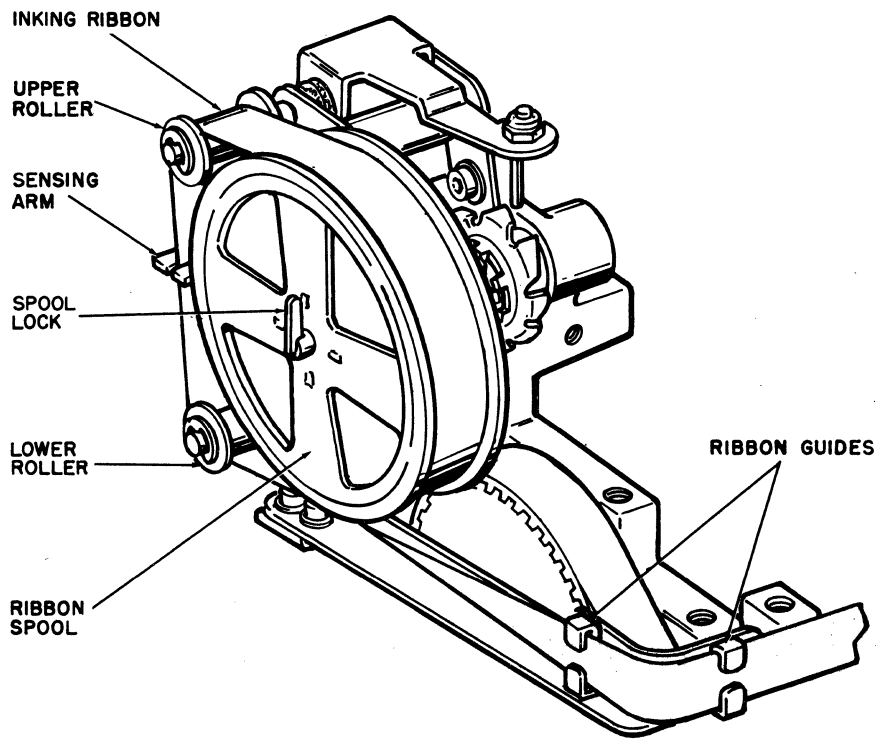

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Figure 1C-3. Ribbon installation.

1C-7 OPERATING PROCEDURE

a. How to Underline. Since the Model 311 is not equipped with a backspace control, the following procedure shall be adopted by the data transmission source when printed characters need to be underlined.

(1) Complete the line that has character(s) to be underlined.

(2) Transmit carriage-return and line-feed signals.

(3) Transmit spacing signals until the print hammer (i.e., number 1 print hammer on two-hammer models) of the 311 printer is directly opposite the leftmost character to be underlined.

Note: In receive only applications where the transmitting source may be far removed from the 311 printer, the transmitter operator shall keep track of the 311 print hammer by counting the number of spacing signals necessary to position the print hammer correctly.

(4) Transmit horizontal bar signal(s) (see fig. 1A-4).

(5) Transmit carriage-return and line-feed signals and continue with the next line.

b. Serial Signaling Equipment. On serial signaling equipment it is important that each line of data be terminated with two carriage-return signals followed by two line-feed signals.

Section D Operator's Maintenance Instructions

1D-1 DEFINITION

Operator's maintenance consists of routine work and inspection performed by the operator to maintain the equipment in good condition.

1D-2 SCOPE

Operator's maintenance is limited to the cleaning and inspection of external parts, inspection of external electrical leads and insulation, replacement of burned-out lamps and fuses; and the replacement of paper and inking ribbon. Operator's maintenance should not involve the removal of covers where the use of tools is required.

1D-3 CLEANING AND INSPECTION

a. Cleaning. For best results inspect the equipment at regular and recorded intervals. Brush (blow or vacuum*) away dust and loose dirt; use cleaning compound to remove more stubborn dirt. Do not use cleaning compound on the type drum.

*Note: Pressure of vacuum or suction devices must be low enough not to damage the equipment.

WARNING: Cleaning compounds may be flammable or toxic; do not use near a flame, and provide adequate ventilation.

b. Inspection.

(1) Inspect plugs and cables of signal and power lines for signs of fraying or damage.

(2) Inspect the carriage feed and return belts for signs of fraying.

(3) Inspect the inking ribbon for signs of wear or damage.

CHAPTER 2

PRINCIPLES OF OPERATION

TABLE OF CONTENTS

CHAPTER 2

PRINCIPLES OF OPERATION

LIST OF ILLUSTRATIONS

CHAPTER 2

PRINCIPLES OF OPERATION

Section A General

2A-1 SIGNALING METHODS

a. Parallel Signaling. In parallel signaling, each code group is represented by five or six information bits on separate data lines. When used on a ready-busy basis, two additional control leads are required:

(1) The ready-busy line is used by the receiver to tell the transmitter when the receiver is ready to process the succeeding code group.

(2) The strobe line is used by the transmitter to tell the receiver when a new code group is applied to the data lines.

b. Serial Signaling. In serial signaling, each code group on a two-wire signaling loop is represented by five or six selecting impulses, a start impulse and a stop impulse. The start impulse is a spacing impulse sent immediately before the selecting impulses. The stop impulse is a marking impulse sent immediately after the selecting impulses.

BINARY POSITION	PARALLEL DATA LINES DESIGNATIONS (6-LEVEL / 5-LEVEL) D_6 D_5 D_4 D_3 D_2 D_1	CORRESPONDING (7.00 OR 8.00) TELETYPEWRITER FORMAT (START AND STOP PULSES NOT SHOWN) 1 2 3 4 5 6
0	0 0 0 0 0 0	
1	0 0 0 0 0 1	
2	0 0 0 0 1 0	
3	0 0 0 0 1 1	
4	0 0 0 1 0 0	
5	0 0 0 1 0 1	
6	0 0 0 1 1 0	
7	0 0 0 1 1 1	
8	0 0 1 0 0 0	
9	0 0 1 0 0 1	
10	0 0 1 0 1 0	
11	0 0 1 0 1 1	
12	0 0 1 1 0 0	
13	0 0 1 1 0 1	
14	0 0 1 1 1 0	
15	0 0 1 1 1 1	
16	0 1 0 0 0 0	
17	0 1 0 0 0 1	
18	0 1 0 0 1 0	
19	0 1 0 0 1 1	
20	0 1 0 1 0 0	
21	0 1 0 1 0 1	
22	0 1 0 1 1 0	
23	0 1 0 1 1 1	
24	0 1 1 0 0 0	
25	0 1 1 0 0 1	
26	0 1 1 0 1 0	
27	0 1 1 0 1 1	
28	0 1 1 1 0 0	
29	0 1 1 1 0 1	
30	0 1 1 1 1 0	
31	0 1 1 1 1 1	
32	1 0 0 0 0 0	
33	1 0 0 0 0 1	
34	1 0 0 0 1 0	
35	1 0 0 0 1 1	
36	1 0 0 1 0 0	
37	1 0 0 1 0 1	
38	1 0 0 1 1 0	
39	1 0 0 1 1 1	
40	1 0 1 0 0 0	
41	1 0 1 0 0 1	
42	1 0 1 0 1 0	
43	1 0 1 0 1 1	
44	1 0 1 1 0 0	
45	1 0 1 1 0 1	
46	1 0 1 1 1 0	
47	1 0 1 1 1 1	
48	1 1 0 0 0 0	
49	1 1 0 0 0 1	
50	1 1 0 0 1 0	
51	1 1 0 0 1 1	
52	1 1 0 1 0 0	
53	1 1 0 1 0 1	
54	1 1 0 1 1 0	
55	1 1 0 1 1 1	
56	1 1 1 0 0 0	
57	1 1 1 0 0 1	
58	1 1 1 0 1 0	
59	1 1 1 0 1 1	
60	1 1 1 1 0 0	
61	1 1 1 1 0 1	
62	1 1 1 1 1 0	
63	1 1 1 1 1 1	

NOTES:
1. ☐ (BINARY "0") = OPEN SWITCH
2. ■ (BINARY "1") = CLOSED SWITCH

99129A-09

Figure 2A-1. Signaling code chart.

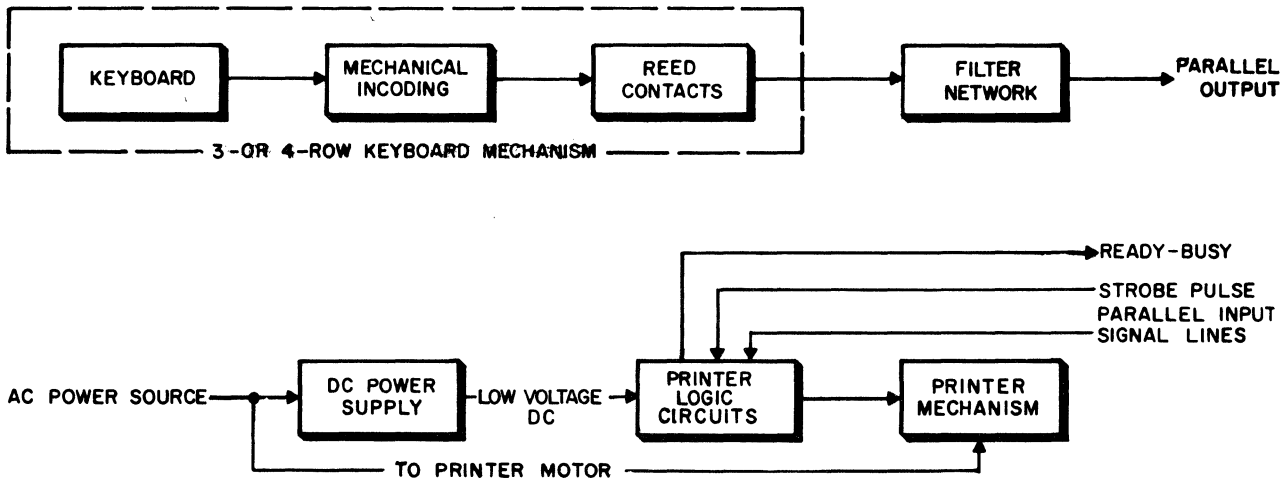
Section B Electronic Theory Introduction

2B-1 GENERAL

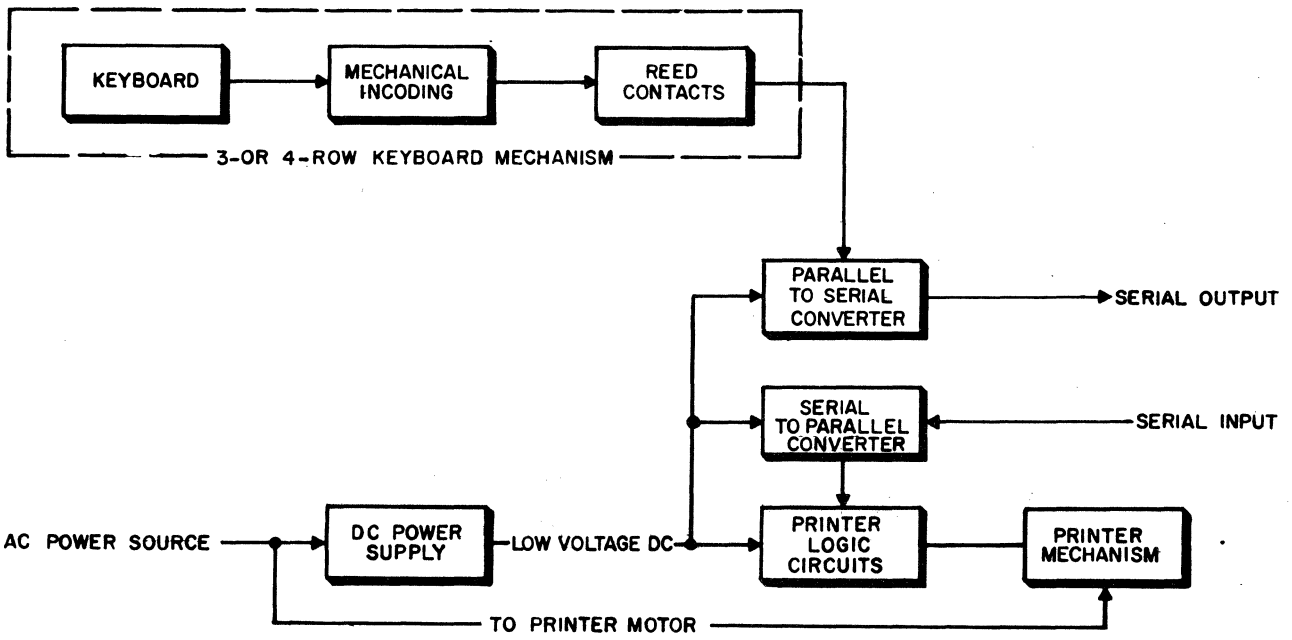
a. The logic circuit boards for the Model 311 comprise the electronic unit, and are housed together with the power supply, either in the rear of the printer console or in a separate module.

b. Figure 2B-1 shows in block form the major circuit elements. All of the circuits of the Model 311 represented by oblong blocks are physically contained on the logic circuit boards (subpara. a above). The switches, magnets and print drum monitors are physically located on the keyboard or printer as appropriate.

c. The power supply provides the low voltage supplies for the entire Model 311 with the exception of the signal line.



A. 5-OR 6-LEVEL READY-BUSY EQUIPMENT.



B. 5-OR 6-LEVEL SERIAL EQUIPMENT.

Figure 2B-1. Operational block diagram.

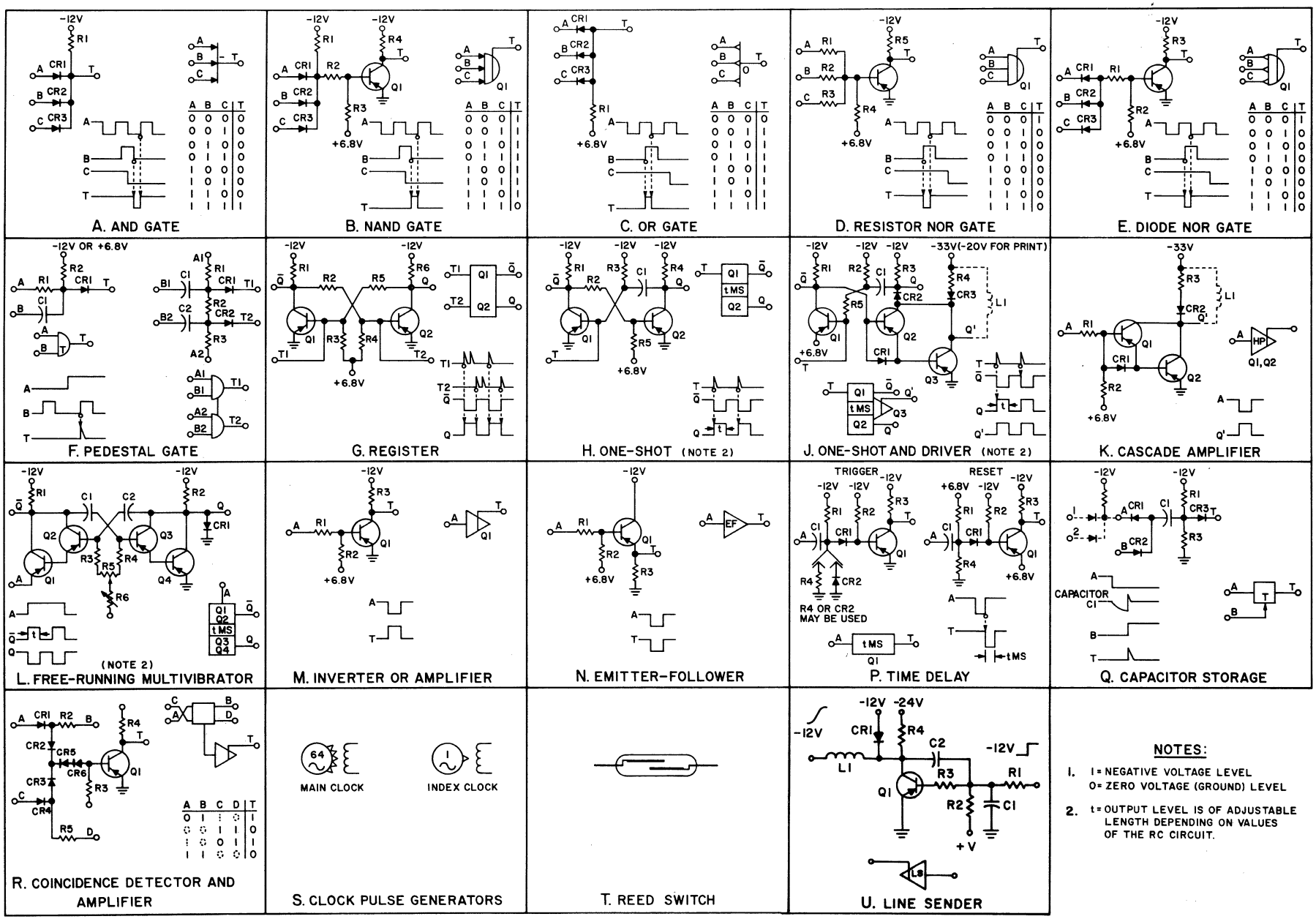


Figure 2B-2. Basic schematic block diagram symbols.

2B-2 TERMINOLOGY

a. Transition. - - A voltage level change from a negative voltage to ground or above is called a "positive transition". A ground to a negative voltage is called a "negative transition".

b. Triggering. - - Positive transitions trigger (activate) one-shots, set or reset registers, and advance counters.

c. Inversion. - - If the input to a stage is inverted by that stage, the corresponding symbol is shown with its output lead vertical (blocks B, D, E, J, K and M).

2B-3 BLOCK DIAGRAM SYMBOL DESCRIPTION

a. General.

(1) The physical circuit stages corresponding to all symbols used in this manual are shown in figure 2B-2.

(2) Flip-flops are reset by positive triggering pulses, or by turning on the OFF transistors with negative pulses.

(3) Voltage levels are defined as follows:

(a) Binary 1 = Negative voltage level.

(b) Binary 0 = Zero volts, or positive with respect to the negative level.

b. AND Gate (Block A). Inputs for the AND symbol are shown as arrowheads pointing towards the output to represent the forward bias direction of the actual circuit. Only when all inputs to an AND gate are binary 1 will the output be 1. The AND gate remains in a binary 1 (negative) condition until any one or more of the input levels go to a binary 0 condition. The corresponding truth table illustrates the AND logic. Negative voltage and resistor R1 provide a forward biased current path through diodes CR1, CR2, or CR3 if the corresponding inputs are binary 0. This makes the output 0 with respect to the negative voltage through R1.

c. NAND Gate (Block B).

(1) NAND means NOT AND, the inverse of AND. In a NAND gate, the output of an AND gate is inverted by a transistor. Only when all the inputs to a NAND gate are 1 is the output 0, otherwise the output is 1.

(2) Note the difference between the AND gate and NAND gate symbols. The vertical line going through the NAND symbol represents inversion. Blocks, D, E, J, K, and M also show inversion from the collector output of transistors.

d. OR Gate (Block C). Inputs for the block OR symbol are shown as arrowheads pointing towards the input to represent the forward bias direction of the actual circuit. When any one of the OR gate inputs is 1, the output is 1. Only when all OR gate inputs are 0 will the output be 0. The corresponding truth table illustrates the OR logic. Positive voltage applied to resistor R1 provides forward bias for any diode to which a 1 input is supplied. To emphasize a condition opposite to an AND, the arrowheads are not filled in.

e. NOR Gate (Blocks D and E). NOR means NOT OR, the inverse of OR. In a NOR gate, the output of an OR gate is inverted by a transistor. Both resistor and diode NOR gates are shown. The truth tables are identical. The transistor is in the ON state until all the inputs are 0.

f. Pedestal Gate (Block F). A pedestal gate produces a positive trigger that turns ON transistors off. This circuit is used to trigger flip-flops (blocks G, H, and J). When input A is at ground level and input B is 1 (negative), capacitor C1 charges. With input B at negative 12 volts the capacitor charges to about 10 volts.* When input B is switched to zero volts, the right side of C1 swings from negative 2 volts to positive 10 volts to maintain the 10-volt charge. This re-referencing of the capacitor causes a positive spike at the right which is passed by the diode to turn off a transistor.

Note: *Resistor R2 holds the right side of C1 a few volts negative to prevent false triggering. Power supply variations also may provide momentary false charging of C1. When input B comes from a gate, it is possible that the gate will provide false outputs momentarily due to variations in switching times of transistors in the gate inputs. The variations are short enough for capacitor C1 to charge to only a few volts.

g. Register (Block G).

(1) A flip-flop used as a register has two stable states. One state is called the set condition, the other state is called the reset condition. Output leads from the two collectors are conventionally labeled 1 and 0 to correspond to their voltage levels when the register is in the set condition.

(2) When a pedestal gate (subpara. f above) provides a positive trigger to the base of Q1, Q1 turns OFF. The collector of Q1 now goes from a 0 to a 1 condition. This negative is impressed on the base of Q2 through crossover resistor R2, turning Q2 ON. Transistor Q2 remains ON until a positive

spike appearing at T2 turns it off, returning the register to its original state. A negative pulse on T1 also resets the flip-flop by turning on Q1 thereby turning off Q2, through cross-coupling resistor R2.

(3) The basic symbol for the register shows the upper portion of the symbol as one transistor and the lower portion as the other transistor. The input lead T1 to the upper transistor Q1 of the symbol is considered the setting input. The output lead of the upper transistor Q1 is its collector. This lead is 1 when the stage is set. Similarly, the lower transistor Q2 in the symbol is the resetting input; the output lead from the lower transistor is from its collector and is 0 when the register is in the set condition.

(4) Therefore, when the reset trigger T2 goes positive, the transistors change state. The collector of the upper transistor Q1 will now be 0 and the lower transistor collector of Q2 will be 1.

h. One-Shot (Block H).

(1) A flip-flop used as a one-shot (that is, a monostable multivibrator) has one stable state. When triggered at the base of transistor Q1, the one-shot switches to its transient state where it remains for a predetermined time before returning to its original stable condition.

(2) With Q1 ON, capacitor C1 charges from the grounded emitter of Q1 through C1 and R4 to the negative collector load voltage. When a positive trigger on the base of Q1 turns Q1 OFF, its collector goes to a 1 condition. Cross coupling resistor R2 transfers the 1 to the base of Q2, turning Q2 ON and thereby switching the right side of the capacitor from negative 12 volts to zero volts. This instantaneous re-referencing of the capacitor forces the left side to positive 12 volts to maintain the charge. C1 now discharges through Q2 and R3. The time the one-shot remains in the transient state is determined by the values of R3 and C1 (see Note 2 on the diagram). As C1 discharges, the cross-coupled lead to the base of Q1 eventually becomes negative enough to turn on Q1 and thereby restore the one-shot to the stable state.

(3) The symbol is similar to a register except that only one input trigger is required. The box in the center of the symbol shows the time delay of the one-shot.

i. One-Shot and Driver (Block J).

(1) A one-shot and driver circuit is similar to a one-shot with the addition of transistor Q3. The collectors of Q2 and Q3 are connected forming a Darlington loop, a compound arrangement that provides the high current required to operate a function solenoid. The emitter of Q1 is connected to positive 6.8 volts instead of ground to function as OFF bias for Q2 and Q3.

(2) In the stable state, transistor Q1 is ON and Q2 and Q3 are OFF. Diode CR1 holds the base of Q3 positive to keep Q3 OFF. Capacitor C1 charges through Q1, R5, and R3; R5 acts as a current limiter. Diode CR2 blocks the negative 33 volts from overriding the negative 12 volts. When the one-shot is triggered by a positive spike on lead T, Q1 turns OFF. The removal of positive 6.8 volts from the base of Q2 and Q3 allows these two transistors to turn ON. Capacitor C1 can now discharge through Q2, Q3, CR2, and R2.

j. Cascade Amplifier (Block K).

(1) This amplifier is similar to the driver arrangement shown in Block J. Both transistors will turn ON or OFF at the same time.

(2) The symbol is similar to the one-transistor inverter; therefore, HP (high power) is printed inside the symbol to distinguish it from Block M.

k. Free-Running Multivibrator (Block L).

(1) The free-running (astable) multivibrator is used as a square wave generator and as a time base. The transistors in this circuit are coupled together for high current gain. In the OFF state of the multivibrator, input lead A is negative, transistors Q1 and Q2 are OFF, Q3 and Q4 are ON, C1 is charged, and C2 is discharged. When the level on input lead A goes positive or to ground, Q1 and Q2 become forward biased and turn ON. The right side of capacitor C1 is now re-referenced to a positive voltage that turns OFF Q3 and Q4.

(2) Capacitor C1 now discharges through Q1, Q2, and R4, and C2 charges through Q1, Q2, and R2. As C1 discharges, the crossover lead begins to go negative until Q3 and Q4 turn ON. When Q3 and Q4 turn ON, their collectors are in the 0 condition, providing a discharge path for capacitor C2 through R3 to the negative voltage. As capacitor C2 discharges, the bases of Q1 and Q2 begin to go

negative and the transistors turn on once more. At this time Q1 and Q2 will begin the next alternation and will continue cycling until the A input goes to a negative level.

(3) The symbol is similar to the one-shot. The rate or frequency of the circuit is shown in the center of the symbol. The input is shown entering the upper portion of the symbol to indicate the emitter input instead of the base as shown on the register and one-shot symbols.

(4) Time networks C1-R4 and C2-R3 are matched as closely as possible to produce a nearly symmetrical circuit. The rate of this circuit, as in the one-shot delay, depends on the predetermined values of the RC networks.

l. Inverter or Amplifier (Block M).

(1) The inverter or amplifier provides current gain and logic inversion. It is particularly useful in gate circuits where two or more inputs are required and where high current is not the primary consideration. When input A is in a logic 0 condition, transistor Q1 is biased OFF, thereby supplying a logic 1 output. When input A is switched to a 1 condition, transistor Q1 is forward biased, and current flows from the grounded emitter through the collector load resistor R3 to the negative voltage. The output stays in a 0 condition until the transistor is turned OFF again.

(2) The symbol for the inverter or amplifier is a triangle with the output leaving the symbol in a vertical direction to show inversion.

m. Emitter Follower (Block N).

(1) The emitter follower provides current gain without inversion. It is used for low-current input, high-current output applications. When the input is 0, transistor Q1 is reversed biased, therefore the output from the emitter is 0. When the input is switched to a 1, the output becomes a 1 with respect to ground (through R1).

(2) The symbol is similar to the inverter except that the output lead leaves the symbol in a horizontal direction to show that the output is not inverted, and the letters EF (emitter follower) are printed within the triangle.

n. Time Delay (Block P).

(1) The time delay provides an output pulse for a time dependent upon the value of capacitor C1 and resistor R2. The back edge of the pulse is used for triggering. Also, the pulse resets a group of flip-flops, its width allows for variations in the turn on time of all the transistors in the group. Transistor Q1 is normally ON because the base is negative through resistor R2. When the input is made negative, capacitor C1 charges from ground through CR2 or R4 to the negative input. As the input is made positive, capacitor C1 is re-referenced and discharged through R2, turning Q1 OFF until C1 is discharged. The base of Q1 goes negative once more, forward biasing the transistor.

(2) The symbol for this time delay is a rectangle showing the delay time of the circuit. The wave form shows that the delay output is not inverted. The time delay must be of a shorter duration than the input transition rate, because the input could go negative and begin charging capacitor C1 again before it is discharged.

o. Capacitor Storage (Block Q).

(1) Capacitor C1 provides storage for one bit of a character. Storage is accomplished by placing a negative level at input A so that capacitor C1 charges from ground through resistor R2. The capacitor remains charged until input B goes positive. This re-references capacitor C1 and gives a positive trigger to the output through CR3. The RC discharge path is through resistor R1.

(2) The square symbol shows input B entering the bottom with a T representing trigger input. The output is also labeled T to correspond to the trigger output provided by a pedestal gate (Block F).

p. Coincidence Detector and Amplifier (Block R). Lead "A" is connected to the right-hand collector of a register and lead "C" is connected to the left-hand collector of the same register. Lead "B" is connected to the left-hand collector of a counter and lead "D" is connected to the right-hand side of the same counter.

(1) When the right-hand collector of a register is negative and the left-hand collector of the corresponding counter is negative, a negative voltage applied to the base of coincidence amplifer #1, holds the base negative.

(2) When the setting of the counter changes, the voltage drop across the register (R2), which connects the left side of the register to the right side of the counter, reduces the voltage

drop across R1, thereby switching off coincidence amplifier #1; this occurs when the setting of the counter coincides with the setting of the associated register.

q. Clock Pulse Generators (Block S). The clock (synchronization) pulse generators are driven by the type drum.

The main clock generates 64 pulses (numbered 0 to 63) per revolution of the type drum, while the index clock generates one pulse. The index pulse occurs between the "0" and "1" main pulses.

r. Reed Switch (Block T).

(1) A magnetic reed switch consists of a pair of normally open contacts sealed in a glass bulb.

(2) When a magnet (whose field is parallel with the reeds) is placed close to the bulb, the contacts close.

(3) When the magnet is removed from the vicinity of (or turned out of parallel with) the reeds, the contacts spring open.

s. Line Sender (Block U). Transistor Q is biased normally off by +V. When a negative voltage is applied via resistor R1, current flows in R2 thereby turning Q1 on. The positive level from the collector of Q1 is applied to the transmission line via L1. L1 in conjunction with C1 and C2 filter to ground R.F. transients, and increase the rise and fall times of the output pulse.

The negative 24 V and negative 12 V (through CR1) on the collector of Q1, clamp the negative level of the output pulse at -12 vdc.

CHAPTER 3

KEYBOARD THEORY AND MAINTENANCE

TABLE OF CONTENTS

CHAPTER 3

KEYBOARD THEORY AND MAINTENANCE

LIST OF ILLUSTRATIONS

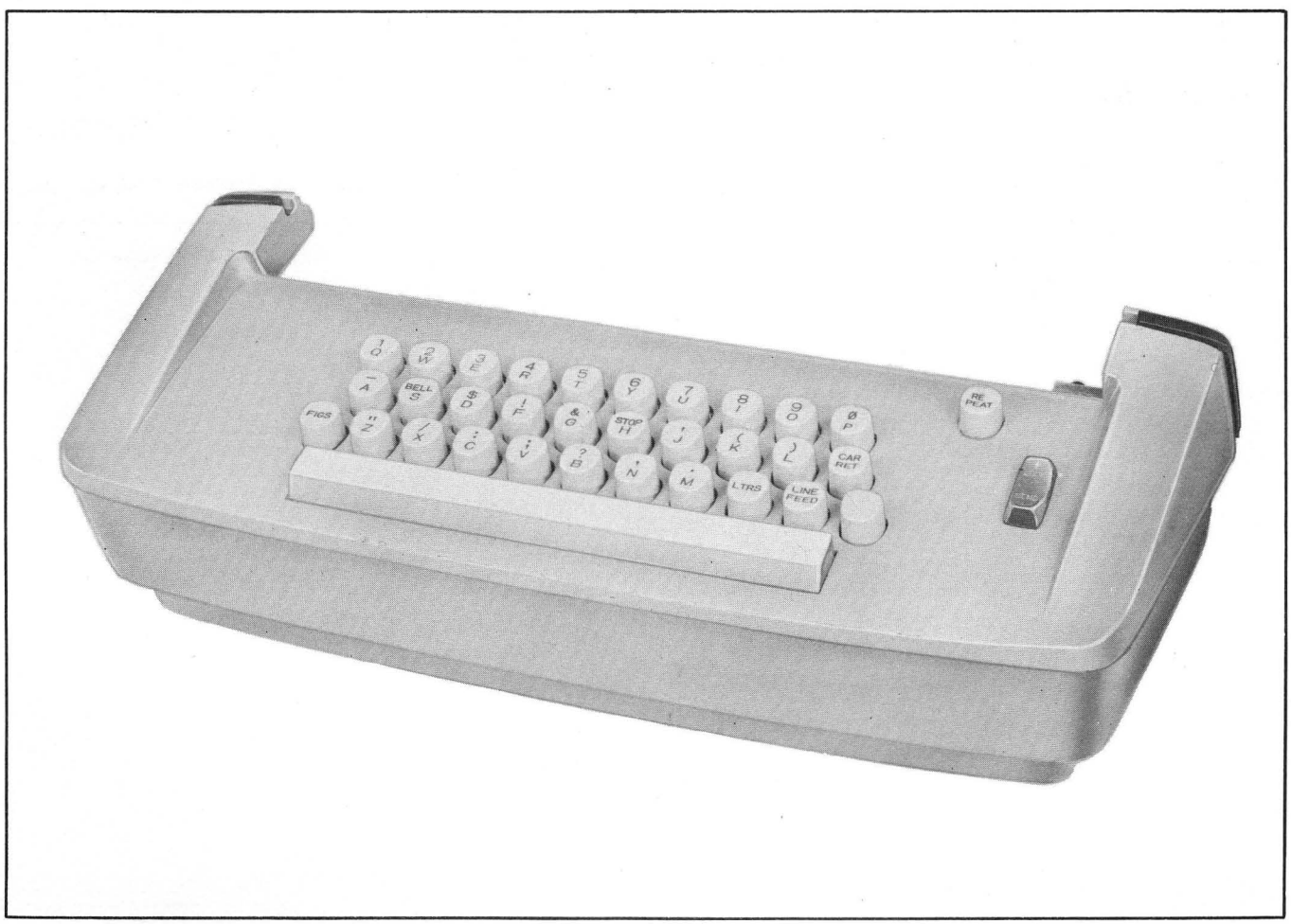
CHAPTER 3

KEYBOARD THEORY AND MAINTENANCE

Section A Mechanical Theory

3A-1 DESCRIPTION (fig. 3A-1)

The keyboard comprises three rows of keys and keylevers i.e., one key and keylever for each character and function, five identical code bails, a universal bail and six magnetically operated reed switches (see Chapter 2, paragraph 2B-3r). A bar magnet mounted on the end of each bail closes or opens the associated reed contact when the bail is rocked. All the above components are supported in the keyboard casting. The keyboard is electrically connected to the electronic circuits by a single connector assembly. The keyboard is mounted on the printer frame with two set screws.



99129A-06

Figure 3A-1. Three-row keyboard.

3A-2 OPERATION (fig. 3A-2)

a. When a key is depressed, the keylever rocks one or more of the code bails clockwise or counterclockwise. The bar magnets on the ends of the bails actuate the associated reed contacts, thereby developing the signaling code (par. 2A-1).

b. The universal bail is rocked by any key depression thus actuating its reed contact every time a key is depressed.

c. When the depressed key is released, a comb spring restores the keylever to the up position. The code bails, with the exception of the universal bail, are not restored. The universal bail is restored to its rest position (reed contact open) by a spring when the depressed key is released.

d. The space keylever (right-hand side of all other keylevers) is actuated when the space bar is depressed. The spacing mechanism comprises a space bar, and space bar lever, two space bar keylevers and a space bar shaft.

e. A manual keyboard lock consisting of a slide switch and lock lever is provided. This mechanism (located at the right of the keys) prevents manipulation of the keyboard when the slide switch is in the "lock" position. In the locked position, the lock lever prevents movement of the U-bar and the U-bar prevents depression of the keys.

f. A keyboard-lock solenoid which is controlled by the receiver is provided. When the solenoid is energized it moves a locking-bail lever which locks the code bails and U-bar, and thereby prevents depression of the keys.

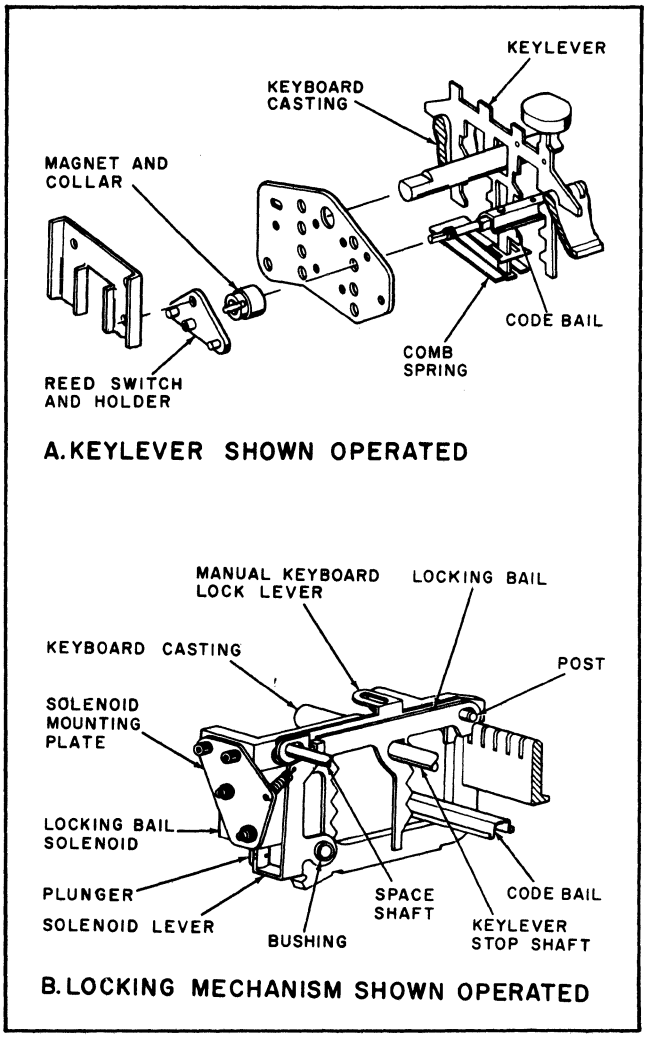


Figure 3A-2. Keyboard mechanism.

Section B Electrical Theory

3B-1 GENERAL (fig. 3B-1)

a. The electrical circuits of the keyboard are described in the following pages with the aid of Keyboard Electronic Block Diagram (fig. 3B-2) and Keyboard Timing Diagram (fig. 3B-3).

b. All of the electronic components (except reed switches and keyboard-lock solenoid) are contained on printed wiring (PW) boards, which are housed in the electronic module along with the printer PW boards.

c. Low voltage dc for operating the electronic components is provided by the dc power supply which is housed in the electronic module along with the PW boards.

d. The keyboard electrical circuits consist of five information (code) reed switches (Chapter 2, par. 2B-3r) and a U-bar (strobe) reed switch connected in parallel with each other; and a parallel-to-serial converter network which converts the parallel outputs of the reed switches into serial form for transmission over a two-wire signaling system.

3B-2 KEYBOARD LOCK SOLENOID

a. Both sides of the keyboard lock solenoid are extended to the external connector for control by the receiver.

b. The lock solenoid achieves two purposes - prevents the operator from depressing keys, and locks the code bails momentarily for each character to prevent miscoding due to rocking of the bails.

3B-3 KEYBOARD CIRCUIT DESCRIPTION (fig. 3B-2)

a. Code Switches. When any key (other than the REPEAT key) is depressed, the reed switches, S1 through S5, assume positions (closed or open) that correspond to the code of the character or function inscribed on the key top. Each closed switch represents a "mark" and each open switch represents a "space". All code switches remain in the assumed position after the depressed key is released.

b. Strobe Switch. After the code switches have been arranged (subpar. a above) the strobe switch (S6) closes, thereby causing PED-1 to produce a positive trigger that activates the strobe 1-shot. When the depressed key is released, the strobe switch (S6) reopens.

c. Strobe 1-Shot (Chapter 2, par. 2B-2h). The output of the $\overline{Q}$ side (Q202 collector) of the strobe 1-shot causes pedestal gate PED-3 to produce a positive trigger that sets the go register. When the strobe 1-shot returns to normal (approximately 2 ms) a positive transition from its $\overline{Q}$ side (Q201 collector) causes PED-5 to produce a positive trigger that sets control register A.

d. Go Register and Keyboard Lock Circuits. The go register (par. 2B-2h) energizes the keyboard-lock solenoid each time a character is typed.

Note: As shown in figure 3B-1, the go register includes a turn-on capacitor, C205, which holds the collector of Q204 off when power is first applied, thus ensuring that the go register starts off in the reset condition (Q203 conducting).

When the go register is set (subpar. c above) the logic 1 output (negative transition) from the $\overline{Q}$ side (collector of Q203) changes the state of the keyboard-lock amplifiers. Q205 turns on, Q206 turns off, and Q207 turns on, energizing the lock solenoid (L12).

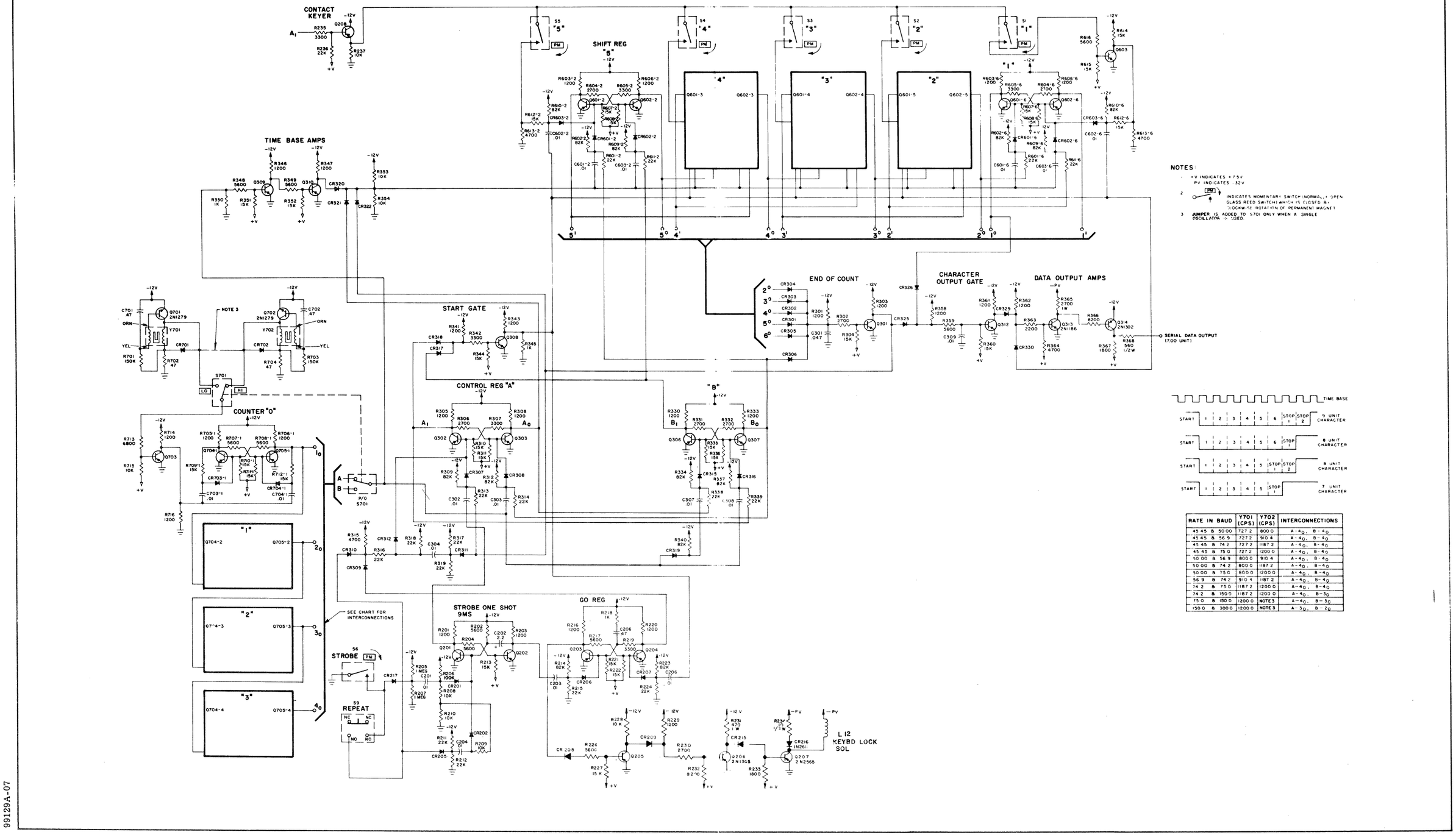
e. Time Base. The time base provides continuous pulses at either 150 or 300 bauds depending on the setting of the LO-HI switch. The time base consists of two tuning-fork oscillators (fig. 3B-1). Each tuning fork and associated coils comprise a "potted" component which determines the oscillating frequency of the circuit. One resistor (R702 or R704) limits the dc current, while the other resistor (R701 or R703) provides positive bias for the base of the NPN transistor. The capacitor (C701 or C702) bypasses transitions to eliminate degeneration. The diode (CR701 or CR702) bypasses positive transitions to protect the transistor. The divider stages consists of a 16-count counter that divides the higher oscillator frequency into the desired output rates. The switch labeled HI-LO selects the divider stage output terminals. Terminal A output comes from the fourth counter stage at 150 bauds. Terminal B comes from the third counter stage at 300 bauds.

The time base amplifiers Q309 and Q310 go ON and OFF following the time base output. These amplified pulses appear at AND gate 2 which gates them to the shift line when the other inputs to the gate are in a 1 condition (fig. 3B-3). The positive-going pulses from the time base also provide a reset trigger for the control registers.

f. Control Registers. Registers A and B provide keyboard character control as follows:

(1) Control register A is set by the back edge of strobe one-shot pulse. The end-of-count detector provides a logic 0 at one input to gate PED-5, allowing the positive going transition from the strobe one-shot to turn Q302 OFF. Logic 1 on the A_1 output lead turns Q208 ON. The resultant logic 1 output is now extended through whichever code switches are closed, marking pedestal gates

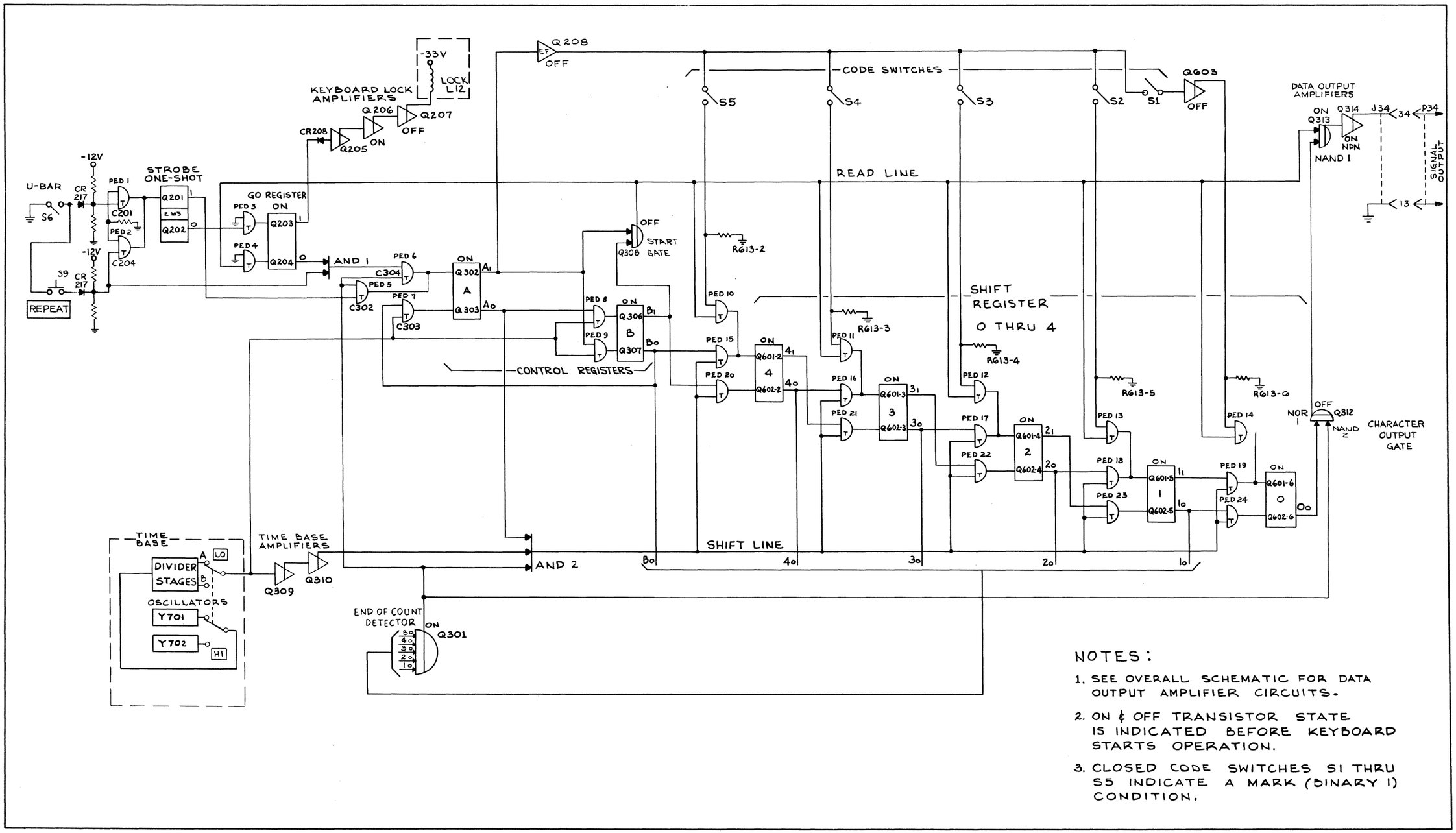
This page not applicable to this equipment.



RATE IN BAUD	Y701 (CPS)	Y702 (CPS)	INTERCONNECTIONS
45.45 & 50.00	727.2	800.0	$A-4_0$, $B-4_0$
45.45 & 56.9	727.2	910.4	$A-4_0$, $B-4_0$
45.45 & 74.2	727.2	1187.2	$A-4_0$, $B-4_0$
45.45 & 75.0	727.2	1200.0	$A-4_0$, $B-4_0$
50.00 & 56.9	800.0	910.4	$A-4_0$, $B-4_0$
50.00 & 74.2	800.0	1187.2	$A-4_0$, $B-4_0$
50.00 & 75.0	800.0	1200.0	$A-4_0$, $B-4_0$
56.9 & 74.2	910.4	1187.2	$A-4_0$, $B-4_0$
74.2 & 75.0	1187.2	1200.0	$A-4_0$, $B-4_0$
74.2 & 150.0	1187.2	1200.0	$A-4_0$, $B-3_0$
75.0 & 150.0	1200.0	NOTE 3	$A-4_0$, $B-3_0$
150.0 & 300.0	1200.0	NOTE 3	$A-3_0$, $B-2_0$

99129A-07

Figure 3B-1. Keyboard schematic. (CD-602, Issue D)

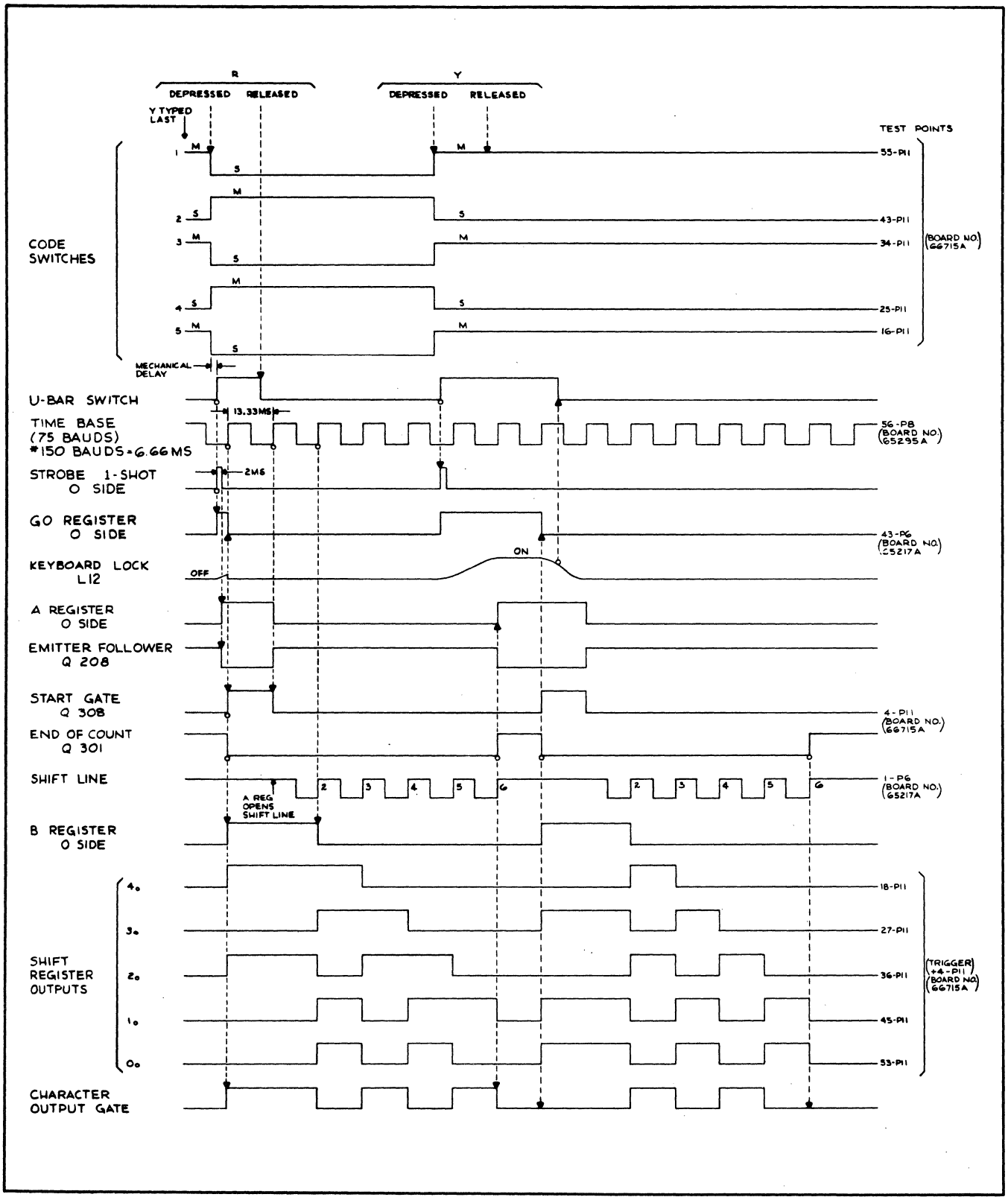


NOTES:

1. SEE OVERALL SCHEMATIC FOR DATA OUTPUT AMPLIFIER CIRCUITS.
2. ON & OFF TRANSISTOR STATE IS INDICATED BEFORE KEYBOARD STARTS OPERATION.
3. CLOSED CODE SWITCHES S1 THRU S5 INDICATE A MARK (BINARY 1) CONDITION.

99129A-06

Figure 3B-2. Keyboard electronic block diagram.



99129A-06

Figure 3B-3. Keyboard timing diagram.

PED-10 through PED-14. Therefore, closed switches which represent a mark provide logic 1 to the gates, and open switches which represent a space allow the R613 resistors to provide logic 0 to the gates. Output A_1 also provides a 1 level input to the start gate. The A_0 output provides a 0 level to gate PED-8 in preparation for triggering through it. The same level acts as an inhibit at gate AND 2, preventing the shift line from providing pulses to the shift register.

(2) When control register A is set, control register B is set by the next negative-to-positive transition from the time base. The transition allows gate PED-8 to turn Q306 OFF. Logic 1 on the B_1 output lead now turns Q308 ON. Output B_1 also inhibits gate PED-20. The functions of the B_0 output in the logic 0 condition are: (1) enables gate PED-15 to allow pulses from the time base to shift the shift register, (2) inhibits the end-of-count indication by turning Q301 OFF, and (3) enables gate PED-7 to allow resetting of the A control register by the next time base pulse.

(3) The B register has the additional functions of enabling shifting of the shift register even though a character is registered that does not require shifting. Such characters have all marks or all spaces. Shifting must be started to keep track of outgoing transmission of the information bits. Otherwise a separate counter would be needed to supply the end-of-count indication to the end-of-count detector. The B register via leads B_1 and B_0 enables switching of flip-flop 4 of the shift register even though flip-flop 3 and 4 have the same kind of information bit registered.

g. Start Gate. When the A and B control registers are in a set condition, they allow start-gate transistor Q308 to turn ON.

(1) The positive-going output reads the code switch information into the shift register. The open switches represent space bits and allow setting of their associated registers. The opposite will be true for the closed code switches.

(2) Another start-gate function is to initiate a start pulse on the outgoing signal line. When the read line is marked with a binary 0 condition by the start gate, the output of gate NAND 4 goes to binary 0, turning data amplifier Q314 OFF. Note that Q314 is an NPN. The line keyer now switches from a mark to a space condition to initiate a start pulse on the outgoing signal line.

h. Shift Register. When the start gate opens to initiate a start pulse on the outgoing signal line, it also triggers the typed character into the shift register. Each information bit that is a space is now represented by a shift register flip-flop in the 1 or set condition. Note that the opposite applies to the 0 flip-flop because of inverter Q603.

(1) The next time base pulse resets the A register. Call this pulse No. 1 to correspond with transmission of information bit No. 1. This closes the start gate to terminate the start pulse on the outgoing signal line. Gate NAND 1 is now controlled by the output of the shift register as indicated on lead 0_0. Whatever bit has been set originally into the 0 flip-flop is now gated onto the outgoing signal line by AND 3, NOR 1, and NAND 1. With the A register reset, gate AND 2 is allowed to pass time-base pulses to the shift register.

(2) The next time base pulse (No. 2) resets the B register and shifts the registered bits one position to the right.

(a) If a mark (binary 1) is registered as the fifth information bit in flip-flop 4, Q601-2 is ON. The positive transition on the shift line turns Q601-2 OFF because of the enabling 0 level on PED-15 from the B_0 lead. The 0 level exists because the B register is in the set condition when the time base transition occurs.

(b) If a space (binary 0) is registered as the fifth information bit, Q602-2 is ON. The positive transition on the shift line has no effect in this case on flip-flop 4.

(c) If a space is registered in flip-flop 3 when a space is in flip-flop 4, the shift pulse has no effect on flip-flop 3 (both Q601-2 and Q601-3 are OFF and remain OFF). Therefore, a space in 4 originally is shifted to 3 by having 3 remain in the space condition. If 3 is in the mark condition originally, the shift pulse switches it to the space condition.

(d) If a mark is registered in flip-flop 3 when a mark is registered originally in 4, both Q601-2 and Q601-3 are OFF. The shift pulse has no effect, since shifting a mark from 4 to 3 must result in 3 remaining in the mark condition.

(e) Flip-flops 2, 1, and 0 change state in the same way to shift information bit 2 into flip-flop 0, bit 3 into flip-flop 1, and bit 4 into flip-flop 2.

99129A-06

(3) The next time base pulse (No. 3) shifts bit 3 into flip-flop 0, bit 4 into flip-flop 1, and bit 5 into flip-flop 2. Pulse No. 3 switches flip-flop 4 if pulse No. 2 did not flip it. The resetting of the B register by pulse No. 2 allows pulse No. 3 to switch flip-flop 4 to the 0 state. It is necessary to switch flip-flop 4 to arrive at the desired 4_0, 3_0, 2_0, 1_0 state as soon as information bit 5 is transmitted.

(4) The next time base pulse (No. 4) shifts bit 4 into flip-flop 0, and bit 5 into flip-flop 1. Pulse No. 4 switches flip-flop 3 to the 0 state.

(5) The next time base pulse (No. 5) shifts bit 5 into flip-flop 0. Pulse No. 5 switches flip-flop 2 to the 0 state.

(6) The next time base pulse (No. 6) switches flip-flop 1 to the 0 state.

i. End-of-Count Detector. Time base pulse No. 6 (par. h above) indicates the end of transmission of information bit No. 5. At this time the shift register is in the 4_0, 3_0, 2_0, 1_0 condition, enabling end-of-count detector Q301 to turn ON again. The output of Q301 is now 0, providing the following conditions: (1) Gate AND 2 is inhibited to prevent time base pulses from appearing on the shift line. (2) NAND Gate 1 is inhibited to provide a stop pulse on the signal line. (3) Gate PED-6 is triggered to allow storage of the next character when repeated characters are being sent (par. k below). The detector remains in the condition described above until the B control register is set by the next incoming character. This causes the B_0 input to go to a 0 condition, turning Q301 OFF while the character is being transmitted.

j. Character Output Gate and Data Output Amplifiers. Information bits in flip-flop 0 of the shift register are impressed on this gate to control the line keyer. Gate AND 3 and two NOR gates make up the character output gate. The start pulse is gated into the data output amplifiers when start gate Q308 is turned ON (par. g above). Q308 provides a 0 to NAND 1, closing the gate to turn OFF Q313 and NPN transistor Q314. The start pulse will thus be a 0. When the start gate is turned OFF, the input to NAND 1 from Q308 will go to a 1 condition, allowing the character output gate to control NAND 1. The end-of-count detector input to NAND 2 will be a 1 condition while the information bits are being shifted onto the signal line. With NAND 2 set as described above, the output from flip-flop 0 will control the data output amplifiers. For example, when the 0_0 output lead is 1, NAND 2 output goes to a 0. NAND 2 therefore follows the 0_0 output, staying OFF for a mark and turning ON for a space. NAND 1 follows NAND 2, staying ON for a mark and turning OFF for a space. Q314 stays ON for a mark and is turned OFF for a space.

k. Repeated Characters. The REPEAT key permits repetition of any given character without having to operate the character key once for each transmission. When any character is depressed and held down, the U-bar switch (strobe) is held closed. Depressing and holding down REPEAT key at the same time provides a circuit from ground at the U-bar switch to gate AND 1. The strobe one-shot triggers the A control register the first time the character is processed. The end-of-count detector directly triggers the A control register each time the character is repeated. The repeat function is outlined as follows:

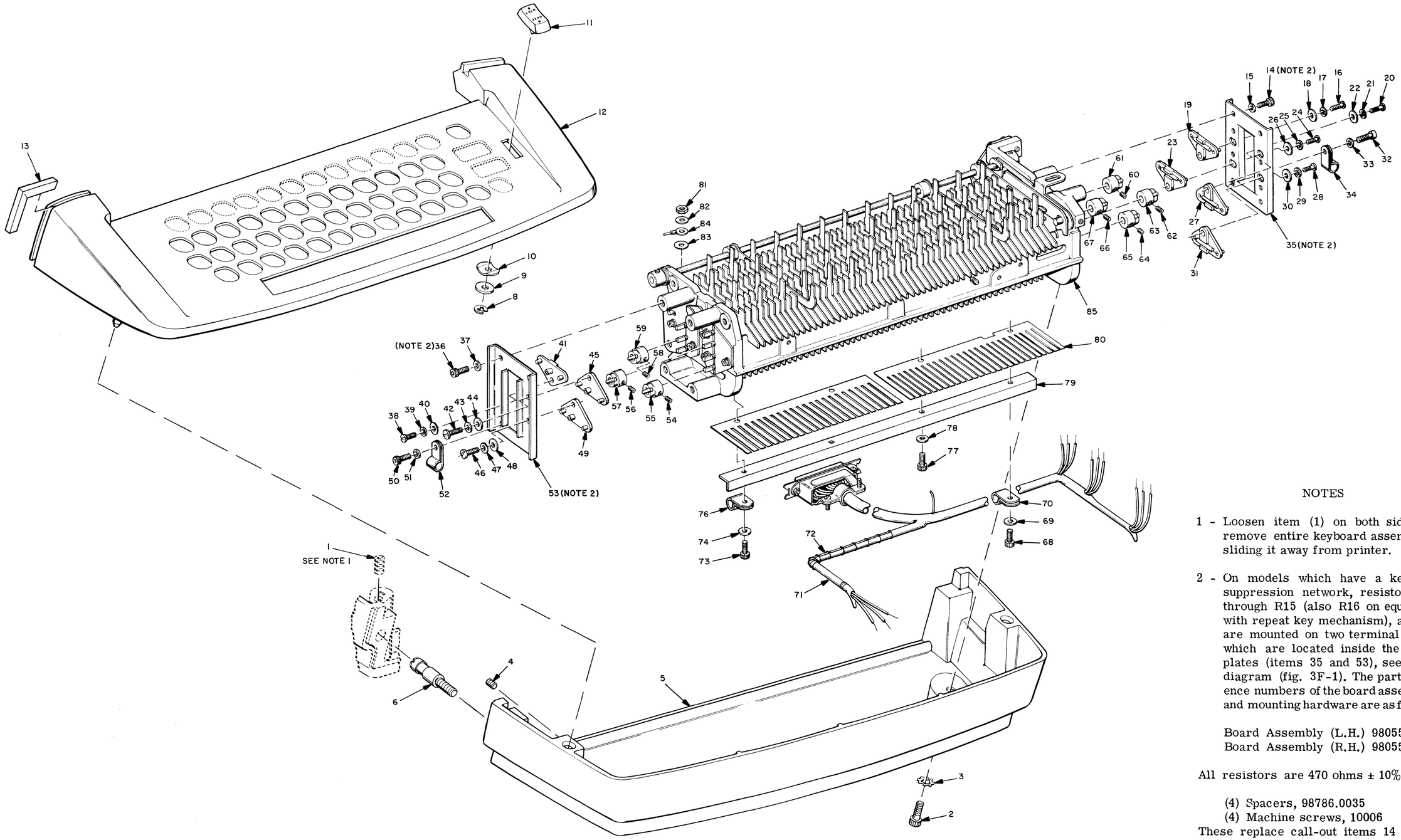
(1) The first time the character is processed the U-bar triggers the strobe one-shot; the 0 output of the Q201 after the 2 millisecond delay triggers gate PED-5. The character is shifted electronically in the same manner as previously described in the above paragraphs.

(2) When the U-bar switch and REPEAT switch are closed, gate PED-6 provides the triggering pulse. The 0 gate output of AND 1 enables gate PED-6 to be triggered by each positive going transition from the end-of-count detector. This directly triggers Q302 of the A register and turns it OFF, recycling the character set up by the code switches. Each time the last information bit is sent out and the shift register is reset, end-of-count Q301 turns ON, providing the necessary 0 output. This recycling process continues until one or both of the depressed keys is released, opening the circuit through the U-bar and REPEAT switches.

Section C Keyboard Disassembly, Part Numbers, and Spring Data

3C-1 GENERAL

For complete disassembly of the keyboard remove the components in the numerical sequence shown in the exploded views.



NOTES

1 - Loosen item (1) on both sides and remove entire keyboard assembly by sliding it away from printer.

2 - On models which have a keyboard suppression network, resistors R10 through R15 (also R16 on equipment with repeat key mechanism), and R17 are mounted on two terminal boards which are located inside the switch plates (items 35 and 53), see wiring diagram (fig. 3F-1). The part reference numbers of the board assemblies and mounting hardware are as follows:

Board Assembly (L.H.) 98055-1-036
Board Assembly (R.H.) 98055-1-038

All resistors are 470 ohms ± 10%, 1/4W.

(4) Spacers, 98786.0035
(4) Machine screws, 10006
These replace call-out items 14 and 36.

99129A-06

Figure 3C-1. Model 311 keyboard, exploded view.

Legend to Figure 3C-1. Model 311 keyboard, exploded view.

Item	Quantity	Part Name	Part No.
1	2	Setscrew (See Printer "Base assembly, exploded view")	
2	2	Machine screw	10024-01
3	2	Lockwasher	10406
4	2	Setscrew	10210
5	1	*Keyboard base	
6	2	Locating stud	65610
7		Not applicable to this equipment	
8	1	Retaining ring	10949
9	1	Washer	50887
10	1	Spring washer	65791
11	1	Lock-send key	65688A
12	1	*Keyboard cover	
13	2	Keyboard gasket	66031
14	3	Machine screw	10003
15	3	Lockwasher	10429
16	1	Machine screw	10335
17	1	Lockwasher	10432
18	1	Washer	57943
19	1	Switch assembly	65689A
20	1	Machine screw	10335
21	1	Lockwasher	10432
22	1	Washer	57943
23	1	Switch assembly	65689A
24	1	Machine screw	10335
25	1	Lockwasher	10432
26	1	Washer	57943
27	1	Switch assembly	65689A
28	1	Machine screw	10335
29	1	Lockwasher	10432
30	1	Washer	57943
31	1	Switch assembly	65689A
32	1	Machine screw	10003
33	1	Lockwasher	10429
34	1	Cable clamp	20517
35	1	Switch plate	65607
36	3	Machine screw	10003
37	3	Lockwasher	10429
38	1	Machine screw	10335
39	1	Lockwasher	10432
40	1	Washer	57943
41	1	Switch assembly	65689A
42	1	Machine screw . (4-row keyboard only)	10335
43	1	Lockwasher . . . (4-row keyboard only)	10432
44	1	Washer . . . . (4-row keyboard only)	57943
45	1	Switch assembly.(4-row keyboard only)	65689A
46	1	Machine screw	10335
47	1	Lockwasher	10432
48	1	Washer	57943
49	1	Switch assembly	65689A
50	1	Machine screw	10003
51	1	Lockwasher	10429
52	1	Cable clamp	20517
53	1	Switch plate	65606A
54	1	Setscrew	10221
55	1	Magnet assembly	65740A
56	1	Setscrew. . . . (4-row keyboard only)	10221
57	1	Magnet assembly.(4-row keyboard only)	65740A
58	1	Setscrew	10221

Legend to Figure 3C-1. Model 311 keyboard, exploded view (continued).

Item	Quantity	Part Name	Part No.
59	1	Magnet assembly	65740
60	1	Setscrew	10221
61	1	Magnet assembly	65740
62	1	Setscrew	10221
63	1	Magnet assembly	65740
64	1	Setscrew	10221
65	1	Magnet assembly	65740
66	1	Setscrew	10221
67	1	Magnet assembly	65740
68	1	Machine screw	10004
69	1	Washer	10429
70	1	Cable clamp	20514
71	1	Cable assembly (includes item 84)	66431A
72	1	Lacing twine (as required)	20812
73	1	Machine screw	10006
74	1	Lockwasher	10429
75		Not applicable to this equipment	
76	1	Cable clamp	20514
77	2	Machine screw	10003
78	2	Washer	10429
79	1	Retaining plate	65608
80	4	Flat spring	65632
81	1	Nut	10513
82	1	Lockwasher	10403
83	1	Lockwasher	10403
84	1	Lug (part of item 71)	
85	1	Frame and keylever assembly	See Fig. 3C-2

*Note: When ordering this part, specify model serial number, see nameplate located (under dust cover) on left side of base frame.

99129A-06

Part Number	Keylever Number	Slot Number 3-row	Slot Number 4-row
65549A	27	8	-
65550A	23	9	5
65551A	3	10	6
65552A	17	12	8
65553A	19	13	9
65554A	5	14	10
65555A	29	16	12
65556A	1	17	13
65557A	9	18	14
65558A	14	20	16
65559A	10	21	17
65560A	13	22	18
65561A	30	24	20
65562A	16	25	21
65563A	26	26	22
65564A	25	28	24
65565A	21	29	25
65566A	20	30	26
65567A	12	32	28
65568A	7	33	29
65569A	11	34	30
65570A	28	36	32
65571A	6	37	33
65572A	15	38	34
65573A	31	40	-
65574A	24	41	37
65575A	18	42	38
65576A	2	44	-
65577A	22	45	41
65578A	8	46	-
65579A	0	48	-
65582A	4	49	49
65665A	-	53	-
66152A	2	-	51
66153A	8	-	50
66154A	33	-	11
66155A	35	-	1
66156A	38	-	31
66157A	39	-	27
66158A	41	-	43
66159A	42	-	15
66160A	43	-	45
66161A	44	-	36
66162A	45	-	47
66163A	46	-	46
66164A	47	-	48
66165A	48	-	19
66166A	49	-	53
66167A	50	-	52
66168A	51	-	7
66169A	53	-	23
66170A	54	-	39
66171A	55	-	3
66172A	56	-	35
66173A	57	-	2
66174A	58	-	4
66175A	60	-	40
66176A	61	-	44
66177A	62	-	42

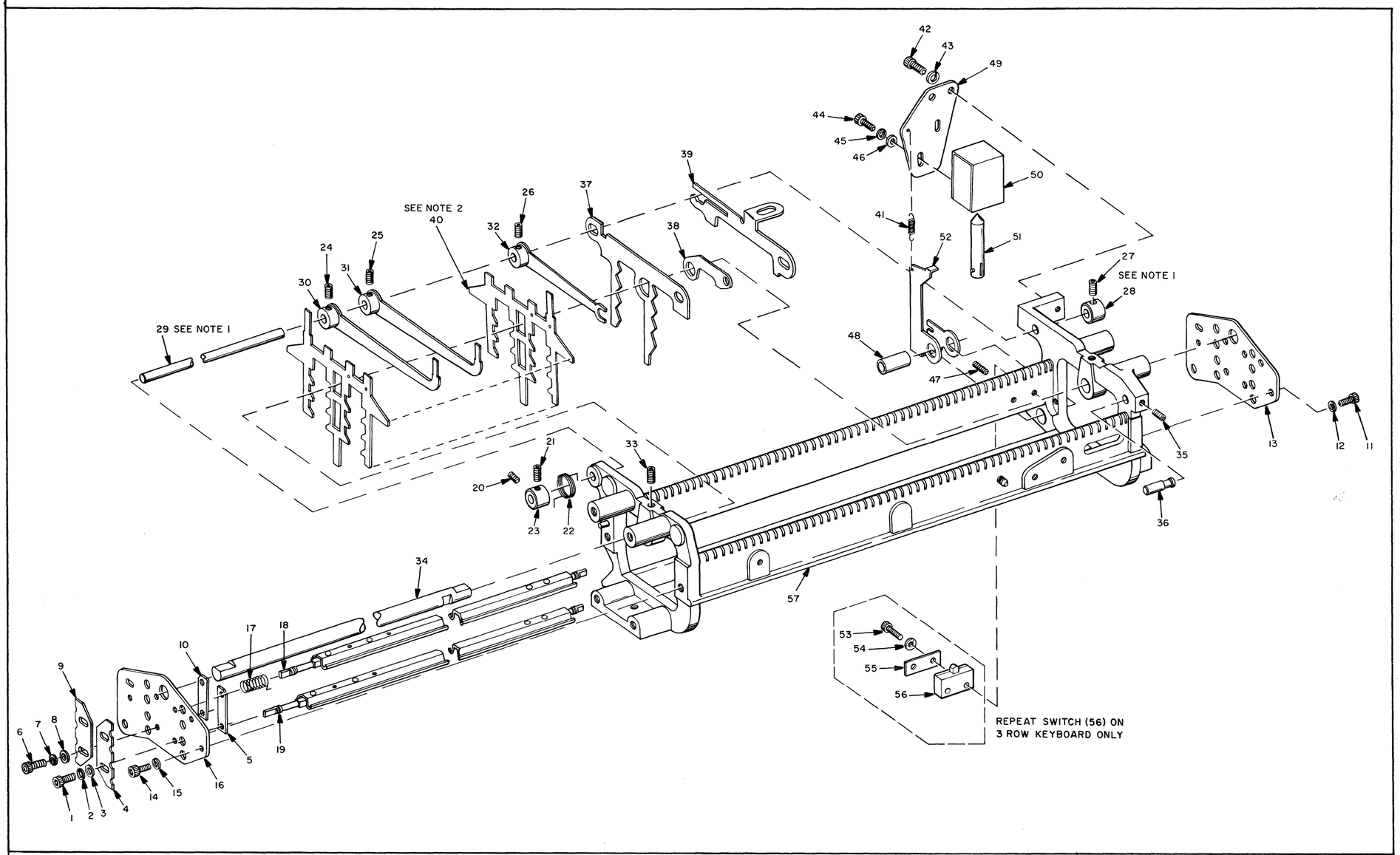


Figure 3C-2. Frame and keylever assembly, exploded view.

NOTES

1 - Slide out collar (28) and shaft (29) before loosening setscrew (27).

2 - Numbers stamped on keylevers must correspond with slot numbers shown in table below.

99129A-06

Legend to Figure 3C-2. Keyboard chassis assembly, exploded view.

Item	Quantity	Part Name	Part No.
1	2	Machine screw	10058
2	2	Lockwasher	10432
3	2	Flat washer	20854
4	1	Retaining plate	65646
5	1	Nut plate	65645
6	2	Machine screw	10058
7	2	Lockwasher	10432
8	2	Flat washer	20854
9	1	Retaining plate	65646
10	1	Nut plate	65645
11	2	Machine screw	10001
12	2	Lockwasher	10421
13	1	Bearing plate	65644
14	2	Machine screw	10001
15	2	Lockwasher	10421
16	1	Bearing plate	65644
17	1	Spring	65692
18	6	Bail assembly (3-row keyboard only)	65589A
19	7	Bail assembly (4-row keyboard only)	65589A
20	1	Setscrew	10203
21	1	Setscrew	10204
22	1	Spring	65743
23	1	Collar	50391
24	2	Setscrew	10203
25	2	Setscrew	10203
26	2	Setscrew	10203
27	2	Setscrew	10203
28	1	Collar	50391
29	1	Space rod	65693
30	1	Lever assembly	65695
31	1	Lever assembly	65695
32	1	Space lever assembly	65612A
33	2	Setscrew	10204
34	1	Stop bar	65599
35	1	Setscrew	10204
36	1	Guide pin	65739
37	1	Lock lever	65598
38	1	Bail stop	66754
39	1	Keyboard lock lever	65686
40	As required	Keylever assembly, See Note 2 and Table	
41	1	Spring	57483
42	2	Machine screw	10001
43	2	Lockwasher	10421
44	2	Machine screw	10059
45	2	Lockwasher	10432
46	2	Washer	10490
47	1	Setscrew	10204
48	1	Bushing	65604
49	1	Solenoid plate	65614
50	1	Solenoid	66317
51	1	Plunger assembly	65621A
52	1	Lever actuator	65615
53	2	Machine screw (3-row keyboard only)	10139
54	2	Lockwasher (3-row keyboard only)	10433
55	1	Nut plate (3-row keyboard only)	60609
56	1	Microswitch (3-row keyboard only)	20145
57	1	Keyboard frame	65603A

99129A-06

3C-2 SPRING DATA

a. General. This paragraph contains specifications of the coil springs used in the keyboard. The serviceability of springs can be verified by checking them against the manufacturing specifications shown below.

b. Crossed-End Spring.

Fig. No.	Part No.	Name	A Free Length (in.)	B Operated Length (in.)	C Number of Coils	D Outside Diameter (in.)	E Wire Thickness (in.)	F Tension at Extended Length
3C-3	57483	Lock solenoid plunger	1/2 ± 1/32	11/16	22-1/4 ± 1	.143 ± .005	.0110 ± .0003	2 oz. ± 10%

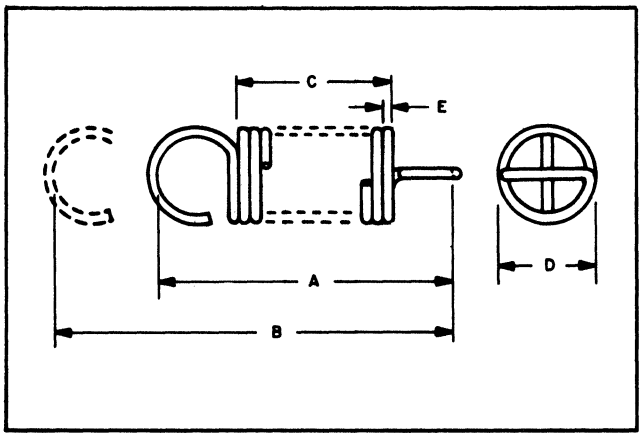


Figure 3C-3. Crossed-end spring.

c. Torsion Springs.

Fig. No.	Part No.	Name	A Free Position	B Max. Deflection	C Number of Coils	D Inside Diameter (in.)	E Wire Thickness (in.)	F Tension at Max. Deflection in. oz.
3C-4	65692	Keylever bail	98°	120°	25.3 ± 20°	.288 ± .008	.017 ± .001	.164 ± 10%
3C-5	65743	Space shaft	110°	100°	2.3 ± 8°	.565 ± .015	.030 ± .0005	8.25 ± 10%

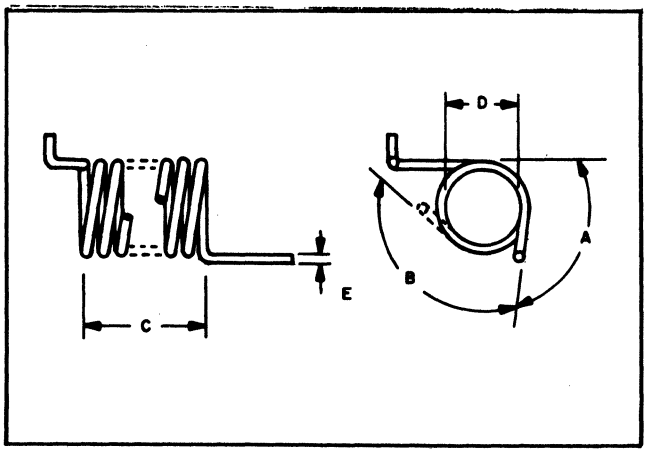


Figure 3C-4. Torsion spring, open coil..

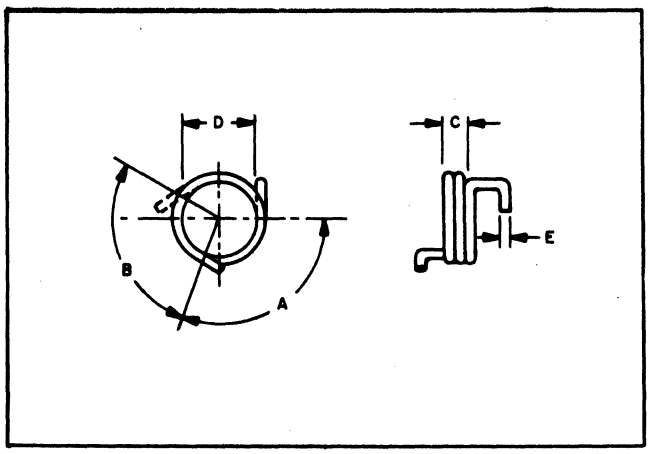


Figure 3C-5. Torsion spring, closed coil..

Section D Preventive Maintenance

3D-1 TOOLS AND MAINTENANCE MATERIALS

The tools and maintenance materials required for the keyboard are listed in paragraphs E-1 and E-2 of Chapter 4.

3D-2 CLEANING AND LUBRICATION

a. Disassembly (fig. 3D-1).

(1) Open the printer cover and loosen the two setscrews that retain the keyboard.

(2) Withdraw the keyboard from the printer and disconnect the cable.

(3) Remove the top cover of the keyboard by loosening the two retaining setscrews.

(4) Remove the bottom cover of the keyboard by removing the two retaining machine screws and lockwashers.

b. Cleaning.

(1) Vacuum or blow out loose dirt.

(2) Remove old grease and oil with a dry, lint-free cloth. Use a cloth moistened with cleaning solvent (par. 4E-5) to remove stubborn dirt. Remove solvent with a dry lint-free cloth.

(3) Examine rubbing surfaces for signs of excessive wear.

(4) Examine electrical wires and connectors for signs of fraying and signs of defective soldered connections.

(5) Use No. 0000 sandpaper to remove corrosion.

c. Lubrication. The recommended lubricants and methods of application are shown in Chapter 4, paragraph 4E-5.

(1) Apply a thin film of oil to keylevers, code bails, comb springs, and locking bail post.

(2) Apply one drop of oil to both rows of casting slots, and both end-bearings of each code bail.

(3) Apply two drops of oil to both end-bearings of the space shaft and solenoid lever pivot pin.

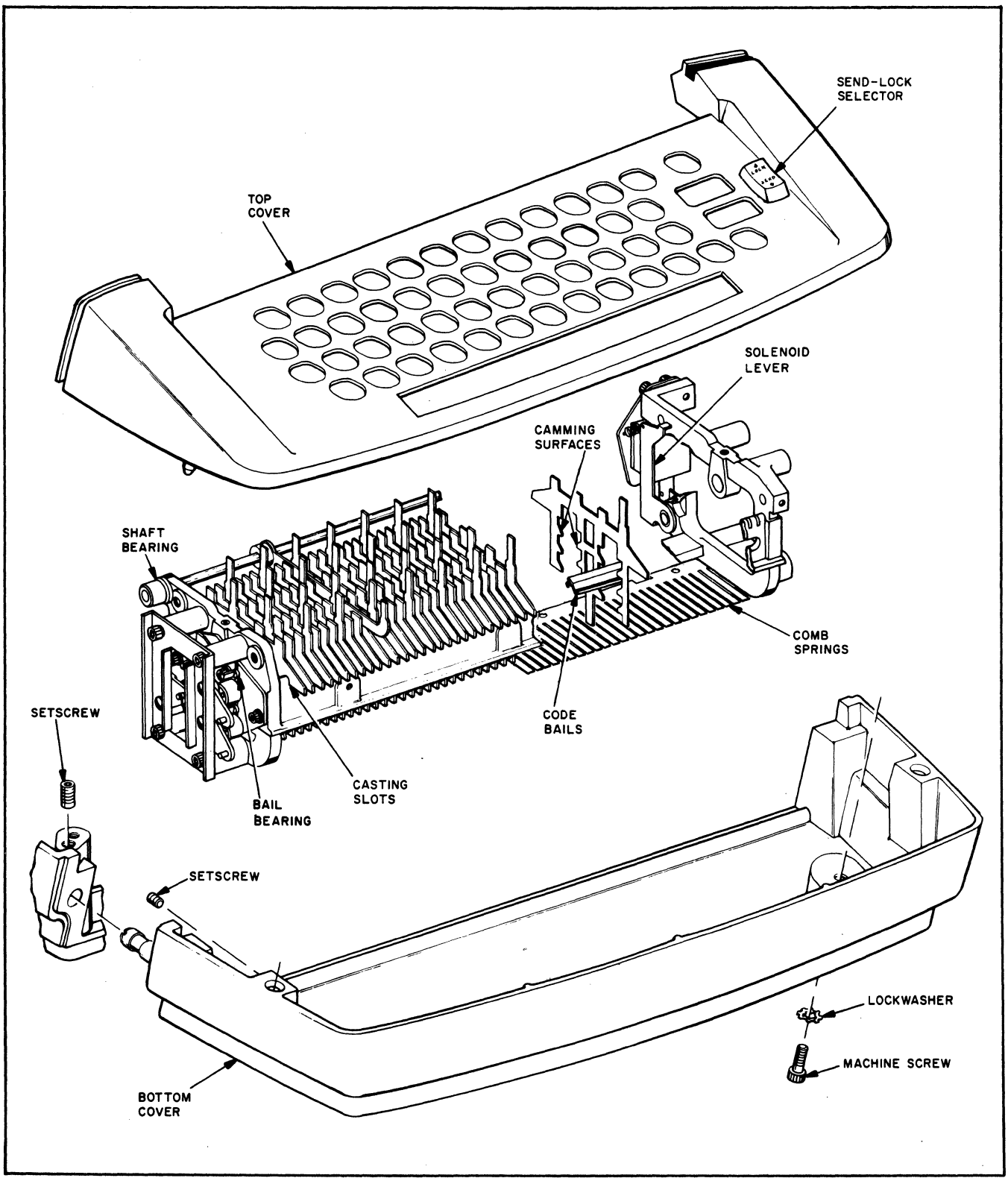


Figure 3D-1. Lubrication points.

Section E Adjustments

This section describes requirements and adjustment procedures for the keyboard of Model 311. Descriptions are arranged in the correct sequence for a complete readjustment of the keyboard. When making individual adjustments, check all related adjustments. When parts or subassemblies must be removed to effect an adjustment, refer to the disassembly sequence shown in the relevant exploded view (Section B of this chapter). The index number below the heading of each adjustment is the manufacturer's adjustment number.

3E-1 CODE BAIL RETAINER PLATE
(05344 Issue A)
(fig. 3E-1)

Note: The switch holder must be removed before performing this adjustment.

a. Requirement. Each retainer plate should fully engage the universal bail and code bails without binding.

b. Adjustment.

(1) Loosen the screws.

(2) Position the plates to meet the requirement and tighten the screws.

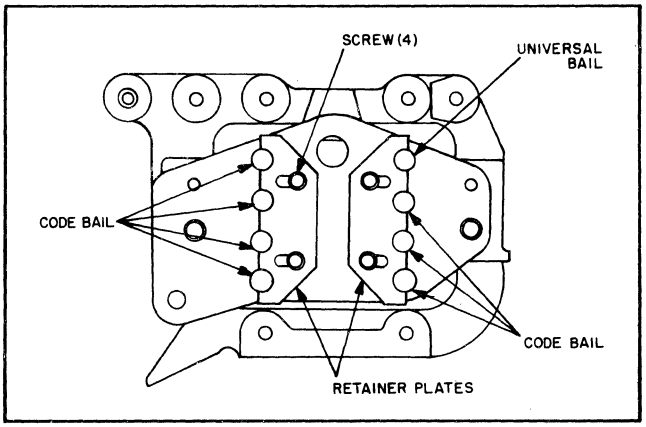


Figure 3E-1. Code bail retainer plate.

3E-2 KEYBOARD SPACE SHAFT
(05345 Issue C)
(fig. 3E-2)

a. Requirement. The space shaft should extend an equal amount through each collar and have .010- to .015-inch end play.

b. Adjustment.

(1) Loosen the setscrews.

(2) Position the shaft and collars to meet the requirement, and tighten the setscrews.

3E-3 SPACE BAR KEYLEVERS
(05346 Issue A)
(fig. 3E-3)

a. Requirement.

(1) The space bar lever should be centered on the stud of the space keylever.

(2) The space bar keylevers must not touch their adjacent keylevers.

(3) The space and space bar keylevers should

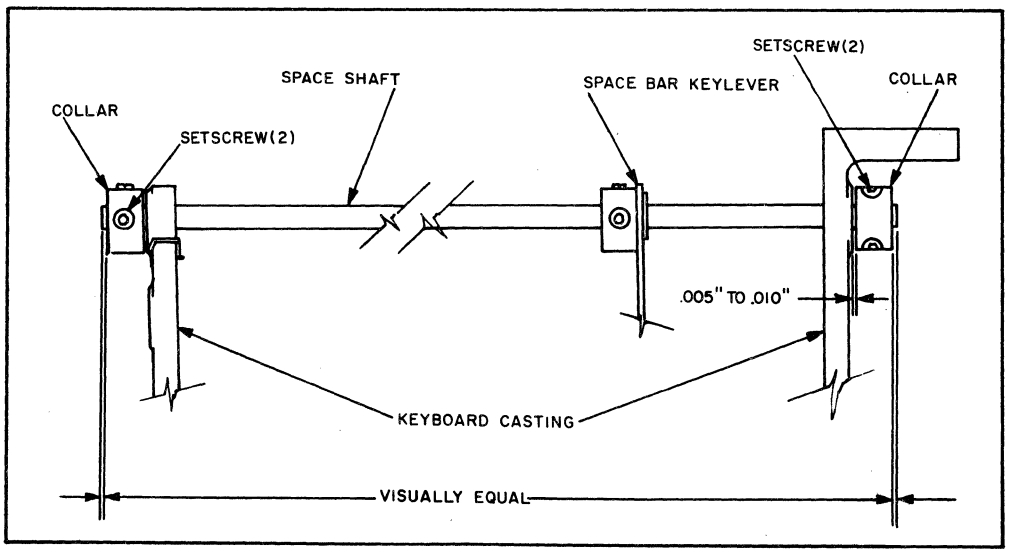


Figure 3E-2. Keyboard space shaft.

bottom on the keylever stop shaft at the same time.

b. Adjustment.

(1) Loosen the setscrews.

(2) Position the space bar lever to meet requirement a(1) and tighten the setscrews.

(3) Position the space bar keylevers to meet requirements a(2) and (3) and tighten the setscrews.

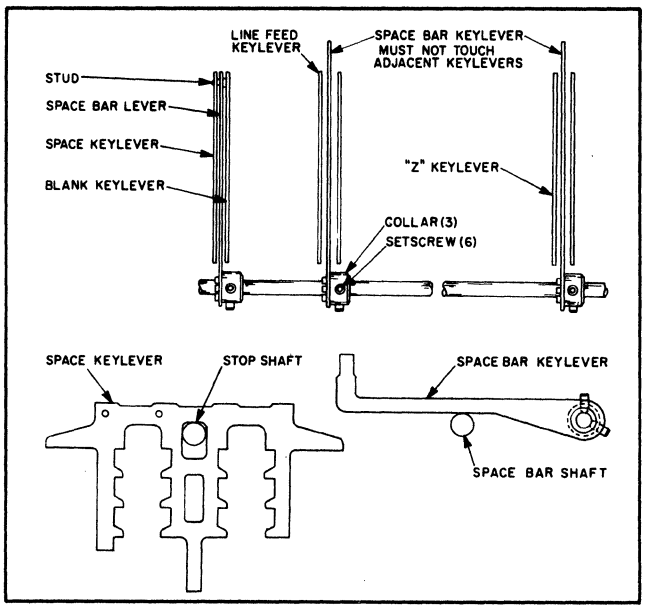


Figure 3E-3. Space bar keylevers.

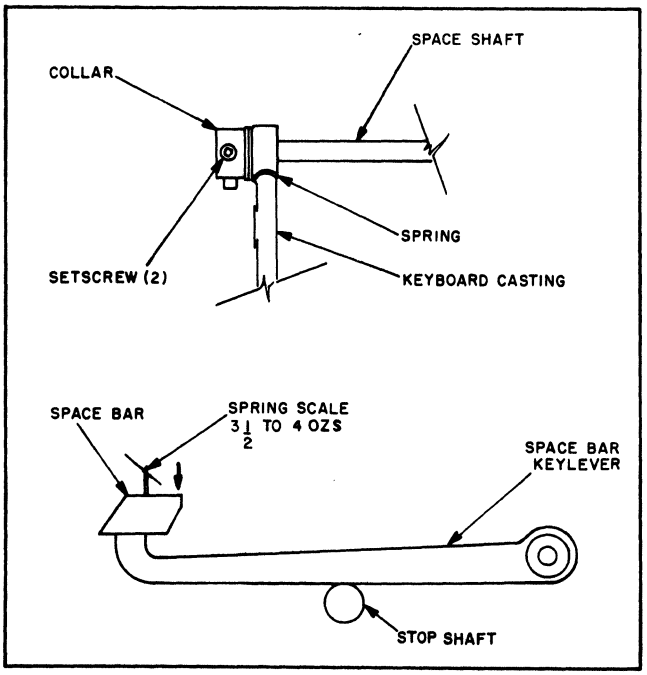


Figure 3E-4. Space shaft tension.

3E-4 SPACE SHAFT TENSION
(05347 Issue A)
(fig. 3E-4)

Note: The adjustment procedure described in paragraphs 3E-2 and 3E-3 must be completed before performing this adjustment.

a. Requirement. The space bar keylevers should just touch the stop shaft when a 3 1/2 to 4 ounce tension is applied to the space bar.

b. Adjustment.

Note: When performing this adjustment, maintain the end play requirement of the adjustment described in paragraph 3E-2.

(1) Loosen the setscrews.

(2) Rotate the collar to meet the requirement and tighten the setscrews.

3E-5 SOLENOID LEVER BUSHING
(05348 Issue A)
(fig. 3E-5)

Note: The code bail plate must be secured before performing this adjustment.

a. Requirement. The solenoid lever bushing must engage the solenoid lever 100 per cent on both sides.

b. Adjustment.

(1) Loosen the setscrew.

(2) Position the bushing through both sides of the solenoid lever.

(3) Hold the bushing against the code bail plate and tighten the setscrew.

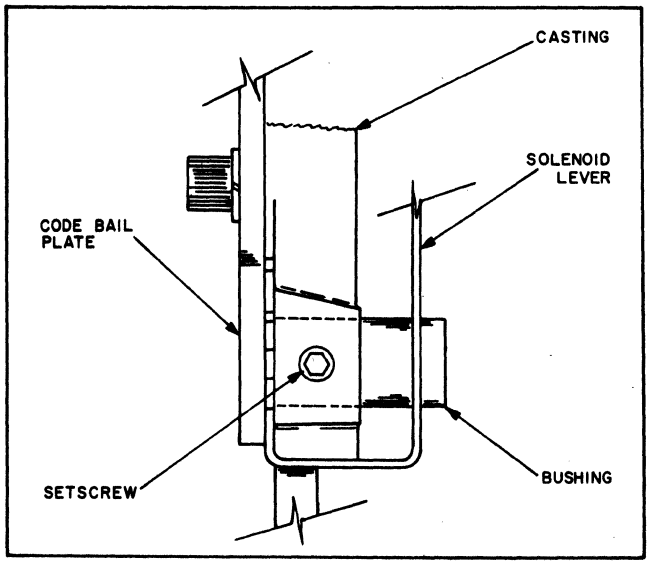


Figure 3E-5. Solenoid lever bushing.

3E-6 KEYLEVER STOP SHAFT POSITIONING (05349 Issue A) (fig. 3E-6)

a. Requirement.

(1) The repeat keylever (3-row keyboard only) must engage the full diameter of the shaft.

(2) The flat surface of the shaft should be alined with and parallel to the flat end of the slot in the locking bail.

b. Adjustment.

(1) Loosen the setscrews.

(2) Position the shaft to meet the requirements.

(3) Tighten the setscrews.

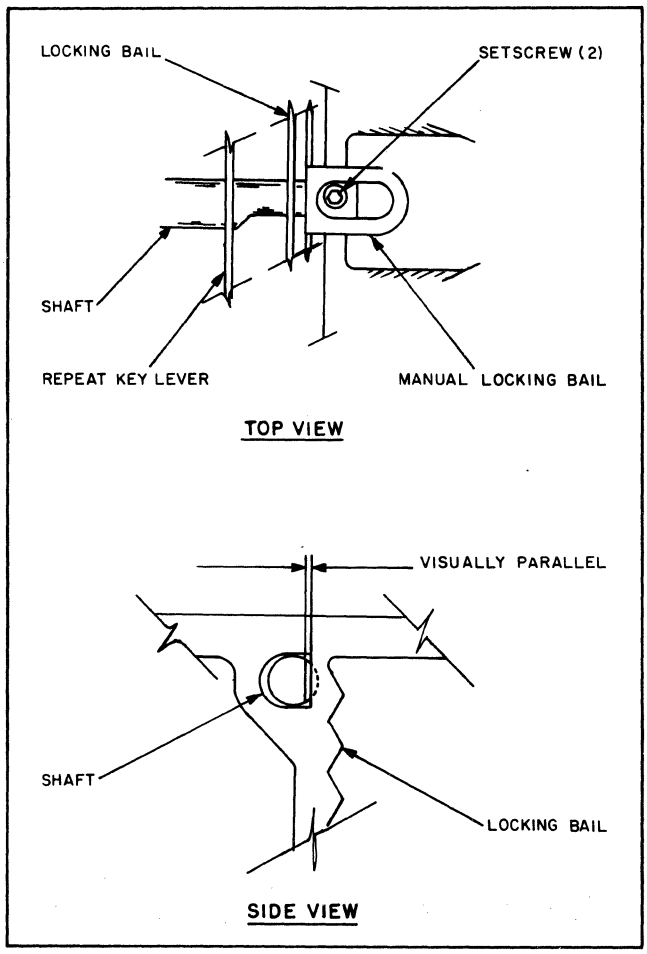


Figure 3E-6. Keylever stop shaft positioning.

3E-7 KEYBOARD LOCKING BAIL POST (05350 Issue A) (fig. 3E-7)

a. Requirement. The post should protrude approximately 1/32-inch beyond the outside surface of the casting so that the undercut in the post is centered in the casting.

b. Adjustment.

(1) Loosen the setscrew.

(2) Position the post to meet the requirement.

(3) Tighten the setscrew.

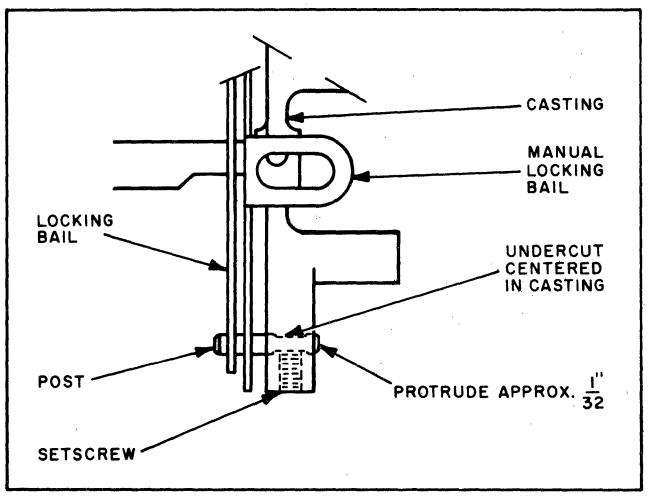


Figure 3E-7. Keyboard locking bail post.

3E-8 SOLENOID AND MOUNTING BRACKET (05351 Issue B) (fig. 3E-8)

a. Requirement.

(1) The plunger and lever should operate freely.

(2) When the plunger is bottomed in the solenoid the locking bail should lock the universal and code bails in their proper positions.

Note: This is not a permanent lock and may be overridden by applying a pressure in excess of 20 ounces on any keylever.

b. Adjustment.

(1) Loosen the bracket screws.

(2) Position the bracket to meet requirement a(1) and tighten the screws.

(3) Loosen the solenoid screws.

(4) Hold the plunger bottomed in the solenoid and position the plunger and the solenoid together to meet requirement a(2).

(5) Tighten the screws and recheck the requirements.

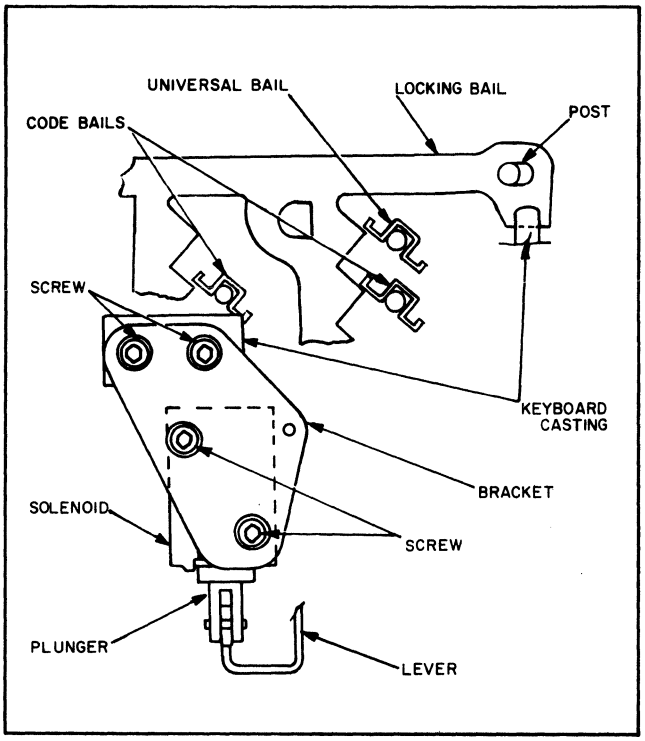


Figure 3E-8. Solenoid and mounting bracket.

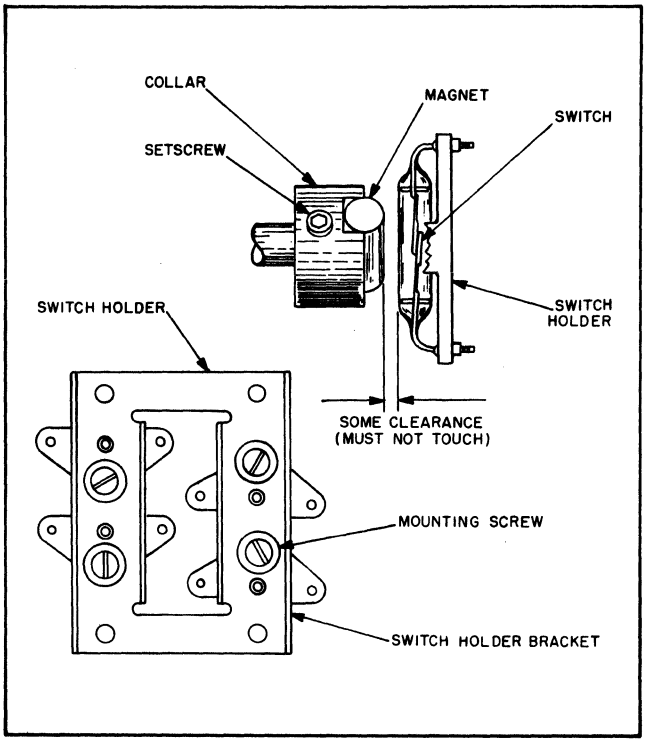


Figure 3E-9. Keyboard switches.

3E-9 KEYBOARD SWITCHES (05354 Issue A) (fig. 3E-9)

a. Requirement.

(1) There should be some clearance between the switch and the magnet. The maximum clearance is dependent upon the sensitivity of each individual switch to meet requirements (2) and (3).

(2) The code switches should operate (open or close) when the keylevers have been depressed one-half of their full travel.

(3) The universal bail switch should operate (close) when the keylevers have been depressed three-quarters of their full travel, but must not operate before all code switches have operated.

b. Method of Checking.

(1) Check requirement a(1) visually and operationally.

(2) Connect an ohmmeter across a code switch at the keyboard connector.

CAUTION: Connecting magnetic material type test leads near the switch actuating magnet can result in distortion of the magnetic field and give false indications.

(3) Slowly depress a keylever that will move the magnet associated with the switch being checked.

(4) Observe the ohmmeter and check requirement a(2).

(5) Repeat for each code switch.

(6) Connect an ohmmeter across the universal bail switch.

(7) Slowly depress a keylever and check requirement a(3).

c. Adjustment.

(1) Loosen each setscrew.

(2) Position each collar to meet requirement a(1) and tighten the setscrew.

Note: Due to the sensitivity of some switches, it may be necessary to move the magnet closer or further away to meet requirement a(2) or a(3). In no case should the magnet touch the switch.

(3) Loosen the mounting screw.

(4) Position each switch holder to meet requirement a(2) or a(3) (as applicable).

(5) Tighten the mounting screw.

3E-10 KEYBOARD POSITIONING
(05355 Issue A)
(fig. 3E-10)

a. Requirement. The keytops and space bar should be visually centered in the keyboard cover.

b. Adjustment.

(1) Loosen the screws.

(2) Position the keyboard to meet the requirement and tighten the screws.

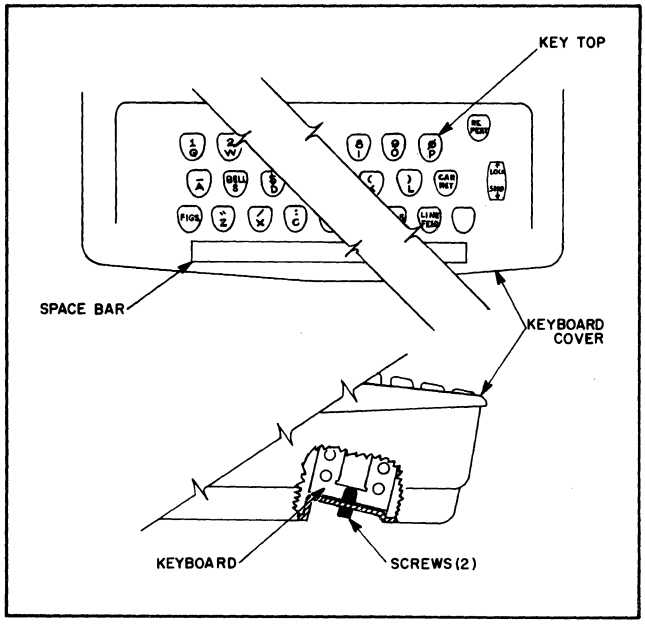
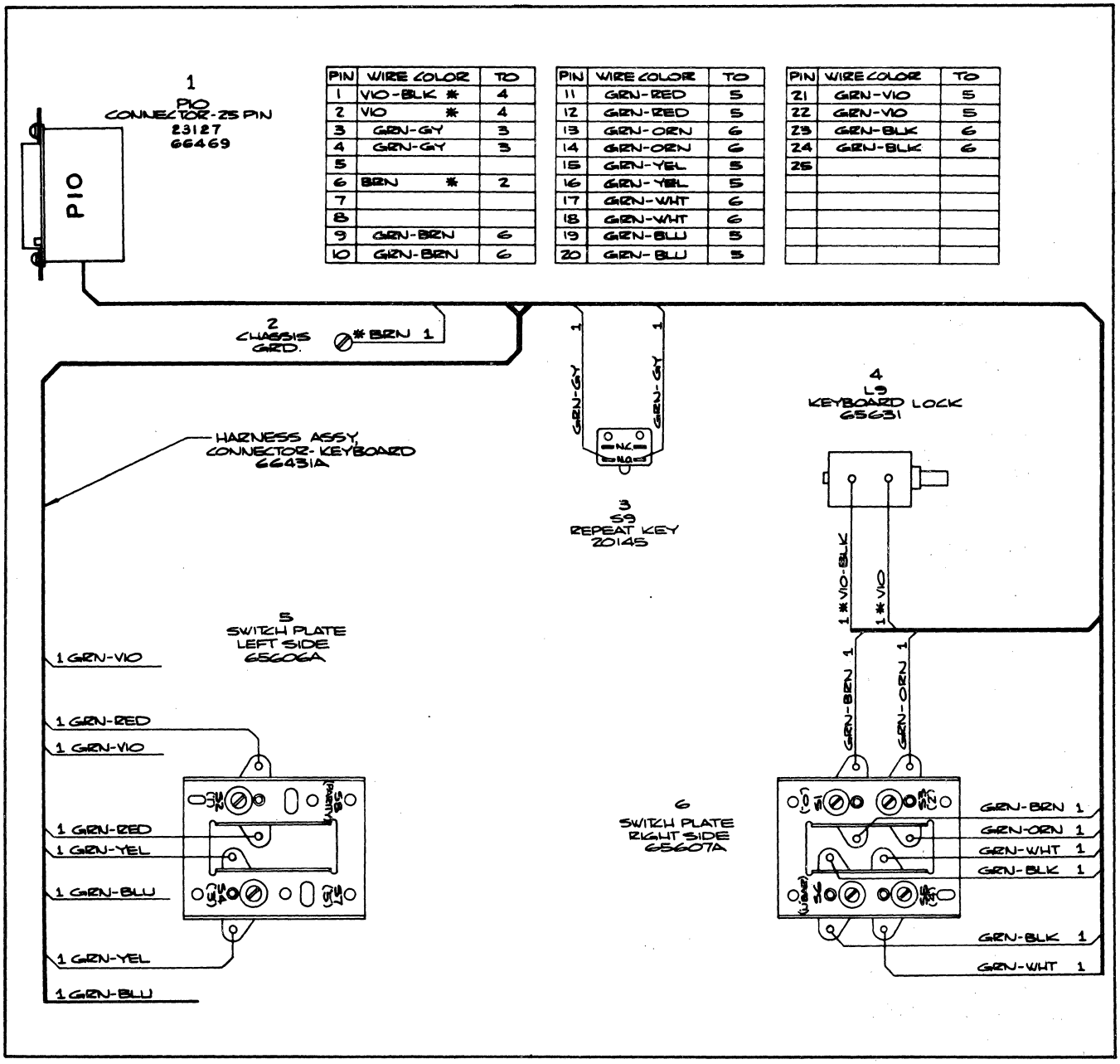


Figure 3E-10. Keyboard positioning.

Section F Wiring Diagram



PIN	WIRE COLOR	TO
1	VIO-BLK *	4
2	VIO *	4
3	GRN-GY	3
4	GRN-GY	3
5		
6	BRN *	2
7		
8		
9	GRN-BRN	6
10	GRN-BRN	6

PIN	WIRE COLOR	TO
11	GRN-RED	5
12	GRN-RED	5
13	GRN-ORN	6
14	GRN-ORN	6
15	GRN-YEL	5
16	GRN-YEL	5
17	GRN-WHT	6
18	GRN-WHT	6
19	GRN-BLU	5
20	GRN-BLU	5

PIN	WIRE COLOR	TO
21	GRN-VIO	5
22	GRN-VIO	5
23	GRN-BLK	6
24	GRN-BLK	6
25		

Figure 3F-1. Keyboard wiring diagram.
(CD-573 Issue D)

CHAPTER 4

PRINTER THEORY AND MAINTENANCE

TABLE OF CONTENTS

CHAPTER 4

PRINTER THEORY AND MAINTENANCE

LIST OF ILLUSTRATIONS

*Not applicable to this equipment.

CHAPTER 4

PRINTER THEORY AND MAINTENANCE

(Model 311 per ES 140)

Section A Mechanical Theory

4A-1 GENERAL

The printer comprises a driving mechanism consisting of a motor, driving belt and notched pulleys, a print drum consisting of 36 double-rings of type characters, paper feed mechanism, line feed mechanism, ribbon feed mechanism, a hammer mechanism mounted in a carriage, carriage feed mechanism, and carriage return mechanism. All of the above mechanisms are mounted on or between two side frames (castings), and with the hinged dust cover constitute the printer assembly. The printer assembly is mounted on the printer base casting.

4A-2 DRIVING MECHANISM (fig. 4A-1)

Power is distributed to the mechanism of the printer from the motor through the drive pulley and driving belt.

a. The print drum pulley rotates the print drum continuously (par. 1A-5).

b. The power shaft extends power to the right hand side of the printer, to operate the paper feed (line feed) and ribbon feed mechanisms.

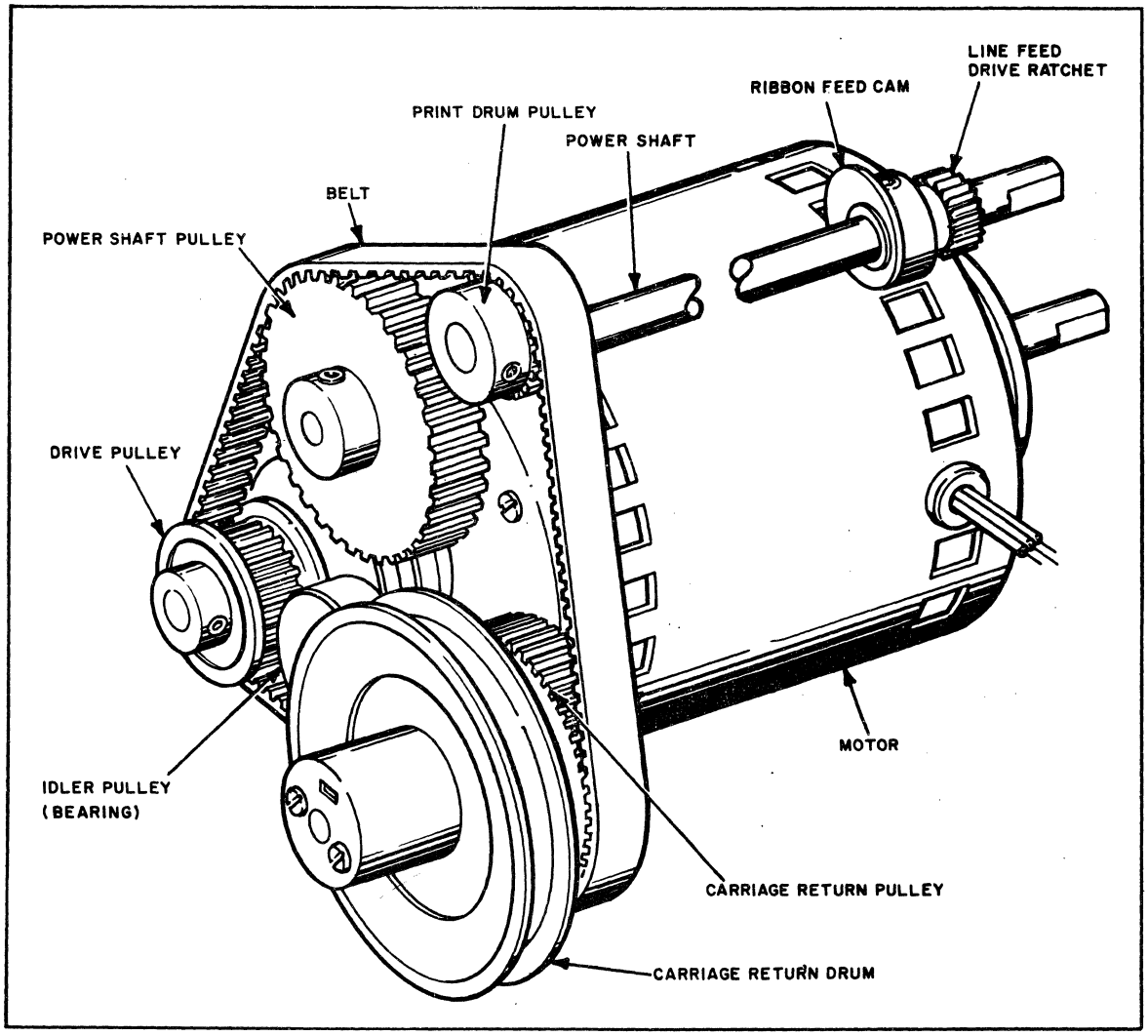


Figure 4A-1. Mechanical power distribution.

c. The carriage return pulley supplies power to move the hammer carriage to the left side of the machine when the carriage return mechanism is actuated.

4A-3 PAPER FEED MECHANISM (fig. 4A-2)

The paper feed mechanism is used to advance the paper, when the line-feed code group is received.

a. When the line feed code group is received by the printer, the line feed magnet is energized, moving the blocking extension of the armature clockwise, out of engagement with the tooth on the stop plate. This allows the clutch to rotate the line feed cam 180 degrees. The armature spring returns the armature to its original position. As the other tooth of the stop plate engages the armature blocking extension, further rotation of the cam is blocked. The detent lever engages the detent cam to insure that the line feed cam does not rebound when its clockwise movement is suddenly arrested.

b. At the start of the 180 degree rotation (a above) of the line-feed cam, the cam follower drops to the low part of the cam, pivoting the link (mounted on the cam follower) counterclockwise; this causes the bail to rotate clockwise and the feed pawl attached to the bail to move away from the stop plate and out of engagement with the detent wheel. Continued rotation of the power shaft causes a lobe of the line-feed cam to turn the cam follower clockwise. As the cam follower turns, the link moves upward; this causes the bail to pivot counterclockwise. The feed pawl attached to the bail moves upward, engages a tooth of the detent wheel and turns the detent wheel and paper feed shaft counterclockwise. The pawl is then held between a tooth of the detent wheel and the stop plate to act as a detent for the paper feed shaft.

c. A driving gear attached at each end of the paper-feed shaft turns associated driven gears on the paper

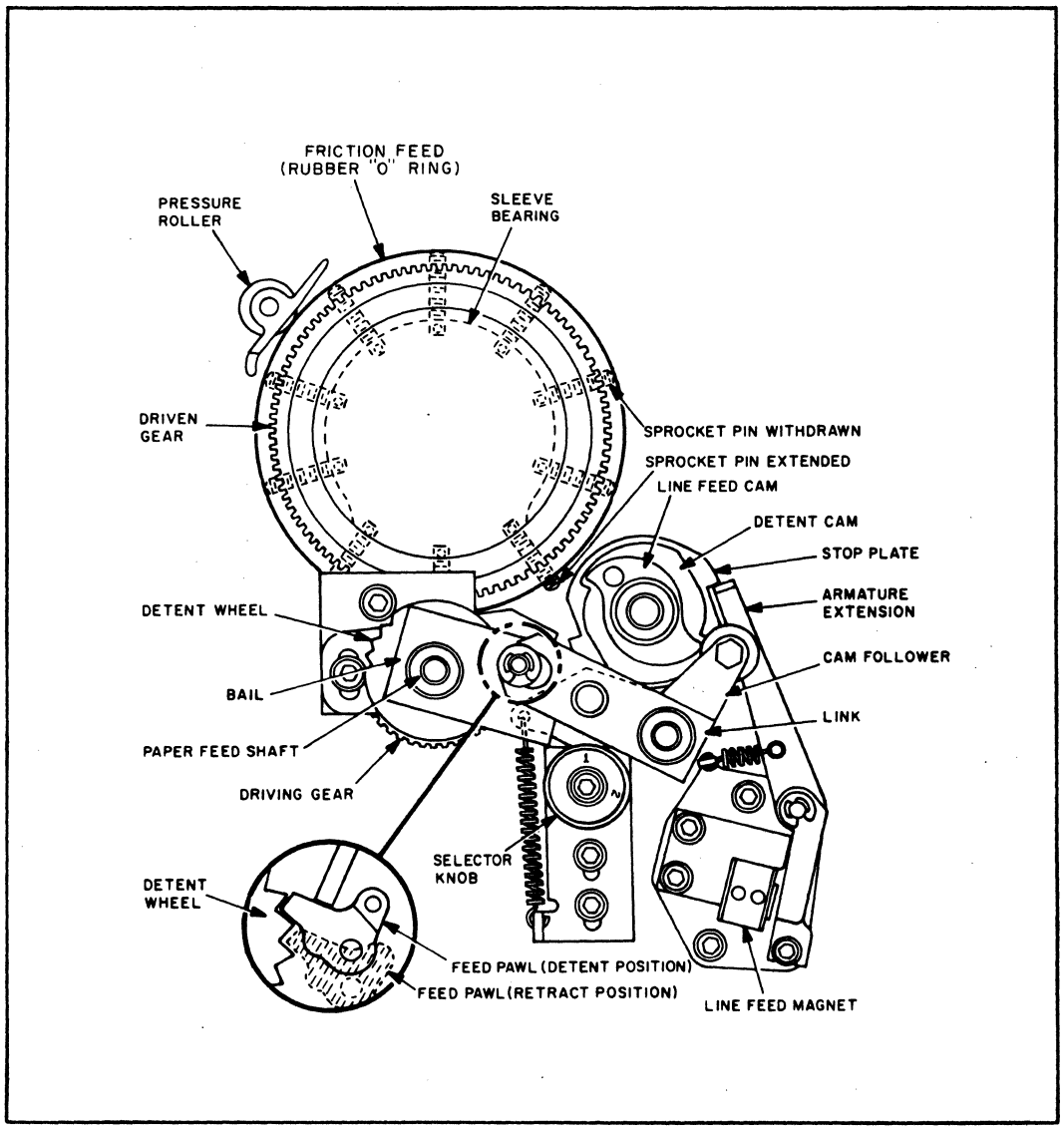


Figure 4A-2. Paper feed mechanism.

feed wheel assemblies. These assemblies rotate independently of the print drum assembly. The paper is held against the feed wheel assemblies by two pressure rollers which are part of the paper guide assembly.

(1) On equipment adapted for friction feed only, rubber O-rings on the feed wheel assemblies, at either end of the print drum, provide a friction drive for roll paper.

(2) On equipment with sprocket-feed mechanism, spring loaded pins in the feed wheel assemblies provide a positive feed for the sprocket fed paper. The knurled peripheries of the sprocket wheel assemblies provide a friction drive for roll paper.

(3) On sprocket feed wheel assemblies, a stationary sleeve bearing withdraws the pins to avoid interference with the inking ribbon, as the feed wheel assemblies rotate.

d. Single or double line feed depends on the stroke of the cam follower. The stroke of the cam follower is controlled by the line-feed selector knob. A flat section on the periphery of the knob permits a longer stroke for double line feed.

4A-4 CARRIAGE FEED MECHANISM (fig. 4A-3)

a. The carriage mechanism (fig. 4D-12) consists of two hammers and magnets mounted in a carriage which is supported on the carriage shaft. A guide (attached to the carriage) is held between guide rails to hold the carriage upright on the carriage shaft. A steady pull to the right is applied to the carriage by the carriage feed spring; the carriage is prevented from moving to the right by a pawl engaging a rack.

b. When a hammer magnet is energized, the respective hammer presses the ribbon and paper against the print drum, thereby printing the character.

c. After both hammers have printed, the space magnet is energized to turn the space bail counterclockwise. The space bail disengages the pawl from the rack momentarily, thereby allowing the carriage feed spring to pull the carriage to the right. Timing of the bail is such that it permits the pawl to reengage the rack after a double space movement.

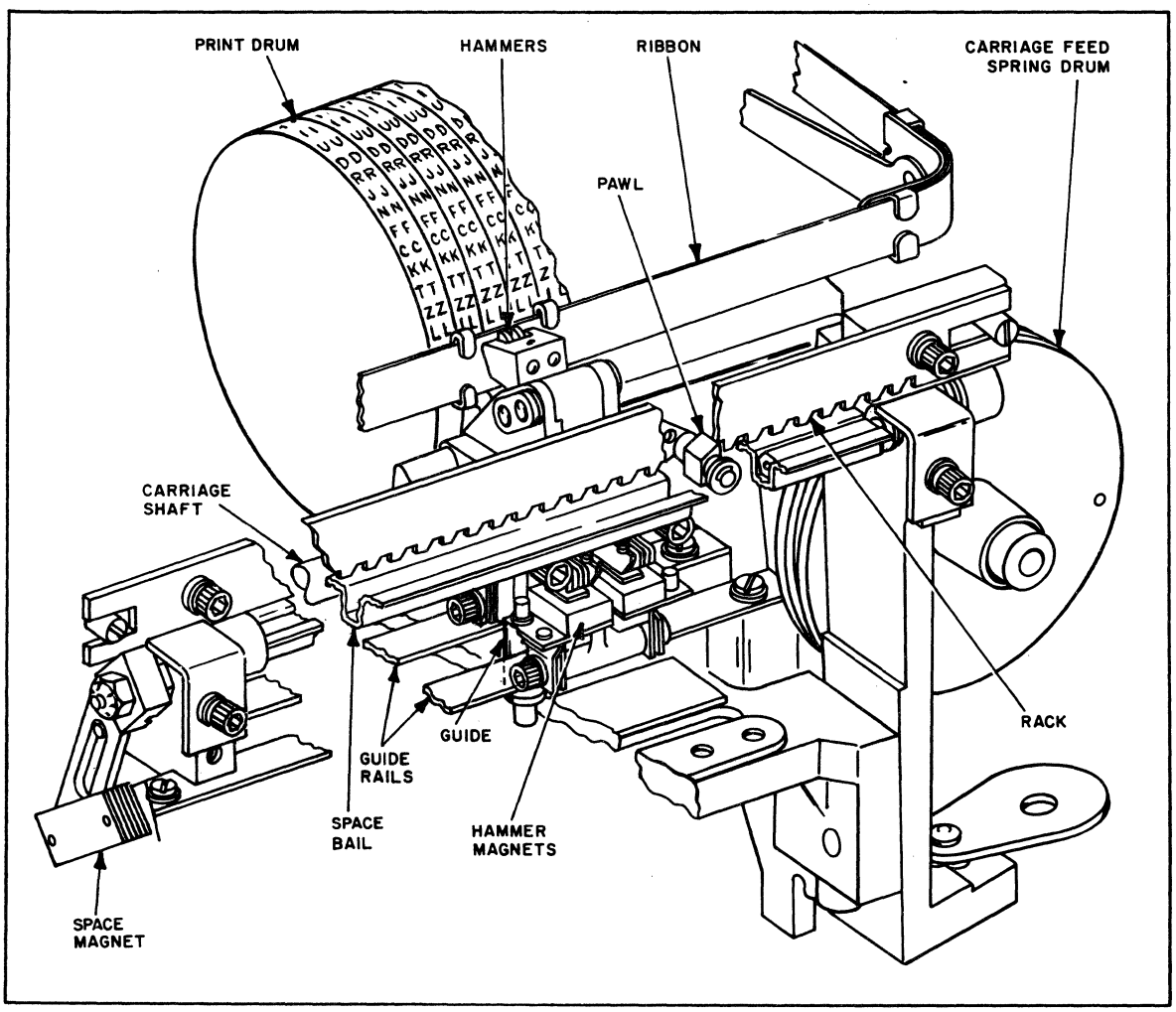


Figure 4A-3. Carriage feed mechanism.

4A-5 CARRIAGE RETURN MECHANISM (fig. 4A-4)

a. After the 72nd character has been received, a carriage return signal is received. This signal actuates the carriage return circuits to energize the carriage-return magnet. When the carriage-return magnet is energized, it creates a friction drive for the carriage-return drum, thereby using motor power to return the carriage to the left-hand margin.

b. At the same time, the space magnet is energized to turn the space bail counterclockwise. The space bail pushes the space pawl out of engagement with the rack to prevent the pawl trailing across the teeth of the rack.

c. A LOCAL C.R. switch on the mode panel permits control of the carriage return circuits.

d. When the carriage reaches the left-hand margin, the magnet on the underside of the carriage actuates the left-hand margin switch, thereby de-energizing the carriage-return clutch; at the same time the carriage pushes the blocking pin into a notch in the carriage-return drum to prevent unwinding of the carriage belt.

4A-6 MARGIN AND SIGNAL BELL OPERATION (fig. 4A-5)

Note: This paragraph and figure 4A-5 are not applicable to certain equipments.

a. When the sixty-sixth character is printed, the margin bell reed switch is actuated by the permanent magnet (fig. 4A-4). The reed switch completes an electrical circuit to energize the bell clapper magnet.

b. On equipment adapted for signal bell operation (par. 4B-2g) when a bell code group is detected, the bell circuit is energized, and the bell rings to alert the printer operator.

4A-7 INKING RIBBON MECHANISM

The inking mechanism includes two ribbon spools and sufficient inking ribbon to fill only one spool. As the printer motor operates, the inking ribbon is unwound from one spool and wound on the other. When the ribbon is almost fully wound on one spool, a ribbon reverse mechanism reverses the direction of ribbon feed and begins to transfer the inking ribbon to the empty spool.

a. Ribbon Feed Mechanism. Power to operate the ribbon feed and ribbon reverse mechanisms is supplied by the ribbon feed cam on the power shaft (fig. 4A-1). The cam follower roller (fig. 4A-6) is held against the cam by a spring. The high part of the cam pivots the cam follower clockwise, extending the spring. The feed pawl located on the upper end of the cam follower is moved toward the right, and trails

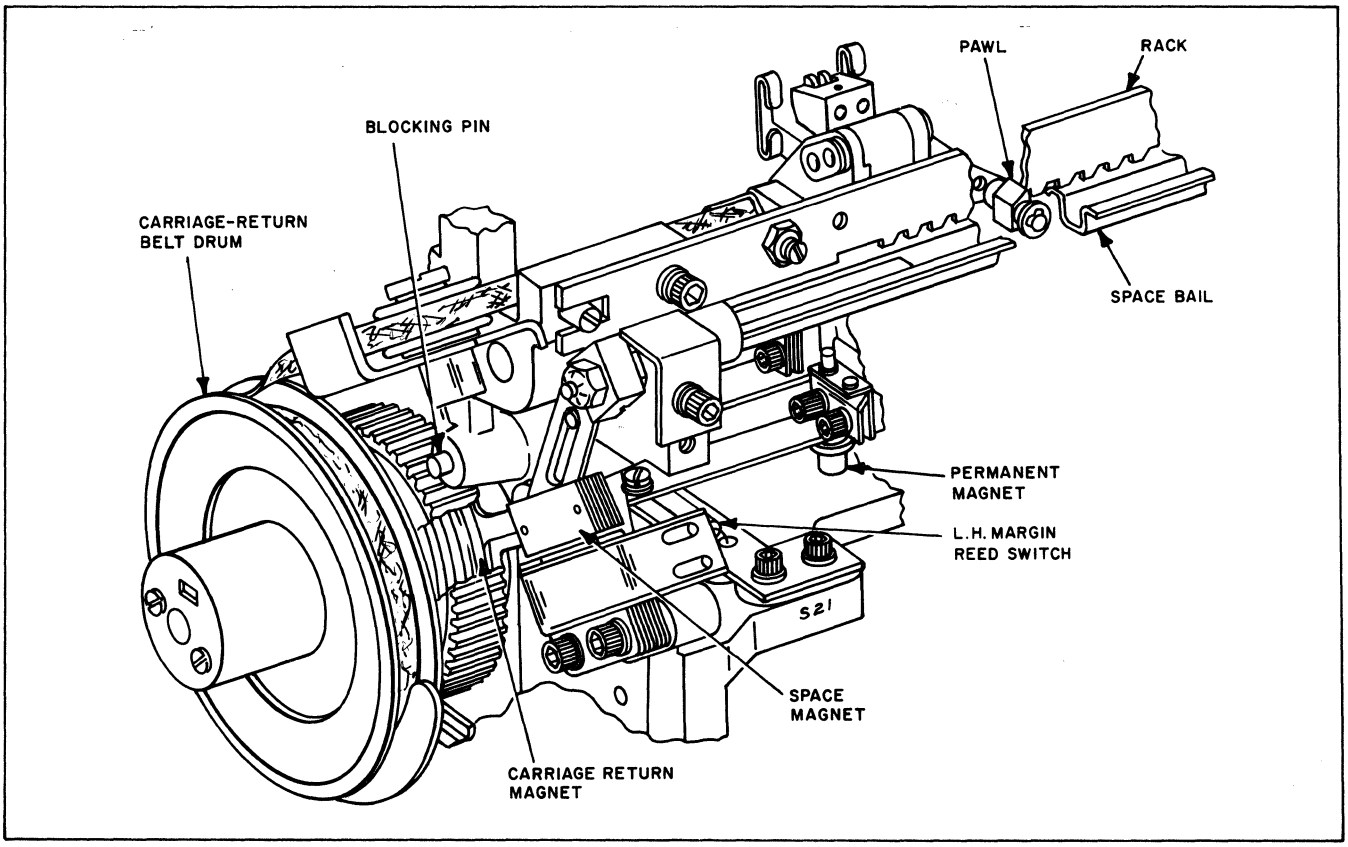


Figure 4A-4. Carriage return mechanism.

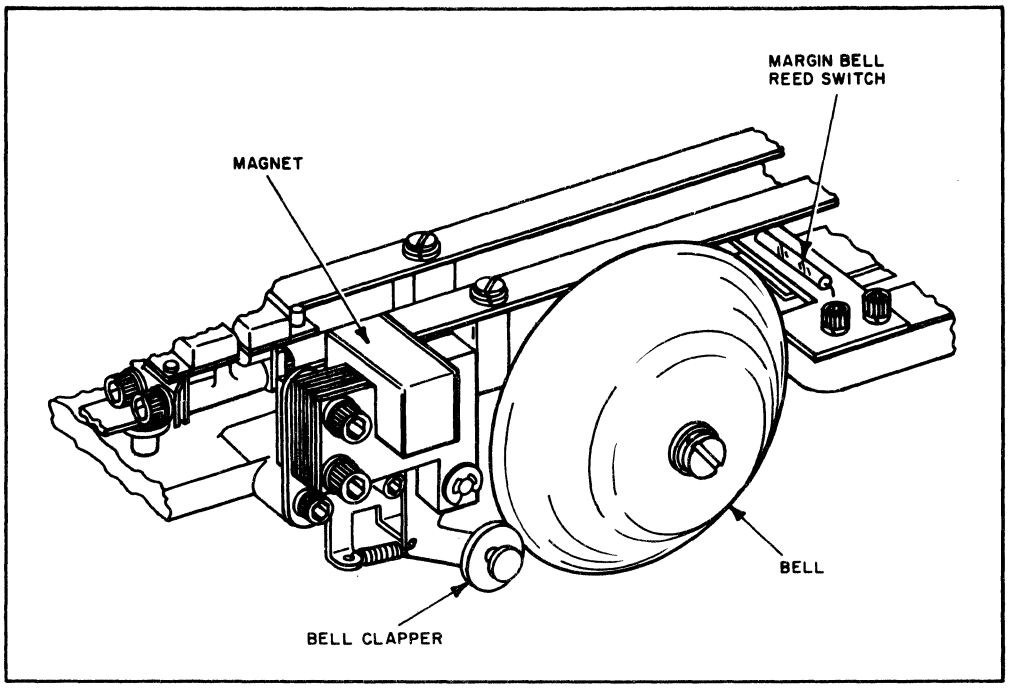


Figure 4A-5. Bell mechanism.

over the ratchet teeth of the right-hand dog assembly. When the high part of the cam moves away from the roller, the cam follower is pivoted counterclockwise by its spring, and the feed pawl engages and rotates the right-hand dog assembly, drive shaft, right-hand spool shaft and ribbon spool clockwise, thereby winding the ribbon onto the right-hand spool. A detent pawl and spring keep the dog assembly and drive shaft from moving between feed strokes.

b. Ribbon Reverse Mechanism. The ribbon reverse mechanism reverses the direction of feed when

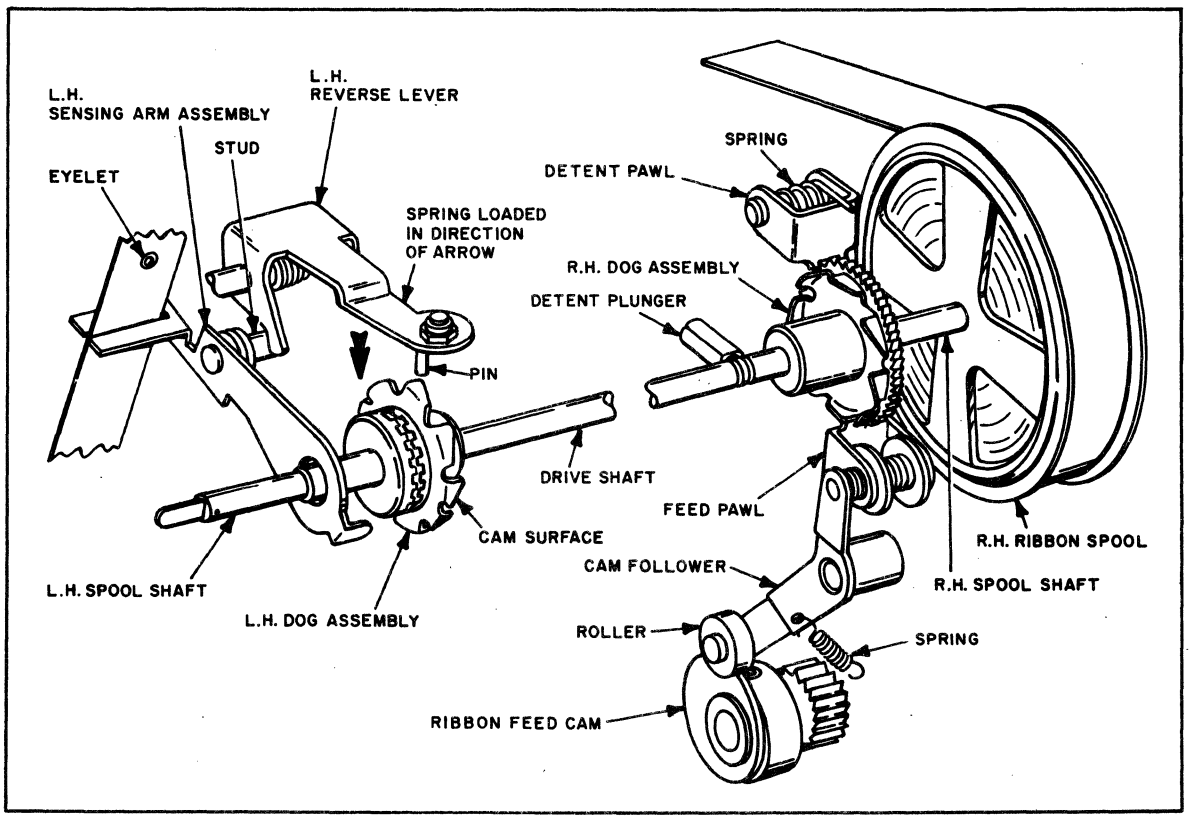


Figure 4A-6. Inking ribbon mechanism.

either spool is nearly empty. As the ribbon spool empties, an eyelet in the ribbon engages the slot in the sensing arm assembly, pivoting the arm assembly counterclockwise until the arm assembly stud is disengaged from the reverse lever. The spring loaded reverse lever rotates clockwise until its pin engages the left-hand dog assembly. On the next feed stroke of the drive shaft (a above) the drive shaft is forced to the left (by the camming action of the dog assembly against the reverse lever pin). The left-hand dog (fig. 4A-6) thus engages the left-hand spool shaft dog, and the empty left-hand spool becomes the driving ribbon spool. Thereafter all feed strokes are used to turn the left-hand spool (instead of the right-hand spool, a above). The spring loaded detent plunger holds the shaft in its new position.

c. Ribbon Lift Mechanism. When the lift magnet (fig. 4A-7) is energized, the armature and link move downward to turn the right-hand bracket, shaft and left-hand bracket (not shown) clockwise. Right- and left-hand lift arms attached to the brackets pivot counterclockwise, and lift the vibrator bail and attached ribbon to the printing position. When the magnet is de-energized, the vibrator bail drops under its own weight and resets the remainder of the ribbon-lift mechanism.

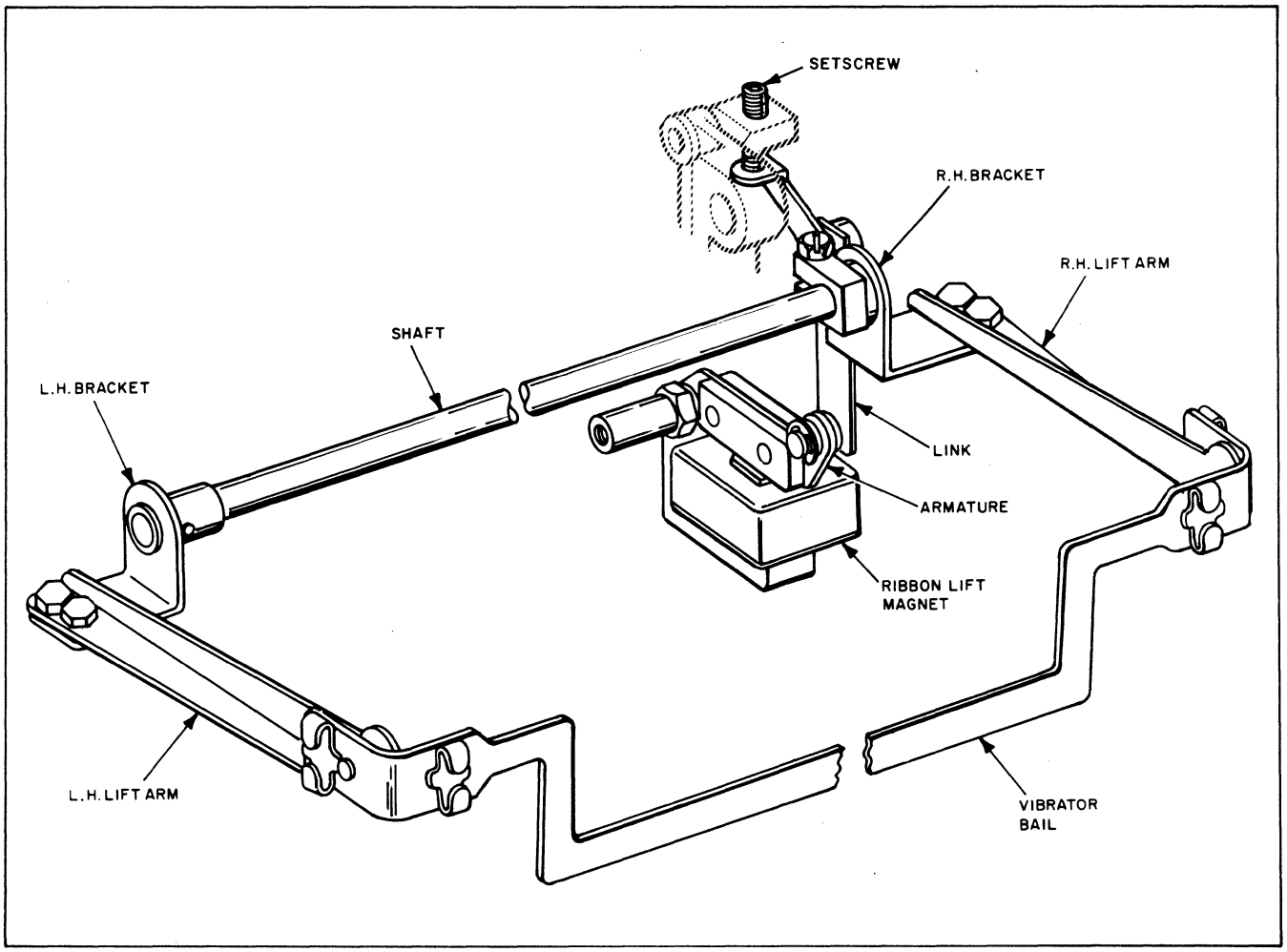


Figure 4A-7. Ribbon lift mechanism.

Section B Electronic Theory

4B-1 GENERAL

The electronic circuits of the printer are shown in block form in figure 4B-1. Electronic components are contained on printed wiring (P.W.) boards which are housed in the electronic module. The P.W. boards with their associated schematic diagrams are shown in Section D. The overall schematic diagram is shown in figure 4G-1.

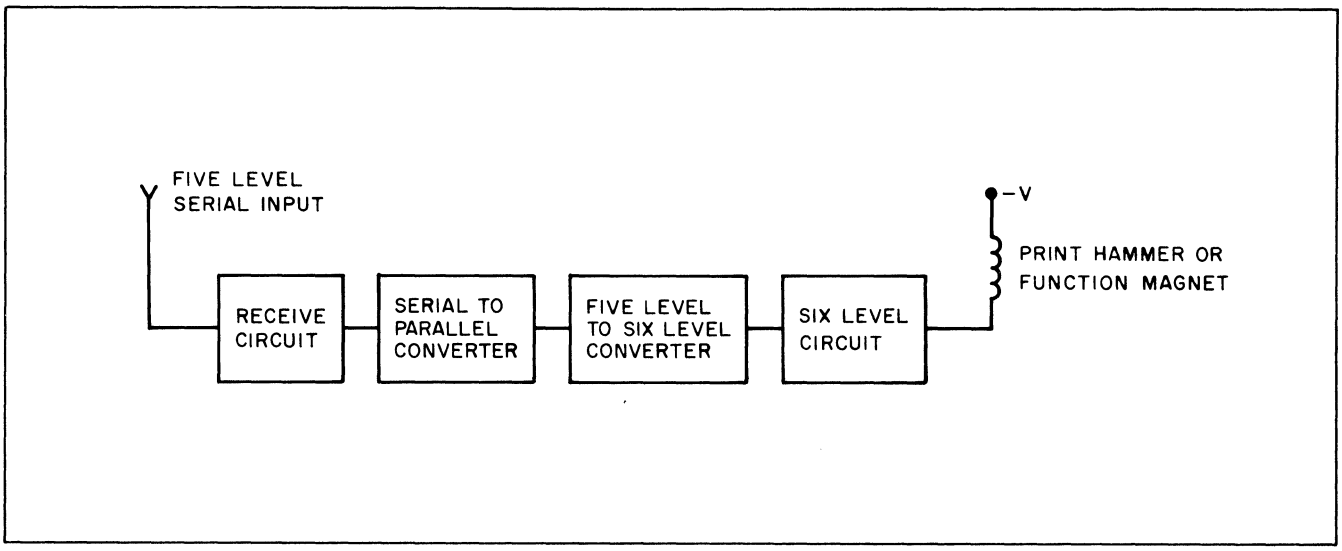


Figure 4B-1. Overall block diagram.

4B-2 FIVE-LEVEL CIRCUIT DESCRIPTION (fig. 4B-2)

When power is applied to the printer, a negative 12 volts is applied via capacitor C1007 to the base of set amplifier Q1005, thereby turning it on until capacitor C1007 has charged sufficiently (from +V) to turn the transistor off. The resultant positive pulse from the collector of Q1005 is applied via diodes (CR813, CR1047, CR1048, CR1049, CR1050) to the right hand sides of the control register, registers "A" and "B" of the read-in counter, and registers "D" and "E" of the read-out counter.

a. Receive Circuit. Sequential "mark" and "space" signals are applied to the base of space detector Q801. Mark signals are indicated by a negative voltage level on the signal line ("serial input"), whereas space signals are indicated by a ground level. When no information is being received, the signal line is held in a steady mark (negative level) condition by the transmitting source. Each information code group is preceded by a start pulse (ground level) and followed by a stop pulse (see paragraph 2A-1b).

b. Serial-to-Parallel Converter. The serial-to-parallel converter comprises an 8-count input counter (registers "A", "B", and "C"), six counter gates ("1" through "5" and "STOP"), read pulse amplifier (Q2203), four storage capacitor groups (Group #1 through #4), and a 4-count read-in counter (Register "A" and Register "B").

(1) The space detector Q801 is on (conducting) when there is a mark on the signal line. The start pulse turns Q801 off. The negative output of Q801 is applied to Q802 and counter gates "1" through "5." The positive transition from Q802 sets the control register via pedestal capacitor C804.

(2) The positive transition from the "$\overline{Q}$" side (Q805) of the control register activates the ribbon-lift circuit; and grounds the emitter of Q806, thereby permitting the time base multivibrator to oscillate. The oscillating frequency of the multivibrator varies with the resistance of the RC time constant, the resistance is preselected by use of the HI-LO switch (S801) located at the rear of the printer. (HI = 300 bauds, LO = 150

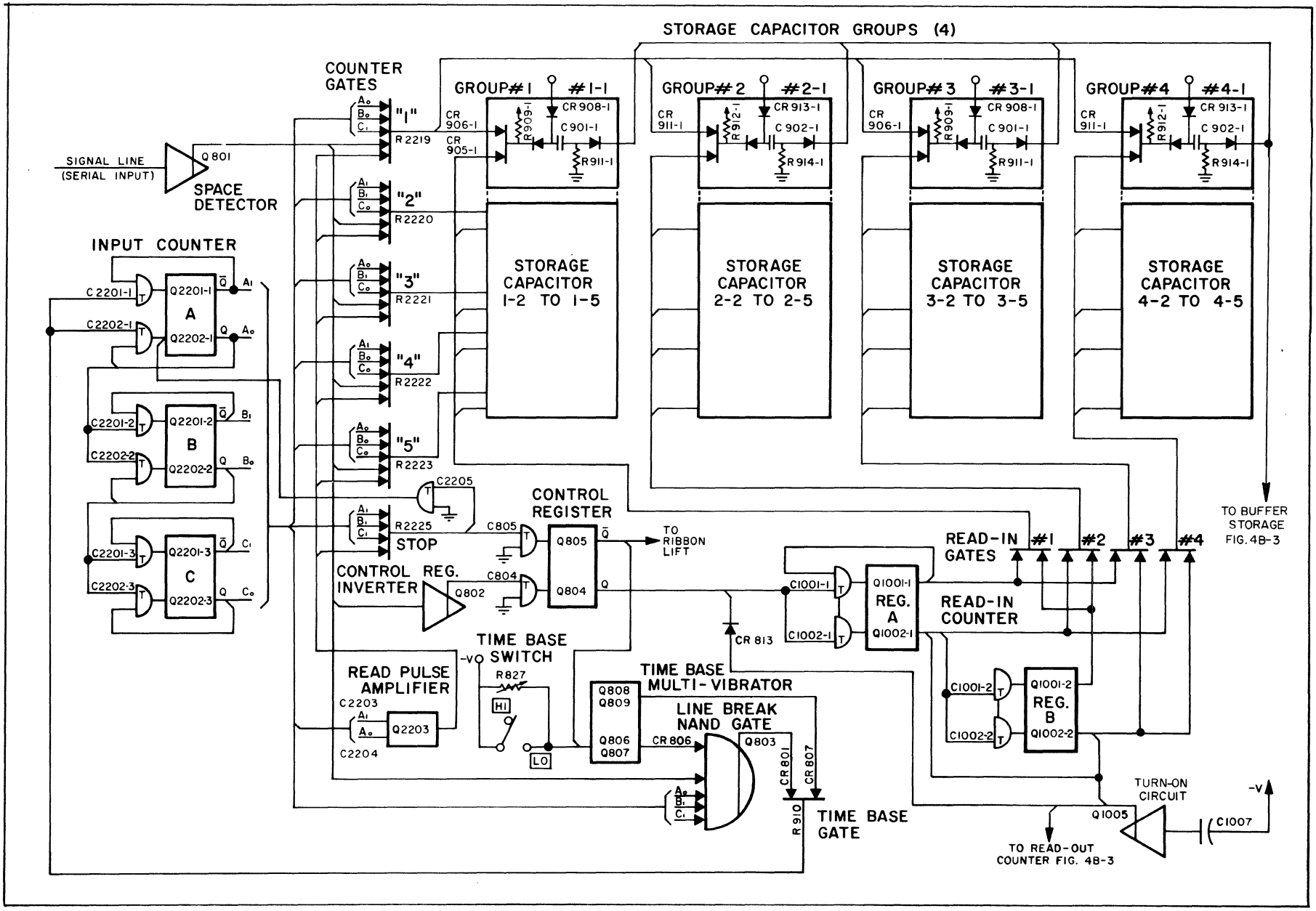


Figure 4B-2. Five-level input circuit.

bauds). The outputs from the "Q" side of the control register (Q804) step the read-in counter.

(3) Positive transitions from the "Q" side (Q808) of the time base multivibrator (amplified by cascade amplifier Q809) trigger (alternately) the pedestal capacitors of register "A" (of the input counter), thereby causing the input counter (A, B, and C) to cycle. The outputs from the collectors of the input counter, during the eight counts, are shown in the following chart, 1 = MARK (negative level), 0 = SPACE (ground level).

	1st	2nd	3rd	4th	5th	6th	7th	8th
COUNTER OUTPUT	START	#1	#2	#3	#4	#5	STOP GATE COUNTER	STOP
A0	0	1	0	1	0	1	0	1
A1	1	0	1	0	1	0	1	0
B0	1	1	0	0	1	1	0	0
B1	0	0	1	1	0	0	1	1
C0	0	0	1	1	1	1	0	0
C1	1	1	0	0	0	0	1	1

(a) The output from either the "Q" or "$\overline{Q}$" sides of each input counter register is applied to each of the counter gates ("1" through "5" and "STOP").

(b) The application of the counter pulses to the counter gates is synchronized with the application of the serial code pulse from the space detector ((1) above) to the counter gates.

(c) Outputs of either A1 and A0 of the input counter turn the read pulse amplifier (Q2203) off for 100 microseconds (approximately) each time the "A" register flips ((3) above). The negative output from the read pulse amplifier is applied to the counter gates to allow the appropriate counter gate to function in the central time period of its associated serial code (start or intelligence) pulse.

(1) Serial code pulses (bits) are read into capacitor storage as follows:

All inputs to number 1 counter gate go negative; the resultant negative output is applied to one diode (CR906-1 (2) and CR911-1 (2) of each storage capacitor group.

The outputs from both sides of both registers of the read-in counter are connected via a matrix of AND gates ("1", "2", "3", and "4") to the capacitor storage groups, thus the read-in counter determines which capacitor storage group will store the incoming serial code group. For example, if the left sides of registers "A" and "B" are negative (Q1001-1 and Q1001-2 not conducting) both inputs to read-in gate #1 will be negative, while gates 2, 3, and 4 will have at least one positive input. The resultant negative output from gate #1 applies a negative voltage to diodes CR905 in capacitor storage group #1. When (for example) the inputs to diodes CR 905-1 and CR906-1 (in group #1) are both negative, capacitors C901-1 will charge (via diode CR907-1 and resistor R909-1 from minus 12V, see fig. 4G-1).

(2) As registers "A", "B", and "C" of the input counter are counted down, the counter gates "1" through "5" sample mark or space voltage levels on the signal line and function accordingly, in numerical order, each counter gate selecting its associated storage capacitor (in group #1). Each space (0 or ground level) at the serial input results in a storage capacitor being charged. Capacitors C901 will remain in this charged state until the read-out circuit triggers the stored character into the buffer storage registers (fig. 4B-3).

(4) On the seventh count the stop gate is completed. The negative output of the stop gate charges pedestal capacitors C805 and C2205. The back edge (positive transition)

of the seventh count triggers the stop gate. The positive transition from the stop gate:

(a) Triggers pedestal capacitor C805 to reset the control register and thereby switch off the time base multivibrator. The positive transition from the "Q" side of the control register steps the read-in counter (to capacitor storage group #2).

(b) Triggers pedestal capacitor C2205. The positive transition from C2205 resets register "A" thereby advancing the input counter to the stop position (8th count, see chart, b(3) above).

c. Line Break.

(1) A line break signal is indicated by a steady spacing signal (ground level) on the signal line. The line break signal is recognized by the receive circuit as a continuous succession of spacing pulses.

(2) The first six of these spacing pulses (equivalent to start and five information pulses) are processed as described in a and b above. After the first six spacing pulses, the continuing ground level on the signal line holds Q801 off, thereby making all five (CR802, CR803, CR804, CR805, CR806) inputs to the line break NAND gate negative. This causes Q803 to conduct. The grounded collector of Q803 clamps counter "A" pedestal capacitors (C2201-1 and C2202-1) at ground, thereby preventing the multivibrator from stepping the counter.

d. Read-Out Circuit (fig. 4B-3). The read-out circuit comprises a 4-count read-out counter (Register "D" and Register "E") with associated read-out

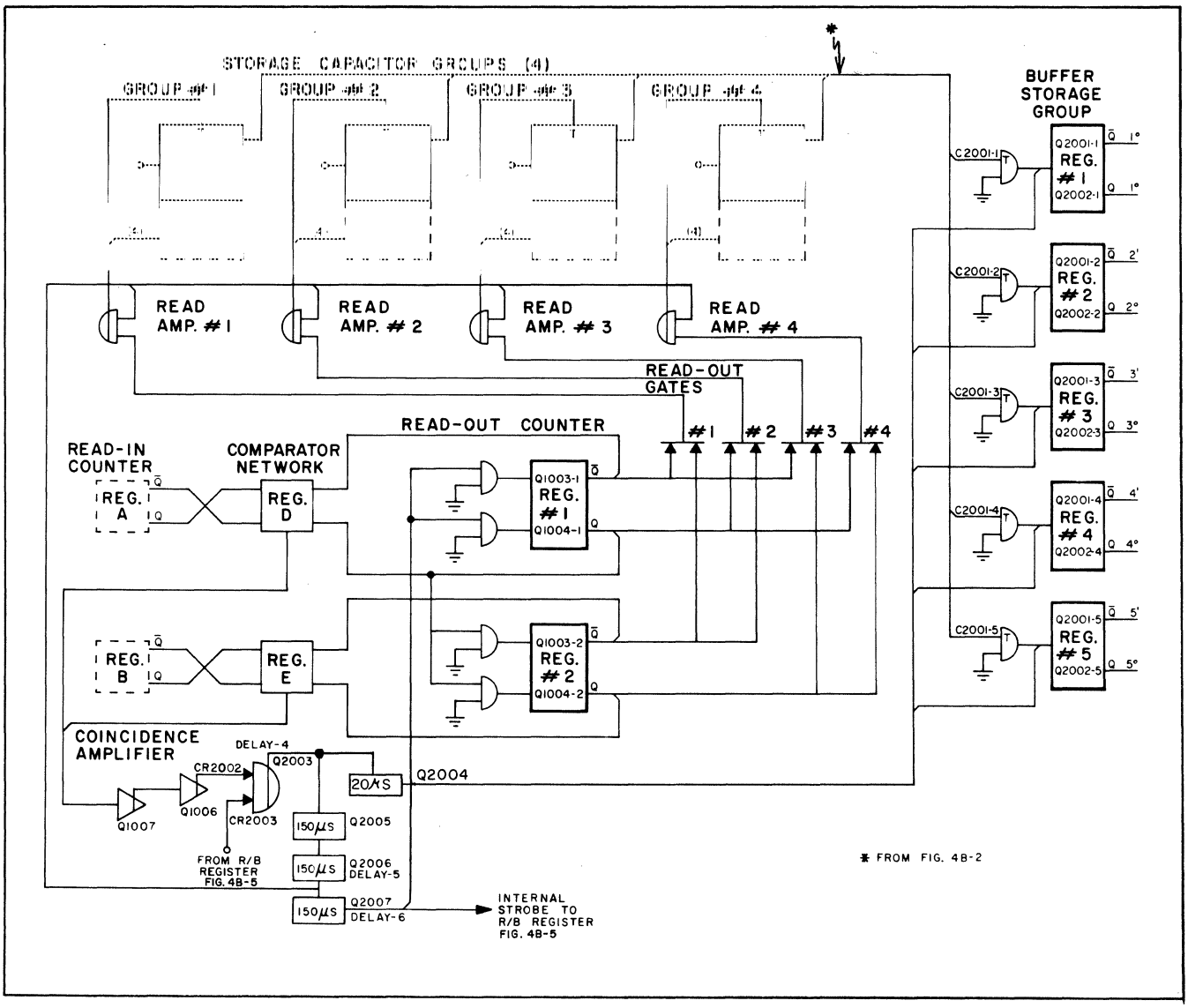


Figure 4B-3. Five-level read-out circuit.

gates 1 through 4, a comparator network (consisting of two coincidence detectors, par. 2B-2p), a coincidence amplifier, four time delay circuits, four read amplifiers - one for each storage capacitor group, and five buffer storage registers.

(1) The outputs of both registers of the read-out counter are compared with the outputs of the read-in counter in the comparator network. When the settings of both registers of the read-in counter agree with the settings of the read-out counter, the coincidence amplifier Q1007 is turned on by a negative level output from the comparator network (coincidence detectors "A" and "B").

Note: Coincidence will occur at the beginning or end of the code group.

(2) During coincidence the positive output of the coincidence amplifier turns off Q1006, thereby turning off diode CR2002. When the printer is ready to process information, diode CR2003 will also be turned off by the "ready" signal (negative level). When diodes CR2002 and CR2003 are both off, transistor Q2003 conducts, thereby activating the delay-4 circuit and the reset delay (C2002). The 20 μS negative pulse from the reset delay resets buffer storage registers. At the end of 150 microseconds Q2005 turns on. The positive transition from Q2005 activates the delay-5, thereby turning Q2006 off.

(3) The negative voltage level from the collector of Q2006 charges capacitor C2005 (part of delay-6); and turns off one diode in each of the read amplifier NAND gates, thereby completing a NAND condition on the read amplifier whose other input is held at a negative level by the read-out counter. The positive output from the completed NAND gate (appropriate read amplifier) triggers the associated group of storage capacitors, thereby transferring the intelligence from the storage capacitors into the buffer storage register as follows:

(a) Storage capacitors which were charged emit positive transitions which trigger the input pedestal gates and set the associated registers ("Q" sides conducting) of the buffer storage group.

(b) The registers associated with uncharged storage capacitors remain in their reset condition ("$\bar{Q}$" sides conducting).

(4) The positive transition (back edge) of the delay-5 pulse activates the delay-6. The back edge of the delay-6 pulse provides the strobe pulse which informs the six-level circuit (par. 4B-4) that there is information in buffer storage. An additional function of the back edge of the delay-6 is to advance the read-out counter, to enable the succeeding code group to read out a different storage capacitor group.

(5) The five-level parallel output of the buffer storage group is applied to five data amplifiers.

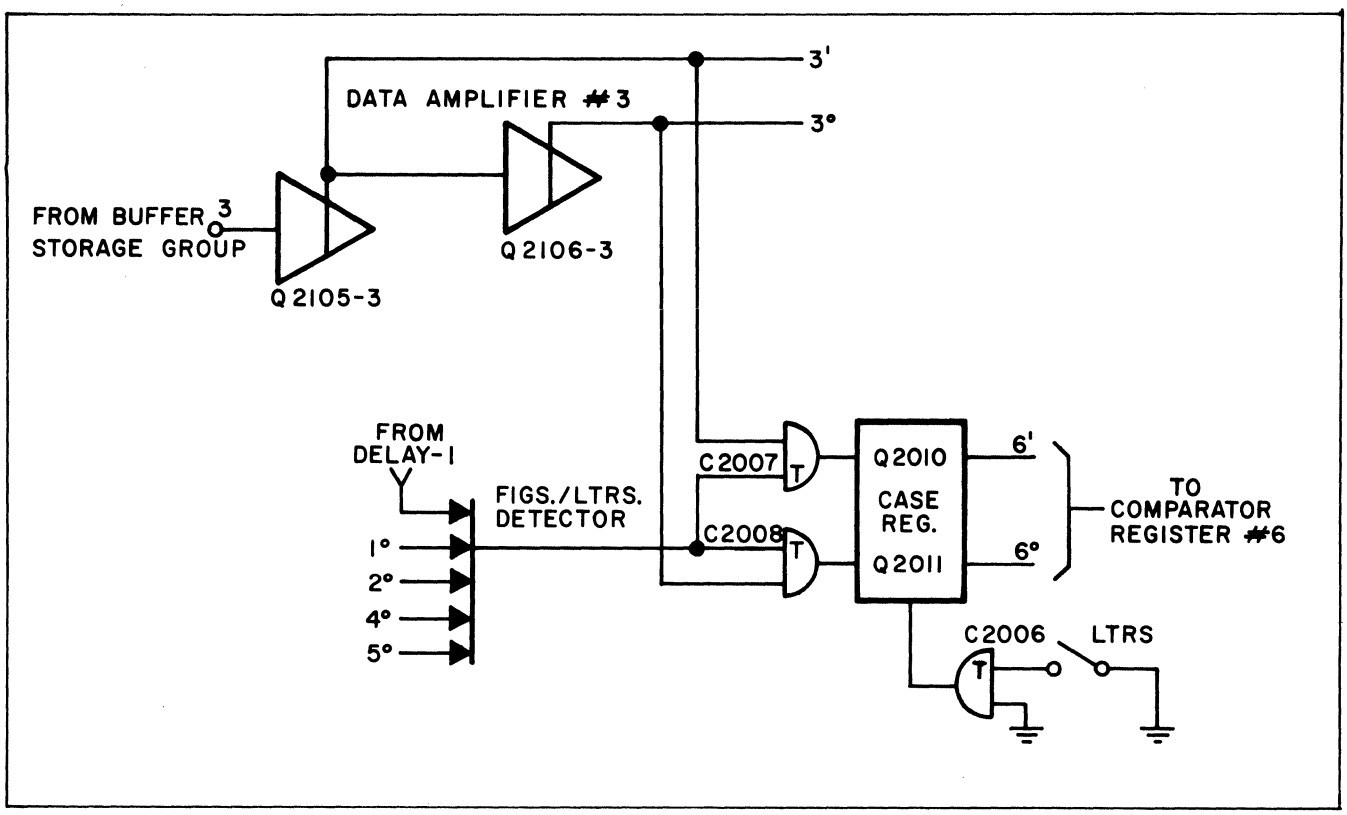


Figure 4B-4. Five-level to six-level converter.

Parallel Circuit Description

4B-3 GENERAL

a. The entire electronic circuit of the printer is shown in schematic form in figure 4G-1. Figure 4G-1 may be the circuit of either a serial receiver or parallel receive printer. The parallel portion of the circuit is virtually identical for serial and parallel Model 311s. A parallel circuit is adapted for use in a serial printer by placing a serial receive and serial-to-parallel converter in front of the parallel circuit.

b. Low voltage dc to operate the electronic components and magnets is provided by the dc power supply, fully described in Section 4C. Electronic components are contained on printed wiring boards which are housed in the electronic module located in the rear of the printer, or in an external package (par. 1A-5).

c. The parallel circuit is designed for processing six-level (six information bits in each character or function code group). When a 311 is used to receive five-level data, a case register is used (fig. 4B-4). Study of figures 1A-4 and 2A-1 shows that the first five levels for figures and letters are identical, with the exception of the D3 level (bit). The sixth bit or level determines whether printing takes place on the "figures" or "letters" half of the print drum. The input pedestal gates to the case register are connected to the 3^1 and 3^0 outputs of data amplifier #3, therefore either pedestal capacitor C2105 or C2106 is always connected to ground, depending on whether the code group is for letters or figures. Each time the FIGS/LTRS detector is completed (on receipt of either a figure or letters code group) the case register pedestal capacitor which is connected to ground will be charged. The next positive transition from the delay-1 (par. 4B-5a(6)) triggers the FIGS/LTRS detector, which in turn flips the case register, thereby polarizing the output leads of the case register 6^1 and 6^0 as appropriate for printing figures or letters.

d. When the LTRS switch (on the mode panel) is depressed, a positive transition passes via pedestal capacitor C2006 to the base of the right hand transistor (Q2011) of the case register, thereby resetting the case register for the printing of letters. When a figures code group arrives, the case register is again set to figures.

4B-4 INTRODUCTION

a. Figure 4B-5 shows the major components of the parallel circuit in block diagram form. Binary data is received on either five or six parallel inputs to the data amplifiers.

b. About 150 microseconds after receipt of the six-level data, a strobe pulse is received by the ready-busy register. The ready-busy register immediately marks the ready-busy line "busy", and transfers the outputs of the data amplifiers simultaneously to hammer-1 register group, hammer-2 detector network, and the function gates. If the received data is a printable character, it will be processed by either hammer-1 or hammer-2 circuits. If the received data is a function code, the appropriate function gate and detector will be completed and the associated function circuit activated. The steer register arranges the hammer circuits for printing of alternate characters. The phase compensators (when included) control printing to adjust for variations in motor speeds. This facility is not included when an ac supply frequency of 60 cycles plus or minus one-half cycle is available.

4B-5 PARALLEL CIRCUIT DESCRIPTION

The components shown in the following schematic block diagrams (for example Q1103 in figure 4B-6) are a cross reference to the actual components as numbered on the schematic diagram figure 4G-1, and on the printed wiring boards (Section 4D). The symbols used throughout this manual are described in detail in paragraph 2B-3.

a. Power Turn-On, Synchronization, Data Receive, and Control Circuits (fig. 4B-6).

(1) When power is applied to the printer, a negative 12 volts is applied via capacitor C1101 to the base of set amplifier Q1103, thereby turning it on until capacitor C1101 has charged sufficiently (from +V) to turn it off. The resultant positive pulse from the set amplifier is applied to the collectors of Q1101 and Q1106 to ensure that the ready-busy and steer registers are reset.

(2) As the print drum begins to rotate, the first pulse generated by the index clock L2 passes via two amplifiers (Q1303 and Q1304) to the counter group, thus synchronizing the counter group with the print drum (par. 2B-3g). The index pulse resets the counter group by applying a negative voltage to the bases of the right hand transistors of the counter stages, see schematic diagram (fig. 4G-1). Unless synchronized the counter group may not agree with the angular position of the print drum, due to over-run of the drum when the power was turned off. The other function of the index clock is to supply triggering pulses to the line feed circuits (described in a later paragraph).

(3) The character (or function) code is applied to the data lines. Two data amplifiers are

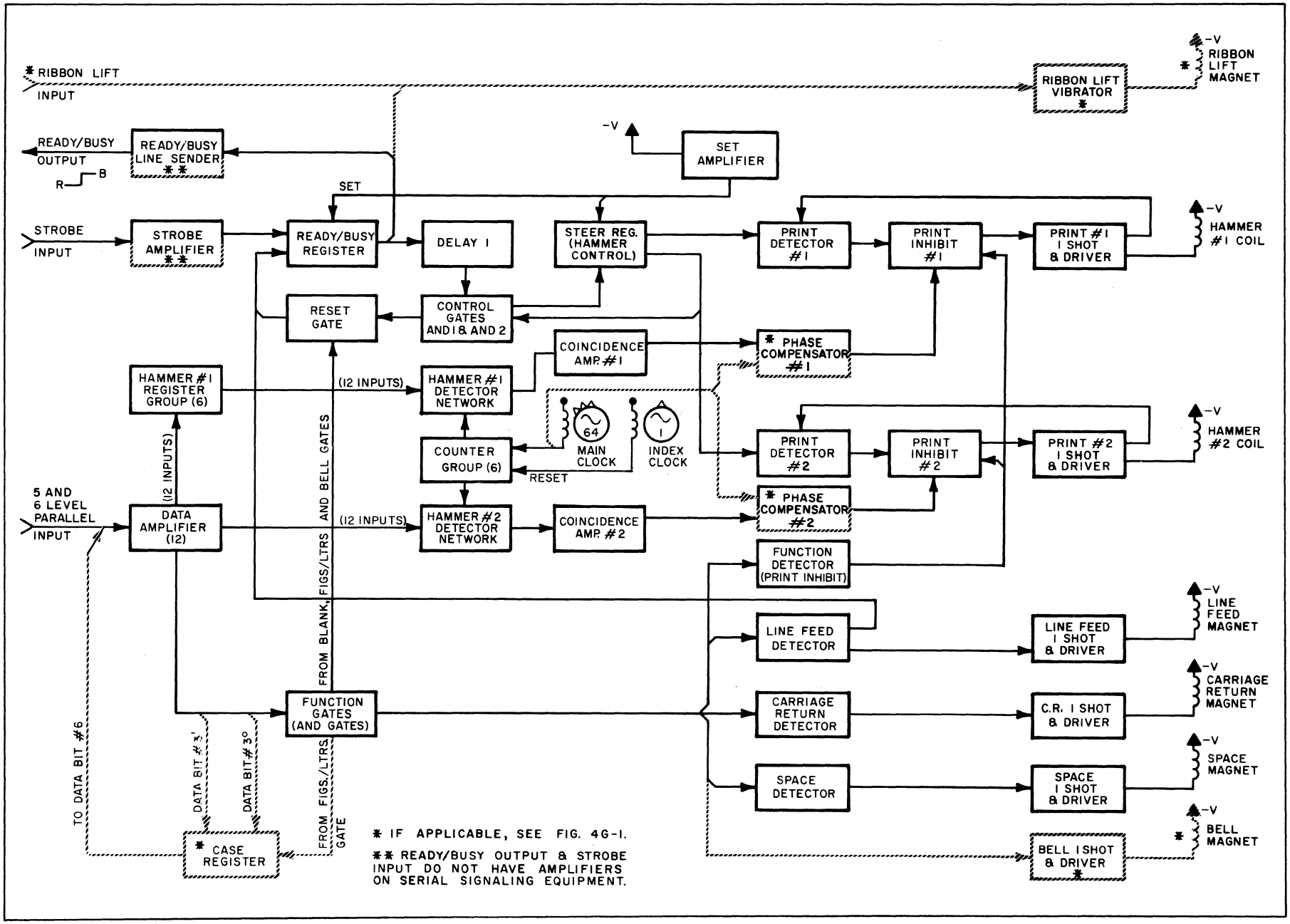


Figure 4B-5. Overall (simplified) block diagram.

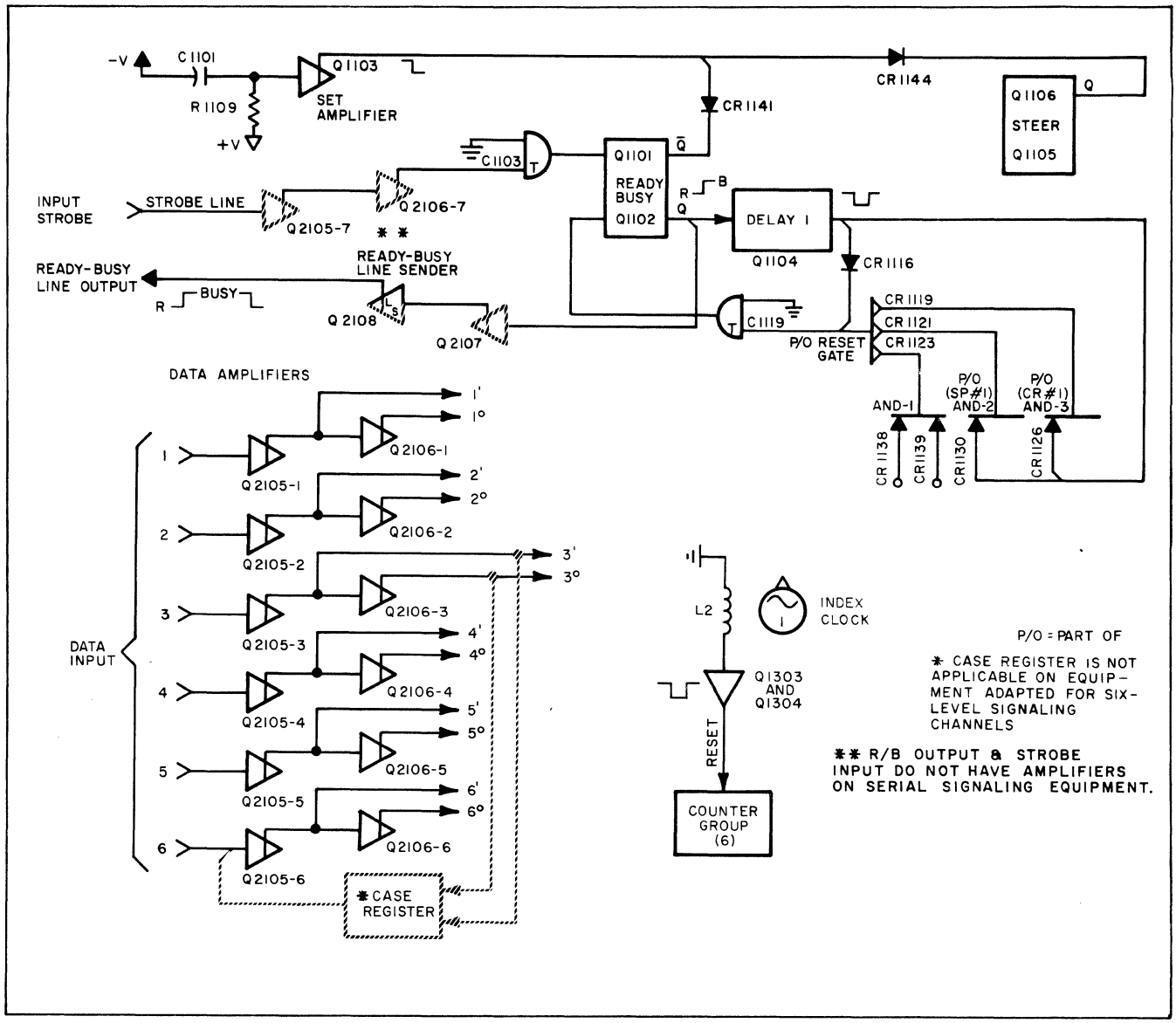


Figure 4B-6. Power turn on, synchronization, data receive and control circuits.

provided for each data line; they amplify the signal current and provide two opposite levels (negative and ground) on their output collectors. If the input on a data line (line "1" for example) is a logic "1" (negative level), the output on lead 1^1 will be a ground level, and the output on lead 1^0 will be a negative level. Conversely if the input is a logic "0", output lead 1^1 will be negative, and output lead 1^0 will be ground.

(4) About 150 microseconds after receipt of the data signals, a strobe signal is received. The strobe signal is a positive transition which is (amplified by Q2105-7 and Q2106-7, parallel signaling 311s) applied via pedestal capacitor C1103 to the set side of the ready-busy register Q1101.

(5) On parallel signal line 311s, when the ready-busy register goes busy, the "Q" side of the ready-busy register goes to ground, thereby turning Q2107 off and Q2108 on. The ground level via the emitter of Q2108 marks the ready-busy line "busy." Choke L2101 in conjunction with capacitors C2109 and C2108 filter to ground unwanted transitions in the ready-busy line (fig. 4G-1). The busy condition of the ready-busy line "tells" the transmitting source (read-out circuit on serial signaling 311s) to retain the data on the data lines and not to send another strobe pulse; this condition prevails until the ready-busy register is reset as described later. On 311s designed for serial operation, the ready-busy signal is taken direct from the "Q" side of the ready-busy register.

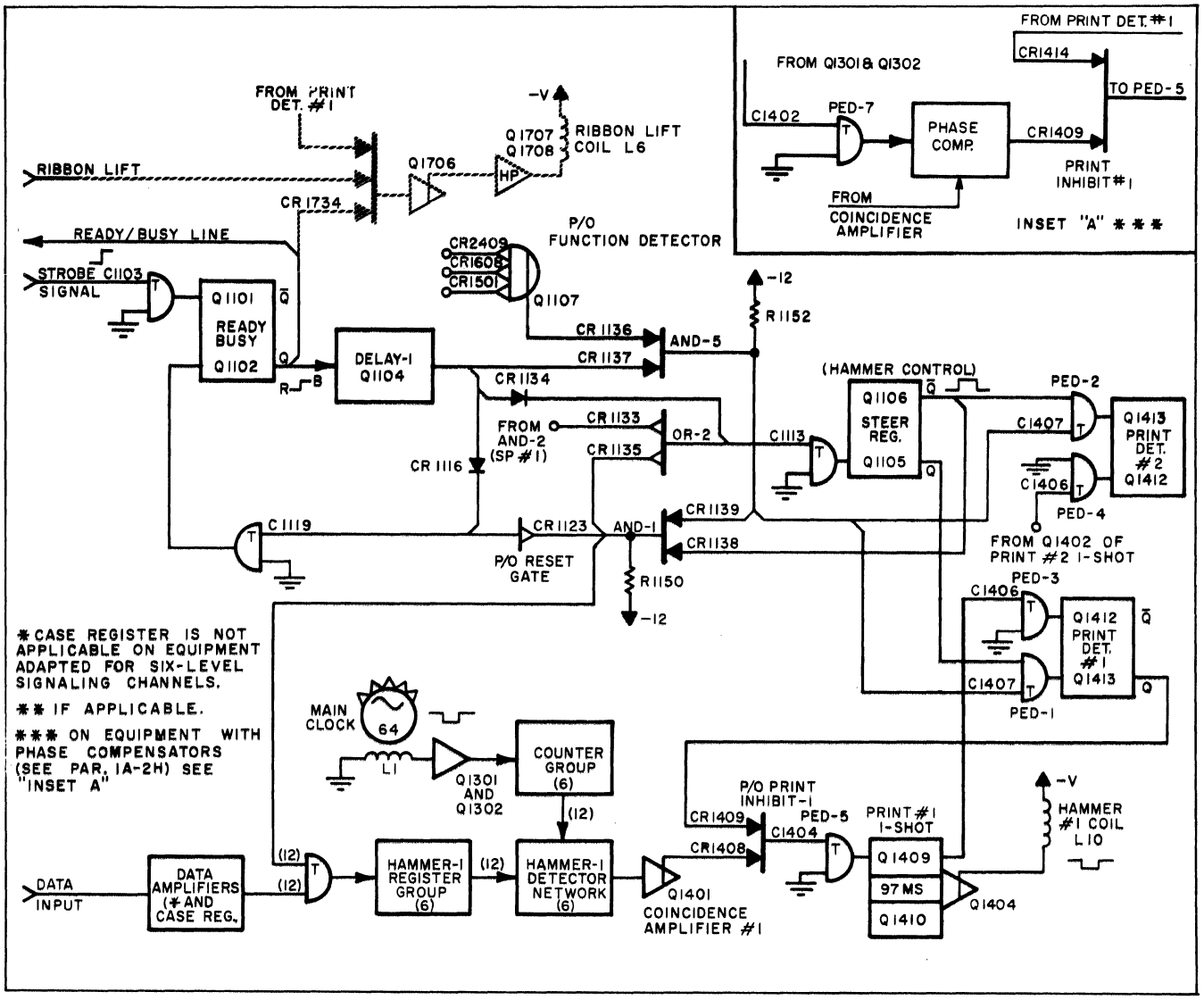


Figure 4B-7. Printing on hammer #1, block diagram.

(6) The positive transition from the "Q" side of the ready-busy register activates delay-1. The output of delay-1 is a 500 microsecond negative pulse (par. 2B-3n). While the delay-1 pulse exists, pedestal capacitor C1119 is allowed to charge via any negative input of the reset gate (OR gate) from the output of AND-1, AND-2, or AND-3 when one of these three gates opens (subpars. c(1) or f or g below). When delay-1 goes positive, pedestal capacitor C1119 discharges, resetting the ready-busy register.

b. General Description of Printing Circuit Components (fig. 4G-1).

(1) The circuit described below comprises the comparator circuits (hammer-1 register group, hammer-1 detector network, counter group, and hammer-2 detector network), function gates and detectors, ribbon lift circuit, print detector register, driver 1-shot and print solenoid for each hammer, and a steer (hammer control) register that determines which hammer shall print (and phase compensators if applicable, see par. 1A-2h).

(2) For a detailed description of registers, 1-shots, and gates, refer to paragraph 2B-3.

(3) The counter group consists essentially of six bistable multivibrators (binary counters) connected in series with each other, and connected in parallel with hammer-1 and hammer-2 detector networks. The counter group is a 2^6 (64) count counter which is continuously stepped by positive transitions from the main clock.

(4) Hammer-1 detector network is connected in parallel between hammer-1 register group

and the counter group. Its purpose is to detect the instant during the counter group cycle when the settings of hammer-1 register group and the counter group are identical; that instant is called "coincidence."

(5) Hammer-2 detector network is connected in parallel between the counter group and the output sides (signal and complement) of the data amplifiers. Hammer-2 detector network detects coincidence between the counter group and the data amplifiers.

(6) The function gates and associated detectors are arranged in a vertical column on figure 4G-1. The inputs to the function gates are connected to the outputs of the data amplifiers, ready-busy register and delay-1 (blank detector only). A diode on each function gate connected to F/D (function detector) is actually an output of the gate.

(7) The ribbon lift mechanism (par. 4B-5b(7)) is raised to the printing position by ribbon lift coil L6. The sequence of operation is as follows:

(a) Transistor Q1706 is normally on, thereby holding Q1707 and Q1708 off, and coil L6 de-energized. When any of the diodes connected to the base of Q1706 go positive, Q1706 turns off, Q1707 and Q1708 turn on and the coil L6 becomes energized.

(b) When the ready-busy register goes busy, a positive level from the collector of Q1102 activates the ribbon lift circuit ((a) above). If the code group being received is for a printable character, print detector #1 is set (par. 4B-5c(2)(a)), thus the positive level from the collector of Q1512 takes over and holds the ribbon lift circuit energized until the printing operation has been completed.

(c) When the ready-busy register goes busy for printing on hammer #2, the ready-busy register remains busy and thereby holds the ribbon lift circuit energized until printing on hammer #2 has been completed (fig. 4B-14).

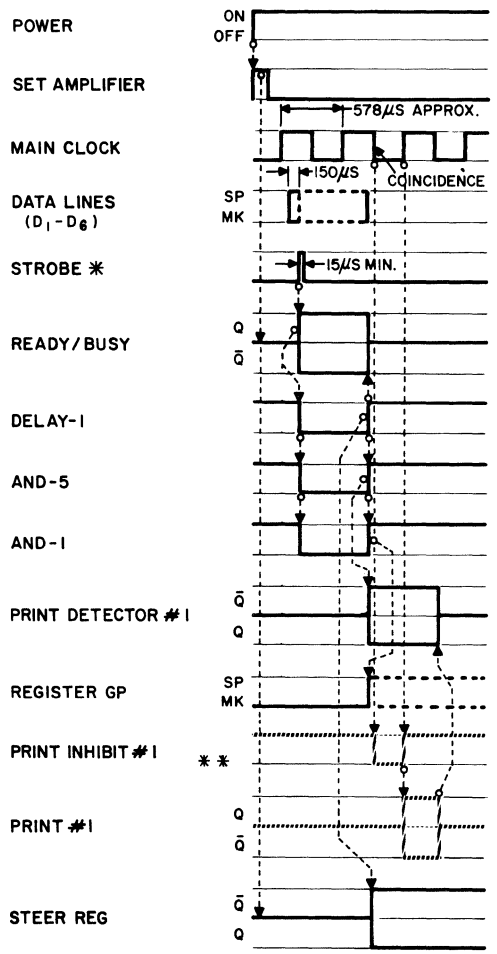
(d) On 311s which are designed for serial signaling the ribbon lift mechanism is activated by the control register on receipt of the start pulse.

On 311s designed for parallel signaling the ribbon lift mechanism may be held in a permanently energized state either locally or by the transmitting source.

(e) When the ribbon lift circuit is actuated, high frequency variations in the voltage applied to L6 are filtered out by L1703, C1705, R7, and C6 (see fig. 4G-1). Back emf generated by L6 is bypassed via CR10 and CR1737.

c. Printing on Hammer Number 1 (figs. 4B-7 and 4B-8). Assume that the information code group described below is the first character of the message, and it is a printable character, i.e., not a function.

(1) The negative level of the delay pulse turns



* WHETHER STROBE IS A POSITIVE OR NEGATIVE PULSE, POSITIVE TRANSITION IS USED BY PRINTER. STROBE PULSE IS SUSTAINED BY TRANSMITTER UNTIL READY/BUSY LINE GOES BUSY. STROBE PULSE SHOULD NOT BE SUSTAINED FOR MORE THAN 100 MICROSECONDS AFTER THE READY/BUSY LINE GOES BUSY.

** SHADED AREA IS MODIFIED AS SHOWN IN FIGURE 4B-10 WHEN PHASE COMPENSATORS ARE INSTALLED (SEE FIGURE 4G-1).

Figure 4B-8. Printing on hammer-1, timing diagram.

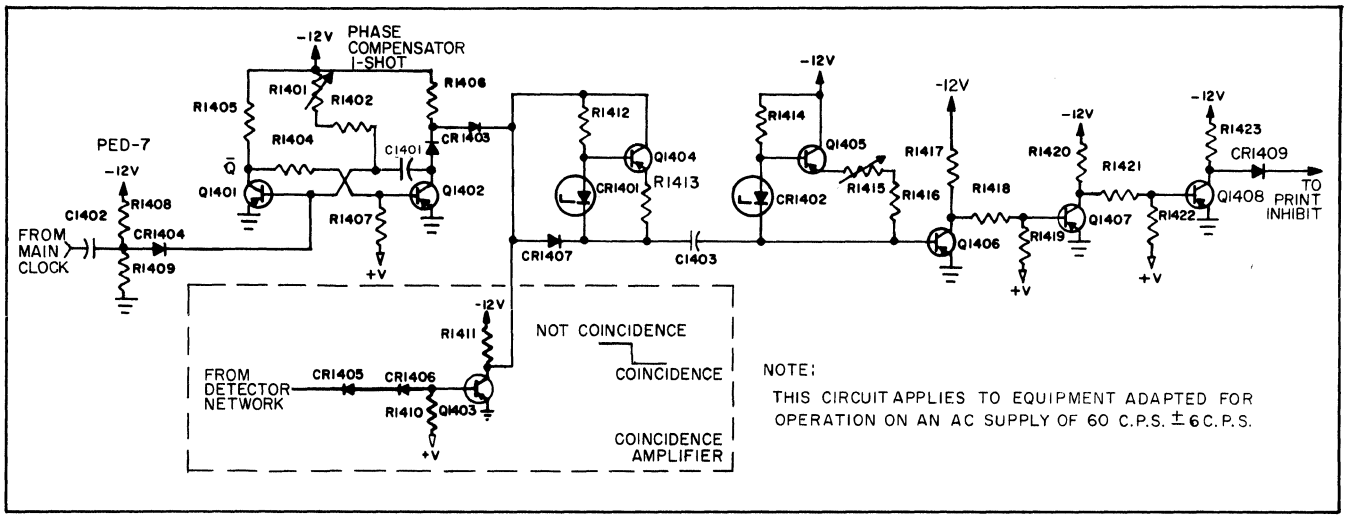


Figure 4B-9. Phase compensator network.

off CR1137, thereby completing an AND condition (all inputs negative) at AND-5. The negative output of AND-5 (actually from minus 12V via R1152, see schematic, figure 4G-1) completes an AND condition at AND-1 (the "$\bar{Q}$" side of the steer register is negative in the steering-1 (RESET) condition), and charges the capacitors of pedestal gates PED-1 and PED-2. When AND-1 is completed a negative voltage (from minus 12V via R1150) charges pedestal capacitor C1119 via the reset (OR) gate, charges pedestal capacitor C1113 via OR-2, and charges the pedestal capacitors of hammer-1 register group that have a logic "0" (that is, zero volts) supplied by the data amplifiers (see a(3) above).

(2) The back edge (positive transition) of the delay pulse triggers capacitors C1119 (via CR1116) and C1113 (via CR1134), and closes gate AND-5.

(a) The positive-going output of AND-5 closes AND-1, and triggers PED-1* to set print detector #1. The positive-going output of AND-1 triggers the charged pedestal capacitors ((1) above) of hammer-1 register group thereby setting the registers in accordance with the information code group on the data lines.

*Note: PED-2 is not triggered at this juncture, because the other input (from "$\bar{Q}$" side of steer register) is still negative.

(b) The positive output transition of capacitor C1119 resets the ready-busy register to "ready." The positive output transition of capacitor C1113 sets the steer register, thereby preparing PED-2 for the second character (sub-par. d below).

(3) To summarize the foregoing briefly:

(a) Power turned on, ready-busy and steer registers reset by output of set amplifier, counter group reset by first index pulse.

(b) Character code group and strobe pulse received.

(c) Ready-busy line marked "busy" and delay pulse generated.

(d) Character sensed, AND-5 and AND-1 opened.

(e) Delay-1 pulse terminated, AND-5 and AND-1 closed, PED-1 triggered, print detector #1 set. First character code group read into hammer-1 register group. Ready-busy register reset. Steer register set, thus PED-2 is prepared for the second printable character.

Finally, if the steer register is in steering-1 (i.e., transistor Q1106 conducting), when the code group is first detected as a printable character, then that character will be printed by hammer-1.

(4) The negative level from the "Q" side of print detector #1 prepares print inhibit #1 via CR1409 (CR1414 if phase compensators are used, see fig. 4G-1).

Note: Paragraphs (5) and (6) are applicable to 311s which are not equipped with phase compensators (see fig. 4G-1). Paragraphs (5.1) and (6.1) are applicable when phase compensators are included.

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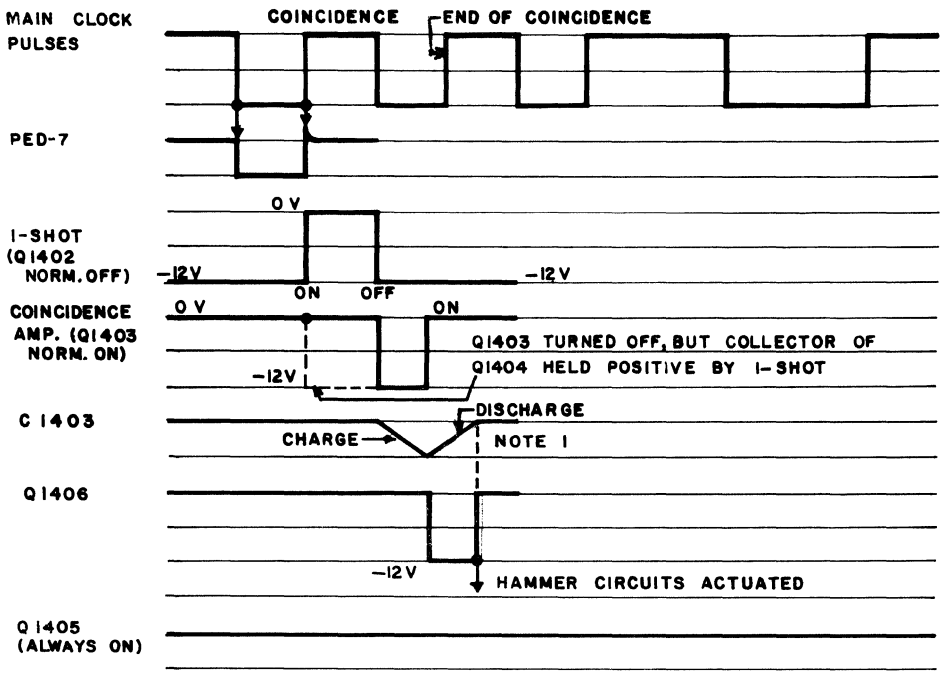

Figure 4B-10. Phase compensator timing diagram.

(5) At coincidence, the output of hammer-1 detector network switches off coincidence amplifier #1, thus completing the logic AND condition (all negative) of print inhibit #1.

(6) Print inhibit #1 is triggered on the positive transition (back edge) of the main-clock pulse (pulse that takes counter group out of coincidence).

(5.1) At coincidence, the output of hammer-1 detector network switches off coincidence amplifier #1, thereby charging capacitor C1403 via the collector/emitter circuit of Q1404 (when the compensator 1-shot returns to its stable state).

(6.1) The purpose of the phase compensator (fig. 4B-9) is to ensure that characters are printed on a horizontal line, irrespective of variations in print drum speed - resulting from variations in ac frequency supplied to the motor. To compensate for drum speed variations, the time between successive main clock pulses is used to control the charge time of capacitor C1403. After an equivalent discharge time the hammer circuit is actuated. The phase compensator 1-shot is triggered by every main pulse (via C1402), thereby turning on Q1404. When a coincidence amplifier is turned off (subpar. (5.1) above), the negative output from Q1403 cannot act on capacitor C1403, until after the compensator 1-shot is reset.

As shown in figure 4B-10, the back edge (positive transition) of the main pulse which caused coincidence (subpar. b(4)) triggers pedestal capacitor PED-7, thereby activating the phase compensator 1-shot (output of Q1402 ground). When the 1-shot is reset the output of Q1402 goes negative, capacitor C1403 begins to charge from ground via emitter-base circuit of Q1406. When the charge on C1403 is sufficient, Q1406 turns off. When the charge on C1403 has leaked away (via emitter/collector circuit of Q1405), Q1406 turns on, Q1407 turns off, Q1408 turns on, and the print inhibit gate goes positive.

(7) The positive transition from print inhibit #1 (fig. 4B-8) triggers print #1 1-shot to energize print hammer coil L10 (par. 4A-4b).

(8) When print #1 1-shot returns to normal, the positive transition from its "Q" side triggers PED-3 to reset print detector #1.

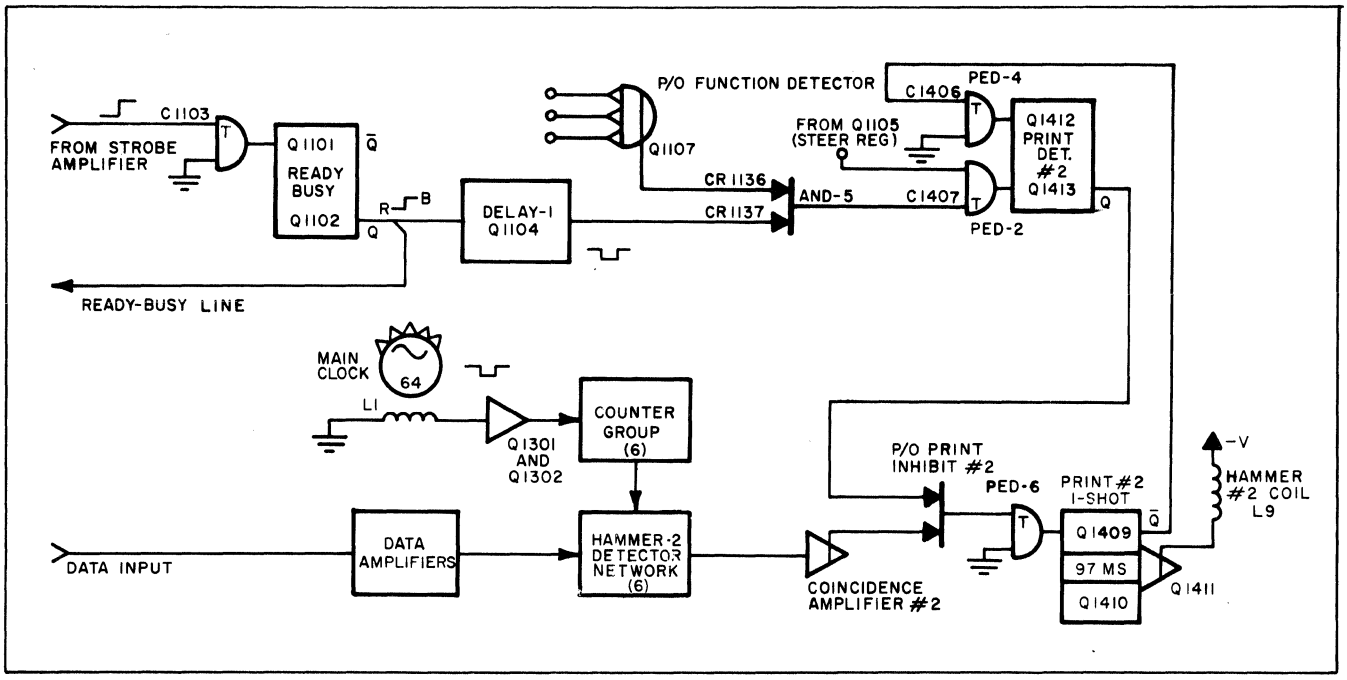

Figure 4B-11. Printing on hammer #2, block diagram.

d. Second Character (figs. 4B-11, 4B-12, and 4G-1). While the first character is being processed as described above, the second character can be received, processed and printed. It is possible that the second character will be printed before the first character - their positions on the drum determine this. Basically, the operation of the circuit for the second character is similar to the operation for the first character with the following exceptions:

(1) The output of the data amplifiers is applied to the right-hand side of hammer-2 detector network.

(2) The positive transition from AND-5 this time sets print detector #2 (via PED-2).

(3) The negative level from the "Q" side of print detector #2 prepares print inhibit #2.

(4) The ready-busy register is not reset immediately; both characters must be printed before another character can be received.

(5) When coincidence is detected (between data lines and counter group), coincidence amplifier #2 is turned off, thereby completing the AND condition of print inhibit #2 (via phase compensator #2 if applicable, see fig. 4B-7).

(6) When the counter comes out of coincidence the positive transition from print inhibit #2 triggers print #2 1-shot.

(7) When print #2 1-shot returns to normal, a positive transition from its "$\overline{Q}$" side resets print detector #2.

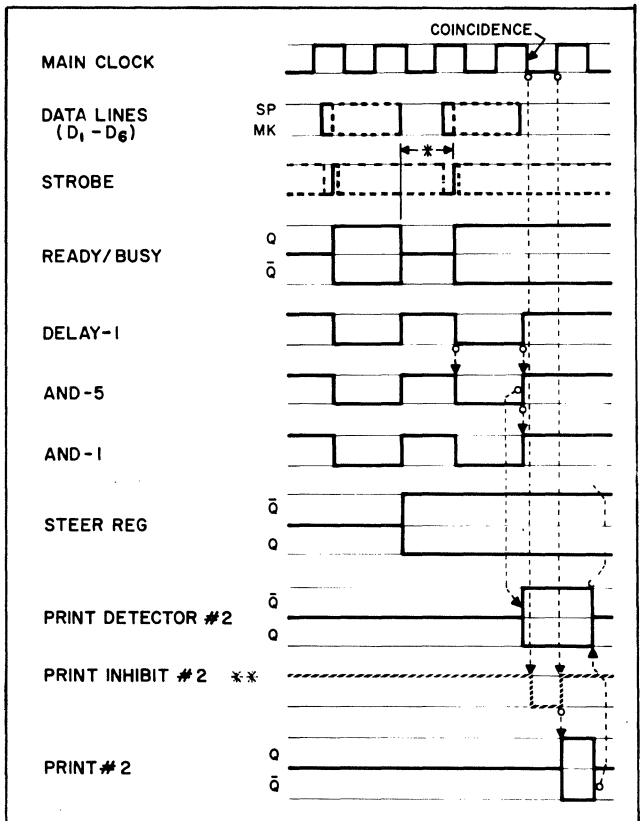

Figure 4B-12. Printing on hammer-2, timing diagram.

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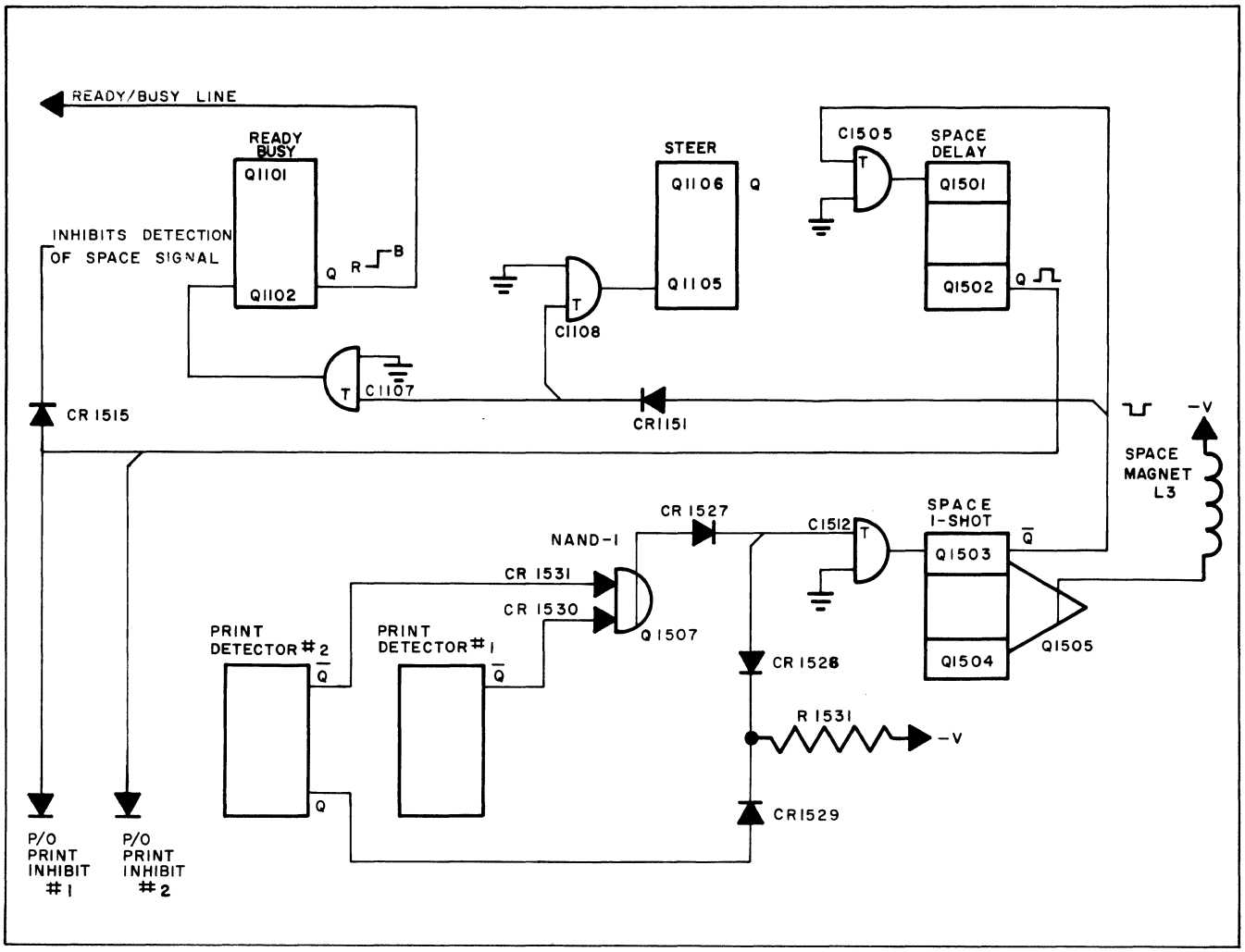

Figure 4B-13. Spacing of carriage after both hammers have printed, block diagram.

e. Spacing of Carriage After Both Hammers Have Printed (figs. 4B-13 and 4B-14). When both hammers have printed, the carriage is spaced to the right. To permit the three alternatives (printing by hammer-1 before hammer-2, both hammers simultaneously, and hammer-2 before hammer-1) NAND-1, pedestal capacitor C1512, diodes CR1529 and CR1528, and resistor R1531 (see figs. 4B-15 and 4B-16 and schematic, fig. 4G-1) operate as described below:

(1) When print detector #2 is set, as the second character is being processed (see par. d(2) above) a negative level from Q1413 turns off diode CR1529, thereby permitting the negative battery via R1531 to charge capacitor C1512.

When both print detectors have been reset, both inputs to NAND-1 will be negative (NAND-1 comprises CR1530, CR1531, and Q1507). The resultant positive output from NAND-1 re-references capacitor C1512 causing a positive transition that triggers the space 1-shot.

The output of the "Q" side of the space 1-shot energizes the space magnet L3 (par. 4A-4c).

(2) The back edge of the negative pulse from the Q1503 side of the space 1-shot triggers the space delay 1-shot via pedestal capacitor C1505, resets the steer register via pedestal capacitor C1108, and resets the ready-busy register via pedestal capacitor C1107.

(3) The purpose of the space delay is to inhibit printing while the carriage is in motion. The positive level from the "Q" side of the space delay (fig. 4B-13) clamps the space detector, print inhibit #1 and print inhibit #2. The clamp on print inhibit #1 and #2 prevents the triggering of the print hammer circuits (pars. c and d above). The clamp on the space detector prevents the triggering of the space 1-shot by a spacing code group (par. f below) while the carriage is being spaced.

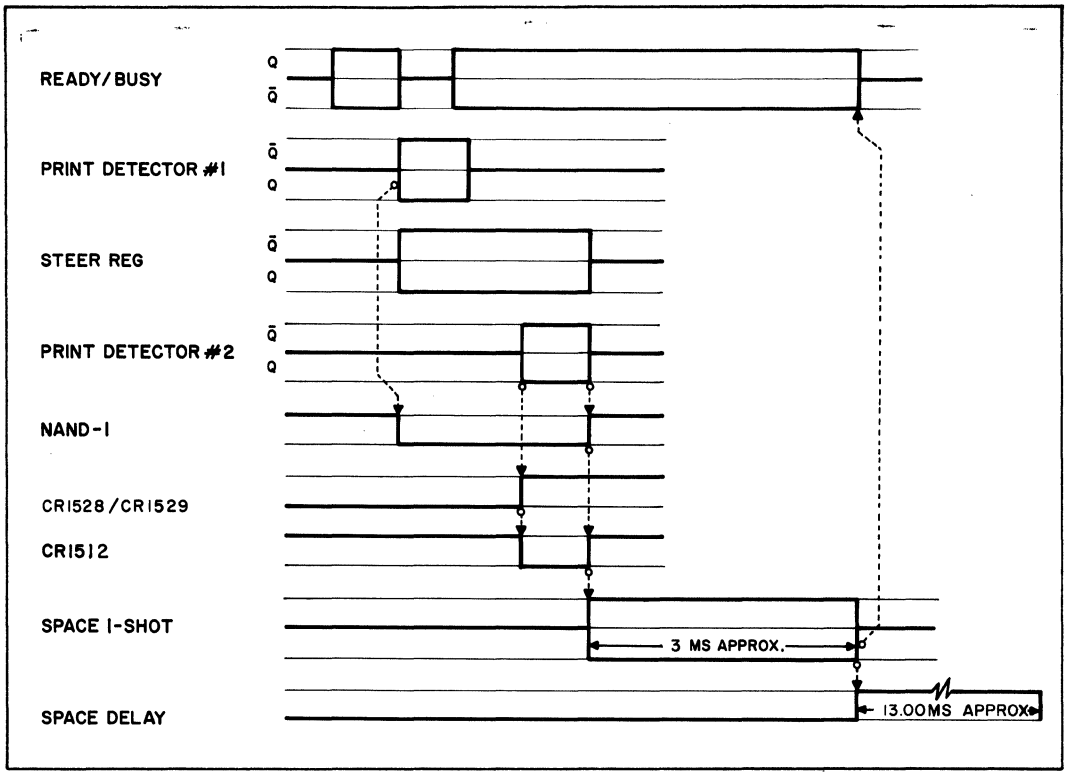

Figure 4B-14. Spacing after both hammers have printed, timing diagram.

f. Spacing on Receipt of Space Signal (fig. 4B-15). When a space code appears on the outputs of the data amplifiers, the space function gate opens (all inputs negative) and the ready-busy register goes busy (a above), the "$\overline{Q}$" side of the ready-busy register provides a negative input to all function gates when set by an incoming strobe pulse. The negative output of the space function gate turns on the function detector (Q1107) via CR1501, thereby inhibiting the printing control operations described in subparagraphs c and d above. At the same time, the negative output of the space function gate prepares gate AND-2 (via CR1132) and the space detector (Q1506) via CR1511.

(1) When the steer register is in steering-1 (reset condition) and a space code is received, the negative level of the delay pulse opens AND-2 (via CR1130). The output of AND-2 charges pedestal capacitors C1113 (via CR1133) and C1119 (via CR1121 of the reset gate). The back edge of the delay pulse (positive transition) triggers capacitor C1113 (via CR1134) to set the steer register, and thereby permits the next character to be printed by hammer-2. Capacitor C1119 is also triggered, resetting the ready-busy register to indicate a "ready" condition.

Note: Because of dual hammers, spacing of the carriage is not required at this juncture.

(2) When the steer register is in steering-2 (set condition) and print detector #1 has been reset (subpar. c above), the positive transition from the space detector triggers the space 1-shot (via pedestal capacitor C1508). The remainder of the spacing function is as described in subparagraphs e(2) and (3) above.

g. Carriage Return (figs. 4B-16 and 4B-17). When a carriage return code is received, and the ready-busy register goes "busy" (a above) the CR function gate opens (all inputs negative). The resultant negative output turns on the function detector (via CR1608), thereby inhibiting the printing control operations via gate AND-5 as described in subparagraphs c and d above. At the same time, the output of the carriage return function gate prepares AND-3 via CR1125, AND-4 via CR1128, carriage return detector (Q1604) via CR1610, and AND-6 via CR1612. The negative output of AND-6 charges pedestal capacitor C1601.

(1) When the steer register is in steering-1 (that is, the preceding character was printed by hammer-2), the negative level of the delay pulse (subpar. b(2)) opens AND-3 and thereby allows storage capacitor C1119 to charge (via CR1119 of the reset gate). The positive transition of the delay pulse triggers storage capacitor C1119 (via CR1116) to reset the ready-busy register. In this case it is not necessary for AND-3 to reset the steer register since the space 1-shot

did this before the carriage return was received. When print detector #1 is reset (c above), the carriage return detector (NAND gate, consisting of Q1604, CR1610, and CR1611) is completed. The positive transition from the collector of Q1604 re-references pedestal capacitor C1605 thereby activating the carriage return 1-shot and carriage return magnet L11 (see par. 4A-5). Whenever the carriage return magnet is actuated, the space magnet is also actuated (from the collector of Q1603 via capacitor C1609 and diode CR1621, see figure 4G-1) to prevent the space pawl from trailing over the space rack teeth. The positive level from the "Q" collector (Q1602) of the carriage return 1-shot clamps the space detector (via CR1630 and CR1514), and print inhibits #1 and #2. The print inhibits prevent detection of space or printable characters while the carriage is moving. When the carriage reaches the left-hand margin, it closes the left-hand margin switch (S21), thereby turning the left-hand margin switch inverter (Q1605) on. The positive output from the collector of Q1605 resets the carriage return 1-shot (via collector of Q1601) and triggers the carriage return delay via pedestal capacitor C1613. The "Q" output of the carriage return delay clamps print inhibits #1 and #2 and the space detector at ground to prevent printing or spacing while the carriage is vibrating after being stopped suddenly.

(2) When the carriage return code is detected, and the steer register is in steering-2, and print detector #1 has not yet been reset, all inputs to AND-4 are negative. The negative output of AND-4 charges pedestal capacitors C1104, C1105, and C1607. The positive transition from AND-4 (resulting from print detector #1 being reset) resets the ready-busy register (via C1104), steer register (via C1105), and triggers the carriage return 1-shot (via C1607). The remainder of the carriage return function is as described in (1) above.

(3) When the carriage return code is detected, and the steer register is in steering-2, and print detector #1 has already been reset, AND-6 is completed. When the space delay is triggered (during spacing after printing of the first two characters), a negative level from the "$\overline{Q}$" side of the space delay is applied to CR1615, if at this time the carriage return function gate is detecting

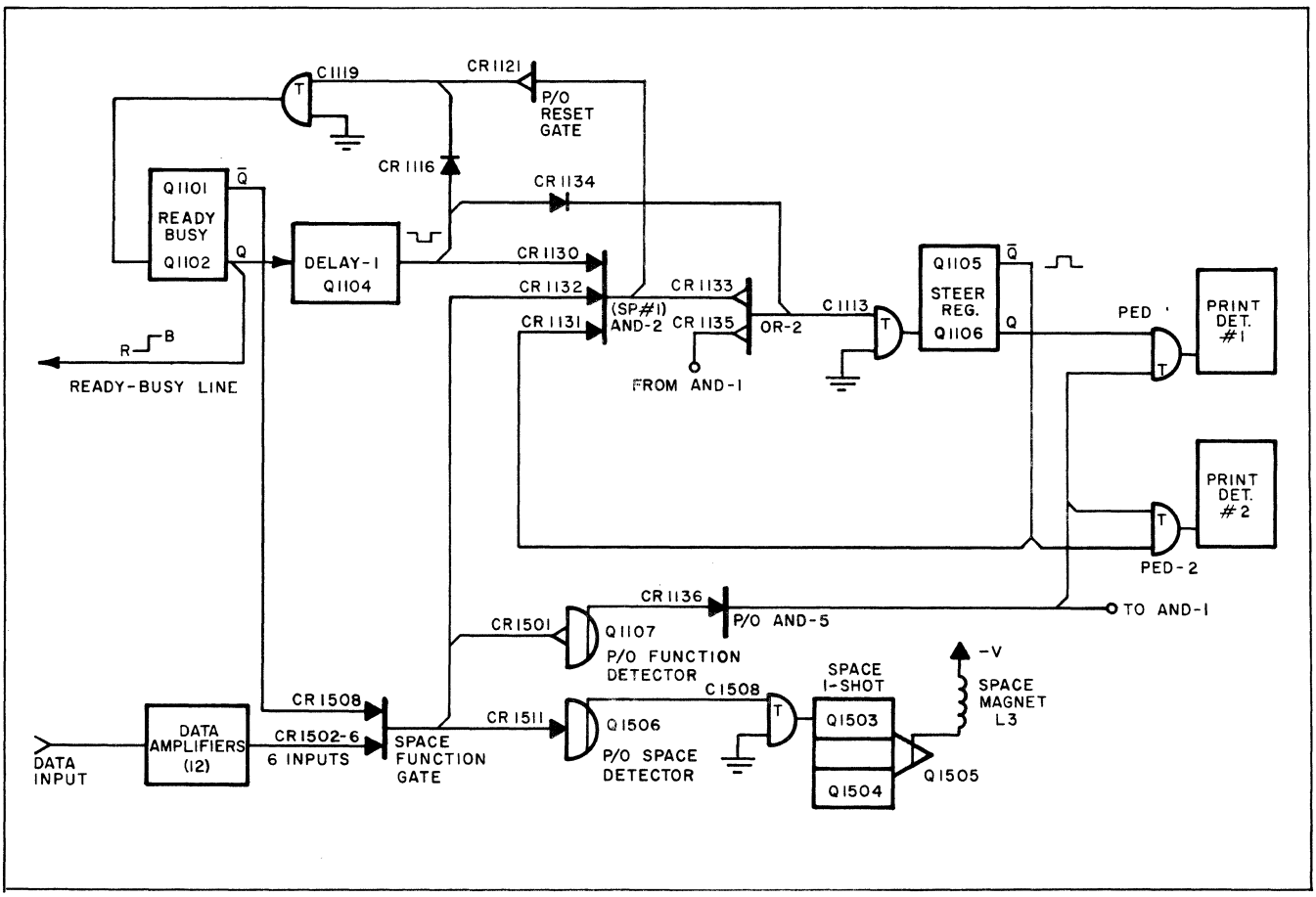

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Figure 4B-15. Spacing on receipt of space function code.

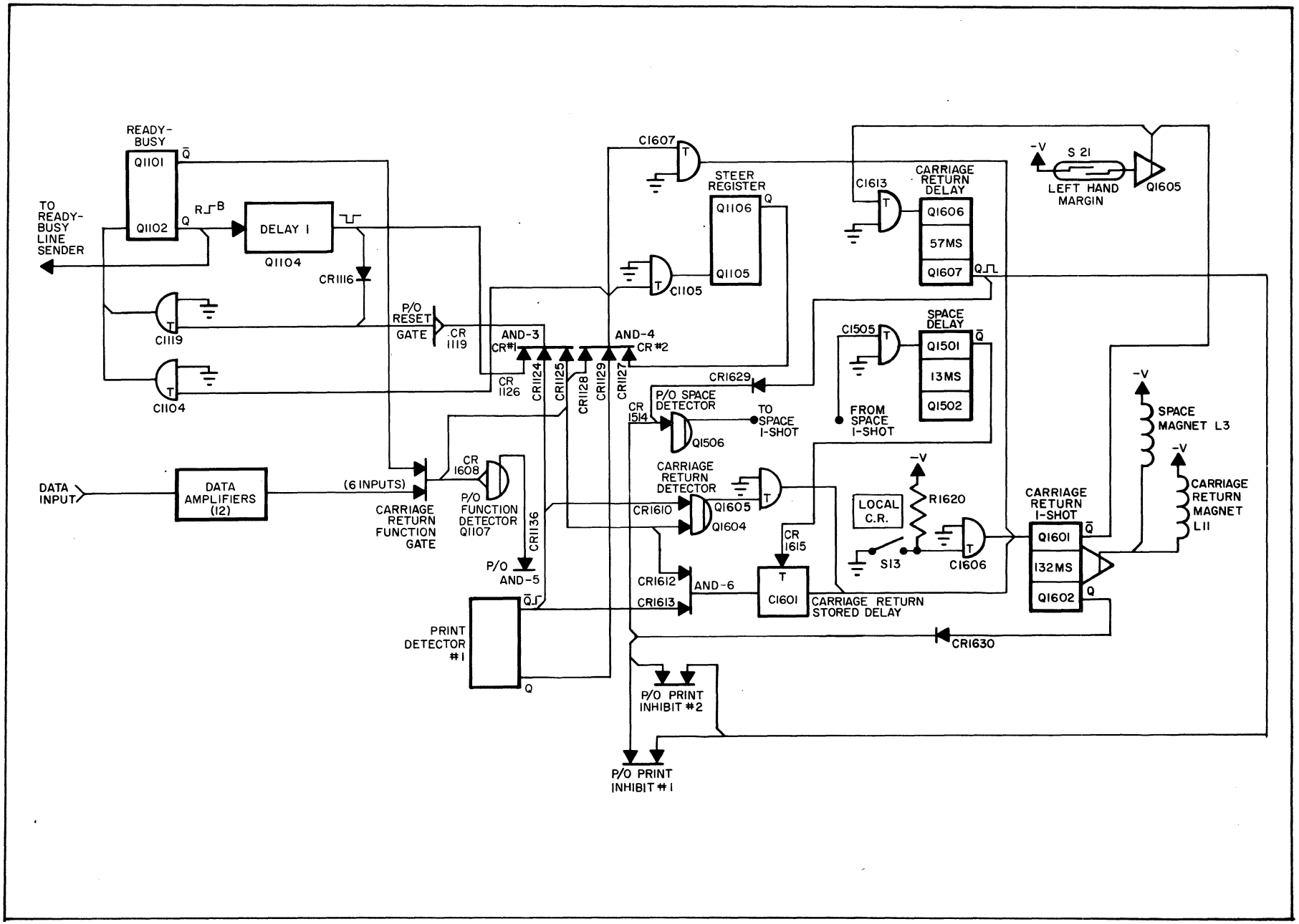


Figure 4B-16. Carriage return function, block diagram.

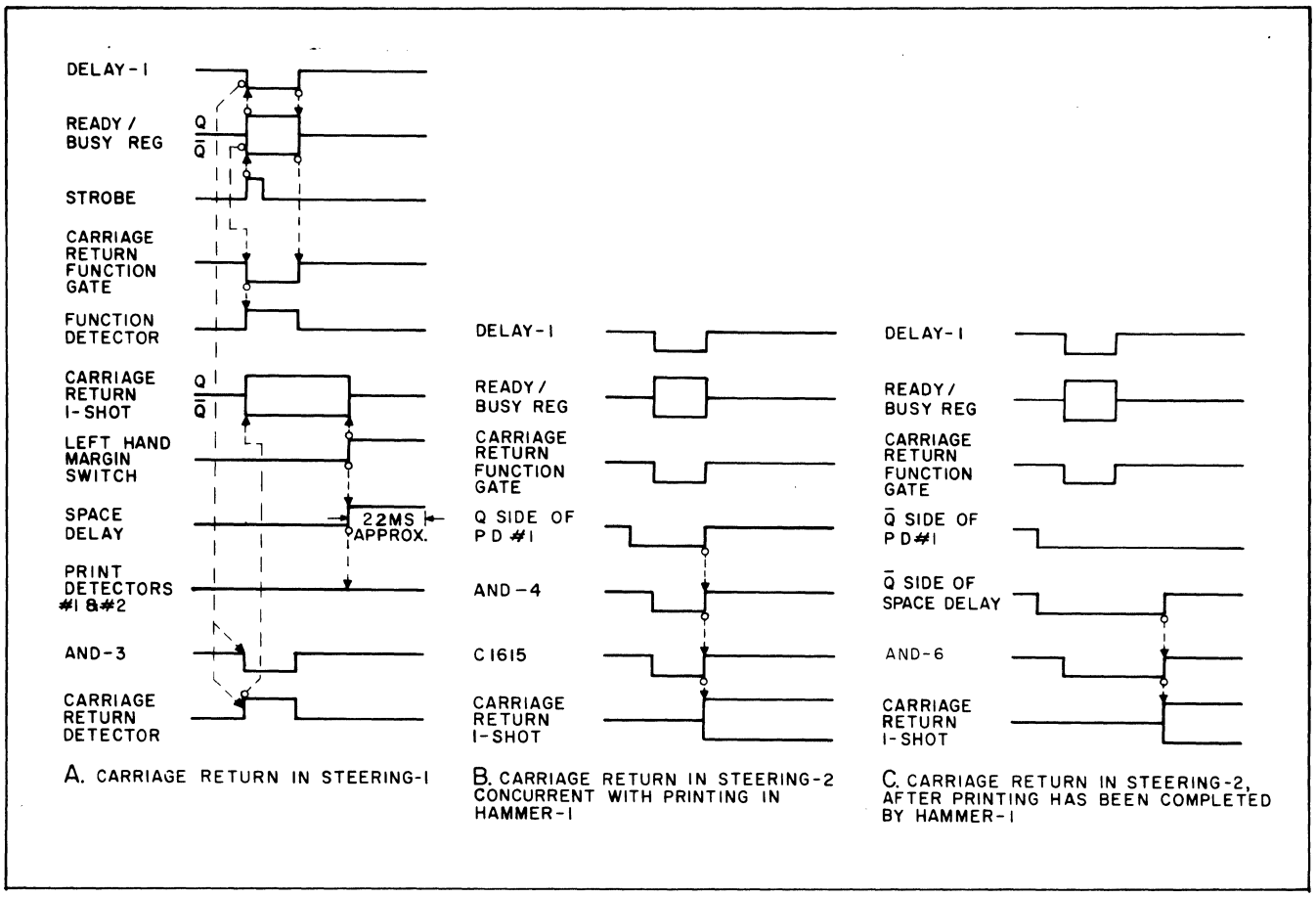


Figure 4B-17. Carriage return, block diagram.

a carriage return code, the voltage applied to CR1612 (of AND-6) will be negative; in these circumstances capacitor C1601 charges (via R1602, figure 4G-1). The back edge of the space delay pulse re-references capacitor C1601 (by turning on CR1615), which triggers the carriage return 1-shot as described in (1) above.

(4) When the LOCAL C.R. switch (on mode panel) is depressed, the leading edge of the ground pulse (from S13) triggers the carriage return 1-shot via pedestal capacitor C1606. The carriage return function then continues as described in (1) above.

h. Line Feed (fig. 4B-18).

(1) When a line-feed code appears on the outputs of the data amplifiers, and the ready-busy register goes "busy" (a above), the line feed function gate opens. The negative output of the line feed function gate turns on the function detector (via CR2409) to inhibit the printing control operations described in subparagraphs c and d. The negative output of the line feed function gate completes the line feed detector. The resultant positive transition from the line feed detector (NAND gate) triggers the line feed 1-shot (via pedestal capacitor C2406) to energize the line feed magnet (par. 4A-3). The positive level from the line feed detector passes via R1128 to charge pedestal capacitor C1106. The back edge of the pulse from the "$\overline{Q}$" side of the line feed 1-shot triggers the line feed delay (via pedestal capacitor C2404). The positive transition from the "Q" side of the line feed delay triggers pedestal capacitor C1106 to reset the ready-busy register. The positive level of the same pulse clamps the LF detector (via CR2412), print inhibit #1 and print inhibit #2 to inhibit the processing of additional line feed codes or printable character codes until the paper stops moving.

(2) When the LOCAL LINE FEED switch (on the mode panel) is partially depressed, one float of multiple switch S12 is actuated to apply ground to pedestal capacitor C2407 which is normally charged via R2424. The positive output of pedestal capacitor C2407 triggers the line feed 1-shot. The line feed function then continues as described in (1) above.

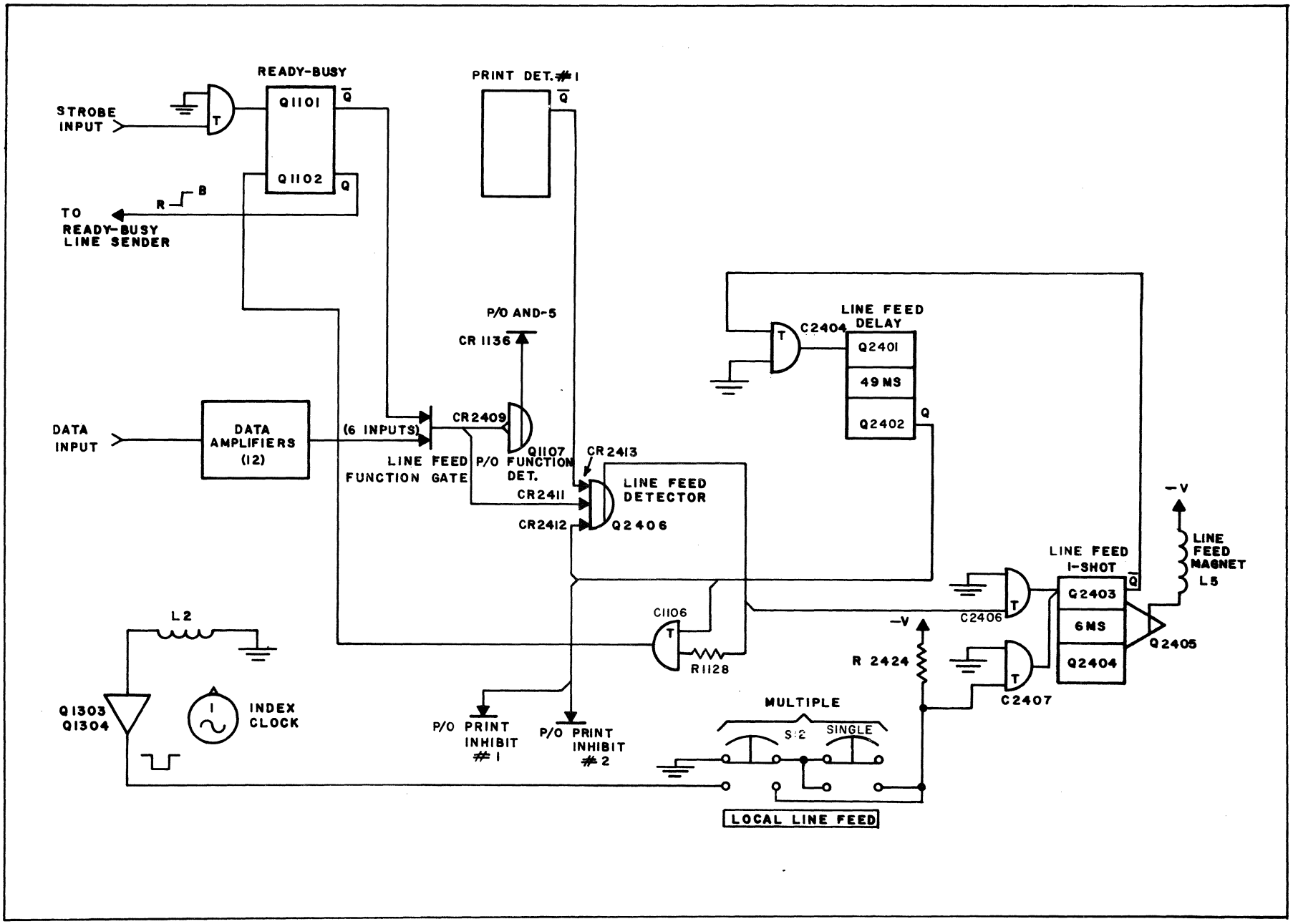


Figure 4B-18. Line feed function, block diagram.

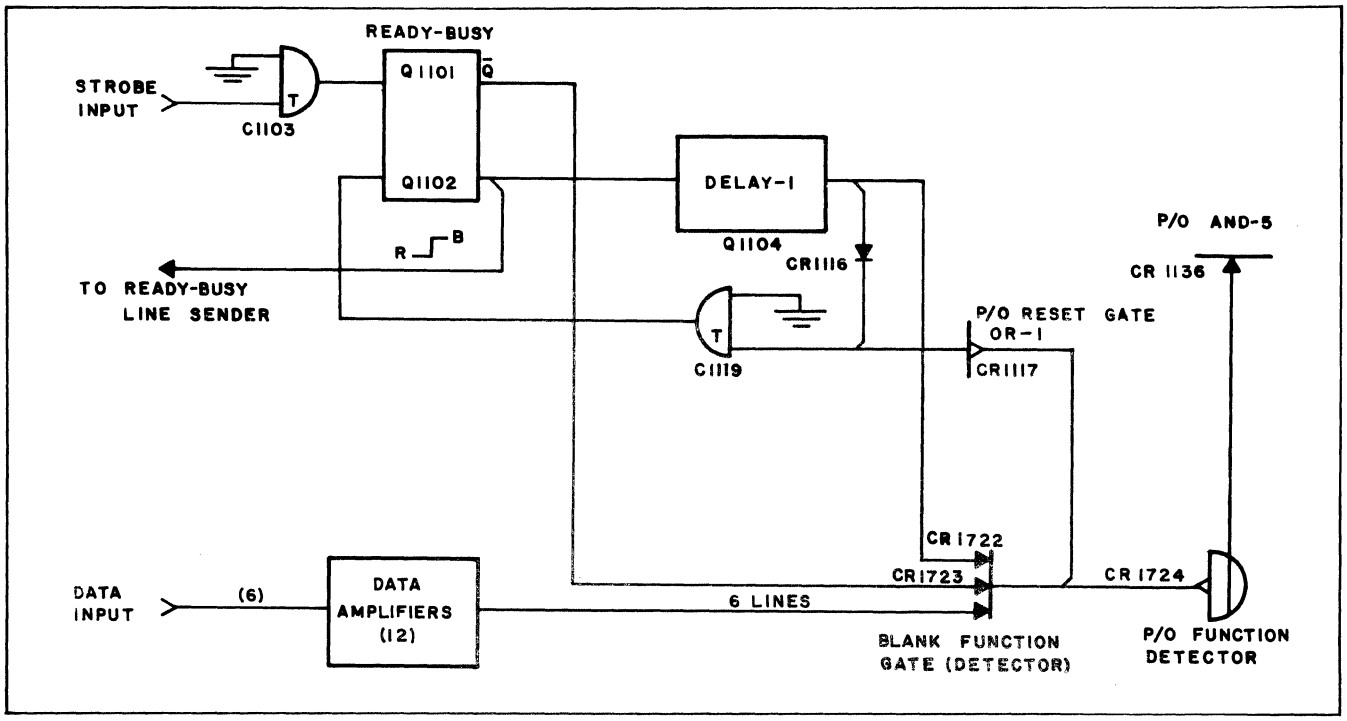


Figure 4B-19. Blank function, block diagram.

(3) When the LOCAL LINE FEED switch is fully depressed, both floats of S12 are actuated and index pulses are applied to pedestal capacitor C2407, thereby continuously recycling the line feed 1-shot (per drum revolution) and causing continuous paper feeding while the switch is held down. The negative voltage through R2424 provides a charge path for C2407 after each index pulse triggers C2407.

i. Blank Function (fig. 4B-19).

(1) When a "blank" code is received, all data inputs to the blank function gate go negative. When the ready-busy register goes "busy" and the delay pulse is generated, the blank function gate is completed. The negative output of the blank function gate turns on the function detector via CR1724 (to inhibit the printable character circuits, pars. c, d, and e above), and charges storage capacitor C1119 (via reset gate CR1117).

(2) The back edge of the delay pulse triggers storage capacitor C1119 and resets the ready-busy register to ready for the next incoming character.

4B-6 OPTIONAL FUNCTIONS
(As Applicable, See Figure 4G-1)

a. Margin Bell (Send/Receive Equipment Only). When the carriage begins to move out of the 66th printing position, the margin bell (reed) switch (S20) is closed by the action of a permanent magnet mounted on the underside of the carriage. Ground from the "$\overline{Q}$" side of the carriage return 1-shot passes via S20 and two amplifiers (Q1705 and Q1704) to trigger pedestal capacitor C1704. The positive spike from C1704 triggers the bell 1-shot and activates the bell magnet circuit (par. 2B-2i). To inhibit the S20 from actuating the bell circuit on the return stroke of the carriage (during carriage return) the bell circuit will not function while the carriage return 1-shot is active.

b. Signal Bell. On equipment with signal bell facilities, the following description applies:

(1) When a signal bell code group is received, all data inputs to the bell gate go negative. When the ready-busy register goes busy and the delay pulse is generated, the bell gate is completed. The negative output of the bell gate charges storage capacitors C1119 (via OR-1), and C1703, and turns on the function detector to inhibit the printable character circuits (pars. 4B-5c, d, and e above).

(2) The back edge of the delay pulse triggers storage capacitor C1119 to reset the ready-busy register to ready, and also triggers the bell gate. The positive transition from the bell gate passes via pedestal capacitor C1703 to trigger the bell 1-shot and energize the bell magnet (see par. 2B-2i).

c. Paper-Out Alarm. When paper is installed in the Model 311, the paper-out switch (S25) is opened and the lamp (DS9) goes off. When the paper is depleted, the switch closes and the light goes on. When the light goes on, sufficient paper for about 16 lines of printing remains.

d. Horizontal Tabulation (fig. 4B-20).

On equipment with horizontal tabulation facilities, the following description applies:

Horizontal tabulation (carriage movement of a predetermined number of spaces from left to right) is accomplished by repeatedly reactivating the carriage spacing mechanism described in subparagraph 4B-5e above.

(1) When a horizontal tab code group is received all data inputs (1 through 6) to the horizontal tab function gate go negative. When the ready-busy register goes busy (par. 4B-5a), an AND condition is completed at the horizontal tab function gate.

(2) The negative output of the horizontal tab function gate turns off CR1809 to complete a NAND condition at the horizontal tab detector NAND-2 (Q1801). The negative output of the horizontal tab function gate also turns on CR1808 to activate the function detector Q1107, thereby inhibiting the printing operations described in pars. 4B-5c and d.

(3) The positive output of NAND-2 is applied via R1813 to prepare pedestal capacitor C1802. The positive transition from NAND-2 triggers pedestal capacitors C1810 and C1804 to set the "even" and "odd" position registers.

(4) The next pulse received from the counter group (par. 4B-5b(3)) charges pedestal capacitor C1802. The back edge (positive transition) of the counter pulse sets the horizontal tab register (via C1802).

(5) With the horizontal tab register set, CR1832 (of NAND-3) is turned off. The negative level of the next counter pulse then completes the NAND condition of NAND-3 via CR1831. The resulting positive transition from Q1811 triggers pedestal capacitor C1109 - to set the steer register to steering two, and C1509 to trigger the space-1-shot. The carriage is then spaced as explained in subpar. 4B-5e above.

(6) While the space-1-shot is active, CR1833 is held on thereby inhibiting the action of the counter pulses on NAND-3. When the space-1-shot active period ends, the space-delay inhibits NAND-3 by turning on CR1834. When the space-delay active period ends, NAND-3 will again be completed by the next counter pulse and the entire carriage spacing function will be repeated.

(7) The carriage is thus continually spaced to the right until it contacts a stop tab. When the contact on the carriage engages a stop tab, a circuit is completed from "-PV" to the base of either Q1806 or Q1810, thereby causing the transistor to conduct. If the stop tab is located in an odd numbered position, a positive voltage from the collector of Q1806 triggers pedestal capacitor C1806. The positive transition from C1806 resets the odd position register.

(8) The ground level from the "$\overline{Q}$" side (Q1805) of the odd position register turns on CR1830 thereby inhibiting NAND-3. The ground level from the "$\overline{Q}$" side of the odd position register also triggers pedestal capacitor C1808, thereby turning off Q1807 momentarily. The back edge (positive transition) of the resultant negative pulse from Q1807 triggers pedestal capacitor C1803 and thereby resets the horizontal tab register, and also triggers pedestal capacitor C1121 "to finally set" the steer register.

(9) The ground transition from the "$\overline{Q}$" side of the horizontal tab register,

(a) resets the even position register via C1813, and

(b) resets the ready-busy register via C1120.

(10) The purpose of pedestal capacitor C1809 is to ensure that the even position register is reset immediately in the event of a horizontal tab code being received in steering one when the tab stop is in the next even position. If R1845 is grounded (via Q1810), capacitor C1809 will be triggered when the steer register is going into steering two.

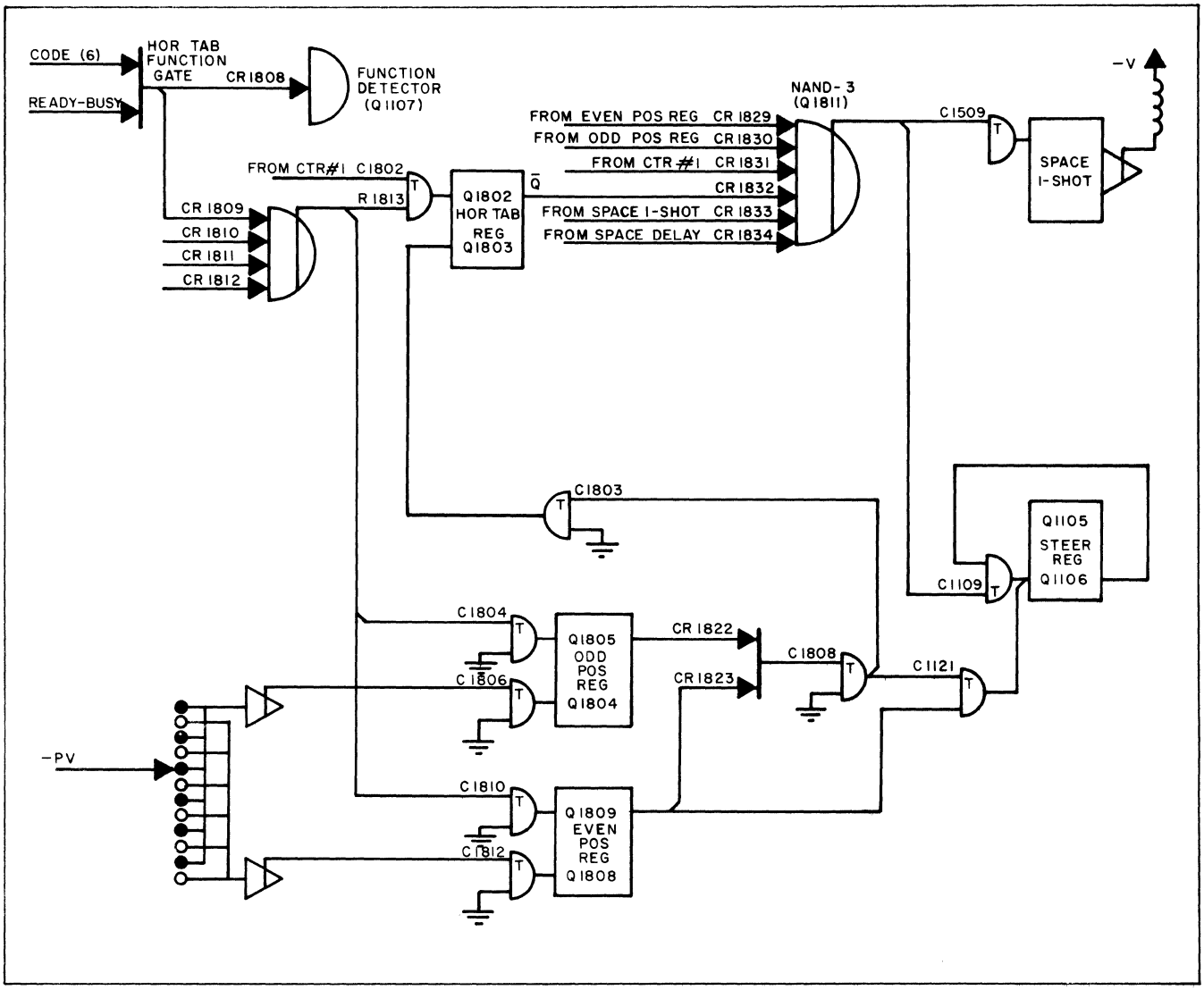


Figure 4B-20. Horizontal tab, block diagram.

Section C Electrical Circuit Descriptions

4C-1 GENERAL

The interconnections between the various electrical components are shown in figure 4G-2. The numbered columns in solid outline represent the printed wiring board sockets; the numbered columns in broken outlines represent plug and jack connectors. The individual printed wiring boards and the components thereon are illustrated in Section 4D.

4C-2 DC POWER SUPPLY (fig. 4C-1)

a. Input Circuit.

(1) Power from an ac source (Chapter 1, par. 1A-2h) is supplied to the Model 311 via plug P1. When the POWER ON/OFF switch (on the mode panel) is depressed, the two switch floats of S10 are moved down and latched, thus connecting ac power to the primary of transformer T1.

(2) Spurious frequencies in the ac supply are blocked by the coils in filter FL1 and grounded via the two capacitors.

(3) The shield of plug P1 is grounded to the 311 chassis via terminal board TB2. The case of filter FL1 is grounded via a mounting screw.

(4) Current for the dc supply and copy lamps is applied to the primary winding of transformer T1. The core of T1 is grounded via a mounting screw.

b. Lamp Circuit.

(1) The lower secondary winding of T1 supplies low voltage AC power (6.3v., r.m.s.) to the COPY LAMP switch and lamps DS1 and DS2.

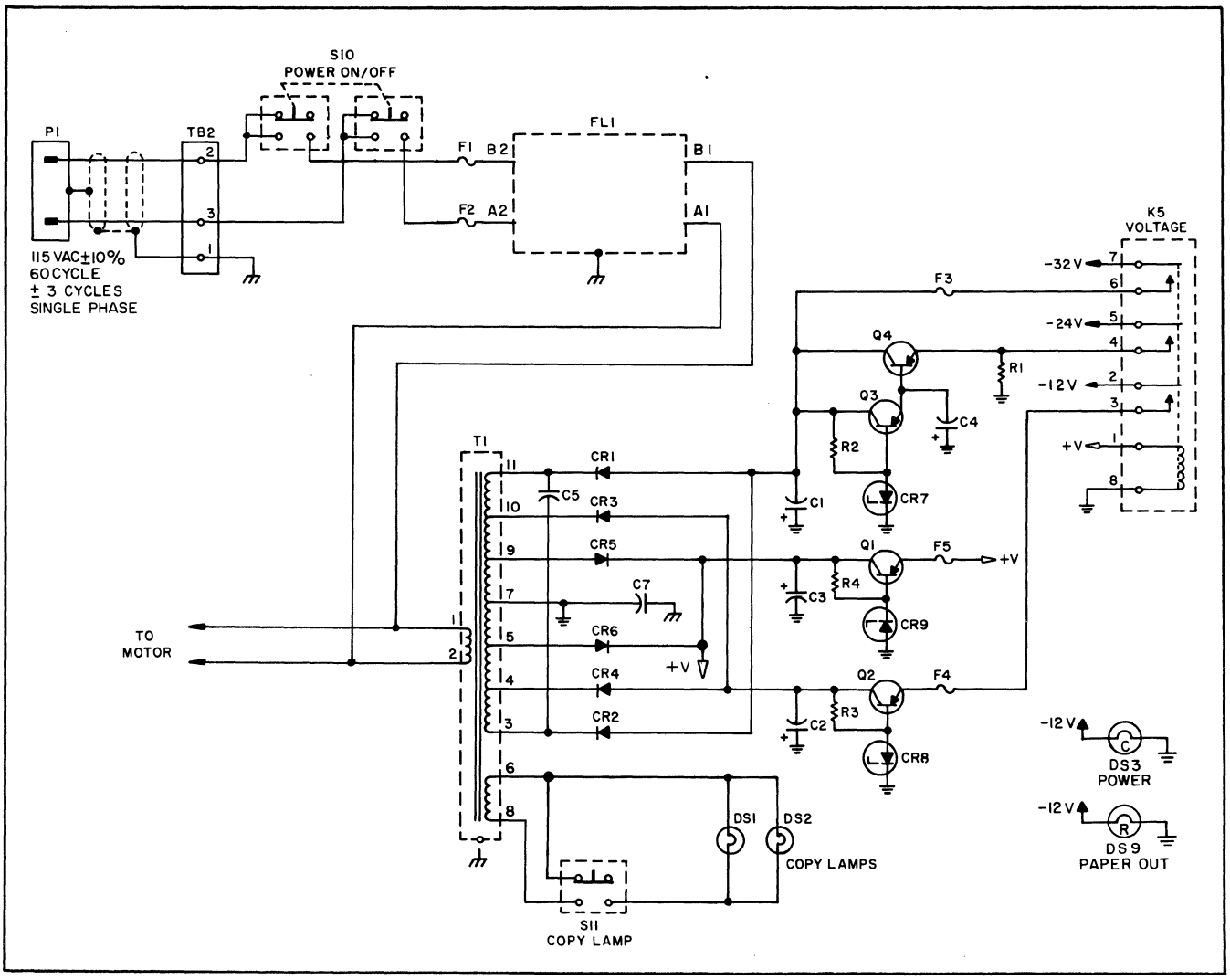


Figure 4C-1. Dc power supply, schematic diagram.

(2) When the POWER ON/OFF switch is depressed the negative 12 vdc will turn on the power lamp DS3.

c. DC Supply Circuits. The upper secondary windings of T1 provide power for the DC supply circuits.

(1) Diodes CR1 and CR2 comprise a full-wave rectifier for the minus 32 volt DC supply. Capacitor C1 holds the applied voltage at a constant potential. The minus 24 volt supply is regulated by cascaded transistors Q3 and Q4. Zener diode CR7 and resistor R2 provide automatic bias for the base of Q3. Voltage peaks exceeding the rated bias are grounded via the zener diode. Capacitor C4 provides a constant voltage for the forward bias on the base of Q4.

(2) Diodes CR3 and CR4 comprise a full-wave rectifier for the minus 12 volt supply. Regulation is provided by series transistor Q2. The forward bias on Q2 is controlled by zener diode CR8 and resistor R3. Capacitor C2 tends to hold the voltage at a constant potential.

(3) Diodes CR5 and CR6 comprise a full-wave rectifier for the plus 7.5 volt supply. Regulation is provided by series transistor Q1. The forward bias on the base of Q1 is controlled by zener diode CR8 and resistor R4. Capacitor C3 tends to hold the applied voltage at a constant potential.

(4) All the negative outputs of the DC supply pass through the contacts of voltage relay K5, and the positive output is supplied to the coil of K5. Positive voltage is used to reverse bias the transistors in the electronic circuit (fig. 4G-1). To protect the transistors in the electronic circuit, in the event of failure of the positive voltage supply, the contacts of relay K5 open and cut off the negative voltages to the electronic circuits.

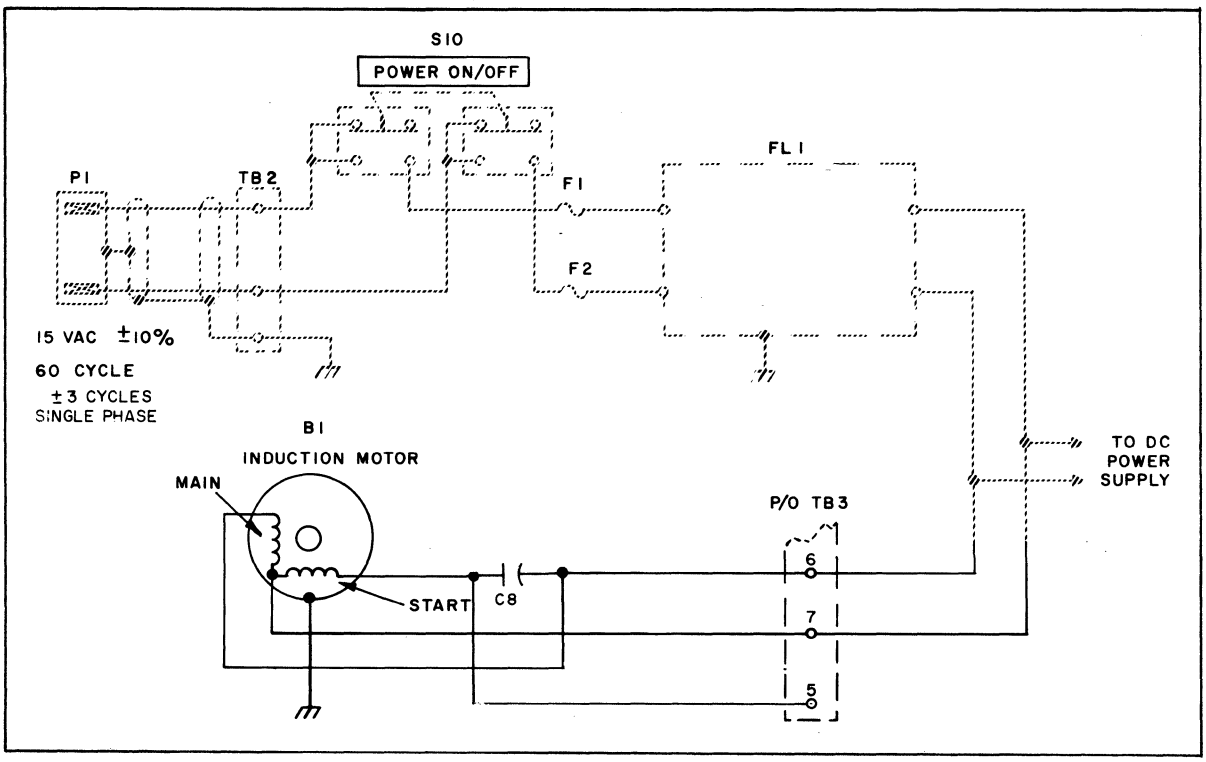
(5) The minus 33, minus 12 and plus 7.5 volt circuits are protected against overload in the electronic circuits by fuses F3, F4, and F5 respectively.

(6) Capacitor C7 between signal ground and chassis ground is provided to hold the two at the same ground level and suppress chassis noise.

4C-3 PRINTER MOTOR CIRCUIT (fig. 4C-2)

a. The AC input circuit described in paragraph 4C-2a(1) through (4) above is connected to terminal board TB3.

b. When the power switch (S10) is depressed, the input voltage applies an instant surge current through capacitor C8 and the motor start winding. This initial surge helps the motor to reach its rated speed. As C8 charges, the current decreases through the start winding. When C8 is fully charged, no current flows through the start winding; the current on the main winding then operates the motor at a constant speed while the printer power is on. After the power switch is turned off, capacitor C8 discharges through both motor windings.



99129A-10

Figure 4C-2. Printer motor circuit, schematic diagram.

Section D Printer Disassembly, Part Numbers and Spring Data

4D-1 GENERAL

For complete disassembly of the printer, remove the components in the numerical sequence shown in the following exploded views. Figures and pages which are not applicable to the particular models of the equipment procured with this manual are not included in this section.

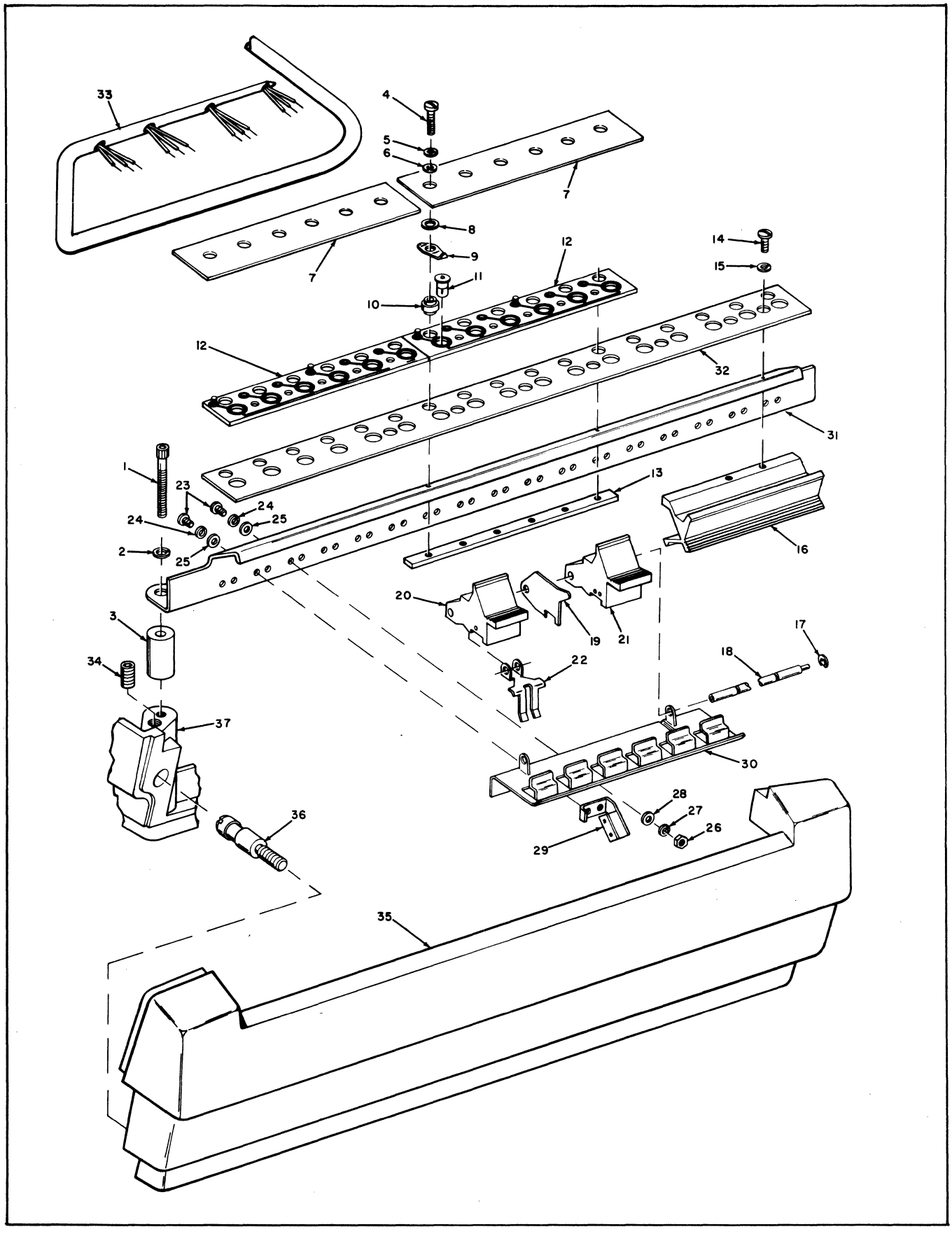


Figure 4D-1. Mode panel assembly, exploded view.

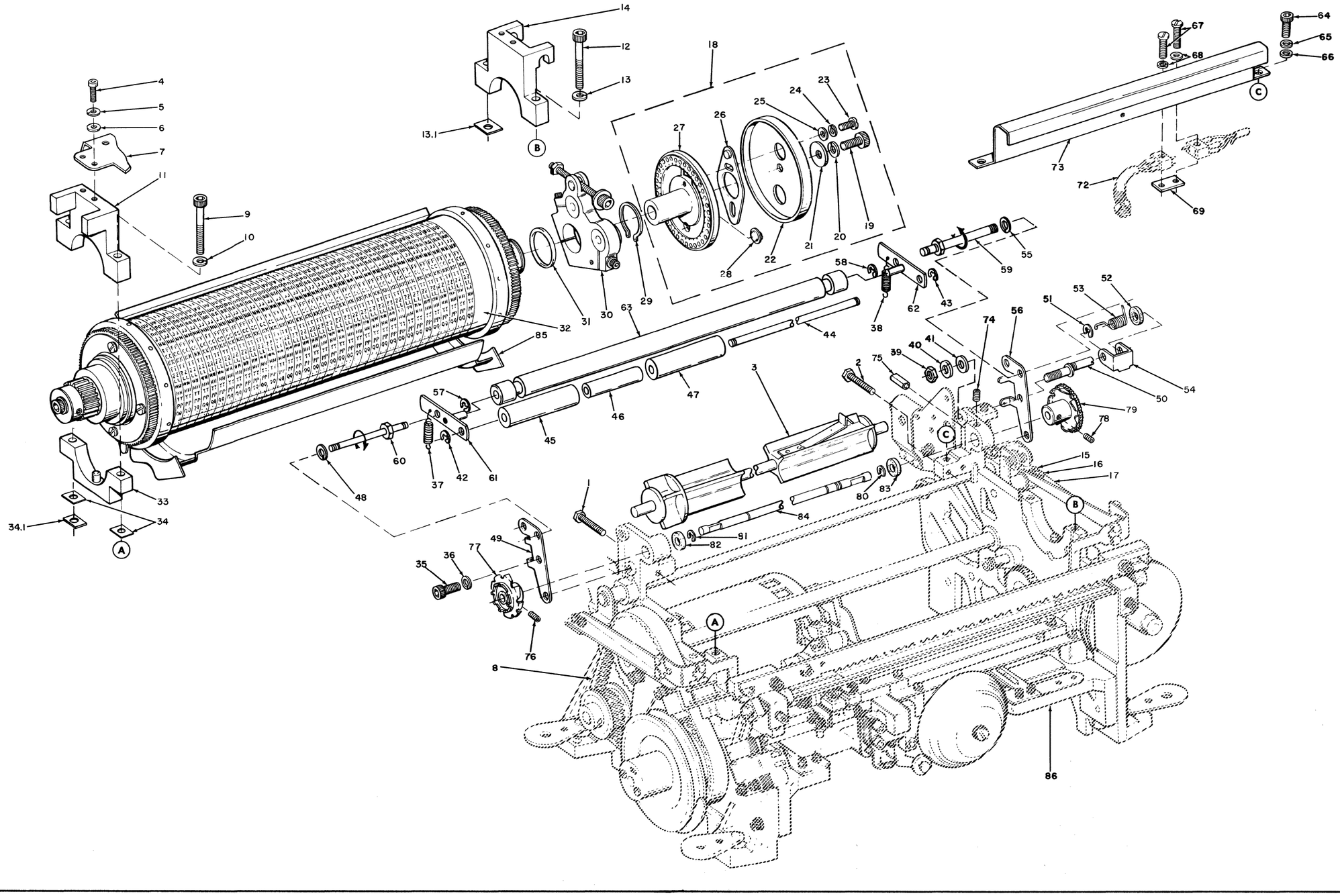
99129A-04

Legend to Figure 4D-1. Mode panel assembly, exploded view.

Item	Quantity	Description	Part No.
1	2	Screw	10029-01
2	2	Lockwasher	10406
3	2	Spacer	66435
4	2	Screw	10382
5	2	Lockwasher	10432
6	2	Flat washer	65669
7	1	Insulator	67756
8	2	Spacer	66205
9	2	Contact	66202
10	2	Spacer	66203
11 *	2	Lamp, clear	24400
12	1	Light mounting board	66972
13	1	Nut plate	66751
14	5	Screw	10335
15	5	Lockwashers	10432
16	1	Filler key	66578
17	2	Retaining ring	12969
18	1	Shaft	66209
19	6	Key separator	66212
20 *	1	Local line feed key	66231A
	1	Local carriage return key	66232A
	1	Local Ltrs key	66233
	1	Copy lamp	66234A
	1	Power key	66235A
21	1	Interlock key	66893
22	5	Switch lever	66356
23	12	Screw	11757
24	12	Lockwasher	10433
25	12	Flat washer	10491
26		Not applicable to this equipment	
27		Not applicable to this equipment	
28		Not applicable to this equipment	
29 *	2	Switch	66221A
	3	Switch	66222A
29.1	1	Board assembly	67757
30	1	Switch bracket	66223A
31	1	Mounting bracket (includes item 32)	66312A
32	1	Insulator (part of item 31)	66220
33	1	Cable assembly	67657
34	2	Setscrew	11160
35	1	Front cover (includes item 36)	66684
36	2	Stud (part of item 35)	65610
37		Printer base (See fig. 4D-41)	

*Note: See wiring diagram 4G-4 for location of switches and lamps.

99129A-13



99129A-10

Figure 4D-3. Mechanical assembly, exploded view.

Legend to Figure 4D-3. Mechanical assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10091
2	1	Machine screw	10091
3	1	Paper shaft	50605
4	4	Machine screw	10003
5	4	Lockwasher	10429
6	4	Plain washer	10459
7	1	Paper guide assembly, 8-1/2-inch paper (or 65971, 9-inch paper)	65972
8	1	Drive belt (See fig. 4D-16)	
9	2	Machine screw	10063
10	2	Lockwasher	10426
11	1	L.H. frame bearing cap (See fig. 4D-31)	
12	2	Machine screw	10037
13	2	Lockwasher	10430
13.1	2	Shim	66228
14	1	R.H. frame bearing cap (See fig. 4D-31)	
15	2	Machine screw (See Note 1)	
16	2	Lockwasher (See Note 1)	
17	1	R.H. ribbon lifter arm (See fig. 4D-9)	
18	1	Timing disk assembly (includes items 19 through 28)	
19	1	Machine screw	10024
20	1	Lockwasher	10431
21	1	Plain washer	58456
22	1	Timing disk cover	66631
23	1	Machine screw	12375
24	1	Lockwasher	10432
25	1	Plain washer	52988
26	1	Adjusting plate	65941
27	1	Timing disk	66240
28	1	Eccentric stud	66352
29	1	Retainer ring	11161
30	1	Timing plate assembly (See fig. 4D-5)	66008
31	1	O ring	65989
32	1	Print drum and feed wheel assembly (See fig. 4D-6)	
33	1	L.H. bearing cap spacer (See fig. 4D-31)	
34	As required	Shim	67587
34.1	As required	Shim	67588
35	1	Machine screw	10008
36	1	Lockwasher	10430
37	1	Spring	66433
38	1	Spring	66433
39	1	Hexagonal nut	10825
40	1	Lockwasher	10431
41	1	Plain washer	10473
42	1	Retainer ring	12960
43	1	Retainer ring	12960
44	1	Paper guide roller shaft	65331
45	1	Paper guide roller	65532
46	2	Paper guide roller spacer	65521
47	2	Paper guide roller	65532
48	1	Lockwasher	10430
49	1	L.H. inner plate	66326
50	1	Eccentric stud	66349
51	1	Retainer ring	10949
52	2	Felt	61474

Legend to Figure 4D-3. Mechanical assembly, exploded view (continued).

Item	Quantity	Description	Part No.
53	1	Spring	66462
54	1	Pawl	66526
55	1	Lockwasher	10430
56	1	R.H. inner plate	66325
57	1	Retainer ring	12949
58	1	Retainer ring	12949
59	1	Pivot stud	66343
60	1	Pivot stud	66343
61	1	Roller arm	67847
62	1	Roller arm	67847
63	1	Paper roller	66084
64	2	Machine screw	10009
65	2	Lockwasher	10430
66	2	Plain washer	10454
67	2	Machine screw	12140
68	2	Lockwasher	10433
69	1	Nut plate	65629
70 *			
71 *			
72	1	Cable assembly (See fig. 4D-12. Do not unsolder leads unless necessary)	
73	1	Cover	65628
74	1	Setscrew	10204
75	1	Plunger assembly	53306
76	2	Setscrew	10203
77	1	L.H. dog assembly	66301
78	2	Setscrew	10203
79	1	R.H. dog assembly	66300
80	1	Retainer ring	12949
81	1	Retainer ring	12949
82	1	Felt	61474
83	1	Felt	61474
84	1	Shaft	66336
85	1	Paper trough, 8-1/2-inch paper (For 9-inch paper use 66018 - See Note 2)	66017
86	1	Chassis assembly (See fig. 4D-10)	

* Not applicable to this equipment

Note 1. Remove machine screw (15) and lockwasher (16). Loosen second machine screw holding R.H. ribbon lift arm (17) and disengage arm from bail assembly, figure 4D-9, item 1. This will facilitate removal of item (18).

Note 2. When reassembling item 85 to the frame refer to paragraph 4F-13

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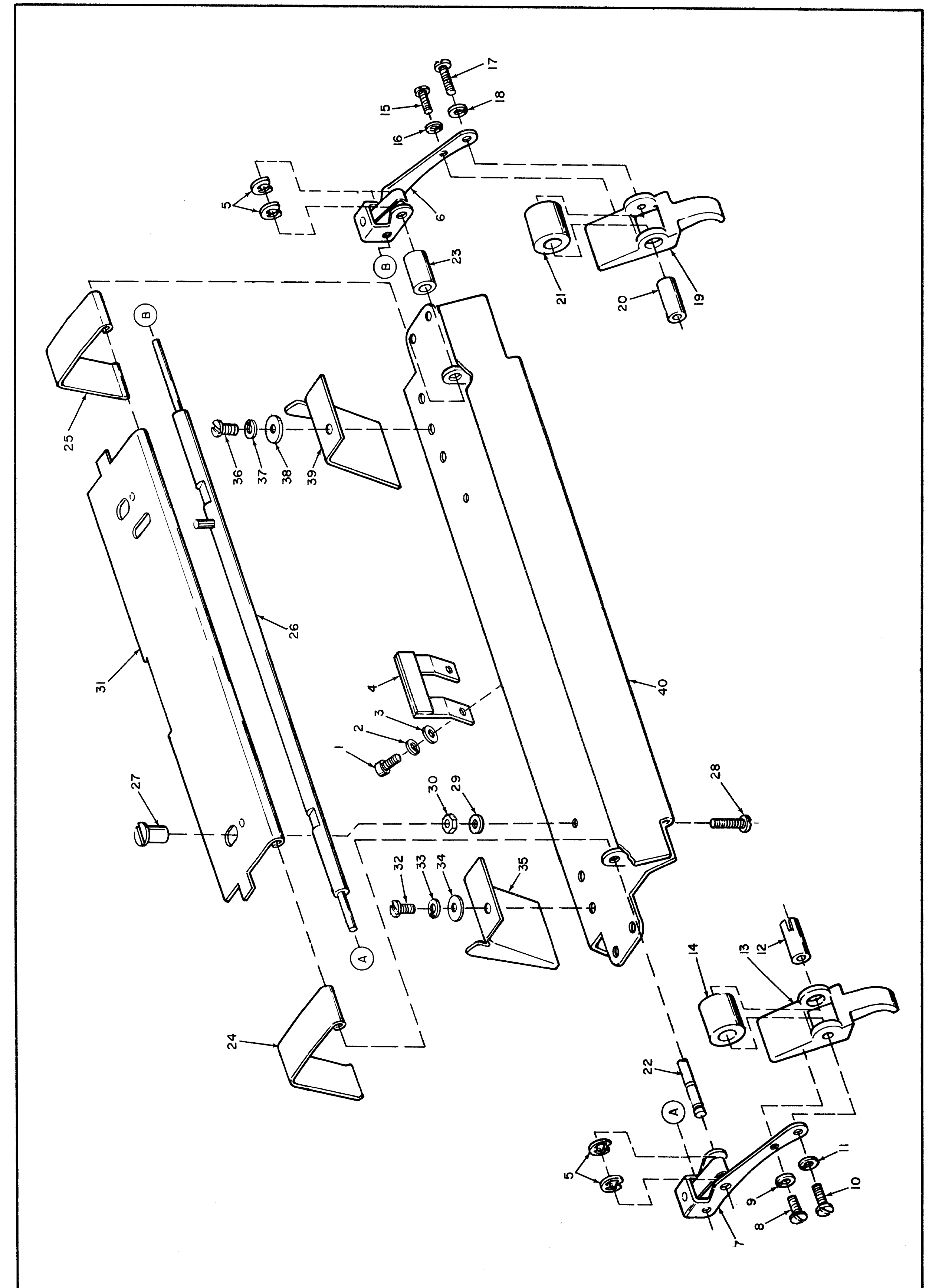

Figure 4D-4. Paper guide assembly, exploded view.

Legend to Figure 4D-4. Paper guide assembly, exploded view.

Item	Quantity	Description	Part No.
1	2	Machine screw	10058
2	2	Lockwasher	10432
3	2	Washer	10490
4	1	Bar assembly	66978
5	4	Retainer ring	12960
6	1	R. H. pressure roller lever assembly	65979
7	1	L.H. pressure roller lever assembly	65978
8	1	Machine screw	10141
9	1	Lockwasher	10433
10	1	Machine screw	10131
11	1	Lockwasher	10432
12	1	Stud	66009
13	1	Left hand finger	66696
14	1	Pressure roller	66010
15	1	Machine screw	10141
16	1	Lockwasher	10433
17	1	Machine screw	10131
18	1	Lockwasher	10432
19	1	Right hand finger	66697
20	1	Stud	66009
21	1	Pressure roller	66010
22	1	Pressure roller shaft, 8-1/2-inch paper (or 65976, 9-inch paper)	65977
23	1	Spacer (9-inch paper only)	65973
24	1	Paper tension finger	66616
25	1	Paper tension finger	66616
26	1	Shaft assembly	66634
27	2	Stop assembly	66630
28	2	Machine screw	12131
29	2	Lockwasher	10432
30	2	Hexagonal nut	10517
31	1	Mounting plate assembly	66633
32	2	Machine screw	10106
33	2	Lockwasher	10421
34	2	Washer	10450
35	1	L.H. paper guide mounting bracket	65984
36	2	Machine screw	10106
37	2	Lockwasher	10421
38	2	Washer	10450
39	1	R.H. paper guide mounting bracket	65983
40	1	Bracket assembly, 8-1/2-inch paper (or 65971, 9-inch paper)	65972

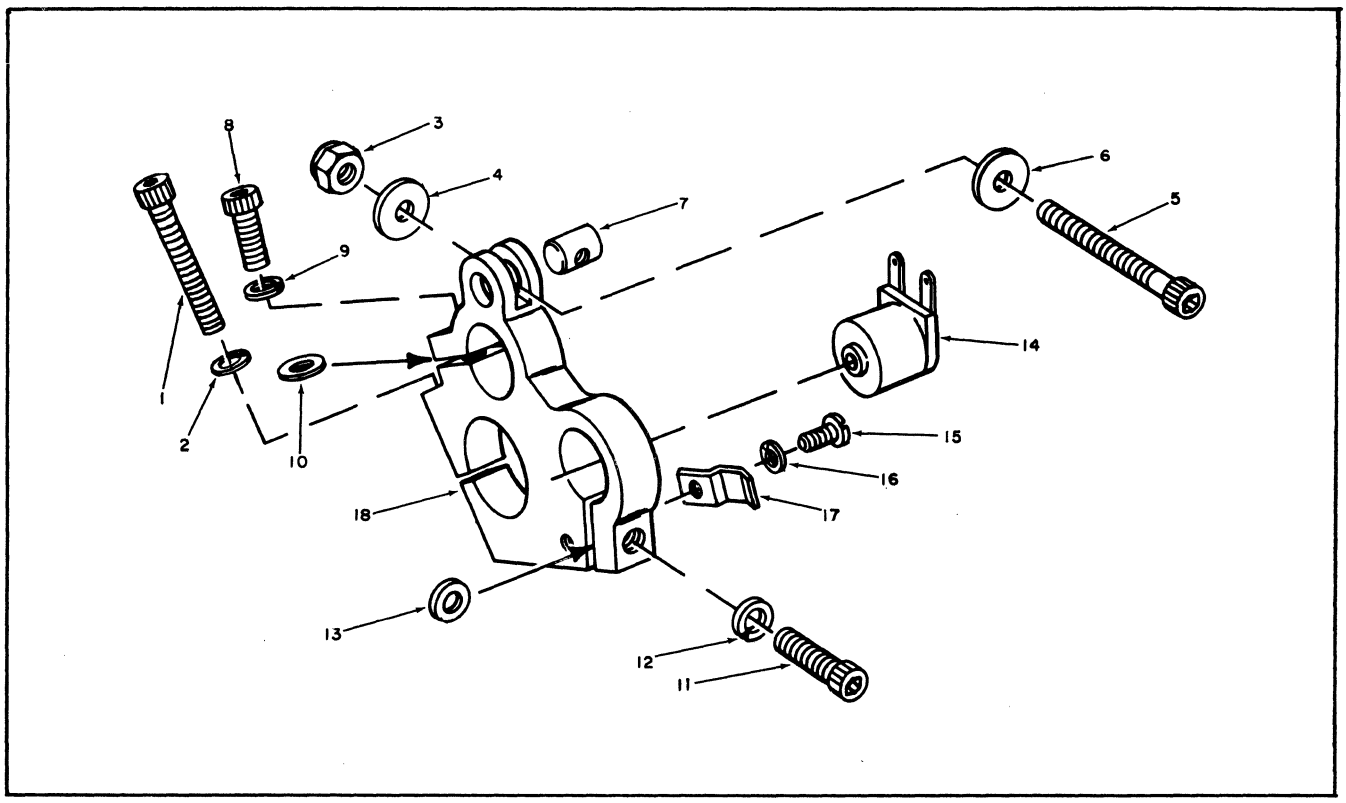

Figure 4D-5. Timing plate assembly, exploded view.

Legend to Figure 4D-5. Timing plate assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10023
2	1	Lockwasher	10429
3	1	Self-locking nut	10500
4	1	Washer	10477
5	1	Machine screw	66029
6	1	Washer	10477
7	1	Adjusting nut	65875
8	1	Machine screw	10005
9	1	Lockwasher	10429
10	1	Washer	10458
11	1	Machine screw	10005
12	1	Lockwasher	10429
13	1	Washer	10458
14	2	Bobbin assembly	66035A
15	1	Machine screw	12335
16	1	Lockwasher	10432
	1	Flat washer	10490
17	1	Cable clamp	20559
18	1	Plate assembly	66271A

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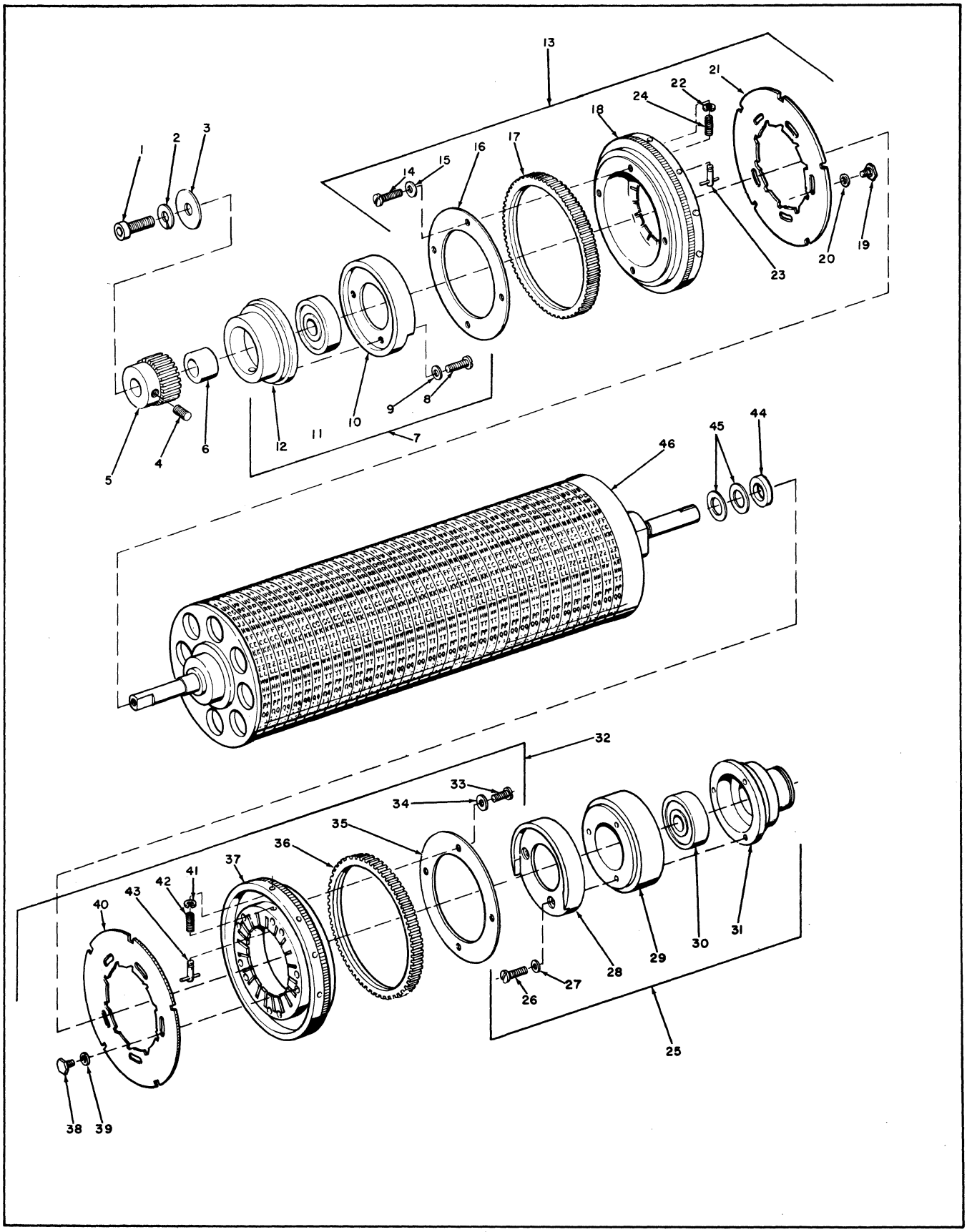

Figure 4D-6. Print drum assembly, exploded view.

Legend to Figure 4D-6. Print drum assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10024
2	1	Lockwasher	10431
3	1	Flat washer	58456
4	2	Setscrew	10209
5	1	Geared pulley	See Note
6	1	Spacer	66063
7	1	L.H. bearing (includes items 8 through 12)	66086
8	3	Machine screw	10173
9	3	Lockwasher	10432
10	1	L.H. bearing sleeve	66088
11	1	Ball bearing	10767
12	1	L.H. bearing housing	66089
13	1	L.H. feed wheel assembly (includes items 14 through 24)	
14	4	Machine screw	12375
15	4	Lockwasher	10432
16	1	Gear clamp ring	66049
17	1	Driven gear	66054
18	1	Feed wheel (for retractable pins)	67647
		or (for non-retractable pins)	67300
19	5	Stud (for retractable pins only)	67649
20	5	Lockwasher (for retractable pins only)	10433
21	1	Feed selector cam (for retractable pins only)	67648
22	10	Retaining ring	10969
23	10	Pin assembly	66071
24	10	Spring	66072
25	1	R.H. bearing assembly (includes items 26 through 31)	66079
26	3	Machine screw	10167
27	3	Lockwasher	10432
28	1	R.H. bearing sleeve	66082
29	1	Spacer	66081
30	1	Ball bearing	10767
31	1	R.H. bearing housing	66083
32	1	R.H. feed wheel assembly (includes items 33 through 43)	
33	4	Machine screw	12375
34	4	Lockwasher	10432
35	1	Gear clamp ring	66049
36	1	Driven gear	66054
37	1	Feed wheel (for retractable pins)	67647
		or (for non-retractable pins)	67300
38	5	Stud (for retractable pins only)	67649
39	5	Lockwasher (for retractable pins only)	10433
40	1	Feed selector cam (for retractable pins only)	67648
41	10	Retainer ring	10969
42	10	Spring	66072
43	10	Pin assembly	66071
44	1	Spacer	66064
45	As req.	Shims	66065 or 66066
46	1	Print drum	See Note

Note: When ordering this part, specify Model Serial Number (90443-xx-xx) - See nameplate located (under dust cover) on left side of base frame.

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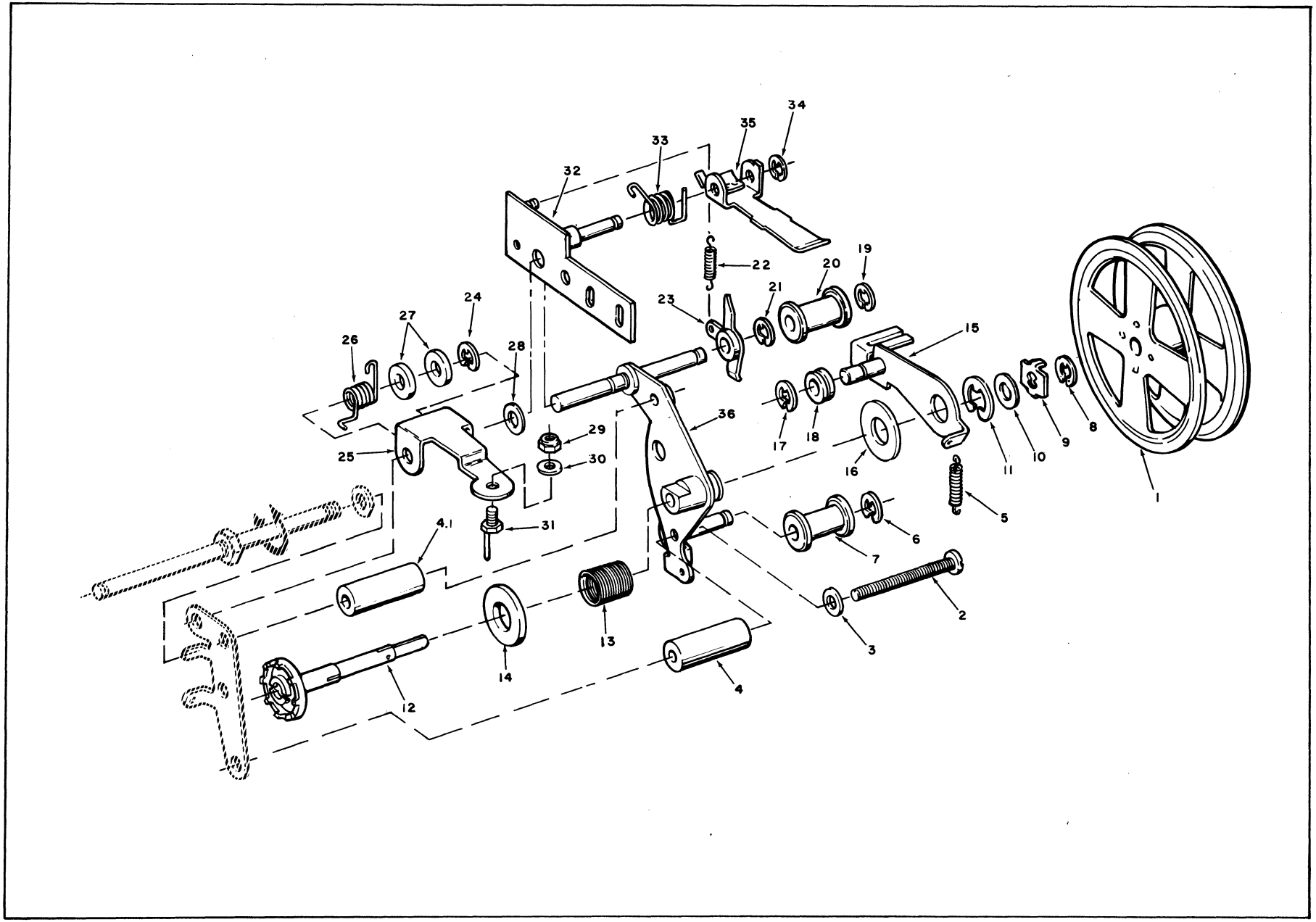

Figure 4D-7. R.H. ribbon feed assembly, exploded view.

Legend to Figure 4D-7. R.H. ribbon feed assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Ribbon spool (without ribbon)	66270
2	1	Machine screw	12130
3	1	Lockwasher	10430
4	1	Spacer	66348
4.1	1	Spacer	67580
5	1	Spring	66432
6	1	Retainer ring	12949
7	1	Roller	66314
8	1	Retainer ring	12960
9	1	Ribbon spool drive disk	66304
10	1	Washer	56546
11	1	Retainer ring	12959
12	1	Ribbon spool shaft assembly	66294
13	1	Spring	66434
14	1	Felt	61668
15	1	R.H. sensing arm assembly	66350
16	1	Washer	66347
17	1	Retainer ring	12949
18	1	Roller	66455
19	1	Retainer ring	12949
20	1	Ribbon roller	66314
21	1	Retainer ring	12949
22	1	Spring	52213
23	1	R.H. latch assembly	68225
24	1	Retainer ring	12949
25	1	R.H. lever	66316
26	1	Spring	66460
27	2	Felt	61474
28	1	Washer	50827
29	1	Nut	10512
30	1	Washer	10429
31	1	Ribbon feed cam stud eccentric	66344
32	1	R.H. mounting plate assembly	67976
33	1	Spring	67973
34	1	Retainer ring	12969
35	1	Retainer	68230
36	1	R.H. plate assembly	66340

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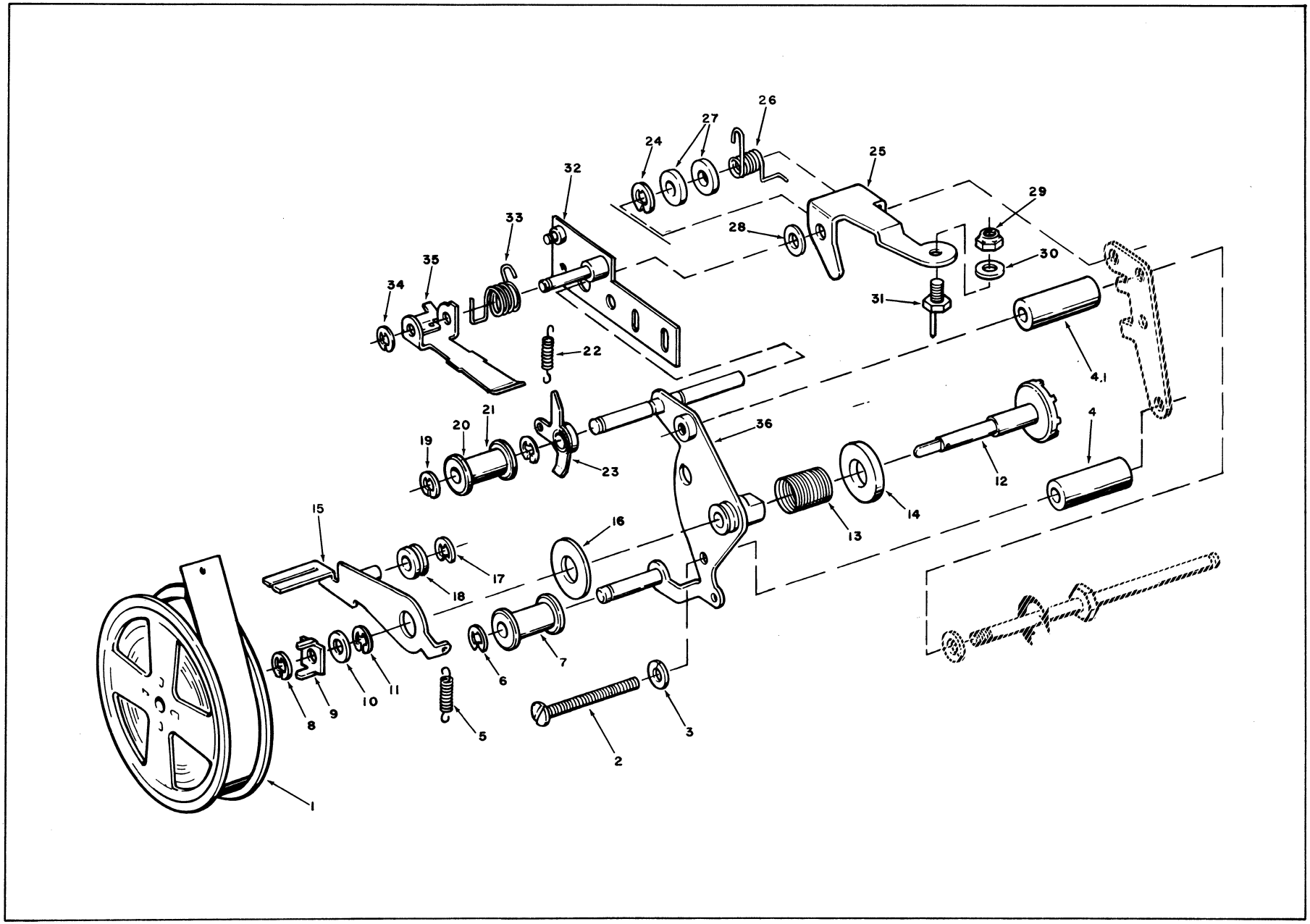

Figure 4D-8. L.H. ribbon feed assembly, exploded view.

Legend to Figure 4D-8. L.H. ribbon feed assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Ribbon spool (with ribbon)	66517
2	1	Machine screw	12130
3	1	Lockwasher	10430
4	1	Spacer	66348
4.1	1	Spacer	67580
5	1	Spring	66432
6	1	Retainer ring	12949
7	1	Roller	66314
8	1	Retainer ring	12960
9	1	Ribbon spool drive disk	66304
10	As required	Spacer	56546
11	1	Retainer ring	12949
12	1	Ribbon spool shaft assembly	66294
13	1	Spring	66434
14	1	Felt	61668
15	1	L.H. sensing arm assembly	66351
16	1	Plain washer	66347
17	1	Retainer ring	12949
18	1	Roller	66455
19	1	Retainer ring	12949
20	1	Ribbon roller	66314
21	1	Retainer ring	12949
22	1	Spring	52213
23	1	Latch assembly L.H.	68226
24	1	Retainer ring	12949
25	1	L.H. lever	66315
26	1	Spring	66461
27	2	Felt	61474
28	1	Washer	50827
29	1	Nut	10512
30	1	Lockwasher	10429
31	1	Eccentric	66344
32	1	L.H. mounting plate assembly	67977
33	1	Spring	67974
34	1	Retainer ring	12969
35	1	Retainer	68231
36	1	L.H. plate assembly	66341

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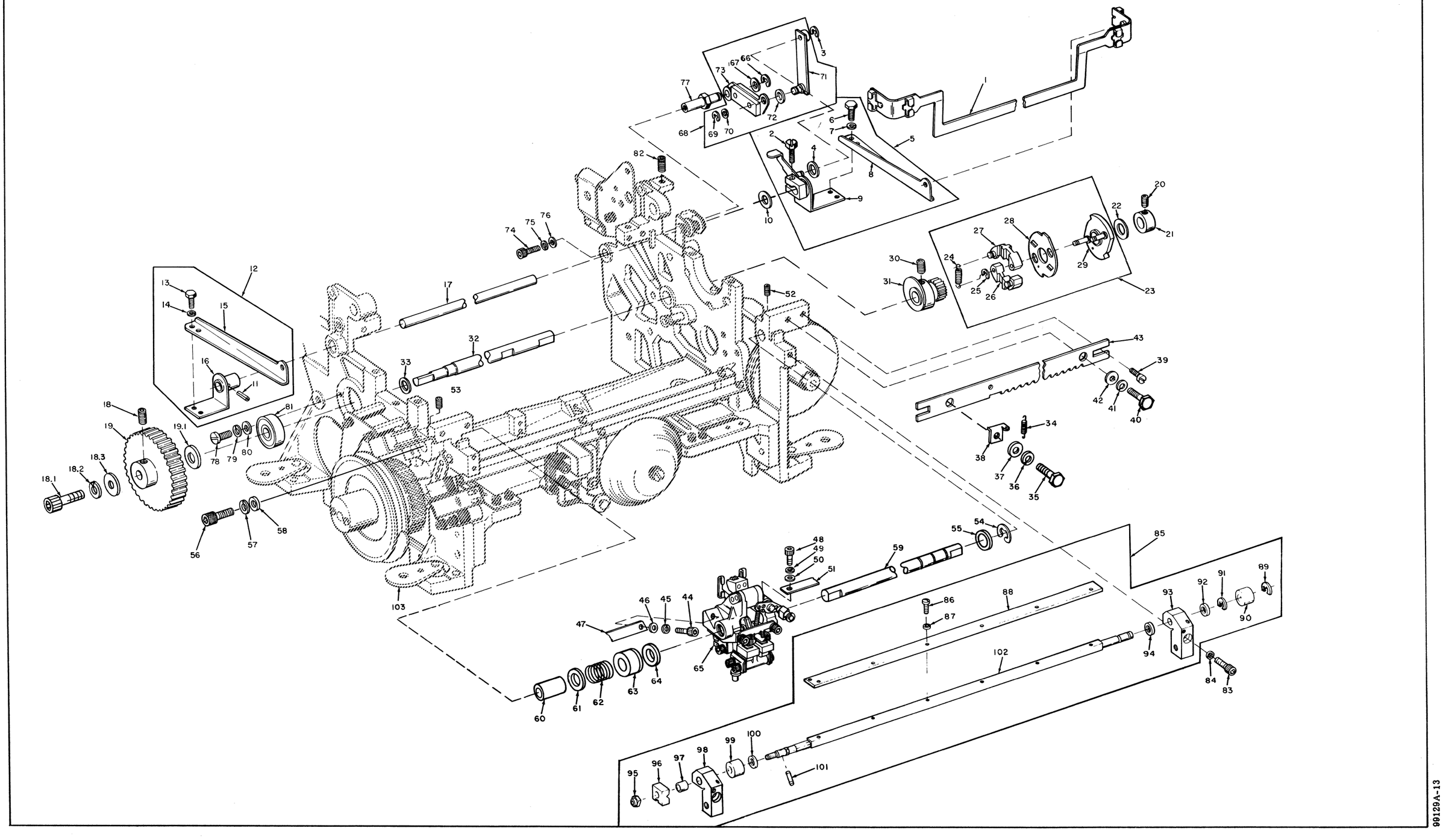


Figure 4D-9. 1st Chassis assembly, exploded view.

Legend to Figure 4D-9. 1st Chassis assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Bail assembly	65719
2	1	Hexagon head machine screw	10085
3	1	Retainer ring	12969
4	1	Felt	61486
5	1	Bracket and arm assembly (includes items 6 through 9)	
6	2	Machine screw	10086
7	2	Lockwasher	10432
8	1	R.H. ribbon lift arm	65806
9	1	Bracket (includes item 2)	65930
10	1	Spacer	66409
11	1	Roll pin	11123
12	1	Bracket and arm assembly (includes items 13 through 16)	
13	2	Machine screw	10086
14	2	Lockwasher	10432
15	1	L.H. ribbon lift arm	65807
16	1	Bracket assembly	65908
17	1	Shaft	65985
18	2	Setscrew	10210
18.1	1	Machine screw	10004
18.2	1	Lockwasher	10429
18.3	1	Washer	10450
19	1	Power shaft pulley	65538
19.1	1	Spacer	65676
20	2	Setscrew	10209
21	1	Collar	50327
22	1	Washer	65735
23	1	Clutch assembly (includes items 24 through 29)	65697
24	1	Spring	65659
25	2	Retainer ring	11103
26	1	Pawl assembly	65707
27	1	Pawl assembly	65707
28	1	Plate	65696
29	1	Cam assembly	65702
30	2	Setscrew	10209
31	1	Ratchet assembly	65778
32	1	Power shaft	65672
33	1	Spacer	65534
34	1	Spring	66993
35	1	Machine screw	11209
36	1	Lockwasher	10426
37	1	Plain washer	50827
38	1	Bail spring bracket	66992
39	1	Eccentric stud	65721
40	2	Machine screw	11209
41	2	Lockwasher	10426
42	2	Plain washer	50827
43	1	Rack	65838
44	1	Machine screw	10050
45	1	Lockwasher	10432
46	1	Plain washer	10490
47	1	Carriage return belt	66187
48	1	Machine screw	10050
49	1	Lockwasher	10432
50	1	Plain washer	10490

99129A-13

Legend to Figure 4D-9. 1st Chassis assembly, exploded view (continued).

Item	Quantity	Description	Part No.
51	1	Carriage feed belt	65648
52	1	Setscrew	10210
53	1	Setscrew	10210
54	1	Retainer ring	10959
55	1	Plain washer	65996
56	1	Machine screw	10050
57	1	Lockwasher	10432
58	1	Plain washer	65619
59	1	Carriage shaft	67806
60	1	Bushing	67942
61	1	Plain washer	67943
62	1	Spring	67808
63	1	Bumper	67941
64	1	Plain washer	67944
65	1	Carriage assembly (2-hammer)	67734
66	1	Retainer ring	12949
67	1	Plain washer	50315
68	1	Armature and link assemblies (includes items 60 through 67)	
69	1	Retainer ring	12969
70	1	Plain washer	50320
71	1	Link assembly	65931
72	1	Plain washer	55251
73	1	Armature assembly	65964
74	1	Machine screw	10008
75	1	Lockwasher	10426
76	1	Plain washer	10463
77	1	Stud	65809
78	2	Machine screw	10393
79	2	Lockwasher	10429
80	2	Plain washer	10450
81	1	Bearing	10756
82	1	Machine screw	10226
83	2	Machine screw	10025
84	2	Lockwasher	10426
85	1	Bail assembly (includes items 80 through 96)	67393
86	6	Machine screw	11757
87	6	Lockwasher	10433
88	1	Space bail	67397
89	1	Retainer ring	10949
90	1	Felt	65543
91	1	Retainer ring	10949
92	1	Plain washer	50827
93	1	Mounting block	67394
94	1	Plain washer	50827
95	1	Hexagonal self-locking nut	10840
96	1	Collar	65896
97	2	Bearing	10773
98	1	Mounting block	67394
99	1	Felt	65543
100	1	Retainer	66970
101	1	Roll pin	11123
102	1	Space bail shaft	67396
103	1	Frame assembly (See fig. 4D-31)	

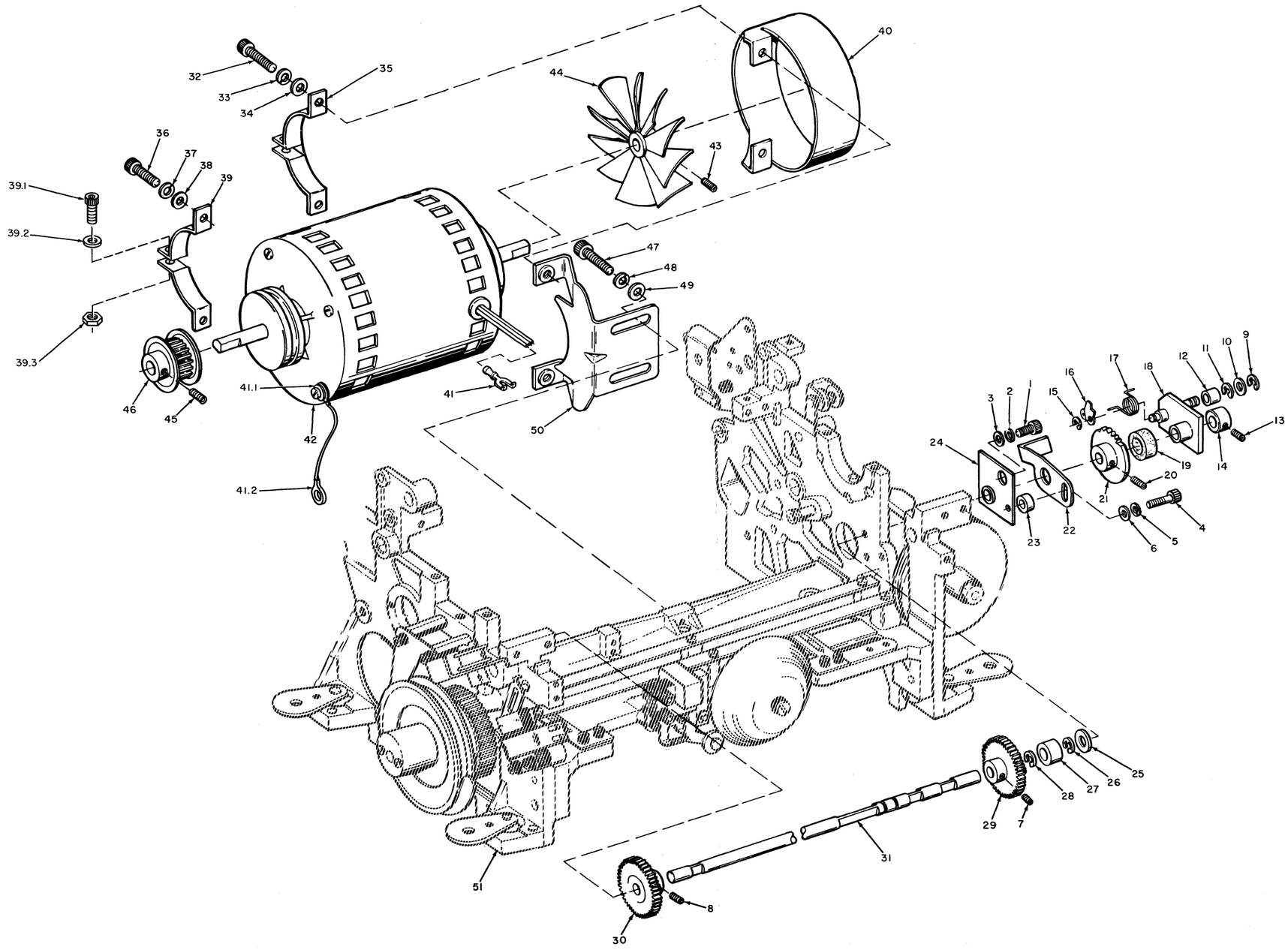


Figure 4D-10. Chassis assembly, exploded view.

Legend to Figure 4D-10. Chassis assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10009
2	1	Lockwasher	10430
3	1	Plain washer	50827
4	1	Machine screw	11235
5	1	Lockwasher	10430
6	1	Plain washer	50827
7	1	Setscrew	10209
8	1	Setscrew	10209
9	1	Retainer ring	12949
10	1	Washer	66195
11	1	Retainer ring	12949
12	1	Roller	65667
13	2	Setscrew	10209
14	1	Collar	50209
15	1	Retainer ring	12969
16	1	Pawl	50165
17	1	Spring	65934
18	1	Lever assembly	67339
19	1	Felt	66193
20	2	Setscrew	10210
21	1	Detent wheel	52807
22	1	Stop plate	67344
23	1	Spacer	67345
24	1	Plate assembly	67343
25	1	Spacer	65676
26	1	Retainer ring	10957
27	1	Felt	66194
28	1	Retainer ring	10957
29	1	Gear	67351
30	1	Gear	67351
31	1	Shaft	67353
32	2	Machine screw	10024
33	2	Lockwasher	10431
34	2	Plain washer	10473
35	2	Clamp	65666
36	2	Machine screw	10024
37	2	Lockwasher	10431
38	2	Plain washer	10473
39	2	Clamp	65666
39.1	2	Machine screw	10010
39.2	2	Washer	10454
39.3	2	Self-locking nut	10841
40	1	Guard	66986
41	1	Terminal	21045
41.1	1	Lockwasher	10404
41.2	1	Lead assembly	67591
42	1	Motor assembly (Relay start)	66454
		Motor assembly (Capacitor start)	67910
43	2	Setscrew	10203
44	1	Fan	23294
45	2	Setscrew	10209
46	1	Pulley	65541
47	2	Machine screw	10397
48	2	Lockwasher	10431
49	2	Washer	10473
50	1	Bracket	65653
51	1	Frame assembly (See fig. 4D-31)	

99129A-09

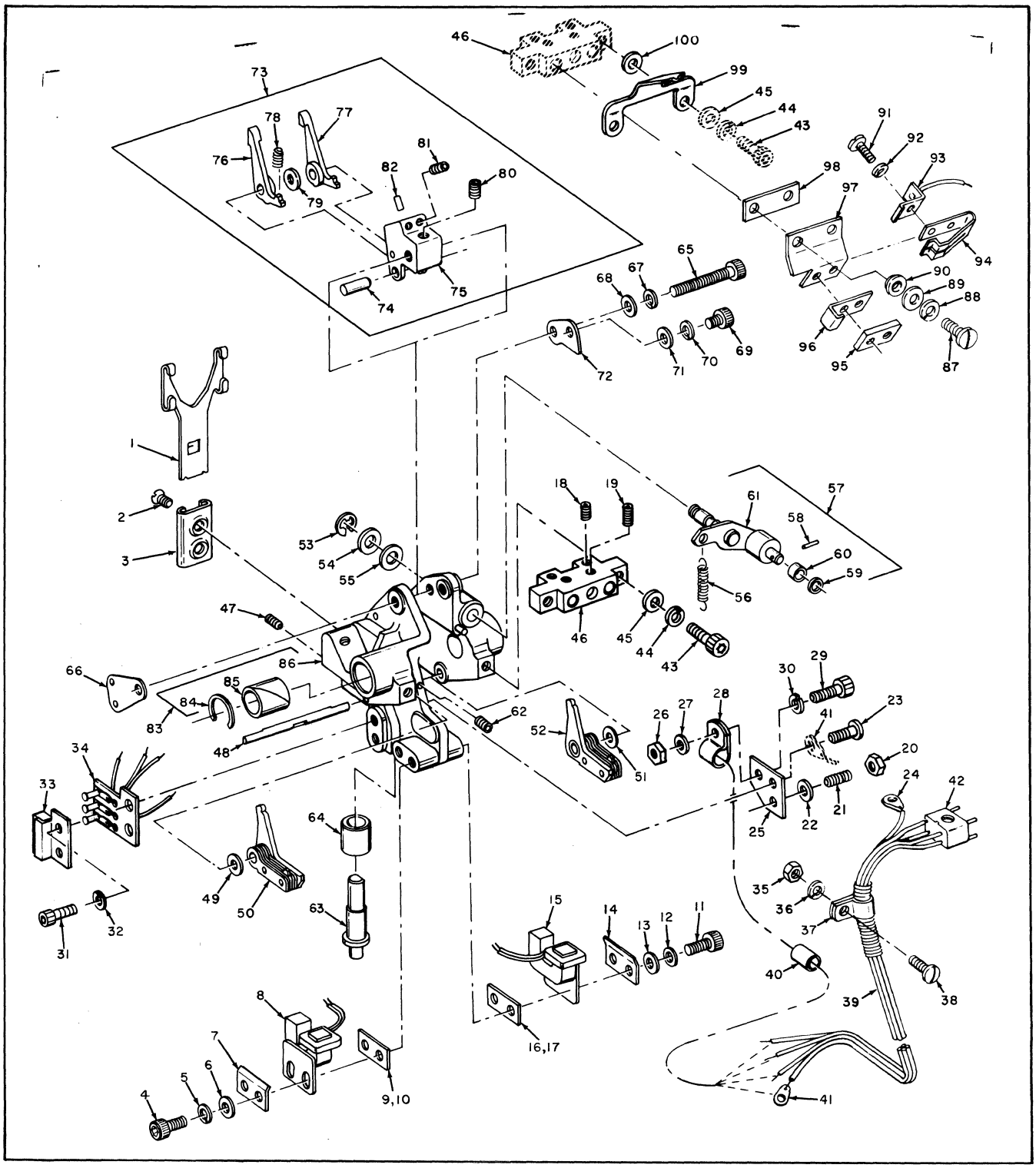


Figure 4D- 12. Carriage assembly, exploded view.

99129A-11

Legend to Figure 4D-12. Carriage assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Ribbon vibrator	65887
2	2	Machine screw	11806
3	1	Vibrator guide	65884
4	2	Machine screw	10050
5	2	Lockwasher	10432
6	2	Flat washer	10490
7	1	Pressure plate	65885
8	1	Magnet assembly	66890
9	As required	Shim	66984
10	As required	Shim	66985
11 **	2	Machine screw	10050
12 **	2	Lockwasher	10432
13 **	2	Flat washer	10490
14 **	1	Pressure plate	65885
15 **	1	Magnet assembly	66891
16 **	As required	Shim	66984
17 **	As required	Shim	66985
18	2	Setscrew	11167
19	1	Setscrew	10223
20	1	Nut	10501
21	1	Setscrew	10233
22	1	Washer	10454
23	1	Machine screw	12375
24	1	Terminal lug (part of cable assembly)	20795
25	1	Plate	68412
26	1	Nut	10517
27	1	Washer	10490
28	1	Cable clamp	20558
29	1	Machine screw	10050
30	1	Lockwasher	10432
31	2	Machine screw	10050
32	2	Lockwasher	10432
33	1	Terminal guard assembly	68473
34	1	Board assembly	68471
35	1	Nut	10840
36	1	Washer	10458
37	1	Cable clamp	20559
38	1	Machine screw	10365
39	1	Cable assembly	67830
40	1	Tubing	21074-07.00
41	1	Terminal lug	20807
42	1	Polarized plug (part of cable assembly)	23260
43	2	Machine screw	10057
44	2	Plain washer	10490
45	2	Lockwasher	10432
46	1	Block	67699
47	2	Setscrew	65888
48	1	Armature shaft	67723
49	1	Washer	65664
50	1	Armature assembly	67683
51 **	1	Washer	65664
52 **	1	Armature assembly	67688
53	1	Retaining ring	10960
54	1	Spacer	65656
55	1	Spacer	65657
56	1	Space pawl spring	65845
57	1	Space pawl assembly (includes items 58 through 61)	66036

99129A-11

Legend to Figure 4D-12. Carriage assembly, exploded view (continued).

Item	Quantity	Description	Part No.
58	1	Spiral pin (part of item 57)	65682
59	1	Washer (part of item 57)	65664
60	1	Space pawl roller (part of item 57)	65680
61	1	Space pawl (part of item 57)	65854
62	1	Setscrew	11256
63	1	Guide stud assembly	65852
64	1	Carriage guide roller	65732
65	1	Machine screw	10062
66	1	Nut plate	67680
67	1	Lockwasher	10432
68	1	Washer	10490
69	1	Machine screw	10058
70	1	Lockwasher	10432
71	1	Washer	10490
72	1	Stop plate	65883
73	1	Print hammer and block assembly (includes items 74 through 82)	***
74	1	Hammer shaft (part of item 73)	67694
75	1	Block (part of item 73)	67692
76	1	Hammer (part of item 73)	67696
77 **	1	Hammer (part of item 73)	67698
78	1	Spring (part of item 73)	67947
79 **	1	Washer (part of item 73)	65664
80	1	Setscrew (part of item 73)	11258
81	1	Setscrew (part of item 73)	11158
82	1	Nylon pin (or Retainer, 67938) (part of item 73)	65850
83	1	Frame assembly (includes items 84 through 86)	67785
84	1	Retainer ring (part of item 83)	65844
85	1	Space pawl bushing (part of item 83)	65846
86	1	Carriage frame assembly (part of item 83)	
87 *	2	Machine screw	12374
88 *	2	Lockwasher	10429
89 *	2	Washer	10477
90 *	2	Insulating washer	67878
91 *	2	Machine screw	12144
92 *	2	Lockwasher	10433
93 *	1	Terminal	67877
94 *	1	Contact	67737
95 *	1	Nut plate	67739
96 *	1	Contact stop	67831
97 *	1	Contact bracket	67603
98 *	1	Insulator	67879
99 *	1	Indicator	67738
100 *	2	Spacer	54643

* Note 1: Applicable to equipment with horizontal tab feature.

** Note 2: Not applicable to single hammer units.

*** Note 3: When ordering this part, specify model serial number (90443-xx-xx) - See nameplate located (under dust cover) on left side of base frame.

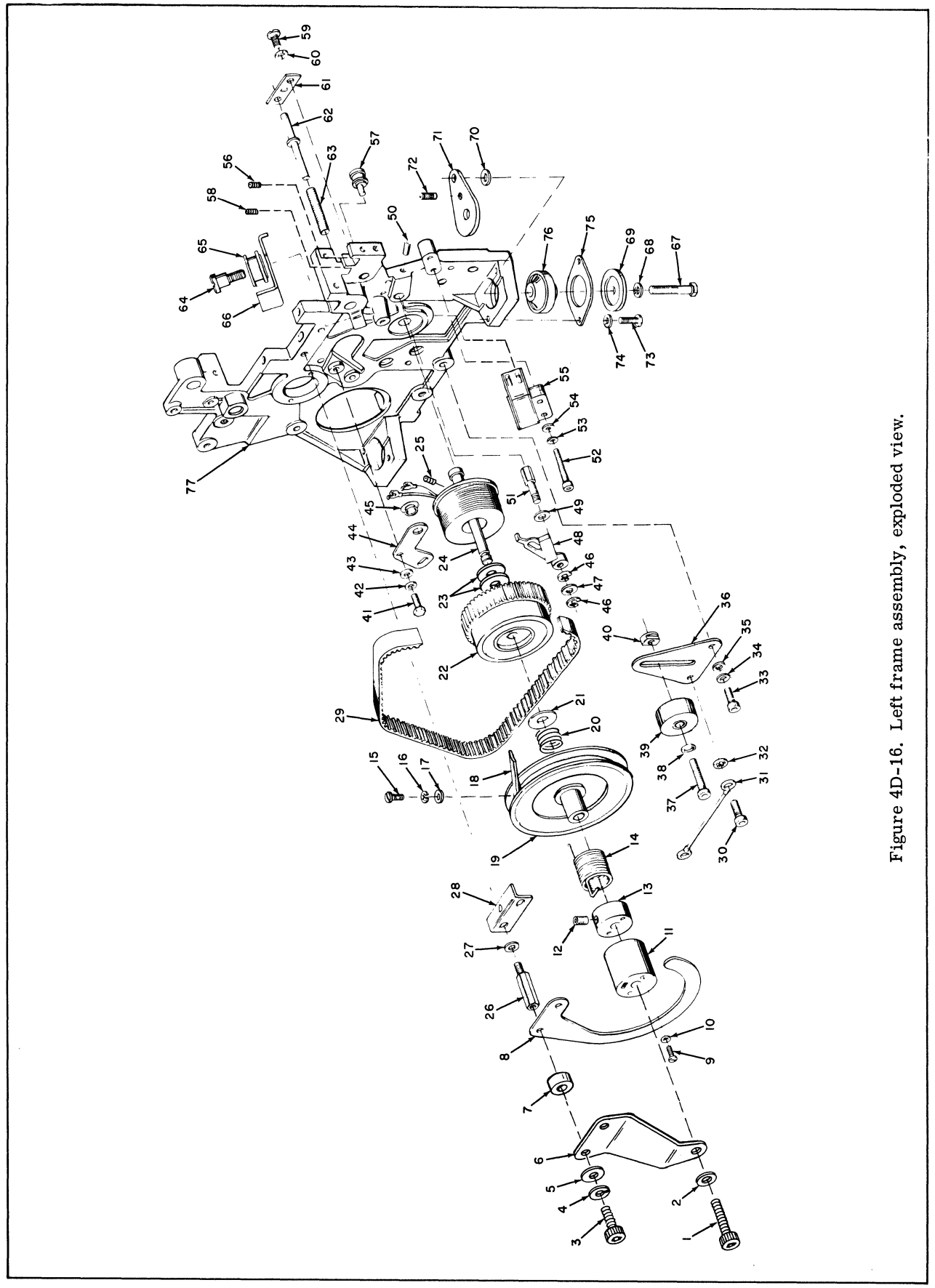


Figure 4D-16. Left frame assembly, exploded view.

Legend to Figure 4D-16. Left frame assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10004
2	1	Lockwasher	10421
3	2	Machine screw	10011
4	2	Lockwasher	10430
5	2	Flat washer	10450
6	1	Support	67951
7	2	Spacer	67949
8	1	Retaining plate	66319
9	1	Machine screw	10350
10	1	Lockwasher	10435
11	1	Spring cover	66556
12	2	Setscrew	10203
13	1	Collar	66024
14	1	Spring	66581
15	1	Machine screw	10335
16	1	Lockwasher	10432
17	1	Flat washer	10490
18	1	Carriage return belt	66187
19	1	Pulley	66028A
20	1	Spring	67842
21	1	Special washer	65785
22	1	Housing assembly	65790A
23	2	Special washer	65785
24	1	Carriage return coil assembly (See Note 1)	66025A
25	2	Setscrew	10204
26	2	Standoff	66264
27	2	Lockwasher	10429
28	1	Bracket	66318
29	1	Drive belt	65925
30	1	Machine screw	10026-01
31	1	Ground lead	67530A
32	1	Lockwasher	10405
33	1	Machine screw	10026
34	1	Lockwasher	10431
35	1	Flat washer	10473
36	1	Pulley plate	65923
37	1	Machine screw	10011
38	1	Lockwasher	10430
39	1	Bearing assembly	66988A
40	1	Slide nut	66330
41	2	Machine screw	11250
42	2	Lockwasher	10426
43	2	Flat washer	10463
44	1	Bracket	65919
45	1	Bearing	10769
46	2	Retaining ring	12960
47	1	Flat washer	66003
48	1	Spacing armature	66001A
49	1	Spacer	65684
50	1	Setscrew	10206
51	1	Post	66004
52	2	Machine screw	10034
53	2	Lockwasher	10429
54	2	Flat washer	10450
55	1	Space magnet assembly (See Note 2)	66353
56	1	Setscrew	11255
57	1	Eccentric stud	66002

99129A-10

Legend to Figure 4D-16. Left frame assembly, exploded view (continued).

Item	Quantity	Description	Part No.
58	1	Setscrew	10210
59	2	Machine screw	10106
60	2	Lockwasher	10429
61	1	Guide plate	65789
62	1	Plunger	65788
63	1	Spring	65805
64	1	Stud	65943
65	1	Pulley	65944
66	1	Bracket	65942
67	4	Machine screw	11213
68	4	Lockwasher	10431
69	4	Finishing washer	65937
70	4	Flat washer	10473
71	4	Mounting plate	65935
72	4	Setscrew	10233
73	8	Machine screw	10304
74	8	Lockwasher	10415
75	4	Mounting washer	66252
76	4	Shock mount	65938
77	1	Left frame assembly (see fig. 4D-31)	

Note 1: Disconnect coil leads from terminal board TB3 to facilitate removal of coil assembly.

Note 2: Disconnect leads from coil assembly to facilitate removal of tubing, Part No. 20765-00.40

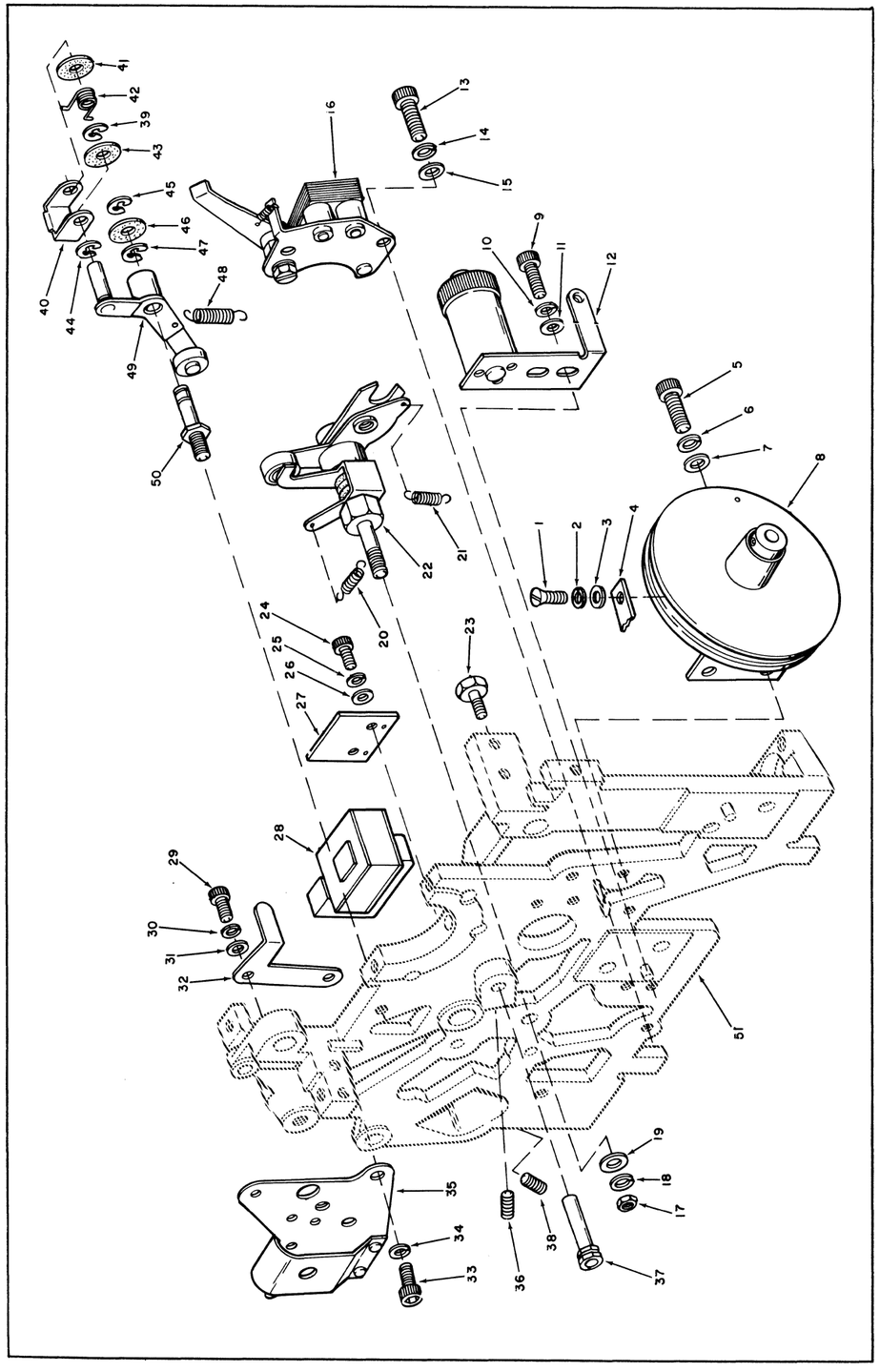


Figure 4D-19. Right hand frame assembly, exploded view.

Legend to Figure 4D-19. Right hand frame assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10335
2	1	Lockwasher	10432
3	1	Plain washer	10490
4	1	Carriage space belt	65648
5	2	Machine screw	10009
6	2	Lockwasher	10430
7	2	Plain washer	10463
8	1	Carriage space drum assembly	66544
9	2	Machine screw	10009
10	2	Lockwasher	10430
11	2	Plain washer	10467
12	1	Line feed adjusting knob assembly (See fig. 4D-21)	
13	2	Machine screw	10009
14	2	Lockwasher	10426
15	2	Plain washer	10463
16	1	Magnet and armature clutch release assembly (See fig. 4D-22)	
17	1	Hexagonal nut	10825
18	1	Lockwasher	10431
19	1	Plain washer	10473
20	1	Spring	65663
21	1	Spring	66267
22	1	Line-feed lever shaft assembly	67346
23	1	Stud	65926
24	2	Machine screw	10004
25	2	Lockwasher	10421
26	2	Plain washer	10450
27	1	Plate	65812
28	1	Ribbon lift magnet assembly	66197
29	2	Machine screw	10004
30	2	Lockwasher	10421
31	2	Plain washer	10450
32	1	Ribbon arm stop	65814
33	2	Machine screw	10026
34	2	Lockwasher	10431
35	1	Plate assembly	65916
36	1	Setscrew	10204
37	1	Stud	66189
38	1	Machine screw	11235
39	1	Retainer ring	12949
40	1	Ribbon feed advance pawl	65526
41	1	Felt	61476
42	1	Spring	65777
43	1	Felt	61476
44	1	Retainer ring	12949
45	1	Retainer ring	12949
46	1	Felt	61476
47	1	Retainer ring	12949
48	1	Spring	65711
49	1	Lever assembly	65734
50	1	Ribbon feed lever pivot stud	65733
51	1	R.H. frame assembly (See fig. 4D-31)	

99129A-09

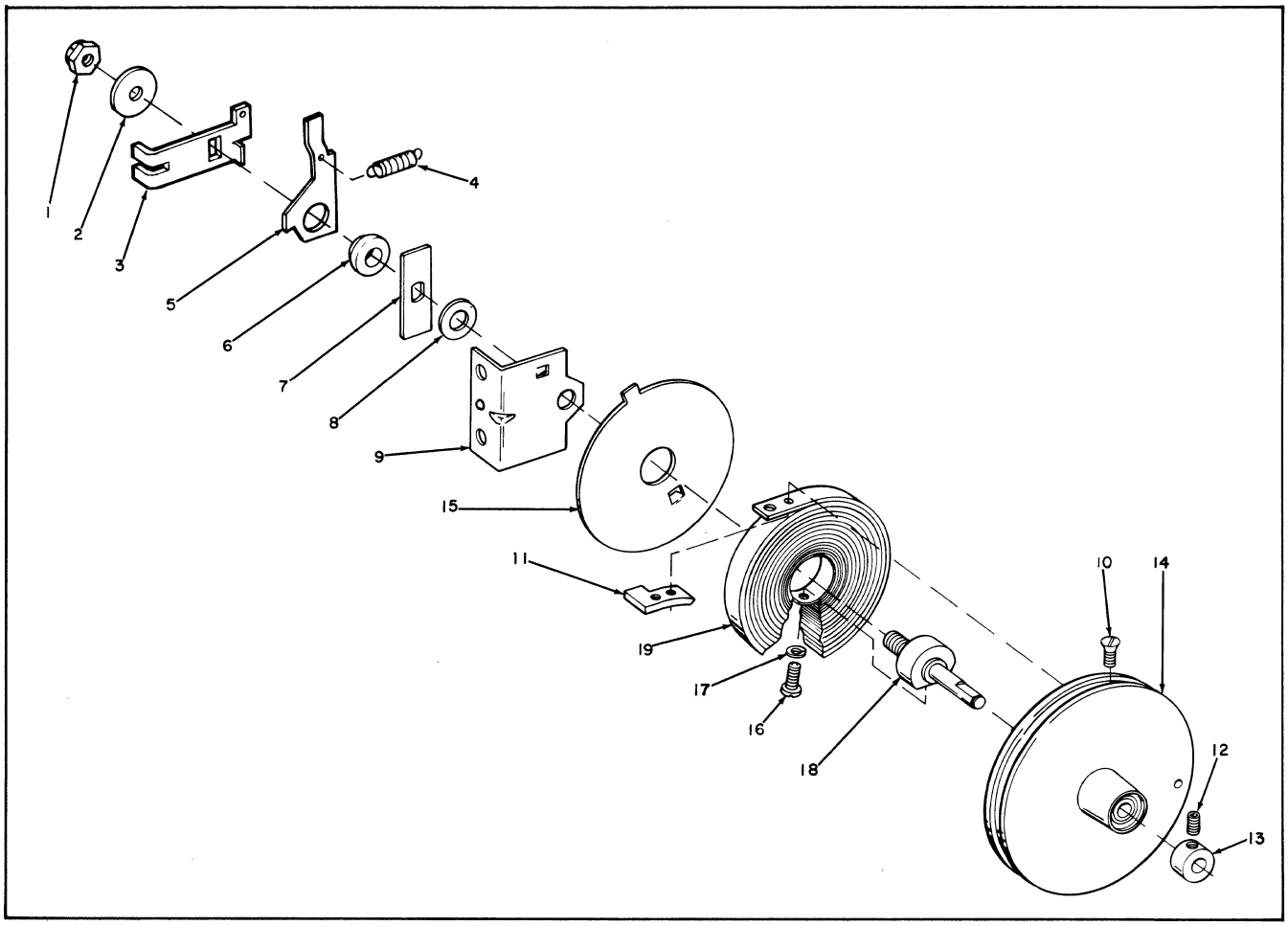


Figure 4D-20. Carriage feed drum assembly, exploded view.

Legend to Figure 4D-20. Carriage feed drum assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Self-locking nut	10573
2	1	Spacer	66787
3	1	Bracket	67613
4	1	Spring	66791
5	1	Stop	66789
6	1	Spacer	66790
7	1	Arm	66541
8	1	Spacer	65676
9	1	Bracket	67611
10	1	Machine screw	10335
11	1	Nut plate	66258
12	2	Setscrew	10203
13	1	Collar	60294
14	1	Drum assembly	66543
15	1	Plate	66254
16	1	Machine screw	10335
17	1	Lockwasher	10432
18	1	Shaft	66515
19	1	Coil spring	66259

99129A-10

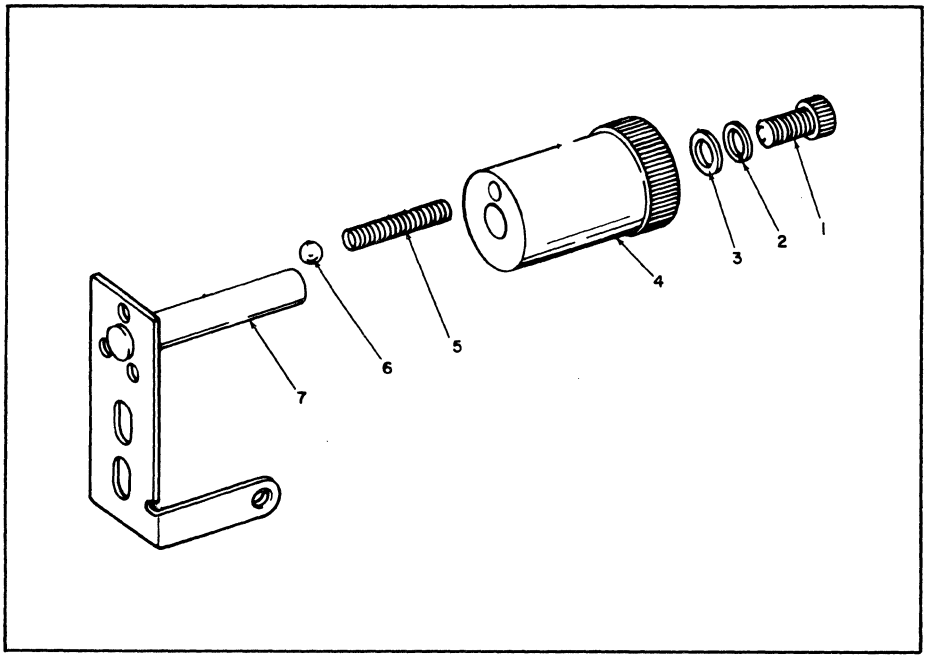


Figure 4D-21. Line feed adjusting knob assembly, exploded view.

Legend to Figure 4D-21. Line feed adjusting knob assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10009
2	1	Lockwasher	10430
3	1	Plain washer	10467
4	1	Line feed knob	65668
5	1	Spring	65658
6	1	Ball	10908
7	1	Plate assembly	65677

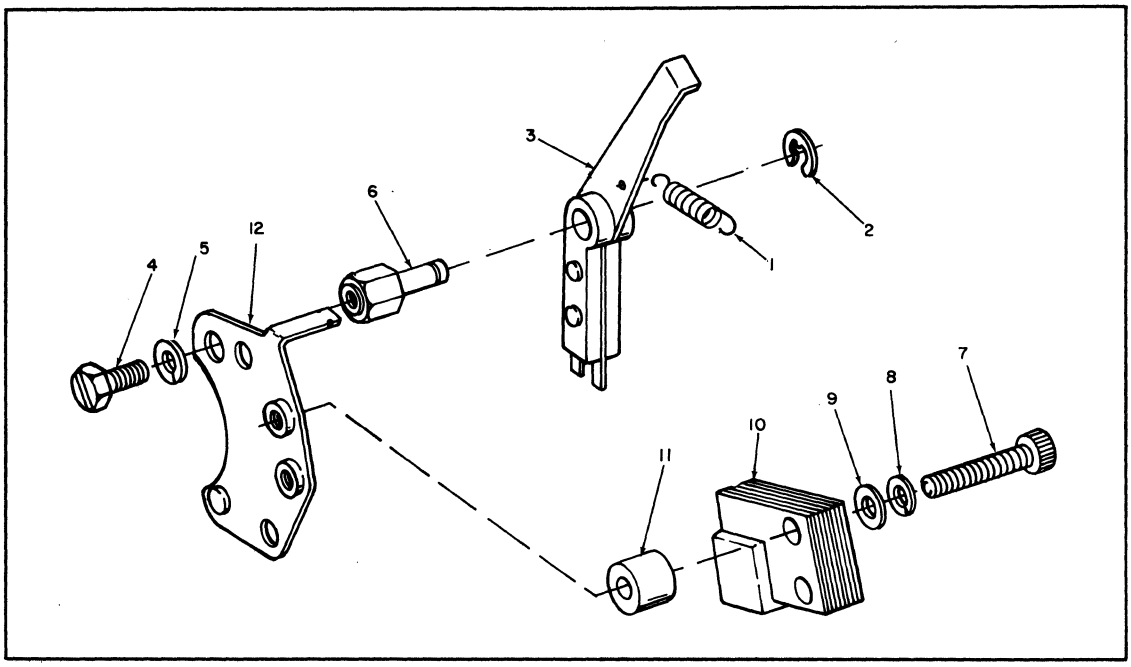


Figure 4D-22. Magnet and armature clutch release assembly, exploded view.

Legend to Figure 4D-22. Magnet and armature clutch release assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Spring	65662
2	1	Retainer ring	10960
3	1	Clutch release armature assembly	65640
4	1	Machine screw	10327
5	1	Lockwasher	10431
6	1	Pivot stud	65639
7	2	Machine screw	10041
8	2	Lockwasher	10421
9	2	Plain washer	10450
10	1	Magnet assembly	66272
11	2	Spacer	65813
12	1	Plate assembly	65636

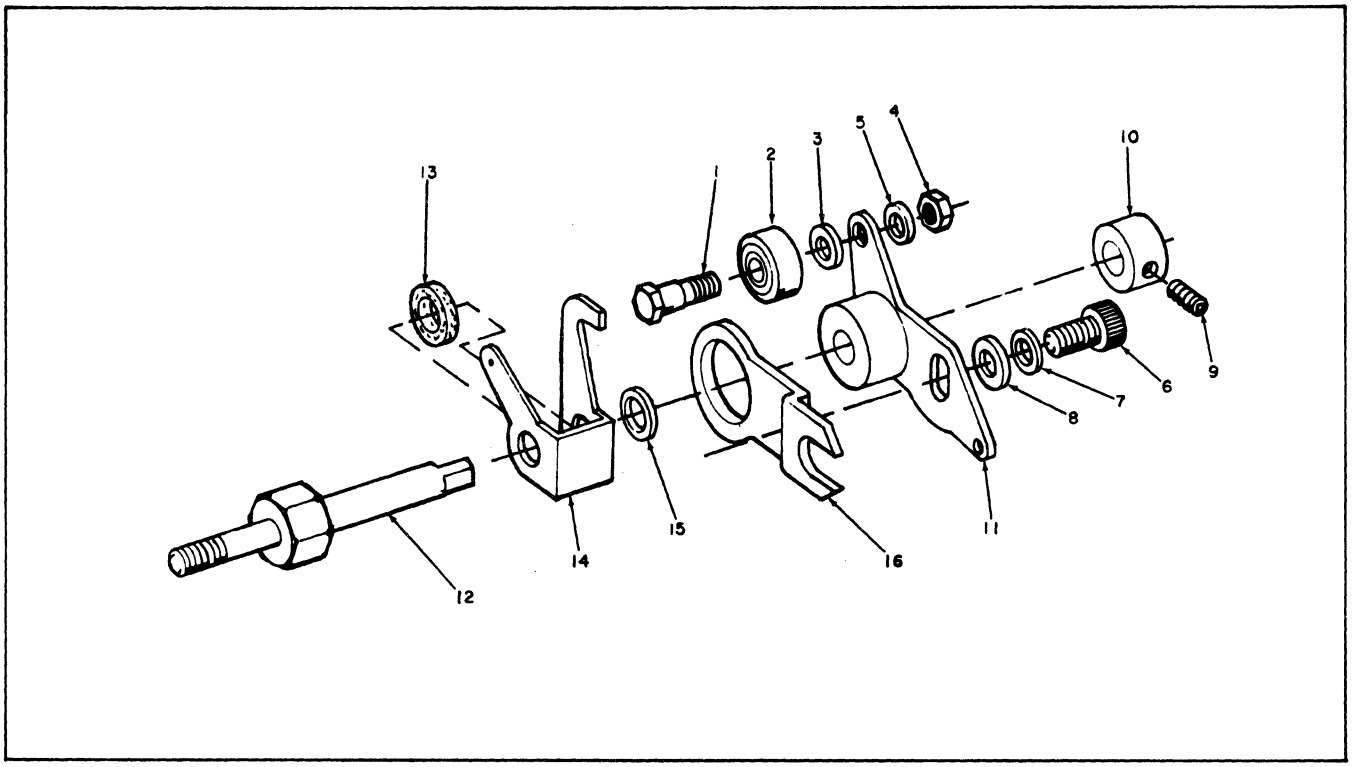
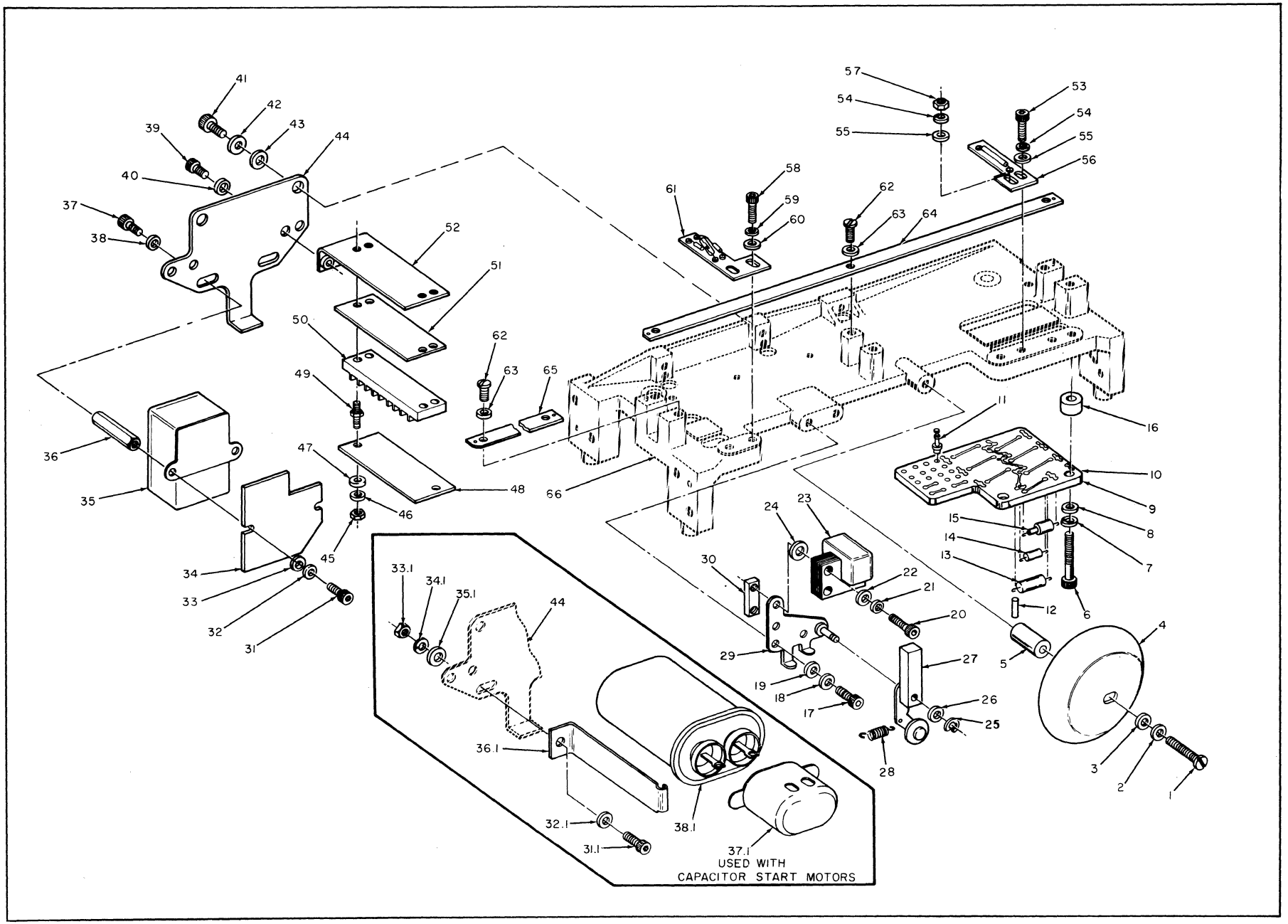


Figure 4D-23. Line-feed stud assembly, exploded view.

Legend to Figure 4D-23. Line-feed stud assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Stud	65712
2	1	Ball bearing	10755
3	1	Spacer	65959
4	1	Plain hexagonal nut	10513
5	1	Lockwasher	10429
6	1	Machine screw	10032
7	1	Lockwasher	10430
8	1	Plain washer	50827
9	2	Setscrew	10209
10	1	Collar	50209
11	1	Link assembly	67338
12	1	Pivot stud	65674
13	3	Felt	61473
14	1	Detent lever	65675
15	1	Special plain washer	51552
16	1	Link	67340

99129A-03



99129A-09

Figure 4D-27. Center frame assembly, exploded view.

Legend to Figure 4D-27. Center frame assembly, exploded view.

Item	Quantity	Description	Part No.
1 [c]	1	Machine screw	10385
2 [c]	1	Lockwasher	10415
3 [c]	1	Washer	10450
4 [c]	1	Bell	51080
5 [c]	1	Spacer	65837
6	2	Machine screw	10006
7	2	Lockwasher	10421
8	2	Washer	10450
9	1	P.C. board assembly TB5 (includes items 10 through 15)	67720
10	1	Board assembly (part of item 9)	67722
11	31	Terminal (part of item 9)	20609
12	4	Tubing (part of item 9)	20814-00.50
13	4	Capacitor (part of item 9)	23429
14	4	Resistor (part of item 9)	23000-1000
15	4	Diode (part of item 9)	23350
16	2	Spacer	67893
17	2	Machine screw	10001
18	2	Lockwasher	10415
19	2	Washer	10450
Note: Items 20 through 30 are part of Bell mechanism 65836A			
20 [c]	2	Machine screw	10006
21 [c]	2	Lockwasher	10415
22 [c]	2	Washer	10450
23 [c]	1	Magnet assembly	66272
24 [c]	2	Spacer	50827
25 [c]	1	Retainer ring	10969
26 [c]	1	Washer	57943
27 [c]	1	Armature assembly	65831
28 [c]	1	Spring	65995
29 [c]	1	Plate assembly	65835
30 [c]	1	Nut plate	65832
31 [b]	2	Machine screw	10087
31.1 [a]	2	Machine screw	10006
32 [b]	2	Lockwasher	10429
32.1 [a]	2	Washer	10459
33 [b]	2	Washer	10450
33.1 [a]	2	Nut	10512
34 [b]	1	Relay cover	66746
34.1 [a]	2	Lockwasher	10429
35 [b]	1	Relay	23164
35.1 [a]	2	Washer	10472
36 [b]	2	Standoff	66747
36.1 [a]	2	Capacitor bracket	67911
37 [b]	2	Machine screw	10354
37.1 [a]	1	Capacitor cover	11910
38 [b]	2	Lockwasher	10403
38.1 [a]	1	Capacitor	23750
39	2	Machine screw	10004
40	2	Lockwasher	10430
41	2	Machine screw	10009
42	2	Lockwasher	10430
43	2	Washer	10463
44	1	Bracket	67349
45	2	Nut	10517
46	2	Lockwasher	10432
47	2	Flat washer	10490

Legend to Figure 4D-27. Center frame assembly, exploded view (continued).

Item	Quantity	Description	Part No.
48	2	Terminal cover	67350
49	2	Standoff	67354
50	1	Terminal strip TB3	23603
51	1	Marker strip	23604
52	1	Bracket assembly	67347
53 [c]	1	Machine screw	10005
54 [c]	1	Lockwasher	10421
55 [c]	1	Washer	10472
56 [c]	1	Reed switch assembly (S20)	66041
57 [c]	2	Nut	10513
58 [c]	2	Machine screw	10005
59 [c]	2	Lockwasher	10421
60	2	Washer	10472
61	1	Reed switch assembly (S21)	66040
62	6	Pan head screw	12397
63	6	Lockwasher	12403
64	1	Rear carriage guide rail	65649
65	1	Front carriage guide rail	67781
66	1	Center frame assembly (See figure 4D-31)	

[a] Applicable to models equipped with capacitor-start motors.

[b] Applicable to models equipped with relay-start motors.

[c] Applicable to models equipped with a bell mechanism.

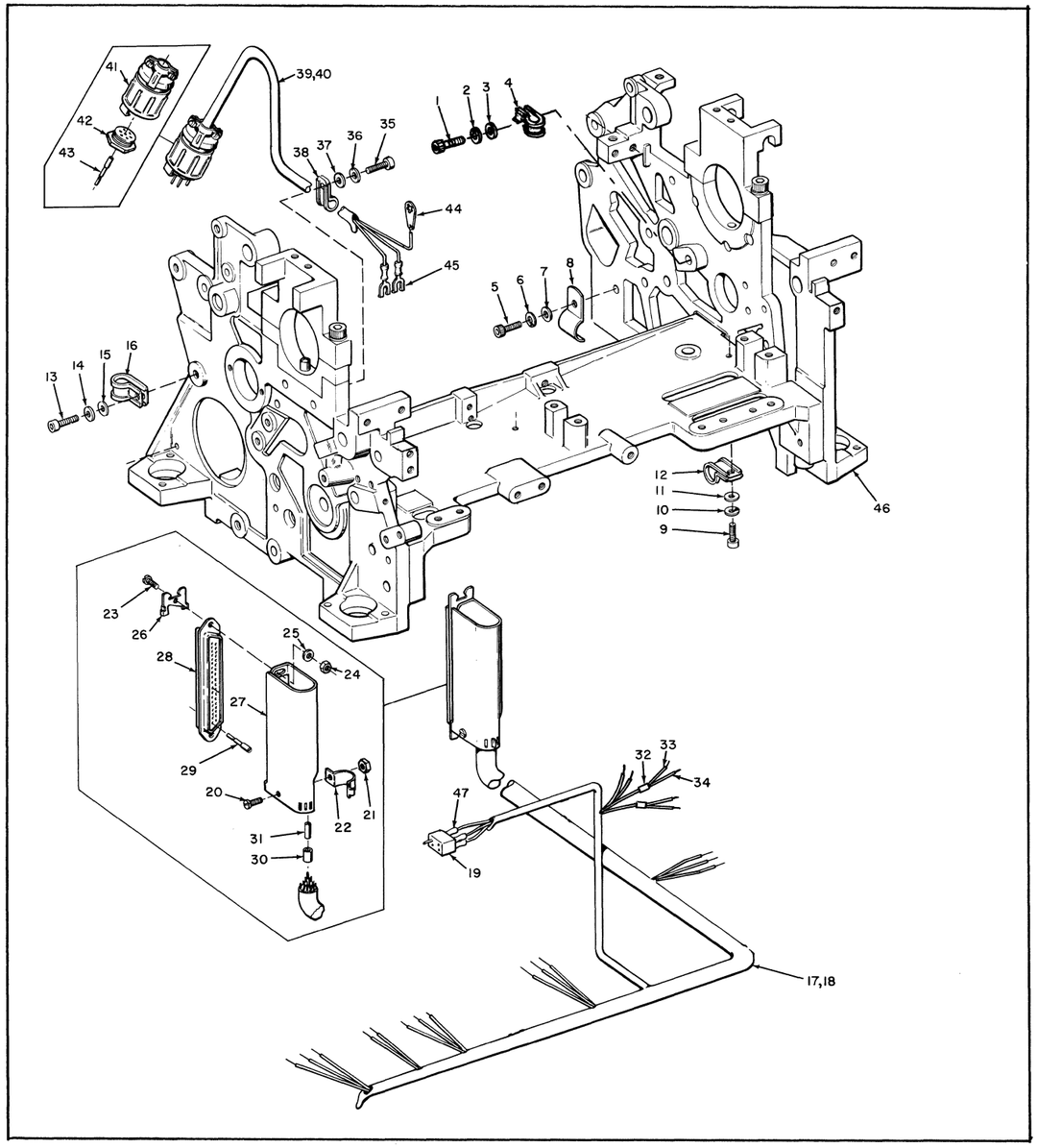


Figure 4D-31. Frame assembly and cable assemblies.

Legend to Figure 4D-31. Frame assembly and cable assemblies.

Item	Quantity	Description	Part No.
1	1	Screw	10004
2	2	Lockwasher	10429
3	1	Flat washer	10450
4	1	Cable clamp	20542
5	1	Screw	10004
6	1	Lockwasher	10429
7	1	Flat washer	10450
8	1	Cable clamp	20548
9	1	Screw	10004
10	1	Lockwasher	10429
11	1	Flat washer	10450
12	1	Cable clamp	20541
13	1	Screw	10004
14	1	Lockwasher	10429
15	1	Flat washer	10450
16	1	Cable clamp	20555
17	1	Cable assembly (complete)	67708
18	1	Cable (less hardware)	67709
19	1	Plug, polarized	23261
20	1	Screw	12335
21	1	Nut	10540
22	1	Clamp	66491
23	2	Screw	12335
24	2	Nut	56182
25	2	Lockwasher	10432
26	2	Lock	11172
27	1	Hood	66471
28	1	Connector body (P7)	23141
29	25	Contact	20178
30	4	Outer shield connector	23192
31	2	Inner shield connector	23193
32	8	Tubing	20754-00.50
33	8	Male contact	23117
34 *	4	Jumper wire	See chart below
35	1	Screw	10004
36	1	Lockwasher	10429
37	1	Flat washer	10450
38	1	Cable clamp	20558
39	1	Cable assembly (complete)	66690
40	1	Cable (less hardware)	66876
41	1	Shield	23135
42	1	Connector body (P5)	23148
43	3	Contact	23131
44	1	Terminal lug	20705
45	2	Terminal lug	21045
46	1	Frame assembly	65800
47	4	Tubing	23701-00.40

Color	Quantity	Length	Part Number
Red	1	3-1/2 inches	22222-03.42
Red	1	1-1/2 inches	22222-01.42
Black	1	4 inches	22200-04.02
Black	1	1-1/2 inches	22200-01.42

99129A-09

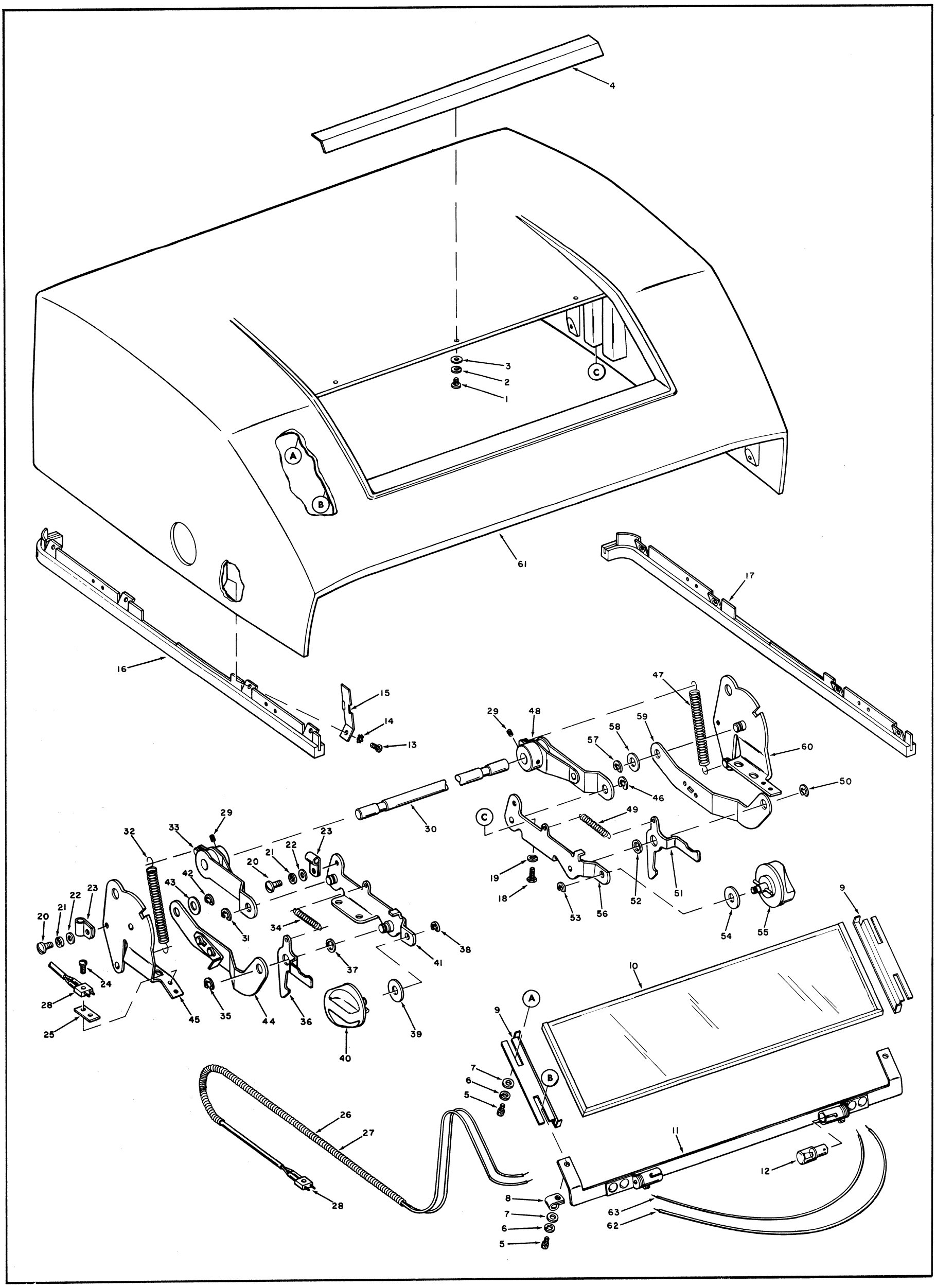


Figure 4D-32. Dust cover assembly, exploded view.

Legend to Figure 4D-32. Dust cover assembly, exploded view. *

Item	Quantity	Description	Part No.
1	3	Screw	12375
2	3	Lockwasher	10432
3	3	Flat washer	10490
4	1	Paper deflector	66047
5	3	Screw (5/16-inch long)	10003
	1	Screw (3/8-inch long)	10004
6	4	Lockwasher	10415
7	4	Flat washer	10450
8	1	Cable clamp	20538
9	2	Window bracket	66560
10	1	Window	65946
11	1	Copy light bracket (includes items 62 and 63)	66053
12	2	Copy lamp	23274
13	8	Screw	10375
14	8	Lockwasher	12408
15	1	Cable clip	66559
16	1	Seal	66511
17	1	Seal	66512
18	4	Screw	10399
19	4	Lockwasher	10426
	4	Flat washer	10467
20	2	Screw	10393
21	2	Lockwasher	10415
22	2	Flat washer	10450
23	2	Cable clamp	20517
24	2	Screw	11807
25	1	Insulator	66969
26	1	Cable assembly (complete)	66565
27	1	Cable spring shield	66558
28	1	Male connector	23190
29	4	Setscrew	10210
30	1	Hinge shaft	66507
31	1	Retaining ring	12957
32	1	Spring	66566
33	1	Arm	66534
34	1	Spring	66567
35	1	Retaining ring	12957
36	1	Latch	66540
37	1	Washer	59563
38	1	Retaining ring	12949
39	1	Spacer	67882
40	1	Knob	66608
41	1	Bracket	66530
42	1	Retaining ring	12957
43	1	Washer	59563
44	1	Arm	66494
45	1	Bracket	66501
46	1	Retaining ring	12957
47	1	Spring	66566
48	1	Arm	66534
49	1	Spring	66567
50	1	Retaining ring	12957
51	1	Latch	66539
52	1	Washer	59563
53	1	Retaining ring	12949
54	1	Spacer	67882
55	1	Knob	66608

Legend to Figure 4D-32. Dust cover assembly, exploded view (continued). *

Item	Quantity	Description	Part No.
56	1	Bracket	66529
57	1	Retaining ring	12957
58	1	Washer	59563
59	1	Arm	66527
60	1	Bracket	66503
61	1	Cover	*
62	1	Wire (part of item 11)	
63	1	Wire (part of item 11)	

*Note: When ordering this part, specify model serial number, see nameplate located (under dust cover) on left side of base frame.

99129A-09

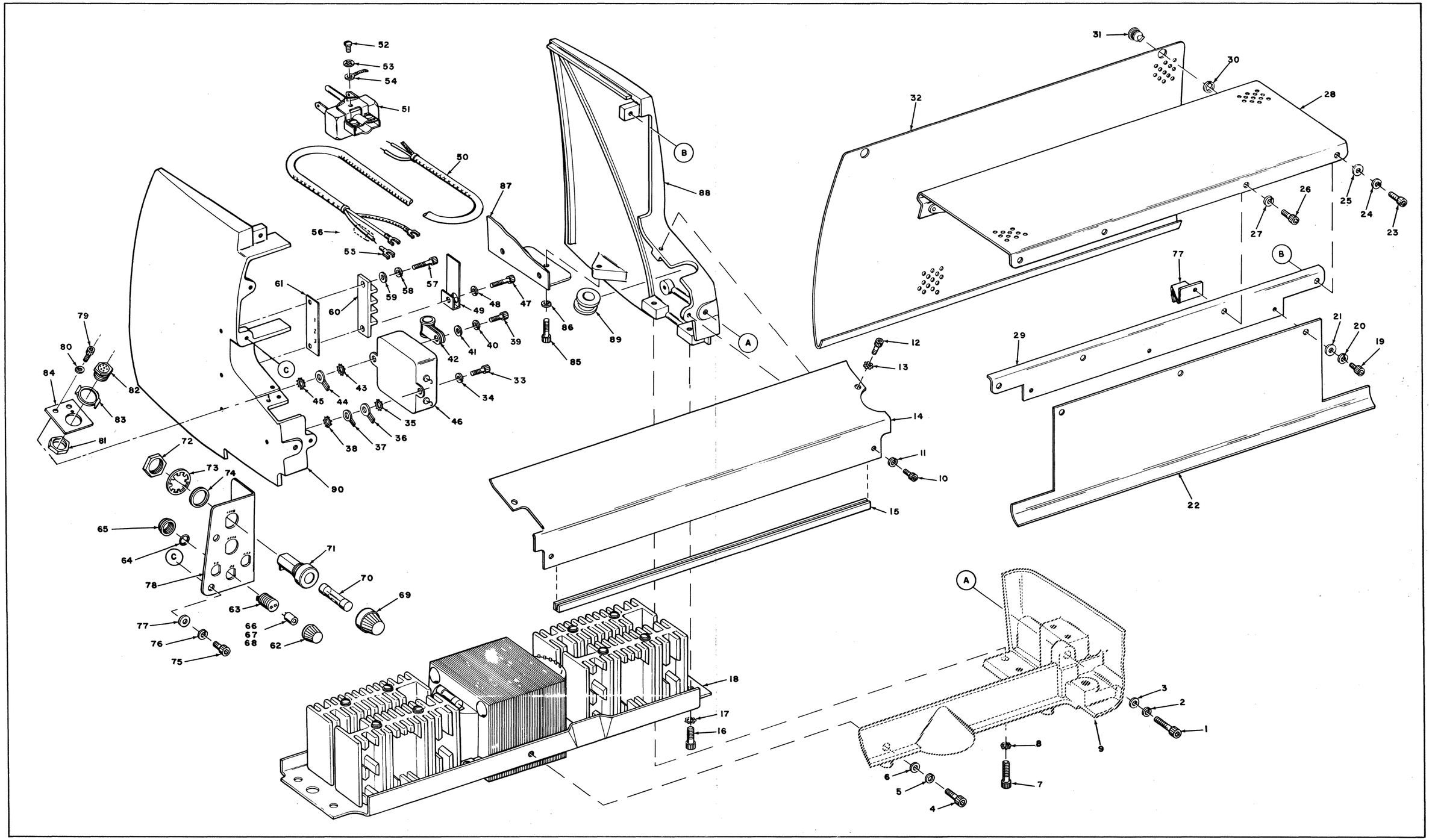


Figure 4D-35. Electronic unit assembly, exploded view.

Legend to Figure 4D-35. Electronic unit assembly, exploded view.

Item	Quantity	Description	Part No.
1	2	Screw	10035
2	2	Lockwasher	10431
3	2	Flat washer	10481
4	1	Screw	11221
5	1	Lockwasher	10431
6	1	Flat washer	10481
7	2	Screw	11221
8	2	Lockwasher	10406
9	1	Base (Ref) (fig. 4D-41)	
10	2	Screw	10055
11	2	Lockwasher	12403
12	2	Screw	10055
13	2	Lockwasher	10406
14	1	Cover (includes item 15)	66668
15	1	Rubber channel	66667
16	2	Screw	10024-01
17	2	Lockwasher	10406
18	1	Power supply assembly (fig. 4D-39)	66600
19	3	Screw	12393
20	3	Lockwasher	10429
21	3	Flat washer	10450
22	1	Cover	66484
23	2	Screw	10004
24	2	Lockwasher	10429
25	2	Flat washer	10450
26	2	Screw	12393
27	2	Lockwasher	10429
28	1	Cover	66589
29	1	Bracket	66468
30	2	Ring (part of item 31)	
31	2	Stud lock (includes item 30)	23571
32	1	Cover (complete)	66583
33	1	Screw	10004
34	1	Lockwasher	10429
35	1	Lockwasher	12403
36	1	Terminal lug (part of cable assembly 66976 - fig. 4G-6)	20705
37	1	Jumper assembly (comprising lug 20705, lug 20951, and wire 22211-03.02)	
38	1	Lockwasher	12403
39	1	Screw	10005
40	1	Lockwasher	10429
41	1	Flat washer	10450
42	1	Cable clamp	20514
43	1	Lockwasher	12403
44	1	Jumper assembly, comprising lug 20705, lug 20951, and wire 22211-03.02	
45	1	Lockwasher	12403
46	1	Filter	54568
47	1	Screw	10005
48	1	Lockwasher	10429
49	1	Cover	66588
50	1	Cable assembly (includes items 51 through 56)	66689
51	1	Plug (includes item 52)	20422
52	1	Screw (part of item 51)	
53	1	Lockwasher (part of item 50)	10403
54	1	Terminal lug (part of item 50)	20708

99129A-09

Legend to Figure 4D-35. Electronic unit assembly, exploded view (continued).

Item	Quantity	Description	Part No.
55	3	Terminal lug (part of item 50)	23609
56	1	Tubing (part of item 50)	20837-02.60
57	1	Screw	10005
58	1	Lockwasher	10429
59	1	Flat washer	10457
60	1	Terminal strip TB2	23612
61	1	Designation strip	67341
62	3	Cap (part of item 63)	
63	3	Fuseholder (includes items 62, 64, and 65)	23508
64	3	Ring (part of item 63)	
65	3	Nut (part of item 63)	
66	1	Fuse, 3/4 amp.	23514
67	1	Fuse, 1-1/2 amp.	23510
68	1	Fuse, 2 amp.	23509
69	2	Cap (part of item 71)	
70	2	Fuse, 4 amp.	20456
71	2	Fuseholder (includes items 69, 72, 73, and 74)	20458
72	2	Nut (part of item 71)	
73	2	Lockwasher (part of item 71)	
74	2	Ring (part of item 71)	
75	2	Screw	10003
76	2	Lockwasher	10429
77	2	Flat washer	10450
78	1	Bracket	66892
79	2	Screw	10003
80	2	Lockwasher	10429
81	1	Nut	10846
82	1	Connector, female	23149
83	1	Locking ring	23223
	3	Locking ring	23132
84	1	Bracket	66650
85	2	Screw	10017
86	2	Lockwasher	10431
87	1	P.W. board frame (fig. 4D-37)	66605
88	1	Right end cover	*
89	1	Grommet	21021
90	1	Left end cover	*

*Note: When ordering this part, specify model serial number, see nameplate located (under dust cover) on left side of base frame.

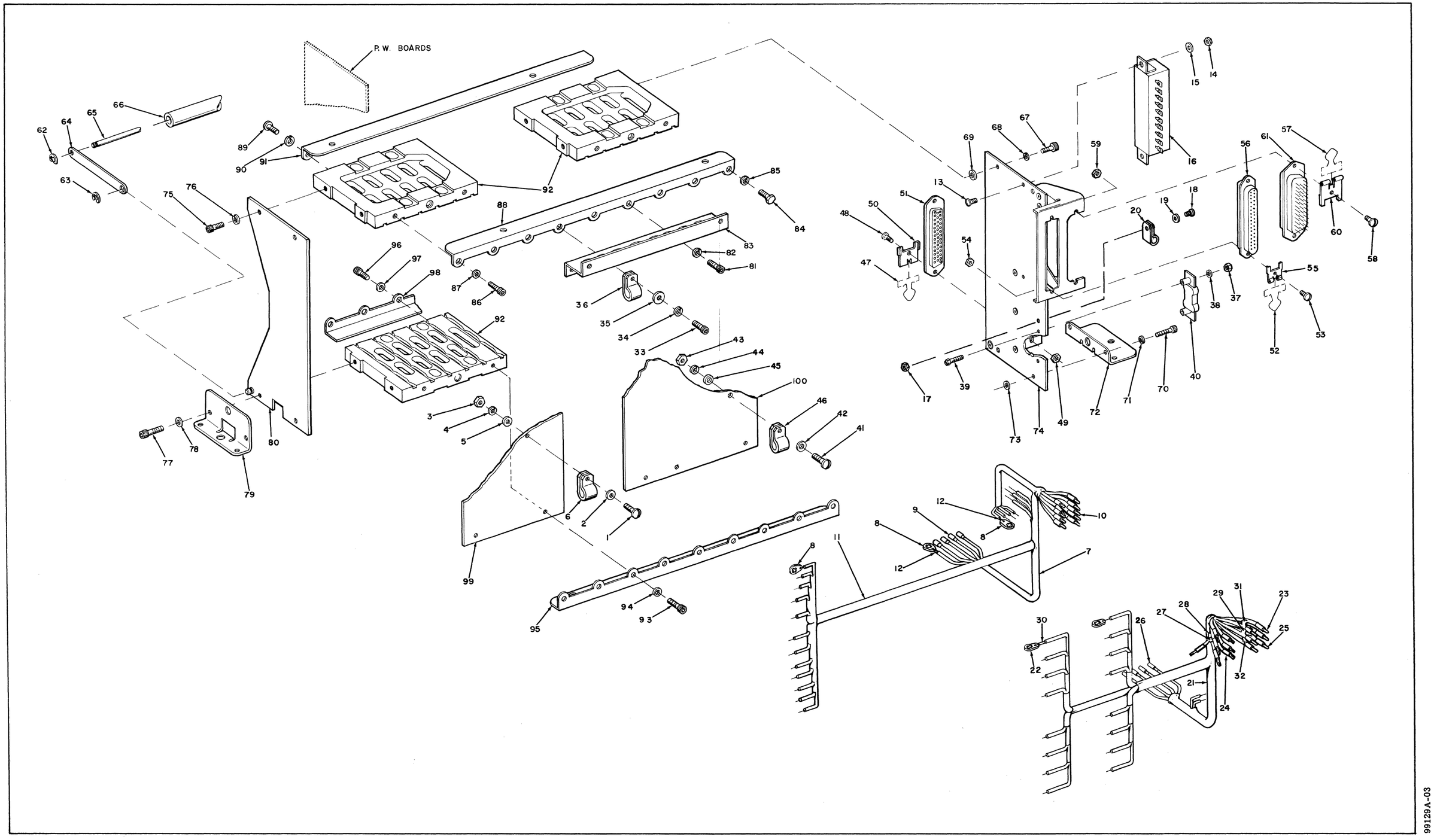


Figure 4D-37. Printed wiring boards frame assembly, exploded view.

Legend to Figure 4D-37. Printed wiring boards frame assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Machine screw	10365
2	1	Flat washer	10450
3	1	Hexagonal nut	10500
4 *	1	Lockwasher	10415
5 *	1	Flat washer	58181
6	1	Cable clamp	20556
7 *	1	Cable assembly (includes items 9, 10, and 11)	67826
8 *	-	Terminal	20795
9 *	13	Female contact	23130
10 *	2	Male contact	23117
	13	Male contact	21078
11 *	1	Tubing	20814-09.60
12 *	-	Tubing	20754-01.60
13 *	2	Machine screw	10306
14 *	2	Hexagonal nut	10512
15 *	2	Lockwasher	10415
16 *	1	Filter	24406
17 *	1	Self-locking hexagonal nut	10500
18 *	1	Machine screw	10114
19 *	1	Plain washer	65669
20 *	1	Cable clamp	20567
21 **	1	Cable assembly (includes items 22 through 32)	67822
22	1	Terminal #6	20705
23	10	Male contact	21078
24	36	Female contact	23130
25	12	Male contact, 2-wire	23117
26	11	Female contact, 2-wire	23116
27	8	Connector, outer	23192
28	8	Connector, inner	23193
29	-	Wire jumper	See chart below
30	1	Tubing	20754-02.40
31	-	Wire jumper	See chart below
32	-	Wire jumper	See chart below
33	1	Machine screw	10005
34	1	Lockwasher	10429
35	1	Plain washer	10450
36	1	Cable clamp	20557
37	2	Hexagonal nut	10517
38	2	Lockwasher	10432
39	2	Machine screw	11231
40	1	Resistor	23466
41	1	Machine screw	10365
42	1	Plain washer	10450
43	1	Hexagonal nut	10500
44 *	1	Lockwasher	10415
45 *	1	Flat washer	58181
46	1	Cable clamp	20562
47	2	Spring clip	11170
48	2	Machine screw	10375
49	2	Hexagonal nut	10540
50	2	Latch	23280
51	1	Connector J2	23141
52	2	Spring clip	11170
53	2	Machine screw	12335
54	2	Hexagonal nut	10540
55	2	Latch	11171
56	1	Connector J7	23189

99129A-13

Legend to Figure 4D-37. Printed wiring boards frame assembly, exploded view (continued).

Item	Quantity	Description	Part No.
57	2	Spring clip	11170
58	2	Machine screw	12335
59	2	Hexagonal nut	10540
60	2	Latch	23280
61	1	Connector J4	23118
62	2	Retaining ring	12960
63	2	Retaining ring	10949
64	2	Link	66553
65	1	Rod	66554
66	1	Bumper	66552
67	2	Machine screw	10004
68	2	Lockwasher	10429
69	2	Plain washer	10467
70	2	Machine screw	10005
71	2	Lockwasher	10429
72	1	Bracket	66522
73	2	Plain washer	10467
74	1	Plate assembly	66595
75	2	Machine screw	10004
76	2	Lockwasher	10429
77	2	Machine screw	10005
78	2	Lockwasher	10429
79	1	Bracket	66522
80	1	Plate assembly	66569
81	3	Machine screw	10005
82	3	Lockwasher	10429
83	1	Bracket	66487
84	1	Machine screw	10090
85	1	Lockwasher	10429
86	1	Machine screw	10005
87	1	Lockwasher	10429
88	1	Mounting bracket	66483
89	6	Machine screw	10357
90	6	Lockwasher	10429
91	1	Mounting bracket	66483
92	6	Guide	65175
93	6	Machine screw	10005
94	6	Lockwasher	10429
95	1	Mounting bracket	66483
96	6	Machine screw	10357
97	6	Lockwasher	10429
98	1	Mounting bracket	66483
99	1	Keyboard mother board (part of item 100)	
100	1	Printer mother board	***

*Note 1: Not applicable to this model of 311.

**Note 2: Listed below are the part numbers of the jumper wires used in this cable assembly. Do not disassemble the jumper wires without good reason. If disassembly becomes necessary, carefully note the locations of the individual jumper wires.

Color	Quantity	Part Number
Blue	1	22266-02.42
Red	4	22222-01.62
Brown	4	22211-03.02 (3-inches)
Brown	2	22211-02.22 (2-1/4 inches)
Black	2	22200-01.42

***Note 3: When ordering this part, specify model serial number, see nameplate located (under dust cover) on left side of base frame.

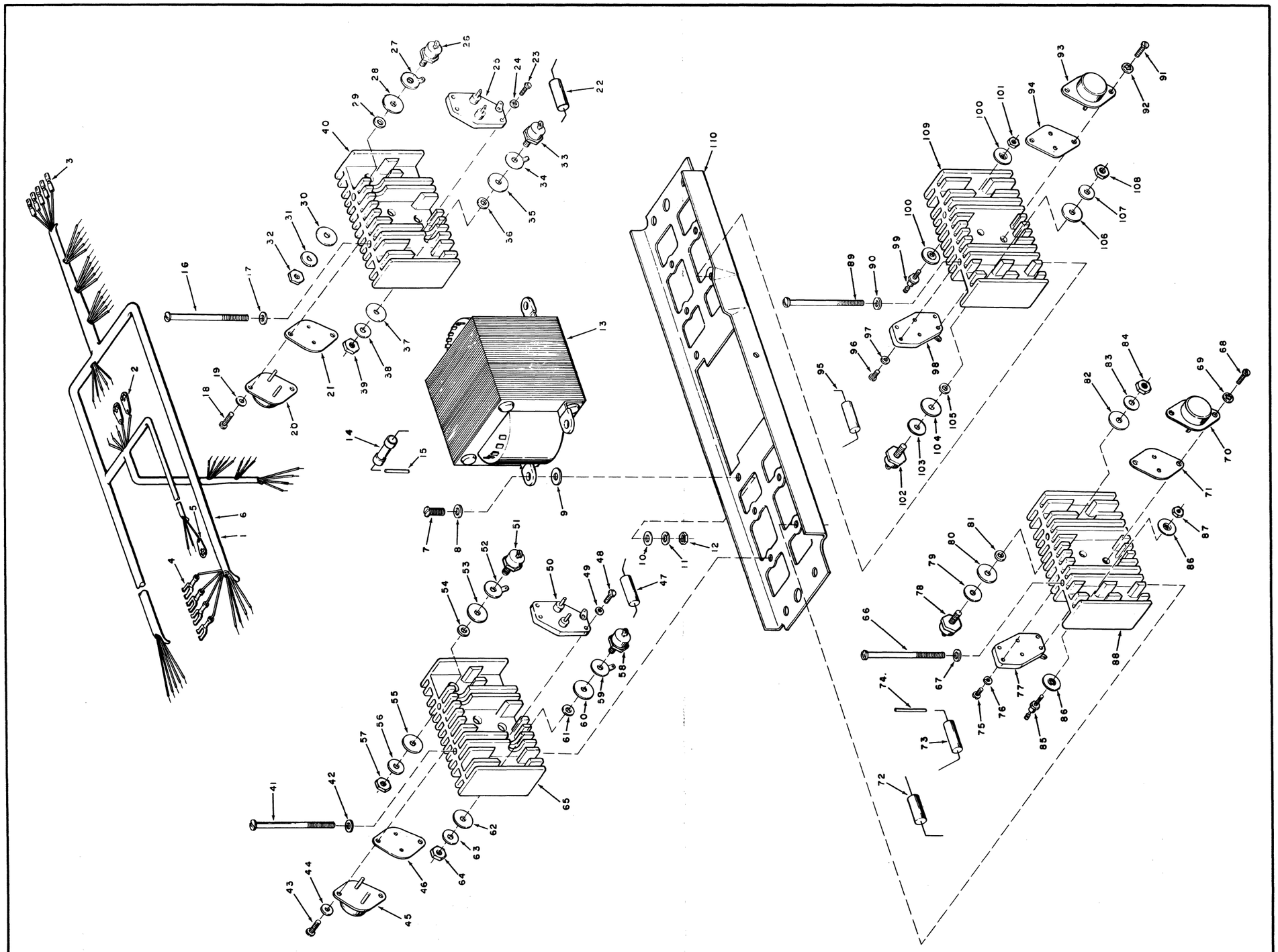


Figure 4D-39. Power supply assembly, exploded view.

Legend to Figure 4D-39. Power supply assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Harness assembly	67833
2	1	Harness assembly	67373
3	2	Terminal lug	20612
4	2	Terminal lug	20795
5	2	Terminal lug	20712
6	2	Terminal lug	20712
7	2	Terminal lug	20612
8	1	Terminal lug	67374
9	4	Machine screw	10006
10	4	Plain washer	10459
11	4	Nut	10512
12	4	Lockwasher	10415
13	1	Terminal strip	23613
14	2	Machine screw	10365
15	2	Plain washer	10459
16	2	Nut	10512
17	2	Spacer	53602
18	1	Capacitor	20218
19	3	Nut	10517
20	3	Plain washer	20854
21	1	Relay	23168
22	4	Machine screw	10005
23	4	Nut	10512
24	2	Lockwasher	10415
25	2	Receptacle	11907
26	4	Screw	10024
27	4	Lockwasher	10438
28	4	Plain washer	10481
29	4	Plain washer	10454
30	1	Transformer	66669
31	1	Capacitor	23433
32	2	Tubing	20733-0050
33	6	Screw	10004
34	6	Lockwasher	10415
35	6	Plain washer	10459
36	3	Screw	10395
37	3	Nut	10512
38	3	Mounting clamp	11174
39	3	Screw	10419
40	3	Lockwasher	10405
41	1	Capacitor	23418
42	1	Capacitor	23419
43	1	Capacitor	23420
44	4	Machine screw	10013
45	4	Lockwasher	10430
46	4	Plain washer	10454
47	2	Mounting block	67370
48	4	Screw	10003
49	4	Lockwasher	10415
50	4	Washer	10459
51	2	Support	67417
52	4	Screw	10003
53	2	Lockwasher	10415
54	2	Plain washer	10459
55	1	Relay mounting bracket	67419
56	2	Screw	10003
57	2	Lockwasher	10415
58	2	Plain washer	10459

99129A-04

Legend to Figure 4D-39. Power supply assembly, exploded view.

Item	Quantity	Description	Part No.
1	1	Cable assembly (Complete)	66976
2	2	Terminal lug	20807
3	12	Contact, female	23130
4	4	Terminal lug	20712
5	1	Terminal lug	20795
6	1	Cable (Less hardware)	66977
7	4	Screw	10104
8	4	Flat washer	10467
9	4	Spacer	51310
10	4	Flat washer	10467
11	4	Lockwasher	10430
12	4	Nut	10515
13	1	Transformer, T1	66669
14	1	Capacitor, C5	23433
15	2	Plastic tubing	20733-00.50
16	4	Screw	12143
17	4	Lockwasher	10430
18	2	Screw	11753
19	2	Lockwasher	12403
20	1	Transistor Q2 (includes item 21)	23313
21	1	Mica washer (Part of item 20)	
22	1	Resistor, R3	23002-3000
23	2	Screw	10140
24	2	Lockwasher	10433
25	1	Socket	20290
26	2	Diode, CR3 and CR4 (includes items 27, 28, 29, 30, 31, and 32)	23288
27	2	Terminal washer (Part of item 26)	
28	2	Mica washer (Part of item 26)	
29	2	Spacer (Part of item 26)	
30	2	Mica washer (Part of item 26)	
31	2	Flat washer (Part of item 26)	
32	2	Nut (Part of item 26)	
33	1	Diode, CR8 (includes items 34, 35, 36, 37, 38, and 39)	23267
34	1	Terminal washer (Part of item 33)	
35	1	Mica washer (Part of item 33)	
36	1	Spacer (Part of item 33)	
37	1	Mica washer (Part of item 33)	
38	1	Flat washer (Part of item 33)	
39	1	Nut (Part of item 33)	
40	1	Heat sink (includes items 18 thru 39)	66599
41	2	Screw	12143
42	2	Lockwasher	10430
43	2	Screw	11753
44	2	Lockwasher	12403
45	1	Transistor, Q1 (includes item 46)	23314
46	1	Mica washer (Part of item 45)	
47	1	Resistor, R4	23002-3000
48	2	Screw	10140
49	2	Lockwasher	10433
50	1	Socket	20290
51	2	Diode, CR5 and CR6 (includes items 52, 53, 54, 55, 56, and 57)	23288
52	2	Terminal washer (Part of item 51)	
53	2	Mica washer (Part of item 51)	
54	2	Spacer (Part of item 51)	
55	2	Mica washer (Part of item 51)	

Legend to Figure 4D-39. Power supply assembly, exploded view (continued).

Item	Quantity	Description	Part No.
56	2	Flat washer (Part of item 51)	
57	2	Nut (Part of item 51)	
58	1	Diode, CR9 (includes items 59, 60, 61, 62, 63, and 64)	23287
59	1	Terminal washer (Part of item 58)	
60	1	Mica washer (Part of item 58)	
61	1	Spacer (Part of item 58)	
62	1	Mica washer (Part of item 58)	
63	1	Flat washer (Part of item 58)	
64	1	Nut (Part of item 58)	
65	1	Heat sink (includes items 43 thru 64)	66602
66	2	Screw	12143
67	2	Lockwasher	10430
68	2	Screw	11753
69	2	Lockwasher	12403
70	1	Transistor, Q3 (includes item 71)	23313
71	1	Mica washer (Part of item 70)	
72	1	Resistor, R2	23002-2210
73	1	Capacitor, C4	23727
74	2	Plastic tube	20741-00.50
75	2	Screw	10140
76	2	Lockwasher	10433
77	1	Socket	20290
78	1	Diode, CR7 (includes items 79, 80, 81, 82, 83, and 84)	23296
79	1	Terminal washer (Part of item 78)	
80	1	Mica washer (Part of item 78)	
81	1	Spacer (Part of item 78)	
82	1	Mica washer (Part of item 78)	
83	1	Flat washer (Part of item 78)	
84	1	Nut (Part of item 78)	
85	1	Terminal post	20604
86	2	Washer, finish	57311
87	1	Nut	10517
88	1	Heat sink (includes items 68 thru 87)	66601
89	2	Screw	12143
90	2	Lockwasher	10430
91	2	Screw	11753
92	2	Lockwasher	12403
93	1	Transistor, Q4 (includes item 94)	23313
94	1	Mica washer (Part of item 93)	
95	1	Resistor, R1	23001-4710
96	2	Screw	10140
97	2	Lockwasher	10433
98	1	Socket	20290
99	1	Terminal post	20604
100	2	Washer, finish	57311
101	1	Nut	10517
102	2	Diode, CR1 and CR2 (includes items 103, 104, 105, 106, 107, and 108)	23288
103	2	Terminal washer (Part of item 102)	
104	2	Mica washer (Part of item 102)	
105	2	Spacer (Part of item 102)	
106	2	Mica washer (Part of item 102)	
107	2	Flat washer (Part of item 102)	
108	2	Nut (Part of item 102)	
109	1	Heat sink (includes items 91 thru 108)	66598
110	1	Base	66597

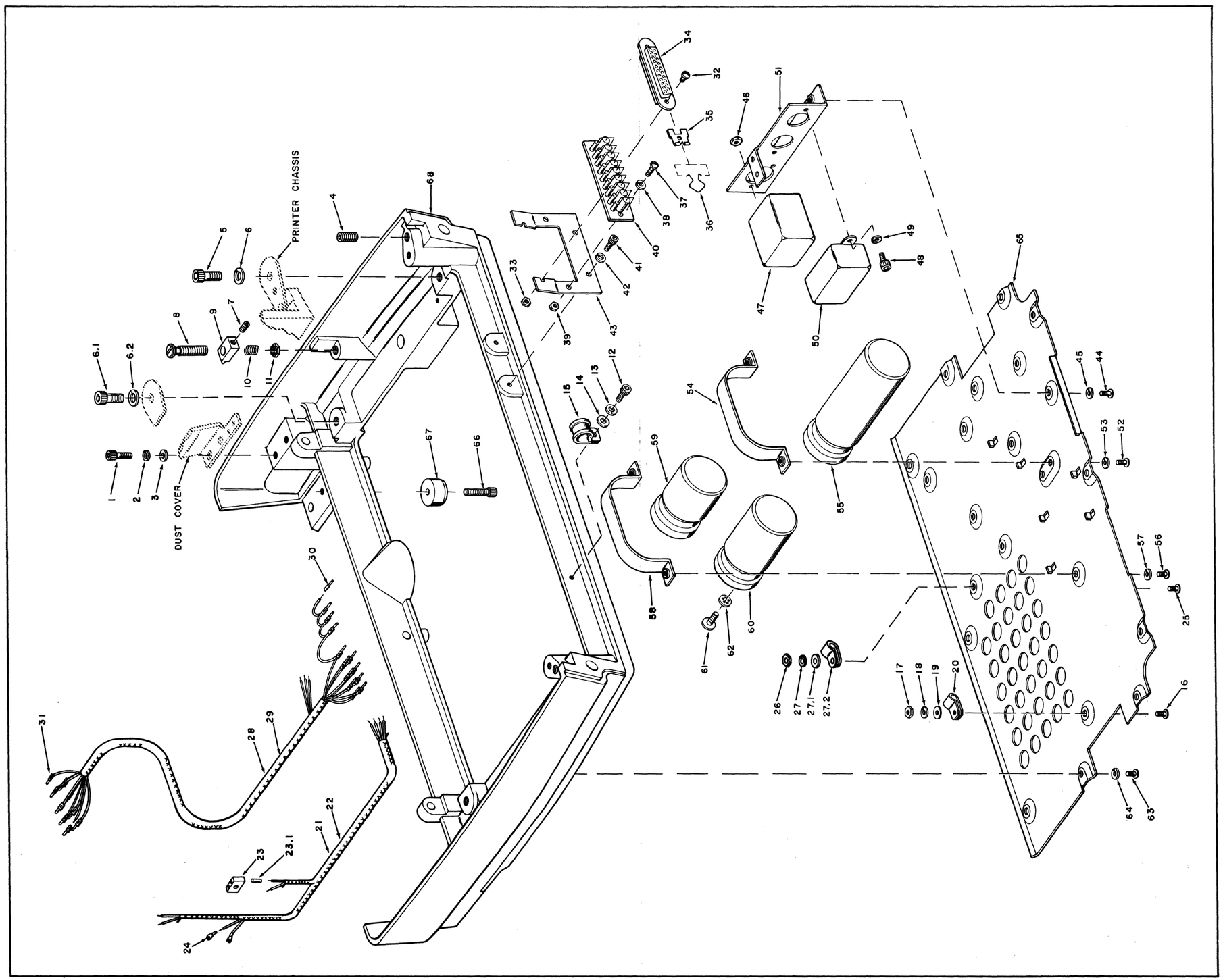


Figure 4D-41. Base assembly, exploded view.

Legend to Figure 4D-41. Base assembly, exploded view.

Item	Quantity	Description	Part No.
1	4	Screw	10024
2	4	Lockwasher	10431
3	4	Flat washer	10481
4	2	Setscrew	11160
5	3	Screw	11254
6	3	Lockwasher	10400
6.1	1	Screw	10019
6.2	1	Lockwasher	10427
7	2	Setscrew	10210
8	2	Stud	66531
9	2	Latch	66504
10	2	Spring	66545
11	2	Nut	66505
12	1	Screw	10004
13	1	Lockwasher	10429
14	1	Flat washer	10450
15	1	Cable clamp	20541
16	1	Screw	10187
17	1	Nut	10512
18	1	Lockwasher	10429
19	1	Flat washer	10450
20	1	Cable clamp	20558
21	1	Copy light cable assembly (complete)	66691
22	1	Cable (less hardware)	66877
23	1	Connector, female, J31	23191
23.1	2	Tubing	20732-01.00
24	2	Terminal lug	20951
25 *	2	Screw	12106
26 *	2	Nut	10512
27 *	1	Lockwasher	10429
27.1 *	1	Washer	10450
27.2 *	1	Cable clamp	20564
28 *	1	Cable (complete)	98096-1-081
29 *	1	Cable (less hardware)	98096-1-080
30 *	6	Contact, female	23116
31 *	24	Contact, female	23130
32 *	2	Screw	10375
33 *	2	Nut	10540
34 *	1	Connector, J4	23128
35 *	2	Latch	11171
36 *	2	Spring clip	11170
37 *	2	Screw	10357
38 *	2	Lockwasher	10454
39 *	2	Nut	10540
40 *	1	Board assembly, suppression, FL5	98056-1-314
41 *	2	Screw	10003
42 *	2	Lockwasher	10429
43 *	1	Mounting bracket	66477
44	2	Screw	12106
45	2	Lockwasher	10429
46	3	Nut	10540
47	1	Relay, K5	23168
48	2	Screw	10001
49	2	Lockwasher	10415
50	1	Capacitor, C7	20218
51	1	Mounting bracket	66995
52	2	Screw	12106

99129A-09

Legend to Figure 4D-41. Base assembly, exploded view (continued).

Item	Quantity	Description	Part No.
53	2	Lockwasher	10429
54	1	Clamp	66547
55	1	Capacitor, C1	23418
56	2	Screw	12106
57	2	Lockwasher	10429
58	1	Clamp	66547
59	1	Capacitor, C3	23419
60	1	Capacitor, C2	23420
61	6	Screw	12122
62	6	Lockwasher	10405
63	10	Screw	12106
64	10	Lockwasher	10429
65	1	Cover	66516
66	4	Screw	10011
67	4	Foot	23585
68	1	Base	***

* Note 1. Not applicable to Receive Only equipment.

*** Note 3. When ordering this part specify Model Serial Number (90443-xx-xx) - See nameplate located (under dust cover) on left side of base frame.

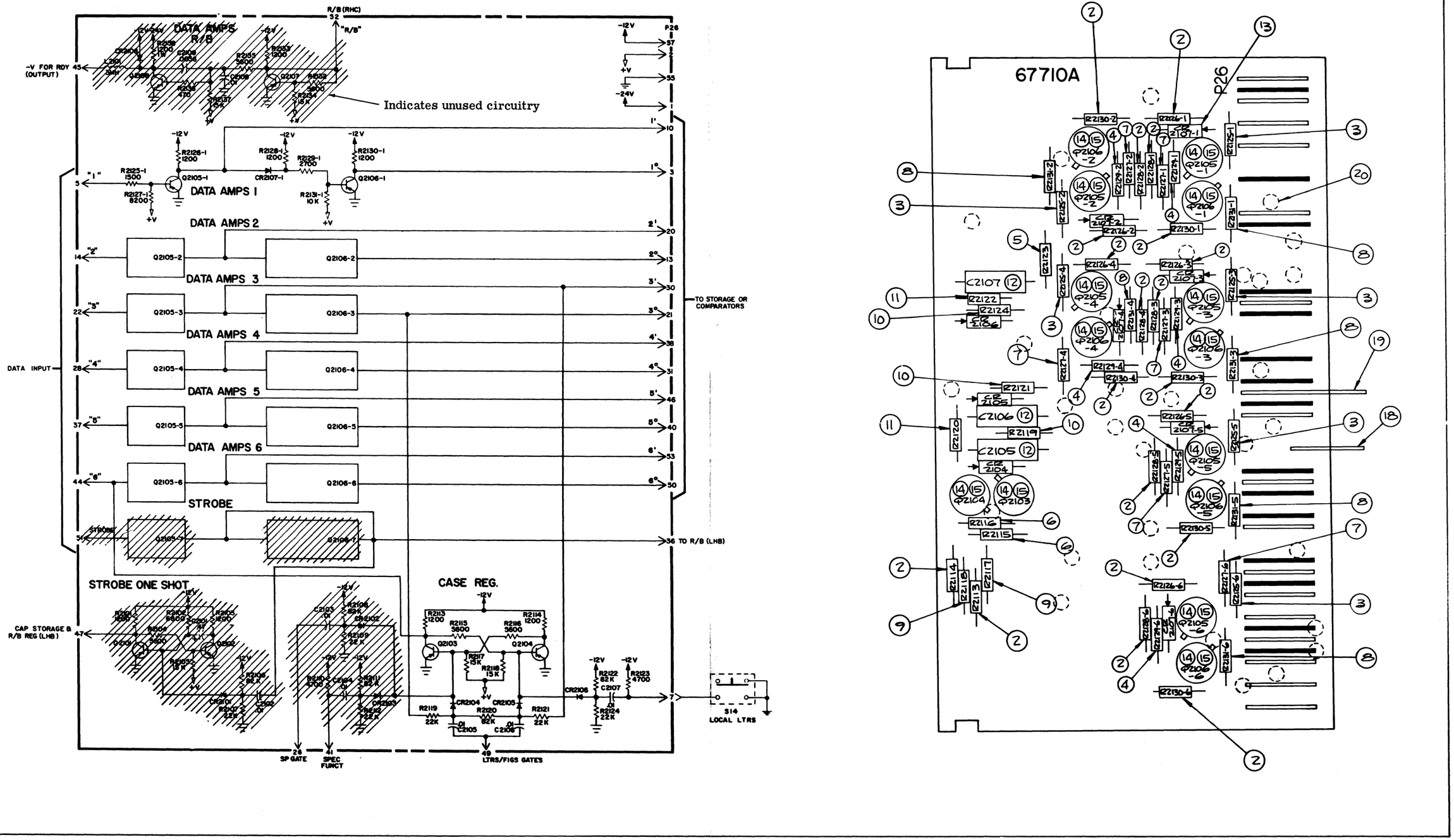
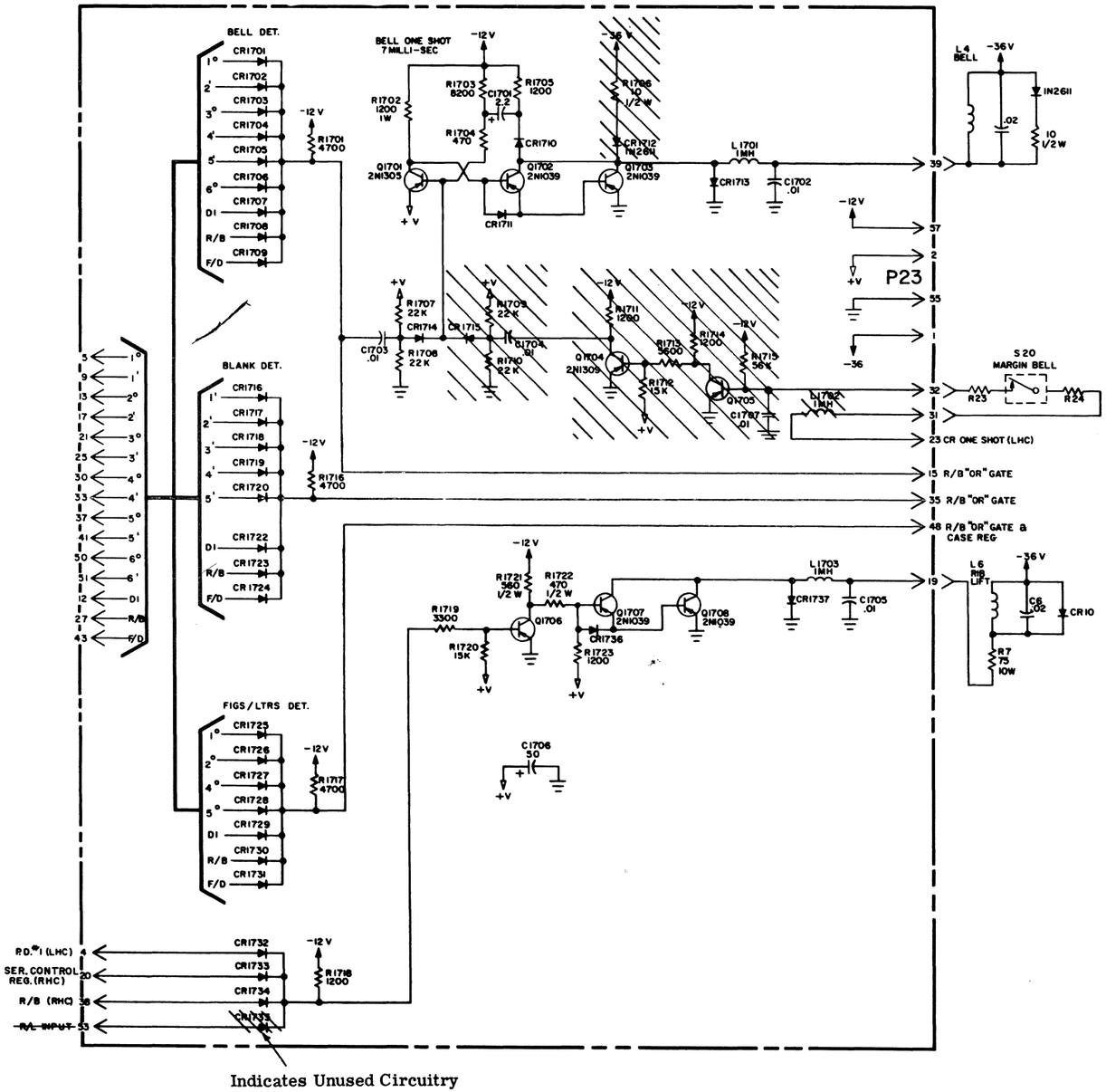


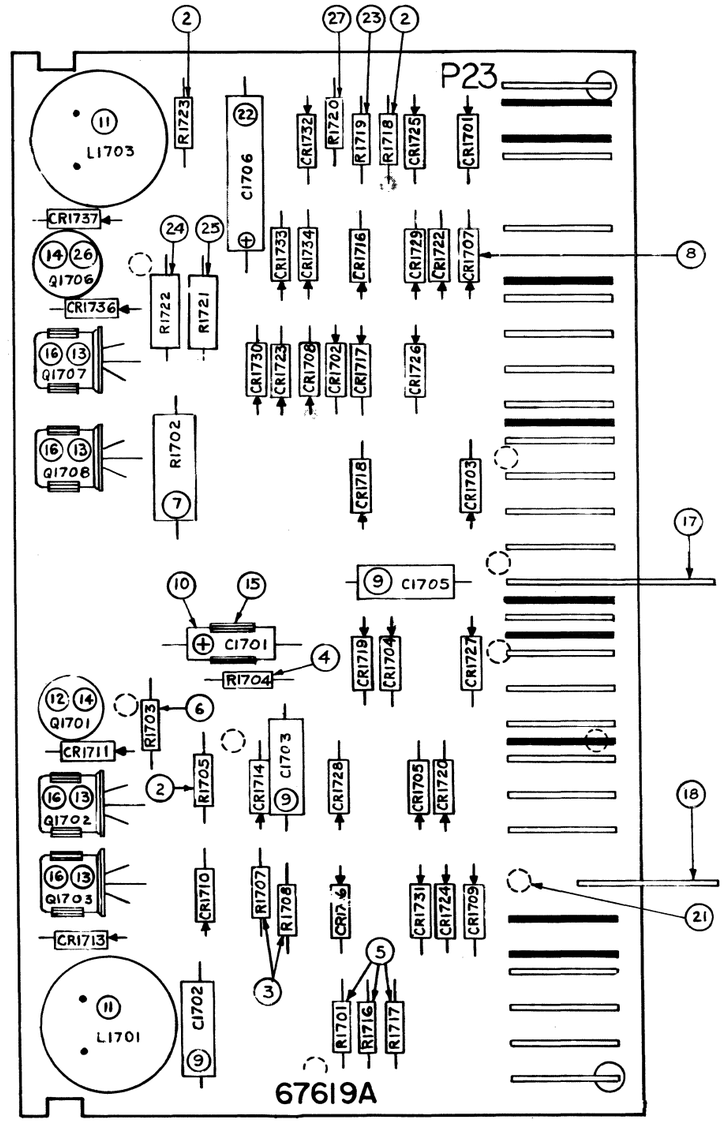
Figure 4D-44. Interface input. (67710, Issue D)

Legend to Figure 4D-44. Interface input.
(67710, Issue D).

Item	Quantity	Description	Part No.
1	-	-	-
2	20	Resistor	23004-1220
3	6	Resistor	23004-1520
4	6	Resistor	23004-2720
5	1	Resistor	23004-4720
6	2	Resistor	23004-5620
7	6	Resistor	23004-8220
8	6	Resistor	23004-1030
9	2	Resistor	23004-1530
10	3	Resistor	23004-2230
11	2	Resistor	23004-8230
12	3	Capacitor	23427
13	9	Diode	23291
14	14	Mount, Transistor	23208
15	14	Transistor	23302
16	-	-	-
17	-	-	-
18	1	Pin, Polarizing	66224
19	1	Pin, Alinement	66882
20	31	Wire, Feed Through	20659-00.00

99129A-07





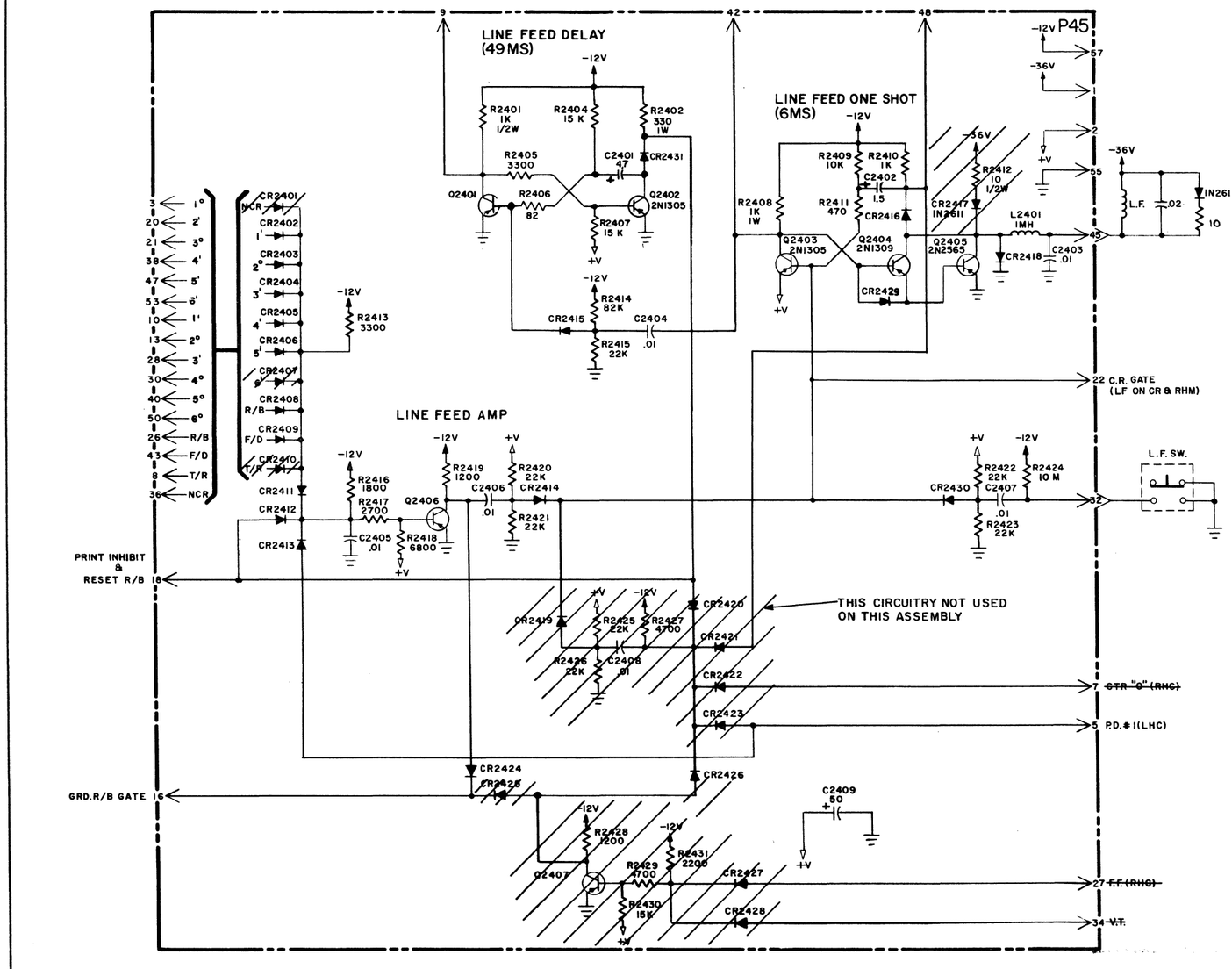
99129A-13

Figure 4D-45. Ribbon lift and miscellaneous functions. (67619A, Issue H)

Legend to Figure 4D-45. Ribbon lift and miscellaneous functions.
(67619A, Issue H)

Item	Quantity	Description	Part No.
1	-	-	-
2	3	Resistor	23004-1220
3	2	Resistor	23004-2230
4	1	Resistor	23004-4710
5	3	Resistor	23004-4720
6	1	Resistor	23004-8220
7	1	Resistor	23001-1220
8	33	Diode	23291
9	3	Capacitor	23427
10	1	Capacitor	23436
11	2	Filter	67717
12	1	Transistor	23305
13	4	Transistor	23315
14	2	Mount, Transistor	23208
15	1	Clip, Cradle	23279
16	4	Clip, Cradle	23278
17	1	Pin, Alinement	66882
18	1	Pin, Polarizing	66224
19	-	-	-
20	-	-	-
21	9	Wire, Feed Through	20659-00.00
22	1	Capacitor	23727
23	1	Resistor	23004-3320
24	1	Resistor	23000-4710
25	1	Resistor	23000-5610
26	1	Transistor	23302
27	1	Resistor	23004-1530

99129A-13



99128A-09

Figure 4D-46. Line feed detector and driver. (67577A, Issue F)

Legend to Figure 4D-46. Line feed detector and driver.
(67577A, Issue F)

Item	Quantity	Description	Part No.
1	-	-	-
2	5	Diode	23291
3	4	Wire, Feed Through	20659-00.00

99129A-09

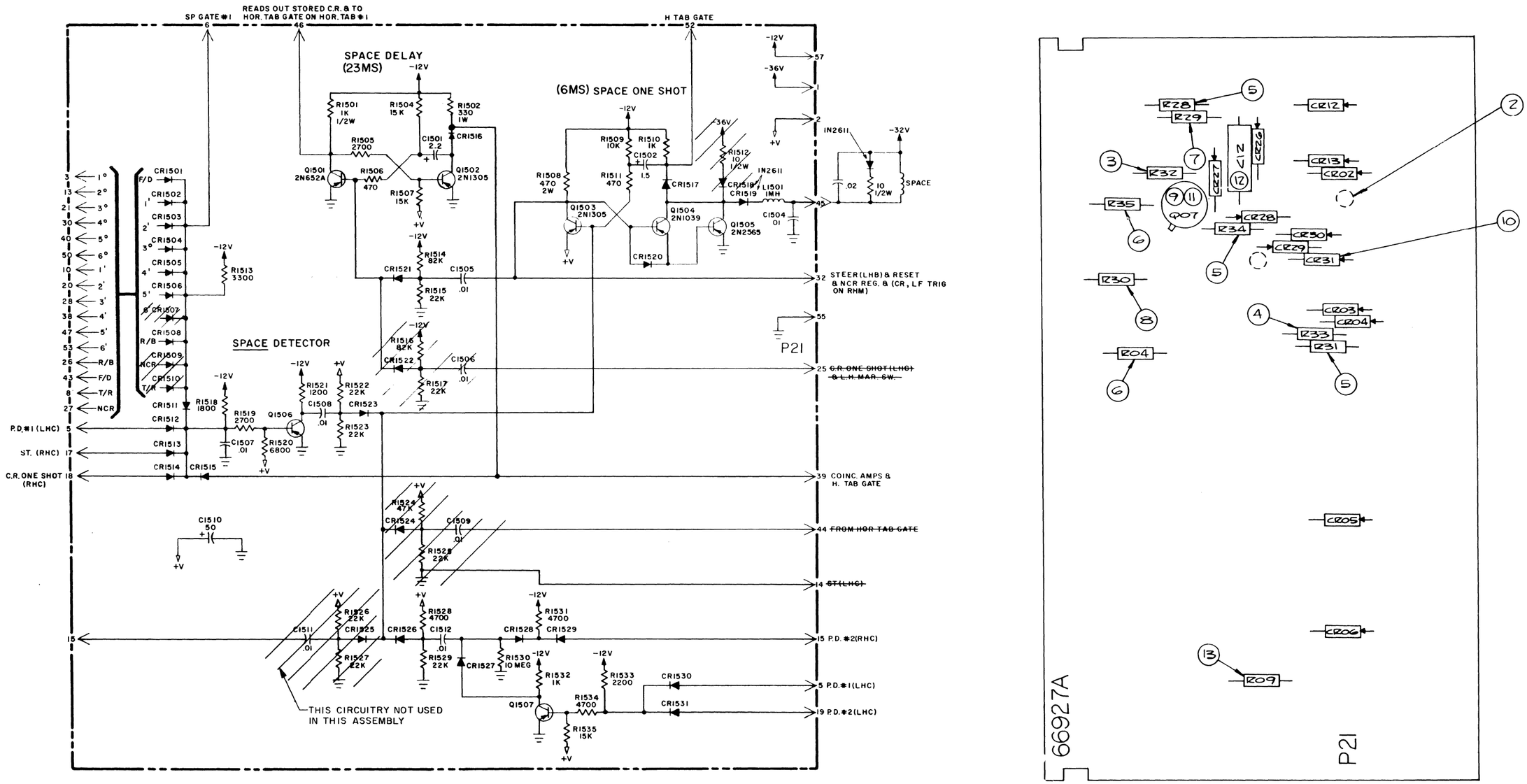
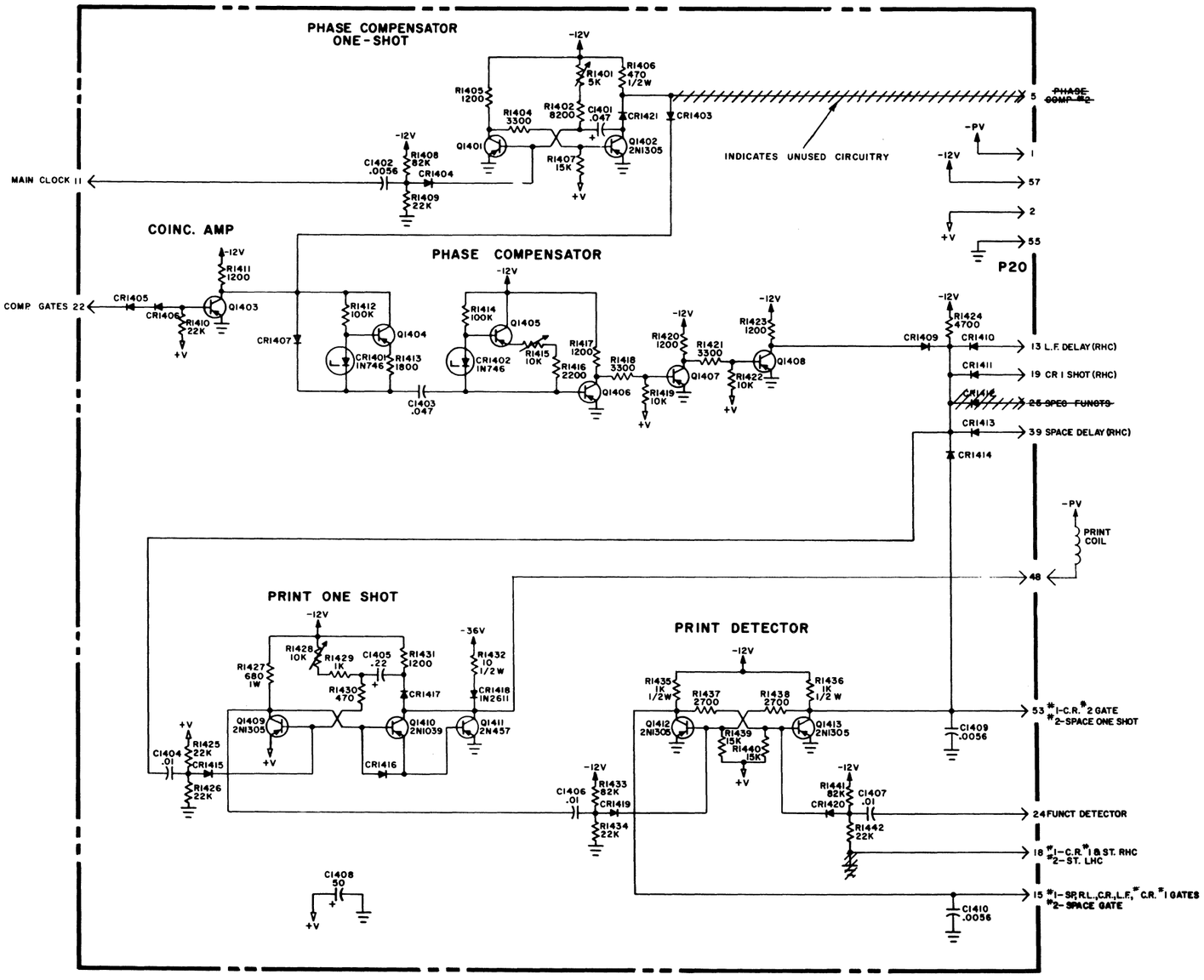
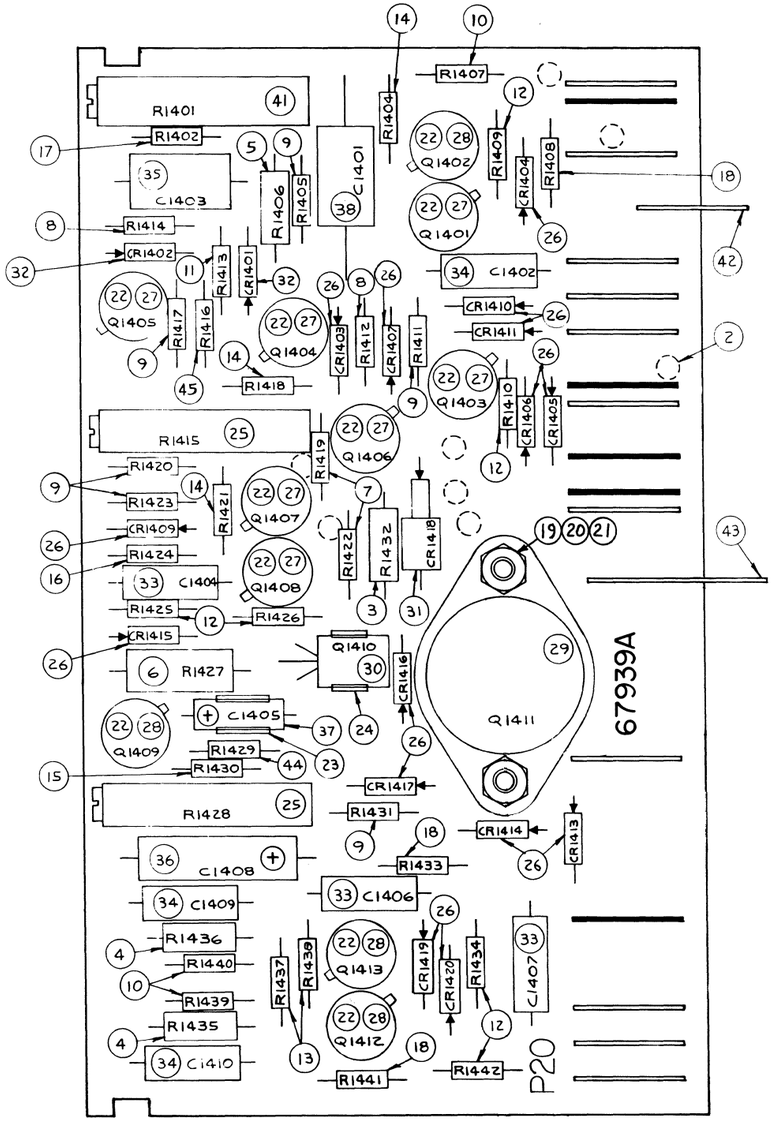


Figure 4D-47. Space detector and driver. (66927A, Issue H)

Legend to Figure 4D-47. Space detector and driver.
(66927A, Issue H)

Item	Quantity	Description	Part No.
1	-	-	-
2	2	Wire, Feed Through	20659-00.00
3	1	Resistor	23004-1020
4	1	Resistor	23004-2220
5	3	Resistor	23004-4720
6	2	Resistor	23004-1530
7	1	Resistor	23004-2230
8	1	Resistor	23004-1060
9	1	Mount, Transistor	23208
10	13	Diode	23291
11	1	Transistor	23302
12	1	Capacitor	23427
13	1	Resistor	23004-1030





99129A-12

Figure 4D-48. Print detectors and drivers. (67939, Issue B)

Legend to Figure 4D-48. Print Detectors and drivers.
(67939, Issue B)

Item	Quantity	Description	Part No.
1			
2	8	Wire, Feed thru	20659-00.00
3	1	Resistor	23000-1000
4	2	Resistor	23000-1020
5	1	Resistor	23000-4710
6	1	Resistor	23001-6810
7	2	Resistor	23004-1030
8	2	Resistor	23004-1040
9	6	Resistor	23004-1220
10	3	Resistor	23004-1530
11	1	Resistor	23004-1820
12	6	Resistor	23004-2230
13	2	Resistor	23004-2720
14	3	Resistor	23004-3320
15	1	Resistor	23004-4710
16	1	Resistor	23004-4720
17	1	Resistor	23004-8220
18	3	Resistor	23004-8230
19	2	Screw	10357
20	4	Washer	10403
21	2	Nut, Hex	10512
22	11	Mount, transistor	23208
23	1	Clip, Cradle	23277
24	1	Clip, Cradle	23278
25	2	Resistor, Variable	23282
26	16	Diode	23291
27	7	Transistor	23302
28	4	Transistor	23305
29	1	Transistor	23312
30	1	Transistor	23315
31	1	Diode	23350
32	2	Diode	23353
33	3	Capacitor	23427
34	3	Capacitor	23428
35	1	Capacitor	23430
36	1	Capacitor	23727
37	1	Capacitor	23732
38	1	Capacitor	23430
39	–	—	—
40	–	—	—
41	1	Resistor, Variable	24409
42	1	Pin, Polarizing	66224
43	1	Pin, Alignment	66882
44	1	Resistor	23004-1020
45	1	Resistor	23004-2220

99129A-12

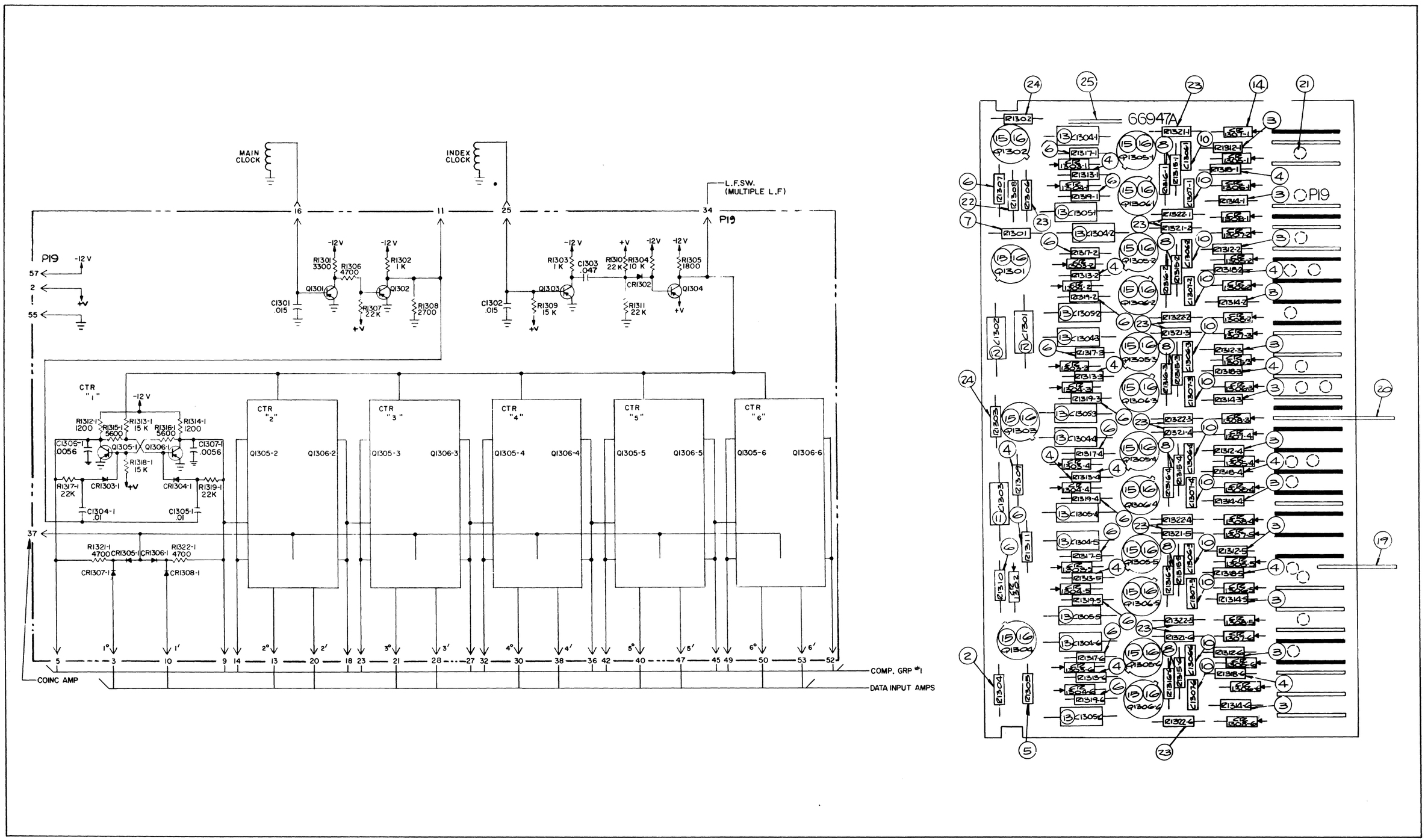
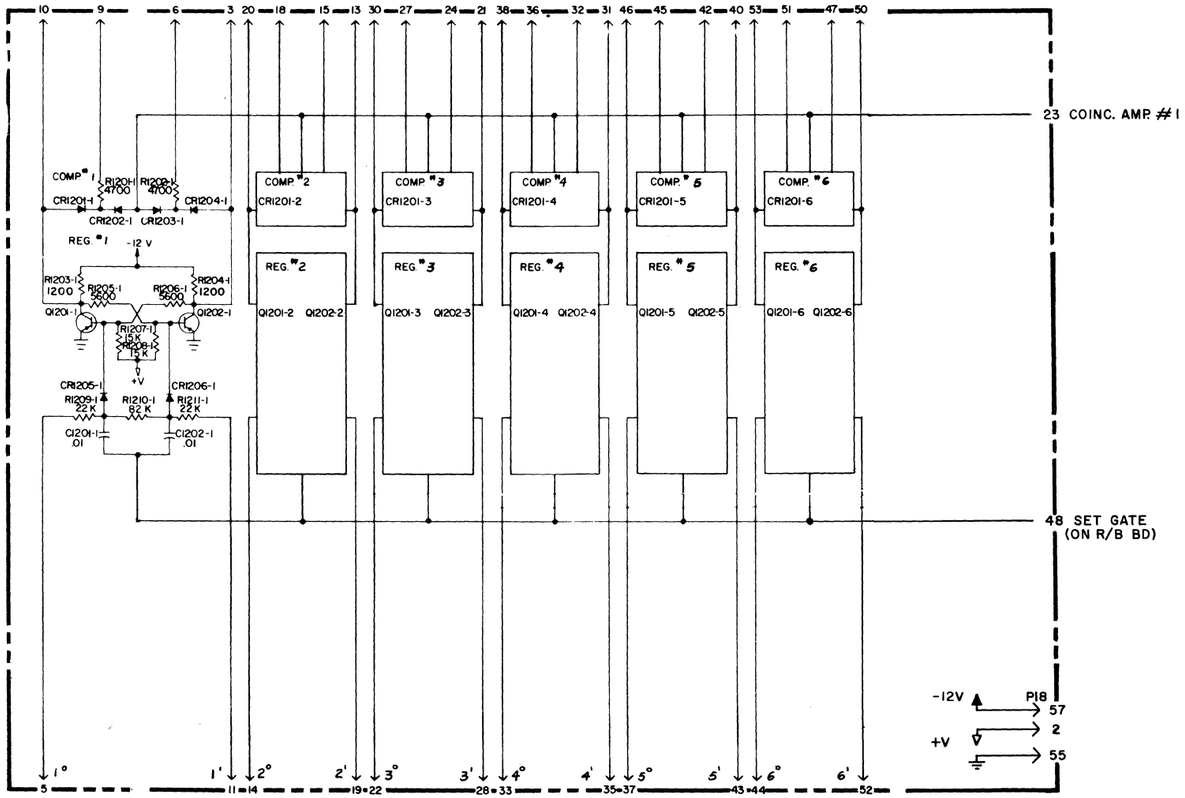


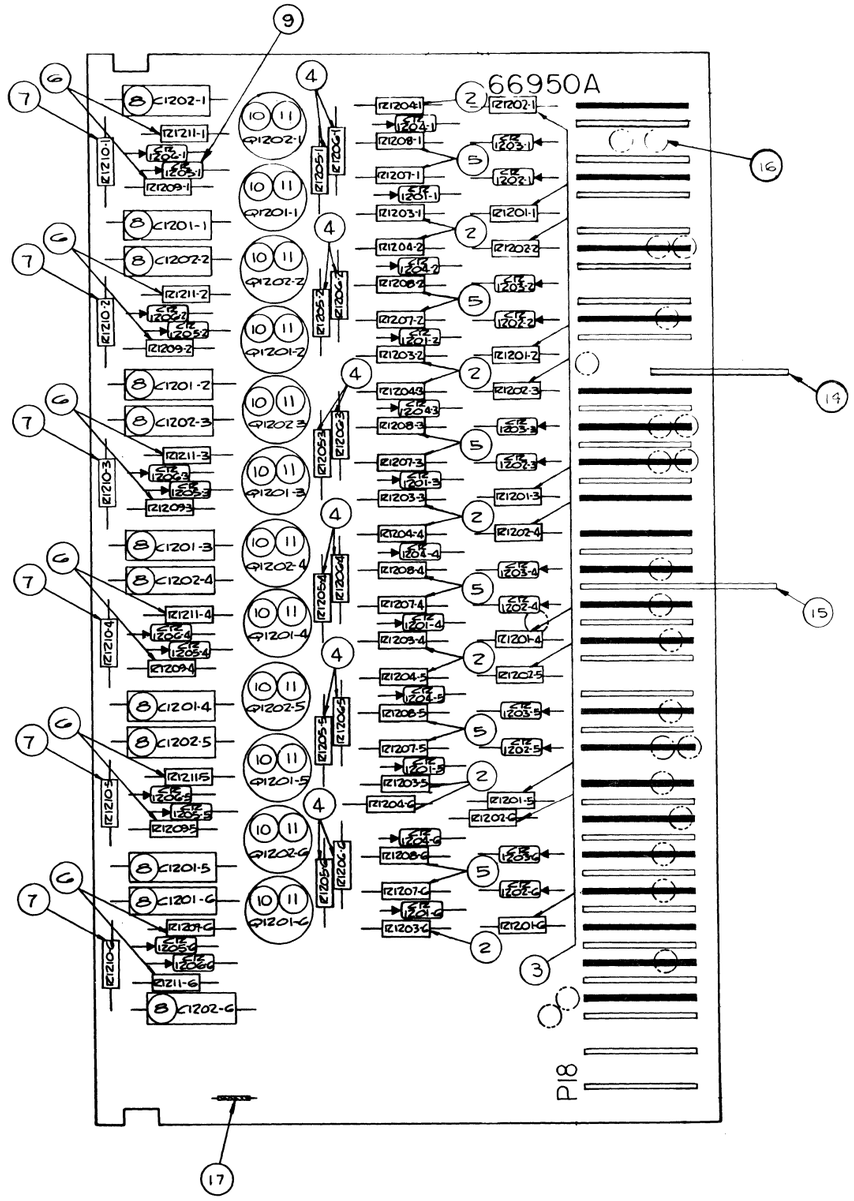
Figure 4D-49. Clocks and counter (66947A, Issue J).

Legend to Figure 4D-49. Clocks and counter.
(66947A, Issue J)

Item	Quantity	Description	Part No.
1	-	-	-
2	1	Resistor	23004-1030
3	12	Resistor	23004-1220
4	13	Resistor	23004-1530
5	1	Resistor	23004-1820
6	15	Resistor	23004-2230
7	1	Resistor	23004-3320
8	12	Resistor	23004-5620
9	-	-	-
10	12	Capacitor	23741
11	1	Capacitor	23430
12	2	Capacitor	23431
13	12	Capacitor	23427
14	37	Diode	23291
15	16	Transistor	23302
16	16	Mount, Transistor	23208
17	-	-	-
18	-	-	-
19	1	Pin, Polarizing	66224
20	1	Pin, Alinement	66882
21	16	Wire, Feed Through	20659-00.00
22	1	Resistor	23004-2720
23	13	Resistor	23004-4720
24	2	Resistor	23004-1020
25	As required	Wire, Jumper	29955-xx

99129A-11





99129A-07

Figure 4D-50. Hammer-1 register group, and hammer-1 detector network. (66950, Issue H)

Legend to Figure 4D-50. Hammer-1 register group, and hammer-1 detector network. (66950A, Issue H)

Item	Quantity	Description	Part No.
1	-	-	-
2	12	Resistor	23004-1220
3	12	Resistor	23004-4720
4	12	Resistor	23004-5620
5	12	Resistor	23004-1530
6	12	Resistor	23004-2230
7	6	Resistor	23004-8230
8	12	Capacitor	23427
9	36	Diode	23291
10	12	Transistor	23302
11	12	Mount, Transistor	23208
12	-	-	-
13	-	-	-
14	1	Pin, Key	66224
15	1	Pin, Warpage	66882
16	24	Wire, Feed Through	20659-00.00
17	1	Wire, Jumper	22655-00.00

99129A-07

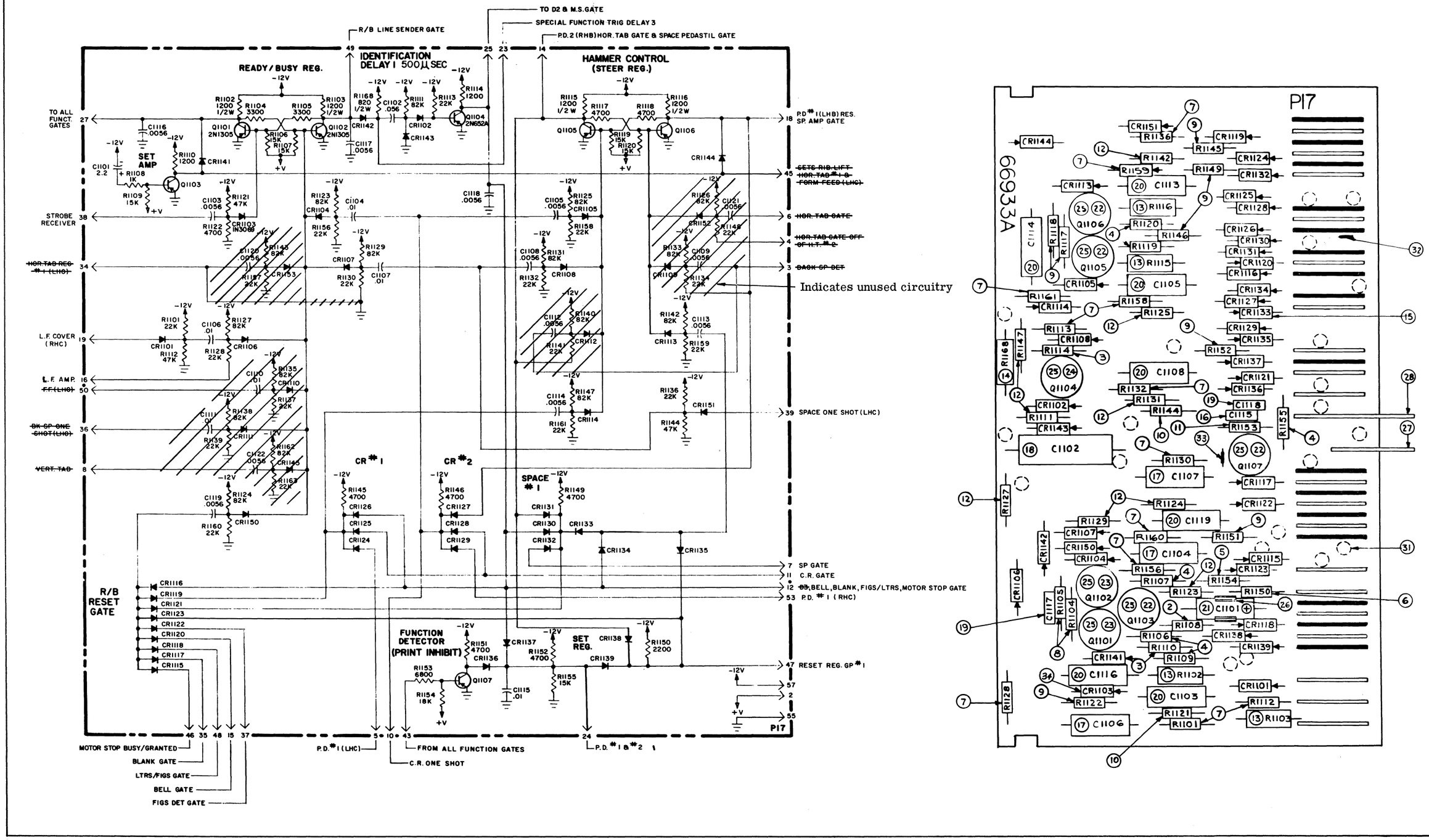
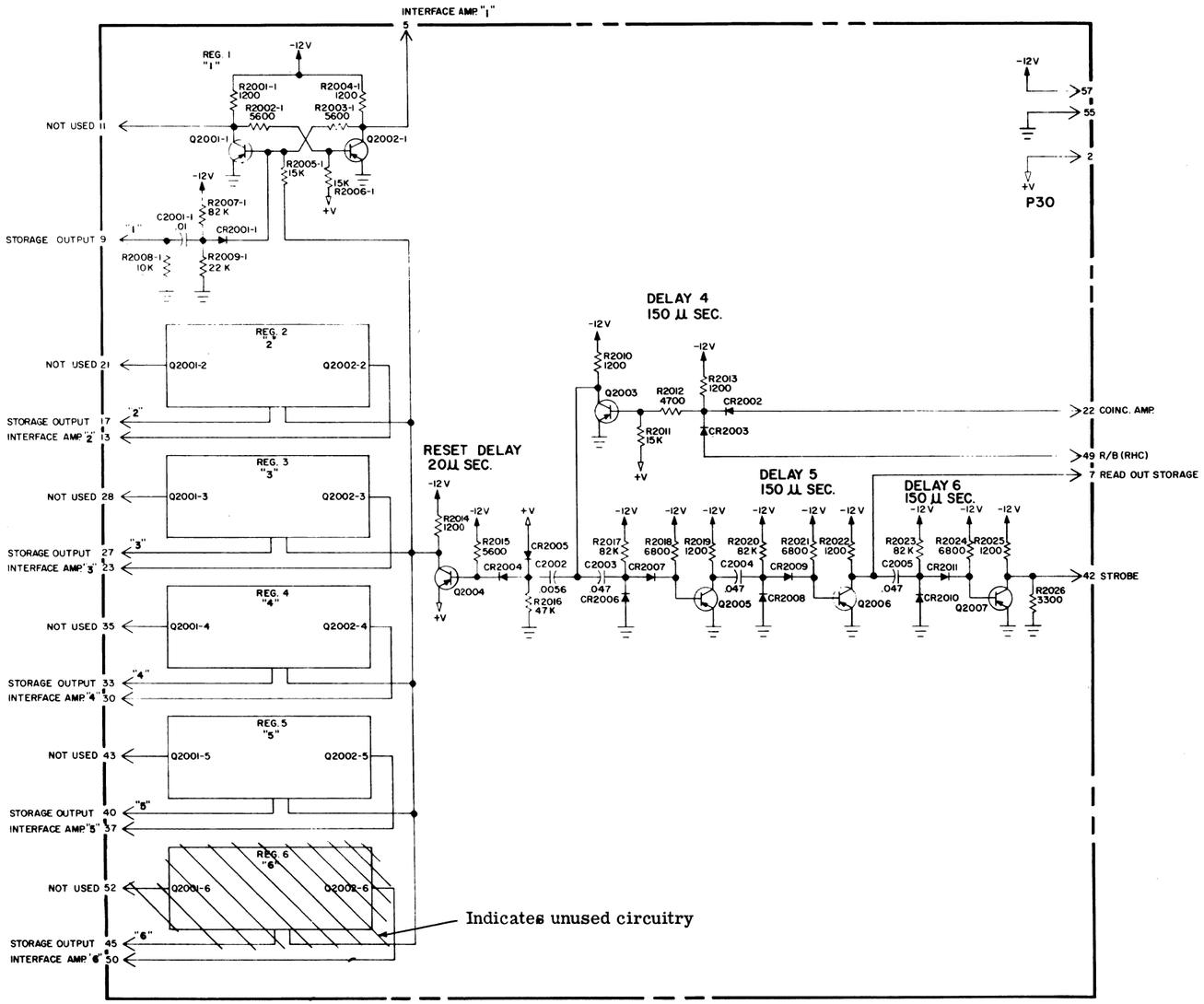


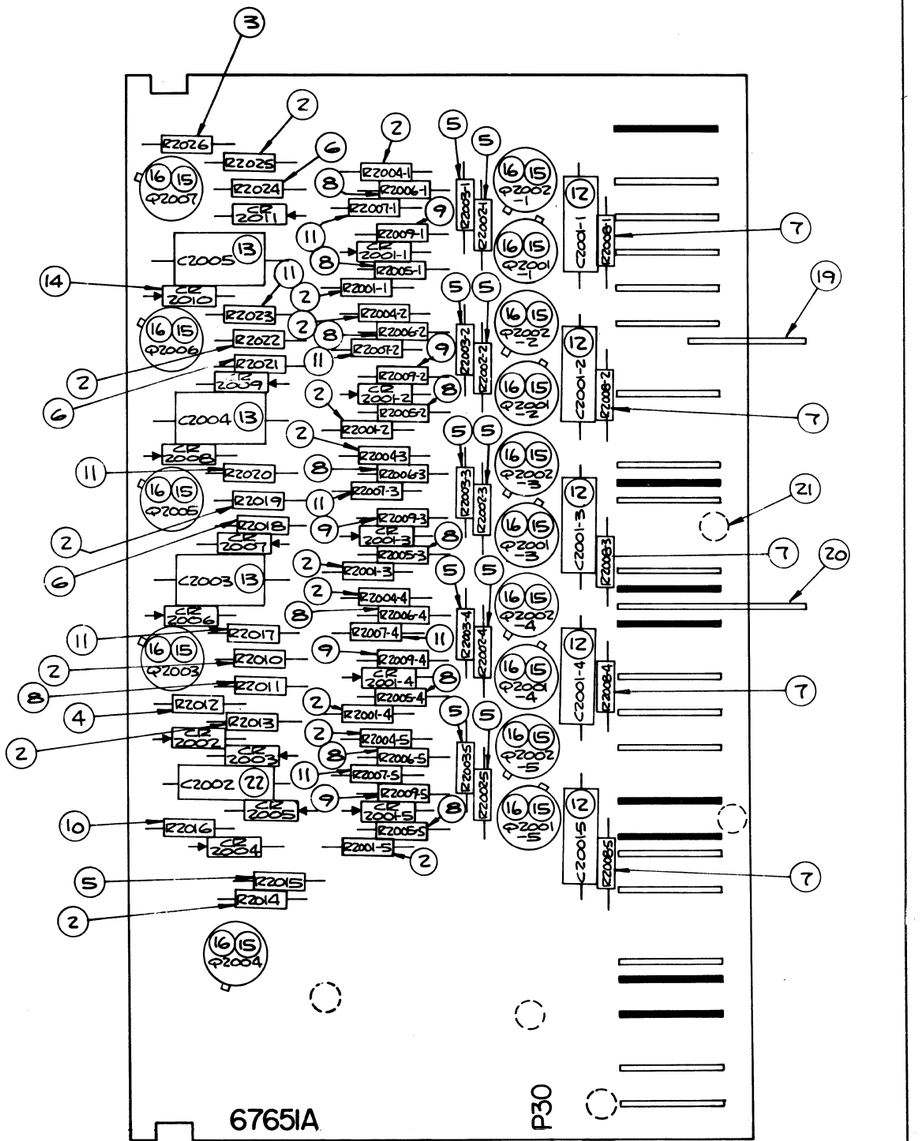
Figure 4D-51. Ready-busy control. (66933A, Issue G)

Legend to Figure 4D-51. Ready-busy control.
(66933A, Issue G)

Item	Quantity	Description	Part No.
1	-	-	-
2	1	Resistor	23004-1020
3	2	Resistor	23004-1220
4	6	Resistor	23004-1530
5	1	Resistor	23004-1830
6	1	Resistor	23004-2220
7	12	Resistor	23004-2230
8	2	Resistor	23004-3320
9	8	Resistor	23004-4720
10	2	Resistor	23004-4730
11	1	Resistor	23004-6820
12	11	Resistor	23004-8230
13	4	Resistor	23000-1220
14	1	Resistor	23000-8210
15	40	Diode	23291
16	1	Capacitor	23736
17	3	Capacitor	23427
18	1	Capacitor	23746
19	2	Capacitor	23741
20	7	Capacitor	23428
21	1	Capacitor	23436
22	4	Transistor	23302
23	2	Transistor	23305
24	1	Transistor	23320
25	7	Mount, Transistor	23208
26	1	Clip, Cradle	23279
27	1	Pin, Polarizing	66224
28	1	Pin, Alinement	66882
29	-	-	-
30	-	-	-
31	28	Wire, Feed Through	29955-00.00
32	1	Jumper wire	29647-00.00
33	1	Jumper wire	23355
34	1	Diode	

99129A-07





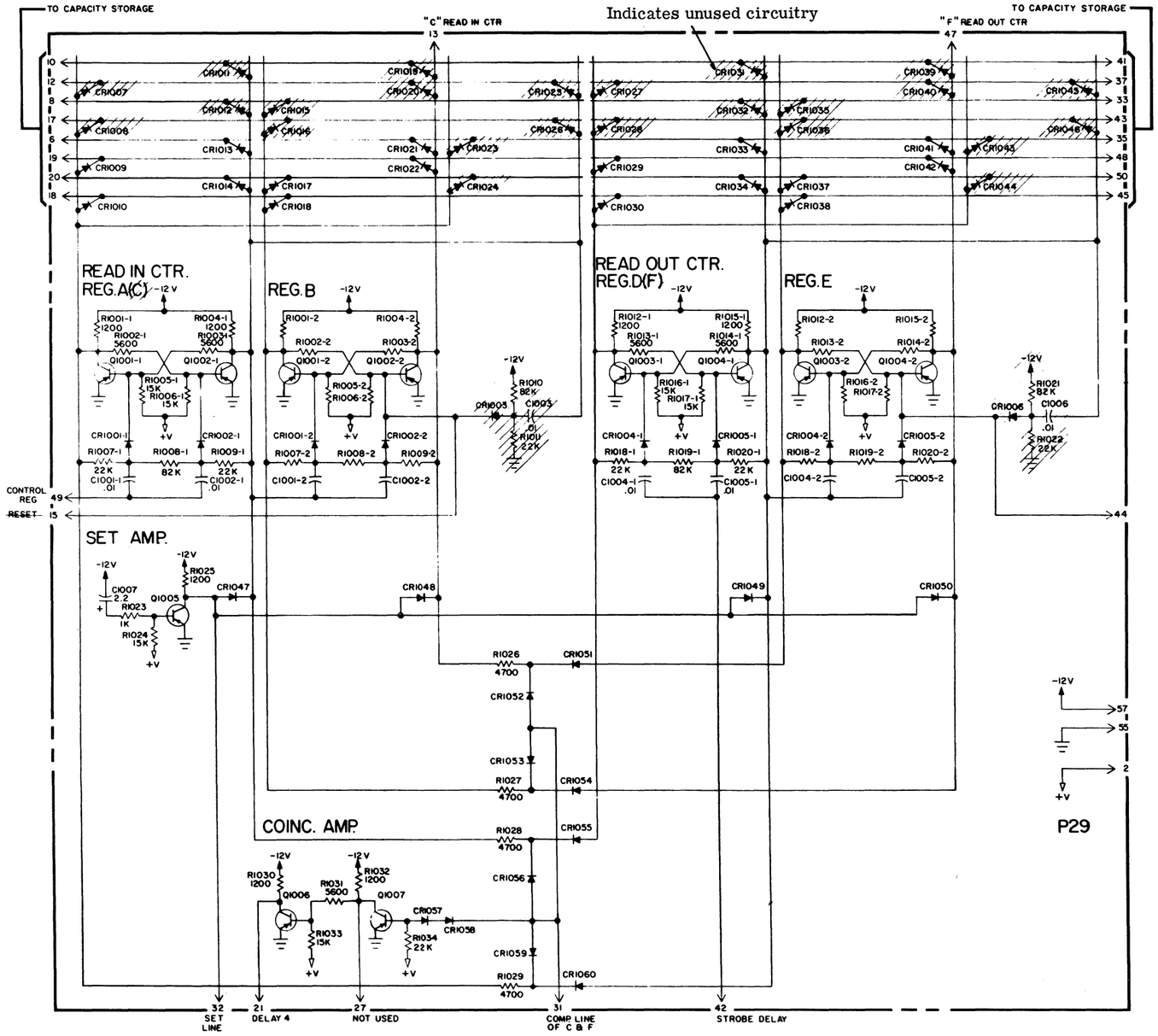
99129A-07

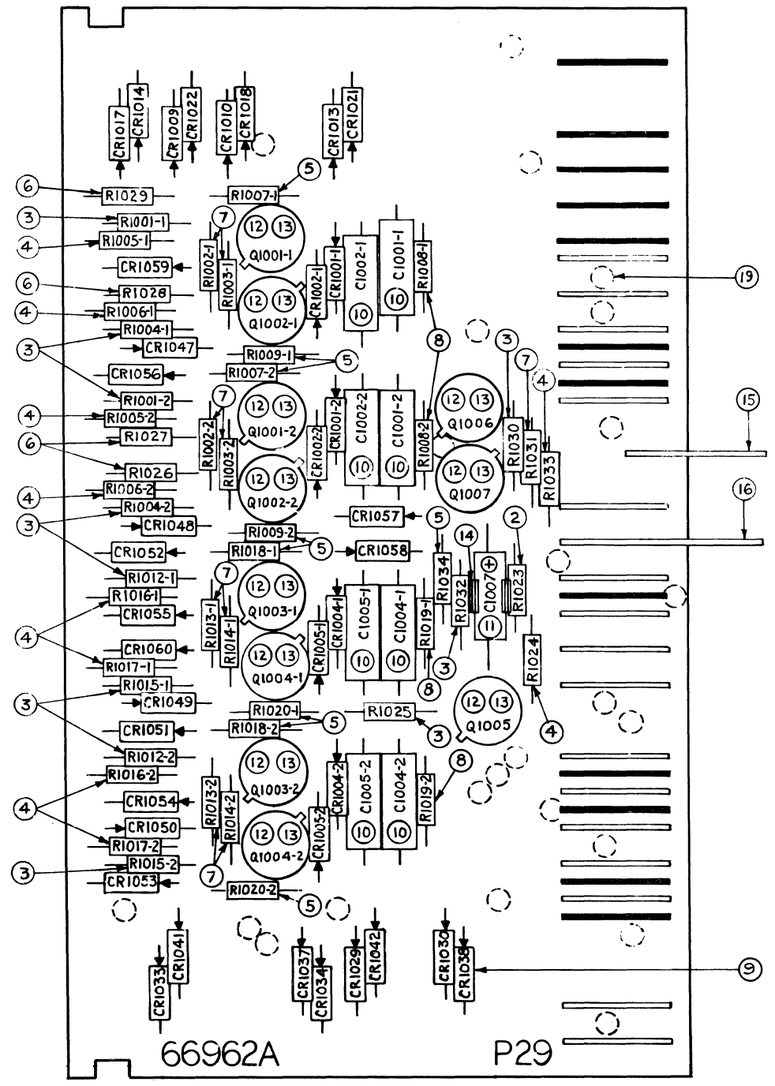
Figure 4D-52. Storage output. (67651A, Issue D)

Legend to Figure 4D-52. Storage output.
(67651A, Issue D)

Item	Quantity	Description	Part No.
1	-	-	-
2	16	Resistor	23004-1220
3	1	Resistor	23004-3320
4	1	Resistor	23004-4720
5	11	Resistor	23004-5620
6	3	Resistor	23004-6820
7	5	Resistor	23004-1030
8	11	Resistor	23004-1530
9	5	Resistor	23004-2230
10	1	Resistor	23004-4730
11	8	Resistor	23004-8230
12	5	Capacitor	23427
13	3	Capacitor	23430
14	15	Diode	23291
15	15	Transistor	23302
16	15	Mount, Transistor	23208
17	-	-	-
18	-	-	-
19	1	Pin, Polarizing	66224
20	1	Pin, Alinement	66882
21	5	Wire, Feed Through	20659-00.00
22	1	Capacitor	23428

99129A-07





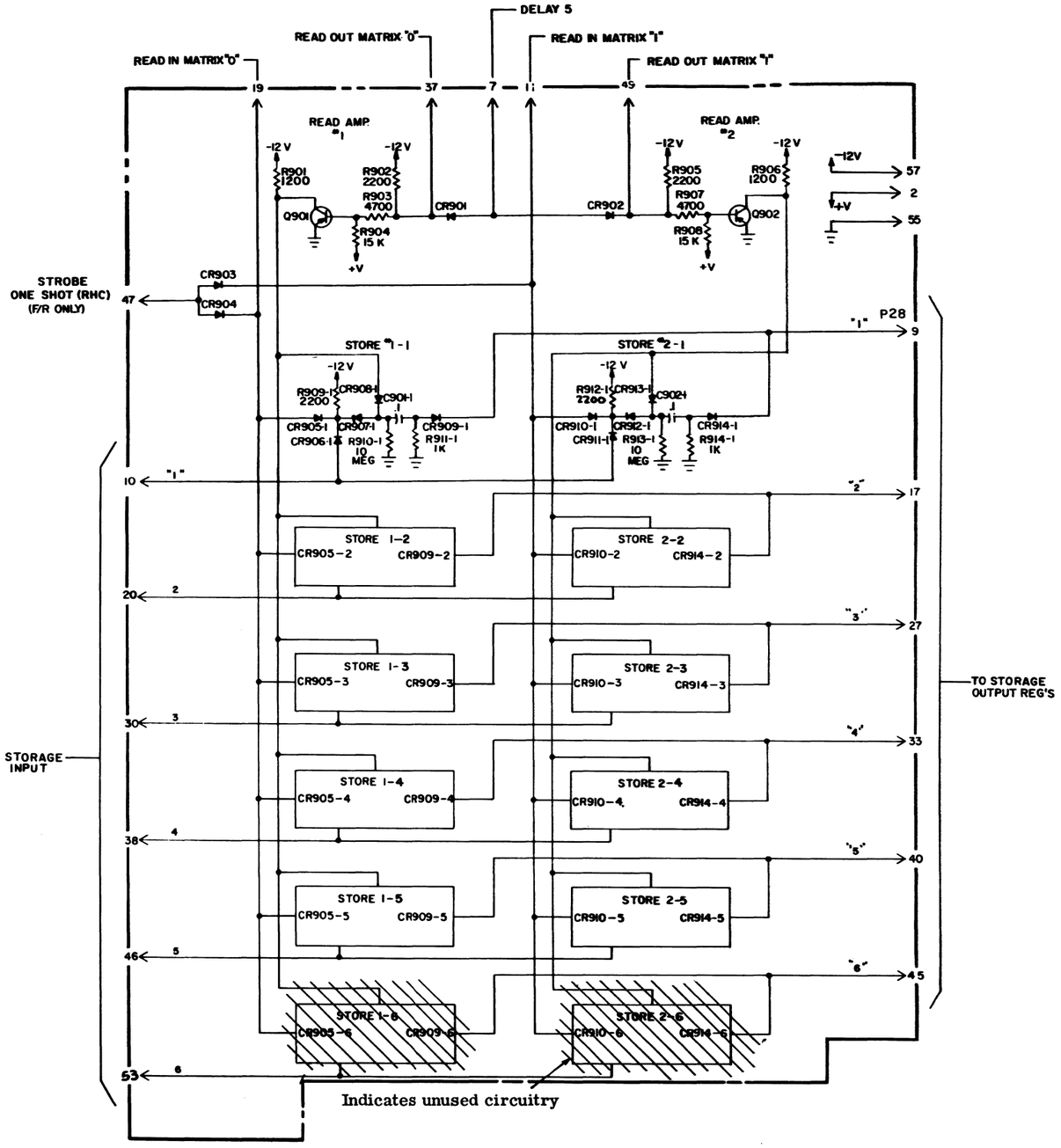
99129A-07

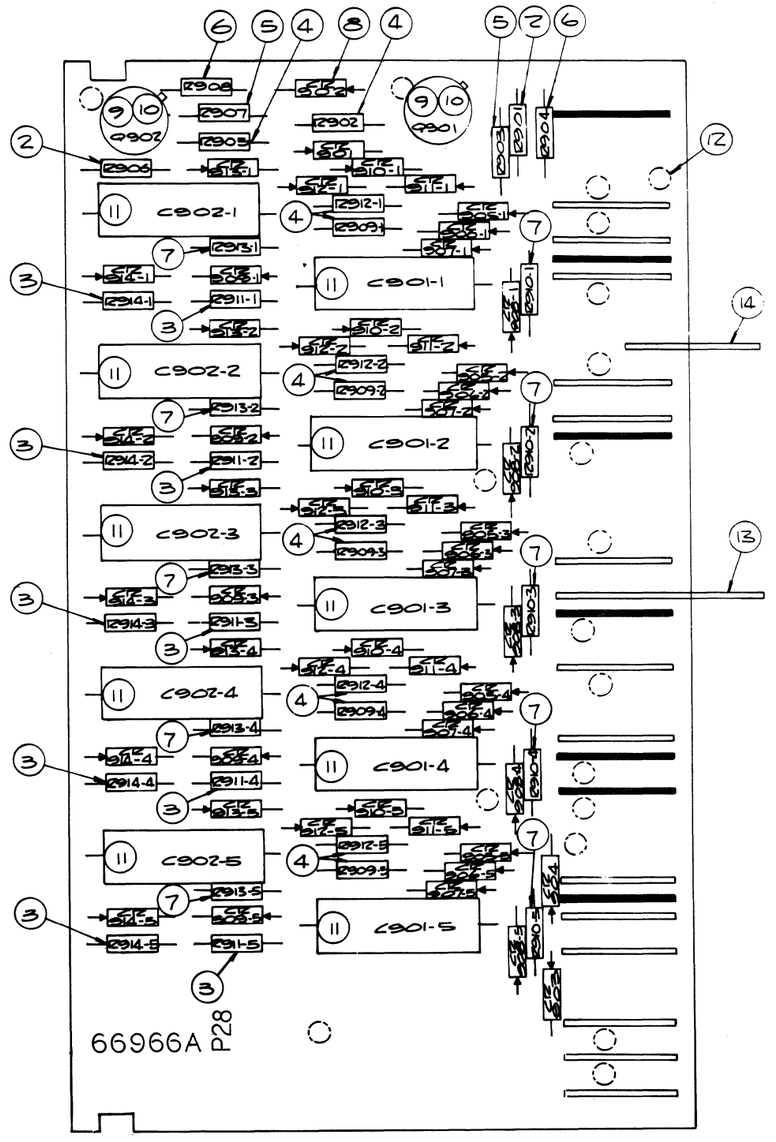
Figure 4D-53. Storage read-in and read-out counters. (66962A, Issue D)

Legend to Figure 4D-53. Storage read-in and read-out counters.
(66962A, Issue D)

Item	Quantity	Description	Part No.
1	-	-	-
2	1	Resistor	23004-1020
3	11	Resistor	23004-1220
4	10	Resistor	23004-1530
5	9	Resistor	23004-2230
6	4	Resistor	23004-4720
7	9	Resistor	23004-5620
8	4	Resistor	23004-8230
9	38	Diode	23291
10	8	Capacitor	23427
11	1	Capacitor	23436
12	11	Transistor	23302
13	11	Mount, Transistor	23208
14	1	Clip, Cradle	23279
15	1	Pin, Polarizing	66224
16	1	Pin, Alinement	66882
17	-	-	-
18	-	-	-
19	24	Wire, Feed Through	20659-00.00

991129A-07





99129A-07

Figure 4D-54. Capacity storage. (66966A, Issue E)

Legend to Figure 4D-54. Capacity storage.
(66966A, Issue E)

Item	Quantity	Description	Part No.
1	-	-	-
2	2	Resistor	23004-1220
3	10	Resistor	23004-1020
4	12	Resistor	23004-2220
5	2	Resistor	23004-4720
6	2	Resistor	23004-1530
7	10	Resistor	23004-1060
8	54	Diode	23291
9	2	Transistor	23302
10	2	Mount, Transistor	23208
11	10	Capacitor	23730
12	19	Wire, Feed Through	20659-00.00
13	1	Pin, Alinement	66882
14	1	Pin, Polarizing	66224

99129A-07

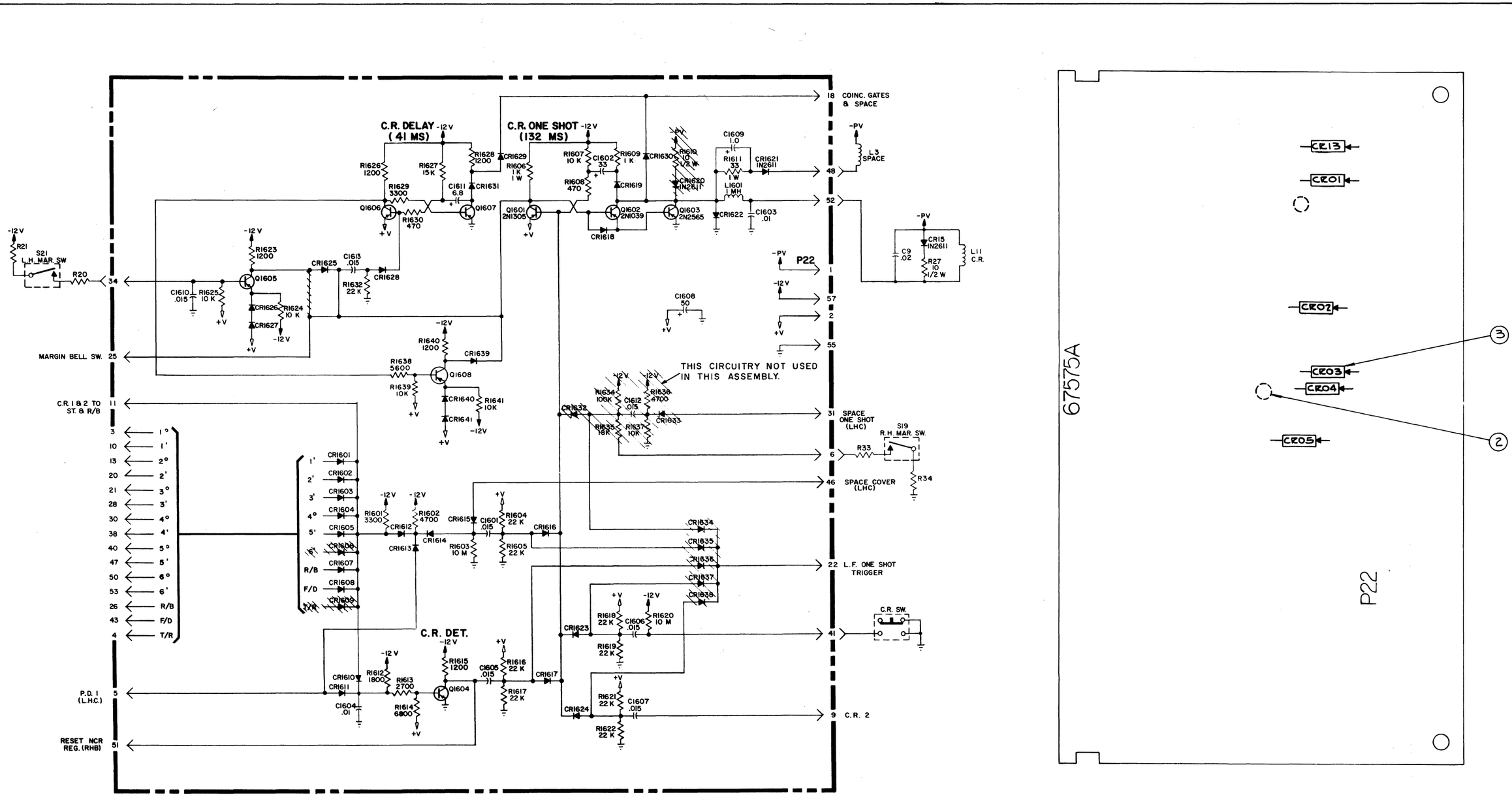
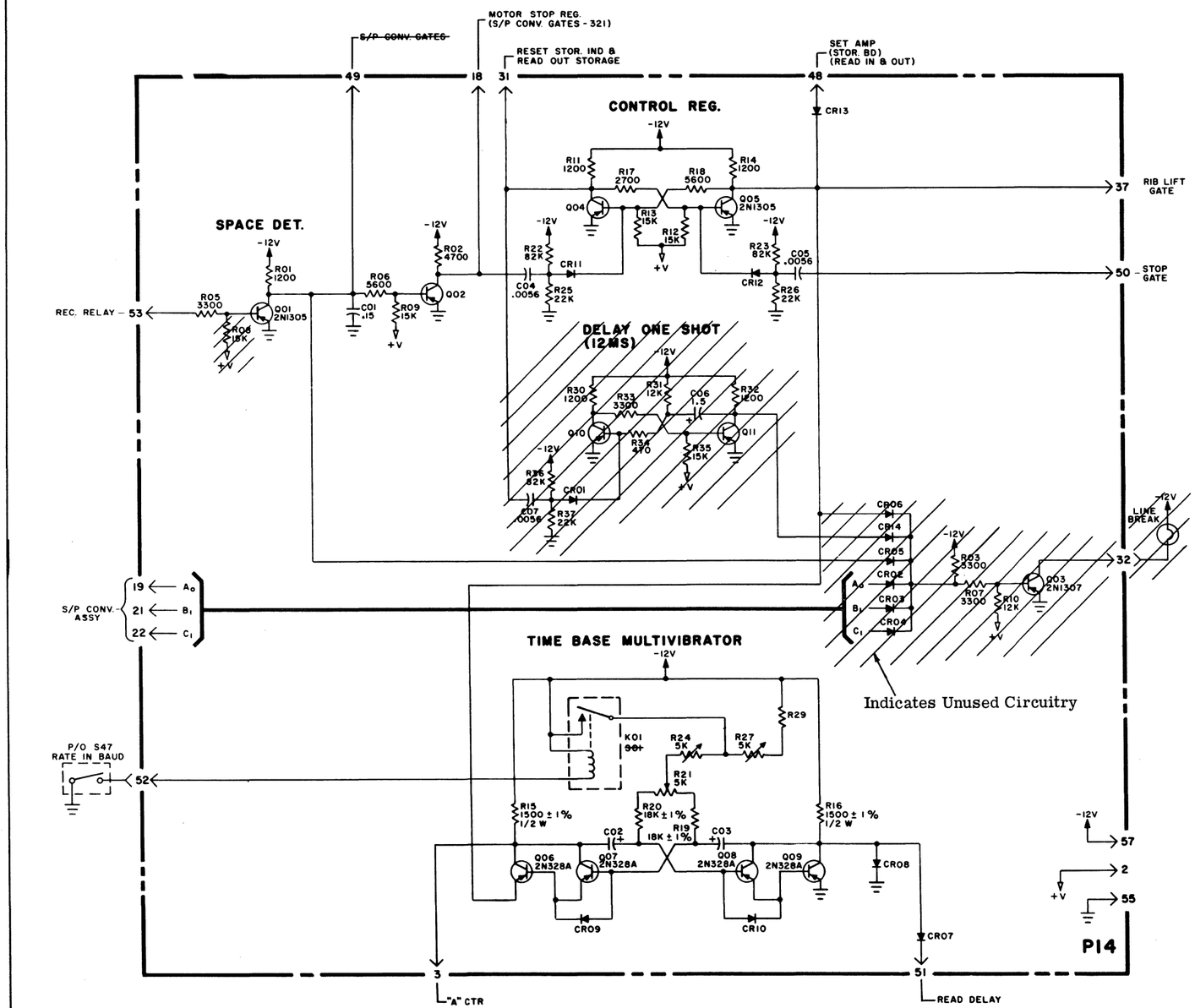


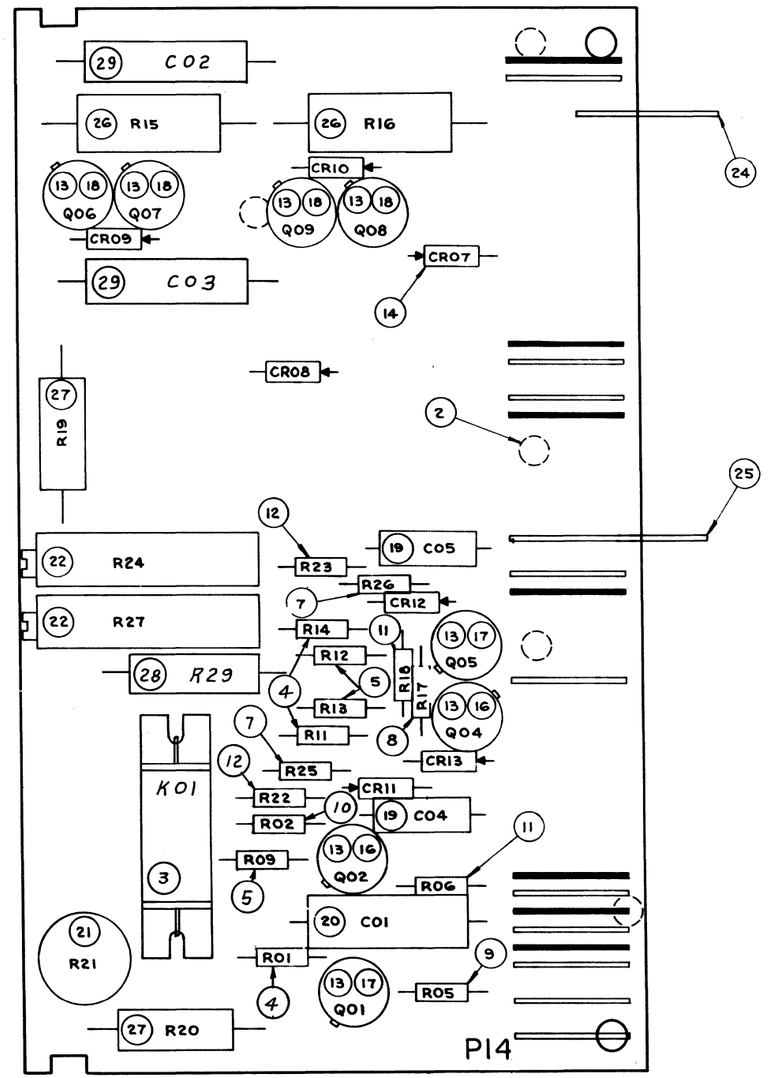
Figure 4D-55. Carriage return detector and driver (67575A, Issue K)

Legend to Figure 4D-55. Carriage return detector and driver.
(67575A, Issue K)

Item	Quantity	Description	Part No.
1	-	-	-
2	2	Wire, Feed Through	20659-00.00
3	6	Diode	23291

99129A-09





99129A-13

Figure 4D-56. Space detector and time base. (68920A, Issue B)

Legend to Figure 4D-56. Space detector and time base.
(68920A, Issue B)

Item	Quantity	Description	Part No.
1	-	-	-
2	9	Wire, Feed Through	20659-00.00
3	1	Relay, Reed	68923
4	3	Resistor	23004-1220
5	3	Resistor	23004-1530
6	-	-	-
7	2	Resistor	23004-2230
8	1	Resistor	23004-2720
9	1	Resistor	23004-3320
10	1	Resistor	23004-4720
11	2	Resistor	23004-5620
12	2	Resistor	23004-8230
13	8	Mount, Transistor	23208
14	7	Diode	23291
15	-	-	-
16	2	Transistor	23302
17	2	Transistor	23305
18	4	Transistor	23310
19	2	Capacitor	23428
20	1	Capacitor	23433
21	1	Potentiometer	24408
22	2	Potentiometer	24409
23	-	-	-
24	1	Pin, Polarizing	66224
25	1	Pin, Alinement	66882
26	2	Resistor	23470
27	2	Resistor	23469
28	1	Resistor	23467
29	2	Capacitor	23743

99129A-13

Legend to Figure 4D-57. Keyboard shift register.
(66916A, Issue E)

Item	Quantity	Description	Part No.
1	-	-	-
2	11	Resistor	23004-1220
3	5	Resistor	23004-2720
4	5	Resistor	23004-3320
5	4	Resistor	23004-4720
6	1	Resistor	23004-5620
7	16	Resistor	23004-1530
8	10	Resistor	23004-2230
9	15	Resistor	23004-8230
10	15	Capacitor	23427
11	15	Diode	23291
12	11	Transistor	23302
13	11	Mount, Transistor	23208
14	-	-	-
15	-	-	-
16	1	Pin, Polarizing	66224
17	1	Pin, Alinement	66882
18	16	Wire, Feed Through	20659-00.00
19	2	Wire, Jumper	22655-00.00

99129A-07

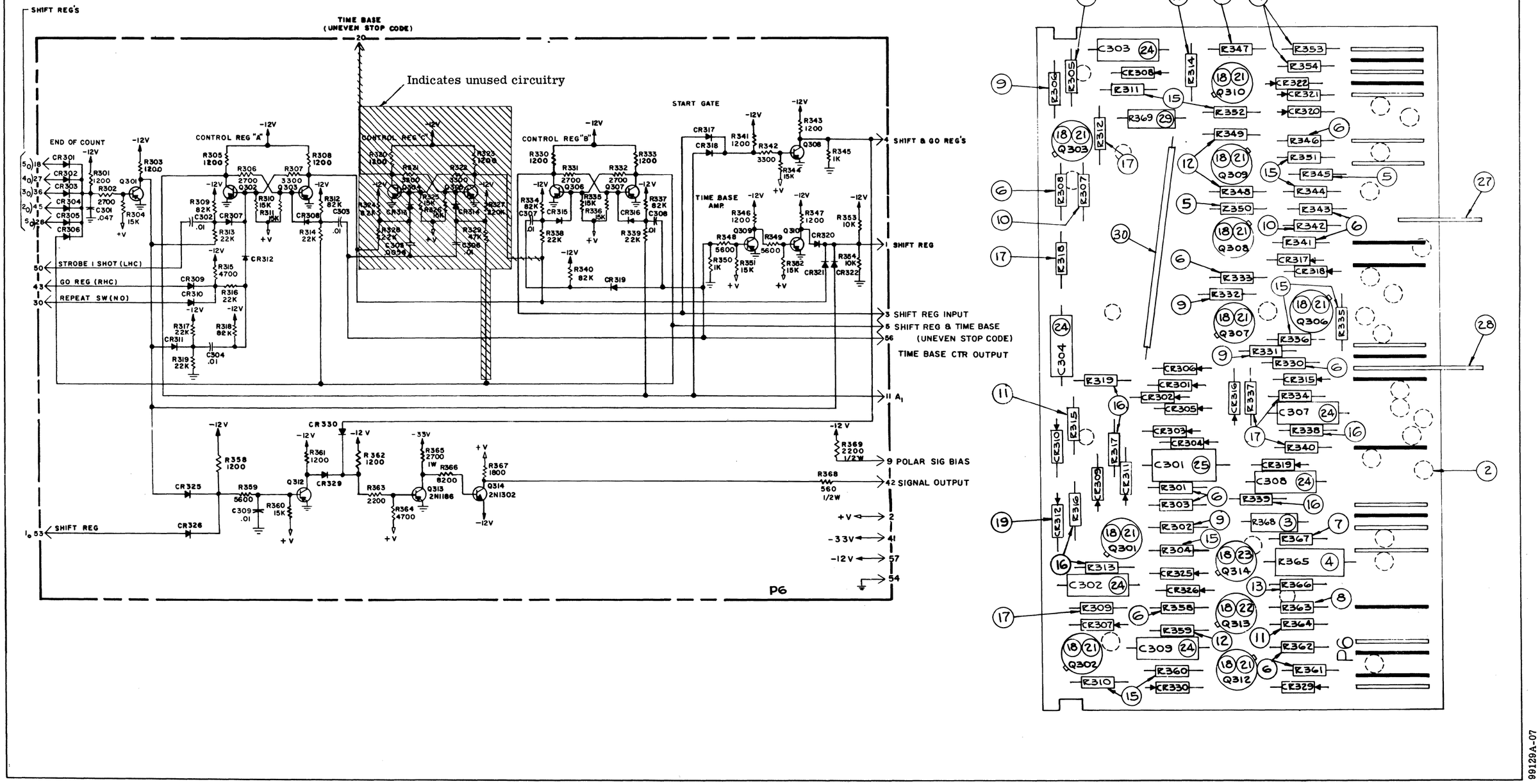
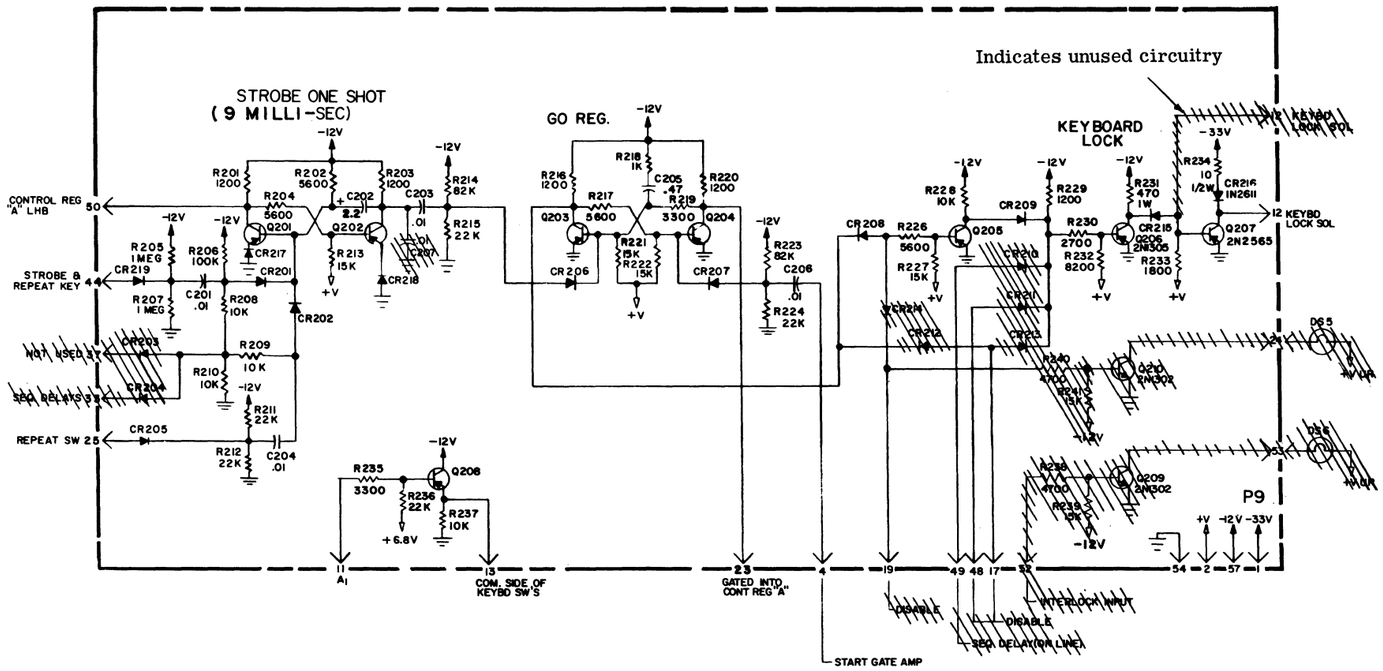


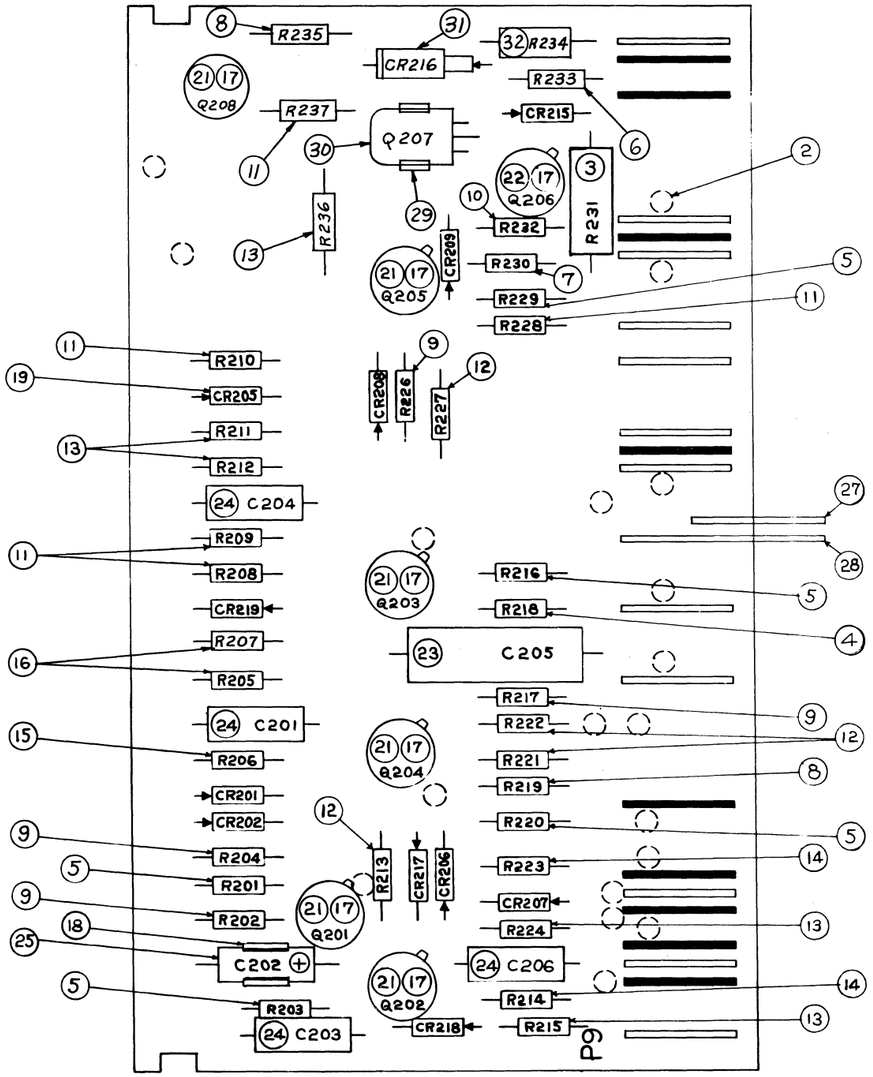
Figure 4D-58. Keyboard shift register control. (66956A, Issue E)

Legend to Figure 4D-58. Keyboard shift register control.
(66956, Issue E)

Item	Quantity	Description	Part No.
1	-	-	-
2	29	Wire, Feed Through	20659-00.00
3	1	Resistor	23000-5610
4	1	Resistor	23001-2720
5	2	Resistor	23004-1020
6	13	Resistor	23004-1220
7	1	Resistor	23004-1820
8	1	Resistor	23004-2220
9	4	Resistor	23004-2720
10	2	Resistor	23004-3320
11	2	Resistor	23004-4720
12	3	Resistor	23004-5620
13	1	Resistor	23004-8220
14	2	Resistor	23004-1030
15	9	Resistor	23004-1530
16	7	Resistor	23004-2230
17	6	Resistor	23004-8230
18	11	Mount, Transistor	23208
19	24	Diode	23291
20	-	-	-
21	9	Transistor	23302
22	1	Transistor	23303
23	1	Transistor	23304
24	6	Capacitor	23427
25	1	Capacitor	23430
26	-	-	-
27	1	Pin, Polarizing	66224
28	1	Pin, Alinement	66882
29	1	Resistor	23000-2220
30	As required	Wire	29955-00.00

99129A-07





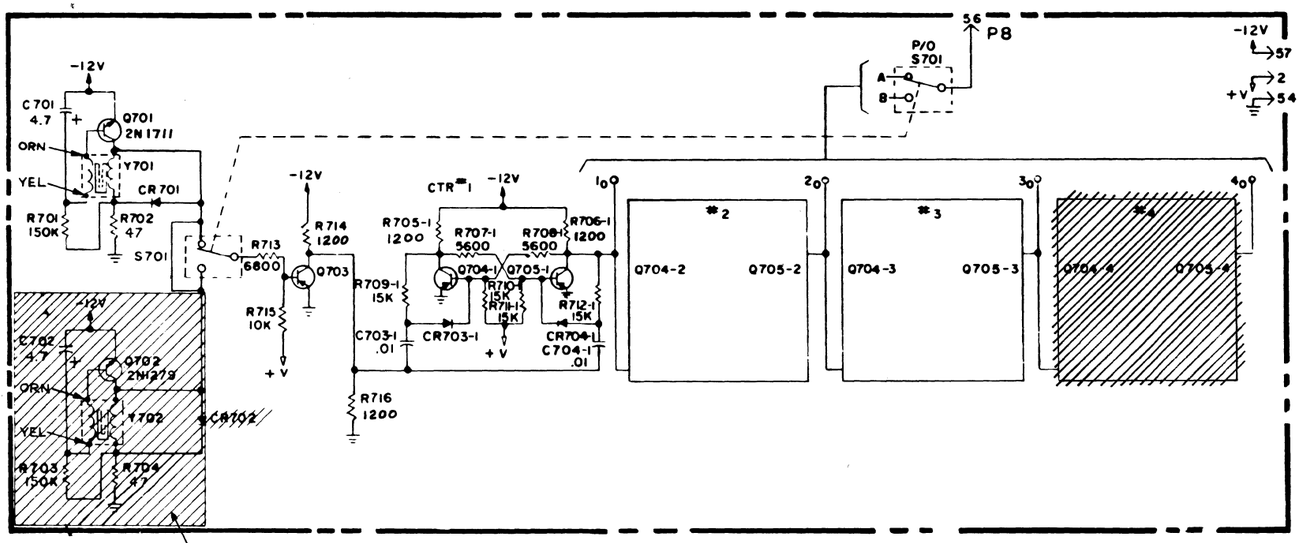
99129A-07

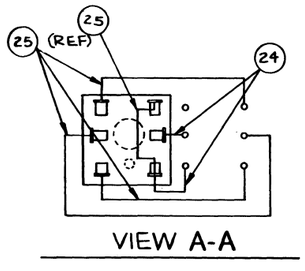
Figure 4D-59. Keyboard control. (66951A, Issue H)

Legend to Figure 4D-59. Keyboard control.
(66951A, Issue H)

Item	Quantity	Description	Part No.
1	-	-	-
2	19	Wire, Feed Through	20659-00.00
3	1	Resistor	23001-4710
4	1	Resistor	23004-1020
5	5	Resistor	23004-1220
6	1	Resistor	23004-1820
7	1	Resistor	23004-2720
8	2	Resistor	23004-3320
9	4	Resistor	23004-5620
10	1	Resistor	23004-8220
11	5	Resistor	23004-1030
12	4	Resistor	23004-1530
13	5	Resistor	23004-2230
14	2	Resistor	23004-8230
15	1	Resistor	23004-1040
16	2	Resistor	23004-1050
17	7	Mount, Transistor	23208
18	1	Clip, Cradle	23279
19	11	Diode	23291
20	-	-	-
21	6	Transistor	23302
22	1	Transistor	23305
23	1	Capacitor	23426
24	4	Capacitor	23427
25	1	Capacitor	23436
26	-	-	-
27	1	Pin, Polarizing	66224
28	1	Pin, Alinement	66882
29	1	Clip, Cradle	23278
30	1	Transistor	23306
31	1	Diode	23350
32	1	Resistor	23000-1000

99129A-07





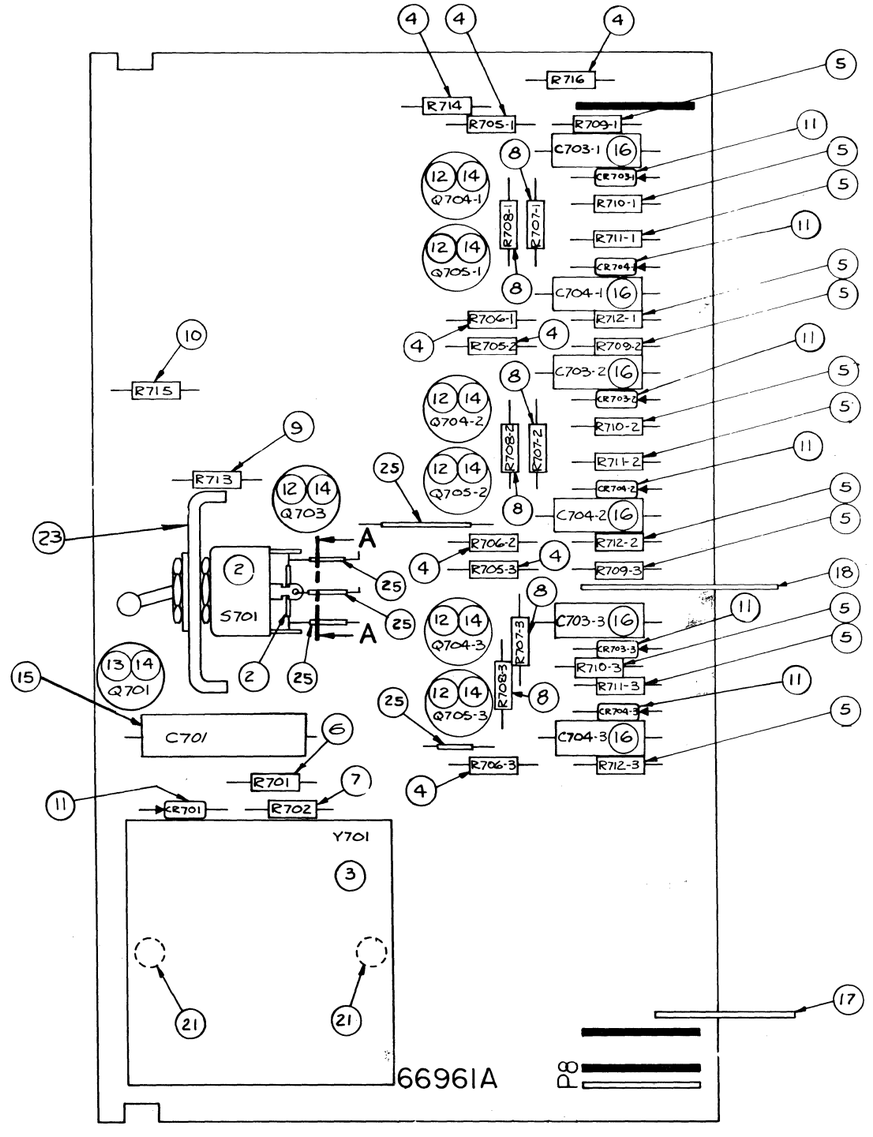
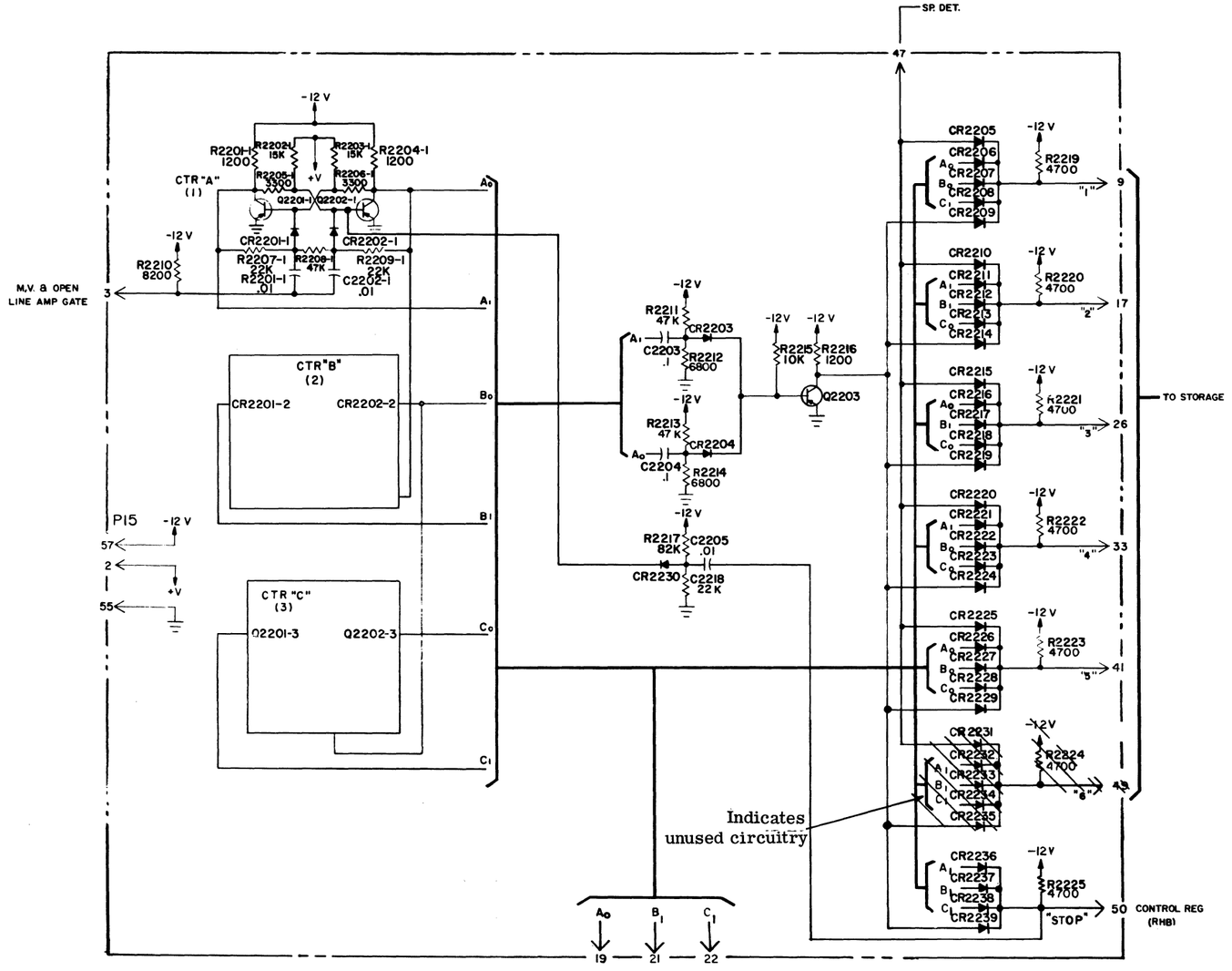
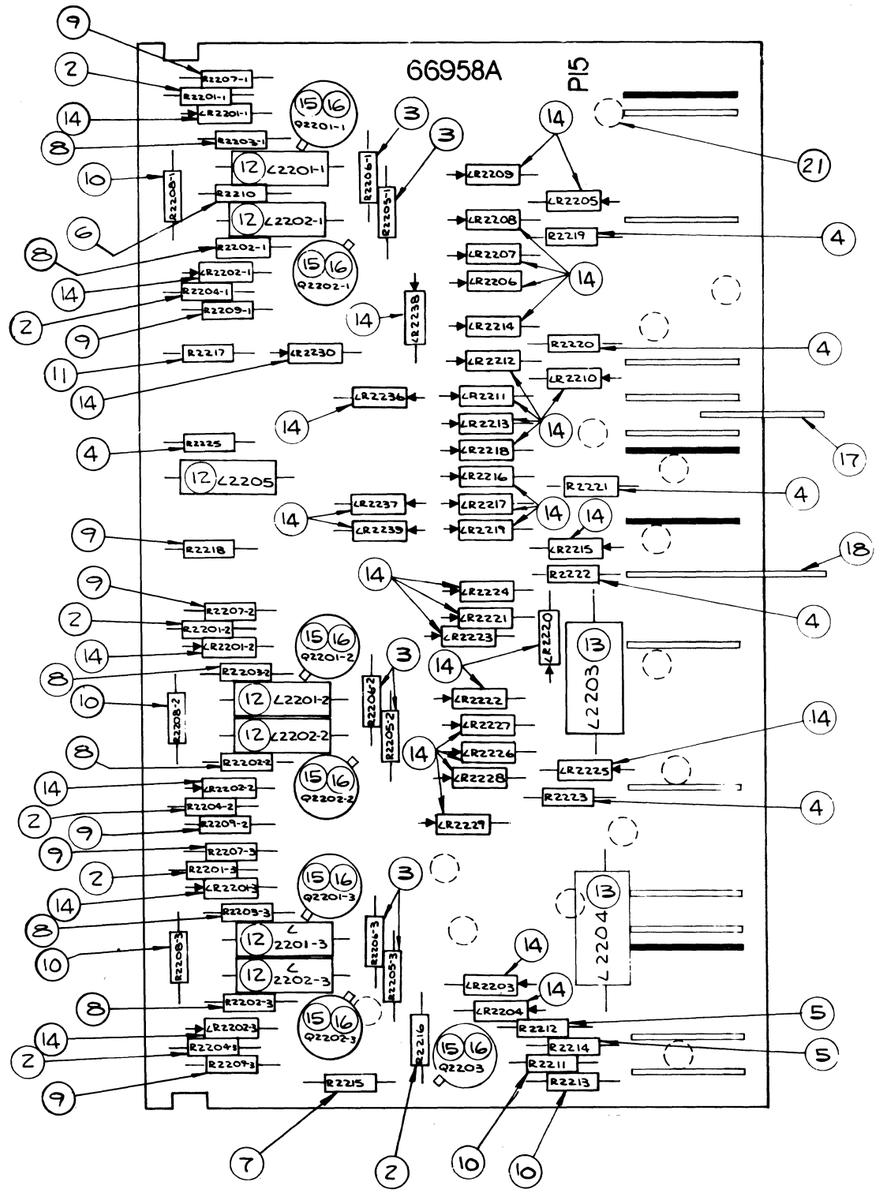


Figure 4D-60. Transmitter time base (66961A, Issue E).

99129A-07





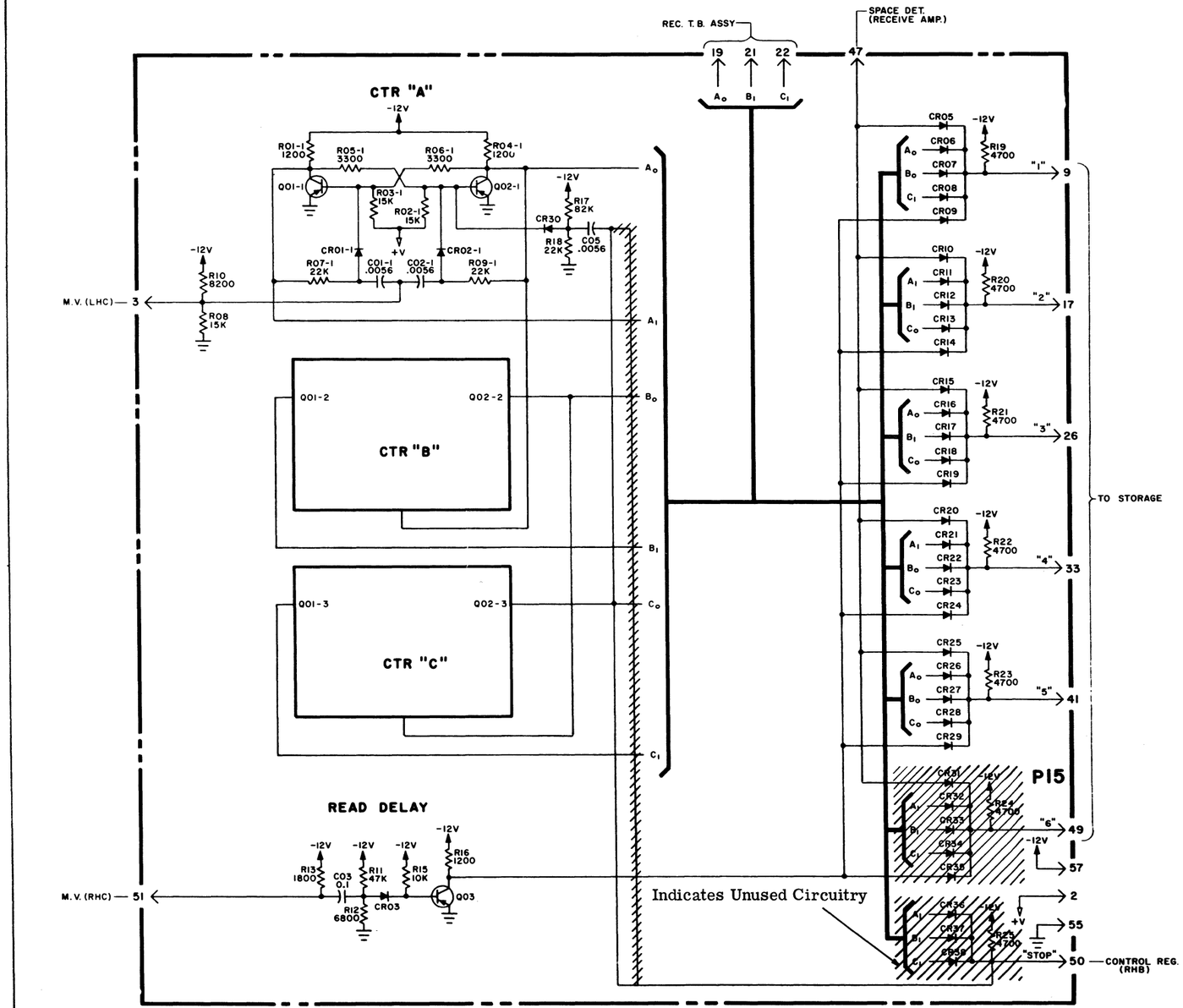
99129A-07

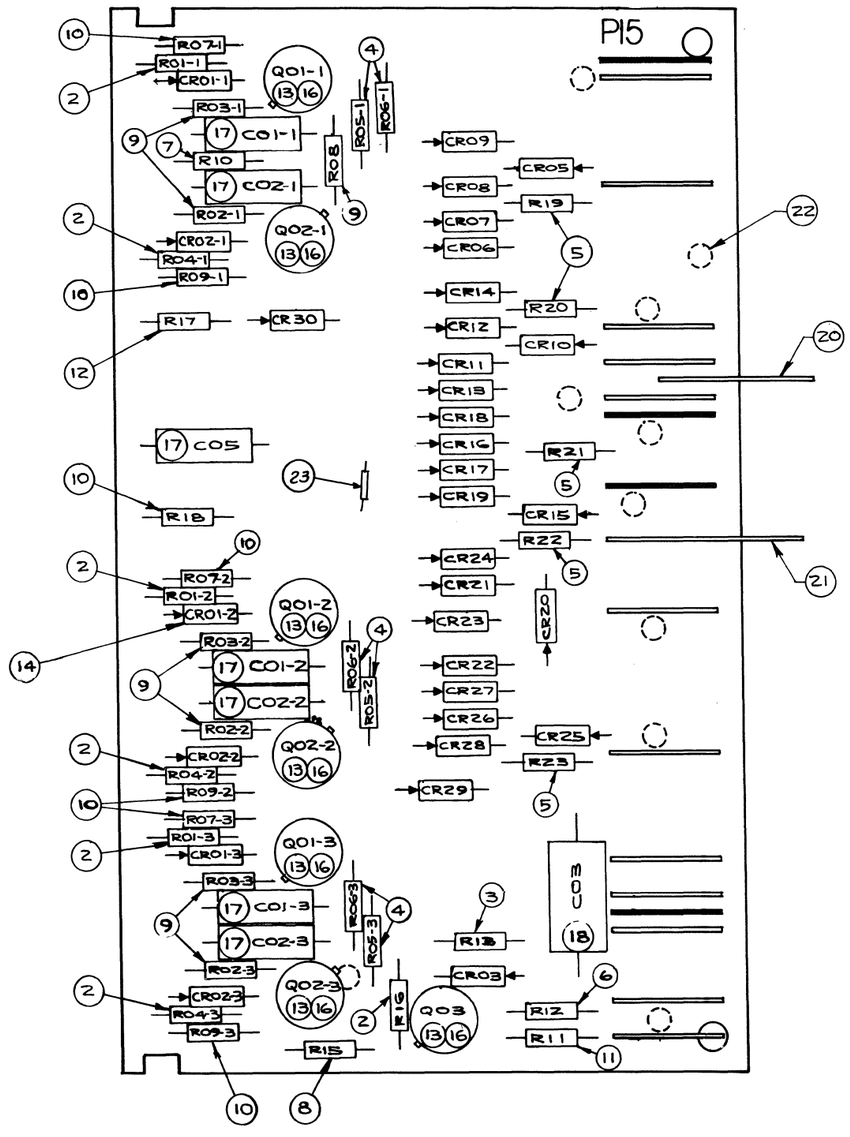
Figure 4D-61. Serial parallel converter and counter gates. (66958A, Issue G)

Legend to Figure 4D-60. Transmitter time base.
(66961A, Issue E)

Item	Quantity	Description	Part No.
1	-	-	-
2	1	Switch	20160
3	1	Fork, Tuning	23271
4	8	Resistor	23004-1220
5	12	Resistor	23004-1530
6	1	Resistor	23004-1540
7	1	Resistor	23004-4700
8	6	Resistor	23004-5620
9	1	Resistor	23004-6820
10	1	Resistor	23004-1030
11	7	Diode	23291
12	7	Transistor	23302
13	1	Transistor	23316
14	8	Mount, Transistor	23208
15	1	Capacitor	23426
16	6	Capacitor	23427
17	1	Pin, Key	66224
18	1	Pin, Warpage	66882
19	-	-	-
20	-	-	-
21	2	Screw	10374
22	-	-	-
23	1	Bracket, Switch	66551
24	2	Wire, Jumper	20647-00.00
25	6	Wire, Jumper	29955-00.00
26	5	Wire, Feed Through	20659-00.00

99129A-07





99129A-13

Figure 4D-61. Serial parallel converter and counter gates. (68924A, Issue B)

Legend to Figure 4D-61. Serial parallel converter and counter gates.
(68924A, Issue B)

Item	Quantity	Description	Part No.
1	-	-	-
2	7	Resistor	23004-1220
3	1	Resistor	23004-1820
4	6	Resistor	23004-3320
5	5	Resistor	23004-4720
6	1	Resistor	23004-6820
7	1	Resistor	23004-8220
8	1	Resistor	23004-1030
9	7	Resistor	23004-1530
10	7	Resistor	23004-2230
11	1	Resistor	23004-4730
12	1	Resistor	23004-8230
13	7	Mount, Transistor	23208
14	33	Diode	23291
15	-	-	-
16	7	Transistor	23302
17	7	Capacitor	23428
18	1	Capacitor	23432
19	-	-	-
20	1	Pin, Polarizing	66224
21	1	Pin, Alinement	66882
22	14	Wire, Feed Through	20659-00.00
23	1	Wire, Jumper	29955

99129A-13

4D-2 SPRING DATA

a. General. This paragraph contains specifications of the coil springs used in the printer. The serviceability of springs can be verified by checking them against the manufacturing specifications shown below.

b. Crossed-End Spring Data.

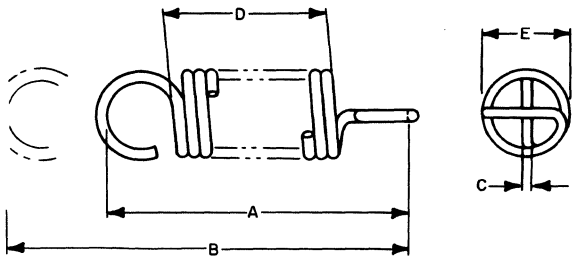


Figure 4D-62. Crossed-end springs.

Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension Extended length (oz.)	C Wire Thickness (in.)	D No. of Coils	E Outside Diameter (in.)
50912	Latch spring	.484 ± .022	21/32	17-1/2 ± 1/2	.0180 ± .0003	12-3/4	.156 ± .004
65659	Line-feed clutch tension spring	25/64 ± 1/32	5/8	4 ± 10%	.0120 ± .0003	11-1/2	.148 ± .005
65662	Armature spring	.460 ± .016	5/8	14 ± 10%	.0180 ± .0003	8-3/4	.178 ± .005
65845	Space pawl spring	.433 ± .015	11/16	7 ± 10%	.0110 ± .0003	24	.101 ± .003
65995	Armature spring	.492 ± .016	19/64	7 ± 10%	.017 ± .001	15-1/4	.142 ± .005
66432	R.H. arm assembly spring	.853 ± .031	1-3/4	136 ± 10% grams	.013 ± .001	42	.173 ± .005
66433	Roller arm spring	.597 ± .031	15/16	9 ± 10%	.015 ± .001	24	.141 ± .005
66098	Paper alarm sensing lever	.990 ± .031	1-3/32	1-3/4 ± 10%	.016 ± .001	47-1/4	.143 ± .005

99129A-10

c. Compression Spring Data (fig. 4D-63).

Reference No.	Name	A Free length (in.)	B Compressed length (in.)	Required tension Operating length (oz.)	C Wire Thickness (in.)	D No. of Coils	E Inside Diameter (in.)
65658	Line feed knob spring	.864 ± .031	1/2	23 ± 10%	.0180 ± .0003	18	.114 ± .003
65851	Double print hammer block spring	.347 ± .016	.187 ± .016	40 ± 10% grams	.0070 ± .001	15 (Active)	.066 ± .003
65902	Armature assembly spring	.460 ± .016	.210 ± .016	45 ± 10% grams	.009 ± .001	14	.117 ± .003
66072	Sprocket wheel assembly spring	.415 ± .016	.250 ± .016	1-1/2 ± 10%	.0100 ± .0003	11	.134 ± .005
66293	Ribbon spool shaft assembly spring	.593 ± .031	.468 ± .016	15 ± 10%	.0150 ± .0003	19	.063 ± .003
66434	Ribbon spool shaft spring	.343 ± .016	.156 ± .016	6 ± 10%	.024 ± .001	4	.445 ± .008
67842	Carriage return clutch spring	.422 ± .016	.110 ± .016	3 ± 10%	.014 ± .001	5	.296 ± .008

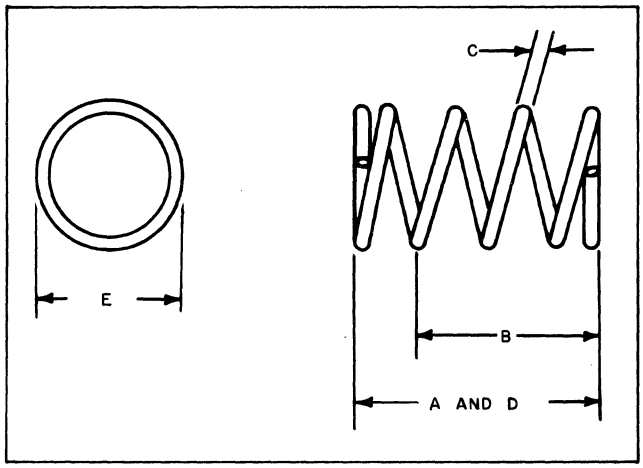


Figure 4D-63. Compression springs.

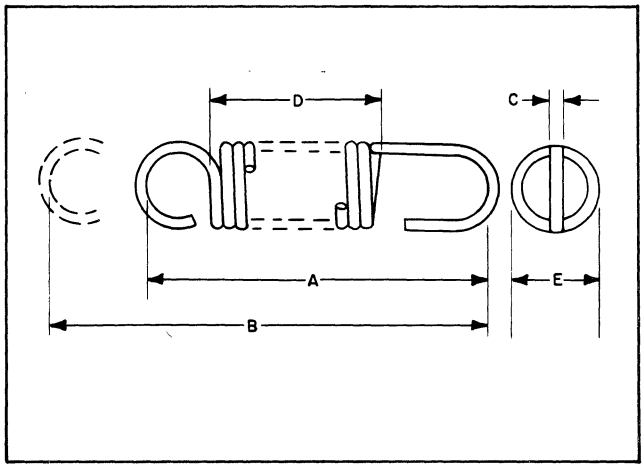


Figure 4D-64. Extension spring data.

d. Extension Spring Data (fig. 4D-64).

Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension Extended length (oz.)	C Wire Thickness (in.)	D No. of Coils	E Diameter (in.)
65663	Line feed cam follower spring	1-7/16 ± 3/64	1-15/16 ± 1/64	30 ± 10%	.023 ± .001	42-1/4	.173 ± .005
65711	Ribbon feed cam follower spring	.937 ± .031	1.219	160 ± 10%	.038 ± .001	14-1/4	.238 ± .005
66267	Line feed detent lever spring	.600 ± .031	13/16 ± 1/32	34 ± 10%	.0240 ± .0003	8-3/4	.204 ± .005
66099	Paper alarm lever assembly	.847 ± .031	1-27/64	34 ± 10%	.018 ± .001	30-1/4	.133 ± .005

99129A-10

e. Special Spring Data (figs. 4D-65 through 4D-70).

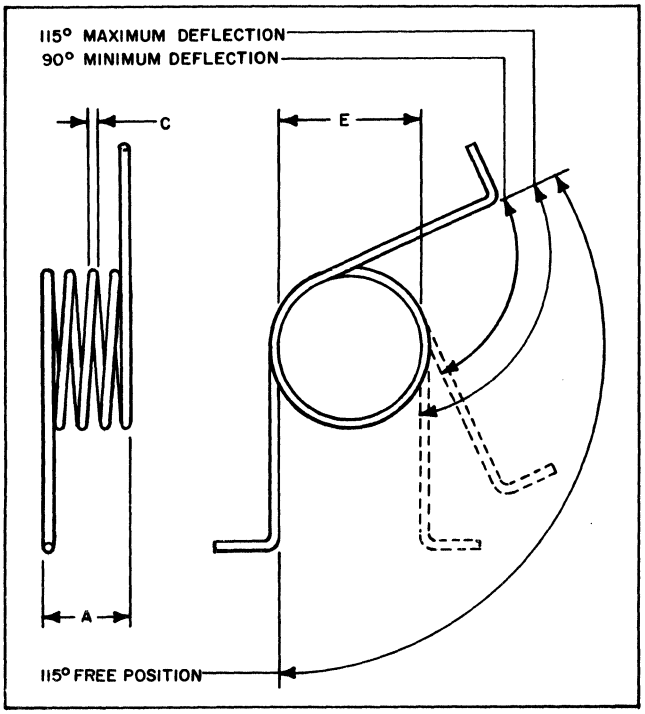


Figure 4D-65. Ribbon feed pawl torsion spring.

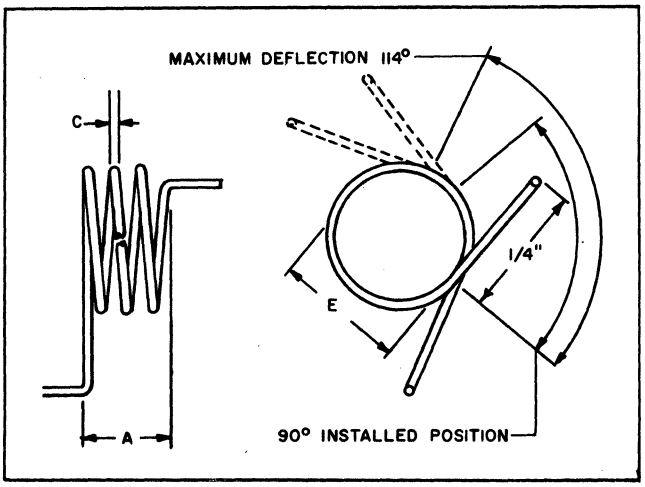


Figure 4D-66. Detent wheel pawl torsion spring.

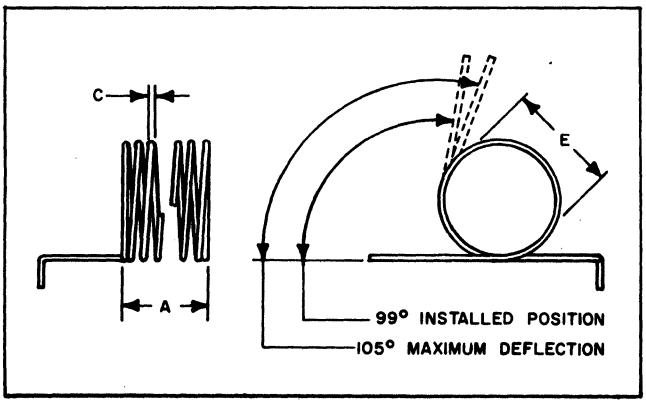


Figure 4D-67. Ribbon feed advance and holding pawl spring.

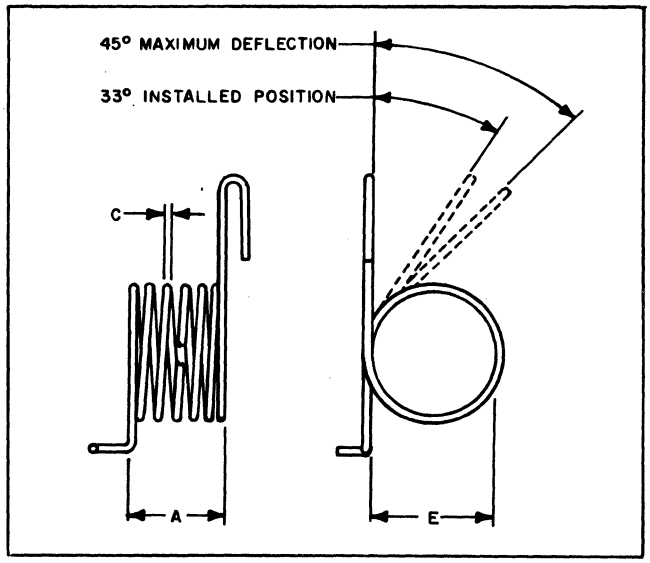


Figure 4D-68. R.H. lever torsion spring.

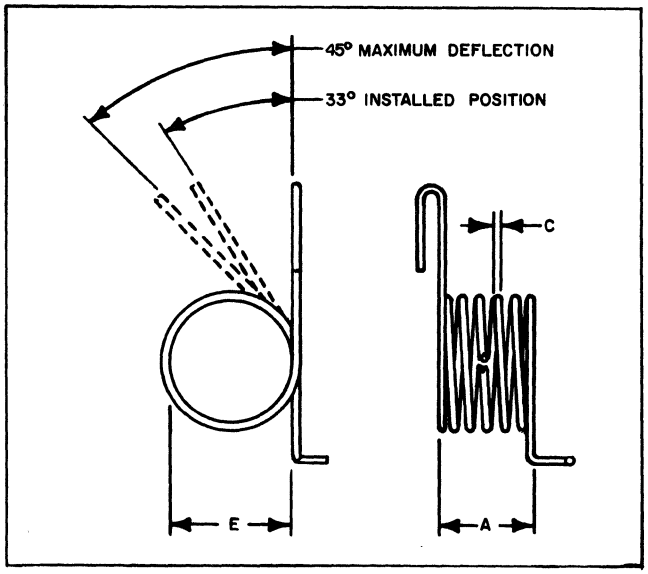


Figure 4D-69. L.H. lever torsion spring.

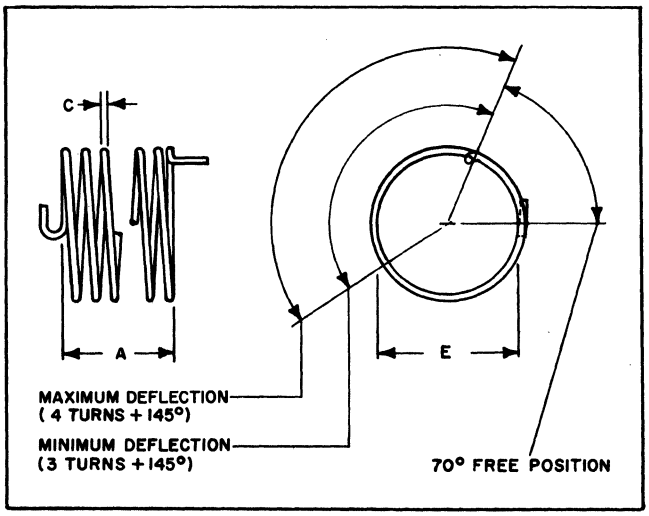


Figure 4D-70. Carriage return pulley torsion spring.

Reference No.	Name	A Free length (in.)	C Wire Thickness (in.)	D No. of Coils	E Inside Diameter (in.)
65777	Ribbon feed pawl torsion spring	11/64 - 1/32	.0180 ± .001	4-1/4	.224 ± .008
65934	Detent wheel pawl torsion spring	5/32 - 1/32	.0150 ± .001	4	.308 ± .008
66460	R.H. lever torsion spring	11/32 ± 1/64	.016 ± .001	11	.211 ± .005
66461	L.H. lever torsion spring	11/32 ± 1/64	.016 ± .001	11	.211 ± .005
66462	Ribbon feed advance and holding pawl spring	1/4 ± 1/64	.020 ± .001	8	.216 ± .005
66581	Carriage return pulley torsion spring	1 ± 1/32	.026 ± .001	30	.820 ± .015

f. Crossed-End Extension Springs (fig. 4D-71).

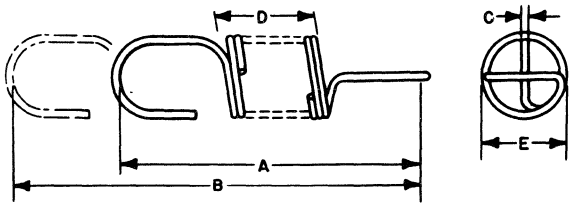


Figure 4D-71. Crossed-end extension springs.

Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension Extended length (oz.)	C Wire Thickness (in.)	D No. of Coils	E Diameter (in.)
66993	Bail bracket spring	.446 ± .016	.562	2 ± 10%	.012 ± .001	12-1/4	.148 ± .005

Section E Preventive Maintenance

4E-1 TOOLS

The tools listed below are recommended for the level of maintenance described in the following pages:

Item	KLEINSCHMIDT Part No.	Description
(1) Tool kit	90043A-00.00	KLEINSCHMIDT Tool Kit (comprising 54 items) or equivalent.
(2) Gram gage (0-150 gms)	15024	Commercial manufacture.
(3) Circuit board extension	98056-1-182 Single hammer, or 98056-1-309 double hammer	Provides ready access to all components on the circuit board under test.
(4) Circuit board extractor	66615	Special tool manufactured by KLEINSCHMIDT for careful removal of printed circuit boards from their sockets.
(5) Oscilloscope	- - - - -	Dual beam. Tektronic Model 545 or equivalent.
(6) Multimeter	15075	Dc = 20,000 ohms per volt Ac = 5,000 ohms per volt Amperes = 0μa - 600 ma at 250 mv. (Triplett Model 310, or equivalent) CAUTION: Do not use a multimeter with internal battery supply greater than 22.5 volts.
(7) 6 inch steel rule	15059	Commercial manufacture.
(8) Orange sticks	15085	Commercial manufacture.
(9) Oil atomizer	- - - - -	DeVilbis Model DV15 or equivalent.

4E-2 MAINTENANCE MATERIALS

The following maintenance materials are recommended for maintenance of the Model 311.

No.	Item
1	Brush, camel's hair, 3/8 inch
2	Brush, small artist, for light oil application
3	Bleached cheesecloth
4	Crocus cloth, 9 inch by 11 inch sheets
5	Cleaning solvent (par. 4E-5b)
6	Dry air pressure source 100 pounds per square inch
7	Cleaning paper 1/4 inch by 2-1/2 inches
8	No. 0000 Sandpaper
9	Clear lacquer, small bottle
10	Atomizer, oil
11	Cotton swabs
12	Vacuum generating source with a "static water lift" capacity of 36 to 51 inches. (Tornado Series 80 or equivalent)

4E-3 RECORDS

To be most effective, preventive maintenance should be performed according to a regular schedule. Keep records of inspection dates and enumerate the readily accessible parts and surfaces requiring inspections for dirt, maladjustments and signs of wear. The need for cleaning and lubrication may be affected by local conditions. Under ideal conditions all rubbing surfaces should be cleaned and lubricated at least every six months.

4E-4 CLEANING INSTRUCTIONS

Note: A type brush and sash brush are included in the KLEINSCHMIDT Tool Kit (par. 4E-1).

a. General.

(1) Use No. 0000 sandpaper to remove corrosion.

(2) Use a clean, dry, lint-free cloth or a dry brush for cleaning purposes.

(3) When necessary, use a cloth moistened with cleaning solvent to clean metallic parts (except electrical contacts). Wipe the solvent and dirt from the part with a clean, dry cloth.

(4) A flushing action normally is best when cleaning electrical contacts. Dip an orange stick in cleaning compound and allow the liquid to drop from the stick through the contacts. Remove the cleaning compound carefully with a clean, dry cloth.

CAUTION: Cleaning compound is flammable; do not use it near a flame.

(5) Vacuum cleaning equipment is suitable for removing loose paper lint and dirt. Compressed dry air may be used, but the pressure must be kept low enough to prevent equipment damage.

(6) Parts with a black metallic color have a protective corrosion-resistant finish. These parts should not be kept in cleaning solvent longer than is necessary to remove dirt, since cleaning solvent is harmful to the protective finish. After cleaning, treat the parts with a lightweight preservative mineral oil (KLEINSCHMIDT Part No. 15090 or equivalent), which has no harmful effects on finishes, plastics, or paint.

b. Oil-Impregnated Bronze Parts. Oil impregnated bronze (oilite) bearings and other parts must not be immersed in solvent or the absorbed oils will be dissolved. To clean, use a stiff brush or wipe with an oil-soaked cloth.

c. Ball Bearings.

(1) Sealed Ball Bearings: Make no attempt to clean or lubricate them other than wiping with a clean, dry cloth. Discard any bearings that do not spin freely.

(2) Open Ball Bearings: Clean all open ball bearings by immersing them in cleaning solvent, blow out dirt and cleaning solvent with filtered dry compressed air and rotate the bearings slowly to check for wear or defects. Discard any bearing that does not roll freely.

d. Motor. To clean the external part of motor use a clean, dry sash brush to remove dust and dirt. Remove all oil and gummy deposits with a clean, lint-free cloth dampened with solvent.

e. Electrical Coils. Clean the coils with a cloth dampened in solvent. If applicable, clean rust off the pole pieces with number 0000 sandpaper, then recoat with a thin film of lacquer.

f. Wiring and Electrical Parts. Remove dust and dirt with a clean, dry sash brush, and remove all oil and gummy deposits with a clean cloth.

g. Base. Clean the base thoroughly. Wipe away all deposits of oil or grease which may have dropped from the mechanical assemblies. Brush away all loose dirt and paper lint from the hard-to-get-at places such as connecting jacks and terminal boards. If grimy deposits are difficult to remove with a dry cloth, moisten the cloth with solvent.

h. Cables and Wiring.

(1) Check all visible wiring for cracked or deteriorated insulation, frayed or cut insulation at connecting points, kinks, and strain caused by improper placement.

(2) Tighten loose fasteners, clamps, and wiring connections. Repair loose or broken connections. Remove corrosion, rust, dirt, and dust from ground connections. Be sure that the outer insulating cover on cords and cables is wiped clean. Do not used mineral oil, solvent, or soap compounds on rubber insulation.

(3) Adjust the wiring so that it does not interfere with the operation of mechanical parts. Resolder defective connections, and replace defective wiring and conductors.

i. Switches.

(1) Inspect the mechanical action of each switch. Remove the mounting screw from the right hand end of the mode panel, and pivot the panel outwards to expose the backs of the

switches. Look for dirt or corrosion. Operate each switch to see that it moves freely and snaps into position. Tighten loose mounting parts. Remove loose connections that are dirty or corroded, clean and reinstall them correctly. Tighten switch connections and repair soldered connections. Reposition the mode panel and reinstall the mounting screw and washers.

(2) Wipe off any moisture present. Carefully clean the exterior surfaces of switches with a dry, stiff brush.

j. Terminal Boards. Terminal boards used as distributing points for electrical circuits usually are made of a strip of insulating material and one or more types of electrical connectors. They normally require little maintenance unless the wiring is changed. Inspect the terminal board for cracks, breakage, and loose connections of mounting screws. Examine the connections for mechanical defects (broken or stripped screws and threads), dirt, grease, and corrosion. Tighten loose screws, lugs, and mounting bolts. Use tools of the correct size. Do not strip the threads by exerting too much force. Solder all loose or broken connections.

k. Print Drum. Clean the print drum with a stiff brush. DO NOT use solvent to clean the type faces.

4E-5 LUBRICATION

a. General. Lubrication of the 311 equipment is limited to the metal and plastic parts. Components made of rubber, cork or other material where friction is a contributing factor to the units, must be kept free of lubricant. When lubrication is applied, care should be taken to prevent it from dripping or splashing onto any of the parts that may transfer it to the paper.

b. Recommended Lubricants. Lubricants and cleaning solvent tabulated below are recommended for use on this equipment.

Common Name	KLEINSCHMIDT Part No.	Federal Stock No.	Application
General Lubricant (Oil)	15090	9150-498-8318	Lubrication of pivots, bearing surfaces and moving parts other than gears and cams.
Gear and Cam Lubricant (Grease)	15171	9150-262-7116	Lubrication of gears and cams other than cams which have phenolic (plastic) cam followers.
Aluminum and Magnesium Threaded Parts (Emulsion)	15092	8030-292-1102	Anti-seize compound for use on screws which enter threaded holes in non ferrous (aluminum, magnesium, etc.) parts except where plain or self-locking nuts are used.
Ferrous Threaded Parts (Emulsion)	15093	9150-K60-4295	Anti-seize compound for use on all ferrous (steel) threaded parts, except where plain or self-locking nuts are used.
Cleaning Solvent	15165	6850-264-9037	For cleaning all equipment. It is non-toxic, and not injurious to ball or oilite bearings, or electrical components. Caution: This cleaning solvent has a flash-point of 104 degrees Fahrenheit.
M2 Lubricant	15166	-	Special purpose oil to be used where indicated.

99129A-07

c. Method of Aplying Oil. To apply a thin film or spray, use atomizer. To apply drops, dip a piece of No. 22 wire one-half inch into oil and immediately touch end of wire to area which requires lubrication. Do not allow oil to contaminate wires, rubber parts or coils. Wipe off excess oil after lubrication is complete.

d. Method of Applying Grease. Apply grease with a stiff brush. Turn gears and cams as grease is being applied to form a continuous film of grease. Do not permit grease to contaminate the belt or print drum.

e. Lubrication Schedule. All lubrication points shown in figures 4E-1 through 4E-19 are to be lubricated every 1000 hours except where otherwise specified. See Note 2 on page 8.

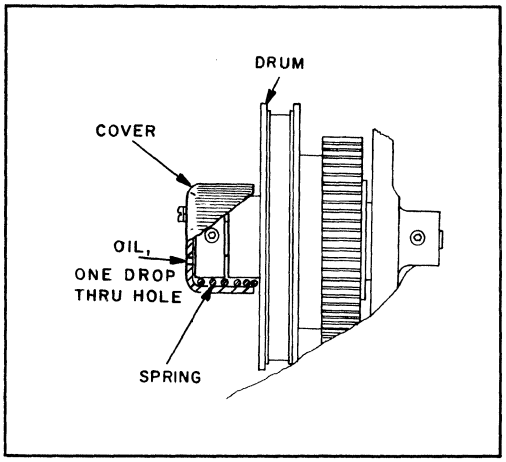


Figure 4E-1. Carriage return drum spring.

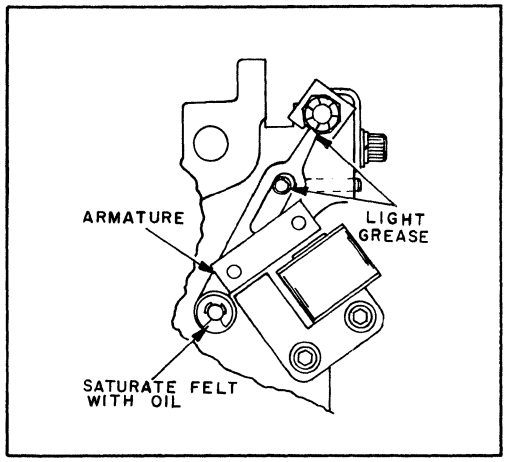


Figure 4E-2. Space magnet armature.

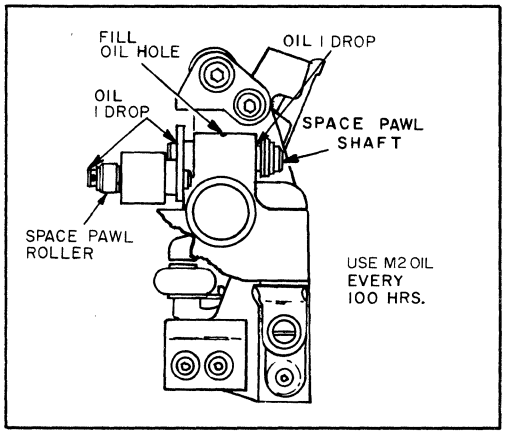


Figure 4E-3. Space pawl shaft.

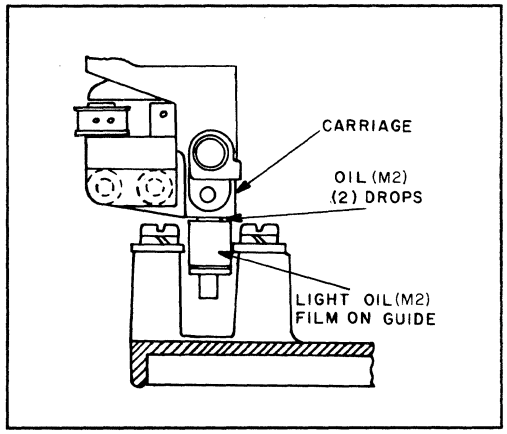


Figure 4E-4. Carriage guide.

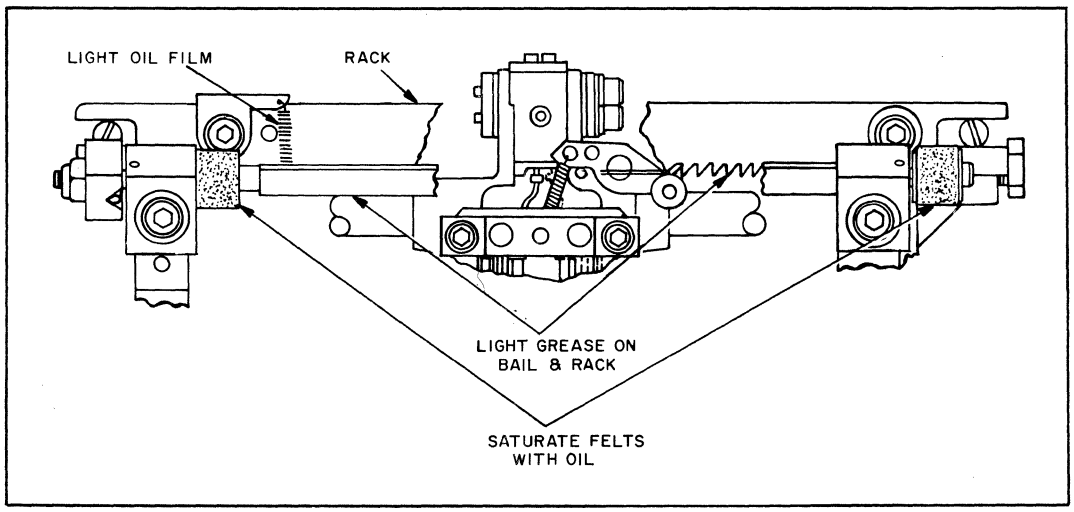


Figure 4E-5. Space pawl and rack.

99129A-13

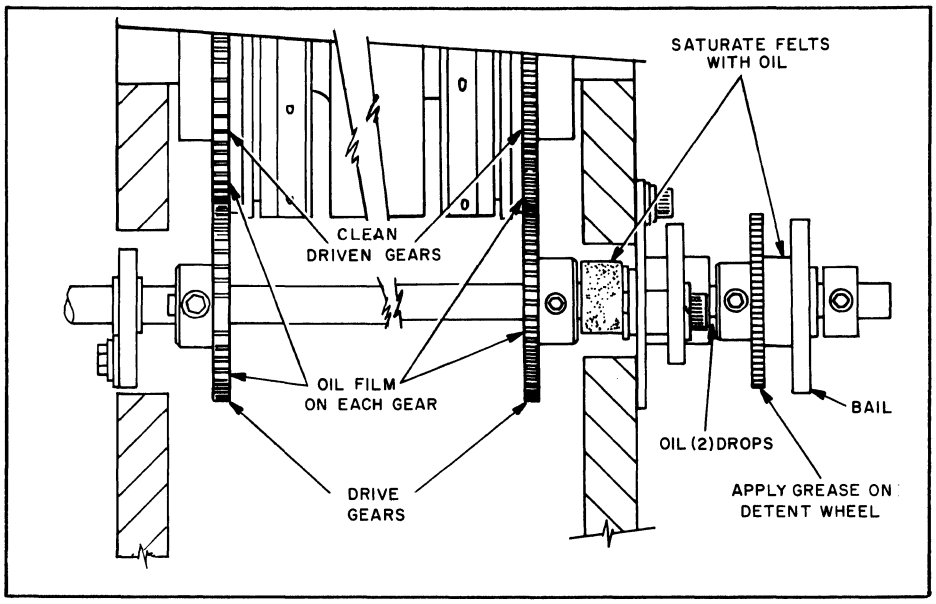


Figure 4E-6. Line feed shaft..

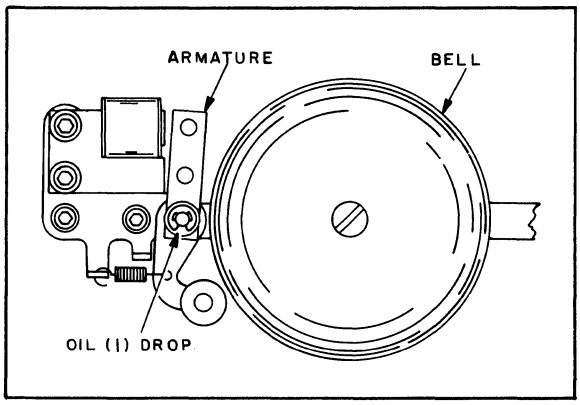


Figure 4E-7. Margin bell armature.

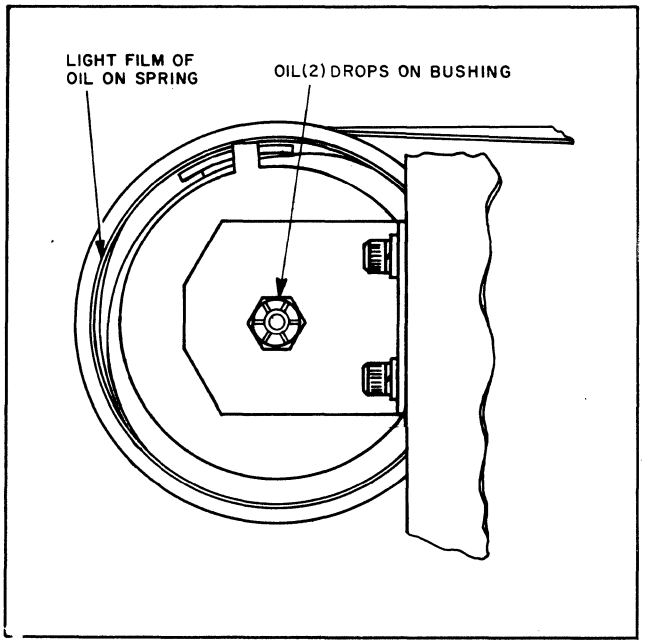


Figure 4E-8. Carriage feed drum mechanism.

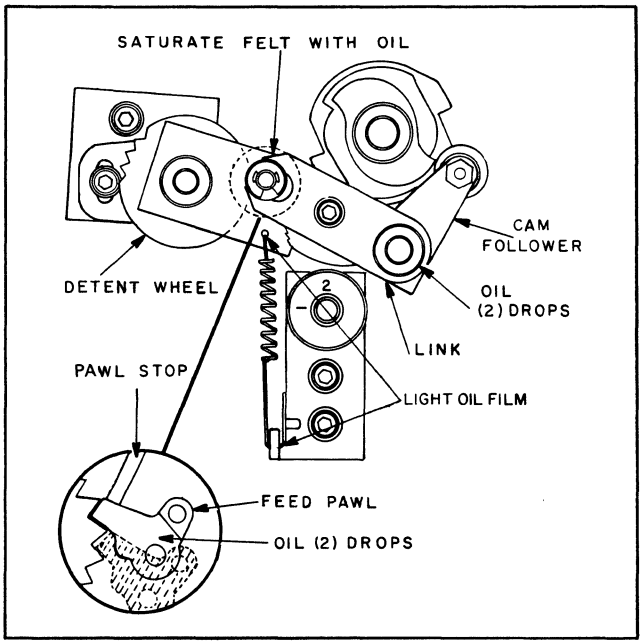


Figure 4E-9. Line feed pawl and linkage.

99129A-13

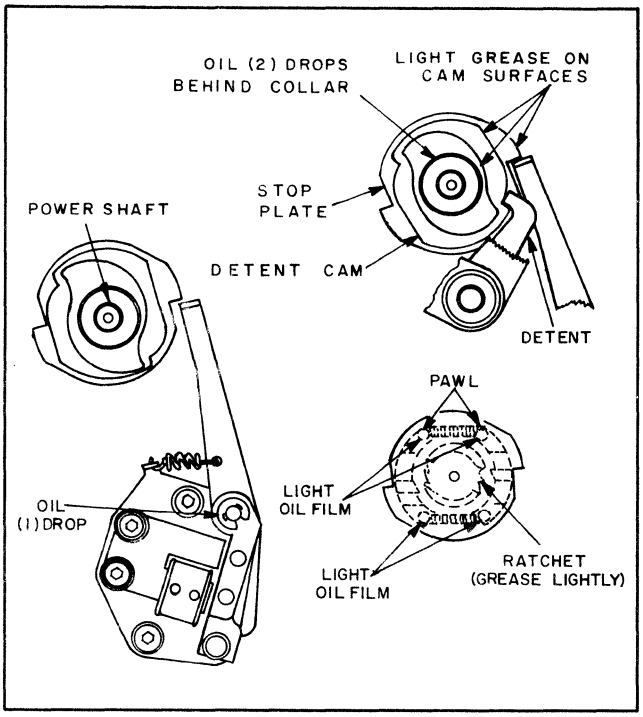


Figure 4E-10. Line feed cam and armature.

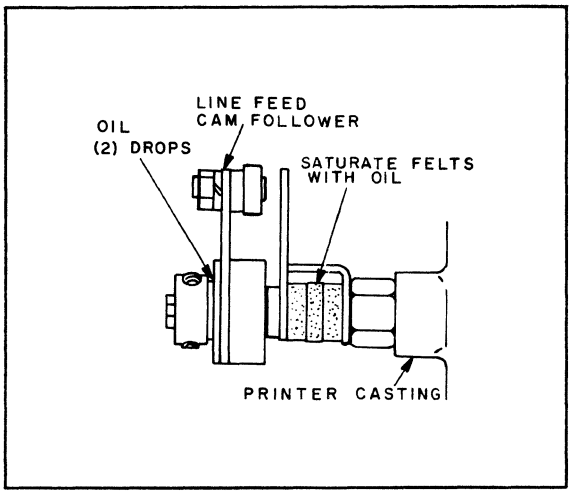


Figure 4E-11. Line feed cam follower.

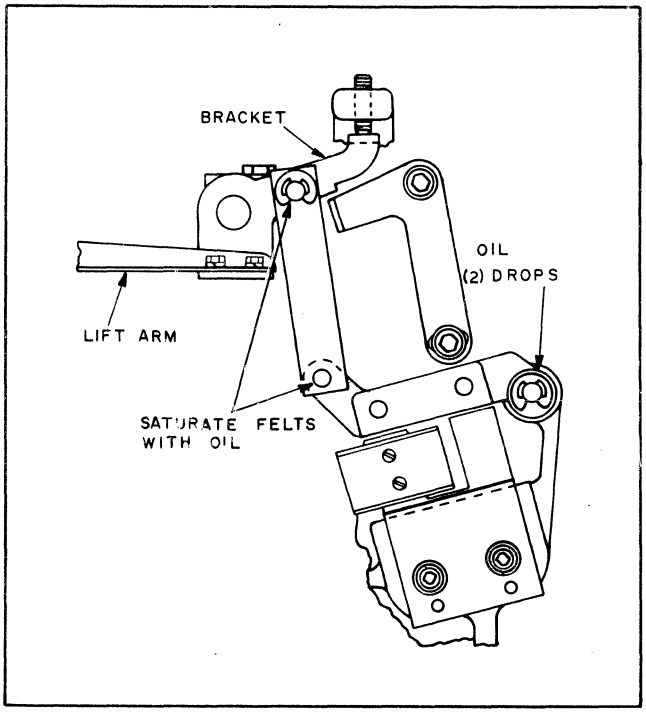


Figure 4E-12. Ribbon lift mechanism.

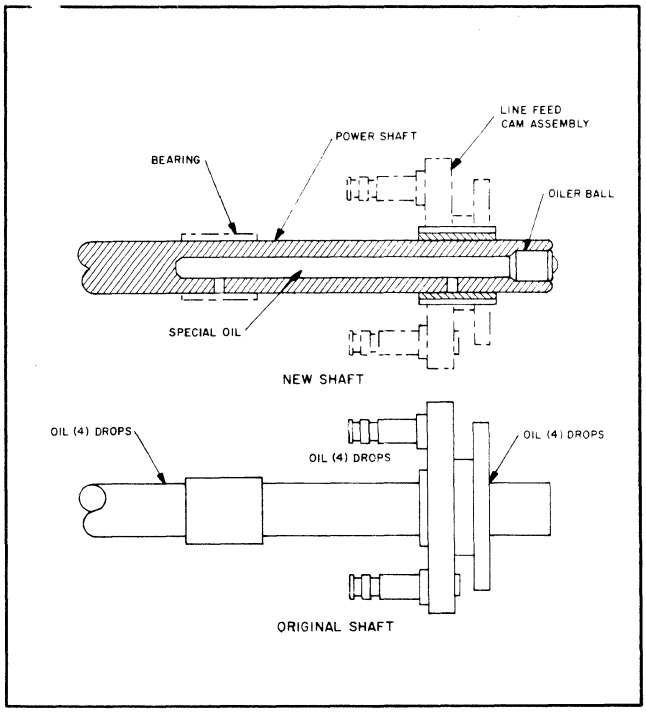


Figure 4E-13. Power Shaft

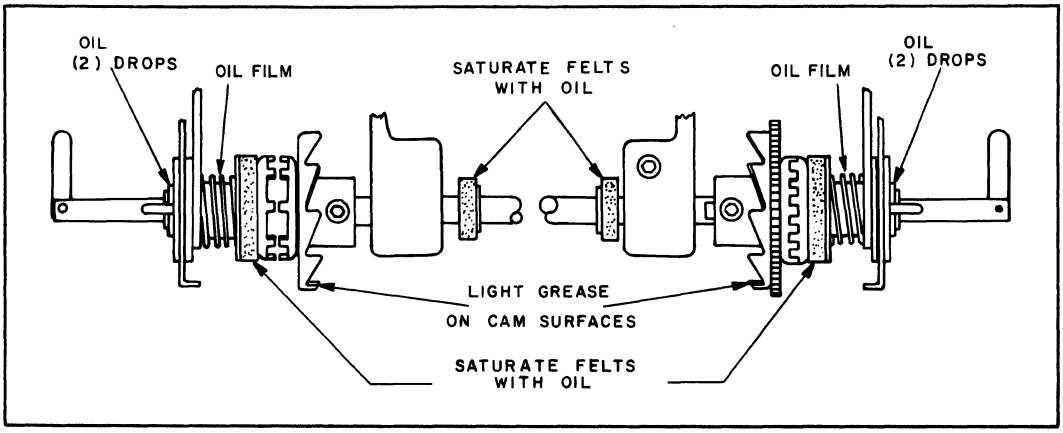


Figure 4E-14. Ribbon driving clutches.

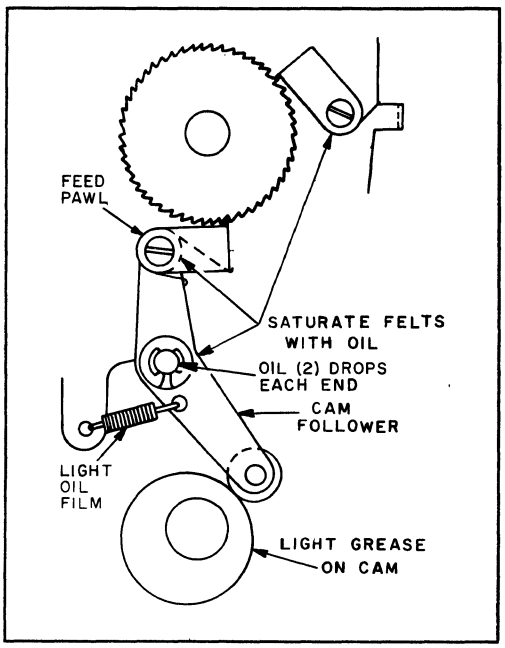


Figure 4E-15. Ribbon feed.

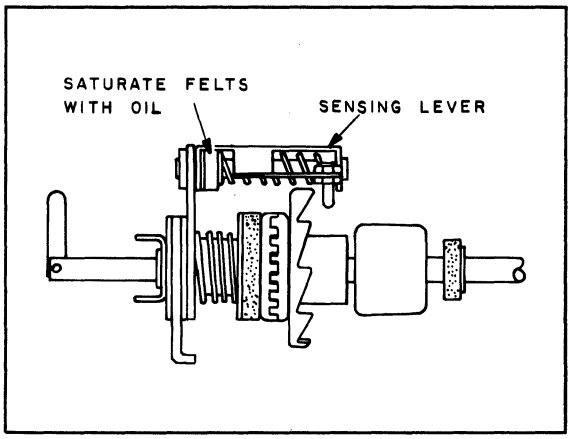


Figure 4E-16. Sensing lever.

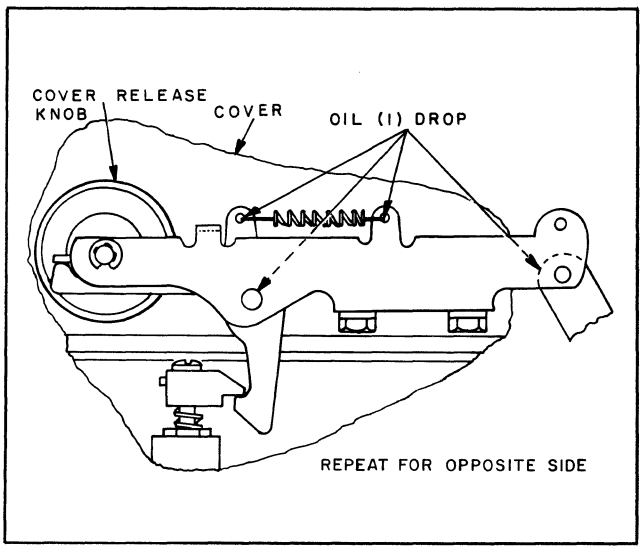


Figure 4E-17. Cover latch.

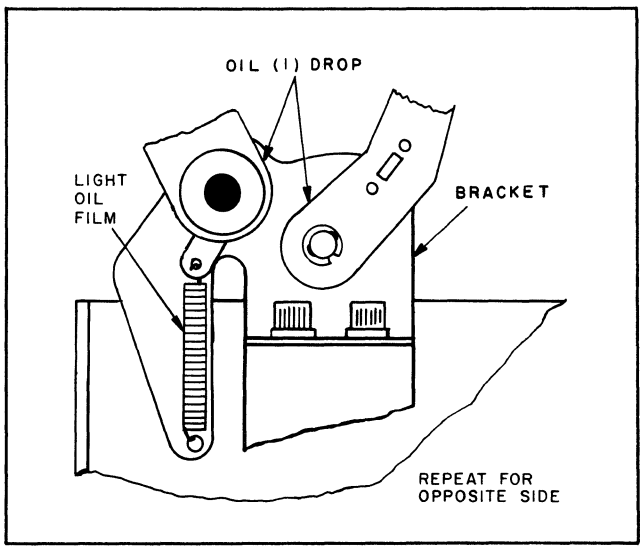


Figure 4E-18. Cover bracket.

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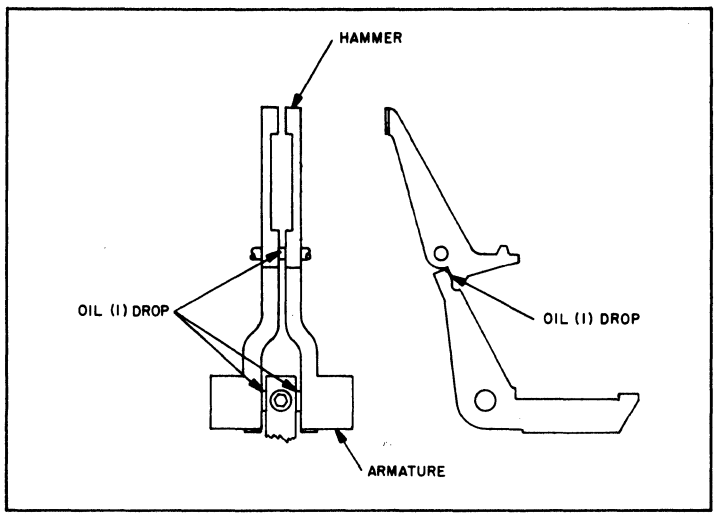

Figure 4E-19. Print Hammer And Armature

Note 1: Not applicable.

Note 2: All oil felts and moving parts not specified in figures 4E-1 through 4E-19 should be lubricated with General Lubricant every 1000 hours.

Section F Printer Adjustments

This section describes requirements and adjustment procedures for the printer of Model 311. Descriptions are arranged in the correct sequence for a complete readjustment of the printer. When making individual adjustments, check all related adjustments. When parts or subassemblies must be removed to effect an adjustment, refer to the disassembly sequence shown in the relevant exploded view (Section D of this chapter). The index number below the heading of each adjustment is for departmental reference only.

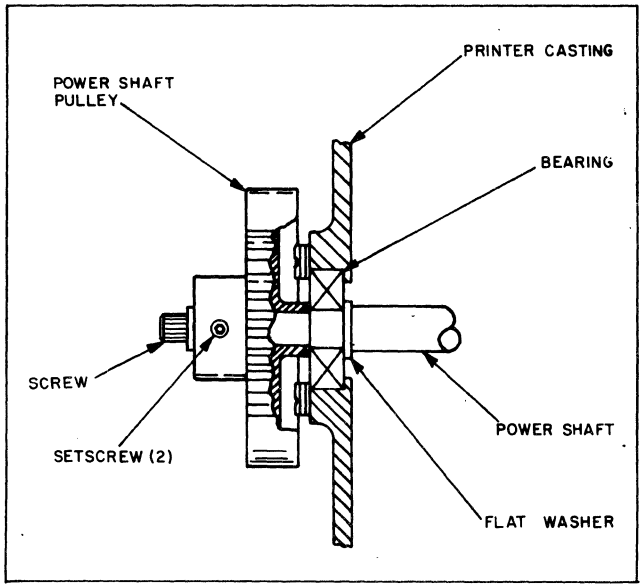

Figure 4F-1. Power shaft.

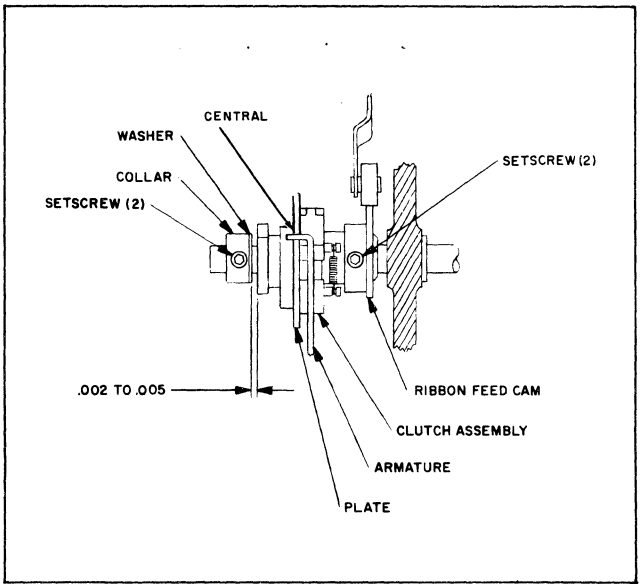

Figure 4F-2. Line feed armature alinement and clutch end play.

4F-1 POWER SHAFT (fig. 4F-1) (05392 Issue B)

a. Requirement. The power shaft should have no end play.

Note: Do not mistake internal bearing movement as shaft end play.

b. Adjustment.

(1) Loosen the screw.

(2) Loosen the power shaft pulley setscrews.

(3) Aline the setscrews with the flats on the shaft and tighten the screw.

(4) Tighten the setscrews.

(5) Perform the adjustment described in paragraph 4F-2.

4F-2 LINE FEED ARMATURE ALINEMENT AND CLUTCH END PLAY (fig. 4F-2) (05370 Issue B)

Note: The adjustment procedure described in paragraph 4F-1 must be completed before performing this adjustment.

a. Requirement.

(1) The clutch plate should be central on the flat horizontal surface of the armature.

(2) There should be .002- to .005-inch end play in the clutch assembly.

b. Adjustment.

(1) Loosen the collar and cam setscrews.

(2) Position the cam and clutch assembly to meet requirement a(1) and tighten its setscrews.

(3) Insert a .003-inch feeler gage between the washer and clutch assembly.

(4) Position the collar and washer against the feeler gage. Tighten the setscrews and remove the gage.

4F-3 LINE FEED CAM FOLLOWER END PLAY (fig. 4F-3) (05391 Issue A)

a. Requirement. The line feed cam follower should be "free" and have a .005-inch maximum end play.

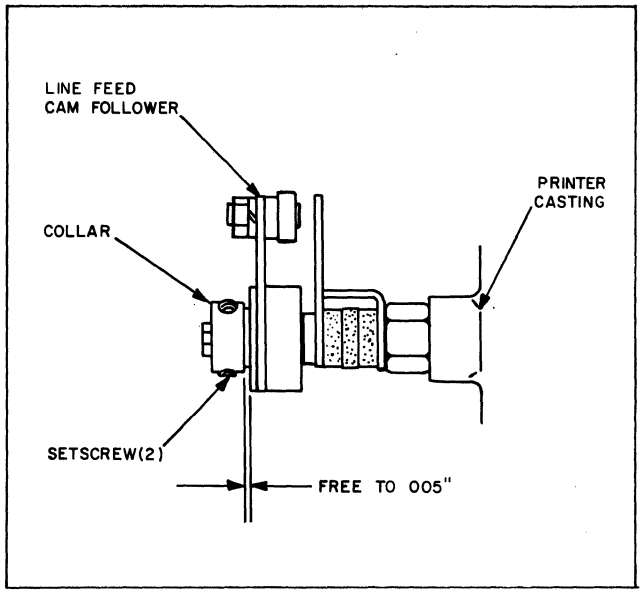

Figure 4F-3. Line feed cam follower end play.

b. Adjustment.

(1) Loosen the setscrews.

(2) Position the collar to meet the requirement and tighten the setscrews.

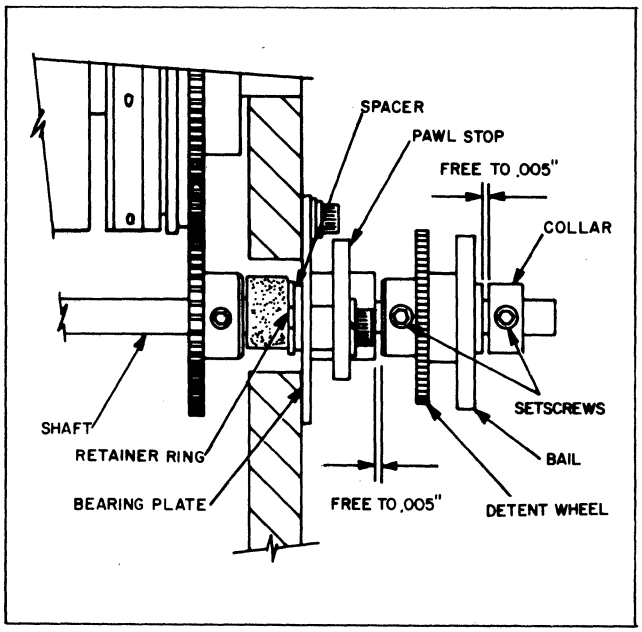

Figure 4F-4. Line feed shaft and bail end play.

4F-4 LINE FEED SHAFT AND BAIL END PLAY (fig. 4F-4) (05357 Issue A)

a. Requirement.

(1) The line feed shaft should be free and should not exceed .005-inch end play.

(2) The line feed bail should be free and should not exceed .005-inch end play.

b. Adjustment.

(1) Loosen the setscrews holding both the detent wheel and collar.

(2) Hold the shaft so that the retainer ring and spacer are against the bearing plate.

(3) Insert a .003-inch feeler gage between the pawl stop bearing and detent wheel.

(4) Position the detent wheel against the feeler gage and tighten the setscrews in the detent wheel.

(5) Remove the feeler gage and place it between the bail and collar.

(6) Position the collar against the gage and tighten the setscrews in the collar.

(7) Remove the gage and recheck the requirement.

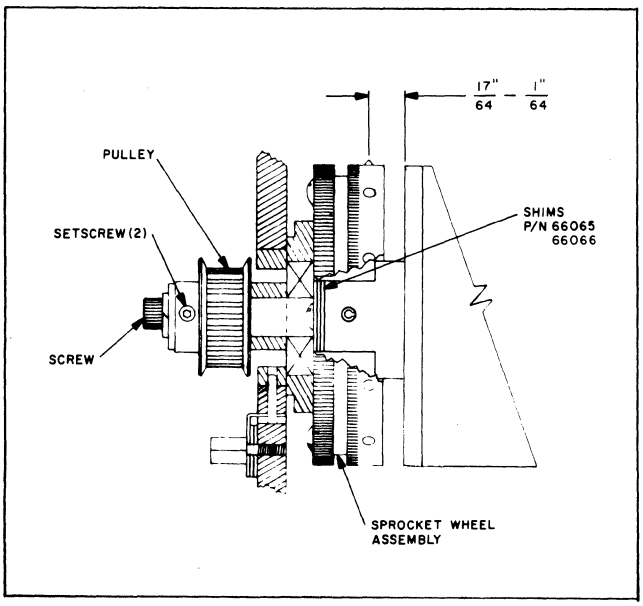

Figure 4F-5. Left sprocket wheel.

4F-5 LEFT SPROCKET WHEEL (fig. 4F-5) (98015-03-48 Issue B)

a. Requirement. The centerline of the left sprocket pins should be 17/64 minus 1/64-inch from the edge of the first print wheel when the sprocket wheel end play is taken up towards the drum.

b. Adjustment.

(1) Remove the clock wheel and the clock bracket.

(2) Remove the print drum bearing caps and remove the drum. Save all shims.

(3) Remove the shaft screw and washers; loosen the pulley setscrews and remove the pulley.

(4) Remove the left sprocket wheel assembly. Install or remove shims (Part No. 66065 or 66066) to meet the requirement.

(5) Recheck the requirement.

(6) Perform the adjustment described in paragraph 4F-6.

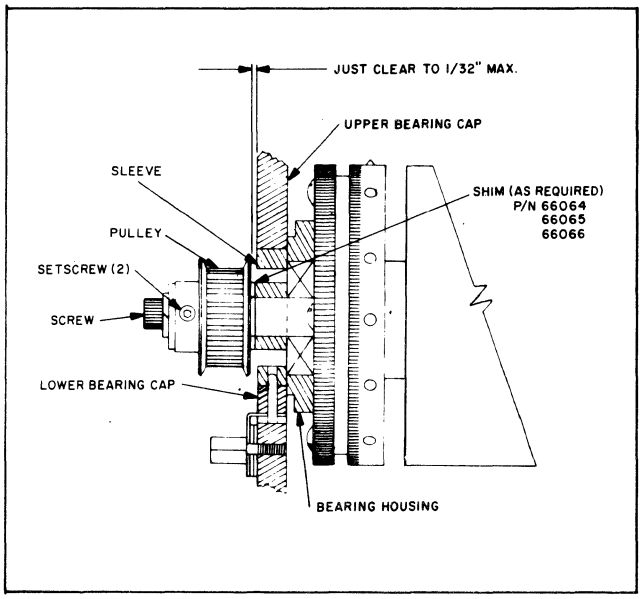

Figure 4F-6. Drum pulley clearance.

4F-6 DRUM PULLEY CLEARANCE (fig. 4F-6) (98015-03-47 Issue A)

Note: The adjustment procedure described in paragraph 4F-5 must be completed before performing this adjustment.

a. Requirement.

(1) The drum pulley must clear the frame. Maximum clearance 1/32-inch.

(2) The bearing housing must have no end play when the drum and pulley are positioned. DO NOT mistake the side movement of the sprocket wheel assembly for end play.

b. Adjustment.

(1) Position the print drum assembly on the lower bearing caps.

(2) Install the sleeve and pulley on the shaft.

(3) Hold the print drum firmly against the left bearing housing.

(4) Install shims (Part No. 66064, 66065 or 66066) between the pulley and the sleeve to meet requirement (1).

(5) Locate the pulley setscrews in line with the shaft flats and tighten the shaft screw. Obtain requirements (1) and (2) and tighten the setscrews.

(6) Recheck the requirements.

(7) Perform the adjustment described in paragraph 4F-7.

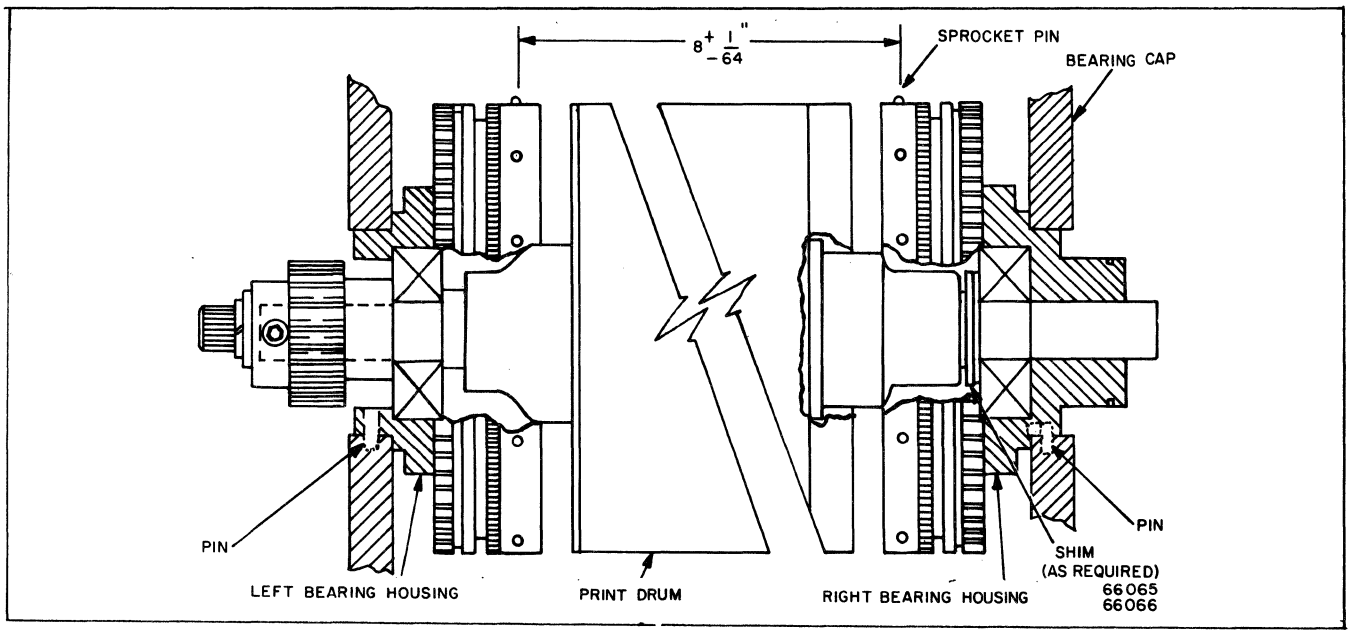

Figure 4F-7. Right hand paper feed wheel positioning.

4F-7 RIGHT HAND PAPER FEED WHEEL POSITIONING (fig. 4F-7) (05388 Issue B)

a. Requirement.

Sprocket Feed: There should be 8 inches (± 1/64-inch) between the left and right sprocket wheel pins when standard width sprocket feed paper is used.

Friction Feed: There should be 8 inches (± 1/32-inch) between the center of the rubber "O" rings on the paper feed wheels.

b. Adjustment.

(1) Remove the print drum from the unit.

(2) Hold the print drum against the left bearing housing and add or remove shims 66065 or 66066 between the right bearing and print drum to meet the requirement.

(3) Aline the bearing housings with their locating pins in the casting.

(4) Install the print drum on the unit with the line feed drive and driven gears properly meshed.

(5) Hold the print drum against the left bearing housing and position the right bearing housing against the shims. Eliminate all end play from the drum.

(6) Tighten both bearing cap screws.

(7) Recheck the requirement.

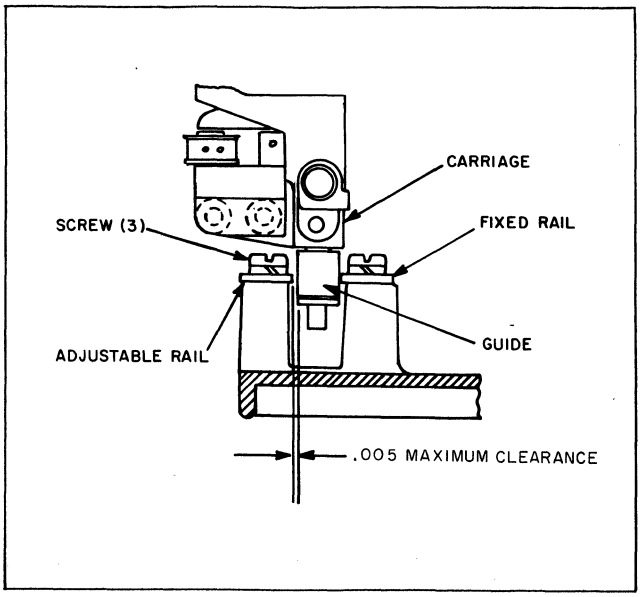

Figure 4F-8. Carriage adjustable guide rail.

4F-8 CARRIAGE ADJUSTABLE GUIDE RAIL (fig. 4F-8) (05358 Issue B)

a. Requirement. The carriage guide should be free between the rails over their entire limit. Maximum clearance should not exceed .005-inch.

b. Adjustment.

(1) Loosen the screws which hold the adjustable rail.

(2) Position the rail to meet the requirement.

(3) Tighten the screws and recheck the requirement.

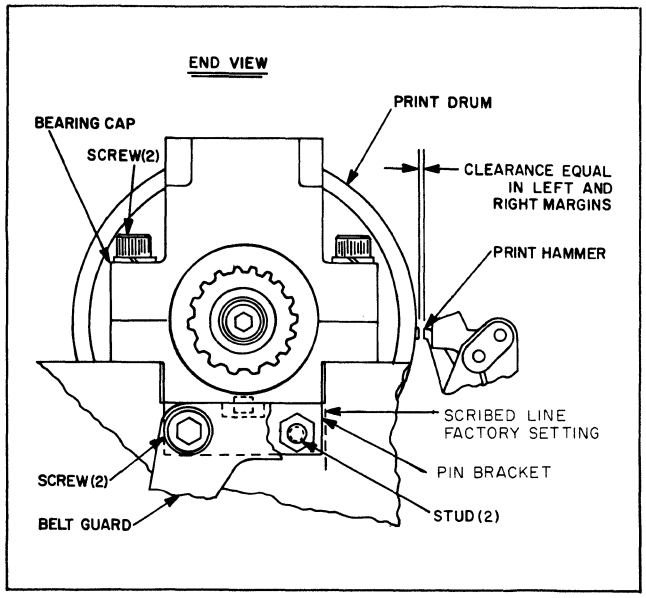

Figure 4F-9. Print drum lateral alinement.

4F-9 PRINT DRUM LATERAL ALINEMENT (fig. 4F-9) (05385 Issue C)

a. Requirement.

(1) The clearance between the print hammers and the print drum should be constant when the carriage is in the left and right margins.

(2) The characters must be fully printed and not cut off at the top or bottom when the carriage is at the left margin.

b. Method of Checking.

(1) Alternately position the carriage in the right and left hand margins and check the clearance between the hammer and the print drum with feeler gages.

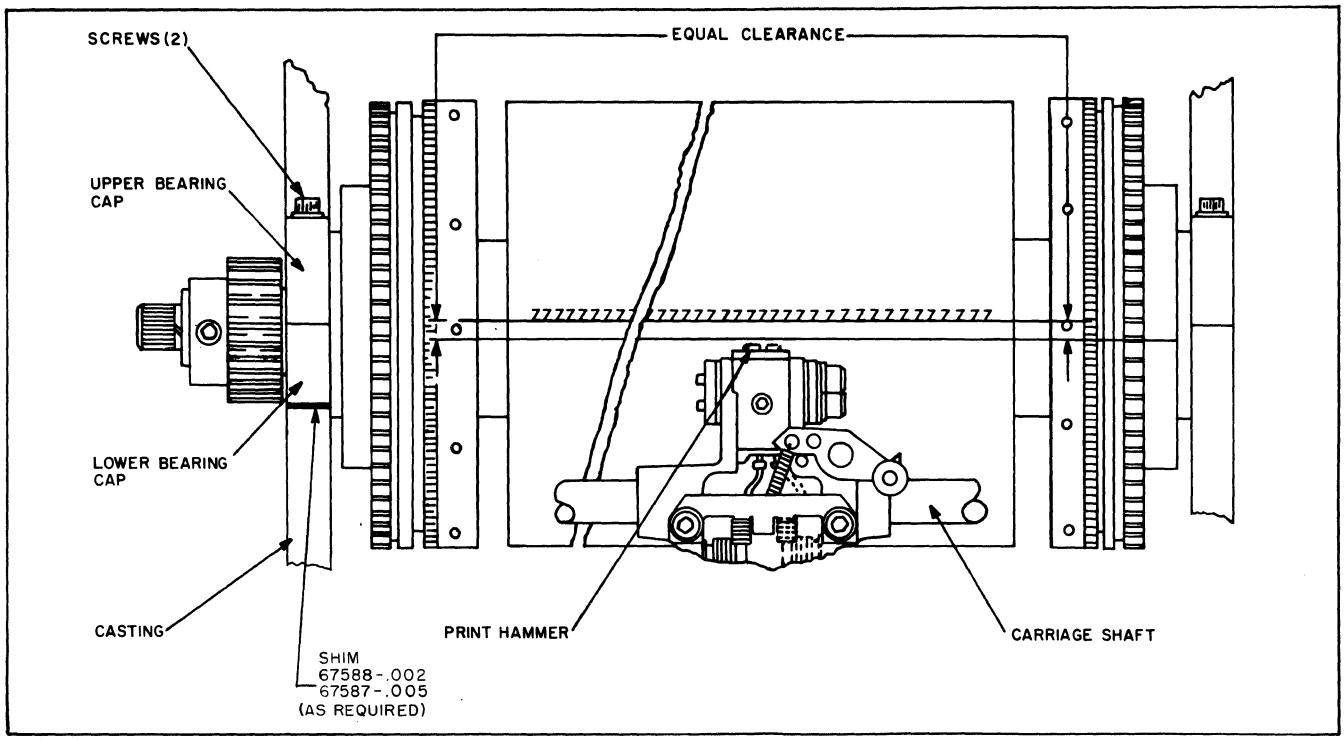

Figure 4F-10. Print drum vertical alinement.

(2) Print a line of characters and check to see that the characters are fully printed.

c. Adjustment.

(1) With the carriage at the left margin loosen the left bearing cap screws and the belt guard screws.

(2) Loosen the studs.

Note: DO NOT remove any shims from under the pin bracket.

(3) Position the drum to meet both requirements.

(4) Recheck the requirements and tighten the bearing cap screws.

(5) Check, and if necessary perform the adjustment described in paragraph 4F-21.

(6) Tighten the belt guard screws and the studs.

4F-10 PRINT DRUM VERTICAL ALINEMENT (fig. 4F-10) (05365 Issue D)

a. Requirement.

(1) Each end of any row of characters should be level with the tops of the print hammers.

(2) Characters must be fully printed at either margin when the machine is operating.

b. Method of Checking.

(1) Visually aline the top of the print hammer(s) with the bottom of a row of characters on the print drum.

(2) Move the carriage from the left to the right margin and note any variations in the alinement to meet requirement a(1).

(3) Print a line of characters on the machine from the left to the right margin and note the impression of each printed character.

c. Adjustment.

(1) Loosen the left bearing cap screws.

(2) Add or remove shims 67588 or 67587 as required, between the lower bearing cap and the casting.

(3) Tighten the screws and recheck requirements a(1) and a(2).

4F-11 LINE FEED DRIVE AND DRIVEN GEAR ALINEMENT AND BACKLASH (fig. 4F-11) (05378 Issue C)

Note: The adjustment procedures described in paragraphs 4F-4, 4F-9, and 4F-10 must be completed before performing this adjustment.

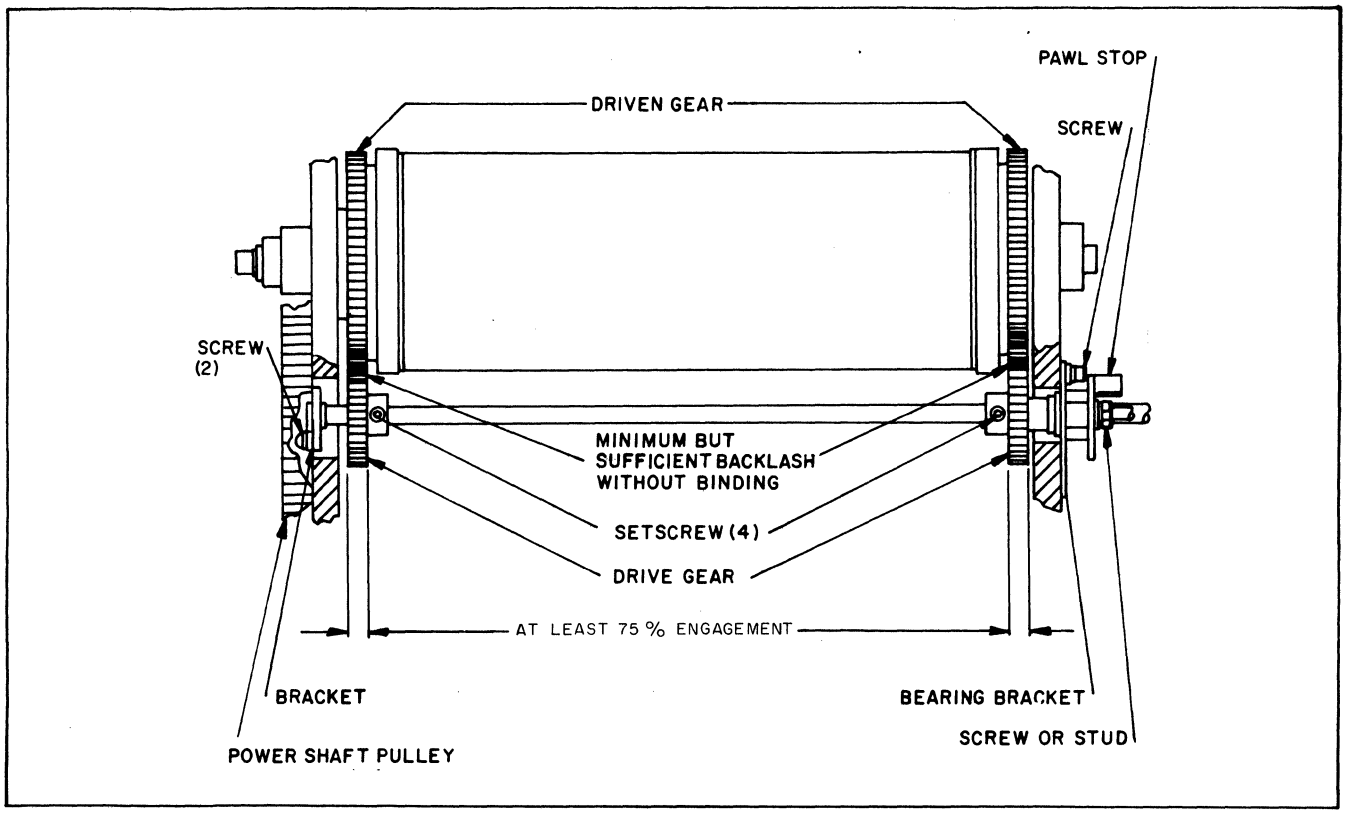

Figure 4F-11. Line feed drive and driven gear alinement and backlash.

a. Requirement.

(1) There should be minimum backlash without binding between the drive and driven gears.

(2) The drive and driven gears should be at least 75 per cent alined with each other.

b. Adjustment.

Note: Access to one of the drive gear bracket screws is through the hole in the power shaft pulley.

(1) Loosen both drive gear bracket screws and the drive gear bearing screws.

(2) Position the brackets to meet requirement a(1) and tighten the screws.

(3) Loosen both drive gear setscrews.

(4) Position the gears to meet requirement a(2) and tighten the setscrews.

(5) Recheck the related adjustment described in paragraph 4F-4.

4F-12 PAPER TROUGH POSITIONING (fig. 4F-12) (05368 Issue B)

Note: The adjustment procedure described in paragraph 4F-7 must be completed before performing this adjustment.

a. Requirement.

Sprocket Feed: The paper trough should not curl the edge of the paper or rub on the sprocket wheels when the pins are centered in the holes of the paper.

Friction Feed: The paper trough should clear the sides of the paper feed wheels.

b. Method of Checking. Feed paper into the unit and check the requirement visually.

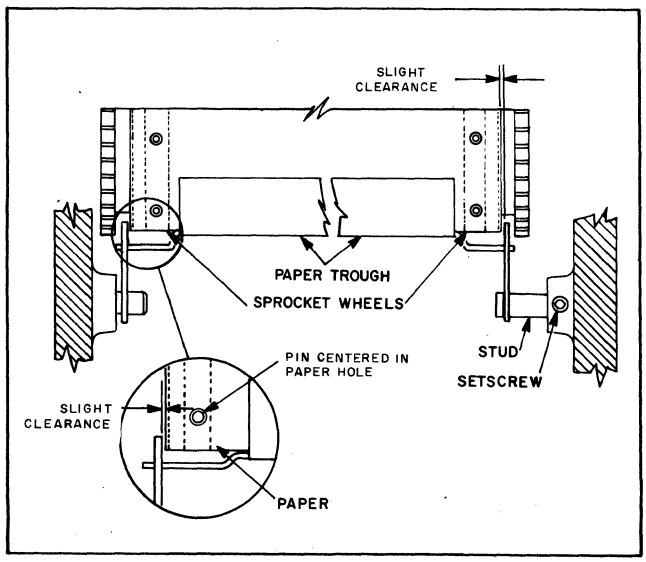

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Figure 4F-12. Paper trough positioning.

c. Adjustment.

(1) Loosen the setscrew.

(2) Position the paper trough to meet the requirement.

(3) Tighten the setscrew.

4F-13 PAPER TROUGH CLEARANCE (fig. 4F-13) (05374 Issue A)

a. Requirement.

(1) The clearance between the paper trough and print drum should be held to the minimum without binding the paper (either single or multiple copy).

(2) The end plates of the paper trough should clear the paper feed wheels.

b. Adjustment.

(1) Back out the screws until the end plates strike the feed wheels or the trough rubs against the print drum.

(2) Turn the screws in to meet requirement a(2).

(3) Insert the single or multiple copy paper.

(4) Turn the screws to meet requirement a(1).

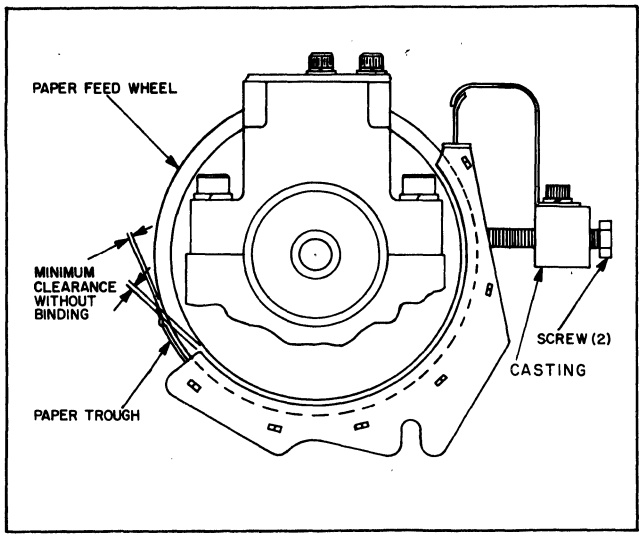

Figure 4F-13. Paper trough clearance.

4F-14 SPROCKET PINS ALINEMENT (fig. 4F-14) (05366 Issue C)

a. Requirement. The pins of the right and left sprocket wheels should be in line with each other.

b. Method of Checking. Check the requirement using sprocket feed paper or by alining the pins with a row of dashes on the type drum.

c. Adjustment.

(1) Loosen the right driven gear screws.

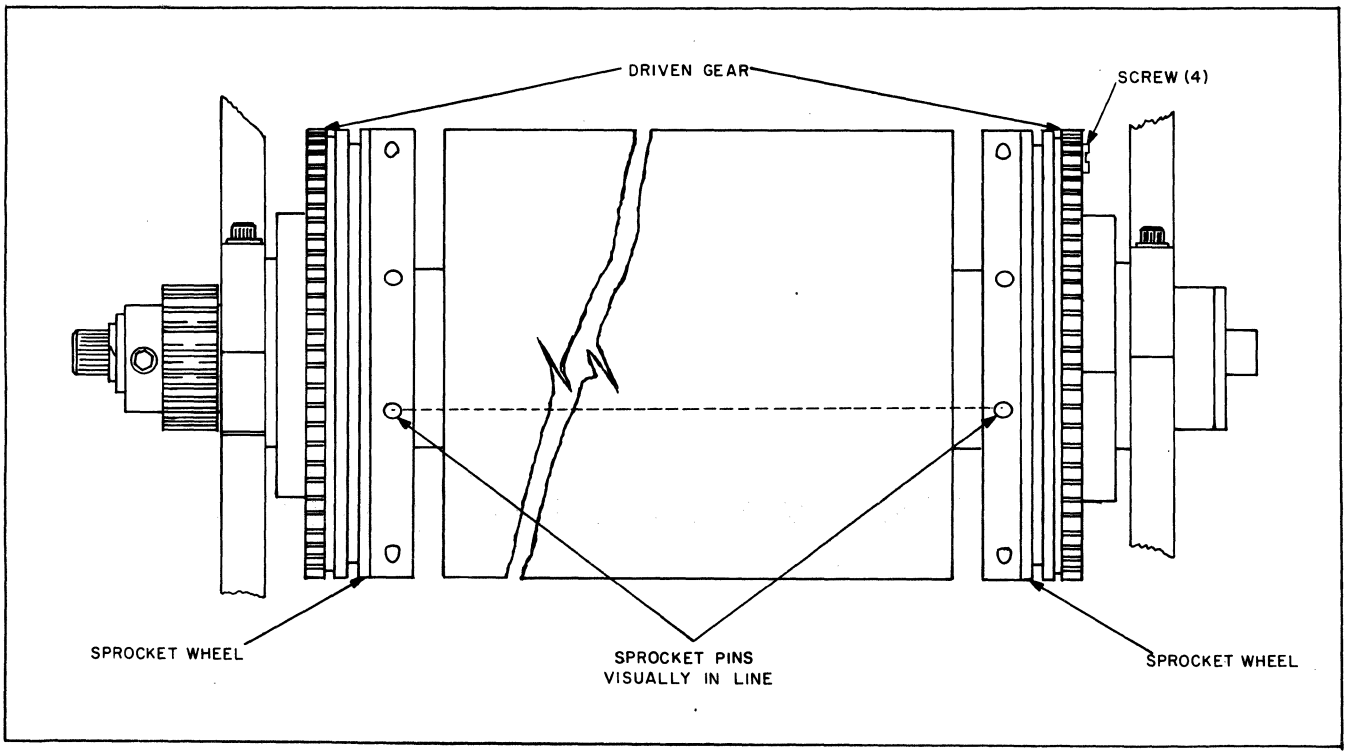

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Figure 4F-14. Sprocket pins alinement.

(2) Hold the driven gear from turning and position the sprocket wheel to meet the requirement.

(3) Tighten the screws.

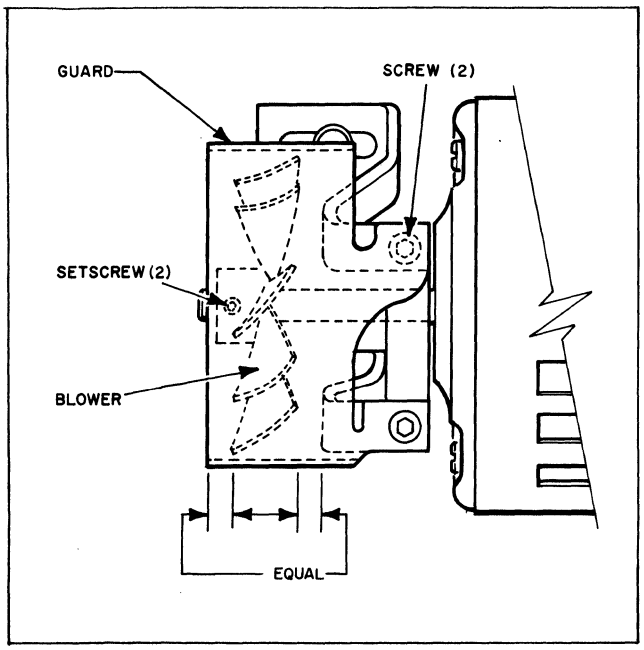

Figure 4F-15. Motor fan.

4F-15 MOTOR FAN (fig. 4F-15)
(05434 Issue A)

a. Requirement. The blades of the fan should be central in, but not touching, the guard.

b. Adjustment.

(1) Loosen the setscrews and center the fan in the guard. Tighten the setscrews.

(2) Rotate the fan and check the requirement.

(3) Loosen the guard mounting screws and reposition or form the guard, as necessary to meet the requirement.

(4) Tighten the screws.

4F-16 DRIVE BELT ALINEMENT (fig. 4F-16)
(05361 Issue D)

a. Requirement. The drive belt should maintain 75 per cent engagement with the drive and driven pulleys when the unit is operating.

b. Adjustment.

(1) Loosen the drive pulley setscrew(s).

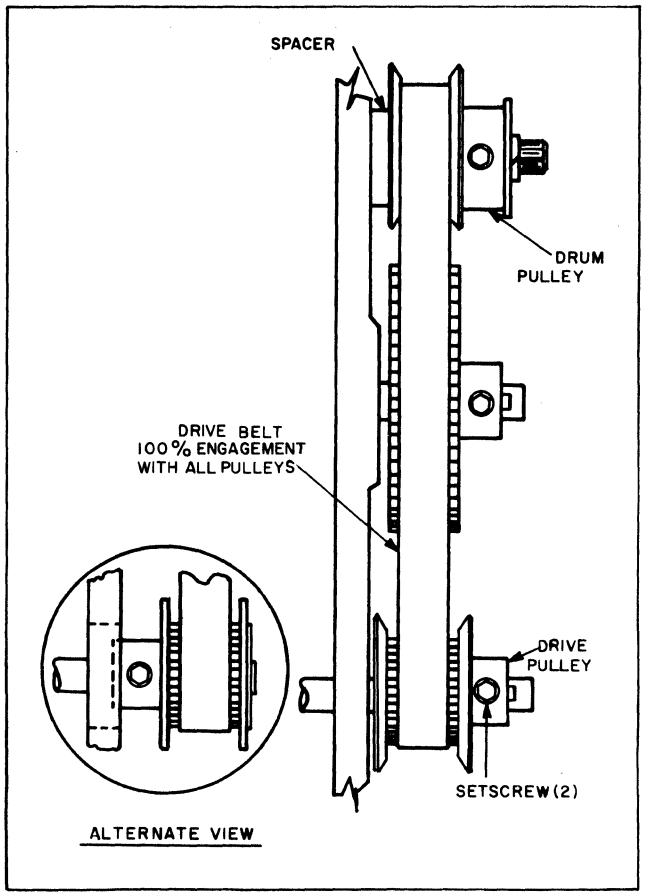

Figure 4F-16. Drive belt alinement.

(2) Position the pulley to meet the requirement and tighten the setscrews on the flats of the shaft.

(3) Recheck the requirement.

4F-17 DRIVE BELT TENSION (fig. 4F-17)
(05382 Issue B)

a. Requirement. The drive belt should be tight enough not to slip a tooth on the pulleys and loose enough not to bind the motor.

b. Method of Checking.

(1) While holding the print drum attempt to rotate the drive pulley and check to see that the belt does not slip a tooth on any of the pulleys.

(2) Depress the belt midway between the power shaft and check for a slight deflection.

c. Adjustment.

(1) Loosen the screw.

(2) Position the idler to meet the requirement and tighten the screw.

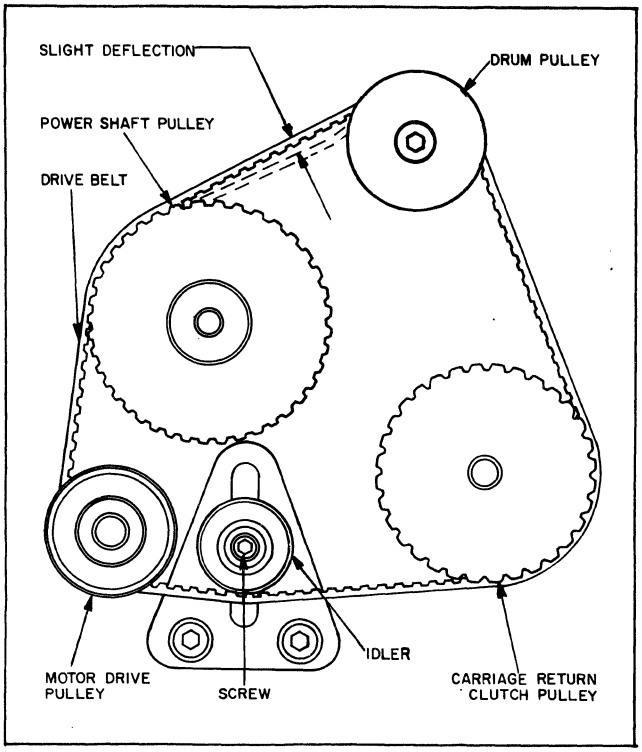

Figure 4F-17. Drive belt tension.

4F-18 LINE FEED BRACKET (fig. 4F-18) (05376 Issue C)

a. Requirement.

(1) There should be some backward movement of the stop plate when:

(a) The armature is engaging the stop plate;

(b) The clutch is disengaged and;

(c) The detent pawl is in the low part of the cam.

(2) There should be .025- to .035-inch clearance between the armature and high portion of the stop plate when the armature is in the energized position.

b. Adjustment.

(1) Loosen the bracket screws and position the bracket to meet requirement a(1).

(2) While maintaining requirement a(1), move the armature to the energized position, and locate the bracket to meet requirement a(2).

(3) Tighten the screws and recheck the requirements.

4F-19 LINE FEED CLUTCH MAGNET (fig. 4F-19) (05362 Issue B)

Note: The adjustment procedure described in paragraph 4F-18 must be completed before performing this adjustment.

a. Requirement. There should be .004- to .010-inch clearance between the pole faces and the armature, when the armature is in the energized position - against the stop.

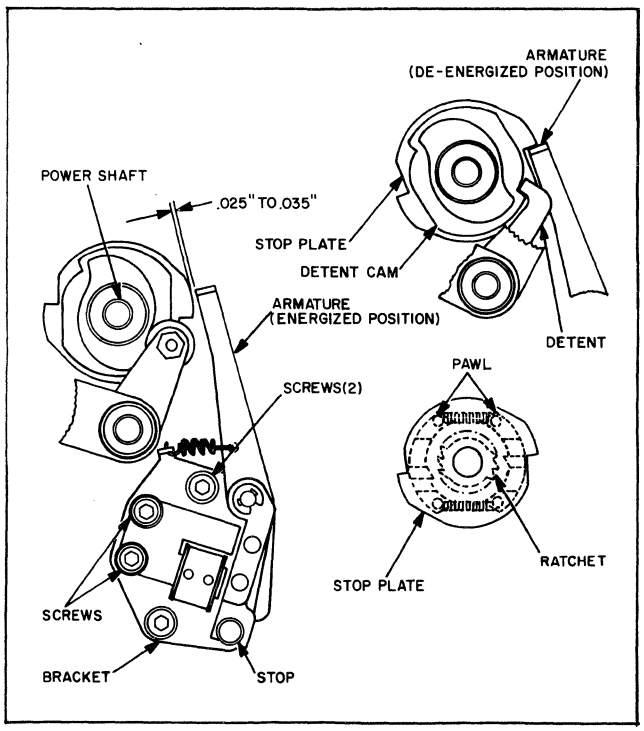

Figure 4F-18. Line feed bracket.

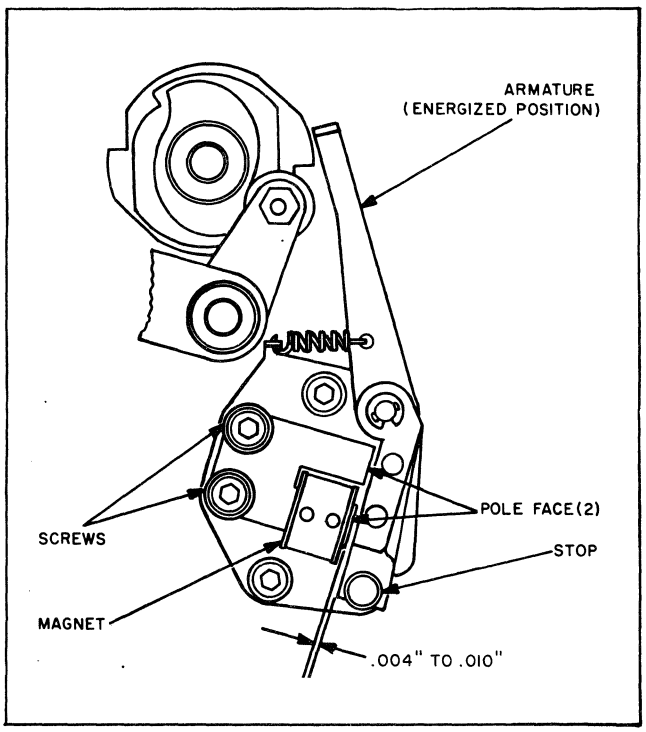

Figure 4F-19. Line feed clutch magnet.

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b. Adjustment.

(1) Loosen the screws.

(2) Hold the armature in the energized position - against the stop, and position the magnet to meet the requirement.

(3) Tighten the screws and recheck the requirement.

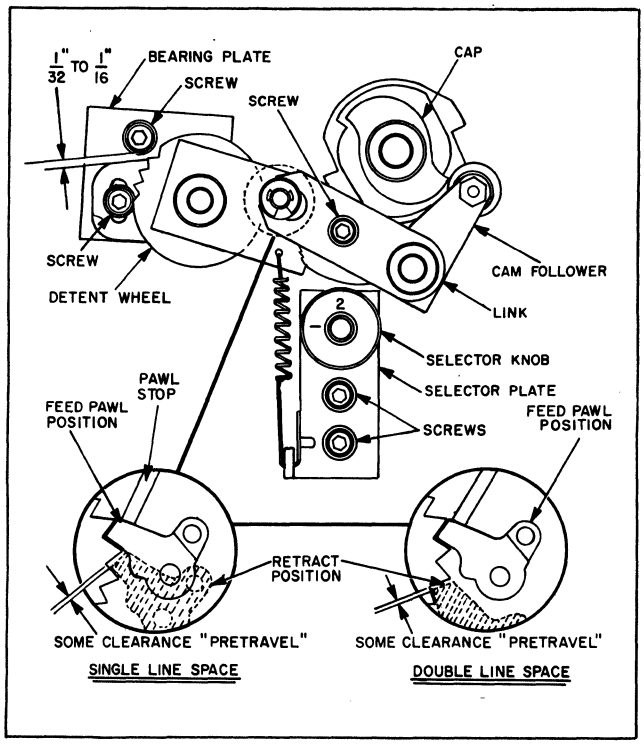

Figure 4F-20. Line feed.

4F-20 LINE FEED (fig. 4F-20)
(05375 Issue A)

Note: The adjustment procedures described in paragraphs 4F-4 and 4F-11 must be completed before performing this adjustment.

a. Requirement.

(1) The line feed detent wheel should rotate one or two teeth, as determined by the selector knob position, when the line feed mechanism operates.

(2) The line feed pawl should have some pretravel before rotating the detent wheel.

(3) The pawl should be locked between the detent wheel and pawl stop when the cam follower is on the high part of the cam.

b. Adjustment.

(1) Loosen the pawl stop, link, and selector plate screws.

(2) Position the pawl stop 1/32- to 1/16-inch away from the bearing plate screw and tighten the pawl stop screw.

(3) Place the cam follower on the high part of the cam.

(4) Rotate the link until the pawl is against the pawl stop and tighten the link screw.

(5) Position the selector knob for double line feed.

(6) Hold the link in position and manually energize the line feed clutch.

(7) Rotate the cam so the low part is under the follower.

(8) Slowly release the link. The pawl should drop two teeth on the detent wheel before the follower strikes the knob.

(9) With the cam follower against the selector knob, move the selector plate to obtain the maximum pretravel requirement of 1/2 tooth.

(10) Tighten the selector plate screws.

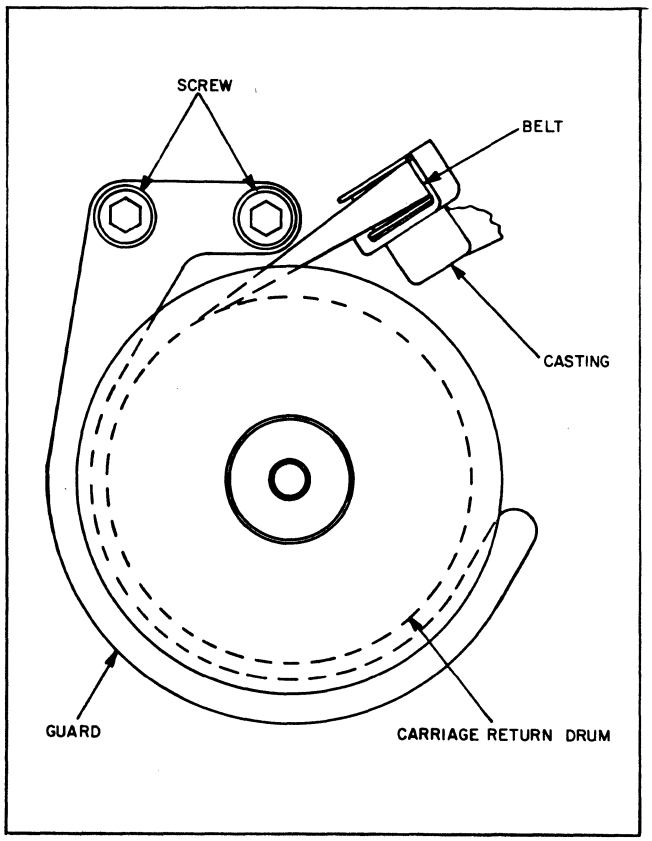

Figure 4F-21. Carriage return belt guard.

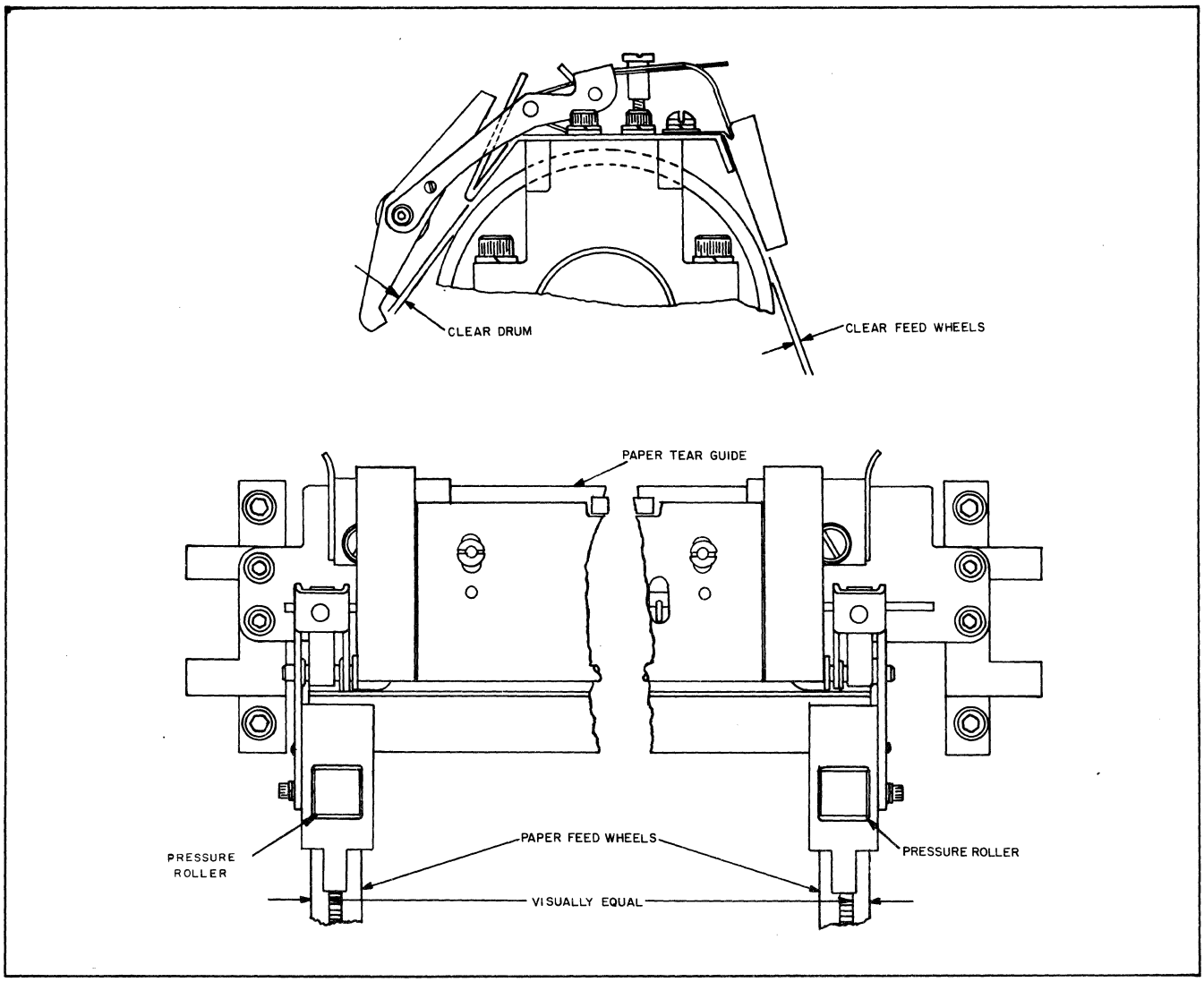

Figure 4F-22. Paper guide assembly positioning.

4F-21 CARRIAGE RETURN BELT GUARD (fig. 4F-21) (05360 Issue A)

a. Requirement. The belt guard should be concentric with the carriage return clutch drum, and must not touch the belt regardless of the carriage position.

b. Adjustment.

(1) Loosen the screws.

(2) Position the guard to meet the requirement and tighten the screws.

4F-22 PAPER GUIDE ASSEMBLY POSITIONING (fig. 4F-22) (05393 Issue B)

a. Requirement.

(1) The paper guide assembly should be positioned as follows:

(a) The front edge should be parallel with, and clear the drum.

(b) The paper guides should be clear of the feed wheels.

(2) The pressure rollers should be central on the paper feed wheels.

b. Adjustment.

(1) Loosen the paper guide assembly screws.

(2) Position the assembly to meet the requirements and tighten the screws.

4F-23 PAPER GUIDE POSITIONING (fig. 4F-23) (05403 Issue A)

a. Requirement. The paper guides should aline the paper with the paper trough without binding or curling the edges of the paper.

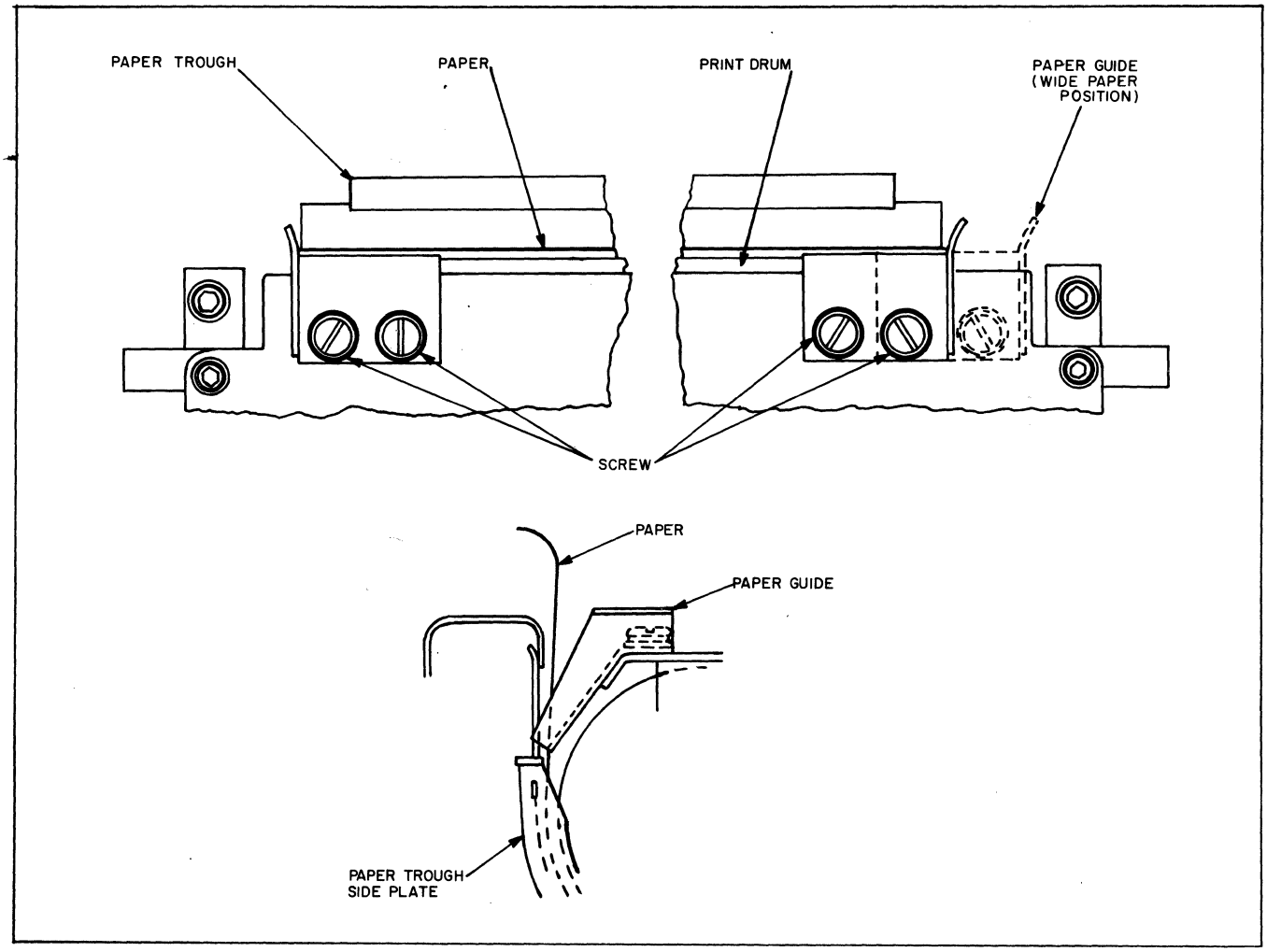

Figure 4F-23. Paper guide positioning.

b. Adjustment.

(1) Loosen both paper guide screws.

(2) Position the guides against the edges of the paper trough and tighten the screws.

4F-24 PAPER PRESSURE ROLLER POSITIONING (fig. 4F-24) (05427 Issue B)

Note: The adjustment procedure described in paragraph 4F-22 must be completed before performing this adjustment.

a. Requirement. When the plate is in the unlatched position (up) and the release knob is in the rear position, the pressure rollers should be against the paper feed wheels, and the roller guides should clear the front of the paper guide assembly with a maximum clearance.

b. Adjustment.

(1) Unlatch the plate.

(2) Turn the plate stops down equally until the pressure rollers just clear the paper feed wheels.

(3) Loosen the slotted head screws on both roller guides.

(4) Hold either pressure roller stud from turning and loosen the socket head screw.

(5) Hold the pressure roller against the paper feed wheels and position the roller guide to meet the requirement. Tighten the screws.

(6) Repeat steps (4) and (5) on the opposite roller guide.

(7) Perform the adjustment described in paragraph 4F-27.

4F-25 Not Applicable To This Equipment

4F-26 Not Applicable To This Equipment

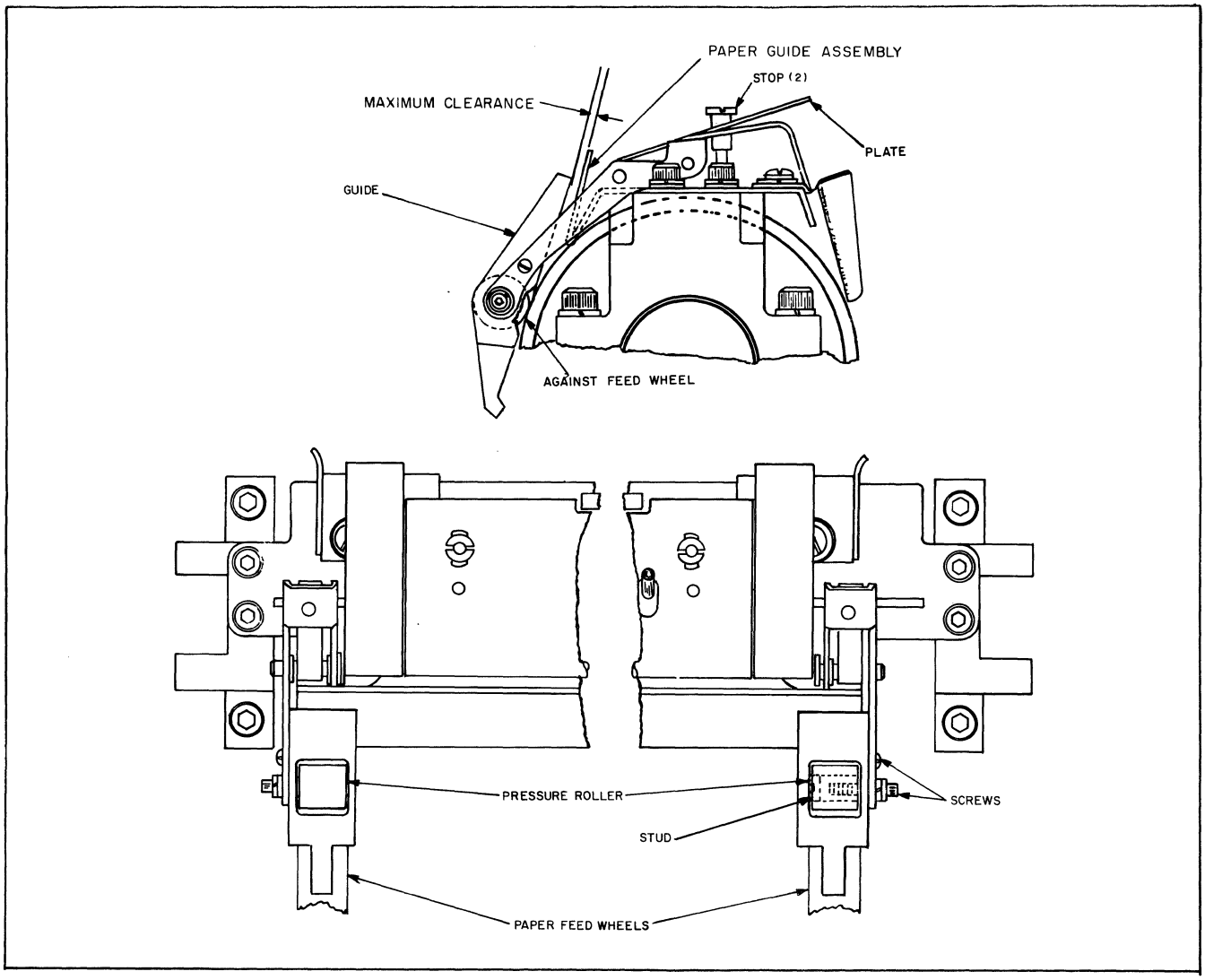

Figure 4F-24. Paper pressure roller positioning.

4F-27 RIBBON LIFT SHAFT END PLAY AND POSITIONING (fig. 4F-27)
(05377 Issue B)

a. Requirement.

(1) The ribbon lift shaft should have a .010- to .020-inch end play.

(2) The ribbon lift arms should be in line with each other.

b. Method of Checking.

(1) Check the requirement manually and with feeler gages.

(2) Move the carriage from one margin to the other and note any variation in the height of the ribbon vibrator.

c. Adjustment.

(1) Loosen the screw that holds the bracket to the shaft.

(2) Insert a .015-inch feeler gage between the spacer and the bearing.

(3) Hold the shaft toward the bracket, and the bracket against the gage to meet requirement a(1).

(4) Position the lift arm to meet requirement a(2).

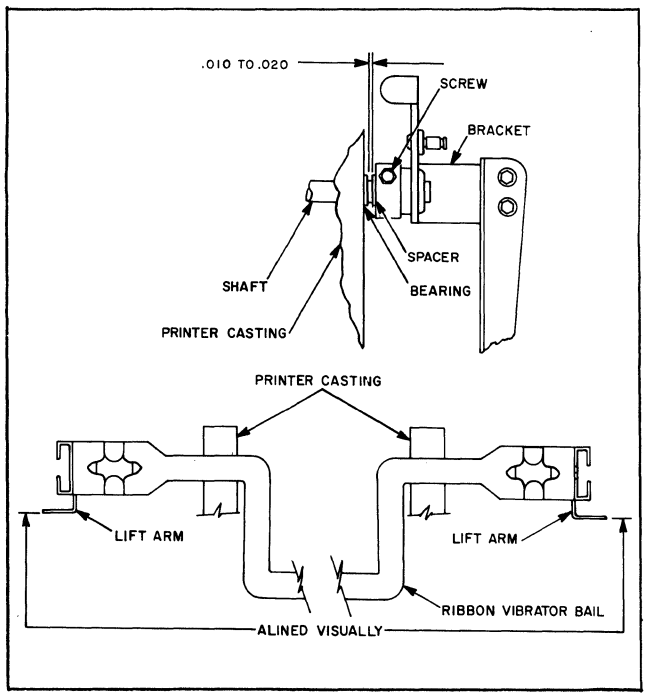

Figure 4F-27. Ribbon lift shaft end play and positioning.

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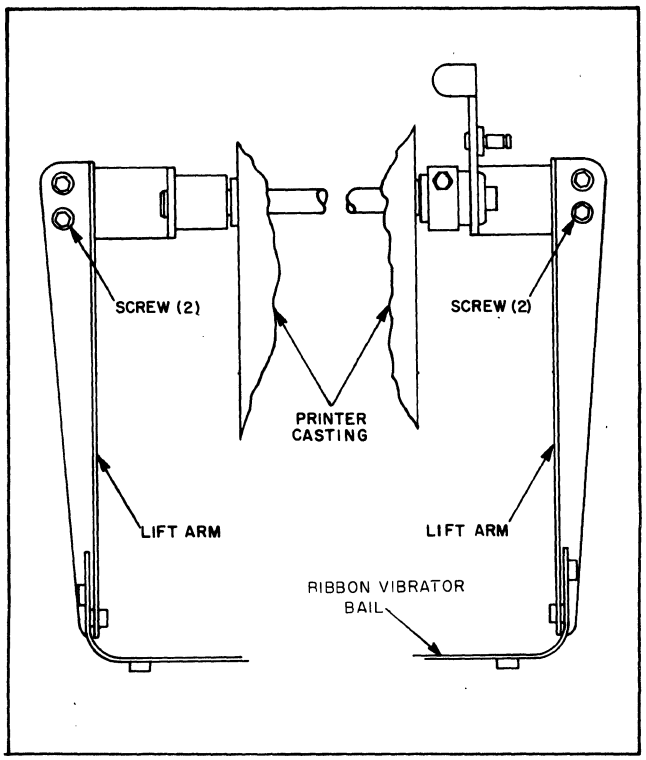

Figure 4F-28. Ribbon lift arm positioning.

(5) Remove the feeler gage and recheck both requirements.

(6) Perform the adjustment described in paragraph 4F-28.

4F-28 RIBBON LIFT ARM POSITIONING
(fig. 4F-28)
(05379 Issue B)

Note: The adjustment procedure described in paragraph 4F-27 must be completed before performing this adjustment.

a. Requirement.

(1) The bail must be central in the printer casting.

(2) The bail must have a minimum end play and swing freely.

b. Adjustment.

(1) Loosen both lift arm screws.

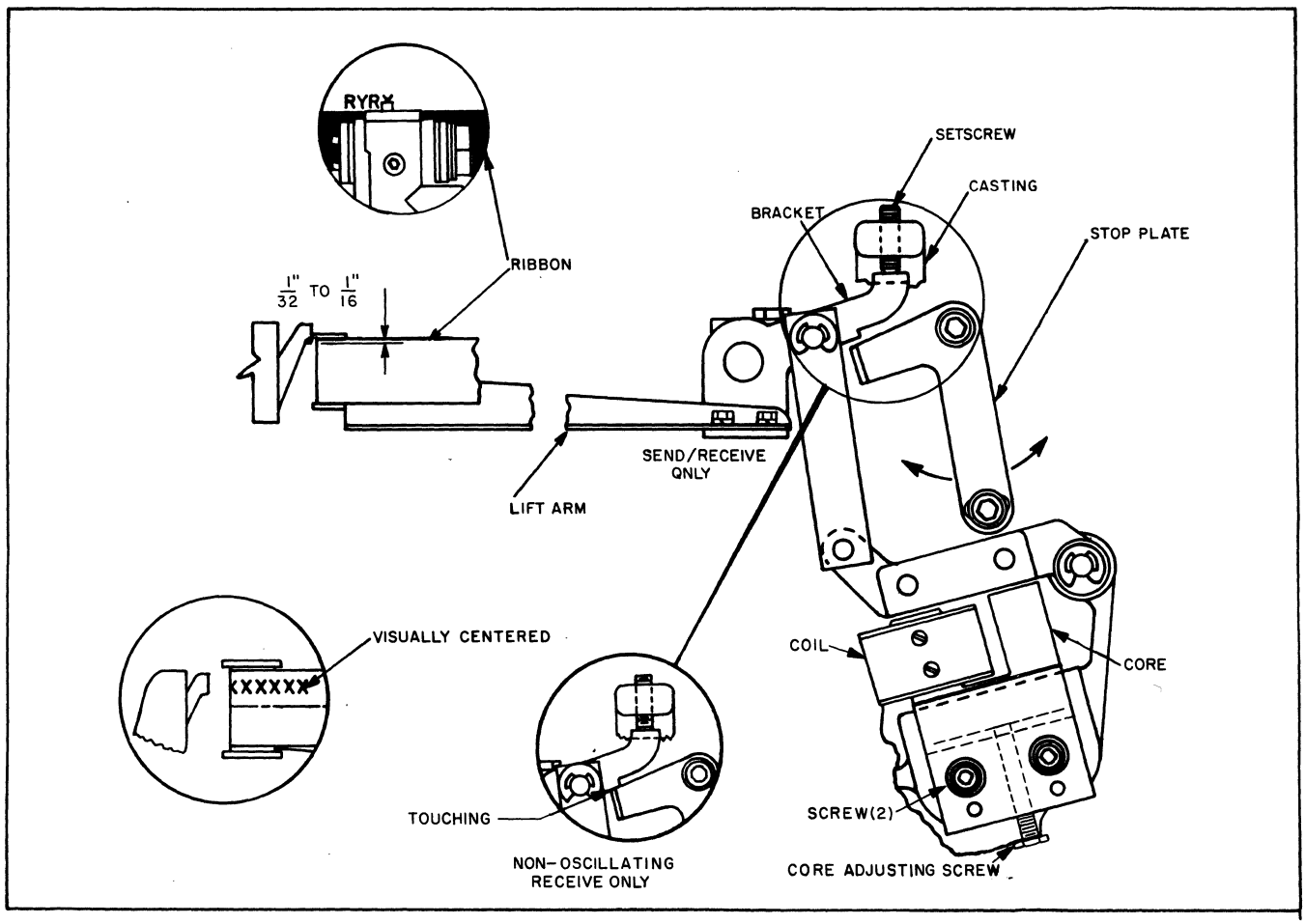

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Figure 4F-29. Ribbon lift.

(2) Position each lift arm to meet the requirements and tighten the screws.

Note: The left lift arm position is for requirement (1) and the right for requirement (2).

(3) Perform the adjustment described in paragraph 4F-29.

4F-29 RIBBON LIFT (fig. 4F-29)
(05386 Issue C)

a. Requirement.

(1) When the bracket is against the stop plate the print hammer should be central with the upper half of the ribbon.

(2) Send Receive Units. The top edge of the ribbon should be 1/32- to 1/16-inch above the bottom of the print hammer when the bracket is against the setscrew.

(3) Receive Only Units. The setscrew should hold the bracket against the stop plate.

b. Adjustment.

(1) Hold the bracket against the setscrew and turn the setscrew in to meet requirement a(2).

(2) Loosen the stop plate screws.

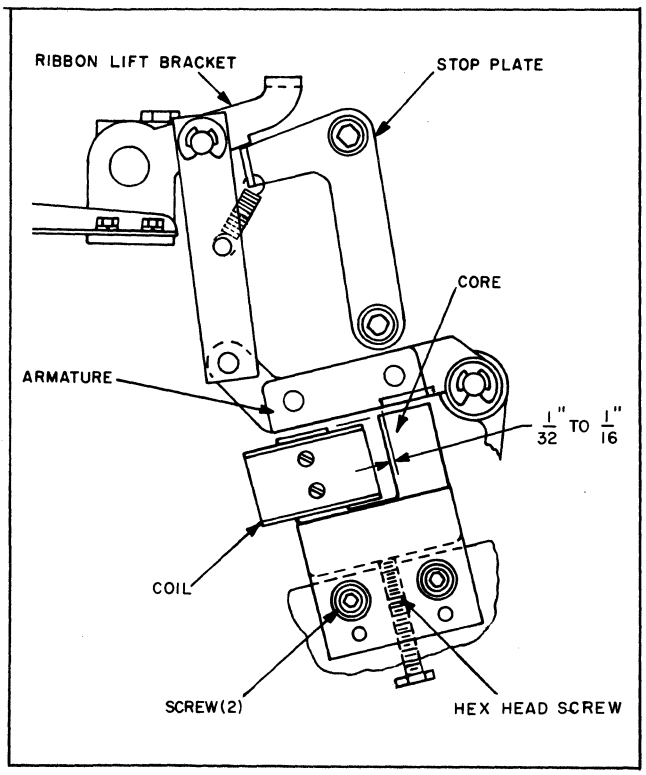

Figure 4F-30. Ribbon lift magnet.

(3) Hold the bracket against the stop plate and position them to meet requirement a(1).

(4) With the bracket held against the setscrew, turn the setscrew to meet requirement a(3) (if applicable).

(5) Recheck the requirement and perform the adjustment described in paragraph 4F-30.

4F-30 RIBBON LIFT MAGNET (fig. 4F-30)
(05394 Issue D)

Note: The adjustment procedure described in paragraph 4F-29 must be completed before performing this adjustment.

a. Requirement.

(1) When the armature is energized, there should be no clearance between the armature and magnet core pole faces.

(2) The coil core should be alined with the armature.

b. Adjustment.

(1) Loosen the screws until the core is held friction tight.

(2) Loosen the hexagon head screw.

(3) Position the core to meet requirement a(2).

(4) Hold the armature in an energized position and turn the setscrew in until requirement a(1) is met.

(5) Tighten the screws and recheck requirements a(1) and a(2).

4F-31 RIBBON FEED (fig. 4F-31)
(05363 Issue C)

a. Requirement. As the cam follower moves from the high part of the cam to the low part, the ratchet wheel should be fed one tooth plus some overtravel (1/2 tooth maximum) past the detent pawl. The feed pawl pretravel and ratchet overtravel should be equal.

b. Adjustment.

(1) Loosen the nut.

(2) Position the eccentric to its normal direction of maximum eccentricity and then to meet the requirement.

(3) Tighten the nut and recheck the requirement at several points around the ratchet.

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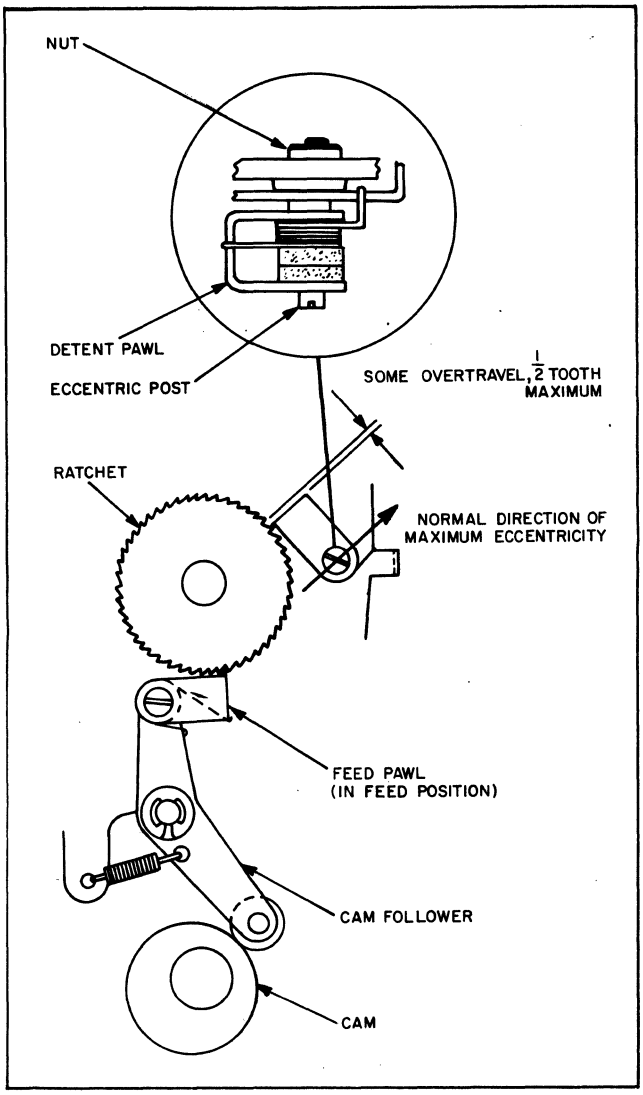

Figure 4F-31. Ribbon feed.

4F-32 DETENT ASSEMBLY AND DRIVING CLUTCH POSITIONING (fig. 4F-32) (05384 Issue C)

a. Requirement.

(1) The detent should hold the shaft firmly without excessive tightness.

(2) When either clutch is engaged, the opposite clutch should have .050- to .054-inch clearance between the teeth.

(3) With the right driving clutch members tooth on tooth the left members should clear each other.

b. Adjustment.

(1) Loosen the detent assembly setscrew and position the detent to meet the requirement.

(2) Tighten the setscrew.

(3) Loosen the setscrews in the driving clutches.

(4) Position the shaft so that it is properly detented (see inset).

(5) Position the right driving clutch to just clear the casting and tighten the setscrews.

(6) Add or remove shims 56546 behind the right driving fork to meet requirement a(2).

(7) Repeat the procedure on the opposite driving clutch.

(8) Check requirement a(3).

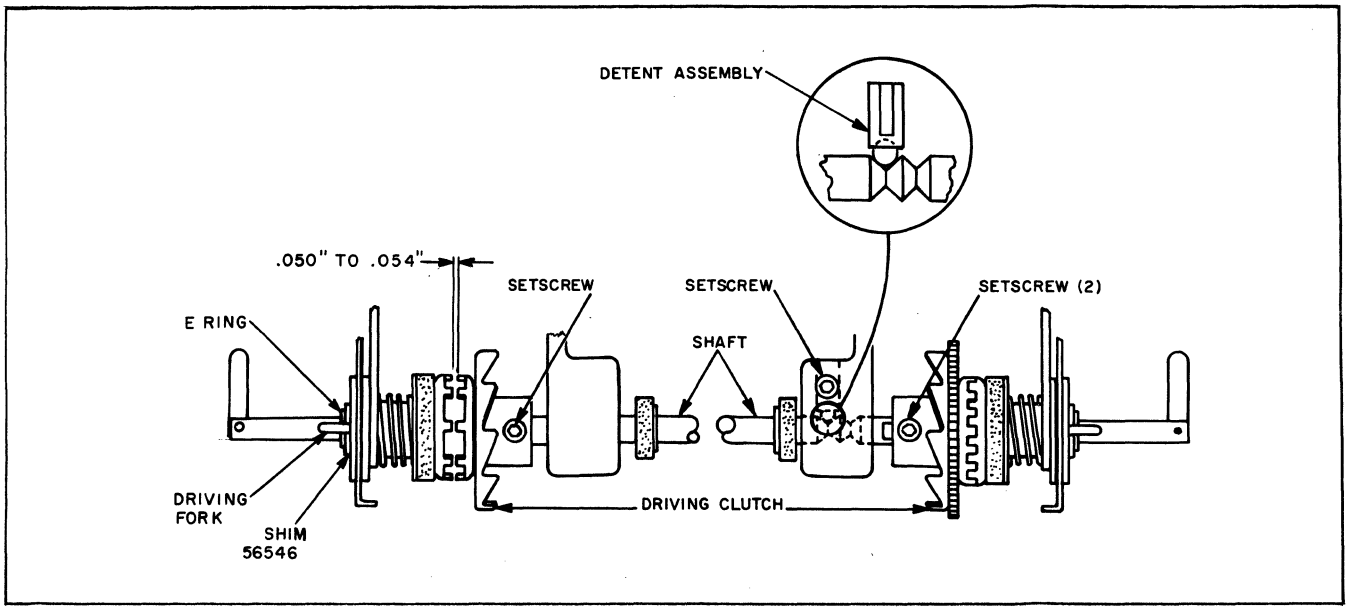

Figure 4F-32. Detent assembly and driving clutch positioning.

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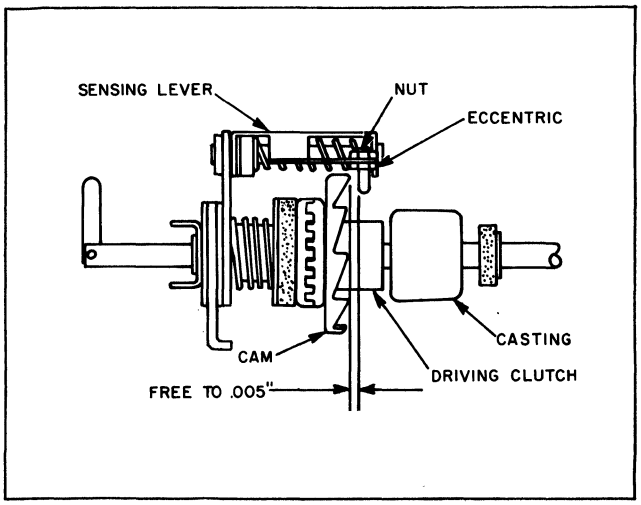

Figure 4F-33. Sensing lever eccentric clearance.

4F-33 SENSING LEVER ECCENTRIC CLEARANCE
(fig. 4F-33)
(05371 Issue C)

a. Requirement. With the clutch fully engaged the eccentric should clear the cam, .005-inch, maximum.

b. Adjustment.

(1) Loosen the nut.

(2) Hold the sensing lever away from the cam.

(3) Position the eccentric so that the maximum eccentricity is towards the front of the machine and then to meet the requirement. Tighten the nut.

(4) Repeat the procedure on the opposite side.

4F-34 SPACE PAWL SHAFT (fig. 4F-34)
(05430 Issue B)

Note: This adjustment should be performed only when the space pawl assembly is replaced.

a. Requirement. The space pawl shaft should rotate freely in its bushing and have .001- to .005-inch end play.

b. Adjustment.

(1) Remove the retainer ring and insert shims 65657 to meet the requirement.

(2) Replace the retainer ring.

4F-35 SPACE ARMATURE CLEARANCE
(fig. 4F-35)
(98015-03-25 Issue A)

a. Requirement. There should be clearance (maximum .005-inch) between the armature and the casting.

b. Adjustment.

(1) Loosen the setscrew.

(2) Position the armature to meet the requirement and tighten the setscrew.

4F-36 SPACE ARMATURE ECCENTRIC (fig. 4F-36)
(98015-05-03 Issue A)

a. Requirement. When the armature is in the de-energized position and against the eccentric, the space pawl lever should be against the pin and the bail should be against the roller.

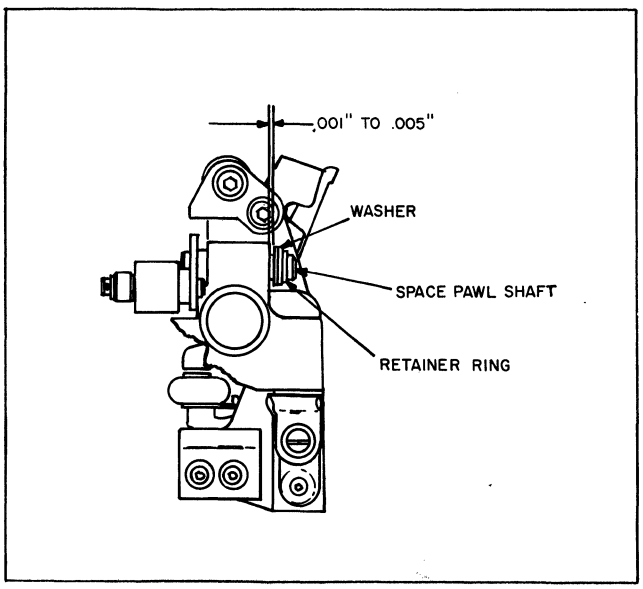

Figure 4F-34. Space pawl shaft.

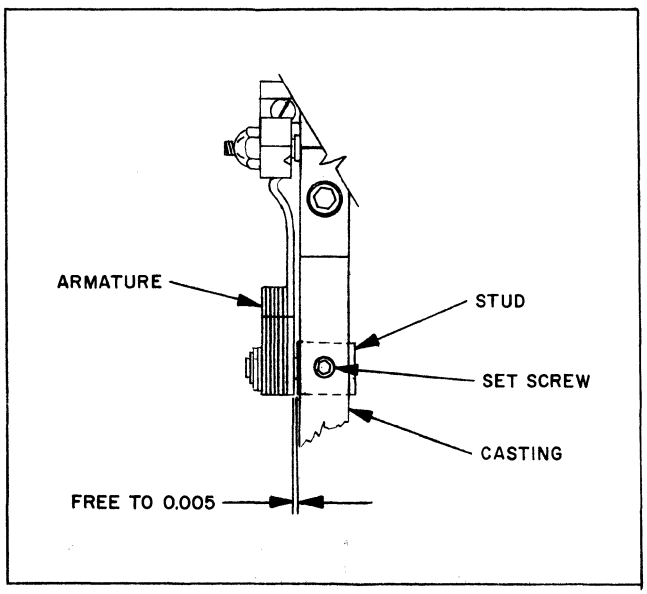

Figure 4F-35. Space armature clearance.

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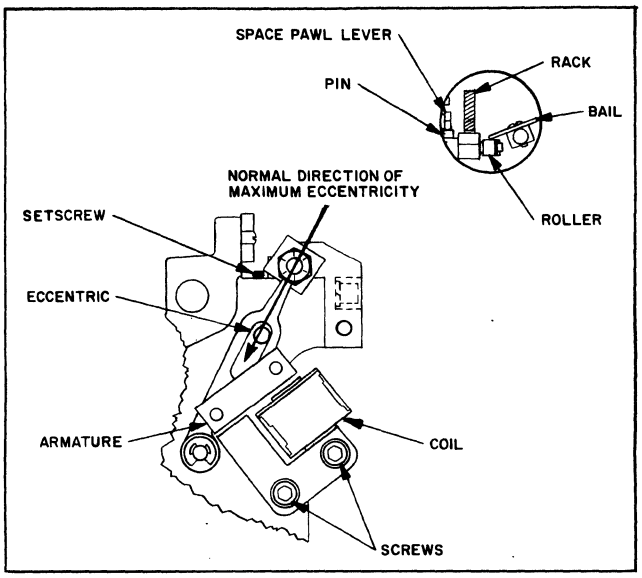

Figure 4F-36. Space armature eccentric.

b. Adjustment.

(1) Loosen the setscrew.

(2) Position the eccentric to its normal direction of eccentricity and then to meet the requirement.

(3) Tighten the setscrew and recheck the requirement.

4F-37 SPACE PAWL CLEARANCE AND REGISTRATION (fig. 4F-37) (98015-05-04 Issue C)

Note: The adjustment procedure described in paragraph 4F-36 must be completed before performing this adjustment.

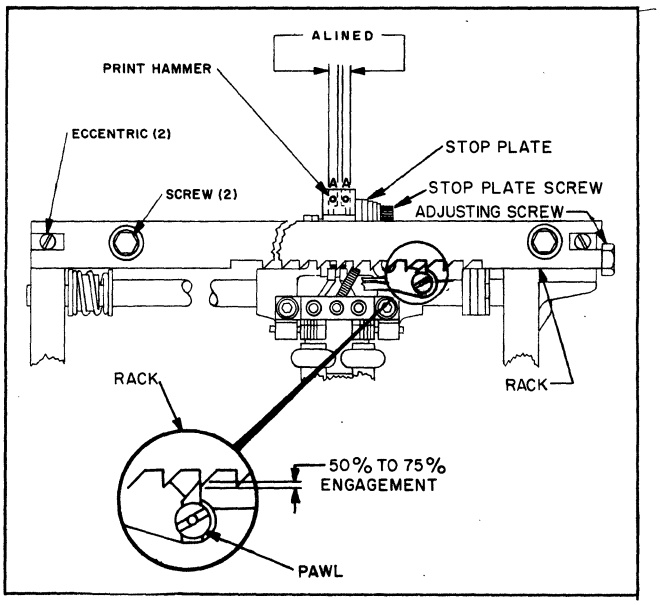

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Figure 4F-37. Space pawl clearance and registration.

a. Requirement.

(1) The print hammers should be alined with the characters on the drum when the pawl is engaged with the space rack.

(2) There should be 50 per cent to 75 per cent engagement between the pawl and the teeth on the space rack when the armature is energized.

b. Adjustment.

(1) Loosen the rack mounting screws.

(2) Hold the rack against the adjusting screw, and position the screw to meet the requirement in a(1).

(3) Prevent the carriage from moving and place the armature in the energized position.

(4) Position the eccentric to meet the requirement in a(2).

(5) Check the requirement with the carriage at the right and left margins.

(6) Tighten the screw.

(7) Perform the adjustment described in paragraph 4F-38.

4F-38 SPACE MAGNET AND PAWL CLEARANCE (figs. 4F-37 and 4F-38) (98015-03-46 Issue C)

Note: The adjustment procedure described in paragraph 4F-37 must be completed before performing this adjustment.

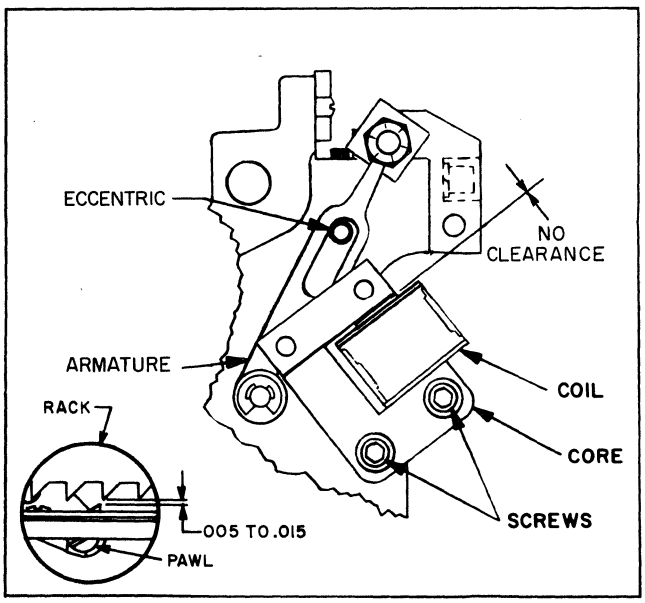

Figure 4F-38. Space magnet.

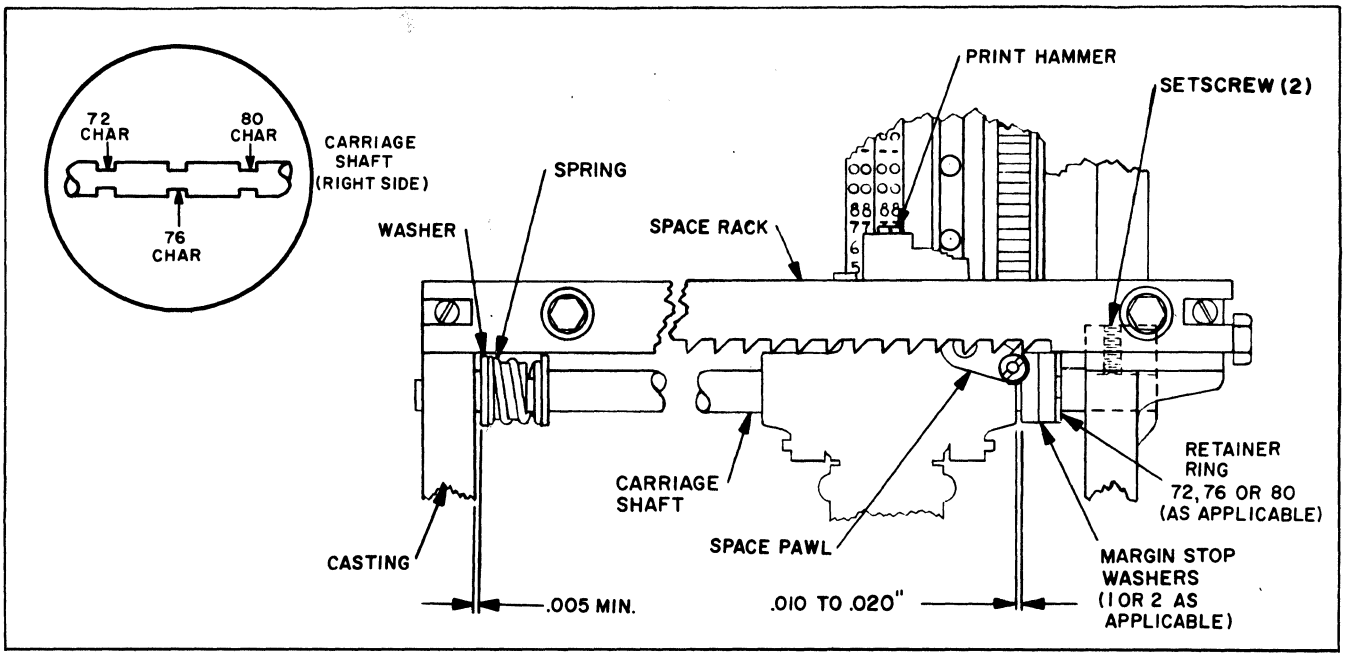

Figure 4F-39. Carriage shaft position.

a. Requirement.

(1) The clearance between the space pawl and the teeth on the space rack should be .005- to .015-inch, when the armature is energized.

(2) There should be no clearance between the armature and the core pole faces when the armature is energized.

b. Adjustment.

(1) Loosen the stop plate screws and the core mounting screws.

(2) Position the space pawl to meet requirement a(1).

(3) Position the stop plate to touch the space pawl and tighten the stop plate screws.

(4) Hold the armature in the energized position and move the magnet to meet requirement a(2).

(5) Tighten the coil assembly mounting screws.

(6) Loosen the stop plate screws and again move the stop plate away from the pawl.

(7) Recheck the requirements in the right and left margins.

(8) Perform the adjustment procedure described in paragraph 4F-41.

4F-39 CARRIAGE SHAFT POSITION (fig. 4F-39) (98015-05-09 Issue A)

Note: The adjustment procedure described in paragraph 4F-37 must be completed before performing this adjustment.

a. Requirement.

(1) The retainer ring must be in the proper groove on the carriage shaft, corresponding to the number of character spaces on the drum (see inset).

(2) There must be one washer to the left of the retainer ring if the carriage has one hammer, or two if it has two hammers.

(3) When the print hammer is alined with the last character on the drum (right hammer for two-hammer carriages) there should be .010- to .020-inch clearance between the carriage and the margin stop washer.

(4) There should be .005-inch minimum clearance between the left margin spring washer and the casting.

Note: Meeting requirements (1) through (3) will result in requirement (4) being met.

b. Method of Checking.

(1) Check to see that the retainer ring is in its proper groove (see inset).

(2) Check to see that there are the appropriate number of washers to the left of the retainer ring.

(3) Check requirements a(3) and a(4) using feeler gages.

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c. Adjustment.

(1) Position the retainer ring in its proper groove (see inset).

(2) Add or remove margin stop washers (65996) to meet requirement a(2).

(3) Aline the print hammer with the last character on the drum.

(4) Loosen the setscrew and engage the space pawl in a tooth on the space rack.

(5) Position the carriage shaft to meet requirements a(3) and a(4).

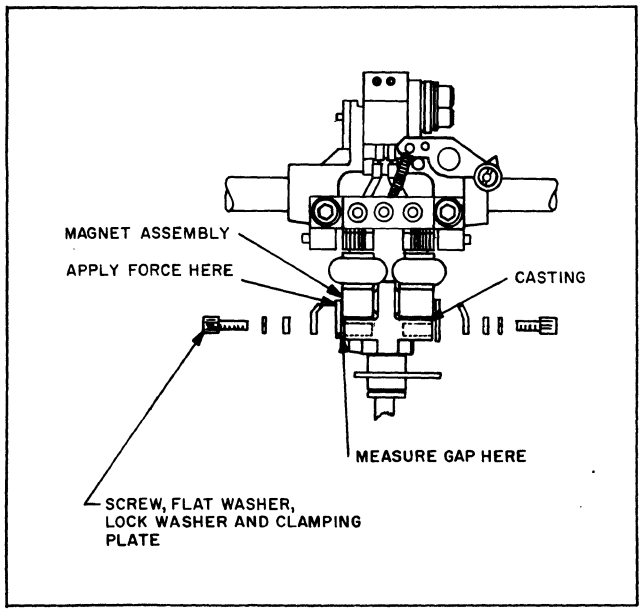

Figure 4F-40. Carriage magnet shimming.

4F-40 CARRIAGE MAGNET SHIMMING (fig. 4F-40) (05429 Issue B)

Note: This adjustment is necessary only in the case of magnet assembly replacement or loss or damage of original shims.

a. Requirement. When the magnet assembly is in its mounted position and held against the casting, the gap between the magnet mounting plate should be properly shimmed.

b. Adjustment.

(1) With the screws, lockwashers, flat washers, and clamping plate removed, and the magnet assembly held as described in the requirement, measure the gap between the casting and magnet mounting plate.

(2) Compile shims 66984 (.002) or 66985 (.005) whose total thickness equals the measurement of the gap.

(3) Insert the shims and secure the mounting plate with the screws, lockwasher, flat washers, and clamping plate.

(4) If the unit has a double hammer carriage, repeat the procedure on the other magnet assembly.

4F-41 PRINT HAMMER ALINEMENT AND SPACE PAWL STOP (fig. 4F-41) (98015-00-70 Issue B)

Note: The adjustment procedures described in paragraphs 4F-8 and 4F-36 must be completed before performing this adjustment.

a. Requirement.

(1) There should be a slight gap between the bottom of the hammer and the character it is held against.

(2) There should be .001- to .006-inch clearance between the pawl and the stop plate when the space bail is in the operated position.

b. Method of Checking. Find the closest point between the pawl and stop plate by holding the armature energized and moving the carriage from end to end.

c. Adjustment.

(1) Back out the print hammer setscrews.

(2) Loosen the hammer block and stop plate screws and leave them friction tight.

(3) Loosen the magnet core screws and position the magnet core away from the armature.

(4) Hold the space armature in the energized position, move the stop plate to meet requirement a(2) and tighten the stop plate screws.

(5) Hold the hammer against a flat character (e.g., M, Z, H, etc.) on the drum and position the block along the step in the casting to meet requirement a(1).

(6) Hold the block in position and turn the block setscrew in until it just contacts the hammer block screw. Tighten the hammer block screws.

(7) Perform the adjustment procedure described in paragraph 4F-42.

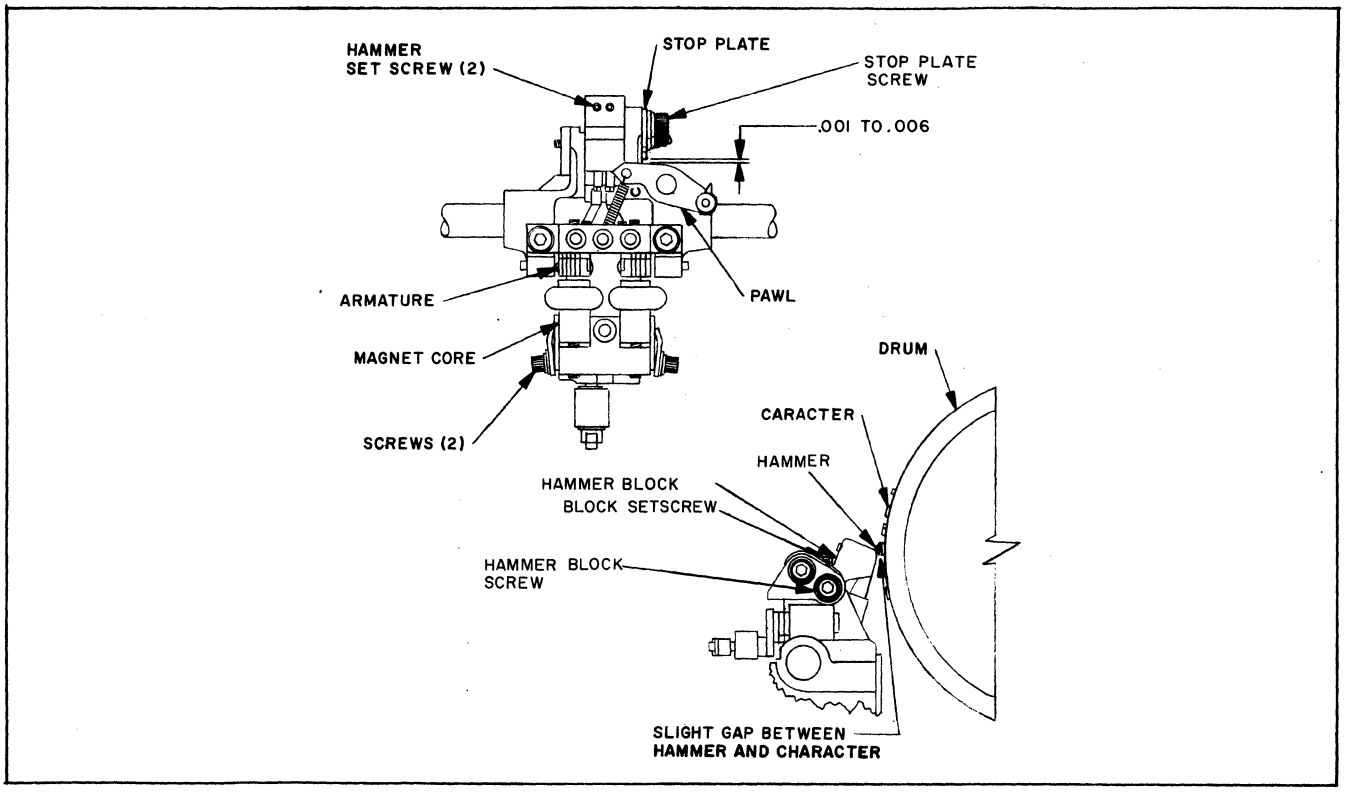

Figure 4F-41. Print hammer alinement and space pawl stop.

4F-42 CARRIAGE MAGNET AND HAMMER CLEARANCE (fig. 4F-42) (98015-00-71 Issue A)

Note: The adjustment procedure described in paragraph 4F-41 must be completed before performing this adjustment.

a. Requirement.

(1) There should be .025- to .030-inch clearance between the hammers and the drum when the armature contacts the rear core pole face and is flush with the front core pole face.

(2) There should be a nominal .006-inch clearance between the armature and core when the armature is against its setscrew.

b. Adjustment.

(1) Turn the armature setscrew in until it just contacts the armature and then to obtain the clearance. Position the core against the armature to meet requirement a(1).

(2) Tighten the core mounting screws and recheck the requirement.

(3) Back out the armature setscrew to meet requirement a(2).

CAUTION: The core mounting screws must be tight to prevent the core from moving during operation.

(4) Perform the adjustment procedure described in paragraph 4F-52.

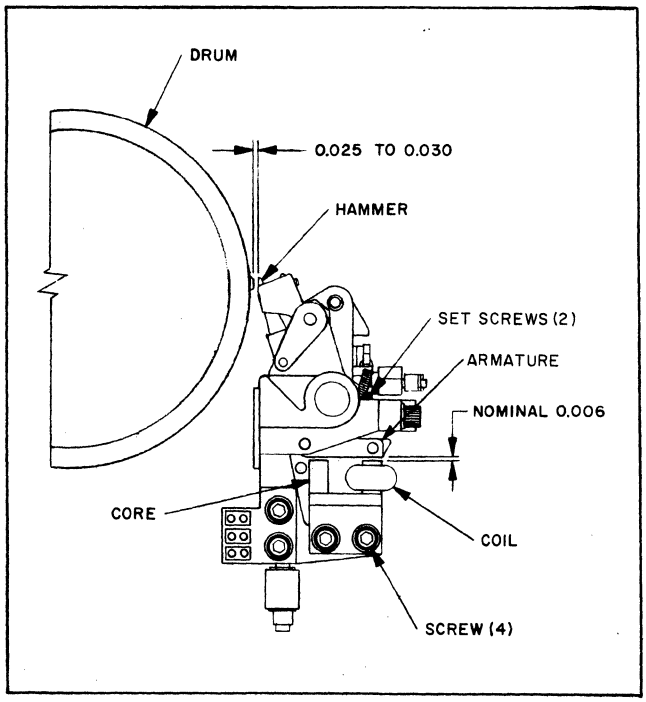

Figure 4F-42. Carriage magnet and hammer clearance.

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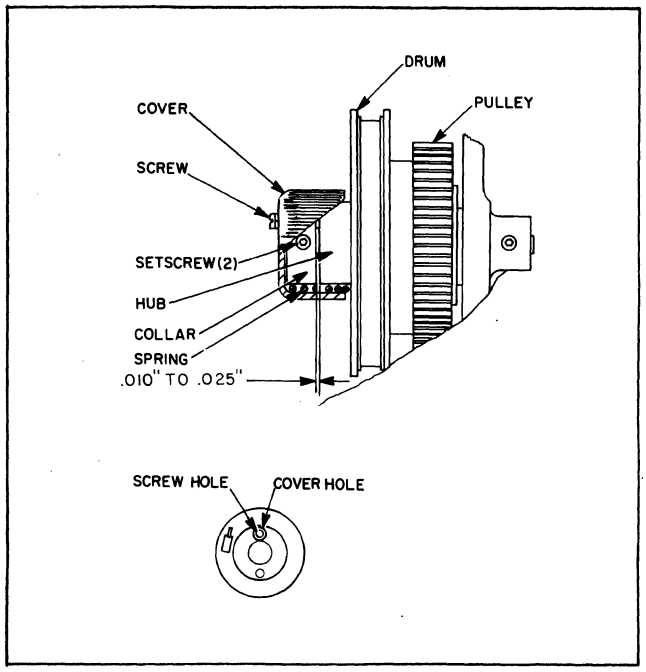


Figure 4F-43. Carriage return drum end play and spring tension.

4F-43 CARRIAGE RETURN DRUM END PLAY AND SPRING TENSION (fig. 4F-43) (05396 Issue C)

Note: This adjustment should be performed only when the carriage return spring is replaced.

a. Requirement.

(1) There should be .010- to .025-inch endplay of the carriage return drum.

(2) When the carriage is one space from the left margin, it should take approximately a 2-ounce spring tension to start the drum moving. (See illustration for location of the spring scale).

b. Method of Checking.

Note: It will be necessary to meet requirement a(2) again if the cover is removed to check requirement a(1) with feeler gages.

(1) Remove the screw, cover, and spring.

(2) Hold the drum against the pulley and check the clearance between the collar and drum with a feeler gage.

c. Adjustment.

(1) Position the carriage one space from the left margin.

(2) Loosen the collar setscrews.

(3) Insert a .005-inch feeler gage between the collar and the drum.

(4) Push the collar, gage and drum against the pulley and tighten the setscrews. Remove the gage.

(5) Install the spring and cover.

(6) Rotate the spring counterclockwise until requirement a(2) is met and then aline the cover hole with the nearest hole in the collar.

(7) Install and tighten the screw.

(8) Recheck the requirement.

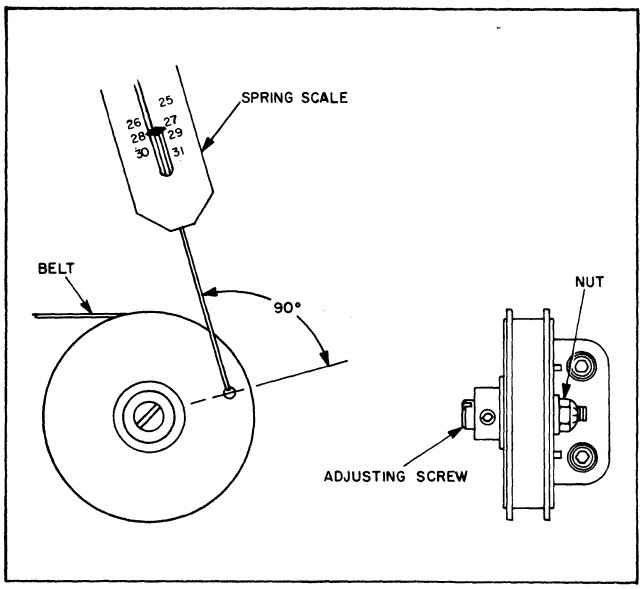


Figure 4F-44. Carriage feed spring tension.

4F-44 CARRIAGE FEED SPRING TENSION (fig. 4F-44) (05373 Issue C)

CAUTION: Overtightening of the carriage feed spring will shorten the life of the spring and cause excessive wear on the space pawl.

a. Requirement. There should be a 27- to 28-ounce tension on the carriage feed spring when the print hammer is alined with the last character (right side) of the print drum.

b. Adjustment.

(1) Position the carriage to aline the print hammer with the last character (right side) of the print drum.

(2) Hold the adjusting screw to keep it from turning, and loosen the nut.

(3) Rotate the screw to meet the requirement and tighten the nut.

(4) Recheck the requirement.

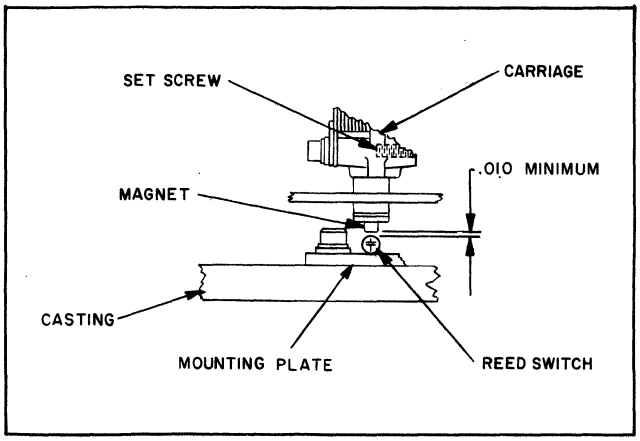


Figure 4F-45. Switch magnet positioning.

4F-45 SWITCH MAGNET POSITIONING (fig. 4F-45) (05405 Issue C)

a. Requirement.

(1) The reed switches should be of equal height within .010-inch.

(2) The magnet should be low enough to actuate the reed switches, yet clear the glass envelopes by .010-inch.

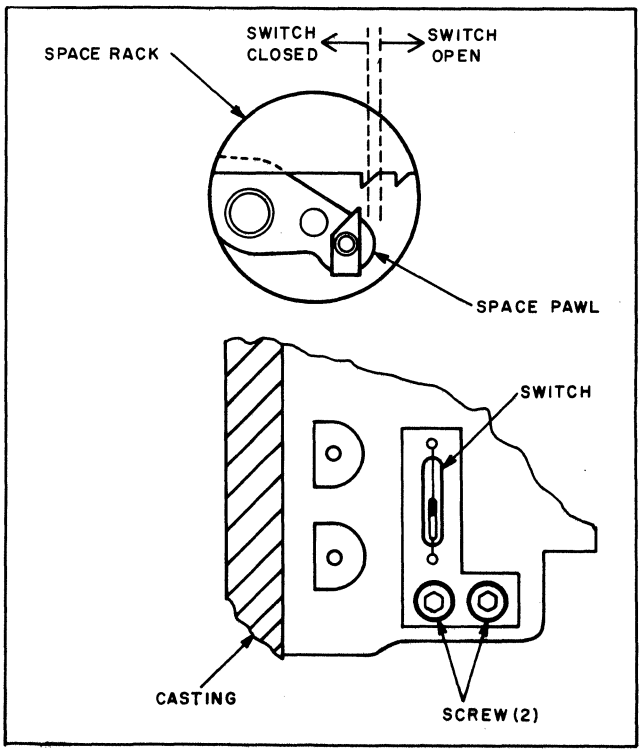


Figure 4F-46. Left hand margin switch.

b. Method of Checking.

(1) Connect a continuity meter to the reed switches.

(2) Position the magnet over the reed switches and check for continuity.

(3) Measure the clearance between the glass envelope and the carriage magnet with feeler gages.

c. Adjustment.

(1) Loosen the magnet setscrew.

(2) Add or remove shims 68210 between the mounting plate and the casting and position the magnet to meet the requirements. Tighten the setscrew.

(3) Perform the adjustment described in paragraph 4F-46.

4F-46 LEFT HAND MARGIN SWITCH (fig. 4F-46) (05364 Issue C)

a. Requirement.

(1) The switch must close when the crown of the space pawl and the first space rack tooth are in line and remain closed during the carriage left margin overtravel.

(2) The switch must be open when the carriage is one space from the left margin.

b. Method of Checking.

(1) Connect a continuity meter to the switch terminals.

(2) Move the carriage slowly to the left margin. The meter should indicate continuity when the crown of the space pawl is in line with the crown of the first tooth on the space rack.

(3) Continue to move the carriage towards the left margin stop and observe the meter for continuity indications.

(4) Space the carriage out one space from the left margin. The meter should indicate no continuity.

c. Adjustment.

(1) Connect the continuity meter as described in subparagraph b(1).

(2) Loosen the switch mounting screws.

99129A-10

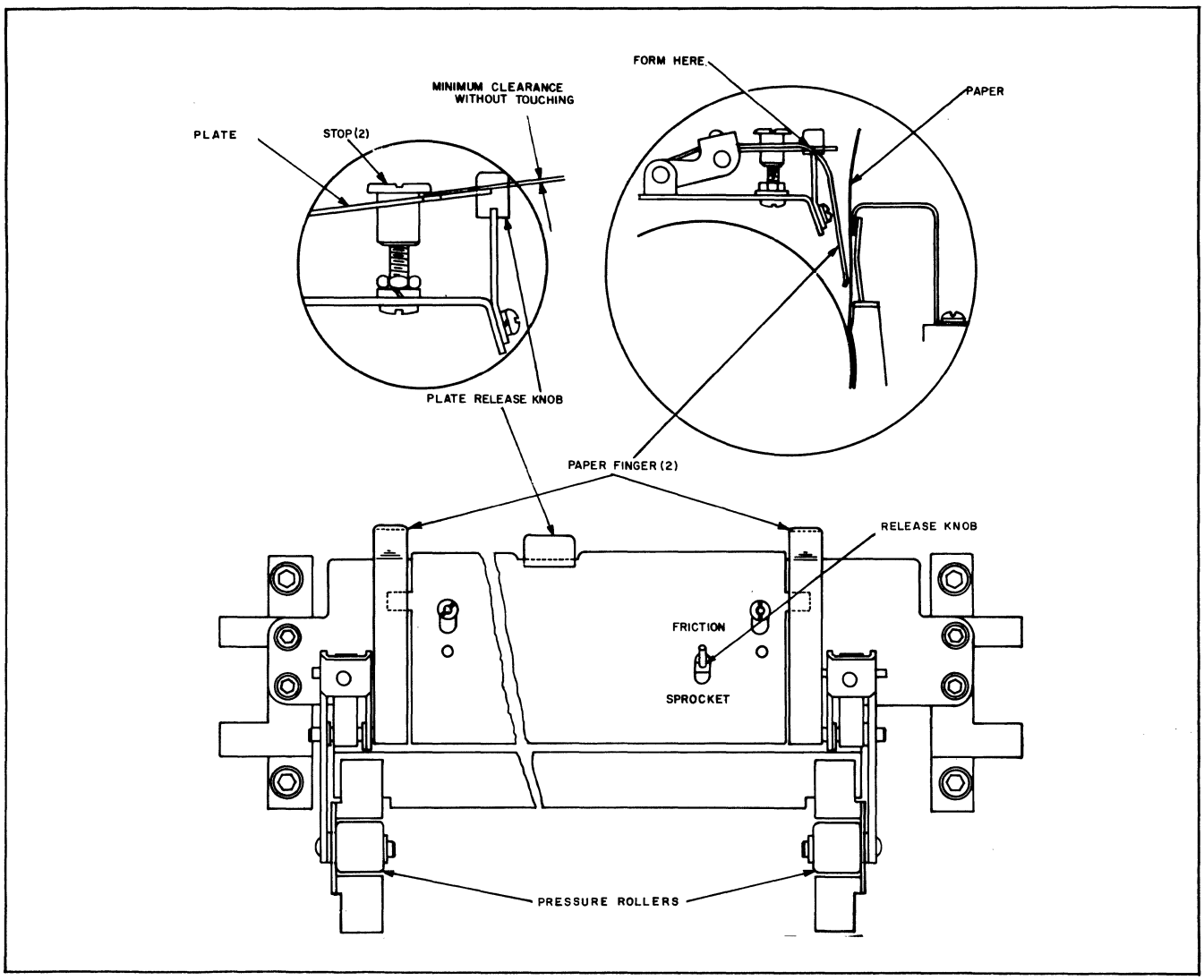


Figure 4F-47. Pressure plate and finger clearance.

(3) Aline the crown of the space pawl and the first tooth of the space rack and hold in position.

(4) Move the switch to the left until it opens, and then to the right until it closes.

(5) Tighten the screws and recheck the requirements.

(6) Remove the continuity meter leads.

4F-47 PRESSURE PLATE AND FINGER CLEARANCE (fig. 4F-47) (05423 Issue C)

a. Requirement.

(1) The fingers should hold the paper against the trough when the plate is in the unlatched position and should clear the paper in the latched position.

(2) When adjusting for friction feed paper, there should be a minimum clearance between the plate and stops when the plate is in the unlatched (up) position.

(3) When adjusting for sprocket feed paper, the pressure roller lever should be in the down position, and there should be a clearance of .030- to .050-inch between the rollers and the paper feed wheels.

b. Method of Checking.

(1) Unlatch the plate and check requirement a(1) visually.

(2) Check requirement a(2) by feeding the paper into the paper trough and alternately latching and unlatching the plate.

(3) Place the pressure roller lever in the down position and check the clearance with feeler gages.

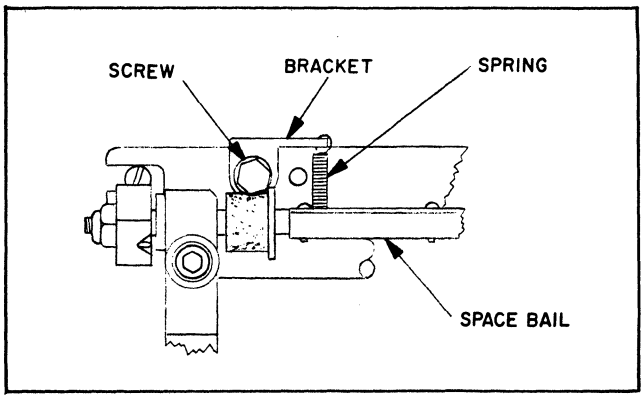


Figure 4F-48. Space bail spring bracket.

c. Adjustment.

(1) Form the paper fingers to meet requirement a(1).

(2) Turn the stops in the direction(s) necessary to meet requirements a(2) and a(3).

(3) Recheck the requirements.

4F-48 SPACE BAIL SPRING BRACKET (fig. 4F-48) (98015-03-44 Issue A)

a. Requirement.

(1) The spring bracket should lie flush with the top of the space rack.

(2) The space pawl should engage the first tooth on the space rack after the carriage returns to the left.

b. Adjustment.

(1) Loosen the screw.

(2) Position the bracket to meet requirements a(1) and a(2) and tighten the screw.

(3) Recheck the requirements.

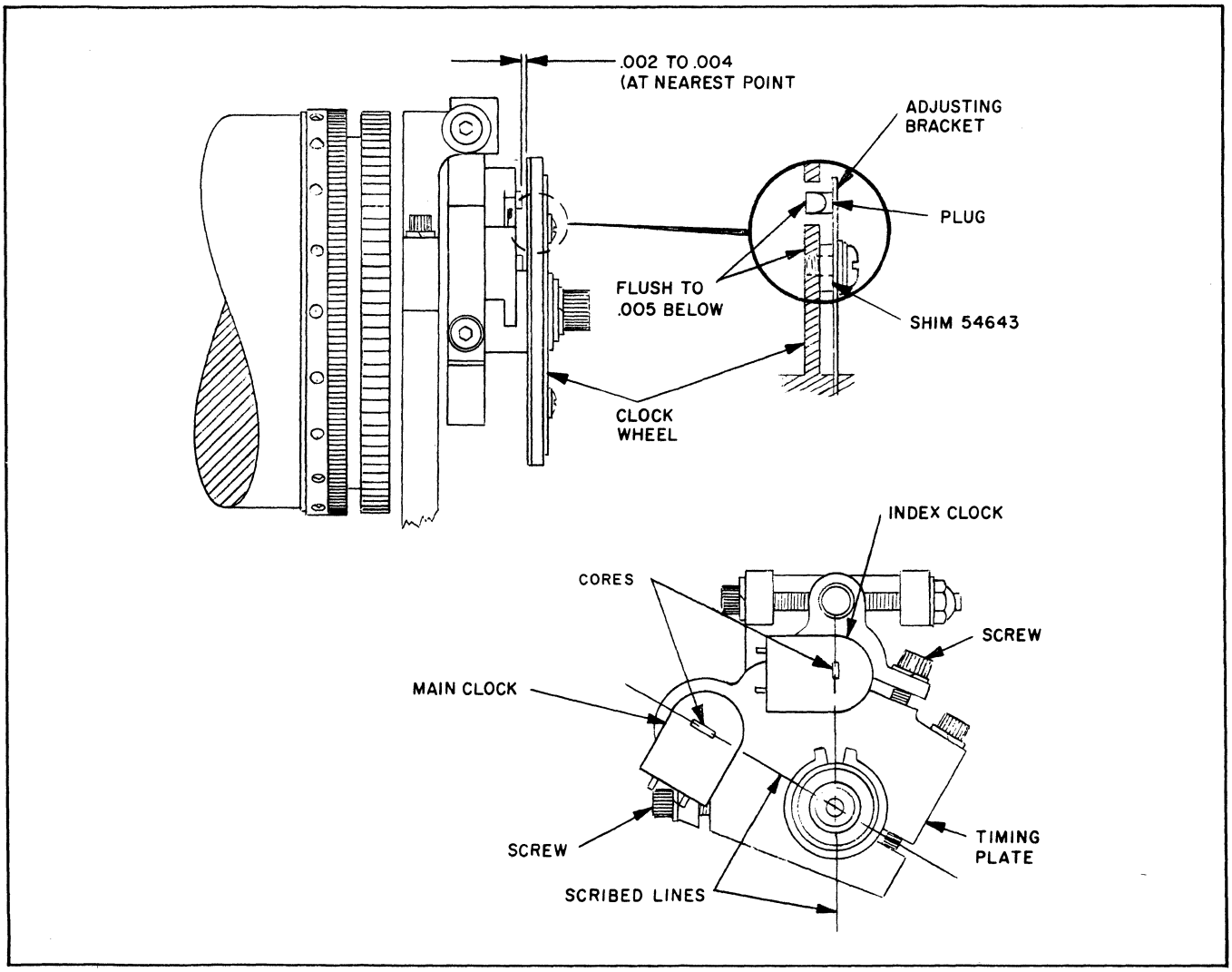


Figure 4F-49. Clock clearance and positioning.

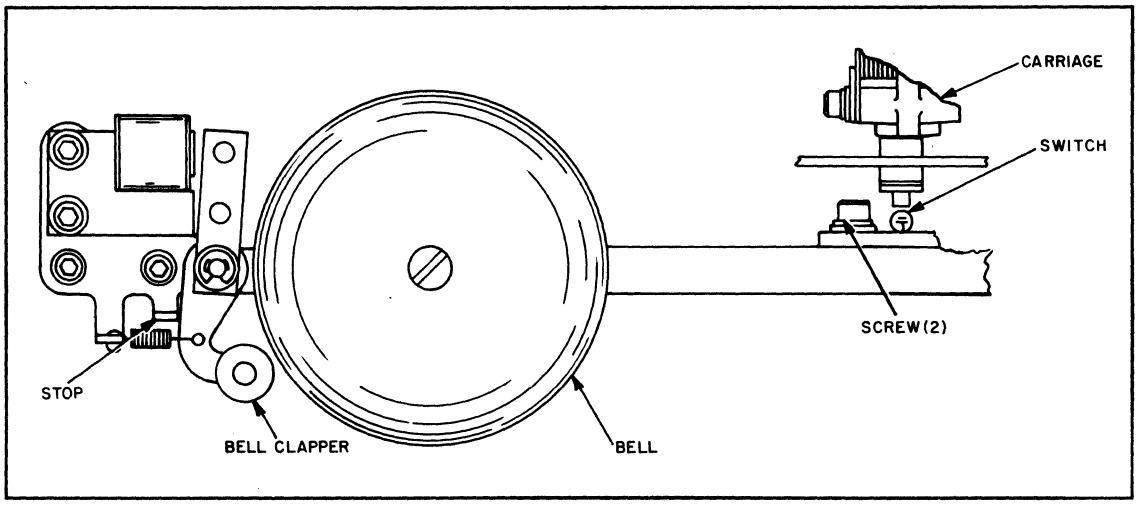


Figure 48.1. Margin bell switch.

4F-48.1 MARGIN BELL SWITCH (fig. 4F-48.1)
(05381 Issue C)

a. Requirement. The margin bell should ring as the 66th or 70th character (as applicable) is printed.

b. Adjustment.

(1) Position the carriage so that the print hammer is alined with the 66th or 70th character (as applicable).

(2) Connect a continuity meter directly to the switch terminals. Loosen the screws.

(3) Position the switch to the left until the continuity meter indicates current and then to the right until it indicates no current.

(4) Tighten the screws and recheck the requirement. Remove the continuity meter leads.

4F-48.2 MARGIN BELL (fig. 4F-48.2)
(05359 Issue A)

a. Requirement.

(1) The armature should stop parallel to the core pole face.

(2) When the coil is energized, the bell should ring loud and clear.

b. Adjustment.

(1) Loosen the coil assembly mounting screws.

(2) Position the armature against the magnet surface until they contact each other squarely (see insets).

(3) Tighten the coil assembly mounting screws.

(4) Loosen the bell screw and position the bell to meet requirement a(2).

(5) Tighten the screws.

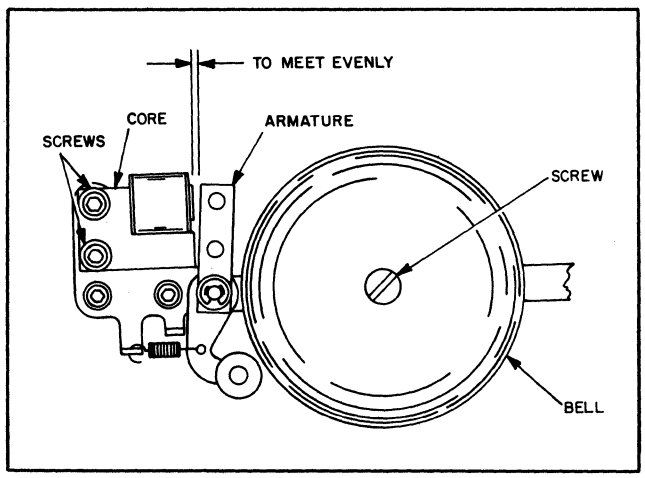


Figure 48.2. Margin bell.

4F-49 CLOCK CLEARANCE AND POSITIONING (fig. 4F-49) (05367 Issue D)

a. Requirement.

(1) The main and index clock cores should be in line with the scribed lines on the timing plate.

(2) The index clock plug should be flush with, or a maximum of, .005-inch below the clock wheel face.

(3) There should be .002- to .004-inch clearance (at closest point) between the clock wheel face and the main and index clock core faces.

b. Adjustment.

(1) Loosen the main and index clock screws.

(2) Position each clock to meet requirement a(1) and tighten the screws securely.

(3) Add or remove shims 54643 (.010-inch) between the adjusting bracket and clock wheel to meet requirement a(2).

(4) Insert a strip of non-magnetic material between the clock core faces and the wheel.

(5) Rotate the clock wheel to locate the point closest to the core faces.

(6) Loosen the main and index clock screws.

(7) Reposition each clock to meet requirements a(1) and a(3). Tighten the screws.

(8) Recheck the requirements.

4F-50 MAIN AND INDEX CLOCK PULSE ALINEMENT (fig. 4F-50) (05402 Issue C)

Note: The adjustment procedure described in paragraph 4F-49 must be completed before performing this adjustment.

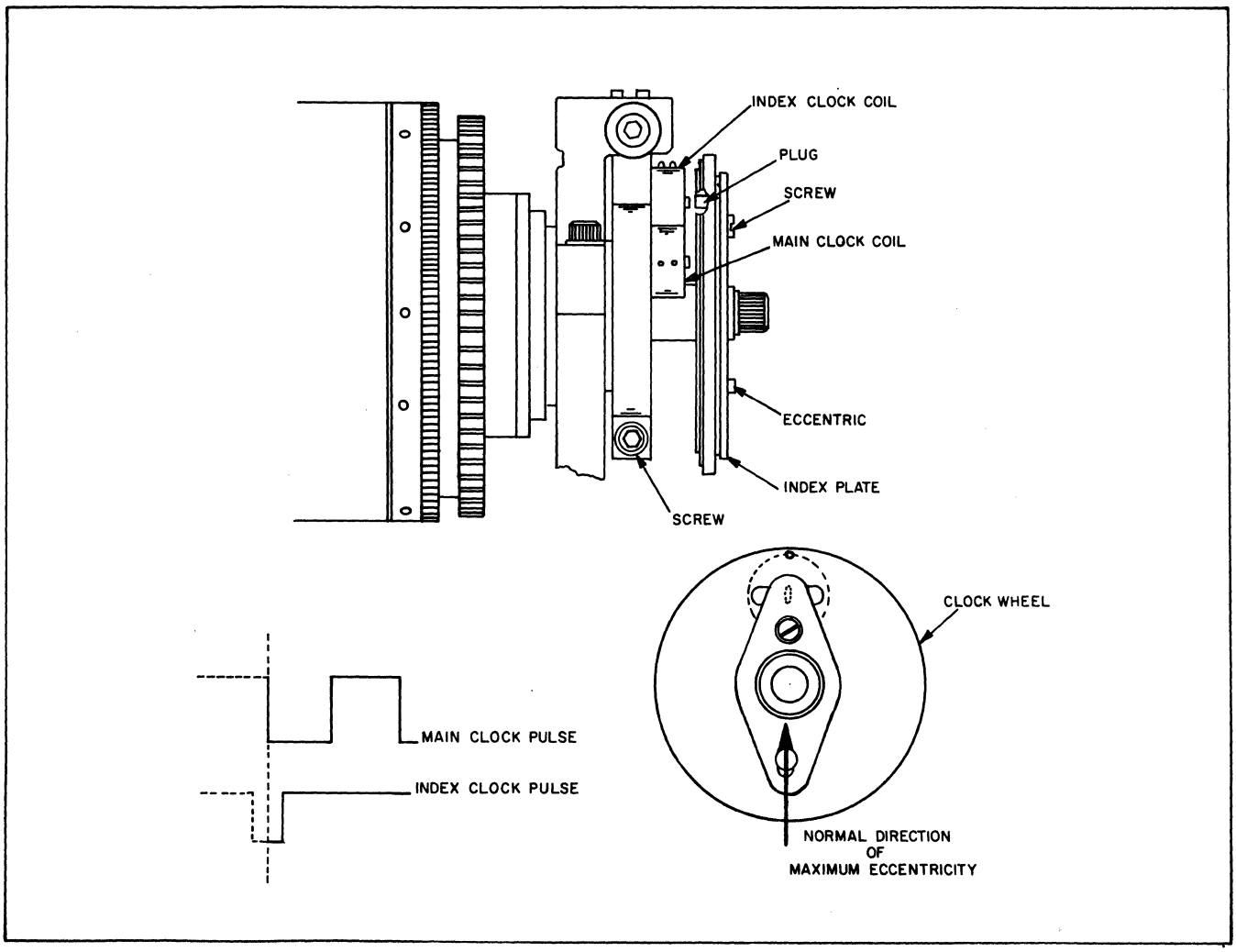


Figure 4F-50. Main and index clock pulse alinement.

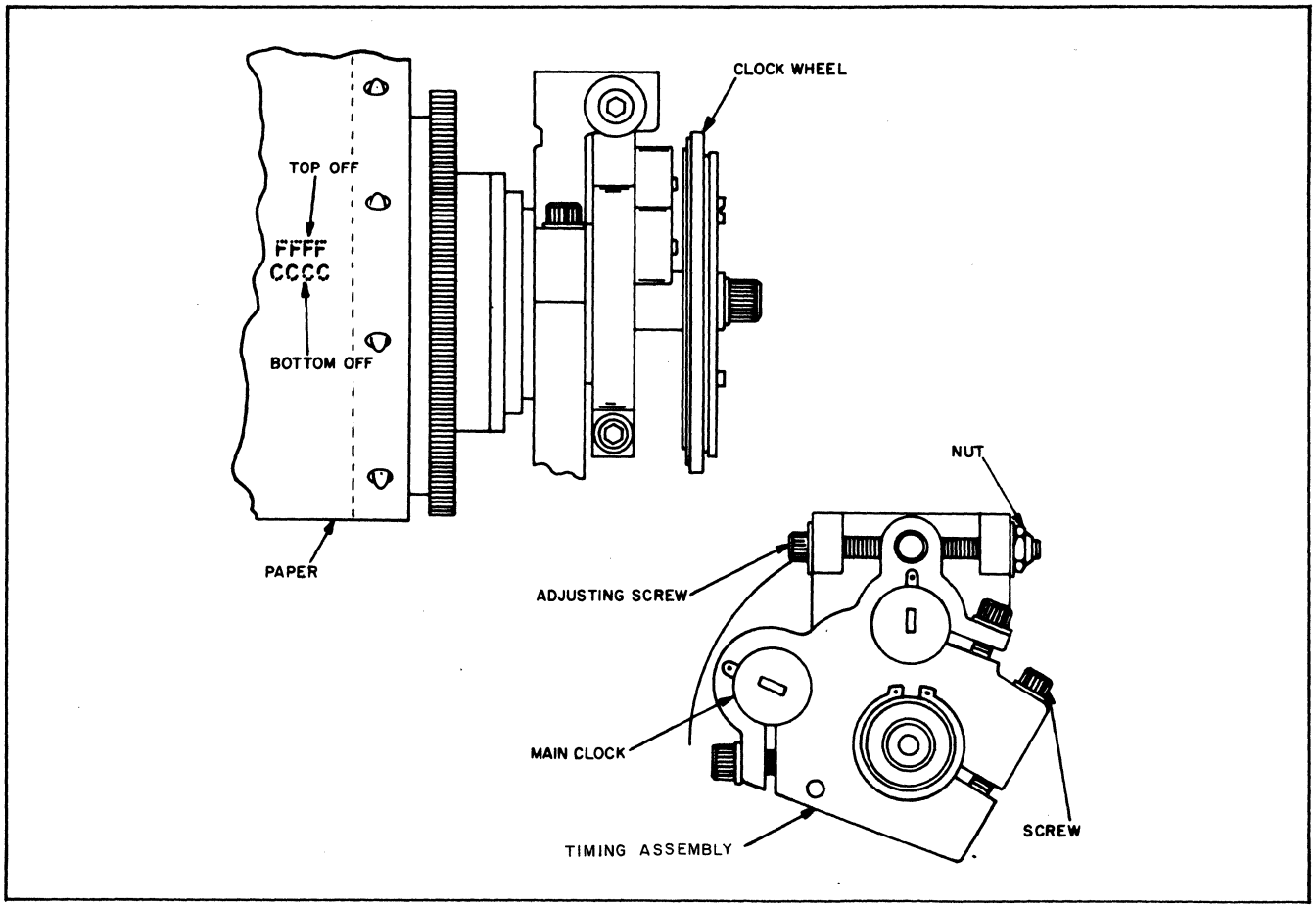


Figure 4F-51. Character phasing, mechanical.

a. Requirement.

(1) The main clock output signal should be symmetrical.

(2) The center of the index pulse should be in line with the negative transition of the main clock pulse.

b. Method of Checking.

(1) Replace printed wiring board 98056-1-253 with extension board 98056-1-309. Plug the printed wiring board into the extension board.

(2) Connect the leads of a dual beam oscilloscope to the following pins of the printed wiring board:

(a) "A" vertical input lead to pin 11 (main clock output).

(b) "B" vertical input lead to pin 34 (index clock output).

(c) Negative external trigger input lead to pin 34.

(d) Scope ground lead to pin 55 (circuit ground).

(3) With the printer operating, check requirements a(1) and a(2).

c. Adjustment.

Note: Requirements a(1) and a(2) represent ideal settings for the main clock and index clock pulses. The clock coil and index eccentric must be adjusted as close as possible to the ideal requirements.

(1) Loosen the main clock coil screw.

(2) While viewing the scope, rotate the coil to meet requirement a(1) and tighten the screw.

(3) Observe the relationship between the main clock and index clock pulse on the scope.

(4) Turn the printer off and loosen the index plate screw.

(5) Position the eccentric to meet requirement a(2) and tighten the screw.

(6) Recheck the requirement.

99129A-10

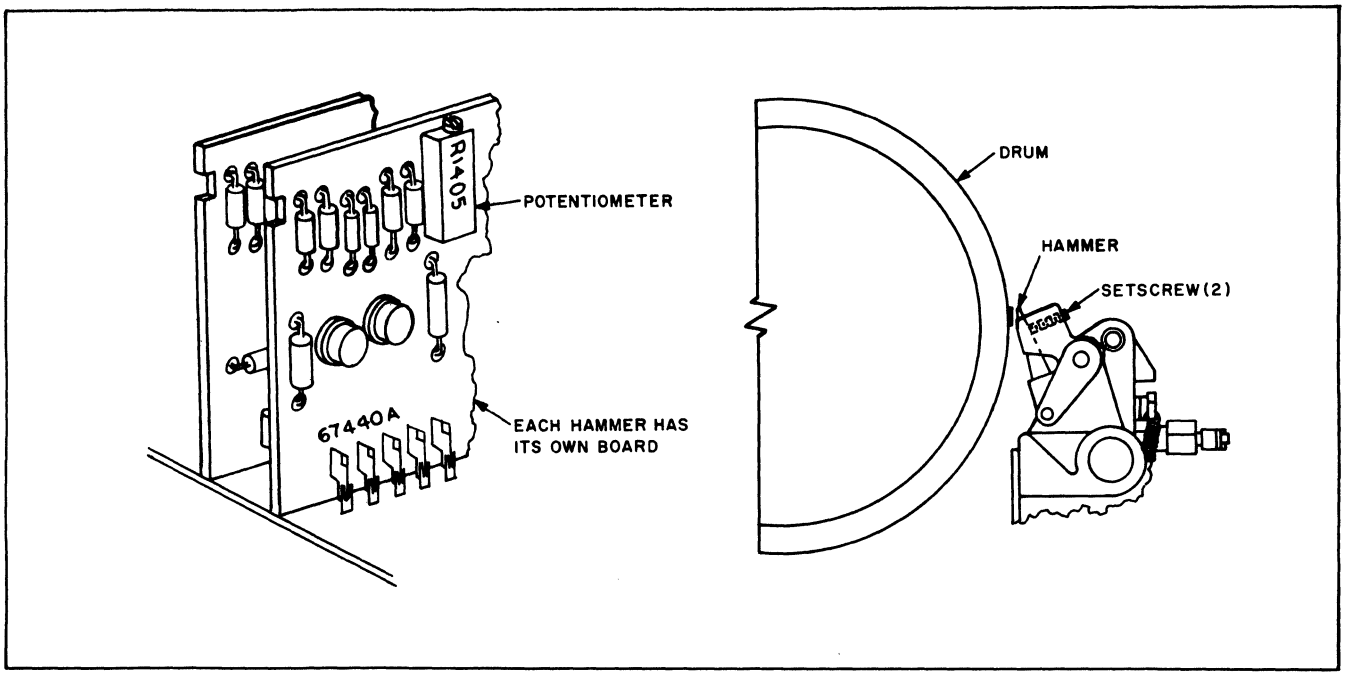


Figure 4F-52. Print impact (final) single or double hammer.

4F-51 CHARACTER PHASING, MECHANICAL (fig. 4F-51) (05372 Issue B)

Note: The adjustment procedures described in paragraphs 4F-41 and 4F-50 must be completed before performing this adjustment.

a. Requirement. The characters should be clearly printed on the page copy without being cut off at the top or bottom.

Note: The adjusting screw nut is not for locking the screw in place. It is for removal of end play on the adjusting screw.

b. Adjustment: While receiving a message:

(1) Loosen the timing plate assembly screw.

(2) Loosen the adjusting screw nut.

(3) Turn the adjusting screw clockwise to correct "top cutoffs" and tighten the nut.

(4) Turn the adjusting screw counterclockwise to correct "bottom cutoffs" and tighten the nut.

(5) Tighten the timing plate assembly screw and recheck the requirement.

Note: If character top or bottom cutoffs occur only at the left end of the print drum, the adjustment described in paragraph 4F-9 should be checked.

4F-52 PRINT IMPACT (FINAL) SINGLE OR DOUBLE HAMMER (fig. 4F-52) (98015-03-34 Issue B)

Note: The adjustment procedure described in paragraph 4F-42 must be completed before performing this adjustment.

a. Requirement.

(1) The print one-shot pulse length must be 700 microseconds long.

(2) The characters should be fully printed, have equal density and be alined.

b. Adjustment.

(1) Set the scope's internal trigger to positive.

(2) With a current probe connected to the scope's vertical input, connect the scope leads as follows:

(a) Current probe to the red wire at plug P27.

(b) Ground lead to circuit ground terminal on mode panel.

(3) With the unit receiving character code groups adjust the potentiometer (R1405) on printed circuit board 67440A plugged into J20-1 of the mother board to meet requirement a(1) on the number-one hammer.

CAUTION: DO NOT allow the print one-shot to equal or exceed one millisecond.

(4) Connect the current probe to the yellow wire at plug P27. Leave the scope's ground attached to the terminal on the mode panel.

(5) Adjust potentiometer (R1405) to meet requirement a(1) on the number-two hammer (observe caution note above).

(6) With the unit receiving character code groups, check the printed copy for the requirement described in a(2).

Note: If character clipping (top or bottom cutoff) occurs, it may be necessary to perform the adjustment described in paragraph 4F-51.

(7) If the characters are of unequal density, it may be necessary to meet requirement a(2) of the adjustment described in paragraph 4F-42. It may also be necessary to refine the "nominal clearance" between the armature and the core.

(8) If the characters are of equal density, but not alined (the number-one hammer is low) perform the adjustment described in paragraph 4F-42 toward the low end of the tolerance. (High end of the tolerance if character is too high).

(9) If double characters appear on the printed copy, turn the print hammer setscrew in to contact the hammer.

4F-53 MODE PANEL SWITCH AND ACTUATOR POSITIONING (fig. 4F-53) (05383 Issue C)

a. Requirement.

(1) The switch separators should be held tightly between the lower bracket and mode switch panel.

(2) The actuator should close or open the switch before the switch key is against the lower or upper stop.

(3) When the line feed switch key is operated, the single line feed switch should close before the repeat line feed switch.

b. Adjustment.

(1) Loosen all the bracket screws of the switch section to be adjusted.

(2) Position the bracket to meet requirement a(1) and tighten the screws.

(3) Position each switch to meet requirement a(2) by loosening its screws, set the switch against its actuator and tighten the screws. If necessary form the actuators to meet requirement a(2).

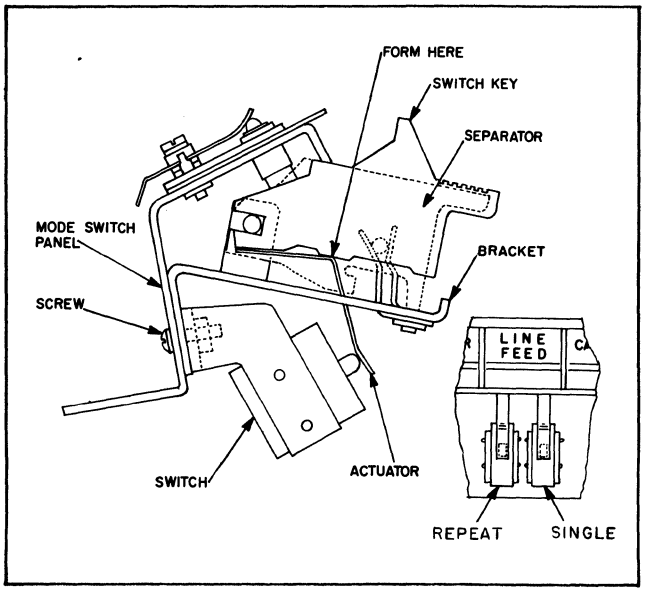


Figure 4F-53. Mode panel switch and actuator positioning.

(4) Form the switch actuator to meet requirement a(3).

(5) Recheck the requirements.

4F-54 COVER RELEASE KNOB (fig. 4F-54) (05390 Issue A)

a. Requirement. The cover release knob should be free to rotate without binding in the cover.

b. Adjustment.

(1) Loosen the bracket screws and position the bracket to meet the requirement.

(2) Tighten the screws.

(3) Repeat the procedure on the opposite side.

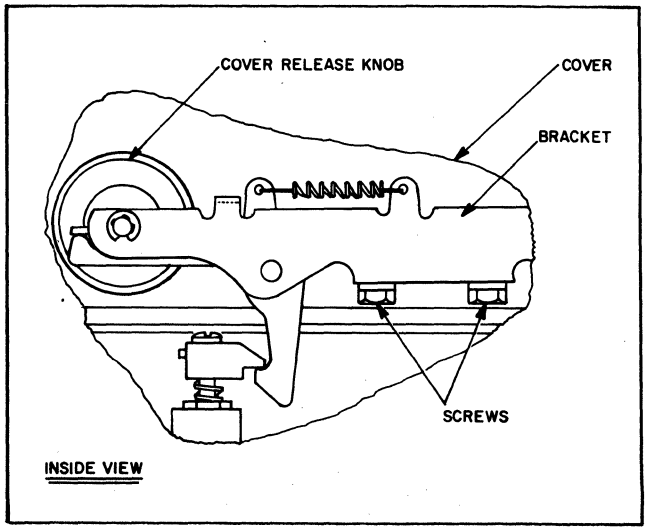


Figure 4F-54. Cover release knob.

99129A-10

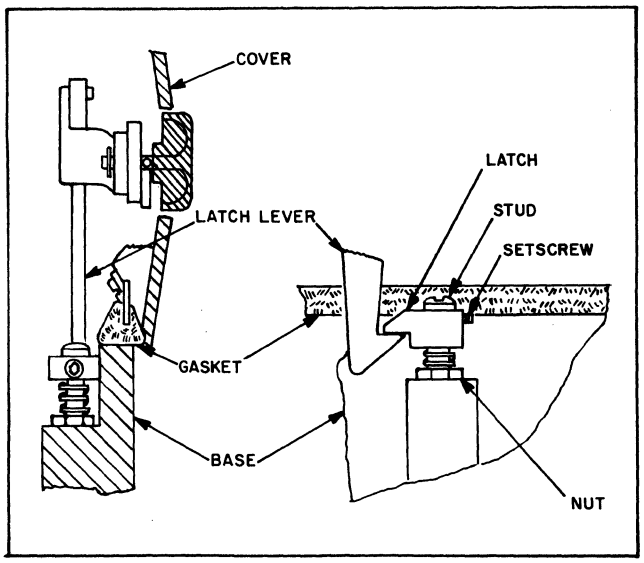


Figure 4F-55. Cover latch.

4F-55 COVER LATCH (fig. 4F-55)
(05401 Issue A)

a. Requirement. The rubber gasket should be slightly compressed along both sides of the base when the cover is closed and latched.

b. Adjustment.

(1) Loosen the latch setscrew.

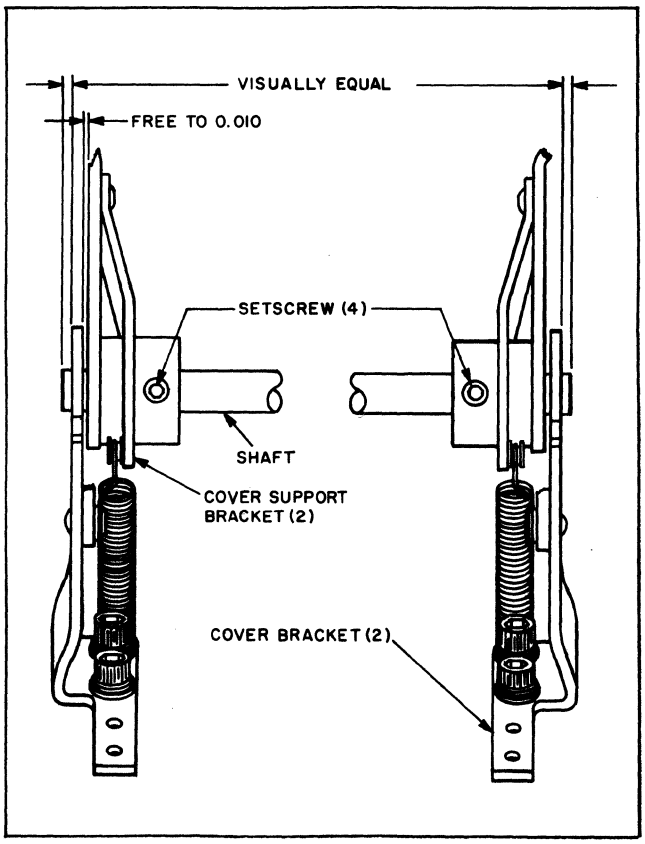


Figure 4F-56. Cover pivot shaft and bracket alinement.

(2) Loosen the nut and position the stud to meet requirement a(1). Tighten the nut and setscrew.

(3) Recheck the requirement.

(4) Repeat the procedure on the opposite side.

4F-56 COVER PIVOT SHAFT AND BRACKET ALINEMENT (fig. 4F-56)
(98015-03-26 Issue A)

a. Requirement.

(1) The shaft should protrude equally from the right and left cover mounting brackets.

(2) There should be clearance up to .010-inch between the cover mounting bracket and cover support.

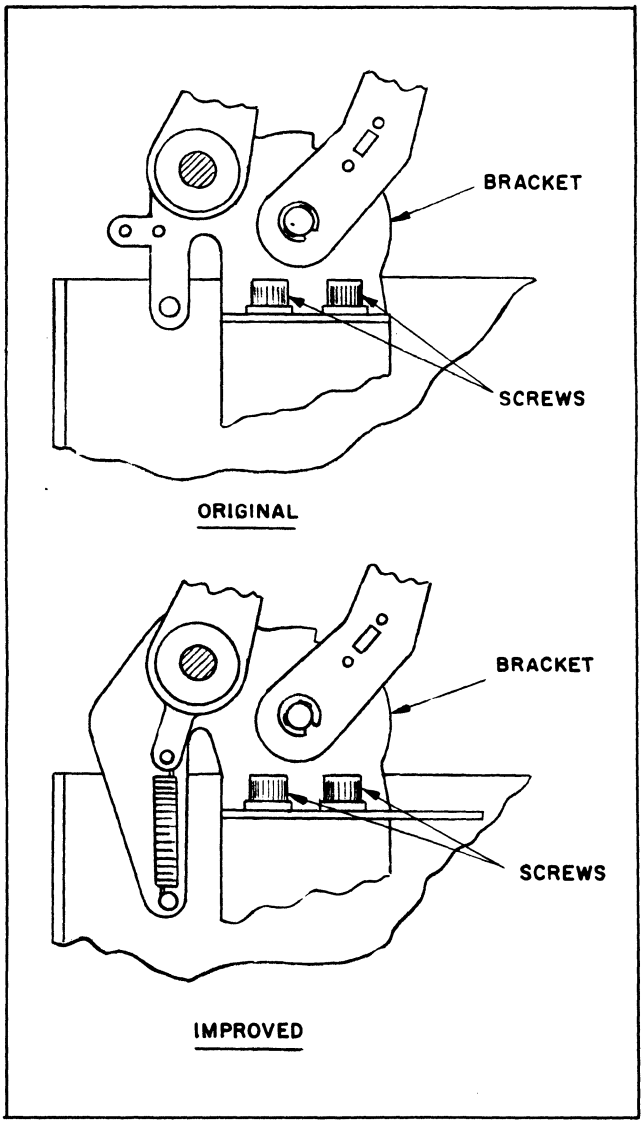


Figure 4F-57. Cover bracket.

99129A-10

b. Adjustment.

(1) Loosen the setscrews.

(2) Position the shaft to meet requirement a(1) and tighten one set of the support setscrews.

(3) Position the other cover support to meet requirement a(2) and tighten the setscrews.

(4) Recheck the requirements.

(5) Perform the adjustment described in paragraph 4F-57.

4F-57 COVER BRACKET (fig. 4F-57)
(05387 Issue B)

a. Requirement. The cover should fit over the mode switch panel without interferring with the switch keys, and the front of the cover should be central with the receive only cover or keyboard casting.

b. Adjustment.

(1) Loosen both cover bracket screws.

(2) Position the cover to meet the requirement and tighten the screws.

4F-58 COPY WINDOW AND DEFLECTOR
(fig. 4F-58)
(05389 Issue B)

a. Requirement.

(1) When the unit is receiving repeated line feeds the paper should feed automatically out of the cover.

(2) The deflector should be parallel to and should hold the paper against the window without restricting the flow of paper from the unit.

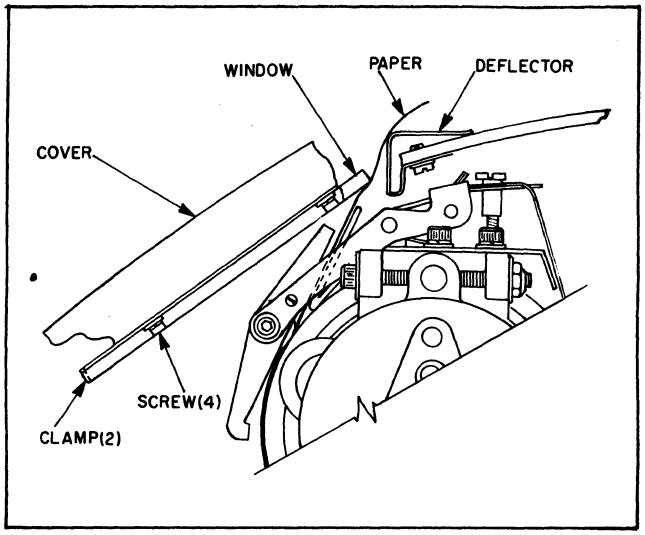


Figure 4F-58. Copy window and deflector.

b. Method of Checking.

(1) Remove the excess paper by tearing it along the paper guide assembly.

(2) Send repeated line feeds and check the requirement.

c. Adjustment.

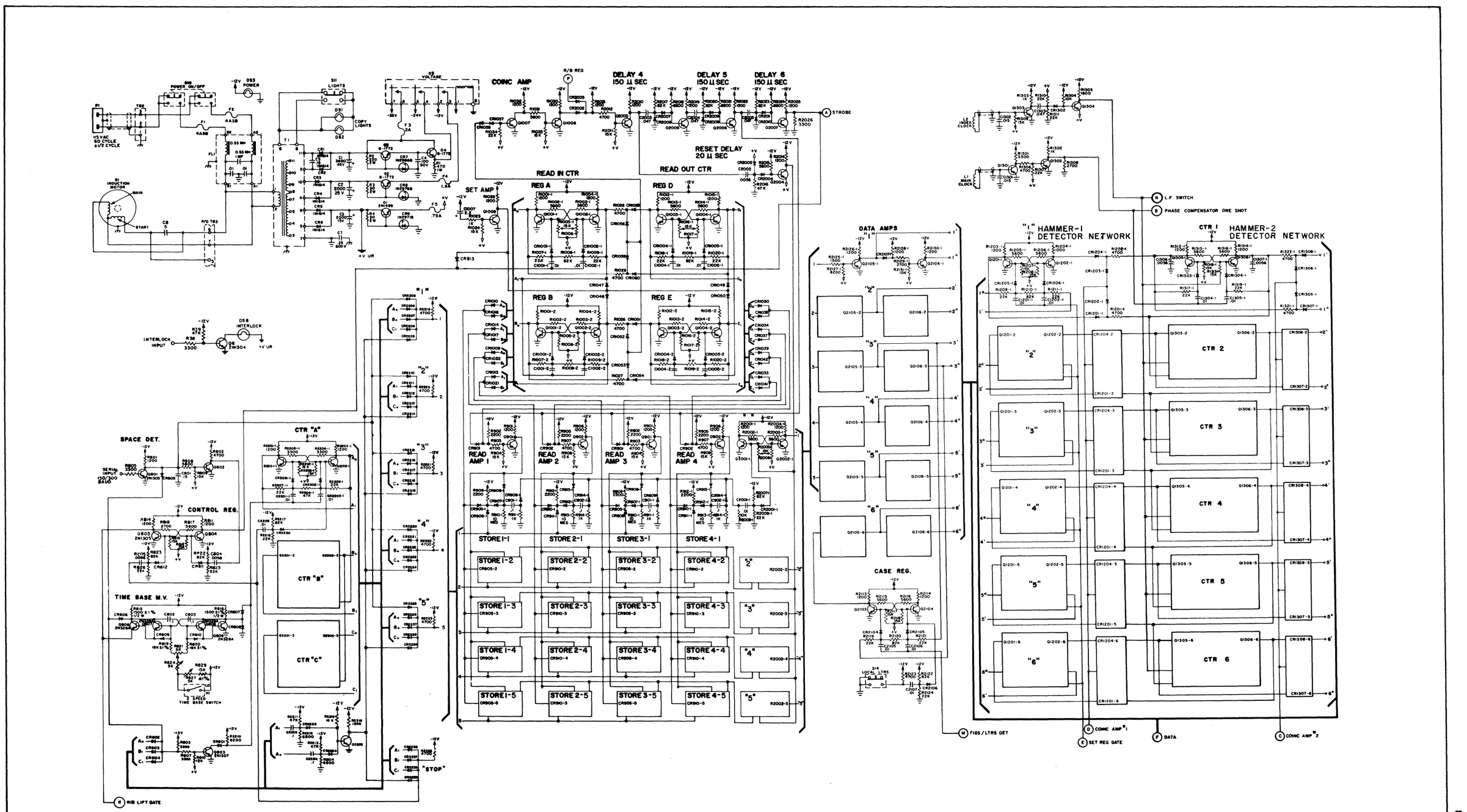
(1) Loosen the window clamp and deflector screws.

(2) Position the window so that it touches the paper evenly along its entire width. Tighten the screws.

(3) Position the deflector to meet requirement a(2) and tighten the screws.

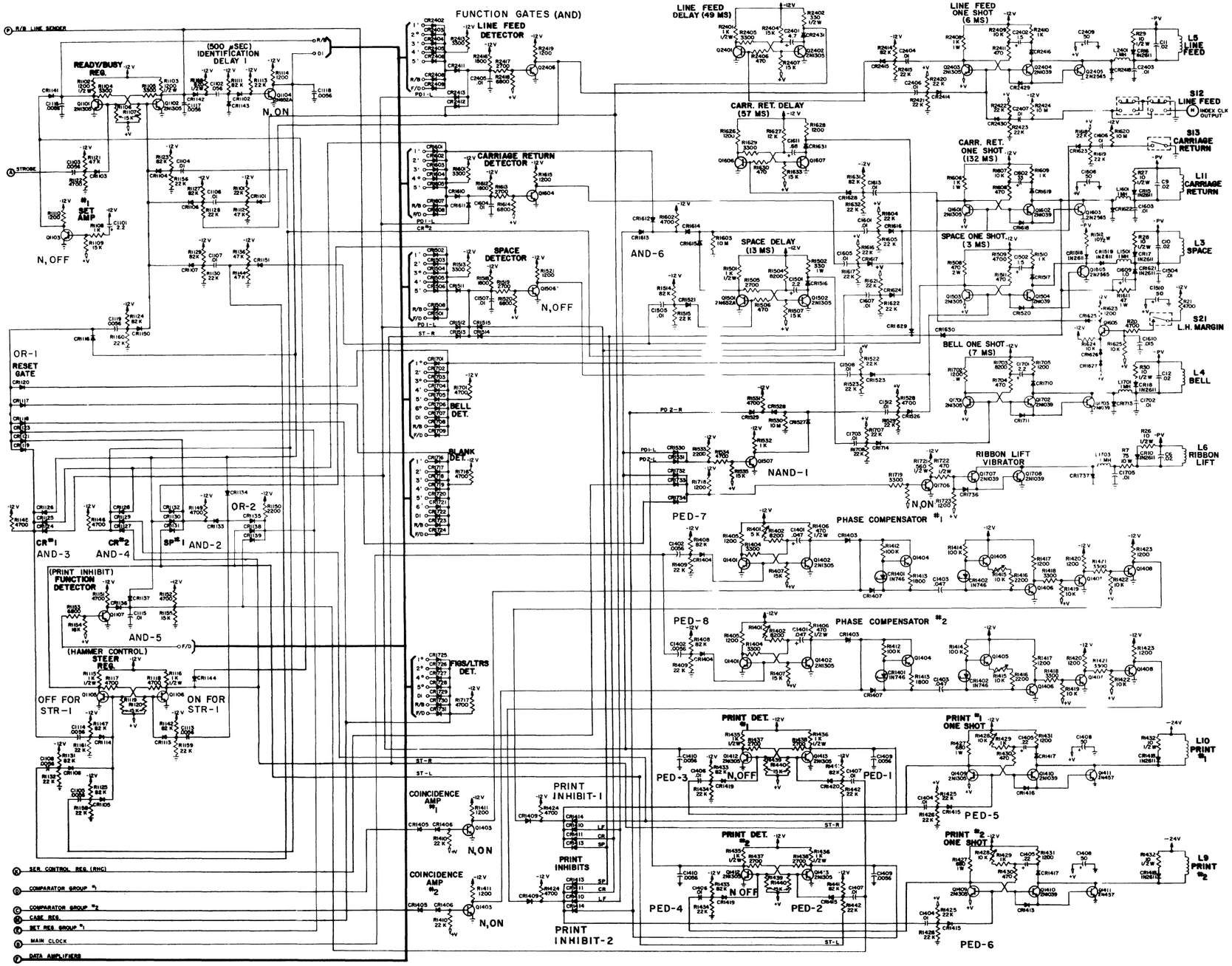
(4) Recheck the requirement.

Section G Wiring Diagrams



99129A-13

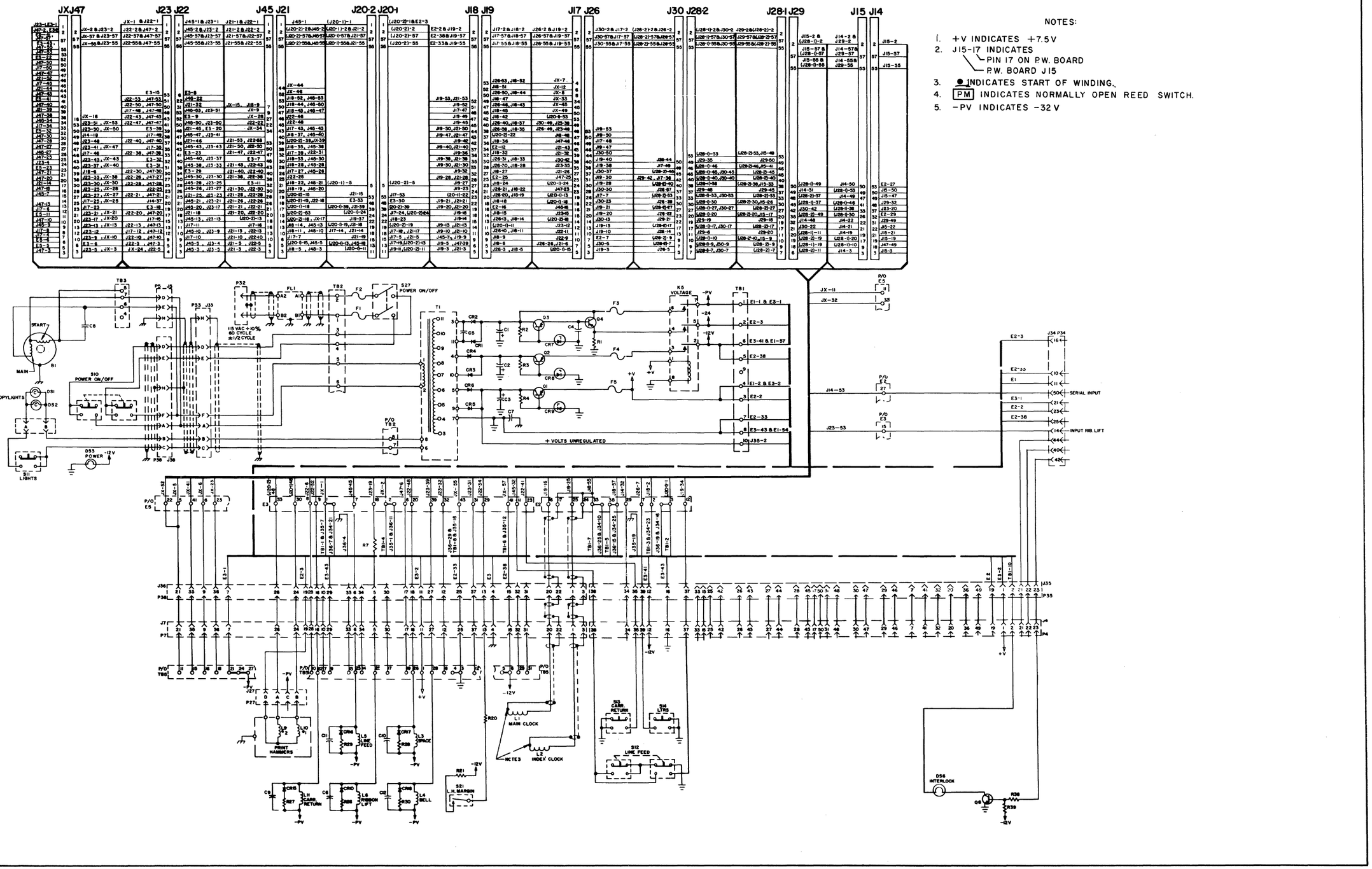
Figure 4G-1. Overall schematic diagram (98210-3-127, Issue C).



NOTES:
1. +V INDICATES +7.5 V, N OFF INDICATES NORMALLY OFF (TRANSISTOR IN NON-CONDUCTIVE STATE.).
2. −PV INDICATES −32 V.
3. +VUR INDICATES +VOLTS UNREGULATED.

99129A-13

Figure 4G-1. Overall schematic diagram (98210-3-127, Issue C). (continued)



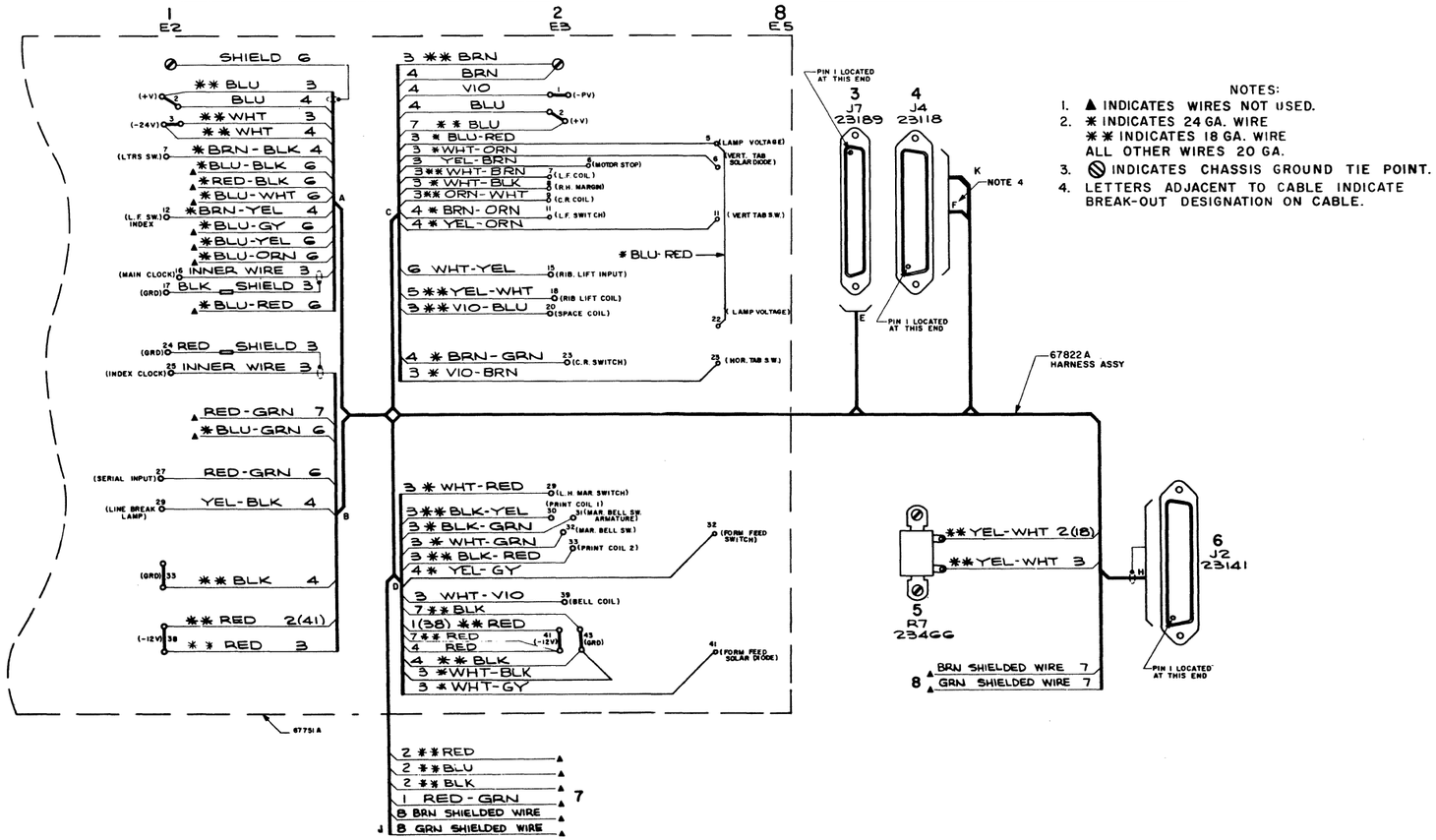
99129A-13

Figure 4G-2. Interconnection diagram (CD-666. Issue C)

3 (J7)					
PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO
1	INNER WIRE	1(25)	20	INNER WIRE	1(16)
2			21	* BLU-RED	8
3	RED (SHIELD)	1(24)	22	BLK (SHIELD)	1(17)
4	** BRN	2	23		
5	**YEL-WHT	5	24	**BLK-YEL	2(30)
6	**WHT-BRN	2(7)	25	BLK	4(18)
7	** VIO	4(6)	26	**BLK-RED	2(33)
8			27	WHT-VIO	2(39)
9	* WHT-ORN	8	28	* WHT-BLK	2
10			29	* WHT-BLK	2
11	* * BLU	1(2)	30		
12	* WHT-GRN	2(32)	31		
13	* WHT-RED	2(29)	32		
14			33		
15	* * RED	1(38)	34		
16	**ORN-WHT	2(9)	35	* WHT-GY	8
17	YEL-BRN	2(6)	36	* VIO-BRN	8
18	**VIO-BLU	2(20)	37	* BLK-GRN	2(31)
19	* * WHT	1(3)			

4 (J4)					
PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO
1	BLU	2(2), PIN 5	26		
2	(2) BLU	1(2), 6	27		
3	BLU	PIN 1	28	BRN	PIN 19
4	** WHT	1(3)	29		
5			30		
6	** VIO	3	31		
7			32	* YEL-ORN	8
8			33	* YEL-GY	8
9	(2) VIO	6, 2(1)	34	YEL-BLK	1(29)
10	RED	6, PIN 13	35	* BRN-GRN	2(23)
11	RED	2(41), PIN 15	36		
12			37	* BRN-YEL	1(12)
13	RED	PIN 10, 11	38	* BRN-ORN	2(11)
14			39	* BRN-BLK	1(7)
15	** BLK	2(43)	40		
16	** BLK	1(33)	41		
17			42		
18	(2) BLK	3, 6	43		
19	BRN	2, PIN 28	44		
20			45		
21	ORN-BLU	6	46		
22	BLU-BLK	6	47		
23	BLU-BRN	6	48		
24			49		
25			50		

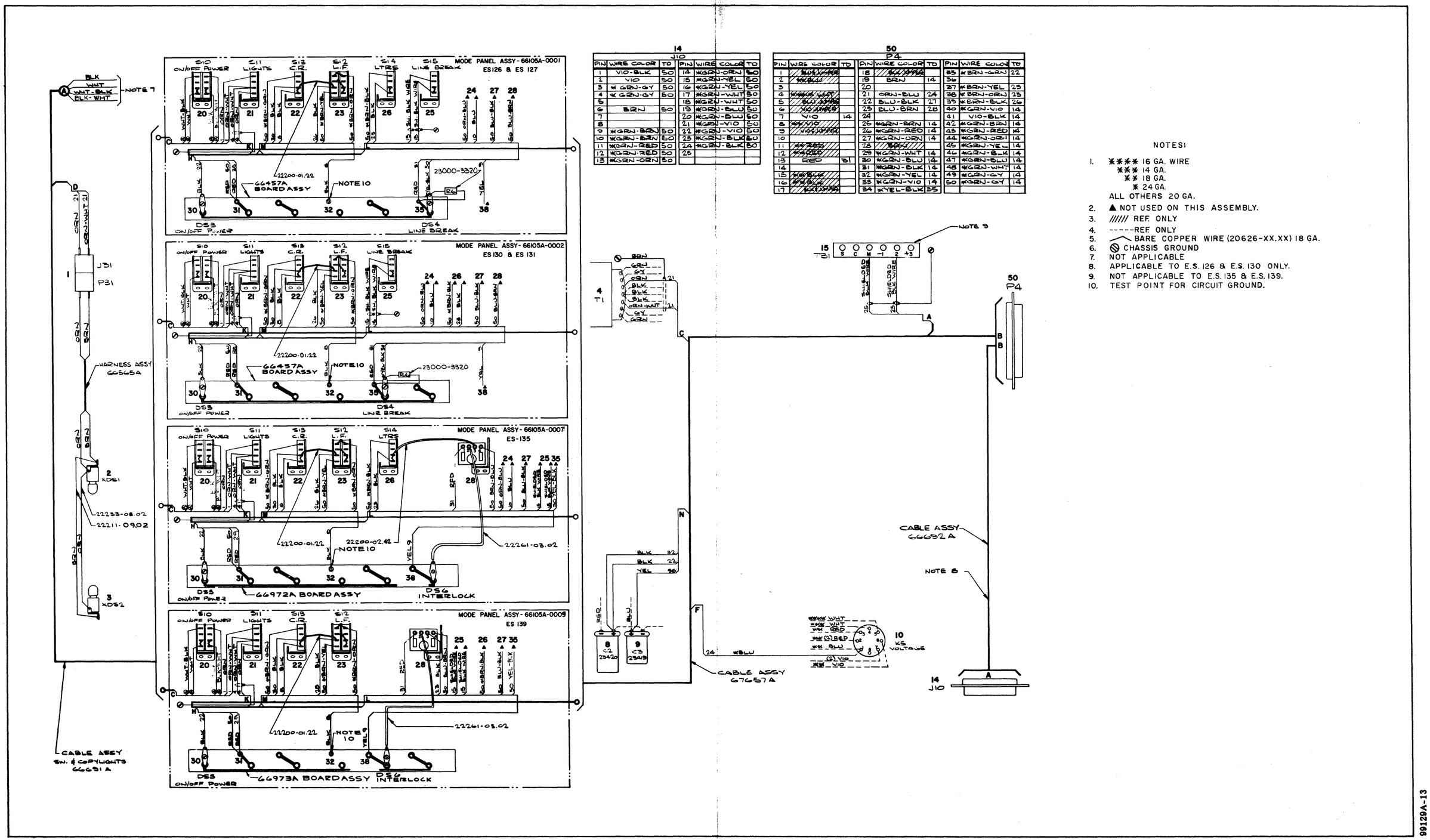
6 (J2)					
PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO
1	* BLU-RED	1	26		
2	* BLU-ORN	1	27		
3	* BLU-YEL	1	28		
4	* BLU-GRN	1	29		
5	* BLU-GY	1	30		
6	* BLU-WHT	1	31		
7	* BLU-BLK	1	32		
8	* RED-BLK	1	33		
9	BLK	4(18)	34		
10			35		
11	**BRN (SHIELD)	1	36		
12			37		
13			38		
14	WHT-YEL	2(15)	39		
15			40	BLU-BLK	4(22)
16			41		
17			42	BLU-BRN	4(23)
18			43		
19			44	ORN-BLU	4(21)
20			45		
21	VIO	4(9)	46		
22			47		
23	BLU	4(2)	48		
24			49		
25	RED	4(10)	50	RED-GRN	1(27)



NOTES:
1. ▲ INDICATES WIRES NOT USED.
2. * INDICATES 24 GA. WIRE
   ** INDICATES 18 GA. WIRE
   ALL OTHER WIRES 20 GA.
3. ⊘ INDICATES CHASSIS GROUND TIE POINT.
4. LETTERS ADJACENT TO CABLE INDICATE BREAK-OUT DESIGNATION ON CABLE.

99129A-13

Figure 4G-3. Electronic unit wiring diagram (CD-658, Issue B).



14 J10					
PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO
1	VIO-BLK	50	14	*GRN-ORN	50
2	VIO	50	15	*GRN-YEL	50
3	* GRN-GY	50	16	*GRN-YEL	50
4	* GRN-GY	50	17	*GRN-WHT	50
5			18	*GRN-BLU	50
6	BRN	50	19	*GRN-BLU	50
7			20	*GRN-BLU	50
8			21	*GRN-VIO	50
9	*GRN-BRN	50	22	*GRN-VIO	50
10	*GRN-BRN	50	23	*GRN-BLK	50
11	*GRN-RED	50	24	*GRN-BLK	50
12	*GRN-RED	50	25		
13	*GRN-ORN	50			

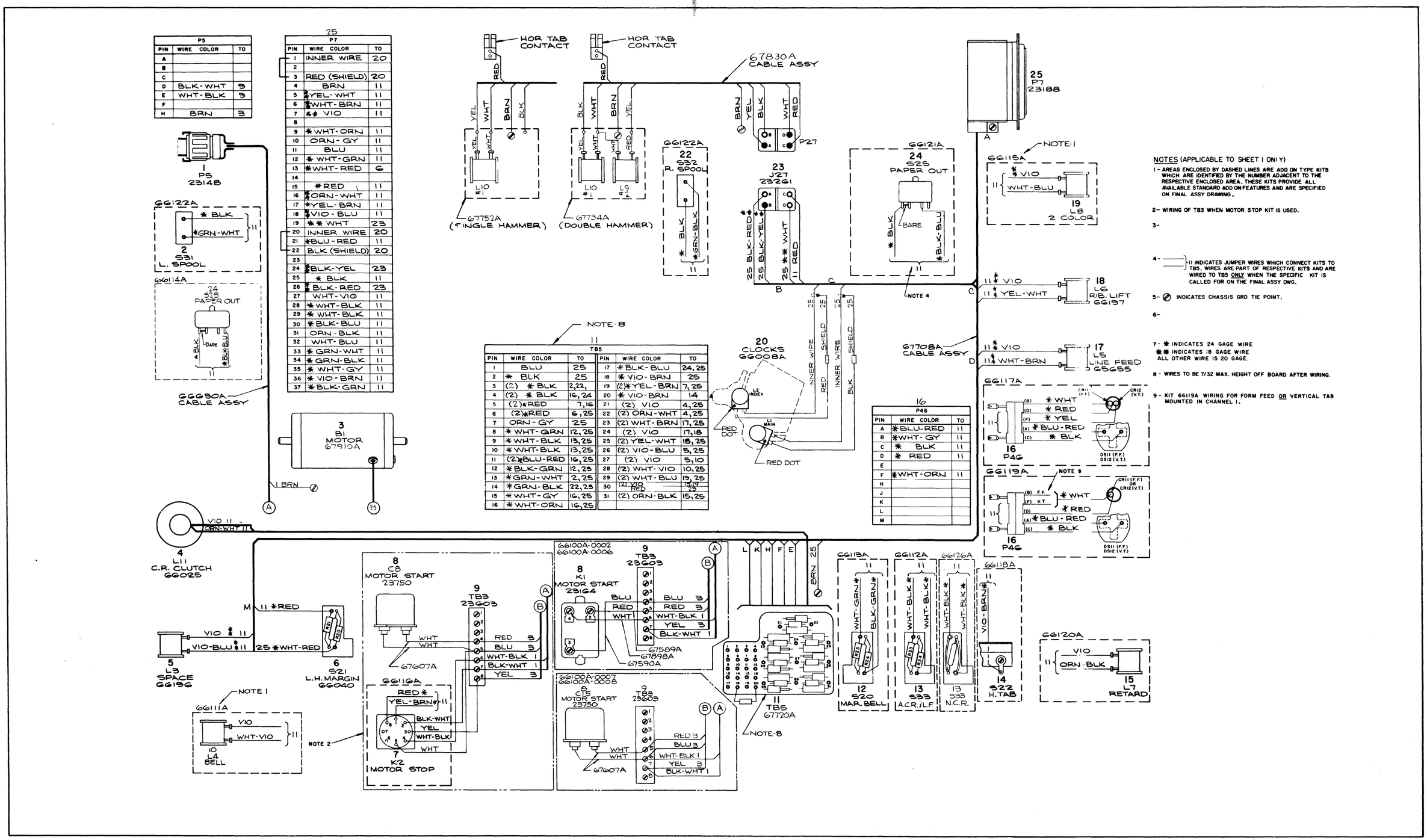
50 P4								
PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO
1	BLK-WHT		18	BLK-WHT		35	*BRN-GRN	22
2	WHT-BLU		19	BRN	14	36		
3			20			37	*BRN-YEL	25
4	WHT-GRN		21	ORN-BLU	24	38	*BRN-ORN	23
5	BLU-WHT		22	BLU-BLK	27	39	*BRN-BLK	26
6	VIO-WHT		23	BLU-BRN	28	40	*GRN-VIO	14
7	VIO	14	24			41	VIO-BLK	14
8			25	*GRN-BRN	14	42	*GRN-BRN	14
9	VIO-WHT		26	*GRN-RED	14	43	*GRN-RED	14
10			27	*GRN-ORN	14	44	*GRN-ORN	14
11	RED-WHT		28	BRN		45	*GRN-YEL	14
12	RED-BLK		29	*GRN-WHT	14	46	*GRN-BLK	14
13	RED	81	30	*GRN-BLU	14	47	*GRN-BLU	14
14			31	*GRN-BLK	14	48	*GRN-WHT	14
15	BLK-WHT		32	*GRN-YEL	14	49	*GRN-GY	14
16	BLK-WHT		33	*GRN-VIO	14	50	*GRN-GY	14
17	BLK-WHT		34	*YEL-BLK	35			

NOTES:

1. **** 16 GA. WIRE
   *** 14 GA.
   ** 18 GA.
   * 24 GA.
   ALL OTHERS 20 GA.
2. ▲ NOT USED ON THIS ASSEMBLY.
3. ////// REF. ONLY
4. -----REF. ONLY
5. ⌒ BARE COPPER WIRE (20626-XX.XX) 18 GA.
6. ⊘ CHASSIS GROUND
7. NOT APPLICABLE
8. APPLICABLE TO E.S. 126 & E.S. 130 ONLY.
9. NOT APPLICABLE TO E.S. 135 & E.S. 139.
10. TEST POINT FOR CIRCUIT GROUND.

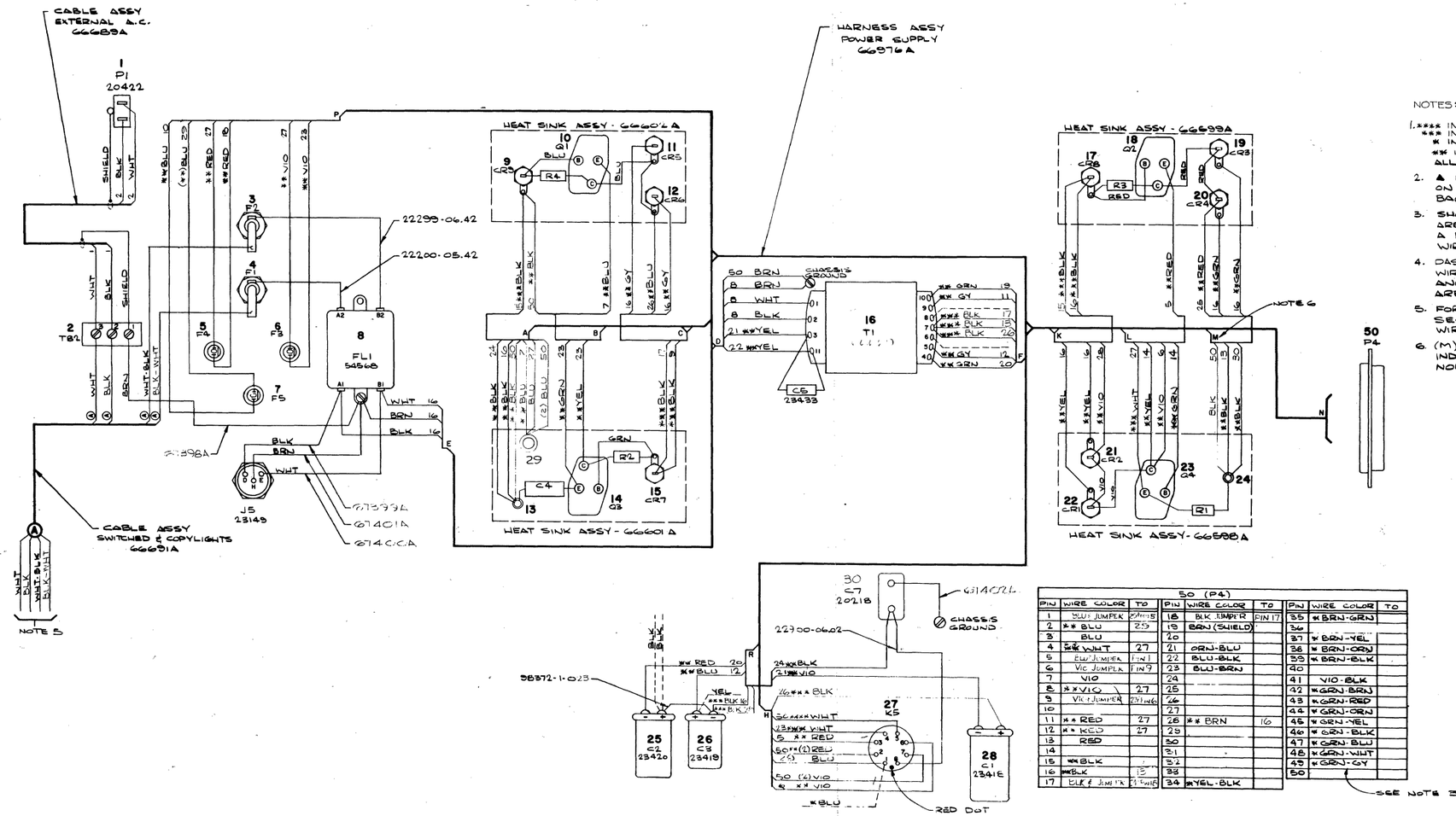
99129A-13

Figure 4G-4. Mode panel wiring diagram (CD-631, Issue C).



99129A-10

Figure 4G-5B. Printer wiring diagram.



50 (P4)								
PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO	PIN	WIRE COLOR	TO
1	WHT JUMPER	2 THRU 5	18	BLK JUMPER	PIN 17	35	* BRN-GRN	
2	** BLU	23	19	BRN (SHIELD)		36		
3	BLU		20			37	* BRN-YEL	
4	** WHT	27	21	ORN-BLU		38	* BRN-ORN	
5	BLU JUMPER	1 THRU 4	22	BLU-BLK		39	* BRN-BLK	
6	VIO JUMPER	7 THRU 9	23	BLU-BRN		40		
7	VIO		24			41	VIO-BLK	
8	* VIO	27	25			42	* GRN-BRN	
9	VIO JUMPER	27 THRU 6	26			43	* GRN-RED	
10			27			44	* GRN-ORN	
11	* RED	27	28	** BRN	16	45	* GRN-YEL	
12	* RED	27	29			46	* GRN-BLK	
13	RED		30			47	* GRN-BLU	
14			31			48	* GRN-WHT	
15	** BLK		32			49	* GRN-GY	
16	** BLK	13	33			50		
17	BLK JUMPER	21 THRU 18	34	* YEL-BLK				

99129A-10

Figure 4G-6. Power supply wiring diagram.