

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TM 11-5815-244-35

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TO 31W4-2FGC-232

FIELD AND DEPOT MAINTENANCE MANUAL

TELETYPEWRITER  
SETS AN/FGC-25  
AN/FGC-25X  
AN/FGC-26, AND  
AN/FGC-57



DEPARTMENTS OF THE ARMY AND THE AIR FORCE

OCTOBER 1960

**WARNING**

**DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT**

Be careful when working on the 115-volt motor circuits, or on the 95- to 250-volt power supply circuits.

**DON'T TAKE CHANCES!**



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\*This manual together with TM 11-5815-244-12, 1 March 1960, supersedes TM 11-2246, 26 June 1956, including C 1, 13 December 1956; C 2, 10 January 1957; C 3, 26 April 1957; C 4, 2 July 1958; C 5, 25 July 1958; and C 6, 15 May 1959.

# CHAPTER 1

## INTRODUCTION

### 1. Scope

*a.* This manual covers the installation, the theory, and the field and depot maintenance of Teletypewriter Sets AN/FGC-25, AN/FGC-25X, AN/FGC-26, and AN/FGC-57. The operation and organizational maintenance instructions for the equipments are contained in TM 11-5815-244-12. Minor features which are unique to the AN/FGC-57 are covered in TM 11-5815-203-15.

*b.* Forward comments concerning this man-

*a. Page Printers.*

ual to the Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

*Note.* For applicable forms and records, see paragraph 2, TM 11-5815-244-12.

### 2. Internal Differences in Models

Internal differences in the various models of the equipment affect field and depot maintenance. The most significant differences are shown in *a* and *b* below.

Variable features	TT-117/FG of AN/FGC-25	TT-118/FG of AN/FGC-26	TT-119/FG of AN/FGC-25X	TT-117A/FG of AN/FGC-25 or AN/FGC-57	TT-119A/FG of AN/FGC-25X
Synchronous motor.....	×	×		×	
Series governed motor.....			×		×
Communication symbols.....	×		×	×	×
Weather symbols.....		×			
Mechanical keyboard lockout mechanism.....		×		×	×
Electrical keyboard lockout mechanism.....	×		×		
Two-relay motor stop mechanism activated by FIGS-H sequence.	×		×	×	×
Three-relay motor stop mechanism activated by FIGS-BLANK-H sequence.		×			

*b. Perforators.*

Variable features	TT-178/FG of AN/FGC-25X	TT-179/FG of AN/FGC-25	TT-181/FG of AN/FGC-26	TT-178A/FG of AN/FGC-25X	TT-179A/FG of AN/FGC-25	TT-250/FG of AN/FGC-57
Series-governed motor.....	×			×		
Communication symbols.....	×	×		×	×	×
Weather symbols.....			×			
Equipped with 1-piece double gear.....	×	×				×
Equipped with ball-bearing mounted double gear.			×	×	×	
Equipped with special switch (S31) and connector for AN/FGC-30 application.						×
Electrical parts identified by 2-digit reference symbols.	×	×				×
Electrical parts identified by 3-digit reference symbols.			×	×	×	

## CHAPTER 2 INSTALLATION

### Section I. SERVICE UPON RECEIPT OF EQUIPMENT

#### 3. Siting

The selection of a suitable location requires that consideration be given to the accessibility of equipment for maintenance, convenience of operating personnel, illumination needs, and the flow of message traffic in the communications center. Whenever possible, sufficient room should be allowed at the rear of the equipment to permit free access for maintenance personnel. A minimum of 3 feet of clearance should be provided at the front of the equipment for the operator. Power outlets within the range of 95- to 250-volts alternating current (ac) are essential; AN/FGC-25, AN/FGC-26, and AN/FGC-57 require a regulated 60-cycle source; AN/FGC-25X requires a 50- to 60-cycle source.

#### 4. Unpacking

*a. Packaging Data.* Each teletypewriter set is packed in three wooden boxes for shipment as follows:

Box. No.	Unit	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Unit weight (lb)
1	Page printer.	18 $\frac{3}{4}$	24 $\frac{3}{4}$	29	7.8	88
2	Perforator	20 $\frac{3}{4}$	26	32 $\frac{1}{2}$	10.2	110
3	Table and accessories.	29 $\frac{3}{8}$	25 $\frac{3}{8}$	43 $\frac{1}{2}$	18.8	109

- (1) The page printer (fig. 1) and perforator (fig. 2) are each mounted on a

separate shipping baseboard. Shock mounts are installed between the equipments and the baseboards. A heat-sealed waterproof barrier incloses each component which is then placed in a nailed wooden box.

- (2) The table and accessory package (fig. 3) has a separate carton which contains a spent tape chute, copyholder, TD tape guide, and tape storage guide. This carton is packed in a second carton along with the paper rolls, perforator tape, inking ribbon, and technical manuals. After this carton is sealed with gummed tape, it is placed inside the spent tape and chad bin. The spent tape and chad bin is positioned in its normal place in the table, and the table door is closed. Filler strips are placed on both ends of the table top, and the entire unit is placed in a corrugated carton, which then is sealed with gummed tape and placed in a nailed wooden box.

#### *b. Unpacking Table (fig. 3)*

- (1) Remove the nails from the wooden box and remove the cover. Use a nail puller.
- (2) Remove the fiberboard carton from the wooden box.
- (3) Open the carton by slitting three of the corner edges to permit the fourth edge to act as a hinge and remove the table.
- (4) Remove the accessory package.



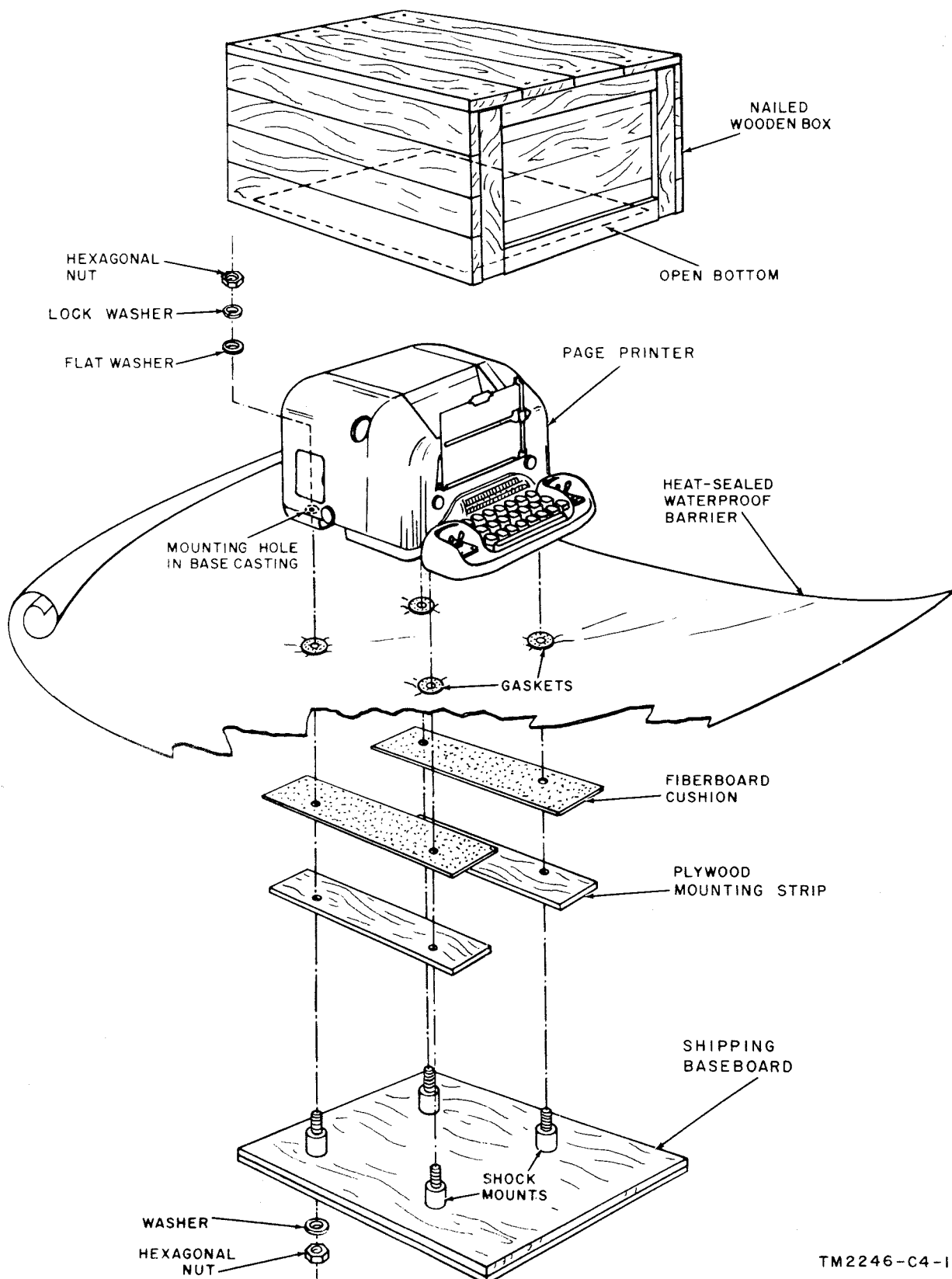
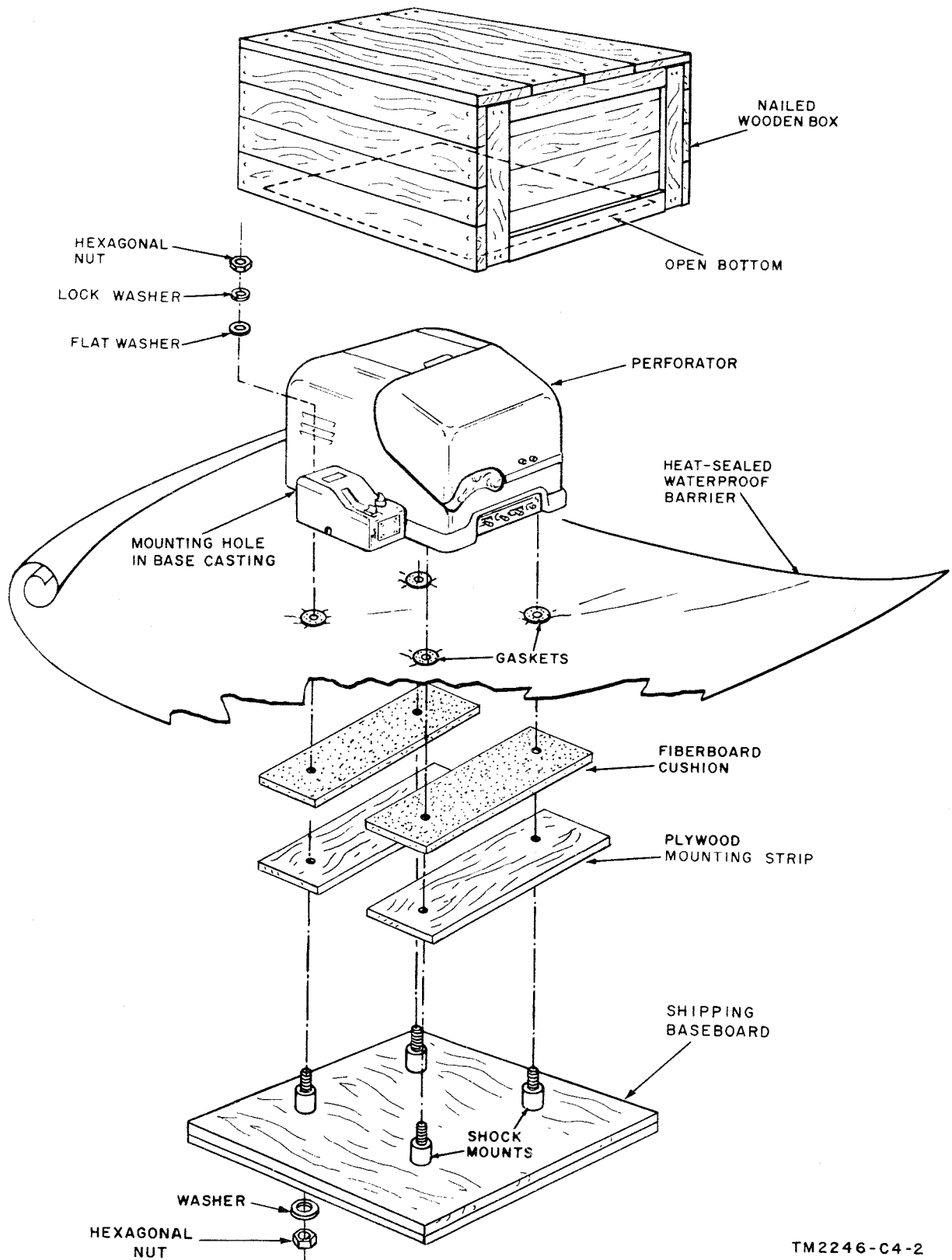


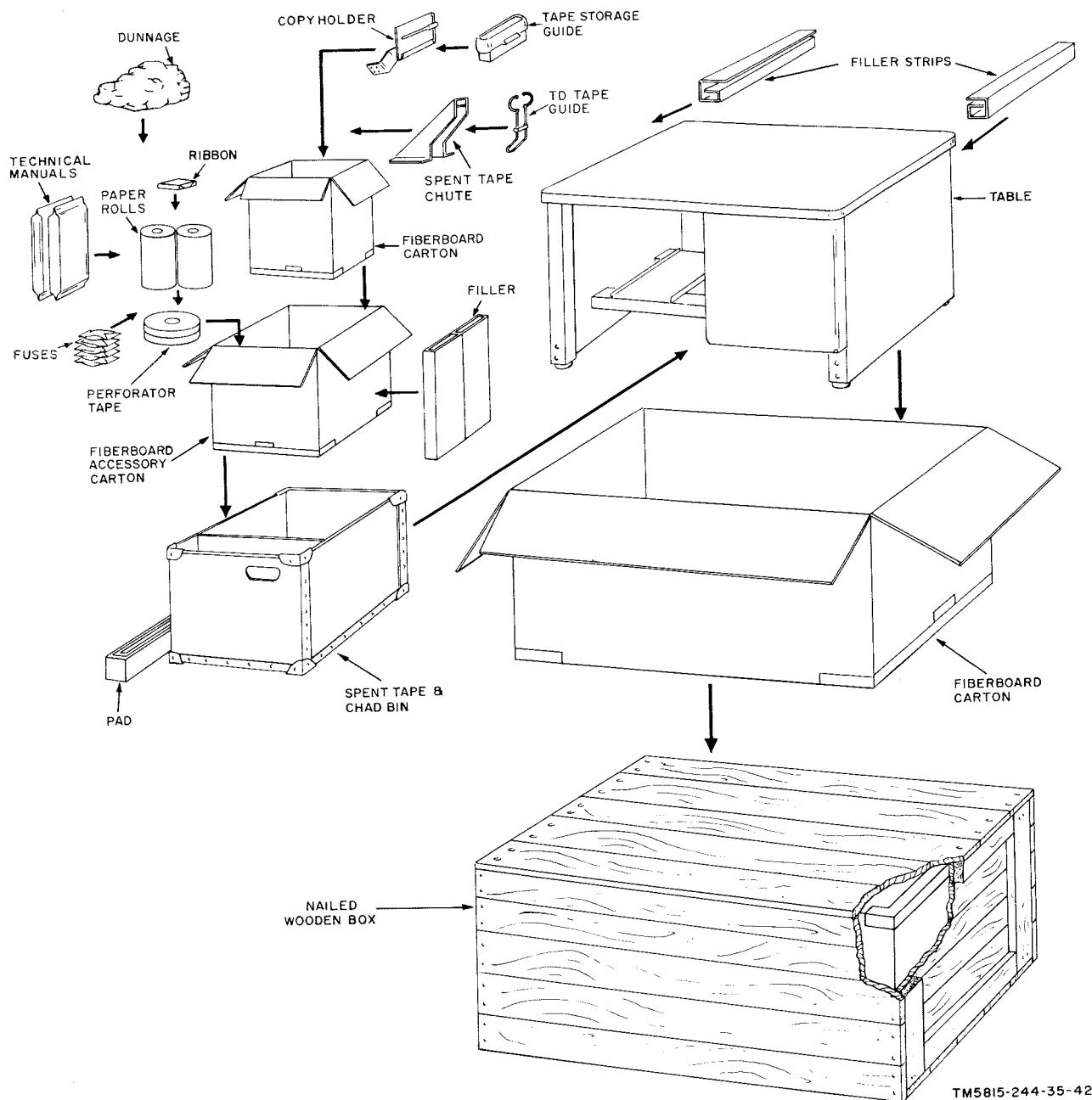
Figure 1. Page printer packaged for domestic or export shipment.

TM2246-C4-1



TM2246-C4-2

Figure 2. Perforator packaged for domestic or export shipment.



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Figure 3. Table and accessories packed for domestic or export shipment.

*c. Unpacking Page Printer or Perforator (figs. 1 and 2).*

- (1) Remove all but one or two nails along opposite edges of the shipping baseboard.
- (2) Carefully set the box on its shipping baseboard and pry up the box from the shipping baseboard. Use a heavy wedge or crowbar.

- (3) Lift the wooden box straight up.
- (4) Carefully cut around the base of the sealed barrier. Remove the sealed barrier.
- (5) Remove the equipment dust cover by loosening the two locking knobs and lifting the cover upward.
- (6) Remove the hexagonal nut, lock-



washer, and flat washer from each of the four shock mounts.

- (7) Remove the platen crank and the power cord from the paper spindle above the power supply when unpacking the page printer. Replace the dust cover and tighten the locking knobs.
- (8) Lift the unit from the shock mounts.

## 5. Checking Unpacked Equipment

Check the equipment against the packing list. When a packing list does not accompany the equipment, refer to Section II of TM 11-5815-244-12P which lists the items comprising an operable equipment.

## 6. Mounting of Components

(fig. 4)

### a. Tape Chute.

- (1) Position the spent tape chute (56982A) over the four mounting holes at the center of the table with the opening of the chute facing the front of the table.
- (2) Insert the four roundhead screws (10153) through the mounting holes of the spent tape chute and through the holes in the tabletop.
- (3) Secure the tape chute in place with speed nuts (10579) applied to the screws from the underside of the tabletop.
- (4) Spread the broad open ends of the TD tape guide assembly (56967A) and permit them to snap together in the holes provided in the spent tape chute.

### b. Tape Storage Guide.

- (1) Position the tape storage guide (56954) over the large hole in the front center of the tabletop.
- (2) Place the two guide clamps (56391) on either side of the tape storage guide and parallel to the front of the table.

- (3) Fasten the guide clamps to the table with the four screws (10309).

c. *Page Printer and Perforator.* The page printer and the perforator may be secured in place in either of two ways, depending on the installation site. The units may be placed on locating studs fastened into the table or they may be bolted in place. The determining factor is the amount of vibration that might be encountered.

- (1) Position the page printer and the perforator on the table so that the four mounting holes in each base casting are alined with the mounting holes in the tabletop.
- (2) If the units are to be used with locator studs only, insert four screw posts (56534) into the table, one through each of the mounting holes at the rear of the page printer and the perforator.
- (3) If the units are to be bolted in place, insert one  $\frac{1}{4}$ -20 by 2-inch bolt (10065) and lockwasher (10427) through each mounting hole of the page printer, and one  $\frac{1}{4}$ -20 by  $1\frac{3}{4}$ -inch bolt (10066) and lockwasher (10427) through each mounting hole of the perforator.

### d. Extra Copyholder.

- (1) Remove the page printer dust cover (fig. 1).
- (2) Place the nut plate associated with the copyholder (fig. 3) inside the dust cover and aline its holes with the mounting holes in the dust cover.
- (3) Position the extra copyholder against the exterior of the dust cover and in alinement with the mounting holes.
- (4) Fasten the extra copyholder to the dust cover with the four screws and lockwashers provided with the extra copyholder.
- (5) Replace the page printer dust cover.

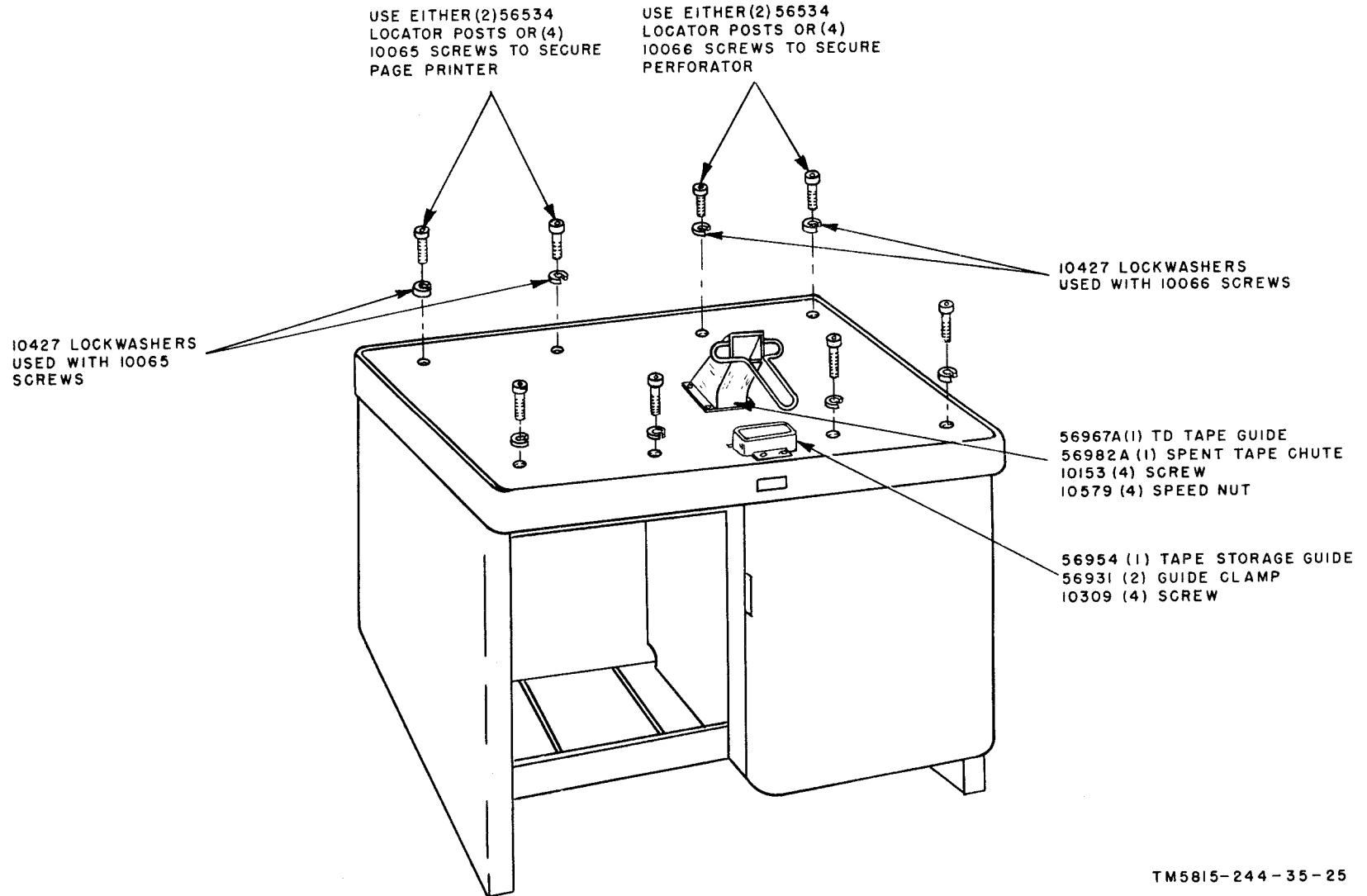


Figure 4. Mounting details.

## Section II. INSTALLATION AND INTERCONNECTION OF COMPONENTS

### 7. Fuse Check

Check the value of each of the fuses listed in the chart below before applying power to the unit.

Fuse	Component	Fuse rating (Amps)	Reference (fig.)
Power input.....	Page printer.....	1.6	5
Bias.....	Page printer.....	$\frac{1}{16}$	6
Line circuit.....	Perforator.....	$\frac{3}{4}$	8
Power circuit (2).....	Perforator.....	4	8
Bias circuit.....	Perforator.....	$\frac{1}{2}$	8

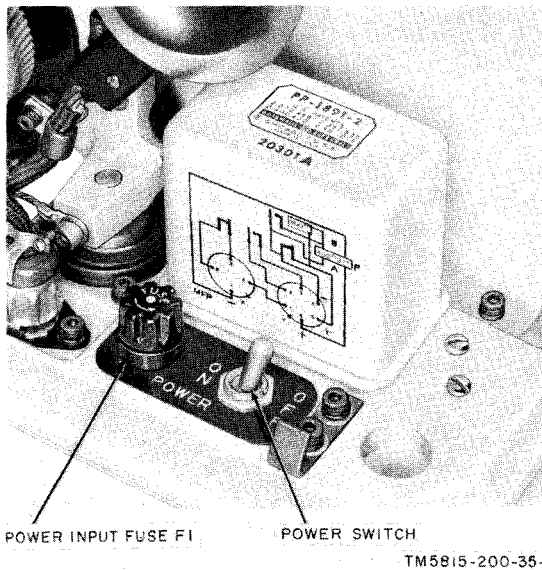


Figure 5. Page printer power input fuse and POWER switch location.

### 8. Clearing Locking Devices of Page Printer

a. Check the carriage lockup arm (16, fig. 206); if it is engaged, loosen the wingnut (14) and swing the carriage lockup arm free of the carriage locking stud (22).

b. Check the platen lockup arm (25, fig. 199); if it is engaged, loosen the wingnut (27) and swing the platen lockup arm free of the platen locking stud (8, fig. 203).

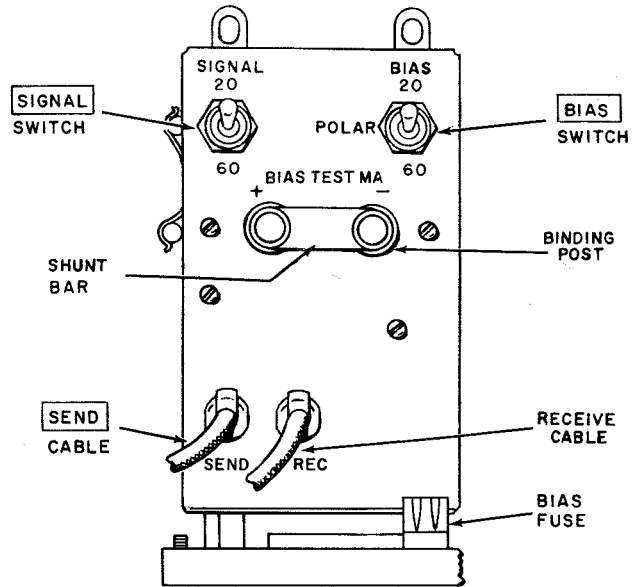


Figure 6. Bias fuse and terminal box (TT-117A/FG, TT-118/FG, TT-119A/FG).

c. Check the blocking plate; if it is in the shipping position (A, fig. 7), remove the self-locking hexagonal nuts and remove the blocking plate. Install the blocking plate in the machine-operating position (B, fig. 7) and secure it in place with the two self-locking hexagonal nuts.

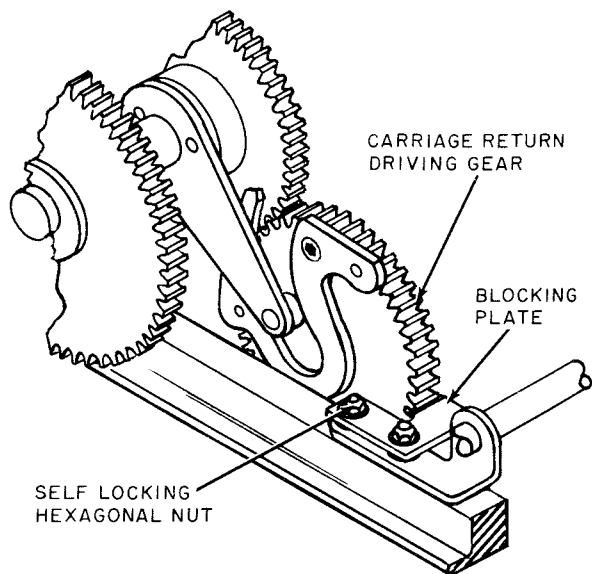
### 9. Ground, Power, and Intermachine Connections

a. Connect the ground lead on the perforator power cable assembly to a low resistance ground.

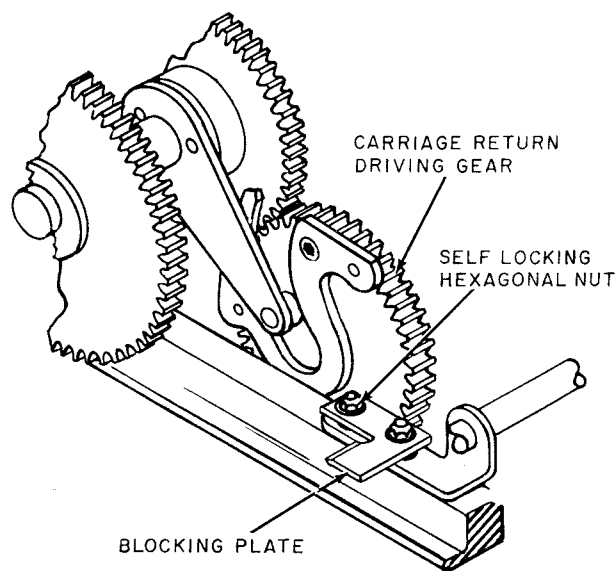
b. Interconnect the machines as follows:

- (1) Feed the ends of the keyboard cable assembly and the perforator cable assembly through the openings provided in the tabletop. Interconnect the two cables beneath the table.
- (2) Insert the red plug of the receive cable (fig. 6) from the page printer terminal box into the REC PRINTER jack (fig. 8) on the rear control panel of the perforator.
- (3) Insert the black plug of the send cable (fig. 6) from the page printer termi-





A. BLOCKING PLATE IN SHIPPING POSITION



B. BLOCKING PLATE IN MACHINE OPERATING POSITION

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Figure 7. Blocking plate positions.

nal box into the SEND PRINTER jack (fig. 8) on the rear control panel of the perforator.

c. Make power connections as follows:

- (1) Turn the page printer POWER (fig. 5) and MOTOR (A, fig. 12) switches to the OFF positions.
- (2) Turn the perforator POWER (fig. 8) and MOTOR (B, fig. 12) switches to the OFF positions.
- (3) Before installing the power cable assemblies, adjust the power supply transformer of the perforator. The perforator power supply transformer plugs and jacks (figs. 9 and 10) may be reached through an opening on the underside of the perforator base. Remove the dust cover and tip the perforator, allowing it to rest on its right side.

d. Adjust the power supply transformer as follows:

- (1) With a voltmeter, check the voltage of the power supplied by the outlet to be used.
- (2) Place the center flexible lead (primary winding) (figs. 9 and 10) into the jack nearest the voltage of the power available. If the voltage is midway between numbers, use the higher-numbered jack.
- (3) Place the secondary winding coarse adjustment lead into the jack marked M. Place the fine adjustment lead into the jack marked 3.

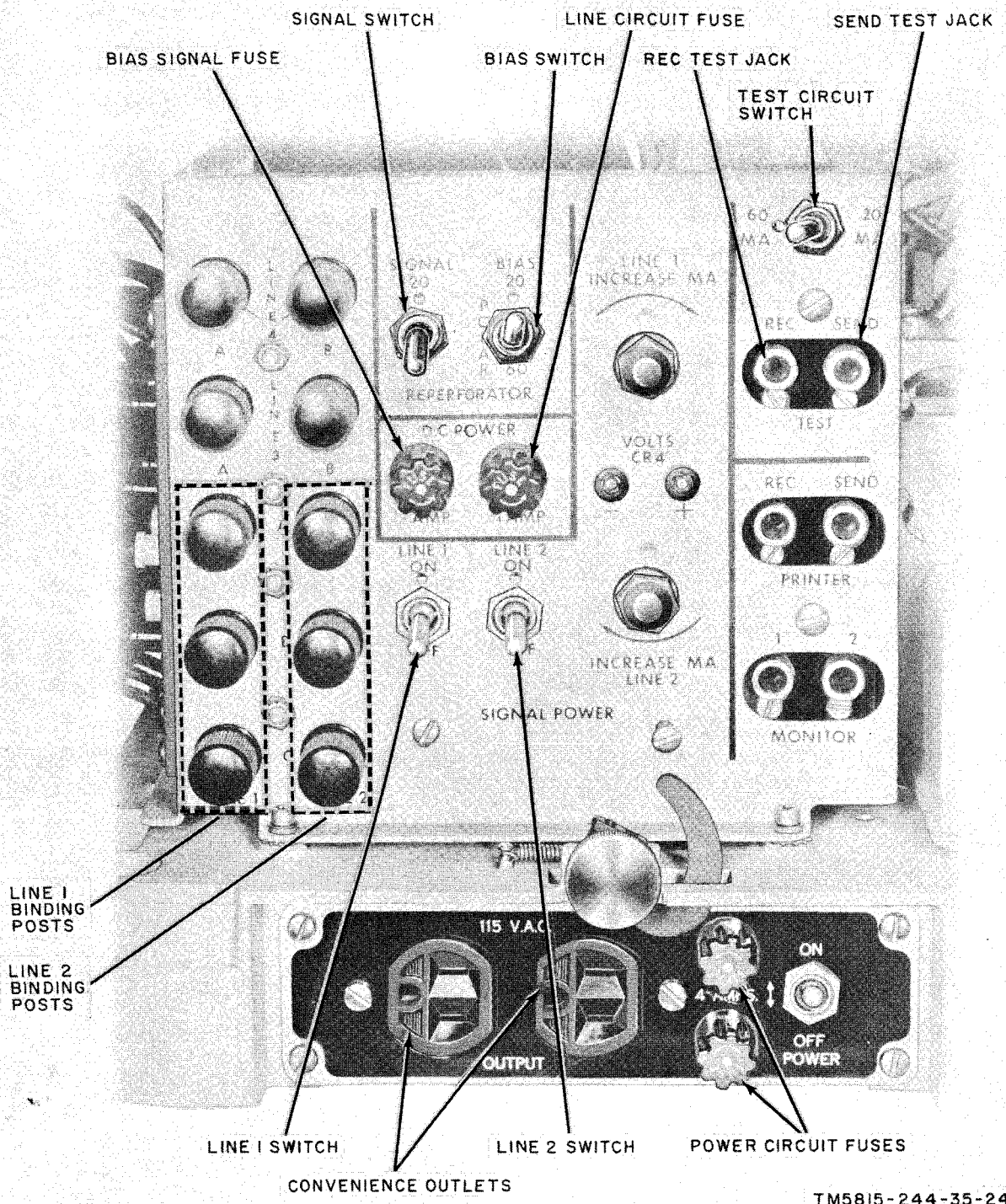
e. Insert the page printer power cable assembly in the 115 V.A.C. convenience outlet (fig. 8) at the back of the perforator.

f. Insert the power cable assembly from the perforator into the wall outlet.

g. Turn the perforator POWER switch (fig. 8) to ON and check the voltage across the test jacks to the right of the line circuit fuse. Turn the perforator power switch to OFF and change the position of the secondary winding fine adjustment plug (fig. 10), if necessary, to obtain a 115-volt reading.

h. Turn the page printer POWER switch (fig. 5) to ON and use the following procedure to check the bias current.

- (1) Remove the shunt bar (fig. 6) and connect a milliammeter between the two



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Figure 8. Perforator rear control panel (TT-178/FG and TT-179/FG).

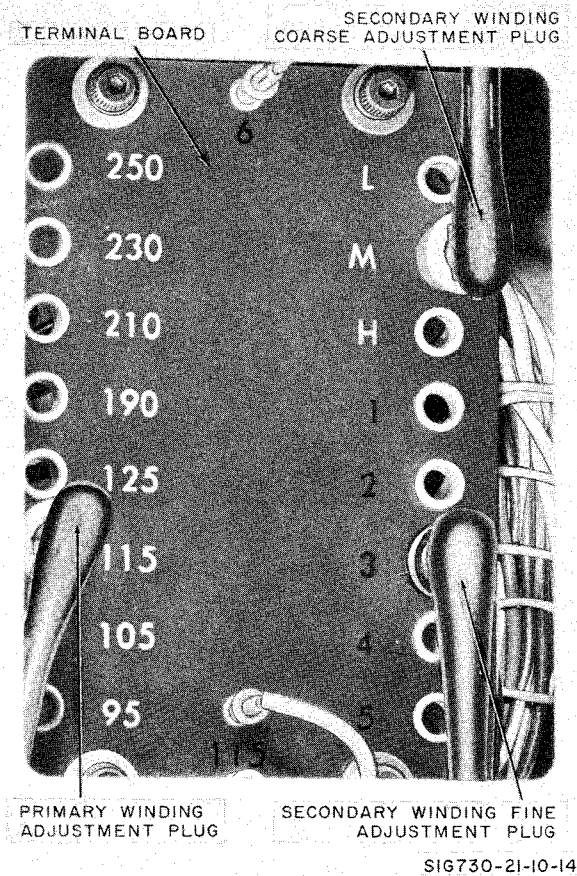


Figure 9. Power transformer terminal board (TT-178/FG and TT-179/FG).

binding posts marked BIAS TEST MA.

- (2) Read the current in the bias circuit. The milliammeter should indicate 12 milliamperes (ma) when the BIAS switch is in the 60 ma position and 8.2 ma when the BIAS switch is in the 20 ma position.
- (3) If necessary, adjust as required (par. 530b (1)).

*i.* Follow the same procedure as *h* above and check the bias circuit of the perforator.

## 10. Preparation

Follow the procedures described in paragraph 16, TM 11-5815-244-12 to prepare the equipment for use.

- a. Service the page printer as follows:
  - (1) Adjust the platen roll sprocket feed mechanism, if necessary (par. 325).
  - (2) Install the required type of paper.
  - (3) Install a new inking ribbon if necessary.
- b. Service the perforator as follows:
  - (1) Install a roll of paper tape.
  - (2) Check the condition of the inking ribbon; install a new inking ribbon, if necessary.

## 11. Local Test Patch Panel Connections

The patch panel on the perforator controls the signal circuits in the set. Before local testing, set up the panel for the local test condition. Make the connections indicated in the chart under patch panel condition A in paragraph 17a to place all receiving mechanisms and sending mechanisms in series (fig. 11).

## 12. Local Test Control Settings

a. Page Printer.

- (1) Set the SIGNAL switch on the terminal box (fig. 6) to 20 or 60, depending

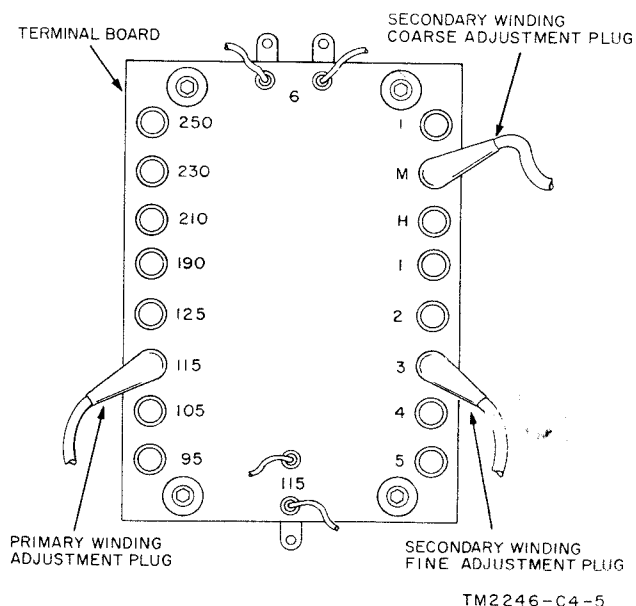
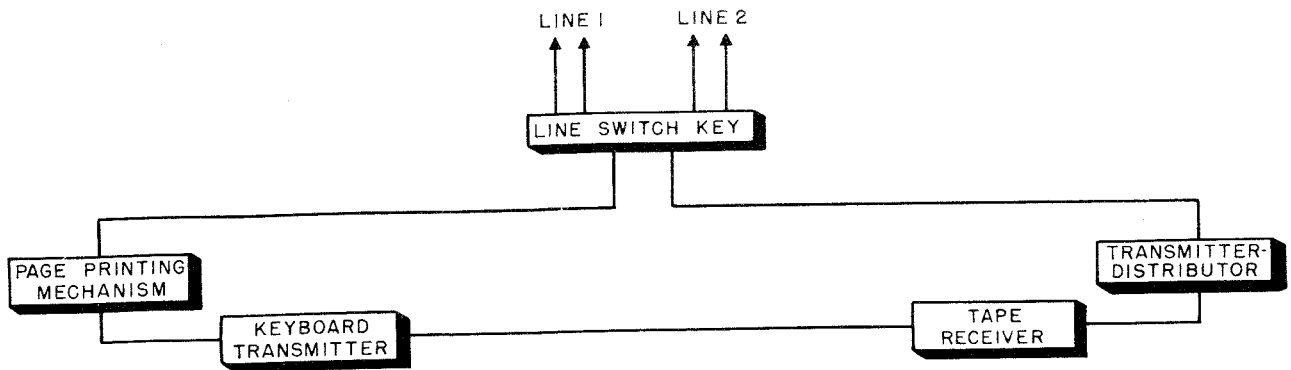


Figure 10. Power transformer terminal board (not applicable to TT-178/FG and TT-179/FG).





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Figure 11. Local test condition simplified circuit, condition A.

- upon the signal level of the signal line to which the unit will be connected.
- (2) Set the BIAS switch to the same setting as the SIGNAL switch.
  - (3) Set the SEND LOCK switch (A, fig. 12) to the SEND position.
  - (4) Turn the page printer POWER switch to ON (fig. 5).
  - (5) Turn the page printer LIGHT switch (A, fig. 12) to ON; the copy light should glow.
  - (6) Turn the page printer MOTOR switch to ON; the page printer motor should operate.
  - (7) Set the rangefinder dial (fig. 13) to 60 on the range scale.
- b. *Perforator.*
- (1) Set the SIGNAL switch (fig. 8) to the same setting as the SIGNAL switch on the terminal box on the page printer.
  - (2) Set the BIAS switch to the same setting.
  - (3) Set the switch above the test jacks to the same setting.
  - (4) Turn the perforator POWER switch (fig. 8) to ON.
  - (5) Turn the perforator MOTOR switch (B, fig. 12) to ON; the perforator

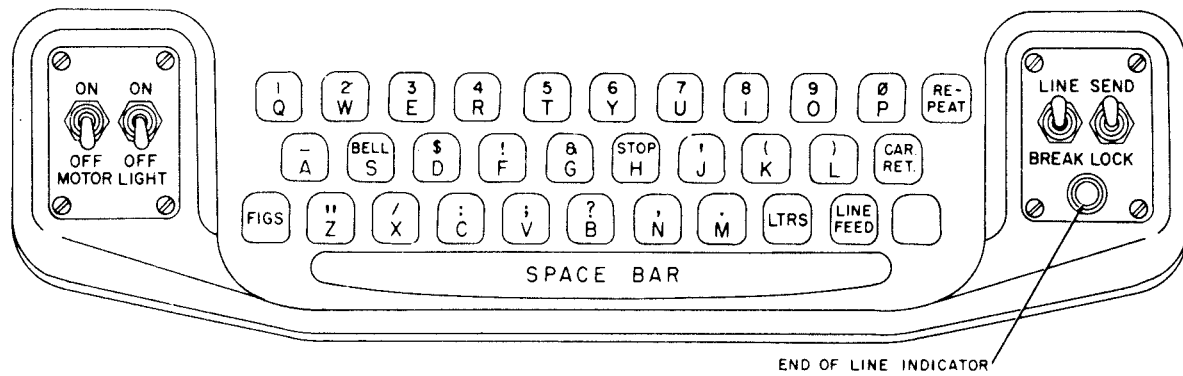
motor should operate and the copy light should glow.

- (6) Set the rangefinder dial (fig. 14) to 60 on the range scale.

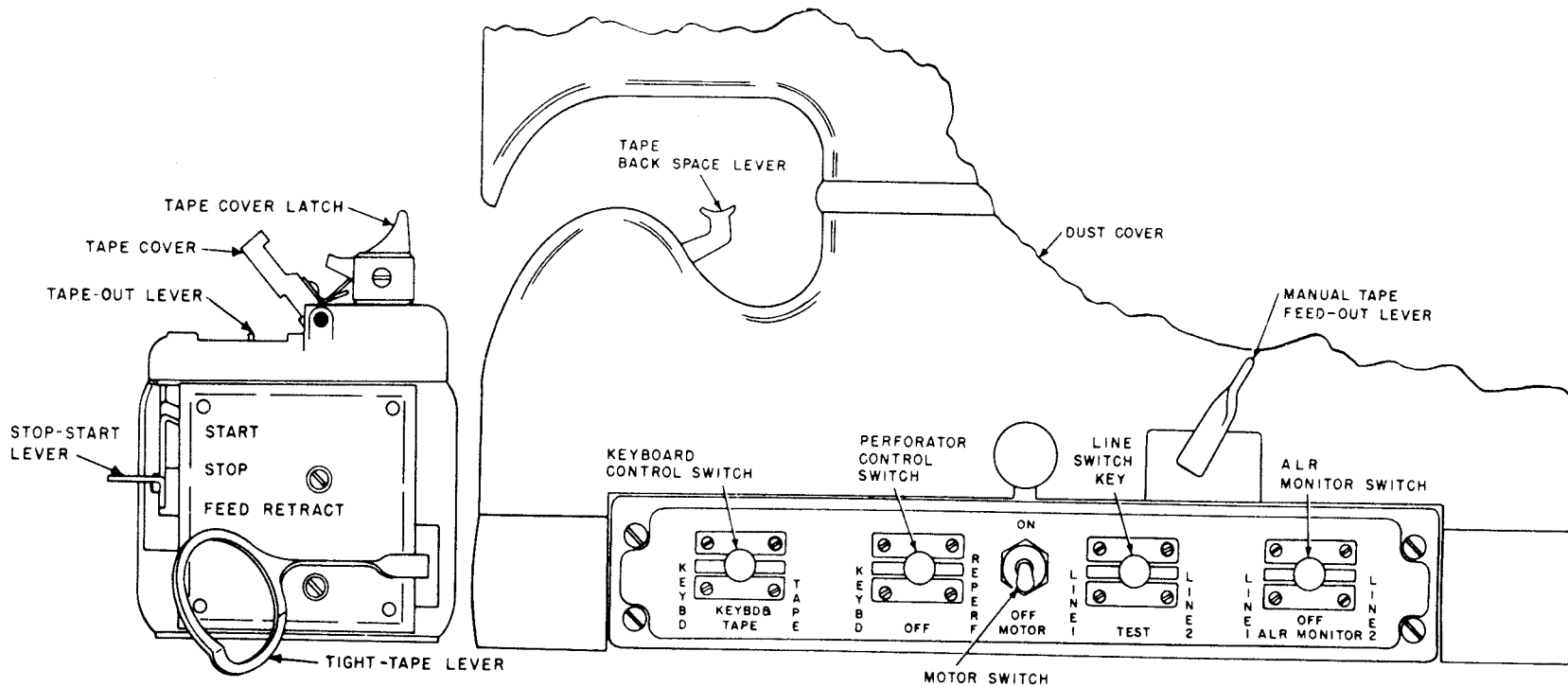
### 13. Speed Adjustment, Series-Governed Motor

Adjust the motor speed as follows:

- a. Strike a tuning fork marked 180-vps against the palm of the hand. Do not strike the tuning fork sharply against a metal object, or the fork may be damaged.
- b. View the target spots at the end of the motor-governor subassembly through the vibrating shutter of the tuning fork.
- c. Make no adjustment if the target spots appear motionless when viewed through the vibrating shutter. If the spots appear to be moving clockwise (motor speed too fast), pull the end of the motor-governor adjustment worm outward. Hold it out until the apparent clockwise motion of the target spot has practically stopped. If the target spot appears to be moving counterclockwise (motor speed too slow), push the end of the motor-governor adjustment worm inward until the apparent counterclockwise motion of the target spot has practically stopped. To avoid overadjustment, release the worm slightly before the spot comes to a complete standstill.



A. KEYBOARD CONTROLS



B. PERFORATOR CONTROLS

Figure 12. Keyboard and perforator controls.

## 14. Lubrication and Adjustment of Friction Clutch and Transfer Lever Tension Spring

Before operating the equipment, check the lubrication and adjustment of the friction clutches and the tension springs as directed below.

### a. Page Printer Friction Clutches and Transfer Lever Spring.

Name of part	Lubrication reference		Adjustment reference
	Item and fig.	Par.	Par.
Selector friction clutch	17, fig. 159	115c	298
Square shaft driving friction clutch.	18, fig. 159	115c	299
Carriage-feed friction clutch.	2, fig. 157	115c	340
Keyboard-transmitter friction clutch.	11, fig. 157	115c	400
Carriage-return safety clutch.	10, fig. 157	115f	343
Page printer transfer lever spring.			278

### b. Perforator Friction Clutches and Transfer Lever Spring.

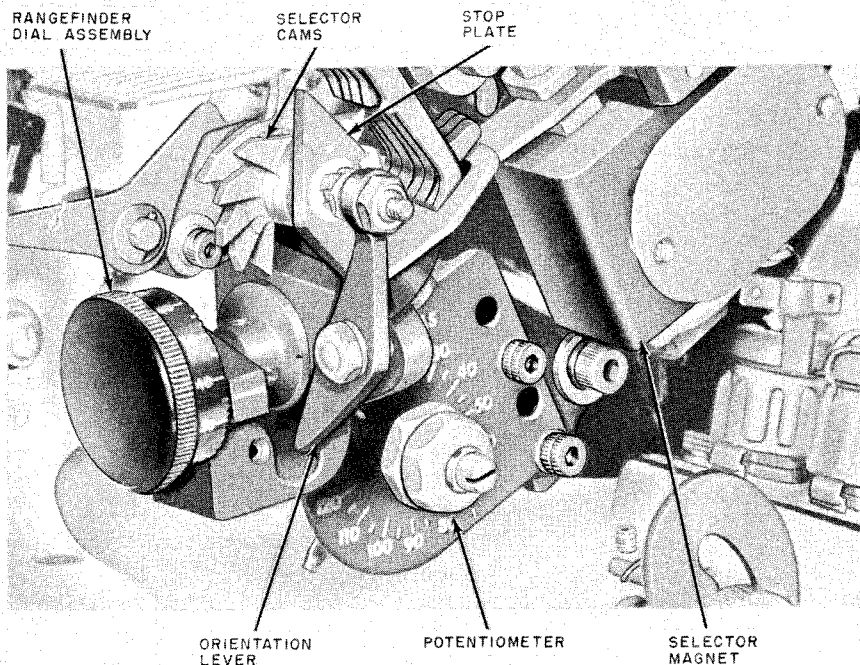
Name of part	Lubrication reference		Adjustment reference
	Item and fig.	Par.	Par.
Transmitter-distributor drive shaft friction clutch.	21, fig. 174	116c	517
Perforator transfer lever spring.			442
Stop arm shaft friction clutch.	13, fig. 172	116c	457
Selector camshaft friction clutch.	2, fig. 177	116c	427

## 15. Preliminary Test Procedure (fig. 12)

a. Check the simultaneous signal circuit between the keyboard-transmitter and perforator as follows:

- (1) Set the keyboard control switch to the TAPE position.
- (2) Set the perforator control switch to the KEYBD position.
- (3) Set the keyboard control lever (fig. 15) to the right (all models except TT-117/FG and TT-119/FG).

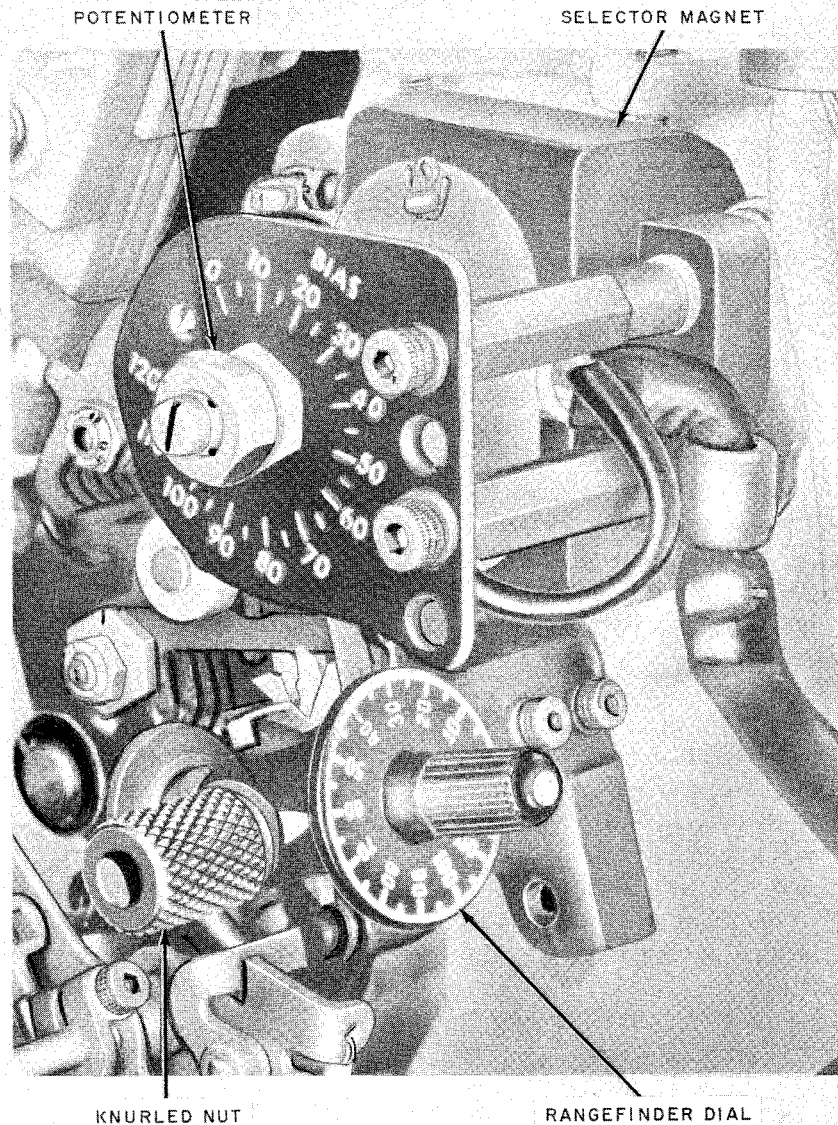
- (4) Set the line switch key to the TEST position.
  - (5) Set the ALR MONITOR switch to the OFF position.
  - (6) Send alternate R and Y code combinations until about 36 inches of tape have been cut in this manner. Do not use the manual carriage return. The carriage should automatically return after the 72d character has been struck (76th character on TT-118/FG). The end-of-line indicator lamp should light when the 66th character is struck (70th character on TT-118/FG). Check the printed and punched tape to make sure that the printing and code punches are sharp and correct. Save the tape for later tests.
  - (7) Send the following test message five times in rapid succession: THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK 1234567890-\$!&'( )"/:;?.,. Depress the CAR. RET. and LINE FEED keys after each test message. The carriage indicator should return to the left margin each time. Check the perforated tape for accuracy. Save the tape for later tests.
  - (8) Depress the FIGS key and then the S (BELL) key. The perforator signal bell should ring.
- b. Check the transmitter-distributor as follows:
- (1) Insert the test message tape into the transmitter-distributor as described in c(6) below.
  - (2) Move the STOP-START lever to the FEED RETRACT position. The tape should move freely forward or backwards with light hand pressure.
  - (3) Move the STOP-START lever to the START position. The tape should feed steadily into the mechanism without bind.
  - (4) Move the STOP-START lever to the STOP position. The tape should cease to feed into the machine immediately.
  - (5) Move the STOP-START lever to the START position.



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Figure 13. Page printer rangefinder mechanism.

- (6) Lift the tight-tape lever. The tape should cease to feed immediately. Release the tight-tape lever.
  - (7) Operate the tape cover latch to release the tape cover. The tape should cease to feed instantly.
  - (8) Close the tape cover and reinsert the tape if necessary.
  - (9) Allow the end of the tape to feed into the mechanism. The mechanism should cease to run as soon as the end of the tape feeds under the cover.
  - (10) Check the spent tape after it passes through the transmitter-distributor. It should be smooth and flat, and the code and feed holes should be sharp and free of distortion.
- c. Set the rangefinders as follows:
- (1) Set the keyboard SEND-LOCK switch in the LOCK position.
  - (2) Set the keyboard control switch in the KEYBD position.
  - (3) Set the perforator control switch in the KEYBD position.
  - (4) Set the line switch key in the TEST position.
  - (5) Set the ALR MONITOR switch in the OFF position.
  - (6) Install the tape cut during the procedure described in a(6) above in the transmitter-distributor. Be sure that the printed portion of the tape is toward the outer edge of the machine, and that the tape is properly threaded through the tight-tape lever. Close the tape cover.
  - (7) Move the STOP-START lever to the START position; the tape should start feeding into the transmitter-distributor.
  - (8) The alternate R and Y message should be printed on the page printing mechanism. Turn the rangefinder dial on the page printer (fig. 13) to the maximum and minimum positions between which good copy is received. Note the readings at each position; then set the rangefinder dial in a position midway between these points.



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Figure 14. Perforator rangefinder mechanism.

- (9) Set the perforator control switch in the REPERF position.
  - (10) Similarly set the perforator rangefinder (fig. 14). Loosen the knurled nut before setting the adjustment, and tighten it when the adjustment is made.
- d. Check the automatic line feed and carriage-return. The automatic line feed and carriage-return should operate after the print-

ing of the 72d (76th on TT-118/FG) character on a line. Since it takes approximately as long for the carriage to return as it does for three consecutive code groups to be received, letters will be printed while the carriage is returning. One letter will be printed two-thirds of the way from the left margin, another will be printed one-third of the way from the left margin, and the third will print in the first space at the left margin. This condition occurs whenever copy

is received during automatic carriage-return and line feed.

e. With the switches set as directed in c above, insert the test message tape in the transmitter-distributor. Check as follows:

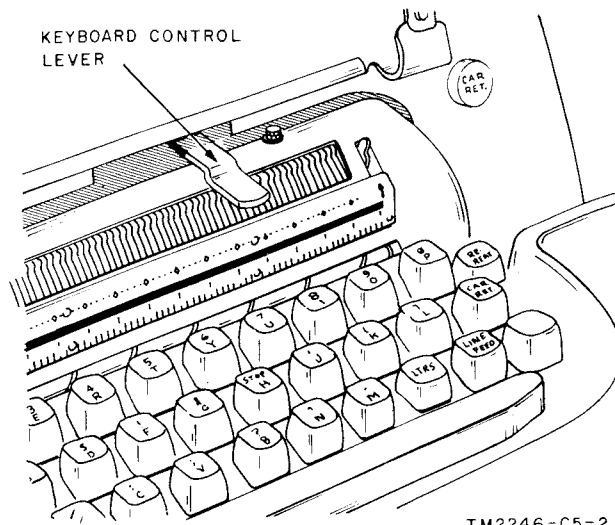
- (1) Move the STOP-START lever to the START position. A page copy of the test message should be printed by the page printing mechanism, and a printed and punched tape copy should be made by the perforator. Check the accuracy of the message.
- (2) Check the page copy for proper carriage-return and line feed. At the end of each message line, the carriage should return and the paper should feed. Move the line feed lever to the single and then to the double line feed positions. The forward position is single line feed and the double line feed position is to the rear.

f. Check transmission of sequential signals from the keyboard-transmitter as follows:

- (1) See that the keyboard control switch is in the KEYBD position.
- (2) See that the perforator control switch is in the REPERF position.
- (3) See that the keyboard control lever (fig. 15) is to the left on all models except TT-117/FG and TT-119/FG.
- (4) See that the line switch key is in the TEST position.
- (5) See that the ALR MONITOR switch is in the OFF position.
- (6) Send the test message (a(7) above) five times in rapid succession from the keyboard. A page copy of the test message should be printed by the page printing mechanism, and a printed and punched tape copy should be made by the perforator. Check both copies for accuracy and clarity of printing. Check the perforator copy for correct punching.

g. Check the page printer signal bell as follows:

- (1) Turn the perforator MOTOR switch to the OFF position.
- (2) Depress the FIGS and then the S (BELL) keys. The page printer signal bell should ring.



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Figure 15. Keyboard control lever (all models except TT-117/FG and TT-119/FG).

- (3) Return the perforator MOTOR switch to ON.

h. Check the motor stop operation as follows:

- (1) Depress the FIGS and then the H (STOP) key levers. The page printer motor should stop. On TT-118/FG, depress FIGS, BLANK, and H, in sequence to achieve the same result.
- (2) Operate the LINE-BREAK switch to the BREAK position and release it. The page printer motor should start.

*Note.* The perforator motor does not have the motor stop feature, and must be shut off with the MOTOR switch.

i. Make the following additional tests:

- (1) Depress the FIGS key lever to shift the platen to the upper case position. Press the LTRS button on the left side of the page printer dust cover. The platen should shift to the lower case position.
- (2) Space the carriage to the midpoint of the page printer and press the CAR. RET. button on the right side of the dust cover. The carriage should return to the left side of the page printer.
- (3) With the carriage at the left position of the page printer, press the manual

space pushbutton located behind the right side of the platen. The carriage should move toward the right of the machine. Carriage movement should stop when the button is released.

- (4) With the switches set as described in *f* above, type on the keyboard to check the movement of the perforator and page printer inking ribbons. The perforator inking ribbon should move once for every two operations; the page printer inking ribbon should move with every operation.
- (5) Space the carriage to the 65th space from the left margin. Depress the

space bar once. The page printer margin signal bell should operate and the end-of-line indicator lamp should light.

- (6) Check the operation of the tabulator mechanism as follows:
  - (a) Press down on the tab crank arm (fig. 16) at the left of the tabulator and, with a pencil or other suitable instrument, pull down all of the red tab set levers. Release the tab crank arm.
  - (b) Move the tabulator locking lever at the right of the tabulator mechanism to its upward position.



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Figure 16. Tabulator controls.



- (c) Depress and hold the space bar and the repeat key. The indicator carriage should move to the right, stopping at the first red tab set lever from the left. Release the space bar and the repeat key.
- (d) Depress and hold the space bar and the repeat key; the carriage should stop at the second red tab set lever from the left. Release the space bar and repeat key. Continue to check in this manner, making sure

the carriage stops at every red tab set lever.

- (e) Move the tab locking lever to the downward position. Press the carriage-return key to cause the carriage to move to the left side of the page printer. Depress and hold the space bar and the repeat key. The carriage should move all of the way to the right side of the page printer without stopping at any of the tab set levers.

### Section III. CONNECTION TO SIGNAL LINE

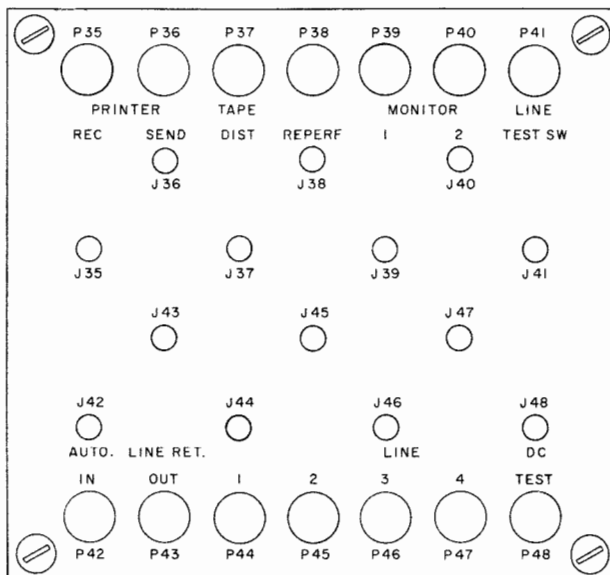
#### 16. General

The teletypewriter set may be installed to meet a variety of operational requirements. This variety of operational possibilities is achieved by the use of the patch panel (fig. 17 or 18) and by varying the connections of the signal lines into the unit. Varying the setup of the patch panel changes the circuits through the teletypewriter set thus changing the operation of the unit. Fifteen typical patch panel conditions are described in paragraph 17. These conditions are designated as condition A, condition B, condition C, etc. in the subsequent text for ease of identification. The patch panel plugs may be easily inserted or removed by pressing inward on the cord with the thumb

and grasping the bakelite section of the plug with two fingers. After the patch panel has been set up, the operator can further control the operation of the equipment by means of the switches on the front panels (fig. 12). Detailed switch settings for each of the typical patch panel conditions described are given in chart form in paragraph 18, TM 11-5815-244-12.

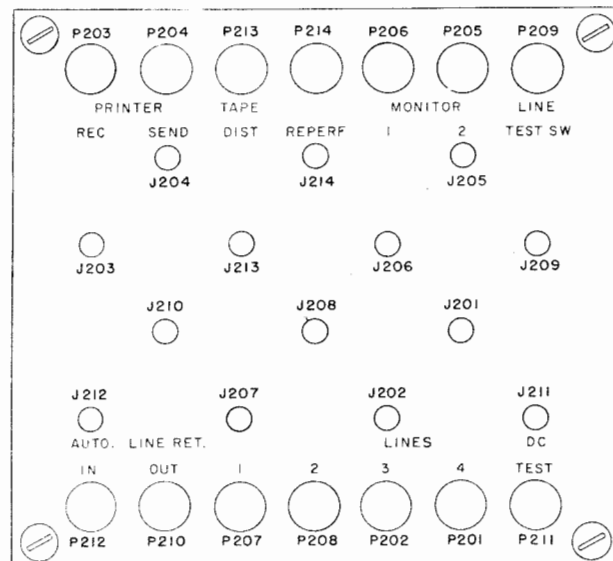
#### 17. Typical Patch Panel Connections

The patch panel condition used for installation testing is described in paragraph 11. Other typical patch panel conditions are described in a through o below. Figure 11 is a simplified diagram showing how units of the teletype-



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Figure 17. Patch panel (TT-178/FG and TT-179/FG).



TM5815-244-35-27

Figure 18. Patch panel (all models except TT-178/FG and TT-179/FG).



writer set are connected in series with each other and with the distant station. A block diagram of the equipment in each condition is furnished to aid in visualizing the operation of the unit. In addition to the illustration, a connection chart is provided for all of the patch panel conditions.

a. *Patch Panel Condition A.* Patch panel condition A (fig. 11) is used for testing the equipment, or for half-duplex operation of all

of the equipment on line 1 or line 2. The automatic line return provision permits the page printer to monitor the local keyboard during tape perforation without disturbing the signal line, or to make a page copy of a tape being sent through the transmitter-distributor. The page printer will automatically return to the line at the start of an incoming message. Connections necessary to set up condition A are given in (1) and (2) below.

(1) *TT-178/FG and TT-179/FG* (fig. 17).

Patch panel plugs	Patch panel condition															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
PRINTER REC	P35	J42	J38	J39	J46	J38	J46	J42	J38	J42	J42	J46	J47	J46	J44	J46
PRINTER SEND	P36	J37	J44	J40	J44	J45	J37	J41	J40	J41	J38	J39	J40	J37	J39	J40
TAPE DIST	P37	J40	J45	J38	J45	J44	J41	J40	J39	J40	J41	J40	J39	J41	J40	J39
REPERF	P38	J39	J36	J44	J35	J47	J36	J39	J46	J45	J45	J47	J46	J47	J46	J44
MONITOR 1	P39	J36	J39	J37	J39	J39	J44	J36	J44	J36	J43	J44	J44	J44	J35	J38
MONITOR 2	P40	J41	J40	J45	J40	J40	J45	J45	J45	J38	J36	J45	J45	J45	J45	J45
LINE TEST	P41	J43	J41	J41	J41	J41	J38	J43	J41	J43	J39	J41	J41	J36	J41	J41
AUTO LINE RET IN	P42	J35	J42	J42	J42	J42	J42	J35	J42	J35	J35	J42	J42	J42	J42	J42
AUTO LINE RET OUT	P43	J38	J43	J43	J43	J43	J43	J38	J43	J39	J37	J43	J43	J43	J43	J43
LINE 1	P44	J44	J35	J35	J36	J37	J39	J44	J37	J44	J44	J36	J37	J39	J36	J37
LINE 2	P45	J45	J37	J36	J37	J36	J40	J37	J36	J37	J40	J37	J36	J40	J37	J36
LINE 3	P46	J46	J46	J46	J38	J46	J35	J46	J35	J46	J46	J35	J38	J35	J38	J35
LINE 4	P47	J47	J47	J47	J47	J35	J47	J47	J47	J47	J47	J38	J35	J38	J47	J47
D. C. TEST	P48	J48	J48	J48	J48	J48	J48	J48	J48	J48	J48	J48	J48	J48	J48	J48

*Note.* To set up any condition on the patch panel: Patch the plug indicated in the extreme left-hand column into the jack indicated under the condition desired. For example: To set up condition B, PRINTER-REC plug P35 would be inserted into jack J38 and PRINTER-SEND plug P36 would be inserted into jack J44, etc.

(2) *All models except TT-178/FG and TT-179/FG* (fig. 18).

Patch panel plugs	Patch panel condition															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
PRINTER REC	P203	J212	J214	J206	J202	J214	J202	J212	J214	J212	J212	J202	J201	J202	J207	J202
PRINTER SEND	P204	J213	J207	J205	J207	J208	J213	J209	J205	J209	J214	J206	J205	J213	J206	J205
TAPE DIST	P213	J205	J208	J214	J208	J207	J209	J205	J206	J205	J209	J205	J206	J209	J205	J206
REPERF	P214	J206	J204	J207	J203	J201	J204	J206	J202	J208	J208	J201	J202	J201	J202	J207
MONITOR 1	P206	J204	J206	J213	J206	J206	J207	J204	J207	J204	J210	J207	J207	J207	J203	J214
MONITOR 2	P205	J209	J205	J208	J205	J205	J208	J208	J208	J214	J204	J208	J208	J208	J208	J208
LINE TEST SW	P209	J210	J209	J209	J209	J209	J214	J210	J209	J210	J206	J209	J209	J204	J209	J209
AUTO LINE RET IN	P212	J203	J212	J212	J212	J212	J212	J203	J212	J203	J203	J212	J212	J212	J212	J212
AUTO LINE RET OUT	P210	J214	J210	J210	J210	J210	J210	J214	J210	J206	J213	J210	J210	J210	J210	J210
LINE 1	P207	J207	J203	J203	J204	J213	J206	J207	J213	J207	J207	J204	J213	J206	J204	J213
LINE 2	P208	J208	J213	J204	J213	J204	J205	J213	J204	J213	J205	J213	J204	J205	J213	J204
LINE 3	P202	J202	J202	J202	J214	J202	J203	J202	J203	J202	J202	J203	J214	J203	J214	J203
LINE 4	P201	J201	J201	J201	J201	J203	J201	J201	J201	J201	J201	J214	J203	J214	J201	J201
DC TEST	P211	J211	J211	J211	J211	J211	J211	J211	J211	J211	J211	J211	J211	J211	J211	J211

*Note.* To set up any condition on the patch panel: Patch the plug indicated in the extreme left-hand column into the jack indicated under the condition desired. For example: To set up condition B, PRINTER REC, plug P203 would be inserted into jack J214 and PRINTER-SEND plug P204 would be inserted into jack J207, etc.

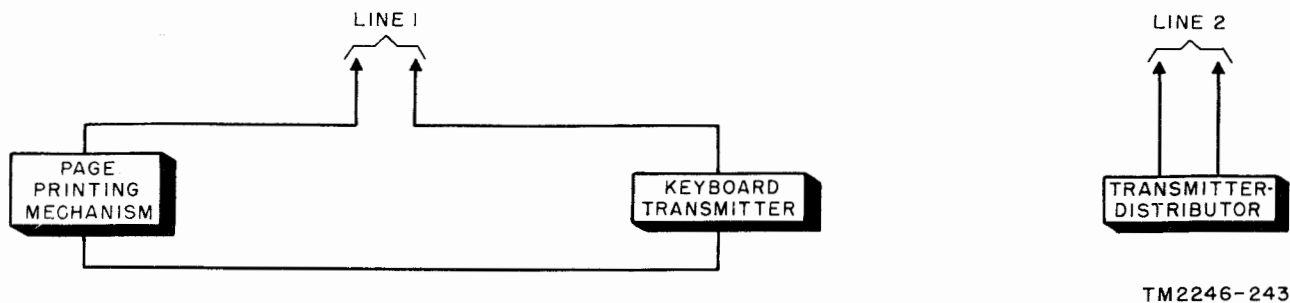


Figure 19. Block diagram, condition B.

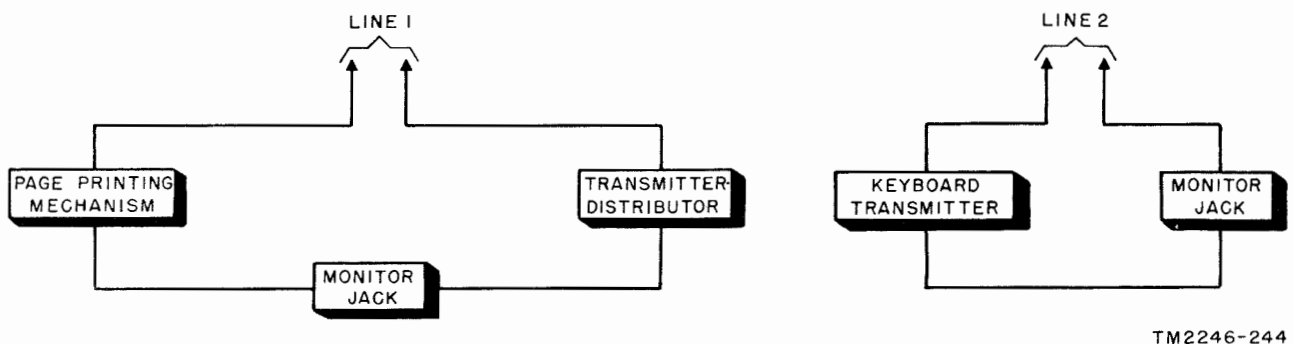


Figure 20. Block diagram, condition C.

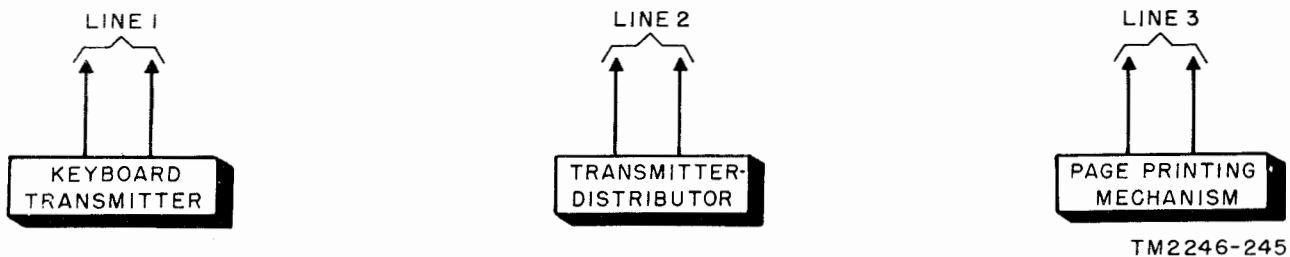


Figure 21. Block diagram, condition D.

b. *Patch Panel Condition B.* Patch panel condition B (fig. 19) connects the page printing mechanism and the keyboard-transmitter in a half-duplex circuit on line 1 and the transmitter-distributor on a *send only* circuit on line 2. In this condition, tape may be perforated locally, or a tape may be made of the messages transmitted from the keyboard-transmitter. Connect the patch panel plugs to the jacks shown under B of the chart in *a* above.

c. *Patch Panel Condition C.* Patch panel condition C (fig. 20) connects the transmitter-distributor and the page printing mechanism

in a half-duplex circuit on line 1 and the keyboard-transmitter on line 2. Connections of the patch panel required to set up condition C are listed in *a* above.

d. *Patch Panel Condition D.* Patch panel condition D (fig. 21) is a full-duplex condition in which the keyboard-transmitter is connected to line 1, the transmitter-distributor is connected to line 2, and the page printing mechanism is connected to line 3. Connect the plugs of the patch panel to the jacks listed under D in the chart in *a* above.

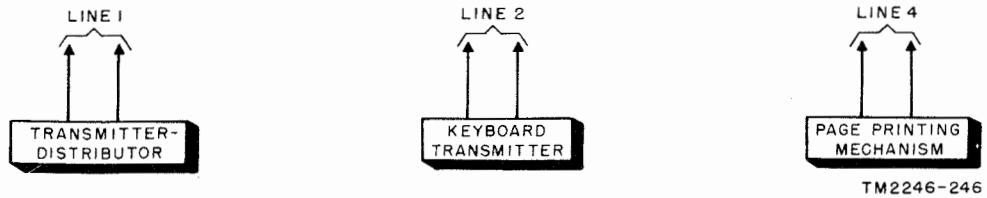


Figure 22. Block diagram, condition E.

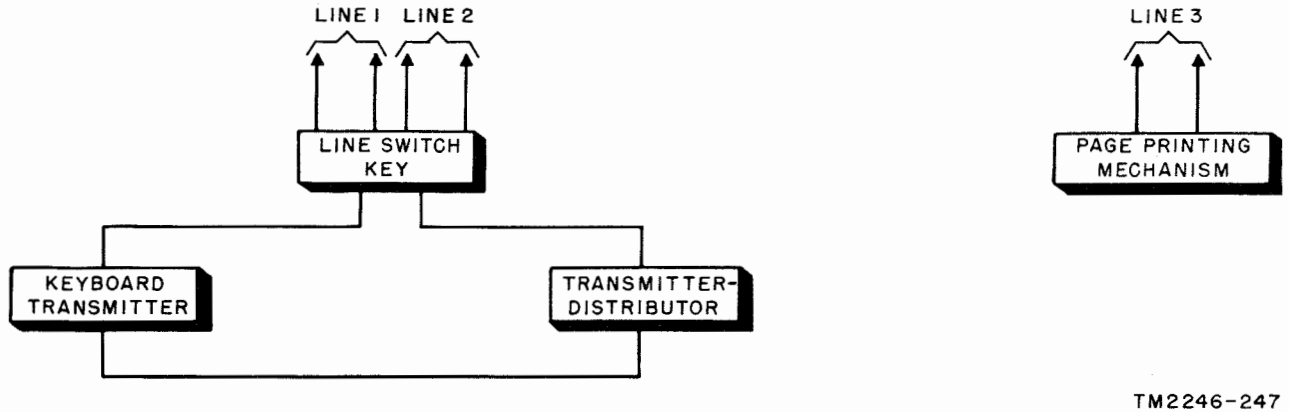


Figure 23. Block diagram, condition F.

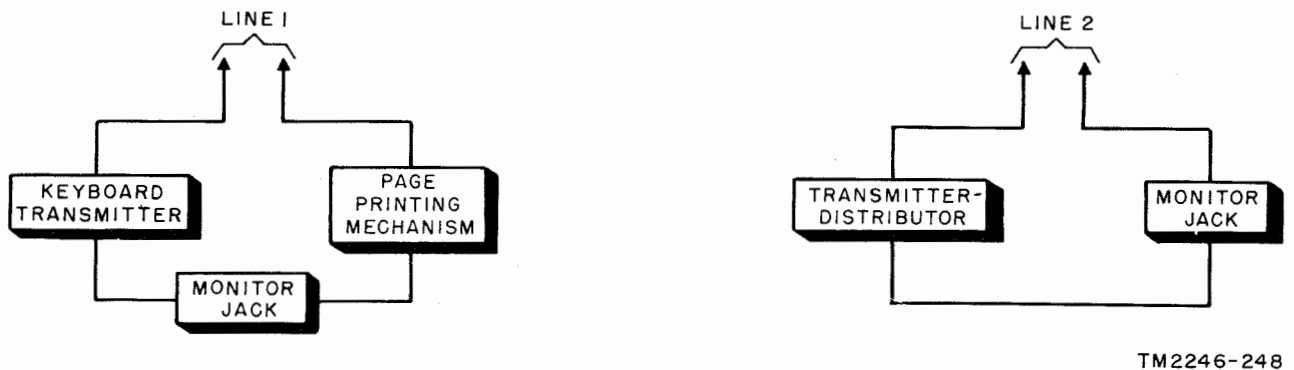
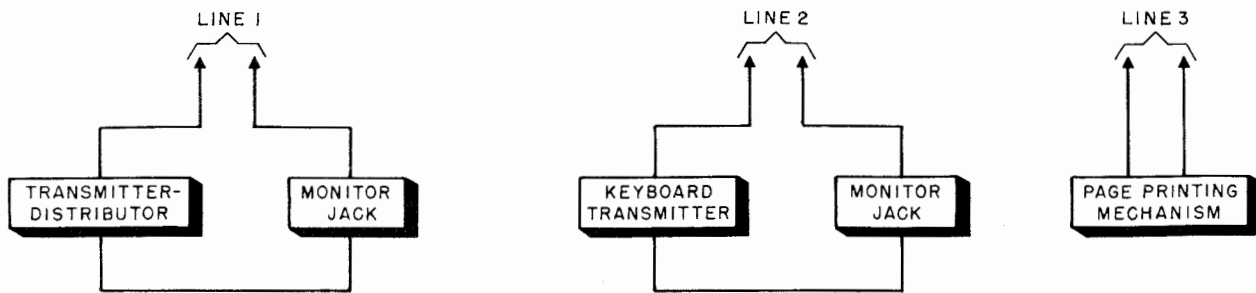


Figure 24. Block diagram, condition G.

e. *Patch Panel Condition E.* Patch panel condition E (fig. 22) is a full-duplex condition in which the transmitter-distributor is connected to line 1, the keyboard-transmitter is connected to line 2, and the page printing mechanism is connected to line 4. Connect the plugs to the jacks under column E of the chart in *a* above to set up condition E.

f. *Patch Panel Condition F.* Patch panel condition F (fig. 23) connects the transmitter-distributor and the keyboard-transmitter in a *send only* circuit with line 1 or line 2 as determined by the line switch key. The page printing mechanism is connected to line 3. Connect the plugs of the patch panel as shown in the chart in *a* above to set up condition F.

g. *Patch Panel Condition G.* Patch panel condition G (fig. 24) connects the page printing mechanism, the keyboard, and monitor jack No. 1 in a half-duplex circuit with line 1. It also connects the transmitter-distributor and monitor jack No. 2 to line 2. Provision is made to permit the use of the page printer to monitor the keyboard during the tape perforation or to make a page copy of a tape being sent through the transmitter-distributor. The page printer will automatically return to the line at the start of an incoming message. Connect the plugs of the patch panel as shown in the chart in *a* above to set up condition G.



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Figure 25. Block diagram, condition H.



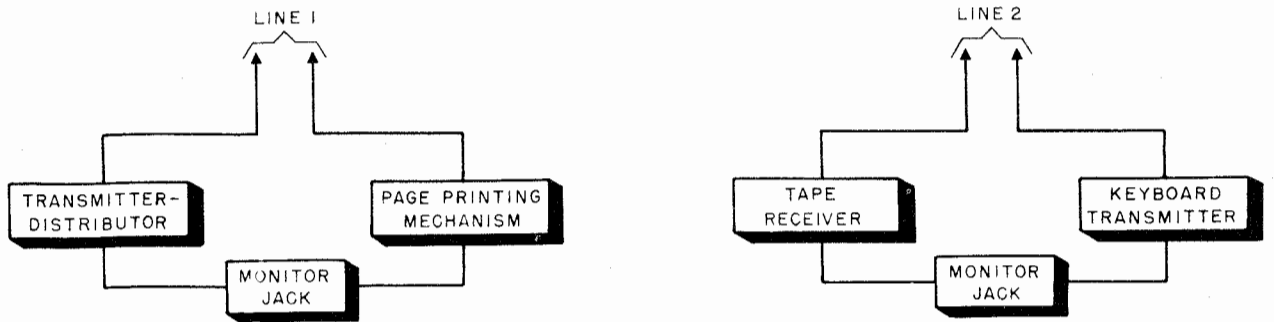
TM2246-602

Figure 26. Block diagram, condition I.

*h. Patch Panel Condition H.* Patch panel condition H (fig. 25) connects the transmitter-distributor in line 1. It also connects the keyboard-transmitter to line 2 and the page printing mechanism to line 3. Connect the plugs of the patch panel as shown in the chart in *a* above to set up condition H.

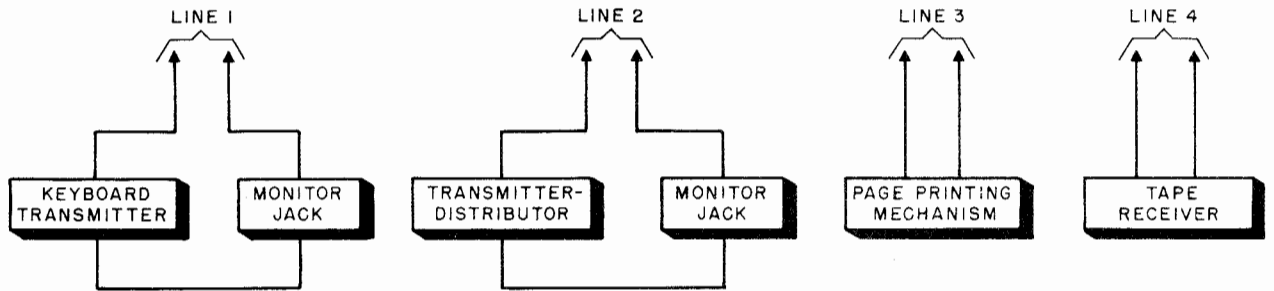
*i. Patch Panel Condition I.* Patch panel condition I (fig. 26) connects the page printing mechanism and the keyboard-transmitter in a half-duplex circuit on line 1, and the tape re-

ceiver and the transmitter-distributor in a half-duplex circuit on line 2. An external reperforator must be used when it is desired to cut tape locally. Provision is made to permit the use of the page printer to monitor the keyboard during tape perforation. The page printer will automatically return to the line at the start of an incoming message. Connect the plugs of the patch panel as shown in the chart in *a* above to set up condition I.



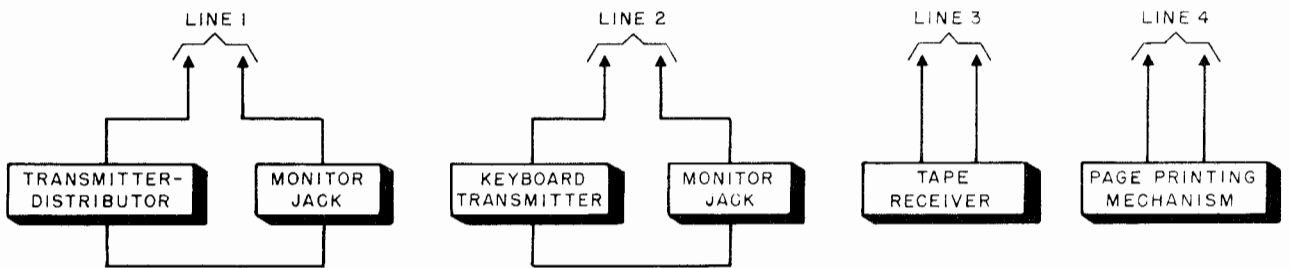
TM2246-603

Figure 27. Block diagram, condition J.



TM2246-604

Figure 28. Block diagram, condition K.



TM2246-605

Figure 29. Block diagram, condition L.

*j. Patch Panel Condition J.* Patch panel condition J (fig. 27) connects the page printing mechanism in a half-duplex circuit with the transmitter-distributor on line 1, and the tape receiver and keyboard-transmitter in a half-duplex circuit on line 2. Provision is made to permit the use of the page printer to monitor the tape being sent through the transmitter-distributor. The page printer will automatically return to the line at the start of an incoming message. An external reperforator must be used when it is desired to cut tape locally. Connect the patch panel as indicated by the chart in *a* above to set up condition J.

*k. Patch Panel Condition K.* Patch panel condition K (fig. 28) is a full-duplex condition

in which the keyboard-transmitter is connected to line 1, the transmitter-distributor is connected to line 2, the page printing mechanism is connected to line 3, and the tape receiver connected to line 4. Connect the patch panel as indicated by the chart in *a* above to set up condition K.

*l. Patch Panel Condition L.* Patch panel condition L (fig. 29) is a full-duplex condition in which the transmitter-distributor is connected to line 1, the keyboard-transmitter is connected to line 2, the tape receiver is connected to line 3, and the page printing mechanism is connected to line 4. Connect the patch panel as indicated in the chart in *a* above to set up condition L.

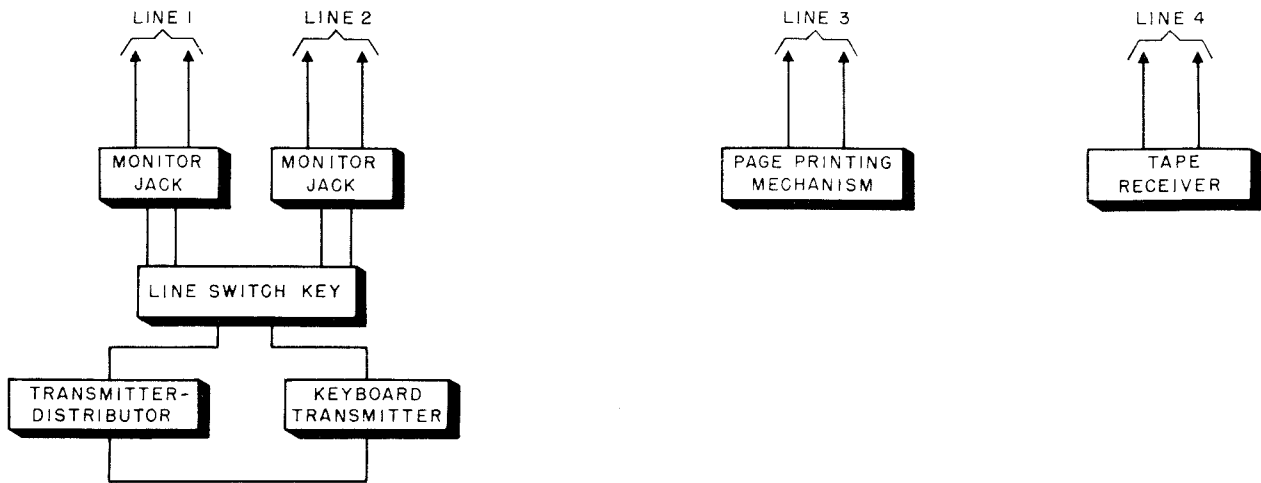


Figure 30. Block diagram, condition M.

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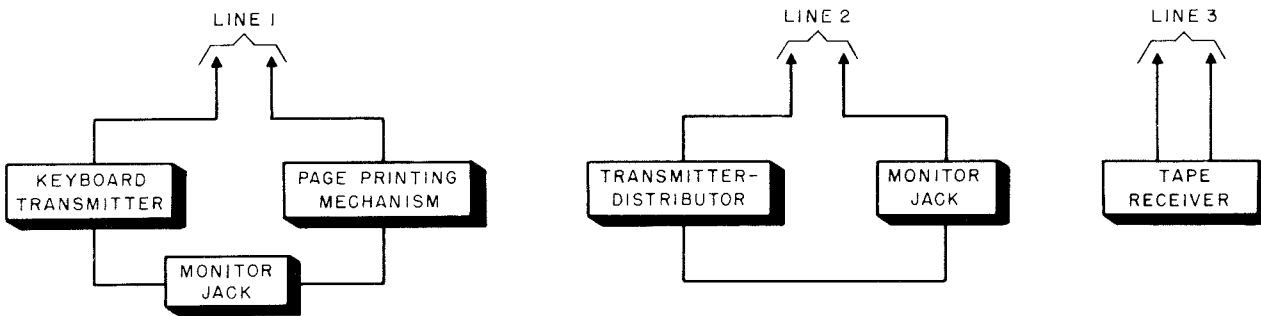
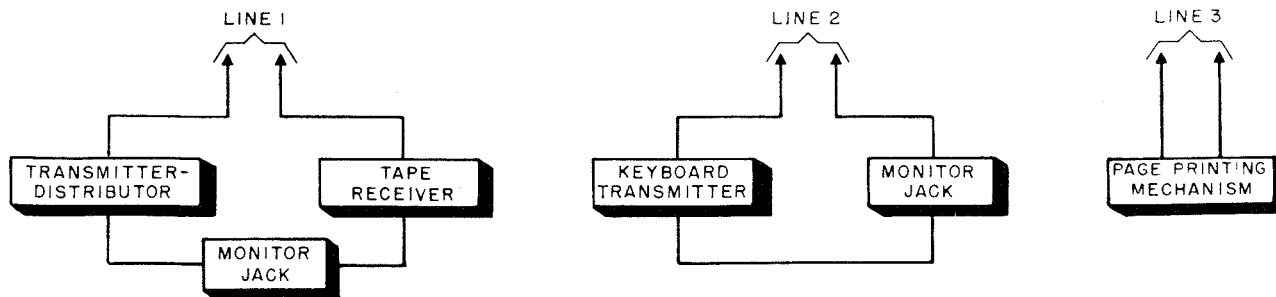


Figure 31. Block diagram, condition N.

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*m. Patch Panel Condition M.* Patch panel condition M (fig. 30) connects the transmitter-distributor and the keyboard-transmitter in a *send only* circuit with line 1 or line 2 as determined by the line switch key. The page printing mechanism is connected to line 3 and the tape receiver is connected to line 4. Connect the patch panel as indicated in the chart in *a* above to set up condition M.

*n. Patch Panel Condition N.* Patch panel condition N (fig. 31) connects the page printing mechanism and the keyboard-transmitter in a half-duplex circuit with line 1. It also connects the transmitter-distributor to line 2 and the tape receiver to line 3. This condition is used only when it is not desired to cut tape locally. Connect the patch panel as indicated in the chart in *a* above to set up condition N.



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Figure 32. Block diagram, condition O.

*o. Patch Panel Condition O.* Patch panel condition O (fig. 32) connects the transmitter-distributor and the tape receiver in a half-duplex circuit with line 1. It also connects the keyboard-transmitter to line 2 and the page printing mechanism to line 3. This condition is used only when it is not desired to cut tape locally. Connect the patch panel plugs as indicated in the chart in *a* above to set up condition O.

## 18. Alternate Patch Panel Arrangements Using Automatic Line Return

*Note.* The general information in this paragraph is applicable to all Teletypewriter Sets AN/FGC-25 (\*). The reference symbols used are those assigned to TT-178/FG and TT-179/FG. Reference symbols for other equipments may be found in the conversion chart in paragraph 91.

*a.* The patch panel can be patched in numerous ways in addition to the typical patch panel conditions listed in paragraph 17. In all conditions using the automatic line return, however, the connections indicated in the solid line portion of figure 33 should be made as follows:

- (1) Place plug P35 into jack J42.
- (2) Place plug P41 into jack J43.
- (3) Place plug P42 into jack J35.
- (4) Place plug P43 into jack J38.
- (5) Place plug P48 into Jack J48.

*b.* The dotted line portion of figure 33 shows the remaining components which may be required for operation in a particular circuit arrangement. The required components are placed in series between plug P38 and jack J41. For example, if the tape transmitter (TAPE DIST) is to be included in the circuit arrangement, place plug P38 into jack J37 and place plug P37 into jack J41. Likewise, if both the

tape transmitter and monitor jack (MONITOR 1) are to be used, proceed as follows:

- (1) Place plug P38 into jack J39.
- (2) Place plug P39 into jack J37.
- (3) Place plug P37 into jack J41.

*c.* The local tape perforation circuit is always available regardless of the patching arrangement utilized. The circuit is closed when the keyboard control switch is set to TAPE and the perforator control switch is set to KEYBD.

## 19. Changing Teletypewriter Operating Speed

*a.* The equipment is shipped with gearsets for 368.1 operations per minute (opm), 60 words per minute (wpm) installed. Gears also are provided for speed changes to 460 opm (75 wpm) and 600 opm (100 wpm).

*b.* To change the operating speed of the page printer, it is necessary to change only the worm gear on the shaft of the motor armature and the main shaft worm wheel gear with which the worm gear meshes. The extra gear sets for the page printer are mounted on the worm gear cover plate (fig. 199) and beneath the paper roller stand. The speed, in operations per minute, is stamped on the sides of the main shaft worm wheel gears and on the cylindrical portions of the worm gears. Check both gears to make sure they are correct for the operating speed desired.

*c.* To change the operating speed of the perforator, it is necessary to change to worm gear on the shaft of the motor armature and the worm wheel on the perforator main shaft. It is also necessary to check that the double gear for the speed desired is installed on the receiving multisolenoid function shaft, and that the

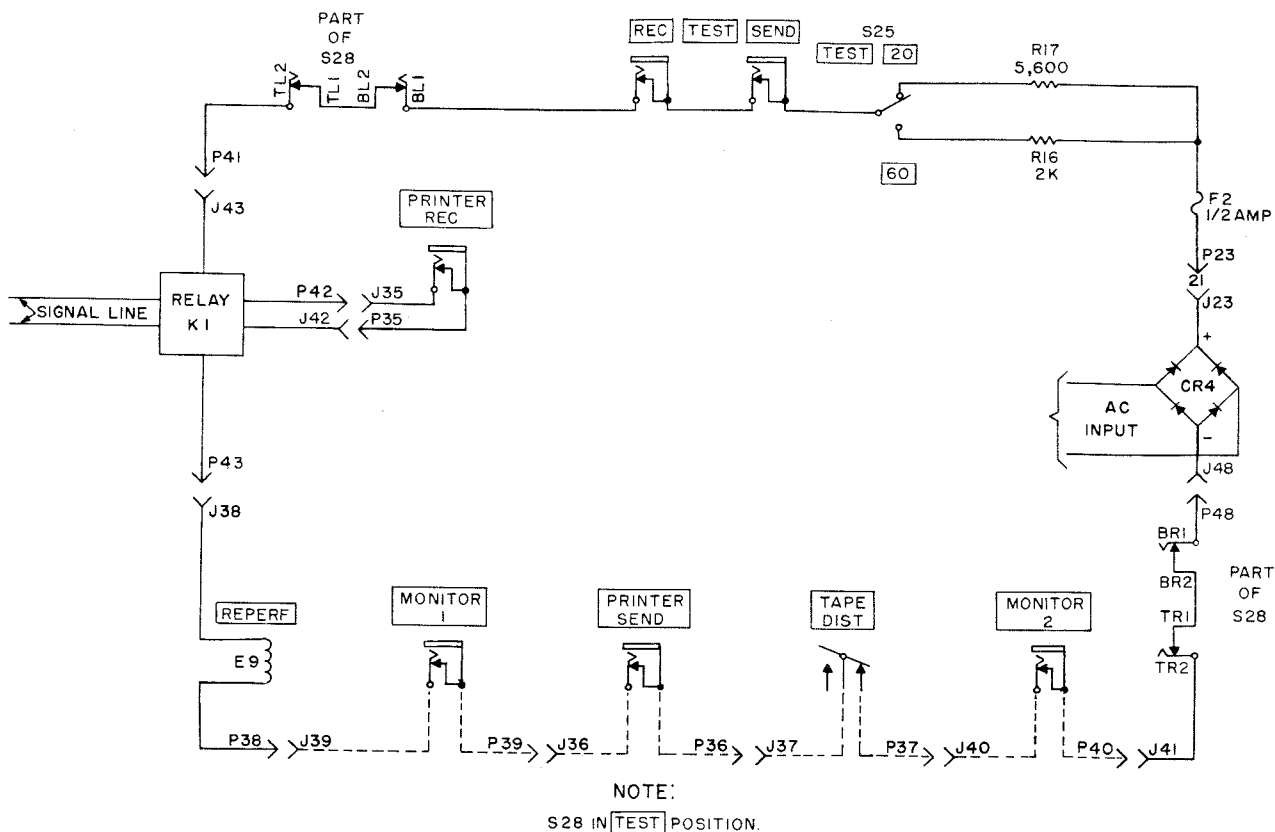


Figure 33. Basic pattern for alternate patch panel arrangements using automatic line return.

idler gear engages the correct surface of the double gear. The 600 opm and 460 opm gears are mounted on the perforator base along with a 460- 600-opm (75 to 100 wpm) receiving multisolenoid function shaft double gear. The gears of the perforator are marked in the same way that the page printer gears are marked. The receiving multisolenoid function shaft double gear has the speed in operations per minute stamped on one side. Operations necessary to change the operating speed of the page printer are listed in *d* below. Operations necessary to change the operating speed of the perforator are listed in *e* below.

*Note.* The gears for 404 opm (66 wpm) are not supplied with the equipment. If the need arises the gears must be procured separately.

*d.* To change the page printer operating speed use the chart in *e* below to determine which worm gear and worm wheel should be used for the desired operating speed. Remove the worm gear as instructed in paragraph 148a(1) and (2). Remove the old worm wheel and install the new worm wheel as instructed

in paragraph 175a(3) and *c*. Install the new worm gear as instructed in paragraph 148b(6) through (8).

*Note.* A change in operating speed often affects the darkness of the page copy. If this occurs, adjust in accordance with the instructions in paragraphs 344 and 345.

*e.* To change the perforator operating speed, use the following chart to determine which gears are to be used to obtain the desired operating speed. For identification purposes, the receiver multisolenoid function shaft double gears have the operating speeds stamped on the side opposite the clutch teeth. If these stampings are not legible, the double gears can be identified by measuring the outside diameters or by counting the number of teeth on each gear. The 368.1- to 460-opm double gear has outside diameters of  $1\frac{1}{4}$  and  $1\frac{1}{2}$  inches and has 27 and 33 gear teeth. The 460- to 600-opm double gear has outside diameters of  $1\frac{1}{2}$  and  $1\frac{7}{8}$  inches and has 33 and 43 gear teeth. Follow the procedure outlined in *f* through *t* below if it is necessary to change gears.



Operating speed (wpm)	Worm gear		Worm wheel		Double gear			
	Marking (opm)	Reference designation	Marking (opm)	Reference designation	In mesh with idler gear	Marking (opm)	Reference designation	
							TT-178/FG and TT-179/FG	All other models
60	368.1	50350	368.1	50352A	Small portion	368.1-460	} 56128A	59878A
66	404	50351	404	50353A	Small portion	368.1-460		
75	460	52366	460	52348A	Large portion	368.1-460		
					or			
100	600	50596	600	50597A	Small portion	460-600	} 56105A	60196A
					Large portion	460-600		

Note. The idler gear and double gear changes are required to keep the speed of the receiving multisolenoid function shaft at 125 wpm.

f. Remove the perforator chassis (par. 196a).

g. Remove the perforator motor (par. 208a).

h. Remove the worm gear from the motor armature shaft (par. 147a(3)).

i. Install the correct worm gear on the motor armature shaft (par. 147b(6)).

j. Remove the perforator main shaft worm wheel gear (par. 240a(4)).

k. Install the correct perforator main shaft worm wheel gear (par. 240b(6)).

l. Replace the perforator motor (par. 208b).

m. Remove the pulsing contact assembly (par. 232a(2) and (3)).

n. Loosen the two screws (10024, fig. 278) that hold the idler gear bracket to the perforator frame.

o. If only a change of position is required by the chart for the new operating speed, remove the idler gear and interchange its position with that of the spacer (par. 242a(4)), and proceed q below to complete the change.

p. If a change of the double gear is required by the chart for the new operating speed, proceed as follows:

- (1) Loosen the machine screw (1, fig. 275) that holds the shaft collar (2) to the transfer lever shaft (36) and remove the shaft collar.
- (2) Loosen the function clutch latch screw (3) so that the clutch latch arm (7) is loose on the transfer lever shaft.
- (3) Remove the double gear (17 or 43, fig. 279) from the receiving multisolenoid

function shaft (par. 244a(2) and (3)).

(4) If applicable, remove items 15, 16, 18, and 19 (as shown in fig. 279) from the double gear that was in use, and place them in the double gear to be installed.

(5) Reassemble components on the receiving multisolenoid function shaft (par. 244) and adjust the clutch latch arm (par. 444).

(6) Replace the shaft collar (2, fig. 275) and adjust (par. 413).

q. Tighten the two screws (6, fig. 278) that hold the idler gear bracket to the perforator. Recheck to be sure that the idler gear meshes with the correct surface of the double gear as required by the chart.

r. Replace the pulsing contact assembly (par. 232b(1) and (2)).

s. Replace the tape receiver chassis (par. 196).

t. Adjust the clutch latch arm (par. 447).

## 20. Signal Line Connections

Connect the signal lines to the teletypewriter set as follows:

a. Remove the capnuts from the LINE 1 and LINE 2 LINE INCREASE MA potentiometers (fig. 8) on the rear control panel of the perforator. With a screwdriver, adjust both potentiometers to their maximum counterclockwise (maximum resistance) settings.

b. Adjust the REPERFORATOR SIGNAL switch to the 20- or 60-ma setting, whichever is used on the signal line on which the perforator is connected. Use the 60-ma setting for 30-ma polar reception.

c. Adjust the BIAS switch as required by the conditions of the line on which the perforator is connected. The upper setting of the switch is for 20-ma operation, the lower setting is for 60-ma operation, and the midpoint setting is for polar operation.

d. Turn the LINE 1 and LINE 2 switches (fig. 8) to the OFF position.

e. Adjust the page printer SIGNAL switch (fig. 6) to 20- or 60-ma operation, whichever is used on the signal line to which the page printer is connected. The upper setting is for 20-ma neutral and the lower setting is for 60-ma neutral or 30-ma polar operation.

f. Adjust the BIAS switch of the page printer as required by the conditions on the line to which the page printer is connected. The upper setting of the switch is for 20-ma neutral operation, the lower setting is for 60-ma neutral operation, and the midpoint setting is for polar operation.

g. Connect the signal lines to the terminals designated by the setting of the patch panel. Lines 1 and 2 have three terminals designated A, B, and C. Connect the signal lines to the A and B terminals of these lines. Lines 3 and 4 have only two terminals. Connect the signal lines to these terminals if required.

## 21. Circuit Lineup Procedure

a. To secure the best possible machine operation, it is necessary to adjust the teletypewriter set to meet the conditions of the signal line. Circuit lineup normally includes adjusting the line current and rangefinder dial assemblies for the equipment at both ends of the circuit, followed by an exchange of test copy. Before the equipment is installed on the line, it is necessary for all personnel concerned to know the type of operation required and the predetermined source of line current.

b. The station from which the circuit lineup is directed is called the control station. Generally the station of higher authority is the control station. Lineup of a circuit between stations of equal authority is normally directed by the station that has the lowest numerical designation.

c. Line current for any particular line in a system is usually supplied by the station in the network that has the transmitting device on that line. If two or more stations have transmitting devices on the line, the station of highest authority usually supplies the power. Two or more stations may supply current when it is necessary because of excessive line leakage or other line factors. The teletypewriter sets are designed to supply line current, either as the main source of supply or on a series-aiding basis, only on line 1 or line 2. Current on line 3 or line 4 can neither be supplied nor controlled by the set.

d. Polar or neutral signals can be received by either the page printer or by the perforator, but only neutral signals can be sent from the keyboard-transmitter or from the transmitter-distributor. Polar signals must be 30 ma while neutral signals may be either 20 or 60 ma.

e. Line current is normally adjusted on line 1 or line 2 as follows:

- (1) Turn the page printer and perforator POWER switches (figs. 5 and 8) to the ON positions.
- (2) If the set is to supply current to line 1 or line 2, or both, set the appropriate LINE switch or switches to the ON positions.
- (3) The control station turns its line 1 or 2 INCREASE MA potentiometer to maximum counterclockwise (maximum resistance) position.
- (4) Noncontrol stations turn their LINE INCREASE MA potentiometer to the maximum clockwise (minimum resistance) position.
- (5) The control station gradually decreases resistance until the current reaches 75 ma for 60-ma circuits, or 30 ma for 20-ma circuits.

- (6) Noncontrol stations then add resistance gradually to bring the current down to the predetermined level.
  - (7) If enough current cannot be supplied to the line in this manner, proceed as follows:
    - (a) Turn the perforator and page printer POWER switches to the OFF positions.
    - (b) Disconnect the signal line lead from the B terminal of the appropriate line and reconnect it to the C terminal. This decreases the internal resistance of the perforator by 1,000 ohms and allows more current to flow through the circuit.
    - (c) Repeat the procedures described in (3) through (6) above.
    - (d) If sufficient current cannot be obtained on the signal line in this manner, another station in the circuit will have to supply power on a series-aiding basis. To accomplish this, have another station on the line turn the LINE 1 or 2 INCREASE MA potentiometer counterclockwise to its maximum resistance position. Then, instruct that station to turn the LINE switch to the ON position, and proceed to adjust the LINE 1 or 2 INCREASE MA potentiometer to decrease the resistance until the proper line current is attained.
- (e) If the current decreases instead of increasing, reverse the signal line connections.
  - f. The rangefinder dial assemblies (figs. 13 and 14) are adjusted as follows:
    - (1) Noncontrol station transmits repeated R and Y signals. The control station then turns its rangefinder dial to the maximum and minimum good copy position. If the machine continues to receive good copy when the rangefinder dial is set at zero, use zero as the low reference point. Determine the midpoint between the two settings and adjust the rangefinder dial assembly to this point. Both page printer and perforator rangefinders are adjusted in this manner. When the setting is complete, the control station signals the noncontrol station with two 5-second break signals.
    - (2) The control station now transmits repeated R and Y signal code groups while the noncontrol station adjusts the rangefinders in the same manner as the control station described in (1) above.
    - (3) The stations then exchange test messages. The messages must be correctly received.

# CHAPTER 3

## THEORY

### Section I. THEORY OF TELETYPEWRITER SET

#### 22. General

This chapter contains a complete explanation of the theory of operation of the teletypewriter sets. The first section covers the overall fundamentals of teletypewriter communication and the means by which these sets operate in circuits with other teletypewriters as well as the interfunctioning of the components of the sets. Paragraphs 30 through 64 describe the function of the page printer, paragraphs 65 through 90 describe the perforator, paragraphs 91 through 102 explain in detail the electrical circuits of the teletypewriter sets.

#### 23. Teletypewriter Set Application

The teletypewriter sets include two sending units (keyboard-transmitter and transmitter-distributor) and two receiving units (page printing mechanism and tape receiver). When connected with another teletypewriter set in a half-duplex circuit (fig. 34), the sending mechanisms controlled by the keyboard-transmitters or the transmitter-distributors operate sending contacts to transmit start-stop, five-unit code groups. The selector magnets at the receiving units respond to these signals and position the selector mechanisms which in turn control the characters printed by the page printing mechanisms and punched and printed by the perforators. The mechanisms of these sets are driven by constant speed motors operated in synchronism so that code signals sent at a given speed will be received at the same speed at the receiving unit.

#### 24. Signaling Code (fig. 35)

The signaling code used in teletypewriter communication systems consists of a sequence

of marking and spacing impulses. Each code group is composed of five selecting impulses which may be either marking or spacing, depending on the code of the character or function to be transmitted. The five selecting impulses are preceded by a start impulse (spacing) and followed by a stop impulse (marking) to maintain a synchronism between the transmitting

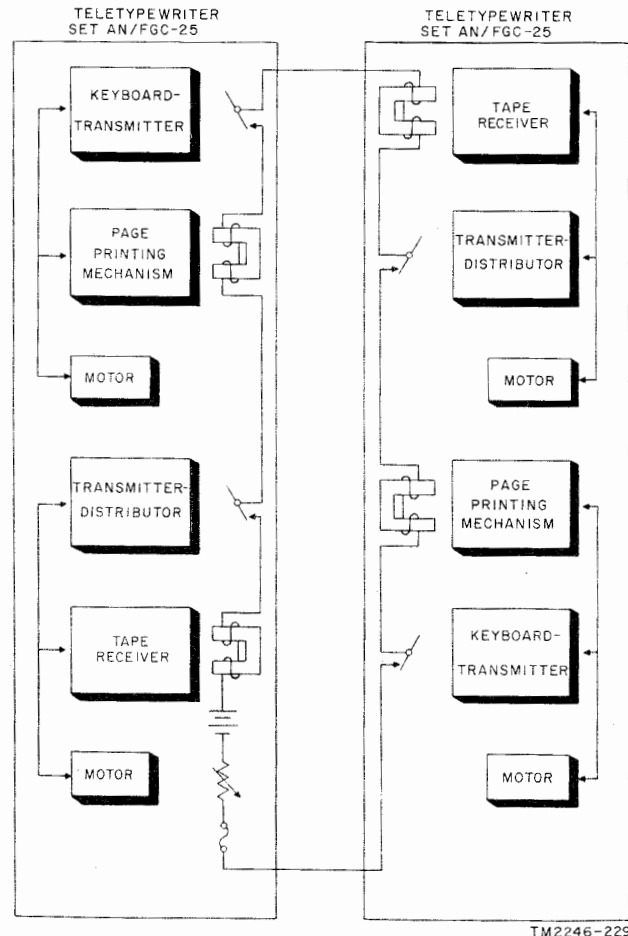
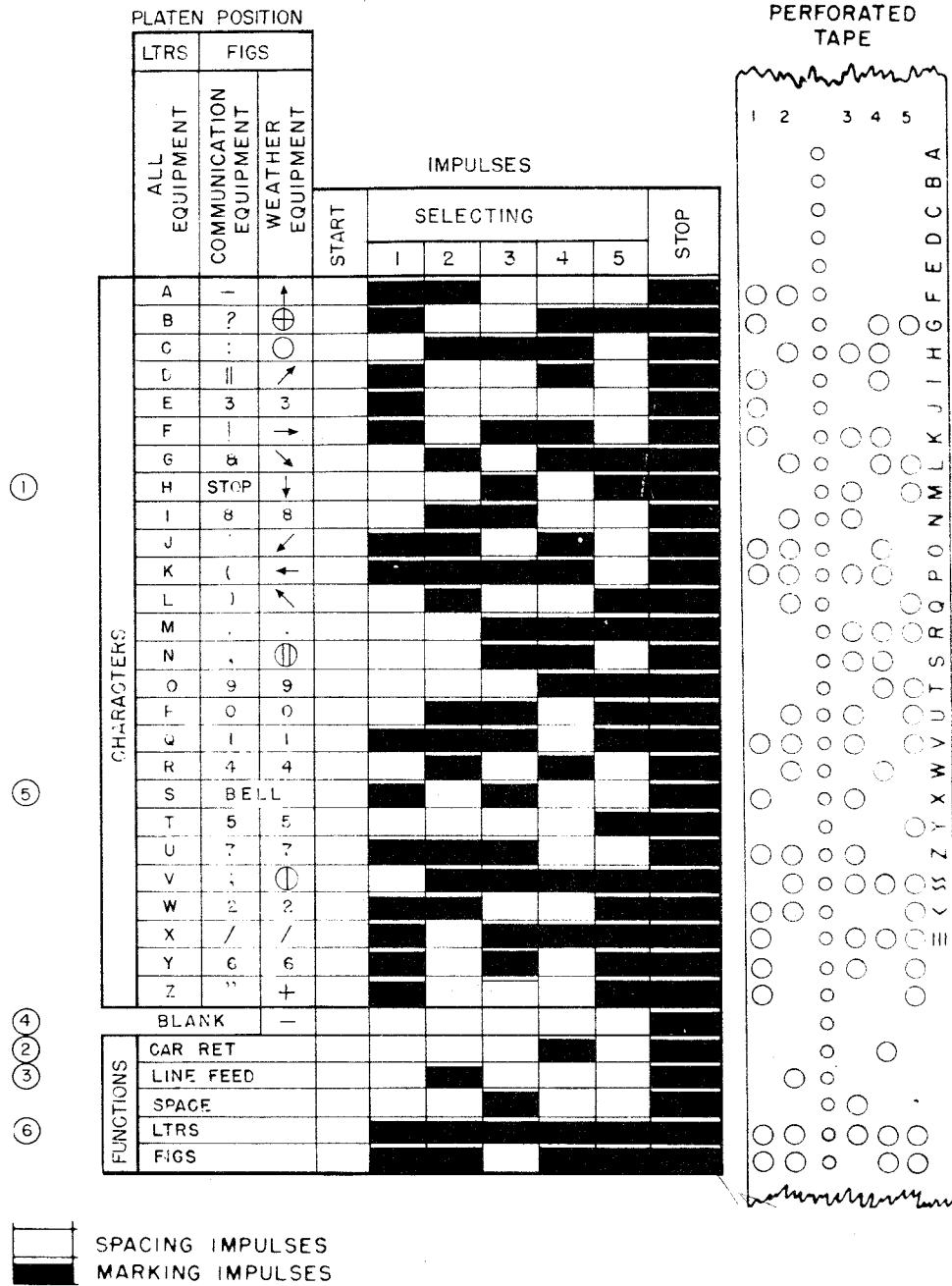


Figure 34. Interconnected Teletypewriter Sets AN/FGC-25, block diagram (half-duplex operation).



 SPACING IMPULSES  
 MARKING IMPULSES

- ① MOTOR STOP OPTIONAL
- ② < IS PRINTED ON TYPING REPERFORATORS
- ③ ≡ IS PRINTED ON TYPING REPERFORATORS
- ④ ≲ ≳ IS PRINTED ON TYPING REPERFORATORS
- ⑤ Δ IS PRINTED ON TYPING REPERFORATORS IN FIGS POSITION
- ⑥ ⋮ IS PRINTED ON TYPING REPERFORATORS IN LETTERS POSITION.

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Figure 35. Standard start-stop, five-unit code chart.

and receiving mechanisms. When the five selecting impulses are arranged in all possible combinations, they provide 32 different code groups.

## 25. Neutral and Polar Operation

a. Standard start-stop signals are transmitted sequentially in either neutral or polar operation. In neutral operation, current flows in one direction only. Marking impulses are current impulses, and spacing impulses are no-current impulses. In polar operation, current flows in both directions. Marking impulses are current impulses in one direction, spacing impulses are current impulses in the opposite direction. Figure 36 shows the signals transmitted for the letter Y in neutral operation. Figure 37 shows the signals transmitted for the same letter in polar operation.

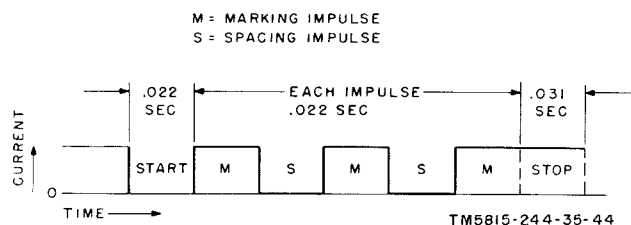


Figure 36. Neutral signals for letter Y at 60 wpm (7.42 unit code).

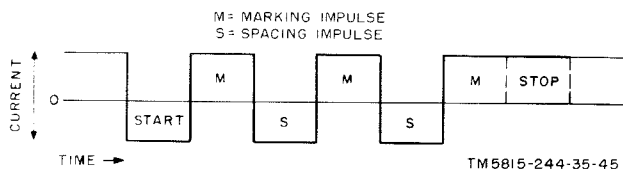


Figure 37. Polar signals for letter Y.

b. The page printing mechanism and the perforator can receive both neutral and polar impulses. The keyboard-transmitter and the transmitter-distributor in these sets are wired to send neutral impulses. Polar signals can be transmitted if the transmitters are rewired.

## 26. Sequential and Simultaneous Signaling

Sequential signals are used for transmission and reception of message traffic. Simultaneous signals are used within the teletypewriter set for the printing and punching of tape copy.

a. *Sequential Signals.* Each complete code group (fig. 35) consists of a start impulse, five individual intelligence impulses, and a stop impulse. The impulses are sent in the order named, with a fixed time length for each individual impulse (fig. 36).

b. *Simultaneous Signals.* Each complete code group consists of the five intelligence impulses (fig. 35) which are initiated, at the same time, by the closure of five separate circuits to the multisolenoid of the tape receiver (fig. 111). The multisolenoid receives all five impulses at the same time and positions the mechanical assemblies used in the printing and punching of tape copy. When the keyboard-transmitter is used for the preparation of tape copy, a multicontact switch (fig. 51) within the keyboard-transmitter controls the multisolenoid. When sequential signals are received (by the tape receiver) from the signal line, the code actuated switch (fig. 108) controls the multisolenoid.

## 27. Synchronism

The *start* and *stop* impulses used with the sequential signals are used to keep the receiving mechanism in synchronism with the sending mechanism. The *start* impulse is a *spacing* impulse sent before the first code impulse (fig. 35). The *stop* impulse is a *marking* impulse sent after the fifth code impulse. The start impulse causes the receiving mechanism to start a cycle of operation when the sending mechanism starts. The stop impulse causes the receiving mechanism to stop during the time the sending mechanism is transmitting the stop impulse and remains stopped until the sending mechanism sends the next start impulse. The receiving shaft speed is greater than the transmitter shaft speed, thus, the receiving mechanism has enough time to complete its function and remain at rest for a brief interval during the latter portion of the stop impulse.

## 28. Page Printer and Perforator Motors

Transmitting and receiving mechanisms of the page printer and perforator are driven by electric motors located at the right-hand sides of the units. Teletypewriter Sets AN/FGC-25, AN/FGC-26, and AN/FGC-57 are powered by synchronous motors and Teletypewriter Set AN/FGC-25X by series-governed motors.

a. *Synchronous Motors* (fig. 200). The synchronous motor is used with single phase, 115 volt ac at a frequency of 60 cps. This type motor is rated at 1/20 horsepower, at 3,600 rpm, and uses a squirrel cage type motor armature. Its stator has a main running winding and an auxiliary starting winding. The motor is wired so that the motor armature rotates clockwise when viewed from the fan end. The motor armature shaft (fig. 200) has a taper pin and a tapped hole for fastening the worm gear. End play is taken up by a conical spring, which bears against one of the ball bearings. The motor front and rear castings are fastened to the frame by four machine screws and lockwashers. Refer to paragraph 96 for a detailed description of the page printer synchronous motor circuit and to paragraph 101 for the perforator synchronous motor circuit.

b. *Series-Governed Motor* (fig. 201). The series-governed motor operates with 105- to 125-volt regulated or unregulated ac and is governed to run at 3,600 rpm. The armature and field coils are in series with the contacts of the motor governor assembly (par. 29). A motor filter suppresses radio frequencies generated by the governor contacts and the motor commutator. Refer to paragraph 96 for a detailed description of the page printer series-governed motor circuit and to paragraph 101 for the perforator series-governed motor circuit.

## 29. Governor of Series-Governed Motor

The motor governor assembly on the series-governed motors is adjustable to permit the motor speed to be maintained at precisely 3,600 rpm. The governor is mounted on the motor armature shaft and rotates with it. The governor contacts are connected in series with the field coils and motor armature through two sliprings (located on the back of the motor governor assembly) which are contacted by two contact brushes in the motor housing. The movable contact of the motor governor (fig. 38) is

flexible and is held against the stationary contact by the governor spring until the motor speed exceeds 3,600 rpm. When this occurs, the centrifugal force acting on the movable contact is greater than the tension of the spring. The movable contact moves away from the stationary contact. The speed at which this will occur depends on the tension applied to the spring by a governor adjustment lever, which is adjusted (while the motor is running) by manipulating the governor worm (fig. 39).

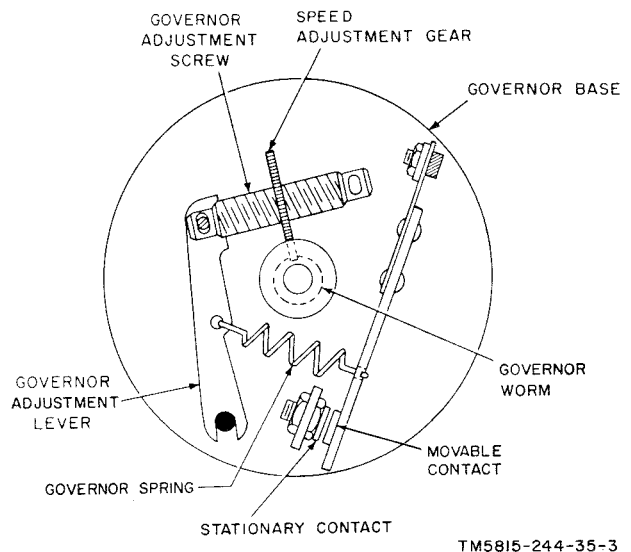


Figure 38. Motor governor, governor cover removed.

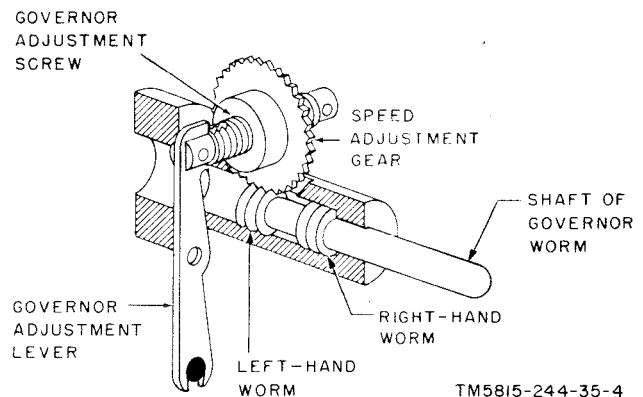


Figure 39. Governor spring tension adjustment train.

## Section II. MECHANICAL THEORY OF PAGE PRINTER

### 30. General

a. The page printers consist of a sending unit (keyboard-transmitter) and a receiving unit (page printing mechanism). The sending and receiving units are mounted on a common base. Each unit is electrically capable of operating independently, if that type of operation is desired.

b. The keyboard-transmitter is capable of transmitting either standard sequential five-unit, start-stop code to the signal line or simultaneous code groups through an 11-wire circuit to the multisolenoid magnet of the perforator. The page printing mechanism can receive only standard start-stop five-unit code groups.

### 31. Page Printer Block Diagram

(fig. 40)

a. *Sending.* As a key lever is depressed, a train of parts within the transmitter mechanism is positioned so that the mechanical arrangement of these parts will represent the five-unit code group for the character or function assigned to that particular key lever. When transmitting to the signal line, the key lever causes an intermediate shaft assembly to operate the transmitter contacts which send electrical code impulses to the selector mechanism and to the signal line. When cutting tape at the keyboard, the transmitter mechanism operates the simultaneous transmitter contacts.

b. *Receiving.* Electrical code impulses from the signal line are received by the selector mechanism. The selector mechanism converts the electrical code impulses into a mechanical arrangement that corresponds to the received code group. This mechanical setting is then transferred to the code bar mechanism which determines the character to be printed or the function to be performed. The main shaft and the intermediate shaft assemblies are driven by the ac motor. The shafts, in turn, provide the mechanical power to perform the printing or functional operation selected by the code bar mechanism.

c. *Ac Power.* The perforator power supply furnishes 115 volts for the motor and copy light circuits and 6.3 volts for the end-of-line indicator.

### 32. Main Shaft and Power Distribution

(fig. 41)

Motion is distributed to the various mechanisms of the page printer through the gears on the main shaft. The main shaft speed is determined by the drive gearset that is used to adapt the 3,600 rpm motor speed to the required speed of operation. This drive gearset consists of a removable worm at the end of the motor armature shaft and its mating fiber worm gear at the end of the main shaft. The page printer is supplied initially with the drive gearset for 60 word-per-minute (wpm) operation (368.1 opm) installed. The page printer may be adapted for 75-wpm (460 ØPM) or 100 wpm (600 opm) by substitution of the appropriate alternate drive gearset in place of the 60-wpm gearset. The main shaft rotates constantly when the page printer is in operation and it transfers mechanical power through the various gears and clutches to the entire assembly. The speeds of rotation for the various parts shown in figure 41 are those that occur at 368.1 opm. When an alternate drive gearset is used, the shaft speeds are proportionately higher, though the motor speed remains constant.

### 33. Friction Clutches

(fig. 42)

The mechanical power required for operation of the transmitter camshaft, the carriage feed shaft, the selector camshaft, and the stop arm shaft is received from the main shaft through friction clutches. These friction clutches make rapid start and stop actions possible.

a. *Transmitter Camshaft Friction Clutch* (A, fig. 42). The clutch fork of the transmitter camshaft engages the notches on the clutch driver plate. Two felt friction plates on the transmitter drive shaft are held against the clutch driver plate by spring pressure. This spring pressure can be increased or decreased by moving the friction adjusting collar, thus increasing or decreasing the torque transmitted through the clutch. The clutch driver plate has projections on each side which engage holes in the felt friction plates. This causes the clutch driver plate and the felt friction plates to rotate in unison. Friction between the



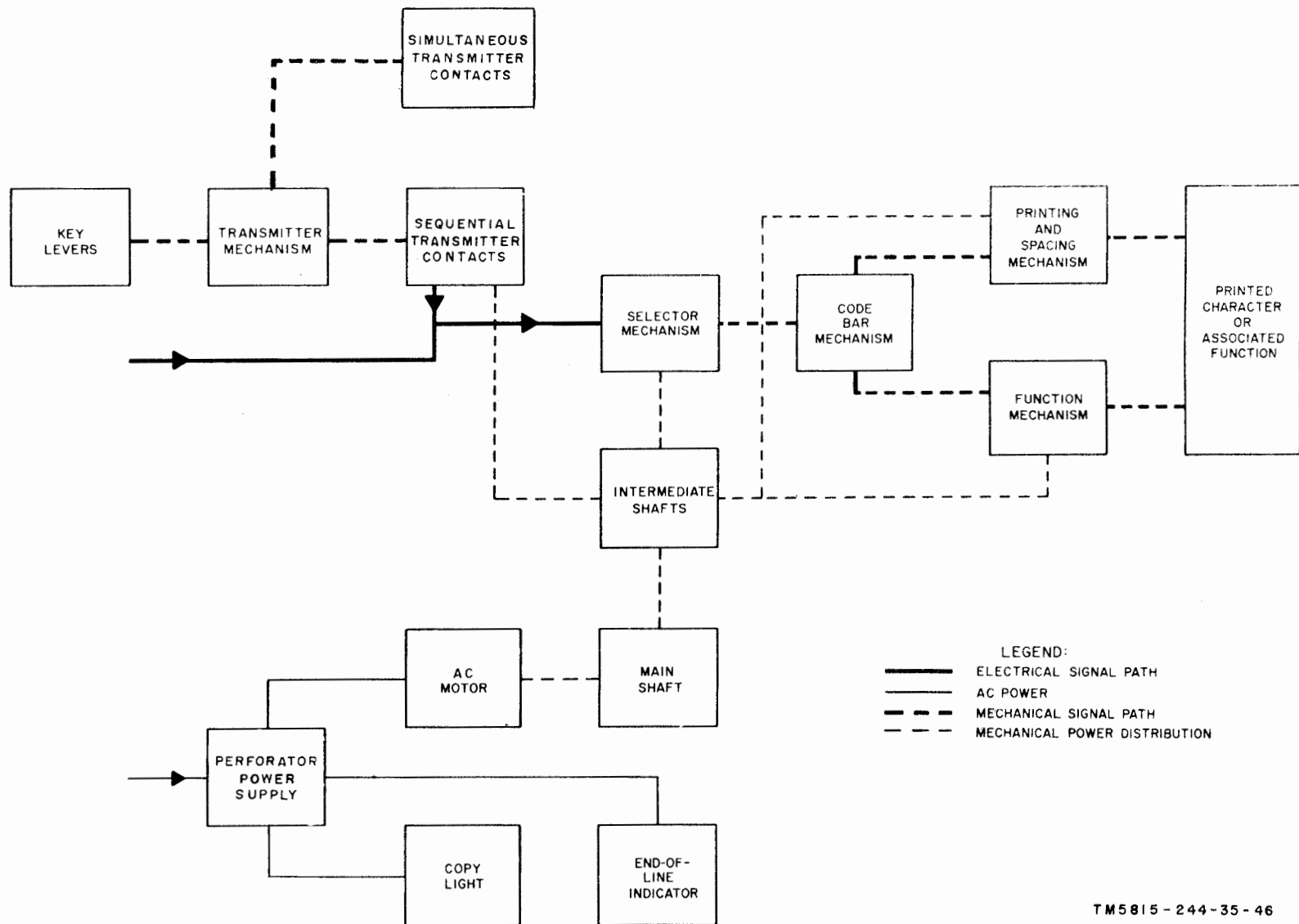
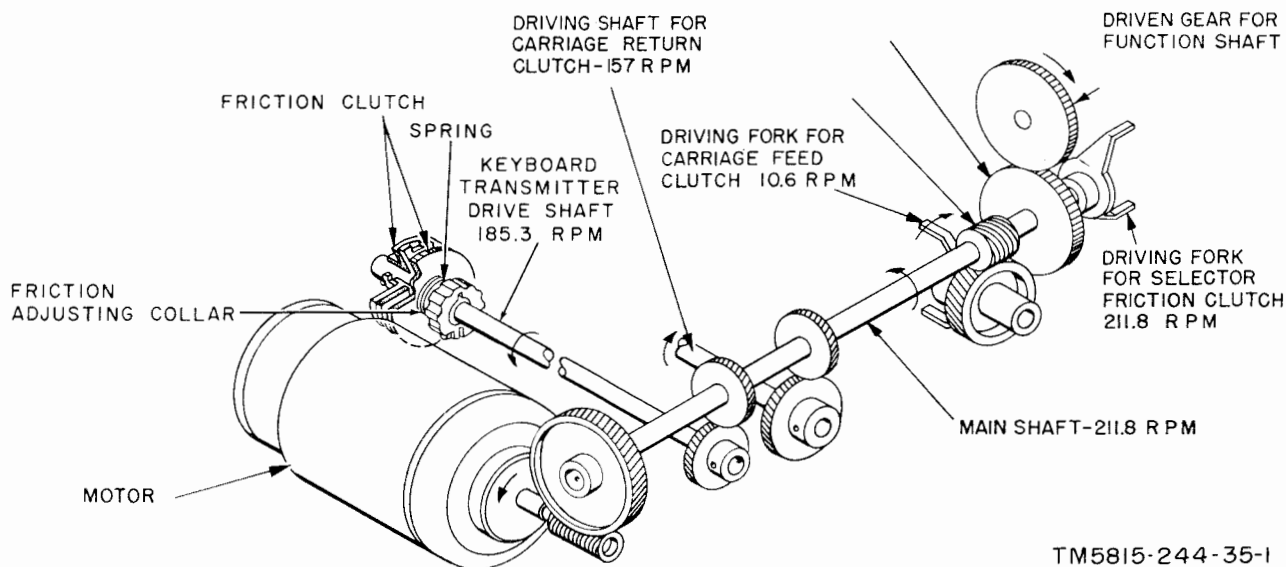


Figure 40. Page printer, block diagram.

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Figure 41. Mechanical power distribution.

clutch disks and the friction plates is sufficient to rotate the transmitter camshaft under its normal workload. When the travel of the transmitter camshaft is blocked (when the cam stop lever is engaged) (par. 37), the friction drive is overcome and slippage occurs between the felt friction plates and the clutch disks. This allows the transmitter camshaft, the clutch driver plate, and the felt plates to stop, but maintains a constant torque at the clutch disks which immediately resume rotation when the blocking member is removed.

b. *Selector Camshaft and Carriage-Feed Shaft Friction Clutches* (B, fig. 42). The design of the selector camshaft and the carriage feed shaft friction clutches is identical to the transmitter camshaft friction clutch, but the operation is reversed. The clutch fork is the driving member and the clutch driver plate and the felt friction plates rotate constantly with the clutch fork. When the motion of the driven shaft (selector camshaft illustrated) is blocked, slippage occurs between the felt friction plates and the clutch disks. When the blocking member is removed, the driven shaft will turn immediately.

c. *Function Shaft Friction Clutch* (C, fig. 42). The design of the function shaft friction clutch, which powers the square shaft, is different from those previously described but the principle of operation is similar. When the

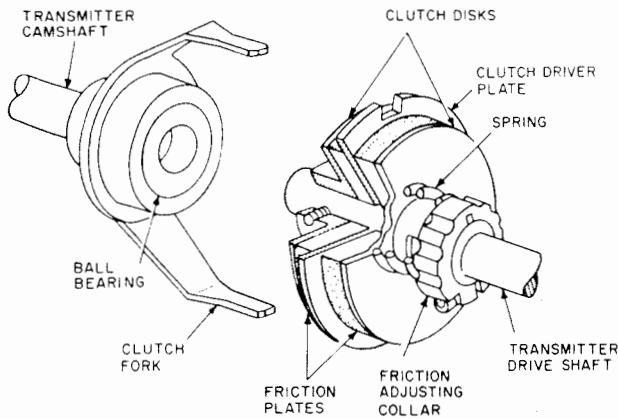
function shaft turns, a friction torque is applied to the square shaft driving gear which (in operation) is meshed with the square shaft driven gear. Whenever the square shaft stop arm is free to turn, the square shaft driving gear and the friction plates rotate with the function shaft. When rotation of the square shaft stop arm is blocked, the square shaft gear remains stationary and slippage occurs at the clutch as the function shaft continues to rotate.

### 34. Keyboard-Transmitter, Sequential Transmission

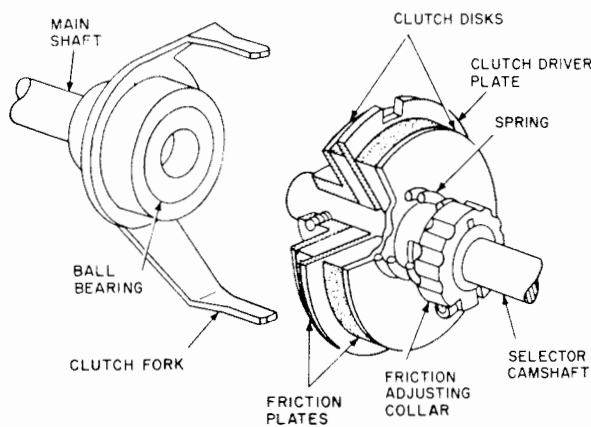
The keyboard-transmitter (fig. 43) may be subdivided into a code selecting mechanism, a code transmitting mechanism, and a transmitter camshaft control mechanism for an explanation of the code transmission function. The code selecting mechanism converts the depression of a key lever into mechanical settings which determine the code to be transmitted. The code transmitting mechanism converts these mechanical settings into an electrical code group. The transmitter camshaft control mechanism provides control of the transmitter camshaft friction clutch.

a. *Code Selecting Mechanism* (fig. 44). This mechanism consists of 32 key levers, 5 code bars, and 5 sensing levers.

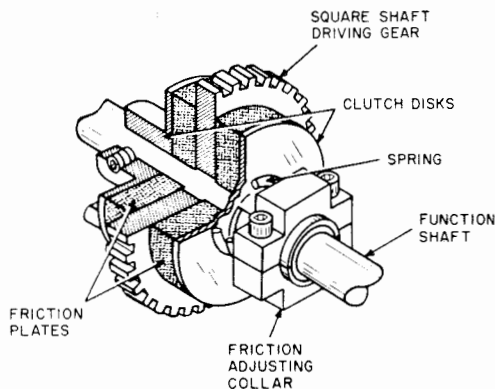
b. *Sequential Transmitter Mechanism* (fig. 45). This mechanism consists of the trans-



A. TRANSMITTER CAMSHAFT FRICTION CLUTCH



B. SELECTOR CAMSHAFT FRICTION CLUTCH



C. FUNCTION SHAFT FRICTION CLUTCH

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Figure 42. Friction clutches.

mitting contacts, 6 selector levers, a transmitter camshaft, and its associated clutch work.

c. *Transmitter Camshaft Control Mechanism* (fig. 47). This mechanism consists of the key

levers, a universal bar, locking lever latch, cam stop lever, repeat blocking lever, and a cam on the transmitter camshaft.

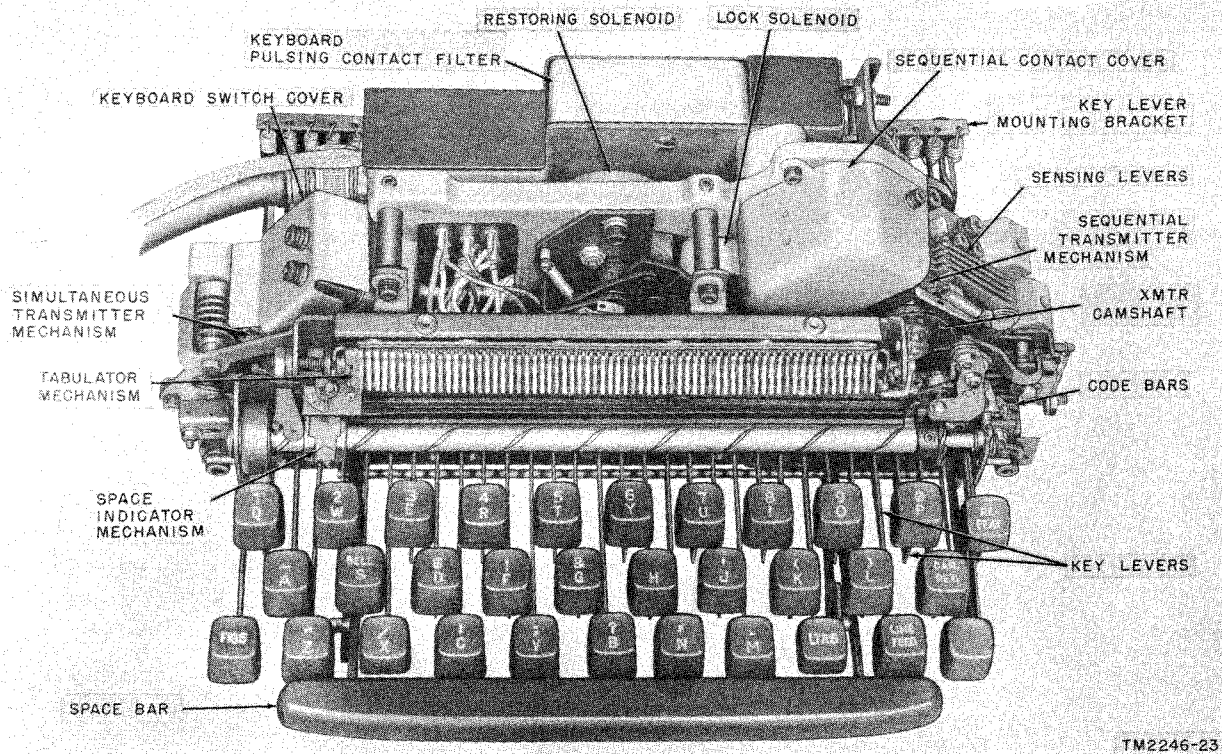
### 35. Code Selecting Mechanism

As a key lever (or the space bar) is depressed, it strikes five code bars that extend across the width of the keyboard. Each of the code bars (fig. 44) is slanted in one of two ways at the point where it is engaged by each of the key levers; thus, the depression of a key lever results in each of the code bars moving either to the right or to the left on their bearings. If the key lever for the letter Y is depressed, the first, third, and fifth code bars are slanted to move to the right and the second and fourth code bars are slanted to move to the left. This mechanical setting of code bars corresponds to the code for the letter Y (fig. 35) which is to be sent to the signal line. As the code bars are positioned, each code bar moves its associated sensing lever, which is engaged in a notch at the right side of the code bar. A code bar moved to the right (marking) pivots its sensing lever counterclockwise into engagement with its associated selector lever. A code bar moved to the left (spacing) pivots its sensing lever clockwise and out of engagement with its associated selector lever.

### 36. Sequential Transmitting Mechanism (fig. 45)

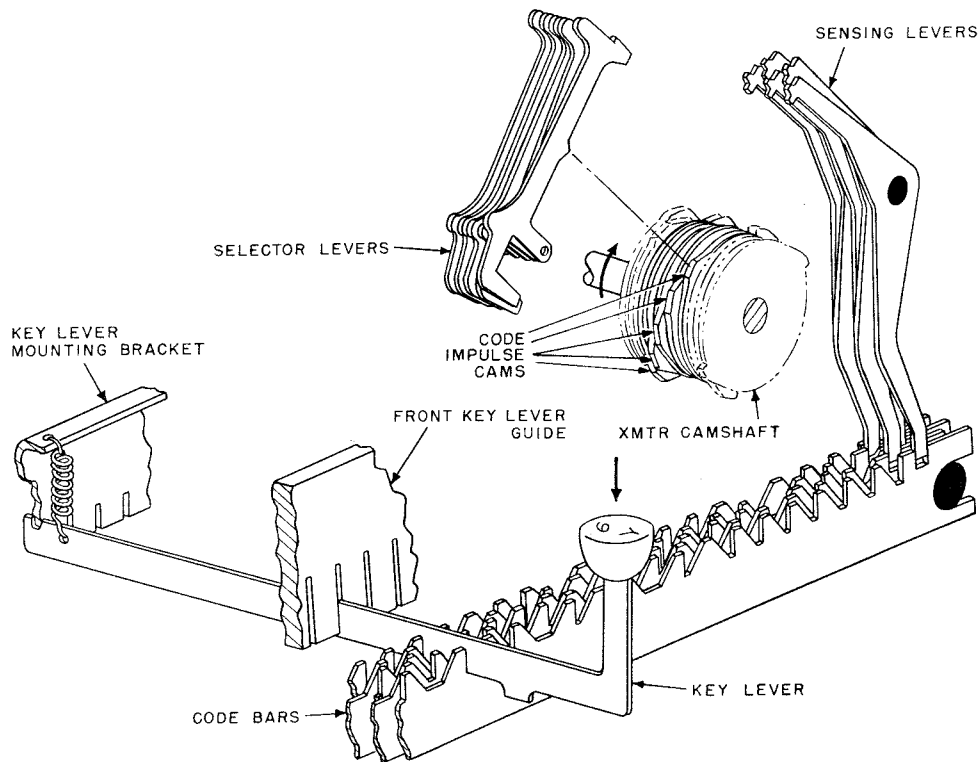
a. The transmitting contacts consist of a stationary upper contact, located at the base of the transmitter contact screw, and a lower contact mounted on a movable contact bail. The contact bail is located directly above the six selector levers and is pivoted clockwise by a selector lever to close the contacts for a marking (current) impulse and counterclockwise by the contact bail spring to open the contacts for a spacing (no current) impulse.

b. Each of the six selector levers beneath the contact bail is operated by its own cam. The cams are distributed in a 180° arc around the transmitter camshaft, and as the camshaft turns (par. 37), each selector lever is operated in a sequence. If a cam strikes the projection on a selector lever that is latched by a sensing lever (C, fig. 45), the lower end of the selector lever is forced upward and the contact bail is



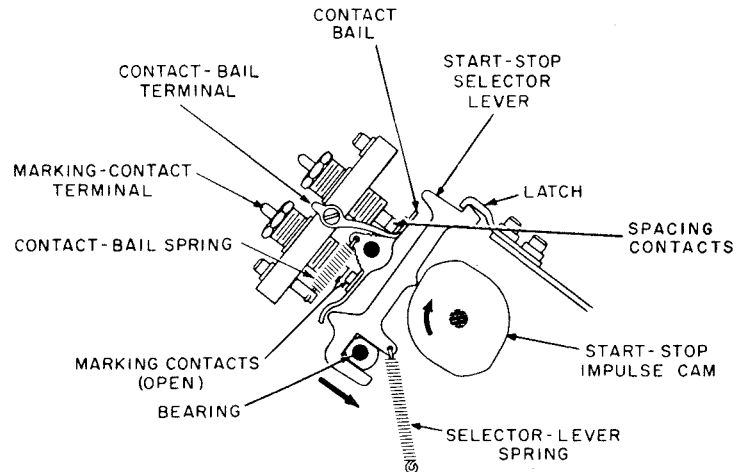
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Figure 43. Keyboard-transmitter parts.

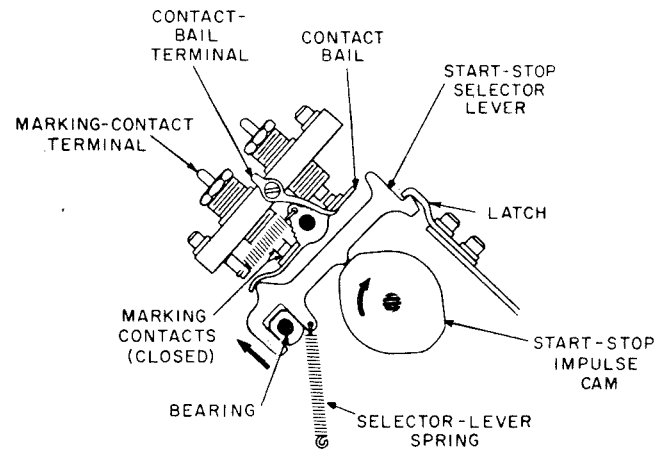


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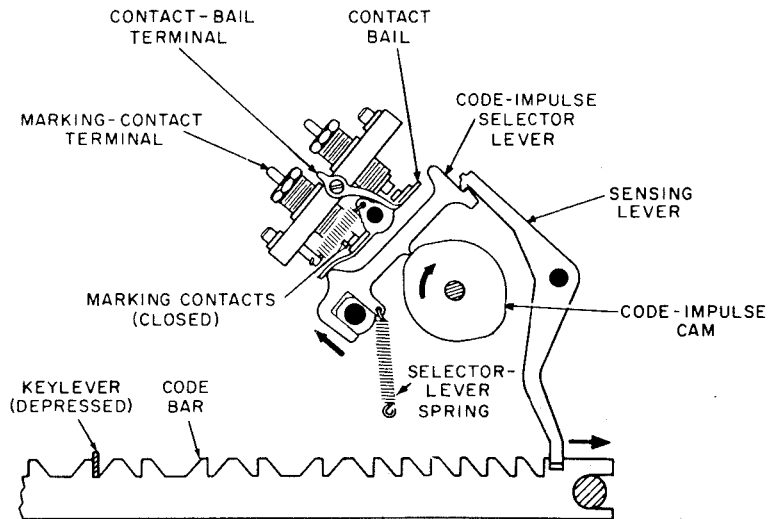
Figure 44. Code selecting mechanism with Y-key lever operated.



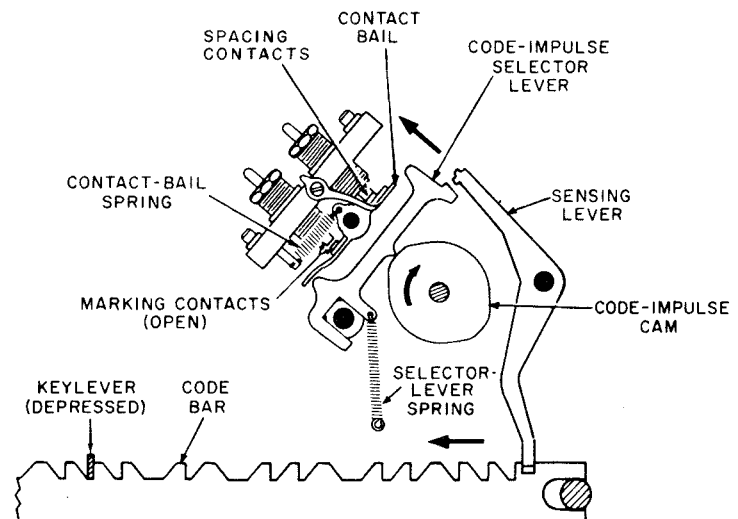
A. TRANSMITTING START IMPULSE



B. TRANSMITTING STOP IMPULSE



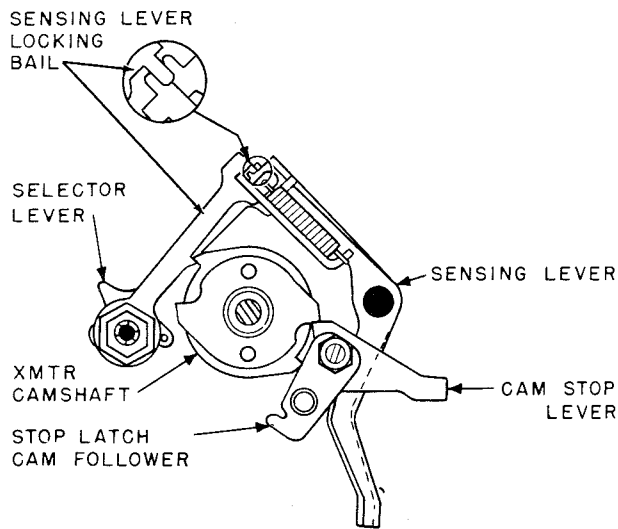
C. TRANSMITTING MARKING CODE IMPULSE



D. TRANSMITTING SPACING CODE IMPULSE

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Figure 45. Sequential transmitter mechanism operation.



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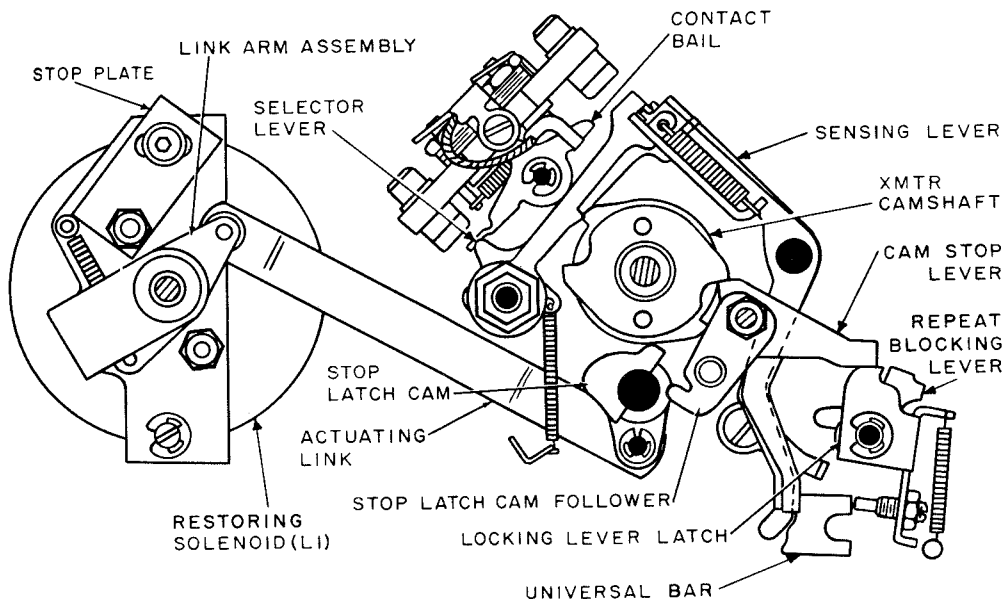
Figure 46. Sensing levers locked by locking bail.

moved clockwise to close the marking contacts. If the selector lever is not latched (D, fig. 45), the cam action results in the raising of the opposite end of the selector lever; the selector lever spring serves to hold the selector lever firmly on the bearing as the selector lever pivots. The contact bail spring then exerts pressure to open the marking contacts.

c. The five selector levers involved in the transmission of the five selected impulses (fig.

35) are controlled, in each operation, by their associated sensing levers. The sixth selector lever is positioned and permanently latched to provide a stop (marking) impulse in the normal stopped position of the transmitter camshaft (B, fig. 45). The absence of a high portion of a cam in the area which would normally be effective at the start of the transmitter camshafts motion provides the start (spacing) impulse (A, fig. 45). Therefore, seven impulses are sent in each one-half revolution of the transmitter camshaft: a start impulse, five selecting impulses, and a stop impulse.

d. As the transmitter camshaft begins each cycle of operation (par. 37), the sensing lever locking bail (fig. 46) moves downward (under spring tension) to a low part of its cam on the camshaft, locking the sensing levers in place during transmission of the selected code group. During this time (when the sensing levers are locked in place) no other key lever can be fully depressed and therefore, transmission of the previously selected code group cannot be affected either by the typing speed of the operator, or by the accidental depression of another key lever. During transmission of the last impulse (stop impulse) of each code group, a high portion of the locking bail cam pushes the locking bail out of engagement with the ends of



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Figure 47. Transmitter camshaft control mechanism.

the sensing levers, permitting selection of another code group for transmission.

### 37. Transmitter Camshaft Control Mechanism

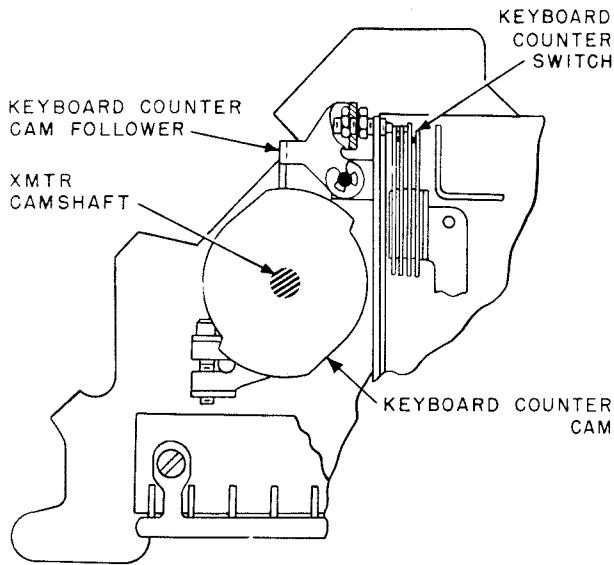
a. The transmitter camshaft is normally held in the stopped position by the cam stop lever (fig. 47). When any key lever (or the space bar) is depressed, the universal bar is moved to the right. As the universal bar moves, the upper end of the locking lever latch moves to the left and allows the right arm of the cam stop lever to move downward between the locking lever latch and the repeat blocking lever under pressure of the cam stop lever spring. The clockwise movement of the cam stop lever causes the blocking extension of the cam stop lever to move out of engagement with the stop tooth of the transmitter camshaft. This permits the friction clutch (par. 33a) to turn the transmitter camshaft.

b. The transmitter camshaft is normally stopped at the end of one-half of a complete revolution by the cam stop lever. As the camshaft turns (a above) the keyboard counter cam follower (fig. 48) rides up on a high portion of the keyboard counter cam and closes the contacts of the keyboard counter switch which, in turn, energizes the restoring solenoid. The restoring solenoid rotates the link arm assembly (fig. 47) counterclockwise and draws the actuating link to the left. This motion causes the stop latch cam to pivot clockwise and strike the stop latch cam follower. This action rotates the cam stop lever counterclockwise. The repeat blocking lever (moved by its spring) moves clockwise beneath the cam stop lever and the cam stop lever is then held in position by the repeat blocking lever. As the stop tooth of the transmitter camshaft engages the cam stop after turning 180°, further rotation is blocked. When the key lever is released, the universal bar is moved to the left by its spring. The locking lever latch is moved to the right by its spring and it carries the repeat blocking lever with it. This causes the right extension of the cam stop lever to come to rest on the top of the locking lever latch. A more rapid release of the key lever causes the cam stop lever to come to rest on top of the locking lever latch directly, without contacting the repeat blocking lever.

c. The following chart summarizes the sending operation sequences for sequential signals whenever a key lever (other than the repeat key lever) is struck:

*Sequence chart for sending sequential signals*

1	Key lever or space bar depressed.	
2	Universal bar shifted to right.	Five code bars moved individually to right or left according to code.
3	Locking lever latch turned.	Five sensing levers turned individually counterclockwise or clockwise.
4	Cam stop lever dropped between locking lever latch and repeat blocking lever.	
5	Transmitter camshaft starts revolving.	Five sensing levers locked by sensing lever locking bail (key lever may be released at any time hereafter).
6	Contact bail spring turns contact bail counterclockwise.	
7	Start impulse sent.	
8	First five-unit code impulse raises No. 1 selector lever.	
9	If latched by sensing lever, lower end of selector lever No. 1 turns contact bail clockwise; if not latched by sensing lever, contact bail spring turns contact bail counterclockwise.	
10	Mark or space impulse sent, depending upon whether contact bail is turned clockwise or counterclockwise.	
11	Keyboard counter cam follower pivoted by keyboard counter cam action to close keyboard counter switch and energize restoring solenoid L1.	
12	Restoring solenoid L1 pivots stop latch cam, raising cam stop lever in position to engage tooth on transmitter camshaft.	
13	Cam stop lever latched up in position by repeat blocking lever if universal bar is still shifted, or locking lever latch if universal bar has been released by key lever.	
14	Second, third, fourth, and fifth code impulses sent by corresponding parts of transmitter mechanism as for first code impulse.	
15	Cam stop lever raises No. 6 selector lever (permanently latched).	
16	Lower end of No. 6 selector lever turns contact bail clockwise.	
17	Stop impulse sent.	
18	Tooth on transmitter camshaft strikes cam stop lever and camshaft stops revolving (having completed one-half revolution).	
19	Key must be released before above sequence can be repeated for any other or for same key lever to allow locking lever latch to return under cam stop lever.	

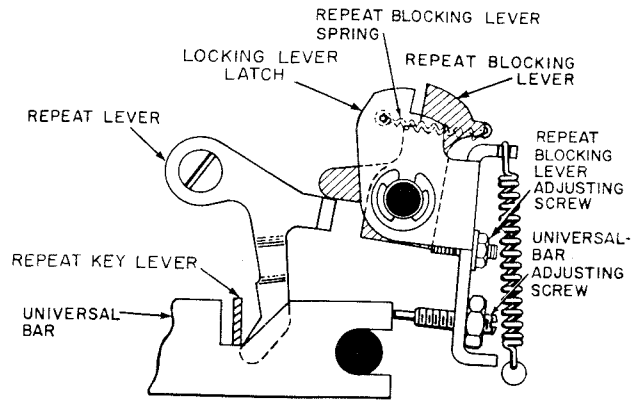


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Figure 48. Keyboard counter switch mechanism.

### 38. Character Repeat Feature

The transmitter camshaft rotates constantly when any key lever and the REPEAT key lever are depressed at the same time. When the REPEAT key lever moves downward, it strikes the lower extension of the repeat lever, pivoting the repeat lever counterclockwise (fig. 51). The upper arm of the repeat lever strikes the repeat blocking lever, pivoting the blocking lever clockwise, out of the downward path of the right extension of the cam stop lever (fig. 47). At the same time, the depression of the associated key lever causes the universal bar to move to the right and pivot the locking lever latch counterclockwise. In each type of operation, the restoring cam solenoid is energized and the cam stop lever is moved counterclockwise (par. 37b). However, the repeat blocking lever is held out of the path of the camshaft lever (due to the depression of the repeat key) and the cam stop lever rotates clockwise, out of the path of the stop tooth of the transmitter camshaft. The transmitter camshaft rotates without interruption and the code group (selected by the key lever which is held downward with the REPEAT key lever) is sent repeatedly until the REPEAT key lever is released.

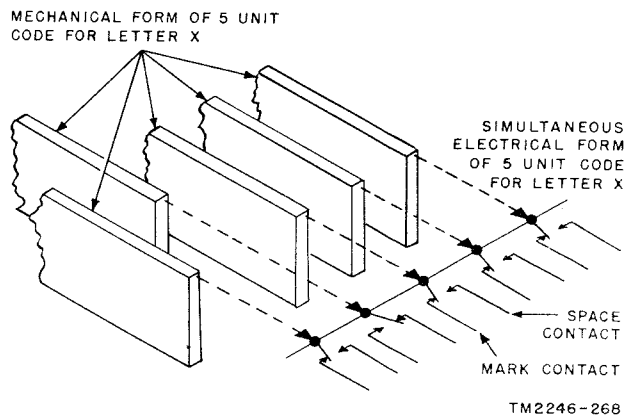


TM5815-244-35-51

Figure 49. Repeat mechanism.

### 39. Keyboard-Transmitter, Simultaneous Transmission to Perforator

The keyboard-transmitter uses the same five-unit code for simultaneous operation that it uses for sequential operation except that the five units of code are transmitted at the same instant in simultaneous operation. The depression of a key lever is transformed into five electrical impulses through the mechanical linkage of the five code bars to five spring contacts. Each of the spring contacts prepares a separate circuit through the multisolenoid of the perforator and five such circuits must be completed for each code group transmitted. After the spring contacts are positioned through the depression of a key lever, the five circuits are energized simultaneously, through the closure of



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Figure 50. Relationship between mechanical and electrical forms of five-unit code in simultaneous circuit.



the keyboard reader switch that is activated by the movement of the cam stop lever (par. 41). This mode of transmission is limited to use with the preparation of message tapes within these teletypewriter sets.

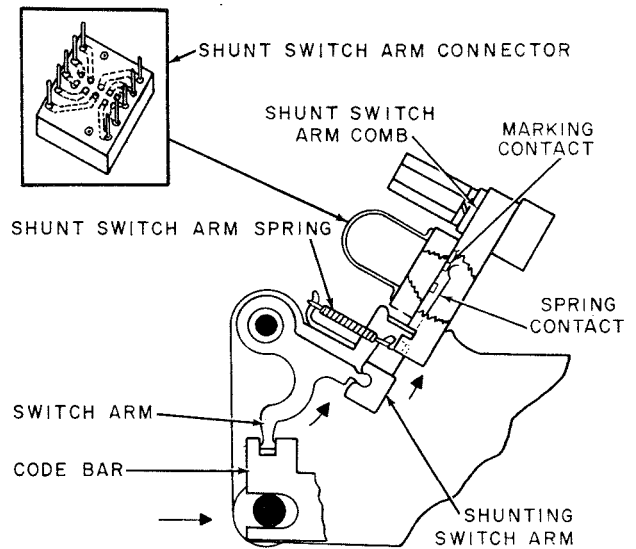
#### 40. Positioning of Simultaneous Switch Spring Contacts (fig. 51)

The depression of a key lever positions each of the five code bars either to the right (marking position) or to the left (spacing position). Engaged in a notch at the left end of each of the code bars is a switch arm. A movement to the right by a code bar raises the right extension of the switch arm (A, fig. 51). The right extension of each switch arm is fitted into the shunt switch arm associated with it and the shunt switch arm has the spring contact fastened to its upper surface. The spring contact is moved upward into engagement with a marking contact of the switch as a result of a code bar being positioned to the right. Through the same train of parts, a movement of the code bar to the left (B, fig. 51) results in the contact spring coming to rest in engagement with the spacing contact. The positioning of the five individual spring contacts, determines the circuits which will be energized to transfer the code combination to the receiving multisolenoid of the perforator.

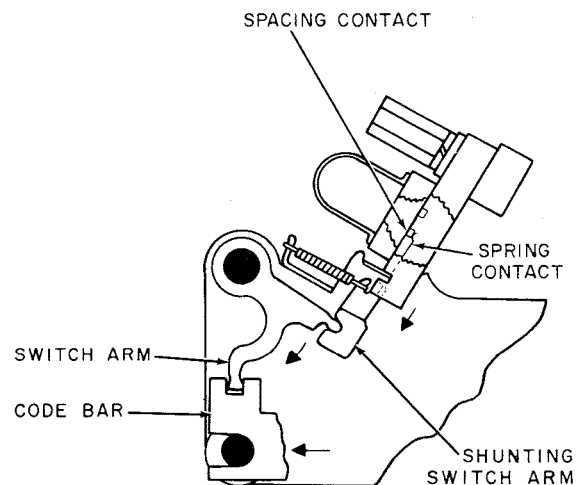
#### 41. Transmission of Simultaneous Code From Keyboard-Transmitter

Immediately after the five selected circuits have been set up (par. 40), they must be energized to send the code selection to the receiving multisolenoid in the perforator. This is accomplished by closing the keyboard reader switch (S11 on TT-117/FG and TT-119/FG; S10 on all other models). The keyboard reader switch is mounted on the right rear portion of the keyboard casting (fig. 52).

a. Each time a code group is selected by the depression of a key lever, the universal bar (fig. 47) pivots the locking lever latch, which causes the horizontal arm of the cam stop lever to move *downward* into a notch formed between the repeat blocking lever and the locking lever



A. MARKING POSITION



B. SPACING POSITION

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Figure 51. Setting up mechanical form of five-unit code for simultaneous transmission.

latch (par. 37). When the arm of the cam stop lever moves downward, a train of parts (fig. 52) consisting of the cam stop lever and its shaft, switch cam lever, switch cam follower, switch arm and shaft, plunger spring, and plunger operate to permit the contacts of the

keyboard reader switch to close, energizing the selected simultaneous circuits.

b. After the code impulses have been transmitted to the perforator (*a* above), the perforator latch pulsing contacts in the perforator (fig. 134) close to energize restoring solenoid L1 in the keyboard-transmitter (fig. 47). When energized, the restoring solenoid causes the arm of the cam stop lever to move upward (par. 37*d*), pivoting the switch cam lever downward (fig. 52) to cause the keyboard reader contacts to open, *deenergizing* the simultaneous circuits to the perforator.

c. The transmitter camshaft does not rotate during simultaneous transmission from the keyboard-transmitter to the perforator. Either the transmitter lock solenoid L2 on the TT-117/FG and TT-119/FG or a manually operated locking feature on all other models is used

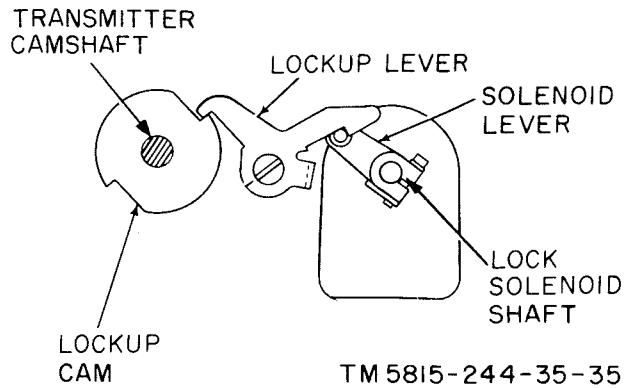


Figure 53. Locking transmitter camshaft during simultaneous operation (TT-117/FG and TT-119/FG.)

to prevent rotation of the transmitter camshaft when the keyboard control switch is in TAPE position.

(1) Transmitter lock solenoid L2 (TT-117/FG and TT-119/FG only) is energized continuously when the keyboard control switch on the perforator is in the TAPE position (fig. 134). When L2 is energized, its shaft and the solenoid lever are held in the clockwise position (when viewed from the rear, fig. 53) and the lockup lever is held in the counterclockwise position (latching end in engagement with the lockup cam on the transmitter camshaft).

(2) All models except the TT-117/FG and TT-119/FG are equipped with a manually operated keyboard control lever and detent lockup lever (fig. 54) which is used to prevent rotation of the transmitter camshaft when the keyboard control lever is in the TAPE position. During sequential transmission, (when the camshaft must rotate to transmit), the keyboard control lever holds one arm of the detent lockup lever downward and the opposite (latching) end of the lever is held away from the lockup cam (fig. 54). However, during *simultaneous* transmission (in TAPE position), the keyboard control lever must be in the clockwise position (when viewed

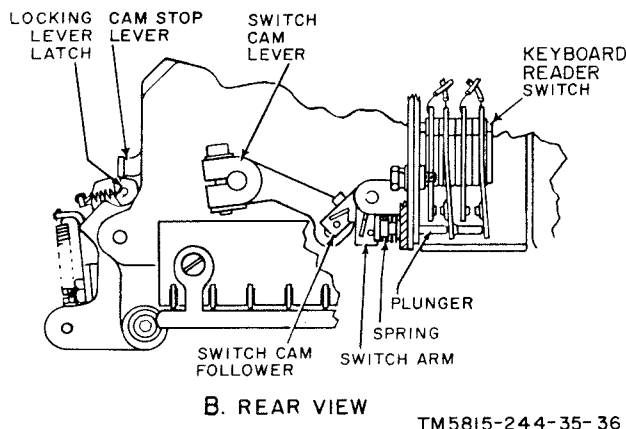
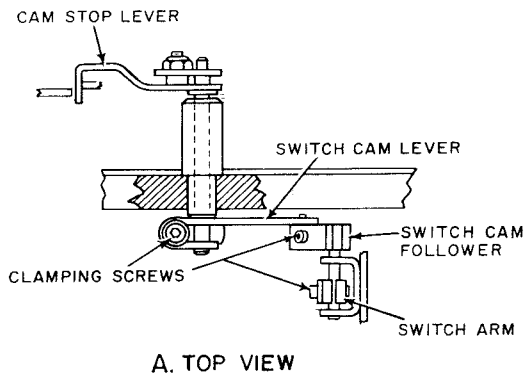
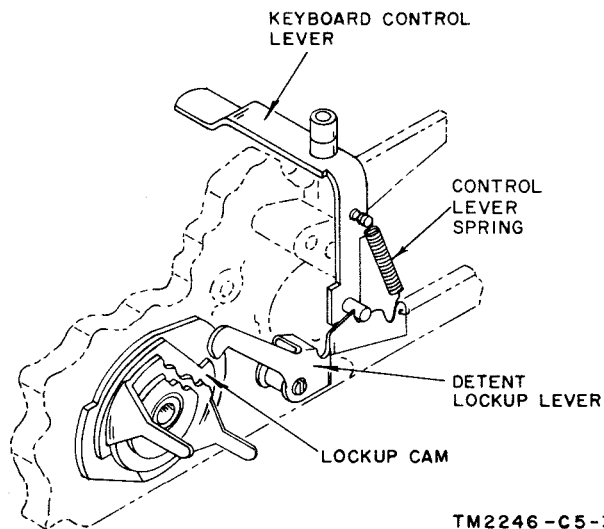


Figure 52. Closing Keyboard reader switch.

from the top) and the control lever spring keeps the latching end of the detent lockup lever in engagement with a stop tooth on the lockup cam.

d. The maximum operating speed for simultaneous transmission is 125 words-per-minute and is determined by the speed of the receiving multisolenoid function shaft in the perforator. Transmission of this type is termed as transmission with a "free keyboard" because rotation of the transmitter camshaft is not required and no time lag is necessary to wait for each half-revolution of the camshaft to be completed.

e. The following sequence chart lists the sequence of operations which result in the transmission of simultaneous signals from the keyboard-transmitter.



TM2246-C5-3

Figure 54. Transmitter camshaft locking mechanism (TT-117A/FG, TT-118/FG, and TT-119A/FG).

Sequence chart for sending simultaneous signals

1	Key lever depressed.	
2	Universal bar shifted to right.	Five code bars shifted individually to right or to left to accommodate code.
3	Locking lever latch turned.	Five switch arms turned individually counter-clockwise or clockwise.
4	Cam stop lever drops between locking lever latch and repeat blocking lever.	Shunting switch arm moves to close either upper or lower circuit on shunt switch arm connector.
5	Switch cam lever on other end of cam stop lever shaft pivots, pivoting switch cam follower and switch arm.	
6	Switch arm closes keyboard reader switch, energizing selected simultaneous circuits.	
7	Perforator selects and accomplishes desired operation.	
8	Receiving multisolenoid pulsing contacts on perforator energize restoring solenoid L1 on keyboard-transmitter.	
9	Restoring solenoid L1 pivots stop latch cam.	
10	Stop latch cam moves cam stop lever counter-clockwise, latching it with repeat blocking lever if key lever has not been released, or with locking lever latch if key lever has been released.	
11	Switch cam lever on other end of cam stop lever pivots clockwise, pivoting switch cam follower and switch arm.	
12	Switch arm allows keyboard reader switch to open, deenergizing simultaneous circuits.	

## 42. Receiving Sequential Code Impulses

### a. Polar Selector Magnet Operation.

(1) *Selector magnet.* A polar selector magnet (fig. 55) consists of a permanent bar magnet, and armature, a potentiometer, and two line and two bias windings mounted on a U-shaped steel core. Around each arm of the U-shaped core are wound one line and one bias winding. A detailed description of the circuits of the magnet is given in paragraph 93b and c.

(2) *Magnet theory.* The armature (fig. 55) is pivoted at its center and is magnetically balanced over the open end of the core. The permanent magnet sets up a magnetic field that is concentrated around the core. When a winding around the core is energized, the magnetic field that is set up by the energized circuit unbalances the permanent magnet field and causes the armature to move on the central pivot. Currents through the windings increase the magnetic field pull on one end of the armature, while decreasing the permanent magnet field pull on the opposite end. This makes the armature sensitive to slight current flows in the windings.

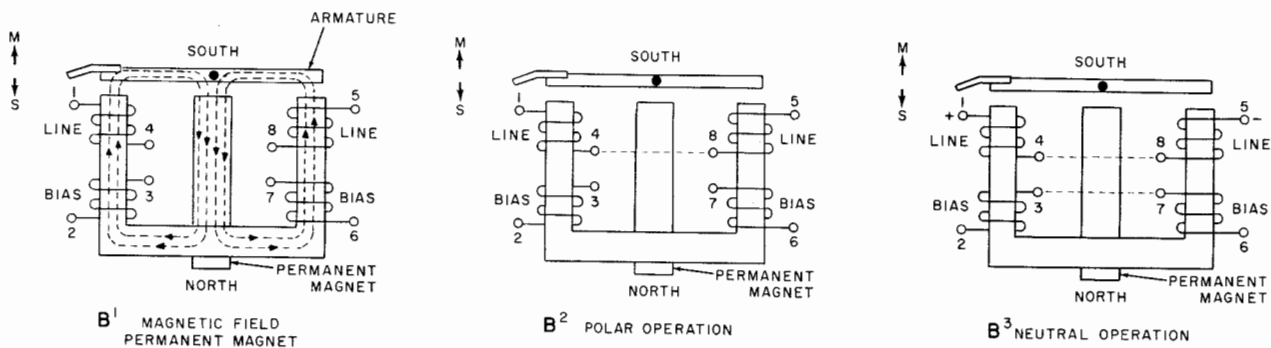
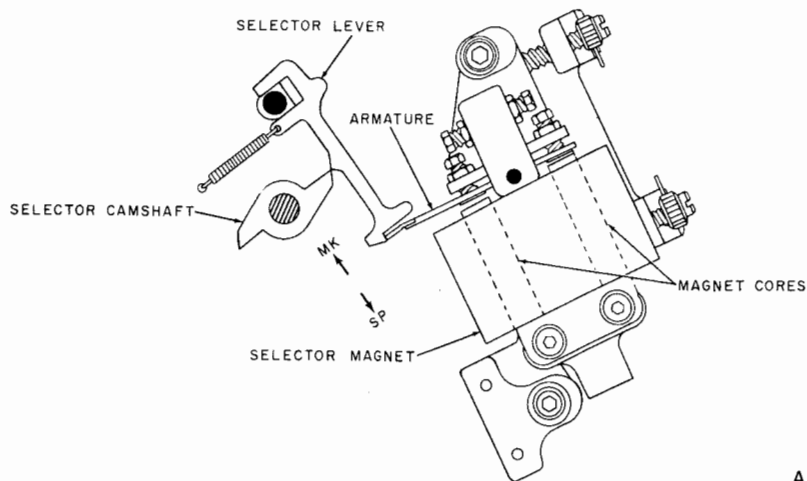


Figure 55. Polar selector magnet.

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(3) *Polar operation.* The bias windings are not used for operation in polar circuits. The line windings are connected in parallel for 30-ma operation (B<sup>2</sup>, fig. 55).

(a) *Polar marking impulse.* During a marking impulse, current flows through the line windings. Terminals 1 and 8 are positive and terminals 4 and 5 are negative. The magnetic field set up by the line winding around the left core arm opposes the field of the permanent magnet, and little pull is present on the left side of the armature. The magnetic field set up by the line winding around the right core arm is poled to aid the field of the permanent magnet; therefore, the right end of the armature is pulled toward the right core arm. The

left end of the armature, which includes the armature blade, moves to the marking position away from the left core arm and into the path of the selector levers.

(b) *Polar spacing impulse.* During reception of a polar spacing impulse, current flows in the line windings is reversed, and the opposite of the above occurs. The magnetic pull on the right end of the armature is weakened and the pull on the left end is increased, causing the armature to be drawn toward the left core arm.

(4) *Neutral operation.* The bias windings must be used for operation in neutral circuits. They are wired in series and are energized constantly. The magnetic field set up by the left bias winding is poled to aid the magnetic

field of the permanent magnet. The field of the right bias winding *opposes* the field of the permanent magnet.

(a) *Neutral spacing impulse.* During reception of a neutral spacing impulse, current is not present in the line windings. The combined magnetic fields of the energized bias windings and the permanent magnet cause the blade end of the armature to be pulled toward the left core arm away from the selector levers.

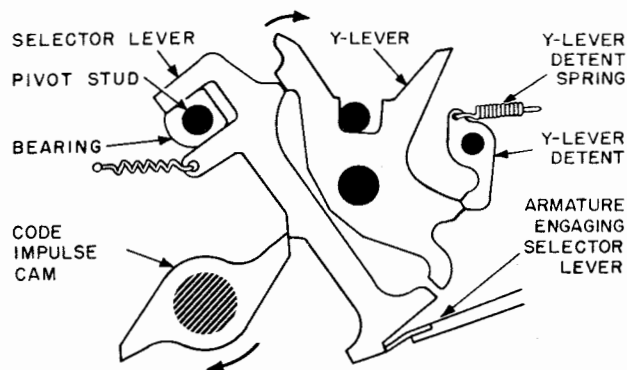
(b) *Neutral marking impulse.* During reception of a neutral marking impulse, current flows in both windings. The current value in the line winding normally is twice the bias current value. The field set up by the energized line winding around the left core arm *opposes* the combined magnetic fields of the left bias winding and the permanent magnet. The energized line winding around the right core arm *aids* the field of the permanent magnet and *opposes* the field of the right bias winding.

b. *Transformation of Electrical Impulses Into Mechanical Settings.* Figure 56 shows the parts of the selector mechanism that are used to transform electrical code impulses received from the signal line into mechanical settings. Primarily, they consist of recording the movements made by the selector magnet armature in accordance with the code impulses received. The windings of the magnet cause the armature to move to one of two positions, depending on whether the impulse received is a marking or a spacing impulse (a above). This position is then recorded by the subsequent positioning of the selector mechanism of the page printing mechanism.

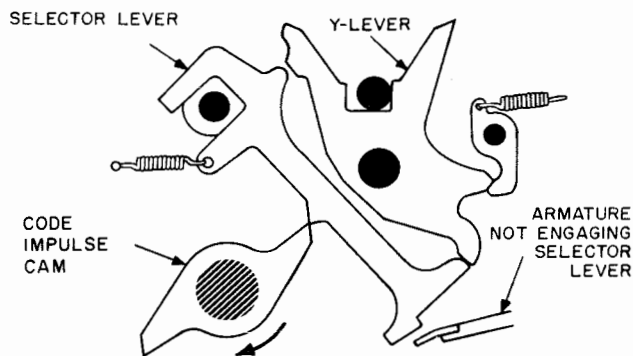
c. *Selecting Operation.*

(1) Each of the five electrical impulses that comprise the code for a character is recorded in the form of a clockwise or counterclockwise movement of five corresponding Y-levers. This is accomplished through the use of five code impulse cams operating in conjunction with five selector levers and

the armature. The five Y-levers are mounted on a common Y-lever pivot stud. The five selector levers are mounted on the selector lever pivot stud, and the five code impulse cams are mounted on a shaft with the cam lobes projecting at angles from the camshaft. Each cam lobe operates in conjunction with only one selector lever and one Y-lever. Thus, there are five planes of parts, one in back of the other, each containing one of these three parts. The end of the selector magnet armature is broad enough to engage all five selector levers. Each of these five sets of parts records one of the five code impulses; the first set records the first impulse, the second set the second impulse, etc.



A. RECORDING MARKING IMPULSE



B. RECORDING SPACING IMPULSE

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Figure 56. Impulse recording portion of the selector mechanism.

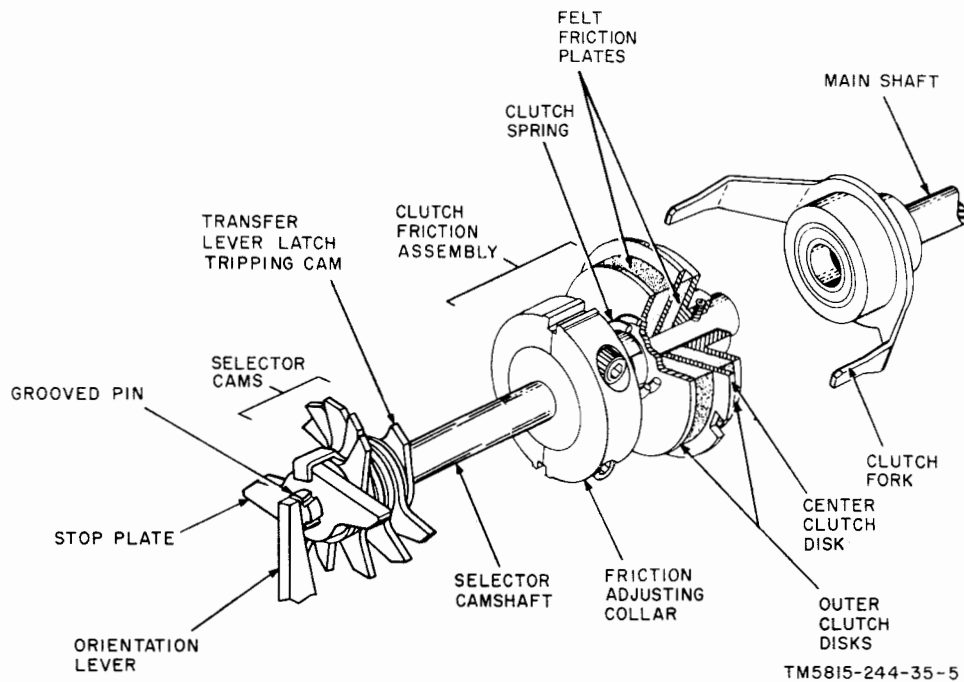


Figure 57. Selector camshaft and selector friction clutch.

- (2) During the time a marking impulse is received (A, fig. 55 and A, fig. 56), the selector magnet armature is held upward in the marking position (in engagement with the lower end of all five selector levers). Near the middle of this period, a lobe of the selector cam corresponding to the code impulse being received (the first cam for the first impulse or the second cam for the second impulse, etc.) rotates to the position shown and raise the selector lever. The armature prevents movement of the lower end of the selector lever, and its upper end is forced to slide on the bearing. The upper end of the selector lever pushes against the Y-lever, turning it clockwise (unless it is already in that position). Further rotation of the selector camshaft permits the selector lever to drop back, but the Y-lever is held in the clockwise position by the Y-lever detent. *A marking impulse thus is recorded in the form of the clockwise position of a Y-lever.*
- (3) During the time a spacing impulse is received (B, fig. 56), the selector mag-

net armature is moved away from the selector levers. Near the middle of this period, the selector cam lobe corresponding to the impulse being received will rotate to the position shown and raise the selector lever. The end of the armature now does not prevent movement of the lower end of the selector lever; therefore it is free to move. In moving, the selector lever pushes against the lower portion of the Y-lever, turning it counterclockwise (unless it is already in that position). The Y-lever detent holds the Y-lever in the space position. *A spacing impulse thus is recorded in the form of the counterclockwise position of a Y-lever.*

- (4) Each code impulse, in turn, thus is recorded in the form of a clockwise (marking) or a counterclockwise (spacing) setting of its corresponding Y-lever.

*d. Synchronization.*

- (1) The selector cams are set into motion from a stopped position at the beginning of each code group and stopped at the end of each code group to syn-

chronize the selector cam operation with the incoming electrical impulses. The selector camshaft is driven from the end of the main shaft by a friction clutch (fig. 57). When no messages are being received, current flows in the line windings of the selector magnet, and the selector camshaft is prevented from turning by the interoperation of the selector magnet armature, stop lever, and stop plate (fig. 58). When raised, the armature engages the stop lever which prevents the stop plate and selector camshaft from turning (A, fig. 58). When the start (no-current) impulse for a code group is received, the armature moves downward, releasing the stop lever and stop plate (B, fig. 58). The selector camshaft (fig. 57), driven by the friction clutch, immediately starts to turn, bringing a lobe of the first selector cam into engagement with its selector lever by the time the next impulse (first code impulse) is received.

- (2) Thereafter, a lobe of each of the remaining five code impulse cams engages its corresponding selector lever in sequence (due to the angular displacement of the cam lobes with respect to each other). The speed with which the selector camshaft rotates is such that each of the five cam lobes operates its respective selector lever when the corresponding electrical impulse is being received. All five cam lobes operate their selector levers within one-half revolution of the selector camshaft. The selector camshaft is limited to making only one-half revolution per code group because the stop impulse raises the selector magnet armature to engage the stop lever after the last code impulse is received. The other end of the stop plate which then comes around is held by the stop lever to stop the camshaft.

e. *Summary.* The operations described in a through d above are summarized in the sequence chart below.

<i>Receiving sequence chart</i>	
1	Start impulse received.
2	Selector magnet armature moves away from stop lever.
3	Stop lever released.
4	Stop plate released.
5	Selector camshaft starts revolving.
6	First code impulse pulls armature up or armature remains down, depending on whether code impulse is marking or spacing.
7	No. 1 selector cam lobe lifts No. 1 selector lever.
8	No. 1 selector lever pivots about end of armature if armature is up (marking), or about selector lever pivot stud if armature is down (spacing).
9	No. 1 selector lever pushes No. 1 Y-lever clockwise if selector lever is pivoting about armature (marking) or counterclockwise if selector lever is pivoting about pivot stud (spacing).
10	Second, third, fourth, and fifth code impulses in turn operate the corresponding parts of the selector mechanism, as described above for the first impulse, so that each Y-lever is set clockwise or counterclockwise for its corresponding mark of space impulse.
11	Latch-tripping cam turns transfer lever latch.
<small><i>Note.</i> The action described in transfer operation sequence chart (par. 43e) begins at this point in the sequence of operations.</small>	
12	Stop impulse received.
13	Armature moves in path of stop lever.
14	Stop lever latched by armature.
15	Stop plate engages stop lever.
16	Stop plate held by stop lever.
17	Selector camshaft stopped at end of $\frac{1}{2}$ revolution.

### 43. Page Printer Transfer Operation

The purpose of the transfer operation is to pivot each of the five code rings to a position (marking or spacing) to correspond with the nature (marking or spacing) of each of the five code impulses of a received code group. When positioned, the code rings select a stop bar (par. 44) which controls the selection of the character to be printed or the function (non-printing mechanical operation) to be performed. The transfer operation occurs automatically, immediately after the five Y-levers are positioned clockwise or counterclockwise in

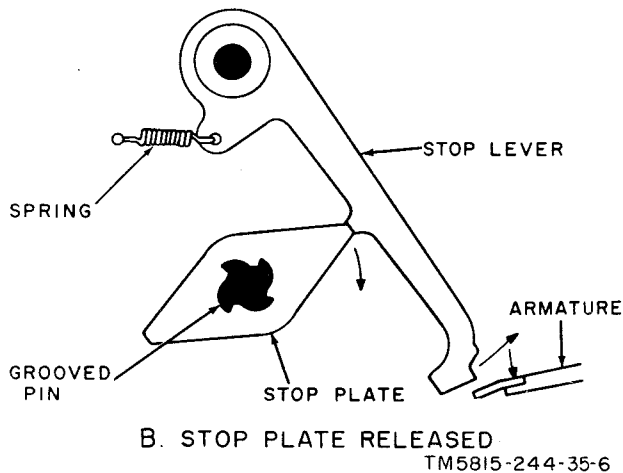
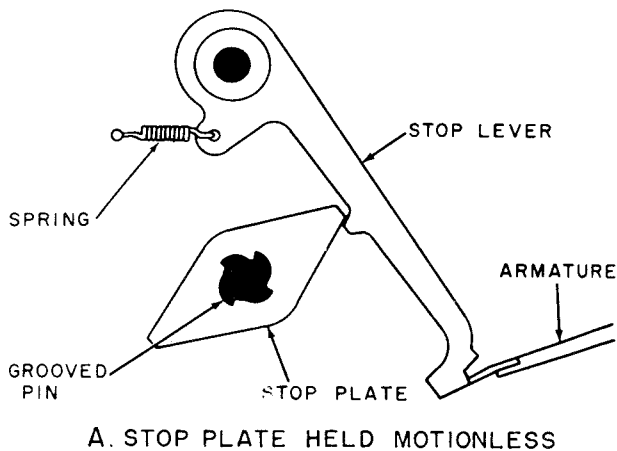


Figure 58. Selector camshaft and stop plate.

accordance with the nature of each of the five code impulses of the code group (par. 42c).

Five T-levers (fig. 59) are used to position the code rings. The T-levers are mounted on a common pivot stud that is attached to one arm of the transfer lever. Each T-lever is mounted above, and in alignment with, an associated Y-lever. The vertical arm of each T-lever is in engagement with a slot in the tail of an associated code ring. The five code rings pivot around the stop arm shaft to the marking and spacing positions as described in *a* and *b* below. During printing, the code rings are locked in their selected positions (*d* below).

*a. Condition Before Transfer Operation.* While the five Y-levers are being positioned (par. 42), the transfer lever latch holds the transfer lever in the counterclockwise position

against the pull of the transfer lever spring, and the five T-levers are held above their respective Y-levers.

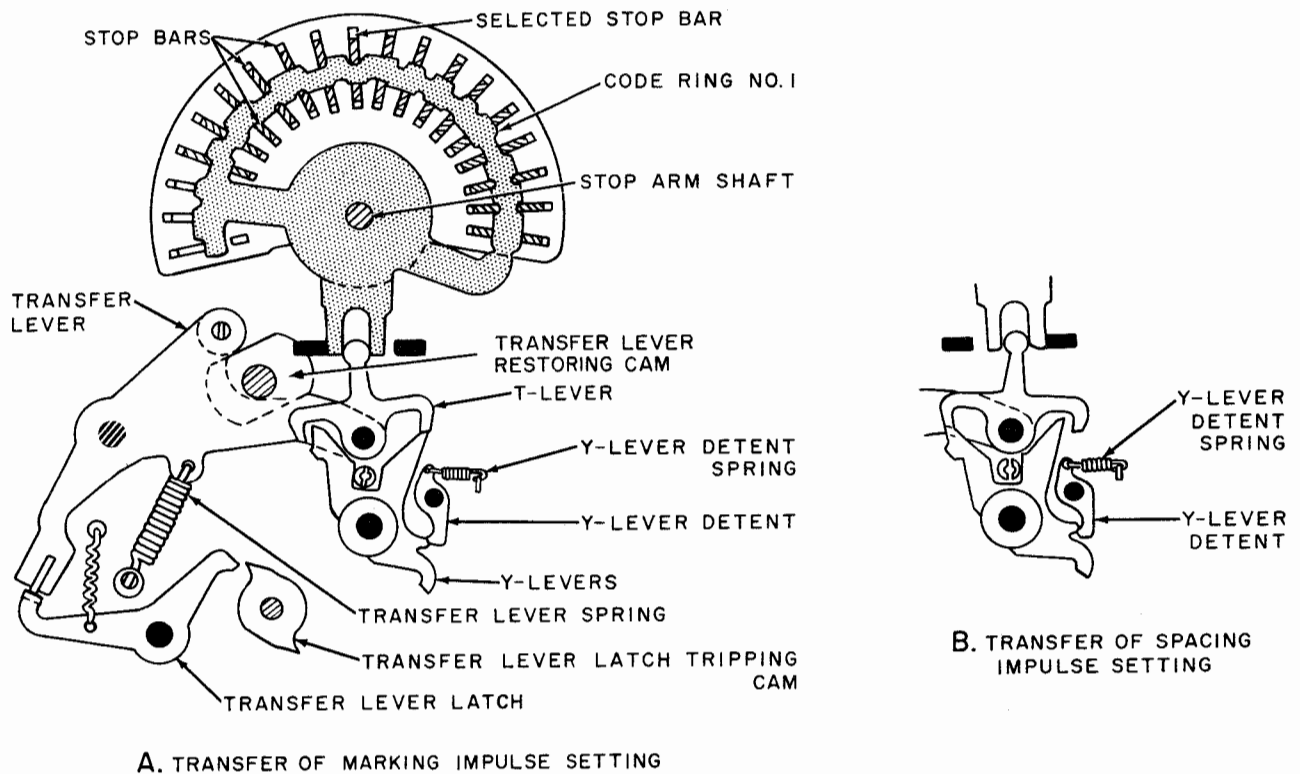
*b. Positioning T-levers and Code Rings.* Immediately after the fifth selector cam positions the fifth Y-lever, a lobe of the transfer lever latch tripping cam (fig. 59) pushes against one arm of the transfer lever latch. The latch pivots counterclockwise, releasing the lower arm of the transfer lever. The tension of the transfer lever spring turns the transfer lever clockwise and the T-levers move downward, against the upper arms of the Y-levers.

- (1) *Setting code ring to marking position.* If a Y-lever is in the marking (clockwise) position when its associated T-lever moves downward, the right-hand arm of the T-lever strikes the right-hand arm of the Y-lever (A, fig. 59). The left-hand arm of the T-lever clears the left-hand arm of the Y-lever and the T-lever pivots counterclockwise, causing its associated code ring to pivot clockwise to the marking position.
- (2) *Setting code ring to spacing position.* If a Y-lever is in the spacing (counterclockwise) position when the T-levers move downward, the left-hand arm of its associated T-lever strikes the left-hand arm of the Y-lever and the T-lever pivots clockwise, causing its associated code ring to pivot counterclockwise to the spacing position (B, fig. 59).

*c. Restoring Transfer Lever to Latched Position.* When the transfer operation occurs (*b* above), the transfer lever must be restored to its original position (latched by the transfer lever latch) to permit the positioning of the Y-levers in accordance with the code impulses of the next code group.

- (1) During the transfer operation (*b* above), the transfer lever roller moves toward a low part of the transfer lever restoring cam (fig. 59). Immediately after the transfer operation occurs, the restoring cam starts to turn, ((2) below). A lobe of the restoring cam pushes the roller upward





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Figure 59. Transfer mechanism operation.

to cause the transfer lever to pivot counterclockwise slightly until it is latched by the transfer lever latch.

- (2) The transfer lever restoring cam is fastened to one end of the function shaft (fig. 60). The function shaft driving gear on the main shaft and the function shaft driven gear on the function shaft rotate continuously when the motor is operating. The driven gear rotates freely on the function shaft and the function shaft does not turn while the Y-levers are being positioned. When the transfer lever moves the T-levers downward to accomplish the transfer operation, the function clutch latch moves downward also, releasing an arm of the function clutch drum. This action permits the function clutch spring to push the function clutch drum along the function shaft until the teeth of the drum are meshed with the teeth cut into the side of the rotating func-

tion shaft driven gear. The clutch drum is keyed to the flexible coupling disk, the disk is fastened firmly to the function shaft. Therefore, the function shaft rotates whenever the function clutch drum is pushed against the function shaft driven gear.

- (3) When a lobe of the transfer lever restoring cam pushes the transfer lever roller upward ((1) above), the function clutch latch also moves upward, into the path of an arm of the function clutch drum. When the arm of the drum strikes the roller of the function clutch latch, the drum is cammed away from the teeth of the function shaft driven gear, and the function shaft stops turning. The shaft remains stationary until another transfer operation occurs after the next code group is received.

*d. Locking Code Rings in Selected Position.* Immediately after the transfer operation occurs, the code-ring locking bail locks the code

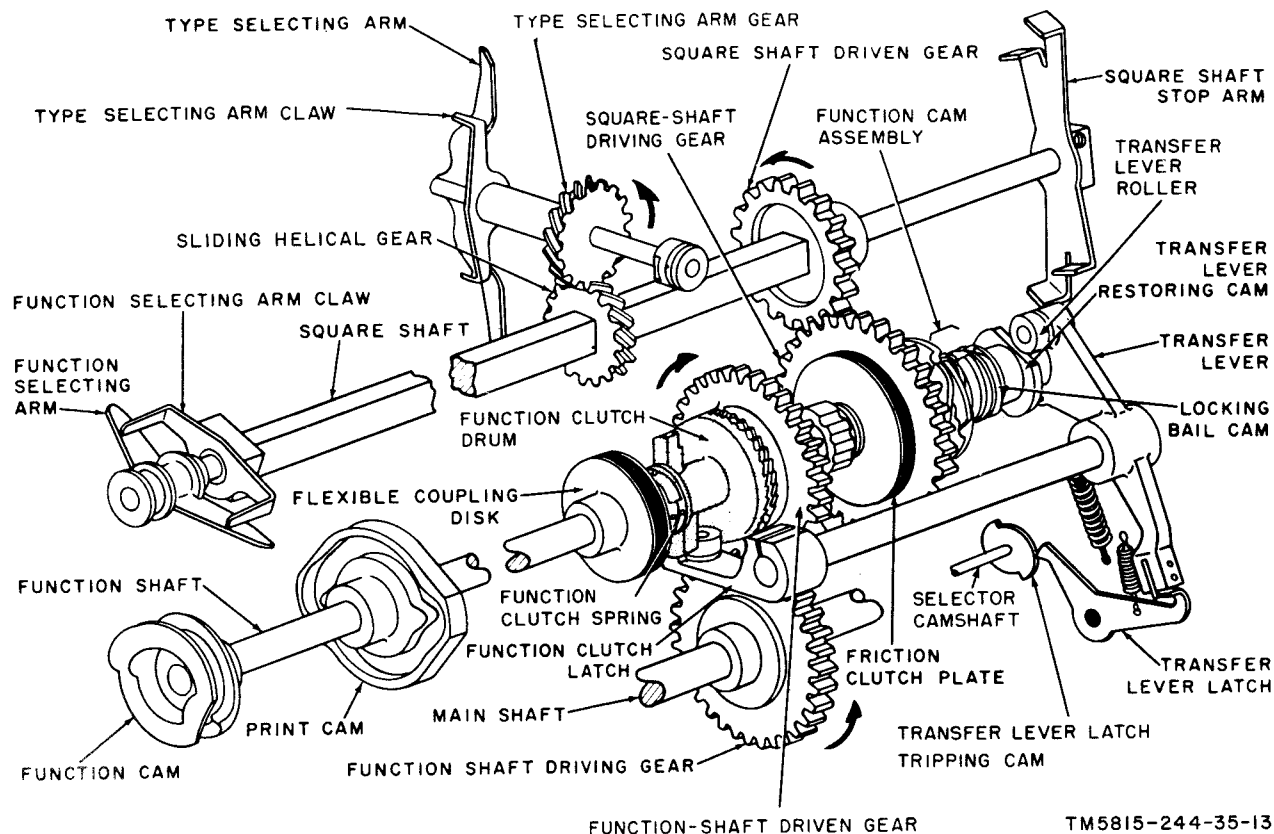


Figure 60. Mechanical power transfer from main shaft to function shaft and square shaft.

rings in their selected positions to prevent movement of the code rings during the printing operation (par. 45). The locking bail cam on the function shaft (figs. 60 and 61) controls operation of the code-ring locking bail as described below.

- (1) While the Y-levers are being positioned, the function shaft and locking bail cam are stationary, the cam follower is against a lobe of the locking bail cam, the cam follower lever is held in the clockwise position, the locking bail lever is in the counterclockwise position, and the lower end of the code-ring locking bail is held away from the code rings.
- (2) The locking bail cam on the function shaft begins to turn *after* the transfer operation (c(2) above) occurs. The cam follower drops to a low part of the cam, the cam follower lever pivots counterclockwise, the locking bail

lever pivots clockwise, and the code-ring locking bail moves against the code rings, locking the code rings in position until the *opposite* lobe of the locking bail cam moves against the cam follower to release the code rings for the next transfer operation.

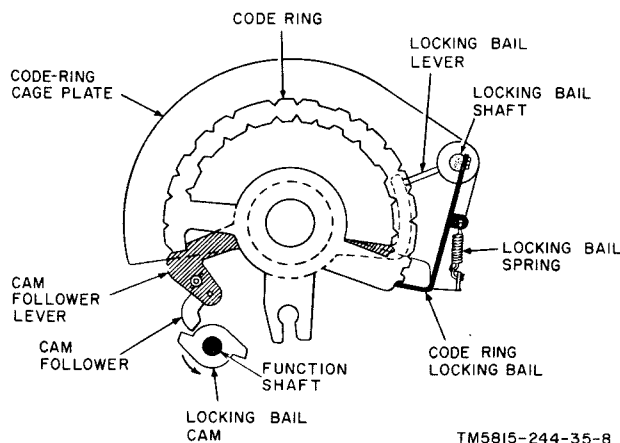


Figure 61. Code-ring locking mechanism.

e. *Sequence of Transfer Operations.* The following chart lists the sequence of operations that occurs in the page printer immediately after the fifth code impulse is received.

Transfer operation sequence chart		
1	Transfer lever latch tripping cam pivots transfer-lever latch (fig. 59).	
2	Transfer lever latch releases transfer lever (fig. 59).	
3	Transfer lever spring pulls transfer lever clockwise.	
4	Transfer lever moves five T-levers downward.	Function clutch latch moves downward, releasing function clutch drum (fig. 60).
5	T-levers transfer settings of Y-levers to code rings.	Function clutch spring pushes function clutch drum against function shaft driven gear.
6	Code rings form groove in line with stop bar to be selected.	Function shaft starts $\frac{1}{2}$ revolution.
7	Stop bar moves into groove in code rings; previously selected stop bar pushed to non-selected position.	Locking bail cam follower moves to low part of cam; locking bail moves against code rings to lock them in selected position (fig. 61).
8	Selected character printed or function accomplished.	
9	Transfer lever restoring cam on function shaft pivots transfer lever counterclockwise (fig. 59).	Lobe of locking bail cam pivots cam follower lever to move locking bail away from code rings (fig. 61).
10	T-levers move upward, away from Y-levers.	Function clutch latch moves upward into path of arm on function clutch drum.
11	Transfer lever latch locks transfer lever in counterclockwise position.	Function clutch latch cams function clutch drum out of engagement with function shaft driven gear: function shaft stops ( $\frac{1}{2}$ revolution completed).

#### 44. Selection of Stop Bars by Code Rings

A stop bar is selected by the code rings immediately after the five code rings are set to the marking or spacing positions as determined by the five code impulses of the received code

group (par. 42c). Thirty-two of the thirty-five stop bars are used to control the point at which rotation of the square shaft stop arm (fig. 62) is halted after each code group is received. The remaining three stop bars do *not* affect rotation of the square shaft stop arm; they activate mechanisms for the carriage-return, line-feed, and figures shift operations (pars. 49, 51, and 52).

a. *Stop Bar Location.* The stop bars are mounted in slots in the code-ring cage. Thirty-two of the stop bars are arranged in pairs in two semicircles, with one outer stop bar and one inner stop bar mounted in each slot. A compression type stop bar spring is mounted between each pair of stop bars (fig. 63). The pressure of the springs causes the *opposite* ends of the 16 *outer* stop bars to press *inward*, against the outer surface of the notched, curved portion of the 5 code rings. The same spring pressure causes the 16 *inner* stop bars to press *outward*, against the inner, notched surface of the code rings. Each of the 32 possible code combinations (fig. 35) is assigned to one of the 32 stop bars. When a code combination is received, its assigned stop bar is selected by the code rings as described in b below.

b. *Stop Bar Selection.* The pattern of notches in each code ring differs from the notch pattern of the other four code rings. When the transfer operation occurs, each of the code rings is positioned clockwise or counterclockwise, and the five code rings form a groove in line with one of the stop bars. Pressure of the stop bar spring causes the stop bar to move into the groove formed by the code rings, and the

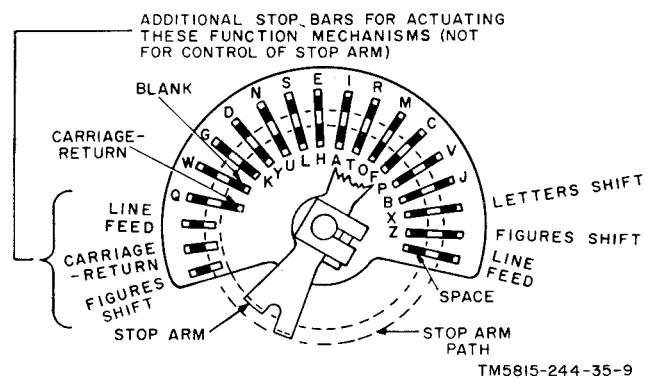
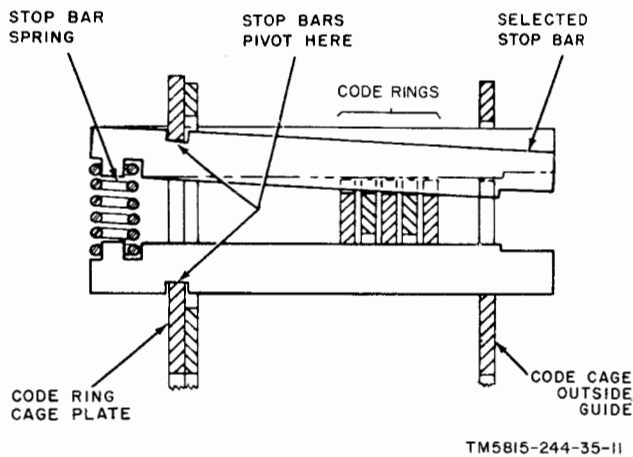


Figure 62. Side view of code-ring cage, showing location of stop bars.



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Figure 63. Cross-sectional view of stop bars in code-ring cage.

end opposite the spring moves into the path of one of the projections of the square shaft stop arm. When the square shaft stop arm starts rotating, one of its projections strikes against the blocking end of the selected stop bar, preventing further rotation of the stop arm. The point at which the stop arm is halted determines the selection of the character to be printed (par. 45) or the function to be performed (pars. 46-56). Figure 62 illustrates the location of each of the stop bars. The ends of the three extra function stop bars do not project into the path of the square shaft stop arm and therefore have no control over rotation of the stop arm.

## 45. Printing Operation

The printing operation occurs immediately after a stop bar is selected by the code rings (par. 44). The printing operation includes selecting the character (*a* below) and printing the selected character (*b* below).

*a. Character Selection.* The type bars and their associated connecting bars are mounted in a semicircle in the carriage of the page printer (figs. 64 and 166). The type selecting arm is geared to the square shaft and rotates with it. The square shaft starts to turn immediately after the transfer operation occurs and stops when it strikes against the selected stop bar (par. 44*b*). When the selected stop bar halts rotation of the square shaft, it causes one of the fingers of the type selecting arm to be aligned with one of the connecting bars. The

type selecting arm then pushes the connecting bar forward to cause printing (*b* below). Power to rotate the square shaft is obtained from the main shaft (*c* below). Bouncing of the square shaft stop arm when it strikes the selected stop bar is prevented by the stop arm antibounce clutch (*d* below).

*Note.* The type selecting arm can be halted at any of 32 different positions. The standard communication page printers include 26 type bars and the weather communications page printer (TT-118/FG) includes one additional type bar (27) which is used to print a dash in the figures shift position when the blank code group is received. The positions of the type selecting arm that are not used for printing are used to perform other necessary functional operations (carriage-return, line feed, etc.).

*b. Printing Selected Character.* Printing occurs immediately after rotation of the type selecting arm is halted (*a* above). A lobe of the print cam (fig. 65) causes the print cam follower to pivot counterclockwise, causing the print bail blade to move forward sharply. The print bail blade is engaged in the groove of the round nut on the shaft of the type selecting arm. The type selecting arm pushes the aligned connecting bar forward to cause the type bar to strike against the platen. The roller of the print cam follower then moves to a low portion of the print cam, causing the type selecting arm to return to the rearward position. The print cam is firmly fastened to the function shaft (fig. 60) and turns  $\frac{1}{2}$  revolution each time the transfer lever latch tripping cam trips the transfer lever (par. 43*b*).

*c. Square Shaft Rotation.* The square shaft does not turn while the code impulses are being received in the page printer and the Y-levers are being positioned. When the last Y-lever is positioned, the transfer lever latch tripping cam trips the transfer lever latch to start the transfer operation, and the function clutch latch moves downward (par. 43*b* and *c*). The teeth of the function clutch drum engage the teeth in the side of the function shaft driven gear. At this time, the function shaft starts turning because the function shaft driven gear is in mesh with the constantly rotating function shaft driving gear on the main shaft. The square shaft driving gear on the function shaft is driven by a friction clutch that includes a clutch disk and a felt friction plate on each side

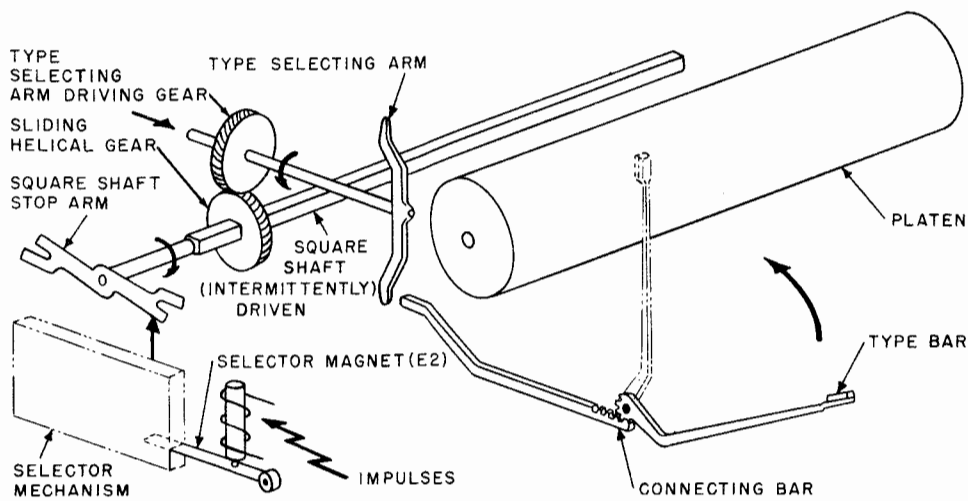


Figure 64. Typing unit basic components.

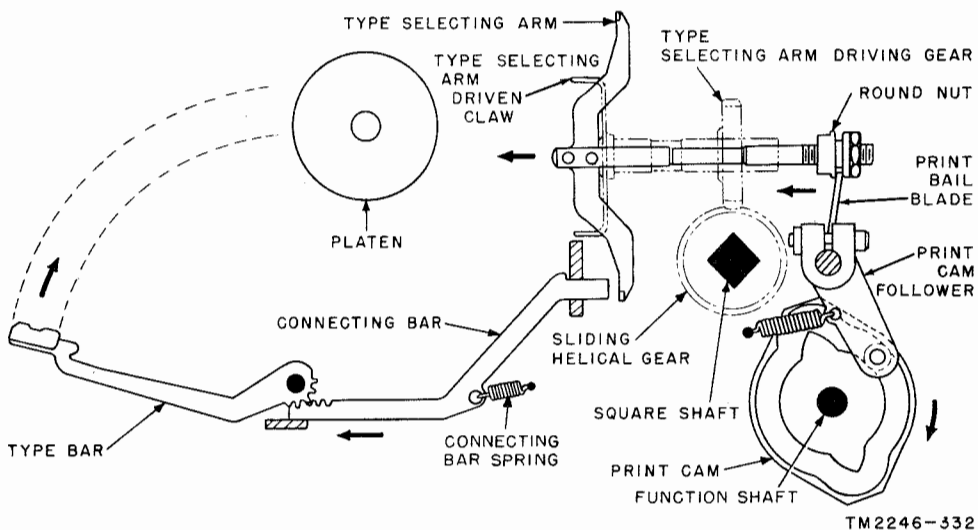
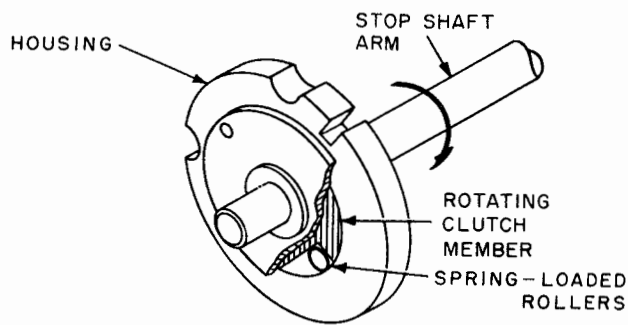


Figure 65. Cross-section of teletypewriter showing operation of printing mechanism.

of the gear. When the function shaft turns, the friction clutch causes the square shaft driving gear to turn the square shaft driven gear and the square shaft until the stop arm strikes the selected stop bar. The function shaft continues to turn until the function clutch drum is cammed away from the function shaft driven gear by the function clutch latch which has been moved upward to the latching position by the transfer lever restoring cam.

d. *Stop Arm Antibounce Clutch.* The square shaft stop arm must not bounce backward when the stop arm strikes the selected stop bar (b above). This is necessary because a

finger of the type-selecting arm must be aligned with one of the connecting bars when the type selecting arm is moved forward to cause printing. Stop arm bounce is prevented by the anti-bounce clutch, which consists of the housing, rotating clutch member, and four spring-loaded rollers (fig. 66). The housing is pinned to the code-ring cage and cannot rotate. The rotating clutch member is part of the stop arm shaft and rotates clockwise with the shaft until the stop arm strikes the selected stop bar. Stop arm bounce (counterclockwise movement of the rotating clutch member) is not possible, because the springs keep the rollers wedged be-



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Figure 66. Antibounce clutch for stop arm.

tween the flat surfaces of the rotating clutch member and the inner circumference of the housing.

*e. Sequence of Printing Operations.* The following chart lists the sequence of operations that causes the printing of a character by the page printer.

Printing operation sequence chart

1	As a result of transfer operation (par. 43), selected stop bar moves into groove in code rings; function shaft starts $\frac{1}{2}$ revolution (fig. 60).	
2	Square shaft stop arm and type selecting arm.	Print cam starts $\frac{1}{2}$ revolution (fig. 65).
3	Square shaft stop arm strikes selected stop bar; type selecting arm aligned with correct connecting bar.	Lobe of print cam pivots print cam follower.
4	Print bail blade pushes type selecting arm and connecting bar forward.	
5	Type bar moves upward to print character.	
6	Print cam follower moves against low part of print cam.	
7	Print bail blade, type selecting arm, and connecting bar moved rearward; type bar moves downward.	
8	Print cam and function shaft complete $\frac{1}{2}$ revolution.	

## 46. Functions

The page printing mechanism performs two types of operations, printing and non-printing. The printing operation is described in paragraph 45. The non-printing operations, called functions (pars. 47-56), consists of rotating the platen for line-feed, moving the platen upward for printing figures and downward for letters, returning the carriage, spacing across the line, stopping the motor, and ringing the

signal bell. The letters shift, spacing, motor stop, and signal bell functions are operated by the function cam and function selecting arm (fig. 67). The figures shift, line-feed, and carriage-return functions are controlled by the function stop bars in the code-ring cage.

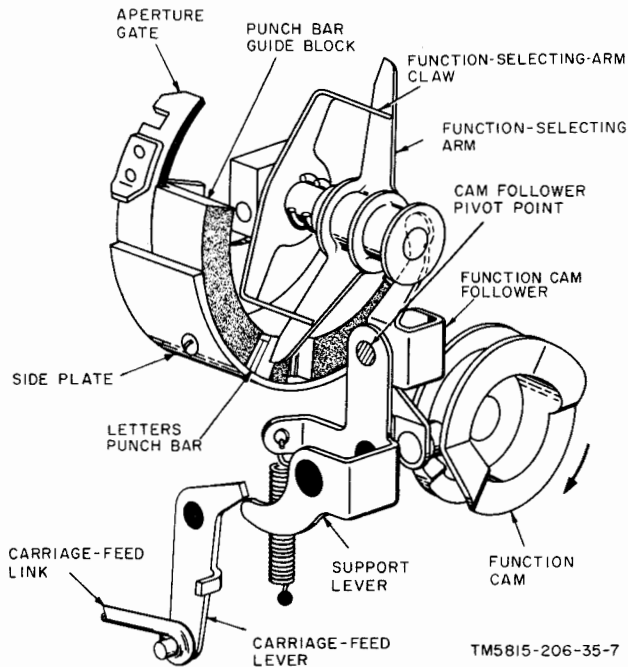
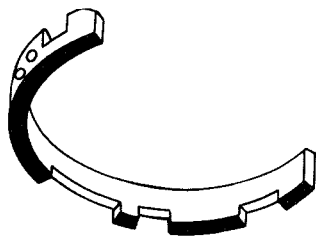


Figure 67. Function selecting arm and associated mechanism.

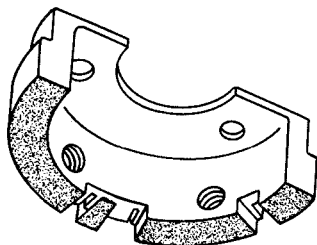
## 47. Function Cam and Function Selecting Arm Controlled Functions

*a.* The function selecting arm is mounted on one end of the square shaft (fig. 60) and rotates and stops with the shaft. It moves axially in and out to operate the punch bars mounted in the punch bar guide block (figs. 67 and 68). However, axial movement does not occur for all 32 possible stopped positions of the function selecting arm. The function cam, mounted on one end of the function shaft (fig. 60), moves the lower end of the function cam follower each time the function shaft makes one-half revolution. If axial movement of the function selecting arm is not blocked, the function cam follower pivots about its midpoint so that its upper end pushes the function selecting arm inward (fig. 67). However, if the function selecting arm is blocked to prevent axial movement, the function cam follower pivots about its upper end and forces the support lever, on

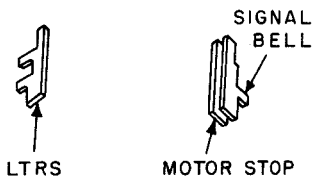
APERTURE GATE



PUNCH BAR GUIDE BLOCK



PUNCH BARS



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Figure 68. Punch bar guide block, aperture gate, and punch bars.

which it is mounted, to pivot. This movement of the support lever feeds the carriage to the right when printing or spacing takes place. Axial movement of the function selecting arm takes place *only* when functions are performed. When characters are printed or spacing operations take place, the support lever pivots to cause carriage-feed.

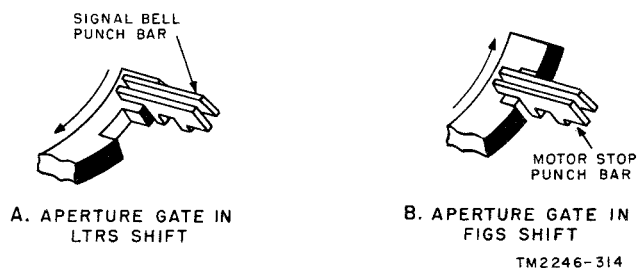
b. The axial movement of the function selecting arm is governed by the construction of the punch bar guide block and its associated aperture gate (fig. 68). The outer surface of the guide block is cut away in three areas. When the function selecting arm is stopped at a position in line with a solid portion (shown shaded in all views), of the punch bar guide block, axial movement of the arm is prevented. It can be moved axially only when it is stopped at a position in line with one of the cutaway areas. Three function punch bars (letters, motor stop, and signal bell) are mounted in grooves located in the cutaway areas and are operated by axial movement of the function

selecting arm. With three exceptions (the H, S, and spacing positions), the areas which are not cut away correspond to the position to which the function selecting arm is turned when printed characters are selected.

*Note.* The TT-118/FG includes a punch bar in the blank code group slot of the guide block in order to block axial movement of the function selecting arm when the platen is in the figures position. The dash symbol is printed; therefore, a carriage-feed operation must take place. The blank punch bar is spring loaded and returns to its original position with the retraction of the function selecting arm.

c. The letters H and S print only in the letters position of the platen. In the figures shift position of the platen, the position of the function selecting arm is used to operate the punch bar for the motor stop and signal bell functions. These two punch bars are operable in the figures shift position of the platen and are inoperable (in order to block the function selecting arm) in the letters shift position. This is accomplished by the aperture gate which slides in the semicircular groove formed by the punch bar guide block and the side plate (fig. 67). The position of the aperture gate is controlled by the position of the platen. It has cutaway portions located so that in the letters position the motor stop and signal bell punch bars are blocked, and in the figures position the punch bars are free to move (fig. 69).

d. Figure 70 shows the 32 points at which the function selecting arm is positioned. It also shows how the cutaway portions of the aperture gate and the cutaway portion of the guide block are used to allow the function selecting arm to move axially, or to block such movement for functions in the two platen positions. The raised portions of the aperture gate are shown black, and the raised portions of the punch bar guide block are shown shaded.



A. APERTURE GATE IN LTRS SHIFT

B. APERTURE GATE IN FIGS SHIFT

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Figure 69. Motor stop and signal bell punch bars in blocked and unblocked positions.

e. Operations described in *a* through *d* above are summarized in the following chart.

Square shaft and function shaft operation sequence chart

1	Sequence starts with transfer operation; function shaft starts to revolve.			
2	Square shaft stop arm released by previous stop bar unless previous signal was repeated.			
3	Square shaft and type selecting arm rotate unless previous signal was repeated.			
4	Square shaft stop arm arrested by operated stop bar.			
5	Type selecting arm stopped in corresponding positions.			
6	Print cam lifts, print cam follower	Function cam lifts follower.		
7	Print bail blade rocked forward	Function cam follower pivots about upper end if function selection arm is blocked, <sup>b</sup> or function cam follower pivots about midpoint if function selecting arm is not blocked. <sup>b</sup>		
8	Type selecting arm plunged forward	If function selecting arm is blocked, carriage feeds (see Carriage-feed Sequence Chart, par. 48).	Function selecting arm plunged axially inward.	
9a	Selected connecting bar struck forward. <sup>a</sup>	Ribbon lifts (see Ribbon Lifter Sequence Chart, par. 58).	Print cam returns print cam follower.	If function selecting arm is not blocked, function punch bar for letters, signal bell, or motor stop is moved inward; no punch bar is struck when carriage return line feed, or figures functions, or blank is selected (see appropriate sequence chart for each function).
9b	----- Type selecting arm drawn back.			
9c	Character printed on paper against platen.			
10	Connecting bar moves back.			
11	Ribbon drops (see Ribbon Lifter Sequence Chart).			
12	Function shaft stops turning.			

<sup>a</sup> Except for certain functions.

<sup>b</sup> With platen in letters shift, function selecting arm is blocked for all letters. With platen in figures shift, function selecting arm is blocked for all letters except H and S.

## 48. Carriage-Feed Operation

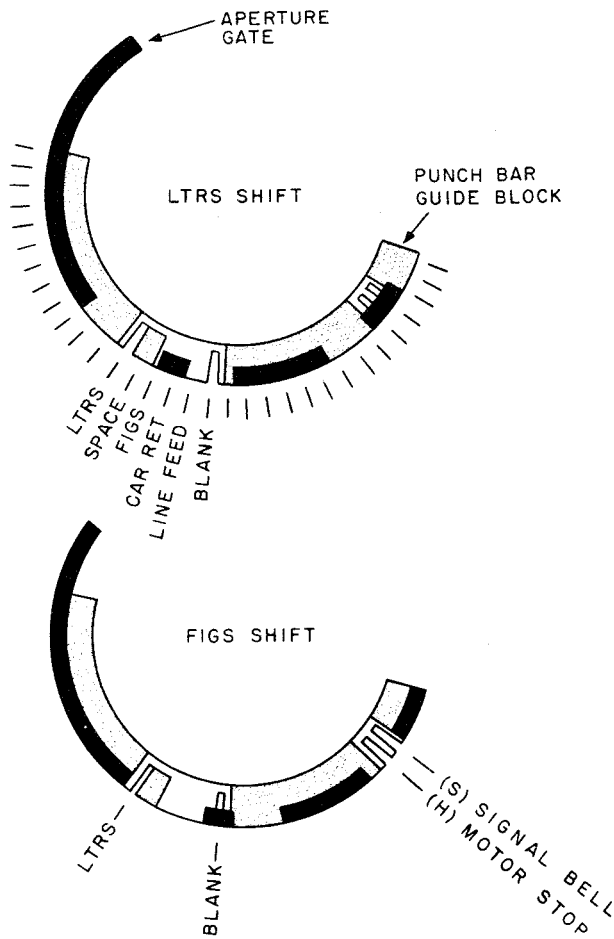
The carriage (fig. 71) moves one space to the right automatically each time a character is printed or the space code group (fig. 35) is received. The carriage-feed operation causes clockwise rotation of the carriage rack driving gear, to cause the carriage to move to the right. When a carriage-return code group is received, the carriage rack driving gear rotates counterclockwise and the carriage moves to the left-hand margin (par. 49).

*a. Carriage Support.* The front of the carriage is supported by the guide rail (17, fig. 206). The rear of the carriage is supported by the sliding helical gear (fig. 65) which is in mesh with the type selecting arm driving gear on the rear of the carriage. Two projections of the carriage support bracket (10, fig. 206) engage the groove in the sliding helical gear, and the gear slides along the length of the square

shaft as the carriage moves to the right and left.

*b. Carriage-Feed Shaft Assembly.* Power to turn the carriage-feed shaft (fig. 71) is obtained from the main shaft (carriage-feed worm on main shaft in mesh with the gear on the carriage-feed shaft). When the motor is operating, the fork of the friction clutch and the center clutch disk rotate continuously, exerting a counterclockwise torque against the ratchet wheel which is firmly fastened to the carriage-feed shaft. When the carriage-feed pawl releases the ratchet wheel (*c* below), the torque of the friction clutch turns the carriage-feed shaft, the drive collar, and the carriage-feed clutch drum. The carriage-feed driving gear turns counterclockwise to cause the carriage rack driving gear to turn clockwise to feed the carriage to the right.





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Figure 70. Location of function selecting arm positions, showing aperture gate in blocked and unblocked positions.

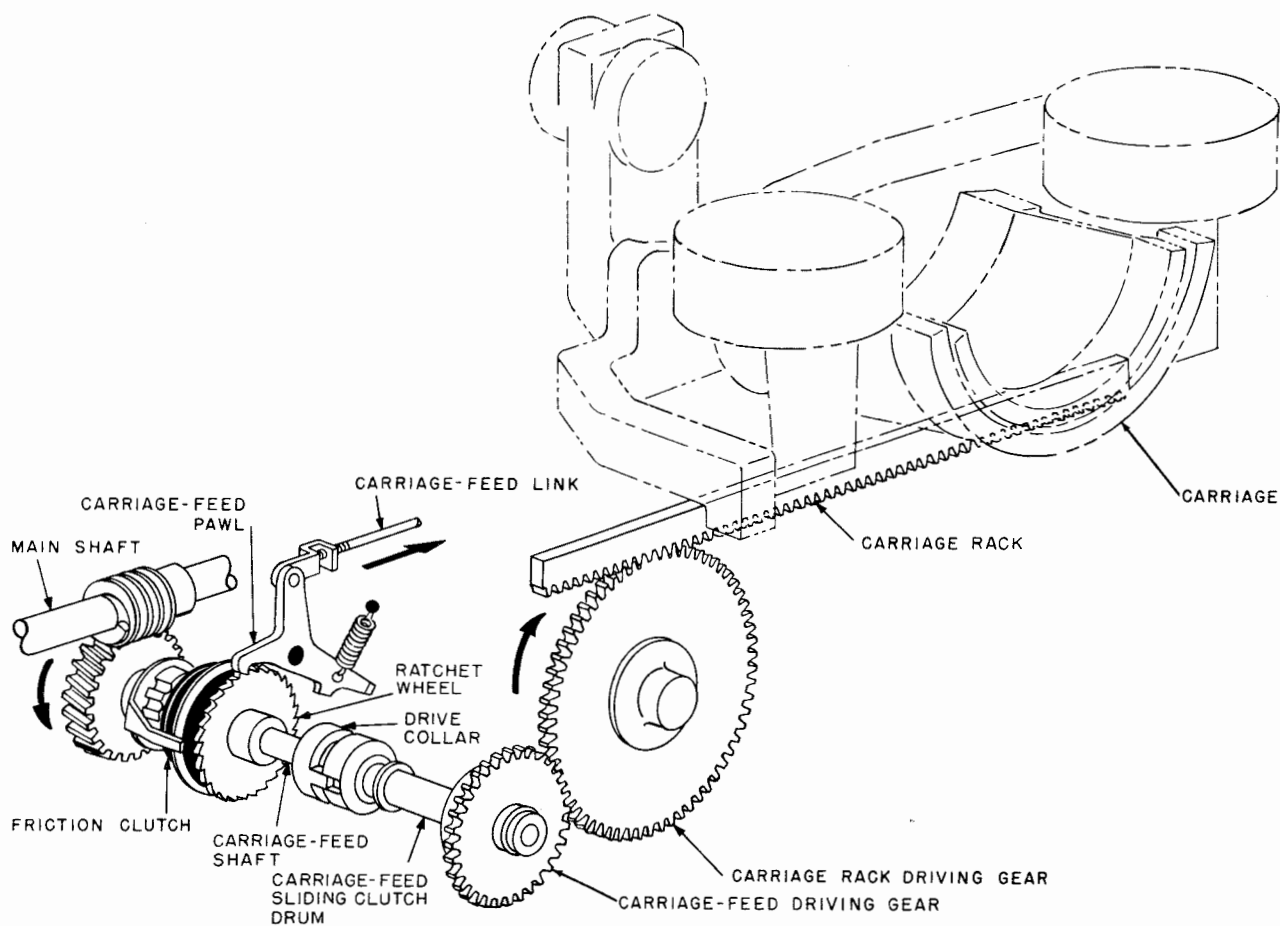
c. *Carriage-Feed Control.* Movement of the carriage-feed pawl is controlled by the carriage-feed link (fig. 71) and the function selecting arm mechanism (fig. 67).

- (1) The function selecting arm is attached to the square shaft (fig. 60), and rotates and stops with the square shaft stop arm. The function cam, on one end of the function shaft, starts to turn  $\frac{1}{2}$  revolution each time the transfer operation occurs (par. 43). When a lobe of the function cam pushes the roller end of the function cam follower (fig. 67), the upper arm of the follower pushes the function selecting arm toward the punch bar guide block.

(a) If one of the fingers of the function

selecting arm is alined with a slot in the guide block, the function selecting arm moves *into the slot* and carriage feeding does *not* occur.

- (b) If the finger moves against a solid portion of the guide block, further movement of the function selecting arm and the upper arm of the function cam follower is halted. Continued movement of the lower arm of the function cam follower to the right causes the support lever to pivot clockwise slightly and the lower arm of the support lever turns the carriage-feed lever counterclockwise, pulling the carriage-feed link horizontally.
- (2) When the carriage-feed link is pulled horizontally (fig. 71), it pivots the carriage-feed pawl slightly. The upper latching arm of the pawl releases the ratchet wheel, the lower latching arm of the pawl moves into the path of a ratchet tooth, and the friction clutch rotates the ratchet wheel slightly until it is stopped by the lower latching arm of the pawl. Continued rotation of the function cam (fig. 67) causes the roller of the function cam follower to move to a low portion of the cam. The support lever is pulled counterclockwise by its spring, permitting the feed pawl spring (fig. 71) to pull the lower latching arm of the pawl upward, away from the ratchet, and the upper latching arm downward, into the path of the next tooth on the ratchet. The carriage-feed friction clutch again turns the ratchet slightly until it is stopped by the upper latching arm of the pawl.
  - (3) Total rotation of the carriage-feed ratchet during operation of the carriage-feed pawl ((2) above), equals the distance between two teeth of the ratchet. When the ratchet rotates an amount equal to this distance, the carriage-feed driving gear and the carriage rack driving gear rotate sufficiently to move the carriage one space to the right.



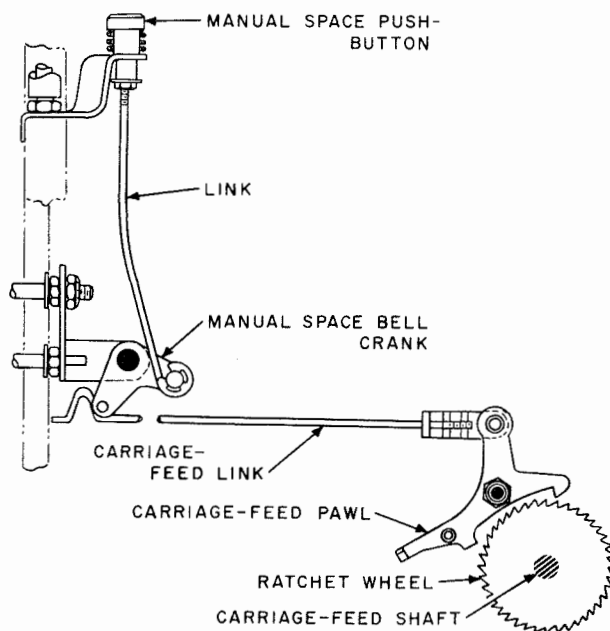
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Figure 71. Carriage-feed mechanism.

d. Sequence Chart. The following chart shows the sequence of operation for carriage feeding:

Carriage-feed sequence chart

- 1 Printed character or space selected.
- 2 Function cam lifts function cam follower.
- 3 Function cam follower pivots about its upper end (function selecting arm blocked).
- 4 Support lever turned.
- 5 Carriage-feed lever turned.
- 6 Carriage-feed link pulled.
- 7 Carriage-feed pawl turned up.
- 8 Ratchet wheel starts turning (friction clutch drive).
- 9 Carriage moves to right.
- 10 Function cam returns function cam follower.
- 11 Support lever turned back.
- 12 Carriage-feed lever turned back.
- 13 Carriage-feed link pushed back.
- 14 Carriage-feed pawl turned down.
- 15 Next ratchet wheel tooth engages carriage-feed pawl.
- 16 Ratchet wheel held and carriage stopped (carriage has moved one letter space to right).



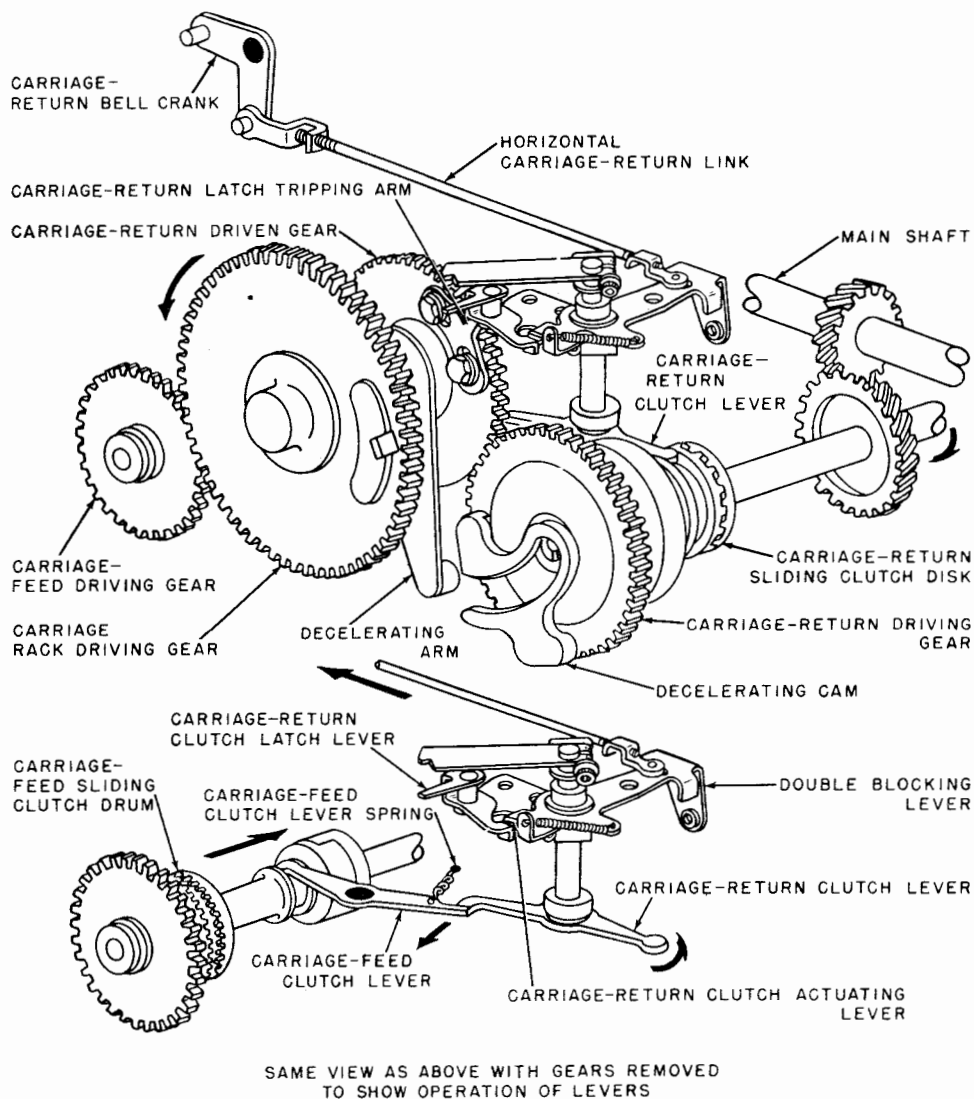
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Figure 72. Manual carriage-feed mechanism.

*e. Manual Carriage-Feed.* A manual carriage-feed mechanism (fig. 72) allows the carriage to move to the right without receiving a code group. It consists of a vertical link which connects the manual space pushbutton to a bellcrank. When the manual space pushbutton is depressed, the bellcrank is rotated against the loop in the carriage-feed link, pulling the carriage-feed pawl out of engagement with the ratchet wheel on the carriage-feed shaft. This allows the main shaft to drive the carriage-feed driving gear and carriage rack driving gear to move the carriage to the right until the manual space pushbutton is released.

## 49. Carriage-Return Operation

*a.* The carriage is moved to the left by reversing the direction of rotation of the large carriage rack driving gear (fig. 73). This is accomplished by uncoupling the carriage-feed sliding clutch drum from the small carriage-feed driving gear and engaging the carriage-return sliding clutch drum. Power from the main shaft thus is transmitted to the large carriage rack driving gear through the carriage-return clutch and the carriage-return driving and driven gears. The carriage-feed sliding clutch drum is uncoupled to permit the carriage-feed driving gear to idle while the



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Figure 73. Carriage-return driving mechanism.

carriage rack driving gear rotates counterclockwise. Both clutches are operated simultaneously, one disengaged, the other engaged, by turning the carriage-return bellcrank to pull the horizontal carriage-return link attached to the double blocking lever. The carriage-return clutch lever, which moves with the double blocking lever, engages the carriage-return sliding clutch drum directly and at the same time turns the carriage-feed clutch lever to disengage the carriage-feed sliding clutch drum.

b. The decelerating cam (fig. 73) is used to slow down the movement of the carriage as it approaches the extreme left end of its travel to reduce shock and prevent damage. The decelerating cam is mounted on the carriage-return driving gear and is engaged by the decelerating arm attached to the carriage-return driven gear. The decelerating arm engages the cam *only* when the gears have turned the carriage to within approximately seven-eighths inch of the left end. No teeth are provided on that portion of the carriage-return driven gear that would be in mesh when the decelerating arm and decelerating cam are engaged; the driving action is transferred from the gear teeth to the decelerating cam and decelerating arm. The decelerating cam and decelerating arm continue the driving action but, as the decelerating arm moves farther into the cam opening, the turning ratio between the two becomes smaller and smaller. That is, the carriage-return driven gear turns through a smaller and smaller angle for the same angular movement of the carriage-return driving gear and thus decelerates the carriage motion.

c. Both the carriage-return and carriage-feed clutches are held in the position shown in figure 73 throughout the carriage-return movement by the holding action of the carriage-return clutch latch actuating against the carriage-return clutch latch lever. When the carriage reaches the end of its travel, the carriage-return clutch latch lever is disengaged by the carriage-return latch tripping arm mounted on the carriage-return driven gear. If for any reason, the carriage-return clutch does not disengage, further action of the carriage-return driven gear causes the carriage-return latch tripping arm to contact the throwout lever. The throwout lever pivots the carriage-return

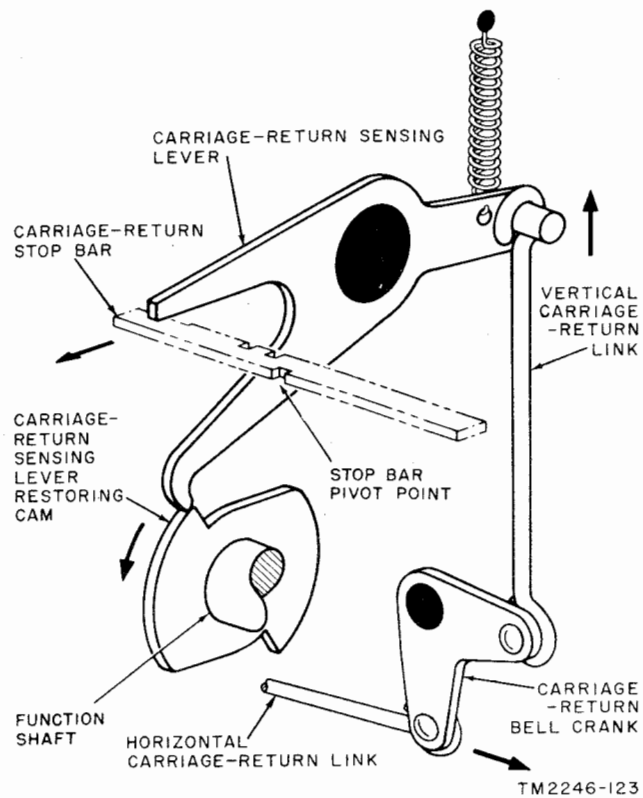


Figure 74. Carriage-return operating mechanism as seen from the rear of the teletypewriter.

clutch lever, disengaging the carriage-return clutch. This permits the carriage-feed clutch spring attached to the carriage-feed clutch lever to return the levers and clutches to the carriage-feed position (the carriage-return sliding clutch drum disengaged, and the carriage-feed sliding clutch drum engaged).

d. The pulling of the horizontal carriage-return link by turning the carriage-return bellcrank is accomplished by the mechanism shown in figure 74 when the carriage-return stop bar moves away from the carriage-return sensing lever. The stop bar (like the other two function stop bars) has an extension on the rear side of the code-ring cage, which normally engages the sensing lever.

e. The carriage-return sensing lever is released *only* when the carriage-return stop bar is selected by the code rings. The carriage-return sensing lever restoring cam, which is mounted on the function shaft, turns one-half revolution every time a code group is received. Thus, whenever the carriage-return stop bar is

operated, its sensing lever drops to a low point of the carriage-return sensing lever restoring cam and pulls the vertical carriage-return link upward, turning the carriage-return bellcrank. Before the carriage-return sensing lever restoring cam completes its one-half revolution, it restores the carriage-return sensing lever to its initial position ready to be held there by the carriage-return stop bar when the carriage-return stop bar moves back as a result of reception of a different code group.

f. The horizontal carriage-return link engages an elongated hole in the double blocking lever (fig. 73). This elongation is provided to allow the horizontal carriage-return link to move back to its unoperated position when the carriage-return sensing lever is restored, even though the carriage-return clutch actuating lever is still latched. This is necessary because it takes approximately three times as long for the carriage to return as it does for the function shaft to make one-half revolution.

g. The carriage-return clutch cannot be engaged when the carriage is in its extreme left-

hand position because the adjusting plate of the double blocking lever will engage the end of a carriage-return blocking lever (fig. 338). The double blocking lever cannot move; therefore the carriage-return clutch cannot be engaged. As soon as the carriage is moved one space, the carriage-return blocking lever moves downward enough to clear the end of the double blocking lever (fig. 337) so that the lever can move (if a carriage-return code group is received) sufficiently to operate the carriage-return clutch.

h. A manual carriage-return mechanism (fig. 75) allows the operator to return the carriage to the left-hand margin without receiving a carriage-return code group. Pushing the manual CAR. RET. pushbutton on the right front of the dust cover causes the pushbutton lever to pivot and the manual carriage-return lever trip pawl to move the double blocking lever counterclockwise so that the carriage-return mechanism operates as described above. To prevent damage to the operating mechanism by pushing the double blocking lever too far,

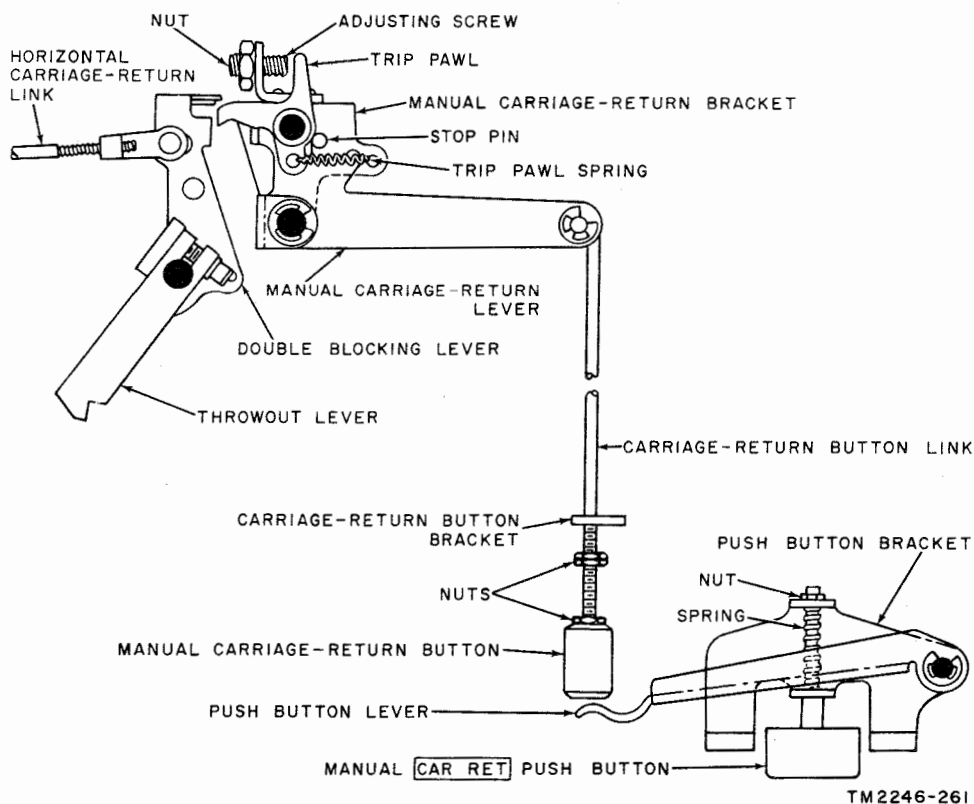


Figure 75. Manual carriage-return mechanism.

the trip pawl is automatically disengaged by the adjusting screw as soon as it has caused the mechanism to latch. When the manual CAR. RET. pushbutton is released, the entire manual carriage-return mechanism is pulled

back by the trip pawl spring to its unoperated position against a stop pin.

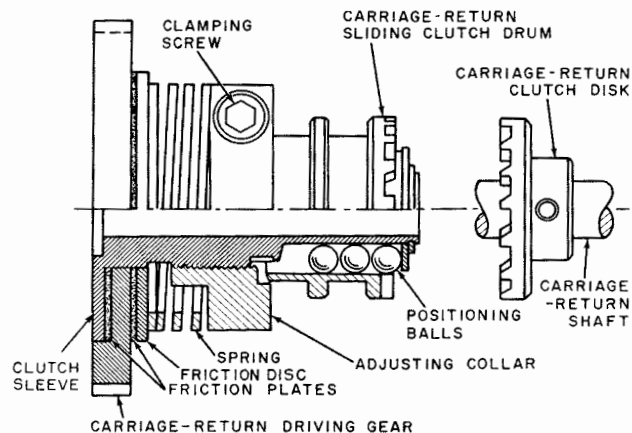
i. The operations described in this paragraph are summarized in the following chart in the sequence in which they occur.

Carriage-return sequence chart

1	Carriage-return code group received.		
2	Transfer lever released.		
3	Code rings alined for carriage return stop bar selection.		Function shaft starts revolving.
4	Carriage-return stop bars operated.		Carriage-return sensing lever restoring cam turns past carriage-return sensing lever.
5	Carriage-return sensing lever released.		
6	Vertical carriage-return link pulled up.		
7	Carriage-return bellcrank turned.		
8	Horizontal carriage-return link pulled.		
9	Double blocking lever turned and carriage-return clutch actuating lever latched.		
10	Carriage-return clutch lever turned.	Carriage-feed clutch lever turned.	Carriage-return sensing lever raised by carriage-return sensing lever restoring cam.
11	Carriage-return clutch drum engaged.	Carriage-feed clutch drum disengaged.	Carriage-return bellcrank and horizontal carriage-return link moved back.
12	Carriage-return driving gear turns carriage-return driven gear and large carriage rack driving gear to move carriage to left.	Small carriage-feed driving gear idles.	Function shaft stops (after completing 1/2 turn.)
13	Carriage nears left end of travel.		Carriage-return stop bar latches carriage-return sensing lever on receipt of next code group.
14	Decelerating arm engages decelerating cam.		
15	Carriage-return driven gear teeth clear carriage return driving gear teeth.		
16	Carriage decelerates.		
17	Carriage-return latch tripping arm strikes carriage-return clutch latch lever.		
18	Carriage-return clutch actuating lever released. Carriage-return latch tripping arm contacts throwout lever.		
19	Carriage-feed clutch lever and carriage-return clutch lever pulled back (spring action).		
20	Carriage-return clutch drum disengaged.		Carriage-feed clutch drum re-engaged.
21	Carriage stopped at left margin.		

## 50. Carriage-Return Safety Clutch

A considerable amount of force is applied when the carriage-return mechanism drives the carriage to the left margin. To prevent serious damage resulting from the sudden stop caused by an obstruction of the carriage-return mechanism, the carriage-return driving gear is powered by a friction clutch. This friction clutch allows the carriage-return driving gear to slip if the travel is blocked. The carriage-return driving gear itself is coupled to the carriage-return sliding clutch drum (fig. 76) by means of friction plates on both sides. Pressure for creating the necessary friction is obtained by compressing the spring with the adjusting collar.



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Figure 76. Carriage-return safety clutch.

## 51. Line-Feed Operation

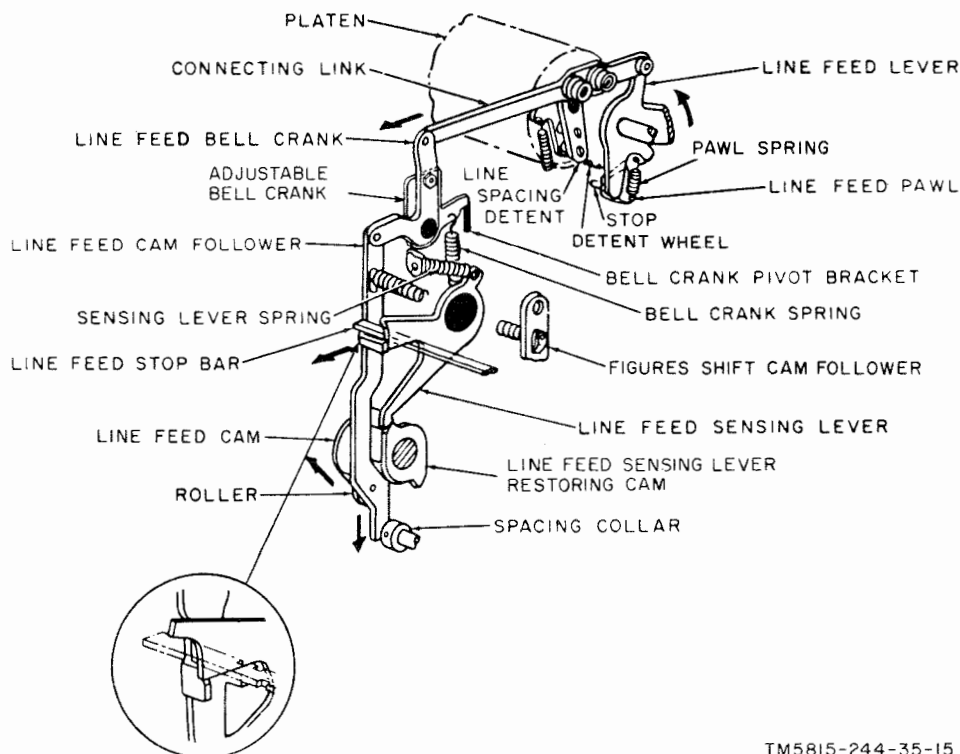
The line-feed mechanism (fig. 77) is used to turn the platen one or two line spaces when the line-feed code group is received. The position of the single-double line-feed lever determines the amount of platen rotation (fig. 78).

*a. Selecting Line-Feed Operation.* When the line-feed code group is received by the page printer, the five Y-levers are positioned in accordance with the code impulses of the code group (fig. 36). After the fifth Y-lever is positioned, the transfer operation occurs (par. 43). The code rings are positioned to form a groove in line with each of *two* line-feed stop bars (fig. 62). Each stop bar moves into its associated groove.

- (1) When the outer end of the line-feed stop bar that is mounted between the carriage-return stop bar and the letter Q stop bar moves into its groove in the code rings, the inner end of the stop bar moves away from the upper arm of the line-feed sensing lever (fig. 77). When the stop bar is in this position, the sensing lever is free to

follow the contour of the sensing lever restoring cam when the cam rotates (*b* below).

- (2) When the outer end of the line-feed stop bar that shares a slot in the code ring cage with the stop bar for the space code group (fig. 62) moves into its groove, it moves into position to stop rotation of the square shaft stop arm. When the square shaft stop arm strikes the stop bar; the following actions occur:
  - (a) The type selecting arm stops at a point where it is *not* aligned with a connecting bar and no symbol is printed by the page printer when the type selecting arm is moved forward by the print bail blade (par. 45).
  - (b) The function selecting arm stops at a point adjacent to a notch in the punch bar guide block (figs. 68 and 70). When stopped at this point, carriage feeding (par. 48) is prevented and the carriage remains



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Figure 77. Line-feed mechanism.

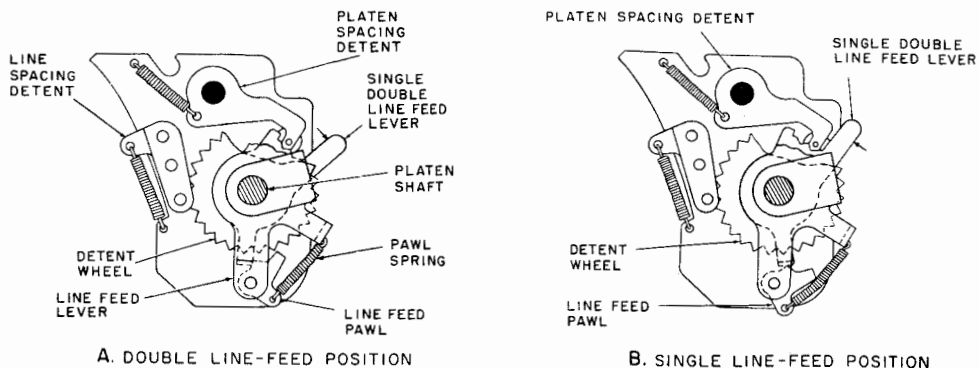


Figure 78. Single-double line-feed controls

motionless when the line-feed operation occurs.

*b. Rotating Platen.* The line-feed sensing lever restoring cam and line-feed cam on the function shaft (fig. 77) start turning at the same time that the transfer operation occurs (par. 43). Tension of the sensing lever spring causes the line-feed sensing lever to move downward when a low part of the cam moves adjacent to the sensing lever. The upper arm of the sensing lever moves past the line-feed stop bar and strikes the slanted portion of two projections of the line-feed cam follower. Continued downward movement of the sensing lever causes the lower end of the cam follower to move horizontally until the roller attached to the lower end of the cam follower is under the line-feed cam. Continued rotation of the function shaft causes a lobe of the line-feed cam to push the cam follower downward. The line-feed bellcrank pivots, pulling the connecting link rearward; this causes the line-feed lever to pivot counterclockwise. The line-feed pawl, attached to the lower arm of the line-feed lever (fig. 78), moves upward, engages a tooth of the detent wheel and turns the detent wheel and the platen counterclockwise. The line spacing detent prevents rotation of the platen while the page printer prints a line of copy. When the single double line-feed lever is in the single line-feed position (B, fig. 78), the line-feed pawl passes the nearest tooth of the detent wheel, engages the next tooth, and then rotates the platen the width of *one* detent tooth. When the single double line-feed lever is in the double line-feed position (A, fig. 78), the pawl engages the nearest tooth and the platen rotates the width of *two* line spaces.

*c. Sequence of Line-Feed Operations.* The following chart lists the sequence of operations that occur when the page printer receives the line-feed code group.

Line-feed operation sequence chart

1	Line-feed code group received; Y-levers positioned accordingly (par. 42).	
2	Transfer lever latch tripping cam trips transfer lever latch (par. 43).	
3	T-levers and code rings positioned for selection of line-feed operation.	Function clutch drum released by function clutch latch.
4	Code rings form groove in line with both line-feed stop bars.	Function clutch drum pushed into engagement with function clutch driving gear.
5	Line-feed stop bars move into grooves in code rings.	Function shaft and square shaft start turning.
6	Line-feed sensing lever moves to low part of line-feed sensing-lever cam (fig. 77).	Square shaft rotates until square shaft stop arm strikes line-feed stop bar.
7	Line-feed sensing lever moves lower end of line-feed cam follower toward line-feed cam; roller on cam follower moves under cam.	
8	Lobe of line-feed cam pushes line-feed cam follower downward.	
9	Line-feed bellcrank pivots, pulling connecting link rearward.	
10	Line-feed lever pivots counterclockwise.	
11	Line-feed pawl engages detent wheel which moves one or two line spaces.	
12	Lobe of line-feed sensing-lever cam pushes line-feed sensing lever upward.	
13	Lower end of line-feed cam follower moves away from line-feed cam.	Arm of function clutch drum strikes function clutch latch; drum moves away from function shaft driving gear; function shaft stops turning.



## 52. Figures Shift Operation

The type bars in the page printer print a letter when the platen is in the letters shift (lower) position and print a numeral or punctuation mark when the platen is in the figures shift (upper) position (fig. 35). The platen is moved to the figures shift position as described below.

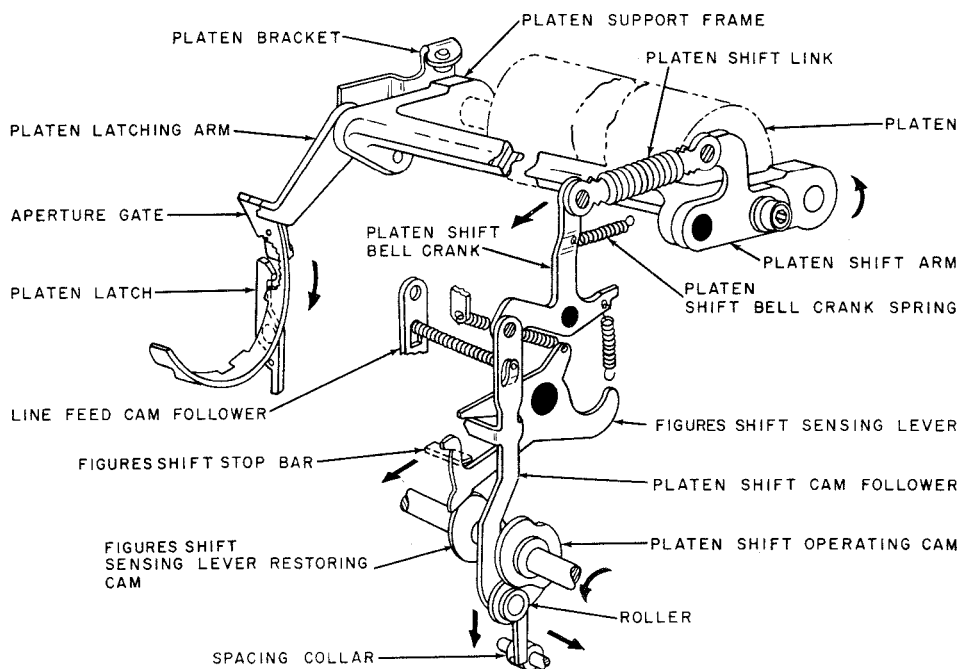
*a. Selecting Figures Shift Operation.* The figures shift code group must be received by the page printer to cause the platen to move to the figures shift position. When the transfer operation occurs (pars. 42 and 43), the code rings are positioned to form a groove in line with each of *two* figures shift stop bars (fig. 62). Each stop bar moves into its associated groove.

- (1) When the outer end of the figures shift stop bar that is mounted next to the carriage-return stop bar (fig. 62) moves into its groove, the inner end of the stop bar moves *away* from the latching arm of the figures shift sensing lever (fig. 79). When the stop bar is in this position, the sensing lever is free to follow the contour of the figures sensing lever restoring cam when the cam rotates (*b* below).

- (2) When the outer end of the figures shift stop bar, which shares a slot in the code-ring cage with the stop bar for the letter Z (fig. 62), moves into its groove in the code rings, it moves into position to stop rotation of the square shaft stop arm. When the square shaft stop arm strikes the stop bar, the following actions occur:

- (a) The type selecting arm stops at a point where it is *not* aligned with a connecting bar and no symbol is printed by the page printer when the type selecting arm is moved forward by the print bail blade (par. 45).
- (b) The function selecting arm stops at a point adjacent to a cut-out portion of the punch bar guide block (fig. 70). When stopped at this point, carriage-feeding (par. 48) is prevented and the carriage remains motionless when the platen is moved upward to the figures shift position.

*b. Moving Platen to Figures Shift Position.* The figures sensing lever restoring cam starts turning when the transfer operation occurs (par. 43). Tension of the sensing lever spring



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Figure 79. Figures shift mechanism.

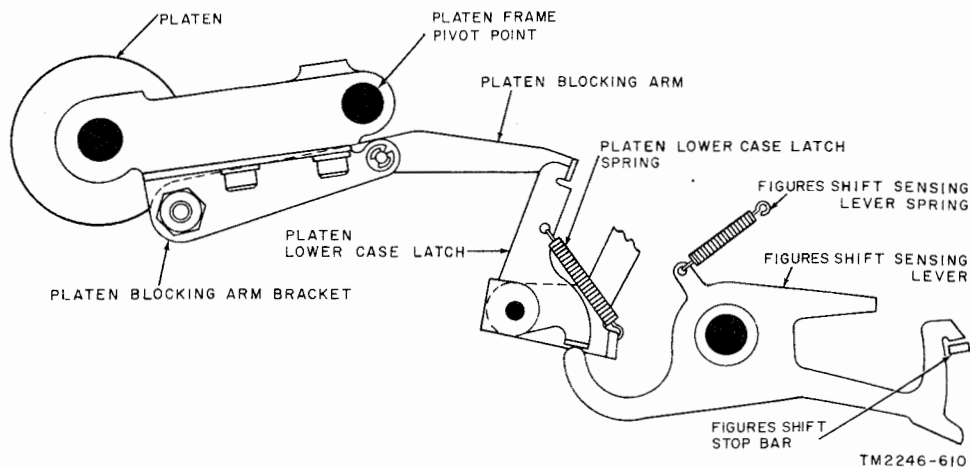


Figure 80. Platen blocking mechanism (letters position).

causes the figures shift sensing lever to move downward when a low part of the cam moves adjacent to the sensing lever. The upper arm of the sensing lever moves against the slanted portion of two projections of the platen shift cam follower. Continued downward movement of the sensing lever causes the lower end of the platen shift cam follower to move horizontally until the roller attached to the lower end of the follower is under the platen shift operating cam. Continued rotation of the function shaft causes a lobe of the cam to push the cam follower downward. The platen shift bellcrank pivots counterclockwise, pulling the platen shift link in the direction shown in figure 79. The platen support frame pivots, moving the platen upward to the figures shift position. The platen is locked in the figures shift position as described in *d* below.

*c. Releasing Platen Lower Case Latch.* The platen blocking arm and the platen lower case latch (fig. 80) are used to lock the platen in the letters shift position until the figures shift sensing lever moves to a low portion of its cam (*b* above). When the sensing lever pivots, the curved arm of the sensing lever moves upward against one arm of the platen lower case latch. The upper arm of the latch moves away from the latching end of the platen blocking arm, and the arm is free to move downward when the platen (on the opposite side of the platen frame pivot point) moves upward.

*d. Latching Platen in Figures Shift Position.* When the platen frame pivots to move the platen upward, one end of the platen latching arm (fig. 79) moves downward; this causes the aperture gate to move in the direction indicated. When the gate is moved to this position, the platen latch (fig. 81) engages a lug on the gate to lock the platen latching arm in the lower position, and the platen in the figures shift position.

*e. Sequence of Figures Shift Operations.* The following chart lists the sequence of oper-

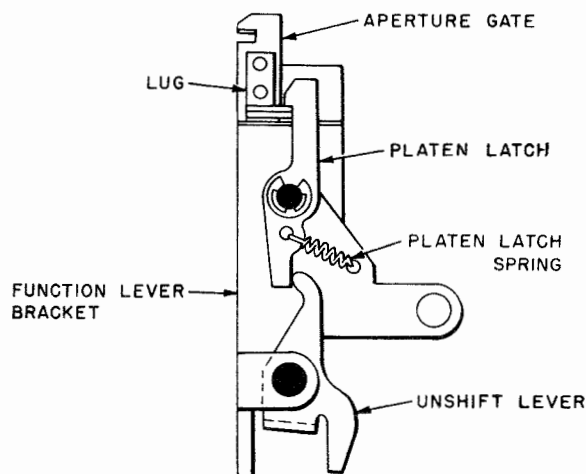


Figure 81. Aperture gate latched in figures shift position.

ations that occur when the page printer receives the figures shift code group.

Figures shift operation sequence chart

1	Figures shift code group received; Y-letters positioned accordingly (par. 42).	
2	Transfer lever latch tripping cam trips transfer lever latch (par. 43).	
3	T-levers and code rings positioned for figures shift selection.	Function clutch drum released by function clutch latch.
4	Code rings form groove in line with both figures shift stop bars.	Function clutch drum pushed into engagement with function shaft driving gear by function clutch spring.
5	Figures shift stop bars move into grooves in code rings.	Function shaft and square shaft start turning.
6	Figures shift sensing lever moves to low part of figures sensing lever restoring cam (fig. 79).	Square shaft rotates until square shaft stop arm strikes figures shift stop bar.
7	Figures shift sensing lever moves lower and of platen shift cam follower toward platen shift operating cam.	Curved arm of figures shift sensing lever pivots platen lower case latch (fig. 80).
8	Roller of platen shift cam follower moves under figures shift cam.	Upper arm of platen lower case latch moves away from platen blocking arm.
9	Lobe of rotating figures-shift cam pushes platen shift cam follower downward.	
10	Platen shift bellcrank pivots, pulling platen shift link rearward.	
11	Platen support frame pivots; platen moved upward to figures shift position.	
12	Platen latching arm and aperture gate move downward; latched in lower position by platen latch.	Platen blocking arm moves downward, below latching surface of platen lower case latch (fig. 80).
13	Lobe of figures sensing lever restoring cam pivots figures shift sensing lever to original position.	
14	Lower end of platen shift cam follower moves away from platen shift operating cam.	Arm of function clutch drum strikes function clutch latch, drum moves away from function shaft driving gear; function shaft stops turning.

### 53. Letters Shift Operation

When the letters shift code group is received, the letter-shift mechanism moves the platen to the letters shift (lower) position as described below.

*a. Selecting Letters Shift Operation.* When the letters shift code group is received (all five code impulses marking), the five Y-levers are set to the marking position. When the transfer operation (par. 43) occurs:

- (1) The code rings are positioned to form a groove into which the letters shift stop bar moves (fig. 62).
- (2) The square shaft rotates until the square shaft stop arm strikes the letters shift stop bar. When this occurs:
  - (a) The function selecting arm stops at a point where it is alined with the letters shift punch bar in the punch bar guide block (fig. 67).
  - (b) The type selecting arm stops at a point where it is *not* alined with a connecting bar. No symbol is printed by the page printer when the letters shift code group is received.

*b. Moving Platen to Letters Shift Position.* Immediately after the function selecting arm is stopped at a point where it is alined with the letters shift punch bar, a lobe of the function cam (fig. 67) causes the function cam follower to pivot counterclockwise. The top of the function selecting cam follower causes the function selecting arm to push the letters shift punch bar toward the center of the page printer (fig. 82). This action causes the unshift lever to pivot counterclockwise. The platen latch pivots clockwise, releasing the aperture gate. The weight of the platen causes it to move downward. The platen latching arm and aperture gate move upward where they remain until the next figures shift code group is received.

*c. Locking Platen in Letters Shift Position.* When the platen moves downward to the letters shift position (*b* above), the latching end of the platen blocking arm (fig. 80) moves upward. The platen blocking arm is held in the upper position by the platen lower case latch

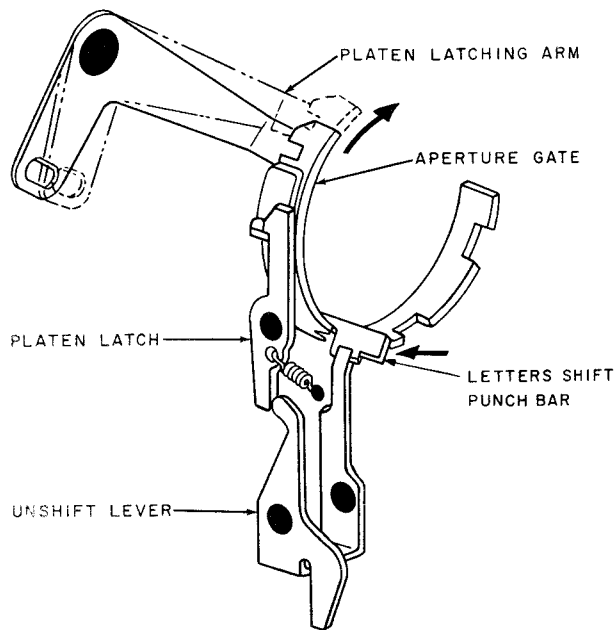
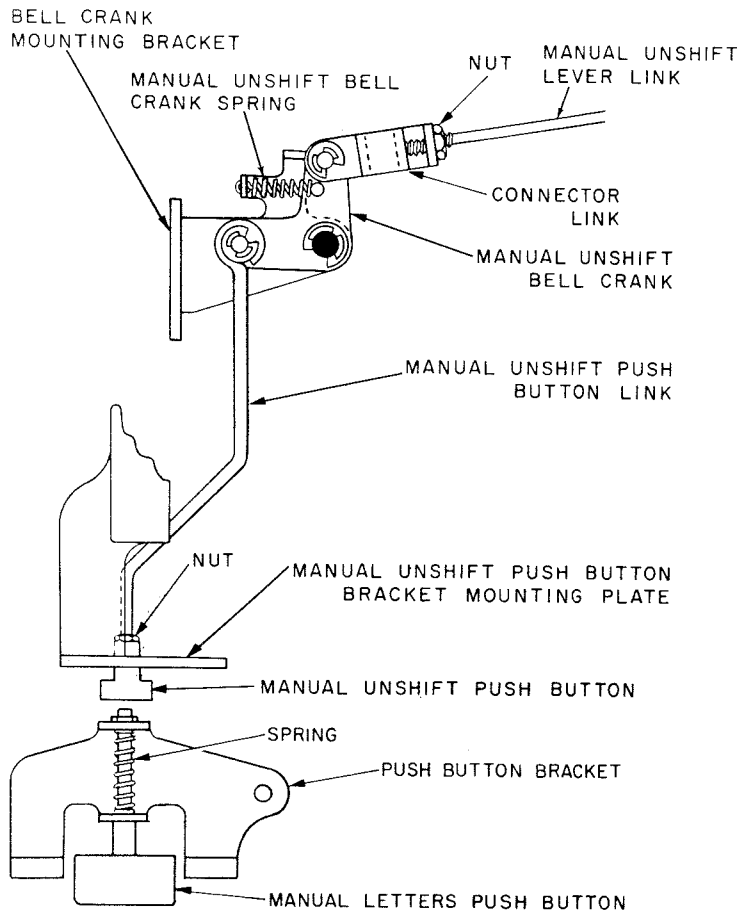
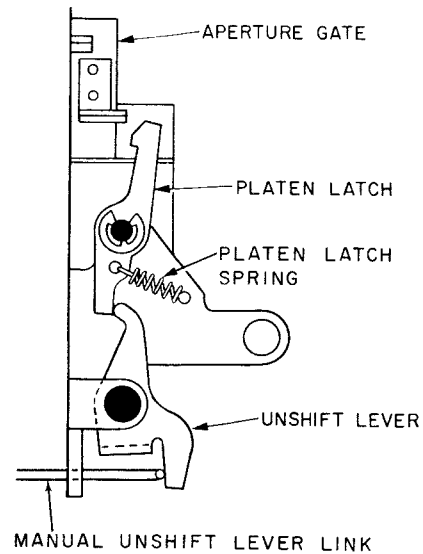


Figure 82. Aperture gate latched.



A



B

Figure 83. Manual letters shift mechanism.

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until the next figures shift code group received causes the curved arm of the figures shift sensing lever to pivot the platen lower case latch counterclockwise when the platen is to be raised to the figures shift position (par. 52).

d. *Manual Letters Shift.* A manual letters shift mechanism (fig. 83) is supplied to allow the operator to shift the platen from the figures position manually. When the manual letters pushbutton (A, fig. 83) on the left front of the dust cover is pressed, it causes the manual unshift bellcrank to rotate and move the manual unshift lever link to the right (when viewed from front). The manual unshift lever link strikes the unshift lever extension and causes it to rotate and move the platen latch out of engagement with the lug on the aperture gate. The platen then drops into letters position by its own weight. When the manual letters pushbutton is released, the entire mechanism is returned to its original position through the

action of the platen latch spring and manual unshift bellcrank spring.

*e. Sequence of Letters Shift Operations.* The following chart lists the sequence of operations that occur when the letters shift code group is received by the page printer.

Letters shift operation sequence chart		
1	Letters shift code group received; Y-levers positioned accordingly (par. 42).	
2	Transfer lever latch tripping cam trips transfer lever latch (par. 43).	
3	T-levers and code rings positioned for selection of letters shift operation.	Function clutch drum released by function clutch latch.
4	Code rings form groove in line with letters shift stop bar.	Function clutch drum pushed into engagement with function shaft driving gear by function clutch spring.
5	Letters stop bar moves into groove in code rings.	Function shaft and square shaft start turning.
6	Square shaft rotates until square shaft stop arm strikes letters stop bar; finger of function selecting arm alined with letters punch bar in punch bar guide block.	
7	Lobe of function cam pivots function cam follower counterclockwise (fig. 67).	
8	Function selecting arm pushes letters punch bar toward center of page printer (fig. 82).	
9	Unshift lever pivots counterclockwise; platen latch pivots clockwise.	
10	Gravity causes platen to move to letters shift position; platen latching arm and aperture gate move upward.	
11	Platen blocking arm moves upward; locked in upper position by platen lower case latch (fig. 80).	
12	Low portion of function cam pivots function cam follower clockwise (fig. 67).	
13	Function selecting arm moves away from letters punch bar.	
14	Spring pulls platen latch counterclockwise, unshift lever pivots clockwise; letters punch bar moves to right to unoperated position.	
15	Arm of function clutch drum strikes function clutch latch; drum moves away from function shaft driving gear. Function shaft stops turning.	

## 54. Signal Bell Operation

The signal bell operation is used by operators for audible signaling. The signal bell sounds when the page printer receives the letter S code group while the platen is in the fig-

ures shift position. Neither printing nor carriage-feeding occurs during the signal bell operation. The signal bell mechanism operates as follows:

*a. Selection of Signal Bell Operation.* When the letter S code group is received and the transfer operation occurs, the code rings are positioned to form a groove in line with the S stop bar, which moves into the groove and stops rotation of the square shaft stop arm. When the square-shaft is stopped in this position, the type selecting arm is in line with the connecting bar which is geared to the S type bar, and the function selecting arm (fig. 67) is in line with the signal bell punch bar in the punch bar guide block (fig. 84).

*b. Ringing Signal Bell.* Immediately after the function selecting arm is positioned (*a* above), a lobe of the function cam (fig. 67) causes the function cam follower to pivot counterclockwise, moving the function selecting arm against the signal bell punch bar (fig. 84). The signal bell punch bar moves inward, pivoting the signal bell clapper against the signal bell. After the bell rings, the function cam moves the function selecting arm away from the signal bell punch bar; the signal bell clapper spring pulls the clapper away from the bell and the signal bell punch bar moves to its normal outward position.

*c. Type Selecting Arm Operation.* When the function selecting arm causes the signal bell to ring (*b* above), the type selecting arm moves forward to push the connecting bar for the letter S type bar. The S type bar swings upward toward the platen, but nothing is printed at this time because the upper case portion of the type bar contains no symbol. The type bar is stopped by the type bar guide before the upper case part of the type bar reaches the platen.

*d. Suppression of Signal Bell Operation.* When the platen is in the letters shift position, the aperture gate also is in the letters shift position (A, fig. 69). When the letter S code group is received under this condition, the type selecting arm causes the letter S to be printed. The function selecting arm is not permitted to push the signal bell punch bar inward to ring the signal bell because a blocking portion of the aperture gate blocks inward movement of the punch bar. The lobe of the

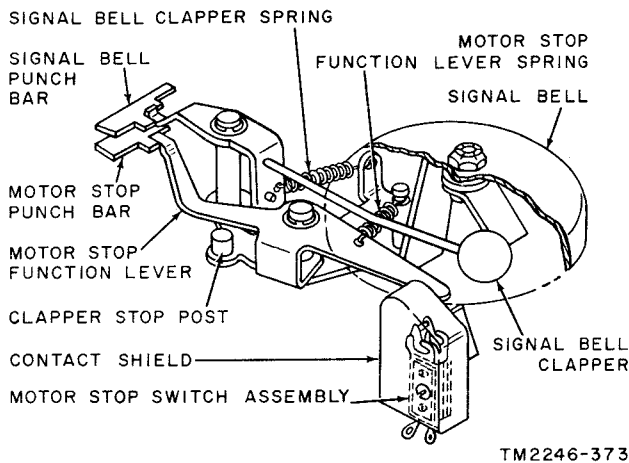


Figure 84. Signal bell and motor stop actuating mechanisms.

function cam causes the lower end of the function-cam follower to move counterclockwise, and the carriage-feed operation occurs (par. 48). When the platen is in the figures shift position, the aperture gate also is in the figures shift position (B, fig. 69) and a notch in the aperture gate permits operation of the signal bell mechanism and the motor-stop mechanism (par. 55).

*e. Sequence of Signal Bell Operations.* The chart below lists the sequence of operations that occur when the S code group is received while the platen of the page printer is in the figures shift position.

Signal bell operation sequence chart		
1	Letter S code group received; platen in figures shift position.	
2	Y-levers positioned for selection of signal bell operation (par. 42).	
3	Transfer lever latch tripping cam trips transfer-lever latch; transfer operation occurs (par. 43).	
4	T-levers and code rings positioned for selection of S stop bar.	Function clutch latch releases function clutch drum; function clutch latch members move into engagement.
5	S stop bar moves into groove in code rings.	Function shaft and square shaft start turning.
6	Square shaft stop arm strikes S stop bar; square shaft stops turning.	
7	Type selecting arm positioned in alignment with connecting bar geared to letter S type bar.	Function selecting arm positioned in alignment with signal bell punch bar in punch bar guide block.

Signal bell operation sequence chart—Continued

8	Lobe of print cam causes type selecting arm to move forward (fig. 65).	Lobe of function cam pivots function cam follower, causing function selecting arm to push signal bell punch bar inward (fig. 84).
9	Letter S type bar swings upward; motion of type bar halted before blank portion of type bar strikes platen; nothing printed.	Signal bell clapper strikes bell.
10	Print cam completes 1/2 revolution; returns type selecting arm to normal (rearward) position.	Function cam completes 1/2 revolution, returns function selecting arm to normal (outward) position.
11	Transfer lever restoring cam causes transfer lever to move T-levers upward, away from Y-levers.	Function clutch latch engages arm of function clutch drum.
12	Function-clutch drum disengaged from function shaft driven gear; function shaft stops turning (1/2 revolution completed).	

## 55. Motor Stop Operation (Standard Symbol Page Printers)

*a.* The motor stop operation places the page printer in a "stand-by" condition and enables any of the interconnected stations to restart the unit. It is controlled by means of two relays which open the circuit to the page printer motor, and hold it open until the signal line circuit is broken and again closed (pars. 95d and 96a). Reception of the H code group in the page printer mechanism when the platen is in the figures shift position causes the motor stop mechanism to operate. The function selecting arm is aligned with the motor stop bar (fig. 84). The function cam (fig. 67) pivots the function cam follower and causes the function selecting arm to move axially and strike the motor stop punch bar. As the motor stop punch bar moves, it pivots the motor stop function lever (fig. 84) and causes the contacts of the motor stop switch to operate. This causes the motor stop relay to energize and opens the motor circuit, stopping the motor. The function cam then pivots the function cam follower in the opposite direction and causes the func-

tion selecting arm to be pulled away from the motor stop punch bar. The motor stop punch bar, the motor stop function lever, and the contacts of the motor stop switch return to their original positions through the action of the motor stop function lever spring. To start the motor again, an operator must first break, then close, the signal line by operating the appropriate switch on his equipment (LINE BREAK switch on these teletypewriter sets). The motor will start only after the signal line is closed.

b. The chart below lists in sequence the operation of the motor stop mechanism.

1	Platen in figures shift position; H code group received; and contacts of motor stop switch operated.
2	Function selecting arm alined with motor stop punch bar.
3	Function cam pivots function cam follower about support lever.
4	Function selecting arm plunged axially.
5	Motor stop punch bar pushed in.
6	Motor stop function lever pivots.
7	Contacts of motor stop switch operate, energizing relays A and B of motor stop relay (par. 95d).
8	Motor circuit opened; motor stops; keyboard circuit locked out.
9	Relays A and B are energized as long as line current is maintained.
10	When next break in line current occurs, relay B releases; relay A stays energized (par. 95d).
11	On next closing of signal line relay A releases.
12	Contacts of motor stop relay return to normal.
13	Motor starts.

## 56. Motor Stop Operation (Weather Symbol Page Printers)

a. The type of motor stop mechanism in Teletypewriter TT-118/FG (weather symbols) differs from the type provided in Teletypewriters TT-117A/FG and TT-119A/FG (standard communications symbols) in that the motor stop relay assembly of the TT-118/FG includes three relays (A, B, and C, fig. 137) instead of two. Relays A and B in the TT-118/FG perform the same function as in the other models. The third relay is necessary in TT-118/FG, because the H code group is used for the printing of a symbol (fig. 36)

when the platen is in the *figures shift* position. To prepare the weather symbol page printer for motor stop, a blank code group must be received *before* reception of the H code group. The selection of the blank stop bar mechanically closes switch S16 to energize relay C (fig. 137). When relay C is energized, and electrical path is prepared to accomplish the motor stop function, if the H code group is the next code group received.

b. The chart below lists in sequence the operation of the TT-118/FG motor stop.

1	Figures shift code group received; platen moved to figures shift position.
2	Blank code group received; relay C is energized (fig. 137).
3	Motor stop (H) code group received; relays A and B are energized through contacts of relay C.
<p><i>Note.</i> Relay C will deenergize if code group for any character or function other than H is received after reception of blank code group.</p>	
4	Refer to steps 2 through 13 of the sequence chart in paragraph 55b.

## 57. Automatic Carriage-Return and Line-Feed Operation

The automatic carriage-return and line-feed operations are initiated when the carriage reaches the right-hand margin. Upon receipt of the 73d character by standard symbol page printers (77th character in weather symbol page printers) the stop bar shift lever (fig. 85) is pivoted by the right-hand margin trip plate. This causes the stop bar shift link, stop bar shift blade, and stop bar shift stop to move horizontally to the left (when viewed from front). The stop bar shift blade moves the carriage-return and line-feed function stop bars into the code-ring cage and away from their sensing levers, while the spring collar compresses the stop bar return spring against the stop bar shift link bracket. The entire mechanism (actuated by the right-hand margin trip plate) is held in this operated position by the delaying latch which engages the stop bar shift stop (fig. 369). The carriage-return and line-feed sensing levers (now free to operate) cause both carriage-return and line-feed to take place on the next half revolution of the function shaft. When the carriage reaches the left-

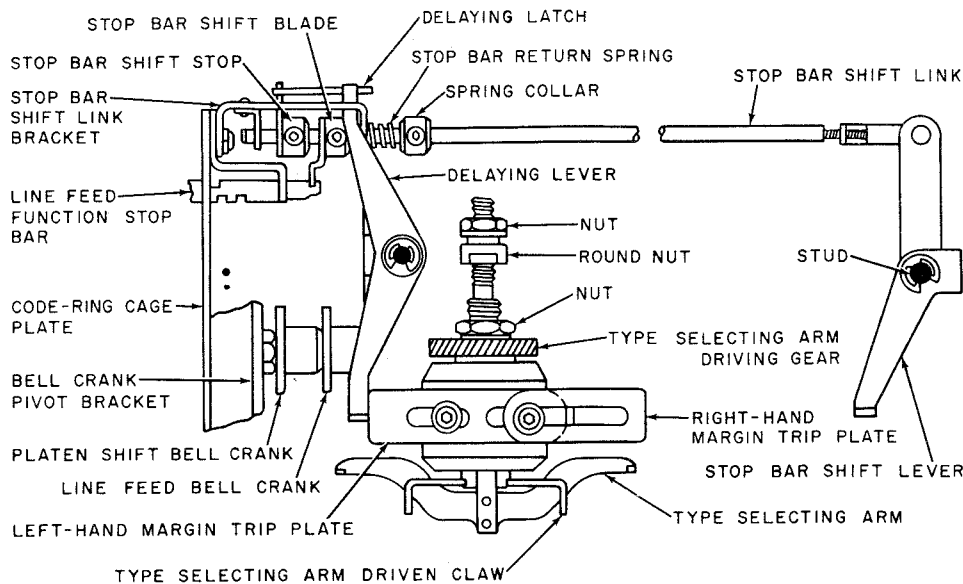


Figure 85. Automatic line-feed and carriage-return control.

hand margin, the left-hand margin trip plate rotates the delaying lever (fig. 367). This moves the delaying latch away from the stop bar return spring then returns the automatic carriage-return and line-feed mechanism to its normal unoperated position and moves the function stop bars back under their associated sensing levers.

## 58. Ribbon Lifter Operation (fig. 86)

a. The normal position of the inking ribbon is below the printing line. In order not to obscure the printing, the inking ribbon must be raised to print each character and must be lowered after printing. The ribbon guide through which the inking ribbon is threaded can slide up and down on its mounting and is lifted when the ribbon vibrator bellcrank is turned. The ribbon vibrator bellcrank is actuated when the type selecting arm pushes the first lever of the ribbon vibrator lever and bracket (at the same time that it taps the type bar actuating connecting bar). Since the inking ribbon must be raised higher for printing figures than for printing letters, the point about which the lever of the ribbon vibrator bellcrank turns is not fixed but is mounted on a pivot bearing. The pivot bearing can be raised and lowered in accordance with the platen position by means of the bar of the platen trough. Thus,

the pivot point of the pivot bearing is in a raised position for figures and in a lowered position for letters.

b. The sequence of operations of the inking ribbon lifter mechanism is shown in the chart below.

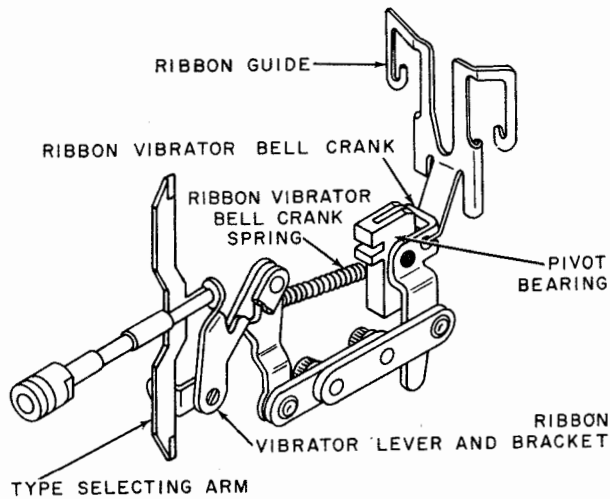
Ribbon lifter sequence chart

1	Type selecting arm turns to selected position.
2	Type selecting arm plunged forward.
3	The first lever of ribbon vibrator lever and bracket struck.
4	Linkage turns ribbon vibrator bell crank.   Type selecting arm pulled backward.
5	Ribbon guide lifted.
6	Type bar strikes inking ribbon against platen.
7	Ribbon guide, ribbon vibrator bell crank, and ribbon vibrator lever and bracket returned to original position by ribbon vibrator bell crank spring.

## 59. Ribbon Feeding Operation

a. The inking ribbon is pulled a short distance through the ribbon guide each time a character is printed. The inking ribbon feed mechanism is mounted on the carriage, and is shown in figure 87. Both printing ribbon spools are mounted on ribbon spool drive shafts. The ribbon spool driving gear on the lower end of one or the other of these ribbon spool drive shafts always is engaged with a





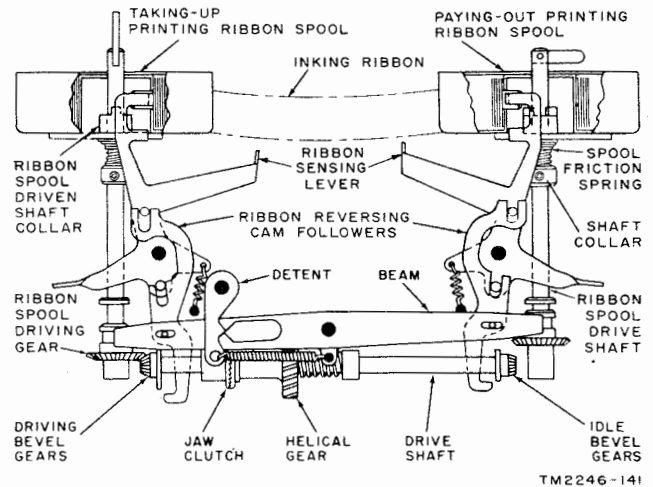
TM2246-227

Figure 86. Ribbon lifter mechanism.

bevel gear on the drive shaft. The helical gear on the drive shaft mates with the ribbon feed rack which is part of the guide rail of the carriage. Movement of the carriage to the right causes the helical gear, drive shafts, and one printing ribbon spool to turn and wind up part of the inking ribbon. The other printing ribbon spool idles and an equivalent amount of inking ribbon unwinds from it. This inking ribbon is kept taut by the spool friction spring of the paying-out printing ribbon spool. When the carriage is returned to the left, the helical gear turns in the opposite direction but the jaw clutch teeth slip so that the drive to the ribbon spools is effectively disengaged, preventing the inking ribbon from unwinding.

b. Sequences of operation of inking ribbon feed are shown in the chart below.

Ribbon feed mechanism sequence chart	
1	Carriage fed one space to right (when printing or spacing operation takes place).
2	Helical gear turns bevel bears on one end (depending on direction of ribbon feed) and the printing ribbon spool.
3	Inking ribbon pulled through the ribbon guide one space.
4	Above sequence repeats for each advance of carriage to right.
5	As carriage returns to left, helical gear reverses direction, but jaw clutch slips and inking ribbon does not unwind.



TM2246-141

Figure 87. Ribbon feed mechanism.

## 60. Ribbon Reversing Operation

a. After the inking ribbon is wound almost entirely on one printing ribbon spool, the direction of inking ribbon feed must be reversed to change the direction of ribbon feed. This reversing operation is done automatically by the inking ribbon feed mechanism (fig. 88) as the last turn of inking ribbon is unwound from the paying-out printing ribbon spool.

b. The core of each printing ribbon spool has a cutout, or window, through which the end of the ribbon sensing lever can project. As long as one layer of inking ribbon is wrapped around the core of the printing ribbon spool, the ribbon sensing lever is retained in position; when the last turn or layer is unwound, the end of the ribbon sensing lever moves through the window. The lower end of the ribbon reversing cam follower (mounted on the ribbon sensing lever) is brought into position under the reversing cam on the drive shaft. The lobe of the reversing cam pulls down the ribbon reversing cam follower (which can slide on its mounting pins) within the next one-half revolution of the drive shaft. The downward movement of the ribbon reversing cam follower forces the beam to pivot, disengaging the bevel gears on one end of the drive shaft and engaging those on the other end. The empty printing ribbon spool thus becomes the taking-up printing ribbon spool and, as soon as one layer of ribbon is wound onto it, the ribbon sensing lever is pushed in and the ribbon reversing cam

follower moves away from the reversing cam. The detent (fig. 87) keeps the beam latched in the new position. When the last layer of inking ribbon is removed from the supply printing ribbon spool, the whole process is repeated.

c. The following chart lists the inking ribbon reversing operation sequences.

Ribbon reversing sequence chart

- |    |   |
|----|---|
| 1  | Starting with left bevel gears meshed and right bevel gears unmeshed, whenever carriage moves to right; left printing ribbon spool is driven, taking up inking ribbon; right printing ribbon spool idles, paying-out inking ribbon. |
| 2  | Eventually, almost entire inking ribbon is unwound from right printing ribbon spool.  |
| 3  | Window in printing ribbon spool becomes uncovered.  |
| 4  | End of ribbon sensing lever projects through window (spring action).  |
| 5  | Ribbon cam follower moved under reversing cam (which turns when carriage moves to right).   |
| 6  | Within one-half revolution of cam, ribbon cam follower is pulled down.  |
| 7  | Beam pivoted clockwise, trips detent, and relatches in clockwise position.  |
| 8  | Left bevel gears unmeshed.  |
| 9  | Right bevel gears meshed.   |
| 10 | Right printing ribbon spool now is driven, taking up inking ribbon, and left printing ribbon spool idles, paying out inking ribbon.   |
| 11 | Above sequence repeats in opposite direction.   |

## 61. Rangefinder Mechanism

a. Transmitted teletypewriter signal waveforms become distorted because of line characteristics such as inductance and capacitance. The rangefinder mechanism permits adjustment for optimum operation with distorted signals.

b. Distortion consists of rounding the corners and sloping the sides of the waveforms and results in some impulses becoming shortened and others becoming lengthened. This has the effect of shifting some of the later code impulses of a code group with respect to the starting impulse. To permit the selector mechanism to work properly, in spite of these shifts, the selector cams are designed so that they operate for only about 20 percent of the time that a code impulse is received.

c. The fact that a selector cam requires only about 20 percent of a code impulse length to perform its function makes it possible to shift

RIBBON SENSING LEVER PROJECTING THROUGH WINDOW IN EMPTY PRINTING RIBBON SPOOL

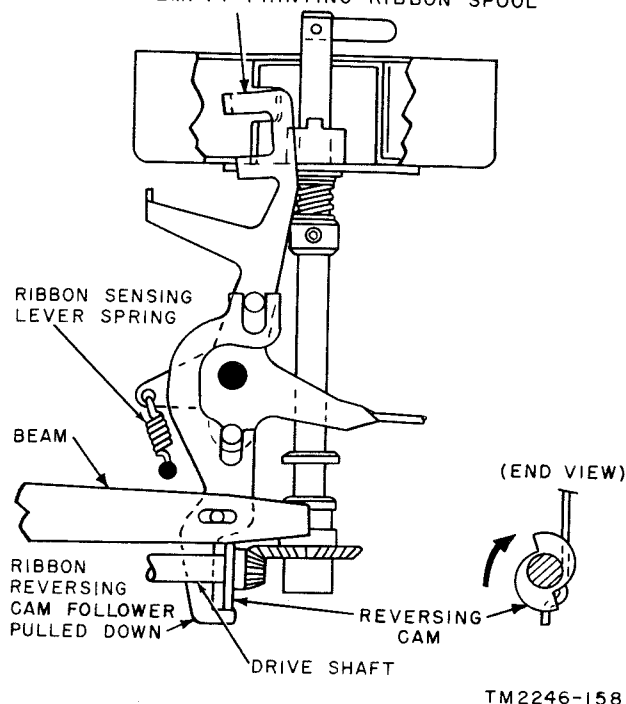
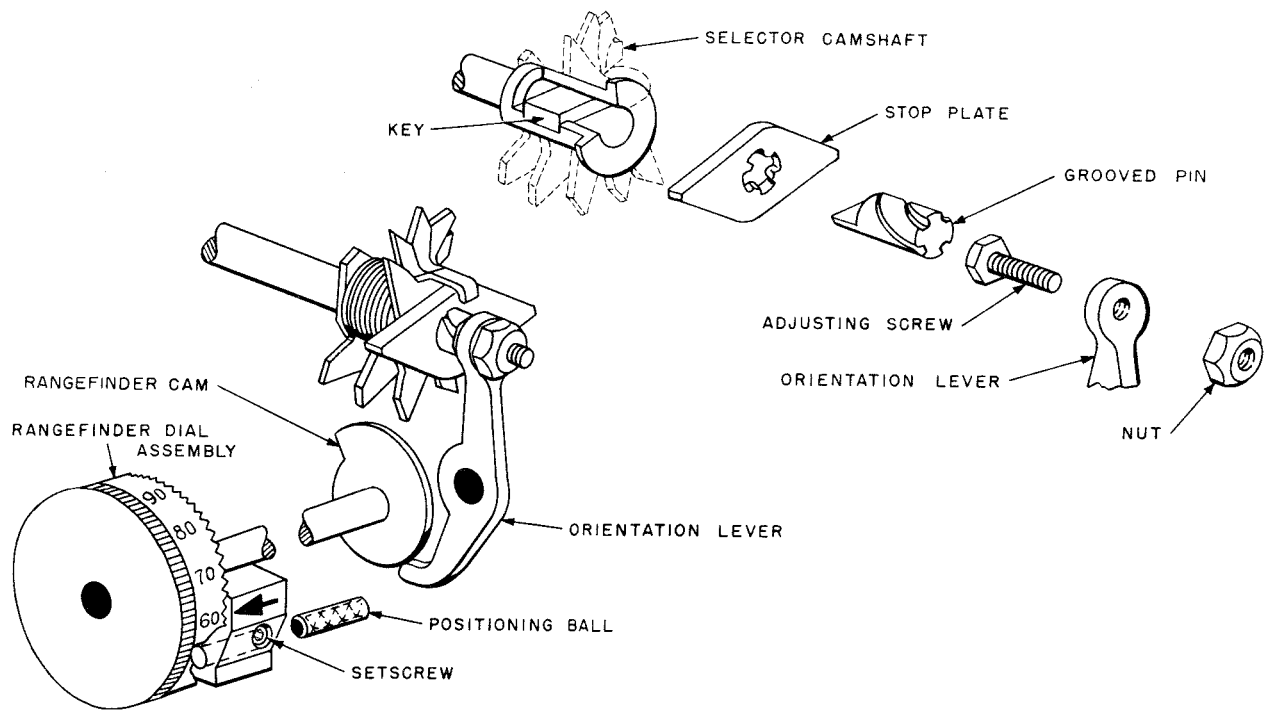


Figure 88. Ribbon reversing mechanism.

the selected 20 percent portion ahead or behind the *mid point* of the code impulse. The relationship between the stop plate and the selector cams is made adjustable to orient the cams within their associated impulses. The mechanism for making the adjustment is described in *d* below.

d. The timing relationship between the selector cams and stop plate is adjusted by altering the angular position of the stop plate with respect to the selector cams on the camshaft (fig. 89). *Increasing* the angle between the stop plate and the selector cams causes the selector cams to operate *later* in the impulse. *Decreasing* the angle causes the cams to operate *earlier*. The angular position of the stop plate may be adjusted by preventing the stop plate from rotating while rotating the selector camshaft. When this is done, the grooved pin on which the stop plate is mounted will move outward. The angular position of the stop plate may be adjusted in the opposite direction by turning the grooved pin inward.

e. The movement of the orientation lever is controlled by means of the rangefinder dial assembly and the rangefinder cam. Turning



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Figure 89. Rangefinder mechanism.

the rangefinder dial assembly clockwise increases the time between the selector cam operating points and the start impulse. Turning it counterclockwise decreases the time.

## 62. Margin Signal Bell Operation

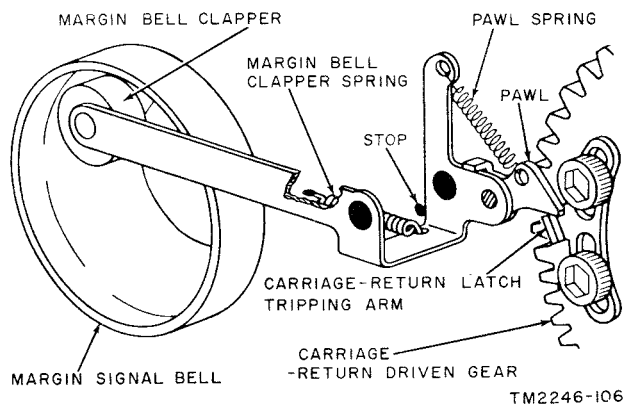
a. The margin signal bell rings automatically to warn the sending operator that the end of a line is about to be reached. It is operated by the carriage-return latch tripping arm attached to the large carriage-return driven gear (fig. 90), when the carriage approaches the end of its travel.

b. As the carriage-return driven gear turns to feed the carriage, the carriage-return latch tripping arm lifts the pawl to cause the margin bell clapper to pivot downward. When the carriage-return driven gear turns farther, the pawl slips past the carriage-return latch tripping arm and the margin bell clapper spring causes the clapper to snap back swiftly. The momentum of the margin bell clapper causes it to strike the upper side of the margin signal bell. The pawl is pivoted and is held to the margin bell clapper by a pawl spring to permit the carriage-return latch tripping arm to move

past the pawl when the carriage-return driven gear comes around for carriage-return.

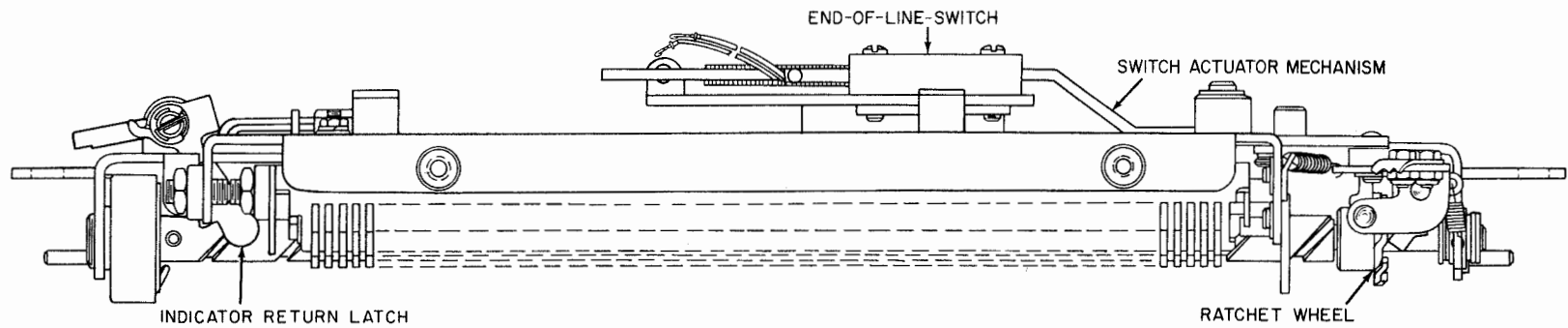
## 63. Character Counter and End-of-Line Indicator Mechanism

a. A character counter and end-of-line indicator mechanism (figs. 91 and 92) is mounted on the keyboard. It indicates to the operator the number of characters sent since the last carriage-return code group was sent and warns

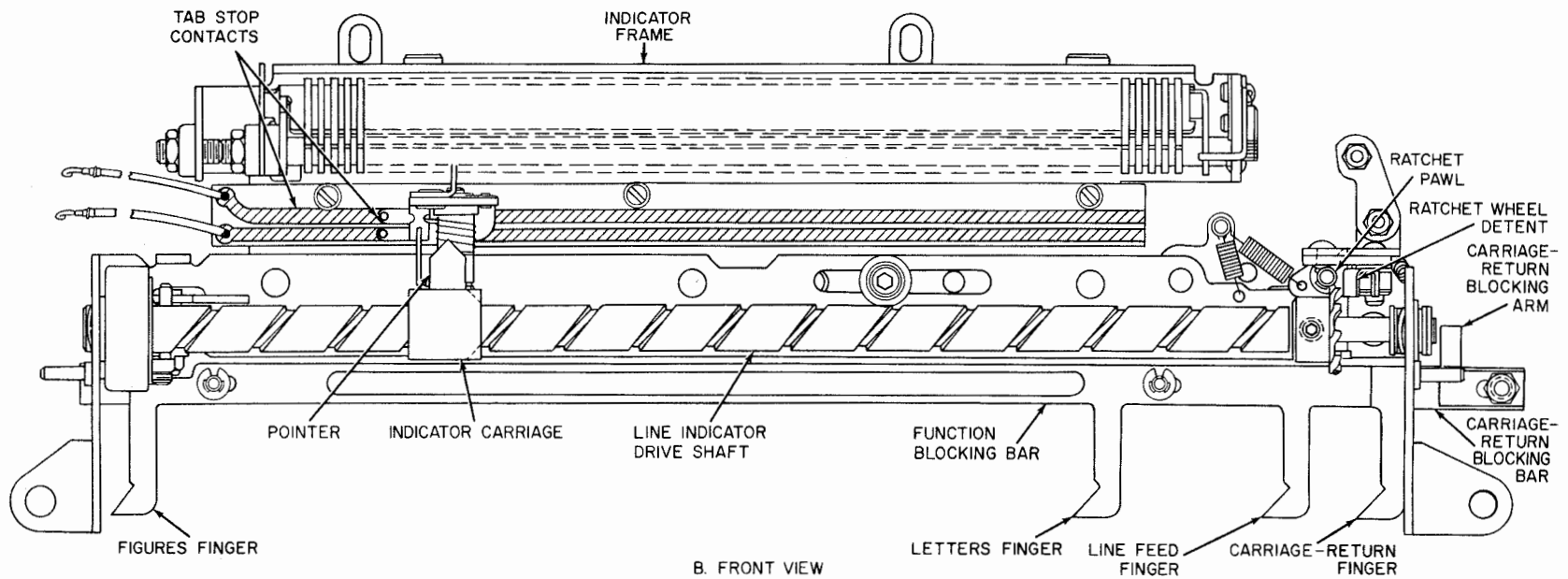


TM2246-106

Figure 90. Margin bell.



A. TOP VIEW



B. FRONT VIEW

TM2246-609

Figure 91. Character counter and end-of-line indicator mechanism (TT-117/FG and TT-119/FG).

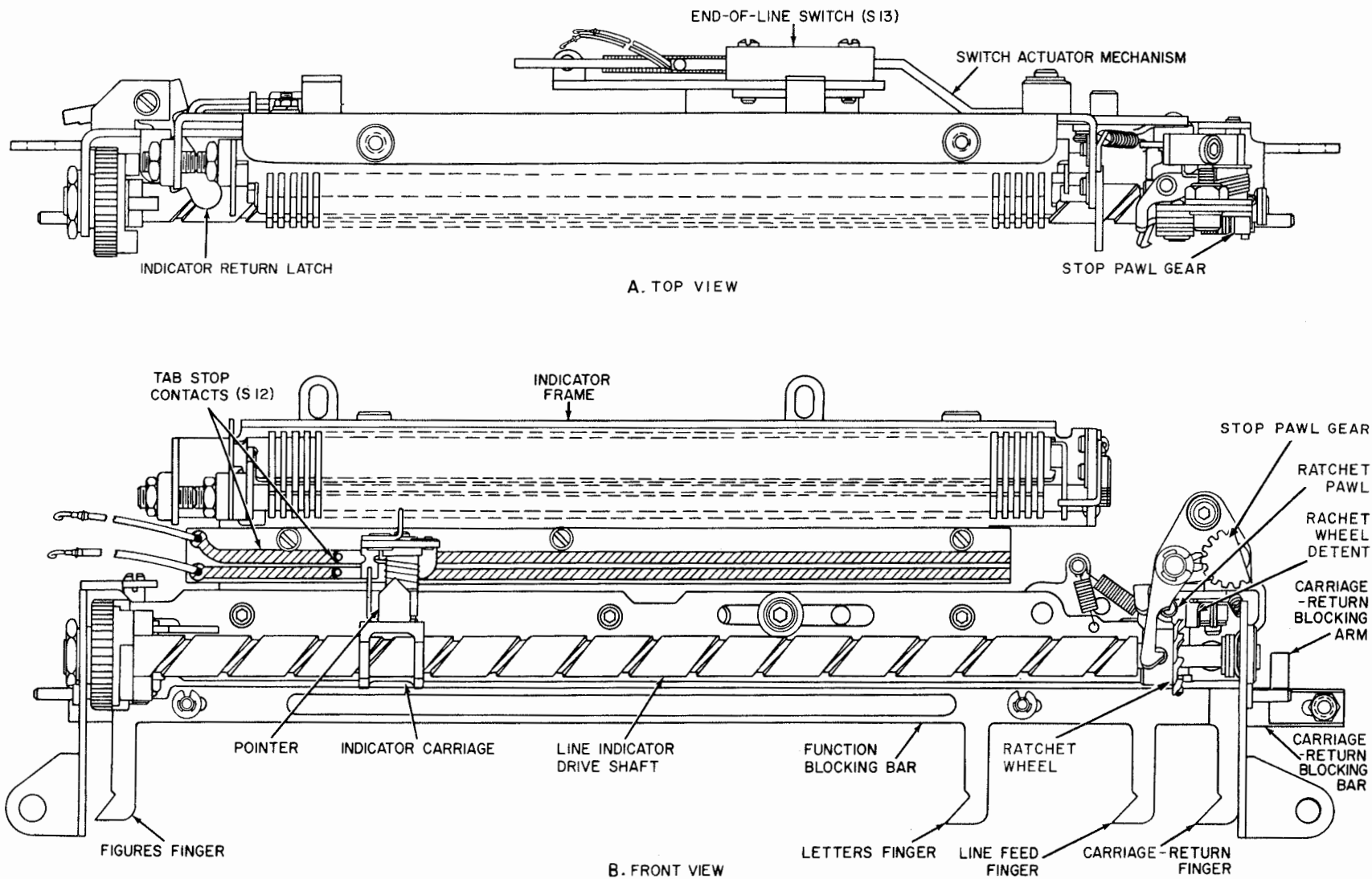


Figure 92. Character counter and end-of-line indicator mechanism (TT-117A/FG, TT-118/FG, and TT-119A/FG).

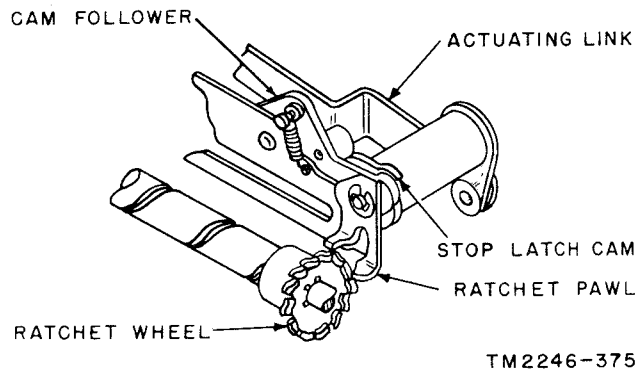


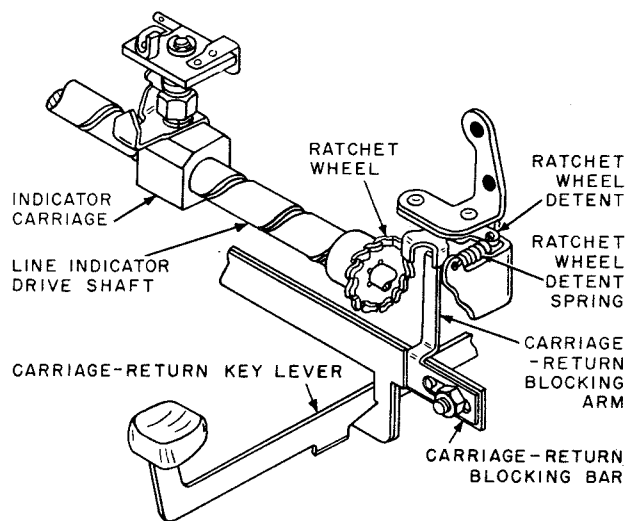
Figure 93. Character counter operation.

the operator of the approach of the end of a line.

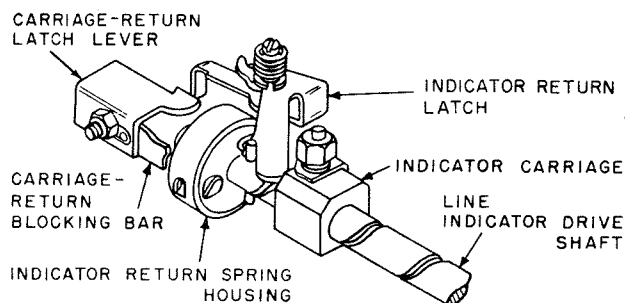
b. The indicator carriage is mounted on the spirally grooved line indicator drive shaft, which is located on the keyboard above the top row of keys. Projections inside the bore of the indicator carriage ride in the spiral groove, and, as the line indicator drive shaft rotates clockwise (when viewed from the right end), the indicator carriage is moved to the right. A pointer mounted on the carriage lines up with an indicator scale on the indicator cover to indicate the number of carriage-feed operations that have occurred since the last carriage-return code group.

c. The line indicator drive shaft is rotated by a ratchet pawl and ratchet wheel at the right side of the line indicator drive shaft (fig. 93). The ratchet wheel is mounted on the line indicator drive shaft and is driven by the ratchet pawl mounted on the cam follower. As the restoring solenoid (L1) is operated to restore the cam-stop lever (fig. 47), it pivots the stop latch cam against which rides the cam follower (fig. 93). The pivoting of the stop latch cam causes the cam follower to move up and down, moving the ratchet pawl with it. As the ratchet pawl moves upward, it engages a tooth of the ratchet wheel, forcing the ratchet wheel and line indicator drive shaft to rotate. The pawl disengages the tooth of the ratchet wheel on the downward stroke, and causes no movement of the ratchet wheel or line indicator drive shaft. Each time the ratchet wheel is moved a tooth space, the ratchet wheel detent is cammed out of the ratchet wheel tooth and then pulled back into the tooth of the ratchet wheel by the detent

spring, preventing any reverse rotation of the line indicator drive shaft (A, fig. 94). As the line indicator drive shaft rotates, it winds up a spring (in housing on left end of line indicator drive shaft on TT-117/FG and TT-119/FG (fig. 186); in center of shaft (fig. 187) of all other models). The spring stores the power required to return the indicator carriage to the left margin when the carriage-return key is depressed. Depression of the carriage-return key causes the key lever to hit the carriage-return finger of the carriage-return blocking bar, shifting it to the right (figs. 94 and 95). It is latched in this position by the indicator return latch. As it shifts to the right,



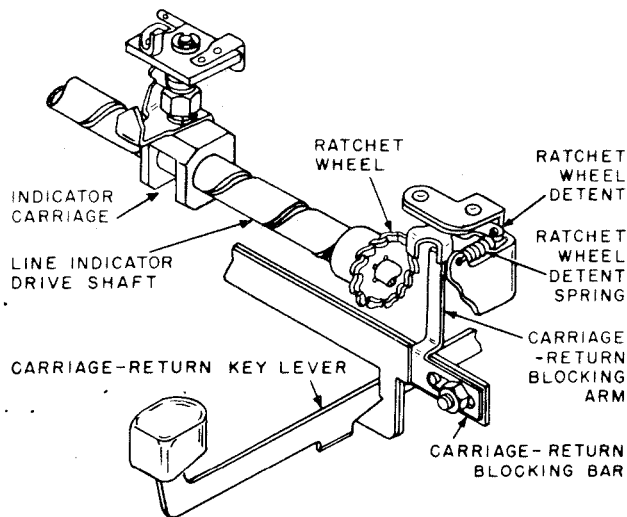
A



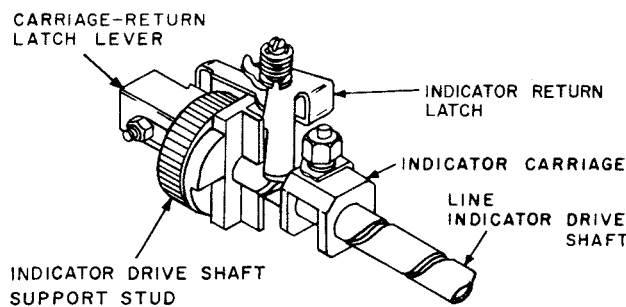
B

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Figure 94. Indicator carriage-return mechanism (TT-117/FG and TT-119/FG).



A

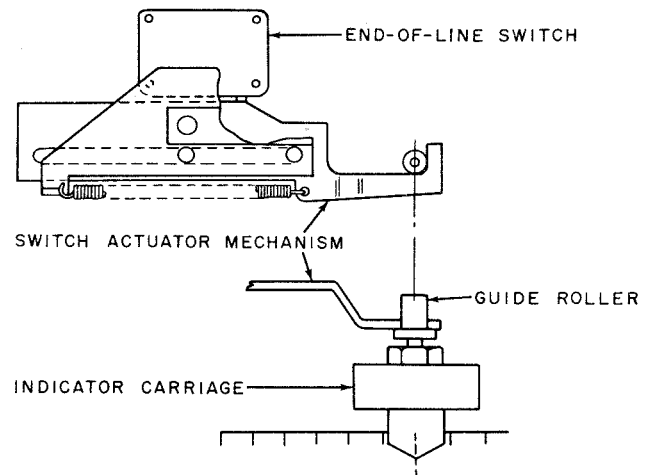


B

TM2246-C4-12

Figure 95. Indicator carriage-return mechanism (TT-117A/FG, TT-118/FG, and TT-119A/FG).

it causes the carriage-return blocking arm to strike the ratchet wheel detent and the ratchet pawl, pivoting them out of engagement with the ratchet wheel. This allows the spring to unwind, reversing the direction of rotation of the line indicator drive shaft. This causes the indicator carriage to return to the left margin. The indicator carriage moves the indicator return latch out of engagement with the carriage-return latch lever. This unlatches the carriage-return blocking bar, allowing it to be moved to the left by the function blocking bar spring to release the ratchet wheel detent and ratchet pawl. The ratchet wheel detent and ratchet pawl are again moved into the path of the



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Figure 96. End-of-line lamp switching mechanism.

ratchet wheel, preventing any reverse rotation of the line indicator drive shaft.

d. The end-of-line lamp (I3 on TT-117/FG and TT-119/FG; DS1 on all other models) is energized through the end-of-line switch (S14 on TT-117/FG and TT-119/FG; S13 on all other models) which is actuated by the indicator carriage. When the indicator carriage moves to the 66th space (70th space on TT-118/FG), the guide roller on the back of the indicator carriage moves an arm of the switch actuator mechanism to the right. The movement of the switch actuator mechanism operates a plunger at the bottom of the end-of-line switch (fig. 96) closing the circuit to the end-of-line lamp. When the carriage-return key lever is depressed, causing the indicator carriage to return to the left margin, the guide roller moves out of contact with the switch actuator mechanism. This allows the switch actuator spring to restore the switch actuator mechanism and open the circuit to the end-of-line lamp.

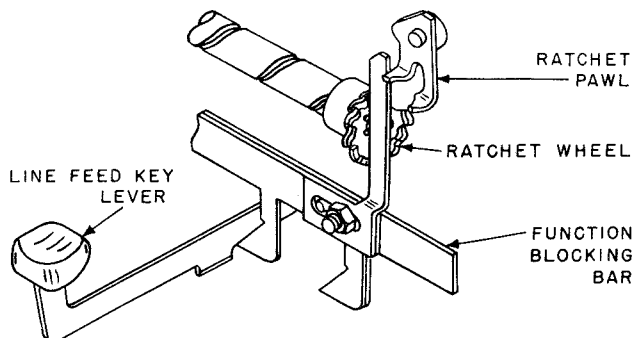
e. Figures shift, letters shift, and line-feed functions do *not* cause the indicator carriage to move to the right. To prevent the indicator carriage from spacing, a blocking mechanism operates when the key levers for the above functions are depressed. The function blocking bar (fig. 97) mounted on the front of the tabulator frame has three slanting fingers (B, figs. 91 and 92); one for each of the nonspacing function key levers. These projections are so

spaced that, when any one of the nonspacing key levers is depressed, the function blocking bar shifts to the right and moves the ratchet pawl out of engagement with the ratchet wheel (fig. 97).

f. A summary of the operation of the character counter and end-of-line indicator mechanism is contained in the chart below.

Character counter and end-of-line indicator mechanism sequence chart

- |    |  |
|----|--|
| 1  | Stop latch cam pivoted by restoring solenoid L1.   |
| 2  | Stop latch cam moves cam follower up.  |
| 3  | Cam follower engages the ratchet pawl, moving it upward.   |
| 4  | Ratchet pawl engages a tooth on the ratchet wheel, rotating ratchet wheel and line indicator drive shaft.  |
| 5  | Ratchet detent moved out of the path of the ratchet wheel.   |
| 6  | Rotation of line indicator drive shaft causes indicator carriage to be moved one space.  |
| 7  | Return spring wound up.  |
| 8  | Ratchet wheel detent spring restores the ratchet wheel detent to prevent reverse rotation of line indicator drive shaft.   |
| 9  | Operation repeats until 66th (70th on TT-118/FG) line space is reached. At 66th space, guide roller moves the switch actuator mechanism, closing circuit to end-of-line lamp.  |
| 10 | Carriage-return key lever is depressed, striking extension on carriage-return blocking bar.  |
| 11 | Carriage-return blocking bar shifts to right.  |
| 12 | Left end of carriage-return blocking bar latched by indicator return latch. Carriage-return blocking arm on right side of carriage-return blocking bar moves ratchet wheel detent and ratchet pawl out of engagement with ratchet wheel. |
| 13 | Indicator return spring unwinds, rotating the line indicator drive shaft in a reverse direction and causing the indicator carriage to move to the left of the shaft.   |
| 14 | As indicator carriage passes the 66th (70th on TT-118/FG) line space on return, the guide roller leaves the switch actuator mechanism, allowing the end-of-line indicator switch to open the circuit of the end-of-line lamp.            |
| 15 | Indicator carriage strikes the extension on the indicator return latch pivoting it clockwise to release the carriage-return latch lever and carriage-return blocking bar, allowing it to move to the left.                               |
| 16 | Carriage-return blocking arm on the carriage-return blocking bar releases ratchet wheel detent and ratchet pawl.   |



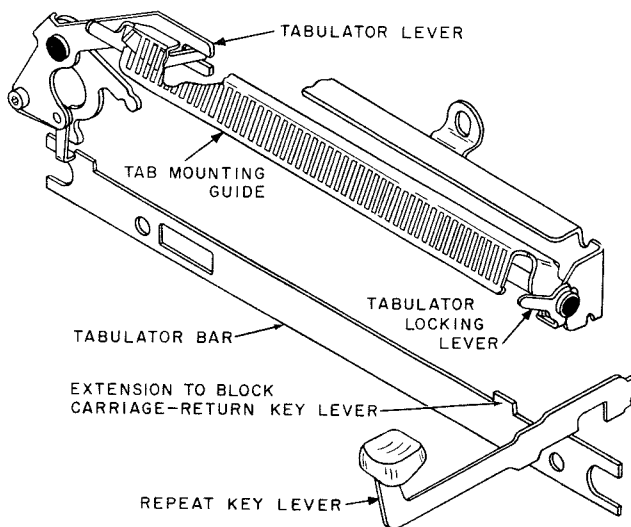
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Figure 97. Indicator carriage operation blocked during sending of nonspacing function.

## 64. Tabulator Operation

a. The tabulator mechanism permits the transmission of messages in tabular form without laborious hand spacing for each column sent.

b. The tabulator mechanism is mounted on the indicator frame. It consists principally of a tab mounting guide and 67 tab set levers (figs. 98 and 99). Every fifth tab set lever is red to aid in the selection of the correct tab set lever. When a desired tab set lever is pulled down the indicator carriage will stop at that point. The tabulator locking lever must also be pulled down to allow the tabulator mechanism to function. In the nonoperating position



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Figure 98. Tabulator mechanism.

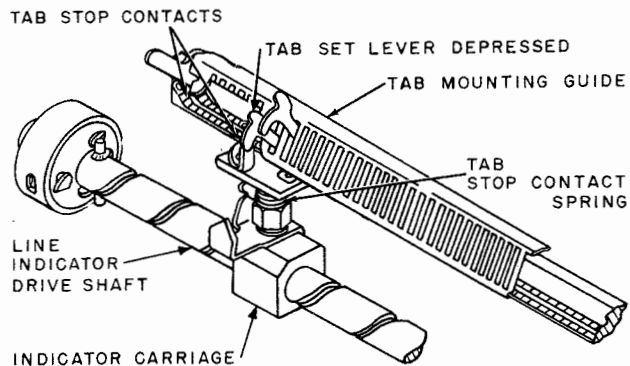


(upward) of the tabulator locking lever the tab set levers cannot be engaged by the tab stop contact (S13 on TT-117/FG and TT-119/FG; S12 on all other models) on the indicator carriage.

c. Installed in front of the universal bar on the page printer is a tabulator bar. When the repeat key lever is depressed it moves the tabulator bar to the right (fig. 98). When the tabulator bar moves to the right, it causes the tabulator lever to pivot counterclockwise, pivoting the tab mounting guide forward. When the tabulator locking lever is pulled down and the space bar and repeat key lever are depressed, the tab mounting guide pivots forward so that the preset tab set levers are in line with the tab stop contact (fig. 99) on the indicator carriage. The keyboard continues to send repeated space impulses and the indicator carriage continues to move to the right until the tab stop contact on the indicator carriage strikes the preset tab set lever. When the tab stop contacts strike the tab set lever, they pivot, forcing the tab stop contacts on the indicator carriage to press against the tab stop contact mounted on the indicator frame. This energizes the restoring solenoid (L1) and prevents further transmission until the repeat key lever is released. The indicator carriage is now in the position predetermined by the setting of the tab set lever.

d. Releasing the repeat key lever allows the tabulator bar to move to the left. The tabulator lever then pivots clockwise, pivoting with it the tab mounting guide. When the tab mounting guide pivots, it moves the preset tab set lever out of the way of the tab stop contacts on the indicator carriage. The tab stop contacts on the indicator carriage are restored to their normal position by the tab stop contact spring. This moves the tab stop contacts on the indicator carriage away from the tab stop contacts on the frame deenergizing the restoring solenoid (L1). The indicator carriage is now aligned with the position of the preset tab set lever.

e. Whenever the tabulator bar has been moved to the right, the extension on the tabula-



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Figure 99. Indicator carriage pivoted after striking preset tab set lever.

tor bar blocks downward movement of the carriage-return key lever and prevents operation of the carriage-return function until the repeat key lever is released.

f. The operation of the tabulator mechanism is summarized in the following sequence chart.

Tabulator sequence chart

Note. The following sequence of operations occurs only when tab set levers and the tabulator locking lever are pulled down.

- 1 Space bar and the repeat key lever are depressed.
2. Tabulator bar shifts to the right.
- 3 Tabulator lever pivots counterclockwise, pivoting the tab mounting guide with it.
- 4 Repeated space code impulses are transmitted, moving the indicator carriage to the right.
- 5 Tab stop contacts (S13 on TT-117/FG and 119/FG; S12 on all other models) on indicator carriage strike the preset tab set lever, causing the tab stop contact to pivot in a clockwise direction.
- 6 Tab stop contacts on the indicator carriage contact the tab stop contacts on the indicator frame energizing the restoring solenoid (L1).
- 7 Restoring solenoid (L1) pivots stop latch cam to move the cam stop lever upward, blocking further transmission.
- 8 Repeat key lever released, allowing the tabulator bar to move to the left.
- 9 Tabulator lever pivots clockwise, pivoting the tab mounting guide with it toward the rear.
- 10 Preset tab set levers on the tab mounting guide move out of way of tab stop contacts on indicator, allowing tab stop contacts to open.
- 11 Keyboard again ready to send, with indicator carriage spaced to the predetermined position.

### Section III. MECHANICAL THEORY OF PERFORATOR

#### 65. General

The two major components of the perforator are the transmitter-distributor and the tape receiver. The transmitter-distributor is attached to the left side of the tape receiver and receives its mechanical power from the same motor as the tape receiver. Though the units are dependent upon the same motor for driving the individual mechanisms, each of the units may be arranged to operate independently.

#### 66. Message Transmission from Transmitter-Distributor

The transmitter-distributor translates the code perforations in a paper tape into electrical impulses and transmits these impulses as start-stop five-unit code groups (par. 24) to teletypewriter receiving units. The transmitter-distributor transmits *sequential* signals only.

#### 67. Tape Receiver Operation

The printing and perforating mechanisms of the tape receiver are controlled by the receive-

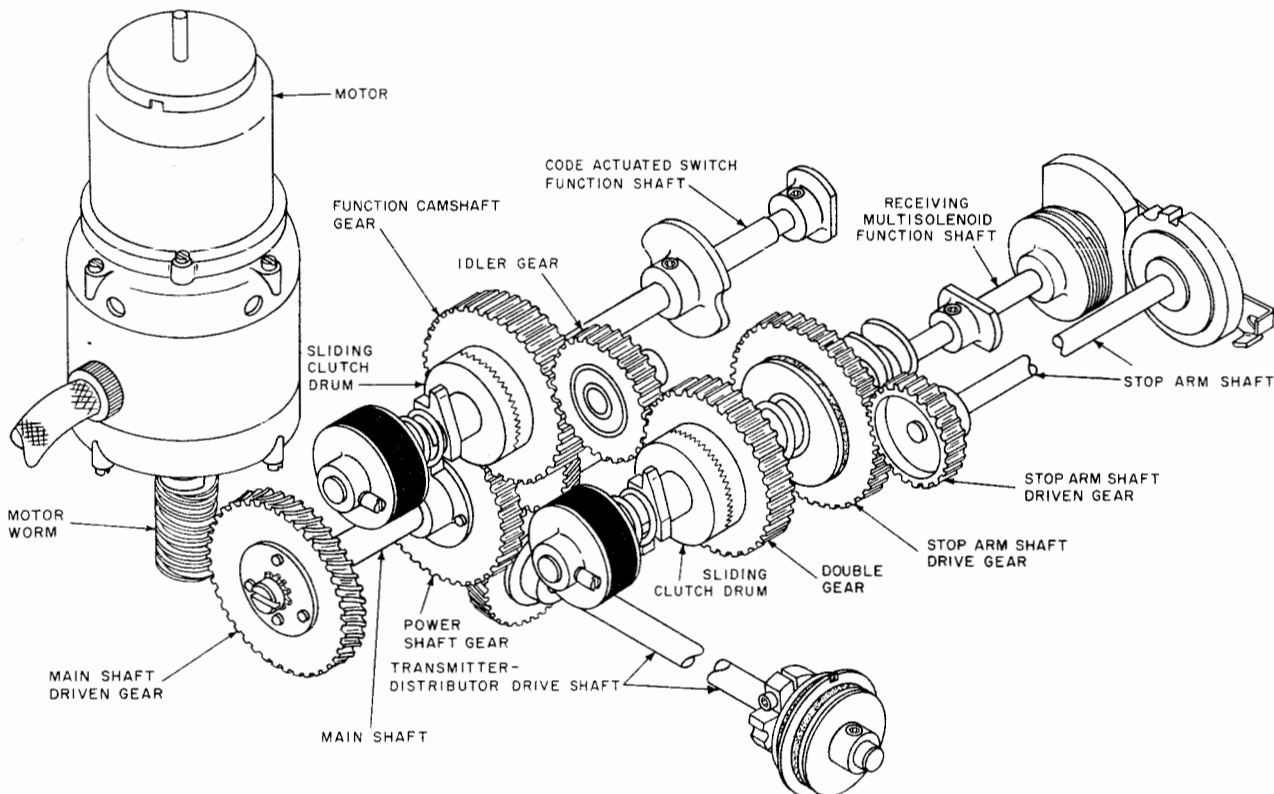
ing multisolenoid which responds *only* to simultaneous signals.

a. Incoming *simultaneous* signals (from the keyboard-transmitter) are received directly into the multisolenoid of the tape receiver and result in an instantaneous positioning of five multisolenoid Y-levers (par. 78).

b. Incoming *sequential* signals are received by the selector magnet. The selector magnet and associated mechanisms move five code plates in the code actuated switch to marking or spacing positions as determined by the incoming code group. When the fifth code plate is positioned, the code actuated switch transfers five code impulses *simultaneously* to the receiving multisolenoid to activate the selecting, printing, and perforating mechanisms (pars. 75-82).

#### 68. Perforator Motors and Power Distribution

a. The perforator of the AN/FGC-25, AN/FGC-26, and AN/FGC-57 are powered by synchronous motors. Series-governed motors



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Figure 100. Perforator mechanical power distribution arrangement.

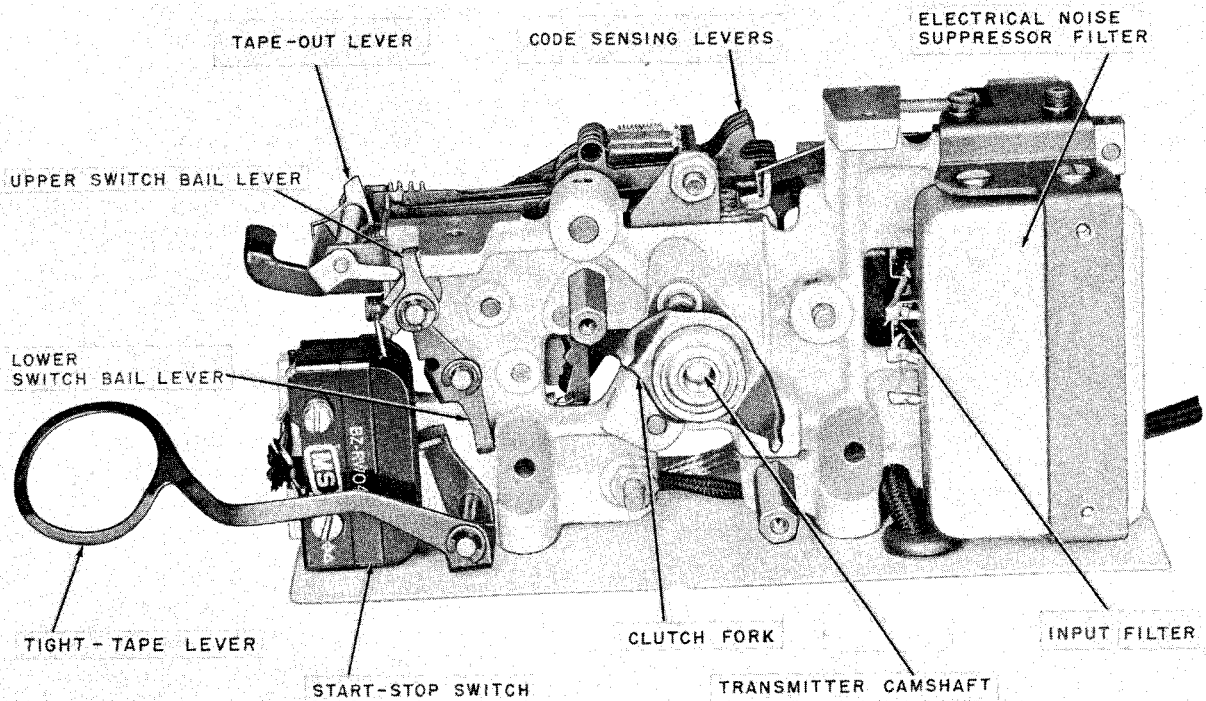


Figure 101. Right side view of the transmitter-distributor, showing switch control mechanism.

are used in the AN/FGC-25X. Refer to paragraphs 28, 96, and 101 for detailed information on these motors.

b. The motor of each of the perforators is geared to the main shaft (fig. 100) which rotates constantly when the motor is running. The transmitter-distributor drive shaft and all other shafts of the tape receiver are driven from the main shaft through gears and clutches.

### 69. Transmitter-Distributor Driving Mechanism

The transmission of each code group from the transmitter-distributor requires a half revolution of the transmitter camshaft (fig. 101). The transmitter camshaft is driven as described below:

a. When the motor in the tape receiver is running, the transmitter-distributor drive shaft (fig. 100) rotates continuously. The drive shaft is coupled to the transmitter camshaft by a friction clutch. The friction clutch consists of a driving friction assembly which is mounted on one end of the transmitter-distributor drive shaft (fig. 100) and a driven clutch fork which is mounted on the transmitter camshaft (fig. 101).

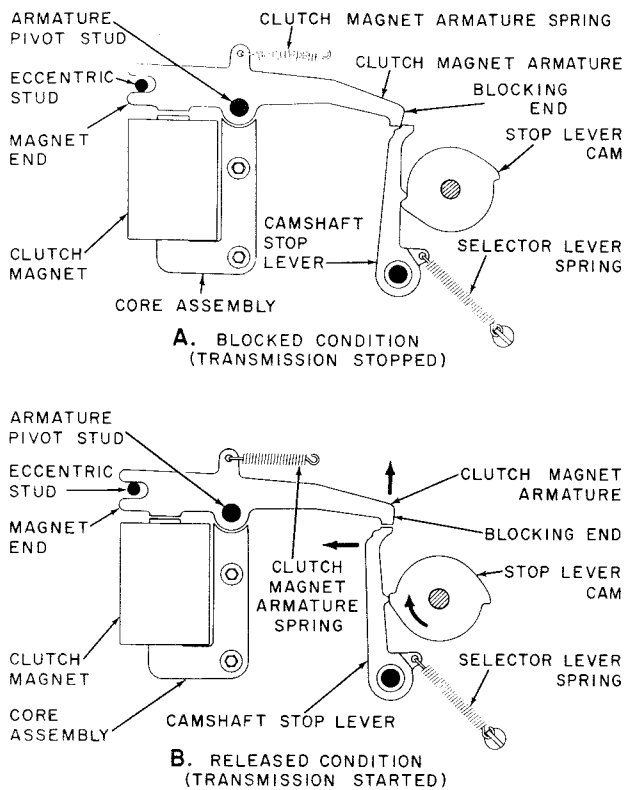
b. Detailed theory of the friction clutch is described in paragraph 33. The camshaft stop lever (fig. 102) is used to control rotation of the transmitter camshaft (par. 70).

### 70. Transmitter-Distributor Transmission Control

The starting and stopping of the transmitter camshaft is controlled by a clutch magnet (E7 on TT-178/FG and TT-179/FG; L201 on all other models), clutch magnet armature, camshaft stop lever, and a stop lever cam that is part of the transmitter camshaft.

a. When the transmitter-distributor is idle, the clutch magnet is *deenergized* and the clutch magnet armature spring holds the armature in the clockwise position. Rotation of the transmitter camshaft is prevented because the upper end of the camshaft stop lever (A, fig. 102) is blocked by the blocking end of the magnet armature, and the center projection of the stop lever contacts a lobe on the stop lever cam. This holds the transmitter camshaft stationary against the drive of the friction clutch.

b. When the STOP-START lever is placed in the START position, a mechanical train of parts operates the start-stop switch (S17 on



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Figure 102. Transmitter camshaft control mechanism.

TT-178/FG and TT-179/FG; S205 on all other models) to energize the clutch magnet (par. 119f). The clutch magnet attracts the magnet end of the clutch magnet armature, causing the blocking end of the armature to move out of the path of the camshaft stop lever. The stop lever cam, driven by the friction clutch, rotates past the blocking projection on the camshaft stop lever.

c. Transmission stops when a train of parts operates the start-stop switch to deenergize the clutch magnet. Any of the following actions cause the clutch magnet to deenergize.

- (1) Upward movement of the tight-tape lever.
- (2) Upward movement of the sensing portion of the tape-out lever.
- (3) Manual movement of the STOP-START lever to either the STOP or FEED RETRACT position.

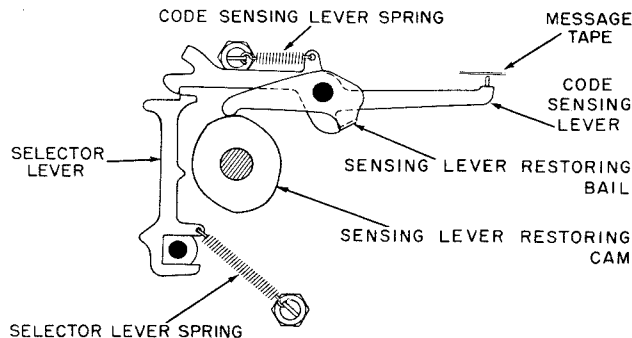
## 71. Tape Sensing

a. The tape sensing mechanism (fig. 103) consists of five identically shaped code sensing

levers, five code sensing lever springs, a sensing lever restoring bail, and a sensing lever restoring cam that is part of the transmitter camshaft.

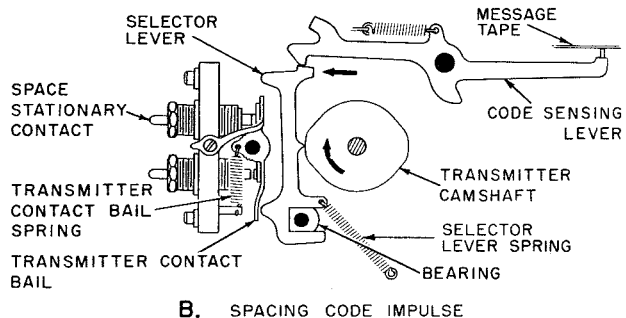
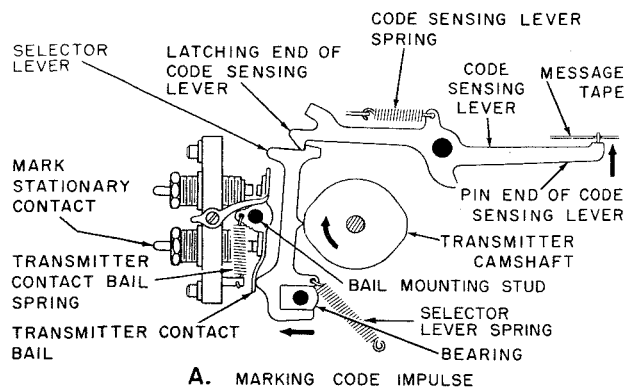
b. When the transmitter-distributor is idle, the pin ends of the five code sensing levers are held down by the sensing lever restoring bail and the sensing lever restoring cam, and the tops of all the pins are below the surface on which the message tape rests. As the transmitter camshaft comes to rest, the high part of the sensing lever restoring cam moves against the sensing lever restoring bail, rotating the sensing lever restoring bail clockwise slightly. The front arm of the sensing lever restoring bail, which is in contact with the center arm of all the code sensing levers, causes the code sensing levers to rotate clockwise, moving the pins below the surface of the message tape.

c. When a message is to be transmitted, a perforated message tape must be placed in the transmitter-distributor. The driving and transmission control mechanisms, described in paragraphs 69 and 70, cause the transmitter camshaft to rotate. As the cams on the transmitter camshaft rotate, the rear arm of the sensing lever restoring bail moves to the low part of the sensing lever restoring cam. The code sensing lever springs provide the tension to cause the pin ends of all the code sensing levers to move upward against the message tape (fig. 104). In this way, the code sensing levers are positioned to correspond with the code perforations in the message tape. If a code hole is present above any particular code sensing lever, the pin moves upward, through the code hole, and the code sensing lever is positioned to transmit



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Figure 103. Tape sensing mechanism.



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Figure 104. Transmitting of marking and spacing impulses.

a marking impulse (A, fig. 104). If no code hole is present, the message tape halts upward movement of the code sensing lever, holding it in the spacing impulse position (B, fig. 104).

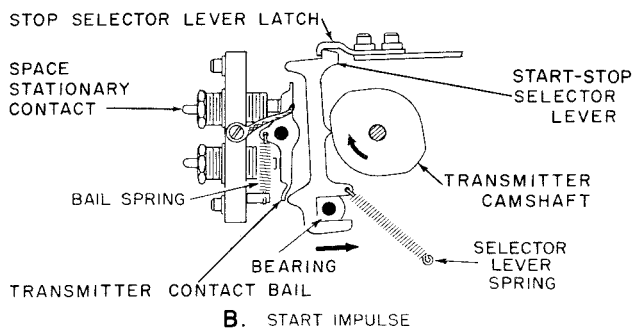
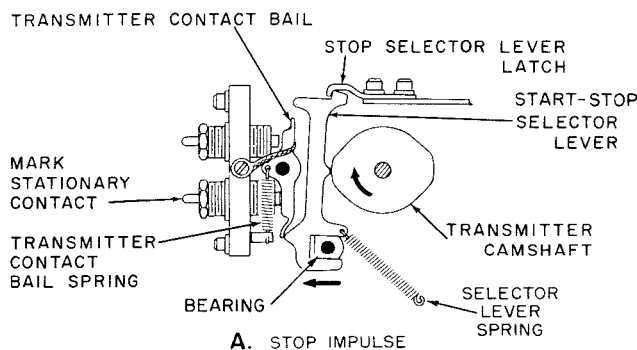
## 72. Impulse Transmission from Transmitter-Distributor

a. A marking code impulse is transmitted in the following manner: if a hole is present in the message tape directly above the pin end of a code sensing lever, during the tape sensing operation the pin continues to move upward through the hole in the message tape (A, fig. 104), and the latching end of the code sensing lever latches its mating selector lever. When a lobe of the associated cam moves against the center projection of the selector lever, the selector lever, now latched at its upper end, slides on its bearing (lower end), closing the contacts of the transmitter contact bail and the mark stationary contact, and a marking impulse is transmitted. If a spacing code impulse is to be transmitted, no hole is present in the

message tape directly above the pin end of a code sensing lever (B, fig. 104). The lever rotates counterclockwise until the upward movement of the pin is blocked by the tape. This slight counterclockwise rotation of the code sensing lever is not enough to cause the latching end to latch a selector lever. When the lobe of the associated selector lever cam moves against the center projection of the selector lever, it pivots on its bearing. The upper end moves counterclockwise, permitting the transmitter contact bail spring to pivot the transmitter contact bail away from the mark stationary contact, and a spacing code impulse is transmitted.

b. The start and stop impulses are transmitted as described below. The transmitter camshaft starts turning when the clutch magnet is energized and stops when the clutch magnet is deenergized (par. 70).

- (1) When the transmitter camshaft is in its stopped position, the lobe on the start-stop cam is opposite the midpoint of the start-stop selector lever (A, fig. 105). The start-stop selector



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Figure 105. Transmission of start and stop impulses.

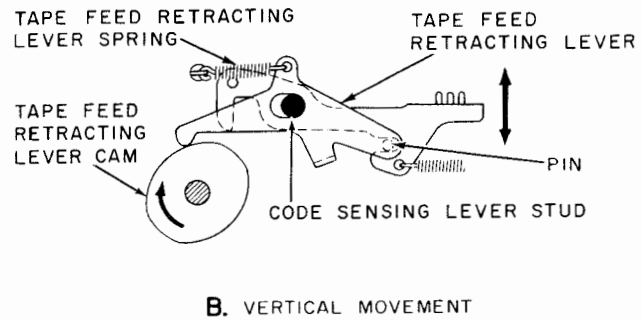
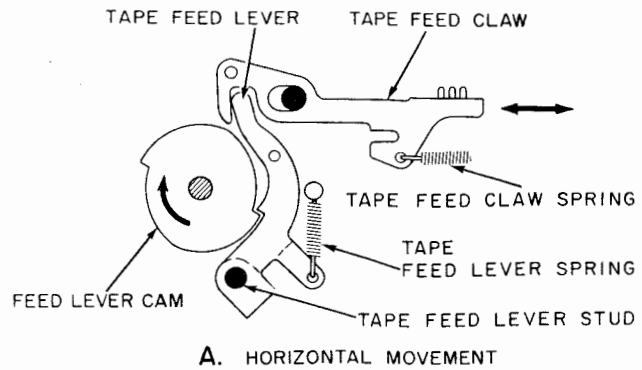
lever, *permanently* held at its upper end by the stop selector lever latch, slides on its bearing. The lower part of the start-stop selector lever moves the transmitter contact bail against the mark stationary contact, sending the stop impulse (mark) to the signal line. This occurs each time the lobe on the start-stop cam pushes the midpoint of the start-stop selector lever toward the transmitter contact bail.

- (2) When a code group is to be transmitted, the transmitter camshaft is permitted to rotate, and the first impulse transmitted is the start impulse (B, fig. 105). As the transmitter camshaft starts turning, the lobe on the start-stop cam moves away from the midpoint of the start-stop selector lever. The lower end of the start-stop selector lever then moves to the right because of the pull of the selector lever spring. The transmitter contact bail spring is then permitted to move the transmitter contact bail away from the mark stationary contact, sending the start impulse (spacing) to the signal line.

c. Each code sensing lever controls only its associated selector lever. Any selector lever, however, will actuate the transmitter contact bail when that selector lever is moved by its cam. The five cams are angularly displaced so that they operate their associated selector levers *in sequence* as the transmitter camshaft rotates.

### 73. Transmitter-Distributor Tape Feed Operation

Tape feed occurs immediately after the transmission of each code group. The tape feed mechanism (fig. 106) consists of a tape feed claw, a tape feed lever and feed lever cam, a tape feed retracting lever and tape feed retracting lever cam, and associated springs. The tape feed mechanism accomplishes tape feeding in two distinct movements: a horizontal movement (motion of the tape feed claw from left to right and back again), and a vertical movement (raising and lowering of the tape feed claw).



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Figure 106. Tape feed mechanism.

a. At the beginning of transmission of a code group, the transmitter camshaft is released by the clutch magnet armature and the feed lever cam starts turning clockwise. The tape feed lever (A, fig. 106) is held against the cam by the tape feed lever spring, and the upper end of the tape feed lever engages a notch in the tape feed claw. As the high portion of the feed lever cam approaches the projection on the tape feed lever, the tape feed claw is moved horizontally from left to right by the tension provided by the tape feed claw spring. When the feed lever cam rotates enough to allow the stronger tape feed lever spring to pull the tape feed lever into the notch in the feed lever cam, the tape feed claw moves abruptly from right to left. The combined action of this assembly moves the tape feed claw horizontally from left to right and back again. Tape is fed on the return movement.

b. In addition to the horizontal movement described above, the tape feed claw is also moved vertically by the tape feed retracting lever and the tape feed retracting lever cam (B, fig. 106).

A pin through the right arm of the tape feed retracting lever extends horizontally through a notch in the tape feed claw. This pin causes the tape feed claw to follow the movement of the right end of the tape feed retracting lever. When the transmitter is idle, the tape feed retracting lever rests against the low part of the tape feed retracting lever cam and the tape feed claw is in the upper position. At the beginning of transmission of a code group, the tape feed retracting lever cam starts turning. The right end of the tape feed retracting lever moves downward, carrying the tape feed claw with it. As the tape feed retracting lever cam completes one-half revolution, the tape feed retracting lever spring causes the tape feed retracting lever to return to the upper position. The combined action of the tape feed retracting lever and tape feed retracting lever cam for this operation is to move the tape feed claw vertically—upward to engage the tape before feeding and downward after feeding.

c. The actual motion of the tape feed claw under control of the tape feed lever, tape feed retracting lever, and their respective cams, is rectangular. The tape feed retracting lever causes the tape feed claw to engage the tape and withdraw after feeding, and the tape feed lever moves the tape feed claw back and forth to feed the tape a distance of one space.

#### 74. Transmitter-Distributor Operation Sequence Chart

The following chart describes the sequence of operations for the transmitter-distributor. It is assumed that the message tape is properly installed in the transmitter-distributor prior to the first operation listed.

1	Stop-start lever moved to the START position.
2	Clutch magnet energized, energizing the core assembly.
3	Clutch magnet armature pivoted counterclockwise by clutch magnet, releasing camshaft stop lever.
4	Camshaft stop lever pivots counterclockwise, freeing stop lever cam.
5	Friction clutch operates.   Transmitter camshaft starts rotating.
6	Sensing lever restoring bail moves into low part of sensing lever restoring cam, code sensing levers raise.

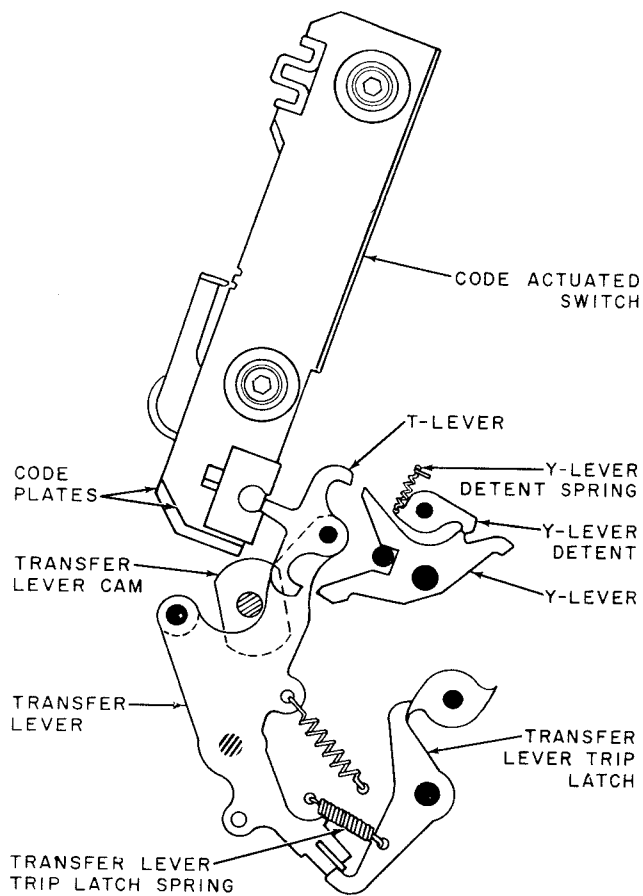
7	Code sensing levers strike message tape.	If code sensing lever is alined with hole in tape (marking), it latches selector lever. If code sensing lever is alined with no hole in tape (spacing), it does not latch selector lever.
8	Start-stop cam allows selector lever spring to pull start-stop selector lever counterclockwise.	
9	Start-stop selector lever pivots transmitter contact bail to spacing position.	Start (no current) impulse sent.
10	Transmitter camshaft causes No. 1 selector lever to pivot at top if latched (marking) or at the bottom if not latched (spacing).	Transmitter contact bail moved to marking or spacing position sending No. 1 marking or spacing impulse.
11	Tape feed claw moves out of engagement with tape feed holes.	
12	Second, third, and fourth code impulses sent.	Tape feed claw moves forward.
13	Fifth code impulse sent.	Feed claw rises to engage with feed holes.
14	Stop impulse sent.	Code sensing levers lowered by cam action out of way of message tape.
15	Tape feed lever moves to low part of cam, allowing tape lever spring to pull tape feed lever to the rear, moving the message tape one space.	
16	Transmitter-distributor ready to transmit another code group.	

#### 75. Reception of Sequential Code Impulses by Perforator

The polar selector magnet used to receive sequential code impulses is identical with the polar selector magnet used on the page printer and described in paragraph 42. The polar selector magnet is mounted on the perforator with the magnetic coils in a horizontal position, while on the page printer, it is mounted in a nearly vertical position. However, its operation is the same in both cases.

#### 76. Code Actuated Switch Transfer Operation

The five code plates (fig. 107) of the code actuated switch must be positioned according to the incoming code group in order to convert



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Figure 107. Transfer mechanism.

the sequential form of the code group to a simultaneous form of the code group which can be received by the receiving multisolenoid for subsequent conversion to printed and punched tape. The incoming code group is stored in the five Y-levers in clockwise and counterclockwise settings in accordance with the marking and spacing impulses of the code group. The Y-lever settings are transferred to the T-levers which position the code plates.

a. The five code plates can be moved up or down in the code actuated switch. Each code plate has a slot which mates with a corresponding tail of one of the five T-levers (fig. 107). These T-levers are mounted on a common pivot on the end of the transfer lever. Turning the T-lever causes its mating code plate to move up or down. The T-levers are mounted in the same planes as their corresponding Y-levers, and the motion of the transfer lever engages the ends of the T-levers with the ends of the

Y-levers. The ends of the T-levers are farther apart than those of the Y-levers, therefore, only one end of the T-lever can engage the Y-lever at any time. When the transfer operation takes place, the transfer lever moves all of the T-levers against the Y-levers; this transfers the settings of the Y-levers to the T-levers and to the code plates. Each Y-lever set clockwise (marking position) engages its T-lever at the top. This causes the corresponding code plate to move downward (if not already in that position). Each Y-lever set counterclockwise (spacing position) engages its corresponding T-lever at the bottom. This causes the corresponding code plate to move upward (if not already in that position).

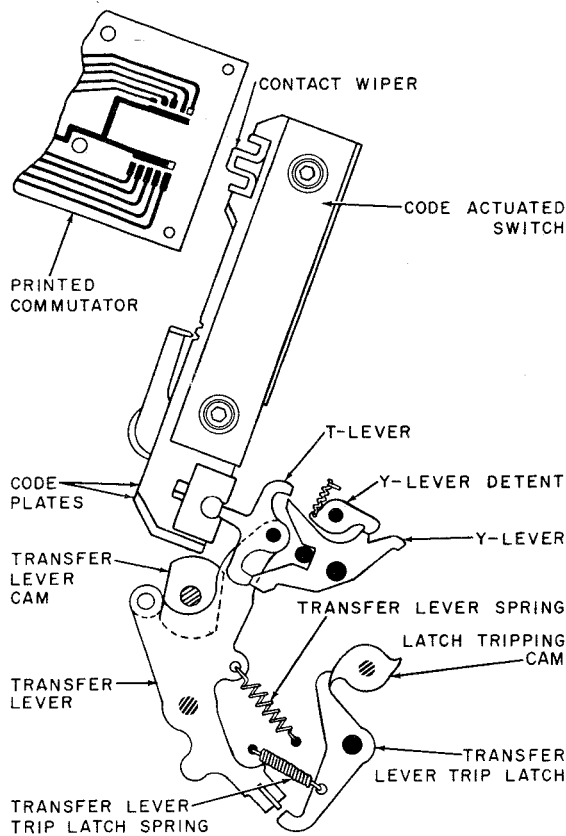
b. The transfer operation, or turning of the transfer lever, takes place after the fifth code impulse is stored in the Y-levers, but before the selector camshaft is brought to rest by the stop impulse. A sixth, or latch-tripping cam mounted on the selector camshaft (fig. 108) trips the transfer lever trip latch that holds the transfer lever in a counterclockwise position, and the transfer lever is pulled clockwise by the transfer lever spring. The timing of the latch-tripping cam with respect to the five selector cams and stop plate is such that the tripping action takes place only after the selecting operation is completed and before the selector camshaft is stopped.

c. Each of the five code plates has a contact wiper (fig. 108) which rides in a notch in the upper portion of the printed commutator. The printed commutator and five associated wipers are designated S32 in the TT-178/FG and TT-179/FG and as S215 in all other models. These contact wipers are held against the printed commutator by spring tension. As the code plates move up and down, the contact wipers move with them, each of them closing one circuit in the upper position and a different circuit in the lower position.

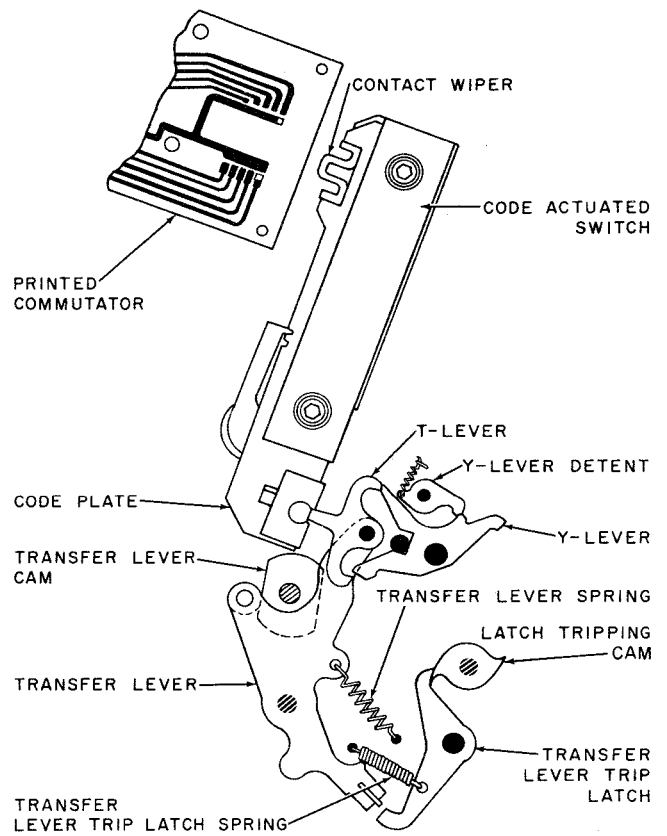
*Note.* The printed commutator (A and B, fig. 108) is shown turned 90° to reveal the printed circuitry of the commutator.

d. The printed commutator (fig. 108) has two strips which provide the common contacts of the circuit. An arm of the contact wiper always contacts one or the other of these common strips when positioned in either the spac-





A. SPACING



B. MARKING

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Figure 108. Code plates positioning switch contact wipers on printed circuit.

ing or the marking position. In the spacing position (code plate up), the lower arm of the contact wiper contacts the lower common strip. In the marking position (code plate down), the upper arm contacts the upper common strip. The printed commutator also provides two more contact points for each contact wiper, one above the upper common strip and one below the lower common strip. Thus, when a code plate is in the upper position (spacing), the lower arm of the contact wiper rides against the lower common strip while the upper arm rides against the upper contact, closing one circuit to the receiving multisolenoid. In the same manner, when a code plate is in the lower position (marking), the upper arm of the contact wiper rides against the upper common strip while the lower arm rides against the lower contact, closing a different circuit to the receiving multisolenoid. In this way, each code plate closes one circuit if the received im-

pulse is a marking impulse, and closes a different circuit if the impulse is a spacing impulse.

e. The operations described in a through d above are summarized in the following sequence chart.

Transfer operation sequence chart

- |   |   |
|---|---|
| 1   | Transfer lever latch tripping cam turns transfer lever trip latch.  |
| 2   | Transfer lever trip latch releases transfer lever.  |
| <i>Note.</i> The action described in the transfer restoring lever sequence chart (par. 77a) begins at this point in the sequence of operations. |   |
| 3   | Transfer lever moves five T-levers against the Y-levers.  |
| 4   | Y-levers position T-levers.   |
| 5   | T-levers position code plate.   |
| 6   | Contact wiper on each code plate closes either marking or spacing circuit as determined by position of associated code plate. |

## 77. Code Actuated Switch Function Shaft Operation

The code actuated switch function shaft restores the transfer mechanism to its latched position, provides the power to register and lock the code plates in place, and controls the receiving multisolenoid pulsing contacts (18 on the TT-178/FG and TT-179/FG; S217 on all other models), which energize the circuits of the receiving multisolenoid. These operations are described in detail in *a* through *c* below.

### *a. Restoring Transfer Mechanism.*

- (1) The T-levers must be moved *away* from the Y-levers before the next code group can be set up in the Y-levers. This T-lever movement is accomplished when the transfer lever is restored to the latched position. The transfer lever must be rotated slightly counterclockwise against the tension of the transfer lever spring and latched in this counterclockwise position by the transfer lever trip latch (fig. 108). The transfer lever cam, mounted on the front of the code actuated switch function shaft, accomplishes this action when the code actuated switch function shaft completes its one-half revolution.
- (2) The code actuated switch function shaft starts turning when the transfer operation occurs. When the transfer lever moves the T-levers against the Y-levers, partial rotation of the transfer lever causes the clutch latch arm to rotate also, since both are attached to the same shaft. The clutch latch arm moves away from an arm of the sliding clutch drum on the function shaft, permitting the teeth on the sliding clutch drum to engage (fig. 100). When the code actuator switch function shaft revolves, the transfer lever cam (fig. 108) moves the transfer lever toward the restored position. Near the end of the one-half revolution, the transfer lever trip latch spring pulls the transfer lever trip latch into position to latch the transfer lever.

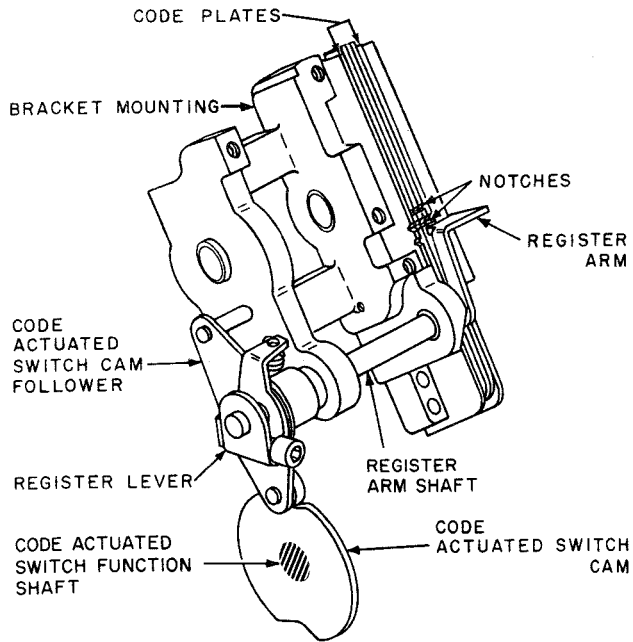
- (3) The operations described in (1) and (2) above are summarized in the following sequence chart.

Restoring transfer lever sequence chart

1	Transfer lever trip latch releases transfer lever.
2	Transfer lever, shaft, and clutch latch arm turn.
3	Clutch latch arm releases sliding clutch drum.
4	Sliding clutch drum engages.
<i>Note.</i> The actions described in the Code Plate Registering Sequence Chart (b(5) below) begin at this point in the sequence of operations.	
5	Code actuated switch function shaft starts turning.
6	Transfer lever cam lifts transfer lever.
7	T-levers move clear of Y-levers, and clutch latch arm returns to position.
8	Transfer lever latched.
9	Arms of sliding clutch drum meets clutch latch arm ball bearing.
10	Sliding clutch drum disengaged.
11	Clutch latch arm holds sliding clutch drum.
12	Code actuated function shaft stops at completion of one-half revolution.

### *b. Registering and Locking Code Plates.*

- (1) After the five code impulses have caused the positioning of the five code plates of the code actuated switch, the five code plates are registered and locked in place to align the contact wipers exactly in the correct position and to prevent the code plates from shifting out of alignment. This is accomplished by a code actuated switch cam on the code actuated switch function shaft, a code actuated switch cam follower, and a register arm (fig. 109).
- (2) While the selection and transfer operations are taking place, the code actuated switch cam follower rests in the indent of the code actuated switch cam. The code actuated switch function shaft is held stationary during this time. When the code actuated switch function shaft is unlatched and starts to rotate (*a* (2) above) the code actuated switch cam follower moves to a high part of the code actuated switch cam, pivoting the register arm shaft and the register arm which is



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Figure 109. Code plate registering and locking mechanism.

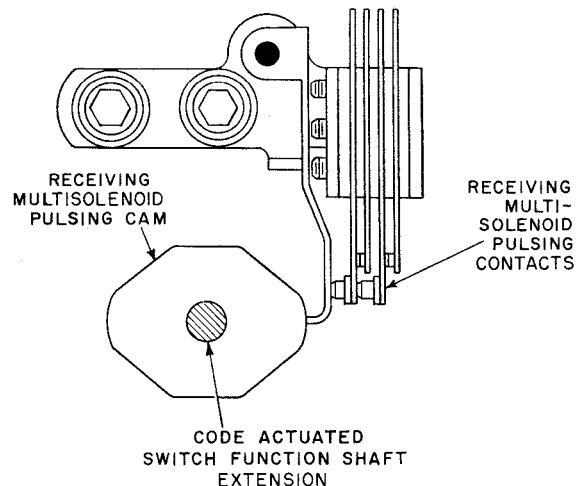
- spring-connected to the code actuated switch cam follower.
- (3) When the register arm is pivoted, a blade on the end of the arm engages one of two V-shaped notches in each of the code plates. When a code group is set up on the code plates, a groove is formed by the upper notches of code plates in the marking position and with the lower notches of code plates in the spacing position. Any slightly out-of-line code plates are cammed into place as the register arm moves into the groove.
  - (4) During the code plate positioning interval, the code actuated switch cam follower rests in an indent of the code actuated switch cam, allowing the code plates to move. Immediately upon the start of rotation of the cam, and during most of the remainder of the half-revolution, the code actuated switch cam follower rests on the high portion of the code actuated switch cam, locking the code plates.

(5) The operations described in (1) through (4) above are summarized in the following sequence chart.

Code plate registering sequence chart

- |   |   |  |
|---|---|--|
| 1   | Code actuated switch function shaft starts turning.   |  |
| 2   | Code actuated switch cam follower moves out of the indent of the code actuated switch cam on code actuated switch function shaft. |  |
| 3   | Code actuated switch cam follower, register lever, and register arm pivot.  |  |
| 4   | Blade on register arm engages notches on code plates, and locks them in place.  |  |
| <p><i>Note.</i> The actions described in the Code Actuated Switch Function Shaft Pulsing Sequence Chart (c below) begin at this point in the sequence of operation.</p> |   |  |
| 5   | Code plates held in place.  | Code actuated switch function shaft continues its one-half rotation. |
| 6   | Code actuated switch cam follower drops to low part of code actuated switch cam.  |  |
| 7   | Code actuated switch cam follower, register lever, and register arm pivot back to original position.                              |  |
| 8   | Register arm blade moves free of code plates, releasing them.   |  |
| 9   | Code actuated switch function shaft stops.  |  |

c. Pulsing Mechanism Operation. The receiving multisolenoid pulsing cam (fig. 110) on the extension of the code actuated switch function shaft operates the receiving multi-



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Figure 110. Code actuated switch function shaft pulsing mechanism.

solenoid pulsing contacts (S18 on the TT-178/FG and TT-179/FG; S217 on all other models) which control the circuit through the perforator latch coils (par. 100a) and through the receiving multisolenoid coils (par. 99). When the contacts close, the perforator latch coils energize and permit the receiving multisolenoid function shaft to rotate. The sequence of operation of the pulsing mechanism is as follows:

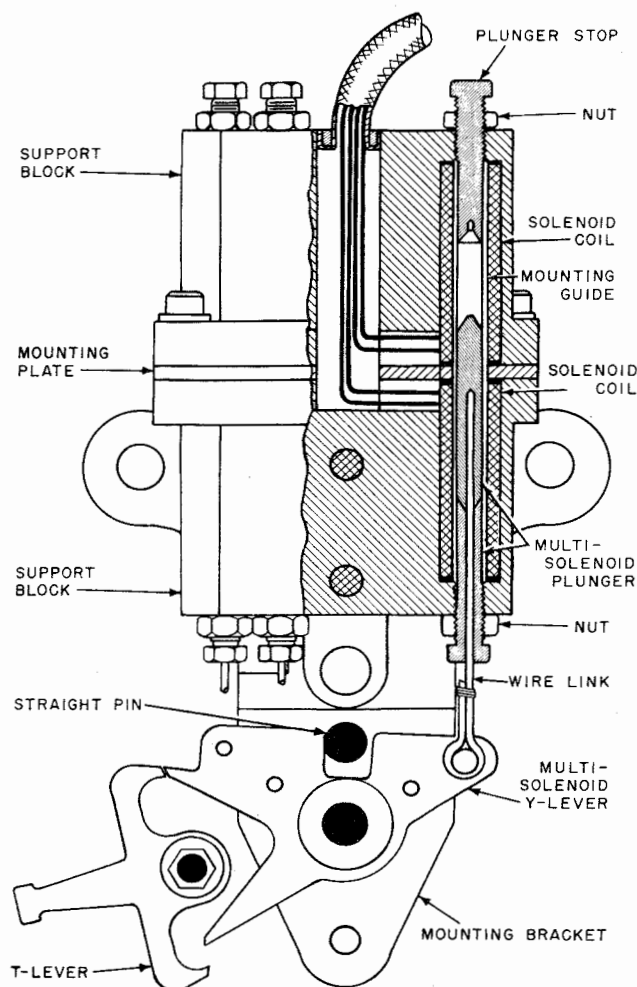
Code actuated switch function shift pulsing sequence chart

1	Code plates held in place.	Code actuated switch function shaft continues its one-half revolution.
2	High part of receiving multisolenoid pulsing cam strikes actuating mechanism of the receiving multisolenoid pulsing contacts.	
3	Receiving multisolenoid pulsing contacts close, pulsing the circuits of the receiving multisolenoid and energizing the perforator latch coils (L3 on the TT-178/FG and TT-179/FG; L203 in all other models) which permits the receiving multisolenoid function shaft to rotate.	
4	High part of receiving multisolenoid pulsing cam moves away from receiving multisolenoid pulsing contacts.	
5	Receiving multisolenoid pulsing contacts open, deenergizing the circuits of the perforator latch coils and the receiving multisolenoid.	
6	Code actuated switch function shaft stops.	

## 78. Receiving Multisolenoid Operation

a. The receiving multisolenoid converts the code group received simultaneously through the 11-wire circuit from the code actuated switch into mechanical settings which select the character to be printed and the code group to be perforated in the message tape. The basic operation of the receiving multisolenoid consists of the energizing of one of two solenoid coils (figs. 111 and 112) for each of the five code impulses. The solenoid coils position five multisolenoid plungers which, in turn, move five multisolenoid Y-levers to one of two possible settings. Which coil of each pair of solenoid coils will be energized is determined by whether a marking or spacing circuit was closed by the code actuated switch (par. 76d).

b. The receiving multisolenoid consists of an upper support block and a lower support block (figs. 111 and 112). Each of these blocks has five holes drilled into it to allow for the insertion of five solenoid coils. The holes are so



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Figure 111. Receiver, multisolenoid, cutaway view (TT-178/FG and TT-179/FG).

spaced that each hole in the upper support block is aligned with a matching hole in the bottom support block when the two blocks are assembled. The solenoid coils have hollow cores and tubular mounting guides inserted to provide five passages extending from the bottom of each coil in the lower support block to the top of its mating coil in the upper support block.

c. Multisolenoid plungers, inserted in the mounting guides, are made of metals which react to a magnetic field. Wire links attached to the bottoms of the multisolenoid plungers extend through the bottom of the lower support block. The ends of the wire links are attached to the multisolenoid Y-levers which are free to pivot on a post under the center of the multi-

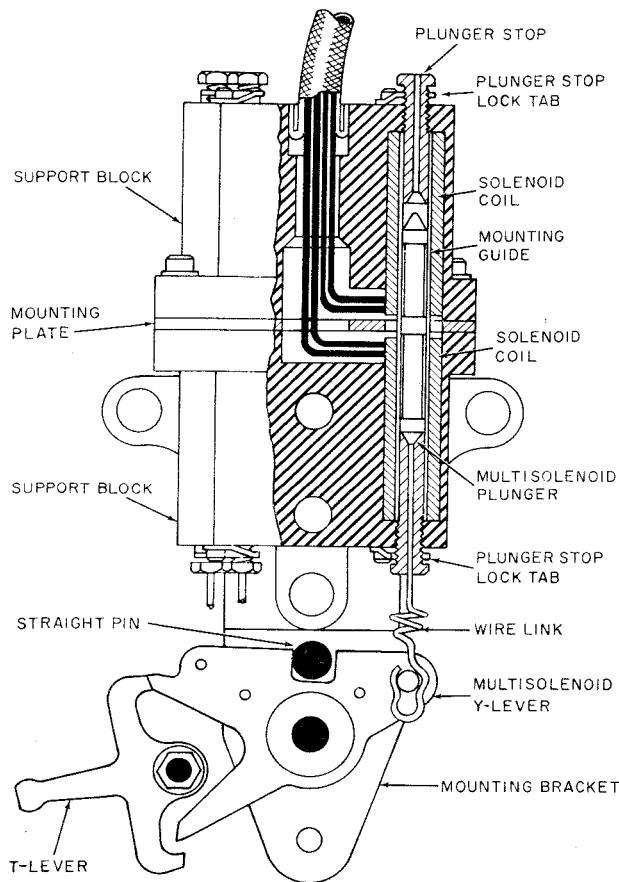


Figure 112. Receiving multisolenoid, cutaway view (TT-178A/FG, TT-179A/FG, and TT-181/FG).

solenoid. Upward and downward movement of the multisolenoid plungers is transferred to the multisolenoid Y-levers in the form of clockwise or counterclockwise movement of the Y-levers about the pivot post (*d* and *e* below).

*d.* When the code impulses are received from the code actuated switch through the 11-wire circuit, either the top or the bottom solenoid coil for each multisolenoid Y-lever is energized, depending upon whether the code impulse is a mark or a space. The energized solenoid coil sets up a magnetic field which attracts the multisolenoid plunger, pulling it toward the center of the energized coil. This movement of the multisolenoid plunger is transferred by a wire link to the multisolenoid Y-levers below the multisolenoid.

*e.* The multisolenoid plungers that control multisolenoid Y-levers 1, 3, and 5 are installed in the left side of the receiver multisolenoid, and

are connected to the multisolenoid Y-levers at connection points to the *left* of the pivot post. When the upper solenoid coils for these multisolenoid Y-levers are energized, the multisolenoid plungers rise, pivoting the multisolenoid Y-levers *clockwise* to a *marking* position; when the lower solenoid coils are energized, the multisolenoid plungers are pulled down, pivoting the multisolenoid Y-levers *counterclockwise* to the *spacing* position. This action is reversed on multisolenoid Y-levers 2 and 4, because the multisolenoid plungers are connected to the multisolenoid Y-levers at connection points on the opposite side of the pivot post. When the multisolenoid plungers rise into the upper solenoid coils, the multisolenoid Y-levers are pivoted *counterclockwise* to a *spacing* position. When the multisolenoid plungers are pulled into the lower solenoid coils, the multisolenoid Y-levers are pivoted *clockwise* to a *marking* position.

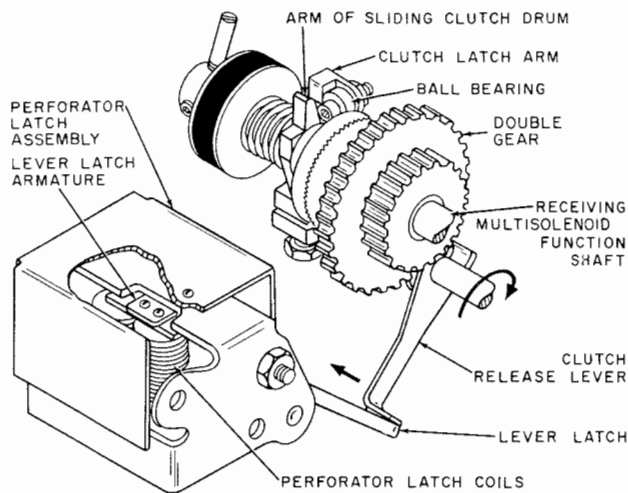
## 79. Multisolenoid Transfer Operation and Stop Bar Selection

### *a. Perforator Latch Assembly Operation.*

When the receiving multisolenoid pulsing contacts (S18 on the TT-178/FG and TT-179/FG; S217 on all other models) are operated by the receiving multisolenoid pulsing cam on the code actuated switch function shaft (par. 77*c*), the contacts complete a circuit to energize the perforator latch coils (L3 on the TT-178/FG and TT-179/FG; L203 on all other models). The energized perforator latch coils produce a magnetic field which attracts the lever latch armature which is connected to the lever latch (fig. 113). The lever latch moves upward, releasing the clutch release lever, and the transfer operation occurs (*b* below).

*Note.* The perforator latch coils may be energized by operation of the manual tape feed-out switch also (par. 84).

*b. Transfer Operation.* The clutch release lever, clutch latch arm (fig. 113), and transfer lever (fig. 114) are firmly fastened to the transfer lever shaft. The transfer lever spring applies a constant clockwise tension on the transfer lever. When the lever latch releases the clutch release lever (*a* above), the tension of the transfer lever spring causes the transfer lever to move the T-levers against the multi-

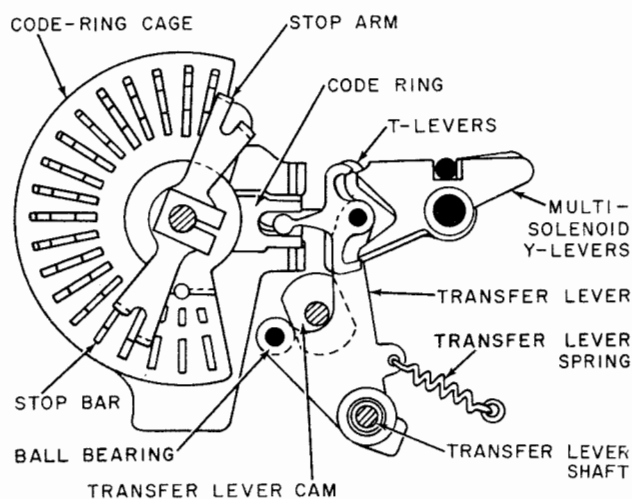


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Figure 113. Perforator latch releasing clutch release lever.

solenoid Y-levers. The *upper* arm of each Y-lever that is in the marking (clockwise) position engages the upper arm of its associated T-lever and the T-lever pivots counterclockwise, turning its associated code ring clockwise to the marking position. The *lower* arm of each Y-lever that is in the *spacing* (counterclockwise) position engages the lower arm of its associated Y-lever, causing the code ring for that impulse to be pivoted counterclockwise to the spacing position.

*c. Stop Bar Selection.* Each code ring has notches cut into the inner and outer edges of the curved portion of the code ring (fig. 59). When the transfer operation positions the code



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Figure 114. Transfer mechanism operated.

rings, a groove is formed under the stop bar to be selected. The pressure of the stop bar spring (fig. 63) pushes the selected stop bar into the groove, placing one end of the bar into position to stop rotation of the stop arm (par. 80d). The previously selected stop bar, in a notch set up by the preceding code group, is pushed out of the selected position by the sloping surfaces at the side of the notch in one or more of the code rings.

*d. Sequence Chart.* The operations described above are summarized in the following sequence chart:

Transfer operation sequence chart

- |   |   |
|---|---|
| 1   | Perforator latch coils (L3 on the TT-178/FG and TT-179/FG; L203 on all other models) energized. |
| 2   | Perforator latch coils trip latching mechanism, releasing clutch latch arm.                     |
| 3   | Clutch latch arm and transfer lever pivot clockwise.  |
| <i>Note.</i> The action described in the Transfer Mechanism Restoring Sequence Chart begins at this point in the sequence of operation. |   |
| 4   | Transfer lever moves five T-levers against multi-solenoid Y-levers.                             |
| 5   | Multisolenoid Y-levers position T-levers.   |
| 6   | T-levers position code rings, forming notch in code rings.                                      |
| 7   | Selected stop bar moves into notch in code rings.   |
| 8   | Previously selected stop bar pushed out by slanting surface of code rings.                      |

*e. Restoring Transfer Mechanism.* After the code rings are positioned, the T-levers must be moved away from the multisolenoid Y-levers to permit the Y-levers to be positioned in accordance with the code impulses of the next code group. This restoring action is accomplished as described below.

- (1) When the lever latch (fig. 113) released the clutch release lever on the transfer lever shaft (a and b above), the clutch latch arm (mounted on the same shaft) moved *away* from an arm of the sliding clutch drum. The clutch spring pushes the sliding clutch drum into engagement with the teeth in the side of the rotating double gear. The sliding clutch drum is keyed to the flexible coupling (which is firmly secured to the receiving multisolenoid shaft); therefore, the function shaft

begins turning when the drum moves into mesh with the double gear. A lobe of the transfer lever cam (fig. 114) pushes against the ball bearing on the transfer lever, rotating the lever counterclockwise. The T-levers move away from the adjacent Y-lever; the clutch latch arm moves into the path of a stop arm on the sliding clutch drum; and the clutch release lever moves counterclockwise and is held there by the lever latch. When the receiving multisolenoid function shaft nears the end of a half revolution, the arm of the sliding clutch drum strikes the ball bearing on the clutch latch arm. The drum is cammed away from the double gear and the shaft stops turning until the next code group is to be transferred to the code rings.

- (2) The operations described above are summarized in the following sequence chart:

Transfer mechanism restoring sequence chart

- |   |   |
|---|---|
| 1 | Sliding clutch drum meshes with the receiving multisolenoid function shaft gear.  |
| 2 | Receiving multisolenoid function shaft starts to rotate.  |
| 3 | Transfer lever cam strikes transfer lever ball bearing.   |
| 4 | Transfer lever pivots counterclockwise pivoting the T-levers and clutch latch arm at the other end of the transfer lever shaft with it. |
| 5 | Ball bearing on clutch latch arm strikes arm on sliding clutch drum.  |
| 6 | Sliding clutch drum cammed out of mesh with gear.   |
| 7 | Receiving multisolenoid function shaft stops.   |
| 8 | Clutch release lever latched by lever latch.  |
| 9 | Clutch latch arm and transfer lever retained in restored position.  |

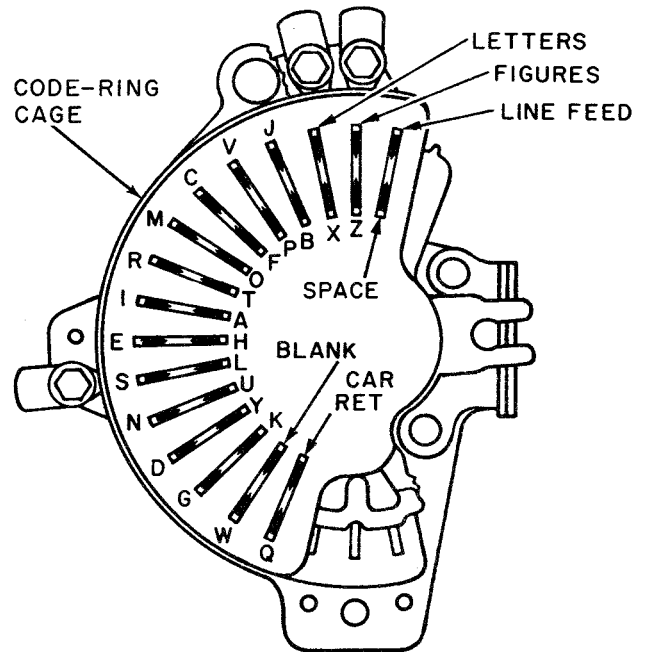
## 80. Translating Stop Bar Settings Into Type-Wheel Positions

a. *Code-Ring Selection of Stop Bars.* The selection of the stop bars by the code rings of the perforator is identical with the same operation in the page printing mechanism. Refer to paragraph 44.

b. *Stop Bar Arrangement.* The 32 stop bars are arranged in one inner and one outer row about a semicircle in the code-ring cage. The

ends of the outer stop bars move inward when selected. The ends of the inner stop bars move outward when selected. The stop arm has one inner and one outer projection on each end for engaging a selected stop bar. The inner projections of the stop arm halt the arm halfway between the outer stop arm positions. The character or function assigned to each stop bar is shown in figure 115. Of these, 26 are used for the alphabet and 6 are used for the operations described below.

- (1) Reception of the letters shift or figures shift code group causes the received code to be punched in the tape and the typewheel to be positioned for printing letters or figures. A symbol for the letters code group as shown in figure 36 is printed by the TT-178A/FG, TT-179/FG, and TT-181/FG.
- (2) Reception of the carriage return, line feed, and blank code groups do not cause any mechanical operation in the perforator other than recording the code group in punched and printed



VIEWED FROM FRONT OF PERFORATOR

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Figure 115. Characters and functions which the stop bars operate.

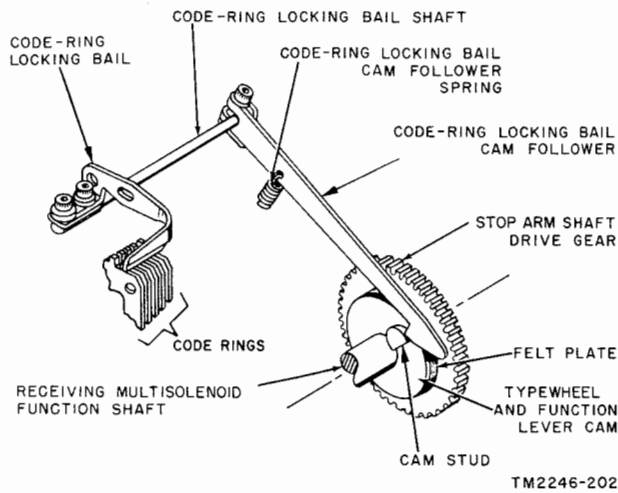


Figure 116. Code-ring locking mechanism.

form on the tape. This is also true with the space code group, except that no symbol is printed.

- (3) Reception of the S code group while the perforator is in the figures shift position causes the signal bell to ring. The code also is punched in the tape and the bell-like symbol is printed.

*c. Code-Ring Locking Arrangement.* During a printing or function cycle of operation in the perforator, the code rings are locked in position by the code-ring locking bail (fig. 116). The code rings remain locked in position for almost a half revolution of the receiving multisolenoid function shaft. As the function shaft reaches the end of the half revolution, the code-ring locking bail releases the code rings to permit positioning of the code rings for the next code group. The typewheel and function lever cam of the friction clutch on the receiving multisolenoid function shaft has two cam studs mounted 180° apart. While the code impulses are being stored in the selector mechanism, the receiving multisolenoid function shaft is motionless with one cam stud just under the code-ring locking bail cam follower. When the receiving multisolenoid function shaft starts rotating, this cam stud moves counterclockwise, allowing the code-ring locking bail cam follower spring to pull the cam follower downward. Because the code-ring locking bail cam follower and the code-ring locking bail are mounted on the same shaft, the code-ring locking bail also

moves downward against the code rings, locking them in position. When the receiving multisolenoid function shaft approaches the end of its half revolution, the opposite cam stud moves the code-ring locking bail cam follower and the code-ring locking bail upward. This unlocks the code rings, preparing them to receive the next code group.

*d. Stop Arm Shaft Operation.*

- (1) The stop arm shaft (figs. 100 and 117) is driven by the receiving multisolenoid function shaft through a friction clutch and gear arrangement which drives the typewheel hub assembly and typewheel and turns the stop arm. The stop arm and typewheel are aligned so that the desired character will appear on the typewheel in the printing position when the selected stop bar stops rotation of the stop arm. Thus, the position of the code rings and stop bars determines the character or symbol to be printed and punched.
- (2) Because the stop arm shaft must be positioned accurately to select the proper characters and functions, little bouncing can be tolerated when rotation of the stop arm is halted by a stop bar. To prevent excessive bouncing, an antibounce clutch (figs. 66 and 117) is mounted on the stop arm shaft between the code-ring cage and the stop arm. The central portion of the antibounce clutch is fastened to the stop arm shaft. The outer part of the antibounce clutch is locked in place by a stud on the code-ring cage. Four rollers in the clutch are spring-loaded in notches cut into the center portion of the clutch at an angle that permits only clockwise rotation of the stop arm shaft. The rollers roll along the inside surface of the cylindrical housing. Any attempt to make the stop arm shaft rotate counterclockwise immediately causes the rollers to jam between the housing and the moving part of the antibounce clutch. Thus, any tendency to reverse direction is minimized.



## 81. Perforator Printing Operation

The printing operation in perforators is accomplished by the mechanism shown in simplified form in figure 117. Portions of the selector and transfer mechanisms are included in this illustration to show the relationship between all the mechanisms concerned. The printing operation is described in the remainder of this paragraph.

*a. Selecting Character or Symbol.* A typewheel contains the raised letters of the alphabet, symbols, and figures that may be printed by this perforator. The typewheel is driven by the typewheel hub assembly on the stop arm shaft. Rotation of the stop arm shaft will rotate the typewheel.

- (1) After a received code group has been set up on the code rings, the stop arm rotates until it is stopped by one of the stop bars of the code-ring cage. The typewheel, geared to the stop arm shaft, also rotates and when stopped, the letter on the typewheel corresponding to the stop arm position will appear directly above the print hammer lever. The perforator can stop the typewheel in any of 32 positions, as the unit includes 32 stop bars, each in a different position in the code-ring cage. Of the 32 possible typewheel positions, 26 are used for letters of the alphabet, 3 are for symbols, and 3 are blank and do not print. On the TT-178A/FG, TT-179A/FG, and TT-181/FG, there are four positions utilizing printed symbols and two positions without any printed symbols.
- (2) When the typewheel is in figures shift, the typewheel positions used for the alphabet are used for numerals, punctuation marks, and communication symbols (fig. 36). Numerals and weather symbols are printed in the figures position of the TT-181/FG. Rotation of the stop arm, therefore, controls rotation of the typewheel which, in turn, brings the desired character to the printing position directly above the print hammer lever. Operated by another mechanism, the

print hammer lever moves upward sharply at the proper instant, striking the message tape and inking ribbon against the character on the typewheel.

*b. Printing Character or Symbol.* The printing operation is controlled by the rotation of the print and register cams on the receiving multisolenoid function shaft (fig. 117). The receiving multisolenoid function shaft begins its one-half revolution immediately after a stop bar is selected.

- (1) The typewheel register lever, riding against the register cam on the receiving multisolenoid function shaft, is pulled sharply upward by spring action when a high part of the register cam passes the contacting surface of the typewheel register lever. The blade at the left end of the typewheel register lever engages a notch of the register wheel, locking the typewheel in the desired character position. At the same time, the print hammer eccentric stop attached to the typewheel register lever moves downward, no longer blocking rotation of the print hammer lever. As a high portion of the print cam rotates past the contacting surfaces of the print hammer lever, the print hammer lever is pulled sharply upward by a spring. The print hammer lever strikes the message tape, pressing the inking ribbon against the desired character on the locked typewheel. After the character has been printed, the register cam moves the typewheel register lever downward, disengaging the register wheel, and the typewheel is free to rotate for printing the next character.
- (2) Printing does not occur when the letters shift, figures shift, or space code group is received. The stop bars for these operations halt rotation of the stop arm at a position that causes a high portion of the register wheel to stop directly above the blade of the typewheel register lever. When the

register cam permits the typewheel register lever to begin moving upward, it strikes against the portion of the register wheel that has no teeth cut into it. This prevents the typewheel register lever from moving fully to the upward position, and the print hammer lever eccentric stop continues to block rotation of the print hammer lever. With the stop in this position, the print hammer lever cannot follow the print cam surface, and printing is prevented.

- (3) The selecting and printing operations described above are summarized in the following sequence chart.

Printing operation sequence chart

1	Printing operation sequence started by transfer operation; receiving multisolenoid function shaft starts to rotate.	
2	Stop arm released by previously dropped stop bar. Typewheel reciprocating spring lever begins to push typewheel reciprocating transfer lever toward figures-letters shift lever (par. 87).	
3	Stop arm stopped by selected stop bar. Typewheel stopped in corresponding position.	
4	Typewheel moves forward, carrying inking ribbon with it. Movement of typewheel is halted by figures-letters shift latch and held under spring tension.	
5	Register cam releases typewheel register lever. Spring tension moves typewheel register lever to engage register wheel if character is to be printed.	
6	Print cam releases print hammer lever, which allows spring to drive hammer against typewheel to print character.	
7	Typewheel register lever is withdrawn from register wheel by register cam.	
8	Print hammer lever is moved away from typewheel by print cam.	
9	Multisolenoid function shaft clutch is disengaged.	Multisolenoid function shaft stops.

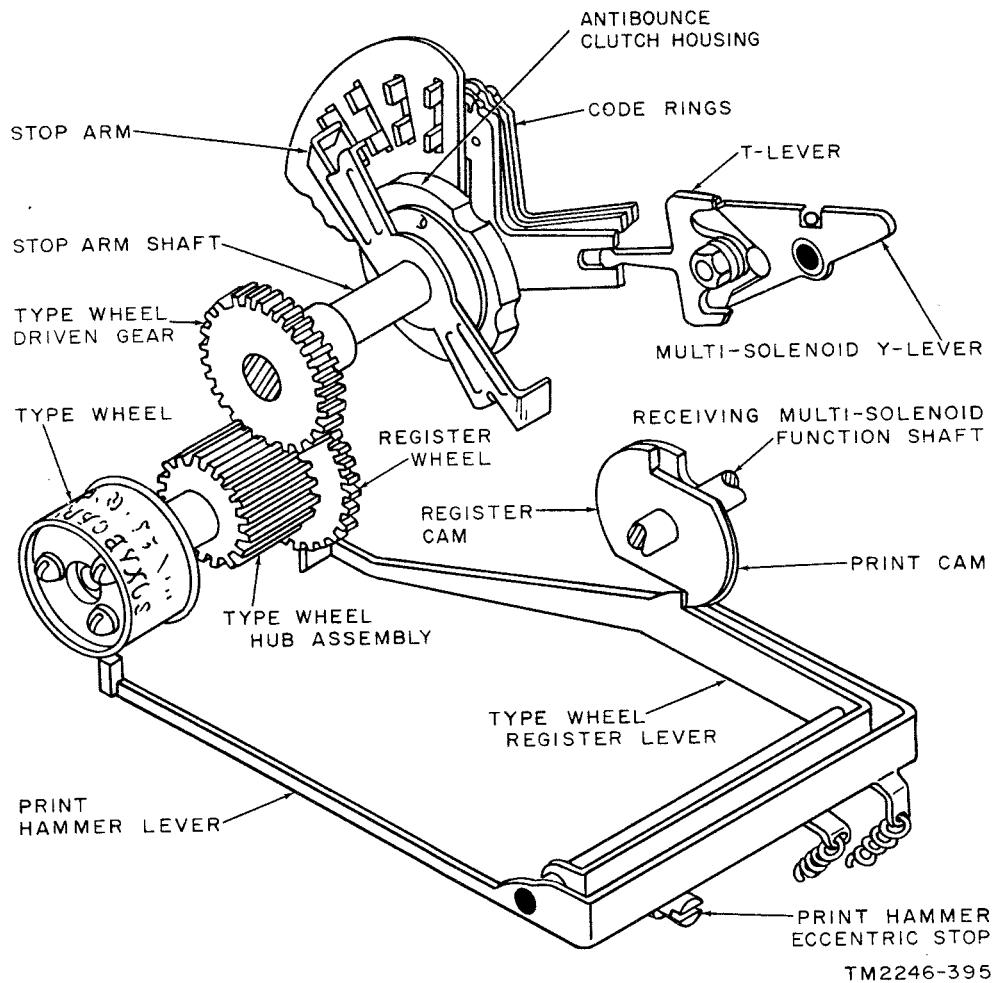
## 82. Tape Punching and Feeding Operations

In addition to printing messages on a message tape (par. 81), the perforator records the code impulses of each received code group in the form of punched code holes in the message tape. Shown in figure 35, at the right of the code chart, is a message tape containing infor-

mation in perforated form. The code impulses are recorded as a row of holes across the tape. This perforated portion of a message tape is subdivided into six columns; five for the code impulse holes and one for the tape feed hole. The first column along the edge opposite the printing is reserved for recording the first code impulse. When it is a marking impulse, a code hole is punched in this column, and when it is a spacing impulse, a hole is not punched. The second column is used to record the second code impulse in a like manner. The third column consists of a continuous row of smaller holes which are used for feeding the message tape through the perforator. The remaining three columns are used for the third, fourth, and fifth code impulses. Start and stop impulses are not recorded in perforated form because the transmitter mechanism automatically provides these impulses. Operation of the mechanism which perforates the code and feed holes and feeds the message tape is described in *a* through *c* below.

*a. Code Hole Punching Selection.* This operation begins when the code impulses of a received code group are stored in the code rings. The lower end of each of the five code rings mates with one of a set of 5-punch interference levers as shown in figure 118. These levers transfer the code-ring settings to the punching mechanism.

- (1) When a code ring is positioned counterclockwise to record a *spacing* impulse, the mating punch interference lever is rotated *clockwise*. The lower arm moves away from the raised portion of its corresponding code hole punch lever and a hole will not be punched when the punching operation occurs.
- (2) When a code ring is positioned clockwise to record a *marking impulse*, the mating punch interference lever rotates *counterclockwise*. This causes the lower arm of the punch interference lever to move in the blocking position directly above the raised portion of its code hole punch lever. When the punching operation occurs, a hole will be punched in the message tape to record this code impulse.

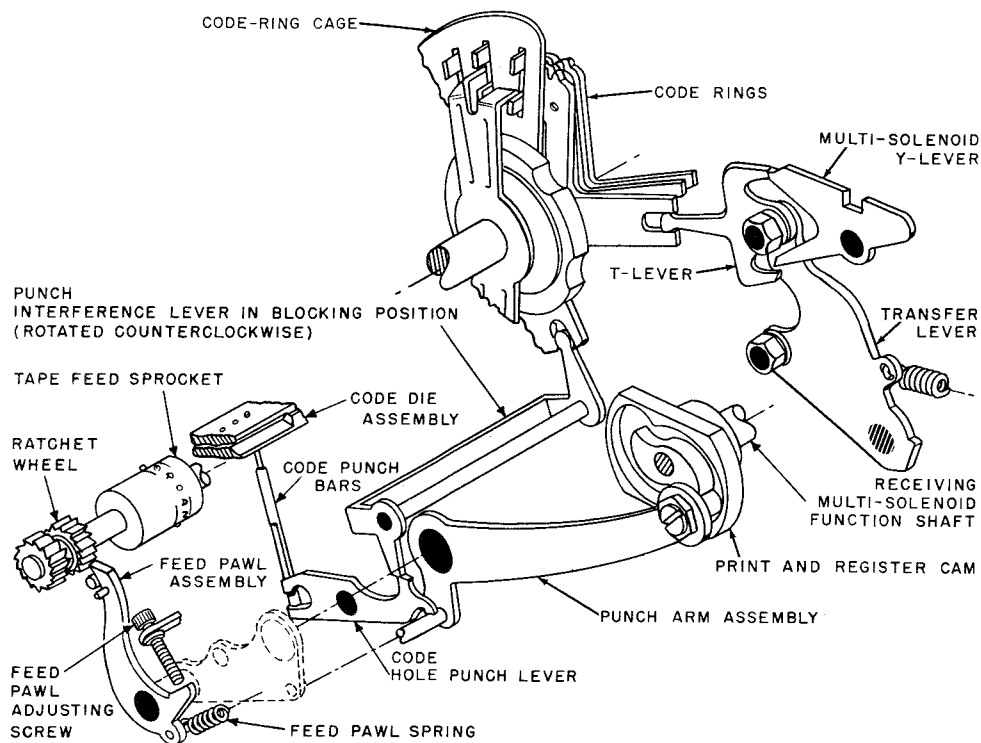


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Figure 117. Selecting and printing functional diagram.

(3) The five code punch bars and the feed punch bar are mounted in the code die assembly and are held in place by a stripper (fig. 119). Each of the code punch bars is engaged by an associated code hole punch lever. The feed punch bar is smaller in diameter than the code punch bars. The feed punch lever is slightly different from the code hole punch levers. It does not have a raised portion like the code hole punch levers, but is hooked around the shaft on the punch arm assembly. This arrangement causes it to raise the feed punch bar during the punching operation to perforate a feed hole in the tape each time the receiving multisolenoid function shaft makes a half revolution.

*b. Punching Operation.* This operation occurs after the transfer operation positions the punch interference levers in accordance with the received code impulses. One-half revolution of the print and register cam, mounted on the receiving multisolenoid function shaft (fig. 119), provides the power required for the punching operation. The print and register cam starts one-half revolution when the receiving multisolenoid function shaft rotates. As the print and register cam revolves, it moves the roller end of the punch arm assembly downward and causes the opposite end, engaging the five code hole punch levers, to move upward toward the code punch bars. The code hole punch levers that are blocked by the lower arm of the mating punch interference levers push their respective code punch bars upward through the message tape to record marking



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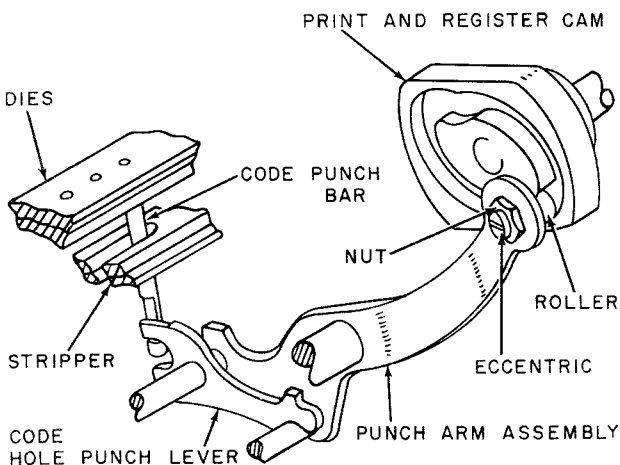
Figure 118. Selecting and punching mechanism, functional diagram.

code impulses. The code hole punch levers that are not blocked by the lower arm of the punch interference levers pivot counterclockwise slightly on the shaft of the punch arm assembly and do not perforate the message tape.

c. *Message Tape Feeding Operation.* Message tape feeding in the perforator is accomplished by a slight rotation of the tape feed sprocket (fig. 120), as it feeds the message tape

one space for each code group received. The pins in the tape feed sprocket engage the feed holes in the message tape and force the message tape to move when the tape feed sprocket turns. Message tape feeding occurs immediately before the message tape is punched.

- (1) Power for message tape feeding is provided by the punch arm assembly when it begins the punching operation. As the code hole punch lever end of the punch arm assembly moves upward, it causes the feed pawl to engage and rotate the feed pawl ratchet wheel, feeding the message tape. The feed pawl must not be permitted to continue turning the back space ratchet wheel during the punching operation or the message tape will be damaged. Proper adjustment of the feed pawl eccentric stud causes the feed pawl to rotate free of the feed pawl ratchet wheel immediately before the message tape is punched.



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Figure 119. Basic punching mechanism.

- (2) At all times, except during message tape feeding, the tape feed sprocket is held motionless by the detent wheel,

the detent lever, and a detent lever spring (fig. 120). The detent wheel is attached firmly to the shaft that contains the tape feed sprocket and back space ratchet wheel. The detent lever spring causes the detent lever to exert a constant pressure against the detent wheel. This pressure also is used to complete message tape feeding. As the feed pawl pushes and immediately releases the feed pawl ratchet wheel, the pressure of the detent lever against the detent wheel completes the feeding operation.

*d. Summary.* The message tape feeding and punching operations described above are summarized in the following sequence chart.

Message tape feeding and punching operation sequence chart	
1	Sequence starts with unlatching of clutch latch arm, receiving multisolenoid function shaft starts to revolve.
2	Punch interference levers, actuated by code rings, are positioned in accordance with received code impulses. For spacing impulses, lower arm of punch interference levers moves to space position and swings clear of raised portion of mating code hole punch levers. For marking impulses, lower arm of punch interference levers moves to blocking position above raised portion of mating code hole punch levers.
3	Punch arm assembly begins to pivot, operated by print and register cam.
4	Feed pawl engages back space ratchet wheel.
5	Message tape is moved forward one character space. Detent lever and detent wheel hold message tape stationary.
6	Continued rotation of punch arm assembly forces code hole punch levers that are blocked by punch interference levers to drive code punch bars through message tape. Other code punch bars remain in lower position. Feed punch lever drives feed punch bar through message tape on every upward movement of punch arm assembly.
7	Print and register cam returns punch arm assembly to original position, withdrawing code punch bars and feed punch bar from message tape.
8	Feed pawl is positioned for the next tape feeding operation.
9	Receiving multisolenoid function shaft clutch arm is disengaged. Receiving multisolenoid function shaft stops.

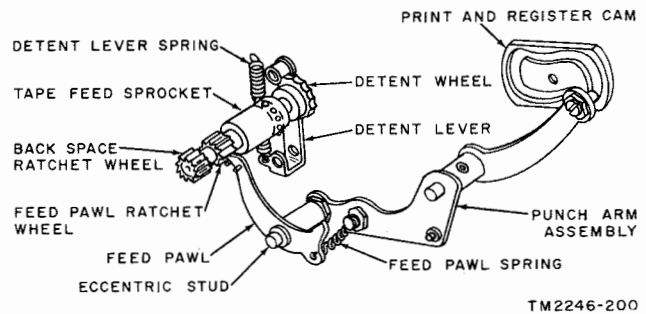


Figure 120. Basic message tape feed mechanism.

### 83. Tape Puller Operation (fig. 121)

A tape puller mechanism is included in the perforator to relieve the tape feed mechanism of the strain of unwinding the paper tape from the tape reel. The motion of the tape puller arm is obtained from the engagement of the tape puller arm roller in the inner surface of the print and register cam. As the printing and punching operations occur, the tape puller arm pivots clockwise on the arm pivot stud and moves the tape puller spring down upon the paper tape, pressing the tape against the tape puller stud. This holds the paper tape (to the left of the tape puller stud) stationary while the tape puller arm traveling further downward pulls the paper tape from the tape reel. As the print and register cam nears the end of a half revolution, the tape puller arm stud and spring are moved upward to free the paper tape so that it may be moved during the tape feeding operation.

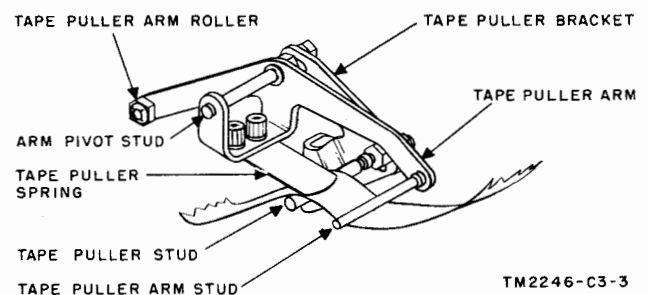
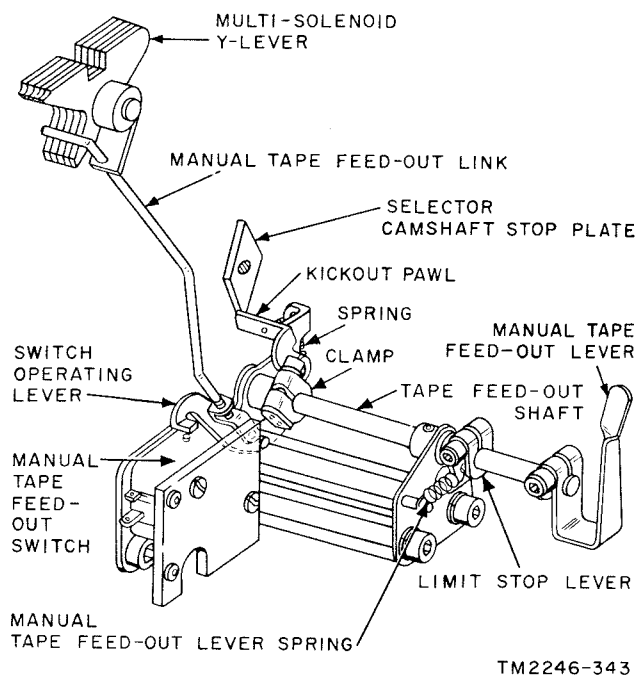


Figure 121. Tape puller mechanism.

### 84. Manual Tape Feed-Out Operation

A manually operated mechanism is included in this perforator to permit feeding message



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Figure 122. Manual tape feed-out mechanism.

tape out of the unit while messages are not being received and the perforator control switch (S31 on the TT-178/FG and TT-179/FG; S204 on all other models) is in the REPERF position. To accomplish this, the operator operates the manual tape feed-out lever (fig. 122) and releases it when sufficient message tape has been fed. Manual operation of the manual tape feed-out lever positions the multisolenoid Y-levers for the blank code group (fig. 35) and energizes the perforator latch coils (par. 79a). The printing mechanism prints the blank signal, the perforating mechanism records the blank code group in the message tape, and the tape feed mechanism feeds the message tape. If a code group is received while the manual tape feed-out lever is operated, the perforator *automatically* disables the manual tape feed-out mechanism and the perforator records the incoming message. Detailed operation of the manual tape feed-out mechanism is described in *a* and *b* below.

*a. Manual Tape Feed Out.* When the manual tape feed-out lever is pivoted counterclockwise, the tape feed-out shaft and the clamp, which are connected to the tape feed-out shaft, also pivot (fig. 122). As the clamp pivots, it

moves against the kickout pawl which is mounted on a stud on the switch operating lever. This causes the switch operating lever to pivot counterclockwise also. When this occurs, the manual tape feed-out link, which is connected to the left of the pivot point, is pulled downward, pulling the multisolenoid Y-levers down with it. This setting of the Y-levers is the setting for the blank code group. A projection at the end on the switch operating lever strikes a switch plunger, closing the manual tape feed-out switch. The closing of the switch energizes the perforator latch coils, releasing the clutch latch arm and allowing the receiving multisolenoid function shaft to turn and feed out the message tape as long as the manual tape feed-out lever is held in the counterclockwise position.

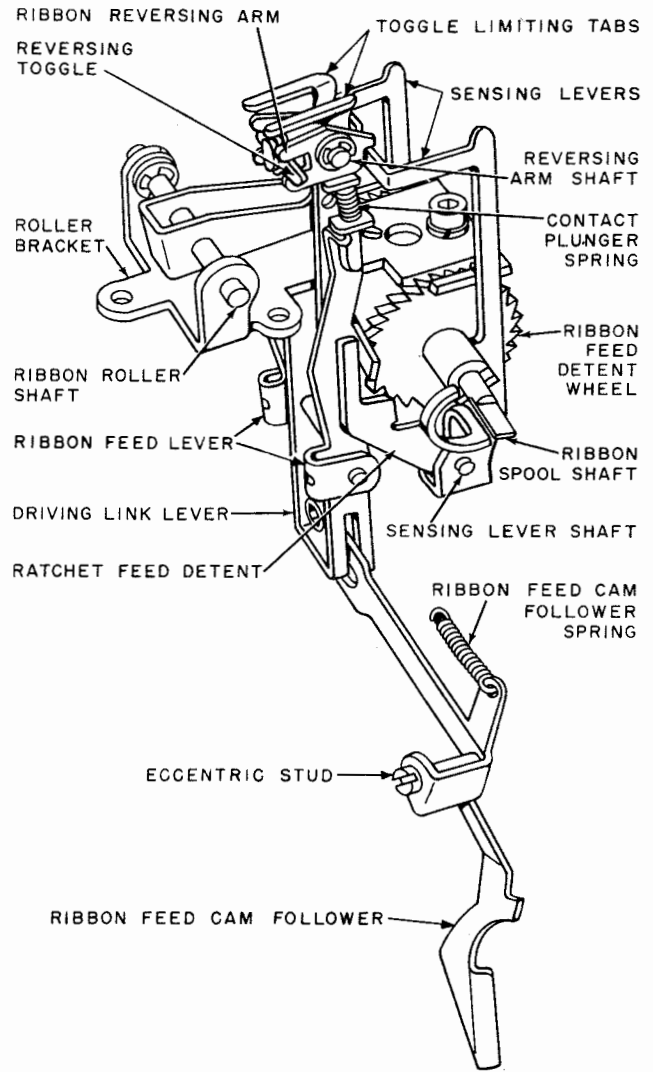
*b. Effects of Received Code Group.* If a code group is received by the selector magnet during the operation of the manual tape feed-out mechanism, the mechanism is disabled immediately upon receipt of the start impulse, which causes the selector camshaft to begin rotation in the normal manner. When the manual tape feed-out mechanism is in the operated position, the upper extension of the kickout pawl is positioned in the path of the stop plate of the selector camshaft (fig. 122). As the selector camshaft rotates, the stop plate moves the kickout pawl out of the path of the clamp. The switch operating lever is released from the clamp and is free to react to the tension of the spring applied downward at the right end of the switch operating lever. The spring pivots the switch operating lever clockwise, moving the manual tape feed-out link out of engagement with the multisolenoid Y-levers. It also releases the switch plunger, opening the manual tape feed-out switch. This action deenergizes the perforator latch coils which causes the clutch latch arm to move the sliding drum clutch out of engagement with the double gear. The receiving multisolenoid function shaft stops. The kickout pawl remains in the unlatched position until the manual tape feed-out lever is restored to its normal position. The incoming code groups continue in their normal sequence and are not affected by the manual tape feed-out operation.

## 85. Perforator Ribbon Feed and Ribbon Reverse Operations

The ribbon mechanism includes two ribbon spools and sufficient inking ribbon to fill only one spool. As the receiving multisolenoid function shaft operates in response to received code groups, the inking ribbon is unwound automatically from one ribbon spool and wound onto the other. When the inking ribbon is almost entirely wound on one ribbon spool, the ribbon mechanism automatically reverses the direction of ribbon feed and begins to wind the ribbon on the empty ribbon spool. The mechanisms that accomplish the feeding and reversing actions are described in *a* and *b* below.

*a. Ribbon Feeding Operation.* Power to operate the ribbon feed and ribbon reverse mechanism is supplied by the ribbon feed cam on the receiving multisolenoid function shaft directly behind the grooved portion of the print and register cam (fig. 118). As the receiving multisolenoid function shaft revolves during reception of code groups, it causes the ribbon feed cam follower to pivot about the eccentric stud, (fig. 123). The cam has only one high and one low portion and reception of every other code group causes the ribbon feed mechanism to feed the inking ribbon. The feed mechanism includes a driving link lever, two ribbon feed detents, two ribbon feed detent wheels, and two ribbon feed levers, one of each for each ribbon spool. The two ribbon feed levers are mounted on a U-shaped driving link lever, which is coupled to the ribbon feed cam follower. As the ribbon feed cam follower pivots to the left, it moves the driving link lever upward. One ribbon feed lever engages its ribbon feed detent wheel and rotates the ribbon spool enough to feed the inking ribbon one character space. On the downward stroke of the driving link lever, the ribbon feed lever also is moved downward in preparation for the next feed stroke. The opposite ribbon feed lever moves up and down also but is held away from its mating ribbon feed detent wheel by the ribbon reversing arm. A ribbon feed detent and spring prevent each ribbon feed detent wheel from rotating freely.

*b. Ribbon Reversing Operation.* The ribbon feed mechanism automatically reverses the di-



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Figure 123. Ribbon feed and reversing mechanism.

rection of feed when the last turn of inking ribbon has been unwrapped from one ribbon spool. When this ribbon spool is empty, a window in the spool hub is uncovered, and a portion of the associated sensing lever moves forward through the opening. As the sensing lever pivots forward (fig. 123), the upper arm of the sensing lever moves into the vertical path of the ribbon reversing toggle arm. On the next downward movement of the driving link lever, the spring-loaded ribbon reversing arm is held stationary at the rear by the sensing lever. The front end pivots downward, carrying with it the engaged end of the reversing toggle. This action causes the ribbon feed detent of the full ribbon

spool to move away from its mating ribbon feed detent wheel, and the other ribbon feed detent to move toward its mating ribbon feed detent wheel. As the perforator continues to operate in response to received messages, the ribbon feed lever associated with the empty ribbon spool now engages its associated ribbon feed detent wheel on each upward movement, and the inking ribbon begins to wind on the empty ribbon spool. This reversing action occurs automatically as each ribbon spool, in turn, becomes empty.

## 86. Stop Bar Selection of Functions

In addition to recording messages in printed and punched form on message tape, the perforator is capable of performing three mechanical operations called functions. These are the letters shift, figures shift, and signal bell functions.

*a. Description.* A stop bar for each function is located in the code-ring cage (fig. 115). The signal bell function shares the same stop bar used for selecting the letter S. The stop bars for these functions are longer than other stop bars; the additional length extends beyond the other bars at the rear of the code-ring cage. Three sensing levers, one for each function, are mounted on the stop arm shaft directly behind the code-ring cage (fig. 124). Springs apply tension to the sensing levers and pull each toward its respective stop bar. The cam lever assembly is against a high part of the sensing lever restoring cam, holding the sensing levers

away from the stop bars while an incoming code group is being set up in the code-ring cage.

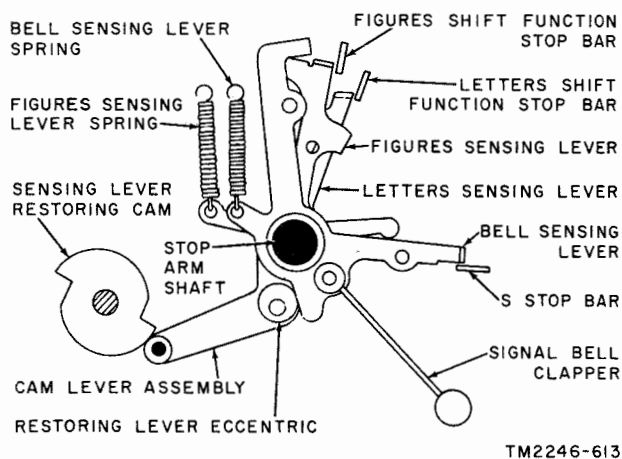
*b. Operation.* The function sensing operation begins after the transfer operation positions the code rings. The sensing lever restoring cam on the receiving multisolenoid function shaft begins to rotate and the cam lever assembly moves against a low portion of the sensing lever restoring cam (fig. 124). The sensing lever springs pull each sensing lever toward its associated stop bar.

- (1) If the code rings have not selected one of the function stop bars, the sensing levers rotate until each sensing lever strikes its stop bar. The sensing levers remain in this blocked position until they are restored by the cam lever assembly and sensing lever restoring cam.
- (2) If the code rings select one of the function stop bars, the selected stop bar is not in position to block the sensing lever of the desired function, and the sensing lever rotates past the stop bar, causing operation of the associated function mechanism. When a function stop bar is in the *selected* position, the front end moves into the notch formed by the code rings and the rear extension of the stop bar moves out of the path of its sensing lever.

## 87. Perforator Letters Shift and Figures Shift Operations

The typewheel of the perforator is moved to a forward position directly above the message tape for printing, and moved backward after printing to expose the printed character to view. This forward and rearward action of the typewheel is called typewheel reciprocation. The reciprocating mechanism moves the typewheel, and the figures shift, and letters shift mechanisms control the length of this typewheel reciprocating stroke.

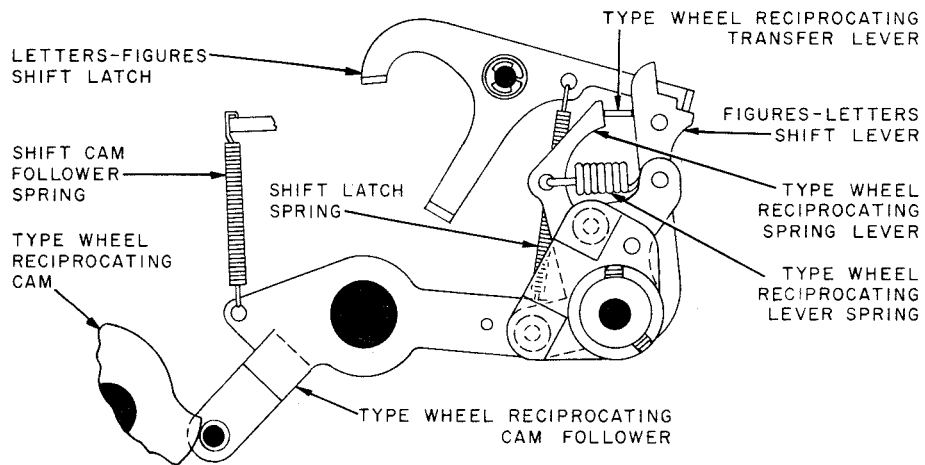
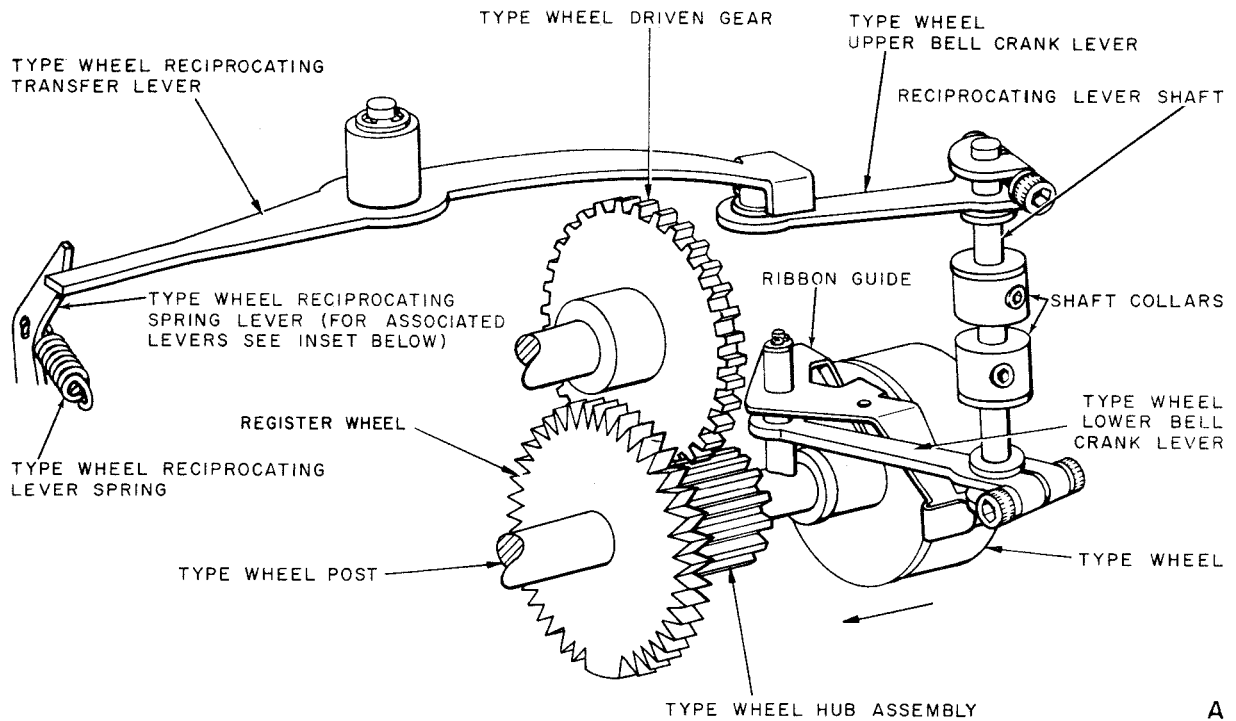
*a. Normal Reciprocation.* Power to move the typewheel forward is supplied by the typewheel reciprocating cam on the receiving multisolenoid function shaft, which begins rotating after the transfer operation. As the typewheel reciprocating cam rotates, a high portion of the



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Figure 124. Function sensing levers in normal (blocked) position.





B

TM2246-197

Figure 125. Typewheel reciprocating and shifting mechanism (rear view).

cam (B, fig. 125) pushes one arm of the typewheel reciprocating cam follower downward. This action causes the opposite arm, coupled to the typewheel reciprocating spring lever, to move upward and rotate the typewheel reciprocating spring lever clockwise as viewed from the rear. When the typewheel reciprocating spring lever rotates, it pivots the typewheel

reciprocating transfer lever (A, fig. 125) thereby rotating the typewheel bellcrank levers, and moving the typewheel forward above the message tape just before printing occurs. The inking ribbon guide assembly, mounted on the same support as the typewheel assembly, reciprocates forward with the typewheel. As the typewheel reciprocating cam continues to rotate

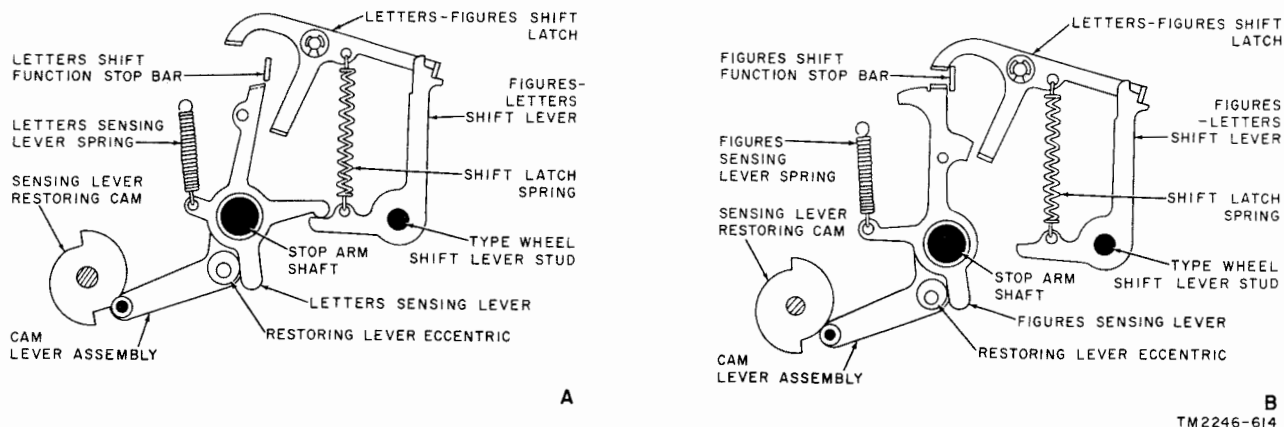


Figure 126. Figures shift and letters shift mechanism.

after printing, a low portion of cam permits the shift cam follower spring to return the typewheel reciprocating cam follower to the original position. This action permits the typewheel to be returned by spring tension to its normal rear position and exposes the printed character to view.

*b. Letters Shift Operation.* The characters and symbols which may be printed by the perforator are arranged in two parallel rows around the typewheel. The outer row contains the letters of the alphabet and three special symbols (LTRS column, fig. 35). The inner row contains the numerals, punctuation marks, and symbols shown in the FIGS columns of figure 35. When the perforator is in the *letters shift position*, the typewheel reciprocates forward just enough to move the outer row of characters to the printing position above the print hammer lever. When the unit is in the *figures shift position*, the reciprocating stroke is longer, and the typewheel moves far enough forward to position the inner row above the print hammer lever. When a letters shift code group is received, the code rings are positioned to select the letters shift function stop bar (fig. 126). The letters sensing lever, no longer blocked by its stop bar, is rotated by the letters sensing lever spring. The arm opposite the spring engages the figures-letters shift lever (A, fig. 126) and rotates the figures-letters shift lever counterclockwise to the letters shift position. This action permits the shift latch spring to pull the letters-figures shift latch downward latching the figures-letters shift lever in the letters-shift position. In this posi-

tion, the figures-letters shift lever limits the forward motion of the typewheel during reciprocation (B, fig. 125). The typewheel is moved forward during reciprocation, as the typewheel reciprocating spring lever rotates the free end of the typewheel reciprocating transfer lever (A, fig. 125). When the free end of the typewheel reciprocating transfer lever strikes the figures-letters shift lever (B, fig. 125), forward motion of the typewheel is halted, and the outer row of characters is positioned directly above the print hammer lever.

*c. Figures Shift Operation.* Operation of the figures shift mechanism (B, fig. 126) results in a long forward stroke of the typewheel during reciprocation. Reception of the figures shift code group causes selection of the figures shift function stop bar in the code-ring cage. The figures sensing lever is not blocked by its stop bar and the figures sensing lever spring rotates the figures sensing lever, causing it to trip the letters-figures shift latch. When tripped, the extension on the right end of the letters-figures shift latch moves upward and allows the figures-letters shift lever to be pulled to the figures shift position by the shift latch spring. In this position, the figures-letters shift lever extends the distance the typewheel reciprocating transfer lever moves during reciprocation, thereby increasing the forward motion of the typewheel. When the figures-letters shift lever is in the figures shift position, forward motion of the typewheel is not halted until the figures (inner) row of the typewheel is directly over the print hammer lever. As operation of the perforator continues, the figures or sym-

bols in this row are printed until a letters shift code group is received.

## 88. Perforator Signal Bell Operation

The perforator includes a signal bell mechanism which is used by operators for signaling purposes. The signal bell rings each time the S code group is received while the shift mechanism is in the figures shift position. The code group also is recorded in punched form on the tape, and the bell symbol (fig. 36) is printed. Reception of the same code group causes the letter S to be printed when the shift mechanism is in the letters shift position.

*a. Operation.* The signal bell mechanism (fig. 127) rings the signal bell whenever the bell sensing lever spring is permitted to rotate the bell sensing lever clockwise (as viewed from the rear), causing the signal bell clapper to strike the signal bell. The S stop bar normally blocks rotation of the bell sensing lever during operations other than ringing the signal bell (fig. 124). Reception of the S code group causes the code rings to select the S stop bar. The stop bar then moves out of the path of the bell sensing lever and permits the bell sensing lever to rotate (when the unit is in the figures shift position). The bell sensing lever moves the signal bell clapper against the signal bell. The mechanism is reset when the high part of the sensing lever restoring cam causes the cam lever assembly to restore the function sensing levers to the original counterclockwise position.

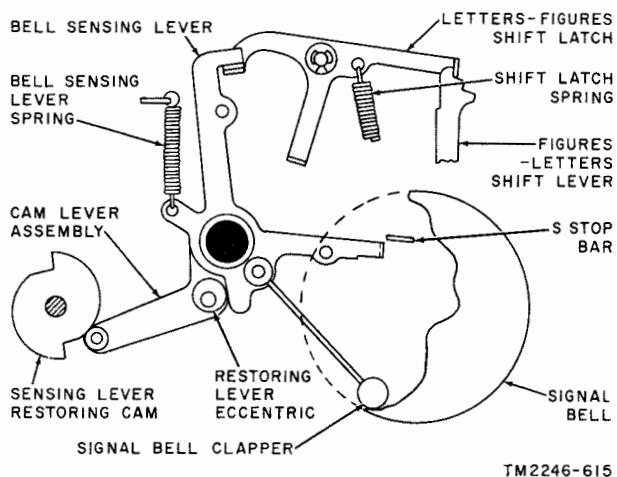


Figure 127. Signal bell mechanism in operated condition.

*b. Signal Bell Suppression in Letters Shift Position.* Although the same code group is used both for printing the letter S and ringing the signal bell, only one is accomplished when this code group is received. When the code group is received while the unit is in the letters shift position, the upper extension of the bell sensing lever (fig. 127) is blocked by the upper arm of the letters-figures shift latch. When this occurs, the perforator prints the letter S and punches the code in the message tape. If the code group is received while the perforator is in the figures shift position, the upper arm of the letters-figures shift latch is positioned below the upper extension of the bell sensing lever and does not block rotation of the bell sensing lever. When this occurs, the signal bell rings, the S code is punched in the message tape, and the typewheel moves forward far enough to print the bell symbol.

## 89. Perforator Rangefinder Mechanism

*a.* The function of the perforator rangefinder is identical with the function of the page printing mechanism rangefinder. For a complete description of rangefinder operation, see paragraph 61.

*b.* The mechanics of the perforator rangefinder are similar to the mechanics of the page printing mechanism rangefinder. The only difference is that the grooved pin on the perforator selector camshaft is moved directly by the rangefinder cam rather than having the operation transferred from a rangefinding cam through the orientation lever, as is the case with the page printing mechanism.

## 90. Receiving Simultaneous Signal Code by Perforator

*Note.* Reference designations in this paragraph and supporting illustrations apply to the TT-117/FG, TT-119/FG, TT-178/FG, and TT-179/FG. Refer to paragraph 91 for reference designations for all other models.

*a.* Simultaneous signal code impulses from the keyboard-transmitter (pars. 39-41) are sent directly to the perforator receiving multisolenoid. The receiving multisolenoid reacts to the simultaneous signals in the identical manner that it reacts to the simultaneous signals received from the code actuated switch (S32).

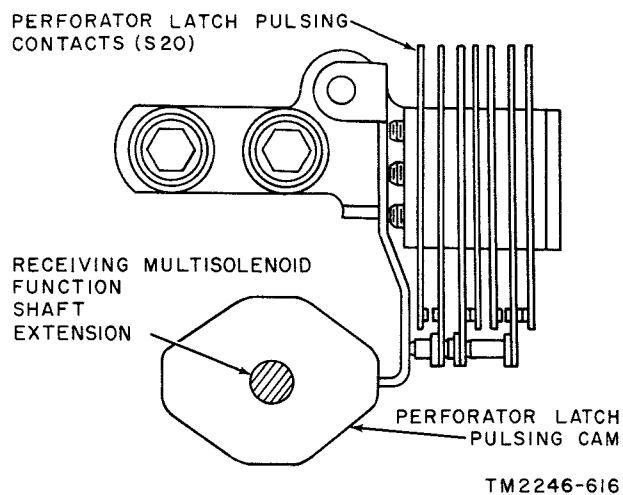


Figure 128. Perforator latch pulsing contacts (S20) operating mechanism.

b. When the receiving multisolenoid receives simultaneous signals from the code actuated switch, perforator latch coils L3 are energized by receiving multisolenoid pulsing contacts S18 at the rear of the code actuated switch function shaft. When perforator latch coils L3 are energized, the receiving multisolenoid function shaft is allowed to rotate as described in paragraph 77c. When the receiving multisolenoid receives simultaneous signals from the keyboard-transmitter, perforator latch coils L3 are energized through the contact of keyboard counter S12 if keyboard control switch S23 is in the KEYBD & TAPE position. Perforator latch coils L3 are energized through the contact of keyboard reader S11 if keyboard control switch S23 is in the TAPE position. (On page

printers TT-117A/FG, TT-118/FG, and TT-119A/FG, the keyboard control lever should also be in the tape position (right side).)

c. When perforator latch coils L3 are energized, they allow the receiving multisolenoid function shaft to rotate. The perforator latch pulsing cam on the rear of the receiving multisolenoid function shaft operates the contacts of perforator latch pulsing contacts S20 (fig. 128). The normally open contact of perforator latch pulsing contacts S20 is closed by the action of the perforator latch pulsing cam and completes a circuit to restoring solenoid L1 on the keyboard-transmitter. When restoring solenoid L1 is energized, it restores the cam stop lever (fig. 47), pivoting the cam stop lever and the switch actuating lever (fig. 52), on the back of the keyboard-transmitter. This pivots the switch arm, opening the keyboard reader switch to the 11-wire simultaneous circuit. Before receiving multisolenoid function shaft completes its half revolution, the perforator latch pulsing cam opens perforator latch pulsing contacts S20 to open the circuit to restoring solenoid L1 and closes the circuit to perforator latch coils L3. However, since keyboard reader switch S11 has been opened by the action of restoring solenoid L1, the circuit is not energized and the perforator latch solenoid does not operate. The receiving multisolenoid function shaft of the perforator rotates at the rate of 120 wpm and restores restoring solenoid L1 at that rate. Therefore, it is possible to transmit from the keyboard-transmitter to the perforator at a maximum rate of 125 wpm.

## Section IV. ELECTRICAL THEORY

### 91. Reference Designation Conversion Charts

The information in this section is written specifically for the TT-117/FG, TT-119/FG, TT-178/FG, and TT-179/FG, unless otherwise indicated. It also applies equally to the TT-117A/FG, TT-118/FG, TT-119A/FG, TT-

178A/FG, TT-179A/FG and TT-181/FG, except that the reference designations for some parts differ. The charts below list (in the left column) the reference designations assigned to the TT-117/FG, TT-119/FG, TT-178/FG, and TT-179/FG and (in the right column) the corresponding reference designation assigned to the other models.

a. Page Printer.

TT-117/FG TT-119/FG	TT-117A/FG TT-118/FG TT-119A/FG	TT-117/FG TT-119/FG	TT-117A/FG TT-118/FG TT-119A/FG	TT-117/FG TT-119/FG	TT-117A/FG TT-118/FG TT-119A/FG	TT-117/FG TT-119/FG	TT-117A/FG TT-118/FG TT-119A/FG
Jacks		Capacitors		Contacts or coils		Filters	
J2	J3	C2	C3	E1	K1	Z1 <sup>a</sup>	FL2 <sup>b</sup>
J3	J9	C5	C1	E2	E3	Z2	FL1
J5	J6	C6	C2	E3	K2		
J6	J8	C9 <sup>a</sup>	C4 <sup>b</sup>	E4	S5		
J7	J2	C1 <sup>c</sup>	C4 <sup>d</sup>	-----	E1		
J8	J4			-----	E3		
J9	P10						
Plugs		Switches		Resistors		Fuses	
P1	P7	S1	S2	R1	R5	F4	F2
P2	P3	S2	S4	R4	R3		
P3	P9	S3	S7	R6	R4		
P5	P6	S4	S6	R8	R2		
P6	P8	S5	S8	R9	R1		
P7	P2	S6	S9	-----	R6		
P8	P4	S7	S3				
P21	P5	S8	S1				
P22	P1	S11	S10	Lamps		Terminal boards	
J9	P10	S12	S11	I1	DS2	TB1	TB3
		S13	S12	I2	DS3	TB2	TB1
		S14	S13	I3	DS1	TB4	TB4
		S15	S14			TB9	TB2
		E4	S5				
		-----	S15				
		-----	S16				

<sup>a</sup> TT-119/FG.      <sup>c</sup> TT-117/FG.  
<sup>b</sup> TT-119A/FG.    <sup>d</sup> TT-117A/FG.

b. Perforator.

TT-178/FG TT-179/FG	TT-178A/FG TT-179A/FG TT-181/FG	TT-178/FG TT-179/FG	TT-178A/FG TT-179A/FG TT-181/FG	TT-178/FG TT-179/FG	TT-178A/FG TT-179A/FG TT-181/FG	TT-178/FG TT-179/FG	TT-178A/FG TT-179A/FG TT-181/FG
Capacitors		Jacks		Plugs		Resistors	
C7A	C207B	J11	J231	P9	P235	R7	R215
C7B	C207A	J12	J230	P10	P227	R10	R204
	C207C	J13	J232	P11	P231	R11	R214
C10 <sup>a</sup>	C209 <sup>c</sup>	J14	J219	P12	P230	R12	R216
C11 <sup>b</sup>	C209 <sup>d</sup>	J15	J234	P13	P232	R13	R213
C12	C205	J16	J228	P14	P219	R14	R212
C13	C204	J17	J224	P15	P234	R15	R205
C14	C203	J18	J225	P23	P217	R16	R210
C15	C202	J19	J223	P24	P218	R17	R211
C16	C16	J20	J222	P25	P226	R18	R208
C17	C17	J21	J221	P26	P229	R19	R209
C18	C201	J22	J220	P34	P233	R20	R206
C19	C208	J23	J217	P35	P203	R21	R207
C20	C210	J24	J218	P36	P204	R22	R201
C21	C206	J25	J226	P37	P213	R23	R202
		J26	J229	P38	P214	R24	R203
		J32	J215	P39	P206	Fuses	
Terminal Boards		J33	J216	P40	P205	F5	F203
		J34	J233	P41	P209	F6	F204
TB5	TB202	J35	J203	P42	P212	F7	F201
TB6A	TB201C	J36	J204	P43	P210	F8	F202
TB6B	TB201B	J37	J213	P44	P207		
TB6C	TB201A	J38	J214	P45	P208		
TB7	TB204	J39	J206	P46	P202		
TB8	TB203	J40	J205	P47	P201		
		J41	J209	P48	P211		
		J42	J212	Motors		Relays	
Rectifiers		J43	J210	B1	B201	K1	K201
		J44	J207			E8	K202
CR3	CR201	J45	J208				
CR4	CR202	J46	J202				
		J47	J201				
		J48	J211				

TT-178/FG TT-179/FG		TT-178A/FG TT-179A/FG TT-181/FG		TT-178/FG TT-179/FG		TT-178A/FG TT-179A/FG TT-181/FG		TT-178/FG TT-179/FG		TT-178A/FG TT-179A/FG TT-181/FG	
Contacts or Coils				Switches				Filters			
E6		S206		S16		S216		Z3		FL202	
E7		L201		S17		S205		Z4		FL207	
E8		K202		S18		S217		Z5		FL206	
E9		E207						Z6		FL204	
E10		L202		S20		S218		Z7		FL205	
L3		L203		S21		S212		Z8		FL208	
-----		E201		S22		S213		Z9		FL203	
-----		E202		S23		S211		Z10		FL201	
-----		E203		S24		S203					
-----		E204		S25		S209					
-----		E205		S26		S208					
-----		E206		S27		S207					
-----		E208		S28		S210					
-----		E209		S29		S202					
-----		E210		S30		S201					
-----		E211		S31		S204					
-----		E212		S32		S215					
-----		E213		S34		S214					
-----				E6		S206					
Transformer				Buzzer				Lamp			
T2		T201		I5		DS202		I4		DS201	

<sup>a</sup> TT-178/FG.

<sup>b</sup> TT-179/FG.

<sup>c</sup> TT-178A/FG.

<sup>d</sup> TT-179A/FG.

## 92. Page Printer Ac Input Circuit

*Note.* Refer to paragraph 91 for the reference designation conversion chart.

When 115 volts is applied to plug P1 (fig. 129), with the POWER switch S4 in the ON position, 115 volts ac is supplied to motor B1, copy lamps I1 and I2, and to rectifier CR1. The output of CR1 is used to supply current to the bias windings of selector magnet E2 (fig. 132) and motor stop relay E1. The circuit is protected by 1.6 AMP fuse F1.

## 93. Page Printer Sequential Signal Circuits

*Note.* Refer to paragraph 91 for reference designation conversion chart.

*a. Keyboard-Transmitter Send Circuit* (fig. 130). The keyboard-transmitter send circuit changes the mechanical movement of the code bars to neutral electrical impulses. The circuit used in this transformation terminates in black SEND plug P21 which is normally con-

nected to PRINTER SEND jack J21 on the perforator. SEND-LOCK switch S2 shorts sequential transmitter contacts E4 when the page printer is used for receive-only operation. LINE-BREAK switch S3, when operated, opens the circuit to signal the distant operator or to break in on a message. During the motor stop function, contacts 3-2 of motor stop relay E1 place a short across the MK and COM contacts of sequential transmitter mechanism E4 so that the line remains closed during motor stop.

*b. Page Printer Receive Circuit* (fig. 131). The received impulses from the signal line control selector magnet E2 which, in turn, governs the position of the mechanical parts within the selector mechanism. The page printer receive circuit terminates in red REC plug P22, which is normally connected to PRINTER REC jack J22 at the rear of the patch panel of the perforator. Either 20- or 60-ma signals may be used to operate selector magnet E2. SIGNAL switch S8 places the selector magnet line windings in parallel for

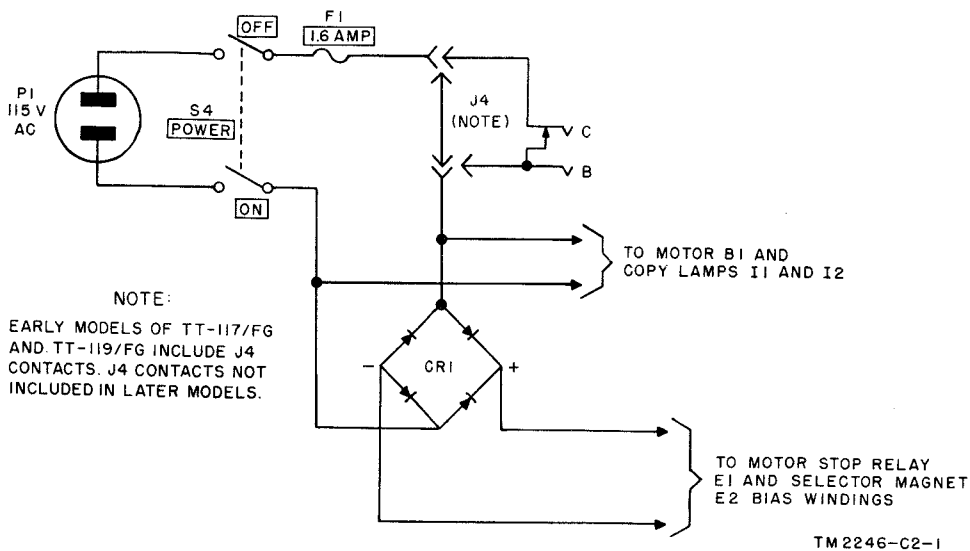


Figure 129. Page printer ac input, simplified schematic diagram.

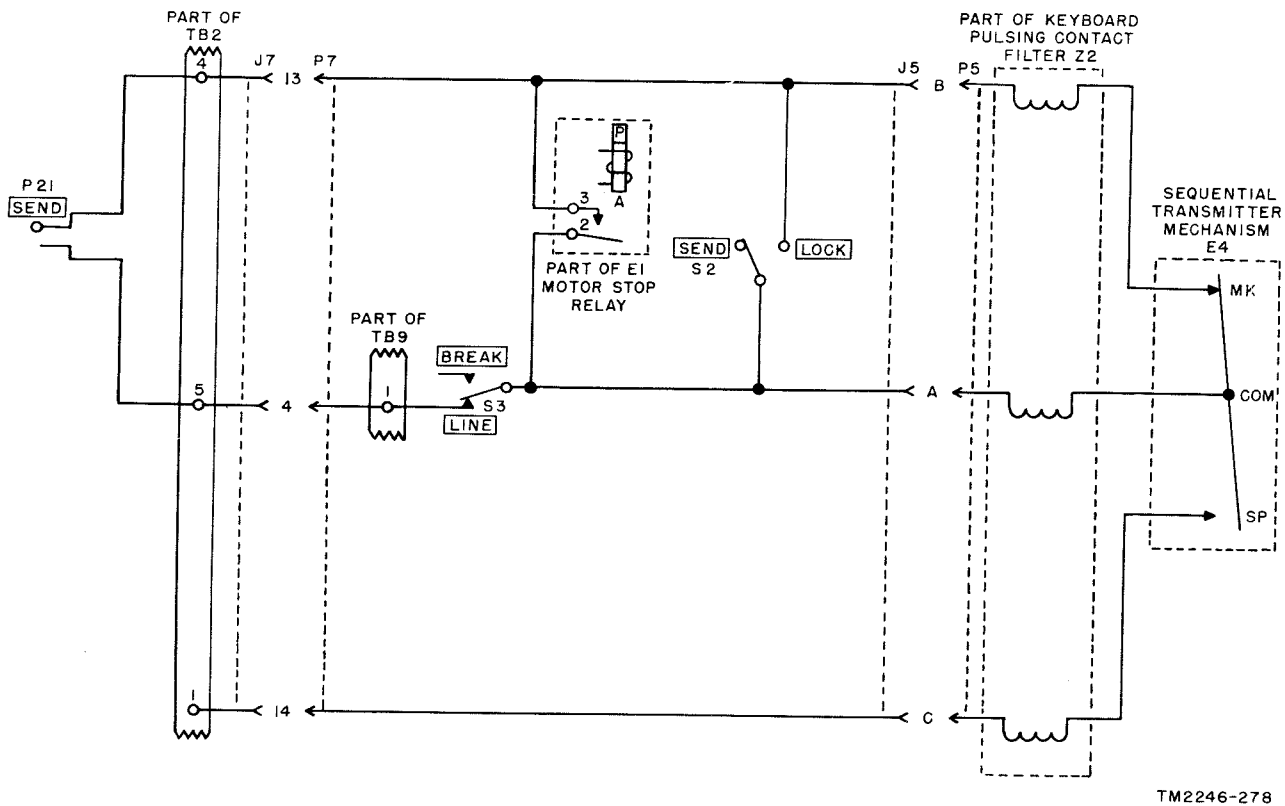
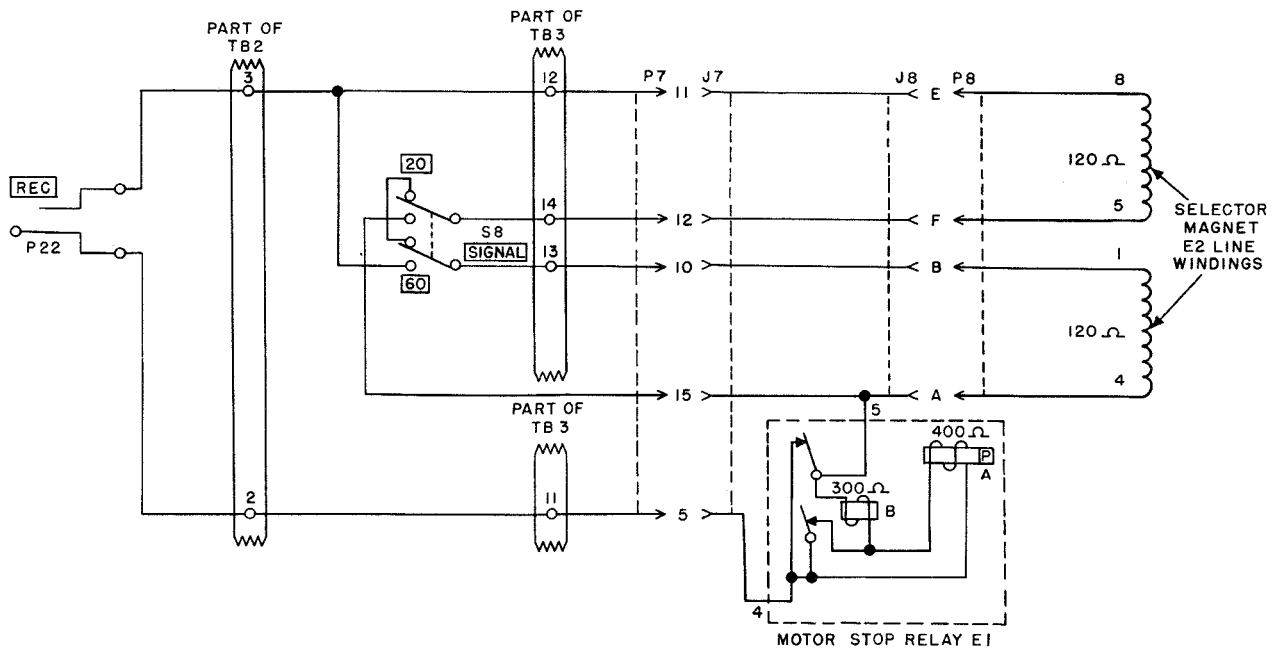


Figure 130. Keyboard-transmitter send circuit, simplified schematic diagram.

60-ma operation and in series for 20-ma operation. The circuit is normally completed through a contact of motor stop relay E1. This circuit path is altered slightly during the motor stop operation (par. 95d (3)).

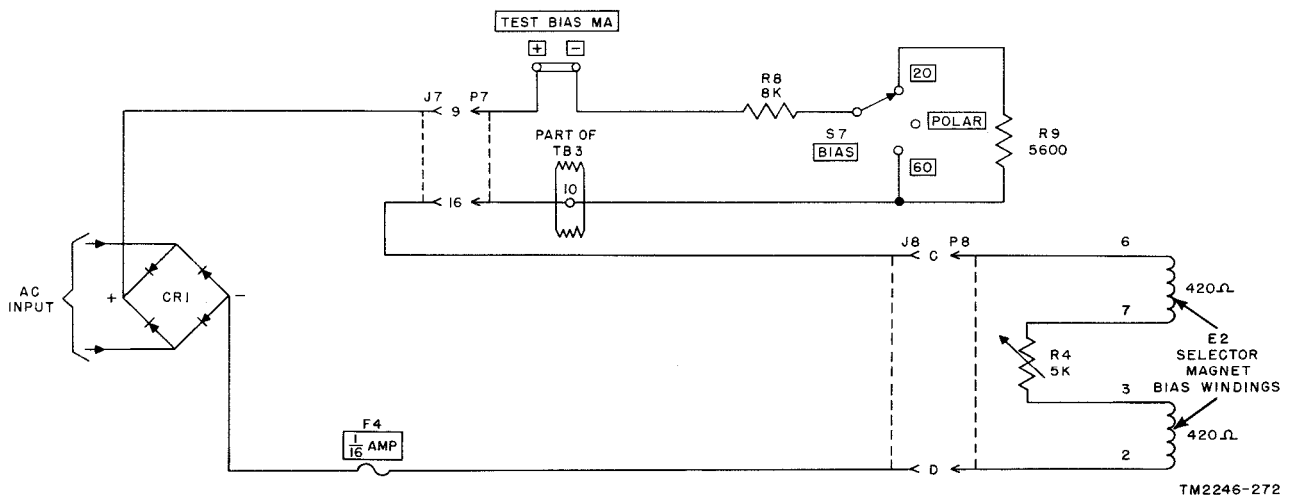
c. Page Printer Selector Magnet Bias Circuit (fig. 132). The bias circuit is used in neutral operation to move the selector magnet armature to the space position when a space (no-current) impulse is received. Power to





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Figure 131. Page printer receive circuit, simplified schematic diagram.



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Figure 132. Page printer selector magnet E2 bias circuit, simplified schematic diagram.

operate the circuit is obtained from rectifier CR1. Three-position BIAS switch S7 adapts the circuit for operation with 20-ma, 60-ma, or polar signals. Figure 132 shows BIAS switch S7 in the 20 position. When the switch is moved to 60, resistor R9 is bypassed and the current in the circuit increases. When the switch is in the POLAR position, the bias circuit is open. Variable resistor R4 is used to adjust the bias current (par. 530b (1) (b)). The BIAS TEST MA binding posts provide a

convenient place at which to measure the bias current.

#### 94. Page Printer Simultaneous Signal Circuit (fig. 133)

Note. Refer to paragraph 91 for the reference designation conversion chart.

The simultaneous signal circuit is used to send from simultaneous transmitter S15 to receiving multisolenoid E10 when tape is pre-

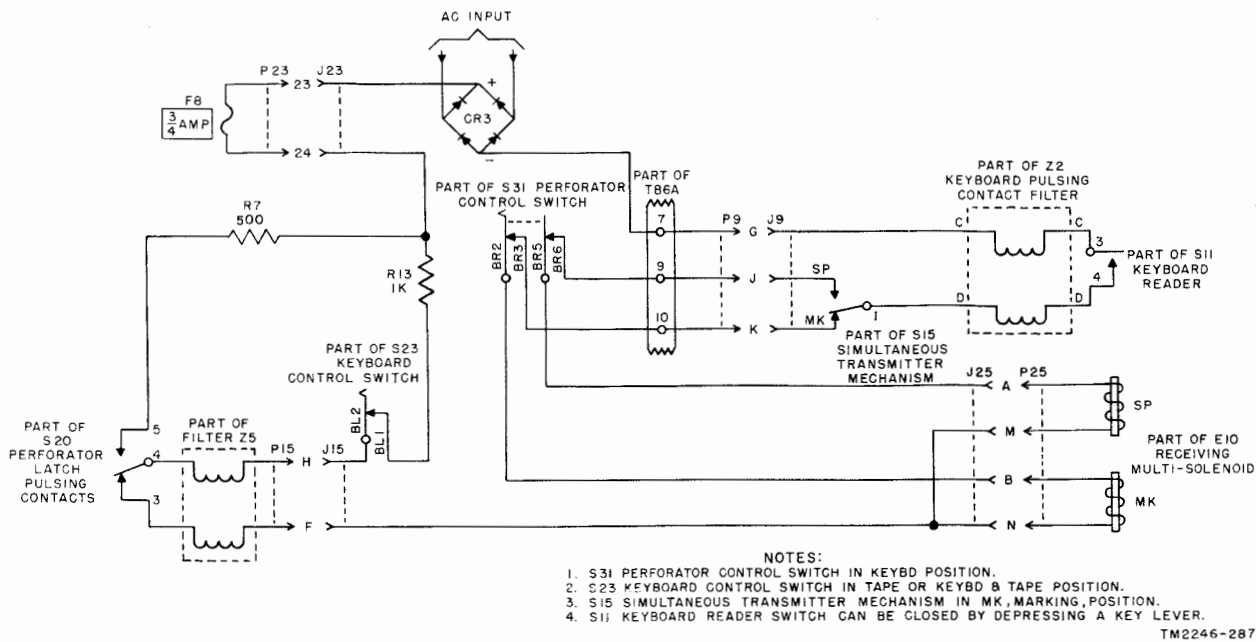


Figure 133. Keyboard simultaneous transmitter mechanism S15 to receiving multisolenoid E10 circuit, simplified schematic diagram.

pared locally. Perforator control switch S31 is in the KEYBD position, keyboard control switch S31 is in the KEYBD & TAPE or TAPE position, and perforator latch pulsing contacts 3 and 4 are closed. When a key lever is depressed, it closes contacts 3 and 4 of keyboard reader switch S11 and positions the contacts of simultaneous transmitter S15 to correspond to the teletypewriter code for that particular character. Two coils are in each of the five solenoids. If the MK (mark) coil is energized, it moves the Y-lever associated with that impulse to the mark position, and if the SP (space) coil is energized, it moves the same Y-lever to the space position. Figure 133 shows the circuit for the first impulse with S15 set up for a mark. The circuit for each of the other four impulses is identical except for terminal and jack designations. When a code group has been set up in the receiving multisolenoids and stored in the Y-levers, the code setting must be transferred to the code rings. This is done electrically by energizing perforator latch coil L3 (par. 100).

## 95. Local Dc Circuits

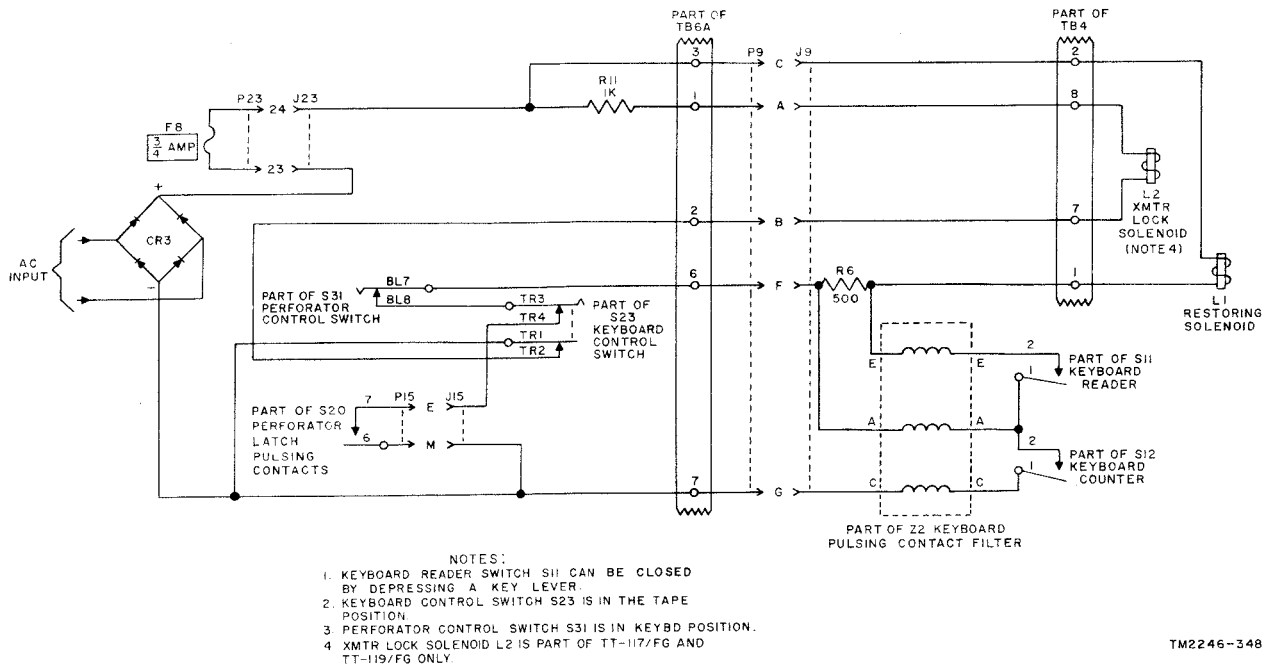
*Note.* Refer to paragraph 91 for the reference designation conversion chart.

### a. Restoring Solenoid Circuit (fig. 134).

- (1) When restoring solenoid L1 is energized, it restores the cam stop lever,

which in turn stops the transmitter camshaft. It also provides the power to rotate the line indicator drive shaft. The position of perforator control switch S31 and keyboard control switch S23 determines which circuit will energize restoring solenoid L1. When the keyboard control switch is in the KEYBD or KEYBD & TAPE position, keyboard counter contacts S12 close the circuit to energize restoring solenoid L1. If the keyboard control switch is in the TAPE position and perforator control switch S31 is in the KEYBD position, the keyboard reader contacts S11 and the perforator latch pulsing contacts S20 close the circuit to energize restoring solenoid L1.

- (2) When keyboard control switch S23 is in the KEYBD or KEYBD & TAPE position, the circuit is traced from the negative side of rectifier CR3 through keyboard counter S12, keyboard reader S11, restoring solenoid L1, and fuse F8 to the positive side of the rectifier CR3.
- (3) When keyboard control switch S23 is in the TAPE position and perforator control switch S31 is in the KEYBD position, the circuit is traced from the



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Figure 134. Restoring solenoid L1 and transmitter lock solenoid L2 circuits, simplified schematic diagram.

negative side of rectifier CR3, through perforator latch pulsing contacts S20, contacts TR4 and TR3 of keyboard control switch S23, contacts BL8 and BL7 of the perforator control switch S31, keyboard reader switch S11, restoring solenoid L1, and fuze F8 to the positive side of rectifier CR3.

b. Transmitter Lock Solenoid Circuit (fig. 134).

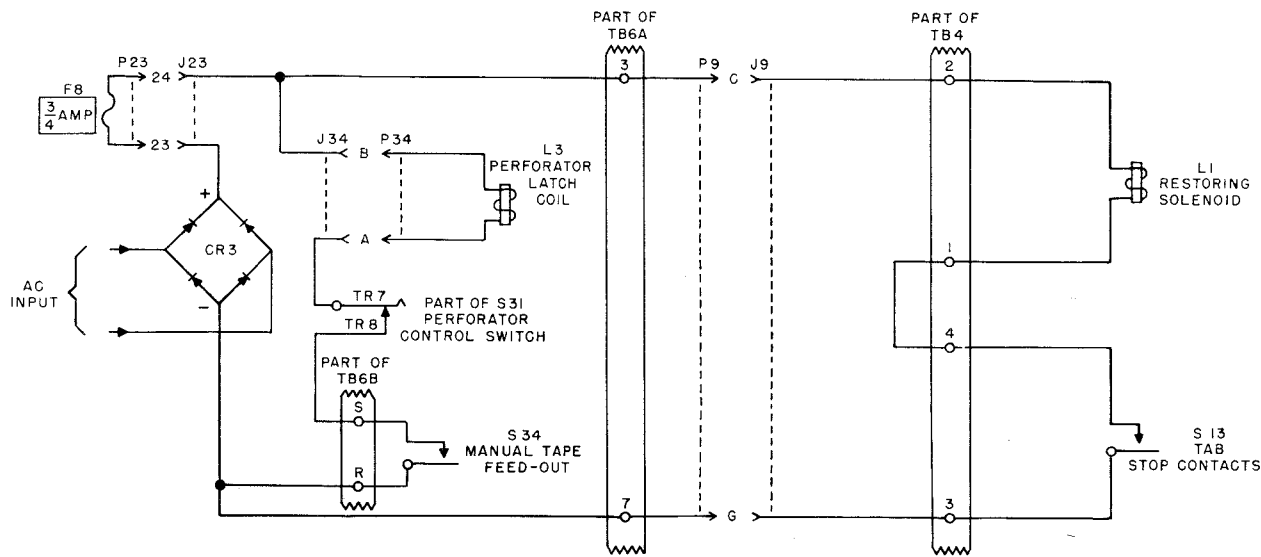
- (1) When keyboard control switch S23 is in the TAPE position, transmitter lock solenoid L2 energizes and prevents the transmitter camshaft from rotating. This circuit is used when punching tape from the keyboard-transmitter.
- (2) When keyboard control switch S23 is in the TAPE position, the circuit is traced from the negative side of rectifier CR3 through contacts TR1 and TR2 of keyboard control switch S23, transmitter lock solenoid L2, resistor R11, and fuze F8, to the positive side of rectifier CR3. (Page printers TT-117A/FG, TT-118/FG, and TT-119A/FG, do not use solenoid L2. The keyboard control lever manually locks

the transmitter cam shaft while keyboard control switch S23 is in the tape position.)

c. Tab Set Lever Circuit (fig. 135).

- (1) A tabulator mechanism is provided on the keyboard-transmitter of the page printer. When a tab set lever is pulled down and the space bar and repeat key are depressed, the indicator carriage moves to the right until it strikes the actuated tab set lever. When the indicator carriage strikes the actuated tab set lever, tab stop contacts S13 are closed, holding restoring solenoid L1 energized. This restores the cam stop lever and stops the rotation of the transmitter camshaft. The dc to energize restoring solenoid L1 is supplied from rectifier CR3.
- (2) The tab set lever circuit is traced from the negative side of rectifier CR3 through tab stop contacts S13, restoring solenoid L1, and fuze F8 to the positive side of rectifier CR3.

d. Motor Stop Circuit (Standard Symbol Page Printers).



NOTES:  
 1. S31 PERFORATOR CONTROL SWITCH IS IN REPERF POSITION.  
 2. S34 MANUAL TAPE FEED-OUT CONTACT IS MANUALLY OPERATED.  
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Figure 135. Tab set lever and manual tape feed-out circuit, simplified schematic diagram.

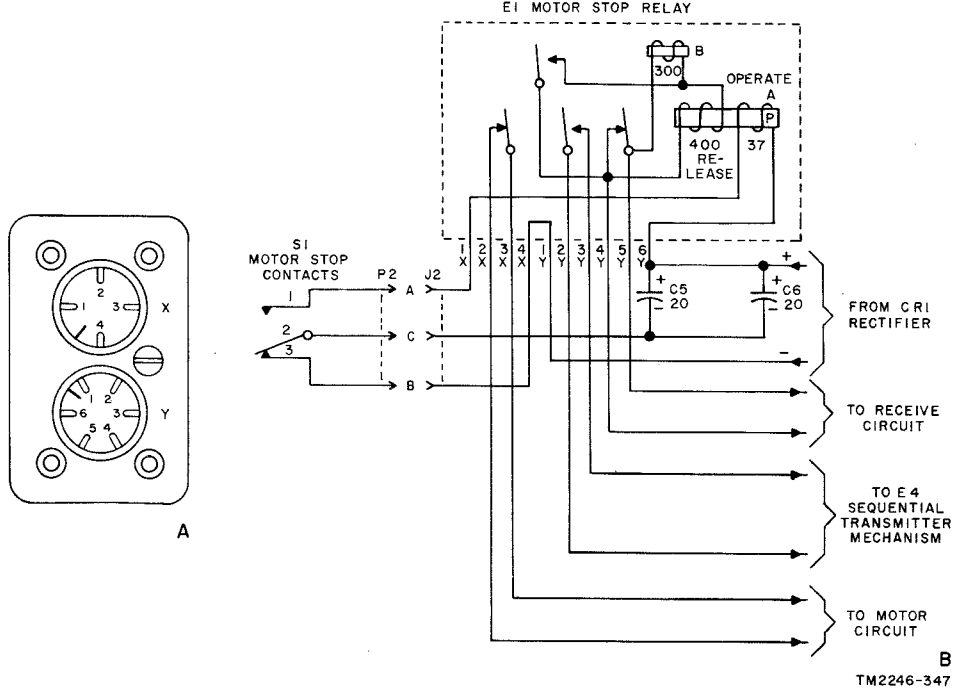


Figure 136. Motor stop circuit (standard symbol page printers), simplified schematic diagram.

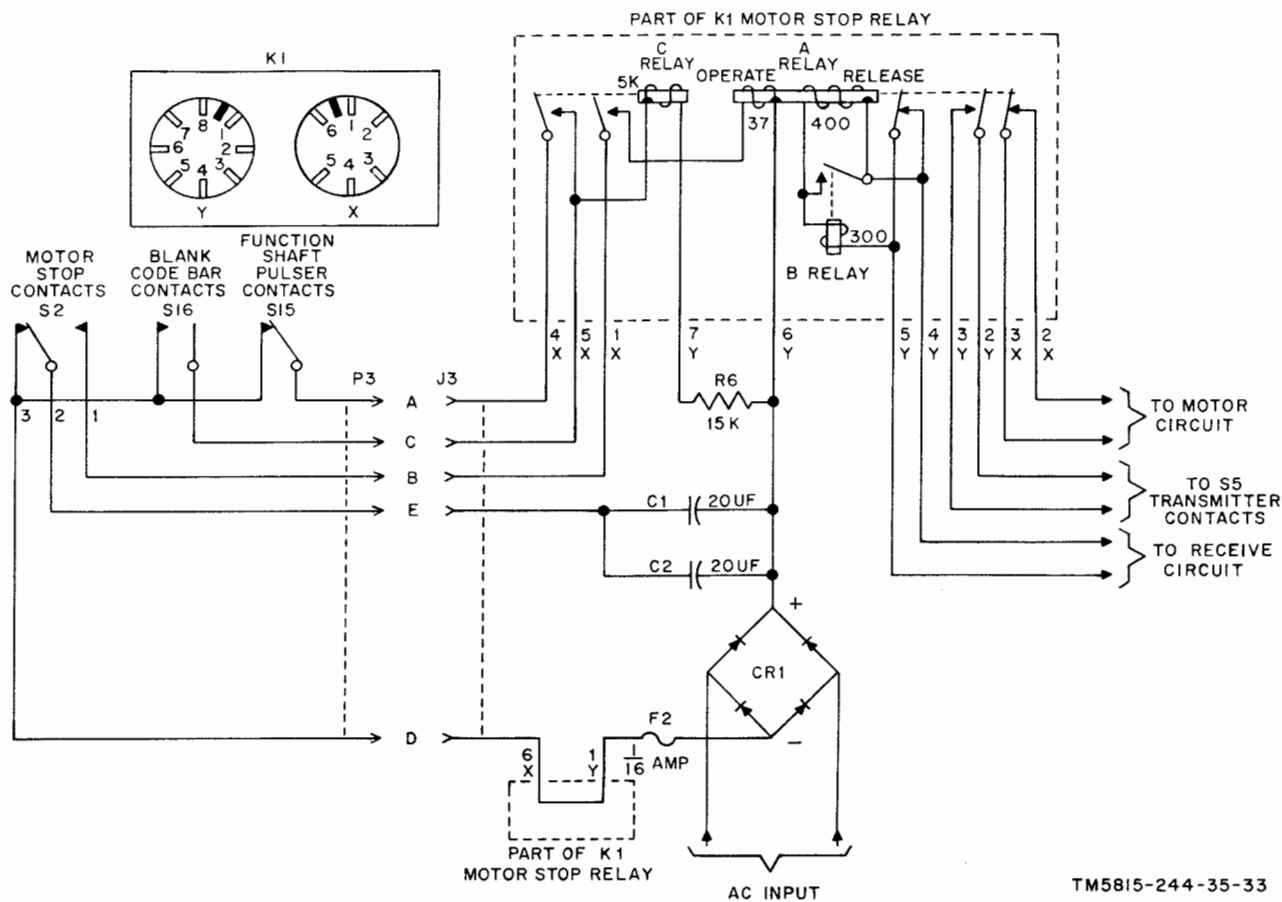
- (1) Motor stop relay E1 is a sealed relay consisting of relays A and B. The bottom view of this relay is shown in A, figure 136.
- (2) In the normal operating condition, capacitors C5 and C6 (B, fig. 136)

are charged from rectifier CR1 when contact 2 of motor stop contacts S1 was against contact 3. The motor stop function is an electromechanical function which is actuated by pressing the H-key lever when the page

printer is in the FIGS position (par. 47c). This causes the function selection arm to be positioned in line with the motor stop punch bar. The function cam then causes the function selecting arm to be moved inward, striking the motor stop punch bar. As the punch bar moves inward, it pivots the motor stop function lever. The motor stop function lever strikes an insulator on contact 2 of motor stop contacts S1, and moves it momentarily from contact 3 to contact 1. This closes a circuit and allows capacitors C5 and C6 to discharge through the 37-ohm operating winding of relay A.

- (3) The discharge path of capacitors C5 and C6 is as follows: from the negative side of capacitors C5 and C6 through contacts 2 and 1 of motor stop contacts S1, to terminal 1X of motor stop relay E1, through the 37-ohm operating winding of relay A to terminal 6Y of motor stop relay E1, and back to the positive side of capacitors C5 and C6. Relay A of motor stop relay E1 is composed of a 37-ohm operating winding, a 400-ohm release winding, and a permanent magnet. The permanent magnet is not strong enough to attract the contact floats to it without the operating winding being energized. But once the contact floats have been operated, the permanent magnet by itself is capable of holding them there. Capacitors C5 and C6, discharging through the operating winding of relay A, aid the permanent magnet and operate the contact floats. This opens the set of contacts connected to terminals 2X and 3X of motor stop relay E1, which are connected in series to the motor circuit, and causes the motor to stop. A second set of contacts connected to terminals 2Y and 3Y of E1 closes. These contacts, connected in parallel across sequential transmitter mechanism E4, short E4 and keep current on the line regardless of the position of the sequential

transmitter mechanism. A third set of contacts, connected to terminals 4Y and 5Y of motor stop relay E1 and in series with the page printer receive circuit, open. This momentarily makes the current in the page printer receive circuit pass through the winding of relay B and the 400-ohm release winding of relay A. Relay B then becomes energized, closing its contact. When this happens the receive current continues to flow through the winding of relay B, but now bypasses the release winding of relay A, through the closed contacts of relay B. Although the release winding of relay A opposes the permanent magnet, the contacts of relay A remain operated during the time receive current is passing through the release winding because, during this time, current is still present in the operating winding. The electromagnetic force of the release winding is in opposition to the force of the operating winding, and the permanent magnet holds the contacts in the operated condition. The motor stop function is completed when the motor stop function lever allows contact 2 of motor stop contacts S1 to return to contact 3, which opens the circuit through the operating winding of relay A and allows capacitors C5 and C6 to be recharged. The receive current continues to flow through relay B. To start the motor, the contact floats of relay A must be released to their normal position. This is accomplished when LINE-BREAK switch S3 is moved to the BREAK position. The receive circuit through the winding of relay B is then opened, causing the contacts of relay B to open. When LINE-BREAK switch S3 is released, it automatically returns to the LINE position, allowing current to flow through the line. The receive current now passes through the winding relay B and also through the release winding of relay A. This causes the contact floats of relay A to release to



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Figure 137. Motor stop circuit, (weather symbol page printers), simplified schematic diagram.

their normal position. When this occurs, contacts 2X and 3X close and start the motor. Contacts 2Y and 3Y open, removing the short across sequential transmitter mechanism E4. Contacts 4Y and 5Y close, and short the winding of relay B and the release winding of relay A.

e. Motor Stop Circuit, (Weather Symbol Page Printers) (fig. 137).

- (1) The motor stop relay on the TT-118/FG is a sealed unit consisting of relays A and B described in d(1) above, plus relay C.
- (2) On the TT-118/FG, the upper case H-position is used to print a weather symbol. To accomplish motor stop, the figures key, the blank key, and the H-key must be pressed. When the blank stop bar is selected it closes blank code bar contacts S16 and en-

ergizes relay C. Relay C closes two pairs of contacts: one pair closes the circuit through normally closed function shaft pulser contacts S15 (which have no effect on the circuit when the blank code bar contacts S16 are closed); the second pair closes and prepares the circuit through the operate winding of relay A. Function shaft pulser contacts S10 are controlled by a cam on the function shaft that rotates one-half revolution for each code group and opens the contacts once for each one-half revolution. As soon as the transfer operation for the H code group takes place, the H stop bar is selected. The blank stop bar returns to its unselected position and blank code bar contacts S16 open. The circuit to relay C remains closed through the normally closed

function shaft pulser contacts S15. As the function shaft rotates, the function selecting arm moves the motor stop punch bar inward and closes contacts 1 and 2 of motor stop contacts S2; capacitors C1 and C2 then discharge through the operate winding of relay A. This energizes relay A and stops the motor. Immediately after motor stop contacts 1 and 2 close, function shaft pulser contacts S15 open and relay C deenergizes. If any character other than H is received after the blank code group, the motor stop contacts will not operate and relay C will deenergize at the end of the one-half revolution of the function shaft. The operation of relays A and B are the same as described in *d* above.

## 96. Page Printer Ac Circuits

*Note.* Refer to paragraph 91 for the reference designation conversion chart.

The ac circuits in the page printer operate from 115 volts, single phase, ac, supplied through plug P1, which is normally connected to convenience outlet J16 on the perforator. The ac input to the page printer is controlled by POWER switch S4 and protected by 1.6 AMP fuse F1. Power is distributed to the motor and copy lamp circuits as indicated in figure 138. The AN/FGC-25, 26, and 57 are equipped with synchronous motors and the AN/FGC-25X is equipped with series-governed motors.

*a. Series-Governed Motor (A, fig. 138).* The series-governed motor is mechanically governed (par. 30) to run at 3,600 rpm. When the MOTOR switch and motor stop relay contacts 2 and 3 are closed, current flows through the series circuit consisting of the filter, the field coils, the armature, and the governor contacts, causing the motor armature to rotate. The motor speed is controlled by opening and closing the governor contacts which are in parallel with a 150-ohm resistor. When the motor speed is above 3,600 rpm, centrifugal force causes the governor contacts to open. This removes the short from across the 150-ohm resistor and reduces the amount of current through the field coils and

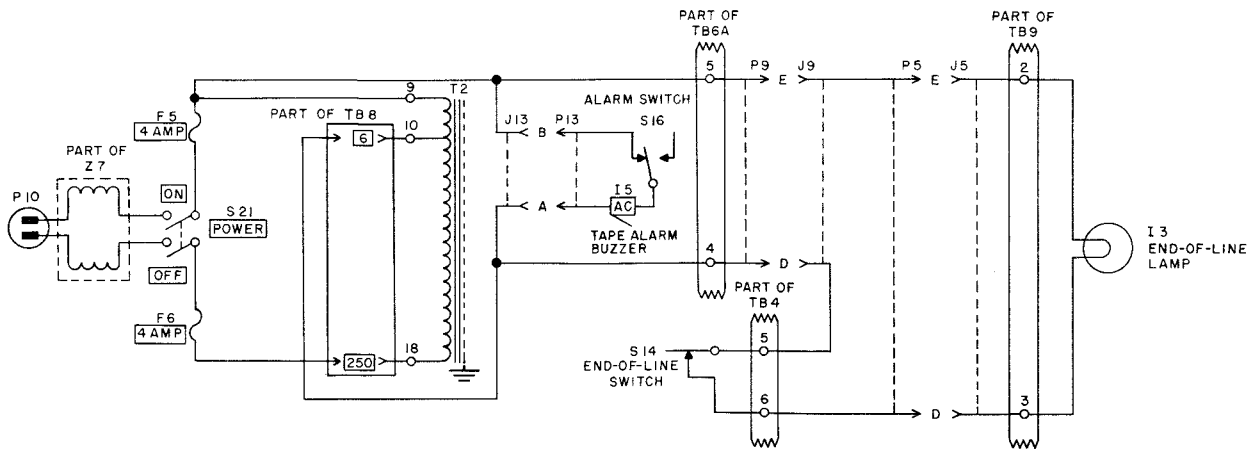
the speed decreases. The 10-ohm portion of the 150-ohm resistor and the .5- $\mu$ f capacitor acts as a spark suppressor for the governor contacts. The filter and the three .1- $\mu$ f capacitors suppress radio frequencies generated by the governor contacts, the motor commutator, and the motor stop relay contacts (page printer only).

*b. Synchronous Motor (B, fig. 138).* The synchronous motor is rated at one-twentieth horsepower and operates at 3,600 rpm. Each motor contains a squirrel cage type rotor (armature), a run winding and a start winding. The start winding is in series with a phase shifting capacitor assembly and the contacts of a current operated relay. When the MOTOR switch and motor stop relay contacts 2 and 3 are closed, the initial starting current causes the motor start relay to energize and close its contact. This places a 10-ohm resistor and 5- $\mu$ f capacitor in parallel with a second 5- $\mu$ f capacitor that is always in series with the start winding. This increases the effective capacity in series with the start winding and provides the initial torque to start the armature rotating. As the armature gains speed, the current flowing through the motor and the relay coil decreases. When the release current value of the relay is reached, the relay deenergizes and removes the 10-ohm resistor and the 5- $\mu$ f capacitor from the circuit. The start winding circuit remains completed through the other 5- $\mu$ f capacitor and maintains a constant motor speed as the load is varied during operation. The armature rotates in a clockwise direction as viewed from the end opposite the motor worm gear.

*c. Copy Lamp Circuit (fig. 138).* The copy lamp circuit is controlled by LIGHT switch S6 and is identical in all models of the equipment.

*d. End-of-line Circuit (fig. 139).*

- (1) The end-of-line lamp I 3 is located on the right side of the keyboard guard of the page printer. When transmitting from the keyboard-transmitter, the end-of-line lamp lights to indicate that 66 characters have been transmitted since the last carriage-return signal. The operator, upon seeing the light, should punch the carriage-return and line feed symbols in the message tape. The 6.3 volts ac to



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Figure 139. End-of-line and tape-out alarm circuits, simplified schematic diagram.

operate this circuit are obtained from the primary winding of transformer T2.

- (2) The circuit is traced from terminal 10 of transformer T2 through end-of-line switch S14 and end-of-line lamp I 3, to terminal 9 of transformer T2.

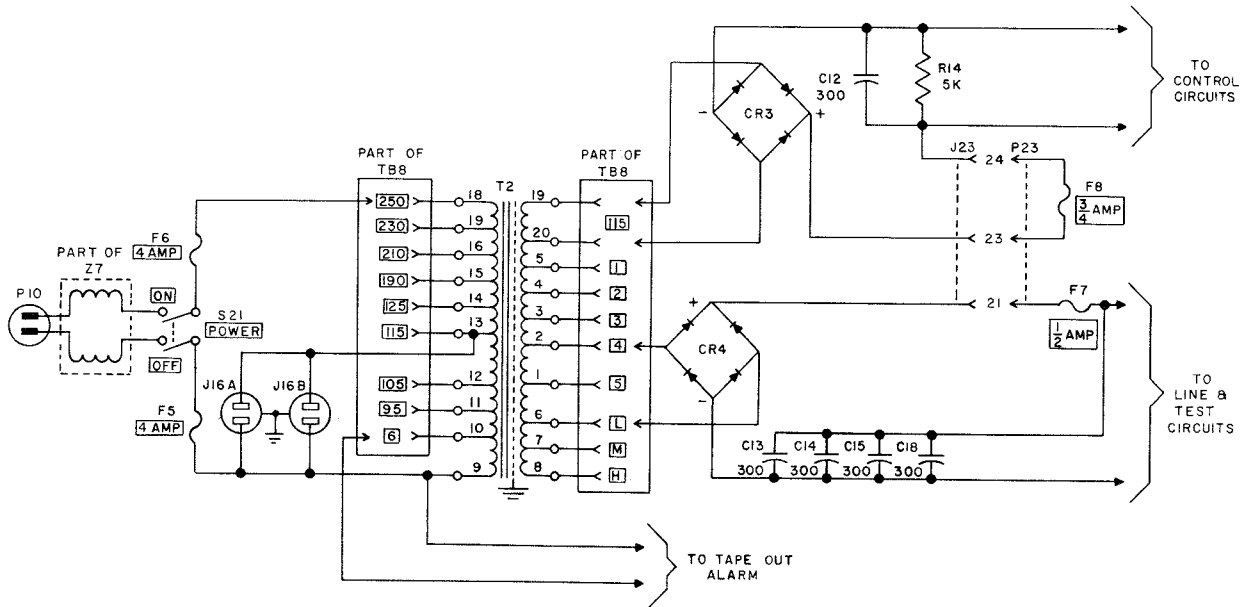
## 97. Perforator Power Circuits

Note. Refer to paragraph 91 for the reference designation conversion chart.

a. Perforator Ac Input Circuit (fig. 140). Transformer T2 can be operated from inputs of

95 to 250 volts, ac. For example, if the input voltage were 125 volts ac, the adjustable tap would be plugged into the jack labeled 125. Whenever the adjustable tap corresponds to the input voltage, 115 volts ac will always be supplied to convenience outlets J16A and J16B. The transformer action of the primary winding steps up or steps down the voltage so that this is always true. POWER switch S21 is provided to control the ac to the primary winding of transformer T2. The ac input circuit is protected by two 4 AMP fuses F5 and F6.

b. Perforator Power Supply Circuit. The ac from the primary winding of transformer



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Figure 140. Perforator ac input and power supply circuits, simplified schematic diagram.



T2 (fig. 140) is induced into the secondary winding, and from there applied to the ac terminals of rectifiers CR3 and CR4. Rectifier CR4 supplies dc for the line and test circuits. The ac input to rectifier CR4 is adjustable by means of coarse jacks L, M, and H and fine jacks 1-5 of terminal board TB8. The output of rectifier CR4 (fig. 140) is filtered by capacitors C13, C14, C15, and C18 and is protected by 1/2 AMP fuse F7. The output of rectifier CR3 is filtered by capacitor C12 and protected by fuse F8. The ac input to rectifier CR3 is fixed. Resistor R14 acts as a bleeder resistor to maintain a consistent load on rectifier CR3, and also reduces the shock hazard. The output of rectifier CR3 supplies dc to the local control circuits.

## 98. Perforator Sequential Circuits

*Note.* Refer to paragraph 91 for the reference designation conversion chart.

*a. Transmitter-Distributor Send Circuit* (fig. 141). The transmitter-distributor translates the mechanical sensing of the code perforations in the message tape into a series of electrical impulses. This is accomplished by the mechanical control and operation of the transmitter contact bail shown in figure 104. When the transmitter contact bail is pivoted, it makes and breaks the circuit at the COM and MK contacts of transmitter-distributor contacts E6. The transmitter-distributor send circuit be-

comes part of a larger circuit when the transmitter-distributor has been placed in series with a signal line through plug P37 and jack J37.

*b. Perforator Receive Circuit* (fig. 142). This circuit terminates on REPERF plug P38 and jack J38, making it possible to connect it in series with any other circuit on the patch panel. The circuit provides a path for coded impulses to pass through the line windings of the selector magnet. Selector magnet E9 changes these coded impulses into a mechanical movement, which, through a train of other mechanical parts, eventually results in a character being punched and printed on the message tape. SIGNAL switch S29 adapts the line windings of the selector magnet for 20-ma or 60-ma operation. When SIGNAL switch S29 is in the 20 position, selector magnet E9 line windings are connected in series with plug P38 and jack J38. When SIGNAL switch S29 is in the 60 position, selector magnet E9 line windings are connected in parallel with plug P38 and jack J38.

*c. Perforator Selector Magnet Bias Circuit* (fig. 143). The bias circuit is used in neutral operation to move the selector magnet armature to the space position when a space (no-current) impulse is received. Power to operate the circuit is obtained from rectifier CR4. Three-position BIAS switch S30 adapts the circuit for operation with 20-ma, 60-ma, or polar

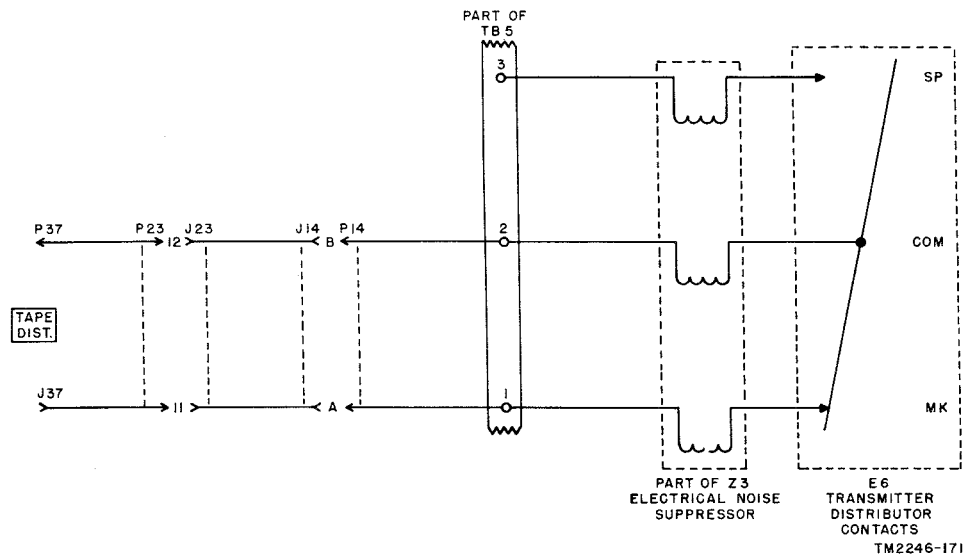
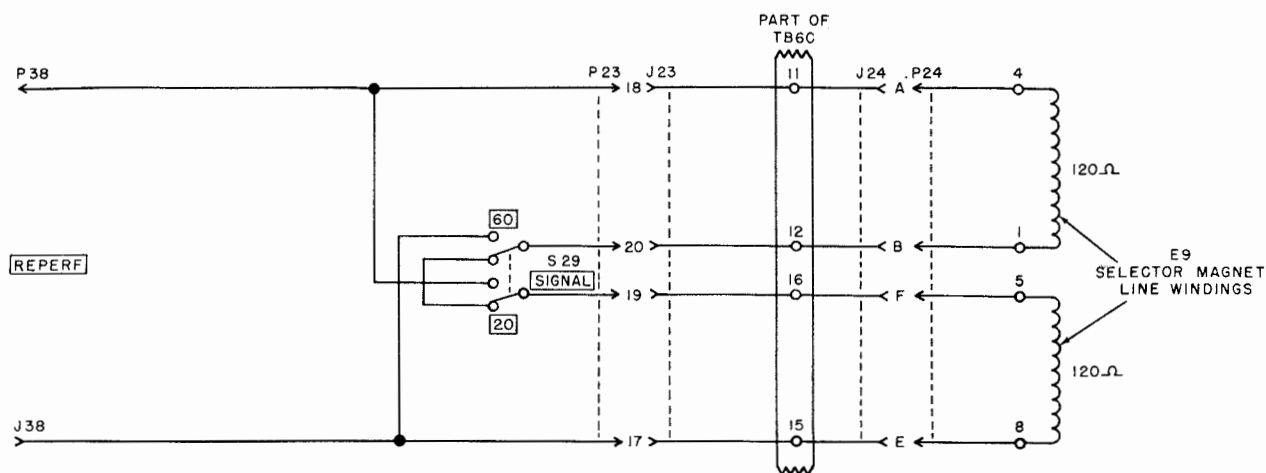
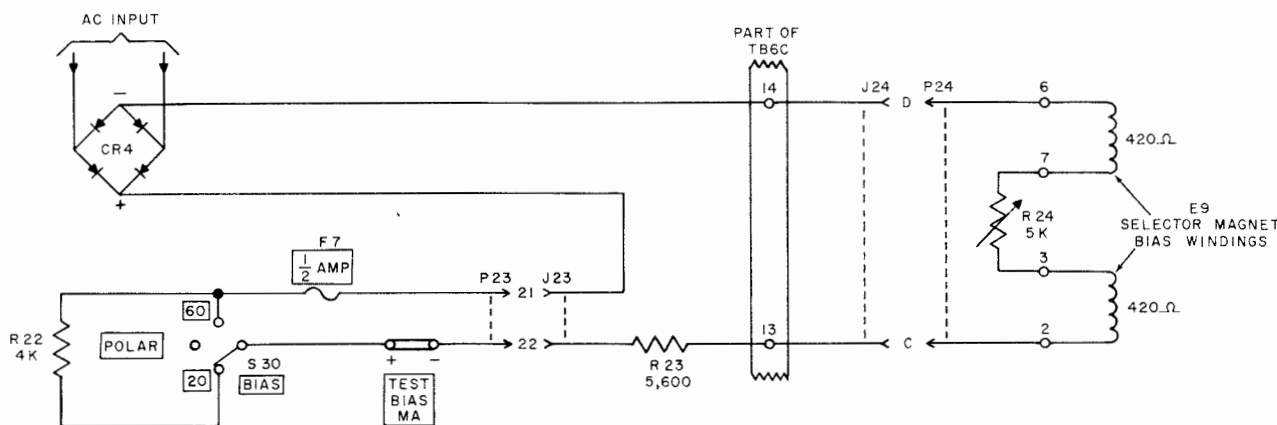


Figure 141. Transmitter-distributor send circuit, simplified schematic diagram.



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Figure 142. Perforator receive circuit, simplified schematic diagram.



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Figure 143. Perforator selector magnet bias circuit, simplified schematic diagram.

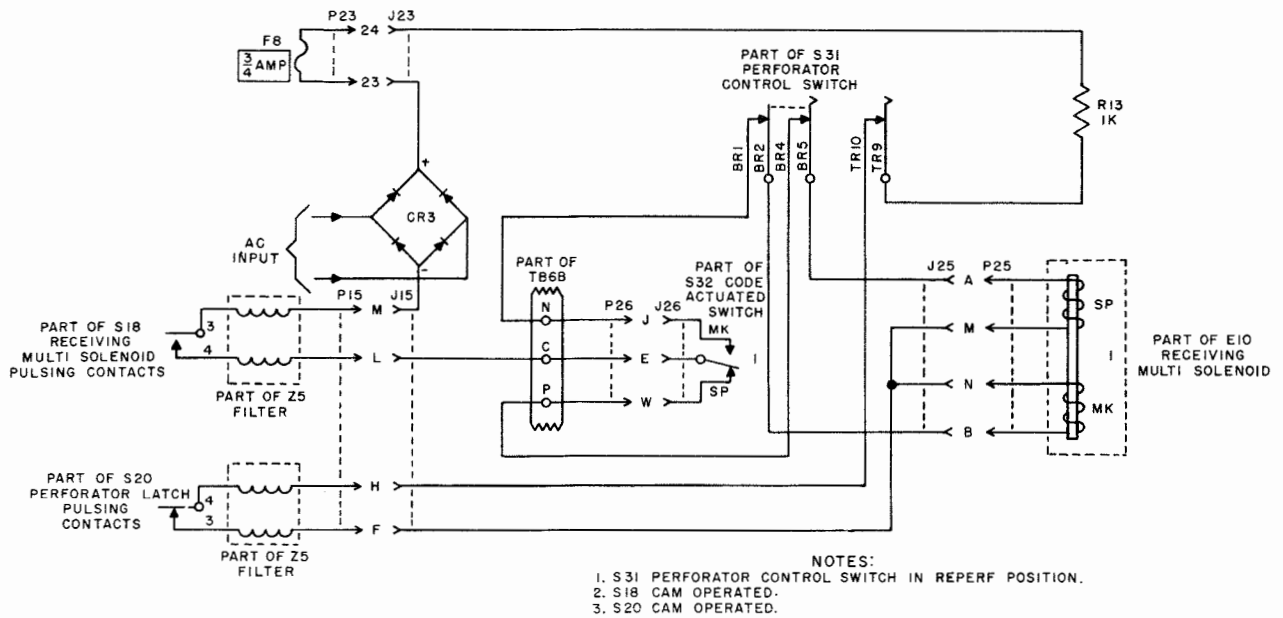
signals. Figure 143 shows BIAS switch S30 in the 20 position. When the switch is moved to 60, resistor R22 is bypassed, and the current in the circuit increases. When the switch is in the POLAR position, the bias circuit is open. Variable resistor R24 is used to adjust the bias current (par. 530b(1)(b)). The BIAS TEST MA binding posts provide a convenient place at which to measure the bias current.

## 99. Receiving Multisolenoid Circuit, Sequential Signals on Line (fig. 144)

*Note.* Refer to paragraph 91 for the reference designation conversion chart.

a. When a code group is received electrically in selector magnet E9, it is mechanically transferred to the code plates. When the code plates

are positioned, they set up circuits through code actuated switch S32. The receiving multi-solenoid pulsing contacts (S18) close and permit dc current to flow from rectifier CR3 through the normally closed perforator latch pulsing contacts 3 and 4 (S20) to the receiving multisolenoid simultaneously for the five intelligence impulses. Two coils are provided in the receiving multisolenoid for each impulse. If the Mk coil is energized it moves the associated multisolenoid Y-lever to the marking position. If the SP coil is energized, it moves the associated multisolenoid Y-lever to the spacing position. The circuit described below is for the first intelligence impulse and is the same for each of the other four impulses, with the exception of the terminal numbers, the jack designations, and the contacts of perforator control switch S31.



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Figure 144. Receiving multisolenoid circuit with sequential signals on line, receive from perforator, simplified schematic diagram.

b. With perforator control switch S31 in the REPERF position, and beginning with the negative side of rectifier CR3, the circuit is traced through contacts 3 and 4 of receiving multisolenoid pulsing contacts S18. If the code plate of code actuated switch S32 is moved to the MK position, the circuit continues through the contacts of code actuated switch S32, contacts BR1 and BR2 of perforator control switch S31 (in the REPERF position), through the Mk coil of receiving multisolenoid E10, and contacts 3 and 4 of the perforator latch pulsing contacts S20, through contacts TR10 and TR9 of perforator control switch S31, through resistor R13 and fuse F8 to the positive side of rectifier CR3. If the code plate of code actuated switch S32 is in the SP position, the circuit is the same except that it goes through the SP coil of receiving multisolenoid E10 and is routed through BR4 and BR5 of perforator control switch S31.

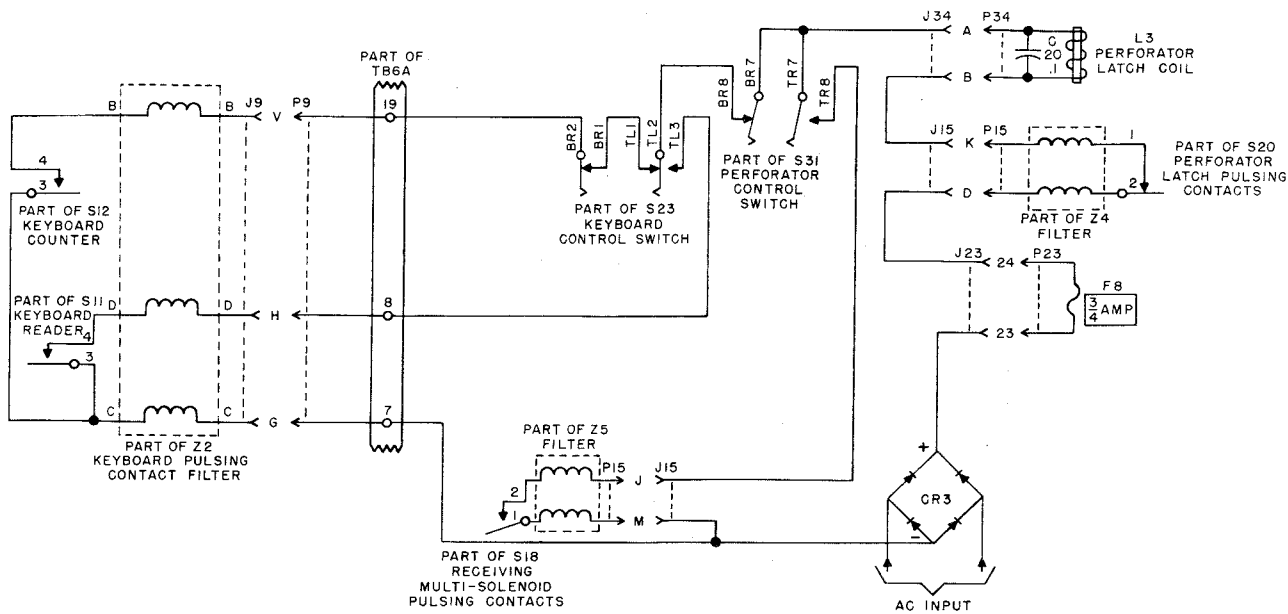
## 100. Perforator Local Dc Circuits

Note. Refer to paragraph 91 for the reference designation conversion chart.

### a. Perforator Latch Circuit (fig. 145).

- (1) When a code group has been received in the receiving multisolenoid and stored in the multisolenoid Y-levers,

that code group is then transferred to the code-ring cage. This operation is begun electrically by energizing perforator latch coil L3. The position of keyboard control switch S23 and perforator control switch S31 determines which set of contacts closes the circuit to energize perforator latch coil L3. The dc to energize perforator latch coil L3 is supplied from rectifier CR3. If the perforator is receiving its impulses from the line, perforator control switch S31 is in the REPERF position, and receiving multisolenoid pulsing contacts S18 close the circuit to energize perforator latch coil L3. If the keyboard-transmitter is sending to the perforator and the line at the same time, keyboard control switch S23 is in the KEYBD & TAPE position, and perforator control switch S31 is in the KEYBD position. At this time, keyboard counter contacts S12 close the circuit to energize perforator latch coil L3. If the keyboard-transmitter is sending to the perforator only, keyboard control switch S23 is in the TAPE position and perforator control switch S31 is in the KEYBD position. At this time key-



- NOTES:
1. S12 KEYBOARD COUNTER CAM OPERATED.
  2. S11 KEYBOARD READER KEY LEVER OPERATED.
  3. S23 KEYBOARD CONTROL SWITCH IN KEYBD & TAPE POSITION.
  4. S31 PERFORATOR CONTROL SWITCH IN KEYBD POSITION.
  5. S18 RECEIVING MULTI-SOLENOID PULSING CONTACTS ARE CAM OPERATED.
  6. S20 PERFORATOR LATCH PULSING CONTACTS ARE CAM OPERATED; CONTACTS 1 AND 2 ARE NORMALLY CLOSED.

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Figure 145. Perforator latch circuit, simplified schematic diagram.

board reader contacts S11 close the circuit to energize perforator latch coil L3. The circuit for each of the above conditions is described separately below.

- (2) When perforator control switch S31 is in the REPERF position, the circuit is traced from the negative side of rectifier CR3, through contacts 1 and 2 of receiving multisolenoid pulsing contacts S18, through contacts TR8 and TR7 of perforator control switch S31, through perforator latch coil L3, through normally closed contacts 1 and 2 of perforator latch pulsing contacts S20 and fuse F8, to the positive side of rectifier CR3.
- (3) When keyboard control switch S23 is in the KEYBD & TAPE position and perforator control switch S31 is in the KEYBD position, the circuit is traced from the negative side of rectifier CR3 to contact 3 and 4 of keyboard counter S12, through contact BR2 and BR1 to

contact TL1 and TL2 of keyboard control switch S23 which is in the KEYBD & TAPE position, through contacts BR8 and BR7 of perforator control switch S31, through perforator latch coil L3, through normally closed contacts 1 and 2 of perforator latch pulsing contacts S20 and fuse F8, to the positive side of rectifier CR3.

- (4) When keyboard control switch S23 is in the TAPE position and perforator control switch S31 is in the KEYBD position, the circuit is traced from the negative side of rectifier CR3, through contacts 3 and 4 of keyboard reader switch S11, through contacts TL3 and TL2 of keyboard control switch S23 which is in the TAPE position, through contacts BR8 and BR7 of perforator control switch S31 which is in the KEYBD position, through perforator latch coil L3, through normally closed contacts 1

and 2 of perforator latch pulsing contacts S20 and fuse F8, to the positive side of rectifier CR3.

b. *Automatic Line Return Circuit.* When the equipment is setup to operate using the automatic line return (fig. 147), the page printer selector magnets (connected to P42 and J42) are in series with the local equipment (connected to J43 and P43) through the contacts of relay C. Relay A is connected in series with the signal line being monitored. While the signal line being monitored is idle, the local equipment may be used (off-line) to print and perforate messages locally. If a message comes in over the line to which relay A is connected, the page printer selector magnets will be disconnected from the local circuit and will be connected to the signal line to receive the message. The equipment remaining in the local circuit will be unaffected.

- (1) The procedure to set up automatic line return K1 is as follows: with ALR MONITOR switch S24 in the OFF position, operate line switch key S28 to the LINE 1 position. This allows current to flow from the negative side of rectifier CR3, through terminal 11 of K1, through relay B, through terminal 9 of K1, through contact BL4 and RL3 of line switch key S28, to the positive side of rectifier CR3. Both LINE positions of switch S28 place a short across relay A. *Relay C is always energized when ALR MONITOR switch S24 is in the OFF position.* Operate ALR MONITOR switch S24 to the LINE 1 position. This opens contact BL1 and BL2 and causes relay C to release. Next, operate line switch key S28 to the TEST position. The signal line can now be traced through K1 starting from LINE 1 binding post A, through contacts BL5 and BL3 of ALR MONITOR switch S24, through terminal 7 of K1 through relay A, through contact 6 and 7 of relay C, through terminal 4 of K1, to AUTO LINE RET IN jack J42. The circuit continues through PRINTER REC plug P35 and jack J35, to AUTO

LINE RET IN plug P42, to terminal 2 of K1. The circuit continues through contacts 4 and 3 of relay C to terminal 1 of K1, through contact BR1 and BR3 of ALR MONITOR switch S24, through contacts BR7, BF6, BL6 and BL7 of line switch key S28, to LINE 1 jack J44 and plug P44, to DC switch S26. When DC switch S26 is in the ON position, the circuit continues through fuse F7, to the positive side of rectifier CR4. The circuit is traced through rectifier CR4 and out the negative side through resistor R19, through resistor R18, through DC switch S26, to binding post B of LINE 1. If DC switch S26 is in the OFF position, the circuit is traced through the switch directly to binding post B of LINE 1. The current passing through relay A causes it to operate, closing the circuit from rectifier CR3 to operate relay C. When line test switch S28 was operated to the TEST position, the circuit to relay B was opened at contact BL4 and BL3 of line switch key S28. However, relay B is slow to release, and its contacts do not open until after relays A and C have operated. After relay C has operated, the circuit can be traced from binding post A of LINE 1, through contacts BL5 and BL3 of ALR MONITOR switch S24, through terminal 7 of K1, through relay A, through contact 1 and 2 of relay C, to terminal 1 of K1, through BR1 and contact BR3 of ALR MONITOR switch S24, through contacts BR7, BR6, BL6, and BL7 of line switch key S28 to LINE 1 jack J44 and plug P44, to DC switch S26 and to binding post B of LINE 1. The printer receive circuit which is patched to AUTO LINE RET IN plug P42 and jack J42 on the patch panel is now connected in series with any circuit patched to AUTO LINE RET OUT plug P43 and jack J43 through contacts 4 and 5 and 7 and 8 of relay C which is operated.

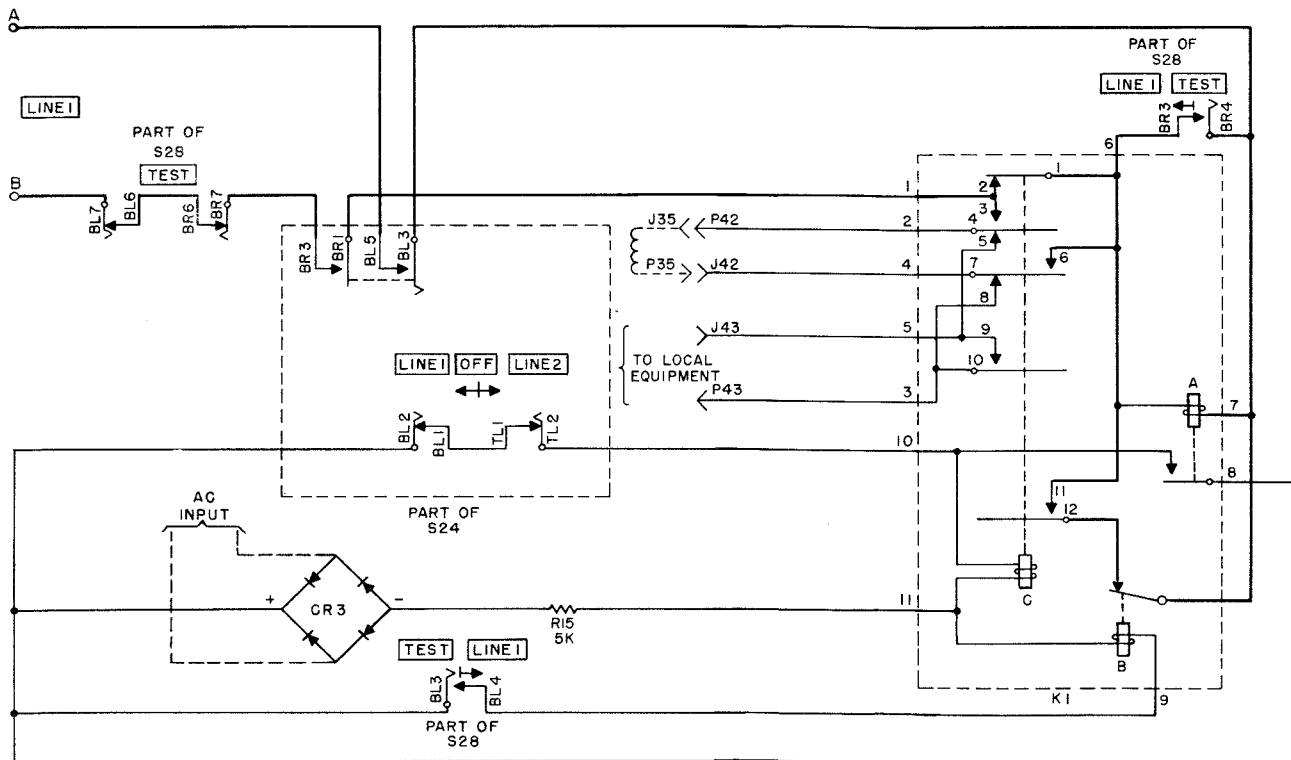
- (2) When the circuit connected to the LINE 1 binding posts begins to transmit, the first impulse is the start impulse (no current). During the start impulse, relay A releases. The contacts of relay A open the circuit between rectifier CR3 and relay C, causing relay C to release and connect the page printer selector magnets to the signal line.
- (3) When line 1 has finished transmitting and it is desired to have AUTO LINE RET OUT and AUTO LINE RET IN connected in series again, but to still monitor line 1, operate line switch key S28 to the LINE 1 position. This energizes relay B of automatic line return K1. Then operate line switch key S28 back to the TEST position. The current on line 1 energizes relay A of automatic line return K1 and closes its contacts. The operated contacts of relay A close, energizing relay C. Operating line switch key S28 to TEST also allows relay B to

release after relays A and C have operated. Automatic line return K1 is again set up to monitor line 1.

- (4) Figure 146 shows the automatic line return circuit for line 1 with only the page printer selector magnets connected. Figure 147 shows the automatic line return circuit for both line 1 and line 2 with the page printer selector magnet and all the local equipment connected.

*c. Dc Test and Line Switching Circuit.*

- (1) *Test circuit* (fig. 148). A test circuit is provided when plug P48 is connected to jack J48 and when plug P41 is connected to jack J41, and line switch key S28 is in the TEST position. The output of rectifier CR4 is connected in series with SEND and REC TEST jacks J17 and J18. TEST switch S25 is provided to adapt the circuit for 20- or 60-ma operation. This circuit is especially designed to test the page printer. When the page



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Figure 146. Automatic line return control circuits, line 1, simplified schematic diagram.

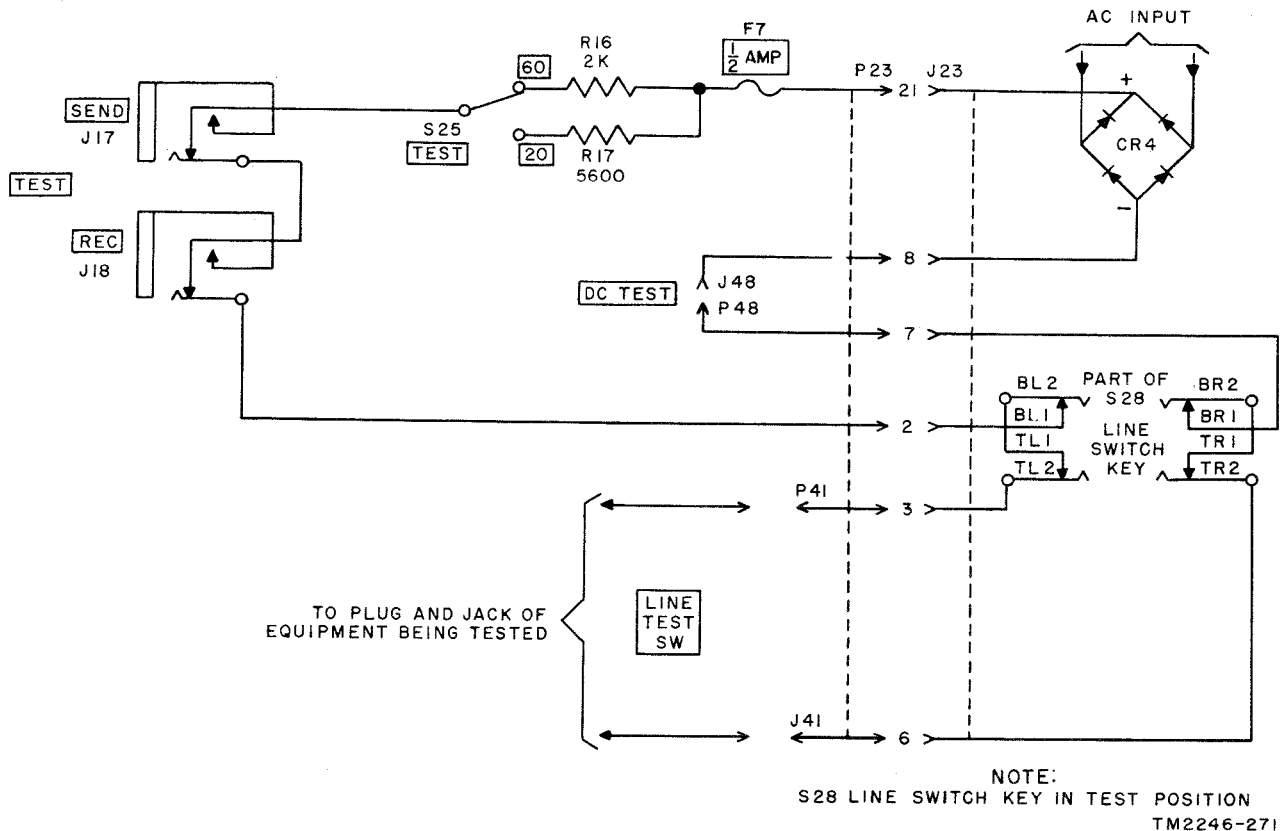
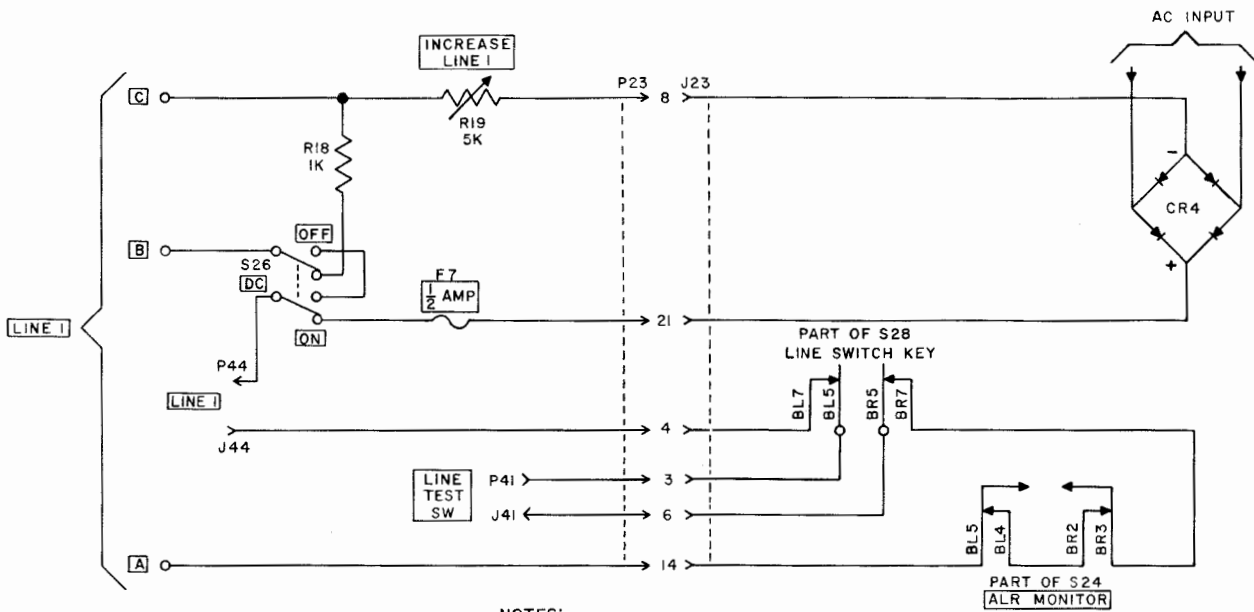


Figure 148. Dc test circuit, simplified schematic diagram.

printer SEND (black) and REC (red) plugs P21 and P22 are placed in the TEST jacks J17 and J18, they connect the send and receive circuits in series, and provide the proper test current. By connecting other components on the patch panel in series with LINE TEST SW plug P41 and jack J41, these other components may be switched from the test circuit to either LINE 1 or LINE 2 by operating line switch key S28. Each of the

above conditions is described separately below:

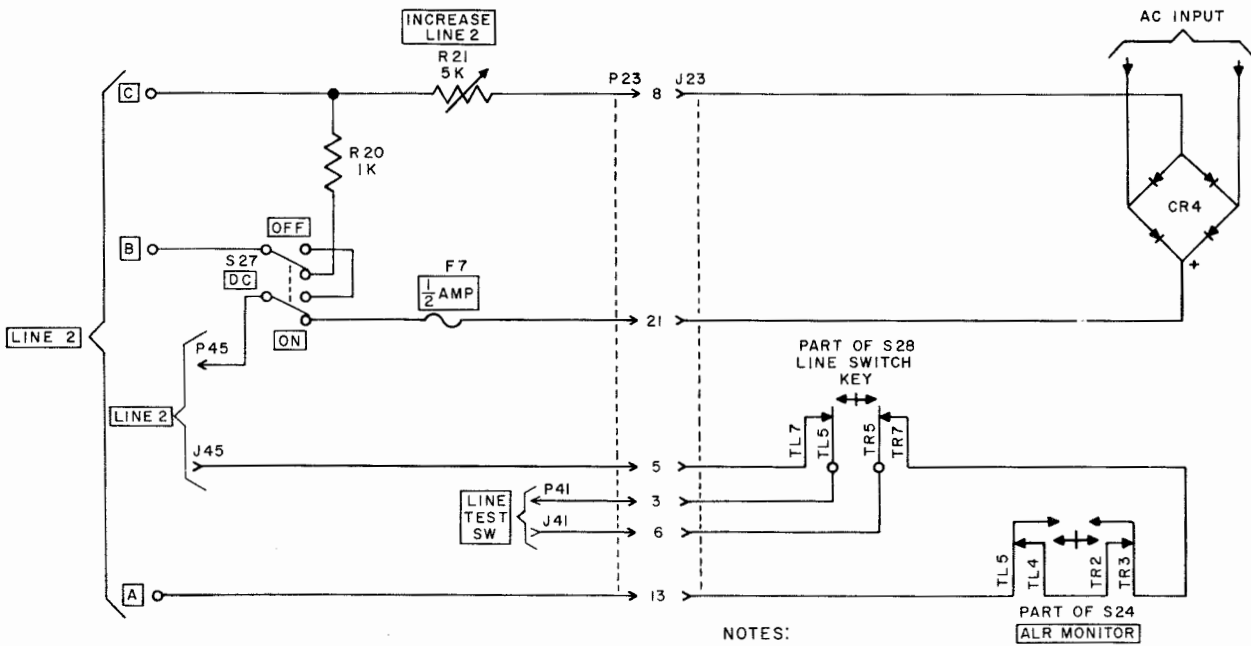
- (2) *LINE 1, switching circuit* (fig. 149). When S28 is operated to the LINE 1 position, LINE TEST SW plug P41 and jack J41 are connected in series with LINE 1 binding posts A, B, and C, through LINE 1 plug P44 and jack J44 on the patch panel.
- (3) *LINE 2, switching circuit* (fig. 150). When line switch key S28 is operated to the LINE 2 position, LINE TEST



- NOTES:
1. S24 ALR MONITOR IN OFF POSITION.
  2. S28 LINE SWITCH KEY IN LINE 1 POSITION.

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Figure 149. Line 1 circuit, simplified schematic diagram.

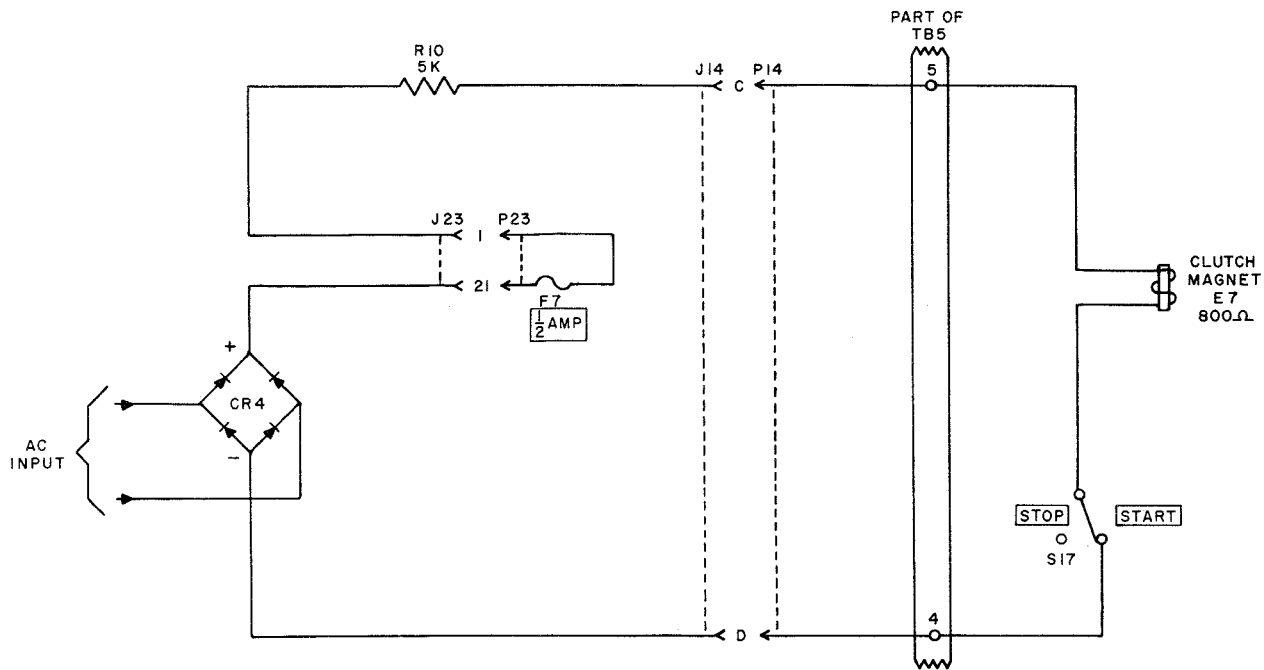


- NOTES:
1. S28 LINE SWITCH KEY IN LINE 2 POSITION.
  2. S24 ALR MONITOR SWITCH IN OFF POSITION.

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Figure 150. Line 2 circuit, simplified schematic diagram.





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Figure 151. Transmitter-distributor clutch magnet E7 and voltage test circuit, simplified schematic diagram (order No. 26563-P-52 only).

SW plug P41 and jack J41 are connected in series with LINE 2 binding posts A, B, and C, through LINE 2 plug P45 and jack J45, on the patch panel.

d. Manual Tape Feed-Out Circuit (fig. 135).

- (1) When perforator control switch S31 is in the REPERF position, the manual tape feed-out circuit provides a means of holding perforator latch coil L3 energized to manually feed-out tape so that the end of the tape message can be removed from the machine. This circuit is controlled by the manual tape feed-out lever which operates manual tape feed-out switch S34. The dc to energize perforator latch coil L3 is supplied by rectifier CR3.

- (2) The circuit may be traced from the negative side of rectifier CR3, through the contacts of manual tape feed-out switch S34, through contacts TR8 and TR7 of perforator control switch S31 in the REPERF position, through perforator latch coil L3 and fuse F8, to the positive side of rectifier CR3.

e. Voltage Test Circuit (B, fig. 152). Jacks J32 and J33, marked TEST VOLTS CR4, provide a convenient access point at which to measure the output of rectifier CR4. If the voltage is not correct, adjust the taps on the secondary of transformer T2.

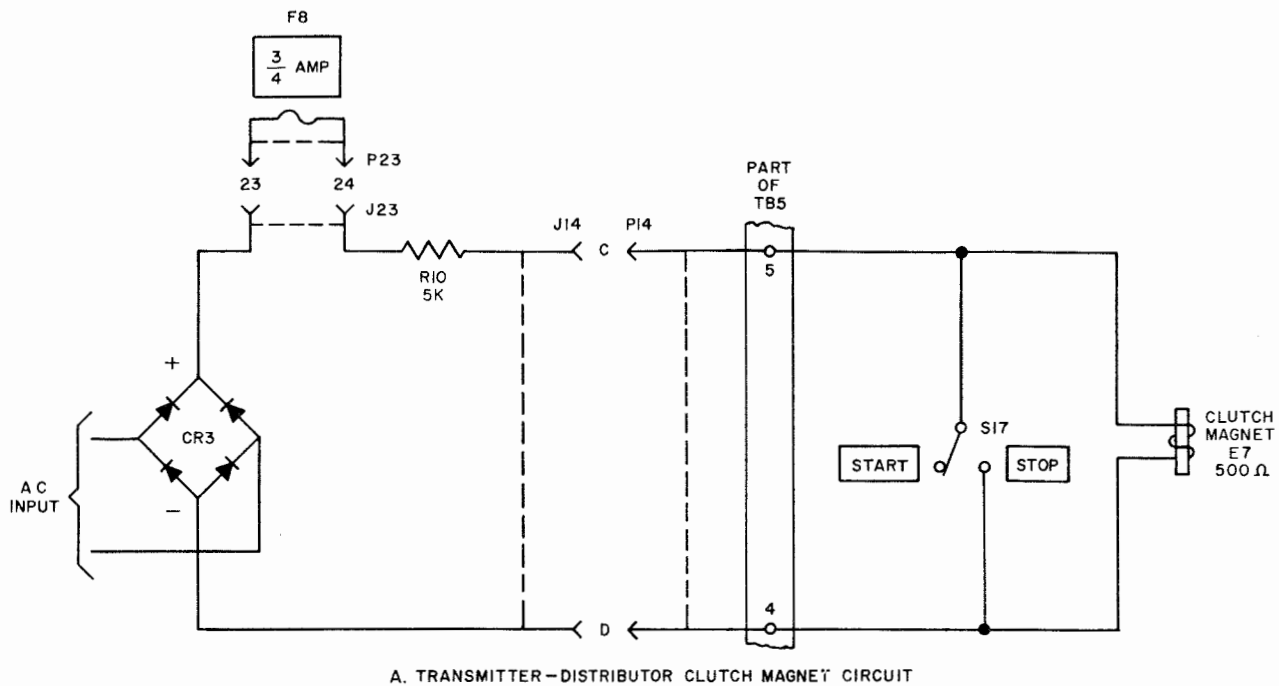
f. Transmitter-Distributor Clutch Magnet Circuit.

- (1) Clutch magnet E7 controls the rotation of the transmitter-distributor camshaft. The circuit is controlled by START-STOP switch S17.
- (2) On Order No. 26563-P-52 the clutch magnet circuit is as shown in figure 151; on all other orders the circuit is as shown in figure 152.

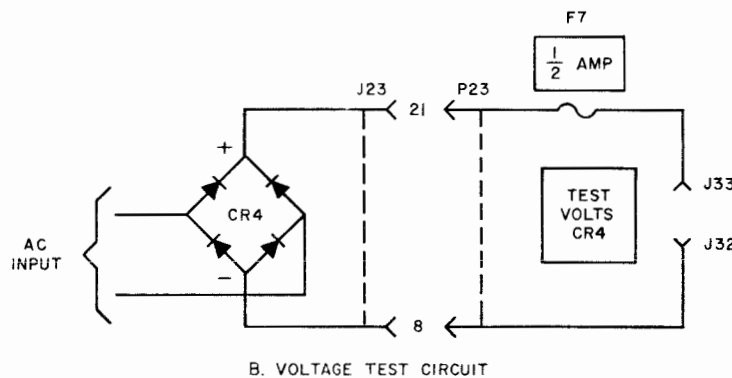
## 101. Perforator Ac Circuits

Note. Refer to paragraph 91 for the reference designation conversion chart.

a. Perforator Motor and Copy Lamp Circuits (fig. 153). The motor and copy lamp circuits operate from 115 volts ac supplied from the 115-volt tap on the primary of transformer T2. Power is distributed to the circuits as indicated in figure 153. The AN/FGC-25, 26, and 57 are equipped with synchronous motors, and the



A. TRANSMITTER-DISTRIBUTOR CLUTCH MAGNET CIRCUIT



B. VOLTAGE TEST CIRCUIT

TM2246-C2-5

Figure 152. Transmitter-distributor clutch magnet and voltage test circuit, simplified schematic diagram.

AN/FGC-25X is equipped with series-governed motors. The perforator motor circuits are identical to those described in paragraph 96a and b except that there are no motor stop relay contacts in the perforator motor circuits.

b. *Tape-Out Alarm Circuit* (fig. 139). This circuit supplies 6.3 volts ac from the primary winding of transformer T2, through alarm switch S16, to tape alarm buzzer I 5. The buzzer sounds an audible alarm when the perforator tape supply is low.

## 102. Patch Panel Connecting Circuits

*Note.* Refer to paragraph 91 for the reference designation conversion charts.

a. *Page Printer Connecting Circuit* (A, fig. 154). When the red and black plugs from the page printer are inserted in the PRINTER SEND and REC jacks on the perforator control panel, this circuit connects the page printer send and receive circuits to the patch panel.

b. *MONITOR 1 and MONITOR 2 Jacks* (B, fig. 154). MONITOR jacks J19 and J20 pro-

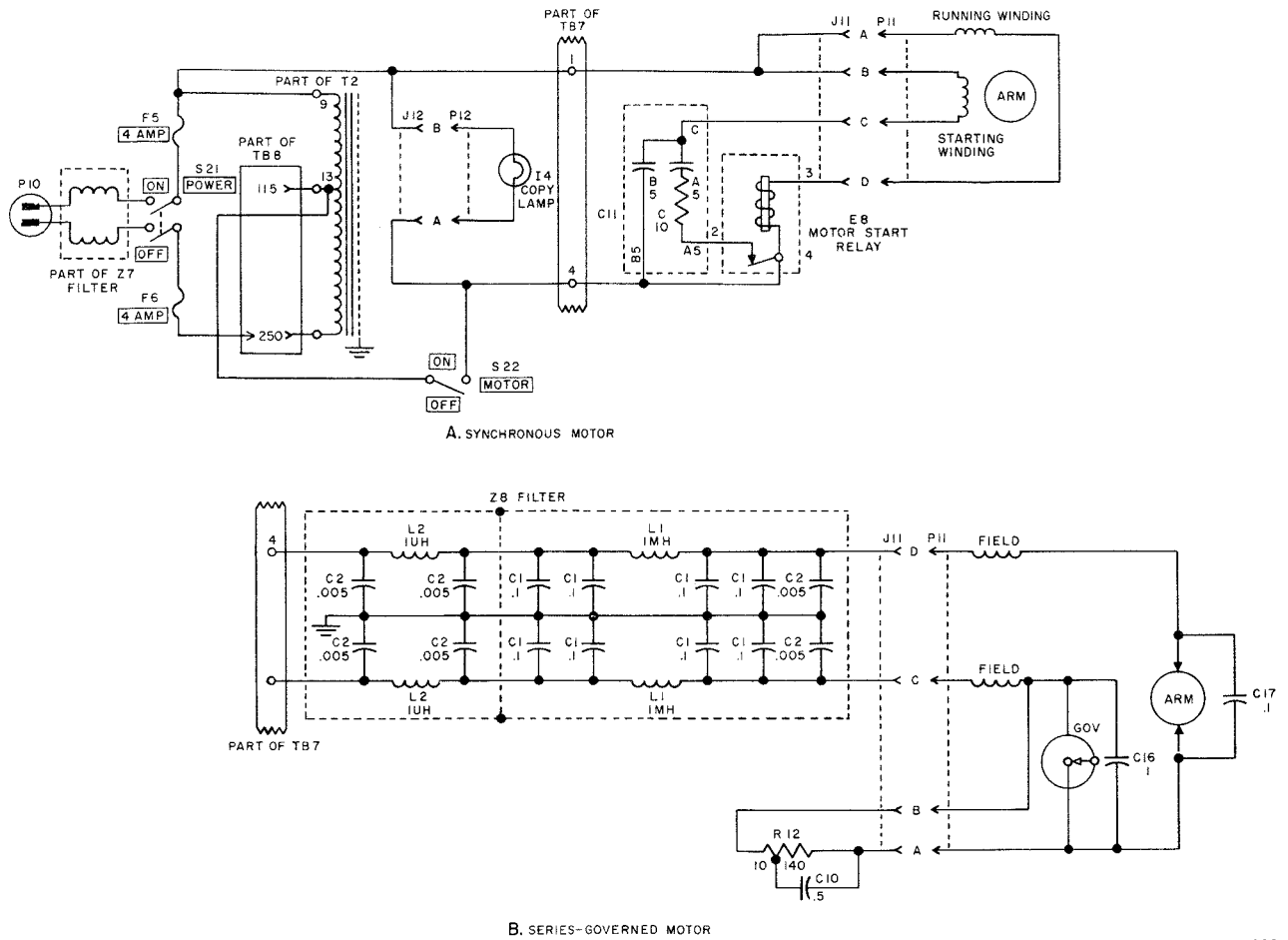


Figure 153. Perforator motor and copy light circuits, simplified schematic diagram.

vide a means of connecting external sending or receiving equipment in series with other equipment terminated on the patch panel.

c. **LINE 1 Circuit** (fig. 149). This circuit extends the signal line circuit terminated on the LINE 1 binding posts to the patch panel. The circuit contains a DC switch which is used to insert or remove the line battery. The external signal lines are normally connected to binding posts A and B; however, on long lines

or on lines containing high resistance the 1,000-ohm resistor may be bypassed by connecting the signal lines to binding posts A and C.

d. **LINE 2 Circuit** (fig. 150). This circuit connects the circuit terminated on the LINE 2 binding posts to the patch panel. The circuit is identical to and has the same function as line 1 (c above).

e. **LINE 3 and LINE 4 Circuits** (fig. 155). These circuits extend the signal line circuits

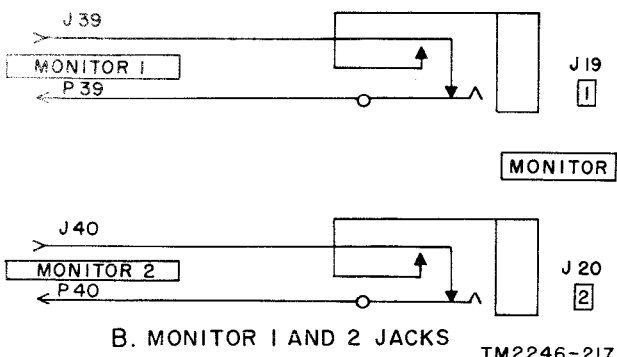
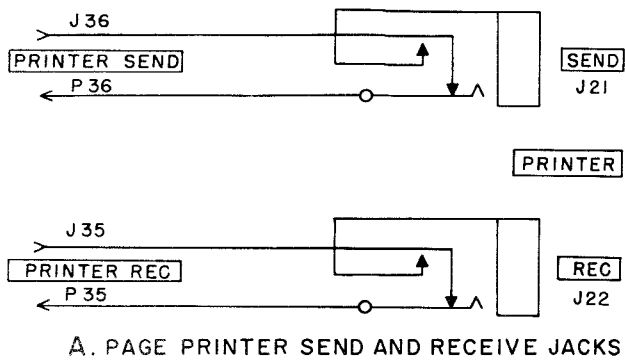


Figure 154. PRINTER SEND and PRINTER REC connecting circuits, and MONITOR 1 and MONITOR 2 connecting circuits, simplified schematic diagrams.

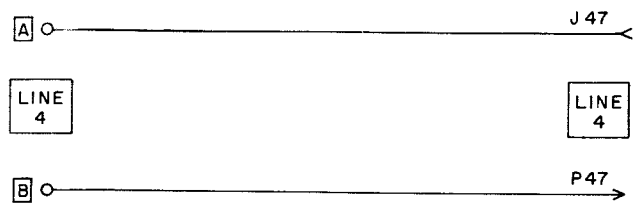
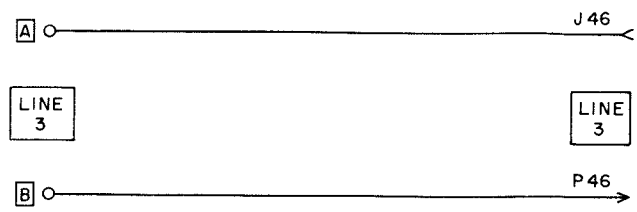


Figure 155. Lines 3 and 4 circuits, simplified schematic diagram.

connected to their respective binding posts, to the patch panel. There is no provision for supplying line current for lines terminated on these binding posts.

## CHAPTER 4

### MAINTENANCE INSTRUCTIONS

#### Section I. GENERAL

#### 103. Scope

This chapter includes instructions for third, fourth, and fifth echelons (field and depot) maintenance of Teletypewriter Sets AM/FGC-25, AM/FGC-25X, AN/FGC-26, and AN/FGC-57. Refer to TM 11-5815-244-12 for supplementary information that also applies to these echelons of maintenance.

#### 104. Tools and Test Equipment

a. The following tool equipments are required for maintenance.

- (1) Tool Equipment TE-50-B.
- (2) Tool Equipment TE-111.

b. In addition to the above, the following tools are required for shop maintenance:

- (1) Fractional and letter size drill sets.
- (2) Tap and die sets (National Coarse and National Fine threads).
- (3) Electric hand drill (1/4-inch capacity).

c. The following chart lists the test equipment required for maintenance of the teletypewriter sets.

Test equipment	Technical manual	Use
Multimeter TS-297/U <sup>a</sup> .	TM 11-5500	Used to measure voltage, current, and resistance.
Test Set TS-2/TG (third echelon).	TM 11-2208	Used to check bias and end distortion tolerance of receiving mechanisms.
Distortion Test Set TS-383/GG (fourth and fifth echelons only).	TM 11-2217	Used to check bias and end distortion tolerance of receiving mechanisms, and quality of signals originated by the transmitted mechanisms.
Multimeter TS-352/U.	TM 11-5527	Used to test the circuits of the teletypewriter sets.

<sup>a</sup> Part of TE-50-B.

## 105. Maintenance Materials

The required maintenance materials are listed in the following chart.

Item	Stock No.
Orangestick <sup>a</sup> -----	5120-408-4036 (Fed)
Brush, toothbrush style <sup>a</sup> -----	53-B-121610 (QMC)
Cheesecloth, bleached <sup>a</sup> 36 inches wide.	27-C-11656-36 (QMC)
Cloth, abrasive, # 9 <sup>a</sup> 9- x 11-inch sheets.	42-C-20363-50 (Ord C)
Cleaning Compound, liquid form.	7930-395-9542 (Fed)

Item	Stock No.
Paper, cleaning, bell seal <sup>a</sup> bond, 1/4- x 2 1/2-inch.	7530-408-0256 (Fed)
Sandpaper, flint, # 000 <sup>a</sup> 9- x 10-inch.	42-P-1154-20 (Ord C)
Dry cleaning solvent (SD)---	6850-264-9039 (QMC)
Compound, antiseize-----	52-2724.5000.080 (CE)
Brush, oval, No. 2 <sup>a</sup> -----	38-4567.300.200 (CE)
Tape TL-636/U <sup>a</sup> -----	5970-296-1175 (Fed)
Tape TL-83 <sup>a</sup> -----	5970-184-2003 (Fed)
Grease (KS7471)-----	6G650 (Sig C)
Oil (KS 7470)-----	6G1325 (Sig C)

<sup>a</sup> Part of Tool Equipment TE-50-B.

## Section II. PREVENTIVE MAINTENANCE

### 106. Use of Preventive Maintenance Form

a. DA Form 11-252 (fig. 156) is to be used as directed by the local commander while performing preventive maintenance.

b. Items not applicable to the teletypewriter sets are lined out in figure 156. Reference in the ITEM block in the figure are to paragraphs in this manual which contain additional maintenance information pertinent to the particular item.

c. Although this form enumerates the readily accessible parts and surfaces requiring regular inspections for dirt, maladjustments, and signs of wear, it does not enumerate all of the many less accessible parts of the AN/FGC-25(\*) that also require preventive maintenance care. When preventive maintenance routines are performed, check all parts for dirt, rust, corrosion, fungus, and ordinary signs of wear whether or not these parts are listed on the form.

d. The inspection intervals shown on the form are based on the assumption that the teletypewriter set will be in operation continuously 24 hours a day. Preventive maintenance inspections for signs of wear and maladjustment may be performed at slightly longer intervals if the teletypewriter set is not in continuous use.

### 107. General Cleaning Instructions

Most preventive maintenance techniques pertain to specific areas of preventive maintenance, such as lubrication, and are thoroughly

covered in later sections. However, the following general instructions should be helpful:

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning purposes.

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

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

**Caution: Prolonged breathing of cleaning compound is dangerous. Make sure that adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame.**

c. If available, vacuum cleaning equipment is suitable for removing loose dust, paper lint, and dirt.

d. Parko-lubricized and parkerized parts (those parts with a black finish) must not be kept in solvent (SD) for any extended period because the protective, impregnated oils and waxes will be removed. Clean all parko-lubricized and parkerized parts with an oil-soaked, lint-free cloth. Treat the parts after cleaning

LEGEND for marking conditions: Satisfactory, Y. Adjustment, Repair or Replacement required, X. Defect corrected, (X).						DAILY CONDITION FOR MONTH OF <b>JUNE 1960</b>																																
DAILY						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	2D 3D ECH- ELON	
NO.	ITEM																																					
1.	CHECK FOR NORMAL OPERATION OF EQUIPMENT. BE ALERT FOR ANY UNUSUAL PERFORMANCE OR CONDITION.					/																																✓
2.	CLEAN DIRT, OIL AND MOISTURE FROM THE EXPOSED SURFACES OF THE TELETYPEWRITER AND COVER. <span style="float: right;">PARA 108a &amp; b</span>					/																																✓
3.	INSPECT ALL EXTERNAL SWITCHES FOR PROPER MECHANICAL ACTION, FREEDOM OF MOVEMENT AND POSITIVE ACTION. <span style="float: right;">PARA 108 h</span>					/																																✓
4.	EMPTY CHAD BOXES ON REPERFORATORS AND CHECK BY OPERATION THAT CHAD BOXES ARE FREE OF OBSTRUCTIONS.					/																																✓
WEEKLY						CONDITION EACH WEEK					2D 3D ECH	ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS															CONDITION											
		1ST	2D	3D	4TH	5TH																																
5.	<del>CLEAN THE INSIDE AND OUTSIDE OF TRANSIT CASES. INSPECT FOR BROKEN OR MISSING LATCHES, HANDLES AND EQUIPMENT SUPPORTS OR BRACKETS.</del>											✓	16.	CLEAN THE TYPE PALLETS. <span style="float: right;">PARA 110d</span>															✓									
6.	INSPECT EXTERNAL CABLES AND CORDS FOR CUTS OR GOUGED JACKETS, FRAYING, BAD BRUISES OR KINKS AND BROKEN PLUGS OR CONNECTORS. <span style="float: right;">PARA 108f</span>											✓	17.	CLEAN THE KEYPADS AND CHECK FOR BROKEN, MISSING, LOOSE, OR ILLEGIBLE KEYPADS. <span style="float: right;">PARA 109c</span>															✓									
7.	INSPECT EXTERNAL BINDING POSTS <del>AND TERMINAL BLOCKS</del> FOR CRACKS, BREAKS, DIRT, LOOSE SCREWS, LOOSE CONNECTIONS AND MOUNTINGS.											✓	18.	<del>CLEAN INK FEED TUBES AND INK WELLS; REPLACE</del> REPLACE <del>INKING FELT OR</del> TYPING RIBBON IF REQUIRED. <span style="float: right;">PARA 110c &amp; 112c</span>															✓									
ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS						CONDITION																																
8.	INSPECT FOR, AND TIGHTEN, ANY LOOSE SCREWS, NUTS OR BOLTS ON THE COVER <del>OR TRANSIT CASES</del> . CHECK FOR BROKEN CATCHES, LATCHES, HANDLES, HINGES AND MOUNTINGS.											✓	19.	INSPECT GENERAL CONDITION OF LUBRICATION AND LUBRICATE AS REQUIRED IN ACCORDANCE WITH APPLICABLE LUBRICATION INSTRUCTIONS. <span style="float: right;">PARA 113-119</span>															✓									
9.	INSPECT COVER WINDOWS FOR CRACKS, BREAKAGE, OR OTHER DAMAGE. <span style="float: right;">PARA 108a</span>											(X)	20.	CLEAN EXCESS OIL, GREASE AND DIRT FROM MECHANICAL ASSEMBLAGES, GEARS, SHAFTS, FRAMES, ETC. <span style="float: right;">PARA 107</span>															✓									
10.	INSPECT ALL ELECTRICAL PLUGS AND RECEPTACLES FOR BREAKAGE, FIRM SEATING, PROPER CONTACT, CORROSION AND GREASE OR OIL DEPOSITS. CLEAN IF REQUIRED.											✓	21.	PERFORM ANY ADJUSTMENT REQUIRED AS A RESULT OF CLEANING, LUBRICATION OR NORMAL WEAR.															✓									
11.	INSPECT CABLES, CORDS AND WIRING FOR CUT OR GOUGED JACKETING, KINKS, BAD BRUISES OR FRAYING. <span style="float: right;">PARA 108f</span>											✓	22.	INSPECT FOR FREE MOVEMENT OF ALL MOVING PARTS: BENT, BROKEN, DISTORTED OR WORN SHAFTS, GEARS, CAMS, SPRINGS, CLUTCHES, BUSHINGS AND BEARINGS.															✓									
12.	INSPECT BINDING POSTS AND TERMINAL BLOCKS FOR CRACKS, BREAKS, DIRT AND LOOSE CONNECTIONS. <span style="float: right;">PARA 108g</span>											✓	23.	OPERATE EACH KEY AND CHECK THE FUNCTIONAL RESPONSE.															✓									
13.	INSPECT FOR LOOSE MOUNTING SCREWS AND NUTS ON PARTS OR BRACKETS.											✓	24.	CHECK THAT THE PRINTING ON PAGE PRINTERS IS IN ALIGNMENT HORIZONTALLY AND THAT THE CHARACTERS ARE EVENLY SPACED AND FULLY PRINTED. CHECK THAT THE CHARACTERS ARE FULLY PRINTED ON TYPING REPERFORATORS.															✓									
14.	INSPECT ALL SWITCHES FOR BINDING, FREEDOM OF MOVEMENT AND POSITIVE ACTION. <span style="float: right;">PARA 108h</span>											✓	25.	CHECK THE TAPE OF TYPING <del>AND NON-TYPING</del> REPERFORATORS AND PERFORATORS FOR CLEAN PUNCHING OF CODE AND FEED HOLES.															✓									
15.	INSPECT MOTOR AND GOVERNOR FOR WORN BRUSHES <del>AND CONTACTS</del> . CLEAN IF REQUIRED. <span style="float: right;">PARA 108d</span>											✓	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. (Continue on page 4, if more space is needed)																									
												<b>REPLACED BROKEN WINDOW</b>																										

Figure 156. DA Form 11-252, Maintenance check list for Signal equipment (teletypewriter).

with oil (KS 7470). This light weight preservative oil is to be used because it has no harmful effects on finishes, rubber, plastics, or paint.

*Note.* The instructions given below cover those parts which cannot be cleaned by scrubbing.

*e.* Oil-impregnated bronze (oilite) bearings and other parts must not be immersed in solvent (SD) because the impregnated oils will become dissolved. To clean, use a stiff brush or wipe with an oil-soaked cloth.

*f.* All ball bearings used on the teletypewriter set are sealed. Make no attempt to clean or lubricate them, other than wiping with a clean, dry cloth. Discard any bearings that do not spin freely.

*g.* Clean the metal parts of the platen with a cloth dampened with solvent (SD). Clean the rubber platen and the plastic paper roller with soap and water; wipe with a clean, dry cloth.

*h.* Clean motors as follows:

- (1) Use a clean, dry sash brush to remove dust and dirt from the exterior of the motor. Remove all oil and gummy deposits with a clean, lint-free cloth dampened with solvent (SD).
- (2) To clean the internal parts of a motor, disassemble the motor. Remove all dust and dirt from the motor with a clean dry, sash brush.

**Caution:** Be careful not to damage the windings.

- (3) Clean all oil, greasy, or gummy deposits from the armature and field with a clean piece of cheesecloth or other lint-free cloth dampened lightly with solvent (SD). Do not use an excessive amount of solvent (SD).
- (4) Clean all parts made entirely of metal by immersing in a container of solvent (SD).

*Note.* Do not remove discoloration from the commutator caused by imbedded particles of carbon unless the brushes spark excessively.

*i.* Clean the coils of the selector magnet with a cloth dampened in solvent (SD). Clean rust off the pole pieces with No. 0000 sandpaper, then recoat with a thin film of lacquer.

*j.* Remove dust and dirt with a clean, dry sash brush, and remove all oil and gummy deposits with a clean cloth.

*k.* Discard any dirty or gritty felt friction plates. Do not clean by immersing in solvent (SD). When overhauling the equipment, replace all felt washers with new ones regardless of condition.

## 108. Preventive Maintenance Procedures

The preventive maintenance services can be performed on the teletypewriter set as a unit, removing the entire unit from service, or the page printer and the perforator may be serviced independently, with the other machine left connected to the signal line. The procedure to be followed depends upon local conditions. Before starting the preventive maintenance check, disconnect the unit from the signal line. Disconnect the power cord, remove the dust cover, and remove the chassis of the unit to be checked from the base. Check the unit as follows:

*a. Dust Covers.*

- (1) Remove and inspect the dust covers thoroughly. Look for dents, cracks, marred painted surfaces, loose or missing screws, and faulty hinges. See that the copyholder is in good condition.
- (2) Check all visible screws for tightness.
- (3) Clean the outer surfaces of the dust covers with a piece of cheesecloth slightly dampened with water. To remove oil, grease, or gummy stains on the surface of the cover, moisten the cloth with a little solvent (SD).

*b. Table.*

- (1) Inspect the table for breaks and cracks. Look for marred painted surfaces, missing or loose screws, dust, and dirt.
- (2) Clean the painted surfaces with a piece of cheesecloth moistened with solvent (SD).

*c. Preventive Maintenance for Teletypewriter Bases.*

- (1) Clean the bases thoroughly with a clean cloth. Wipe away all deposits of oil or grease that may have dropped from the mechanical assemblies. Use



a clean brush to remove all loose dirt and paper lint from hard-to-reach places. If deposits are difficult to remove with a dry cloth, moisten the cloth with solvent (SD).

- (2) Perform the preventive maintenance for cords, cables, wiring, terminal boards, and switches as instructed in *f*, *g*, and *h* below.

*d. Preventive Maintenance for Motors.*

- (1) The motors should turn freely, smoothly, and quietly when turned by hand or when under power. Check the motor unit for evidence of overheating. This may be indicated by discoloration or by an odor of burned insulating material.
- (2) Clean the motors as instructed in paragraph 107*h*. Check to see that the wires leading to the motor are intact and clean.
- (3) Apply any necessary lubrication to the motor governor lubrication points listed in section III of this chapter.

*e. Preventive Maintenance for Power Supply Unit.*

- (1) Inspect for loose connections, damaged or broken parts, and defective or burned-out wiring. Look for evidences of over-heating and note whether the transformer or rectifying stack appear to be discolored. Check to be sure that there is a spare fuse in the spare fuseholder.
- (2) Tighten all loose screws, bolts, nuts, cable clamps, etc. Solder any loose or broken connections. Check the condition of the flexible transformer taps.
- (3) Use a suitable brush, cheesecloth, and a vacuum cleaner, if available, to remove dust and dirt. Remove oily and gummy deposits with a cloth dampened with solvent (SD). Remove all rust spots. Repaint all exposed metal surfaces.

*f. Preventive Maintenance for Cords, Cables, and Wiring.*

- (1) Check wiring for cracked or deteriorated insulation, frayed or cut insulation at connecting or support points,

kinks, or strain caused by improper placement.

- (2) Tighten loose fasteners, clamps, and wiring connections. Repair loose or broken connections. Remove corrosion, rust, dirt, or dust from ground connections. Be sure that the outer insulation cover on cords and cables is wiped clean. Never use oil or solvent (SD) on rubber insulation. Renew the weatherproof coating on any fabric-covered wires requiring it.
- (3) Adjustment of wiring normally is confined to arranging it so that it does not interfere with the operation of mechanical parts. Resolder loose connections and replace worn or damaged wiring.

*g. Preventive Maintenance of Terminal Boards.*

- (1) Terminal boards used as receiving, connecting, and distributing points for electrical circuits usually are made of a strip of insulating material and one or more types of electrical connectors. These devices may be solder or screw-type terminals, contact springs, or contact lugs. They normally require little preventive maintenance unless wiring is changed. Inspect the terminal boards for cracks, breaks, and loose connections or 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. Be extremely careful not to strip the threads by exerting too much force. Use tools of the correct size. Solder loose or broken connections.

- (2) Wipe off any moisture with a clean cloth and brush off dirt and dust with a clean, dry brush. When necessary, terminal strips may be cleaned with a cloth moistened with solvent (SD). However, be careful that the solvent does not come into contact with the insulation of the wires leading into

the terminal strip. Remove and clean corroded connections. Use cleaning compound to clean electrical contact surfaces on all connecting devices.

*h. Preventive Maintenance for Switches.*

- (1) Check the mechanical action of each switch. Look for dirt or corrosion. Operate each switch to see that it moves freely. Note the amount of spring tension and inspect for insufficient contact pressure when applicable. Tighten loose screws, lugs, or mounting bolts. Remove loose connections that are dirty or corroded and clean them before tightening or soldering.
- (2) Wipe off any moisture present. Carefully clean the exterior surfaces of the switches with a clean, dry brush. Use a burnishing tool to polish contact surfaces after cleaning with abrasives, such as No. 0000 sandpaper, crocus cloth, or a contact file. If contacts are pitted, or burned, use a contact file to restore the surfaces and then polish them with a burnishing tool. Be careful not to remove too much metal. Clean the contacts with cleaning compound.

### **109. Preventive Maintenance for Keyboard-Transmitter**

*a.* With the keyboard-transmitter removed from the page printer, inspect for the following:

- (1) Cracks or other damage to the keyboard-transmitter frame and any mechanical linkages.
- (2) Loose, missing, worn, or broken nuts, bolts, screws or fastenings and electrical connections. Frayed, broken, or oil-soaked wiring or insulation.
- (3) Levers, pawls, latches, code bars, springs, bearings, etc. Check to see that all parts move freely and are not damaged or broken.
- (4) Missing, broken, or illegible keytops.
- (5) Missing, broken, or distorted springs.

- (6) Worn, burned, or dirty contacts and insulation in the sequential transmitter mechanism.
- (7) Dirty, burned, or pitted printed circuit in the simultaneous transmitter mechanism.

*b.* Do not tighten the parts that require clearance or tension adjustments. Tighten all screws and bolts that are not part of an adjustment.

*c.* Clean the keyboard-transmitter as follows:

- (1) Clean the keytops with a cloth moistened with water.
- (2) Blow out or brush away dirt or dust that may have accumulated in the keyboard-transmitter mechanism and around the mechanical levers and code bars.
- (3) Burnish or file contacts of the sequential transmitter mechanism if they are dirty, built-up, or pitted. Clean them thoroughly with cleaning compound after filing or burnishing.
- (4) Clean a dirty printed circuit with a cloth dampened with cleaning compound.
- (5) Smooth any sharp or pitted contact points on the shunting switches of the simultaneous transmitter with No. 0000 sandpaper. Clean points thoroughly with a cloth dampened with cleaning compound.
- (6) Lubricate the keyboard-transmitter as described in paragraph 118.

### **110. Preventive Maintenance for Page Printing Mechanism**

*a.* Examine all operating mechanical assemblies for signs of wear, lack of lubrication, accumulations of dirt or grime, and undesired looseness of any operating parts.

*b.* Clean all assemblies to remove any lubricant that may have dripped from lubrication points. This check provides the technician with a good indication as to whether too much lubricant was applied during the last routine servicing.

c. Check the condition of the inking ribbon. If the top edge of the inking ribbon appears frayed and the rest of the inking ribbon is serviceable, check the ribbon lifter adjustment as described in the adjustment section of this chapter.

d. Check the type pallets for dirt deposits in the character symbols. To clean the pallets, carefully insert a piece of paper between the type bars and the type bar backstop and brush lightly with a toothbrush-style brush slightly dampened with solvent (SD). Check the small center areas of letters such as O, Q, D, G, B, P, and R to make certain that no dirt remains.

e. Lubricate the assemblies as instructed in paragraph 118. Remove excess lubricant.

### **111. Preventive Maintenance for Transmitter-Distributor**

a. Inspect the transmitter-distributor for the following:

- (1) Loose, missing, or broken screws, bolts, fastenings, and electrical connections; frayed or broken wire insulation, and oil-soaked wiring and insulation.
- (2) Worn or broken levers, pawls, latches, springs, bearings, etc. Check to see that all parts move freely without binding.
- (3) Missing, broken, or distorted springs.
- (4) Worn, dirty, or burned contacts in the transmitter-distributor transmitter contact assembly.

b. Do not tighten any parts that require clearance or tension adjustments. Tighten all screws that are not part of an adjustment.

c. Clean the transmitter-distributor as follows:

- (1) Blow out or brush away any dirt or paper dust that may have accumulated in the transmitter mechanism, sensing levers, and feed mechanism.
- (2) Burnish or file transmitter-distributor transmitter contacts if they are dirty, built-up, or pitted.

d. Lubricate the transmitter-distributor as instructed in paragraph 119.

### **112. Preventive Maintenance for Perforator Printing and Punching Mechanism**

a. Examine all operating assemblies for wear, lack of lubrication, accumulations of dirt or grime, and undesired looseness of operating parts.

b. Clean all assemblies to remove any lubricant that may have dripped from lubrication points. This check provides the technician with a good indication as to whether too much lubricant was applied during the preceding maintenance check.

c. Check the condition of the inking ribbon. Replace it if necessary. If the one edge of the ribbon appears to be frayed and the rest of the inking ribbon is still serviceable, check the ribbon guides for proper alinement.

d. Check the pulsing mechanism and the actuated switch for worn, burned, or built-up contacts.

e. Do not tighten any parts that require clearance or tension adjustments. Tighten all screws that are not part of an adjustment.

f. Clean the perforator printing and punching mechanism as follows:

- (1) Blow out or brush away dirt and paper dust that may have accumulated around the printing and punching mechanisms.
- (2) Check the characters on the typewheel for dirt deposits. To clean the typewheel, remove the ribbon from the guides and insert a piece of paper under the typewheel. With the typewheel in the forward position, brush lightly with a toothbrush-style brush moistened with solvent (SD). Brush toward the front of the perforator to prevent splattering dirt particles into the operating mechanism. Wipe the cleaned portion with a clean cloth. Rotate the typewheel and repeat the process until the entire wheel has been cleaned.
- (3) After performing all other maintenance checks listed on DA Form 11-252 lubricate the assemblies as instructed in paragraph 119.

## Section III. LUBRICATION

### 113. Recommended Lubricants

The only lubricants recommended for lubrication of these teletypewriter sets are—

a. Oil (KS 7470), Signal Corps stock No. 6G1325 (1-qt. can).

b. Grease (KS 7471), Signal Corps stock No. 6G650 (1 pound container).

### 114. Recommended Lubrication Schedule

The following chart shows the recommended intervals for checking the lubrication of these sets. When checking, lubricate only those lubrication points which require lubrication. *Do not over lubricate.*

Set operating speed (wpm)	Operating periods			
	Up to 8 hours per day (days)	8 to 12 hours per day (days)	12 to 16 hours per day (days)	16 to 24 hours per day (days)
60	30	20	15	10
66	27	18	13	9
75	24	16	12	8
100	18	12	9	6

### 115. Preparation for Lubrication

To lubricate either the page printer or the perforator, take the unit to be lubricated out of service and partially disassemble it as outlined in *a* or *b* below. One unit at a time can be removed from service for lubrication or both can be lubricated at the same time, as the situation warrants.

a. *Page Printer Disassembly.* To disassemble the page printer for lubrication, proceed as follows:

- (1) Disconnect the motor and the line circuits.
- (2) Remove the dust cover.
- (3) Pull out the selector magnet plug connection from the base.
- (4) Remove the keyboard-transmitter plugs and the motor stop plug connections from the base.
- (5) Unscrew the motor power lead from its base coupling.
- (6) Remove the four screws and lock-

washers that mount the page printer to the base.

- (7) Lift the entire mechanism from the base.
- (8) Remove the ribbon spools and inking ribbon.
- (9) Remove the keyboard-transmitter.
- (10) Remove the indicator cover.
- (11) Remove the transmitter contact covers.
- (12) Remove the motor governor cover (series-governor motor only).

b. *Perforator Disassembly.* To disassemble the perforator for lubrication, proceed as follows:

- (1) Disconnect the power and line circuits and disconnect the plug connections between the transmitter-distributor and the perforator base.
- (2) Remove the left dust cover from the transmitter-distributor and remove the transmitter-distributor from the perforator frame.
- (3) Remove the dust cover from the main unit, and the top and right dust covers from the transmitter-distributor.
- (4) Remove the roll of tape from the tape supply reel.
- (5) Remove the ribbon spools and inking ribbon.
- (6) Unscrew the motor power lead plug from its base coupling.
- (7) Remove the selector magnet plug and the receiving multisolenoid plug from the base.
- (8) Remove the perforator latch coil plug and the pulsing contact assembly plug from the base.
- (9) Remove the four socket head screws, lockwashers, and ground straps that hold the tape receiver chassis to the mounts on the base; lift the entire chassis off the base.
- (10) Remove the cover from the pulsing mechanism.
- (11) Remove the motor governor cover (series-governed motor only).

c. *Old Lubricants.* Remove old grease and oil from points to be lubricated with a clean,

dry, lint-free cloth. Wrap the cloth around the end of an orangestick or similar implement to remove old lubricants from hard-to-reach places.

### 116. Lubrication Instructions, Grease

Use the grease gun supplied as part of Tool Equipment TE-50B to grease the cams, racks, and gears. Hold the nozzle of the grease gun at about a 45° angle to the part to be lubricated and operate the handle. At the same time, turn the object to be lubricated until the specified amount of grease is applied.

### 117. Lubrication Instructions, Oil

Tool Equipment TE-50B contains two items for lubricating the teletypewriter mechanisms with oil: a pen-shaped lubricator and a hand-oiler. Use the pen-shaped lubricator to apply oil in one or two drop applications. Use the hand oiler when larger quantities are to be applied. Adjust the stop beneath the handle of

the hand oiler to regulate the amount of oil delivered each time that the handle is pressed.

### 118. Detailed Lubrication Instructions for Page Printer (figs. 157-171)

Listed in *b* through *f* below are the points to be lubricated, the type of lubricant to be used, and the quantity to be applied. The item numbers are arranged according to the method of application, so that the page printer can be treated by one lubricant or by one method at a time in a systematic way. Items to be lubricated are shown as item numbers in figures 157 through 171.

*a. Ball Bearings.* All ball bearings in the teletypewriter are sealed and do not require lubrication.

*b. Gears and Racks.* Wipe off the old grease from the gears and racks with a clean, dry, lint-free cloth, and apply grease as follows:

Fig. No.	Item No.	Name of part	Method and quantity
157	13	Carriage-return driven gear	Apply sparingly all around gear teeth.
158	10	Main shaft driving gears (inside cover)	
159	2	Carriage rack driving gear	Work around gears, cover gear teeth liberally.
159	6	Function driven gear	
159	7	Square shaft driving gear	Apply sparingly all around gear teeth.
159	20	Function staff driving gear	
159	23	Carriage-feed worm gear	
159	25	Carriage-return shaft drive gears	
159	26	Transmitter shaft drive gears	
162	3	Clutch yoke cam	
164	4	Ribbon drive gear	Apply sparingly all around gear teeth.
164	12	Guide rail	Apply sparingly to rack teeth.
166	4	Carriage-feed and return driving rack	

*c. Friction Clutches.* Apply oil as shown in the following chart. Do not release the spring tension on friction clutches for periodic lubrication. If necessary to release the spring tension to provide a thorough cleaning during lubrication, loosen the clamping screw securing the spring positioning collars, turn the friction clutches by turning the motor by hand (or in the case of the transmitter friction clutch with the keyboard removed, turn the clutch itself), and apply oil. After collars are oiled, set them to give approximately the required spring tension on each friction clutch, run the page printer without printing for about 5 minutes, and then operate on repeat space for about 5 minutes. When lubrication is completed, set the spring tension of the friction clutches in accordance with instructions in paragraphs 298, 299, 342, and 400.

Fig. No.	Item No.	Name of part	Method and quantity
157	2	Carriage-feed friction clutch	10 to 15 drops on each washer along periphery of felt friction plates; apply sparingly to spring and driving collar.
157	11	Keyboard-transmitter friction clutch	
159	17	Selector friction clutch	
159	18	Square shaft driving friction clutch	

*d. Oilholes.* Apply oil at the following oilholes:

Fig. No.	Item No.	Name of part	Method and quantity
159	4	Function shaft sliding clutch drum	At least 5 drops in hole on either side.
159	13	Code-ring cage	At least 5 drops in hole on top of central bearing sleeve (underneath stop bars).
159	21	Carriage-feed driven gear	At least 5 drops in hole in hub.
166	7	Type selecting arm bearing cap	At least 5 drops in hole in bearing cap.

*e. Sleeve Bearings.* Apply oil at the following bearings:

Fig. No.	Item No.	Name of part	Method and quantity
157	7	Square shaft bearings	Several drops at either end of both bearings.
157	8	Platen frame pivot bearings	Several drops between pivot and bearings.
157	14	Carriage rack drive shaft bearing	Several drops at both ends of bearings.
158	5	Function selecting arm bearing	Several drops at both ends of bearings.
158	6	Print bail blade shaft bearings	Several drops at either end of both bearings.
159	19	Transfer lever shaft bearings	Several drops at either end of both bearings.
160	6	Stop latch cam post	Several drops of oil at either end.
164	1	Platen shaft bearings	Several drops at either end of both bearings.

*f. Moving Parts.* Apply oil at the following places:

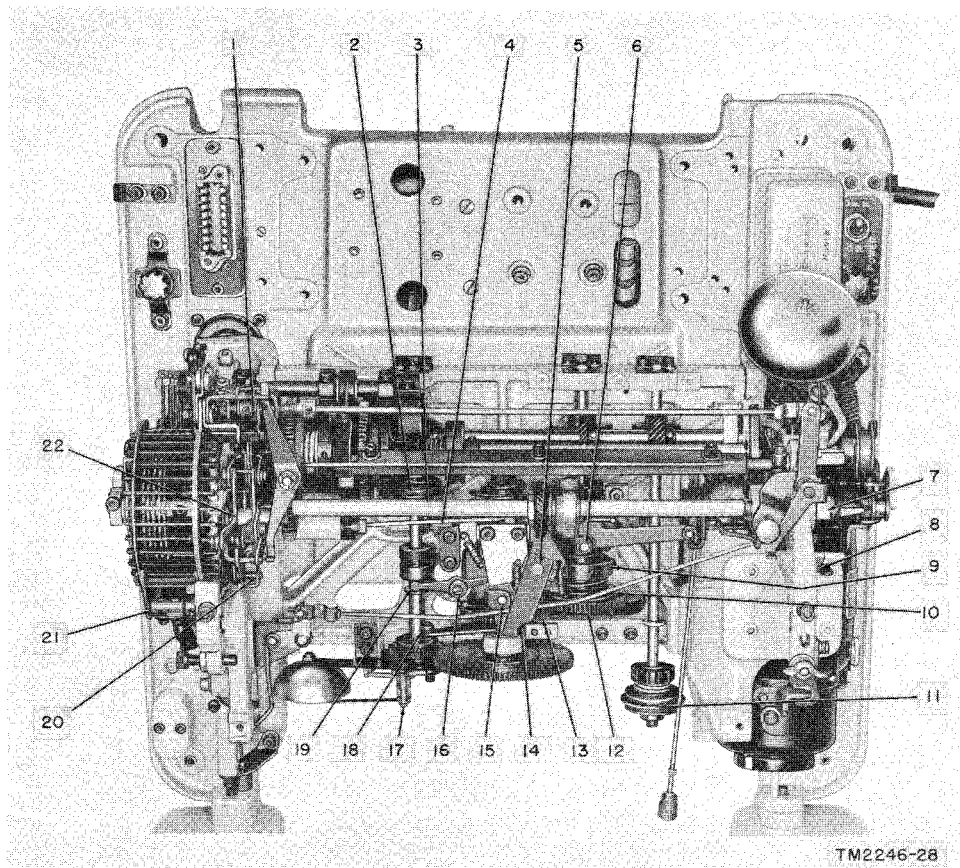
Fig. No.	Item No.	Name of part	Method and quantity
157	1	Stop bar shift blade	Apply sparingly to latching surface.
157	3	Square shaft	Thin film all sides, entire length.
157	4	Carriage-feed pawl and ratchet wheel	Apply sparingly to teeth; 2 drops at each pawl pivot.
157	5	Carriage-return operating mechanism	2 drops at each pivot point.
157	6	Manual carriage-return mechanism	Apply sparingly to all pivots and rubbing surfaces.
157	9	Carriage-return sliding clutch drum	Apply sparingly to teeth and annular grooves, 2 or 3 drops in each group of spline balls inside clutch.
157	10	Carriage-return safety clutch felt plates	Several drops around periphery of each washer.
157	12	Decelerating cam	Thin film on working surface.
157	15	Carriage-return clutch latch lever	2 drops on pivot; thin film on working surfaces.
157	16	Carriage-feed clutch lever	2 drops at pivot; thin film at each end.
157	17	Margin bell clapper and pawl	1 or 2 drops at each pivot point and at tip of pawl.
157	18	Carriage-feed clutch	Apply sparingly to clutch teeth.
157	19	Carriage-feed sliding clutch drum	Apply sparingly to rubbing surfaces.
157	20	Platen lower case latch	1 drop at pivot, apply sparingly to latching surface.
157	21	Code-ring locking bail shaft	1 drop at blade and cam follower locking lever.
157	22	Function bellcrank pivots	Several drops between levers and washers.

Fig. No.	Item No.	Name of part	Method and quantity
158	1, 2	Paper guide link	1 drop at each end.
158	3	Function selecting arm	Apply sparingly to all working surfaces.
158	4	Stop bar shift lever	1 drop at pivot.
158	7	Stop bar shift link	Thin film.
158	8	Paper roller latch	1 drop at pivot.
158	9	Motor-stop actuating lever and signal bell clapper pivots.	2 drops at each pivot point.
158	11	Function cam follower	Apply sparingly to cam groove and bearing of roller.
158	12	Unshift and carriage-feed levers	2 drops at each pivot.
158	13	Support lever	2 drops at each pivot.
158	14	Function punch bars	Several drops between bars and guide block.
158	15	Platen latch	2 drops at pivot; thin film on working surface, each end.
158	16	Aperture gate	2 drops in notch; several drops between gate and guide block.
159	1	Print bail blade	Thin film both sides, along entire edge.
159	3	Clutch spring	Apply sparingly to clutch spring.
159	5	Function driven gear	Several drops at bearing and clutch teeth.
159	8	Delaying lever	1 drop at pivot.
159	9	Line feed and figures connecting links	2 drops at each end of both links.
159	10	Line feed and figures bellcrank pivots	Several drops each.
159	11	Line feed and figures cam follower pivots	2 drops each.
159	12	Delaying latch	1 drop at pivot; apply sparingly to latching surface.
159	14	Code rings	Thin film all along inner and outer working surfaces of each code bar.
159	15	Line feed and figures cam followers	Apply sparingly to rollers, pivots, and all rubbing surfaces.
159	16	Line feed, figures, and sensing lever restoring cams.	Thin film on all exposed surfaces.
159	22	Clutch latch	Apply sparingly to roller and latching surfaces.
159	24	Carriage-return blocking mechanism	1 or 2 drops at pivot; apply sparingly to latch surfaces.
159	27	Print cam follower	Apply sparingly to cam groove and bearing of roller and to spring hook.
160	1	Selector levers, bearings, and separating washers	Apply sparingly to all rubbing and bearing surfaces.
160	2	Transmitter contact E4 pivot	2 or 3 drops between arm and pivot studs.
160	3	Sensing lever locking bail	1 or 2 drops on bail surface and between lever and comb.
160	4	Transmitter camshaft	Thin film on all cam lobes and stop teeth.
160	5	Cam stop lever	1 or 2 drops at pivot; apply sparingly to latching surfaces.
160	7	Locking lever latch stud	2 or 3 drops at pivot points; thin film on latching surface.
160	8	Actuating link	2 drops at pivot point.
160	9	Function blocking bar spring	1 drop at each end; light film on spring surface.
160	10	Shunt switch arm springs	1 drop at each end; light film on spring surface.
160	11	Switch arm	1 or 2 drops at pivot point.
161	1	Stop bars in code-ring cage	2 drops at each end of all 35 stop bars.
161	2	Platen eccentric pivot	1 or 2 drops at pivot points.
161	3	Code-ring locking shaft	1 drop at each pivot.
161	4	Detent wheel	Several drops at lever point; thin film on detent wheel teeth.
161	5	Single-double line feed lever	1 drop at pivot and detent surface.
161	6	T-lever	2 drops on bearing surface.
161	7	Code-ring locking bail latching surface	Thin film on latching surface.

Fig. No.	Item No.	Name of part	Method and quantity
161	8	T-levers and separating washers.....	} Apply sparingly to all rubbing surfaces.
161	9	Y-levers and detents.....	
161	10	Selector lever guide comb.....	
161	11	Selector magnet armature knife edge.....	
161	12	Selector levers, pivot bearings, and separating washers.	
161	13	Orientation lever pivot and rangefinding cam.....	1 or 2 drops. Thin film on cam surface.
161	14	Grooved pin in end of selector camshaft.....	Several drops between pin and camshaft.
161	15	Selector cams and stop plate.....	Thin film on working surfaces.
161	16	Transfer lever latch.....	2 drops on pivot; thin film on latching surface.
161	17	Transfer lever restoring cam.....	1 drop on cam surface.
161	18	Transfer lever roller.....	Apply sparingly to working surfaces.
161	19	Antibounce clutch.....	Several drops in clutch.
162	1	Link arm assembly.....	2 drops at pivot. Thin film all along notched edge of each bar.
162	2	Keyboard counter cam follower.....	2 drops at pivot.
162	4	Sensing levers.....	Apply sparingly at working surfaces at each end of pivot.
162	5	Ratchet pawl.....	} 2 drops at pivot.
162	6	Line indicator drive shaft pivots.....	
162	7	Tabulator lever.....	
163	1	Line indicator drive shaft antibounce plate.....	
163	2	Tabulator lever.....	
164	2	Line feed pawl.....	} 1 drop on each pin.
164	3	Sprocket feed pins.....	
164	5	Beam detent.....	
164	6	Ribbon feed clutch.....	1 drop at pivot; apply sparingly to latching surfaces.
164	7	Ribbon drive shaft.....	Apply sparingly to clutch teeth.
164	8	Ribbon sensing levers.....	Apply sparingly to bearings, cam surfaces, and gear teeth at both ends.
164	9	Ribbon spool driving gears.....	1 or 2 drops at each bearing and pin.
164	10	Ribbon spool drive shafts.....	Apply sparingly to annular groove, teeth, and driving jaws.
164	11	Ball bearing and guide rail.....	1 or 2 drops at bearings, top and bottom.
164	13	Manual letters mechanism.....	Apply sparingly to rolling surfaces.
164	14	Carriage-return bellcrank and vertical link.....	Apply sparingly to all pivots and rubbing surfaces.
164	15	Armature shaft.....	2 drops at each pivot.
165	1	Key levers.....	1 drop at pivot.
165	2	Code bars and studs.....	1 drop at each pivot.
165	3	Spacebar pivots.....	Thin film all along notched edge of each bar. 2 or 3 drops in each groove.
165	4	Front key lever guide.....	1 drop each.
166	1	Ribbon shaft lock.....	1 drop in each key lever guide slot.
166	2	Ribbon guide.....	1 drop at handle pivots.
166	3	Hinge pin.....	Thin film on sliding surfaces.
166	5	Ribbon lifter bellcrank.....	2 or 3 drops at each pivot; apply sparingly to gear teeth.
166	6	Connecting bars guide plate.....	1 or 2 drops at pivots.
166	8	Type selecting arm.....	1 or 2 drops at each guide plate.
166	9	Ribbon lifter bracket.....	Apply sparingly between arm and claw.
166	10	Ribbon lifter pivot bearing.....	1 or 2 drops at each pivot.
167	1	Cam follower.....	Thin film on sliding surfaces.
167	2	Tabulator shaft pivot.....	1 or 2 drops at pivot point and working surface.
167	3	Ratchet wheel.....	2 drops at pivot.
167	4	Indicator carriage drive shaft.....	Light coat on entire working surface.
167	5	Indicator return latch.....	1 or 2 drops at pivots; light coat on the entire length of shaft.
168	1	Indicator carriage.....	1 or 2 drops at pivot and working surface.
			1 or 2 drops on roller and pivot points.

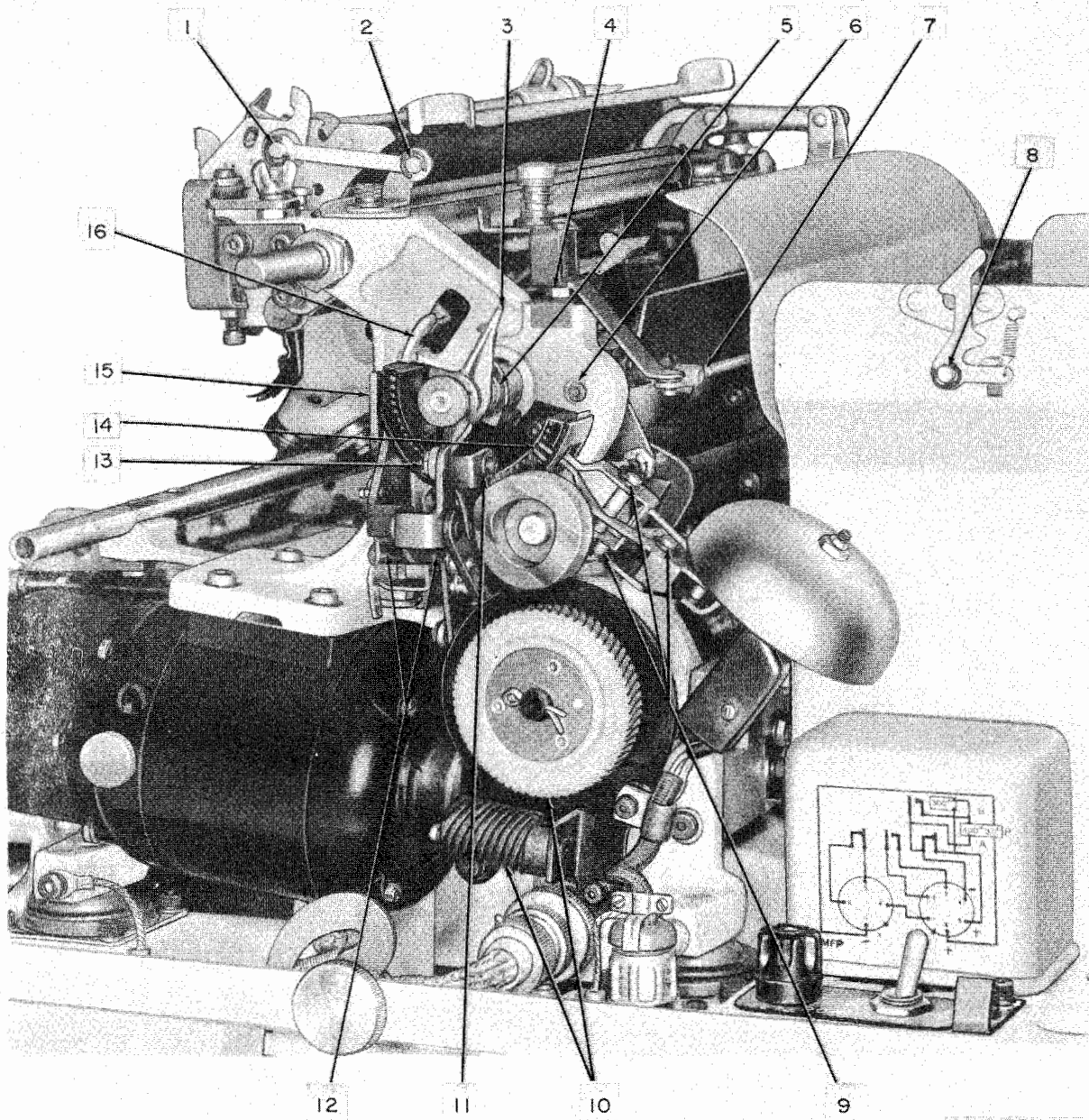


Fig. No.	Item No.	Name of part	Method and quantity
168	2	Tabulator locking lever.....	1 or 2 drops at pivot point and working surface.
169	1	Governor adjustment lever.....	1 or 2 drops at each end.
169	2	Governor adjustment screw.....	Apply sparingly to entire thread.
169	3	Motor governor adjustment gear.....	Apply sparingly to gear teeth.
169	4	Governor worm.....	2 or 3 drops in governor hub opening.
170	1	Transmitter lever post pivot.....	1 or 2 drops at pivot point and working surface.
170	2	Lockup lever roller.....	1 or 2 drops on pin.
170	3	Cam arm.....	Slight film on working surface.
171	1	Keyboard control lever hub.....	2 drops at pivot.
171	2	Detent lockup lever.....	Thin film on detent surfaces.
171	3	Lockup lever eccentric stud.....	2 drops at pivots.



- |  |   |                                       |
|--|---|---------------------------------------|
| 1 Stop bar shift blade                 | 8 Platen frame pivot bearing                | 15 Carriage-return clutch latch lever |
| 2 Carriage-feed friction clutch        | 9 Carriage-return sliding clutch drum       | 16 Carriage-feed clutch lever         |
| 3 Square shaft                         | 10 Carriage-return safety clutch felt plate | 17 Margin bell clapper and pawl       |
| 4 Carriage-feed pawl and ratchet wheel | 11 Keyboard-transmitter friction clutch     | 18 Carriage-feed clutch               |
| 5 Carriage-return operating mechanism  | 12 Decelerating cam                         | 19 Carriage-feed sliding clutch drum  |
| 6 Manual carriage-return mechanism     | 13 Carriage-return driven gear              | 20 Platen lower case latch            |
| 7 Square shaft bearing                 | 14 Carriage rack drive shaft bearing        | 21 Code-ring locking bail shaft       |
|  |   | 22 Function bellcrank pivot           |

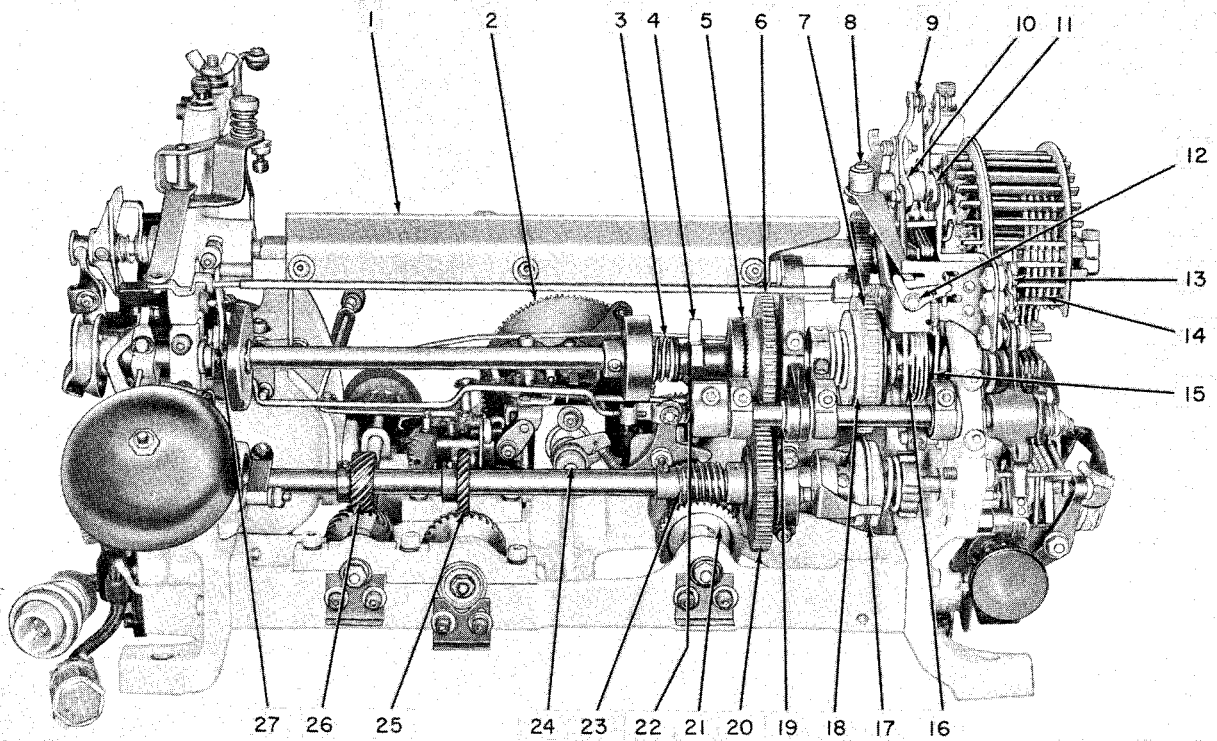
Figure 157. Carriage and platen of page printing mechanism removed to show lubrication points.



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- |                                  |   |                                     |
|----------------------------------|---|-------------------------------------|
| 1 Paper guide link               | 7 Stop bar shift link   | 11 Function cam follower            |
| 2 Paper guide link               | 8 Paper roller latch  | 12 Unshift and carriage-feed levers |
| 3 Function selecting arm         | 9 Motor stop actuating lever and<br>signal bell clapper pivot | 13 Support lever                    |
| 4 Stop bar shift lever           | 10 Main shaft driving gears (inside<br>cover )                | 14 Function punch bar               |
| 5 Function selecting arm bearing |   | 15 Platen latch                     |
| 6 Print bail blade shaft bearing |   | 16 Aperture gage                    |

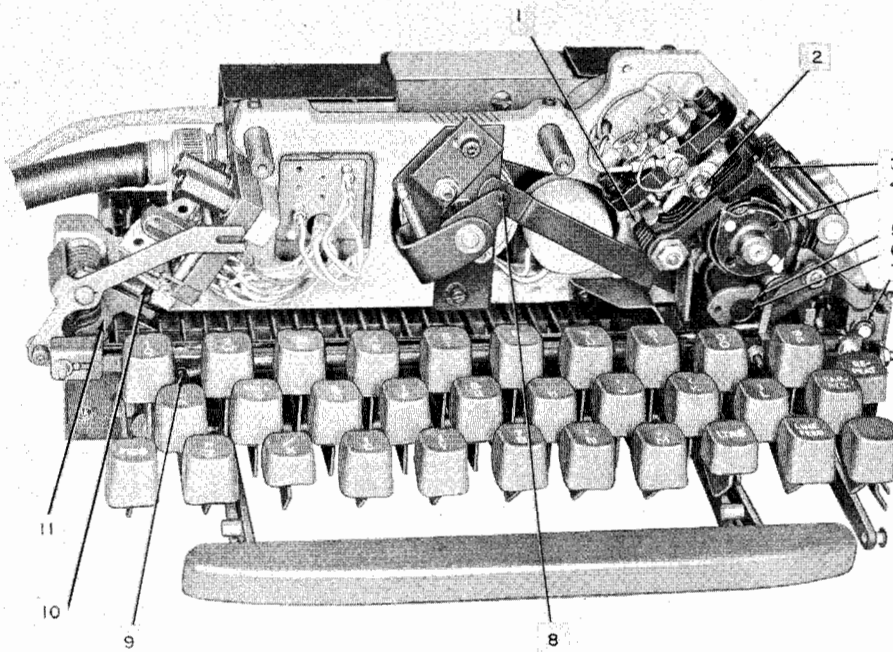
Figure 158. Page printing mechanism, side view, showing lubrication points.



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- |                                    |                                    |                                      |
|------------------------------------|------------------------------------|--------------------------------------|
| 1 Print bail blade                 | 11 Line feed and figures cam fol-  | 20 Function shaft driving gear       |
| 2 Carriage rack driving gear       | lower pivots                       | 21 Carriage-feed driven gear         |
| 3 Clutch spring                    | 12 Delaying latch                  | 22 Clutch latch                      |
| 4 Function shaft sliding clutch    | 13 Code-ring cage                  | 23 Carriage-feed worm gear           |
| 5 Function driven gear             | 14 Code ring                       | 24 Carriage-return blocking mecha-   |
| 6 Function driven gear             | 15 Line feed and figures cam       | nism                                 |
| 7 Square shaft driving gear        | followers                          | 25 Carriage-return shaft drive gears |
| 8 Delaying lever                   | 16 Line feed, figures, and sensing | 26 Transmitter shaft drive gears     |
| 9 Line feed and figures connecting | lever restoring cams               | 27 Print cam follower                |
| 10 Line feed and figures bellcrank | 17 Selector friction clutch        |                                      |
| pivots                             | 18 Square shaft driving friction   |                                      |
|                                    | clutch                             |                                      |
|                                    | 19 Transfer lever shaft bearing    |                                      |

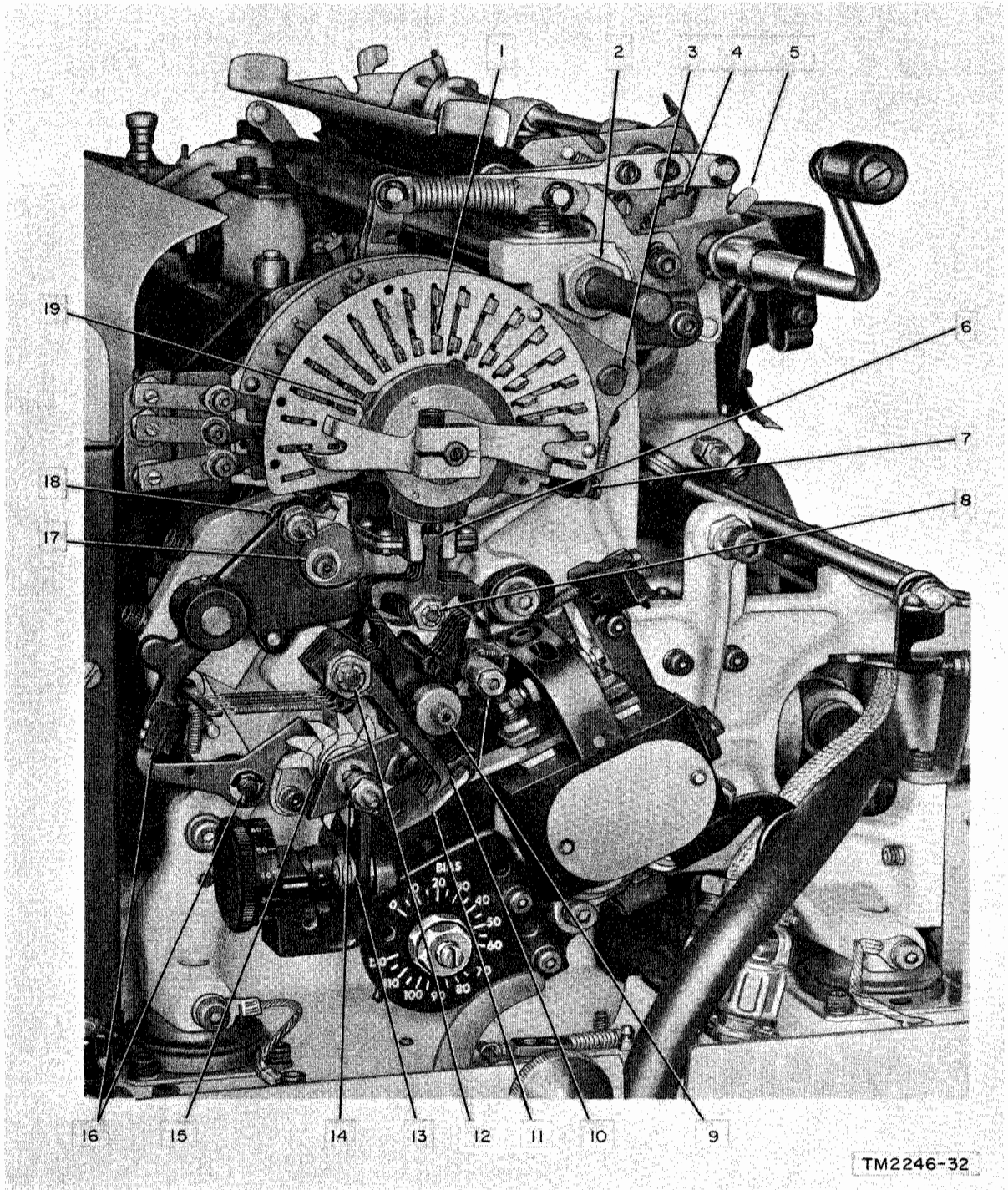
Figure 159. Page printing mechanism, rear view, showing lubrication points.



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- |   |                            |                                |
|---|----------------------------|--------------------------------|
| 1 Selector levers, bearings, and separating washers | 4 Transmitter camshaft     | 8 Actuating link               |
| 2 Transmitter contact E4 pivot                      | 5 Cam stop lever           | 9 Function blocking bar spring |
| 3 Sensing lever locking ball                        | 6 Stop latch cam post      | 10 Shunt switch arm springs    |
|   | 7 Locking lever latch stud | 11 Switch arm                  |

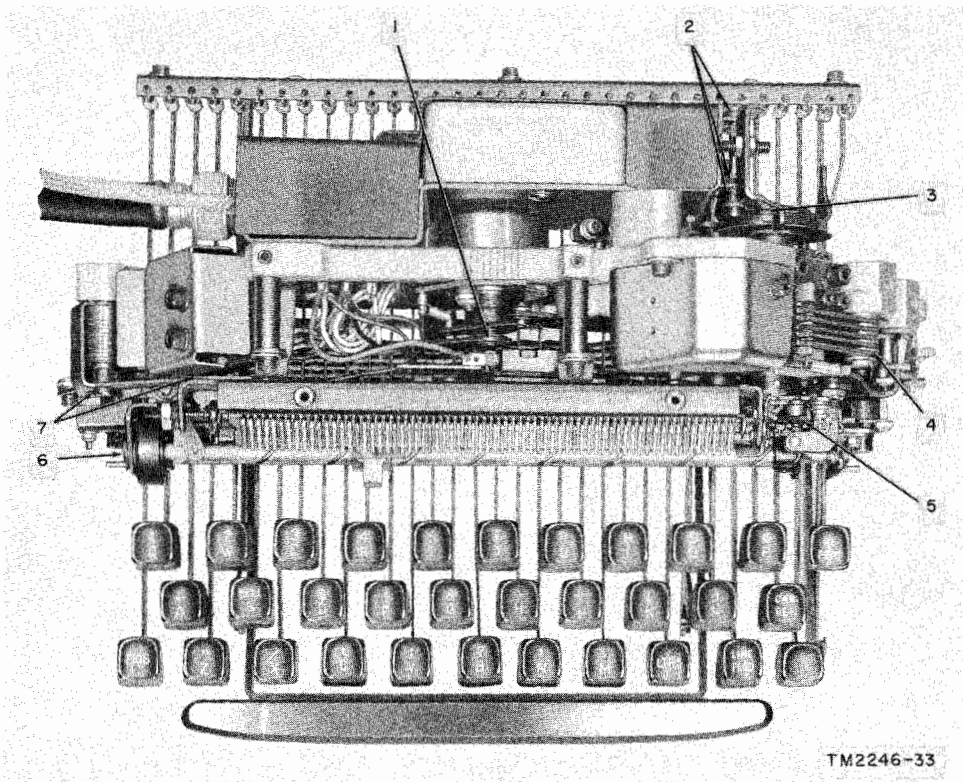
Figure 160. Keyboard-transmitter, left front view, showing lubrication points.



- |   |  |  |
|---|--|--|
| 1 Stop bars in code-ring cage             | 9 Y-levers and detents                                     | 14 Grooved pin in end of selector camshaft |
| 2 Platen eccentric pivot                  | 10 Selector lever guide comb                               | 15 Selector cams and stop plate            |
| 3 Code-ring locking shaft                 | 11 Selector magnet armature knife edge                     | 16 Transfer lever latch                    |
| 4 Detent wheel                            | 12 Selector levers, pivot bearings, and separating washers | 17 Transfer lever restoring cam            |
| 5 Single-double line feed lever           | 13 Orientation lever pivot and range-finding cam           | 18 Transfer lever roller                   |
| 6 T-lever                                 |  | 19 Antibounce clutch                       |
| 7 Code-ring locking bail latching surface |  |  |
| 8 T-levers and separating washer          |  |  |

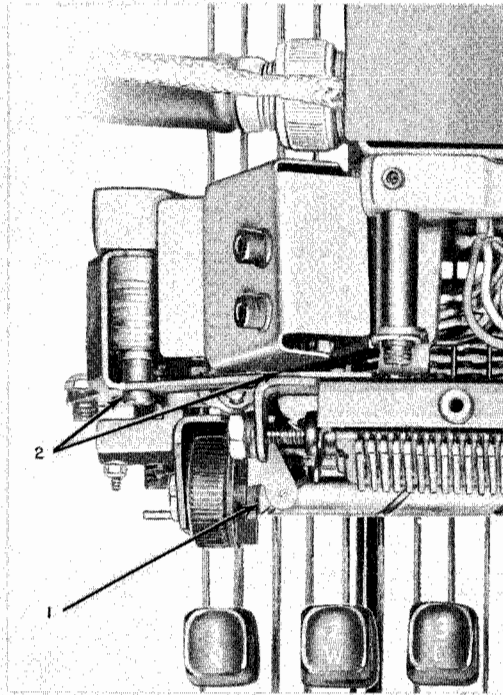
Figure 161. Page printing mechanism, selector side, showing lubrication points.





- |                                 |                  |                                    |
|---------------------------------|------------------|------------------------------------|
| 1 Link arm assembly             | 4 Sensing levers | 6 Line indicator drive shaft pivot |
| 2 Keyboard counter cam follower | 5 Ratchet pawl   | 7 Tabulator lever                  |
| 3 Clutch yoke cam               |                  |                                    |

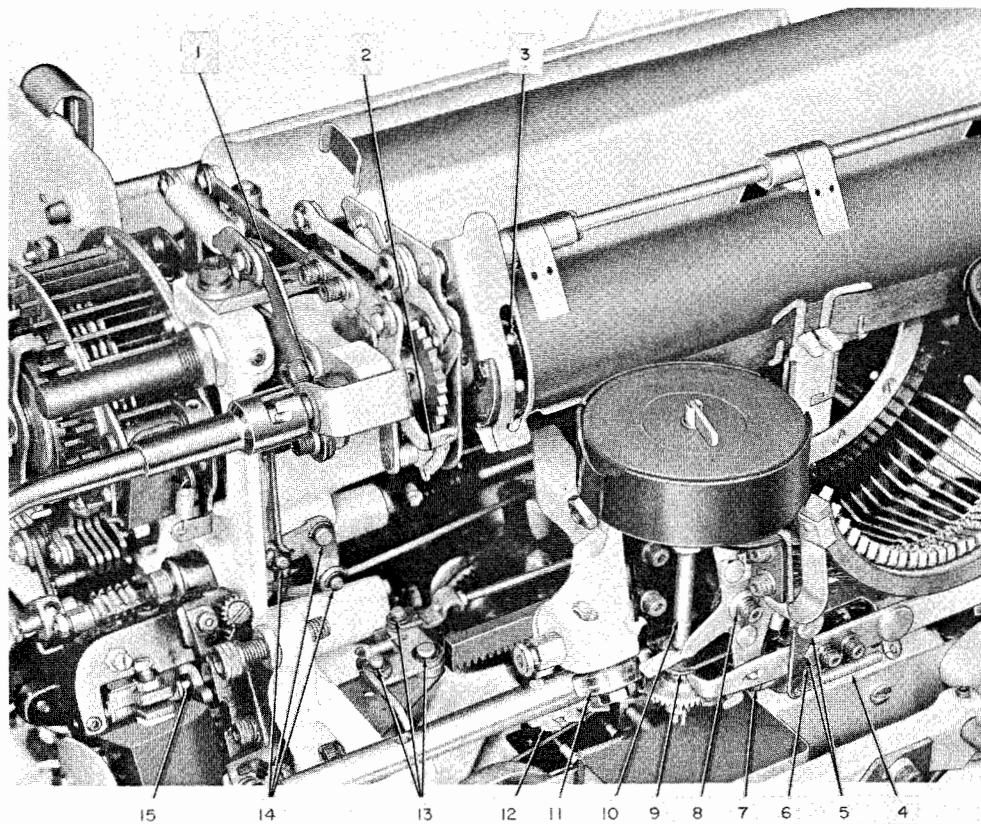
*Figure 162. Keyboard-transmitter, top view, showing lubrication points.*



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- 1 Line indicator drive shaft antibounce plate
- 2 Tabulator lever

*Figure 163. Part of carriage indicator assembly (TT-117A/FG, TT-118/FG and TT-119A/FG).*

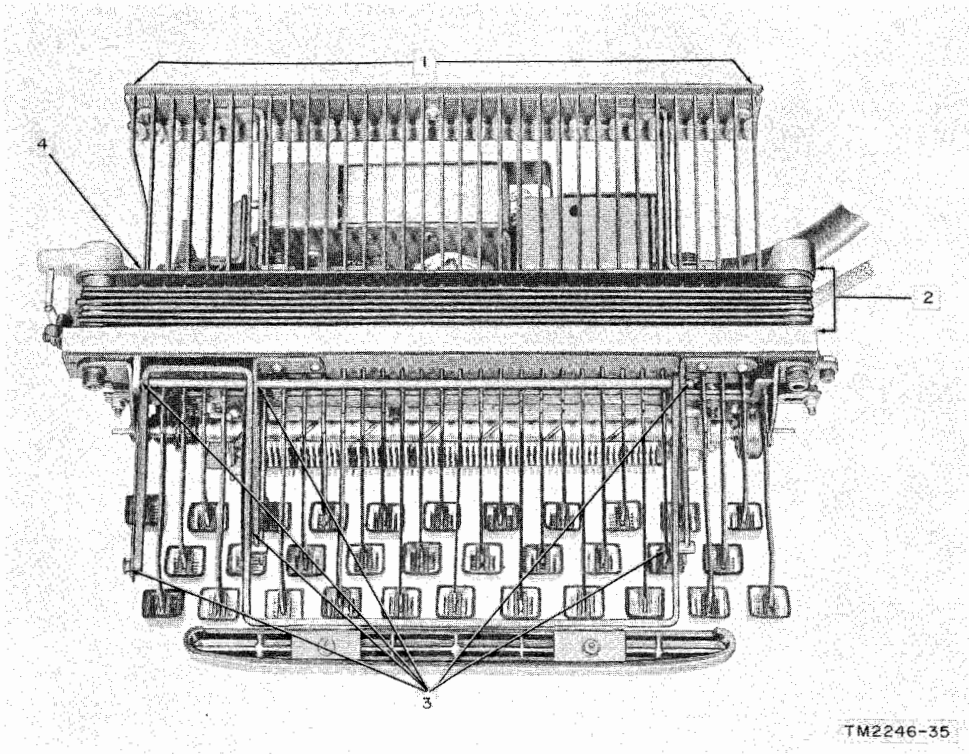


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- |                        |                                |                                  |
|------------------------|--------------------------------|----------------------------------|
| 1 Platen shaft bearing | 7 Ribbon drive shaft           | 12 Guide rail                    |
| 2 Line feed pawl       | 8 Ribbon sensing lever         | 13 Manual letters mechanism      |
| 3 Sprocket feed pins   | 9 Ribbon spool driving gear    | 14 Carriage-return bellcrank and |
| 4 Ribbon drive gear    | 10 Ribbon spool drive shaft    | vertical link                    |
| 5 Beam detent          | 11 Ball bearing and guide rail | 15 Armature shaft                |
| 6 Ribbon feed clutch   |                                |                                  |

Figure 164. Page printing mechanism, left front view, showing lubrication points.

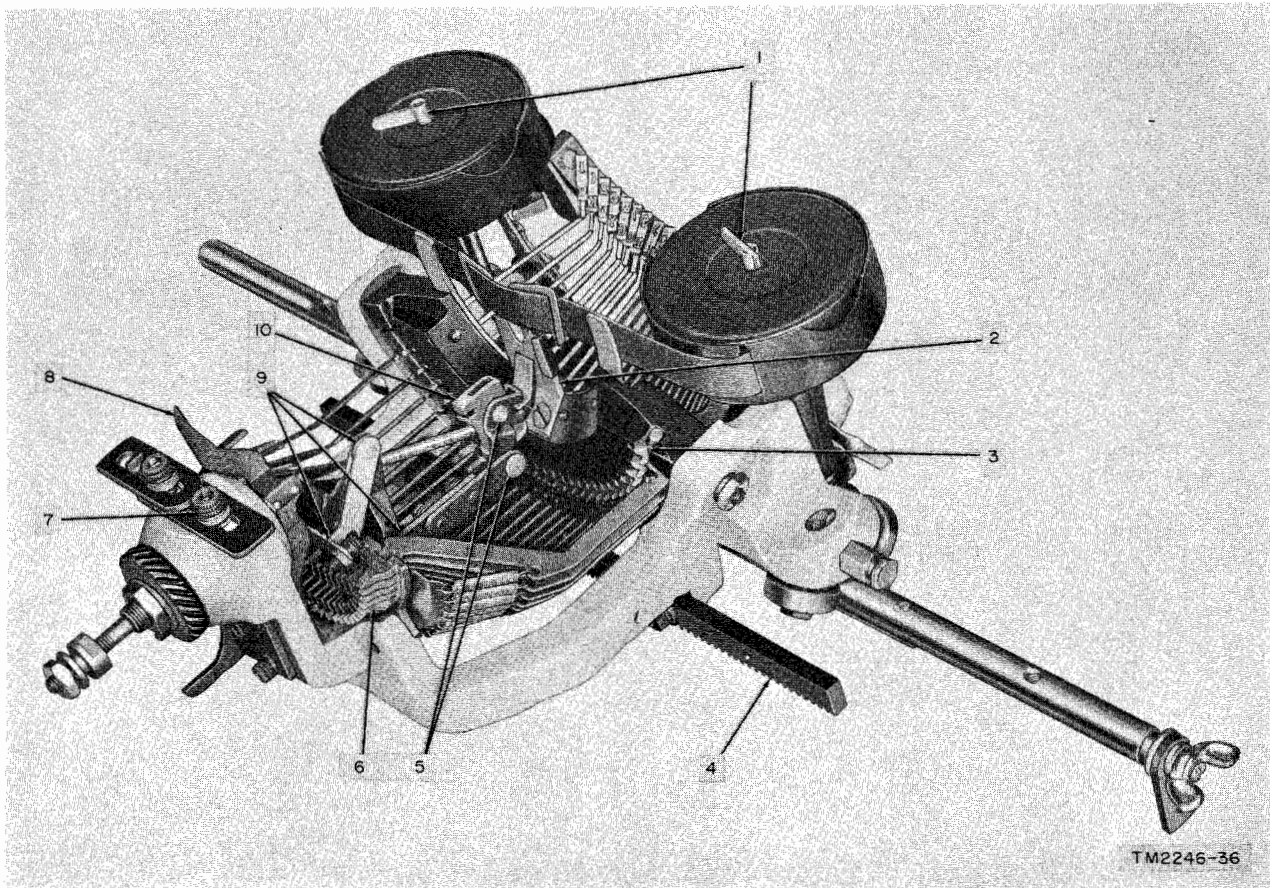




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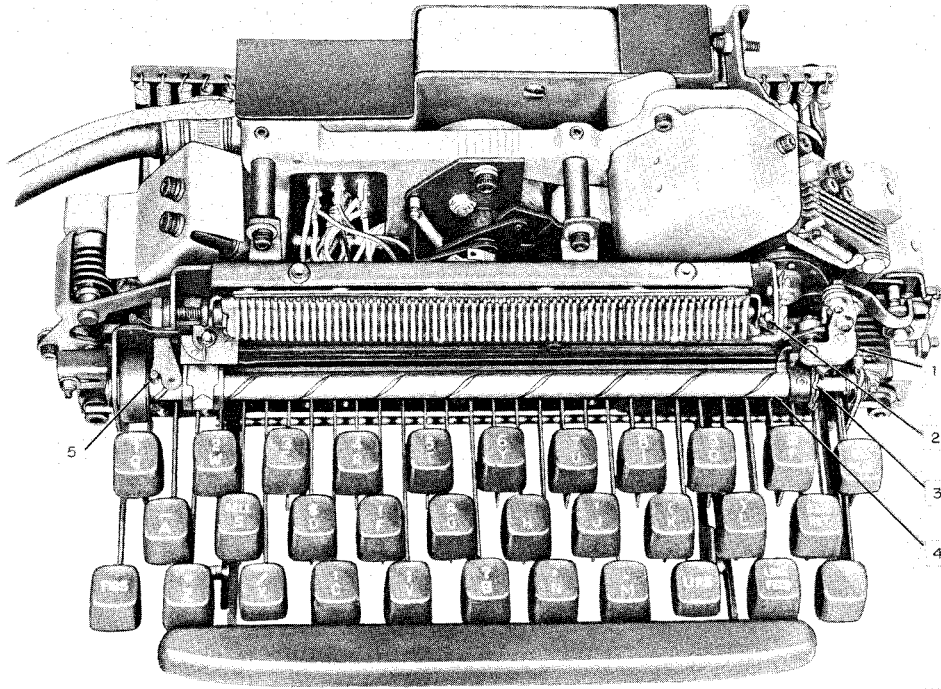
- |                       |                         |
|-----------------------|-------------------------|
| 1 Key levers          | 3 Spacebar pivots       |
| 2 Code bars and studs | 4 Front key lever guide |

*Figure 165. Keyboard-transmitter, underside, showing lubrication points.*



- |   |                                  |                                |
|---|----------------------------------|--------------------------------|
| 1 Ribbon shaft lock                     | 5 Ribbon lifter bellcrank        | 8 Type selecting arm           |
| 2 Ribbon guide                          | 6 Connecting bars guide plate    | 9 Ribbon lifter bracket        |
| 3 Hinge pin                             | 7 Type selecting arm bearing cap | 10 Ribbon lifter pivot bearing |
| 4 Carriage-feed and return driving rack |                                  |                                |

*Figure 166. Page printing mechanism carriage, rear view, showing lubrication points.*



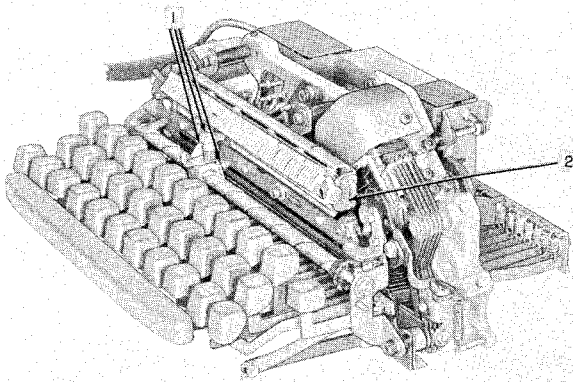
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1 Cam follower  
2 Tabulator shaft pivot

3 Ratchet wheel  
4 Indicator carriage drive shaft

5 Indicator return latch

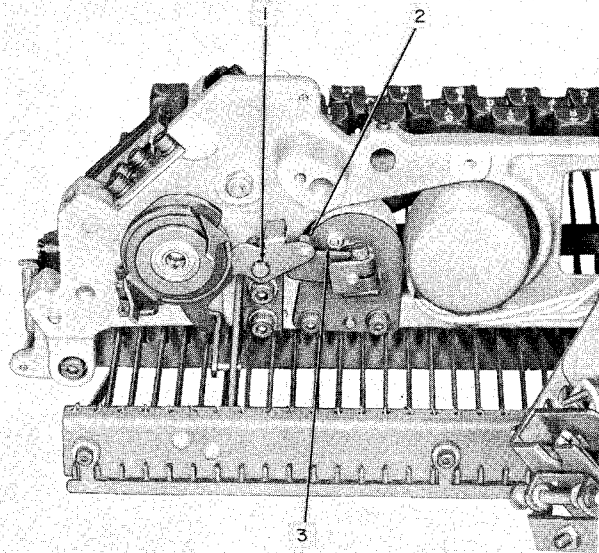
*Figure 167. Keyboard-transmitter, front view, showing lubrication points.*



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- 1 Indicator carriage      2 Tabulator locking lever

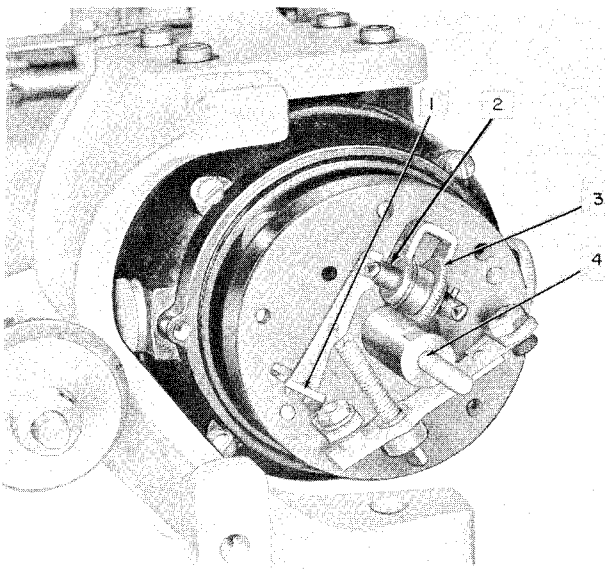
Figure 168. Keyboard-transmitter, right front view, showing lubrication points.



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- 1 Transmitter lever post pivot      2 Lockup lever roller  
3 Cam arm

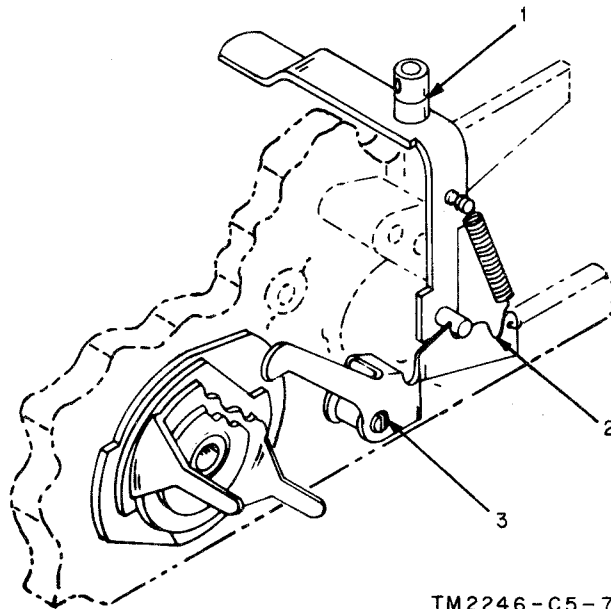
Figure 170. Keyboard-transmitter, rear view, showing lubrication points (TT-117/FG and TT-119/FG).



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- 1 Governor adjustment lever      3 Motor governor adjustment gear  
2 Governor adjustment screw      4 Governor worm

Figure 169. Governor of series-governed motor, showing lubrication points.



TM2246-C5-7

- 1 Keyboard control lever hub  
2 Detent lockup lever  
3 Lockup lever eccentric stud

Figure 171. Keyboard-transmitter camshaft locking mechanism, showing lubrication points (TT-117A/FG, TT-118/FG, and TT-119A/FG).

## 119. Detailed Lubrication Instructions for Perforator (figs. 172-184)

a. *Ball Bearings.* All ball bearings of the perforator are sealed and do not require lubrication.

b. *Gears.* Wipe the old grease off the gears listed below with a clean, lint-free cloth, and apply grease as instructed.

Fig. No.	Item No.	Name of part	Method and quantity
172	11	Stop arm shaft driven gear.....	} Apply sparingly around gear teeth.
172	12	Shaft drive gear.....	
172	14	Double gear.....	Work around gears; cover gear teeth liberally.
173	24	Typewheel hub gear.....	Apply sparingly around gear teeth.
173	27	Typewheel driven gear.....	Do not lubricate this gear.
176	7	Motor driven gear set.....	Work around gears, cover teeth liberally.
179	4	Power shaft gear.....	Apply sparingly around gear teeth.

c. *Friction Clutches.* Lubricate the friction clutches of the perforator listed below. When lubricating, follow the detailed instructions for lubrication of friction clutches as described in paragraph 115c.

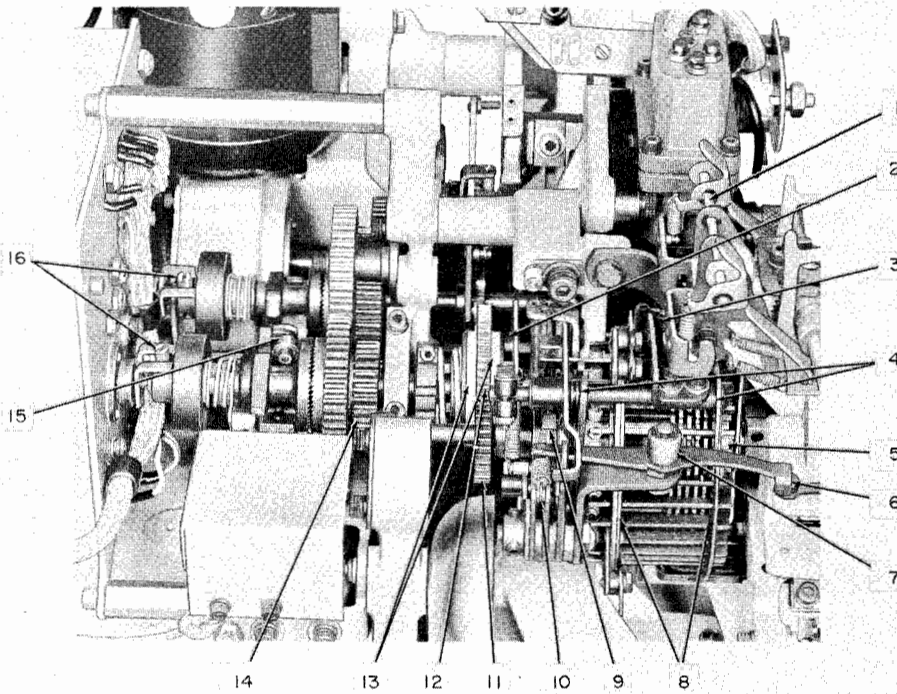
Fig. No.	Item No.	Name of part	Method and quantity
172	13	Stop arm shaft friction clutch.....	} 10 to 15 drops of oil on each disk along periphery of felt friction plates; apply sparingly to spring and collar.
174	21	Transmitter-distributor drive shaft friction clutch.....	
177	2	Selector camshaft friction clutch.....	

d. *Moving Parts.* Apply oil at the following places:

Fig. No.	Item No.	Name of part	Method and quantity
172	1	Ribbon retainer shaft.....	2 drops on pivot points.
172	2	Typewheel and function lever cam.....	Apply thin film on studs.
172	3	Code-ring locking bail.....	Apply sparingly to latching surface.
172	4	Code-ring locking bail shaft.....	2 drops on pivot points.
172	5	Stop arm shaft antibounce clutch.....	Several drops into clutch.
172	6	Typewheel upper bellcrank lever.....	Apply sparingly to coupling of arm and typewheel transfer lever.
172	7	Typewheel reciprocating transfer lever eccentric stud.	2 drops at upper end of pivot.
172	8	Stop bars in code-ring cage.....	2 drops at each end of all 32 stop bars.
172	9	Function sensing levers hub.....	Several drops between levers and washers.
172	10	Typewheel reciprocating lever assembly.....	2 drops at each shoulder pin and between levers and washers.
172	15	Clutch latch arm.....	} Light film on bearing surfaces.
172	16	Pulsing camshaft fork.....	
173	1	Driving link lever.....	} 2 drops on pivot point.
173	2	Code-ring and T-lever engagement.....	
173	3	Manual tape feed-out link.....	
173	4	Receiving multisolenoid Y-lever stud.....	
173	5	Code plate and T-lever engagement.....	Slight film on all working surfaces.
173	6	T-levers and separating washers.....	} Apply sparingly to all rubbing and bearing surfaces.
173	7	Y-levers detent.....	

Fig. No.	Item No.	Name of part	Method and quantity
173	8	Y-levers	Slight film of oil on all bearing surfaces.
173	9	Selector lever stop comb	Apply sparingly to all rubbing surfaces.
173	10	Selector cams and stop plate	Thin film on working surfaces.
173	11	Rangefinder cam	Apply thin film on cam surface.
173	12	Transfer lever trip latch shaft	Apply sparingly at both ends of transfer trip latch shaft.
173	13	Selector levers and separating washers	Apply sparingly between levers and washers.
173	14	Transfer lever cam	Apply thin film on working surfaces of cam.
173	15	Transfer lever roller stud	1 drop between roller and lever.
173	16	Punch arm pivot post	Apply at least 5 drops in oilhole of punch arm shaft.
173	17	Code hole punch lever pivot	Several drops between levers and washers.
173	18	Punch interference lever shaft	} Thin film on working surfaces.
173	19	Code hole punch levers	
173	20	Feed pawl pivot	
173	21	Code punch bars	1 drop at each end of the pivot.
173	22	Tape chute	Slight film on all moving surfaces.
173	23	Typewheel post	2 drops on slot.
173	25	Typewheel lower bellcrank lever	Apply 2 drops at each end of shaft. Slide type-wheel in and out several times for even lubrication.
173	26	Reciprocating lever shaft	Apply sparingly to lower bellcrank lever end.
173	28	Typewheel upper bellcrank lever	2 drops to upper and lower bellcrank shaft sleeves.
173	29	Print and register arm	Apply sparingly to upper bellcrank lever end.
174	1	Code-ring locking bail shaft	Apply sparingly to the cam groove and bearing of roller.
174	2	Ribbon retainer shaft	Apply sparingly to all working surfaces and to pivot point of figures and letters latch.
174	3	Ribbon spool latch	Apply sparingly at retainer-shaft pivot points.
174	4	Ribbon spool shaft	2 drops on pivot post.
174	5	Ribbon reversing toggle assembly	2 drops on bearing surface.
174	6	Ribbon roller shaft	Apply thin film on all working surfaces of toggle assembly.
174	7	Ratchet feed detent	1 drop at each end of rollers.
174	8	Sensing lever shaft	Apply thin film on all working surfaces of ribbon feed pawl.
174	9	Ribbon feed pawl shaft	2 drops at each stud of sensing levers.
174	10	Ribbon feed cam follower stud	2 drops at each ratchet of shaft.
174	11	Ribbon feed cam	Apply sparingly at both ends of stud.
174	12	Ribbon guide hub	Apply thin film on cam.
174	13	Paper guide lever pivot	2 drops on moving surface of pivot stud.
174	14	Manual tape feed-out shaft	} 2 drops at all pivot points.
174	15	Dust cover arm	
174	16	Back space pawl	
174	17	Detent lever roller	2 drops on pivot post.
174	18	Detent lever stud	Thin film on surface of roller and a drop at each side.
174	19	Punch interference levers	1 drop at each end of pivot.
174	20	Code rings	1 drop between interference levers and washers.
175	1	Typewheel register lever cam	} Apply sparingly to cam groove.
175	2	Print hammer cam	
175	3	Armature mounting shaft	Apply sparingly.
175	4	Grooved pin in end of selector camshaft	Several drops between pin and camshaft.
175	5	Switch operating lever	1 drop at pivot and latching surface.
175	6	Connecting link	1 drop at pivot points.
175	7	Print and register levers shaft	Apply sparingly to all working surfaces of levers.
175	8	Tape feed sprocket	2 drops in each hole on both sides of sprocket.

Fig. No.	Item No.	Name of part	Method and quantity
175	9	Tape retainer assembly	1 drop at each pivot of tape retainer.
176	1	Reciprocating and restoring cam follower	Apply sparingly to rollers, pivots, and all rubbing surfaces.
176	2	Stop arm shaft support plate	1 drop each side of collar.
176	3	Latch lever pivot	2 drops on pivot.
176	4	Clutch release lever	Slight film on all bearing surfaces.
176	5	Transfer lever shaft bearings	1 drop between collars and bearings on transfer lever shaft.
176	6	Clutch latch	2 drops on pivot; thin film on latching surface.
177	1	Code actuated switch cam	Slight film on camming surface.
178	1	Alarm lever hub	Apply sparingly at both ends of hub.
178	2	Switch actuating arm latch pivot	Apply sparingly at both ends of pivot.
178	3	Switch actuating lever	Apply sparingly at both ends of pivot.
179	1	Governor worm	2 or 3 drops in governor hub opening.
179	2	Governor adjustment lever	1 or 2 drops at each end.
179	3	Sliding drum clutch	2 drops in hole on drums.
179	5	Governor adjustment screw	Apply sparingly to entire thread.
179	6	Motor governor adjustment gear	Apply sparingly to gear teeth.
180	1, 5	Contact pivot posts	2 drops at pivot point.
180	2, 4	Function shaft pulsing cams	Slight film on all bearing surfaces.
181	1	Clutch magnet armature	1 or 2 drops at pivot and working ends.
181	2	Sensing lever comb	1 or 2 drops in each comb slot.
181	3	Tape feed retracting lever	1 or 2 drops at pivot and working ends.
181	4	Code sensing levers	Apply sparingly at working surfaces and at pivot.
181	5	Start-stop lever	1 or 2 drops at pivot and working points.
181	6	Tape feed lever	
181	7	Transmitter-distributor camshaft	Thin film on all cam lobes and stop lever cam teeth.
181	8	Selector levers, bearing shoes, and flat washers	Apply sparingly to all rubbing and bearing surfaces.
181	9	Transmitter contact-bail pivot	2 or 3 drops between arm and pivot studs.
182	1	Tape-out lever	
182	2	Tape feed claw	
182	3	Start-stop, lever detent	
182	4	Lower switch bail lever	
182	5	Tight-tape lever	
182	6	Upper switch bail lever	
183	1	Tape cover hinge	
183	2	Tape cover latch	
184	1	Tape cover hinge	
184	2	Tape cover latch	

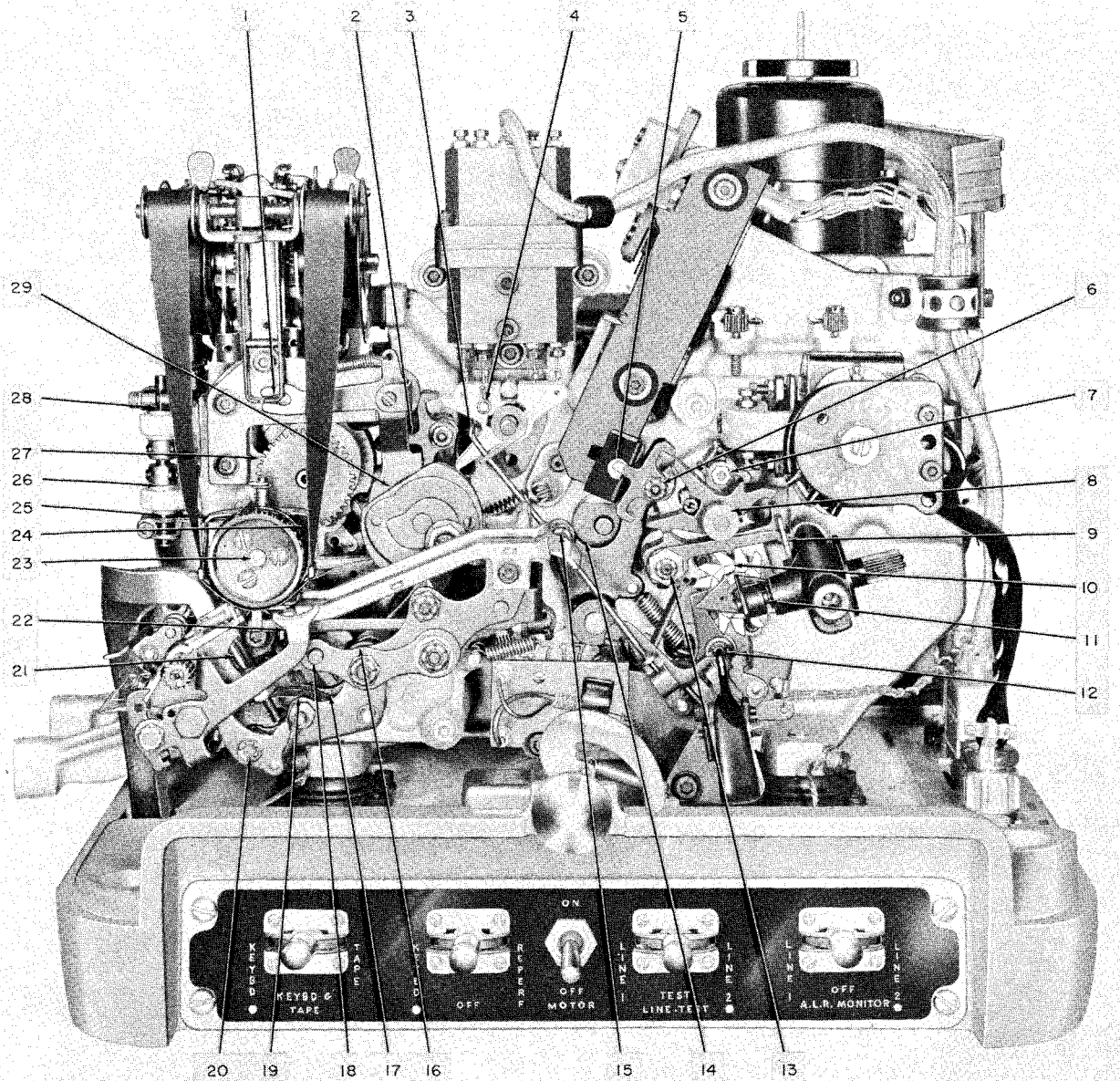


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- |                                    |   |                                   |
|------------------------------------|---|-----------------------------------|
| 1 Ribbon retainer shaft            | 6 Typewheel upper bellcrank lever                       | 11 Stop arm shaft driven gear     |
| 2 Typewheel and function lever cam | 7 Typewheel reciprocating transfer lever eccentric stud | 12 Shaft drive gear               |
| 3 Code-ring locking bail           | 8 Stop bars in code-ring cage                           | 13 Stop arm shaft friction clutch |
| 4 Code-ring locking bail shaft     | 9 Function sensing levers hub                           | 14 Double gear                    |
| 5 Stop arm shaft antibounce clutch | 10 Typewheel reciprocating lever assembly               | 15 Clutch latch arm               |
|                                    |   | 16 Pulsing camshaft fork          |

Figure 172. Perforator, left side, showing lubrication points.

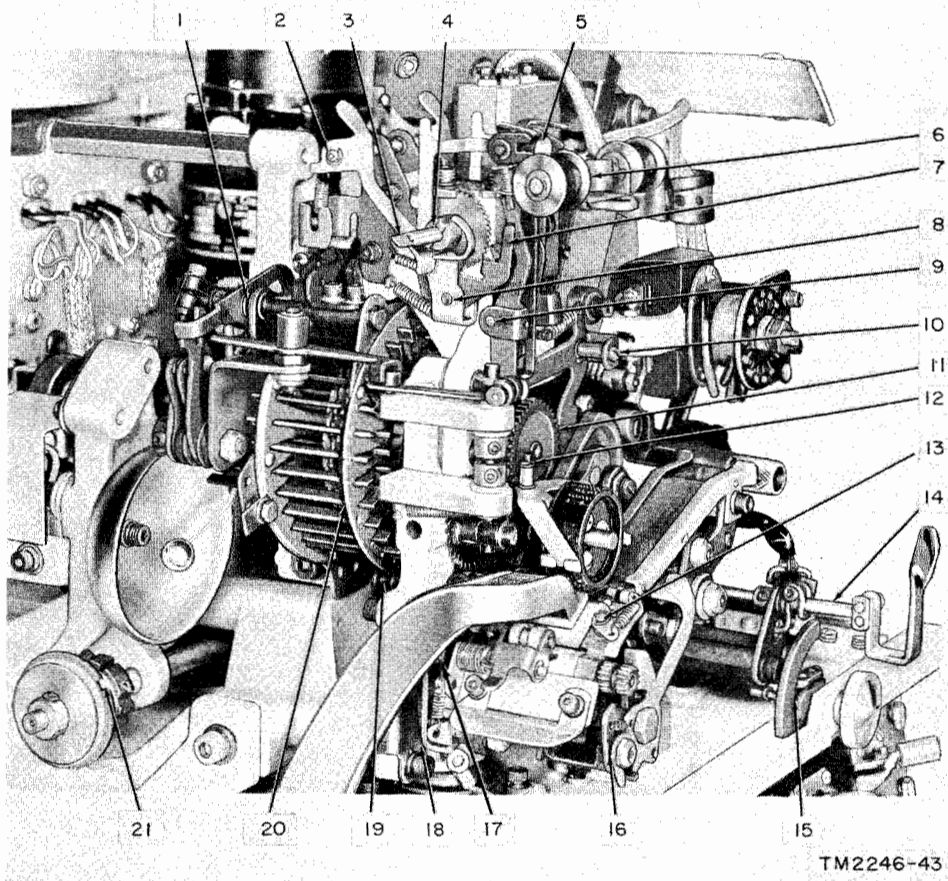




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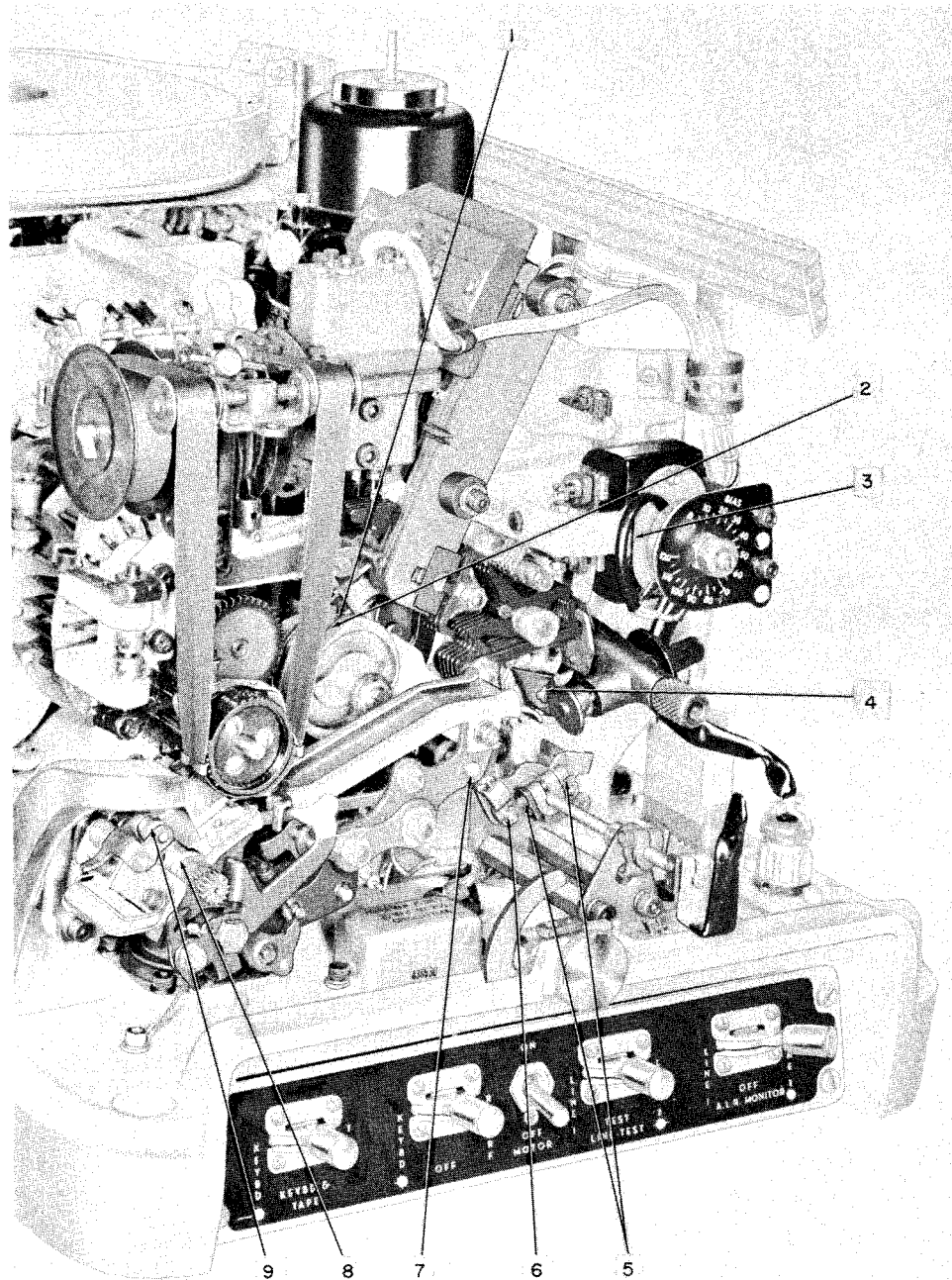
- |  |   |                                    |
|--|---|------------------------------------|
| 1 Driving link lever                   | 9 Selector lever stop comb                | 19 Code hole punch levers          |
| 2 Code-ring and T-lever engagement     | 10 Selector cams and stop plate           | 20 Feed pawl pivot                 |
| 3 Manual tape feed-out link            | 11 Rangefinder cam                        | 21 Code punch bars                 |
| 4 Receiving multisolenoid Y-lever stud | 12 Transfer lever trip latch shaft        | 22 Tape chute                      |
| 5 Code plate and T-lever engagement    | 13 Selector levers and separating washers | 23 Typewheel post                  |
| 6 Y-levers and separating washers      | 14 Transfer lever cam                     | 24 Typewheel hub gear              |
| 7 Y-levers detent                      | 15 Transfer lever roller stud             | 25 Typewheel lower bellcrank lever |
| 8 Y-levers                             | 16 Punch arm pivot post                   | 26 Reciprocating lever shaft       |
|  | 17 Code hole punch lever pivot            | 27 Typewheel driven gear           |
|  | 18 Punch interference lever shaft         | 28 Typewheel upper bellcrank lever |
|  |   | 29 Print and register arm          |

Figure 173. Perforator, front view, showing lubrication points.



- |                                    |                                  |  |
|------------------------------------|----------------------------------|--|
| 1 Code-ring locking bail shaft     | 9 Ribbon feed pawl shaft         | 16 Back space pawl                                     |
| 2 Ribbon retainer shaft            | 10 Ribbon feed cam follower stud | 17 Detent lever roller                                 |
| 3 Ribbon spool latch               | 11 Ribbon feed cam               | 18 Detent lever stud                                   |
| 4 Ribbon spool shaft               | 12 Ribbon guide hub              | 19 Punch interference levers                           |
| 5 Ribbon reversing toggle assembly | 13 Paper guide lever pivot       | 20 Code rings  |
| 6 Ribbon roller shaft              | 14 Manual tape feed-out shaft    | 21 Transmitter-distributor drive shaft friction clutch |
| 7 Ratchet feed detent              | 15 Dust cover arm                |  |
| 8 Sensing lever shaft              |                                  |  |

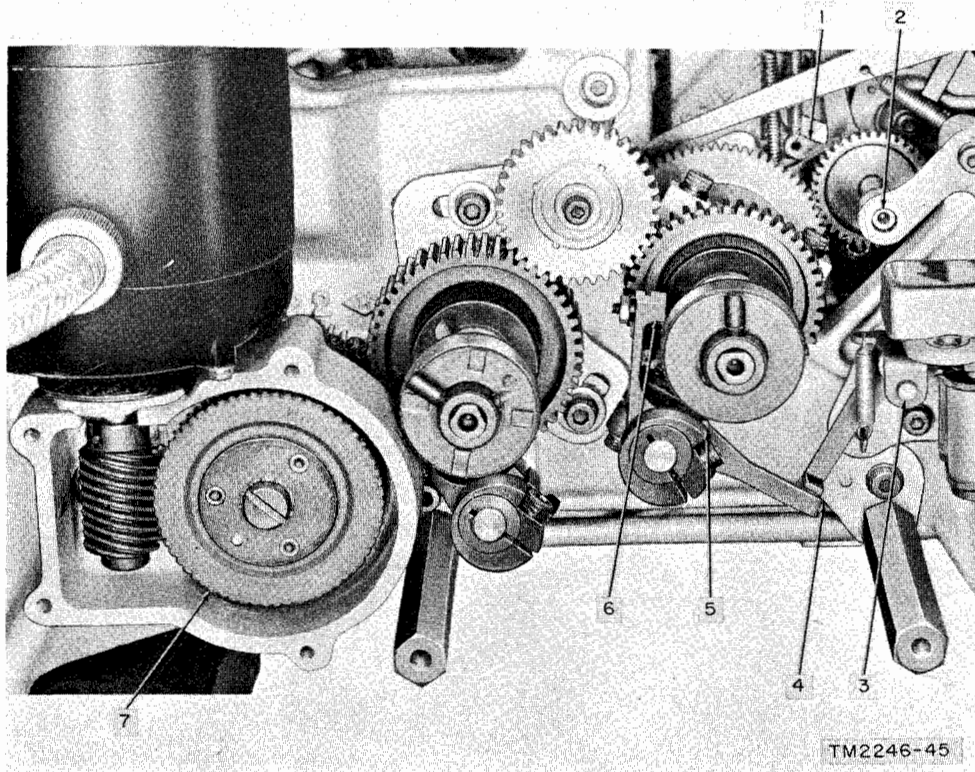
Figure 174. Perforator, left front view, upper portion, showing lubrication points.



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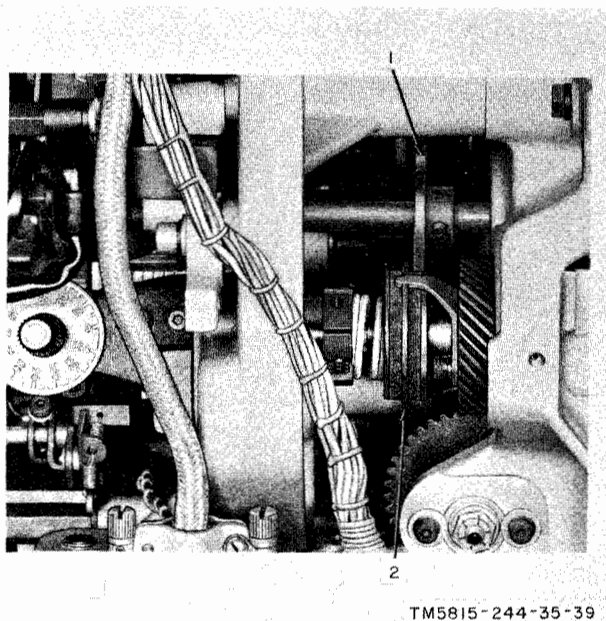
- |                                |                                  |                                   |
|--------------------------------|----------------------------------|-----------------------------------|
| 1 Typewheel register lever cam | 4 Grooved pin in end of selector | 7 Print and register levers shaft |
| 2 Print hammer cam             | camshaft                         | 8 Tape feed sprocket              |
| 3 Armature mounting shaft      | 5 Switch operating lever         | 9 Tape retainer assembly          |
|                                | 6 Connecting link                |                                   |

Figure 175. Perforator, left front view, showing lubrication points.



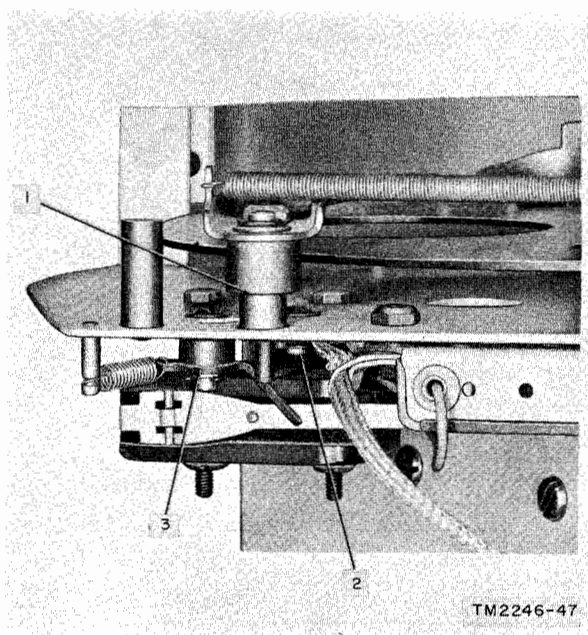
- |  |                                |                         |
|--|--------------------------------|-------------------------|
| 1 Reciprocating and restoring cam follower | 3 Latch lever pivot            | 6 Clutch latch          |
| 2 Stop arm shaft support plate             | 4 Clutch release lever         | 7 Motor driven gear set |
|  | 5 Transfer lever shaft bearing |                         |

Figure 176. Perforator main chassis, rear view, showing lubrication points.



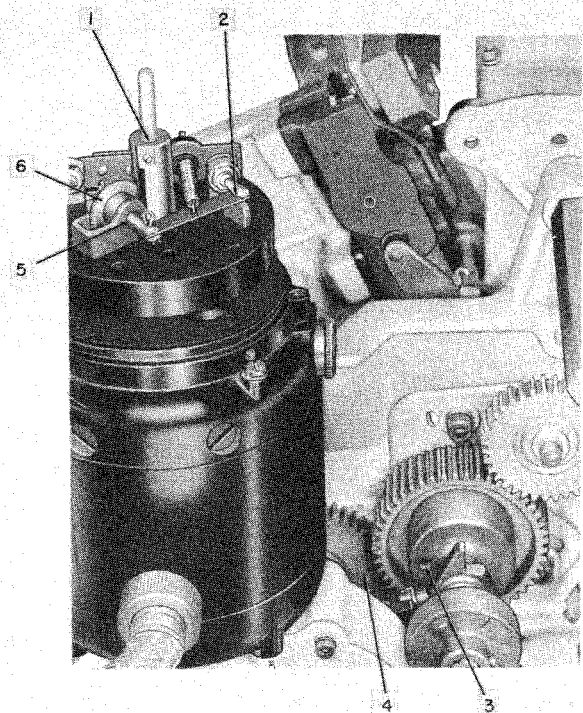
- |                            |                                     |
|----------------------------|-------------------------------------|
| 1 Code actuated switch cam | 2 Selector camshaft friction clutch |
|----------------------------|-------------------------------------|

Figure 177. Perforator main chassis, right side view, showing lubrication points.



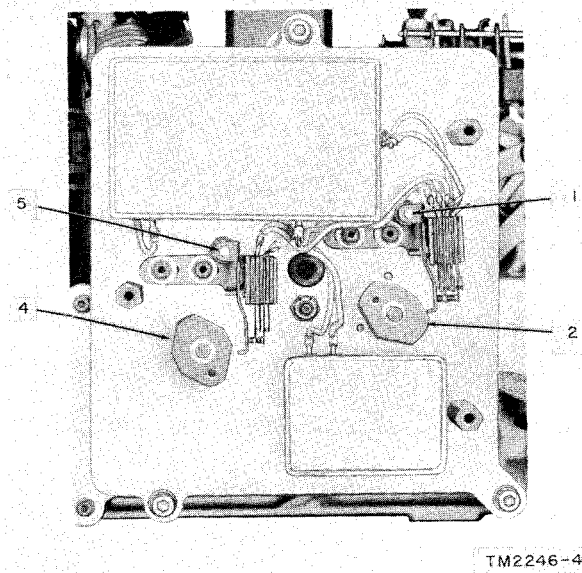
- |                                    |                          |
|------------------------------------|--------------------------|
| 1 Alarm lever hub                  | 3 Switch actuating lever |
| 2 Switch actuating arm latch pivot |                          |

Figure 178. Perforator tape-out lubrication points.



- |                             |                                  |
|-----------------------------|----------------------------------|
| 1 Governor worm             | 5 Governor adjustment screw      |
| 2 Governor adjustment lever | 6 Motor governor adjustment gear |
| 3 Sliding drum clutch       |                                  |
| 4 Power shaft gear          |                                  |

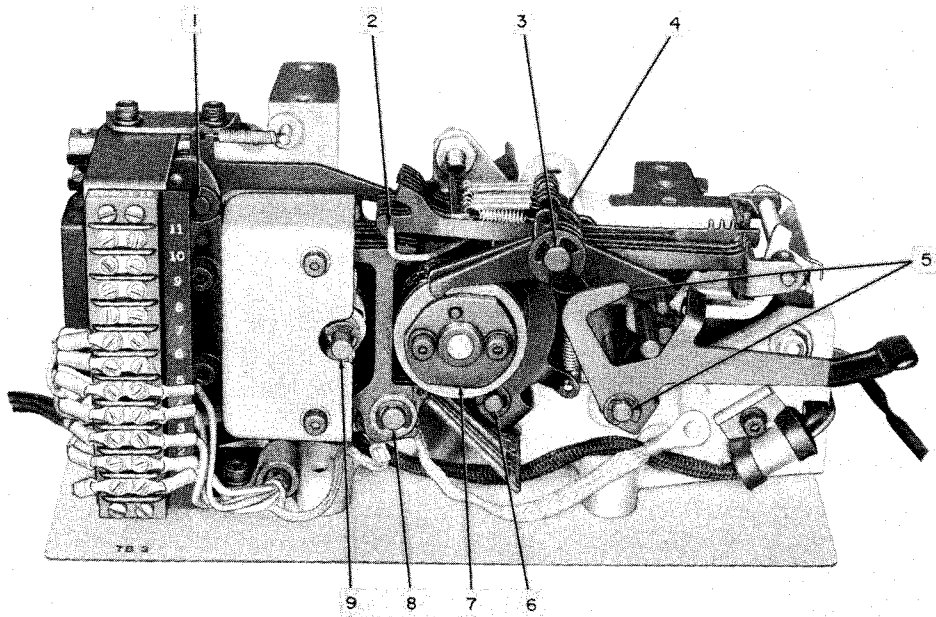
Figure 179. Governor of perforator series-governed motor and adjacent lubrication points.



- |                              |                              |
|------------------------------|------------------------------|
| 1 Contact pivot post         | 4 Function shaft pulsing cam |
| 2 Function shaft pulsing cam | 5 Contact pivot post         |

Figure 180. Perforator pulsing cam assembly lubrication points.

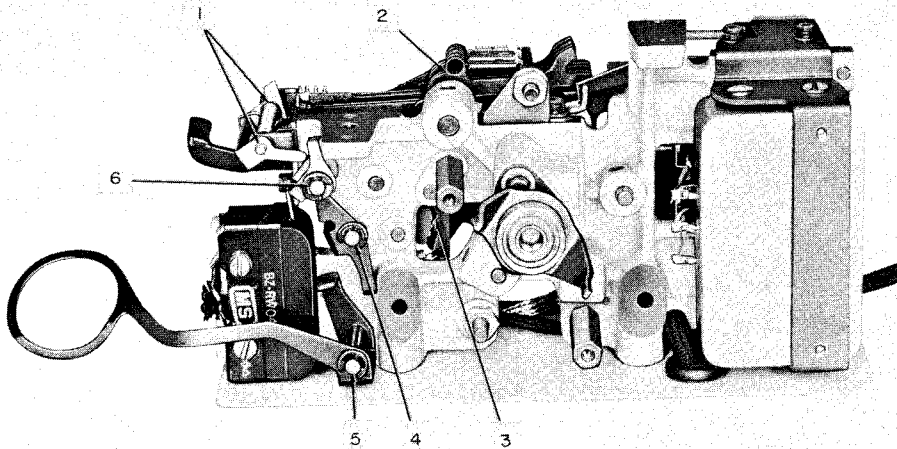




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- |                              |                                     |  |
|------------------------------|-------------------------------------|--|
| 1 Clutch magnet armature     | 5 Start-stop lever                  | 8 Selector levers, bearing shoes, and flat washers |
| 2 Sensing lever comb         | 6 Tape feed lever                   | 9 Transmitter contact bail pivot                   |
| 3 Tape feed retracting lever | 7 Transmitter, distributor camshaft |  |
| 4 Code sensing levers        |                                     |  |

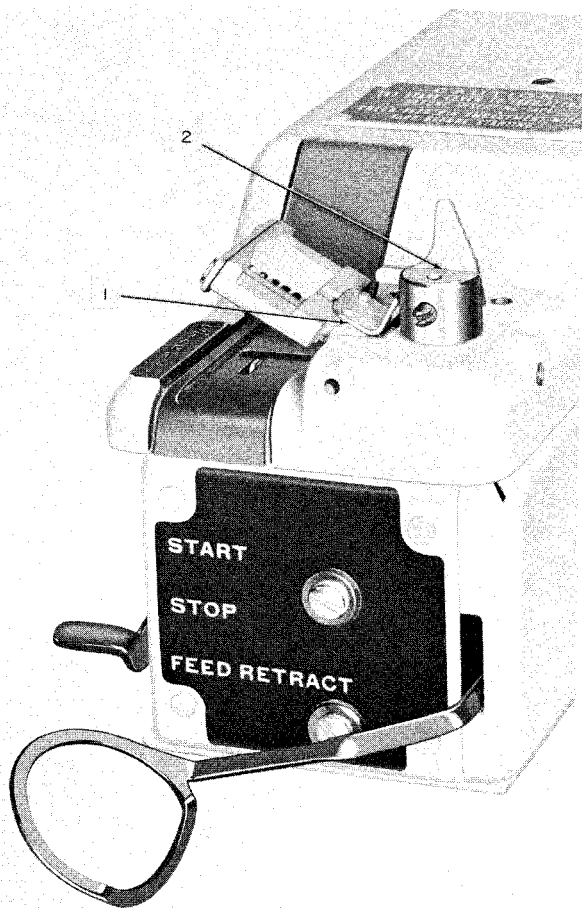
Figure 181. Transmitter-distributor, right side view, showing lubrication points.



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- |                  |                           |                           |
|------------------|---------------------------|---------------------------|
| 1 Tape-out lever | 3 Start-stop lever detent | 5 Tight-tape lever        |
| 2 Tape feed claw | 4 Lower switch bail lever | 6 Upper switch bail lever |

Figure 182. Transmitter-distributor, left side view, showing lubrication points.



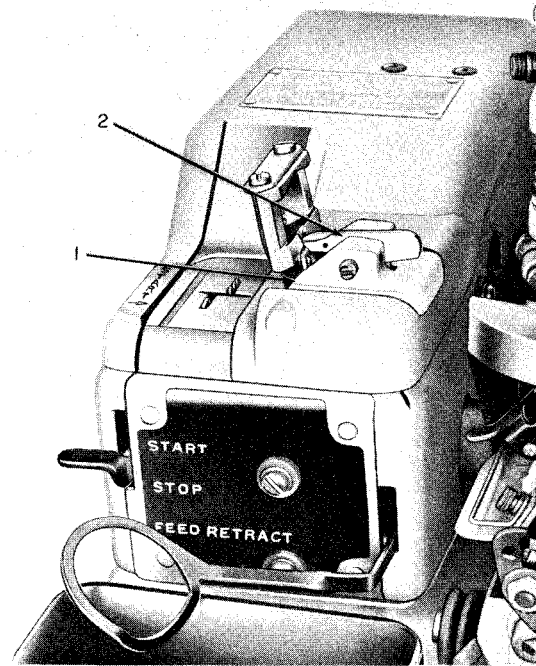
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- 1 Tape cover hinge                      2 Tape cover latch

Figure 183. Tape lid lubrication points of transmitter-distributor.

## 120. Rustproofing and Painting

a. If the finish on painted portions of the teletypewriter set or dust cover is scratched or scarred, prevent rust and corrosion by painting the damaged surfaces. Use No. 00 to No. 000 sandpaper to clean the surfaces down to the bare metal. Obtain a bright, smooth finish. Do not use steel wool when working on this



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- 1 Tape cover hinge                      2 Tape cover latch

Figure 184. Tape lid lubrication points of transmitter-distributor (TT-178A/FG, TT-179A/FG, and TT-181/FG).

teletypewriter set; small particles of steel wool may enter the electrical parts and cause internal shorting and grounding of circuits.

b. When touching up is necessary, apply the paint with a small brush. If numerous scars and scratches warrant complete repainting, remove the unit from service. Remove slight rust or corrosion from metal by cleaning with solvent (SD) to soften the rust, then sandpaper to complete the preparation for painting. Be sure to place protective masking, in advance, over areas where paint is not required or where paint may cause damage. Then spray paint the entire surface.

## Section IV. TROUBLESHOOTING

### 121. Sectionalizing Trouble to Major Component

a. The teletypewriter sets have two sending and two receiving mechanisms; therefore, the first step in troubleshooting, if the trouble is

not obvious, is to check one component against the other until the faulty component is isolated. For example, if the monitor copy of a message being transmitted to the signal line from the transmitter-distributor is garbled, it can be as-

sumed that the fault lies either in the transmitter-distributor or in the page printer. By connecting the set in a local test circuit (par. 17a) and transmitting from the transmitter-distributor it is possible to isolate the malfunctioning unit. If the copy received by both receiving units is garbled, it is safe to assume that the transmitter-distributor is not functioning correctly. If good copy is received on the perforator and garbled copy is received on the page printer, it is safe to assume that the page printer is not functioning correctly. In a similar manner, the trouble can be localized to any unit in the set.

b. Further sectionalization can be done on the keyboard-transmitter and perforator, because both units have sequential and simultaneous circuits. If messages sent from the simultaneous circuit of the keyboard-transmitter are garbled when received through the simultaneous circuit of the perforator, either the simultaneous sending or the receiving unit is at fault. By positioning the switches and sending sequential signals from the transmitter-distributor to the perforator, the trouble can be sectionalized to the malfunctioning unit since sequential signals must pass through the simultaneous circuit of the perforator before they are printed. If the message is received correctly on the perforator, it is safe to assume that the trouble is in the simultaneous circuit of the keyboard-transmitter. If the message is garbled on the perforator, it is safe to assume that the simultaneous circuit of the perforator is at fault.

## 122. Localizing Electrical Troubles

Most electrical troubles are found at the various contacts in the unit. Electrical circuits in teletypewriter sets have binding posts and connectors at most of the points where tests must be made. Do not disturb the wiring more than is necessary when testing or inspecting.

a. *Power Supply Checks.* To be sure that proper operating conditions exist, check power supplies before making other tests.

- (1) Check the line-current supply.
- (2) Insert the lead of a voltmeter into the TEST VOLTS positive and negative jacks in the rear of the perforator to check the voltage output.

b. *Continuity Testing.* The continuity test is used to locate the open circuit by trying to complete the circuits through the suspected sending or receiving unit. Multimeter TS-352/U will conveniently indicate a closed circuit. In making continuity tests, be sure that parallel current paths are disconnected to make the tests, check the continuity through the circuit suspected to be faulty by connecting the test leads so that current can go only through the suspected circuit. Be sure no other part of the circuit is shunting the circuit being tested. If necessary, disconnect certain leads. Check all likely circuits in this manner. If, after checking all possible causes, the fault cannot be located, make a continuity test of the entire circuit. Test from one terminal to a halfway point in the circuit. If continuity is indicated, test the other half of the circuit. Continue subdividing the circuit until the open point is definitely located.

c. *Use of Local Test Circuit.* Place the machine in a local test condition. A local test circuit is most convenient for determining whether the sending and receiving circuits are defective and for making tests for operating performance.

- (1) When the power is applied, current should flow and the set should run closed, indicating that the sending and receiving circuits are complete. If no current flows, one or more of the circuits is probably open. Disconnect the power and test as follows:

- (a) To test the continuity of the sequential transmitter circuit, remove the SEND plug and use the ohmmeter to check the continuity between the tip and the sleeve of the plug. The ohmmeter needle should deflect to indicate continuity.
- (b) To test the continuity of the transmitter-distributor send circuit remove the TAPE DIST. plug on the patch panel. Check between the plug and its associated jack. The ohmmeter needle should deflect to indicate continuity.
- (c) To test the continuity of the page printer receive circuit, remove the REC plug and check between the



tip and the sleeve of the plug. The ohmmeter needle should deflect to indicate continuity.

- (d) To test the continuity of the perforator receive circuit, remove the REPERF plug and check between the plug and its associated jack on the patch panel. The ohmmeter needle should deflect to indicate continuity.
- (2) To test for shorts within a faulty circuit when no open circuit is indicated, send R and Y code combinations from the transmitting units. If the receiving units do not receive impulses from the transmitter, the sending circuit may be shorted internally. If the receive mechanism runs open when current flows into the test circuit, the receiving circuit may be shorted internally.

*d. Testing Capacitors.* Capacitors may cause trouble by being shorted or by leaking. To test, discharge the capacitor with an insulated shorting jumper. Then disconnect one lead and connect the capacitor to an ohmmeter. Use the highest reading scale.

- (1) A good capacitor will be indicated by the ohmmeter pointer first moving up the scale rapidly, then returning slowly to the infinity mark.
- (2) A capacitor in an open circuit will give a reading of infinite ohms. A shorted capacitor will give a reading of constant value between zero and infinity, depending upon the resistance of the short.

**Warning:** Be extremely careful when handling charged capacitors. A severe electrical shock may be received from the capacitor or leads connected to a power supply in operation.

### 123. Localizing Mechanical Troubles

Although many mechanical troubles can occur in teletypewriter sets, no difficulty should be experienced in locating the fault if the se-

quence of operations is checked through its various steps.

*a. Method of Checking Operating Sequences.* A convenient way of checking operating sequences is to turn off the motor switches, leaving the power supply switches closed, and then turn the motor by hand to make the mechanical components of the teleprinter work slowly. Any key on the keyboard-transmitter may be depressed, or any code group can be sent from a punched tape on the transmitter-distributor and, as the motor is turned slowly, each impulse may be checked at the transmitter, the selector mechanism, and on a line current meter. Turn the motor further and observe the transfer, type selecting, printing or the operations of functions on the page printer or the transfers, both to the code actuated switch and to the code rings, print wheel placement, punching, or the operation of functions on the perforator. This procedure allows every step of the operating cycle to be checked and will reveal troubles caused by maladjustment, broken parts, or faulty assembly.

*b. Use of Test Circuit.* Use the test circuit when making the above slow-motion tests. The transmission of each transmitted impulse can be checked visually against the operation of the receiving mechanism. To send from the keyboard-transmitter, depress the key for the signal desired and turn the page printer motor by hand. To send from the transmitter-distributor, insert a tape punched with the operation desired, move the STOP-START lever to START, and turn the perforator motor by hand.

### 124. Troubleshooting Charts

The most common failures that can occur in this teletypewriter set together with the probable cause of the trouble and the corrective action to be taken, are listed in the chart below. Both electrical and mechanical troubles are listed in the order of their importance. Although several probable causes are given for most troubles, all of these may not occur at the same time. Determine which cause applies to the particular situation being investigated.

a. Keyboard-Transmitter Troubleshooting Chart.

Condition	Probable trouble	Correction
1. Cannot send sequential signals from keyboard-transmitter.	<p>SEND plug disconnected from rear of perforator.</p> <p>Transmitter contacts out of adjustment.</p> <p>Keyboard-transmitter plug disconnected.</p> <p>Keyboard-transmitter friction clutch out of adjustment.</p> <p>Transmitter camshaft locked up by improper setting of keyboard control switch on the perforator. On TT-117A/FG, TT-118/FG, and TT-119A/FG, the camshaft is locked by improper setting of the keyboard control lever on the page printer.</p> <p>Cam stop lever binding.</p>	<p>Connect plug.</p> <p>Adjust contacts (par. 364).</p> <p>Connect keyboard-transmitter plug.</p> <p>Adjust friction clutch (par. 400).</p> <p>Adjust switch to KEYBD or KEYBD &amp; TAPE setting as required. Move the keyboard control lever to the left (keyboard) side.</p> <p>Clean and adjust cam stop lever (par. 392).</p>
2. Transmitter camshaft rotates continuously.	<p>Locking lever latch spring missing or broken.</p> <p>Universal bar adjusting screw out of adjustment.</p> <p>Restoring solenoid (L1) not operating.</p> <p>Repeat blocking lever spring broken or missing.</p>	<p>Replace locking lever latch spring.</p> <p>Adjust setting of universal bar adjusting screw (par. 376).</p> <p>Locate and correct circuit fault (par. 95 and 122). Replace restoring solenoid if necessary.</p> <p>Replace repeat blocking lever spring.</p>
3. Sequential transmitter mechanism transmits garbled copy.	<p>Friction clutch dry or out of adjustment.</p> <p>Sequential transmitter contacts dirty or out of adjustment.</p> <p>Contact bail spring weak.</p> <p>Binding in selector levers or sensing levers.</p> <p>Sensing lever locking bail spring weak or missing.</p>	<p>Lubricate (par. 118) and adjust (par. 400). Replace felt disks if necessary.</p> <p>Clean and adjust transmitter contacts (par. 364).</p> <p>Replace contact bail spring.</p> <p>Clean and adjust sensing levers and selector levers (par. 360).</p> <p>Replace sensing lever locking bail spring.</p>
4. Indicator carriage does not advance to the right.	<p>Ratchet pawl spring broken or missing.</p> <p>Cam follower spring broken.</p> <p>Ratchet wheel detent spring missing.</p>	<p>Replace ratchet pawl spring.</p> <p>Replace cam follower spring.</p> <p>Replace ratchet wheel detent spring.</p>
5. Indicator carriage does not return to zero when CAR. RET. key lever is depressed.	<p>Carriage-return finger function blocking bar bent or broken.</p> <p>Indicator return spring broken or improperly adjusted.</p>	<p>Straighten finger or replace function blocking bar.</p> <p>Adjust or replace indicator return spring (par. 369), (par. 371 for TT-117A/FG and TT-119A/FG).</p>
6. End-of-line lamp does not light.	<p>End-of-line lamp burned out.</p> <p>End-of-line switch faulty.</p>	<p>Replace end-of-line lamp.</p> <p>Replace end-of-line switch.</p>

Condition	Probable trouble	Correction
7. Simultaneous transmitter mechanism does not transmit.	Keyboard reader pulsing contacts S11 worn or pitted. Keyboard reader pulsing mechanism binding. Short or open in transmitter simultaneous circuit. Perforator control switch S31 in REPERF position. On the TT-117A/FG, TT-118/FG, and TT-119A/FG, keyboard control lever improperly set.	Clean and burnish keyboard reader pulsing contacts (par. 109). Clean and adjust keyboard reader pulsing mechanism. Locate and correct short or open circuit (pars. 94 and 122). Place perforator control switch S31 in KEYBD position. Move the keyboard control lever to the right (tape) side. Check adjustment in paragraph 374.
8. Keyboard-transmitter operates properly, but causes noise on local radio receivers.	Faulty RF filter Z2. Faulty RF filter Z2 connections.	Replace, if defective. Check and replace defective bonding straps; tighten connections.

*b. Page Printing Mechanism Troubleshooting Chart.*

Condition	Probable trouble	Correction
1. Motor fails to start.	POWER fuse blown. Failure of power source.  Motor stop contacts S1 dirty or do not close. Dirty commutator on motor.  Defective motor brushes. Open in field or armature winding. Dry friction clutches or mechanical binding.	Replace fuse 1.6-amp fuse (fig. 12). Correct defect or use another power source.  Clean and burnish motor stop contacts S1 (par. 107). Clean commutator (pars. 107 and 149). Replace brushes (par. 149). Replace motor. Locate and correct trouble in mechanism.
2. Motor runs but speed is erratic.	Governor contacts dirty or pitted. Governor spring broken. Motor stop contacts weak or broken. Dirty commutator on motor.	Clean, burnish, or replace contacts. Replace spring. Install new motor stop contacts S1. Clean commutator.
3. Page printing mechanism runs open (mechanism runs when line current should be steady marking).	Line circuit fuse F7 blown. External line circuit open or shorted.  No line current or low line current.  Space instead of mark impulses received. Receiving circuit open or shorted.  Sending circuit open.  Selector magnet armature not holding stop lever. Transfer lever latch spring broken. Selector camshaft stop plate or stop lever worn or broken.	Replace fuse F7. Check line from teleprinter terminals for continuity or short. Correct or replace source of voltage. Adjust line increase resistor. Reverse line leads.  Check for continuity or short and repair fault. Check circuit continuity and repair fault. Readjust selector mechanism (pars. 264-293). Replace transfer lever latch spring. Replace stop plate or stop lever.

Condition	Probable trouble	Correction
4. Page printing mechanism prints errors or scrambles letters and functions.	Rangefinder dial assembly improperly set. Sending contacts dirty or pitted. Selector camshaft or transmitter camshaft friction clutch slipping. Dirty, binding, or sticking selector mechanism. Worn or broken Y- or T-levers. Selector camshaft stop plate loose. Selector lever spring broken. Square shaft friction clutch slipping. Selector magnet mounting loose. Type arm or function selecting arm loose.	Adjust rangefinder dial assembly. Clean, burnish, or replace sending contacts. Adjust friction clutch (par. 298 or 400) Clean or adjust selector parts (pars. 264-293). Replace defective levers. Replace worn parts. Replace selector lever spring. Adjust friction clutch (par. 299). Readjust and tighten mounting screws (pars. 264-293). Readjust and tighten selecting arms (par. 321).
5. Page printing mechanism prints same character or performs same function regardless of signals being sent.	Transfer lever latch spring or transfer lever spring broken. Antibounce clutch jammed. Function selecting arm sticking in punch bar guide block.	Replace a broken spring. Replace antibounce clutch. Clean and readjust if necessary.
6. Certain characters (or functions) will not print (or operate).	Stop bar sticking. Stop bar spring broken or missing.	Clean stop bar guide plate and code rings. Replace spring.
7. Page printing mechanism operates, but range (rangefinder measurement) is narrow.	Line current too high or too low. Bias potentiometer improperly set. Motor speed incorrect at transmitter. Selector mechanism improperly adjusted.	Readjust line current. Check and adjust the resistance of the bias potentiometer. Have transmitter motor speed checked. Make complete adjustment of selector mechanism (pars. 264-293).
8. Page printing mechanism prints, but causes noise on local radio receivers.	Faulty RF filter. Faulty RF filter connections.	Check filter; replace if defective. Check and replace defective bonding straps; tighten connections.
9. Page printing mechanism prints but sticks in print position.	Type bar connecting spring weak or missing. Print mechanism binding.	Replace type bar connecting spring. Clean and adjust print mechanism.
10. Platen will not shift.	Figures sensing lever spring broken. Platen shift arm mounting loose. Figures shift sensing lever or cam follower bent or broken.	Replace spring. Readjust arm and tighten mounting screws (par. 330). Replace defective parts.
11. Platen will not unshift.	Function aperture gate stuck. Signal bell or motor stop punch bar stuck in operated position.	Clean function group parts. Clean function group parts.
12. Platen cannot be prevented from returning to figures position or is erratic.	Cam follower stop collar on mounting stud dirty or improperly placed. Line feed and figures shift cam follower spring broken.	Clean and adjust collar (par. 275). Replace broken line feed and figures shift clam follower spring.

Condition	Probable trouble	Correction
13. Carriage will not feed.	Carriage-feed link improperly adjusted. Carriage-feed clutch slipping.  Driving collar loose. Carriage-feed clutch lever spring broken. Ribbon driving mechanism jammed.	Readjust link (par. 335).  Readjust clutch, replace felts if necessary (par. 342). Tighten setscrews. Replace spring.  Readjust ribbon driving mechanism (par. 349).
14. Carriage does not feed properly.	Carriage-return link improperly adjusted. Carriage-feed pawl spring broken.	Adjust link (par. 309). Replace spring.
15. Carriage-return function does not operate.	Carriage-return link improperly adjusted. Carriage-return sensing lever spring broken. Carriage-return clutch mechanism out of adjustment.	Adjust link (par. 309). Replace spring.  Adjust carriage-return mechanism (par. 308-316).
16. Carriage does not make complete return.	Latch tripping arm improperly adjusted. Mechanism binding.	Readjust latch tripping arm (par. 305). Clean and adjust carriage mechanism.
17. Line feed function does not operate.	Line feed sensing lever spring broken. Line feed pawl spring broken. Line feed detent stuck.	Replace spring. Replace spring. Clean detent parts.
18. Line feed occurs on every operation or is erratic.	Cam follower stop collar and stud dirty or stop collar improperly placed. Line feed and FIGS shift cam follower spring broken.	Clean collar and stud and reset collar if necessary.  Replace spring.
19. Signal bell does not ring.	Clapper bent. Signal bell punch bar sticks.	Straighten clapper. Clean function group parts.
20. Motor stop fails to operate.	Motor stop contacts bracket improperly adjusted. Motor stop contacts bent or broken. Motor stop function lever binding.  Motor stop punch bar sticks.	Readjust position of bracket (par. 357). Replace defective parts. Clean and lubricate pivot and bearings. Clean function group parts.
21. Motor stop fails to operate (weather page printer).	<i>Note.</i> In addition to the probable troubles in 20 above, check the following: Blank contacts improperly adjusted or dirty. Pulser contacts S15 improperly timed or dirty.	Readjust contacts S16 (par. 270) or clean and burnish the contacts. Adjust pulsing cam and contacts (par. 356) or clean and burnish the contacts.
22. Only part of characters print.	Ribbon lifter not raising far enough. Stop screw for platen arm not properly adjusted.	Adjust ribbon lifter (par. 344). Adjust platen arm stop screw (par. 332).

Condition	Probable trouble	Correction
23. Printing too light or too heavy.	Round nut on type selecting arm properly adjusted.	Adjust round nut (par. 344).
24. Lines are not printed straight.	Platen arm stop screw loose. Platen casting eccentric mounting screw not properly adjusted.	Tighten stop screw. Adjust platen casting eccentric mount screw (par. 328).
25. Margins printing unevenly.	Carriage-return blocking mechanism improperly adjusted.	Adjust carriage-return blocking mechanism (par. 313).
26. Ribbon lifter not working properly.	Broken liften tension spring. Dirty, bent, or broken parts.	Replace spring. Clean and replace broken parts.
27. Ribbon does not feed or does not reverse.	Ribbon spool not seated correctly on driving collar or collar loose on shaft. No spring tension on ribbon feed clutch. Bevel gears not meshing. Ribbon reversing sensing lever, bent, dirty, or has broken spring.	Check seating of spool and tighten collar setscrew. Reset collar for proper spring tension (par. 350). Replace weak detent spring. Clean, adjust, and replace parts as necessary.
28. Margin bell does not ring properly.	Margin bell pawl tripping arm improperly set or pawl broken. Pawl spring broken. Clapper spring broken. Clapper bent.	Reset arm or replace broken part. Replace pawl spring. Replace clapper spring. Straighten clapper.
29. Paper tension roller cannot be released.	Pin on roller bent or broken. Paper release mechanism binding.	Replace defective pin. Clean and adjust mechanism (par. 327).
30. Page printer emits grinding or whining noise.	Motor drive gears improperly meshed. Fouled bearings in motor, main shift, or function shaft. Motor shaft or main shaft bent.	Adjust position of motor. Clean and lubricate or replace bearings if necessary. Replace bent shaft.
31. Paper feeds off to one side.	Paper guide not adjusted or formed properly.	Adjust and reform paper guides (par. 323).

*c. Transmitter-Distributor Troubleshooting Chart.*

Condition	Probable trouble	Correction
1. Transmitter camshaft does not rotate.	Clutch magnet not energized.  Armature does not clear stop lever.  Friction clutch dry or out of adjustment. START-STOP-lever not in start position. Plug disconnected from jack in perforator base.	Check tape-out linkage (pars. 515 and 516) and switch. Check clutch magnet circuit. Check armature eccentric stud adjustment (par. 501) and magnet cores adjustment (par. 502). Lubricate and adjust (par. 517) friction clutch. Move lever to correct position.  Connect transmitter-distributor plug to perforator base.

Condition	Probable trouble	Correction
2. Camshaft rotates, but signals are not transmitted to signal line.	Signal circuit open or shorted. Line current not furnished by associated equipment. Transmitter-distributor transmitter contacts E6 dirty or out of adjustment. Contact bail spring weak or broken. Binding in the code sensing levers or selector levers.	Locate open or short and correct fault. Supply power to signal line. Clean and adjust (par. 503) transmitter-distributor transmitter contacts E6. Replace contact bail spring. Clean and readjust (par. 512) or replace damaged parts.
3. Transmitter-distributor transmits only blank code combinations.	Transmitter-distributor transmitter contacts dirty or out of adjustment. Selector lever comb out of adjustment. Code sensing lever springs weak. Code sensing levers binding.	Clean and adjust transmitter-distributor transmitter contacts (par. 503). Adjust position of selector lever comb (par. 511). Replace code sensing lever springs. Clean and adjust code sensing levers (par. 512).
4. Transmitter camshaft rotates continuously.	Tape-out linkage out of adjustment. Stop lever binding. Clutch magnet armature spring weak or broken. Stop lever spring weak or broken.	Adjust tape-out linkage (pars. 515 and 516). Free binding. Adjust selector lever comb (par. 500). Replace clutch magnet armature spring. Replace spring.
5. Tape does not feed properly.	Feed claw broken, bent, or binding. Tape feed lever spring, retracting spring, or feed claw spring weak.	Repair or replace if necessary. Replace a weak spring.
6. Transmitter-distributor operates properly but causes noise on local radio equipment.	Faulty RF filter components. Faulty RF filter connections.	Check filter; replace if defective. Check and replace defective bonding straps; tighten connection.

*d. Perforator Troubleshooting Chart.*

Condition	Probable trouble	Correction
1. Motor fails to start.	Power input fuse blown. Failure of power source. Governor contact spring loose or broken. Governor contacts dirty or pitted. Brushes badly worn. Open field or armature windings. Shafts or bearings binding. Dirty commutator on motor.	Replace fuse. Correct defect or use another power source. Replace spring. Clean, burnish, or replace contacts. Replace brushes. Replace motor. Locate and correct trouble in mechanism. Clean commutator.
2. Motor runs but speed is erratic.	Governor contacts dirty or pitted. Governor spring broken. Dirty commutator on motor.	Clean, burnish, or replace contacts. Replace spring. Clean commutator.
3. Perforator operates but causes noise on local radio receivers.	Faulty RF filter. Faulty RF filter connections.	Replace if defective. Check and replace defective bonding straps; tighten connections.

Condition	Probable trouble	Correction
4. Code actuated switch function shaft rotates continuously.	Transfer lever latch spring broken or missing. Low line current. Space instead of mark impulse received (polar operation). Selector camshaft stop lever spring broken. Selector camshaft stop plate or stop lever worn. Bias potentiometer not adjusted properly.	Replace transfer lever latch spring. Increase line current. Reverse signal line connections. Replace spring. Replace worn parts. Check and readjust bias potentiometer.
5. Receiving multisolenoid mechanism runs open.	Clutch latch arm out of adjustment. Receiving multisolenoid pulsing contacts on the rear code actuated switch function shaft do not open. Keyboard reader contacts on keyboard fail to open.	Adjust clutch latch arm (par. 453). Adjust receiving multisolenoid pulsing contacts (par. 493). Adjust keyboard reader contacts (par. 389).
6. Motor operates but perforator runs closed though signals are received from signal line.	Worm gear not rotated by motor. Main shaft not rotated by worm gear. Maladjusted stop lever eccentric. Maladjusted selector magnet bracket.	Check for missing or broken motor shaft pin. Check for missing or broken gear pin on main shaft. Adjust stop lever eccentric (par. 414). Adjust selector magnet bracket (par. 415).
7. Receiving multisolenoid function shaft does not rotate.	Perforator latch coils inoperative. Receiving multisolenoid pulsing contacts on the rear code actuated switch function shaft are dirty, pitted, or out of adjustment. Keyboard reader contacts on keyboard are dirty, pitted, or out of adjustment.	Check perforator latch coils; replace if faulty. Clean, burnish, adjust or replace receiving multisolenoid pulsing contacts (par. 498). Clean, burnish, adjust, or replace keyboard reader contacts.
8. Perforator prints but range (rangefinder adjustment) is narrow.	Line current too high or too low. Motor speed improper. Selector mechanism improperly adjusted. Bias potentiometer improperly set.	Readjust line current. Correct motor speed. Make complete readjustment of selector mechanism. Adjust bias potentiometer.
9. Perforator prints errors or scrambles letters and functions.	Rangefinder improperly set. Transfer lever latch spring broken or missing. Excessive line distortion. Selector camshaft friction clutch dry or slipping. Dirty, binding, or sticking selector mechanism. Receiving multisolenoid has shorted or open solenoid. Worn or broken Y-levers or T-levers. Wrong gear set in use. Selector lever spring broken. Selector magnet mounting loose. Code-ring locking lever spring broken or missing.	Adjust rangefinder (par. 407). Replace spring. Check line and associated equipment. Lubricate (par. 116c) and adjust (par. 433) selector friction clutch. Clean and adjust selector mechanism (pars. 407-432). Check coils in the receiving multisolenoid and replace if necessary. Replace defective parts. Install proper gear set. Replace selector lever spring. Readjust and tighten mounting screws (pars. 407-432). Replace code-ring locking lever spring.



Condition	Probable trouble	Correction
10. Perforator continues to print the same character or perform the same function although no additional signals are received.	Lever latch spring broken or missing. Stop bar sticking.  Typewheel mechanism jammed.	Replace lever latch spring. Clean and adjust stop bars and coding cage (pars. 436-440). Correct binding and adjust mechanism (pars. 464-467).
11. Certain characters (or functions) do not print.	Stop bar sticking.  Stop bar spring broken.	Clean and adjust stop bars and coding cage (pars. 436-440). Replace stop bar spring.
12. Typewheel will not stay in figures shift position.	Shift latch spring broken or missing. Figures shift sensing lever spring broken.	Replace spring. Replace figures spring.
13. Typewheel cannot be prevented from returning to figures shift or is erratic.	Figures stop bar broken. Figures sensing lever spring broken.	Replace stop bar. Replace figures sensing lever spring.
14. Signal bell does not operate.	Clapper bent.  Broken or loose bell sensing lever spring.	Straighten clapper as required to sound bell. Replace bell sensing lever spring.
15. Perforator prints part of characters only.	Typewheel not properly adjusted on typewheel hub assembly. Ribbon feed not operating properly. Register wheel not aligned with typewheel.	Adjust typewheel setting (par. 458). Check ribbon feed mechanism. Check alignment.
16. Printing too light.	Print hammer not properly adjusted. Worn inking ribbon.	Adjust print hammer (par. 470). Replace inking ribbon.
17. Inking ribbon does not feed or ribbon feed does not reverse.	Ribbon spools not correctly set. Reversing toggle spring missing or broken. Ribbon sensing lever bent, dirty, or broken.	Check seating of spools. Replace spring. Clean, straighten, or replace lever.
18. Perforator operates, but emits grinding or whining noise.	Fouled bearings in motor, main shaft, or function shaft. Motor shaft or main shaft bent.	Replace bearings if necessary. Replace defective shaft.
19. Tape perforations improperly spaced.	Feed sprocket detent not adjusted. Tape binding in guide.	Adjust detent (par. 481). Free tape.
20. Manual tape feed-out does not operate.	Loose lever or linkage. Defective switch or circuit.	Adjust mechanism (pars. 492-495). Check circuit for continuity. Replace switch if required.
21. Tape does not feed properly.	Feed pawl adjusting screw out of adjustment. Tape binding in guide.	Adjust screw (par. 482). Free tape.

## Section V. REMOVAL AND REPLACEMENT OF PAGE PRINTER COMPONENTS

### 125. General

a. This section describes replacement procedures required to completely overhaul a defective or inoperative page printer. The procedures include replacement of all parts of the unit except those parts for which the procedure is obvious.

b. Except in extreme emergency, all repairs should be made by personnel thoroughly trained in teleprinter maintenance. Equipment operating with minor faults may fail completely as the result of efforts by inexperienced personnel to correct apparently simple defects.

c. Follow the inspection, cleaning, and lubrication instructions given in paragraphs 106 through 120. Whenever repairs are made, the page printer should be readjusted in accordance with paragraphs 263 through 405.

### 126. General Disassembly Procedure

a. Disconnect the power and signal line connections from the page printer.

b. Remove the dust cover.

c. Remove the inking ribbon and paper from the page printer.

d. Proceed to disassemble the various parts and assemblies; use the correct tool for each specific operation. Do not disassemble the page printer or its assemblies beyond the point necessary to thoroughly inspect and clean the mechanism, and to repair and replace any parts.

e. When small parts are disassembled, place them in a container and mark them to identify their origin.

### 127. General Reassembly Procedures

a. Replace all worn or broken parts that cause malfunctioning of the page printer and adjust them in accordance to the directions in the appropriate paragraph in section VII of this chapter. While the equipment is disassembled for checking and repair, replace any parts that are likely to cause trouble before the next scheduled overhaul of the machine.

b. Tighten all screws, nuts, and bolts carefully, but not excessively. When installing steel screws in aluminum or magnesium alloy castings, they should be coated with Antiseize

Compound, Stock No. CE-52-2724.5000.080 before installation.

c. Be careful to replace the correct springs in the friction clutches. Although the springs are similar in appearance, they are not identical.

d. Be sure to install tapered pins so that the taper of the hole in the shaft and that of the hole in the part being pinned are matched and that the tapered pin is inserted in the proper direction. Before driving the pins, place a support under the parts to prevent bending or distortion.

e. When installing parts on shafts by means of setscrews, make sure the hole is in line with the flat on the shaft.

f. Some bent and distorted parts may be restored to shape and reused, provided no cracks result from the straightening process and that the hardened surfaces have not been softened by the repairs.

g. If the locking edges of lockwashers are rounded, install new ones.

h. Replace screws or nuts that have damaged heads or threads.

### 128. Removal and Replacement of Page Printer Chassis

#### a. Removal.

- (1) Remove the selector magnet and keyboard transmitter plugs from the receptacle connectors at the left of the page printer base. Be sure to turn the locking shields on the plugs fully counterclockwise when removing the plugs. *Failure to do so may result in damage to the devices that hold the plugs in position.*
- (2) Remove the motor stop plug from the receptacle connector at the right rear of the page printer base.
- (3) Tilt the left side of the page printer base upward and disconnect the cannon-type plug connector from the receptacle connector in the page printer base.
- (4) Remove the four socket head screws, lockwashers, and plain washers that

hold the feet of the frame to the vibration mounts on the page printer base. Lift the ends of the four grounding leads free of the mounting screws.

- (5) Remove the page printer chassis from the base by lifting upward and forward.

*b. Replacement.* The sequence for replacement is the reverse of the removal procedure.

## 129. Removal and Replacement of Keyboard Transmitter

### *a. Removal.*

- (1) Remove the page printer from the page printer base as described in paragraph 128a.
- (2) Remove the machine screw (43 and lockwasher 44, fig. 199) that hold the keyboard cable and cable clamp to the frame assembly. Remove the two socket head screws and lockwashers that hold the keyboard frame to the page printer frame; remove the keyboard transmitter assembly.

### *b. Replacement.*

- (1) Position the keyboard transmitter on the page printer frame. Engage the keyboard transmitter clutch yoke with the transmitter friction clutch driver plate and secure the keyboard frame to the page printer frame with two socket head screws and lockwashers. Secure the keyboard cable and cable clamp to the frame assembly with the machine screw (43 and lockwasher 44, fig. 199).
- (2) Replace the page printer on the page printer base as instructed in paragraph 128a.

## 130. Removal and Replacement of Tabulator and Indicator Assembly

### *a. Removal.*

- (1) Remove the two socket head machine screws (1, fig. 185), flat washers (2), and lockwashers (3) that hold the indicator cover (4) to the indicator frame (65); remove the indicator cover.
- (2) Remove the two socket head machine screws (5), flat washers (6), and

lockwashers (7) that hold the indicator frame to the standoffs on the keyboard frame.

- (3) Remove the two machine screws (39, fig. 192), lockwashers (40) and universal bar bracket (56) that hold the lower portion of the indicator frame (65, fig. 185) to the code bar guide studs of the keyboard frame.
- (4) Remove the tabulator and indicator assembly by carefully lifting and rotating it forward slightly to clear the blocking bar.

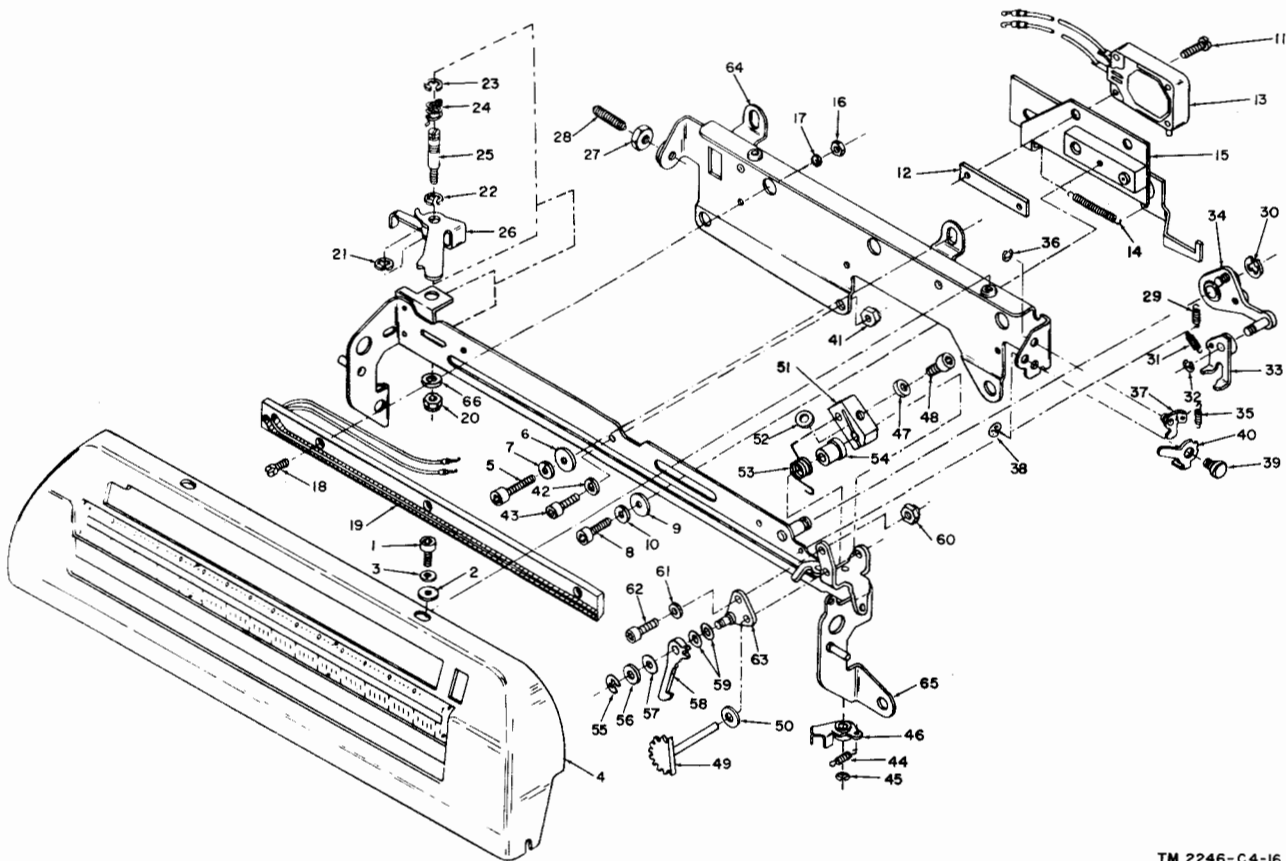
### *b. Replacement.*

- (1) Position the tabulator and indicator assembly on the keyboard frame so that the extensions on the blocking bars engage the ratchet wheel and ratchet pawl.
- (2) Install the two machine screws (39, fig. 192), lockwasher (40), and universal bar bracket (56) that hold the lower portion of the indicator frame (65, fig. 185) to the code bar guide studs on the keyboard.
- (3) Install the two socket head machine screws (5), lockwashers (7), and flat washers (6) to the standoffs on the keyboard frame.
- (4) Position the indicator cover (4) on the indicator frame (65); secure with two socket head machine screws (1), lockwashers (3), and flat washers (2).

## 131. Disassembly and Reassembly of Indicator Drive Shaft Assembly (TT-117/FG and TT-119/FG)

### *a. Disassembly.*

- (1) Remove the retainer ring (1, fig. 186) and the flat washer (2) from the end of the line indicator drive shaft (23).
- (2) Remove the retainer ring (3) from the bearing (4); remove the bearing from the indicator frame (65 fig. 185).
- (3) Remove the retainer ring (5, fig. 186) from the bushing in the indicator return spring housing (8); remove the retainer ring (6) from the line indicator drive shaft (23); slide the line indicator drive shaft to the right and



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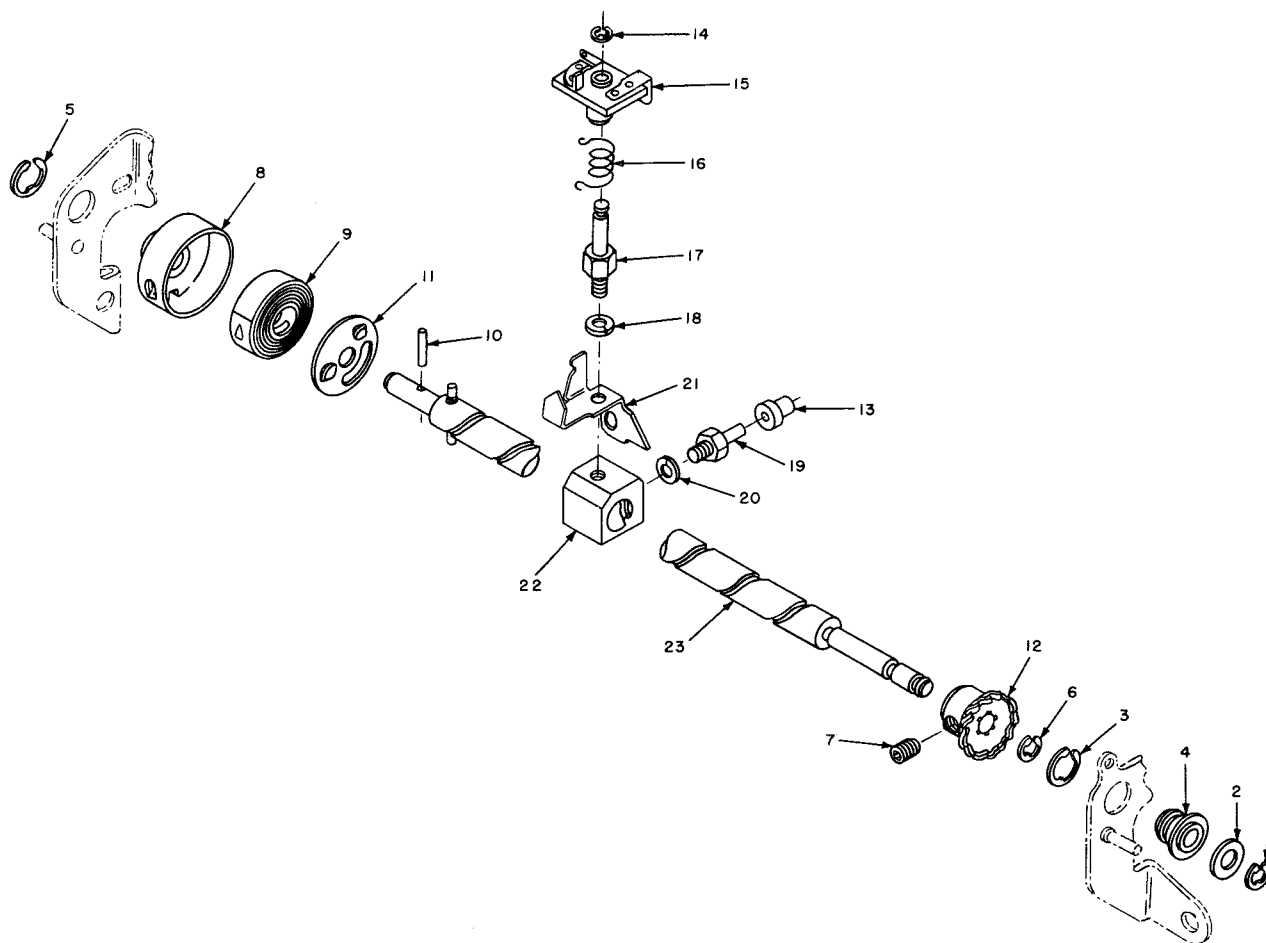
- |                                      |  |  |
|--------------------------------------|--|--|
| 1 Machine screw, 10393               | 24 Indicator return latch spring, 55974                    | 45 Retainer ring, 10969                          |
| 2 Flat washer, 10959                 | 25 Indicator return latch stud, 60058 (55973) <sup>a</sup> | 46 Ratchet wheel detent, 53240A                  |
| 3 Lockwasher, 10429                  | 26 Indicator return latch, 55972                           | 47 Lockwasher, 10421                             |
| 4 Indicator cover, 55945             | 27 Plain hexagonal nut, 10507                              | 48 Machine screw, 10003                          |
| 5 Machine screw, 10004               | 28 Setscrew, 10229   | 49 Stop pawl gear, 56553                         |
| 6 Flat washer, 10450                 | 29 Cam follower spring, 55959                              | 50 Washer, 52988                                 |
| 7 Lockwasher, 10429                  | 30 Retainer ring, 10949                                    | 51 Ratchet pawl stop lever, 56544                |
| 8 Machine screw, 10003               | 31 Ratchet pawl spring, 55958                              | 52 Washer, 56598                                 |
| 9 Flat washer, 10450                 | 32 Retainer ring, 10969                                    | 53 Spring, 56559                                 |
| 10 Lockwasher, 10429                 | 33 Ratchet pawl, 55897A                                    | 54 Bushing, 56552                                |
| 11 Machine screw, 10105              | 34 Cam follower, 55955A                                    | 55 Retainer ring, 10949                          |
| 12 Nut plate, 55829                  | 35 Detent spring, 55942                                    | 56 Washer, 50315                                 |
| 13 End-of-line switch, 56817A        | 36 Retainer ring, 10969                                    | 57 Spacer, 55948                                 |
| 14 Switch actuator spring, 55877     | 37 Detent, 55930A  | 58 Stop pawl, 56557                              |
| 15 Switch actuator mechanism, 56818A | 38 Retainer ring, 10969                                    | 59 Spacer, 55949                                 |
| 16 Nut, 10536                        | 39 Locking lever stud, 55926                               | 60 Self-locking hexagonal nut, 10500             |
| 17 Lockwasher, 10433                 | 40 Tabulator locking lever, 55927                          | 61 Washer, 10459                                 |
| 18 Screw, 10347                      | 41 Self-locking hexagonal nut, 10500 (10536) <sup>a</sup>  | 62 Adjusting screw, 10004                        |
| 19 Tab stop contact, 55951A          | 42 Flat washer, 10458 (10433) <sup>a</sup>                 | 63 Stop pawl adjustable plate, 56558A            |
| 20 Self-locking hexagonal nut, 10500 | 43 Machine screw, 10003 (10347) <sup>a</sup>               | 64 Tabulator frame, 60054A (55871A) <sup>a</sup> |
| 21 Retainer ring, 10960              | 44 Ratchet wheel detent spring, 53313                      | 65 Indicator frame, 60051 (56543A) <sup>a</sup>  |
| 22 Retainer ring, 10960              |  | 66 Lockwasher, 10429                             |
| 23 Retainer ring, 10960              |  |  |

<sup>a</sup> Reference designations in parentheses are applicable to TT-117/FG and TT-119/FG.

Figure 185. Indicator frame assembly, exploded view.

remove the line indicator drive shaft assembly from the tabulator and indicator frame assembly.

- (4) Loosen the setscrew (7) in the ratchet wheel (12); slide the line indicator drive shaft (23) to remove the indicator return spring housing (8) and the end of the line indicator drive shaft (23) from the frame.
  - (5) Unhook the indicator return spring housing (8) from the indicator return spring (9); remove the indicator return spring housing (8) from the line indicator drive shaft (23).
  - (6) Remove the indicator return spring (9) from the pin (10) in the line indicator drive shaft (23); drive the pin from the drive shaft. Remove the spring retainer (11) from the shaft. Remove the ratchet wheel (12) from the line indicator drive shaft (23).
  - (7) Remove the guide roller (13) from the tabulator drive pin stud (19); remove the tabulator drive pin stud (19) and the lockwasher (20) from the indicator carriage (22).
  - (8) Remove the retainer ring (14) from the top of the tab contact mounting pivot (17); remove the tab stop contact (15). Unhook the tab stop contact spring (16) from the tab stop contact (15) and from the space indicator (21); remove the spring from the contact (15).
  - (9) Remove the tab contact mounting pivot (17) and the lockwasher (18) from the indicator carriage (22). Remove the space indicator (21) from the indicator carriage (22).
  - (10) Remove the indicator carriage (22) from the line indicator drive shaft (23).
- b. Reassembly.*
- (1) Install the indicator carriage (22) on the line indicator drive shaft (23) with the tabulator contact mounting pivot hole up, and the tabulator drive pin stud hole facing the frame.
  - (2) Position the space indicator (21) on the indicator carriage (22) and attach the space indicator (21) to the indicator carriage (22) with the lockwasher (18) and the tab contact mounting pivot (17).
  - (3) Install the tab stop contact spring (16) on the tab stop contact (15); hook the upper end of the spring (16) on the ratchet tab on the contact (15). Install the tab stop contact (15) and the tab stop contact spring (16) on the tab contact mounting pivot (17); hook the lower end of the spring (16) on the space indicator (21). Install the retainer ring (14) on the end of the tab contact mounting pivot (17).
  - (4) Place the lockwasher (20) on the tabulator drive pin stud (19); install the tabulator drive pin stud (19) in the indicator carriage (22). Place the guide roller (13) on the tabulator drive pin stud (19).
  - (5) Slide the ratchet wheel (12) and the spring retainer (11) on the line indicator drive shaft (23). Drive the pin (10) in the line indicator drive shaft (23). Attach the inside end of the indicator return spring (9) to the pin (10).
  - (6) Position the indicator return spring housing (8) on the line indicator drive shaft (23) and on the indicator return spring (9); hook the outer end of the indicator return spring (9) to the tab in the indicator return spring housing (8).
  - (7) Install the assembled line indicator drive shaft (23) in the indicator frame; insert the ratchet wheel end of the line indicator drive shaft through the hole in the indicator frame first and then insert the bushing of the indicator return spring housing (8) in the hole at the other end of the indicator frame.
  - (8) Install the retainer ring (5) in the bushing on the indicator return spring housing (8). Install the retainer ring (6) on the line indicator drive shaft (23).
  - (9) Insert the bearing (4) in the indicator frame and secure it to the indicator frame with the retainer ring (3).
  - (10) Place the flat washer (2) over the end of the line indicator drive shaft (23); install the retainer ring (1).



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- |   |                                   |                                       |
|---|-----------------------------------|---------------------------------------|
| 1 Retainer ring, 10949                                      | 9 Indicator return spring         | 17 Tab contact mounting pivot, 55967  |
| 2 Flat washer, 55848  | 10 Pin, 10988                     | 18 Lockwasher, 10429                  |
| 3 Retainer ring, 10998                                      | 11 Spring retainer, 53252         | 19 Tabulator drive pin stud, 55968    |
| 4 Bearing, 53226  | 12 Ratchet wheel, 53230A          | 20 Lockwasher, 10429                  |
| 5 Retainer ring, 10998                                      | 13 Guide roller, 53246            | 21 Space indicator, 55970             |
| 6 Retainer ring, 10949                                      | 14 Retainer ring, 10969           | 22 Indicator carriage, 55966          |
| 7 Setscrew, 10201   | 15 Tab stop contact S13           | 23 Line indicator drive shaft, 56547A |
| 8 Indicator return spring housing, 56547A (includes item 9) | 16 Tab stop contact spring, 55469 |                                       |

Figure 186. Line indicator drive shaft assembly, exploded view (TT-117/FG and TT-119/FG).

(11) Adjust the line indicator drive shaft assembly as instructed in paragraphs 368, 369, 371, 372, 373, 377, and 384.

### 132. Disassembly and Reassembly of Indicator Drive Shaft Assembly (TT-117A/FG, TT-118/FG, and TT-119A/FG) (fig. 187)

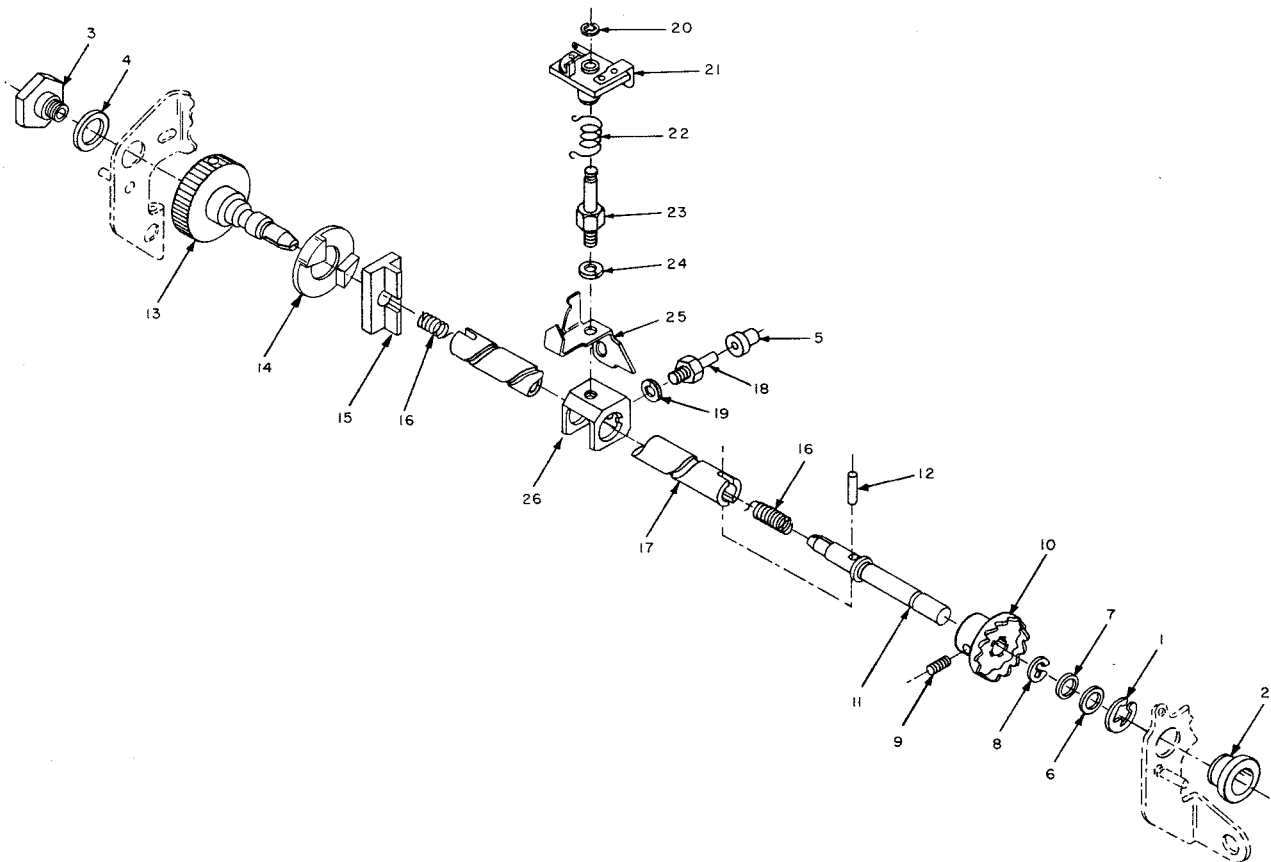
#### a. Disassembly.

(1) Loosen the support stud retaining screw (3) and let the drive shaft torsion spring (16) unwind itself.

Remove screw (3) and spring washer (4).

(2) Remove the spring retainer (1) and retainer ring (8) from the right hand drive shaft support stud (11). Slide off the bearing (2) and the spacers (6) and (7) through the indicator frame hole (65, fig. 185).

(3) Slide the right hand drive shaft support stud (11) as far as possible to the right. Slide the line indicator drive shaft (17) to the right and remove the line indicator drive shaft



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- |                                       |   |  |
|---------------------------------------|---|--|
| 1 Spring retainer ring, 10998         | 10 Ratchet wheel, 53230A                      | 19 Lockwasher, 10429                       |
| 2 Bearing, 60022                      | 11 Right-hand drive shaft support stud, 60017 | 20 Retainer ring, 10969                    |
| 3 Support stud retaining screw, 60020 | 12 Pin, 11065                                 | 21 Tab stop contact (S12) assembly, 55960A |
| 4 Spring washer, 10493                | 13 Drive shaft support stud, 60016            | 22 Tab stop contact spring, 55469          |
| 5 Guide roller, 53246                 | 14 Antibounce plate, 60019                    | 23 Tab contact mounting pivot, 55967       |
| 6 Spacer, 50831                       | 15 Drive shaft stop, 60018                    | 24 Lockwasher, 10429                       |
| 7 Spacer, 55948                       | 16 Drive shaft torsion spring, 60021          | 25 Space indicator, 55970                  |
| 8 Retainer ring, 10949                | 17 Line indicator drive shaft, 60027          | 26 Indicator carriage, 60026               |
| 9 Setscrew, 10201                     | 18 Tabulator drive pin stud, 55968            |  |

Figure 187. Line indicator drive shaft assembly, exploded view (TT-117A/FG, TT-119A/FG, and TT-118/FG).

- assembly from the indicator frame assembly. (Be sure to remove the guide roller (5) from the stud (18) since it is not secured to it.)
- (4) Remove the right hand drive shaft support stud (11) with the ratchet wheel (10) from the line indicator drive shaft assembly. Remove the indicator drive shaft torsion spring (16). Loosen the set screw (9) and remove the ratchet wheel (10).
  - (5) Remove the indicator drive shaft support stud (13) from the line indicator drive shaft assembly. Remove the indicator drive shaft stop (15) and the antibounce plate (14) from the indicator drive shaft support stud (13).
  - (6) Unscrew tabulator drive pin stud (18) and the lockwasher (19) from the indicator carriage (26).
  - (7) Remove the retainer ring (20) from the top of the tab contact mounting pivot (23); remove the tab stop contact assembly (21). Unhook the tab stop contact spring (22) from the tab stop contact assembly and from the space indicator (25); remove the spring.

- (8) Remove the tab contact mounting pivot (23), the lockwasher (24), and the space indicator (25) from the indicator carriage (26).
- (9) Remove the indicator carriage (26) from the line indicator drive shaft (17).

*b. Reassembly.*

- (1) Install the indicator carriage (26) on the line indicator drive shaft (17) with the tabulator contact mounting pivot hole up and the tabulator drive pin stud hole facing the frame.
- (2) Position the space indicator (25) on the indicator carriage (26) and attach the space indicator (25) to the indicator carriage (26) with the lockwasher (24) and the tab contact mounting pivot (23).
- (3) Install the tab stop contact spring (22) on the tab stop contact (21); hook the upper end of the spring (22) on the ratchet tab on the contact (21). Install the tab stop contact (21) and the tab stop contact spring (22) on the tab contact mounting pivot (23); hook the lower end of the spring (22) on the space indicator (25). Install the retainer ring (20) on the end of the tab contact mounting pivot (23).
- (4) Place the lockwasher (19) on the tabulator drive pin stud (18); install the tabulator drive pin stud (18) in the indicator carriage (26).
- (5) Replace the antibounce plate (14) and the indicator drive shaft stop (15) on the indicator drive shaft support stud (13). Insert the indicator drive shaft support stud (13) into the line indicator drive shaft (17) with the flat side of the antibounce plate (14) seated against the face of the knurled knob of the support stud (13) and the indicator drive shaft stop (15) seated flush against the antibounce plate (14). Be sure that the key on the indicator drive shaft stop (15) fits snugly into the slot at the end of the indicator drive shaft.
- (6) Insert the indicator drive shaft torsion spring (16) into the opposite end of the line indicator drive shaft

(17); turn the spring until the straight coil end locks into the slot at the end of support stud (13) within the drive shaft.

- (7) Install the ratchet wheel (10) on the support stud (11) with the ratchet wheel (10) collar against the shoulder stop on the support stud (11). Secure the ratchet wheel with the setscrew (9).
- (8) Before inserting the support stud (11) into the drive shaft (17), be sure that the slotted end of the support stud (11) keys over the straight coil end of the torsion spring (16) within the drive shaft (17). Slide the support stud (11) into the drive shaft (17) until the pin (12) keys into the slotted end of shaft (17).
- (9) Install the guide roller (5) on the tabulator drive pin stud (18). Install the assembled line indicator drive shaft (17) into the indicator frame by first inserting the right end of the support stud (11) through the bearing hole of the indicator frame, and then positioning the left end of stud (13) to receive the support screw (3) and spring washer (4). Place the spring washer (4) on the support screw (3) and install the screw (3) into the end of the support stud (13) through the hole in the indicator frame. Do not tighten.
- (10) Install the retainer ring (8) into the groove on the support stud (11). Slide on the spacers (6) and (7) against the retainer ring (8). Install the bearing (2) through the hole in the indicator frame and insert the spring retainer ring (1) into the grooves on the bearing (2). Adjust the entire assembly as instructed in paragraph 370.

### **133. Disassembly and Reassembly of the Indicator Frame Assembly (TT-117/FG and TT-119/FG)**

*a. Disassembly.*

- (1) Remove the machine screw (8) flat washer (9), and lockwasher (10) that attach the switch actuator mechanism



- (15) to the indicator frame (65); remove the switch actuator mechanism from the indicator frame.
- (2) Remove the two machine screws (11) that attach the end-of-line switch (13) to the switch actuator mechanism (15); remove the end-of-line switch (13) and the nut plate (12).
- (3) Unhook the end of the switch actuator spring (14) from the hole in the switch actuator mechanism (15), and the other end from the hole in the actuator arm; remove the spring.
- (4) Remove the three nuts (16) and lockwashers (17) from the screws (18) in the tab stop contact (19); disconnect the plugs at the ends of the wires, and remove the tab stop contact (19) from the tabulator frame (64).
- (5) Hold the indicator return latch stud (25) securely and remove the self-locking hexagonal nut (20) that attaches the stud (25) to the tab on the indicator frame (65); remove the stud assembly from the indicator frame (65).
- (6) Remove the retainer rings (21, 22, and 23); remove the indicator return latch spring (24) and the indicator return latch (26) from the indicator return latch stud (25).
- (7) Remove the plain hexagonal nut (27) and the setscrew (28) that hold the tabulator mechanism to the tabulator frame (64); remove the tabulator mechanism.
- (8) Remove one end of the cam follower spring (29) from the spring post on the cam follower (34), and the other end from the hole in the indicator frame (65); remove the cam follower spring (29).
- (9) Remove the retainer ring (30) from the mounting stud on the indicator frame (65).
- (10) Remove one end of the ratchet pawl spring (31) from the spring post on the cam follower (34), and the other end from the hole in the ratchet pawl (33); remove the ratchet pawl spring (31).
- (11) Remove the retainer ring (32) from the mounting stud on the cam follower (34); remove the ratchet pawl (33).
- (12) Remove the cam follower (34) from the mounting stud on the indicator frame (65).
- (13) Remove the end of the detent spring (35) from the detent (37), and the other end from the notch in the tabulator frame (64); remove the spring detent (35).
- (14) Remove the retainer ring (36) from the mounting stud on the detent (37); remove the detent (37) from the tabulator frame (64).
- (15) Remove the retainer ring (38) from the locking lever stud (39); remove the locking lever stud (39) and the tabulator locking lever (40) from the tabulator frame (64).
- (16) Remove the three self-locking hexagonal nuts (41), lockwashers (42), and machine screws (43) that secure the tabulator frame (64) to the indicator frame (65).
- (17) Remove one end of the ratchet wheel detent spring (44) from the hole in the ratchet wheel detent (46) and the other end from the hole in the indicator frame (65); remove the ratchet wheel detent spring (44).
- (18) Remove the retainer ring (45) from the mounting stud on the indicator frame (65); remove the ratchet wheel detent (46) from the indicator frame (65).
- (19) Remove the machine screw (48) and lockwasher (47) from the ratchet pawl stop lever (51).
- (20) Remove the stop pawl gear (49) and washer (50) from the indicator frame (65); remove the ratchet pawl stop lever (51), washer (52), spring (53), and bushing (54).
- (21) Remove the retainer ring (55) from the stud of the stop pawl adjustable plate (63); remove the washer (56), spacers (57), stop pawl (58) and spacers (59) from the stud.
- (22) Remove the self-locking hexagonal nut (60), adjusting screw (62), and

washer (61); remove the stop pawl adjustable plate (63).

*b. Reassembly.*

- (1) Position the ratchet wheel detent (46) on the mounting stud on the indicator frame (65); install the retainer ring (45) on the end of the mounting stud.
- (2) Hook one end of the ratchet wheel detent spring (44) in the hole in the ratchet wheel detent (46) and the other end in the hole in the indicator frame (65).
- (3) Position the stop pawl adjustable plate (63) to the indicator frame (65); attach the stop pawl adjustable plate (63) to the indicator frame (65) with the adjusting screw (62), washer (61), and self-locking hexagonal nut (60).
- (4) Install the spacers (59), stop pawl (58), spacers (57), and washer (56) to the stop pawl adjustable plate (63) with the retainer ring (55).
- (5) Position the spring (53), bushing (54), and ratchet pawl stop lever (51), with the washer (52) inserted in the indicator frame (65), and insert the washer (50) and stop pawl gear (49) in the opening of the stop pawl adjustable plate.
- (6) Install the machine screw (48) and lockwasher (47) in the ratchet pawl stop lever (51).
- (7) Secure the indicator frame (65) to the tabulator frame (64) with the machine screws (43), lockwashers (42), and self-locking hexagonal nuts (41).
- (8) Position the tabulator locking lever (40) to the tabulator frame (64); attach to the tabulator locking lever (40) to the tabulator frame (64) with the locking lever stud (39) and the retainer ring (38).
- (9) Insert the mounting stud on the detent (37) in the tabulator frame (64) and position the detent (37) on the indicator frame; attach the detent (37) to the frame with the retainer ring (36).
- (10) Hook one end of the detent spring (35) in the hole in the detent (37) and the other end in the notch in the tabulator frame (64).
- (11) Position the cam follower (34) on the mounting stud on the indicator frame (65).
- (12) Position the ratchet pawl (33) on the mounting stud on the cam follower (34); attach the ratchet pawl (33) to the cam follower (34) with the retainer ring (32).
- (13) Hook one end of the ratchet pawl spring (31) in the hole in the ratchet pawl (33) and the other end of the spring on the spring post on the cam follower (34).
- (14) Install the retainer ring (30) on the mounting stud on the indicator frame (65), holding the cam follower (34) in place.
- (15) Hook one end of the cam follower spring (29) in the hole in the indicator frame (65) and the other end on the spring post on the cam follower (34).
- (16) Position the tabulator mechanism on the indicator frame assembly; secure with the setscrew (28) and plain hexagonal nut (27).
- (17) Install the indicator return latch (26) on the indicator return latch stud (25) and install the retainer rings (21 and 22) to hold the arm (26) in position on the stud (25).
- (18) Hook one end of the indicator return latch spring (24) in the slot in the stud (25) and the other end in the notch in the latch (26). Install the retainer ring (23) to hold the end of the spring (24) on the stud (25).
- (19) Install the stud assembly in the hole in the tab on the indicator frame (65); position the stud (25) with a screwdriver and hold in position while attaching it to the indicator frame (65) with the self-locking hexagonal nut (20).
- (20) Position the tab stop contact (19) on the indicator frame (65); attach the tab stop contact (19) to the indicator frame with three machine screws (18), lockwashers (17), and nuts (16).

- (21) Hook one end of the switch actuator spring (14) in the hole in the switch actuator mechanism (15) and the other end in the hole in the arm.
- (22) Position the nut plate (12) in back and the end of line switch (13) in front of the switch actuator mechanism (15); attach the end-of-line switch (13) to the switch actuator mechanism (15) with two machine screws (11).
- (23) Position the switch actuator mechanism (15) on the indicator frame (65); attach the switch actuator mechanism to the indicator frame with lockwasher (10), flat washer (9), and machine screw (5).
- (24) Adjust the indicator frame assembly as directed in paragraphs 377, 378, 380, 381, 382, 383, 384, 394, and 395.

**134. Disassembly and Reassembly of Indicator Frame Assembly (TT-117A/FG, TT-119A/FG, and TT-118FG)**  
(fig. 185)

*a. Disassembly.*

- (1) Perform the disassembly procedure as described in paragraph 133a (1) through (4).
- (2) Remove the retainer rings (23), (22), and (21) from the stud (25). Unhook the upper end of the indicator return latch spring (24) from the slot in the stud (25); unhook the lower end of spring (24) from the notch on the indicator return latch (26).
- (3) Remove the self-locking hexagonal nut (20) and lockwasher (66). Remove the stud (25) by pulling it upward through the indicator return latch (26) and the bracket on the indicator frame (65). Remove the spring (24) and indicator return latch (26).
- (4) Perform the remainder of the disassembly as described in paragraph 133a(7) through (22).

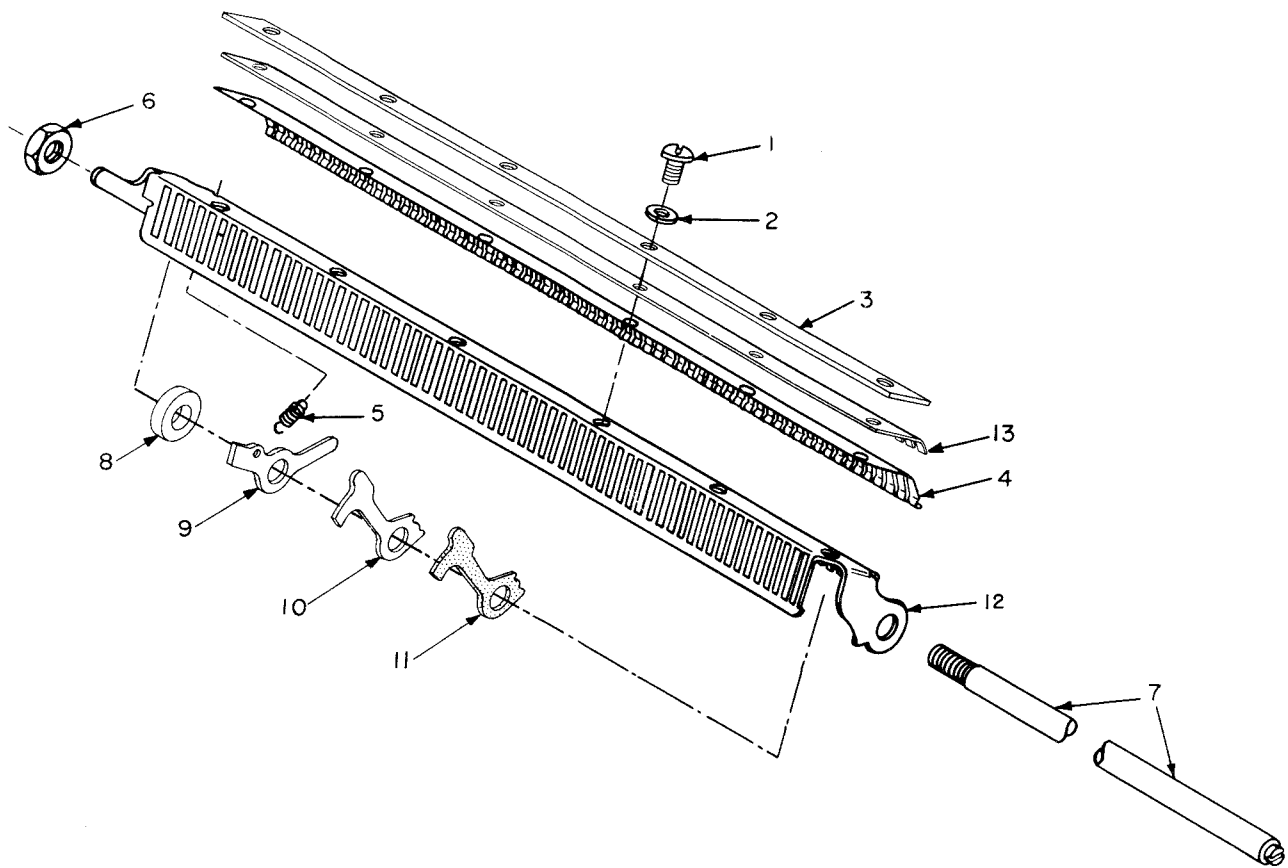
*b. Reassembly.*

- (1) Perform the reassembly procedures as described in paragraphs 133b(1) through (16).
- (2) Install the stud (25) through the hole in the bracket of the indicator frame (65), through the indicator return latch spring (24), through the indicator return latch (26), and through the hole in the lower tab of the bracket on the indicator frame (65).
- (3) Secure the above assembly with the lockwasher and self-locking hexagonal nut (20). Install the retainer rings (21) and (22) to hold the indicator return latch (26) in position on the stud (25).
- (4) Hook the upper end of the indicator return latch spring (24) in the slot in the stud (25) and the lower end in the notch in the indicator return latch (26). Install the retainer ring (23) to hold the upper end of the spring (24) in position on the stud (25). Tighten the hexagonal nut (20) while holding the stud (25) with a screw driver.
- (5) Perform the remainder of the reassembly procedure as described in paragraphs 133b(20) through (24).

**135. Disassembly and Reassembly of Tabulator Mechanism**  
(fig. 188)

*a. Disassembly*

- (1) Remove the tabulator mechanism from the indicator frame assembly as described in paragraph 133a(7).
- (2) Remove the six machine screws (1) and lockwashers (2) that hold the tab rack mounting plate (3) and the detent spring plate (4) to the tab mounting guide (12); remove the tab rack mounting plate (3) and the detent spring plate (4) from the tab mounting guide (12). The tabulator mechanism assembly on Teletypewriters TT-117A/FG, TT-119A/FG, and TT-118/FG contains a detent spring



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- |   |                               |   |
|---|-------------------------------|---|
| 1 Machine screw, 10374 (10375 <sup>a</sup> )          | 5 Tab crank arm spring, 55941 | 10 White tab set lever, 55933                     |
| 2 Lockwasher, 10432                                   | 6 Plain hexagonal nut, 10507  | 11 Red tab set lever, 55934                       |
| 3 Tab rack mounting plate, 55938                      | 7 Tab lever shaft, 55928      | 12 Tab mounting guide, 55935A                     |
| 4 Detent spring plate, 55939<br>(60065 <sup>a</sup> ) | 8 Flat washer, 55929          | 13 Detent spring plate helper, 60064 <sup>a</sup> |
|   | 9 Tab crank arm, 55937        |   |

<sup>a</sup> Reference designation applicable only to Teletypewriters TT-117/FG, TT-118/FG, and TT-119A/FG.

Figure 188. Tabulator mechanism, exploded view.

plate helper (13) between the tab rack mounting plate (3) and the detent spring plate (4).

- (3) Unhook one end of the tab crank arm spring (5) from the hole in the tab rack mounting plate (3) and the other end from the hole in the tab crank arm (9); remove the spring (5).
- (4) Hold the tab lever shaft (7) from turning; remove the plain hexagonal nut (6) from the shaft (7).
- (5) Hold the assembly over a clean container; work the tab lever shaft (7) out of the tab crank arm (9), the flat washers (8), the white tab set levers (10), and the red tab set levers (11). Remove the tab lever shaft (7) from the tab mounting guide (12).

*b. Reassembly.*

- (1) Insert the threaded end of the tab lever shaft (7) part of the way into the end of the tab mounting guide (12). Place the white tab set levers (10) and the red tab set levers (11) on the tab lever shaft so that, every fifth tab set lever from the left end of the tabulator mechanism is a red lever.
- (2) Refer to figure 188 and complete the reassembly. The reassembly sequence is the reverse of the disassembly sequence described in *a* above.
- (3) Install the tabulator mechanism on the tabulator and indicator frame assembly as described in paragraph 133 b(16).

- (4) Adjust the tabulator mechanism as explained in paragraphs 393 and 395.

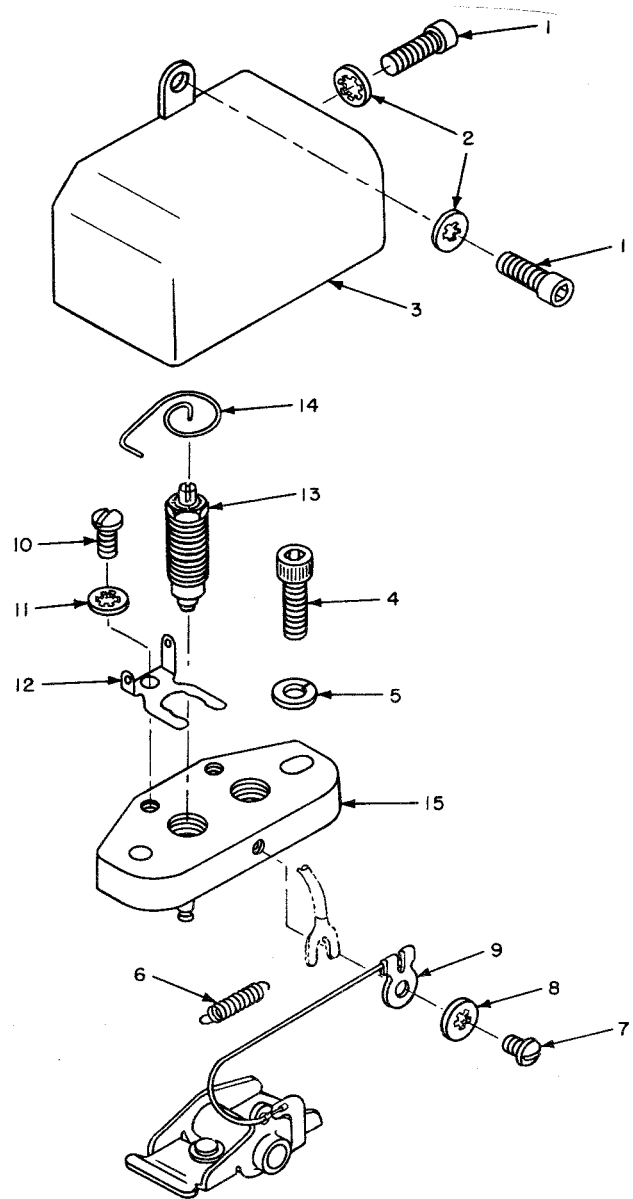
### 136. Disassembly and Reassembly of Sequential Transmitter Contacts

#### a. Disassembly.

- (1) Remove the tabulator and indicator assembly as instructed in paragraph 130a.
- (2) Remove the two machine screws (1, fig. 189) and lockwashers (2) that attach the contact cover (3) to the keyboard frame; remove the cover (3).
- (3) Remove the two machine screws (4) and two lockwashers (5) that attach the contact mounting (15) to the keyboard frame.
- (4) Unhook the end of the contact ball spring (6) from the spring post on the contact mounting (15), and the other end from the hole in the transmitter contact (9).
- (5) Remove the machine screw (7), internal tooth lockwasher (8), and the two electrical terminal lugs from the side of the contact mounting (15).
- (6) Remove the two machine screws (10) and two internal tooth lockwashers (11) that attach the two transmitter contact terminals (12) to the contact mounting (15).
- (7) Unsolder the two spiraled electrical wires from the top of the transmitter contacts (13); remove the spiraled electrical wire and transmitter contact terminal assemblies from the contact mounting (15).
- (8) Remove the two transmitter contacts (13) from the contact mounting (15).

#### b. Reassembly.

- (1) Reassemble the transmitter contacts as indicated in figure 189; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the tabulator and indicator assembly as instructed in paragraph 130b.



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1 Machine screw, 10001	10 Machine screw, 10301
2 Lockwasher, 10403	11 Internal tooth lockwasher, 10403
3 Contact cover, 54681A	12 Transmitter contact terminal, 51597
4 Machine screw, 10009	13 Transmitter contact, 51588A
5 Lockwasher, 10430	14 Electrical wire, 51610
6 Contact ball spring, 51548	15 Contact mounting, 51595A
7 Machine screw, 10301	
8 Internal tooth lockwasher, 10403	
9 Transmitter contact E4	

Figure 189. Sequential transmitter contacts, exploded view.

### 137. Disassembly and Reassembly of Keyboard Transmitter Sensing and Selector Levers

#### *a. Disassembly.*

- (1) Remove the keyboard transmitter from the page printer as described in paragraph 129a.
- (2) Remove the tabulator and indicator assembly as instructed in paragraph 130a.
- (3) Remove the setscrew (1, fig. 190) that holds the sensing lever pivot stud (2) to the keyboard frame; remove the sensing lever pivot stud and catch the flat washers (3, 4, 6, 8, 10, and 12) and sensing levers (5, 7, 9, 11, and 13) as they are released by the stud.
- (4) Remove the six selector lever springs (14) from the selector levers and from the selector lever spring bracket (43). Remove the sensing lever locking bail spring (15) from the sensing lever locking bail (18) and from the sensing lever spring bracket (43).
- (5) Remove the self-locking hexagonal nut (16) that holds the sensing lever locking bail bearing (17) and the sensing lever locking bail (18) to the selector lever pivot post (40); remove the locking bail bearing and locking lever.
- (6) Remove the spacing collar (19) and the six selector levers (20, 23, 26, 29, 32, and 35), the six bearing shoes (21, 24, 27, 30, 33, and 36), and the six flat washers (22, 25, 28, 31, 34, and 37) from the selector lever pivot post, alternating selector lever, bearing shoe, and flat washer until all are removed.
- (7) Remove the flat washer (38) from the selector lever pivot post (40).
- (8) Remove the setscrew (39) that holds the selector lever pivot post (40) to the keyboard frame; remove the pivot post.
- (9) Remove the two socket head machine screws (41) and lockwashers (42) that hold the selector lever spring bracket (43) to the keyboard frame; remove the spring bracket.
- (10) Remove the two machine screws (44) and lockwashers (45) that hold

the adjusting plate (46) and the selector levers comb (50) to the keyboard frame; remove the adjusting plate and the selector levers comb.

- (11) Remove the two socket head screws (47) and lockwashers (48) that hold the stop selector lever latch (49) to the selector levers comb (50); remove the stop selector lever latch.

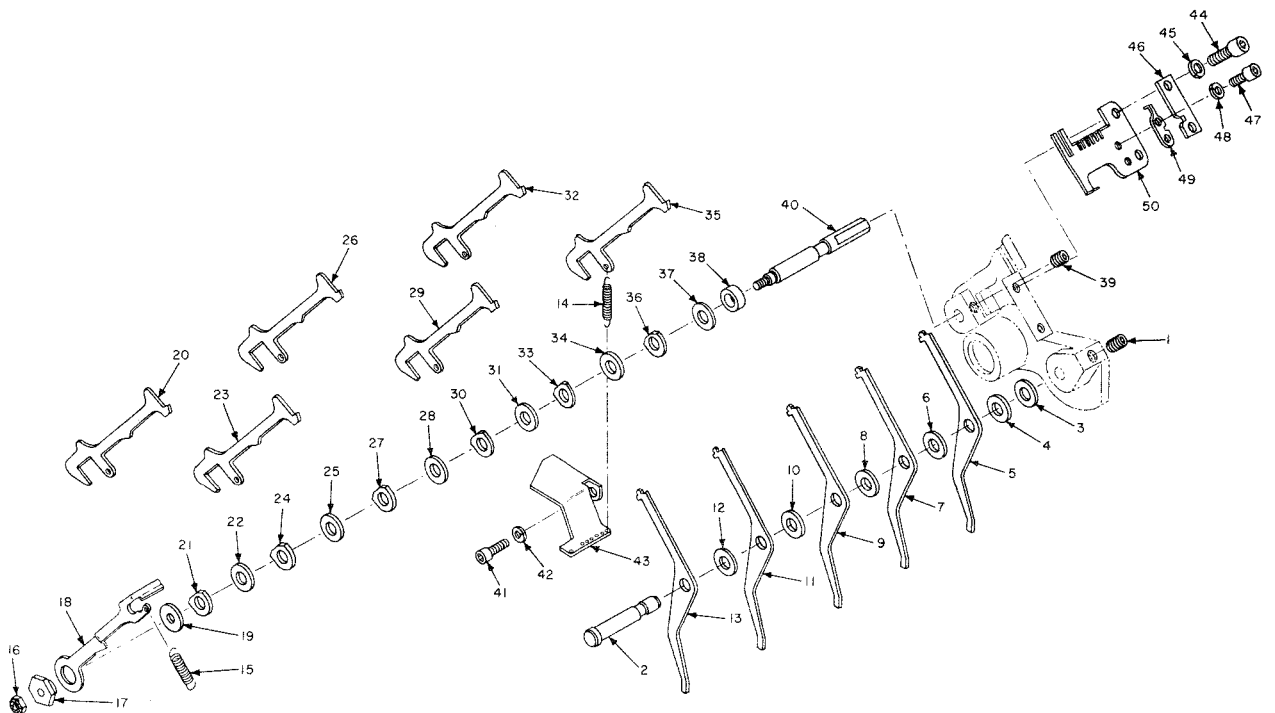
#### *b. Reassembly.*

- (1) Reassemble the keyboard transmitter sensing and selector levers as indicated in figure 190; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the tabulator and indicator assembly as described in paragraph 130b.
- (3) Install the keyboard transmitter on the page printer as described in paragraph 129b.
- (4) Adjust the selector and sensing levers as directed in paragraphs 361 through 365.

### 138. Disassembly and Reassembly of Keyboard Transmitter Camshaft

#### *a. Disassembly.*

- (1) Remove the keyboard transmitter from the page printer as described in paragraph 129a.
- (2) Remove the tabulator and indicator assembly, as described in paragraph 130a.
- (3) Remove the sensing and selector levers as instructed in paragraph 137a.
- (4) Remove the two setscrews (1, fig. 191) that attach the clutch yoke (2) to the transmitter camshaft (3); remove the clutch yoke from the transmitter camshaft and remove the transmitter camshaft from the keyboard frame.
- (5) Remove the machine screws (4), flat washers (5), and lockwashers (6), that hold the ball bearing (7) in the keyboard frame; remove the ball bearing (7), collar (8), and the ball bearing (9) from the frame.



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- |  |   |   |
|--|---|---|
| 1 Setscrew, 10210  | 18 Sensing lever locking bail, 51567                              | 36 Bearing shoe                         |
| 2 Sensing lever pivot stud, 51562                        | 19 Spacing collar, 51555  | 37 Flat washer                          |
| 3 Flat washer, 53526                                     | 20 Selector lever, 51598A (includes items 23, 26, 29, 32, and 35) | 38 Flat washer, 56252                   |
| 4 Flat washer, 51047 (includes items 6, 8, 10, and 12)   | 21 Bearing shoe, 51644A (includes items 24, 27, 30, 33, and 36)   | 39 Setscrew, 10210                      |
| 5 Sensing lever 51573A (includes items 7, 9, 11, and 13) | 22 Flat washer 50147 (includes items 25, 28, 31, 34, and 37)      | 40 Selector lever pivot post, 54673     |
| 6 Flat washer  | 23 Selector lever   | 41 Machine screw, 10003                 |
| 7 Sensing lever  | 24 Bearing shoe   | 42 Lockwasher, 10429                    |
| 8 Flat washer  | 25 Flat washer  | 43 Selector lever spring bracket, 54672 |
| 9 Sensing lever  | 26 Selector lever   | 44 Screw, 10008                         |
| 10 Flat washer   | 27 Bearing shoe   | 45 Lockwasher, 10430                    |
| 11 Sensing lever   | 28 Flat washer  | 46 Adjusting plate, 55869               |
| 12 Flat washer   | 29 Selector lever   | 47 Screw, 10002                         |
| 13 Sensing lever   | 30 Bearing shoe   | 48 Lockwasher, 10429                    |
| 14 Selector lever spring, 50902                          | 31 Flat washer  | 49 Stop selector lever latch, 55870     |
| 15 Sensing lever locking bail spring, 51575              | 32 Selector lever   | 50 Selector levers comb, 51558          |
| 16 Self-locking hexagonal nut, 10500                     | 33 Bearing shoe   |   |
| 17 Sensing lever locking bail bearing, 51557             | 34 Flat washer  |   |
|  | 35 Selector lever   |   |

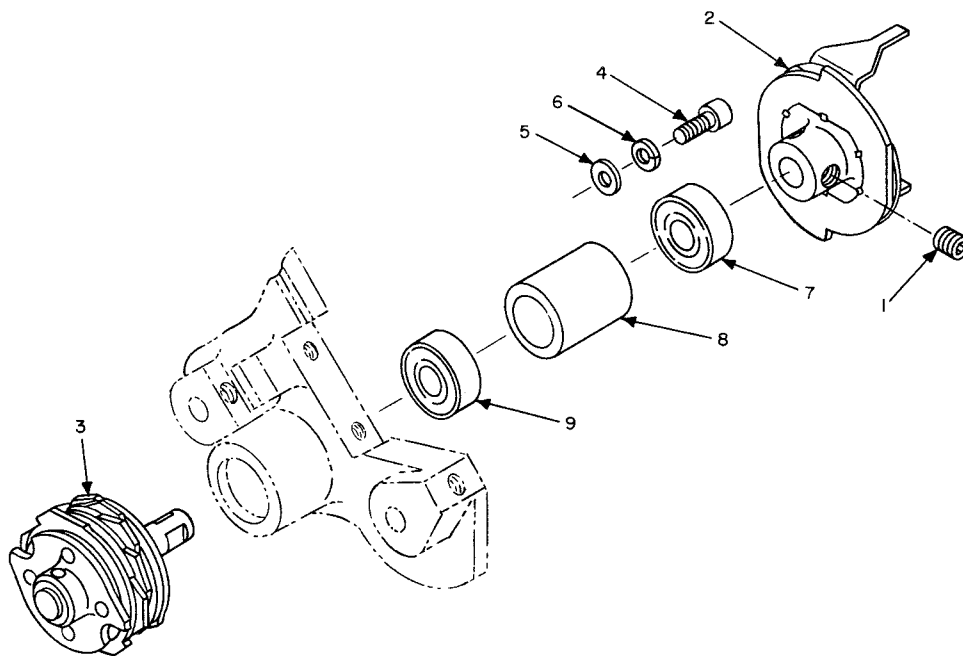
Figure 190. Keyboard-transmitter sensing and selector levers, exploded view.

*b. Reassembly.*

- (1) Install the ball bearing (9), the collar (8), and the ball bearing (7) into the bearing opening in the keyboard frame; hold the bearings and collar in the frame with the two flat washers (5), lockwashers (6), and machine screws (4).
- (2) Insert the transmitter camshaft (3) through the bearings; position the clutch yoke (2) on the transmitter camshaft and attach the clutch yoke

to the transmitter camshaft with two setscrews (1).

- (3) Reassemble the sensing and selector levers as described in paragraph 137*b*.
- (4) Replace the tabulator and indicator assembly as described in paragraph 130*b*.
- (5) Install the keyboard on the page printer as described in paragraph 129*b*.
- (6) Adjust the transmitter camshaft as explained in paragraph 373.



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1 Setscrew, 10209  
 2 Clutch yoke, 54695A  
 3 Transmitter camshaft, 54690A

4 Machine screw, 10003  
 5 Flat washer, 10458  
 6 Lockwasher, 10429

7 Ball bearing, 10753  
 8 Collar, 51599  
 9 Ball bearing, 10753

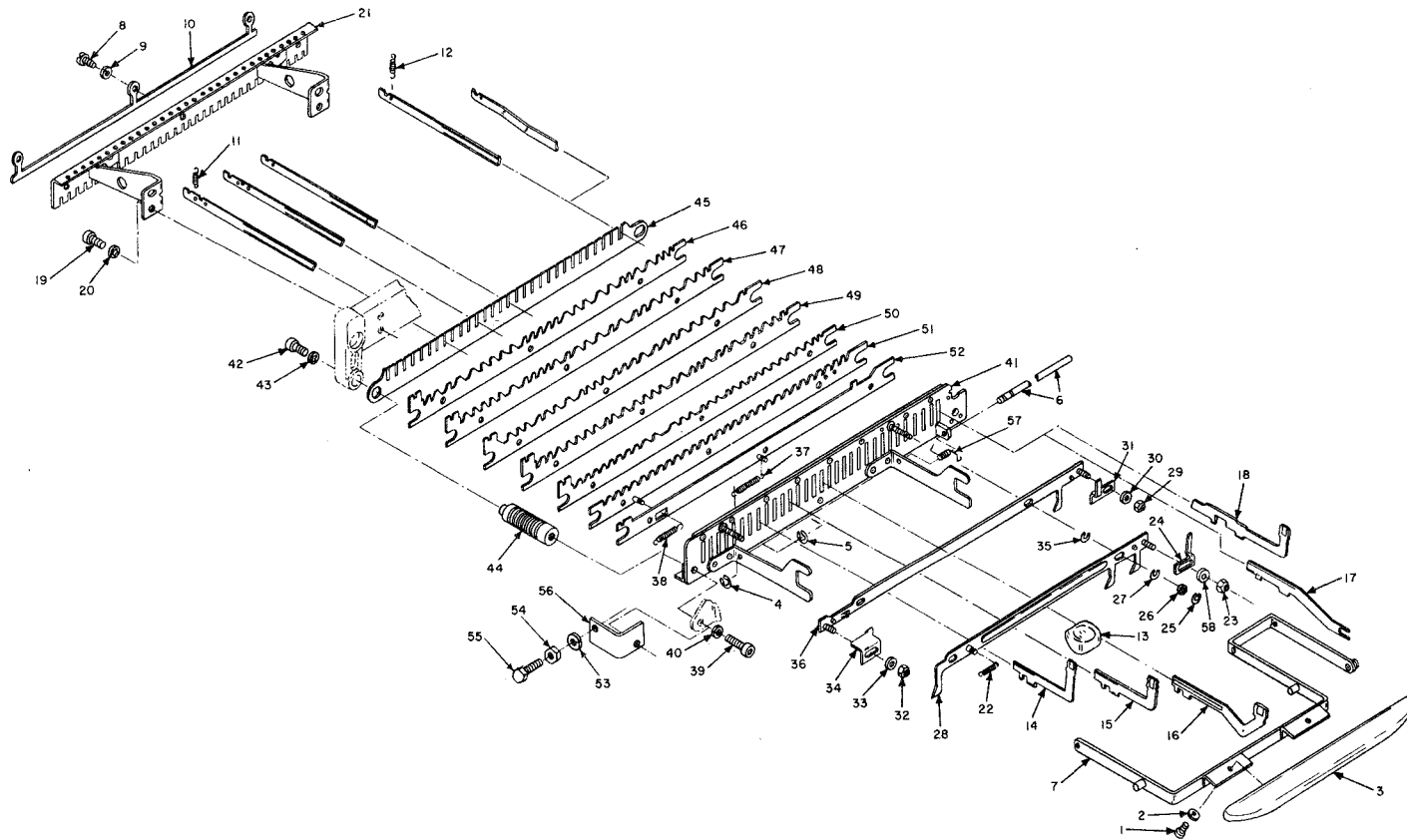
Figure 191. Keyboard transmitter camshaft, exploded view.

### 139. Disassembly and Reassembly of Key Levers and Code Bars

#### a. Disassembly.

- (1) Remove the keyboard-transmitter from the page printer as described in paragraph 129a.
- (2) Remove the tabulator and indicator assembly as described in paragraph 130a.
- (3) Remove the two machine screws (1, fig. 192) and lockwashers (2) that hold the spacebar (3) to the spacebar arm assembly (7); remove the spacebar.
- (4) Remove the two retainer rings (4) and (5) that hold the spacebar arm shaft (6) to the front key lever guide (41); remove the spacebar arm shaft, spring (57), and spacebar arm assembly (7).
- (5) Remove the three machine screws (8) and lockwashers (9) that hold the key lever locking bar (10) to the key lever mounting bracket (21); remove the locking bar.
- (6) Remove the 31 key lever springs (11) and the two space bar springs (12).
- (7) Remove the assembled keytops (13) and short key levers (14), keytops and medium key levers (15), and keytops and long key levers (16). Remove the keytops from the key levers only if either is damaged.
- (8) Remove the spacebar lever (17) and the repeat key lever (18).
- (9) Remove the four machine screws (19) and lockwashers (20) that hold the key lever mounting bracket (21) to the keyboard casting; remove the key lever mounting bracket.
- (10) Remove the function blocking bar spring (22) from the function blocking bar (28).
- (11) Remove the self-locking hexagonal nut (23) that holds the function blocking arm (24) to the function blocking bar (28); remove the function blocking arm.
- (12) Remove the two retainer rings (25), the lubricating pads (26), and re-





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- |                                  |  |  |                                  |
|----------------------------------|--|--|----------------------------------|
| 1 Machine screw, 10001           | 18 Repeat key lever, 55915             | 32 Self-locking hexagonal nut, 10551       | 45 Middle key lever guide, 52915 |
| 2 Lock washer, 10429             | 19 Machine screw, 10015                | 33 Flat washer, 10457                      | 46 Code bar, 53299               |
| 3 Space bar, 53944A              | 20 Lockwasher, 10431                   | 34 Carriage-return latch lever, 55975      | 47 Code bar, 53298               |
| 4 Retainer ring, 10969           | 21 Key lever mounting bracket, 54963A  | 35 Retainer ring, 10969                    | 48 Code bar, 53297               |
| 5 Retainer ring, 10969           | 22 Function blocking bar spring, 50919 | 36 Carriage-return blocking bar, 55823A    | 49 Code bar, 53296               |
| 6 Space bar arm shaft, 55862     | 23 Self-locking hexagonal nut, 10551   | 37 Tabulated bar spring, 54666             | 50 Code bar, 53295               |
| 7 Space bar arm assembly, 55875A | 24 Function blocking arm, 55976        | 38 Universal code bar return spring, 51136 | 51 Universal bar, 51134A         |
| 8 Machine screw, 10304           | 25 Retainer ring, 10969                | 39 Machine screw, 10024                    | 52 Tabulator bar, 55850A         |
| 9 Lockwasher, 10429              | 26 Lubricating pad, 55986              | 40 Lockwasher, 10431                       | 53 Lockwasher, 10429             |
| 10 Key lever locking bar, 53210  | 27 Retainer ring, 10969                | 41 Front key lever guide, 55860A           | 54 Hexagonal nut, 10512          |
| 11 Key lever spring, 50941       | 28 Function blocking bar, 55822A       | 42 Machine screw, 10017                    | 55 Hexagonal head screw, 10080   |
| 12 Space bar spring, 53974       | 29 Self-locking hexagonal nut, 10551   | 43 Lockwasher, 10431                       | 56 Universal bar bracket, 54642  |
| 13 Keytop, 54001                 | 30 Flat washer, 10457                  | 44 Code bar guide stud, 55866              | 57 Spring, 56688                 |
| 14 Short key lever, 55917        | 31 Carriage-return blocking arm, 55977 |  | 58 Flat washer, 10457            |
| 15 Medium key lever, 55918       |  |  |                                  |
| 16 Long key lever, 53969         |  |  |                                  |
| 17 Space bar lever, 55916        |  |  |                                  |

Figure 192. Key lever and code bars, exploded view.

maining two retainer rings (27) that hold the tabulator function blocking bar to the front key lever guide (41): remove the function blocking bar.

- (13) Remove the self-locking hexagonal nut (29) and flat washer (30) that hold the carriage-return blocking arm (31) to the carriage-return blocking bar (36); remove the carriage-return blocking arm.
- (14) Remove the self-locking hexagonal nut (32) and flat washer (33) that hold the carriage-return latch lever (34) to the carriage-return blocking bar (36); remove the carriage-return latch lever.
- (15) Remove the two retainer rings (35) that hold the carriage-return blocking bar (36) to the studs on the front key lever guide (41); remove the carriage-return blocking bar.
- (16) Remove the tabulator bar spring (37) and the universal code bar return spring (38). Remove the front key lever guide (41).
- (17) Remove the two machine screws (42) and lockwashers (43) that hold the code bar guide studs (44) to the keyboard frame; remove the code bar guide studs.
- (18) Remove the middle key lever guide (45), the code bars (46-50), the universal bar (51), and the tabulator bar (52).

*b. Reassembly.*

- (1) Position the tabulator bar (52, fig. 192), the universal bar (51), the five code bars arranged in their proper sequence with code bar No. 1 (50) next to the universal bar, followed by the remaining code bars (49) through (46) and the middle key lever guide (45) on the code bar guide studs (44).
- (2) Position the assembled code bar guide studs and code bars on the keyboard frame; secure with two machine screws (42) and lockwashers (43).

- (3) Position the front key lever guide (41) in front of the tabulator bar (52) and install the universal code bar return spring (38) and the tabulator bar spring (37).
- (4) Position the carriage-return blocking bar (36) on the studs on the front key lever guide (41); secure with two retainer rings (35).
- (5) Position the carriage-return latch lever (34) on the carriage-return blocking bar (36); secure with a flat washer (33) and self-locking hexagonal nut (32).
- (6) Position the carriage-return blocking arm (31) on the carriage-return blocking bar (36); secure with a flat washer (30) and a self-locking hexagonal nut (29).
- (7) Position the function blocking bar (28) on the studs on the front key lever guide (41); secure with two retainer rings (27), two lubricating pads (26) and the remaining two retainer rings (25).
- (8) Position the function blocking arm (24) on the function blocking bar (28); secure with a self-locking hexagonal nut (23).
- (9) Install the function blocking bar spring (22) on the function blocking bar (28) and on the stud on the front key lever guide (41).
- (10) Position the key lever mounting bracket (21) on the keyboard casting; secure with four machine screws (19) and lockwashers (20).
- (11) Install the repeat key lever (18) and the spacebar lever (17).
- (12) Install the assembled long key levers (16) and keytops (13) from left to right in the order given in the chart below. Similarly install the assembled medium key levers (15) and short key levers (14) and keytops from left to right as indicated in the chart below. The chart also gives the part number for each of the keytops.

Keypoint chart

Part ref No.		Keypoint characters			
Standard communication	Weather communication	Standard communication		Weather communication	
Short keylevers:		Ltrs position	Figs position	Ltrs position	Figs position
54001	Same part ref numbers as standard symbol keytops.	Q	1	Same as standard keyboard characters.	
54002		W	2		
54003		E	3		
54004		R	4		
54005		T	5		
54006		Y	6		
54007		U	7		
54008		I	8		
54009		O	9		
54010		P	φ		
54011		Repeat		Repeat	
Medium keylevers:					
54012	59930	A	-	A	See fig. 35 for all upper case weather symbols.
54013	54013	S	BELL	S	
05414	59931	D	\$	D	
45015	59932	F	!	F	
54016	59933	G	&	G	
54017	59934	H	STOP	H	
54018	59935	J	'	J	
54019	59936	K	(	K	
54020	59937	L	)	L	
54021	54021	Car Ret		Car Ret	
Long keylevers:					
54022	54022	Figs		Figs	
54023	59938	Z	"	Z	See fig. 35. See fig. 35. See fig. 35. See fig. 35.
54024	54024	X	/	X	
54025	59940	C	:	C	
54026	59941	V	;	V	
54027	59954	B	?	B	
54028	59942	N	,	N	
54029	54029	M	.	M	
54030	54030	Ltrs		Ltrs	
54031	54031	Line Feed		Line Feed	
54032	59943	Blank (no symbol)		Blank (no symbol)	— (upper-case)

- (13) Install the 31 key lever springs (11) and the two space bar springs (12).
- (14) Position the key lever locking bar (10) on the key lever mounting bracket (21); secure with three machine screws (8) and lockwashers (9).
- (15) Position the spacebar arm assembly (7) on the front key lever guide (41); install the spacebar arm shaft (6) through the holes in the spacebar arm assembly and the arms of the front key lever guide. Secure with two retainer rings (4) and (5).
- (16) Position the space bar (3) on the space bar arm assembly (7); secure with two machine screws (1) and lockwashers (2).
- (17) Install the tabulator and indicator assembly as described in paragraph 130*b*.
- (18) Install the keyboard-transmitter on the page printer as described in paragraph 129*b*.
- (19) Adjust the key levers and code bars as instructed in paragraphs 360, 376, 384, 385, and 386.

#### **140. Disassembly and Reassembly of Transmitter Camshaft Locking Mechanism**

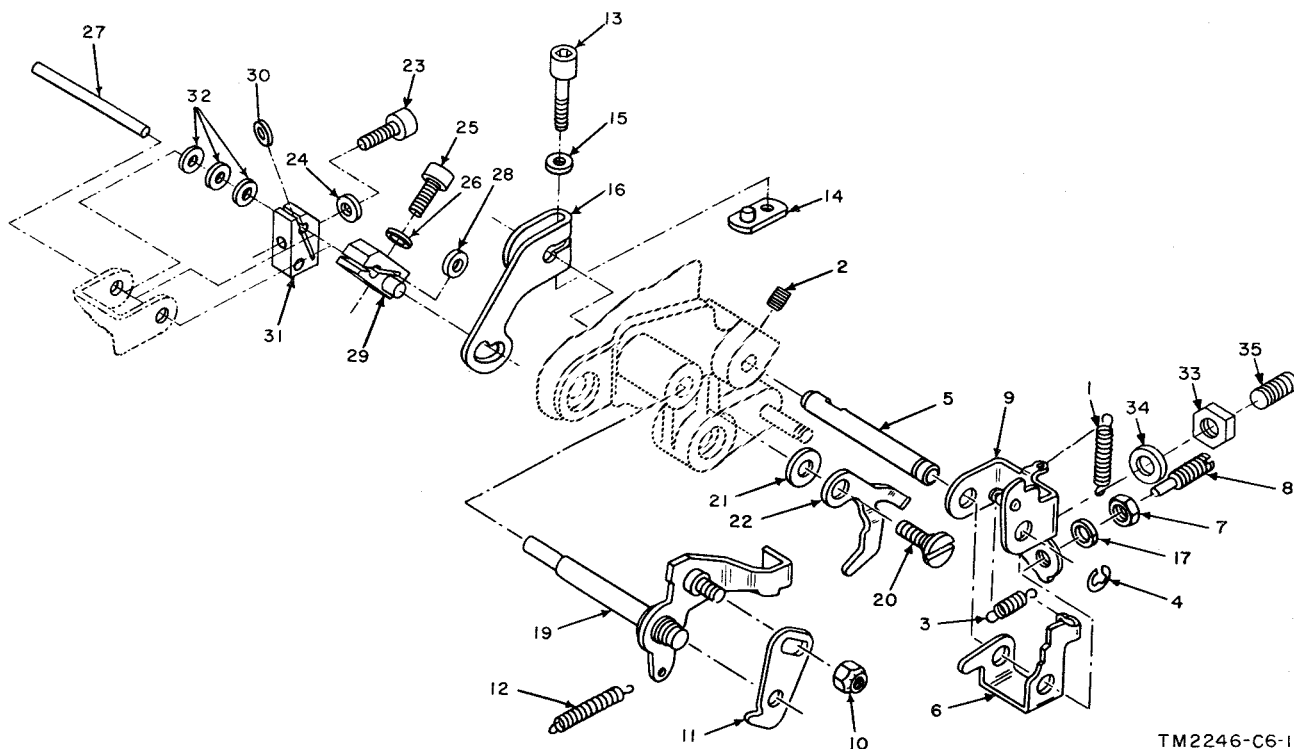
##### *a. Disassembly.*

- (1) Remove the keyboard-transmitter from the page printer as described in paragraph 129*a*.
- (2) Remove the tabulator and indicator assembly as described in paragraph 130*a*.
- (3) Remove the sensing levers as described in paragraph 137*a*(3).
- (4) Remove the ends of the locking lever latch spring (1, fig. 193) from the pin in the keyboard frame and from the spring tab on the locking lever latch (9); remove the spring.
- (5) Remove the setscrew (2) holding the locking lever latch stud (5) in the keyboard frame.
- (6) Remove the ends of the repeat blocking lever spring (3) from the repeat blocking lever (6) and from the spring post on the locking lever latch (9); remove the spring.

- (7) Remove the retainer ring (4) from the end of the locking lever latch stud (5).
- (8) Remove the assembled locking lever latch, repeat blocking lever, and the locking lever latch stud from the keyboard frame. Disassemble the parts; remove the plain hexagonal nut (7), lockwasher (17), and the universal bar adjusting screw (8) from the locking lever latch. On models equipped with an adjustable repeat blocking lever remove the plain hexagonal nut (33), flat washer (34), and repeat blocking lever adjusting screw (35) from the locking lever latch (9).
- (9) Remove the self-locking hexagonal nut (10) from the threaded stud of the cam stop lever (19); remove the stop latch cam follower (11) from the cam stop lever.
- (10) Remove the cam stop lever spring (12) from the bottom of the cam stop lever.
- (11) Remove the clamping screw (13) and the flat washer (15) from the clamp nut (14).
- (12) Remove the cam stop lever (19).
- (13) Remove the repeat lever pivot stud (20), flat washer (21), and repeat lever (22) from the keyboard frame.
- (14) Remove the clamping screw (23) and lockwasher (24) from the switch arm (31).
- (15) Remove the clamping screw (25) and lockwasher (26) from the switch cam follower (29).
- (16) While removing the switch arm shaft (27), remove the switch cam follower (29), washer (28), switch cam lever (16), switch arm (31), washer (30), and spacer (32).

##### *b. Reassembly.*

- (1) Reassemble the camshaft locking mechanism as indicated in figure 193; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the tabulator and indicator assembly as described in paragraph 130*b*.



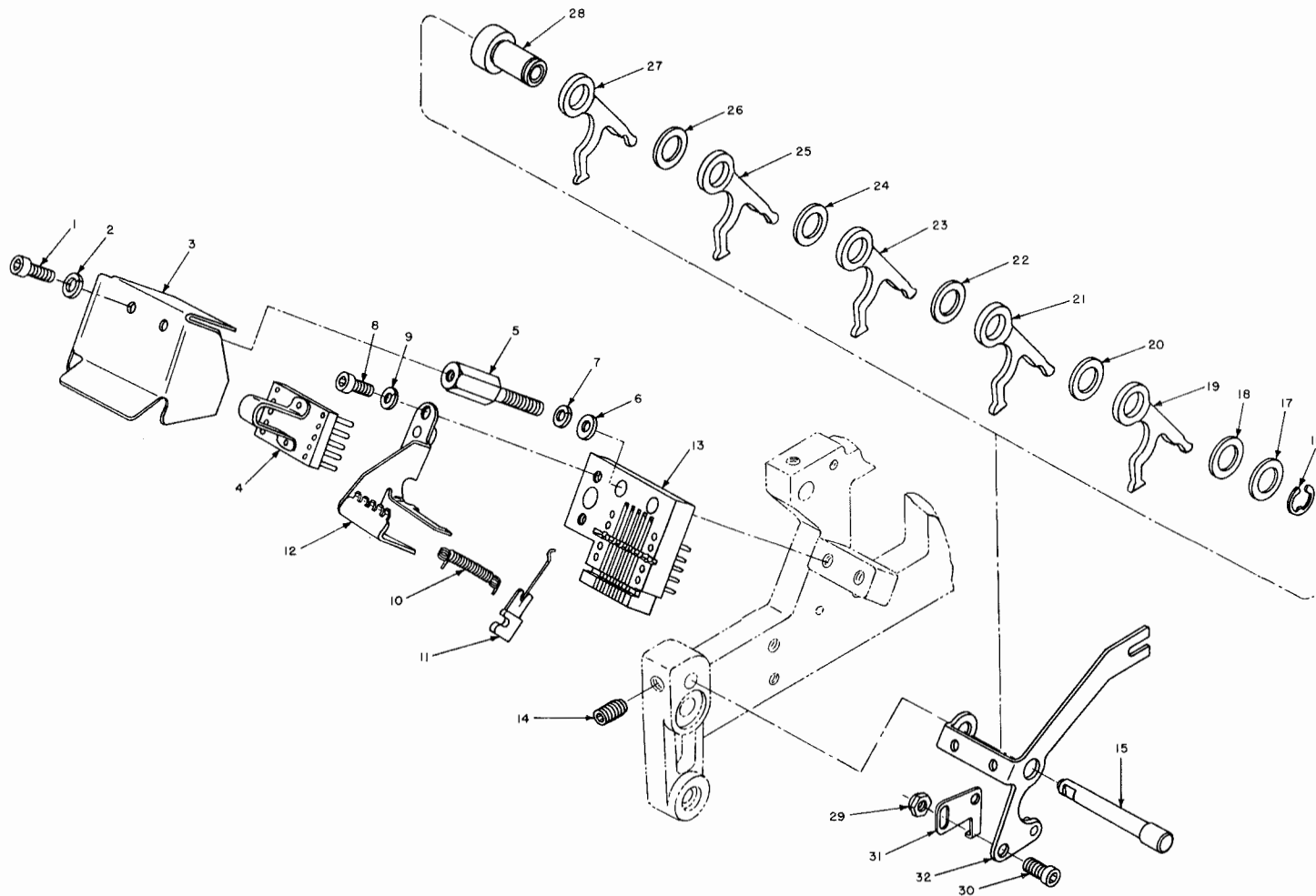
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- |   |                                      |   |
|---|--------------------------------------|---|
| 1 Locking lever latch spring, 51544                 | 10 Self-locking hexagonal nut, 10500 | 24 Lockwasher, 10421  |
| 2 Setscrew, 10210                                   | 11 Stop latch cam follower, 55562    | 25 Clamping screw, 10003                                      |
| 3 Repeat blocking lever spring, 50944               | 12 Cam stop lever spring, 51575      | 26 Lockwasher, 10421  |
| 4 Retainer ring, 10949                              | 13 Clamping screw, 10006             | 27 Switch arm shaft, 10919                                    |
| 5 Locking lever latch stud, 51564                   | 14 Clamp nut, 50174                  | 28 Washer, 56598  |
| 6 Repeat blocking lever, 51569 (59477) <sup>a</sup> | 15 Flat washer, 10459                | 29 Switch cam follower, 56566A                                |
| 7 Plain hexagonal nut, 10507                        | 16 Switch cam lever, 56564           | 30 Washer, 56598  |
| 8 Universal bar adjusting screw, 50658              | 17 Lockwasher, 10409                 | 31 Switch arm, 56568A   |
| 9 Locking lever latch, 51570A (59475A) <sup>a</sup> | 19 Cam stop lever, 54686A            | 32 Spacer, 52988  |
|   | 20 Repeat lever pivot stud, 51568    | 33 Plain hexagonal nut (10507) <sup>a</sup>                   |
|   | 21 Flat washer, 50414                | 34 Flat washer (10409) <sup>a</sup>                           |
|   | 22 Repeat lever, 52914               | 35 Repeat blocking lever adjusting screw (10233) <sup>a</sup> |
|   | 23 Clamping screw, 10003             |   |

<sup>a</sup> Reference designations in parentheses are applicable to models equipped with an adjustable repeat blocking latch.

Figure 193. Transmitter camshaft locking mechanism, exploded view.

- (3) Install the keyboard on the page printer as described in paragraph 129b.
  - (4) Adjust the mechanism as directed in paragraphs 376, 388, 389, 390, and 392.
- 141. Disassembly and Reassembly of Simultaneous Transmitter Mechanism**  
(fig. 194)
- a. Disassembly.*
- (1) Remove the keyboard-transmitter from the page printer as described in paragraph 129a.
  - (2) Remove the tabulator and indicator mechanism as described in paragraph 130a.
  - (3) Remove the two machine screws (1) and two lockwashers (2) that hold the keyboard switch cover (3) in place; remove the cover.
  - (4) Pull out the shunt switch arm connector (4) from the shunt switch arm comb (13).
  - (5) Remove the two socket mounting studs (5), flat washers (6), and lockwashers (7) that attach the shunt switch arm comb (13) to the keyboard frame.



- 1 Machine screw, 10032
- 2 Lockwasher, 10430
- 3 Keyboard switch cover, 55889
- 4 Shunt switch arm connector, 55885A
- 5 Socket mounting stud, 55898
- 6 Flat washer, 10467
- 7 Lockwasher, 10430
- 8 Machine screw, 10004
- 9 Lockwasher, 10429

- 10 Shunt switch arm spring
- 11 Shunting switch arm
- 12 Shunt switch arm spring mounting bracket, 55903A (includes items 10 and 11)
- 13 Shunt switch arm comb, 55855
- 14 Set screw, 10210
- 15 Switch arm mounting post pivot, 55828
- 16 Retainer ring, 10959

- 17 Flat washer, 50552
- 18 Switch arm spacer, 55878
- 19 Switch arm, 55894
- 20 Switch arm spacer, 55878
- 21 Switch arm, 55894
- 22 Switch arm spacer, 55878
- 23 Switch arm, 55894
- 24 Switch arm spacer, 55878
- 25 Switch arm, 55894
- 26 Switch arm spacer, 55878

- 27 Switch arm, 55894
- 28 Switch arm centering sleeve, 55895
- 29 Self-locking hexagon nut, 10500
- 30 Machine screw, 10001
- 31 Tabulator lever adjusting arm, 55901
- 32 Tabulator lever, 55900A

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Figure 194. Simultaneous transmitter mechanism, exploded view.

- (6) Remove the two machine screws (8) and lockwashers (9) that attach the shunt switch arm spring mounting bracket (12) to the shunt switch arm comb (13).
- (7) Remove the shunt switch arm comb. Tag and unsolder the electrical leads.
- (8) Remove the setscrew (14) that holds the switch arm mounting post pivot (15) in the keyboard frame; remove the switch arm mounting post pivot with the tabulator lever (32) and the switch arms (19, 21, 23, 25, and 27) assembled on it.
- (9) Remove the switch arm mounting post pivot (15) from the tabulator lever (32) and switch arms; remove the retainer ring (16) from the switch arm centering sleeve (28).
- (10) Slide the switch arm centering sleeve from the tabulator lever (32), and remove the flat washer (17), and the switch arm spacers (18, 20, 22, 24, and 26) and switch arms (19, 21, 23, 25, and 27) alternately.
- (11) Remove the self-locking hexagonal nut (29) from the machine screw (30); remove the tabulator lever adjusting arm (31) from the tabulator lever (32).

*b. Reassembly.*

- (1) Reassemble the simultaneous transmitter mechanism as indicated in figure 194; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) When soldering the electrical leads to the shunt switch arm comb, refer to the applicable wiring diagram (fig. 555, 556, or 557).
- (3) Install the tabulator and indicator assembly as directed in paragraph 130b.
- (4) Install the keyboard-transmitter as directed in paragraph 129b.
- (5) Adjust the keyboard simultaneous transmitting mechanism as directed in paragraphs 336 and 367.

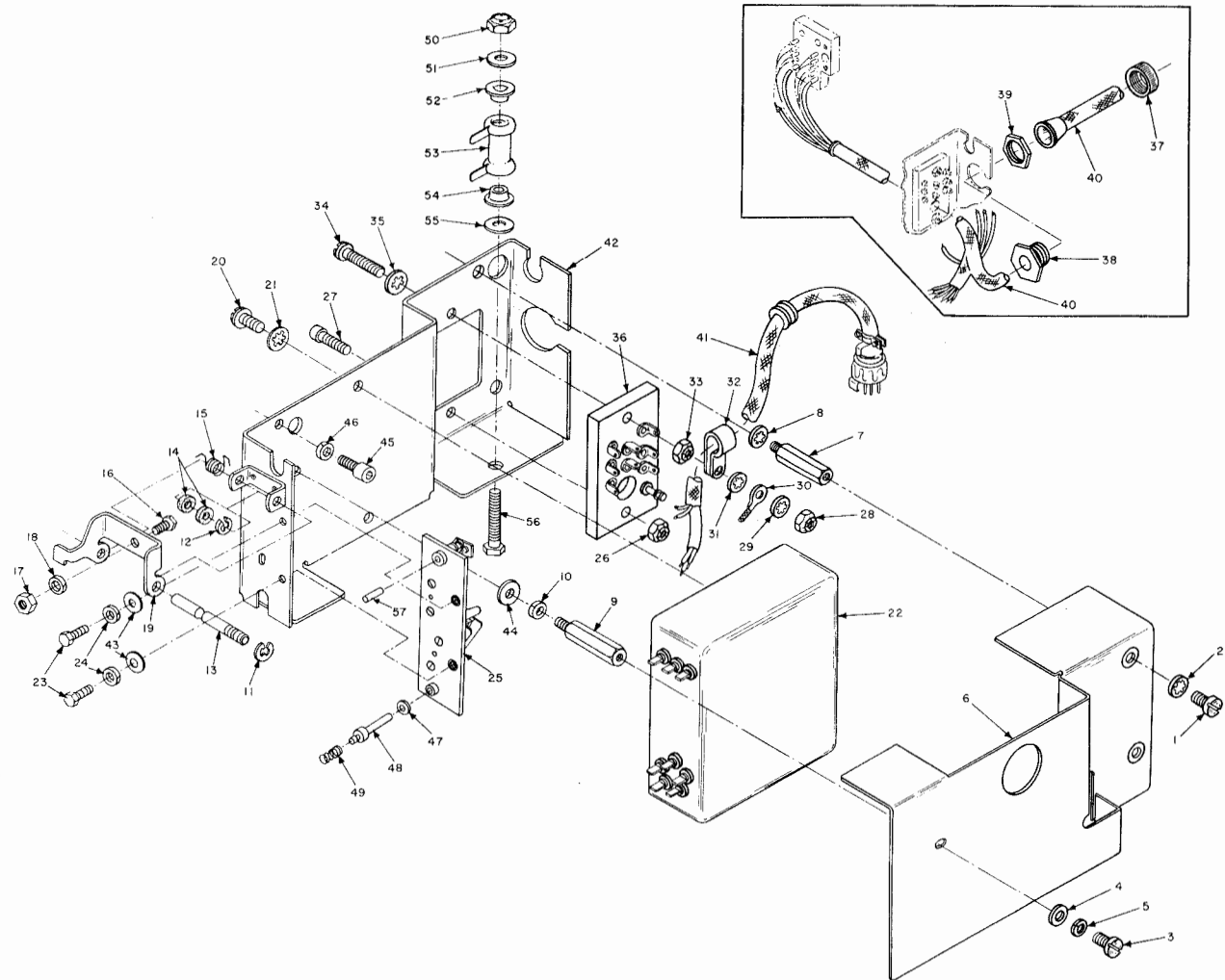
## 142. Removal and Replacement of the Keyboard Filter Mounting Bracket

*a. Removal.*

- (1) Remove the keyboard-transmitter from the page printer as described in paragraph 129a.
- (2) Remove the tabulator and indicator assembly as described in paragraph 130a.
- (3) Remove the simultaneous transmitting mechanism as described in paragraph 141a(3) through (8).

*Note.* It is not necessary to disassemble the simultaneous transmitter mechanism any farther than the removal of the shunt switch arm (13, fig. 194). Do not remove the wires from the shunt switch arm comb unless the entire keyboard filter mounting bracket is going to be disassembled. The shunt switch arm comb will pass through the opening in the frame without removal of the electrical leads.

- (4) Remove the two machine screws (1, fig. 195) and lockwashers (2) that hold the right side of the filter switch cover (6) to the spacing post studs (7). Remove the machine screw (3), flat washer (4), and lockwasher (5) that hold the left side of the filter switch cover to the spacing post stud (9); remove the filter switch cover.
- (5) Remove the two spacing post studs (7) and lockwashers (8) that hold the right side of the keyboard filter mounting bracket assembly to the keyboard frame. Remove the spacing post stud (9), lockwasher (10), washer (44), machine screw (45), and lockwasher (46) that hold the left side of the filter mounting bracket to the boss on the keyboard frame. Shift the assembly slightly to the right to clear the switch actuating arm at the left of the keyboard frame and lift the filter mounting bracket assembly free. If the shunt switch arm comb (13, fig. 194) has not been disconnected from the electrical leads (see *note* in (3) above), thread the shunt switch arm



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Figure 195. Keyboard filter mounting bracket, exploded view.



1 Machine screw, 10393	21 Lockwasher, 10404	38 Cable retainer
2 Lockwasher, 10403	22 Keyboard pulsing contact filter, 54567A (59175)*	39 Hexagonal cable nut
3 Machine screw, 10393	23 Machine screw, 10398	40 Cable, (59181A)*
4 Flat washer, 10450	24 Lockwasher, 10429	41 Cable, 56310A (59182A)*
5 Lockwasher, 10429	25 Keyboard counter and keyboard reader contact assembly, 55910A.	42 Keyboard filter mounting bracket, 55880A (59180A)*
6 Filter switch cover, 55907	26 Self-locking hexagonal nut, 10500	43 Washer, 10458
7 Spacing post stud, 55921	27 Machine screw, 10005	44 Washer, 50839
8 Lockwasher, 10404	28 Self-locking hexagonal nut, 10512	45 Machine screw, 10025
9 Spacing post stud, 55909	29 Lockwasher, 10403	46 Lockwasher, 10404
10 Lockwasher, 10429	30 Terminal lug, 20379	47 Shim, 54643
11 Retainer ring, 10960	31 Lockwasher, 10403	48 Plunger, 54646 (items 48 and 49, part No. 54645A).
12 Retainer ring, 10960	32 Clamp, 20519	49 Spring, 54644
13 Keyboard counter cam follower pivot, 55998	33 Self-locking hexagonal nut, 10500	50 Self-locking hexagonal nut, 10500
14 Lubricating pad, 55986	34 Machine screw, 10161	51 Washer, 54561
15 Keyboard counter cam follower spring, 55999	35 Lockwasher, 10403	52 Plate, 20878
16 Machine screw, 54648	36 Terminal board, 55905A	53 Resistor, 20044
17 Hexagonal nut, 10507	37 Round cable nut, (part of No. 55855A, which also includes items 38, 39, and 40)	54 Plate, 20878
18 Lockwasher, 10426		55 Washer, 54561
19 Keyboard counter cam follower, 55834		56 Machine screw, 10082
20 Machine screw, 10376		57 Plunger, 54647

\* Reference designations in parentheses apply to Teletypewriter TT-117A/FG, TT-118/FG and TT-119A/FG.

Figure 195.—Continued.

comb through the opening in the keyboard frame and remove the filter mounting bracket assembly.

*b. Replacement.*

- (1) Carefully thread the shunt switch arm comb (13, fig. 194) through the opening in the keyboard frame. Position the filter mounting bracket assembly on the keyboard frame; secure the left side with the spacing post stud (9, fig. 205) lockwasher (10) and washer (44), machine screw (45) and lockwasher (46); secure the right side with two spacing post studs (7) and lockwashers (8).
- (2) Position the filter switch cover (6) on the spacing post studs (7 and 9). Secure the left side with a machine screw (3), lockwasher (5), and a flat washer (4). Secure the right side with two machine screws (1) and lockwashers (2).
- (3) Reassemble the simultaneous transmitter mechanism as described in paragraph 141*b*.

### 143. Disassembly and Reassembly of Keyboard Filter Mounting Bracket

*a. Disassembly.*

- (1) Remove the keyboard filter mounting bracket as described in paragraph 142*a*.

- (2) Remove the two retainer rings (11 and 12, fig. 195) that hold the keyboard counter cam follower pivot (13) to the keyboard filter mounting bracket (42); remove the keyboard counter cam follower pivot, two lubricating pads (14), the keyboard counter cam follower spring (15), and the keyboard counter cam follower (19).
- (3) Remove the hexagonal nut (17), lockwasher (18), and machine screw (16), from the keyboard counter cam follower (19).
- (4) Remove the two machine screws (20) and lockwashers (21) that hold the keyboard pulsing contact filter (22) to the keyboard filter mounting bracket (42); unsolder the leads and remove the filter. Tag the leads to facilitate reassembly.
- (5) Remove the two machine screws (23), lockwashers (24), and washer (43) that hold the keyboard counter and keyboard reader contact assembly (25) to the keyboard filter mounting bracket (42); remove the contact assembly.
- (6) Remove the plunger (57), spring (49), plunger (48), and shims (47) from the keyboard counter and keyboard reader contact assembly (25).

- (7) Remove the self-locking hexagonal nut (50), washer (51), plate (52), resistor (53), plate (54), and washer (55) from the machine screw (56); remove the machine screw (56) from the keyboard filter mounting bracket (42).
- (8) Remove the self-locking hexagonal nut (26) and the machine screw (27) that hold the bottom of the terminal board (36) to the keyboard filter mounting bracket (42).
- (9) Remove the self-locking hexagonal nut (28), lockwasher (29), lockwasher (31), and clamp (32) from the top terminal board mounting machine screw (34).
- (10) Remove the self-locking hexagonal nut (33), machine screw (34), and lockwasher (35) that hold the top of the terminal board (36) to the keyboard filter mounting bracket (42). If they are not already removed, disconnect the leads from the shunt switch cam comb (13, fig. 194) and pull the cable (40, fig. 195) through the opening in the terminal board. Unsolder the remaining electrical leads from the terminal board. Tag the leads to facilitate reassembly.
- (11) Remove the round cable nut (37), the cable retainer (38), and the hexagonal cable nut (39) from the cable and remove the cable (40) from the keyboard filter mounting bracket (42).
- (12) Remove the cable (41) from the opening in the keyboard filter mounting bracket.

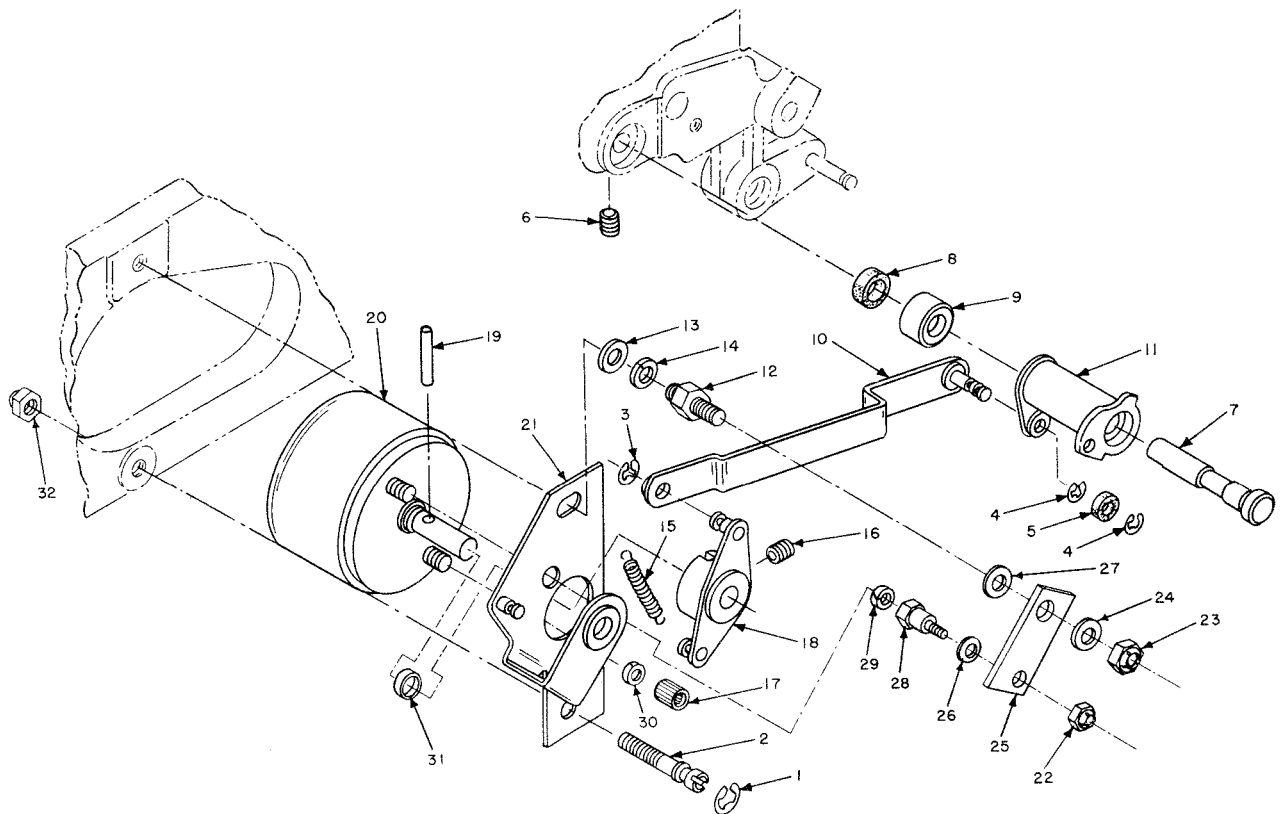
*b. Reassembly.*

- (1) Reassemble the keyboard filter mounting bracket as indicated in figure 195; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Replace the assembled filter mounting bracket as described in paragraph 142*b*.
- (3) Make the adjustment described in paragraph 389.

## 144. Disassembly and Reassembly of Transmitter Restoring Solenoid and Linkage

*a. Disassembly.*

- (1) Remove the keyboard-transmitter from the page printer as described in paragraph 129*a*.
- (2) Remove the tabulator and indicator assembly as described in paragraph 130*a*.
- (3) Remove the sensing and selector levers as described in paragraph 137*a*.
- (4) Slide the front key lever guide (41, fig. 192) forward.
- (5) Remove the retainer ring (1, fig. 196), nut (34), and the bracket pivot stud (2).
- (6) Remove the retainer ring (3) from the pivot stud on the link arm assembly (18) and remove the two retainer rings (4) and the lubricating pad (5).
- (7) Remove the setscrew (6) that attaches the stop latch cam post (7) to the keyboard frame; remove the stop latch cam post, lubricating washer (8), stop latch cam spacing collar (9), actuating link (10), and the stop latch cam (11).
- (8) Remove the nuts (22 and 23) and washer (24) that secure the stop plate (25) and remove the stop plate.
- (9) Remove the washers (26 and 27), studs (12 and 28), lockwashers (14 and 29), and flat washer (13) that secure the restoring solenoid mounting bracket (21) to the keyboard frame.
- (10) Remove one end of the link arm spring (15) from the spring post on the restoring solenoid mounting bracket (21), and the other end from the spring post on the link arm assembly (18).
- (11) Remove the setscrew (16) from the link arm assembly (18).
- (12) Remove the socket head nut (17), and lockwasher (30) from the restoring solenoid (20); remove the link arm assembly (18) as the restoring solenoid is removed from the restoring solenoid mounting bracket (21).

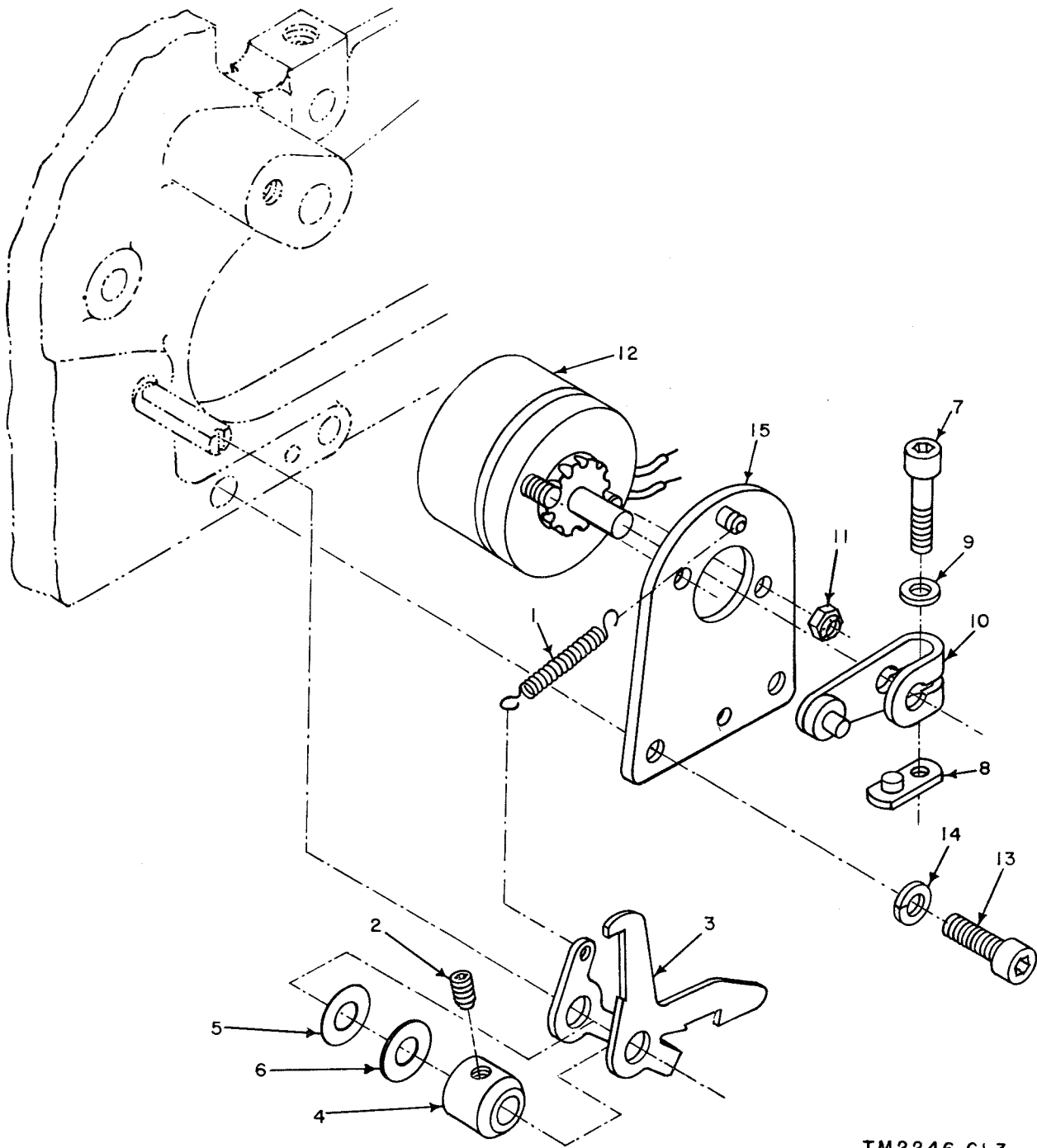


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- |  |  |                      |
|--|--|----------------------|
| 1 Retainer ring, 10949                 | 12 Stud, 55912                                 | 22 Nut, 10500        |
| 2 Pivot stud, 55881                    | 13 Flat washer, 10454                          | 23 Nut, 10501        |
| 3 Retainer ring, 10960                 | 14 Lockwasher, 10430                           | 24 Washer, 10454     |
| 4 Retainer ring, 10969                 | 15 Link arm spring, 55135                      | 25 Stop plate, 55893 |
| 5 Lubricating pad, 55986               | 16 Setscrew, 10232                             | 26 Washer, 10459     |
| 6 Set screw, 10211                     | 17 Socket nut, 10581 (2 rqr)                   | 27 Washer, 10454     |
| 7 Stop latch cam post, 55987           | 18 Link arm assembly, 55872                    | 28 Stud, 55944       |
| 8 Lubricating washer, 55984            | 19 Pin, 55842                                  | 29 Lockwasher, 10429 |
| 9 Stop latch cam spacing collar, 55983 | 20 Restoring solenoid (L1) 56290               | 30 Lockwasher, 10429 |
| 10 Actuating link, 55854A              | 21 Restoring solenoid mounting bracket, 55825A | 31 Spacer, 55947     |
| 11 Stop latch cam, 55980A              |  | 32 Nut, 10501        |

Figure 196. Transmitter restoring solenoid and linkage, exploded view.

- (13) Drive the pin (19) from the shaft of the restoring solenoid (20); remove spacer (31).
  - (14) Remove the electrical leads from the restoring solenoid (20).
- b. Reassembly.
- (1) Reassemble the transmitter restoring solenoid and linkage as indicated in figure 196; the sequence for assembling the parts is the reverse of the disassembly sequence.
  - (2) Install the sensing and selector levers as described in paragraph 137b.
  - (3) Install the tabulator and indicator assembly as described in paragraph 130b.
  - (4) Adjust the restoring solenoid and linkage as described in paragraph 378.
  - (5) Install the keyboard-transmitter on the page printer as described in paragraph 129b.
- ### 145. Disassembly and Reassembly of Transmitter Lock Solenoid and Linkage (TT-117/FG and TT-119/FG) (fig. 197)
- a. Disassembly.
- (1) Remove the keyboard-transmitter from the page printer as described in paragraph 139a.



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- 1 Spring, 56573
- 2 Setscrew, 10209
- 3 Lockup lever, 56560
- 4 Spacing collar, 55845
- 5 Shim, 56545 (.005-inch)

- 6 Shim, 56546 (.010-inch)
- 7 Machine screw, 10006
- 8 Anchor nut, 50174
- 9 Flat washer, 10456
- 10 Solenoid lever, 55988A

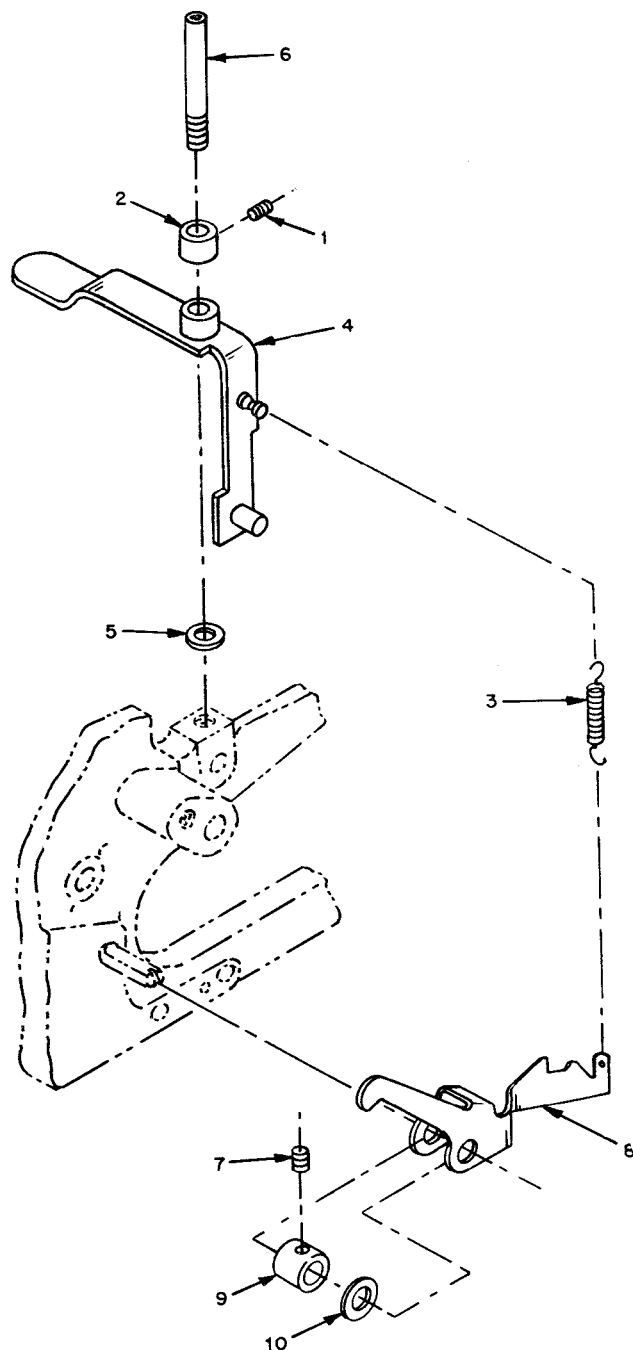
- 11 Self-locking hexagonal nut, 10580
- 12 Transmitter lock solenoid, 20305
- 13 Machine screw, 10205
- 14 Lockwasher, 10430
- 15 Solenoid mounting plate, 56562A

Figure 197. Transmitter lock solenoid and linkage, exploded view (TT-117/FG and TT-119/FG).

- (2) Remove the filter mounting bracket as described in paragraph 142a.
- (3) Remove the spring (1) from the lockup solenoid mounting plate (15) and from the lockup lever (3).
- (4) Remove the setscrew (2) from the spacing collar (4); remove the lockup lever (3), spacing collar (4), and shims (5 and 6).
- (5) Remove the machine screw (7) from the anchor nut (8); remove the flat washer (9) and the solenoid lever (10) from the shaft of the transmitter lock solenoid (12).
- (6) Remove the two self-locking hexagonal nuts (11) that attach the transmitter lock solenoid (12) to the solenoid mounting plate (15).
- (7) Remove the two machine screws (13) and the two lockwashers (14) that attach the solenoid mounting plate (15) to the keyboard casting.

*b. Reassembly.*

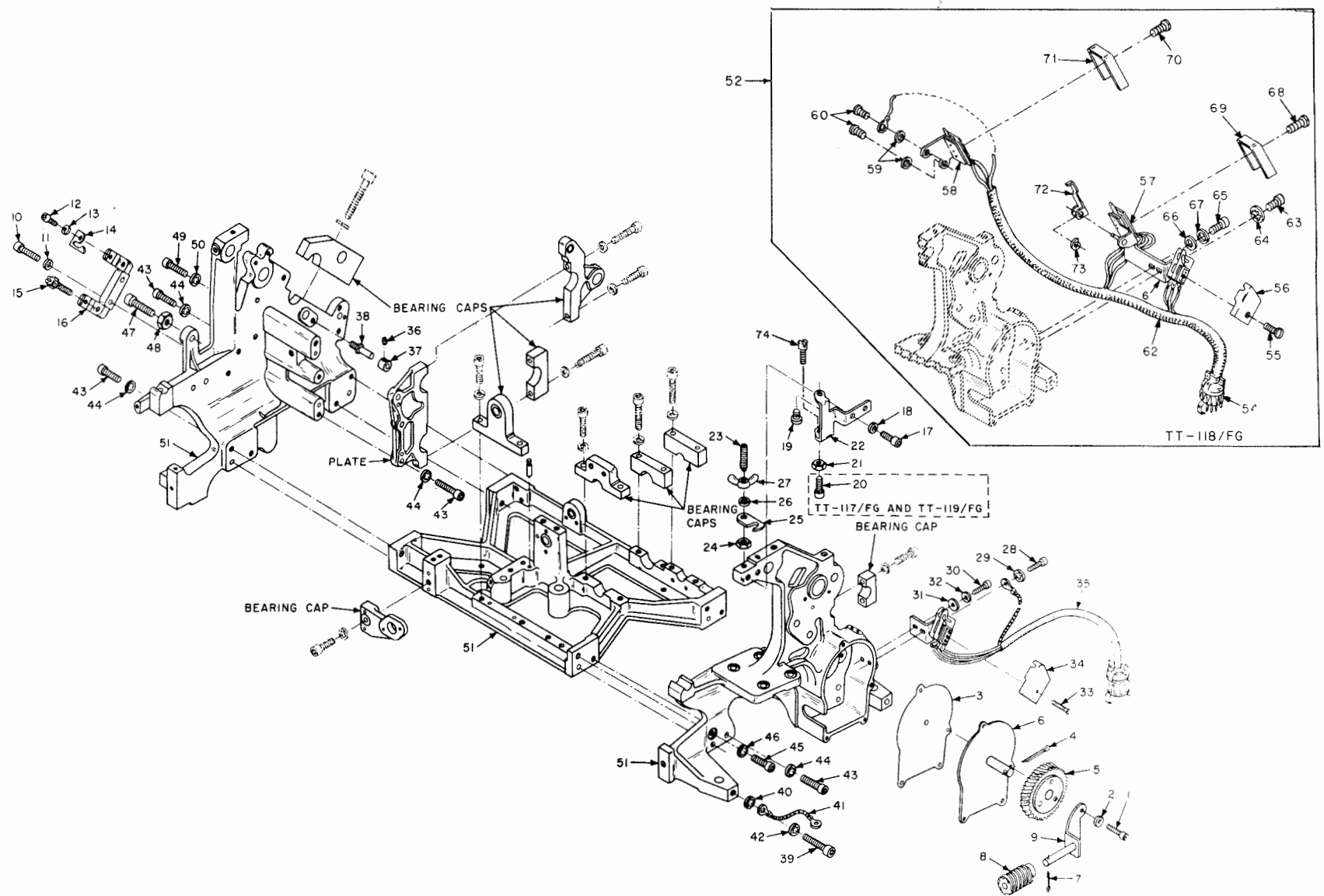
- (1) Position the transmitter lock solenoid (12) on the solenoid mounting plate (15); attach it with the two self-locking hexagonal nuts (11).
- (2) Position the assembled solenoid mounting plate on the keyboard frame; attach it with two lockwashers (14) and two machine screws (13).
- (3) Position the solenoid lever (10) on the shaft of the transmitter lock solenoid (12); attach the solenoid lever (10) with the flat washer (9); anchor nut (8), and machine screw (7).
- (4) Position the spacing collar (4) and shims (5 and 6) between the extended portions of lockup lever (3); shims should be added or removed to provide for some clearance not to exceed .010 inch between the extensions of the lockup lever and the assembled shims and collar pileup.
- (5) Position the lockup lever (3), spacing collar (4), and shims (5 and 6) on the selector lever pivot stud; adjust in accordance with paragraph 371.



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- |   |  |
|---|--|
| 1 Setscrew, 10208                         | 6 Keyboard control lever pivot post, 60548 |
| 2 Control lever retaining collar, 50391   | 7 Setscrew, 10209                          |
| 3 Spring, 51755                           | 8 Detent lockup lever, 60547               |
| 4 Keyboard control lever assembly, 60544A | 9 Spacing collar, 55845                    |
| 5 Flat washer, 50315                      | 10 Shim, 56546 (and 56545, as required)    |

Figure 198. Transmitter camshaft locking mechanism, exploded view (TT-117A/FG, TT-118/FG, and TT-119A/FG).



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Figure 199. Page printing mechanism frame assembly, exploded view.

1 Machine screw, 10004	32 Lockwasher, 10429	55 Screw, 10386
2 Lockwasher, 10429	33 Machine screw, 10386	56 Contact shield, 53116
3 Gasket, 50725	34 Contact shield, 53116	57 Motor stop contacts S2 and S15 assembly, 53770A (includes item 61)
4 Cotter pin, 10805	35 Motor stop switch assembly, S2, 59989A (includes switch 59979A; cable, 54083; and plug, 20419)	58 Stop bar contact S16 assembly, 60036A
5 Main shaft driven gear (par. 19)	36 Setscrew, 10201	59 Lockwasher, 10418 (TT-118/FG only)
6 Gear cover, 51381A (50853A*)	37 Spacing collar, 51717	60 Screw, 10362 (TT-118/FG only).
7 Cotter pin, 10805	38 Cam follower stop stud, 51719	61 Bracket
8 Worm gear, 50596	39 Machine screw, 10042	62 Motor stop cable, 53365A
9 Worm gear bracket, 50858A	40 Lockwasher, 10405	63 Machine screw, 10003
10 Machine screw, 10010	41 Electrical lead, 53651	64 Lockwasher, 10403
11 Lockwasher, 10430	42 Lockwasher, 10405	65 Machine screw, 10003
12 Machine screw, 10004	43 Machine screw, 10018-01	66 Flat washer, 10459
13 Lockwasher, 10429	44 Lockwasher, 10405	67 Lockwasher, 10429
14 Anchor plate, 52687	45 Machine screw, 10024	68 Screw, 10386
15 Adjustment screw, 52688	46 Lockwasher, 10405	69 Contact shield, 53769
16 Bracket, 52527	47 Machine screw, 10021	70 Screw, 10386
17 Machine screw, 10076	48 Plain hexagonal nut, 10502	71 Contact shield, 53769
18 Lockwasher, 10430	49 Machine screw, 10026-01	72 Pulsing contact cam follower, 53771
19 Bumper, 20762	50 Lockwasher, 10405	73 Retainer ring, 10969
20 Hexagonal head screw, 10009	51 Frame assembly, 55700A (59812A*) (includes bearing caps, three main castings, plate dowels, and spring posts)	74 Machine screw, 11209 (not used on TT-117/FG or TT-119/FG)
21 Plain hexagonal nut, 10516	52 Motor stop switches and cable assembly, TT-118/FG only, 59822A (includes items 54 through 58 and 62 through 73)	
22 Platen bracket, 51464	54 Connector plug, 20419	
23 Setscrew, 10212		
24 Plain hexagonal nut, 10509		
25 Platen lockup arm, 50598		
26 Lockwasher, 10431		
27 Plain wing nut, 10508		
28 Machine screw, 10003		
29 Lockwasher, 10403		
30 Machine screw, 10003		
31 Flat washer, 10459		

\* Reference designation applicable to TT-117A/FG, TT-118/FG, and TT-119A/FG.

Figure 199.—Continued.

- (6) Install the spring (1) between the stud of the solenoid mounting plate (15) and the lockup lever (3).
- (7) Install the filter mounting bracket as described in paragraph 142*b*.
- (8) Adjust the transmitter lock solenoid and linkage as described in paragraphs 371, 372, and 373.
- (9) Install the keyboard-transmitter on the page printer as described in paragraph 129*b*.

#### 146. Disassembly and Reassembly of Transmitter Camshaft Locking Mechanism (TT-117A/FG, TT-118/FG, and TT-119A/FG) (fig. 198)

##### *a. Disassembly.*

- (1) Remove the keyboard-transmitter from the page printer (par. 129*a*).
- (2) Remove the filter mounting bracket (par. 142*a*).
- (3) Loosen the setscrews (1) in the control lever retaining collar (2), unhook spring (3) from the post on the keyboard control lever assembly (4). Slide the control lever retaining col-

lar (2) from the keyboard control lever pivot post (6); then slide off the keyboard control lever assembly (4) and flat washer (5). Do not remove the keyboard control lever pivot post (6) unless the tabulator frame assembly is to be removed.

- (4) Loosen the setscrews (7) in the spacing collar (9); slide the detent lockup lever assembly (8) off the eccentric post, and collect the spacing collar (9) and shims (10).

##### *b. Reassembly.*

- (1) Align the spacing collar (9) and shims (10) with the holes in the detent lockup lever (8) and slide onto the eccentric post on the casting. Tighten the setscrew (7) so that it bears onto the flat of the eccentric stud in the casting.
- (2) Install the flat washer (5) and keyboard control lever assembly (4) on the keyboard control lever pivot post (6). Hook one end of the spring (3) to the detent lockup lever (8) and the other end to the post on the keyboard control lever assembly (4);

tighten the setscrews (1) in the control lever retaining collar (2).

- (3) Install the filter mounting bracket (par. 142a).
- (4) Adjust the transmitter camshaft locking mechanism (par. 374).
- (5) Install the keyboard-transmitter on the page printer (par. 129b).

## 147. Removal and Replacement of Motor

### a. Removal.

- (1) Lift the left side of the page printer and disconnect the motor plug connector (13, fig. 200) from the receptacle connector in the printer base.
- (2) Remove the four machine screws (1, fig. 199) and lockwashers (2) that hold the gear cover (6) to the frame assembly (51); remove the worm gear bracket (9); gear cover, and gasket (3).
- (3) Remove the four machine screws (1, fig. 200) and lockwashers (2) that hold the motor to the frame casting; remove the assembled motor by moving it sideways away from the frame.
- (4) Remove the shims from the right and left spacer plates (6 and 7).

### b. Replacement.

- (1) Position the shims on the right and left spacer plates (6 and 7) so that the holes in the shims line up with the holes in the spacer plates.
- (2) Position the motor on the frame casting; secure with two machine screws (1) and lockwashers (2).
- (3) Position the gasket (3, fig. 199), gear cover (6), and worm gear bracket (9) on the printer frame; secure with four machine screws (1) and lockwashers (2).
- (4) Lift the left side of the page printer and connect the motor plug connector to the receptacle in the page printer base.

## 148. Disassembly and Reassembly of Synchronous Motor (fig. 200)

### a. Disassembly.

- (1) Remove the motor as described in paragraph 147a.

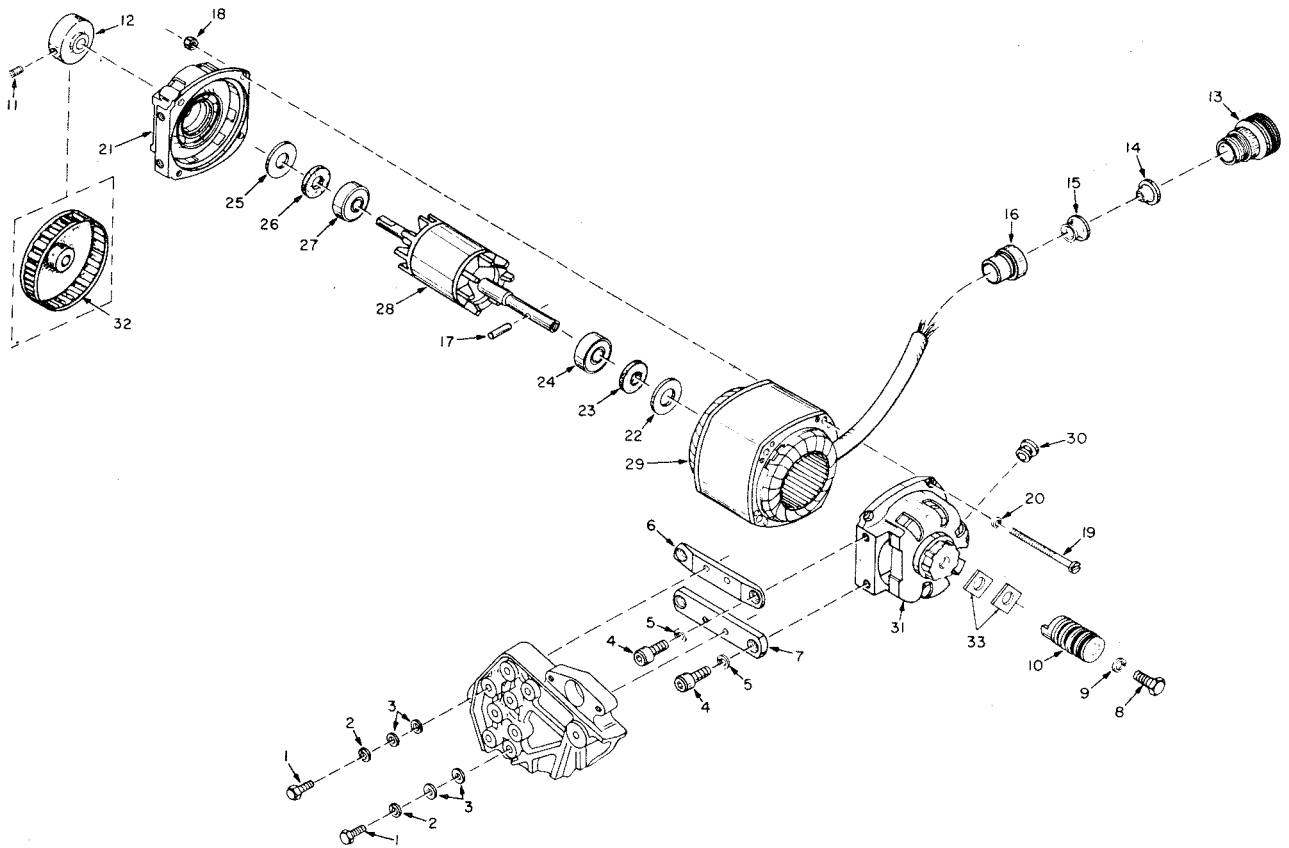
- (2) Steady the motor shaft at the end opposite the worm gear, and remove the machine screw (8), the lockwasher (9), and the worm gear (10).

- (3) Remove the machine screws (4) and the lockwashers (5) that hold the spacer plates (6 and 7) to the motor; remove the spacer plates.
- (4) Tap the pin (17) from the shaft and remove the two grease seals (33).
- (5) Loosen the setscrew (11) and remove the unit it mounts.
- (6) Remove the four through bolts (19), the lockwashers (20), and the hexagonal nuts (18) that fasten the three major portions of the motor case together.
- (7) Remove the rear-end casting (21) and remove the assembled rotor core and shaft assembly from the stator (29).
- (8) Remove the thrust pads (22 and 25), the spacer washers (23 and 26), and the ball bearings (24 and 27).
- (9) If necessary, remove the nut (16), the ferrules (14 and 15), and the receptacle connector (13) from the motor cable, and remove the front end casting (31) from the stator.

### b. Reassembly.

- (1) Position the rotor core and shaft (28, fig. 200) in the motor stator with the ball bearings (24 and 27), the spacer washers (23 and 26), and the thrust pads (22 and 25), in place.
- (2) Thread the motor leads through the grommet (30) in the front-end casting (31). Position the front-end casting and the rear-end casting (21) on the motor stator (29); secure them with four through bolts (19), lockwashers (20), and hexagonal nuts (18).
- (3) Install the plastic tubing on the motor leads, and install the receptacle connector (13) on the leads.
- (4) Position the grease seals (33) on the motor shaft and install the pin (17).
- (5) Position the impeller fan (32) (or the motor shaft knob (12) as applicable) on the armature shaft; secure it in place with the setscrew (11).





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- |  |  |   |
|--|--|---|
| 1 Machine screw, 10079                               | 12 Motor shaft knob, 54217 <sup>b</sup>                      | 23 Spacer washer, 60531                                       |
| 2 Lockwasher, 10431                                  | 13 Receptacle connector, 20421                               | 24 Ball bearing, 10760  |
| 3 Flat washer, 10464                                 | 14 Ferrule, 20847  | 25 Thrust pad, 60530  |
| 4 Machine screw, 10008                               | 15 Ferrule, 20848  | 26 Spacer washer, 60531                                       |
| 5 Lockwasher, 10430                                  | 16 Nut, 10533  | 27 Ball bearing, 10760  |
| 6 Spacer plate, 53478                                | 17 Pin, 50359  | 28 Rotor core and shaft, 53361A                               |
| 7 Spacer plate, 53479                                | 18 Hexagonal nut, 60534                                      | 29 Stator, 53362A <sup>a</sup> , 56852 <sup>b</sup>           |
| 8 Machine screw, 56142                               | 19 Through bolt, 60533                                       | 30 Grommet  |
| 9 Lockwasher, 10438                                  | 20 Lockwasher, 60535   | 31 Front-end casting, 60536 <sup>a</sup> , 56885 <sup>b</sup> |
| 10 Worm gear (see chart, par. 19)                    | 21 Rear-end casting, 60536 <sup>a</sup> , 56884 <sup>b</sup> | 32 Impeller fan, 20839 <sup>a</sup>                           |
| 11 Setscrew, 10210 <sup>a</sup> , 10211 <sup>b</sup> | 22 Thrust pad, 60530   | 33 Grease seal, 50949   |

<sup>a</sup> Bodine motor.

<sup>b</sup> Howard motor.

Figure 200. Synchronous motor, exploded view.

- (6) Position the worm gear (10) on the armature shaft; secure it with the machine screw (8) and the lockwasher (9).

*Note.* Be sure that the worm gear and the mating gear on the main shaft are correct for the speed desired.

- (7) Position the left spacer plate (7) and the right spacer plate (6) on the motor; secure them in place with four machine screws (4) and lockwashers (5).

- (8) Replace the motor as described in paragraph 147b.

## 149. Disassembly and Reassembly of Series-Governed Motor

(fig. 201)

### a. Disassembly.

- (1) Remove the motor from the teletypewriter (par. 147).
- (2) Remove the machine screw (3), the lockwasher (4), and the worm gear (5) from the armature shaft.

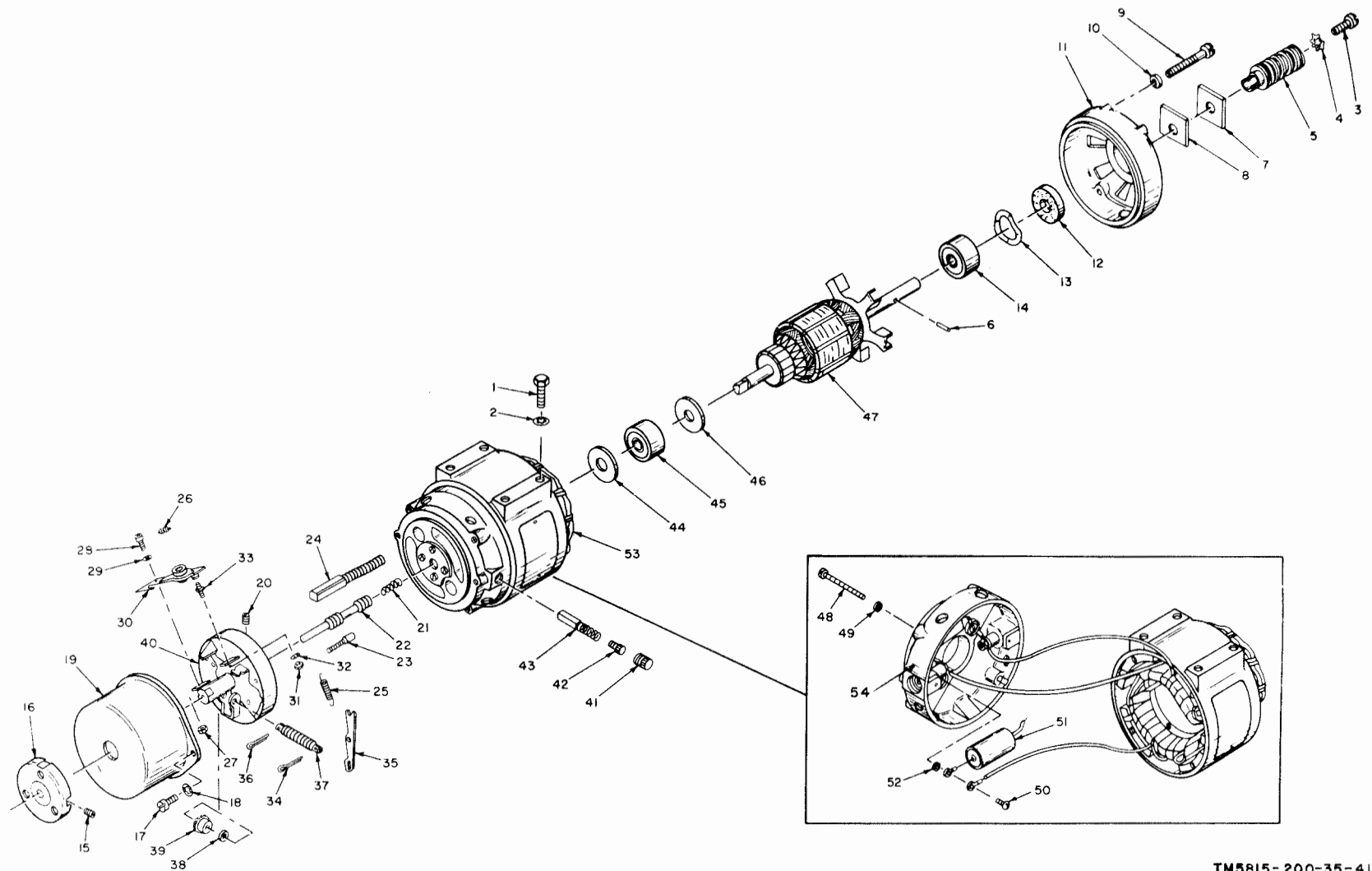


Figure 201. Series-governed motor, exploded view.

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1 Machine screw, 10017	21 Governor worm spring, 51855	39 Governor adjustment gear, 50278A
2 Lockwasher, 10405	22 Governor worm, 56555A	40 Governor base, 51249A
3 Machine screw, 50207	23 Electrical contact brush, 51154A	41 Brush shield, 51155 <sup>a</sup> , 60495 <sup>b</sup>
4 Lockwasher, 10406	24 Electrical contact brush, 51543A	42 Brush cap, 20747 <sup>a</sup> , 60496 <sup>b</sup>
5 Worm gear, (see chart, par. 19)	25 Adjustment lever spring, 50334	43 Brush, 56834A <sup>a</sup> , 60503 <sup>b</sup>
6 Pin, 50359	26 Grooved pin, 50302	44 Flat washer
7 Grease seal, 50949	27 Self-locking hexagonal nut, 10500	45 Ball bearing, 10760 <sup>a</sup> , 10765 <sup>b</sup>
8 Grease seal, 50949	28 Machine screw, 10001	46 Flat washer
9 Machine screw, 10333 <sup>a</sup> , 10172 <sup>b</sup>	29 Lockwasher, 10403	47 Armature, 51187 <sup>a</sup> , 60492 <sup>b</sup>
10 Lockwasher, 10412 <sup>a</sup> , 10444 <sup>b</sup>	30 Electrical contact, 50281A	48 Machine screw, 10333 <sup>a</sup> , 10172 <sup>b</sup>
11 Gear end bell, 20751 <sup>a</sup> , 60505 <sup>b</sup>	31 Hexagonal nut, 10507	49 Lockwasher, 10412 <sup>a</sup> , 10444 <sup>b</sup>
12 Thrust pad, 20739, 20748	32 Lockwasher, 10404	50 Machine screw
13 Thrust washer, 60531 <sup>a</sup> , 60501 <sup>b</sup>	33 Electrical contact, 50338	51 Capacitors C16 and C17, 20212
14 Ball bearing, 10760	34 Cotter pin, 10800	52 Lockwasher
15 Setscrew, 10204	35 Governor adjustment lever, 50301	53 Motor housing, 51861A <sup>a</sup> , 61109A <sup>b</sup> (which includes items 9-14 and 41-52)
16 Governor target, 50303A	36 Cotter pin, 10800	54 Governor end bell, 51804 <sup>a</sup> , 60490 <sup>b</sup>
17 Machine screw, 10321	37 Governor adjustment screw, 50299	
18 Lockwasher, 10412	38 Flat washer, 50148	
19 Governor cover, 50311		
20 Setscrew, 10203		

<sup>a</sup> Bodine motor.

<sup>b</sup> Howard motor.

Note. Shims 51509 and 51510 are used between the motor and the casting.

Figure 201.—Continued.

- (3) Remove the pin (6) and the grease seals (7 and 8) from the armature shaft.
  - (4) Remove the four machine screws (9), the lockwashers (10), and the gear end bell (11). Remove the thrust pad (12) and the thrust washer (13). Use a bearing puller to remove the ball bearing (14) from the armature shaft.
  - (5) Remove the setscrew (15) that holds the governor target (16) to the shaft of the governor base (40). Remove the governor target.
  - (6) Remove the two machine screws (17) and lockwashers (18) that hold the governor cover (19) to the motor housing (53). Remove the governor cover.
  - (7) Remove the two setscrews (20) that hold the governor base (40) to the armature shaft. Remove the assembled governor.
  - (8) Remove the governor worm spring (21) and the governor worm (22) from the governor.
  - (9) Remove the electrical contact brush (23) from the governor.
  - (10) Remove the two electrical contact brushes (24).
  - (11) Remove the brush shields (41), the brush caps (42), and the brushes (43).
  - (12) Remove the armature (47) from the motor housing. Remove the flat washer (44), the ball bearing (45), and the flat washer (46) from the armature shaft.
  - (13) Remove the four machine screws (48) and lockwashers (49) that hold the governor end bell (54) to the motor housing. Separate the end bell and housing carefully.
  - (14) Unsolder and disconnect the capacitors (51) from the brush holder bushing in the end bell. Remove the machine screws (50) that hold capacitors C16 and C17 (51) to the end bell; remove the capacitors.
- b. Reassembly.* Examine the brushes (43); clean them if they are dirty or glazed; replace them if they are worn, chipped, or saturated with oil.
- (1) Reassemble the motor by reversing the steps and procedures outlined in a(2) through (14) above.
  - (2) Replace the motor (par. 147b).
  - (3) Adjust the motor speed (par. 13).

## 150. Disassembly and Reassembly of Governor (fig. 201)

### *a. Disassembly.*

- (1) Remove the governor from the motor (par. 149a(5) through (7)).

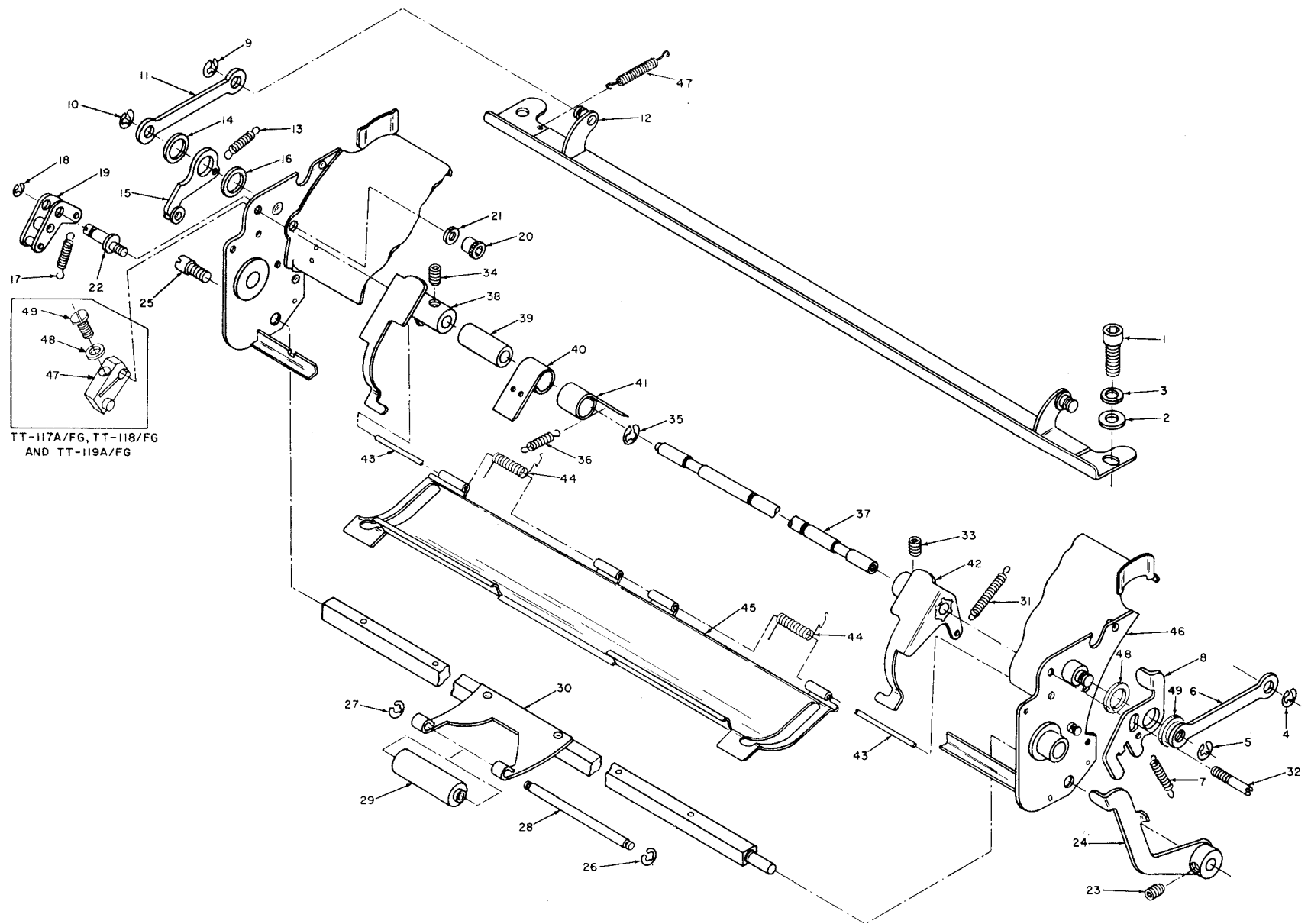


Figure 202. Platen trough assembly, exploded view.

1 Machine screw, 10024	20 Plain round nut, 10537	36 Stripper spring, 55143
2 Flat washer, 10464	21 Lockwasher, 10429	37 Paper guide shaft, 55152 (59820 <sup>a</sup> )
3 Lockwasher, 10431	22 Platen detent eccentric stud, 52931	38 Paper guide, 55144A (57076A, TT-118/FG only)
4 Retainer ring, 10949	23 Setscrew, 10203	39 Sleeve, 55041
5 Retainer ring, 10949	24 Pressure roller lever, 54954A	40 Paper stripper, 55151
6 Connecting link, 50215	25 Pressure roller operating shaft screw, 50238	41 Paper stripper, 55151
7 Platen lever latch spring, 53149	26 Retainer ring, 51099	42 Paper guide, 55141A (57077A, TT-118/FG only)
8 Platen lever latch, 54951	27 Retainer ring, 51099	43 Hinge pin, 55146
9 Retainer ring, 10949	28 Platen pressure roller shaft, 54968	44 Platen trough spring, 54967
10 Retainer ring, 10949	29 Platen pressure roller, 50161A	45 Paper trough guide, 54962
11 Connecting link, 50215	30 Platen pressure roller operating shaft, 55530A	46 Platen trough 59432A
12 Bracket link, 53138A	31 Paper guide spring, 52169	47 Paper guide adjusting lever, 60084A <sup>a</sup>
13 Platen spacing detent spring, 51851	32 Pivot screw, 55139	48 Lockwasher, 10421 <sup>a</sup>
14 Flat washer, 51768	33 Setscrew, 10201	49 Screw, 10001 <sup>a</sup>
15 Platen spacing detent, 53202A	34 Setscrew, 10201	
16 Flat washer, 51768	35 Retainer ring, 10949	
17 Platen detent spring, 51851		
18 Retainer ring, 10960		
19 Line spacing detent, 50108A		

<sup>a</sup> Additional reference designation used only with TT-117A/FG, TT-118/FG, and TT-119A/FG.

Figure 202.—Continued.

- (2) Remove the adjustment lever spring (25) from the governor adjustment lever (35) and from the grooved pin (26). Remove the grooved pin.
- (3) Remove the self-locking hexagonal nut (27), the machine screw (28), the lockwasher (29), and the electrical contact (30) from the governor base (40).
- (4) Remove the hexagonal nut (31), the lockwasher (32), and the electrical contact (33) from the governor base (40).
- (5) Remove the cotter pin (34) and the governor adjustment lever (35) from the governor adjustment screw (37).
- (6) Remove the cotter pin (36) from the opposite end of the governor adjustment screw (37). Remove the governor adjustment screw from the mounting on the governor base (40). Catch the flat washer (38) and the governor adjustment gear (39) as they fall from the governor base.

*b. Reassembly.* If necessary, clean or burish the electrical contacts of the governor before reassembly. Remove any built-up or pitted portions of the contacts with a contact file. Do not remove any more metal than is necessary.

- (1) Reassemble the governor by reversing the steps and procedures outlined in a(3) through (6) above.
- (2) Replace the governor (par. 149b).
- (3) Adjust the motor speed (par. 13).

## 151. Removal and Replacement of Platen Frame Assembly

### *a. Removal*

- (1) Remove the retainer ring (18, fig. 219) that holds the line feed connecting link (23) to the stud on the line feed bell cranks.
- (2) Remove the retaining ring (28) that holds the platen shift link (29) to the platen shift bellcrank (30); disengage the link.
- (3) Remove the platen shift bellcrank spring (25) from the hole in the bracket link (12, fig. 202).
- (4) Remove the two machine screws (1, fig. 202), flat washer (2) and lockwasher (3) that hold the bracket link to the platen frame.
- (5) Remove the two retainer rings (5 and 10) that hold the connecting links (6 and 11) to the platen trough (46); disengage the connecting links.
- (6) Remove the two setscrews (1, fig. 203) that hold the eccentric pivots (4) in the platen frame.
- (7) Hold the platen assembly and remove the assembled eccentric pivots, spacing collar and hexagonal nuts. Move the platen assembly slightly toward the rear and to the left so that, the pressure roller operating shaft and the platen latching arm are free.
- (8) Lift the platen assembly from the unit.

*b. Replacement.*

- (1) Replace the platen frame assembly by reversing the sequence described in *a* above. When placing the platen frame assembly on the unit be sure that the ribbon lifter bellcrank is in engagement with the lip on the forward edge of the platen pressure roller operating shaft (30, fig. 202) and that the platen latching arm (7, fig. 203) is in engagement with the notch in the aperture gate.
- (2) Adjust the platen assembly as described in paragraph 324 through 337.

## **152. Disassembly and Reassembly of Platen Assembly**

*a. Disassembly.*

- (1) Remove the platen assembly from the page printer as described in paragraph 151*a*.
- (2) Remove the machine screw (5, fig. 203) and lockwasher (6), that hold the platen latching arm (7) to the platen support frame (30); remove the platen latching arm.
- (3) Remove the platen locking stud (8) from the platen support frame (30).
- (4) Remove the retainer ring (9) from the mounting stud on the platen blocking arm (13).
- (5) Remove the self-locking hexagonal nut (10), machine screw (11) and flat washer (12); then secure the platen blocking arm (13) to the platen blocking arm bracket (16); remove the platen blocking arm.
- (6) Remove the two machine screws (14) and lockwashers (15) that attach the platen blocking arm bracket (16) to the platen support frame (30); remove the platen blocking arm bracket.
- (7) Remove the machine screw (17) and lockwasher (18) that hold the platen shift arm (19) on the platen support frame (30); remove the platen shift arm.
- (8) Remove the two setscrews (20) that hold the detent wheel (24) to the platen shaft (22).

- (9) Remove the two setscrews (21) that hold the shaft collar (25) on the platen shaft (22).
- (10) Remove the setscrews that secure the platen to the platen shaft (22); remove the platen shaft. Remove the single-double line feed lever (23), detent wheel (24), shaft collar (25), platen, the platen trough, and the assembled line feed lever (29) and line feed pawl (28).
- (11) Remove one end of the line feed pawl spring (26) from the hole in the line feed pawl (28), and the other end from the hole in the line feed lever (29); remove the spring.
- (12) Remove the retainer ring (27) from the pivot stud on the line feed lever (29); remove the line feed pawl (28) from the line feed lever.

*b. Reassembly.*

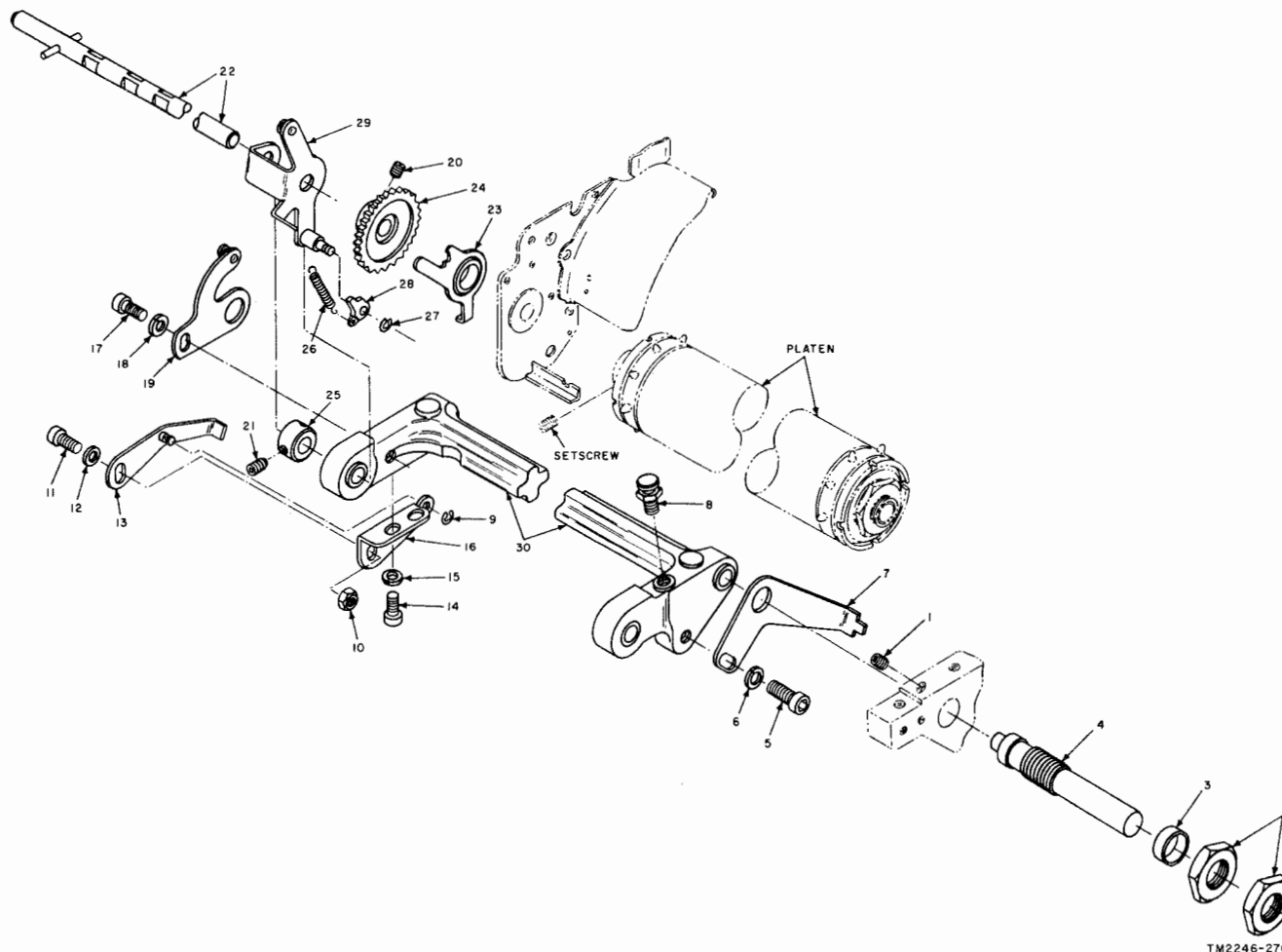
- (1) Reassemble the platen assembly as indicated in figure 203; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Replace and adjust the platen as explained in paragraph 151*b*.

## **153. Disassembly and Reassembly of Platen Trough**

(fig. 202)

*a. Disassembly.*

- (1) Remove the platen from the platen frame as described in paragraph 152*a*.
- (2) Remove the retainer rings (4 and 5) that hold the connecting link (6) to the platen trough (46) and to the bracket link (12).
- (3) Remove the platen lever latch spring (7) from the spring post on the platen trough and from the platen lever latch (8); remove the platen lever latch.
- (4) Remove the retainer rings (9 and 10) that hold the connecting link (11) to the platen trough (46) and to the bracket link (12); remove the connecting link and the bracket link.
- (5) Remove the platen spacing detent spring (13) from the platen spacing detent (15) and from the spring post on the platen trough (46).



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- |                              |                                       |  |                                 |
|------------------------------|---------------------------------------|--|---------------------------------|
| 1 Setscrew, 10211            | 9 Retainer ring, 10969                | 17 Machine screw, 10005                  | 24 Detent wheel, 52807          |
| 2 Plain hexagonal nut, 10524 | 10 Self-locking hexagonal nut, 10501  | 18 Lockwasher, 10431                     | 25 Shaft collar, 50209          |
| 3 Spacing collar, 55174      | 11 Machine screw, 10008               | 19 Platen shift arm, 53134A              | 26 Line feed pawl spring, 50333 |
| 4 Eccentric pivot, 55173     | 12 Flat washer, 10467                 | 20 Setscrew, 10209                       | 27 Retainer ring, 10969         |
| 5 Machine screw, 10015       | 13 Platen blocking arm, 53095A        | 21 Setscrew, 10209                       | 28 Line feed pawl, 50165        |
| 6 Lockwasher, 10431          | 14 Machine screw, 10008               | 22 Platen shaft, 54955                   | 29 Line feed lever, 53137A      |
| 7 Platen latching arm, 50214 | 15 Lockwasher, 10430                  | 23 Single-double line feed lever, 51762A | 30 Platen support frame, 53305A |
| 8 Platen locking stud, 50762 | 16 Platen blocking arm bracket, 52307 |  |                                 |

Figure 203. Platen frame assembly, exploded view.

- (6) Remove the flat washer (14), platen spacing detent (15), and flat washer (16) from the platen trough.
- (7) Remove the platen detent spring (17) from the line spacing detent (19) and from the spring post on the platen trough (46).
- (8) Remove the retainer ring (18) that holds the line spacing detent (19) to the platen detent eccentric stud (22); remove the line spacing detent.
- (9) Remove the plain round nut (20) and lockwasher (21) that hold the platen detent eccentric stud (22) to the platen trough (46); remove the platen detent eccentric stud.
- (10) Remove the setscrew (23) that holds the pressure roller lever (24) to the platen pressure roller operating shaft (30); remove the pressure roller lever.
- (11) Remove the pressure roller operating shaft screw (25) that holds the platen pressure roller operating shaft (30) to the platen trough; slide the platen pressure roller operating shaft to the left to remove it from the platen trough (46).
- (12) Remove the two retainer rings (26 and 27) from the platen pressure roller shaft (28); remove the platen pressure roller (29) from the platen pressure roller shaft and the platen pressure roller operating shaft (30).
- (13) Remove the two paper guide springs (31) from the paper guides (42 and 38) and from the platen trough (46).
- (14) Remove the pivot screw (32) that holds the paper guide shaft (37) to the platen trough (46).
- (15) Remove the two setscrews (33 and 34) that hold the paper guides (38 and 42) to the paper guide shaft (37).
- (16) Remove the three stripper springs (36) from the six paper strippers (40 and 41). On Teletypewriters TT-117A/FG, TT-119A/FG, and TT-118/FG, loosen the clamping screw (49) and remove the paper guide ad-

justing lever (47) from the shaft (37).

- (17) Remove the four retainer rings (35) that position the six paper strippers (40) on the paper guide shaft (37); remove the paper guide shaft, and catch the paper guide (38), three sleeves (39), six paper strippers (40 and 41), and paper guide (42), as they fall from the shaft.
- (18) Remove the hinge pin (43) that holds the paper trough guide (45) to the platen trough (46); remove the platen trough spring (44) and the paper trough guide.

*b. Reassembly.*

- (1) Reassemble the platen trough as indicated in figure 202; the sequence for assembling the parts is the reverse of the disassembly sequence. When installing paper guide adjusting lever (47) on shaft (37) in the TT-117A/FG, TT-118/FG and TT-119A/FG; make sure that the stud on adjusting lever (47) is seated in the recessed edge of the paper trough before tightening binding head screw (49).
- (2) Adjust the platen trough as instructed in paragraphs 324, 325, 327, 331, 332, 334, and 335.
- (3) Install the platen on the platen frame as described in paragraph 152*b*.

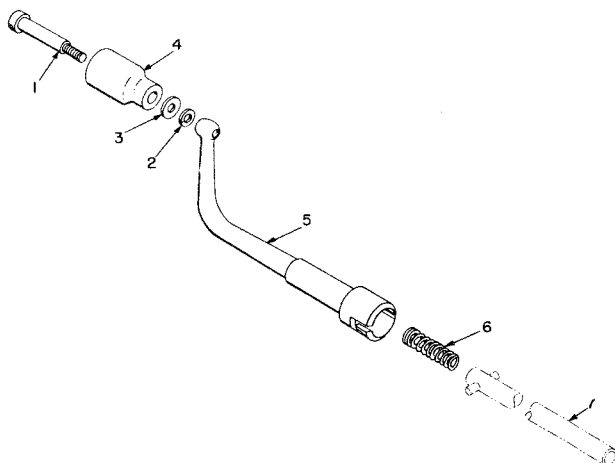
## 154. Disassembly and Reassembly of Platen Crank (fig. 204)

*a. Disassembly.*

- (1) Remove platen crank (5) from platen shaft (7) at the bayonet-type connection by pushing the crank in and turning it clockwise; remove spring (6).
- (2) Remove screw (1) that holds platen crank knob (4) on platen crank (5); remove platen crank knob (4), plain washer (3), and lockwasher (2).

*b. Reassembly.* Reassemble the platen crank as indicated in figure 204.





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- |                            |                        |
|----------------------------|------------------------|
| 1 Machine screw, 54959     | 5 Platen crank, 54958  |
| 2 Lockwasher, 10409        | 6 Spring, 54957        |
| 3 Plain washer, 10454      | 7 Platen shaft, 54955A |
| 4 Platen crank knob, 54961 |                        |

Figure 204. Platen crank, exploded view.

## 155. Disassembly and Reassembly of Platen

(fig. 205)

### a. Disassembly.

- (1) Remove the platen from the platen assembly as described in paragraph 152a(1) through (10).
- (2) Remove the plain hexagonal nut (2) from the shaft (3); remove the pinwheel body (13) and the plate roller (4) from the pinwheel body (21).
- (3) Remove the parts from the pinwheel body (13) by removing the retainer ring (5), flat washer (6), sprocket friction plate (7), sprocket cam plate (8), inside guide (9), sprocket feed pin (10), and locking pin (12) from the pinwheel body (13).
- (4) Remove the parts from the pinwheel body (21) by removing the retainer ring (14), flat washer (15), sprocket friction plate (16), sprocket cam plate (17), inside guide (18), sprocket feed pin (19), and locking pin (20).

### b. Reassembly.

- (1) Assemble the pinwheel body (21) by inserting the nine sprocket feed pins (19) in the holes in the pinwheel body; position the inside guide (18) on the pins in the side of the sprocket feed pins.

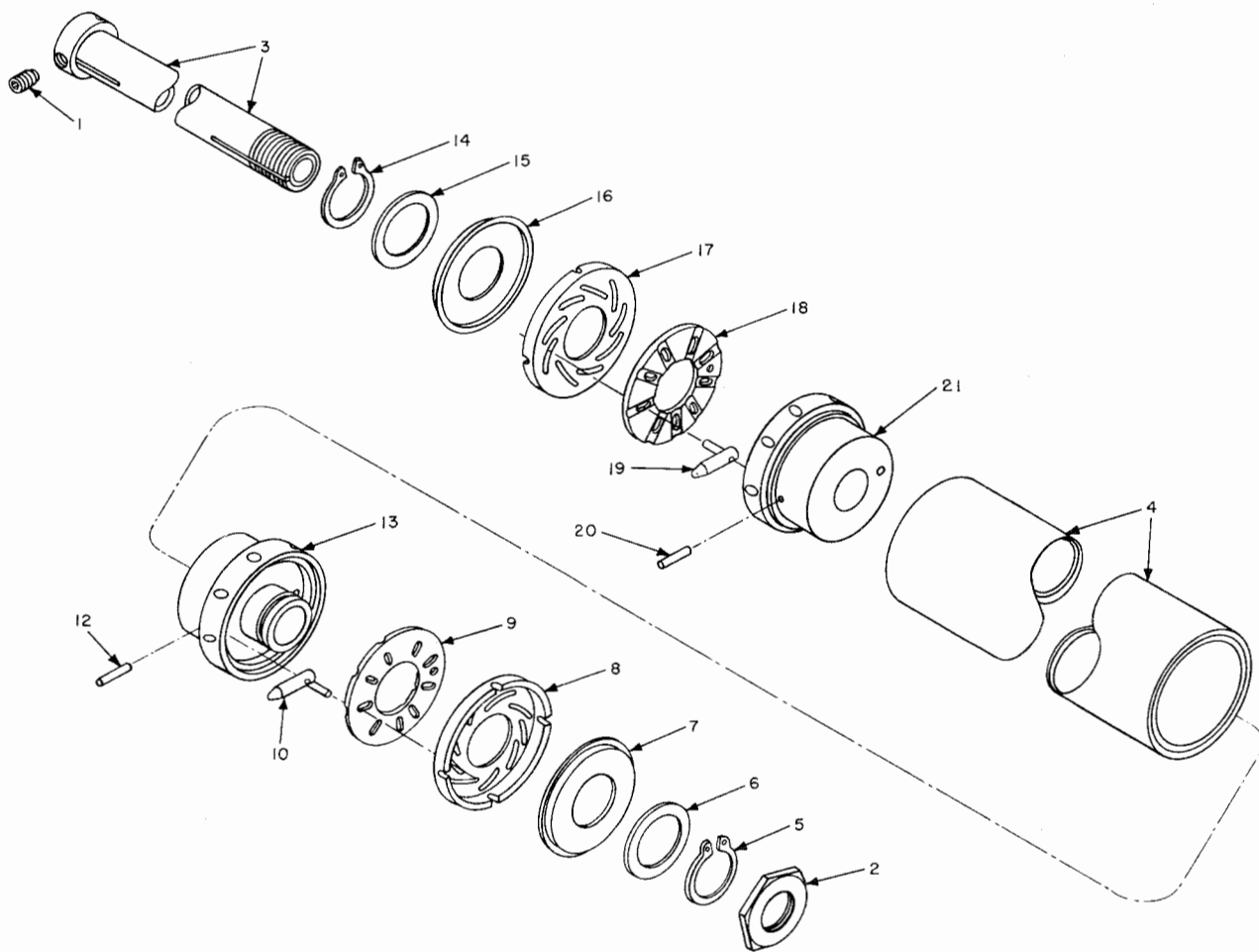
- (2) Attach the inside guide (18) to the pinwheel body (21) with the dowel pin. The head of the dowel pin should be flush with or 0.005 inch below the outer edge of the pinwheel body (21).
- (3) Position the sprocket cam plate (17) on in the pins in the side of the sprocket feed pins (19).
- (4) Place the sprocket friction plate (16) and the flat washer (15) on the sprocket cam plate; hold the assembled parts in place in the pinwheel body (21) with the retainer ring (14).
- (5) Assemble the parts in the pinwheel body (13) in the same manner as for the pinwheel body (21).
- (6) Slide the assembled pinwheel body (21) on the shaft (3); position the hole in the pinwheel body over the slot in the shaft and bottom the locking pin (20) in the slot in the shaft.
- (7) Slide the platen roller (4) over the assembled pinwheel body (21) and up against the shoulder.
- (8) Slide the assembled pinwheel body (13) over the threaded end of the shaft (3); insert the locking pin (12) through the pinwheel body (13) and into the slot in the shaft. Hold the platen tube with the slot up and slide the pinwheel body into the platen roller with the locking pin (12) bottomed in the slot.
- (9) Hold the platen together with the plain hexagonal nut (2) drawn up on threads of the platen shaft.
- (10) Adjust the platen as described in paragraph 325.
- (11) Replace and adjust the platen in the platen assembly as described in paragraph 152b.

## 156. Removal and Replacement of Carriage

(fig. 206)

### a. Removal.

- (1) Remove the page printer from the page printer base as described in paragraph 128a.
- (2) Move the carriage to the left margin stop and mark the two teeth on the



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- |                                  |   |  |
|----------------------------------|---|--|
| 1 Setscrew, 10209                | 9 Inside guide  | 17 Sprocket cam plate, 55158                             |
| 2 Plain hexagonal nut, 52806     | 10 Sprocket feed pin, 55170A                            | 18 Inside guide  |
| 3 Shaft, 52755A                  | 12 Locking pin, 55161                                   | 19 Sprocket feed pin, 55170                              |
| 4 Platen roller, 55079A          | 13 Pinwheel body, 55180A (includes items 9, 10, and 12) | 20 Locking pin, 55161                                    |
| 5 Retainer ring, 11046           | 14 Retainer ring, 11046                                 | 21 Pinwheel body, 55180A (includes items 18, 19, and 20) |
| 6 Flat washer, 55169             | 15 Flat washer, 55169                                   |  |
| 7 Sprocket friction plate, 55160 | 16 Sprocket friction plate, 55160                       |  |
| 8 Sprocket cam plate, 55158      |   |  |

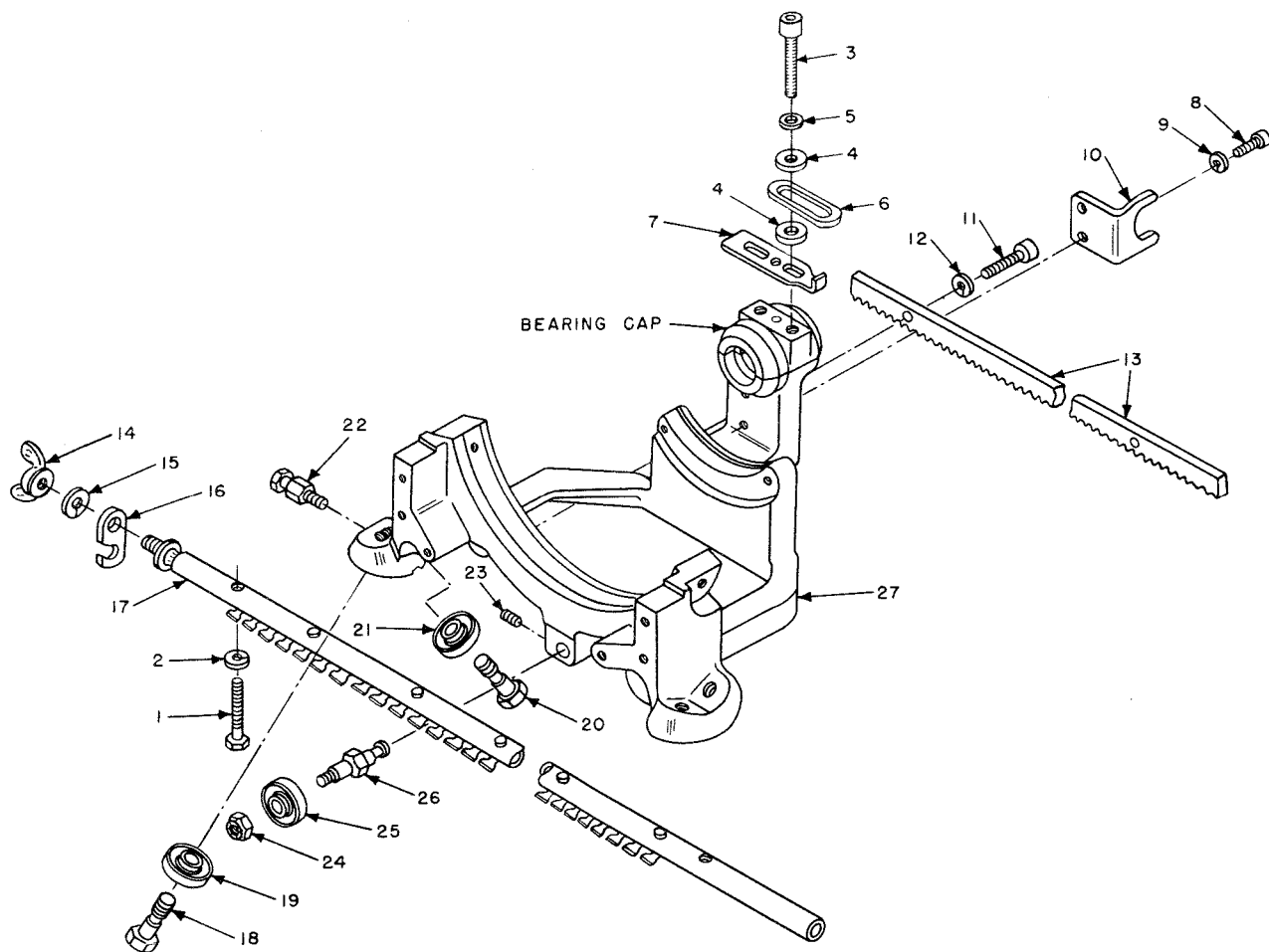
Figure 205. Platen, exploded view.

fiber carriage rack driving gear that engage the last tooth on the carriage-feed and return driving rack.

- (3) Remove the machine screw (1) and lockwasher (2) that hold the guide rail (17) to the page printer frame on the left side and the similar screw and two lockwashers that hold the guide rail and the carriage-return button bracket to the frame on the right side.
- (4) Remove the two socket head machine screws (3), flat washers (4), and

lockwashers (5) that hold the right-hand margin trip plate (6), left-hand margin trip plate (7), bearing cap, and the type selecting arm assembly to the carriage frame; remove the right-hand and left-hand margin trip plates, bearing cap, and type selecting arm.

- (5) Remove the two machine screws (8) and lockwashers (9) that hold the carriage rear support bracket (10) to the carriage frame; slide the assembled support and sliding helical gear



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- |                                       |  |                                      |
|---------------------------------------|--|--------------------------------------|
| 1 Machine screw, 10319                | 10 Rear support bracket, 50571                       | 19 Ball bearing, 10752               |
| 2 Lockwasher, 10430                   | 11 Machine screw, 10011                              | 20 Cap screw, 50591                  |
| 3 Machine screw, 10063                | 12 Lockwasher, 10430                                 | 21 Ball bearing, 10752               |
| 4 Flat washer, 10467                  | 13 Carriage-feed and return driving rack, 57951      | 22 Carriage locking stud, 50594      |
| 5 Lockwasher, 10430                   | 14 Plain wingnut, 10508                              | 23 Setscrew, 10204                   |
| 6 Right-hand margin trip plate, 52257 | 15 Lockwasher, 10431                                 | 24 Self-locking hexagonal nut, 10501 |
| 7 Left-hand margin trip plate, 60516  | 16 Carriage lockup arm, 50598                        | 25 Ball bearing, 10752               |
| 8 Machine screw, 10003                | 17 Guide rail, 50394 (includes items 14, 15, and 16) | 26 Roller mounting stud, 50593       |
| 9 Lockwasher, 10429                   | 18 Cap screw, 50591                                  | 27 Carriage frame, 50545A            |

Figure 206. Carriage frame assembly, exploded view.

to the function side of the square shaft and remove the carriage rear support.

- (6) Remove the carriage from the page printer frame by lifting it forward and upward.

*b. Replacement.*

- (1) Position the assembled carriage and guide rail on the page printer frame so that the carriage frame is against the left margin stop and the two marked teeth on the fiber carriage

rack driving gear is in mesh with the last tooth at the right of the carriage-feed and return driving rack.

- (2) Position the carriage rear support bracket (10) on the sliding helical gear bearing so that the fork of the support is engaged with the flat portions of the bearing. Position the sliding helical gear assembly so that the holes in the support bracket are alined with the tapped holes in the carriage frame; secure the support

bracket with two machine screws (8) and lockwashers (9).

*Note.* When fully engaged with the flats on the bearing, the carriage rear support bracket will just clear the carriage frame. Do not force the support bracket into place. If difficulty is encountered in alining or fastening the support bracket to the carriage frame; raise the front end of the assembled carriage frame and guide rail and move it forward slightly.

- (3) Aline the carriage guide rail (17) with the two tapped holes in the page printer frame; secure it with machine screw (1) and lockwashers (2) on the left side and a similiar screw and two lockwashers on the right side. Attach the carriage-return button bracket between the two lockwashers on the right side.

*Note.* Be sure the groove in the ribbon on lifter bellcrank is on the rail beneath the platen assembly.

- (4) Manually select the BLANK code group and turn the page printer motor by hand until the square shaft stops turning. Install the type selecting arm assembly so that the type selecting arm is in the blank code group position (the last notch in the right side of the guide plate).
- (5) Position the bearing cap on the carriage frame; position the left-hand margin trip plate (7) and the right-hand margin trip plate (6) on the bearing cap; secure with the two machine screws (3), lockwashers (5), and flat washers (4).
- (6) Adjust the carriage as described in paragraphs 302, 303, 304, and 350.
- (7) Install the page printer on the printer base as described in paragraph 128b.

### 157. Disassembly and Reassembly of Carriage Frame (fig. 206)

#### *a. Disassembly.*

- (1) Remove the carriage from the page printer as described in paragraph 156a.
- (2) Remove the two machine screws (11) and lockwashers (12) that hold the

carriage-feed and return driving rack (13) to the carriage frame (27); remove the carriage-feed and return driving rack (13).

- (3) Remove the plain wingnut (14), lockwasher (15), and platen lockup arm (16) from the threaded end of the guide rail (17); remove the guide rail from the rollers.
- (4) Remove the two capscrews (18) that hold the ball bearings (19) in place on the carriage frame (27); remove the two ball bearings.
- (5) Remove the two capscrews (20) that hold the ball bearings (21) on the carriage frame (27); remove the ball bearings.
- (6) Remove the carriage locking stud (22) from the carriage frame (27).
- (7) Remove the setscrew (23) that holds the roller mounting stud (26) in the carriage frame (27); remove the assembled roller stud and ball bearing (25).
- (8) Remove the self-locking hexagonal nut (24) and the ball bearing (25) from the roller mounting stud (26).

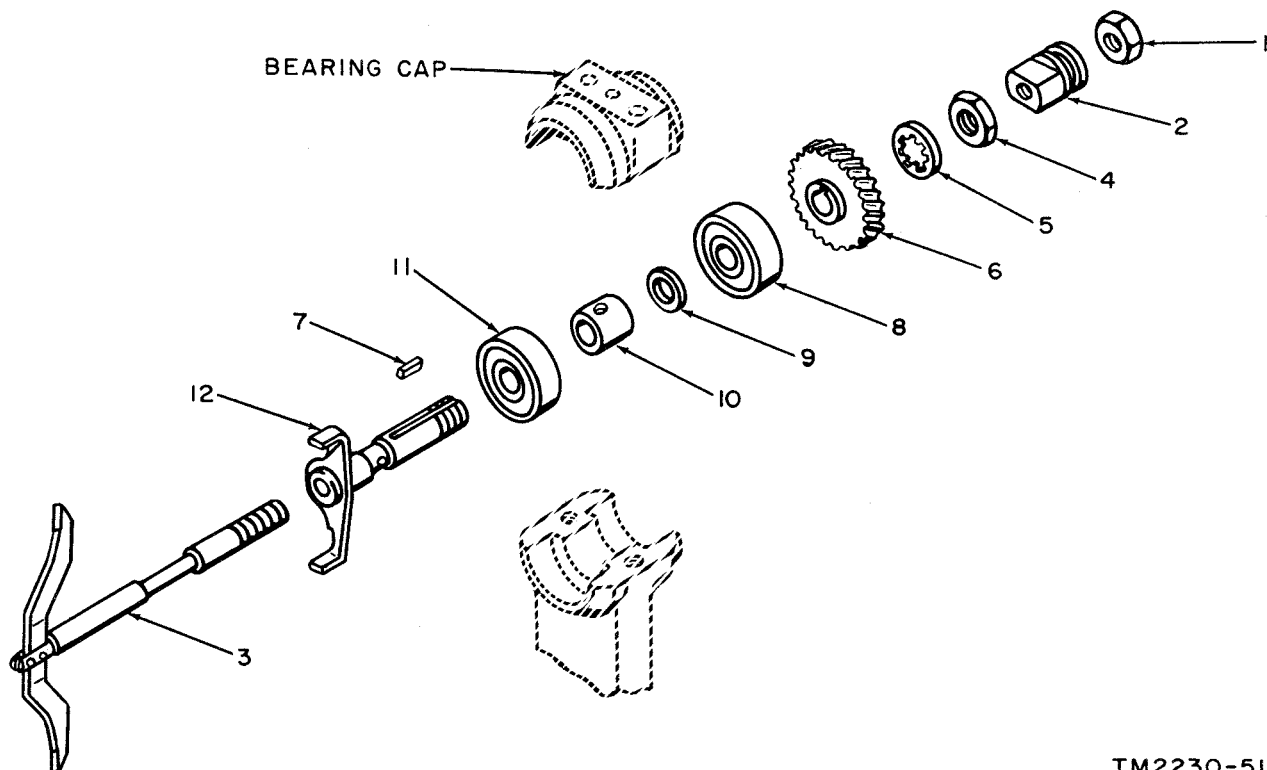
#### *b. Reassembly.*

- (1) Reassemble the carriage frame as indicated in figure 206; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the carriage as described in paragraphs 302, 303, 304, and 350.

### 158. Disassembly and Reassembly of Type Selecting Arm (fig. 207)

#### *a. Disassembly.*

- (1) Remove the type selecting arm (par. 156a (1)-(4)).
- (2) Remove the plain hexagonal nut (1) and the round nut (2) from the threaded shaft of the type selecting arm (3); remove the type selecting arm from the type selector arm driven claw (12).
- (3) Remove the plain hexagonal nut (4) and the lockwasher (5) from the type selector arm driven claw.
- (4) Remove the type selector arm driving gear (6) from the type selector arm



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- 1 Hexagonal nut, 10509
- 2 Round nut, 50564
- 3 Type selecting arm, 50560A
- 4 Hexagonal nut, 50559
- 5 Lockwasher, 10401

- 6 Type selector arm driving gear, 50556
- 7 Machine key, 50558
- 8 Ball bearing, 10757
- 9 Flat washer, 50552

- 10 Spacing collar, 50557
- 11 Ball bearing, 10757
- 12 Type selector arm driven claw, 50553A

Figure 207. Type selecting arm, exploded view.

driven claw (12); remove the machine key (7).

- (5) Remove the ball bearing (8), flat washer (9), spacing collar (10), and the ball bearing (11) from the type selector arm driven claw (12).

*b. Reassembly.*

- (1) Reassemble the type selecting arm as indicated in figure 207; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the type selecting arm (par. 156b (4) through (6)).
- (3) Adjust the type selecting arm as directed in paragraphs 322, 344, 350, and 351.

**159. Disassembly and Reassembly of Ribbon Lifter Assembly**  
(fig. 208)

*a. Disassembly.*

- (1) Remove the carriage (par. 156a).

- (2) Remove the ribbon guide (1) from the ribbon lifter bell-crank (9).

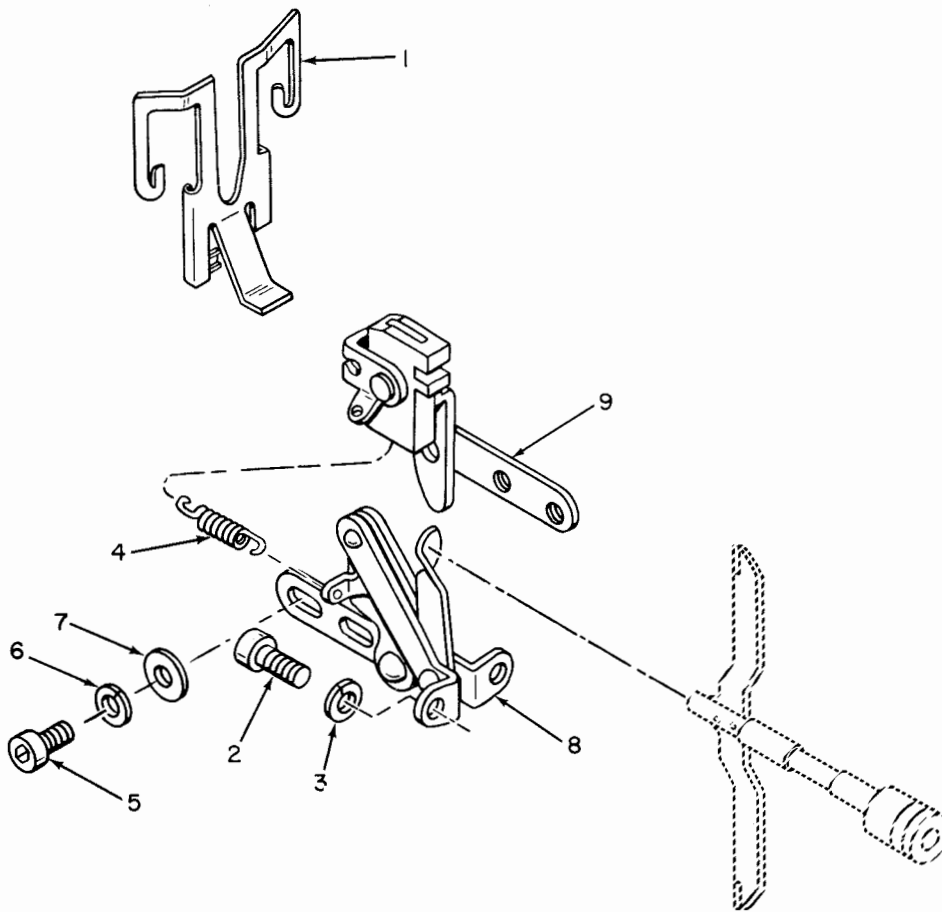
- (3) Remove the ribbon lifter spring (4) from ribbon lifter lever assembly (8) and from the ribbon lifter bellcrank (9).

- (4) Remove the two machine screws (2) and lockwashers (3) that hold the ribbon lifter lever assembly (8) to the carriage; remove the assembled ribbon lifter lever assembly.

- (5) Remove the two machine screws (5), lockwashers (6), and flat washers (7) that hold the ribbon lifter lever assembly (8) to the ribbon lifter bellcrank (9); remove the ribbon lifter lever assembly.

*b. Reassembly.*

- (1) Reassemble the ribbon lifter assembly as indicated in figure 208; the sequence for assembling the parts is the reverse of the disassembly sequence.



TM2230-523

- 1 Ribbon guide, 55036
- 2 Machine screw, 10001
- 3 Lockwasher, 10429
- 4 Ribbon-lifter spring, 51544
- 5 Machine screw, 10050

- 6 Lockwasher, 10432
- 7 Flat washer, 50320
- 8 Ribbon lifter lever assembly, 55790A
- 9 Ribbon lifter bell crank, 55795A

Figure 208. Ribbon lifter assembly, exploded view.

*Note.* Be sure the end of the ribbon guide (1) engages the notch in the front of the ribbon lifter bellcrank (9).

- (2) Replace the carriage (par. 156).
- (3) Adjust the ribbon lifter assembly (par. 346).

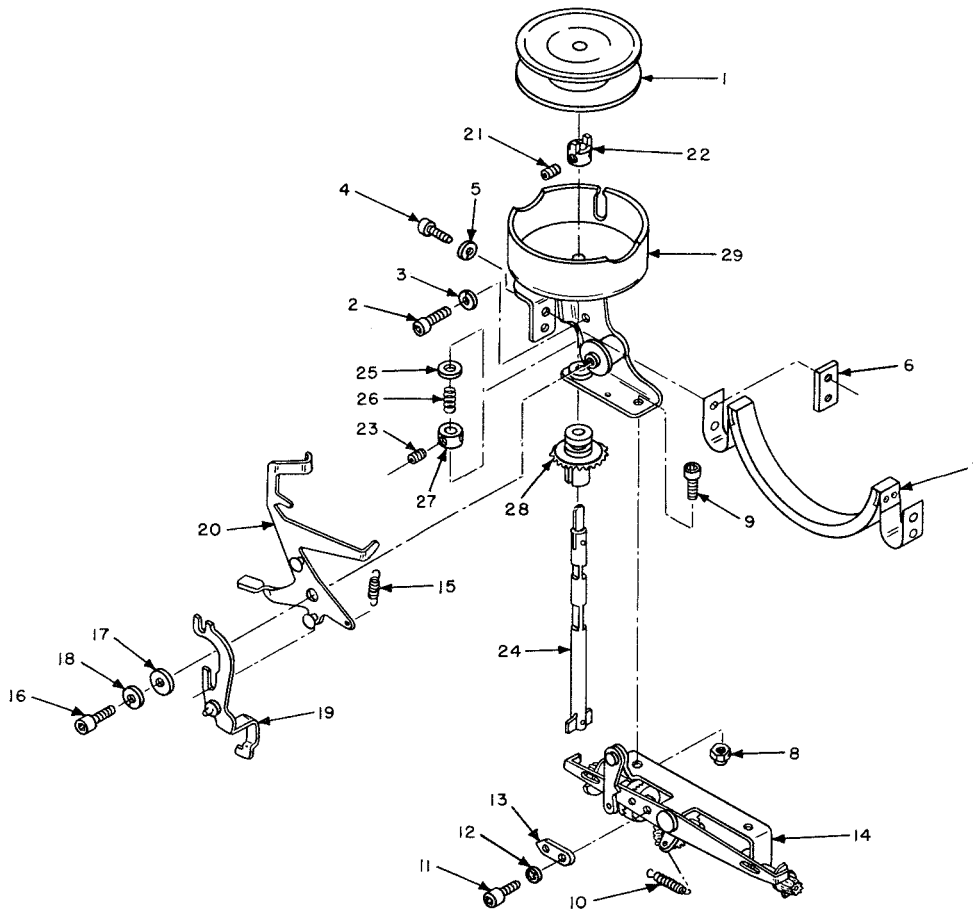
## 160. Disassembly and Reassembly of Ribbon Feed Mechanism (fig. 209)

### a. Disassembly.

- (1) Remove the carriage from the page printer as described in paragraph 156a.
- (2) Lift the locking latch and press in the ribbon sensing levers (20) to remove the printing ribbon spools (1) from

the ribbon spool drive shafts (24); remove the printing ribbon spools and the printing ribbon from the machine.

- (3) Remove the machine screws (2) and lockwashers (3) that hold the two ribbon drive mountings (29) to the carriage frame; remove the ribbon feed mechanism.
- (4) Remove the four machine screws (4), lockwashers (5), and retainer plates (6) that attach the type bar backstop cushion (7) to the ribbon drive mountings; remove the type bar backstop cushion.
- (5) Remove the two self-locking hexagonal nuts (8) from the machine screws (9) that attach the ribbon drive sub-



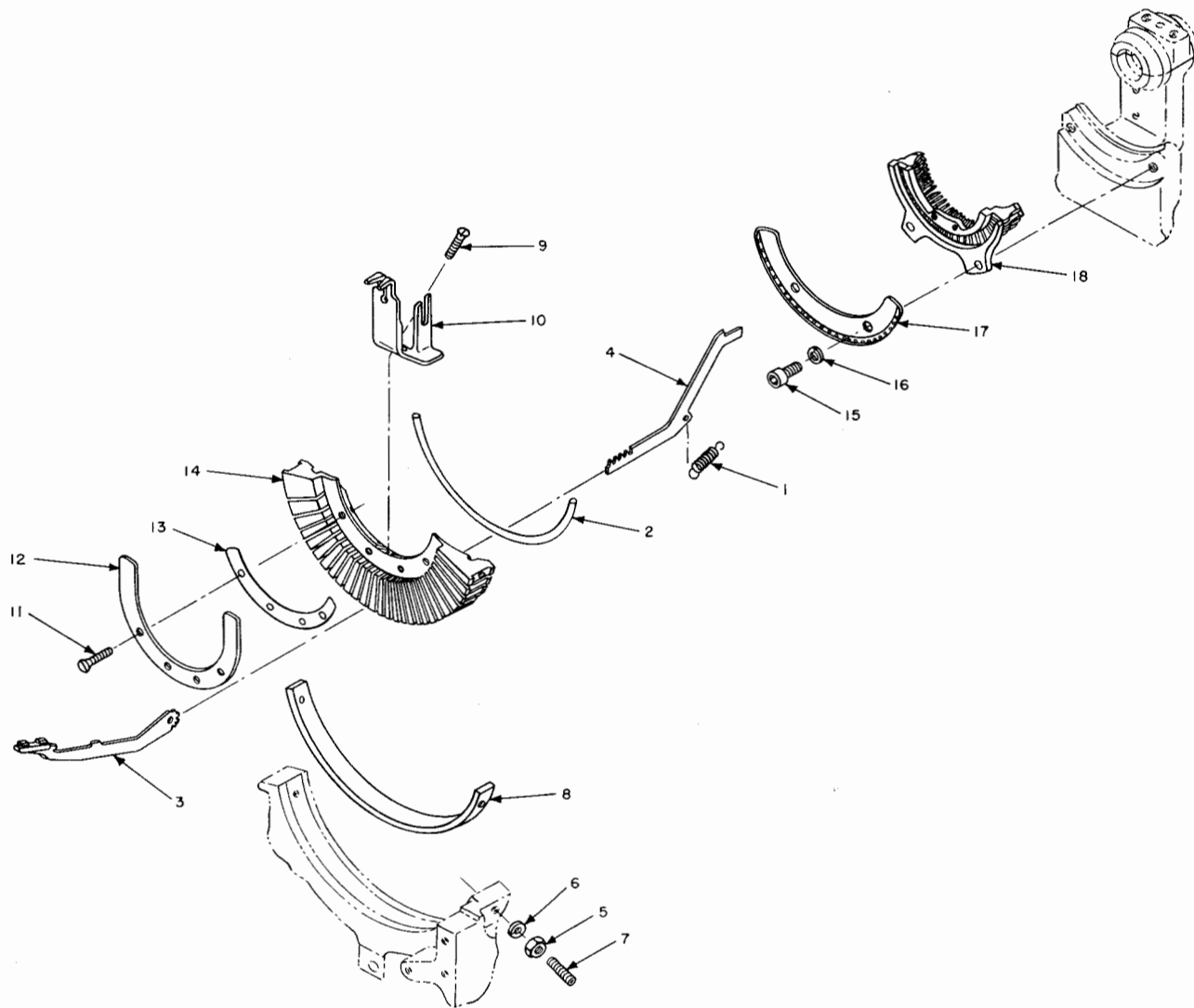
TM 2246-366

- |  |   |  |
|--|---|--|
| 1 Printing ribbon spool, 10900           | 12 Lockwasher, 10429  | 20 Ribbon sensing lever 55026A (lh), 55028A (rh)   |
| 2 Machine screw, 10004                   | 13 Ribbon reversing detent plate, 50393                             | 21 Setscrew, 10201                                 |
| 3 Lockwasher, 10429                      | 14 Ribbon drive subassembly, 50400A (includes items 11, 12, and 13) | 22 Ribbon spool driven shaft collar, 50392         |
| 4 Machine screw, 10001                   | 15 Ribbon sensing lever spring, 50447                               | 23 Setscrew, 10201                                 |
| 5 Lockwasher, 10429                      | 16 Machine screw, 10003   | 24 Ribbon spool drive shaft, 50435A                |
| 6 Retainer plate, 50434                  | 17 Flat washer, 50414   | 25 Flat washer, 50315                              |
| 7 Type bar backstop cushion, 50429A      | 18 Lockwasher, 10429  | 26 Spool friction spring, 53961                    |
| 8 Self-locking nut, 10500                | 19 Ribbon reversing cam follower, 50423A (lh), 50424A (rh)          | 27 Shaft collar, 50391                             |
| 9 Machine screws, 10003                  |   | 28 Ribbon spool driving gear, 50448                |
| 10 Ribbon reversing detent spring, 50403 |   | 29 Ribbon drive mounting, 50451A (lh), 50453A (rh) |
| 11 Machine screw 10002                   |   |  |

Figure 209. Ribbon feed mechanism, exploded view.

- assembly (14) to the two ribbon drive mountings; lift the ribbon drive subassembly from the pins on the ribbon sensing levers (20) and from the two ribbon drive mountings.
- (6) Remove the ribbon reversing detent spring (10) from the detent lever and frame of the ribbon drive subassembly (14).
  - (7) Remove the two machine screws (11) and lockwashers (12) that hold the

- ribbon reversing detent plate (13) on the ribbon drive subassembly (14); remove the detent plate.
- (8) Remove the two ribbon sensing lever springs (15) that are attached to the two ribbon sensing levers (20) and to the two ribbon drive mountings.
  - (9) Remove the two machine screws (16), flat washers (17), and lockwashers (18) that attach the two ribbon sensing levers to the posts on the two rib-



TM 2246-444

- |  |                              |                                      |
|--|------------------------------|--------------------------------------|
| 1 Spring, 50595  | 5 Plain hexagonal nut, 10509 | 13 Type bar bumper plate shim, 51244 |
| 2 Hinge pin, 50572   | 6 Lockwasher, 10431          | 14 Type bar segment, 50549           |
| 3 Type bar (for part No. see sequence chart in paragraph 161b(6))          | 7 Setscrew, 10214            | 15 Machine screw, 10025              |
| 4 Connecting bar (for part number see sequence chart in paragraph 161b(6)) | 8 Machine key, 50550         | 16 Lockwasher, 10430                 |
|  | 9 Machine screw, 10306       | 17 Mounting plate, 50548             |
|  | 10 Mounting bracket, 55147   | 18 Guide plate, 50547                |
|  | 11 Machine screw, 51132      |                                      |
|  | 12 Stop plate, 55791         |                                      |

Figure 210. Type bar group, exploded view.

bon drive mountings; remove the ribbon sensing levers and slide off the two ribbon reversing cam followers (19).

- (10) Remove the setscrews (21) that hold the ribbon spool driven shaft collars (22) on the ribbon spool drive shafts (24); remove the two ribbon spool driven shaft collars.

- (11) Remove the setscrews (23) from the two shaft collars (27); remove the two ribbon spool drive shafts (24) from the ribbon drive mountings. Remove the two flat washers (25), spool friction springs (26), and shaft collars (27) from the shaft as the shafts are removed.



- (12) Slide the two ribbon spool driving gears (28) from the two ribbon spool drive shafts.

*b. Reassembly.*

- (1) Reassemble the ribbon feed mechanism as indicated in figure 209; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the ribbon feed mechanism as described in paragraphs 346 through 349.

## 161. Disassembly and Reassembly of Type Bar Group

(fig. 210)

*a. Disassembly.*

- (1) Remove the ribbon feed mechanism as described in paragraph 160a(1) through (3).
- (2) Remove the springs (1) from the guide plate (18) and from the connecting bars (4).
- (3) Push the hinge pin (2) out of the type bar segment (14).
- (4) Remove the type bars (3) and the connecting bars (4) from the type bar segment (14) and from the mounting plate (17).
- (5) Remove the two plain hexagonal nuts (5) and lockwashers (6) that lock the setscrews (7) in the carriage frame; remove the setscrews from the type bar segment (14) and the carriage frame. Remove the type bar segment from the carriage frame.
- (6) Remove the type bar segment machine key (8) from the carriage frame.
- (7) Remove the two machine screws (9) that hold the ribbon guide mounting bracket (10) in place in the type bar segment (14); remove the ribbon guide mounting bracket.
- (8) Remove the four machine screws (11) that hold the stop plate (12) and type bar bumper plate shim (13) to the type bar segment (14); remove the type bar bumper stop plate, and the type bar bumper plate shim.

- (9) Remove the two machine screws (15) and lockwashers (16) that attach the mounting plate (17) and the guide plate (18) to the carriage frame; remove the guide plate and the mounting plate.

*b. Reassembly.*

- (1) Reassemble the type bar group as indicated in figure 219; the sequence for assembling the parts is the reverse of the disassembly sequence. Numbers are stamped in both the connecting bars and the type bars. Install them in matched pairs with the No. 1 set on the left side of the carriage. The sequence and reference numbers of each bar is given in the chart below.

Type and Connecting Bar Sequence Chart

No. stamped in bar	Connecting bar ref No.	Type bar ref No. (standard keyboards)	Type bar ref No. (weather keyboard)	Type bar symbol all models LTRS position
1	50022	50054A	53074A	Z
2	50023	50055A	53075A	J
3	50024	50056A	50056A	X
4	50025	50057A	53076A	V
5	50026	50058A	53077A	B
6	50027	50059A	53078A	C
7	50028	50060A	50060A	P
8	50029	50061A	50061A	M
9	50030	50062A	53079A	F
10	50031	50063A	50063A	R
11	50032	50064A	50064A	O
12	50033	50065A	50065A	I
13	50034	50066A	50066A	T
14	50035	50067A	50067A	E
15	50036	50068A	53080A	A
16	50037	53260A	53260A	S
17	50038	53280A	53081A	H
18	50039	50071A	53082A	N
19	50040	50072A	53083A	L
20	50041	50073A	53084A	D
21	50042	50074A	50074A	U
22	50043	50075A	53085A	G
23	50044	50076A	50076A	Y
24	50045	50077A	50077A	W
25	50046	50078A	53086A	K
26	50047	50079A	50079A	Q
27	50048	None	53087A	None

- (2) Install the ribbon feed mechanism as described in paragraph 160b.

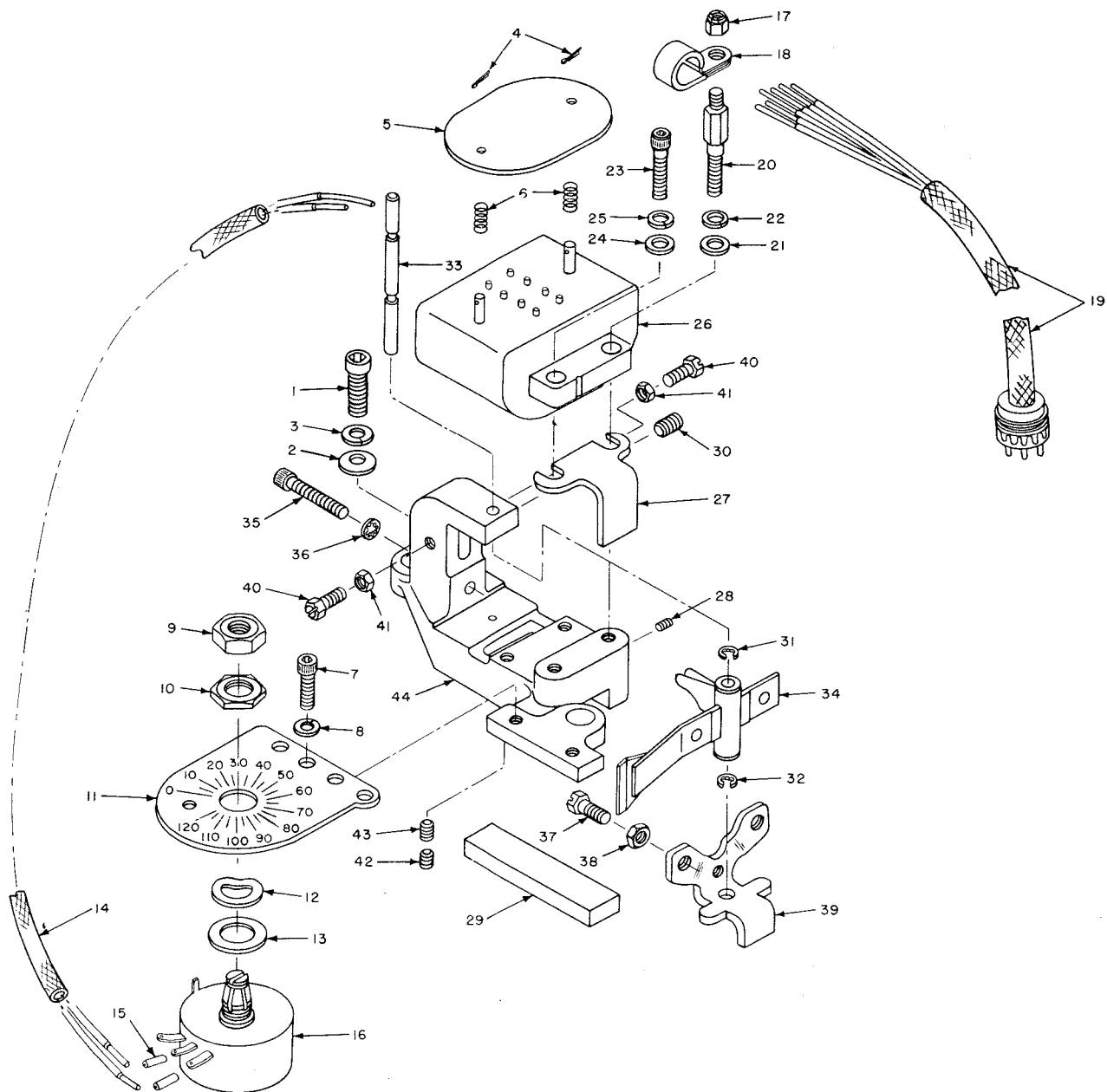
## 162. Disassembly and Reassembly of Selector Magnet (TT-117/FG and TT-119/FG) (fig. 211)

### *a. Disassembly.*

- (1) Remove the two machine screws (1), flat washers (2), and lockwashers (3) that attach the selector magnet bracket (44) to the frame of the page printer; remove the selector magnet assembly from the frame of the page printer.
- (2) Remove the two cotter pins (4) that hold the cover (5) on the studs of the selector magnet (26); remove the cover and the two cover springs (6).
- (3) Remove the two machine screws (7) and lockwashers (8) that attach the assembled potentiometer mounting bracket (11) to the selector magnet bracket (44); remove the assembled potentiometer (16) and bracket.
- (4) Remove the nut (9) and the plain hexagonal nut (10) from the threaded bushing of the potentiometer (16); remove the potentiometer mounting bracket (11) from the potentiometer.
- (5) Unsolder the two electrical leads in the tubing (14) from the two terminal posts on the selector magnet (26) and from the two terminal lugs on the potentiometer (16); tag the leads. Remove the tubing from the electrical cable assembly. Remove the two pieces of tubing (15) from the electrical leads at the potentiometer.
- (6) Remove the hexagonal nut (17) and the lockwasher from the selector magnet cable stud (20). Remove the electrical clamp (18) from the selector magnet cable stud.
- (7) Unsolder the six electrical wires of the selector magnet cable (19) from the six terminal posts on the selector magnet (26) and tag the leads; remove the selector magnet cable from the electrical clamp.
- (8) Remove the selector magnet cable stud (20), flat washer (21), lockwasher (22), machine screw (23), flat washer (24), and lockwasher

(25) that attach the selector magnet (26) and the bracket (27) to the selector magnet bracket (44); remove the selector magnet and the magnet bracket.

- (9) Remove the setscrew (28) that holds the magnet (29) in the selector magnet bracket (44); mark the magnet and bracket before removing the magnet from the selector magnet bracket.
  - (10) Remove the setscrew (30) that holds the armature lever mounting shaft (33) in the selector magnet bracket (44).
  - (11) Remove the retainer rings (31 and 32) from the armature lever mounting shaft (33); slide the armature lever mounting shaft from the armature (34) and from the selector magnet bracket (44). Remove the armature from the selector magnet bracket.
  - (12) Remove the machine screw (35) and lockwasher (36) that hold the armature stop bracket (39) on the selector magnet bracket (44); remove the assembled armature stop bracket and machine screws (37).
  - (13) Remove the two machine screws (37) and the plain hexagonal nuts (38) from the armature stop bracket (39).
  - (14) Remove the two armature leaf spring stop screws (40) and plain hexagonal nuts (41) from the selector magnet bracket (44).
  - (15) Remove the setscrews (42 and 43) from the selector magnet bracket.
- ### *b. Reassembly.*
- (1) Install the four setscrews (43 and 42) in the selector magnet bracket (44), with the leading ends flush with the top surface of the mounting bracket.
  - (2) Install the plain hexagonal nuts (41) on the armature leaf spring stop screws (40) about halfway up the threads; install the machine screws in the selector magnet bracket.
  - (3) Install the plain hexagonal nuts (38) on the machine screws (37); install the machine screws in the armature



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- |   |   |   |
|---|---|---|
| 1 Machine screw, 10018                              | 17 Self-locking hexagonal nut, 10501    | 34 Armature, 54092A   |
| 2 Flat washer, 10464                                | 18 Electrical clamp, 20513              | 35 Machine screw, 10010   |
| 3 Lockwasher, 10420                                 | 19 Selector magnet cable, 53545A        | 36 Lockwasher, 10404  |
| 4 Cotter pin, 10806                                 | 20 Selector magnet cable stud, 56127    | 37 Machine screw, 53183   |
| 5 Cover, 56089                                      | 21 Flat washer, 50315                   | 38 Plain hexagonal nut, 10507                                     |
| 6 Cover spring, 56091                               | 22 Lockwasher, 10430                    | 39 Armature stop bracket, 52529                                   |
| 7 Machine screw, 10032                              | 23 Machine screw, 10011                 | 40 Armature leaf spring stop screw, 53183                         |
| 8 Lockwasher, 10430                                 | 24 Flat washer, 50315                   | 41 Plain hexagonal nut, 10507                                     |
| 9 Nut   | 25 Lockwasher, 10430                    | 42 Setscrew, 10221  |
| 10 Plain hexagonal nut, 10529                       | 26 Selector magnet, 56126A              | 43 Setscrew, 10235  |
| 11 Potentiometer mounting bracket, 53333            | 27 Bracket, 52292                       | 44 Magnet bracket assembly, 56130A (includes items 20 through 43) |
| 12 Lockwasher, 10465                                | 28 Setscrew, 10220                      |   |
| 13 Flat washer, 10468                               | 29 Magnet, 52289                        |   |
| 14 Tubing, 20837                                    | 30 Setscrew, 10225                      |   |
| 15 Tubing, 20732                                    | 31 Retainer ring, 10969                 |   |
| 16 Potentiometer (R-4), 20025 (includes item No. 9) | 32 Retainer ring, 10969                 |   |
|   | 33 Armature lever mounting shaft, 52288 |   |

Figure 211. Selector magnet 59970A, exploded view (TT-117/FG and TT-119/FG).

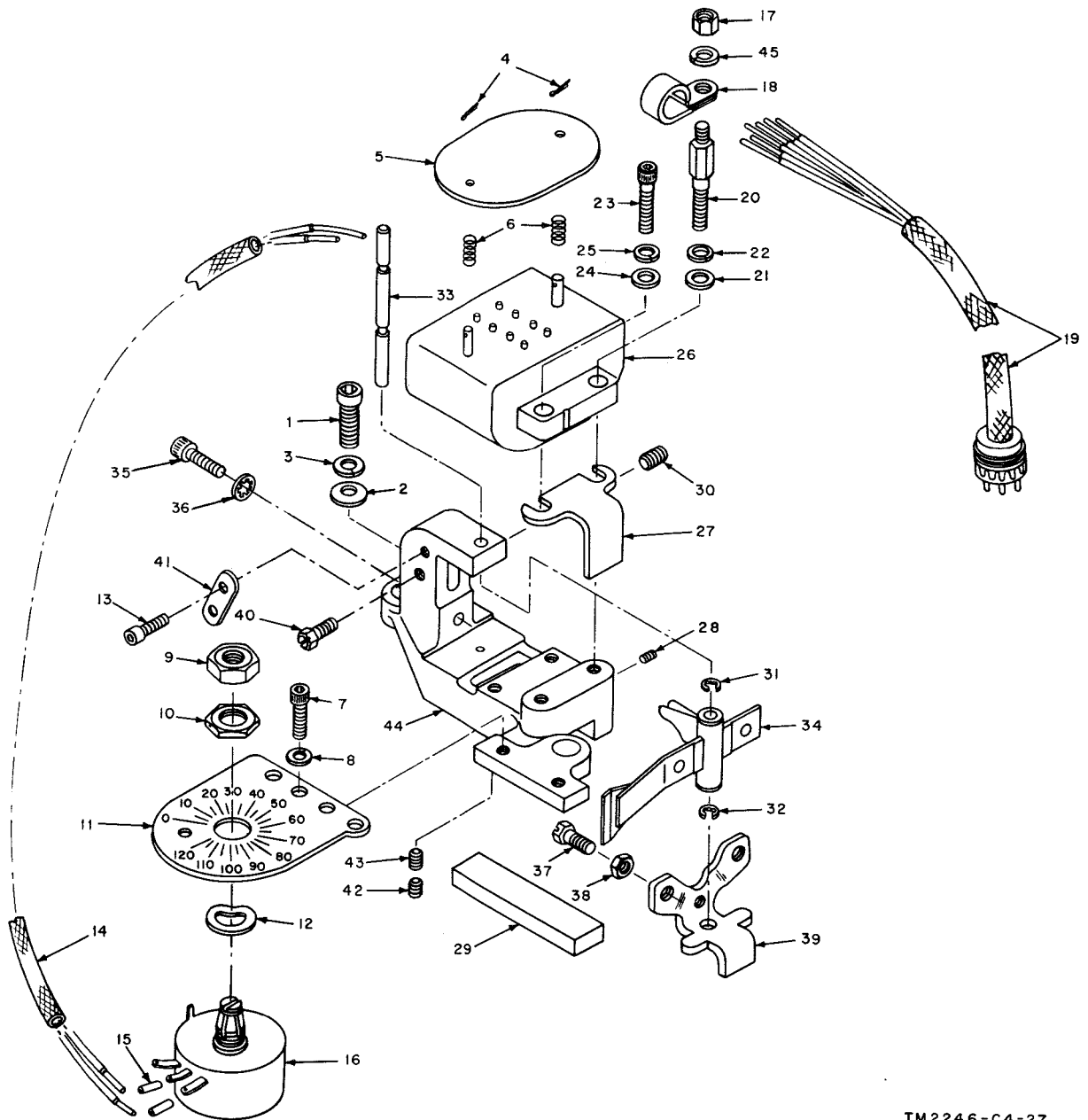
stop bracket (39) with the ends of the machine screws approximately flush with the face of the armature stop bracket.

- (4) Position the armature stop bracket (39) on the selector magnet bracket; hold in place with a machine screw (35) and lockwasher (36).
- (5) Position the armature (34) in the selector magnet bracket (44); insert the armature lever mounting shaft (33) through the selector magnet bracket, armature, and armature stop bracket (39). Install the retainer rings (32 and 31) on the armature lever mounting shaft (33).
- (6) Hold the armature lever mounting shaft (33) in the selector magnet bracket (44) with a setscrew (30).
- (7) Assemble the magnet (29) on the selector magnet bracket (44); leave an air gap of 0.015 inch between the south pole of the magnet and the end of the armature stop bracket (39) (par. 287) hold the magnet in place with a setscrew (28). The north pole of the magnet is designated by a red dot.
- (8) Position the bracket (27) on the selector magnet bracket (44) and on the end of the magnet for full surface contact.
- (9) Position the selector magnet (26) on the selector magnet bracket; hold the bracket (27) and the selector magnet on the selector magnet bracket with a lockwasher (25), flat washer (24), machine screw (23), lockwasher (22), flat washer (21), and selector magnet cable stud (20). Adjust the position of the selector magnet before tightening the machine screw (23) and cable stud (20) (par. 319).
- (10) Install the selector magnet cable (19) through the electrical clamp (18); solder the ends of the six electrical wires in the cable and the two potentiometer wires to the proper terminal posts on the selector magnet.
- (11) Position the electrical clamp on the selector magnet cable stud (20) and secure with the lockwasher and hexagonal nut (17).
- (12) Slide the two pieces of insulating tubing (15) over the ends of the wires in the tubing (14); solder the two cable wires to the two terminal lugs on the potentiometer (16). Slide the two pieces of tubing over the soldered connections.
- (13) Install the potentiometer on the mounting bracket (11), hold it in place with the plain hexagonal nut (10). Draw up the nut (9) finger-tight.
- (14) Position the assembled potentiometer (16) and potentiometer mounting bracket (11) on the selector magnet bracket (44); attach with the two lockwashers (8) and machine screws (7).
- (15) Place the two cover springs (6) on the studs on the selector magnet (26); position the cover (5) on the studs and hold it in place with the two cotter pins (4).
- (16) Perform the adjustments described in paragraphs 287 through 293.

### **163. Disassembly and Reassembly of Selector Magnet (TT-117A/FG, TT-119A/FG, and TT-118/FG)** (fig. 212)

#### *a. Disassembly.*

- (1) Perform the disassembly procedure as described in paragraph 162a(1) through (3).
- (2) Remove the locking nut (9) and the plain hexagonal nut (10) from the threaded bushing of potentiometer R3 (16); remove the mounting bracket (11) and lockwasher (12) from the potentiometer.
- (3) Perform the procedure described in paragraph 162a(5).
- (4) Remove the hexagonal nut (17) and lockwasher (45) from the selector magnet cable stud (20). Remove the



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- |  |   |   |
|--|---|---|
| 1 Machine screw, 10018                         | 17 Plain hexagonal nut, 10507           | 34 Armature, 54092A   |
| 2 Flat washer, 10464                           | 18 Electrical clamp, 20513              | 35 Machine screw, 10010   |
| 3 Lockwasher, 10420                            | 19 Selector magnet cable, 53545A        | 36 Lockwasher, 10404  |
| 4 Cotter pin, 10806                            | 20 Selector magnet cable stud, 56127    | 37 Machine screw, 53183   |
| 5 Cover, 56089                                 | 21 Flat washer, 50315                   | 38 Plain hexagonal nut, 10507   |
| 6 Cover spring, 56091                          | 22 Lockwasher, 10430                    | 39 Armature stop bracket, 52529                                       |
| 7 Machine screw, 10032                         | 23 Machine screw, 10011                 | 40 Armature leaf spring stop screw, 53183                             |
| 8 Lockwasher, 10430                            | 24 Flat washer, 50315                   | 41 Adjusting tab, 59896   |
| 9 Nut, 3/8" x 32 (part of item 16)             | 25 Lockwasher, 10430                    | 42 Setscrew, 10221  |
| 10 Plain hexagonal nut, 10529                  | 26 Selector magnet, 56126A              | 43 Setscrew, 10235  |
| 11 Potentiometer mounting bracket, 59998       | 27 Bracket, 52292                       | 44 Magnet bracket assembly (includes item 13 and items 20 through 43) |
| 12 Lockwasher, 10419                           | 28 Setscrew, 10220                      |   |
| 13 Machine screw, 10058                        | 29 Magnet, 52289                        |   |
| 14 Tubing, 20837                               | 30 Setscrew, 10225                      |   |
| 15 Tubing, 20732                               | 31 Retainer ring, 10969                 |   |
| 16 Potentiometer (R3), 20025 (includes item 9) | 32 Retainer ring, 10969                 |   |
|  | 33 Armature lever mounting shaft, 52288 |   |
|  |   | 34 Armature, 54092A   |
|  |   | 35 Machine screw, 10010   |
|  |   | 36 Lockwasher, 10404  |
|  |   | 37 Machine screw, 53183   |
|  |   | 38 Plain hexagonal nut, 10507   |
|  |   | 39 Armature stop bracket, 52529                                       |
|  |   | 40 Armature leaf spring stop screw, 53183                             |
|  |   | 41 Adjusting tab, 59896   |
|  |   | 42 Setscrew, 10221  |
|  |   | 43 Setscrew, 10235  |
|  |   | 44 Magnet bracket assembly (includes item 13 and items 20 through 43) |
|  |   | 45 Lockwasher, 10430  |

Figure 212. Selector magnet 59970A, exploded view (TT-117A/FG, TT-118/FG, and TT-119A/FG).

electrical clamp (18) from the cable stud.

- (5) Continue the disassembly procedure as described in paragraph 162a(7) through (13).
- (6) Remove the two machine screws (13) that hold the adjusting tabs (41); remove the two armature leaf spring stop screws (40) and the two adjusting tabs (41) from the selector magnet bracket (44).
- (7) Remove the setscrews (42 and 43) from the selector magnet bracket.

*b. Reassembly.*

- (1) Install the setscrews (43 and 42) in the selector magnet bracket (44), with the leading ends flush with the surface of the mounting bracket.
- (2) Pull the two adjusting tabs (41) on their respective machine screws (13) and install the two machine screws (13) on the selector magnet bracket. Be sure that the larger holes of the tabs (41) align with the holes for the leaf spring stop screws (40). Turn the two armature leaf spring stop screws (40), about halfway up the thread, into the selector magnet bracket.
- (3) Continue the reassembly procedures as described in paragraph 162b(3) through (10).
- (4) Position the electrical cable clamp (18) on the selector magnet cable stud (20) and secure it with the lockwasher (45) and hexagonal nut (17).
- (5) Repeat the procedure described in paragraph 162b(12).
- (6) Place the lockwasher (12) on the threaded bushing of the potentiometer (16); install the potentiometer (16) into the mounting bracket (11) and secure it in place with the hexagonal nut (10). Turn down the locking nut (9) fingertight.
- (7) Follow the remaining procedures of reassembly as described in paragraph 162b(14) through (21).

## 164. Disassembly and Reassembly of Rangefinder

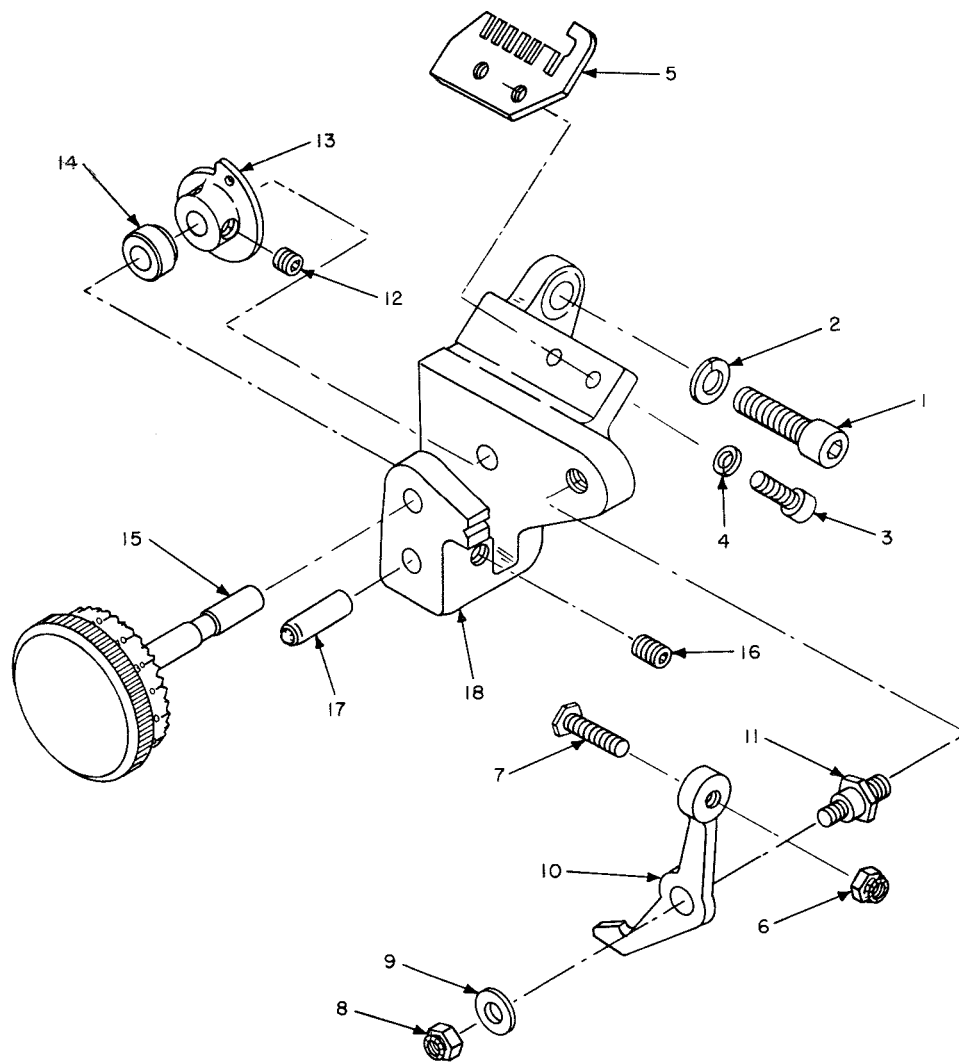
(fig. 213)

*a. Disassembly.*

- (1) Remove the two machine screws (1) and lockwashers (2) that attach the selector lever comb bracket (18) to the frame of the page printer; remove the assembled selector lever comb bracket.
- (2) Remove the two machine screws (3) and lockwashers (4) that attach the selector lever guide comb (5) to the selector lever comb bracket (18); remove the selector lever guide comb.
- (3) Remove the self-locking hexagonal nut (8) and the flat washer (9) that attach the orientation lever (10) to the orientation lever stud (11); remove the assembled orientation lever and machine screw (7).
- (4) Remove the self-locking hexagonal nut (6) and machine screw (7) from the orientation lever (10).
- (5) Remove the orientation lever stud (11).
- (6) Remove the two setscrews (12) that hold the rangefinding cam (13) to the shaft of the rangefinder dial assembly (15); pull the dial assembly from the rangefinding cam (13) and the spacer (14).
- (7) Remove the setscrew (16) that holds the positioning ball (17) in the selector lever comb bracket (18); remove the positioning ball.

*b. Reassembly.*

- (1) Reassemble the rangefinder as indicated in figure 213; the sequence for assembling the parts is the reverse of the disassembly sequence. When replacing the selector lever guide comb (5) be sure the selector levers are aligned in the slots in the comb.
- (2) Adjust the rangefinder as described in paragraphs 266, 267, and 268.



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- |                                     |                                     |  |
|-------------------------------------|-------------------------------------|--|
| 1 Machine screw, 10018              | 8 Self-locking hexagonal nut, 10500 | 15 Rangefinder dial assembly<br>52920A   |
| 2 Lockwasher, 10431                 | 9 Flat washer, 50414                | 16 Setscrew, 10203                       |
| 3 Machine screw, 10004              | 10 Orientation lever, 53112         | 17 Positioning ball, 53306A              |
| 4 Lockwasher, 10429                 | 11 Orientation lever stud, 53111    | 18 Selector lever comb bracket,<br>53109 |
| 5 Selector lever guide comb, 50511  | 12 Setscrew, 10201                  |  |
| 6 Self-locking hexagonal nut, 10500 | 13 Rangefinding cam, 50317          |  |
| 7 Machine screw, 10307              | 14 Spacer, 51424                    |  |

Figure 213. Rangefinder, exploded view.

## 165. Disassembly and Reassembly of Selector Levers and Y-Levers (fig. 214)

### a. Disassembly.

- (1) Remove the six selector lever springs (1) from the anchor post (2) and from the stop lever (35) and the five selector levers (32).
- (2) Remove the plain hexagonal nut (3) from the anchor post (2); remove the anchor post (2) from the page printer frame.
- (3) Unhook the ends of the Y-lever detent springs (4) from the five Y-lever detents (9, 11, 13, 15, and 18) and from the Y-lever detent spring bracket (48); remove the Y-lever detent springs.
- (4) Remove the plain hexagonal nut (5), lockwasher (6), and centering sleeve

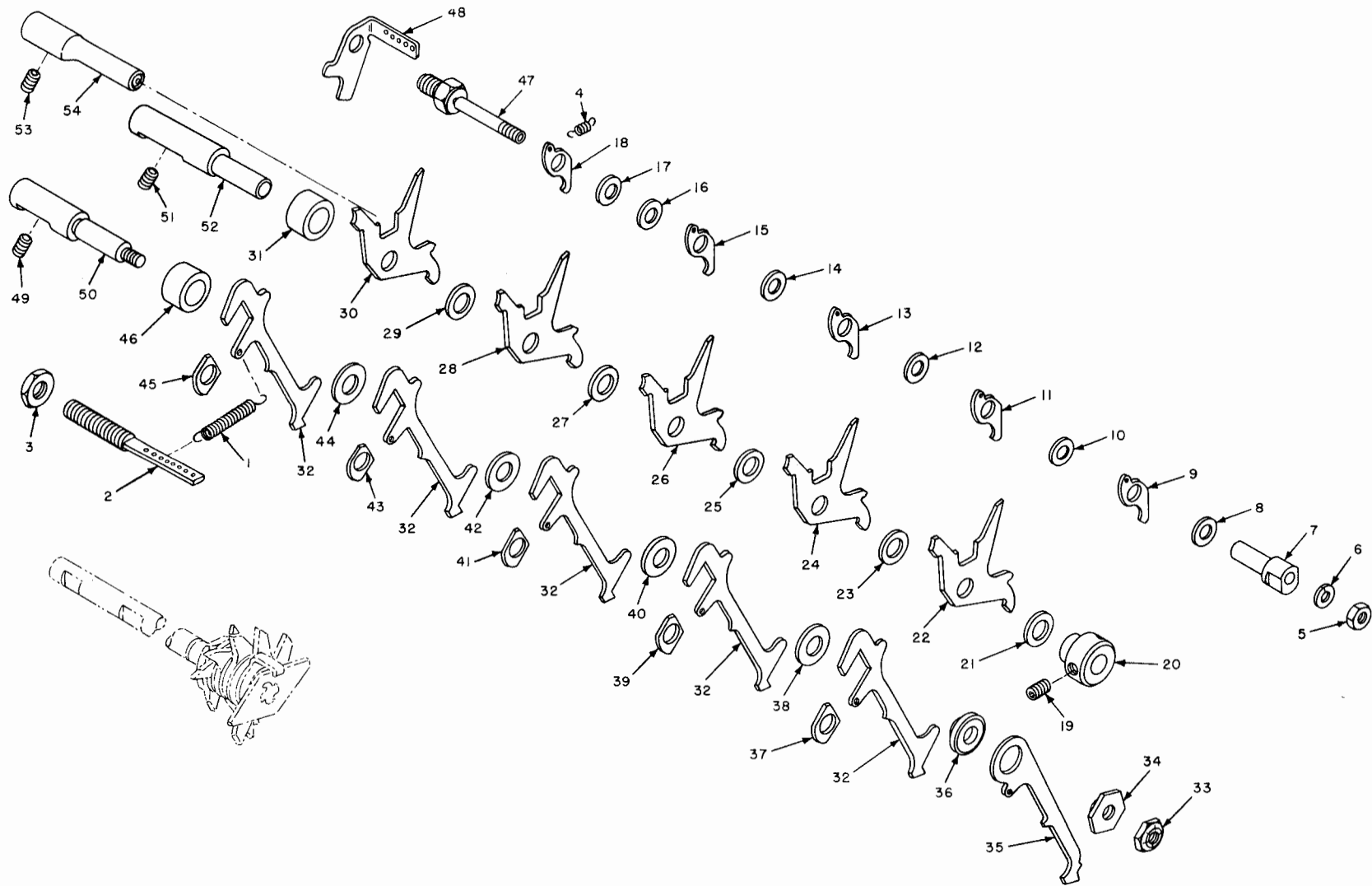


Figure 214. Selector levers and Y-levers, exploded view.



1 Selector lever spring, 50902 (5 reqd)	18 Y-lever detent	36 Flat washer, 50053
2 Anchor post, 50325	19 Setscrew, 10209	37 Bearing, 50019A (consists of set of 5, items 37, 39, 41, 43, and 45)
3 Plain hexagonal nut, 10509	20 Spacing collar, 55006	38 Flat washer, 50147 (consists of set of 4, items 38, 40, 42, and 44)
4 Y-lever detent spring, 55009 (5 reqd)	21 Flat washer, 50148 (consists of set of 5, items 21, 23, 25, 27, and 29)	39 Bearing
5 Plain hexagonal nut, 10504	22 Y-lever, 53540A (consists of set or 5, items 22, 24, 26, 28, and 30)	40 Flat washer
6 Lockwasher, 10434	23 Flat washer	41 Bearing
7 Centering sleeve, 55007	24 Y-lever	42 Flat washer
8 Thrust washer, 55001 (consists of set of 5, items 8, 10, 12, 14, and 16)	25 Flat washer	43 Bearing
9 Y-lever detent, 55004 (consists of set of 5, items 9, 11, 13, 15, and 18)	26 Y-lever	44 Flat washer
10 Thrust washer	27 Flat washer	45 Bearing
11 Y-lever detent	28 Y-lever	46 Collar, 51416
12 Thrust washer	29 Flat washer	47 Y-lever detent pivot, 55008
13 Y-lever detent	30 Y-lever	48 Y-lever detent spring bracket, 55002
14 Thrust washer	31 Collar, 51416	49 Setscrew, 10211
15 Y-lever detent	32 Selector lever, 51068A (consists of set of 5)	50 Selector lever pivot stud, 53268
16 Thrust washer	33 Self-locking hexagonal nut, 10500	51 Setscrew, 10247
17 Flat washer, 55076	34 Eccentric bearing, 51046	52 Y-lever pivot stud, 53269
	35 Stop lever, 50014	53 Setscrew, 10211
		54 Y-lever eccentric stop, 50152

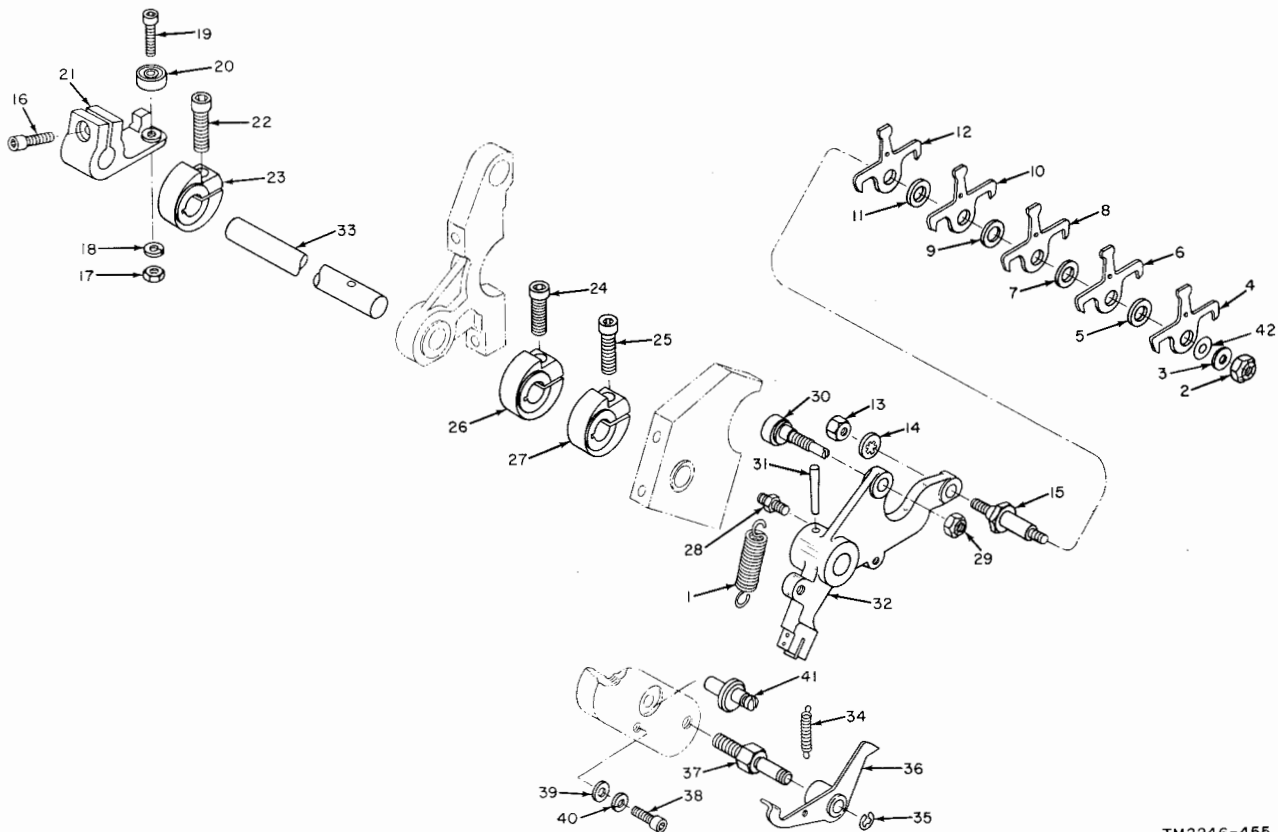
Figure 214.—Continued.

- (7) from the Y-lever detent pivot (47). Remove the five thrust washers (8, 10, 12, 14, and 16) and five Y-lever detents (9, 11, 13, 15, and 18) alternately, and the flat washer (17) from the centering sleeve (7).
- (5) Remove the two setscrews (19) that hold the spacing collar (20) on the end of the Y-lever pivot stud (52); remove the flat washers (21, 23, 25, 27, and 29) and Y-levers (22, 24, 26, 28, and 30) alternately, and the collar (31) from the Y-lever pivot stud (52). Note the relative position of each Y-lever.
- (6) Remove the five selector levers (32) from the bearings (37, 39, 41, 43, and 45). Note the relative position of each lever.
- (7) Remove the self-locking hexagonal nut (33) and the eccentric bearing (34) from the selector lever pivot stud (50); remove the stop lever (35) and the flat washer (36).
- (8) Remove the bearings (37, 39, 41, 43, and 45) and the flat washers (38, 40, 42, and 44) alternately, and remove the collar (46) from the selector lever pivot stud (50).
- (9) Remove the Y-lever detent pivot (47) and the Y-lever detent spring bracket (48) from the page printer frame.
- (10) Remove the setscrew (49) that holds the selector lever pivot stud (50) to the page printer frame; remove the selector lever pivot stud.
- (11) Remove the setscrew (51) that holds the Y-lever pivot stud (52) to the page printer frame; remove the Y-lever pivot stud.
- (12) Remove the setscrew (53) that holds the Y-lever eccentric stop (54) to the page printer frame; remove the Y-lever.
- b. Reassembly.*
- (1) Reassemble the selector lever and Y-lever assemblies as indicated in figure 214; the sequence for assembling the parts is the reverse of the disassembly sequence. Do not replace individual selector levers or Y-levers; replace the entire set.
- (2) Adjust the selector levers and Y-levers as described in paragraphs 264, 265, 266, 282, 284, and 291.

## 166. Disassembly and Reassembly of Transfer Lever Shaft (fig. 215)

### *a. Disassembly.*

- (1) Remove the paper roller stand and terminal box as described in paragraph 192a.



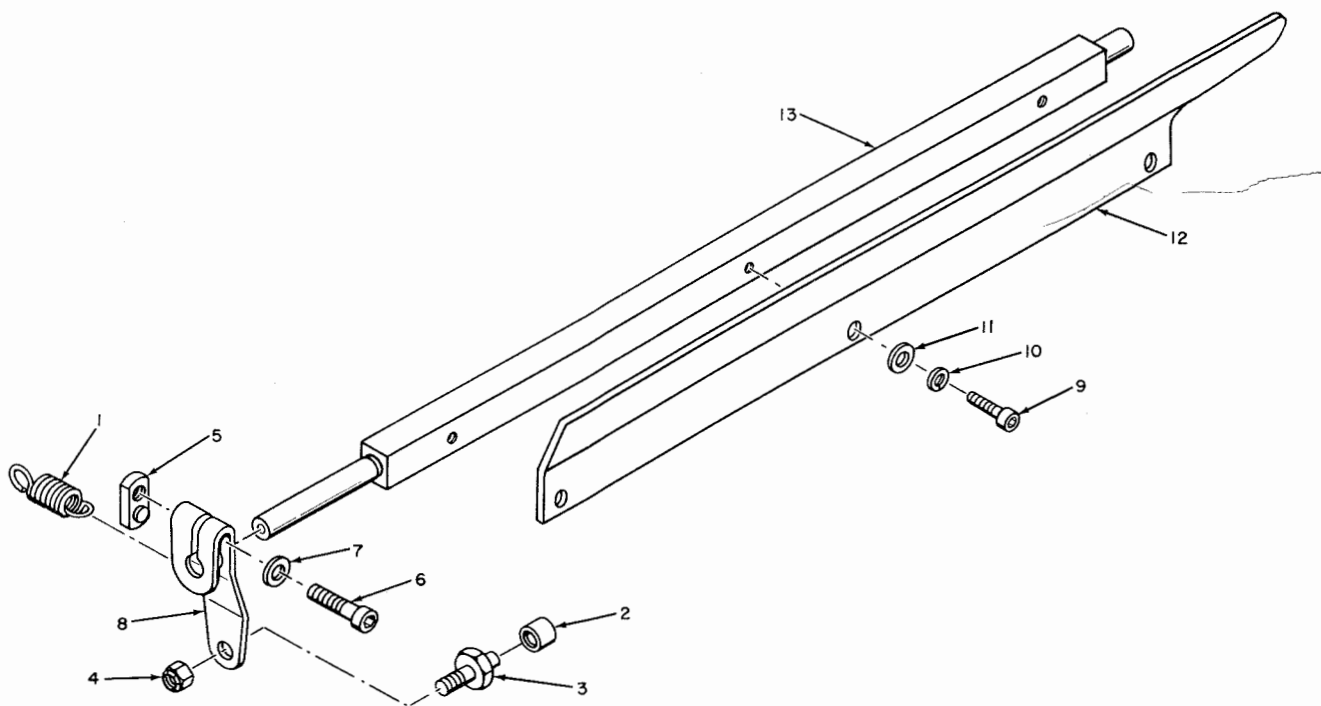
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- |  |                                      |  |
|--|--------------------------------------|--|
| 1 Transfer lever spring, 50903                         | 15 T-lever pivot stud, 50650         | 30 Transfer lever roller stud, 56185A                        |
| 2 Self-locking hexagonal nut, 10500                    | 16 Machine screw, 10008              | 31 Taper pin   |
| 3 Flat washer, 50414                                   | 17 Plain hexagonal nut, 10504        | 32 Transfer lever assembly 52394A (includes items 31 and 33) |
| 4 T-lever, 56766A (includes items 4, 6, 8, 10, and 12) | 18 Lockwasher, 10434                 | 33 Transfer lever shaft                                      |
| 5 Flat washer, 50148 (includes items 5, 7, 9, and 11)  | 19 Machine screw, 10000              | 34 Spring, 50904   |
| 6 T-lever  | 20 Ball bearing, 10754               | 35 Retainer ring, 10949                                      |
| 7 Flat washer  | 21 Clutch latch, 50535               | 36 Transfer lever latch, 50020A                              |
| 8 T-lever  | 22 Machine screw, 10010              | 37 Transfer lever latch stud, 52319                          |
| 9 Flat washer  | 23 Shaft collar, 53973               | 38 Machine screw, 10003                                      |
| 10 T-lever   | 24 Machine screw, 10010              | 39 Flat washer, 50839  |
| 11 Flat washer   | 25 Machine screw, 10010              | 40 Lockwasher, 10429   |
| 12 T-lever   | 26 Shaft collar, 53973               | 41 Spring post eccentric, 56076                              |
| 13 Plain hexagonal nut, 50651                          | 27 Shaft collar, 53973               | 42 Shim: .002-in., 57072; .003-in., 57073                    |
| 14 Lockwasher, 10404                                   | 28 Spring stud, 50649                |  |
|  | 29 Self-locking hexagonal nut, 10501 |  |

Figure 215. Transfer lever shaft, exploded view.

- (2) Remove the transfer lever spring (1) from the transfer lever spring stud (28) and from the spring post eccentric (41).
- (3) Remove the self-locking hexagonal nut (2), shims (42), and flat washer (3) that hold the T-levers (4, 6, 8, 10, and 12) to the T-lever pivot stud (15); alternately remove the T-levers and the flat washers (5, 7, 9, and 11).
- (4) Remove the plain hexagonal nut (13) and lockwasher (14) that hold the T-lever pivot stud (15) to the transfer lever assembly (32); remove the T-lever pivot stud.
- (5) Remove the machine screw (16) that holds the clutch latch (21) to the transfer lever shaft (33); remove the assembled clutch latch and ball bearing (20).

- (6) Remove the plain hexagonal nut (17), lockwasher (18), and machine screw (19) that hold the ball bearing (20) to the clutch latch (21); remove the ball bearing.
  - (7) Remove the machine screw (22) that holds the shaft collar (23) to the transfer lever shaft (33); remove the shaft collar.
  - (8) Remove the machine screw (24) that holds the shaft collar (26) to the transfer lever shaft (33), and the machine screw (25) that holds the shaft collar (27) to the shaft.
  - (9) Pull the transfer lever assembly (32) out of the bearing caps in the page printer frame; catch the shaft collars (26 and 27) as they fall from the shaft.
  - (10) Remove the spring stud (28) from the transfer lever assembly (32).
  - (11) Remove the self-locking hexagonal nut (29) that holds the transfer lever roller stud (30) to the transfer lever assembly (32); remove the transfer lever roller stud.
  - (12) Remove the spring (34) from the transfer lever latch (36) and from the spring post; remove the spring.
  - (13) Remove the retainer ring (35) that holds the transfer lever latch (36) to the transfer lever latch stud (37) on the page printer frame; remove the transfer lever latch.
  - (14) Remove the transfer lever latch stud (37) from the page printer frame.
  - (15) Remove the machine screw (38), flat washer (39), and lockwasher (40) that hold the spring post eccentric (41) to the printer frame; remove the spring post eccentric.
- b. Reassembly.*
- (1) Reassemble the transfer lever and shaft assemblies as indicated in figure 215; the sequence for assembling the parts is the reverse of the disassembly sequence.
  - (2) Adjust the transfer lever shaft and the clutch latch as described in paragraphs 279, 280, 281, 283, 294, 295, and 296.
- (3) Replace the paper roller stand and terminal box as described in paragraph 192*b*.
- ## 167. Disassembly and Reassembly of Print Bail Shaft Assembly
- a. Disassembly.*
- (1) Remove the paper roller stand and terminal box as described in paragraph 192*a*.
  - (2) Remove the transfer lever shaft assembly from the teletypewriter (par. 166*a*).
  - (3) Remove the two setscrews (41, fig. 221) that hold the print cam (42) to the function shaft (46). Slide the print cam to the selector side of the teletypewriter. Be careful not to lose the bushing (2, fig. 216) from the print cam follower roller stud (3).
  - (4) Remove the print cam follower spring (1) from the print cam follower (8) and from the spring post on the page printer frame.
  - (5) Remove the two machine screws (3 and 5, fig. 221) and lockwashers (4 and 6) that hold the middle bearing cap to the frame assembly; remove the middle bearing cap by sliding it to the selector side.
  - (6) Remove the assembled print bail shaft (13, fig. 216), print bail blade (12), print cam follower (8) by moving the shaft toward the selector side.
  - (7) Remove the bushing (2), print cam follower roller stud (3), and self-locking hexagonal nut (4) from the print cam follower (8).
  - (8) Remove the clamp nut (5), machine screw (6), and flat washer (7) that hold the print cam follower (8) to the print bail shaft (13); remove the print cam follower.
  - (9) Remove the three machine screws (9), lockwashers (10), and flat washers (11) that hold the print bail blade (2) to the print bail shaft (13); remove the print bail blade.
- b. Reassembly.*
- (1) Reassemble the print bail shaft assembly; the sequence for assembling



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- |   |                             |                            |
|---|-----------------------------|----------------------------|
| 1 Print cam follower spring, 50921      | 5 Clamp nut, 50174          | 10 Lockwasher, 10429       |
| 2 Bushing, 50943                        | 6 Machine screw, 10006      | 11 Flat washer, 10450      |
| 3 Print cam follower roller stud, 50886 | 7 Flat washer, 10459        | 12 Print bail blade, 50533 |
| 4 Self-locking hexagonal nut, 10501     | 8 Print cam follower, 50948 | 13 Print bail shaft, 50534 |
|   | 9 Machine screw, 10004      |                            |

Figure 216. Print bail shaft assembly, exploded view.

the parts is the reverse of the disassembly sequence.

- (2) Install the transfer lever shaft assembly as described in paragraph 166b.
- (3) Adjust the print bail blade shaft as described in paragraphs 344 and 345.
- (4) Replace the paper roller stand and terminal box as described in paragraph 192b.

## 168. Disassembly and Reassembly of Signal Bell (fig. 217)

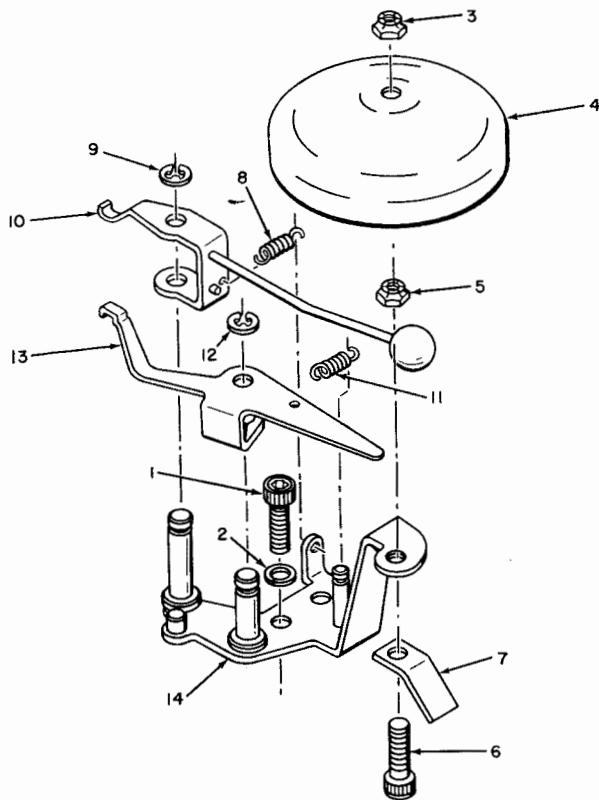
### a. Disassembly.

- (1) Remove two machine screws (1) and lockwashers (2) and remove the signal bell assembly by sliding it downward until the bell clapper (10) and the motor stop function lever (13) are clear of their punch bars.

- (2) Remove the locknut (3) and signal bell (4).
- (3) Remove the locknut (5) and machine screw (6) and remove the clapper stop (7).
- (4) Remove the spring (8) from the clapper (10) and signal bell bracket (14).
- (5) Remove the retainer ring (9) and the signal bell clapper (10).
- (6) Unhook the spring (11) from the motor stop function lever (13) and from the spring post on the signal bell bracket (14).
- (7) Remove the retainer ring (12) and the motor stop function lever (13).

### b. Reassembly.

- (1) Reassemble the signal bell as indicated in figure 217; the sequence for assembling the parts is the reverse of the disassembly sequence.



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- |                        |                                     |
|------------------------|-------------------------------------|
| 1 Machine screw, 10008 | 9 Retainer ring, 10949              |
| 2 Lockwasher, 10430    | 10 Clapper, 50879A                  |
| 3 Locknut, 10501       | 11 Spring, 50919                    |
| 4 Signal bell, 50180   | 12 Retainer ring, 10949             |
| 5 Locknut, 10501       | 13 Motor stop function lever, 50874 |
| 6 Machine screw, 10010 | 14 Signal bell bracket, 53157A      |
| 7 Clapper stop, 51102  |                                     |
| 8 Spring, 50920        |                                     |

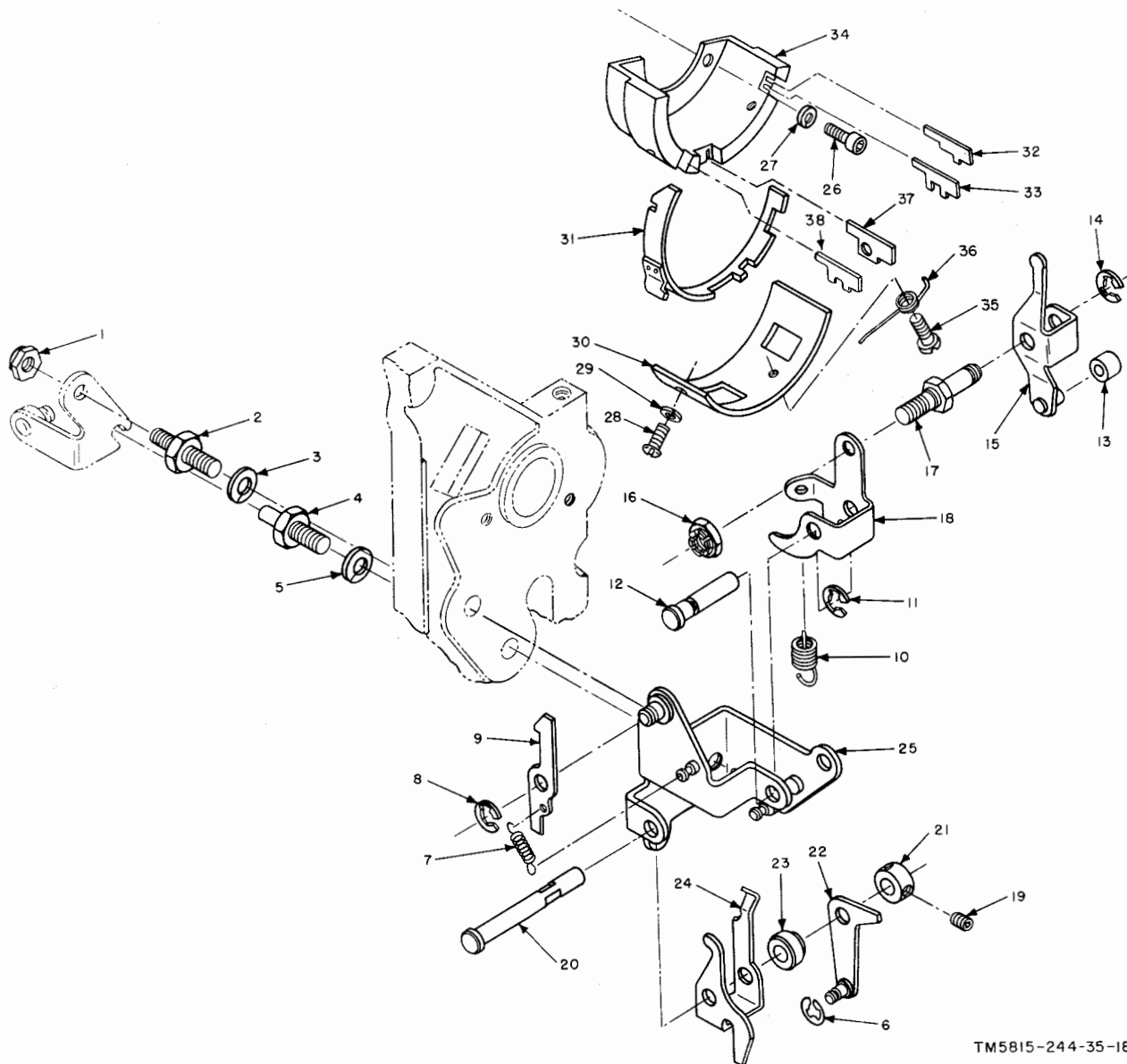
Figure 217. Signal bell, exploded view.

- (2) Adjust the signal bell as described in paragraphs 358 and 359.

## 169. Disassembly and Reassembly of Function Mechanism (fig. 218)

### a. Disassembly.

- (1) Remove the self-locking hexagonal nut (1) that holds the manual space bracket to the mounting bracket stud (2); remove the manual space bracket.
- (2) Remove the mounting bracket stud (2), lock washer (3), mounting bracket stud (4), and lockwasher (5) that hold the function bracket (25) to the function side of the page printer frame.
- (3) Remove the retainer ring (6) that holds the carriage-feed link to the carriage-feed lever (22); remove the assembled function bracket mechanism.
- (4) Remove the platen latch spring (7) from the platen latch (9) and from the spring post on the function bracket (25).
- (5) Remove the retainer ring (8) that holds the platen latch (9) to the stud on the function bracket (25); remove the platen latch.
- (6) Remove the supporting lever spring (10) from the support lever (18) and from the stud on the function bracket (25).
- (7) Remove the retainer ring (11) that holds the pin (12) to the function bracket (25); remove the pin and remove the assembled function cam follower (15) and support lever (18).
- (8) Remove the cam follower roller (13) from the function cam follower (15).
- (9) Remove the retainer ring (14) that holds the function cam follower (15) to the stud on the support lever (18); remove the follower.
- (10) Remove the self-locking hexagonal nut (16) that holds the function cam follower pivot stud (17) to the support lever (18); remove the function cam follower pivot stud.
- (11) Remove the two setscrews (19) that hold the shaft collar (21) to the pivot (20); remove the pivot, catching the carriage feed lever (22), spacer (23), and unshift lever (24) as they fall from the pivot.
- (12) Remove the two machine screws (26) and lockwashers (27) that hold the punch bar guide block (34) to the function side of the page printer frame; remove the guide block.
- (13) Remove the two machine screws (28) and lockwashers (29) that hold the side plate (30) to the punch bar guide block (34); remove the aperture



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- |                                     |  |   |
|-------------------------------------|--|---|
| 1 Self-locking hexagonal nut, 10501 | 15 Function cam follower, 50822A           | 28 Machine screw, 10304                                   |
| 2 Mounting bracket stud, 55501      | 16 Self-locking hexagonal nut, 10501       | 29 Lockwasher, 10429                                      |
| 3 Lockwasher, 10431                 | 17 Function cam follower pivot stud, 52553 | 30 Side plate, 50735                                      |
| 4 Mounting bracket stud, 55502      | 18 Support lever, 50760                    | 31 Aperture gate, 50743A                                  |
| 5 Lockwasher, 10431                 | 19 Setscrew, 10203                         | 32 Signal bell punch bar, 50881                           |
| 6 Retainer ring, 10960              | 20 Pivot, 50829                            | 33 Motor stop punch bar, 50755*                           |
| 7 Platen latch spring, 52501        | 21 Shaft collar, 50391                     | 34 Punch bar guide block, 51428                           |
| 8 Retainer ring, 10949              | 22 Carriage-feed lever, 53129A             | 35 Machine screw, 51568                                   |
| 9 Platen latch, 50821               | 23 Spacer, 51424                           | 36 Blank punch bar torsion spring, 53649 (TT-118/FG only) |
| 10 Supporting lever spring, 50915   | 24 Unshift lever, 52445                    | 37 Blank punch bar, 53648 (TT-118/FG only)                |
| 11 Retainer ring, 10949             | 25 Function bracket, 52543A                | 38 Letters punch bar, 50755 (.625 inch in overall length) |
| 12 Pin, 53131                       | 26 Machine screw, 10004                    |   |
| 13 Cam follower roller, 50843       | 27 Lockwasher, 10403                       |   |
| 14 Retainer ring, 10949             |  |   |

\* On TT-118/FG, motor stop punch bar 53606 is used. This part is .687 inch in overall length.

Figure 218. Function mechanism, exploded view.

gate (31), signal bell punch bar (32), motor stop punch bar (33) and letters punch bar (38) from the punch bar guide block (34).

- (14) On Teletypewriter TT-118/FG only, the machine screw (35) that holds the side plate (30) to the punch bar guide block (34) is equipped with the blank punch bar torsion spring (36). Remove the blank punch bar torsion spring (36).

*b. Reassembly.*

*Note.* Check the length of the TT-118/FG punch bars for letters and motor stop before reassembling. The punch bars are identical except for overall length. The longer of the two is the motor stop punch bar.

- (1) Position the motor stop punch bar (33), signal bell punch bar (32), the letters punch bar (38) and aperture gate (31) in the punch bar guide block (34). Position the side plate (30) on the guide block; secure with the two machine screws (28) and lockwashers (29). On Teletypewriter TT-118/FG, add blank punch bar (37) and its associated blank punch bar torsion spring (36) in the reassembly.
- (2) Position the punch bar guide block (34) on the function side of the page printer frame; secure with the two machine screws (26) and lockwashers (27).
- (3) Insert the pivot (20) in the drilled hole in the function bracket (25); install the unshift lever (24), spacer (23), carriage-feed lever (22), and shaft collar (21) on the pivot. Insert the pivot all the way into the bracket and secure the shaft collar to the pivot by installing the two setscrews (19).
- (4) Position the function cam follower pivot stud (17) on the support lever (18); secure with a self-locking hexagonal nut (16).
- (5) Position the function cam follower (15) on the function cam follower pivot stud (17); secure with a retainer ring (14).

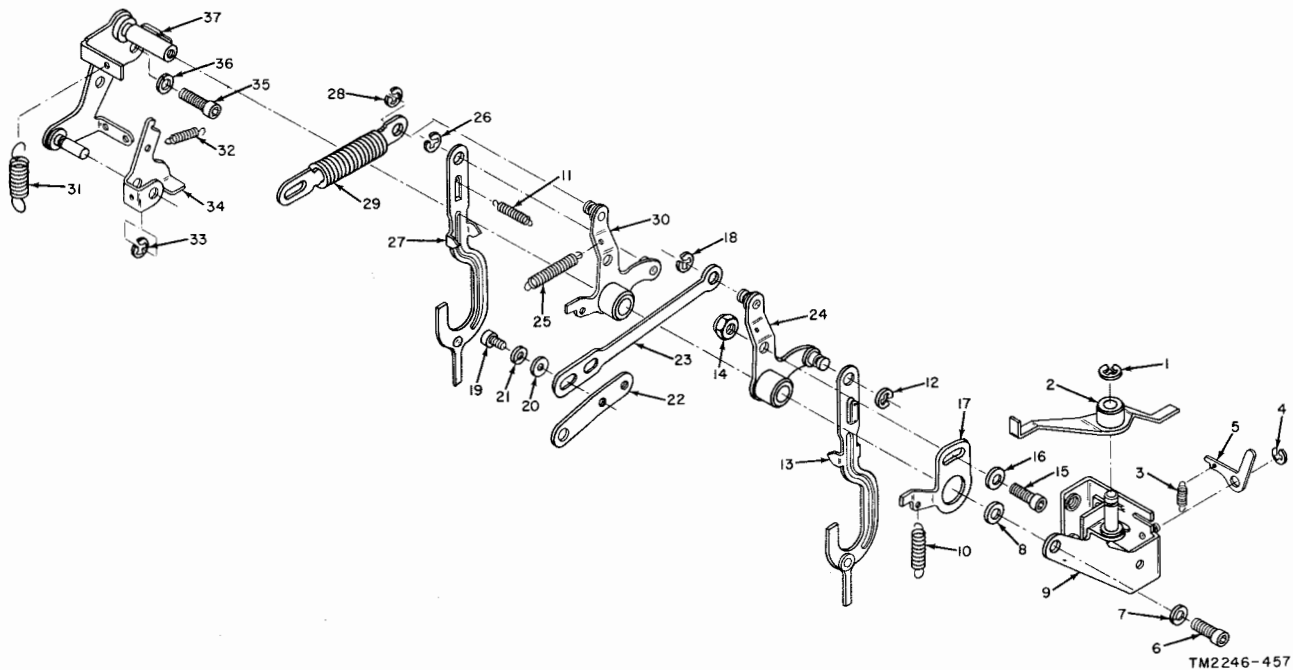
- (6) Install the cam follower roller (13) on the function cam follower (15).
- (7) Position the assembled function cam follower (15) and support lever (18) on the function bracket (25); install the pin (12). Secure the pin to the bracket with a retainer ring (11).
- (8) Install the supporting lever spring (10) on the support lever (18) and on the spring post on the function bracket (25).
- (9) Position the platen latch (9) on the stud on the function bracket (25); secure with a retainer ring (8).
- (10) Install the platen latch spring (7) on the platen latch (9) and on the spring post on the function bracket (25).
- (11) Position the carriage-feed link on the carriage feed lever (22); secure with a retainer ring (6).
- (12) Position the function bracket on the function side of the page printer frame; secure with a mounting bracket stud (4), lockwasher (5), mounting bracket stud (2), and lockwasher (3).
- (13) Position the manual space bracket on the bracket mounting stud (2); secure with a self-locking hexagonal nut (1).
- (14) Loosen the two screws that secure the side plate (30) to the punch bar guide block (34). Position the side plate to obtain a .001- to .008-inch clearance between the punch bars and the adjacent edge of the aperture gate when the gate is in the letters shift position and tighten the screws.
- (15) Perform the adjustment described in paragraph 321*b* (2).

## **170. Disassembly and Reassembly of Line Feed and Platen Shift Mechanism**

(fig. 219)

*a. Disassembly.*

- (1) Remove the paper roller stand and terminal box as described in paragraph 192*a*.



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- |   |   |  |
|---|---|--|
| 1 Retainer ring, 10949                                    | 13 Line feed cam follower, 51714A       | 26 Retainer ring, 10949                    |
| 2 Delaying lever, 52960A                                  | 14 Self-locking hexagonal nut, 10500    | 27 Platen shift cam follower, 51712A       |
| 3 Delaying latch spring, 50916                            | 15 Machine screw, 10003                 | 28 Retainer ring, 10949                    |
| 4 Retainer ring, 10960                                    | 16 Flat washer, 10450                   | 29 Platen shift link, 56676A               |
| 5 Delaying latch, 52963                                   | 17 Adjustable bellcrank, 53462          | 30 Platen shift bellcrank, 53135A          |
| 6 Machine screw, 10003                                    | 18 Retainer ring, 10949                 | 31 Carriage-return bellcrank spring, 50906 |
| 7 Lockwasher, 10429                                       | 19 Machine screw, 10002                 | 32 Platen lower case latch spring, 50920   |
| 8 Flat washer, 10450                                      | 20 Flat washer, 10458                   | 33 Retainer ring, 10960                    |
| 9 Stop bar shift link bracket, 55730A                     | 21 Lockwasher, 10429                    | 34 Platen lower case latch, 52748          |
| 10 Adjustable bellcrank spring, 51755                     | 22 Connecting link, 51771               | 35 Machine screw, 10025                    |
| 11 Line feed and figures shift cam follower spring, 50901 | 23 Connecting link, 50474               | 36 Lockwasher, 10430                       |
| 12 Retainer ring, 10949                                   | 24 Line feed bellcrank, 53136A          | 37 Bellcrank pivot bracket, 52303A         |
|   | 25 Platen shift bellcrank spring, 51645 |  |

Figure 219. Line feed and platen shift mechanism, exploded view.

- (2) Remove the retainer ring (1, fig. 219) that holds the delaying lever (2) on the mounting stud on the stop bar shift link bracket (9); remove the delaying lever (2).
- (3) Remove the delaying latch spring (3) from the delaying latch (5) and from the stop bar shift link bracket (9).
- (4) Remove the retainer ring (4) and the delaying latch (5) from the pivot stud on the stop bar shift link bracket (9).
- (5) Remove the machine screw (6) and lockwasher (7) from the bellcrank pivot bracket (37); catch the flat washer (8) as it drops out.
- (6) Remove the adjustable bellcrank spring (10) from the adjustable bellcrank (17) and from the bellcrank pivot bracket.
- (7) Remove the line feed and figures shift cam follower spring (11) from the platen shift cam follower (27) and from the line feed cam follower (13).
- (8) Remove the retainer ring (12) from the pivot stud on the line feed bellcrank (24); slide the line feed cam follower (13) down to unhook it from the function shaft. Remove the line feed cam follower.
- (9) Remove the self-locking hexagonal nut (14), flat washer (16), and machine screw (15) that secure the adjustable bellcrank (17) to the line feed bellcrank (24); remove the adjustable bellcrank.
- (10) Remove the retainer ring (18) from the pivot stud on the line feed bellcrank (24).



- (11) Remove the two machine screws (19), flat washers (20), and lockwashers (21) that hold the connecting link (23) to the connecting link (22); remove the connecting link (23) from the connecting link (22).
- (12) Remove the line feed bellcrank (24).
- (13) Remove the platen shift bellcrank spring (25) from the platen shift bellcrank (30) and from the platen bracket link.
- (14) Remove the setscrew (36, fig. 199) that holds the spacing collar (37) to the cam follower stop stud (38); remove the spacing collar and the cam follower stop stud.
- (15) Remove the retainer ring (26, fig. 219) from the pivot stud on the platen shift bellcrank (30); slide the platen shift cam follower (27) down to clear the function shaft. Remove the platen shift cam follower.
- (16) Remove the retainer ring (28) from the pivot stud on the platen shift bellcrank (30); remove the platen shift link (29) from the pivot stud.
- (17) Remove the platen shift bellcrank (30).
- (18) Remove the carriage-return bellcrank spring (31) from the bellcrank pivot bracket (37) and from the carriage-return sensing lever.
- (19) Remove the platen lower case latch spring (32) from the platen lower case latch (34) and from the bellcrank pivot bracket (37).
- (20) Remove the retainer ring (33) from the pivot post on the bellcrank pivot bracket (37); remove the platen lower case latch (34).
- (21) Remove the two machine screws (35) and lockwashers (36) that attach the bellcrank pivot bracket (37) to the page printer frame; remove the bellcrank pivot bracket.

*b. Reassembly.*

- (1) Reassemble the line feed and platen shift mechanism as indicated in figure 219; the sequence for assembling the parts is the reverse of the disassembly sequence.

- (2) Adjust the line feed and platen shift mechanism as described in paragraphs 335, 336, 351, 352, 353, and 354.
- (3) Replace the paper roller stand and terminal box as described in paragraph 192b.

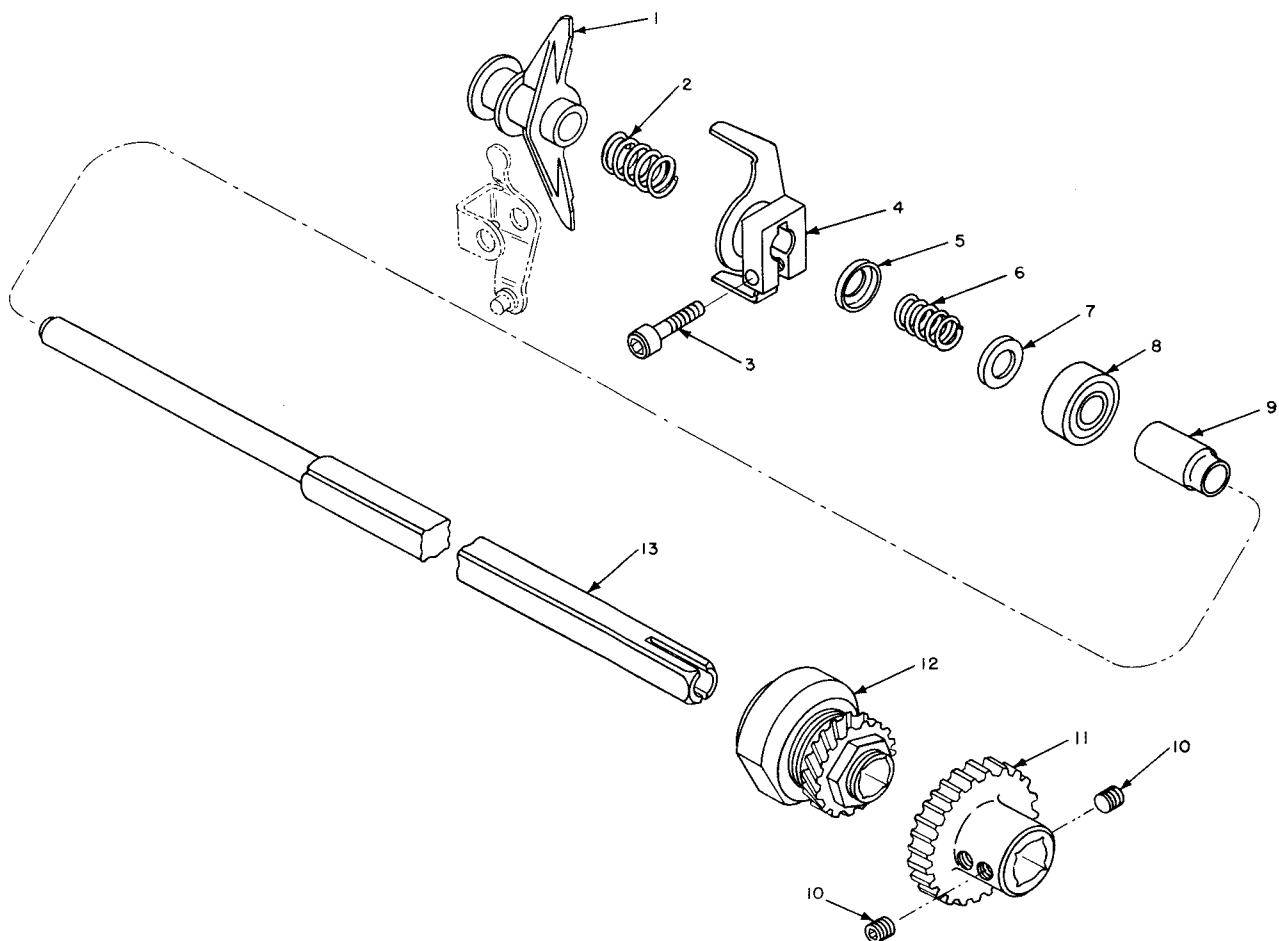
## **171. Disassembly and Reassembly of Square Shaft Assembly** (fig. 220)

*a. Disassembly.*

- (1) Loosen the four setscrews (10) that hold the square shaft driven gear (11) to the square shaft and to the stop arm shaft.
- (2) Remove the assembled cam follower support lever and function cam follower as described in paragraph 169a(7).
- (3) Remove the function selecting arm (1) and function selecting arm spring (2) from the square shaft (13).
- (4) Remove the machine screw (3) that holds the function selecting arm claw (4) to the square shaft (13); remove the function selecting arm claw, spring retainer (5), square shaft bearing spring (6); and spring retainer (7).
- (5) Move the square shaft (13) axially toward the function side, dislodging the ball bearing (8) from its seat in the page printer frame; remove the bearing and spacing collar (9) from the shaft.
- (6) Pull the square shaft (13) through the opening in the page printer frame; catch the square shaft driven gear (11) and sliding helical gear (12) as they fall from the shaft.

*b. Reassembly.*

- (1) Reassemble the square shaft assembly as indicated in figure 220; the sequence for assembling the parts is the reverse of the disassembly sequence. When replacing the sliding helical gear (12) be sure that the flats on the bearing are engaged with the fork on the carriage mechanism.
- (2) Adjust the square shaft as described in paragraphs 273, 274, and 322.



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- |  |                                      |                                    |
|--|--------------------------------------|------------------------------------|
| 1 Function selecting arm, 50936        | 5 Spring retainer, 56277             | 9 Spacing collar, 56278            |
| 2 Function selecting arm spring, 50917 | 6 Square shaft bearing spring, 56279 | 10 Setscrew, 10209                 |
| 3 Machine screw, 10009                 | 7 Spring retainer, 56277             | 11 Square shaft driven gear, 50383 |
| 4 Function selecting arm claw, 50841A  | 8 Ball bearing, 10753                | 12 Sliding helical gear, 50565A    |
|  |                                      | 13 Square shaft, 50456             |

Figure 220. Square shaft assembly, exploded view.

## 172. Removal and Replacement of Page Printer Function Shaft

### a. Removal.

- (1) Remove the paper roller stand and terminal box as described in paragraph 192a.
- (2) Remove the two machine screws (1, fig. 217) and lockwashers (2) and remove the signal bell assembly by sliding it downward until the bell clapper (10) and the motor stop function lever (13) are clear of their punch bars.
- (3) Remove the transfer lever shaft as described in paragraph 166a.
- (4) Remove the line feed and figures shift cam follower spring (11, fig. 219) from the platen shift cam follower (27) and from the line feed cam follower (13).
- (5) Remove the retainer ring (12, fig. 219) from the pivot stud on the line feed bellcrank (24); slide the line feed cam follower (13) down to unhook it from the function shaft. Remove the line feed cam follower.
- (6) Remove the setscrew (36, fig. 199) that holds the spacing collar (37) to the cam follower stop stud (38); re-

move the spacing collar and the cam follower stop stud.

- (7) Remove the retainer ring (26, fig. 219) from the pivot stud on the platen shift bellcrank (30); slide the platen shift cam follower (27) down to clear the function shaft. Remove the platen shift cam follower.
- (8) Remove the two machine screws (1, fig. 221) and lockwashers (2) that hold the bearing cap to the function side of the page printer frame; remove the bearing cap.
- (9) Remove the machine screw (3), lockwasher (4), machine screw (5), and lockwasher (6) that hold the center bearing cap to the center frame; slide the bearing cap toward the selector side of the page printer to clear the print bail blade shaft and remove the center bearing cap
- (10) Remove the two machine screws (7) and lockwashers (8) that hold the bearing cap to the selector side of the page printer frame; remove the bearing cap.
- (11) Loosen the two setscrews (41) that hold the print cam (42) to the function shaft (46); slide the print cam out of engagement with the bushing on the print cam follower.
- (12) Remove the assembled function shaft (46) by pulling from the three bearing supports in the page printer frame.

*b. Replacement.*

- (1) The sequence for replacement of the function shaft is the reverse of the removal procedure described in *a* above.
- (2) Adjust the function shaft as described in paragraphs 275, 297, 299, 319, 320, and 321.
- (3) Replace the paper roller stand and terminal box as described in paragraph 192*b*.

## 173. Disassembly and Reassembly of Function Shaft

(fig. 221)

*a. Disassembly.*

- (1) Remove the function shaft from the page printer as described in paragraph 172*a*.
- (2) Remove the machine screw (9), lockwasher (10), and flat washer (11) that hold the transfer lever restoring cam (12) to the function shaft (46); remove the transfer lever restoring cam, flat washer (13), locking bail cam (14), flat washer (15), flat washer (16), ball bearing (17), and flat washer (18) from the function shaft.
- (3) Remove the two setscrews (19) that hold the line feed and platen shift sensing cam (20) to the function shaft (46); remove the line feed and platen shift sensing cam, friction plate (21), square shaft driving gear (22), friction plate (23), friction clutch plate (24), and clutch pressure spring (25).
- (4) Loosen the clamping screws (or screw) (26) that hold the friction adjusting collar (27) to the driving collar (29); unscrew the friction adjusting collar.
- (5) Remove the two setscrews (28) that hold the driving collar (29) to the function shaft (46); remove the driving collar.
- (6) Remove the ball bearing (30) from the function shaft (46).
- (7) Remove the retainer ring (31) that holds the function driven gear (33) to the function shaft (46); remove the flat washer (32), function driven gear, and flat washers (34 and 35) from the function shaft.
- (8) Remove the retainer ring (36) that holds the function shaft sliding clutch drum (37) to the function shaft (46); remove the function shaft sliding clutch drum and clutch spring (38).

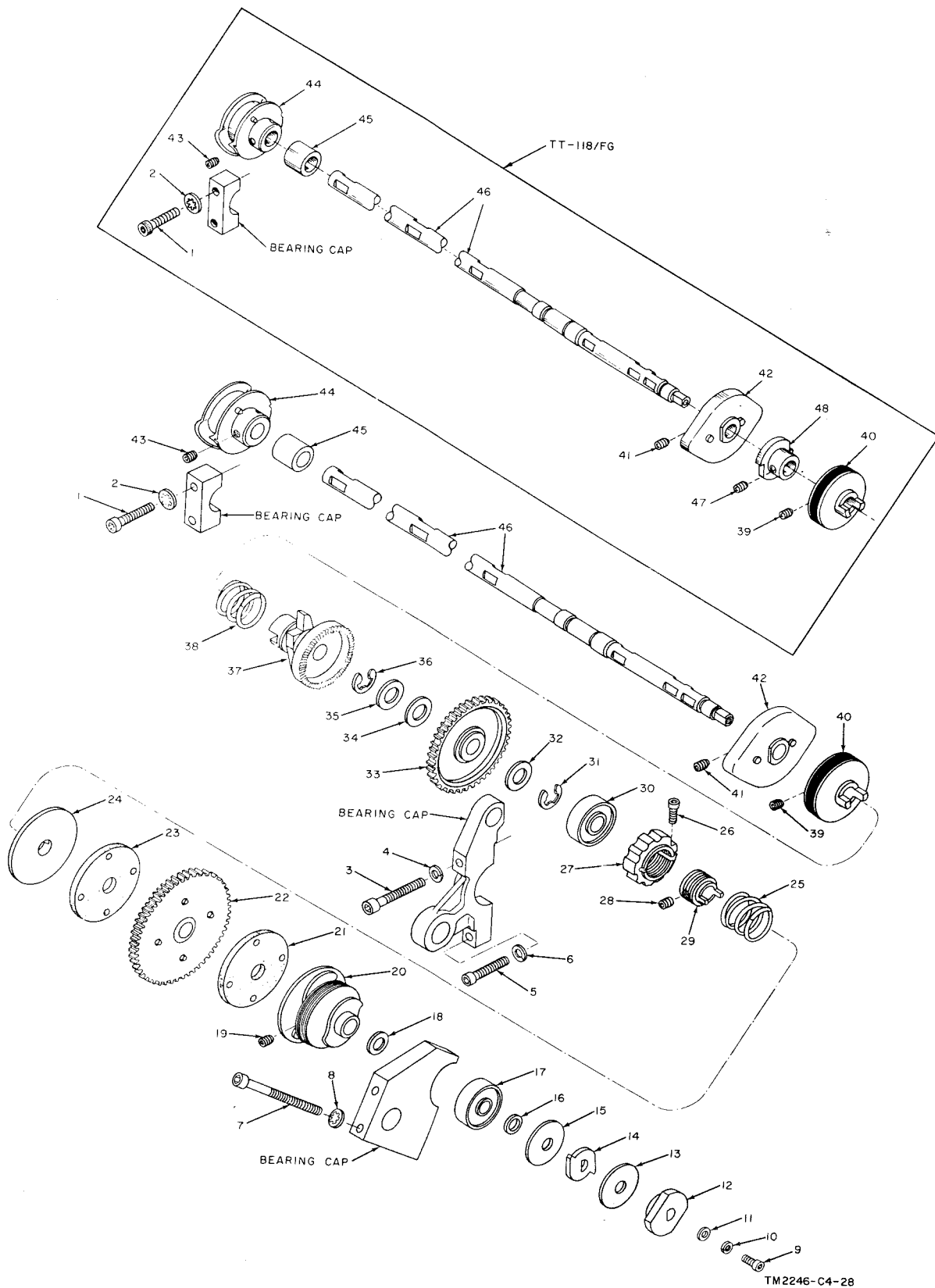


Figure 221. Function shaft, exploded view.

1 Machine screw, 10011	18 Flat washer, 50552	33 Function driven gear, 50512
2 Lockwasher, 10404	19 Setscrew, 10208	34 Flat washer, 51847
3 Machine screw, 10012	20 Line feed and platen shift sensing cam, 51612	35 Flat washer, 50515
4 Lockwasher, 10430	21 Friction plate, 56764	36 Retainer ring, 10959
5 Machine screw, 10011	22 Square shaft driving gear, 56274A	37 Function shaft sliding clutch drum, 50516
6 Lockwasher, 10430	23 Friction plate, 56764	38 Clutch spring, 50848
7 Machine screw, 10014	24 Friction clutch plate, 54929	39 Setscrew, 10209
8 Lockwasher, 10404	25 Clutch pressure spring, 54933	40 Flexible coupling disk, 51167A
9 Machine screw, 10003	26 Clamping screw, 10043	41 Setscrew, 10209
10 Lockwasher, 10429	27 Friction adjusting collar, 56832A*	42 Print cam, 50753A
11 Flat washer, 10458	28 Setscrew, 10209	43 Setscrew, 10209
12 Transfer lever restoring cam, 53878	29 Driving collar, 54927	44 Function cam, 50752
13 Flat washer, 53885	30 Ball bearing, 10757	45 Sleeve bearing, 50852
14 Locking bail cam, 53881	31 Retainer ring, 10959	46 Function shaft, 55522
15 Flat washer, 53885	32 Flat washer, 50515	47 Setscrew, 10209
16 Flat washer, 51552		48 Pulsing cam, 53772
17 Ball bearing, 10756		

\* Teletypewriters TT-117A/FG, TT-118/FG, and TT-119A/FG.

Figure 221.—Continued.

- (9) Remove the two setscrews (39) that hold the flexible coupling disk (40) to the function shaft (46); remove the flexible coupling disk.
- (10) On the TT-118/FG, remove the two setscrews (item 47) that hold the pulsing cam (48) to the function shaft (46); remove the pulsing cam.
- (11) Remove the two setscrews (41) that hold the print cam (42) to the function shaft (46); remove the print cam.
- (12) Remove the two setscrews (43) that hold the function cam (44) to the function shaft (46); remove the function cam.
- (13) Remove the sleeve bearing (45) from the function shaft (46).

*b. Reassembly.*

- (1) Reassemble the function shaft as indicated in figure 221; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Replace the function shaft as described in paragraph 172*b*.

## 174. Disassembly and Reassembly of Selector Camshaft (fig. 222)

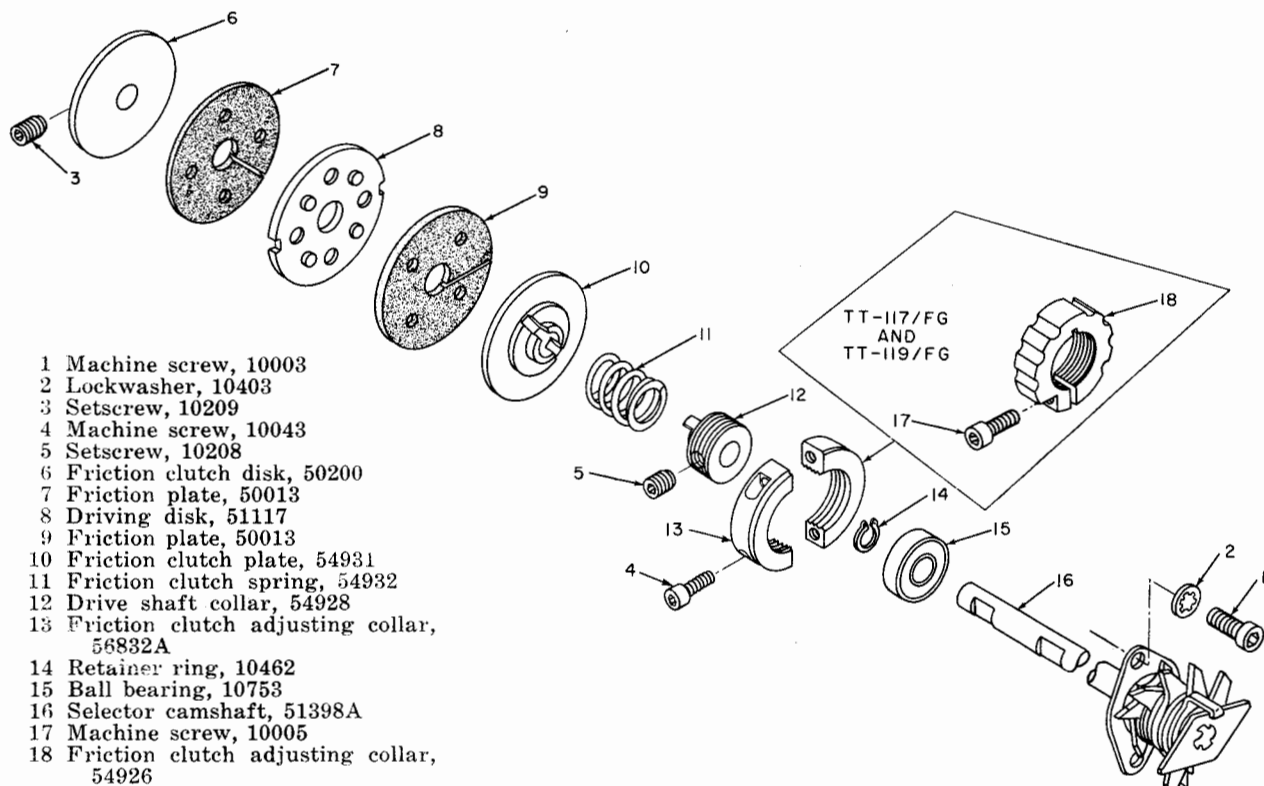
*a. Disassembly.*

- (1) Remove the orientation lever from the rangefinder as described in paragraph 164*a*(3).
- (2) Remove the two machine screws (1) and lockwashers (2).

- (3) Remove the two setscrews (3) that hold the friction clutch disk (6) to the selector camshaft (16).
- (4) Loosen the socket head machine screws (or screw) (4) that hold the friction clutch adjusting collar (13) to the drive shaft collar (12); unscrew the friction clutch adjusting collar far enough to remove the two setscrews (5) from the drive shaft collar; remove the two setscrews.
- (5) Remove the assembled selector camshaft (16) and ball bearing (15) from the printer frame; catch the friction clutch disk (6), friction plate (7), driving disk (8), friction plate (9), friction clutch plate (10), friction clutch spring (11), drive shaft collar (12) and friction clutch adjusting collar (13) as they fall from the selector camshaft.
- (6) Remove the retainer ring (14) that holds the ball bearing (15) on the selector camshaft (16); remove the ball bearing.

*b. Reassembly.*

- (1) Reassemble the selector camshaft as indicated in figure 222; the sequence for assembling the parts in the reverse of the disassembly sequence.
- (2) Adjust the friction clutch adjusting collar as described in paragraph 298.
- (3) Replace the orientation lever on the rangefinder.



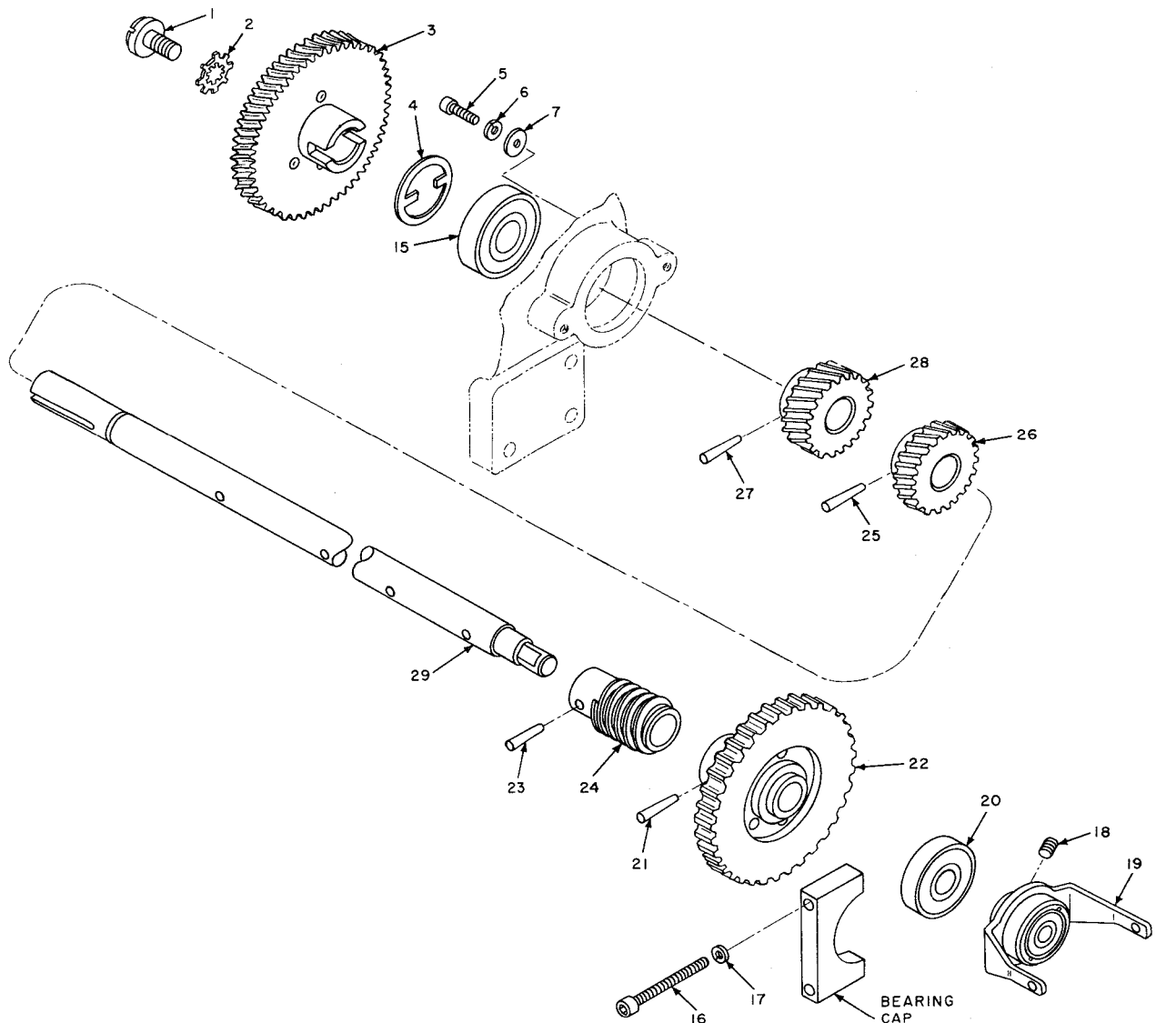
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Figure 222. Selector camshaft, exploded view.

## 175. Removal and Replacement of Main Shaft

### a. Removal.

- (1) Remove the paper roller stand and terminal box as described in paragraph 192a.
- (2) Remove the four machine screws (1, fig. 199) and lockwashers (2) that hold the gear cover (6) to the frame assembly (51); remove the worm gear bracket (9), gear cover (6), and gasket (3).
- (3) Remove the machine screw (1, fig. 223) and lockwasher (2) that hold the main shaft driven gear (3) to the main shaft (29). Loosen the four motor mounting screws (1, fig. 200) and remove the main shaft driven gear.
- (4) Remove the five drive keys (4, fig. 223) from the main shaft driven gear.
- (5) Remove the two machine screws (5), lockwashers (6), and flat washers (7) that hold the ball bearing (15) in the page printer frame. Remove the ball bearing.
- (6) Remove the two machine screws (16) and lockwashers (17) that hold the bearing cap to the printer frame; remove the bearing cap.
- (7) Remove the rangefinder orientation lever (10, fig. 213) from the rangefinder mechanism as described in paragraph 164a(3).
- (8) Remove the two machine screws (1, fig. 230) and lockwashers (2) that hold the selector camshaft (16) to the printer frame; pull the selector camshaft out of the frame far enough to allow the selector friction clutch fork (19, fig. 223) to clear the driving disk (8, fig. 222) on the selector camshaft.



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1 Machine screw, 50207  
 2 Lockwasher, 10406  
 3 Main shaft driven gear, 50352A  
 4 Drive key, 54566  
 5 Machine screw, 10003  
 6 Lockwasher, 10429  
 7 Flat washer, 10450  
 15 Ball bearing, 10758  
 16 Machine screw, 10012

17 Lockwasher, 10430  
 18 Setscrew, 10209  
 19 Selector friction clutch fork, 50484A  
 20 Ball bearing, 10757  
 21 Taper pin, 10852  
 22 Function shaft driving gear, 50354A  
 23 Taper pin, 10850

24 Carriage-feed worm gear, 50268  
 25 Taper pin, 10852  
 26 Carriage-return shaft drive gear, 55167  
 27 Taper pin, 10852  
 28 Transmitter shaft drive gear, 55166  
 29 Main shaft, 54563

Figure 223. Page printer main shaft, exploded view.

(9) With the function shaft in the stop position, remove the main shaft (29, fig. 223).

b. Disassembly (fig. 223).

(1) Remove the two setscrews (18) that hold the selector friction clutch fork

(19) to the main shaft (29); remove the clutch fork.

(2) Remove the ball bearing (20) from the main shaft.

(3) Drive out the taper pin (21) that holds the function shaft driving gear

(22) to the main shaft; remove the function shaft driving gear.

- (4) Drive out the taper pin (23) that holds the carriage-feed worm gear (24); remove the worm gear from the main shaft (29).
- (5) Drive out the taper pin (25) that holds the carriage-return shaft drive gear (26) to the main shaft (29); remove the carriage-return shaft drive gear.
- (6) Remove the taper pin (27) that holds the transmitter shaft drive gear (28) to the main shaft (29); remove the transmitter shaft drive gear.

*c. Replacement.* Reassemble the main shaft as indicated in figure 223; the sequence for assembling and replacing the main shaft is the reverse of the sequence described in *b* and *a* above.

## 176. Removal and Replacement of Code-Ring Cage

### *a. Removal.*

- (1) Remove the two machine screws (1, fig. 224) and lockwashers (2) that hold the code-ring cage to the selector side of the page printer frame.
- (2) Remove the four setscrews (10, fig. 220) that fasten the square shaft driven gear (11) to the stop arm shaft (5, fig. 224). Remove the assembled stop arm shaft and square shaft stop arm (4).
- (3) Remove the three machine screws (6), flat washers (7), and lockwashers (8) that hold the two line feed and carriage-return stop bar adjustable fulcrums (9), the figures stop bar adjustable fulcrum (10), and the bracket (13) to the function stop bar support guide (15); remove the three fulcrums and the bracket. On Teletypewriter TT-118/FG, remove the two screws (item 60, fig. 224) and lockwashers (59) that hold the motor stop blank contact switch assembly, S16 (58) to the code-ring cage guide (39). Remove the switch assembly by carefully sliding the contact spring sideways out of the notch in the blank contact link (61).

- (4) Remove the code-ring cage by pulling it away from the page printer casting.

### *b. Replacement.*

- (1) The sequence for replacing the code-ring cage is the reverse of the removal sequence described in *a* above.
- (2) Adjust the code-ring cage as described in paragraphs 271, 277, 278, 285, 299, 300, and 301.

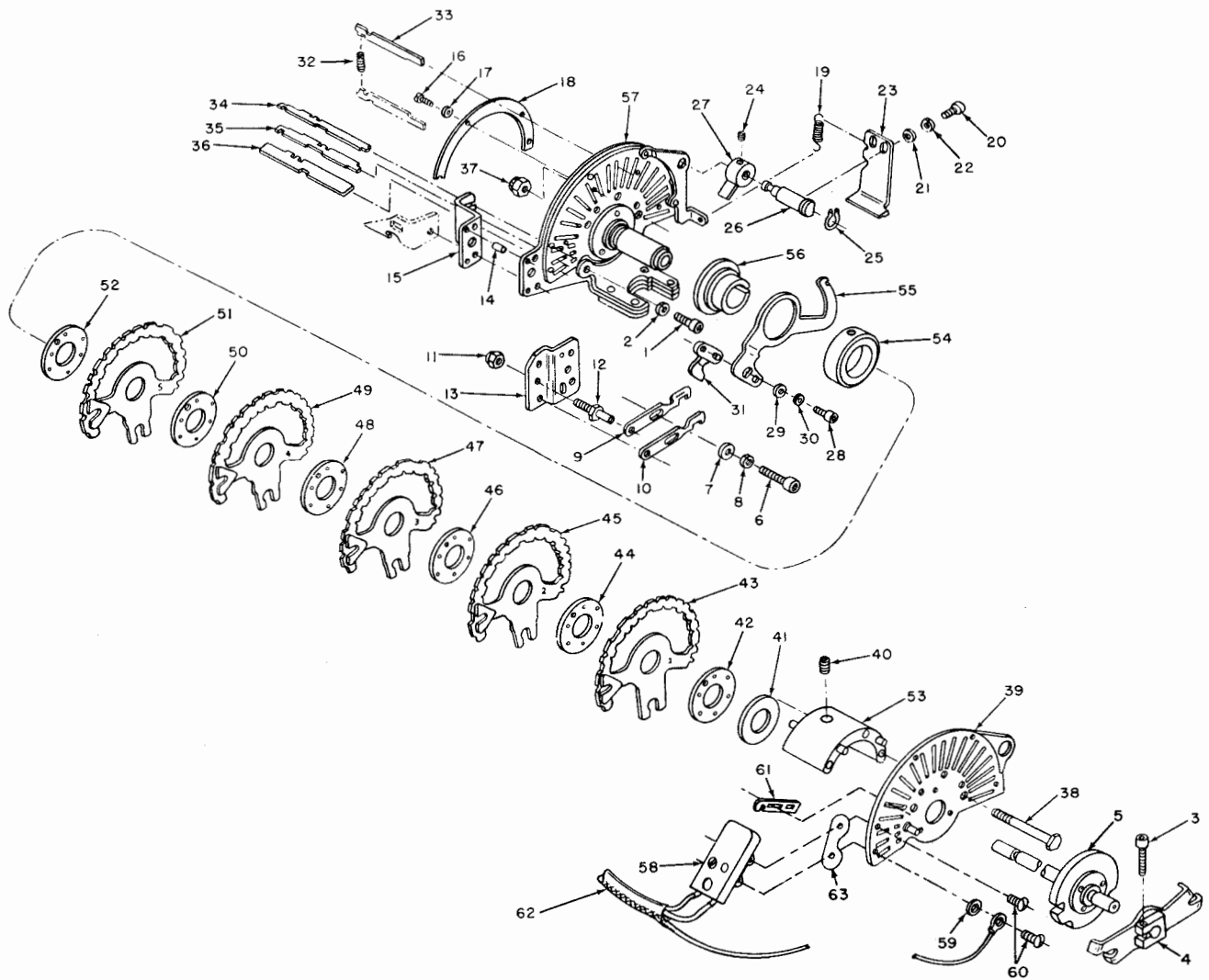
## 177. Disassembly and Reassembly of Code-Ring Cage

(fig. 224)

### *a. Disassembly.*

- (1) Remove the code-ring cage from the page printer as described in paragraph 176*a*.
- (2) Remove the machine screw (3) that holds the square shaft stop arm (4) to the stop arm shaft (5); remove the square shaft stop arm.
- (3) Remove the three self-locking hexagonal nuts (11) that hold the three eccentric studs (12) to the bracket (13); remove the eccentric studs.
- (4) Remove the two dowels (14) from the function stop bar support guide (15) and from the code ring cage plate (57); remove the function stop bar support guide.
- (5) Remove the three machine screws (16) and lockwashers (17) that hold the retainer plate (18) to the code ring cage plate (57); remove the retainer plate.
- (6) Remove the locking bail spring (19) from the code-ring locking bail (23) and from the code ring cage plate (57).
- (7) Remove the two machine screws (20), flat washers (21), and lockwashers (22) that hold the code-ring locking bail (23) to the code-ring locking bail shaft (26); remove the code-ring locking bail.
- (8) Remove the two setscrews (24) that hold the code-ring locking lever (27) to the code-ring locking bail shaft (26).
- (9) Remove the retainer ring (25) that holds the code-ring locking bail shaft





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- |   |  |  |
|---|--|--|
| 1 Machine screw, 10024  | 22 Lockwasher, 10429   | 45 Code ring, 53642 (52357*)                                   |
| 2 Lockwasher, 10431   | 23 Code-ring locking bail, 53884                                 | 46 Ball retainer, 53647A                                       |
| 3 Machine screw, 10009  | 24 Setscrew, 10201   | 47 Code ring, 53643 (52358*)                                   |
| 4 Square shaft stop arm, 53802A<br>(includes item 3)              | 25 Retainer ring, 10451  | 48 Ball retainer, 53647A                                       |
| 5 Stop arm shaft, 50377A  | 26 Code-ring locking bail shaft,<br>53871                        | 49 Code ring, 53644 (52359*)                                   |
| 6 Machine screw, 10005  | 27 Code-ring locking lever, 53875A                               | 50 Ball retainer, 43647A                                       |
| 7 Flat washer, 10458  | 28 Machine screw, 10001  | 51 Code ring, 53645 (52360*)                                   |
| 8 Lockwasher, 10429   | 29 Flat washer, 10459  | 52 Ball retainer, 53647A                                       |
| 9 Line feed carriage-return stop<br>bar adjustable fulcrum, 56178 | 30 Lockwasher, 10429   | 53 Code cage spacer, 53445A                                    |
| 10 Figures stop bar adjustable ful-<br>crum, 56176                | 31 Cam follower, 53882   | 54 Code-ring collar, 53868                                     |
| 11 Self-locking hexagonal nut, 10500                              | 32 Stop bar spring, 52940  | 55 Code-ring cam follower locking<br>lever, 53869              |
| 12 Eccentric stud, 55738  | 33 Stop bar, 50502   | 56 Sleeve bearing, 53867                                       |
| 13 Bracket, 55737   | 34 Line feed stop bar, 52959                                     | 57 Code ring cage plate, 53102A                                |
| 14 Dowel, 50458   | 35 Carriage-return stop bar, 52961A                              | 58 Stop bar contact, S16, assembly,<br>60036A (TT-118/FG only) |
| 15 Function stop bar support guide,<br>52964                      | 36 Figures stop bar, 50503 (56179*)                              | 59 Lockwasher, 10418 (TT-118/FG<br>only)                       |
| 16 Machine screw, 10317   | 37 Self-locking hexagonal nut, 10500                             | 60 Binding head screw, 10362 (TT-<br>118/FG only)              |
| 17 Lockwasher, 10433  | 38 Code cage outside guide, 53809A<br>(includes items 53 and 57) | 61 Blank contact link, 53778 (TT-<br>118/FG only)              |
| 18 Retainer plate, 56177  | 39 Code cage outside guide, 53809A<br>(includes items 53 and 57) | 62 Motor stop cable, 53365A (TT-<br>118/FG only)               |
| 19 Locking bail spring, 50941                                     | 40 Setscrew, 10223   | 63 Retaining plate, 59332                                      |
| 20 Machine screw, 10004   | 41 Flat washer, 53453  |  |
| 21 Flat washer, 10459   | 42 Ball retainer, 53647A   |  |
|   | 43 Code ring, 53641 (52356*)                                     |  |
|   | 44 Ball retainer, 53647A   |  |

\* Additional reference number used with Teletypewriters TT-117A/FG, TT-118/FG, and TT-119A/FG.

Figure 224. Code-ring cage, exploded view.

(26) to the code-ring cage. Remove the code-ring locking bail shaft; catch the code-ring locking lever (27) as it falls off the shaft.

- (10) Remove the machine screw (28), flat washer (29), and lockwasher (30) that hold the cam follower (31) to the code-ring cam follower locking lever (55); remove the cam follower.
  - (11) Remove the 19 stop bar springs (32) from the stop bars (33) in the code-ring cage; remove the 32 stop bars, the line feed stop bar (34), carriage-return stop bar (35), and the figures stop bar (36). On the TT-118/FG, remove the blank contact link (61) at the same time that the blank and *W* (fig. 62) stop bars are removed.
  - (12) Remove the three self-locking hexagonal nuts (37) and cage tie bolts (38) that hold the code cage outside guide (39) to the code ring cage plate (57); remove the code cage outside guide.
  - (13) Remove the setscrew (40) that holds the code cage spacer (53) to the code-ring collar (54).
  - (14) Remove the flat washer (41) from the stud on the code ring cage plate. Remove the six ball retainers (42, 44, 46, 48, 50, and 52) and the five code rings (43, 45, 47, 49, and 51) from the stud on the code ring cage plate, alternately remove a ball retainer and a code ring until all are removed.
  - (15) Remove the code cage spacer (53) from the code ring cage plate (57).
  - (16) Remove the code-ring collar (54), code-ring cam follower locking lever (55), and the sleeve bearing (56) from the code ring cage plate (57).
- b. Reassembly.*
- (1) Install the sleeve bearing (56), code-ring cam follower locking lever (55), and code-ring collar (54) on the stud on the code ring cage plate (57).
  - (2) Install the code cage spacer (53) on the code-ring guide plate.
  - (3) Install the six ball retainers (52, 50, 48, 46, 44, and 42) and the five code rings (51, 49, 47, 45, and 43) on the stud on the code ring cage plate (57); alternate a ball retainer and a code ring and, starting with a ball retainer and number 5 code ring, install the code rings in descending numerical order. Install the flat washer (41).
  - (4) Install the setscrew (40) that holds the code cage spacer (53) to the code-ring collar (54).
  - (5) Position the code cage outside guide (39) on the code cage spacer (53) and on the code ring cage plate (57); secure with three cage tie bolts (38) and self-locking hexagonal nuts (37).
  - (6) Install the 32 stop bars (33) and 16 stop bar springs (32); position the stop bars in pairs and install one spring for each pair of stop bars. Install the line feed stop bar (34), carriage-return stop bar (35), figures stop bar (36), and three springs. On the TT-118/FG be sure to insert the *W* and blank (fig. 62) stop bars through the blank contact link (61) between the code ring cage plate (57) and the cage outside guide (39) and then install the spring (32).
  - (7) Position the cam follower (31) on the code-ring cam follower locking lever (55); secure with a machine screw (28), lockwasher (30), and flat washer (29).
  - (8) Insert the code-ring locking bail shaft (26) part of the way into the hole in the code cage outside guide (39); install the code-ring locking lever (27) on the shaft so that the blade of the code-ring locking lever engages the notch in the code-ring cam follower locking lever (55). Position the code-ring locking bail shaft on the code-ring cage; secure with a retainer ring (25).
  - (9) Install the two setscrews (24) in the collar of the code-ring locking lever (27), lock the lever to the code-ring locking bail shaft (26).
  - (10) Position the code-ring locking bail (23) on the code-ring locking bail shaft (26); secure with the two ma-

- chine screws (20), lockwashers (22), and flat washers (21).
- (11) Install the locking bail spring (19) on the code-ring locking bail (23) and on the code ring cage plate (57).
  - (12) Position the retainer plate (18) on the code ring cage plate (57); secure with the three machine screws (16) and lockwashers (17).
  - (13) Position the two dowels (14) in the function stop bar support guide (15) and in the code ring cage plate (57).
  - (14) Position the three eccentric studs (12) on the bracket (13); secure with the three self-locking hexagonal nuts (11).
  - (15) Position the square shaft stop arm (4) on the stop arm shaft (5); secure with a machine screw (3).
  - (16) Replace the code-ring cage on the page printer as described in paragraph 176b.

## 178. Disassembly and Reassembly of Function Sensing Lever Group

(fig. 225)

### a. Disassembly.

- (1) Remove the square shaft as described in paragraph 171a.
- (2) Remove the line feed and the platen shift mechanism as described in paragraph 170a.
- (3) Remove the retainer ring (1) from the pivot stud on the connector link (2); remove the connector link from engagement with the double-blocking lever.
- (4) Remove the retainer ring (3) from the pivot stud on the carriage-return bellcrank (9); remove the horizontal carriage-return link (4) from the stud.
- (5) Remove the retainer rings (5 and 6) from the pivot studs; remove the vertical carriage-return link (7) from the pivot studs.
- (6) Remove the retainer ring (8) from the carriage-return bellcrank pivot (10); remove the carriage-return bellcrank (9) from the carriage-return bellcrank pivot.

- (7) Remove the carriage-return bellcrank pivot (10).
- (8) Remove the flat washer (11) from the stop arm shaft.
- (9) Remove the line feed sensing lever spring (12) from the line feed sensing lever (13) and from the bellcrank pivot bracket.
- (10) Remove the line feed sensing lever (13) from the stop arm shaft.
- (11) Remove the flat washer (14), carriage-return sensing lever (15), and flat washer (16).
- (12) Remove the figures shift sensing lever spring (17) from the figures shift sensing lever (18) and from the bellcrank pivot bracket.
- (13) Remove the figures shift sensing lever (18), spacing collar (19), and tolerance takeup flat washer (20) from the stop arm shaft.

### b. Reassembly.

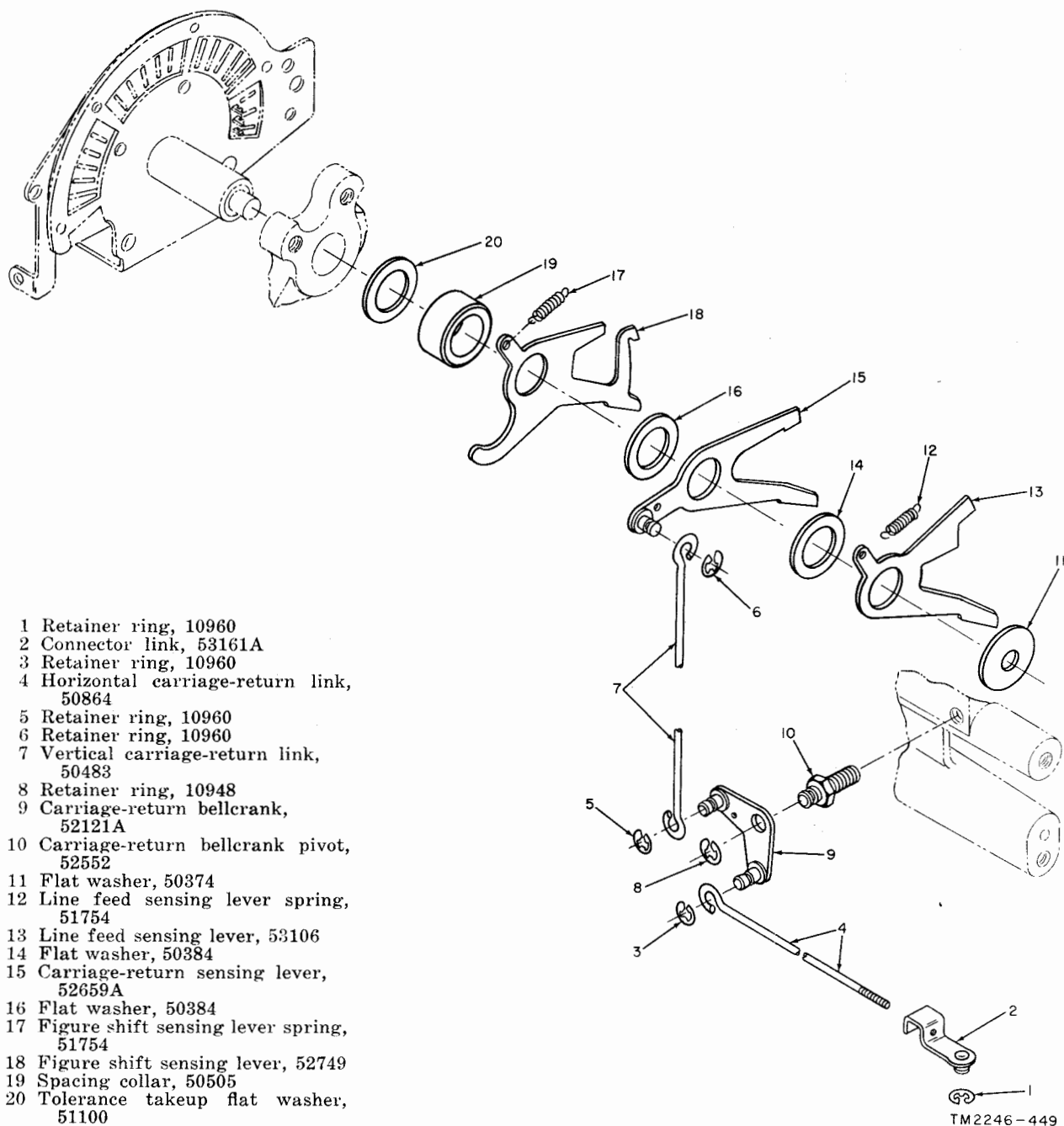
- (1) Reassemble the function sensing lever group as indicated in figure 225; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Replace the line feed and platen shift mechanism (par. 170).
- (3) Replace the square shaft (par. 171).

## 179. Disassembly and Reassembly of Manual Unshift Mechanism

(fig. 226)

### a. Disassembly.

- (1) Remove the retainer ring (1) that holds the manual unshift pushbutton link (4) to the manual unshift bellcrank (14); remove the assembled link (4) and manual unshift pushbutton (2).
- (2) Remove the manual unshift pushbutton (2) and plain hexagonal nut (3) from the manual unshift pushbutton link.
- (3) Remove the two machine screws (5) and lockwashers (6) that hold the manual unshift pushbutton bracket mounting plate (7) to the page printer frame; remove the manual un-



- 1 Retainer ring, 10960
- 2 Connector link, 53161A
- 3 Retainer ring, 10960
- 4 Horizontal carriage-return link, 50864
- 5 Retainer ring, 10960
- 6 Retainer ring, 10960
- 7 Vertical carriage-return link, 50483
- 8 Retainer ring, 10948
- 9 Carriage-return bellcrank, 52121A
- 10 Carriage-return bellcrank pivot, 52552
- 11 Flat washer, 50374
- 12 Line feed sensing lever spring, 51754
- 13 Line feed sensing lever, 53106
- 14 Flat washer, 50384
- 15 Carriage-return sensing lever, 52659A
- 16 Flat washer, 50384
- 17 Figure shift sensing lever spring, 51754
- 18 Figure shift sensing lever, 52749
- 19 Spacing collar, 50505
- 20 Tolerance takeup flat washer, 51100

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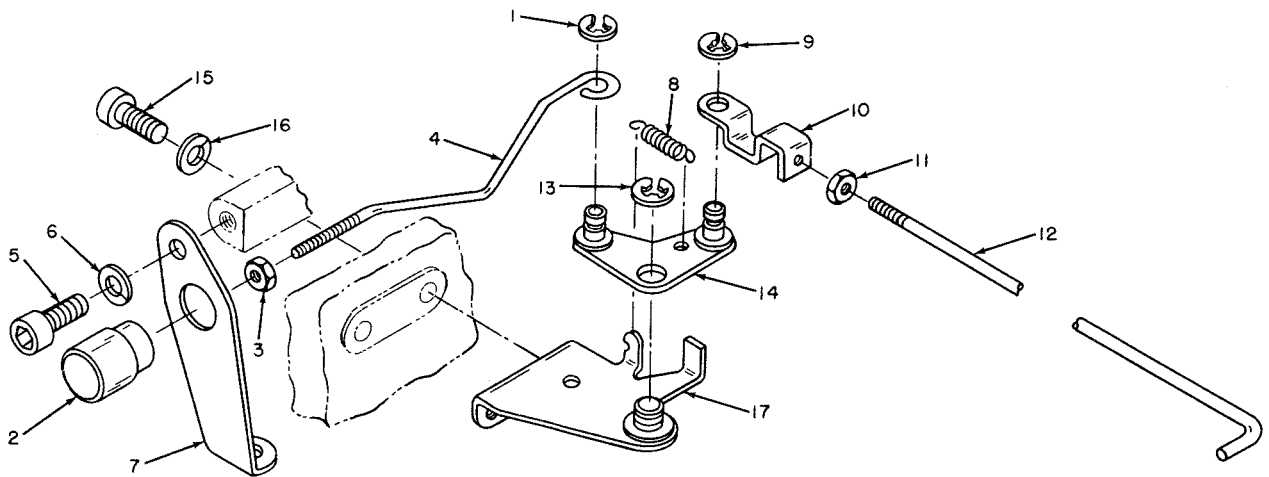
Figure 225. Function sensing lever group, exploded view.

shift pushbutton bracket mounting plate.

- (4) Remove the manual unshift bellcrank spring (8) from the manual unshift bellcrank (14) and from the bellcrank mounting bracket (17).
- (5) Remove the retainer ring (9) that holds the connector link (10) to the manual unshift bellcrank (14). Re-

move the connector link and plain hexagonal nut (11) from the manual unshift lever link (12); remove the manual unshift lever link by pulling it through the opening in the function side of the page printer frame.

- (6) Remove the retainer ring (13) that holds the manual unshift bellcrank (14) to the bellcrank mounting



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- |   |  |                                       |
|---|--|---------------------------------------|
| 1 Retainer ring, 10960                  | 7 Manual unshift pushbutton<br>bracket mounting plate, 56211 | 12 Manual unshift lever link, 56267   |
| 2 Unshift pushbutton, 55513             | 8 Manual unshift bellcrank spring, 50916                     | 13 Retainer ring, 10949               |
| 3 Plain hexagonal nut, 10520            | 9 Retainer ring, 10960                                       | 14 Manual unshift bellcrank, 52121A   |
| 4 Manual unshift pushbutton link, 55506 | 10 Connector link, 51783                                     | 15 Machine screw, 10025               |
| 5 Machine screw, 10008                  | 11 Plain hexagonal nut, 10520                                | 16 Lockwasher, 10430                  |
| 6 Lockwasher, 10430                     |  | 17 Bellcrank mounting bracket, 53415A |

Figure 226. Manual unshift mechanism, exploded view.

bracket (17); remove the manual unshift bellcrank.

- (7) Remove the two machine screws (15) and lockwashers (16) that hold the bellcrank mounting bracket (17) to the selector side of the page printer frame; remove the bellcrank mounting bracket.

*b. Reassembly.*

- (1) Reassemble the manual unshift mechanism as indicated in figure 226; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the manual unshift mechanism as described in paragraph 338.

## 180. Disassembly and Reassembly of Manual Space Mechanism

*a. Disassembly.*

- (1) Remove the retainer ring (1, fig. 228) that holds the stop bar shift lever (3) to the connector link (5). Remove the retainer ring (2) that holds the stop bar shift lever (3) on the stud (4). Remove the stop bar shift lever.

- (2) Remove the retainer ring (1, fig. 227) that holds the link (7) to the manual space bellcrank (9).
- (3) Remove the stud (4, fig. 228). Remove the assembled push button and link (items 2, 3, 4, 5, 6, and 7, fig. 105).
- (4) Remove the manual space pushbutton (2) from the link (7). Remove the manual space pushbutton spring (3), bracket (4), and washer (5).
- (5) Remove the nut (6) from the link (7).
- (6) Remove the retainer ring (8) and the manual space bellcrank (9).
- (7) Remove the self-locking hexagonal nut (10) and bracket (11).

*b. Reassembly.*

- (1) Reassemble the manual space mechanism as indicated in figure 227; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the manual space mechanism as described in paragraph 323.

## 181. Disassembly and Reassembly of Automatic Carriage-Return Mechanism

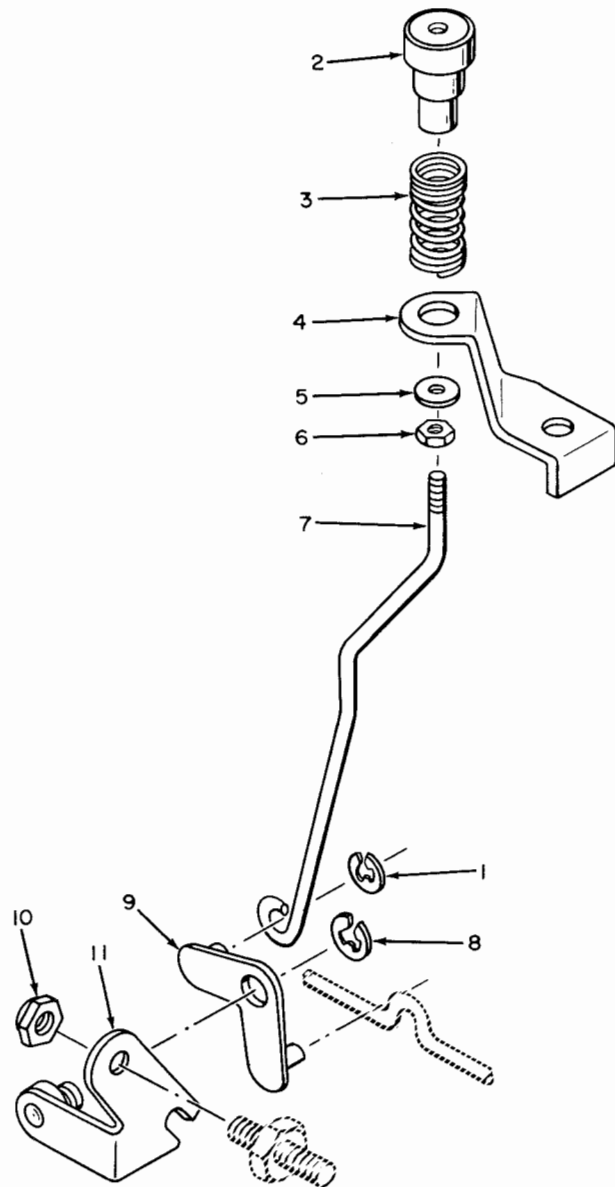
(fig. 228)

### a. Disassembly.

- (1) Remove the retainer ring (1) that holds connector link (5) to the stop bar shift lever (3).
- (2) Remove the retainer ring (2) that holds the stop bar shift lever (3) to the stud (4); remove the stop bar shift lever.
- (3) Remove the stud (4) from the frame.
- (4) Remove the connector link (5) from the stop bar shift link (9).
- (5) Remove the setscrew (6) that holds the spring collar (13) on the stop bar shift link (9).
- (6) Remove the setscrew (8) that holds the stop bar shift blade (11) to the stop bar shift link (9).
- (7) Remove the setscrew (7) that fastens the stop bar shift stop (10) to the stop bar shift link (9).
- (8) Remove the stop bar shift link (9) by moving it toward the function side of the page printer. Catch the stop bar shift stop (10) and stop bar shift blade (11) as they fall from the link. Remove the stop bar return spring (12) and spring collar (13) from the link.

### b. Reassembly.

- (1) Reassemble the automatic carriage-return mechanism as indicated in figure 228; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the automatic carriage-return mechanism as described in paragraphs 351, 352, and 353.



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- |  |                                      |
|--|--------------------------------------|
| 1 Retainer ring, 10960                   | 7 Link, 55506                        |
| 2 Manual space push-button, 55508        | 8 Retainer ring, 10949               |
| 3 Manual space push-button spring, 55518 | 9 Manual space bell-crank, 55510A    |
| 4 Bracket, 55503                         | 10 Self-locking hexagonal nut, 10501 |
| 5 Washer, 52988                          | 11 Bracket, 55515A                   |
| 6 Nut, 10520                             |                                      |

Figure 227. Manual space mechanism, exploded view.

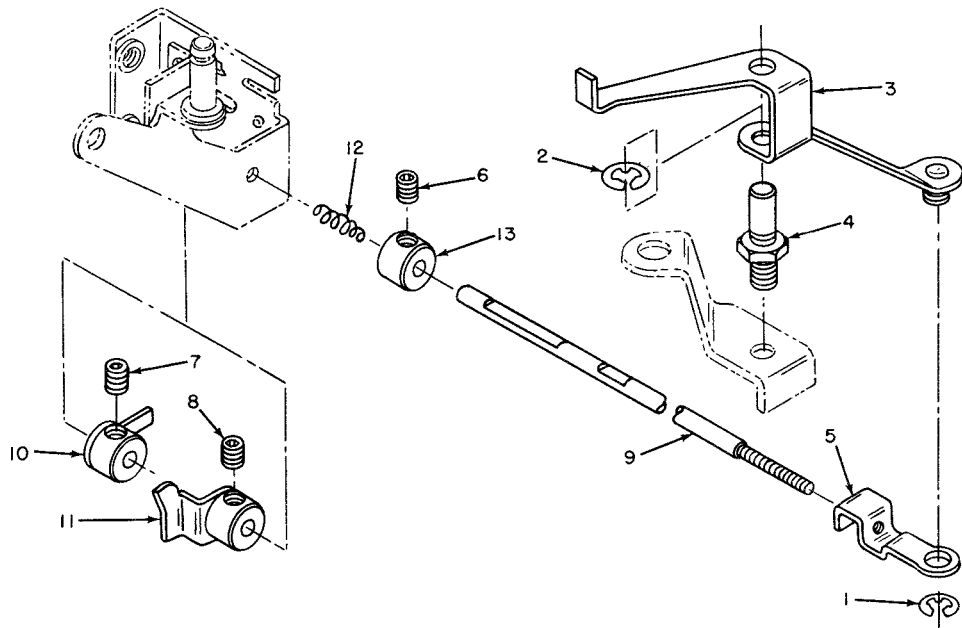
## 182. Disassembly and Reassembly of Manual Carriage-Return Button Mechanism

(fig. 229)

### a. Disassembly.

- (1) Remove the machine screw (1) and two lockwashers (2) that hold the carriage-return button bracket (8) to the page printer frame.

- (2) Remove the two machine screws (3) and lockwashers (4) that hold the manual carriage-return bracket (15) to the page printer frame; remove the manual carriage-return button mechanism.

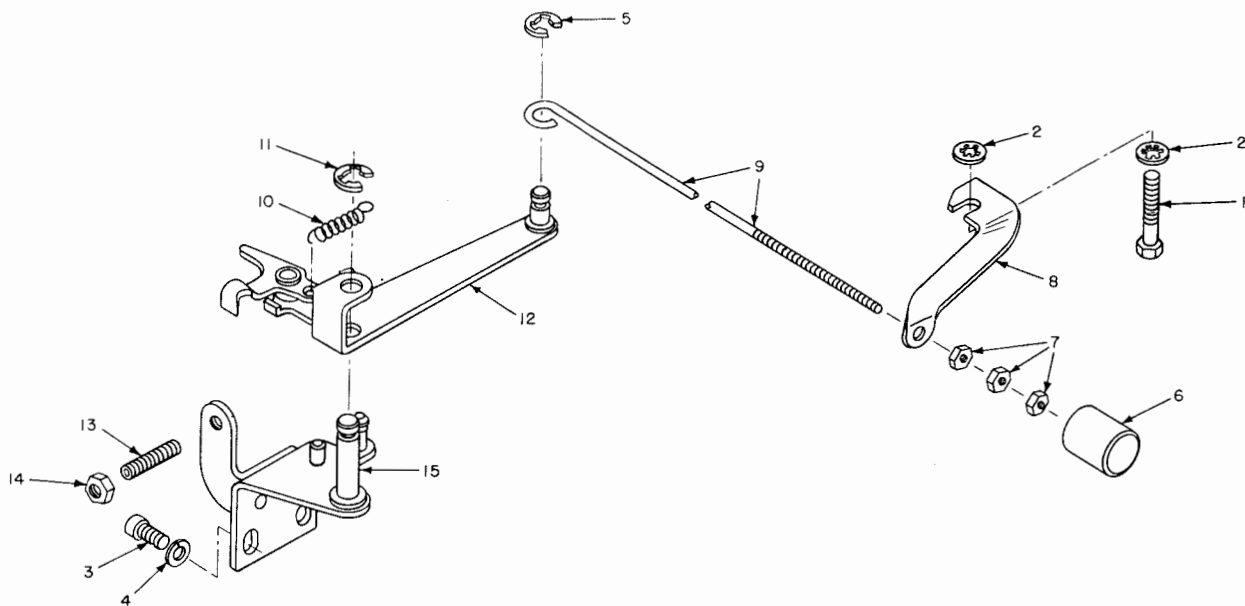


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- |                                |                               |                                   |
|--------------------------------|-------------------------------|-----------------------------------|
| 1 Retainer ring, 10960         | 6 Setscrew, 10201             | 10 Stop bar shift stop, 55740A    |
| 2 Retainer ring, 10949         | 7 Setscrew, 10201             | 11 Stop bar shift blade, 56613A   |
| 3 Stop bar shift lever, 52945A | 8 Setscrew, 10201             | 12 Stop bar return spring, 59620A |
| 4 Stud, 52948                  | 9 Stop bar shift link, 56622A | 13 Spring collar, 55736           |
| 5 Connector link, 51783        |                               |                                   |

Figure 228. Automatic carriage-return mechanism, exploded view.

- (3) Remove the retainer ring (5) that holds the carriage-return button link (9) to the manual carriage-return lever (12); remove the assembled manual carriage-return button (6) and link (9).
  - (4) Remove the manual carriage-return button (6) from the carriage-return button link (9).
  - (5) Remove the three plain hexagonal nuts (7) from the carriage-return button link (9); remove the carriage-return button bracket (8).
  - (6) Remove the trip pawl spring (10) from the spring post on the manual carriage-return bracket (15) and from the manual carriage-return lever (12).
  - (7) Remove the retainer ring (11) that holds the manual carriage-return lever (12) to the manual carriage-return bracket (15); remove the manual carriage-return lever.
  - (8) Remove the adjusting screw (13) and plain hexagonal nut (14) from the manual carriage-return bracket (15); remove the plain hexagonal nut from the adjusting screw.
- b. Reassembly.*
- (1) Reassemble the manual carriage-return button mechanism as indicated in figure 229; the sequence for assem-



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- |  |   |   |
|--|---|---|
| 1 Machine screw, 10320                 | 7 Plain hexagonal nut, 10520            | 12 Manual carriage-return lever, 52791A   |
| 2 Lockwasher, 10404                    | 8 Carriage-return button bracket, 55514 | 13 Adjusting screw, 10206                 |
| 3 Machine screw, 10008                 | 9 Carriage-return button link, 55517    | 14 Plain hexagonal nut, 10505             |
| 4 Lockwasher, 10430                    | 10 Trip pawl spring, 50196              | 15 Manual carriage-return bracket, 52790A |
| 5 Retainer ring, 10960                 | 11 Retainer ring, 10949                 |   |
| 6 Manual carriage-return button, 55513 |   |   |

Figure 229. Manual carriage-return button mechanism, exploded view.

bling the parts is the reverse of the disassembly sequence.

- (2) Adjust the mechanism as described in paragraphs 316, 317, and 318.

### 183. Disassembly and Reassembly of Carriage-Feed Mechanism

#### a. Disassembly.

- (1) Remove the retainer ring (6, fig. 218) that holds the carriage-feed link (3, fig. 230) to the carriage-feed lever; remove the carriage-feed link from the carriage-feed lever.
- (2) Remove retainer ring (1) that holds connector link (2) to the carriage-feed pawl (9); remove the assembled carriage-feed link (3) and connector link. Remove the connector link from the carriage-feed link.
- (3) Remove spring (4) from the carriage-feed pawl (9) and the spring stud on the page printer frame.
- (4) Remove the two machine screws (5) and lockwashers (6) that hold the space pawl mounting bracket (11) to

the page printer frame; remove the assembled space pawl mounting bracket and carriage-feed pawl (9).

- (5) Remove the self-locking hexagonal nut (7) and flat washer (8) that hold the carriage feed pawl (9) to the space pawl mounting bracket (11); remove the carriage-feed pawl and the space pawl flat washer (10).
- (6) Remove the carriage-feed clutch lever spring (12) from the carriage-feed clutch lever (14) and the spring post on the page printer frame.
- (7) Remove the retainer ring (13) that holds the carriage-feed clutch lever (14) to the carriage-feed clutch lever pivot stud (16); remove the carriage-feed clutch lever.
- (8) Remove the setscrew (15) that holds the carriage-feed clutch lever pivot stud (16) to the page printer frame; remove the stud.

#### b. Reassembly.

- (1) Reassemble the carriage-feed mechanism as indicated in figure 230; the



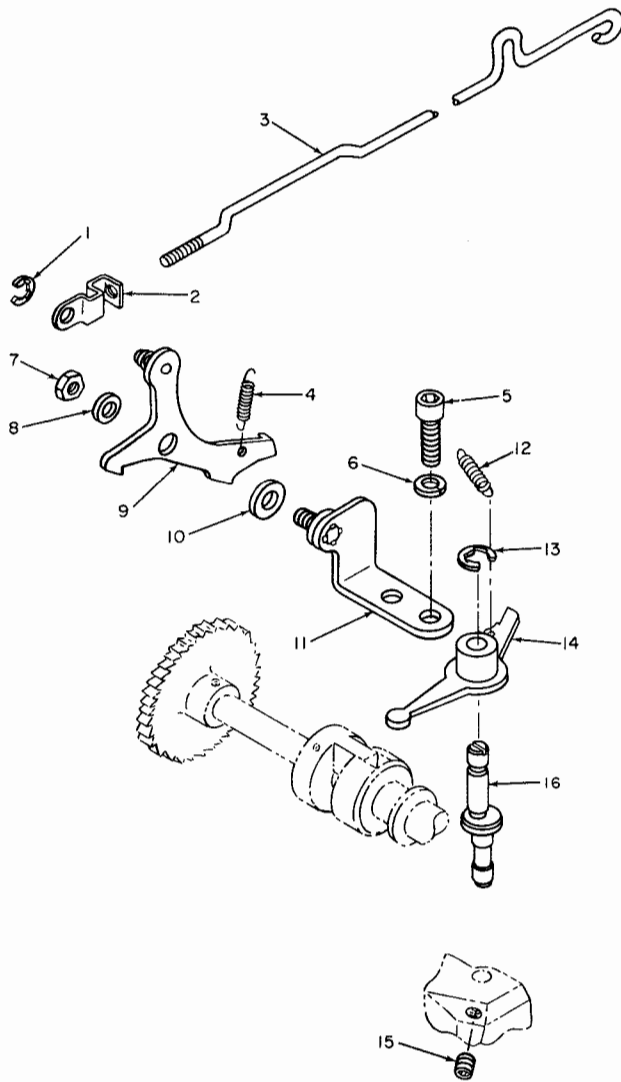
## 184. Removal and Replacement of Carriage-Return Operating Mechanism

### a. Removal.

- (1) Remove the platen from the page printer as described in paragraph 151a.
- (2) Remove the retainer ring (9, fig. 226) that holds the connector link (10) to manual unshift bellcrank (14). Remove the connector link and plain hexagonal nut (11) from manual unshift lever link (12); remove the manual unshift lever link by pulling it through the opening in the function side of the page printer frame.
- (3) Remove the retainer ring (3, fig. 225) from the pivot stud on the carriage-return bellcrank (9); remove the horizontal carriage-return link (4) from the stud.
- (4) Remove the two machine screws (1, fig. 231) and lockwashers (2) that hold the clutch latch mounting plate (16) to the page printer frame; remove the assembled carriage-return operating mechanism.

### b. Disassembly (fig. 231).

- (1) Remove the machine screw (3), flat washer (5), and clamp nut (4) that hold the throwout lever (6) to the shaft of the carriage-return clutch lever (22); remove the throwout lever.
- (2) Remove the carriage-return clutch actuating lever spring (7) that connects the double blocking lever (12) and the carriage-return clutch actuating lever (18).
- (3) Remove the assembled double blocking lever and adjusting plate (11) from the shaft of the carriage-return clutch lever (22).
- (4) Remove the machine screw (8), flat washer (9), and lockwasher (10) that hold the adjusting plate (11) to the double blocking lever (12); remove the adjusting plate.
- (5) Remove the double blocking lever spring (13) that connects the carriage-return clutch latch lever (15)



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1 Retainer ring, 10960	10 Space pawl flat washer, 50827
2 Connector link, 51783	11 Space pawl mounting bracket, 55788A
3 Carriage-feed link, 55504	12 Carriage-feed clutch lever spring, 50911
4 Carriage-feed pawl spring, 50912	13 Retainer ring, 10949
5 Machine screw, 10025	14 Carriage-feed clutch lever, 50005A
6 Lockwasher, 10430	15 Setscrew, 10204
7 Self-locking hexagonal nut, 10500	16 Stud, 52318
8 Flat washer, 10450	
9 Carriage-feed pawl, 54490A	

Figure 230. Carriage-feed mechanism, exploded view.

sequence for assembling the parts is the reverse of the disassembly sequence.

- (2) Adjust the mechanism as described in paragraph 323.

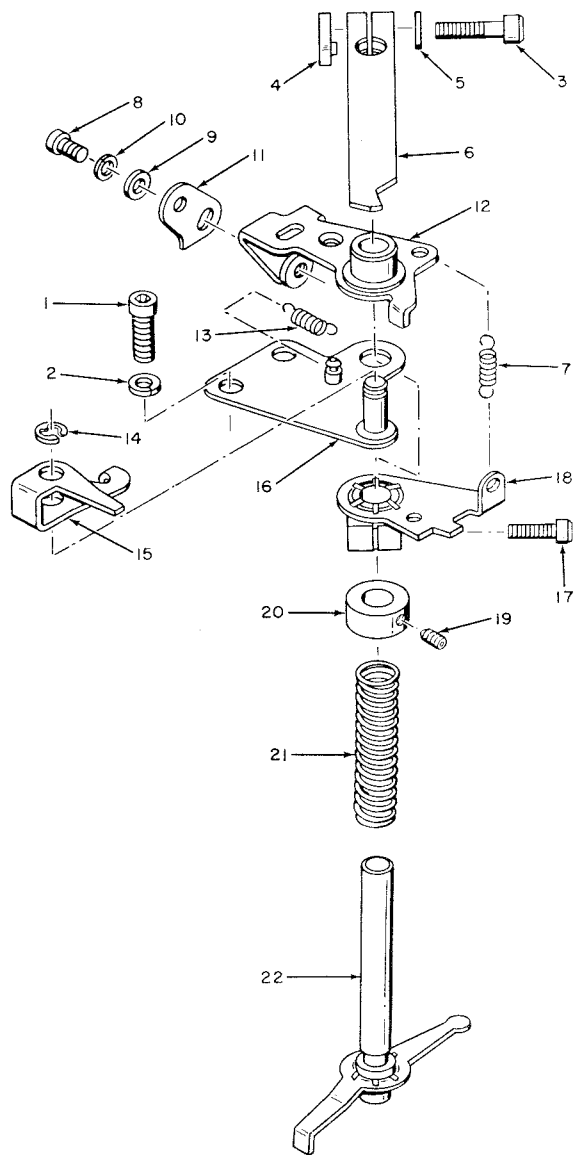


Figure 231. Carriage-return operating mechanism, exploded view.

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and the clutch latch mounting plate (16).

- (6) Remove the retainer ring (14) that holds the carriage-return clutch latch lever (15) to the stud on the clutch latch mounting plate (16); remove the carriage-return clutch latch lever.
- (7) Remove the clutch latch mounting plate (16) from the shaft of the carriage-return clutch lever.
- (8) Remove the machine screw (17) that holds the carriage-return clutch actuating lever (18) to the shaft of the carriage-return clutch lever (22); remove the clutch actuating lever.
- (9) Remove the two setscrews (19) that hold the shaft collar (20) to the shaft of the carriage-return clutch lever; remove the shaft collar and spring (21).

*c. Replacement.*

- (1) Reassemble the carriage-return operating mechanism as indicated in figure 231; the sequence for assembling and replacing the mechanism is the reverse of the disassembly and removal sequence described in *b* and *a* above. When replacing the assembled mechanism be sure that the carriage-return clutch lever (22, fig. 231) is in the groove in the carriage-return sliding clutch disk (20, fig. 235).
- (2) Adjust the mechanism as described in paragraphs 305, 307, 313, 314, 315, and 355.

1 Machine screw, 10008	13 Double blocking lever spring, 50946
2 Lockwasher, 10430	14 Retainer ring, 10949
3 Machine screw, 10011	15 Carriage-return clutch latch lever, 50011
4 Clamp nut, 52073	16 Clutch latch mounting plate, 53163A
5 Flat washer, 10467	17 Machine screw, 10009
6 Throwout lever, 56283	18 Carriage-return clutch actuating lever, 56241A
7 Carriage-return clutch actuating lever spring, 56258	19 Setscrew, 10209
8 Machine screw, 10003	20 Shaft collar, 50209
9 Flat washer, 10458	21 Spring, 52259
10 Lockwasher, 10429	22 Carriage-return clutch lever, 56243A
11 Adjusting plate, 56237	
12 Double blocking lever, 56265A	

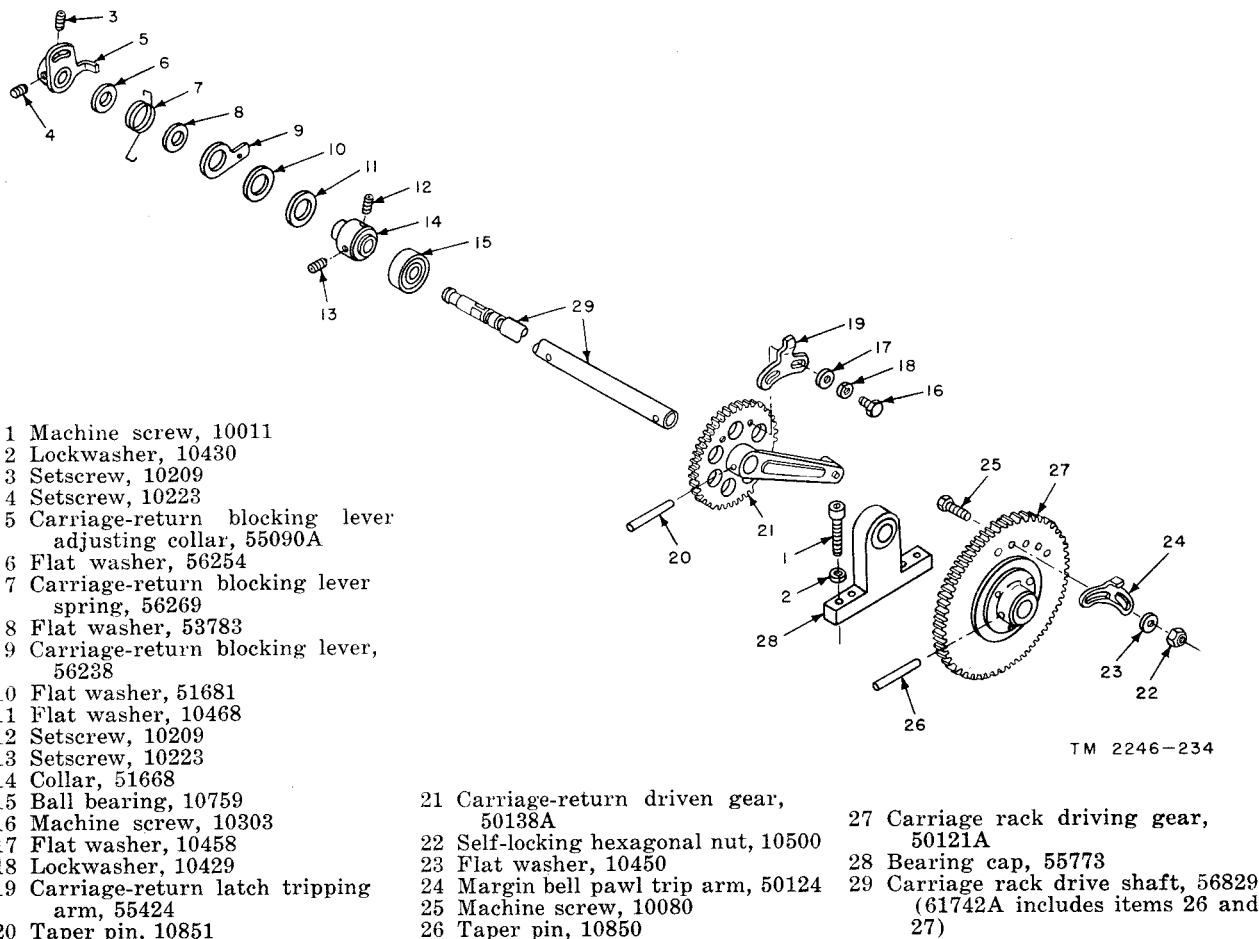


Figure 232. Carriage rack drive shaft, exploded view.

## 185. Disassembly and Reassembly of Carriage Rack Drive Shaft

(fig. 232)

### a. Disassembly.

- (1) Remove the keyboard-transmitter from the page printing mechanism as described in paragraph 129a.
- (2) Remove the platen from the page printer as described in paragraph 151a.
- (3) Remove the carriage from the page printer as described in paragraph 156a.
- (4) Remove the two machine screws (1) and lockwashers (2) that hold the bearing cap (28) to the front of the page printer frame.
- (5) Remove the two setscrews (3 and 4) that hold the carriage-return blocking

lever adjusting collar (5) to the carriage rack drive shaft (29); remove the carriage-return blocking lever adjusting collar, flat washer (6), carriage-return blocking lever spring (7), flat washer (8), carriage-return blocking lever (9), and the two flat washers (10 and 11).

- (6) Remove the two setscrews (12 and 13) that hold the collar (14) to the carriage rack drive shaft (29); remove the collar.
- (7) Pull the assembled carriage rack drive shaft forward until it clears the ball bearing (15) in the page printer frame; remove the ball bearing from the frame.
- (8) Remove the two machine screws (16), flat washers (17), and lockwashers (18), that hold the carriage-return

latch tripping arm (19) to the carriage-return driven gear (21); remove the carriage-return latch tripping arm.

- (9) Remove the taper pin (20) that holds the carriage-return driven gear (21) to the carriage rack drive shaft (29); remove the carriage-return driven gear.
- (10) Remove the two self-locking hexagonal nuts (22) flat washers (23), and machine screws (25) that hold the margin bell pawl trip arm (24) to the carriage rack driving gear; remove the margin bell pawl trip arm.

*Note.* Items 26, 27, and 29 comprise one part and ordinarily should not be disassembled.

*b. Reassembly.*

- (1) Reassemble the carriage rack drive shaft as indicated in figure 232; the

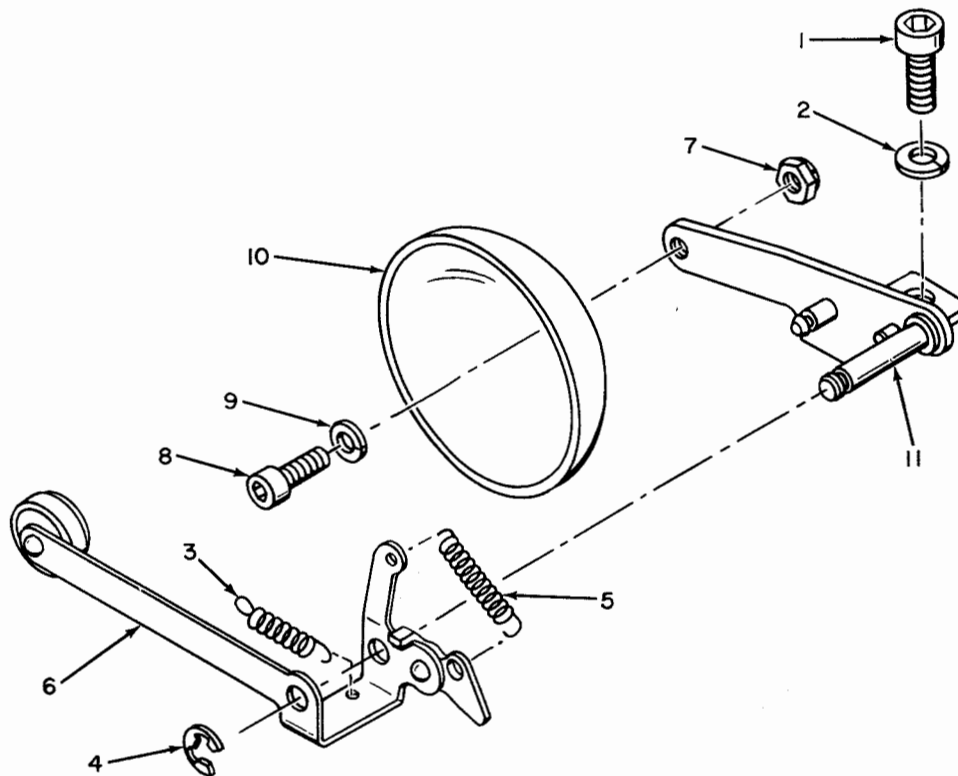
sequence for assembling the parts is the reverse of the disassembly sequence.

- (2) Adjust the carriage rack drive shaft as described in paragraphs 305, 307, 313, 314, 315, and 355.

## 186. Disassembly and Reassembly of Margin Signal Bell (fig. 233)

*a. Disassembly.*

- (1) Remove the machine screws (1), lockwashers (2), and margin signal bell assembly.
- (2) Remove the spring (3) from the margin bell clapper (6) and from the spring post on the margin bell bracket (11).
- (3) Remove the retainer ring (4) and remove the margin bell clapper (6).
- (4) Remove the spring (5) from the margin bell clapper (6).



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- 1 Machine screw, 10008
- 2 Lockwasher, 10430
- 3 Spring, 50231
- 4 Retainer ring, 10960

- 5 Spring, 50232
- 6 Margin bell clapper, 50244A
- 7 Locknut, 10500
- 8 Machine screw, 10003

- 9 Lockwasher, 10429
- 10 Margin signal bell, 10403
- 11 Margin bell bracket, 53164A

Figure 233. Margin signal bell, exploded view.

- (5) Remove the locknut (7), machine screw (8), and lockwasher (9) and remove the margin signal bell (10).

*b. Reassembly.*

- (1) Reassemble the margin signal bell mechanism as indicated in figure 233; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the margin signal bell as described in paragraph 355.

## **187. Removal and Replacement of Carriage-Feed Shaft**

(fig. 234)

*a. Removal.*

- (1) Remove the page printer from the printer base as described in paragraph 128a.
- (2) Remove the keyboard-transmitter from the page printing mechanism as described in paragraph 129a.
- (3) Remove the platen from the page printer as described in paragraph 151a.
- (4) Remove the carriage-feed mechanism from the page printer as described in paragraph 183a.
- (5) Remove the machine screw (1) and lockwasher (2) that hold the bearing block to the page printer frame; remove the assembled bearing block and ball bearing (6).
- (6) Remove the two machine screws (3), flat washers (4), and lockwashers (5), that hold the ball bearing (6) to the bearing block; remove the ball bearing.
- (7) Remove the two machine screws (7), flat washers (8), and lockwashers (9) that hold the bearing retainer (10) to the printer frame; remove the bearing retainer.
- (8) Remove the self-locking hexagonal nut (11) that holds the ball bearing (12) to the carriage-feed shaft (34); pull the shaft forward far enough to clear the ball bearing. Remove the

carriage-feed shaft from the page printer.

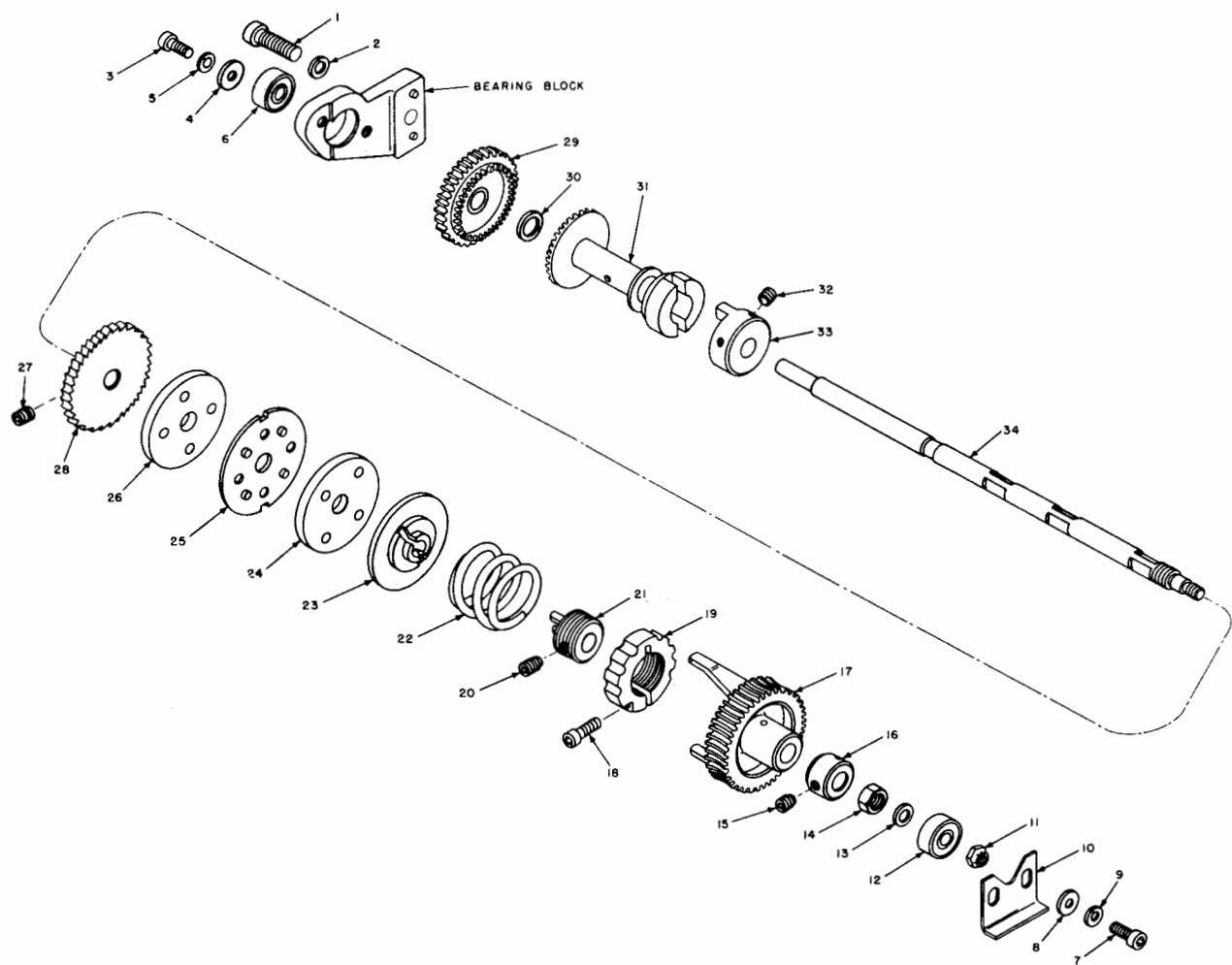
- (9) Remove the ball bearing from the bearing seat in the page printer frame. Remove flat washer (13).

*b. Disassembly.*

- (1) Remove adjusting nut (14) from the carriage-feed shaft (34); loosen the two setscrews (15) and remove the shaft collar (16) from the carriage-feed shaft (34).
- (2) Slide the carriage-feed driven gear (17) from the clutch driving disk (25) and from the carriage-feed shaft (34).
- (3) Loosen the clamping screw (18); back off and remove the adjusting collar (19).
- (4) Remove the two setscrews (20) that hold drive shaft collar (21) on the carriage-feed shaft (34); remove the drive shaft collar.
- (5) Remove friction clutch spring (22), friction clutch plate (23), friction plate (24), clutch driving disk (25), and friction plate (26) from the carriage-feed shaft (34).
- (6) Remove the two setscrews (27) that hold ratchet wheel (28) on the carriage-feed shaft (34); remove the ratchet wheel.
- (7) Remove carriage-feed driving gear (29), the flat washer (30), and the carriage-feed sliding clutch drum (31), from the carriage-feed shaft (34).
- (8) Remove the two setscrews (32) that hold shaft collar (33) on the carriage-feed shaft (34); remove the shaft collar.

*c. Replacement.*

- (1) Reassemble the carriage-feed shaft as indicated in figure 234; the sequence for assembling and replacing the mechanism is the reverse of the disassembly and removal sequence described in *b* and *a* above. When replacing the assembled shaft be sure



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- |                                      |  |   |
|--------------------------------------|--|---|
| 1 Machine screw, 10017               | 15 Setscrew, 10209   | 25 Clutch driving disk, 51117   |
| 2 Lockwasher, 10405                  | 16 Shaft collar, 50209   | 26 Friction plate, 56765  |
| 3 Machine screw, 10003               | 17 Carriage-feed driven gear, 54930A   | 27 Setscrew, 10209  |
| 4 Flat washer, 10450                 | 18 Clamping screw, 10052 (10043 on TT-117A/FG, TT-118/FG, and TT-119A/FG)    | 28 Ratchet wheel, 50201 (60479A, TT-118/FG)                             |
| 5 Lockwasher, 10429                  | 19 Adjusting collar, 54926 (56832A on TT-117A/FG, TT-118/FG, and TT-119A/FG) | 29 Carriage-feed driving gear, 50884A (60478A TT-118/FG)                |
| 6 Ball bearing, 10755                | 20 Setscrew, 10208   | 30 Flat washer, 50887   |
| 7 Machine screw, 10003               | 21 Drive shaft collar, 54928   | 31 Carriage-feed sliding clutch drum, 50331                             |
| 8 Flat washer, 10459                 | 22 Friction clutch spring, 54934   | 32 Setscrew, 10209  |
| 9 Lockwasher, 10429                  | 23 Friction clutch plate, 54931  | 33 Shaft collar, 50336 (59447 on TT-117A/FG, TT-118/FG, and TT-119A/FG) |
| 10 Bearing retainer, 55020           | 24 Friction plate, 56765   | 34 Carriage-feed shaft, 50525   |
| 11 Self-locking hexagonal nut, 10500 |  |   |
| 12 Ball bearing, 10755               |  |   |
| 13 Flat washer, 51408                |  |   |
| 14 Adjusting nut, 51079              |  |   |

Figure 234. Carriage-feed shaft, exploded view.

that the carriage-feed clutch lever (14, fig. 230) is in the groove in the carriage-feed sliding clutch drum (31, fig. 238).

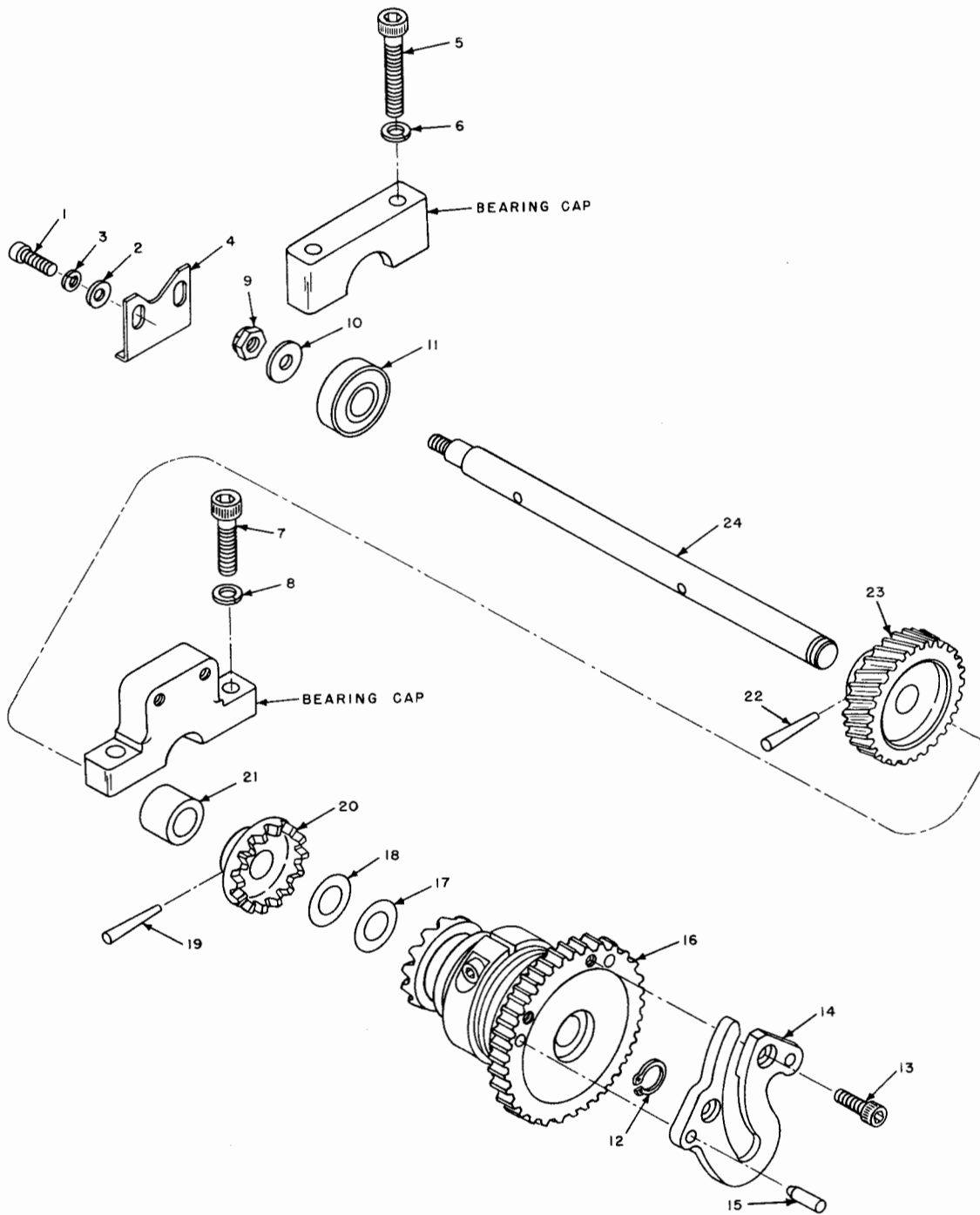
- (2) Adjust the carriage-feed shaft as described in paragraphs 306, 339, 340, 341, and 342.

## 188. Disassembly and Reassembly of Carriage-Return Shaft (fig. 235)

### a. Disassembly.

- (1) Remove the page printer from the printer base as described in paragraph 128a.

- (2) Remove the keyboard-transmitter from the page printing mechanism as described in paragraph 129a.
  - (3) Remove the platen from the page printer as described in paragraph 151a.
  - (4) Remove the carriage-feed clutch lever as described in paragraph 183a(7).
  - (5) Mark the two teeth on the carriage-return driving gear of the carriage-return safety clutch (16) that engage the last tooth on the carriage return driven gear.
  - (6) Remove the two machine screws (1), flat washers (2), and lockwashers (3), that hold the bearing retainer (4) to the page printer frame; remove the bearing retainer.
  - (7) Remove the two machine screws (5) and lockwashers (6) that hold the bearing cap to the page printer frame; remove the bearing cap.
  - (8) Remove the two machine screws (7) and lockwashers (8) that hold the bearing cap to the page printer frame; remove the bearing cap.
  - (9) Remove the self-locking hexagonal nut (9) and flat washer (10) that hold ball bearing (11) to the carriage-return shaft (24); remove the ball bearing.
  - (10) Lift the front of the carriage-return shaft (24) slightly and slide the bearing (21) toward the rear of the shaft, far enough to clear the bearing seat in the page printer frame.
  - (11) Loosen the machine screw that holds carriage-return clutch actuating lever to the carriage-return clutch lever. Tilt the carriage-return shaft (24) forward, far enough to clear the carriage-return clutch lever and pivot the lever so that it is parallel with the carriage-return shaft. Pull the carriage-return shaft upward and forward to remove it from the page printer.
  - (12) Remove retainer ring (12) that holds the carriage-return safety clutch (16); remove the assembled carriage-return safety clutch and decelerating cam (14).
  - (13) Remove the two machine screws (13) that hold decelerating cam (14) to the carriage-return safety clutch (16); remove the decelerating cam.
  - (14) Remove the two dowel pins (15) from the carriage-return safety clutch (16).
  - (15) Remove the two spacers (17 and 18) from the carriage-return shaft (24).
  - (16) Tap out taper pin (19) that holds the carriage-return sliding clutch disk (20) to the carriage-return shaft (24); remove the carriage-return sliding clutch disk and the bearing (21).
  - (17) Tap out taper pin (22) that holds the carriage-return shaft driven gear (23) to the carriage-return shaft (24); remove the carriage-return shaft driven gear.
- b. Reassembly.*
- (1) Position the carriage-return shaft driven gear (23) on the carriage-return shaft (24); secure with a taper pin (22).
  - (2) Position bearing (21) and carriage-return sliding clutch disk (20) on the carriage-return shaft (24); secure the carriage-return clutch disk to the shaft with a taper pin (19).
  - (3) Position the two spacers (18 and 17) on the carriage-return shaft (24).
  - (4) Install the two dowel pins (15) in the carriage-return safety clutch (16).
  - (5) Position decelerating cam (14) on the carriage-return safety clutch (16); secure with the two machine screws (13).
  - (6) Position the assembled carriage-return safety clutch (16) and decelerating cam (14) on the carriage-return shaft (24); secure with a retainer ring (12).
  - (7) Slide the bearing (21) toward the rear of the carriage-return shaft (24) so that it clears the bearing seat in the page printer casting. Position the assembled carriage-return shaft on



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- |                                     |  |   |
|-------------------------------------|--|---|
| 1 Machine screw, 10003              | 30 Flat washer, 10458                    | 19 Taper pin, 10852                           |
| 2 Flat washer, 10459                | 31 Ball bearing, 10759                   | 20 Carriage-return sliding clutch disk, 50211 |
| 3 Lockwasher, 10429                 | 32 Retainer ring, 10451                  | 21 Bronze bearing, 59398A                     |
| 4 Bearing retainer, 55020           | 33 Machine screw, 10001                  | 22 Taper pin, 10852                           |
| 5 Machine screw, 10012              | 34 Decelerating cam, 50364               | 23 Carriage-return shaft driven gear, 55164   |
| 6 Lockwater, 10430                  | 35 Dowel pin, 10917                      | 24 Carriage-return shaft, 55171               |
| 7 Machine screw, 10011              | 36 Carriage-return safety clutch, 51642A |   |
| 8 Lockwasher, 10430                 | 37 Spacer, 52117                         |   |
| 9 Self-locking hexagonal nut, 10500 | 38 Spacer, 52118                         |   |

Figure 235. Carriage-return shaft, exploded view.



the page printer so that the two marked teeth on the carriage-return driving gear of the carriage-return safety clutch (16) engage the last tooth on the carriage return driven gear. Tighten the machine screw that holds the carriage-return clutch actuating lever to the carriage-return clutch lever.

- (8) Lift the front of the carriage-return shaft (24) far enough to slide the bearing (21) into position on the shaft.
- (9) Position ball bearing (11) on the carriage-return shaft (24); secure with a flat washer (10) and self-locking hexagonal nut (9).
- (10) Position the front bearing cap on the page printer frame; secure with two machine screws (7) and lockwashers (8).
- (11) Position the rear bearing cap on the page printer frame; secure with two machine screws (5) and lockwasher (6).
- (12) Position bearing retainer (4) on the page printer frame; secure with two machine screws (1), lockwashers (3), and flat washers (2).
- (13) Replace the carriage-feed clutch lever as described in paragraph 183*b*(2).
- (14) Replace the platen as described in paragraph 151*b*.
- (15) Replace the keyboard-transmitter as described in paragraph 129*b*.
- (16) Replace the page printer as described in paragraph 128*b*.
- (17) Adjust the carriage-return shaft as described in paragraphs 309 and 343.

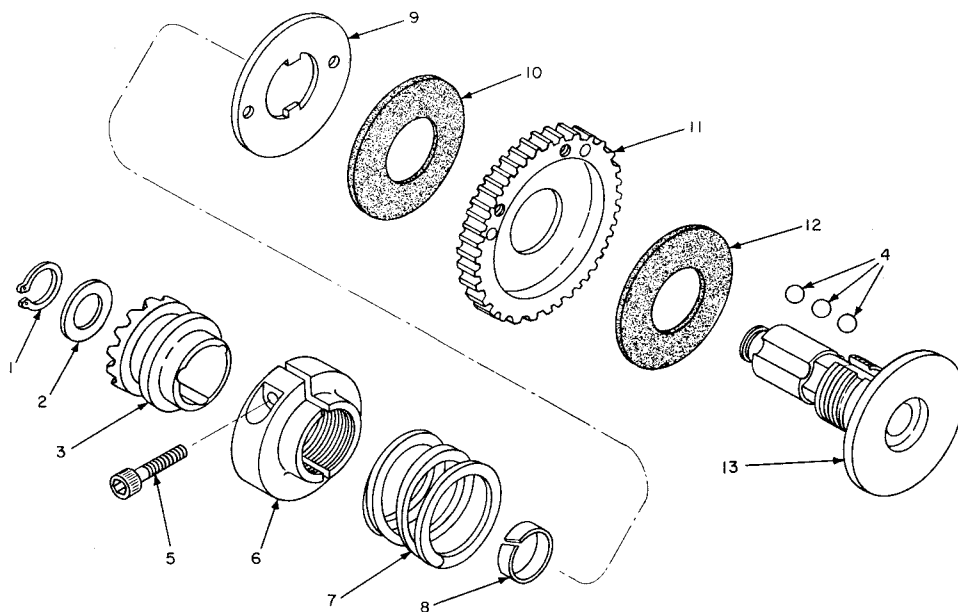
## **189. Disassembly and Reassembly of Carriage-Return Safety Clutch** (fig. 236)

### *a. Disassembly.*

- (1) Remove the carriage-return shaft as described in paragraphs 188*a*(1) through (11).
- (2) Remove the carriage-return safety clutch from the carriage-return shaft as described in paragraph 188*a*(13).
- (3) Remove retainer ring (1) and the flat washer (2) from the end of the sleeve (13).
- (4) Remove carriage-return sliding clutch drum (3) from sleeve (13); catch the nine positioning balls (4) as they drop out of the carriage-return sliding clutch drum.
- (5) Remove machine screw (5) from the adjusting collar (6); remove the adjusting collar from the threaded portion of the sleeve.
- (6) Remove spring (7) and the ball retainer ring (8) from the sleeve.
- (7) Remove clutch disk (9), friction plate (10), carriage-return driving gear (11), and friction plate (12) from the sleeve.

### *b. Reassembly.*

- (1) Assemble friction plate (12), carriage-return driving gear (11), friction plate (10), and clutch disk (9), on sleeve (13).
- (2) Position ball retainer ring (8) and spring (7) on sleeve (13).
- (3) Start adjusting collar (6) on the threaded portion of sleeve (13); turn it into spring (7) but do not draw it up tight.
- (4) Start machine screw (5) in adjusting collar (6); do not draw it up tight.
- (5) Position the carriage-return sliding clutch drum (3) on the sleeve (13); drop the nine positioning balls (4) into the three grooves.
- (6) Place flat washer (2) on the end of the sleeve (13); install the retainer ring (1).
- (7) Adjust the carriage-return safety clutch as described in paragraphs 309 and 343.
- (8) Replace the carriage-return safety clutch in the carriage-return shaft as described in paragraph 188*b*(6).



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- |   |                             |  |
|---|-----------------------------|--|
| 1 Retainer ring, 10453  | 5 Machine screw, 10010      | 10 Friction plate, 50260               |
| 2 Flat washer, 50306  | 6 Adjusting collar, 51697   | 11 Carriage-return driving gear, 50257 |
| 3 Carriage-return sliding clutch drum, 51406A (includes items 8 and 13) | 7 Spring, 55042             | 12 Friction plate, 50260               |
| 4 Positioning ball, 10908   | 8 Ball retainer ring, 51651 | 13 Sleeve                              |
|   | 9 Clutch disk, 51678        |  |

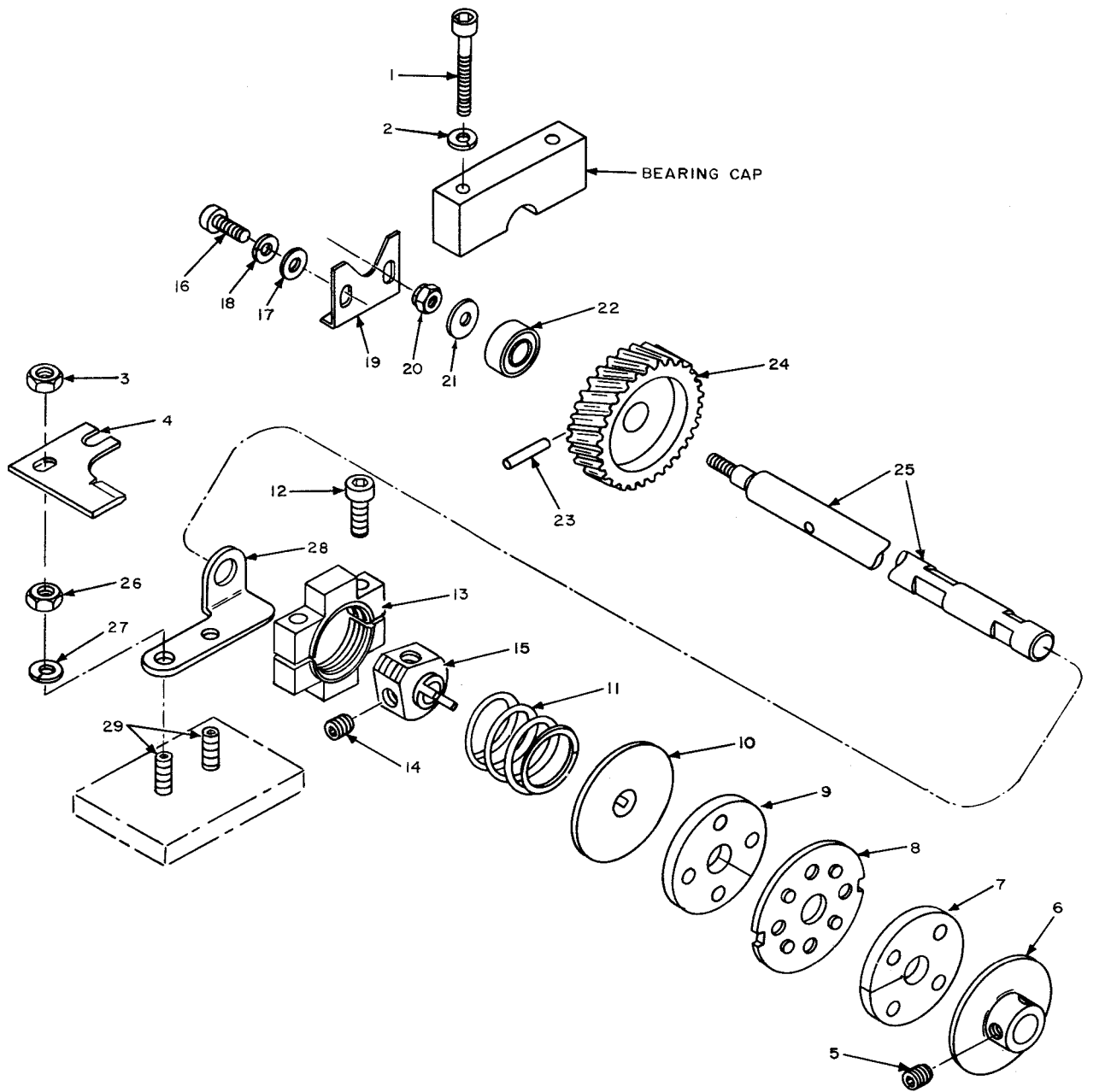
Figure 236. Carriage-return safety clutch, exploded view.

- (9) Replace the carriage-return shaft as described in paragraph 188b(7) through (19).

## 190. Disassembly and Reassembly of Keyboard-Transmitter Drive Shaft (fig. 237)

### a. Disassembly.

- (1) Remove the page printer from the printer base as described in paragraph 128a.
- (2) Remove the keyboard-transmitter from the page printer as described in paragraph 129a.
- (3) Remove the two machine screws (1) and lockwashers (2) that hold the bearing cap to the page printer frame; remove the bearing cap.
- (4) Remove the two self-locking hexagonal nuts (3) that hold the blocking plate (4) in place. Remove the blocking plate.
- (5) Remove the two setscrews (5) that hold the friction clutch disk (6) to the transmitter drive shaft (25); remove the friction clutch disk, friction plate (7), clutch driver plate (8), friction plate (9), friction clutch plate (10), and friction clutch spring (11).
- (6) Loosen the clamping screw (12) that holds the friction adjusting collar (13) to the drive shaft collar (15); turn the friction adjusting collar back until the setscrews (14) are accessible.
- (7) Remove the two setscrews (14) that hold the drive shaft collar (15) to the transmitter drive shaft (25); remove the drive shaft collar.
- (8) Remove the two machine screws (16), flat washers (17), and lockwashers (18) that hold the bearing retainer (19) to the page printer frame; remove the bearing retainer.
- (9) Remove the self-locking hexagonal nut (20) that holds the ball bearing (22) to the transmitter drive shaft (25); remove the ball bearing and washer (21).



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- |                                     |                                      |   |
|-------------------------------------|--------------------------------------|---|
| 1 Machine screw, 10012              | 11 Friction clutch spring, 54932     | 21 Washer, 50414                        |
| 2 Lockwasher, 10430                 | 12 Clamping screw, 10005             | 22 Ball bearing, 10755                  |
| 3 Self-locking hexagonal nut, 10501 | 13 Friction adjusting collar, 56382A | 23 Taper pin, 10854                     |
| 4 Blocking plate, 56707             | 14 Setscrew, 10208                   | 24 Transmitter shaft driven gear, 55163 |
| 5 Setscrew, 10209                   | 15 Drive shaft collar, 54928         | 25 Transmitter drive shaft, 55172       |
| 6 Friction clutch disk, 50200       | 16 Machine screw, 10003              | 26 Hexagonal nut, 10505                 |
| 7 Friction plate, 56765             | 17 Flat washer, 10459                | 27 Lockwasher, 10430                    |
| 8 Clutch driver plate, 51117        | 18 Lockwasher, 10429                 | 28 Mounting bracket, 55787              |
| 9 Friction plate, 56765             | 19 Bearing retainer, 55020           | 29 Mounting stud, 10237                 |
| 10 Friction clutch plate, 54931     | 20 Self-locking hexagonal nut, 10500 |   |

Figure 237. Keyboard-transmitter drive shaft, exploded view.

- (10) Tilt the transmitter shaft forward enough to clear the gear on the main shaft and remove the assembled transmitter drive shaft and transmitter shaft driven gear (24).
- (11) Remove taper pin (23) that holds the transmitter shaft driven gear (24) to the transmitter drive shaft (25); remove the transmitter shaft driven gear.
- (12) Remove the two hexagonal nuts (26) and lockwashers (27) that hold the mounting brackets (28) in place on the mounting studs (29).

*b. Reassembly.*

- (1) Reassemble the keyboard-transmitter drive shaft as indicated in figure 237; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the keyboard-transmitter friction clutch as indicated described in paragraph 400.

### **191. Removal and Replacement of Miscellaneous Page Printer Frame Assemblies, Parts, and Mounting Hardware**

Remove or replace the page printer frame assemblies listed below as indicated in figure 199.

*a. Gear Cover Group.* Items 1 through 9.

*b. Selector Magnet Bracket Assembly.* Items 10 through 16.

*c. Platen Bracket Assembly.* Items 17 through 22.

*d. Platen Lock Mechanism.* Items 23 through 27.

*e. Motor Stop Switch Assembly* (except TT-118/FG). Items 28 through 35.

*f. Motor Stop Switch Assembly* (TT-118/FG).

- (1) Remove stop bar contact S16 (58) as described in paragraph 176a.
- (2) Remove items 54 through 57 and 59 through 73 as indicated in figure 199.

*g. Printer Frame Mounting Hardware.* Items 39, 40, and 41 are used to secure the page printer frame to the vibration mounts on the printer base.

*h. Printer Casting Interconnecting Hardware.* Items 43, 44, and 47 through 50.

*Note.* The page printer frame is made up of three major castings and various bearing caps, all of which are machined together to insure correct alinement of the components. The page printer frame must be replaced as a unit. The three major castings should never be separated unless the complete unit is being replaced.

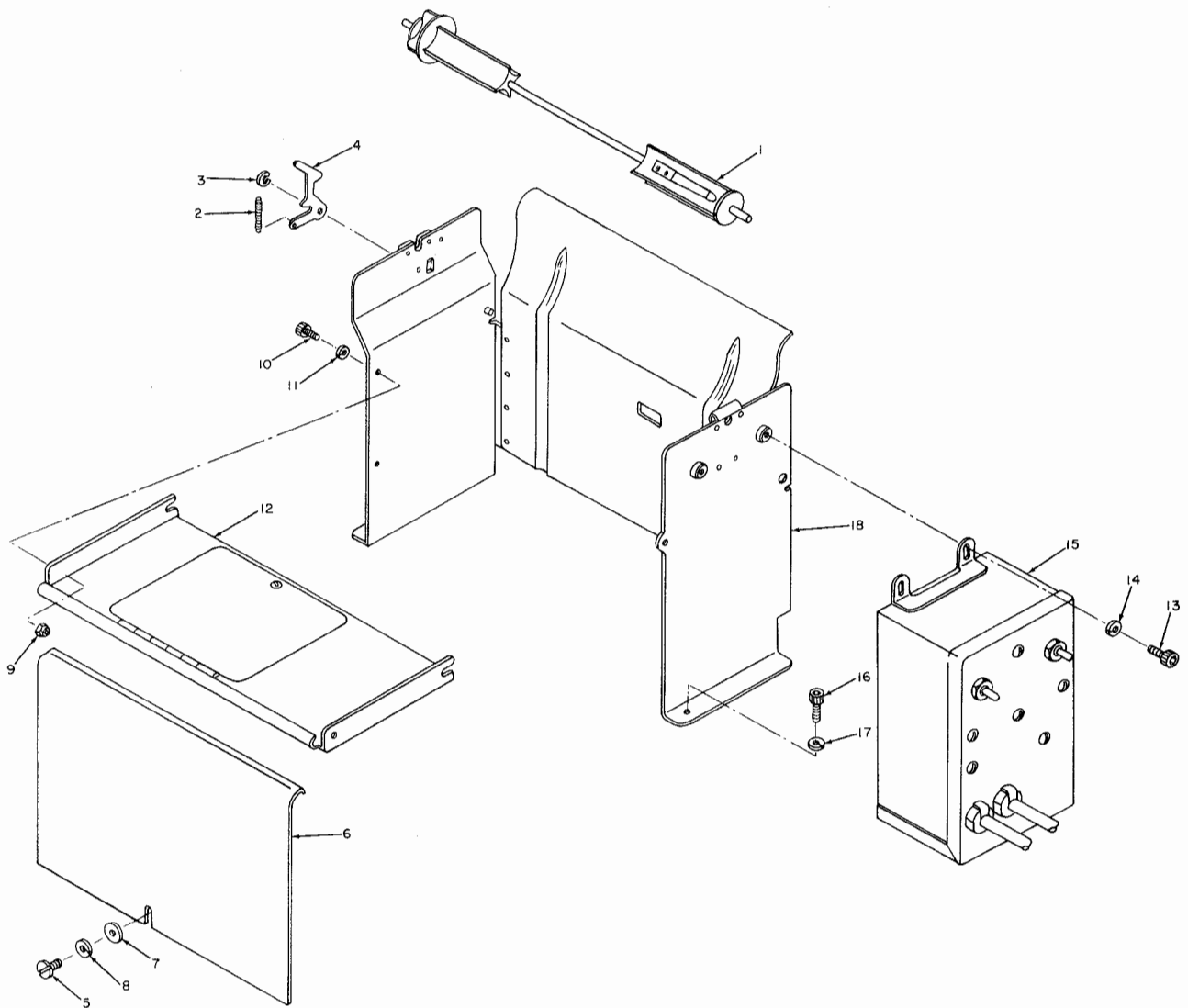
### **192. Disassembly and Reassembly of Paper Roller Stand, and Terminal Box**

(fig. 238)

*a. Disassembly.*

- (1) Pull paper roller latch (4) to the rear and remove the paper roller shaft (1).
- (2) Remove paper roller latch spring (2) from paper roller latch (4) and from the spring post on the paper roller stand (18).
- (3) Remove the retainer ring (3) that holds paper roller latch (4) to a stud on the paper roller stand (18); remove the paper roller latch.
- (4) Remove machine screw (5), flat washer (7) and lockwasher (8) that hold the rear paper deflector (6) to the paper roller stand; remove the rear paper deflector (6).
- (5) Remove the two self-locking hexagonal nuts (9), machine screws (10), and flat washers (11) that hold the paper stand cross brace (12) to the paper roller stand (18); remove the paper stand cross brace.
- (6) Remove the two machine screws (13) and lockwashers (14) that hold terminal box (15) to the paper roller stand (18); lift the terminal box far enough to clear the multiple jack on the printer base under the terminal box. Remove the terminal box.
- (7) Remove the four machine screws (16) and lockwashers (17) that hold the paper roller stand (18) to the printer base; remove the paper roller stand.

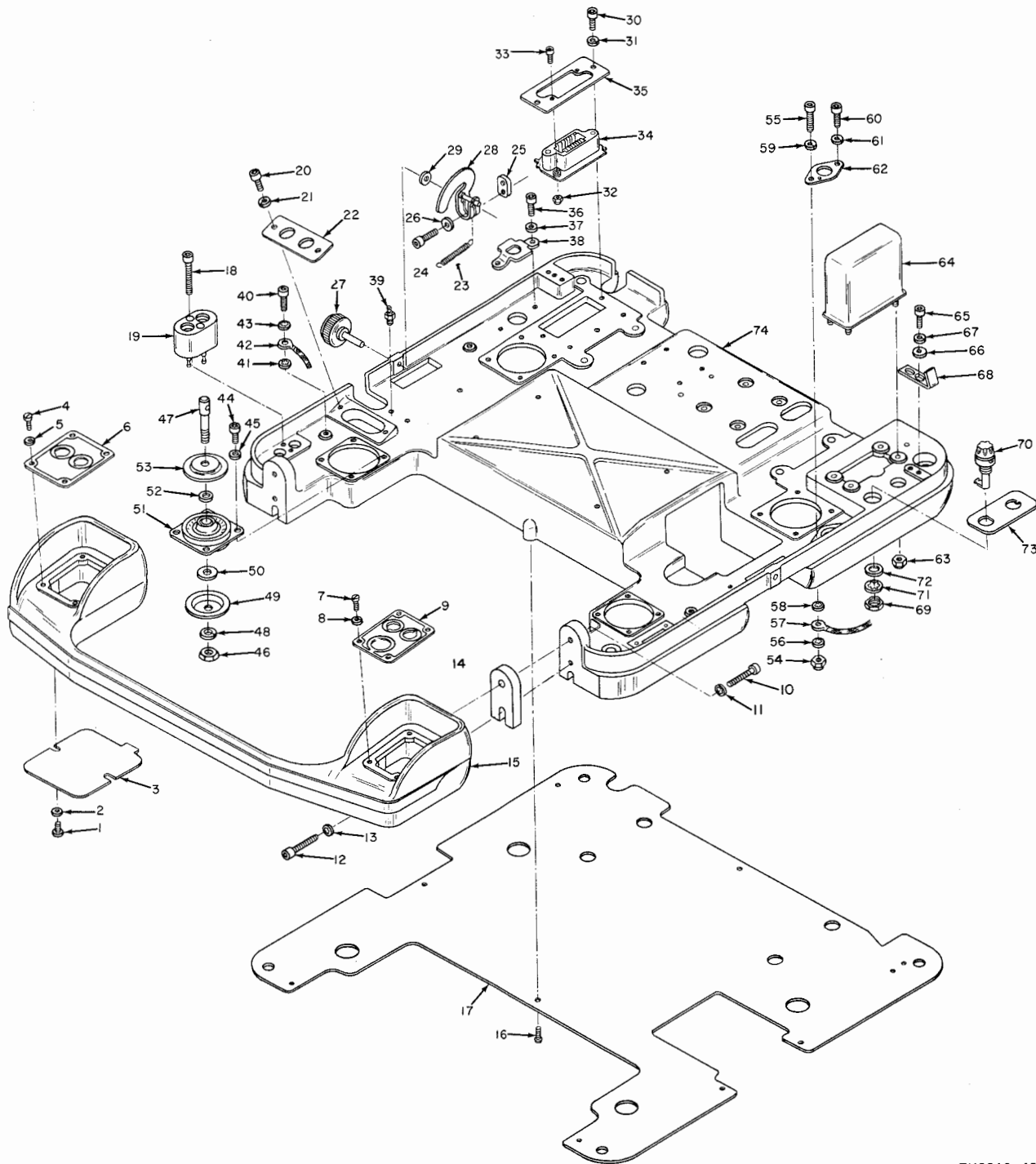
*b. Reassembly.* Reassemble the paper roller stand and terminal box as indicated in figure 238; the sequence for assembling the parts is the reverse of the disassembly sequence.



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- |                                    |                                     |   |
|------------------------------------|-------------------------------------|---|
| 1 Paper roller shaft, 50605A       | 8 Lockwasher, 10429                 | 14 Lockwasher, 10430  |
| 2 Paper roller latch spring, 50912 | 9 Self-locking hexagonal nut, 10500 | 15 Terminal box, 53640A (59804A on TT-117A/FG, TT-118/FG, and TT-119A/FG) |
| 3 Retainer ring, 10949             | 10 Machine screw, 10003             | 16 Machine screw, 10008   |
| 4 Paper roller latch, 52938        | 11 Flat washer, 10450               | 17 Lockwasher, 10430  |
| 5 Machine screw, 10111             | 12 Paper stand cross brace, 53447A  | 18 Paper roller stand, 53490A   |
| 6 Rear paper deflector, 55537      | 13 Machine screw, 10008             |   |
| 7 Flat washer, 10450               |                                     |   |

Figure 238. Paper roller stand and terminal box, exploded view.



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Figure 239. Page printer base, exploded view.

1 Machine screw, 10393	28 Dust cover arm, 55010A (LH)	53 Vibration mount limit stop, 54127
2 Lockwasher, 10429	and 55015A (RH)	54 Self-locking hexagonal nut, 10501
3 Cover plate, 53171	29 Flat washer, 50315	55 Machine screw, 10010
4 Machine screw, 10393	30 Machine screw, 10008	56 Lockwasher, 10404
5 Lockwasher, 10429	31 Lockwasher, 10430	57 Terminal lug, 20838
6 Switch plate, 52998 (59807*)	32 Self-locking hexagonal nut, 10550	58 Lockwasher, 10404
7 Machine screw, 10393	33 Machine screw, 10056	59 Lockwasher, 10430
8 Lockwasher, 10429	34 Receptacle connector (J7),	60 Machine screw, 10008
9 Switch plate, 54661 (59819*)	20263	61 Lockwasher, 10430
10 Machine screw, 10013-01	35 Mounting plate, 53092	62 Mounting plate, 53172
11 Lockwasher, 10404	36 Machine screw, 10008	63 Self-locking hexagonal nut, 10501
12 Machine screw, 10013-01	37 Lockwasher, 10430	64 Motor stop relay (E1), 20301A
13 Lockwasher, 10404	38 Mounting bracket, 53806	(20302A on TT-118/FG)
14 Spacer plate, 54952	39 Spring post, 50649	65 Machine screw, 10008
15 Keyboard guard, 52997	40 Machine screw, 10008	66 Flat washer, 10467
16 Machine screw, 10179	41 Lock washer, 10404	67 Lockwasher, 10430
17 Printer base plate, 53421	42 Grounding lead, 53651A	68 Dust cover guide, 55021
18 Machine screw, 10013	43 Lockwasher, 10404	69 Hexagonal nut
19 Receptacle connector, 53320A	44 Machine screw, 10008	70 Fuseholder (F1), 20458 (includes
20 Machine screw, 10008	45 Lockwasher, 10430	items 69, 71, and 72) and fuse
21 Lockwasher, 10430	46 Plain hexagonal nut, 10502	cap, 20460
22 Switch plate, 53563 (53167*)	47 Vibration mount stud, 53557	71 Lockwasher
23 Dust cover arm spring, 55014	48 Lockwasher, 10427	72 Rubber washer
24 Machine screw, 10010	49 Vibration mount limit stop, 54127	73 Switch plate (S4), 53563
25 Nut plate, 52073	50 Flat washer, 50862	74 Printer base, 55780 (59806 on the
26 Flat washer, 10467	51 Vibration mount, 10911	TT-117A/FG and TT-119A/
27 Locking knob, 55013	52 Flatwasher, 50494	FG, 59889 on the TT-118/FG)

\* Part reference number applies only to TT-117A/FG, TT-118/FG, and TT-119A/FG.

Figure 239.—Continued.

### 193. Removal and Replacement of Miscellaneous Page Printer Base Assemblies, Parts and Mounting Hardware

*a. Keyboard Guard.* Remove the two machine screws (10, fig. 239), lockwashers (11), two machine screws (12), and lockwashers (13) that hold the keyboard guard (15) to the printer base (74); remove the spacer plates (14) and the keyboard guard.

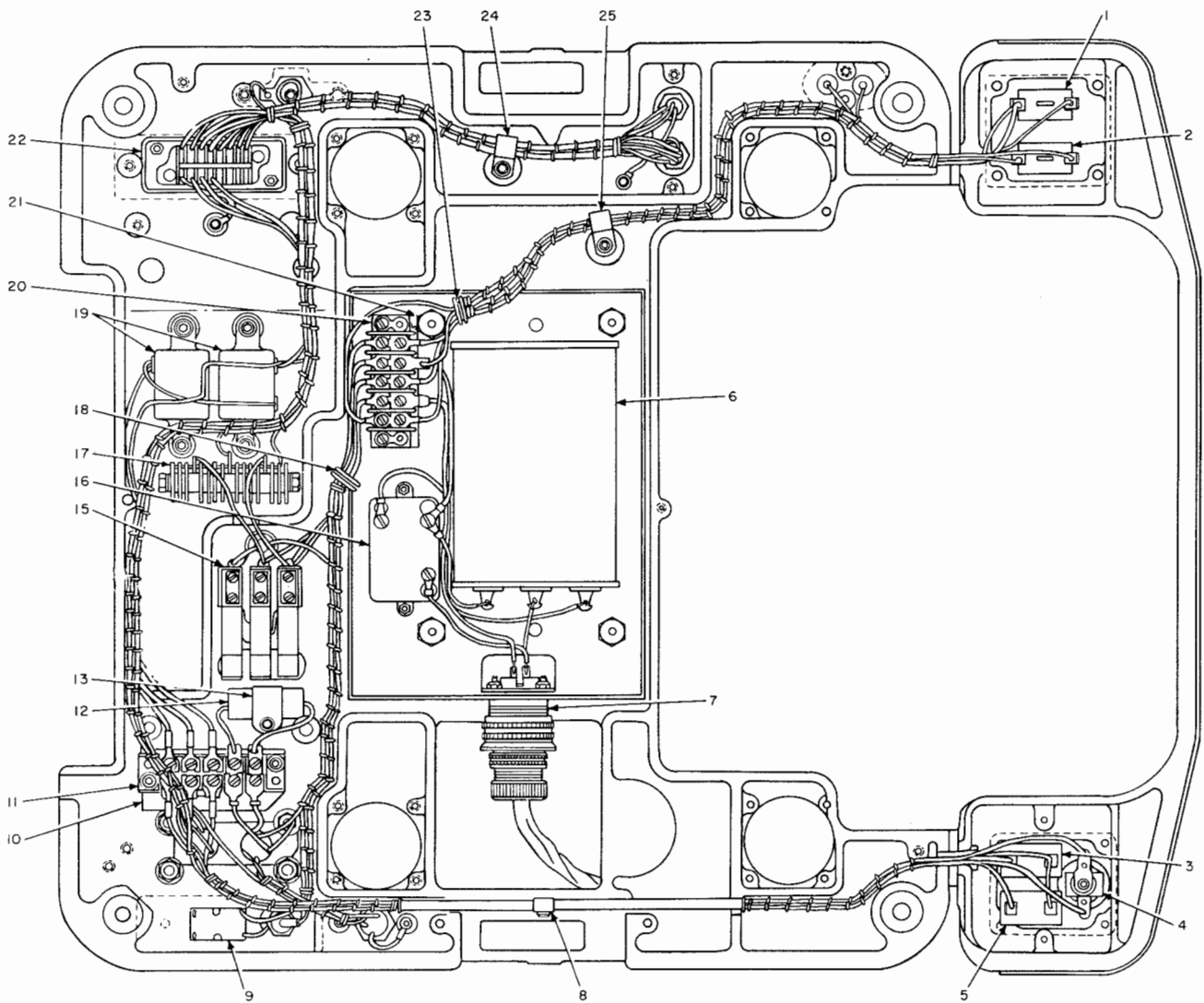
*b. Vibration Mounts.* Remove the four machine screws (44) and lockwashers (45) that

hold each of the vibration mounts to the printer base (74); remove the vibration mount.

*c. Other Miscellaneous Components.* Remove the other miscellaneous components using figure 239 as a guide.

### 194. Removal and Replacement of Printer Base Electric Components

The electrical components mounted in the printer base are illustrated in figure 240. These components should not be removed unless they are damaged or inoperative. Reference numbers are shown on the legend which accompanies the illustration.



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- |                                  |                                     |                                     |
|----------------------------------|-------------------------------------|-------------------------------------|
| 1 Toggle switch (S5), 20119      | 8 Electrical clamp, 20503           | 18 Bushing insulator, 20726         |
| 2 Toggle switch (S6), 20119      | 9 Toggle switch (S4), 20115         | 19 Capacitor (C5 and C6), 20213     |
| 3 Toggle switch (S3), 20116      | 10 Mounting plate, 20382            | 20 Terminal board (TB1), 20370      |
| 4 Lamp socket (I3), 20790 Lamp,  | 11 Terminal board (TB9), 20385      | 21 Mounting plate, 20382            |
| 20791, Amber lens, 20771         | 12 Capacitor (C2), 20212            | 22 Receptacle connector (J7), 20263 |
| 5 Toggle switch (S2), 20119      | 13 Electrical clamp, 20774          | 23 Bushing insulator, 20726         |
| 6 Capacitor (C9), 53343          | 14 Electrical contact (J4), 53414   | 24 Electrical clamp, 20514          |
| 7 Receptacle connector (P3, J3), | 15 Motor start relay (CR3), 20114   | 25 Electrical clamp, 20513          |
| 20264                            | 16 Metallic rectifier (CR1), 54356A |                                     |

Figure 240. Printer base electrical components.



## Section VI. REMOVAL AND REPLACEMENT OF PERFORATOR COMPONENTS

### 195. General

#### a. Introduction.

- (1) This section describes replacement procedures required for repairing a defective or inoperative perforator. The procedures include replacement of all parts of the unit except those parts for which the procedure is so simple that it is obvious.
- (2) Except for cases of extreme emergency, all repairs should be made by personnel thoroughly trained in typewriter maintenance. Equipment operating with minor faults may fail completely because of efforts by inexperienced personnel to correct apparently simple defects.
- (3) Follow the inspection, cleaning, and lubrication instructions given in paragraphs 106 through 120. Whenever repairs are made, the perforator should be completely adjusted in accordance with paragraphs 406 through 523.

b. *General Disassembly and Reassembly Procedure.* Paragraph 126 describes the procedure to be used when disassembling the equipment. Paragraph 120 describes the procedure to be used when reassembling the equipment. Refer to these paragraphs before beginning any overhaul or repair work on the perforator.

### 196. Removal and Replacement of Perforator Chassis

#### a. Removal.

- (1) Disconnect the plug connections between the perforator base and the transmitter-distributor.
- (2) Unscrew the motor plug connector from its coupling in the perforator base.
- (3) Remove the selector magnet plug from the jack in the perforator base.
- (4) Remove the receiving multisolenoid plug from the jack in the perforator base.
- (5) Remove the perforator latch plug and the pulsing contact assembly plug

from the jacks in the perforator base.

- (6) Remove the two machine screws (44, fig. 251) and lockwashers (45) that hold the tape guide (46) to the frame; remove the tape guide.
- (7) Remove the four machine screws, lockwashers, and grounding electrical leads that hold the perforator chassis to the perforator base; lift the chassis from the base.

#### b. Replacement.

- (1) Position the perforator chassis upon the vibration mounts on the perforator base; secure with four grounding leads, machine screws, and lockwashers.
- (2) Position the tape guide (46) on the perforator frame; secure with two machine screws (44) and lockwashers (45).
- (3) Install the plugs removed in *a* above.

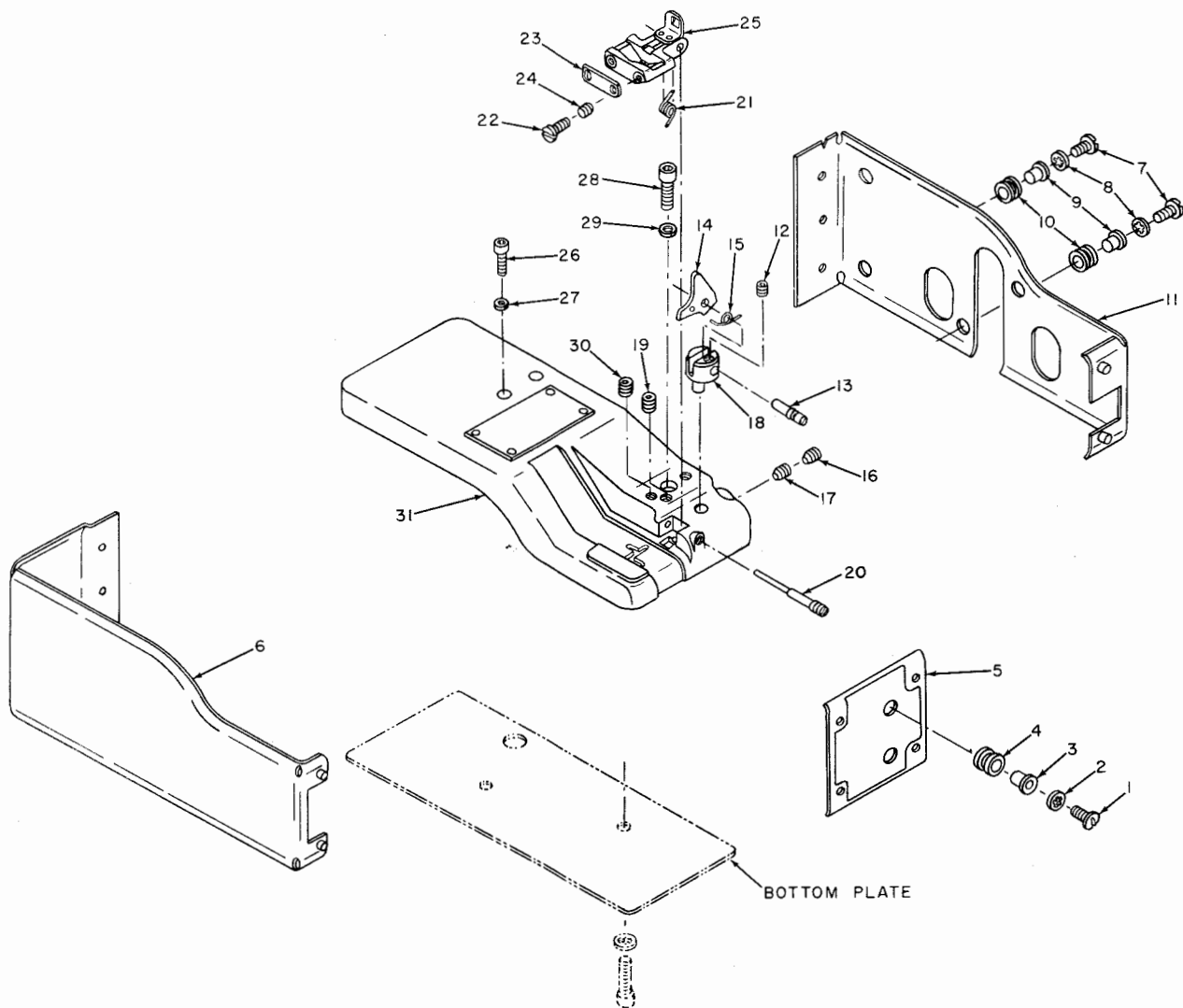
### 197. Removal and Replacement of Transmitter-Distributor

#### a. Removal.

- (1) Remove the transmitter-distributor plug from the jack in the perforator base.
- (2) Snap off the outside cover (6, fig. 241) of the transmitter-distributor.
- (3) Remove the two machine screws (1, fig. 250) and lockwashers (2) that hold the transmitter-distributor frame to the perforator frame; remove the transmitter-distributor, carefully disengaging the friction clutch fork from the clutch driver.

#### b. Replacement.

- (1) Position the transmitter-distributor on the perforator frame, carefully engaging the friction clutch fork with the clutch driver. Secure with two machine screws and lockwashers.
- (2) Install the outside cover on the transmitter-distributor.
- (3) Connect the transmitter-distributor plug to the jack on the perforator base.



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- |                         |  |                            |
|-------------------------|--|----------------------------|
| 1 Machine screw, 10357  | 12 Setscrew, 10221                         | 22 Adjustment screw, 52884 |
| 2 Lockwasher, 10403     | 13 Tape cover latch eccentric pivot, 53952 | 23 Tape guide, 52809       |
| 3 Bushing, 52860        | 14 Tape cover latch, 56322                 | 24 Setscrew, 10221         |
| 4 Grommet, 20725        | 15 Tape cover latch spring, 56323          | 25 Tape cover, 56801A      |
| 5 Front plate, 52853    | 16 Setscrew, 10209                         | 26 Machine screw, 10003    |
| 6 Outside cover, 52817A | 17 Setscrew, 10211                         | 27 Lockwasher, 10429       |
| 7 Machine screw, 10393  | 18 Pivot, 56320                            | 28 Machine screw, 10006    |
| 8 Lockwasher, 10403     | 19 Setscrew, 10234                         | 29 Lockwasher, 10429       |
| 9 Bushing, 52860        | 20 Pin, 53349                              | 30 Setscrew, 10224         |
| 10 Grommet, 20725       | 21 Tape cover spring, 56324                | 31 Top cover, 53794        |

Figure 241. Transmitter-distributor covers, exploded view.

## 198. Disassembly and Reassembly of Transmitter-Distributor Covers (fig. 241)

### a. Disassembly.

- (1) Remove the transmitter-distributor as described in paragraph 197.
- (2) Remove the two machine screws (1), lockwashers (2), and bushings (3)

that hold the front plate (5) to the frame of the transmitter-distributor; remove the front plate.

- (3) Remove the two grommets (4) from the front plate (5).
- (4) Remove the four machine screws (7), lockwashers (8), and bushings (9) that hold the inside cover (11) to the

frame of the transmitter-distributor; remove the inside cover.

- (5) Remove the four grommets (10) from the inside cover (11).
- (6) Remove the setscrew (12) and the tape cover latch eccentric pivot (13) from the pivot post (18); lift the tape cover latch (14) and the tape cover latch spring (15) from the pivot post.
- (7) Remove the setscrews (16 and 17) that hold the pivot post (18) in the top cover (31); remove the pivot post.
- (8) Remove the setscrew (19) that holds the pin (20) in the top cover (31); remove the pin. Remove the tape cover (25) and the tape cover spring (21) from the top cover.
- (9) Remove the two adjustment screws (22) and setscrews (24) that hold the tape guide (23) on the tape cover (25); remove the tape guide.
- (10) Remove the two machine screws (26), lockwashers (27), machine screw (28), and lockwasher (29) that hold the top cover (31) to the frame; remove the top cover.
- (11) Remove the two setscrews (30) from the top cover (31).

*b. Reassembly.*

- (1) Install the two setscrews (30) in the top cover (31).
- (2) Position the top cover (31) on the frame of the transmitter-distributor; hold with a lockwasher (29), machine screw (28), two lockwashers (27), and two machine screws (26).
- (3) Install two setscrews (24) in the tape cover (25).
- (4) Position the tape guide (23) on the tape cover (25); hold with two adjustment screws (22).
- (5) Position the tape cover (25) and the tape cover spring (21) on the top cover (31); insert the pin (20). Secure the pin with a setscrew (19).
- (6) Position the pivot post (18) in the top cover (31); hold the pivot post in place with setscrews (17 and 16).
- (7) Position the tape cover latch spring (15) and the tape cover latch (14) in the pivot post (18); install the tape

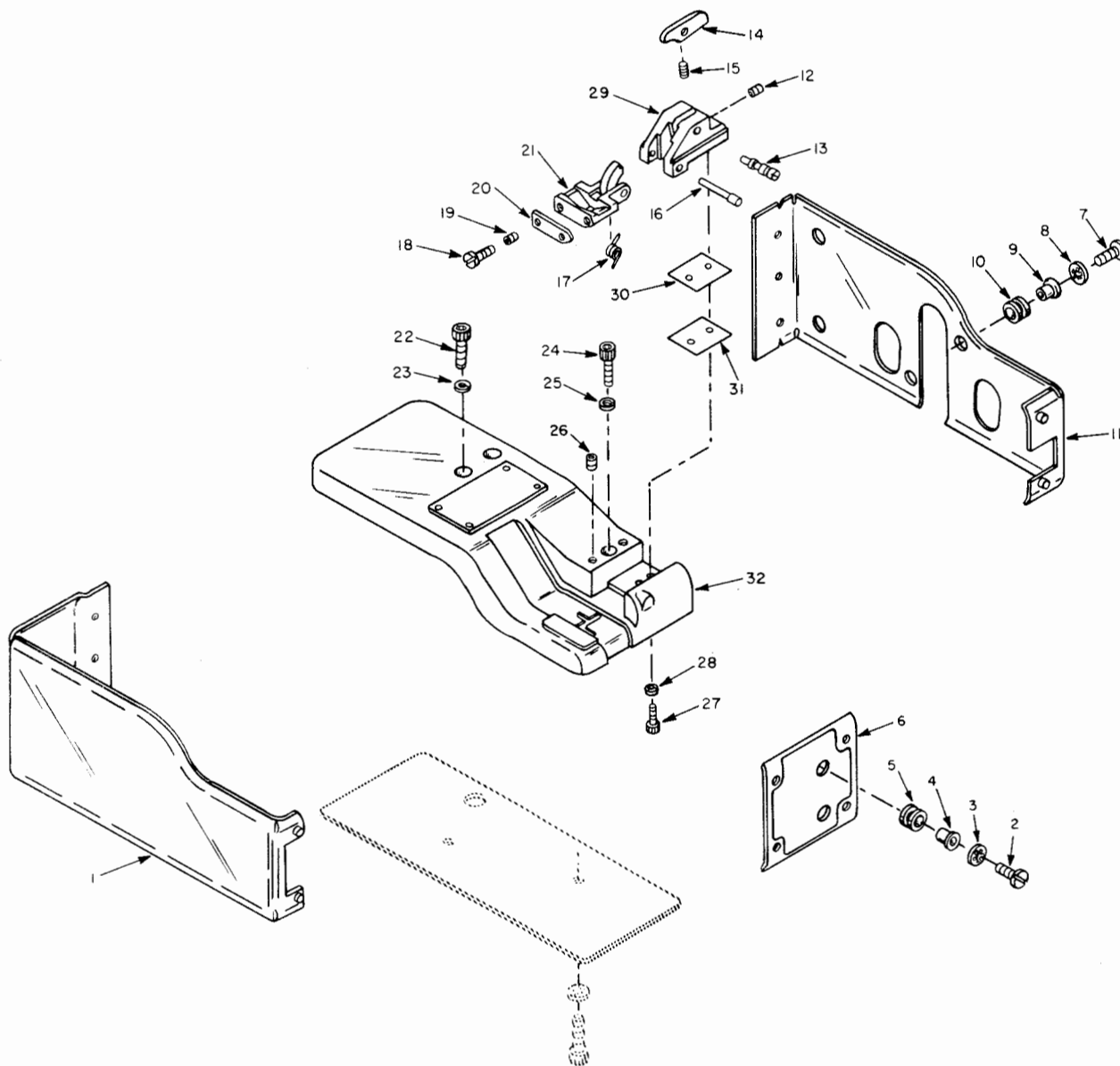
cover latch eccentric pivot (13). Hold the tape cover latch in place with a setscrew (12).

- (8) Install the four grommets (10) in the inside cover (11).
- (9) Position the inside cover on the frame of transmitter-distributor; hold in place with four bushings (9), lockwashers (8), and machine screws (7).
- (10) Install the two grommets (4) in the front plate (5).
- (11) Position the front plate (5) on the inside cover (11) and outside cover (6); hold to the frame of the transmitter-distributor with two bushings (3), lockwashers (2), and machine screws (1).
- (12) Adjust the transmitter-distributor as described in paragraphs 498 through 517.
- (13) Replace the transmitter-distributor as described in paragraph 197b.

**199. Disassembly and Reassembly of Transmitter-Distributor Covers (TT-178A/FG, TT-179A/FG and TT-181/FG)**  
(fig. 242)

*a. Disassembly.*

- (1) Remove the transmitter-distributor as described in paragraph 197a.
- (2) Remove the two machine screws (2), lockwashers (3), bushings (4), and grommets (5) that hold the front plate (6) to the transmitter-distributor frame; remove the front plate (6).
- (3) Remove the four machine screws (7), lockwashers (8), bushings (9), and grommets (10) that hold the inside cover (11) to the transmitter-distributor frame; remove the inside cover (11).
- (4) Remove the setscrew (12) that holds the tape cover latch stud (13) to the tape cover bracket (29); remove the tape cover latch stud (13), tape cover latch (14), and tape cover latch spring (15).
- (5) Remove the pin (16) that holds the tape cover (21) to the tape cover



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- |                         |                                   |                              |
|-------------------------|-----------------------------------|------------------------------|
| 1 Outside cover, 59638A | 12 Setscrew, 10201                | 23 Lockwasher, 10429         |
| 2 Machine screw, 10357  | 13 Tape cover latch stud, 53952   | 24 Machine screw, 10006      |
| 3 Lockwasher, 10403     | 14 Tape cover latch, 57204        | 25 Lockwasher, 10429         |
| 4 Bushing, 52860        | 15 Tape cover latch spring, 57203 | 26 Setscrew, 10224           |
| 5 Grommet, 20725        | 16 Pin, 57214                     | 27 Machine screw, 10004      |
| 6 Front plate, 52853    | 17 Tape cover spring, 56324       | 28 Lockwasher, 10421         |
| 7 Machine screw, 10357  | 18 Machine screw, 52884           | 29 Tape cover bracket, 57211 |
| 8 Lockwasher, 10403     | 19 Setscrew, 10221                | 30 Shim, .002 in., 57201     |
| 9 Bushing, 52860        | 20 Tape guide, 52809              | 31 Shim, .005 in., 57202     |
| 10 Grommet, 20725       | 21 Tape cover, 57209              | 32 Top cover, 59636A         |
| 11 Inside cover, 59640A | 22 Machine screw, 10003           |                              |

Figure 242. Transmitter-distributor covers, exploded view (TT-178A/FG, TT-179A/FG, and TT-181/FG).

bracket (29); remove the tape cover spring (17) and the assembled tape cover (21) and tape guide (20).

- (6) Remove the two machine screws (18) and setscrews (19) that hold the tape

guide (20) to the tape cover (21); remove the tape guide.

- (7) Remove the two machine screws (22), lockwashers (23), machine screw (24), and lockwasher (25) that hold

the top cover (32) to the transmitter-distributor frame; remove the top cover. Remove the two setscrews (26) from the top cover.

- (8) Remove the two machine screws (27) and lockwashers (28) that hold the tape cover bracket (29) to the top cover (32); remove the tape cover bracket (29) and shims (30 and 31).

*b. Reassembly.*

- (1) Reassemble the transmitter-distributor covers by reversing the procedures described in *a*(2) through (8) above.
- (2) Adjust the tape cover and top cover as described in paragraphs 506, 508, 510 and 514.
- (3) Replace the transmitter-distributor as described in paragraph 197*b*.

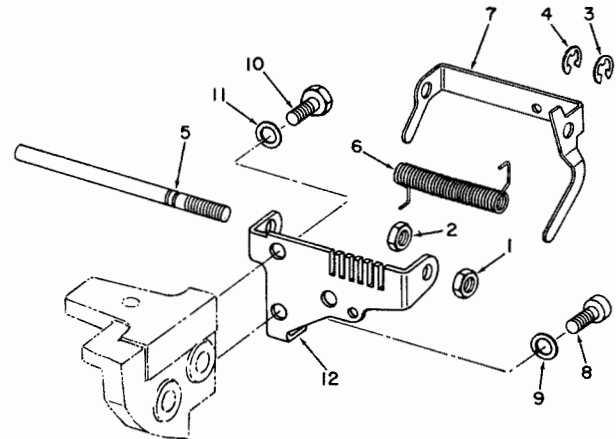
## 200. Disassembly and Reassembly of Tape-Out Sensing Mechanism (fig. 243)

*a. Disassembly.*

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197*a*.
- (2) Remove the covers from the transmitter-distributor as described in paragraph 198*a*.
- (3) Remove the two plain hexagonal nuts (1 and 2) from the tape-out lever pivot shaft (5).
- (4) Remove the two retainer rings (3 and 4) that hold the tape-out lever (7) in place on the tape-out lever pivot shaft (5); slide the tape-out lever pivot shaft from the code sensing lever guide (12), removing the tape-out lever spring (6) and the tape-out lever.
- (5) Remove the machine screw (8), lockwasher (9), machine screw (10), and lockwasher (11) that hold the code sensing lever guide (12) to the frame of the transmitter-distributor; remove the code sensing lever guide.

*b. Reassembly.*

- (1) Position the code sensing lever guide (12) on the frame of the transmitter-



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- |                                     |                                    |
|-------------------------------------|------------------------------------|
| 1 Plain hexagonal nut, 10504        | 6 Tape-out lever spring, 53156     |
| 2 Plain hexagonal nut, 10504        | 7 Tape-out lever, 52824            |
| 3 Retainer ring, 10969              | 8 Machine screw, 10003             |
| 4 Retainer ring, 10969              | 9 Lockwasher, 10429                |
| 5 Tape-out lever pivot shaft, 52718 | 10 Machine screw, 10398            |
|                                     | 11 Lockwasher, 10429               |
|                                     | 12 Code sensing lever guide, 52861 |

Figure 243. Tape-out sensing mechanism, exploded view.

distributor; secure it in place with a lockwasher (11), machine screw (10), lockwasher (9), and machine screw (8).

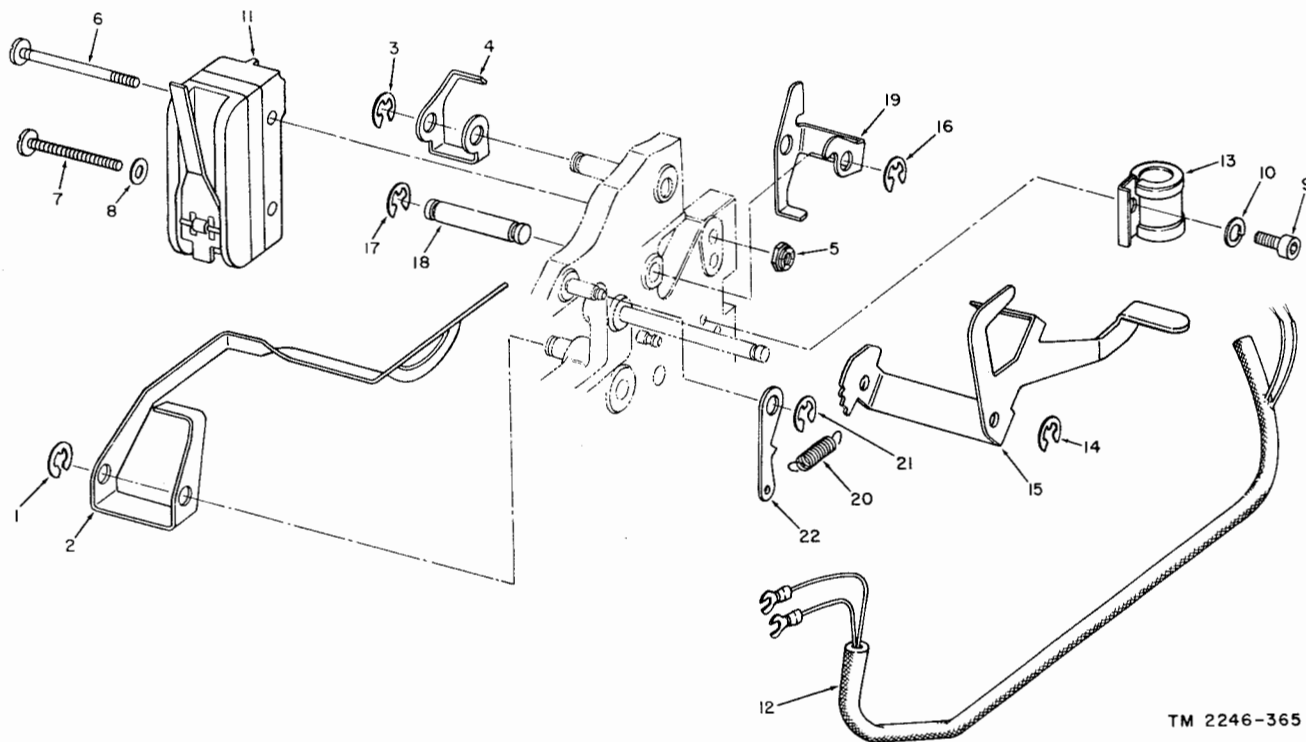
- (2) Position the tape-out lever (7) and the tape-out lever spring (6) on the code sensing lever guide; slide the tape-out lever pivot shaft (5) through the guide, spring, and plain hexagonal nut (2), guide, and plain hexagonal nut (1). Turn the nuts on the shaft threads.
- (3) Hold the tape-out lever (7) in place on the tape-out lever pivot shaft (5) with two retainer rings (4 and 3).
- (4) Adjust the transmitter-distributor as described in paragraphs 498 through 517.
- (5) Install the covers on the transmitter-distributor as described in paragraph 198*b*.
- (6) Replace the transmitter-distributor as described in paragraph 197*b*.

## 201. Disassembly and Reassembly of the Transmitter-Distributor Operating Levers

(fig. 244)

### a. Disassembly.

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197a.
- (2) Remove the covers from the transmitter-distributor as described in paragraph 198a.
- (3) Remove the retainer ring (1) that holds the tight-tape lever (2) to the pivot post on the frame; remove the tight-tape lever.
- (4) Remove the retainer ring (3) that holds the upper switch bail lever (4) to the pivot post on the frame; remove the upper switch bail lever.
- (5) Remove the self-locking hexagonal nut (5) machine screw (6), machine screw (7), and flat washer (8) that attach the start-stop switch (11) to the frame of the transmitter-distributor.
- (6) Remove the machine screw (9) and lockwasher (10) that attach the electrical clamp (13) to the frame.
- (7) Unsolder the ends of the two wires in the wiring harness (12) from the solder lugs on the start-stop switch (11); tag the wires and remove the start-stop switch.
- (8) Disconnect the terminal lugs of the wires at the other end of the wiring harness from the terminal board; remove the wiring harness and the electrical clamp.



- |                                     |                                   |  |
|-------------------------------------|-----------------------------------|--|
| 1 Retainer ring, 10949              | 9 Machine screw, 10003            | 17 Retainer ring, 10949                  |
| 2 Tight-tape lever, 52810           | 10 Lockwasher, 10429              | 18 Pin, 52872                            |
| 3 Retainer ring, 10949              | 11 Start-stop switch (S17), 20108 | 19 Lower switch bail lever, 52812        |
| 4 Upper switch bail lever, 52811    | 12 Wiring harness, 53339          | 20 Start-stop lever detent spring, 53149 |
| 5 Self-locking hexagonal nut, 10500 | 13 Electrical clamp, 20507        | 21 Retainer ring, 10949                  |
| 6 Machine screw, 10385              | 14 Retainer ring, 10949           | 22 Start-stop lever detent, 50404        |
| 7 Machine screw, 10359              | 15 Start-stop lever, 52863        |  |
| 8 Flat washer, 10459                | 16 Retainer ring, 10949           |  |

Figure 244. Transmitter-Distributor operating levers, exploded view.

- (9) Remove the retainer ring (14) that holds the start-stop lever (15) to the pivot stud on the frame; remove the start-stop lever.
- (10) Remove the retainer rings (16 and 17) from the pin (18); remove the pin from the lower switch bail lever (19) and from the frame. Remove the lower switch bail lever.
- (11) Remove the start-stop lever detent spring (20) from the start-stop lever detent (22) and from the spring post on the frame.
- (12) Remove the retainer ring (21) and the start-stop lever detent (22) from the pivot post.

*b. Reassembly.*

- (1) Reassemble the transmitter-distributor operating levers as indicated in figure 244; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the covers on the transmitter-distributor as described in paragraph 198*b*.
- (3) Replace the transmitter-distributor as described in paragraph 197*b*.

## **202. Disassembly and Reassembly of Transmitter-Distributor Code Sensing Levers** (fig. 245)

*a. Disassembly.*

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197*a*.
- (2) Remove the covers from the transmitter-distributor as described in paragraph 198*a*.
- (3) Remove the five code sensing lever springs (1) from the code sensing levers (16, 17, 18, 20, and 21) and from the code sensing lever spring post (5).
- (4) Remove the tape feed retracting lever spring (2) from the tape feed retracting lever (14) and from the code sensing lever spring post (5).
- (5) Remove the plain hexagonal nuts (3 and 4) from the code sensing lever spring post (5); remove the post from the selector lever comb guide.

- (6) Remove the tape feed claw spring (6) from the tape feed claw (19) and from the lever guide.
- (7) Remove the setscrew (7) that holds the code sensing lever stud (13) in the frame.
- (8) Remove the retainer rings (8, 9, 10, 11, and 12) from the code sensing lever stud (13); slide the code sensing lever stud out of the code sensing levers and the frame.
- (9) Remove the tape feed retracting lever (14), sensing lever restoring bail (15), code sensing levers (16, 17, 18, 20, and 21), and the tape feed claw (19). Mark the position of the code sensing levers on the levers.

*b. Reassembly.*

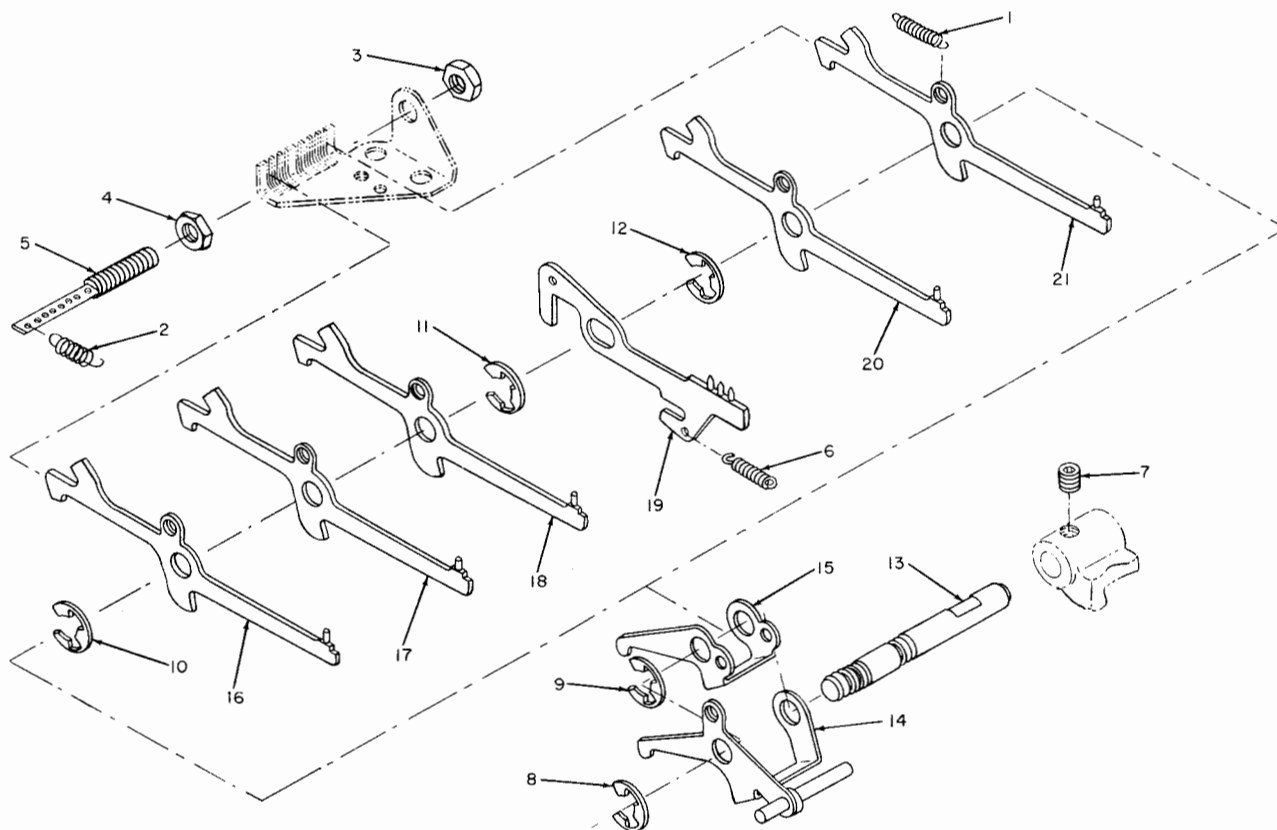
- (1) Reassemble the transmitter code sensing levers as indicated in figure 245; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the covers on the transmitter-distributor as described in paragraph 198*b*.
- (3) Replace the transmitter-distributor on the perforator as described in paragraph 197*b*.

## **203. Disassembly and Reassembly of Transmitter-Distributor Selector Levers**

(fig. 246)

*a. Disassembly.*

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197*a*.
- (2) Remove the covers from the transmitter-distributor as described in paragraph 198*a*.
- (3) Remove the seven springs (1) from the anchor post (38) and from the selector levers (4, 7, 10, 13, 16, and 19) and the camshaft stop lever (22).
- (4) Remove the retainer ring (2) securing the selector levers to the selector lever stud (25). Remove the flat washers (3, 6, 9, 15, 18, and 21), the selector levers, and bearing shoes (5, 8, 11, 14, 17, and 20), alternately.



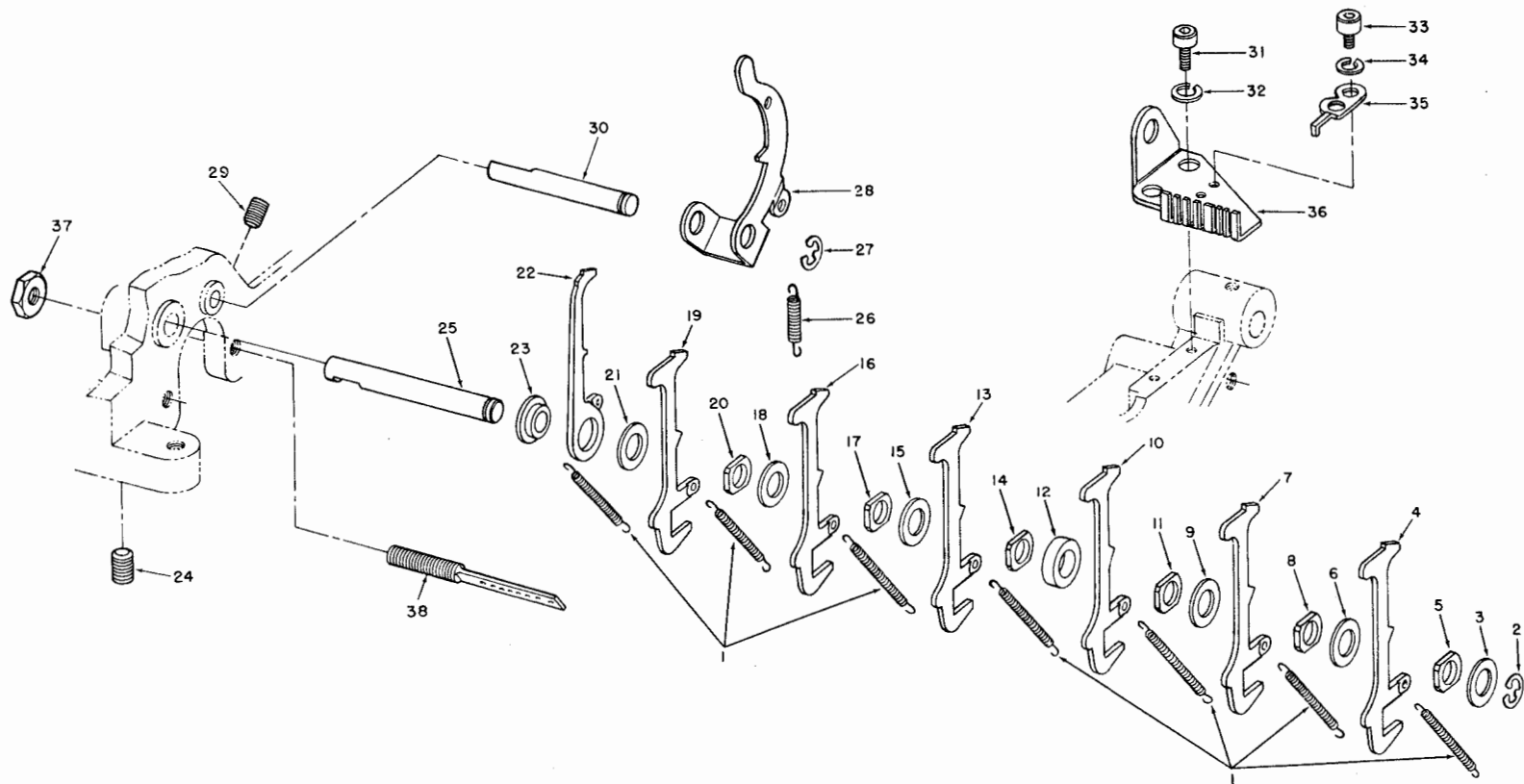
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- |  |                                       |   |
|--|---------------------------------------|---|
| 1 Code sensing lever spring, 53152         | 8 Retainer ring, 10957                | 15 Sensing lever restoring bail, 52858                        |
| 2 Tape feed retracting lever spring, 53154 | 9 Retainer ring, 10957                | 16 Code sensing lever, 52843A (includes items 17, 18, 20, 21) |
| 3 Plain hexagonal nut, 10509               | 10 Retainer ring, 10957               | 17 Code sensing lever   |
| 4 Plain hexagonal nut, 10509               | 11 Retainer ring, 10957               | 18 Code sensing lever   |
| 5 Code sensing lever spring post, 50325    | 12 Retainer ring, 10957               | 19 Tape feed claw, 52836                                      |
| 6 Tape feed claw spring, 53153             | 13 Code sensing lever stud, 52835     | 20 Code sensing lever   |
| 7 Setscrew, 10209                          | 14 Tape feed retracting lever, 52829A | 21 Code sensing lever   |

Figure 245. Transmitter-distributor code sensing levers, exploded view.

- Remove the spacer collar (12) in sequence. Remove the camshaft stop lever (22) and the sleeve bearing (23).
- (5) Remove the setscrew (24) that holds the selector lever stud (25) in the frame; remove the selector lever stud.
  - (6) Remove the tape feed lever spring (26) from the tape feed lever (28) and from the spring post on the frame.
  - (7) Remove the retainer ring (27) holding the tape feed lever (28) to the tape feed lever stud (30); remove the tape feed lever.
  - (8) Remove the setscrew (29) that holds the tape feed lever stud (30) in the frame; remove the stud.
  - (9) Remove the two machine screws (31) and lockwashers (32) from the selector lever comb (36); remove the selector lever comb from the frame.
  - (10) Remove the two machine screws (33), lockwashers (34), and the stop selector lever latch (35) from the selector lever comb (36).
  - (11) Remove the plain hexagonal nut (37) from the anchor post (38); remove the anchor post from the frame.
- b. Reassembly.
- (1) Reassemble the transmitter-distributor selector levers as indicated in figure 246; the sequence for assembling the parts is the reverse of the disassembly sequence.





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- |  |                         |                                  |                                     |
|--|-------------------------|----------------------------------|-------------------------------------|
| 1 Selector lever spring, 50902                                 | 10 Selector lever       | 20 Bearing shoe                  | 30 Tape feed lever stud, 52842      |
| 2 Retainer ring, 10949   | 11 Bearing shoe         | 21 Flat washer, 50147            | 31 Machine screw, 10003             |
| 3 Flat washer, 50147   | 12 Spacer collar, 52833 | 22 Camshaft stop lever, 53613    | 32 Lockwasher, 10429                |
| 4 Selector lever, 51598A (includes items 7, 10, 13, 16 and 19) | 13 Selector lever       | 23 Sleeve bearing, 52834         | 33 Machine screw, 10002             |
| 5 Bearing shoe, 51644A   | 14 Bearing shoe         | 24 Setscrew, 10210               | 34 Lockwasher, 10429                |
| 6 Flat washer, 50147   | 15 Flat washer, 50147   | 25 Selector lever stud, 52840    | 35 Stop selector lever latch, 55870 |
| 7 Selector lever   | 16 Selector lever       | 26 Tape feed lever spring, 53149 | 36 Selector lever comb, 52841       |
| 8 Bearing shoe   | 17 Bearing shoe         | 27 Retainer ring, 10949          | 37 Plain hexagonal nut, 10509       |
| 9 Flat washer, 50147   | 18 Flat washer, 50147   | 28 Tape feed lever, 52845        | 38 Anchor post, 50325               |
|  | 19 Selector lever       | 29 Setscrew, 10210               |                                     |

Figure 246. Transmitter-distributor selector levers, exploded view.

- (2) Install the covers on the transmitter-distributor as described in paragraph 198b.
- (3) Install and adjust the transmitter-distributor on the perforator as described in paragraph 197b.

#### **204. Disassembly and Reassembly of Transmitter-Distributor Camshaft** (fig. 247)

##### *a. Disassembly.*

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197a.
- (2) Remove the covers from the transmitter-distributor as described in paragraph 198a.
- (3) Remove the two machine screws (1) and lockwashers (2) that hold the tape feed retracting lever cam (3), flat washer (4), sensing lever restoring cam (5), and flat washer (6) on the transmitter-distributor camshaft (9); remove the cams and flat washer from the transmitter camshaft.
- (4) Remove the two setscrews (7) securing the friction clutch fork (8) to the transmitter-distributor camshaft (9); remove the friction clutch fork.
- (5) Slide the transmitter-distributor camshaft (9) from the ball bearings in the frame; catch the flat washers (10 and 11).
- (6) Remove the two machine screws (12), lockwashers (13), and flat washers (14) that hold the ball bearing (15) in the frame of the transmitter-distributor; remove the ball bearing, spacing collar (16), and ball bearing (17) from the frame.

##### *b. Reassembly.*

- (1) Reassemble the transmitter-distributor camshaft as indicated in figure 247; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the covers on the transmitter-distributor as described in paragraph 198b.

- (3) Replace the transmitter-distributor on the perforator as described in paragraph 197b.

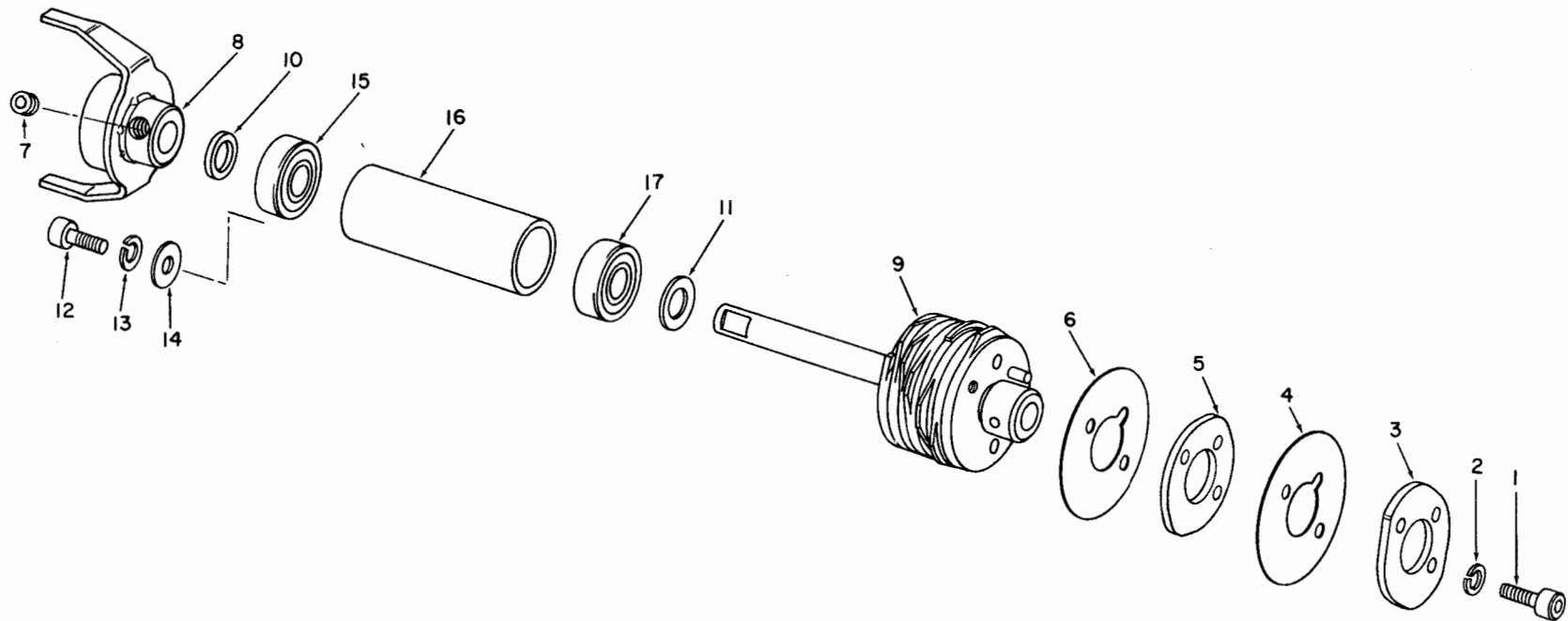
#### **205. Disassembly and Reassembly of Transmitter-Distributor Contacts** (fig. 248)

##### *a. Disassembly.*

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197a.
- (2) Remove the covers from the transmitter-distributor as described in paragraph 198a.
- (3) Remove the two machine screws (1) and four lockwashers (2) that attach the transmitter contact cover (3) to the transmitter-distributor frame; remove the transmitter contact cover.
- (4) Remove the two machine screws (4) and lockwashers (5) that attach the contact holder mounting (15) to the frame.
- (5) Unhook the transmitter contact bail spring (6) from the spring post on the contact holder mounting (15) and from the hole in the transmitter contact bail (9).
- (6) Remove the machine screw (7), lockwasher (8), and the two electrical terminal lugs from the side of the contact holder mounting (15).
- (7) Remove the two machine screws (10) and lockwashers (11) that attach the transmitter contact terminals (12) to the contact holder mounting (15).
- (8) Unsolder the two spiraled electrical wires (14) from the top of the stationary contacts (13); remove the wires and the stationary contacts from the contact holder mounting (15).
- (9) Remove the retainer ring securing the transmitter contact bail (9) to the armature pivot stud (11, fig. 250). Remove the transmitter contact bail.

##### *b. Reassembly.*

- (1) Position the transmitter contact bail (9) on the post on the frame; hold with a retainer ring, 10949.



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1 Machine screw, 10004

2 Lockwasher, 10429

3 Tape feed retracting lever cam,  
52867

4 Flat washer, 56175

5 Sensing lever restoring cam,  
52868

6 Flat washer, 56175

7 Setscrew, 10209

8 Friction clutch fork, 50484A

9 Transmitter-distributor  
camshaft, 52871

10 Flat washer, 51552

11 Flat washer, 52210

12 Machine screw, 10003

13 Lockwasher, 10429

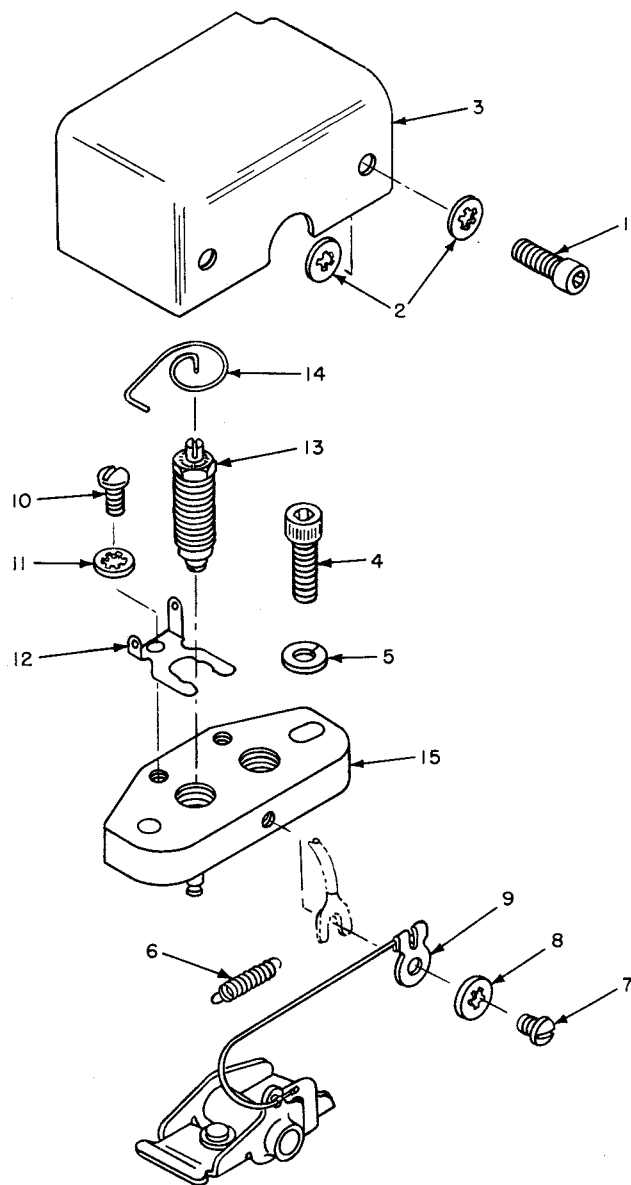
14 Flat washer, 10450

15 Ball bearing, 10753

16 Spacing collar, 52852

17 Ball bearing, 10753

Figure 247. Transmitter-distributor camshaft, exploded view.



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- |                                     |  |
|-------------------------------------|--|
| 1 Machine screw, 10001              | 9 Transmitter contact bail E6, 51582A  |
| 2 Lockwasher, 10403                 | 10 Machine screw, 10301                |
| 3 Transmitter contact cover, 52808A | 11 Lockwasher, 10403                   |
| 4 Machine screw, 10009              | 12 Transmitter contact terminal, 51597 |
| 5 Lockwasher, 10403                 | 13 Stationary contact (E6), 51588A     |
| 6 Transmitter contact bail spring   | 14 Electrical wire, 51610              |
| 7 Machine screw, 10301              | 15 Contact holder mounting, 51595A     |
| 8 Lockwasher, 10403                 |  |

Figure 248. Transmitter-distributor contacts, exploded view.

- (2) Install the two stationary contacts (13) in the contact holder mounting (15) at approximately the correct contact spacing.

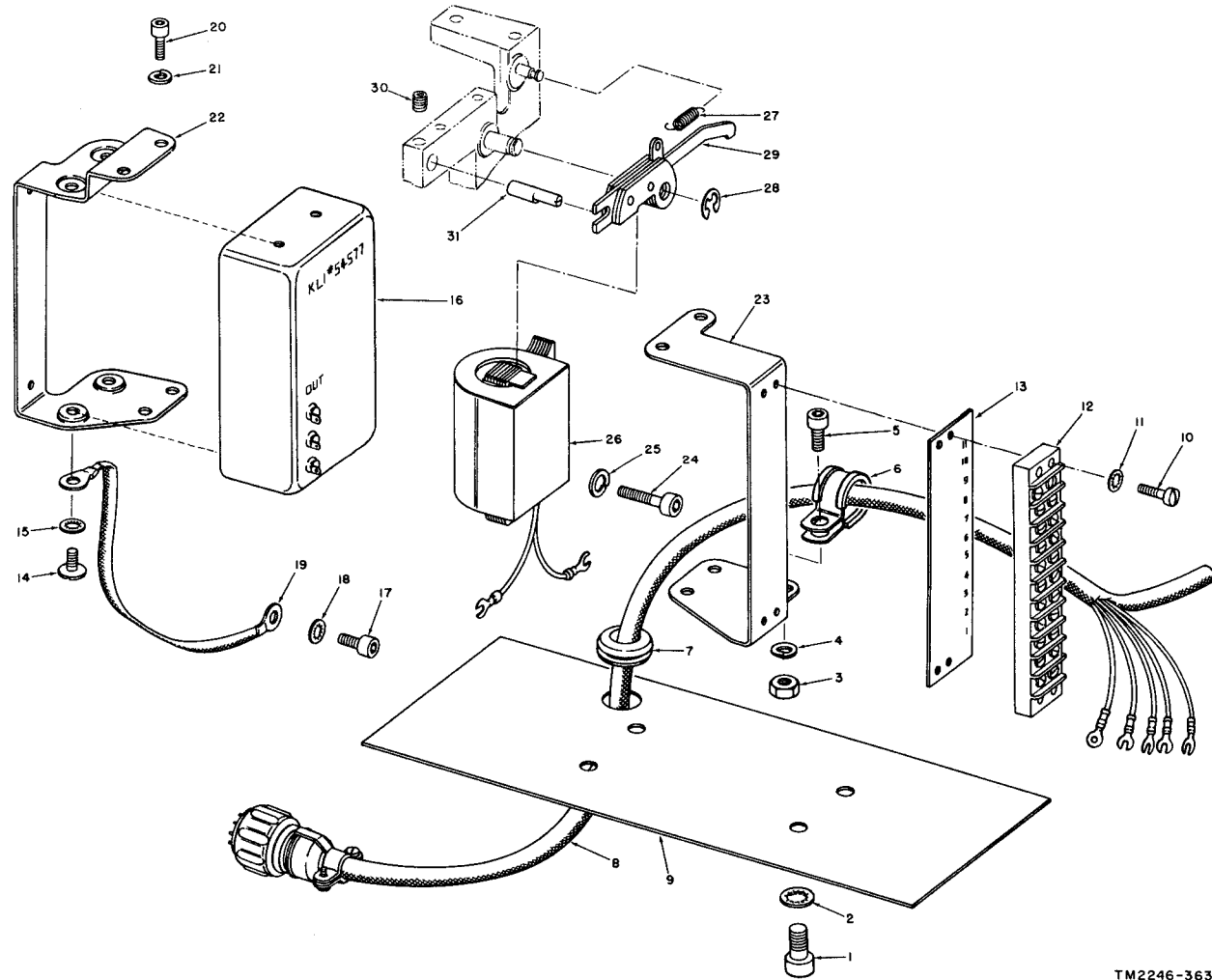
- (3) Solder the electrical wires (14) in the slots in the top of the stationary contacts (13).
- (4) Insert the transmitter contact terminals (12) in the threads of the stationary contacts (13),  $\frac{1}{2}$  to  $1\frac{1}{2}$  threads above the contact holder mounting (15); hold with two lockwashers (11) and machine screws (10). Do not tighten the screws.
- (5) Position the two electrical terminal lugs on the side of the contact holder mounting; hold with a lockwasher (8) and the machine screw (7).
- (6) Hook one end of the transmitter contact bail spring (6) in the hole in the transmitter contact bail (9) and the other end on the spring post on the contact holder mounting (15).
- (7) Position the contact holder mounting (15) on the frame of the machine so that the contacts are in correct alignment; attach with two lockwashers (5) and machine screws (4).
- (8) Position the transmitter contact cover (3) over the contact holder mounting (15); secure with two lockwashers (2) and machine screws (1).
- (9) Install the covers on the transmitter-distributor as described in paragraph 198b.
- (10) Replace the transmitter-distributor on the perforator as described in paragraph 197b.

## 206. Disassembly and Reassembly of Transmitter-Distributor Clutch Magnet and Wiring (fig. 249).

### a. Disassembly.

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197a.
- (2) Remove the covers as described in paragraph 198a.
- (3) Remove the two machine screws (1) and lockwashers (2) that attach the bottom plate (9) to the frame of the transmitter-distributor.
- (4) Remove the plain hexagonal nut (3), lockwasher (4), and machine screw

- (5) that hold the electrical clamp (6) and cable ground wire terminal to the terminal strip mounting bracket (23); remove the electrical clamp.
  - (5) Disconnect all wires from the terminal board (12); tag the wires.
  - (6) Pull the electrical cable (8) through the bushing insulator (7) and bottom plate (9).
  - (7) Push the bushing insulator (7) out of the bottom plate.
  - (8) Remove the four machine screws (10) and lockwashers (11) that attach the terminal board (12) and insulating strip (13) to the terminal strip mounting bracket (23); remove the terminal board and insulating strip.
  - (9) Remove the four machine screws (14) and lockwashers (15) that attach the electrical noise suppressor (16) to the filter box mounting bracket (22); remove the electrical noise suppressor.
  - (10) Remove the machine screw (17) and lockwasher (18) that hold the grounding lead (19) to the frame; remove the grounding lead.
  - (11) Remove the four machine screws (20) and lockwashers (21) that attach the filter box mounting bracket (22) and the terminal strip mounting bracket (23) to the frame; remove the two brackets.
  - (12) Remove the two machine screws (24) and lockwashers (25) that attach the clutch magnet (26) to the frame; remove the clutch magnet.
  - (13) Unhook the clutch magnet armature spring (27) from the armature (29) and from the spring stud on the frame.
  - (14) Remove the retainer ring (28) that attaches the clutch magnet armature (29) to the pivot stud on the frame of the transmitter-distributor; remove the clutch magnet armature.
  - (15) Remove the setscrew (30) that holds the eccentric stud (31) in the frame; remove the eccentric stud.
- b. Reassembly.*
- (1) Insert the eccentric stud (31) in the frame of the transmitter-distributor; hold with a setscrew (30) but do not tighten securely.
  - (2) Position the clutch magnet armature (29) on the eccentric stud (31) and on the pivot stud in the frame; hold with a retainer ring (28).
  - (3) Hook the clutch magnet armature spring (27) to the clutch magnet armature (29) and the spring stud on the frame.
  - (4) Position the clutch magnet (26) on the frame; attach with two lockwashers (25) and machine screws (24).
  - (5) Position the terminal strip mounting bracket (23) and the filter box mounting bracket (22) on the frame of the transmitter-distributor; attach the brackets with four lockwashers (21) and machine screws (20).
  - (6) Position one end of the grounding lead (19) on the frame; attach with a lockwasher (18) and machine screw (17).
  - (7) Position the electrical noise suppressor (16) in the filter box mounting bracket (22), hold with four lockwashers (15) and machine screws (14). Place the free end of the grounding lead (19) between one lockwasher (15) and the frame.
  - (8) Position the insulating strip (13) and the terminal board (12) on the terminal strip mounting bracket (23); attach with four lockwashers (11) and machine screws (10).
  - (9) Install the bushing insulator (7) in the bottom plate (9).
  - (10) Insert the electrical cable (8) through the bushing insulator (7) and through the electrical clamp (6).
  - (11) Connect the electrical wires to the terminal board (12).
  - (12) Position the electrical clamp (6) and the cable ground wire terminal on the terminal strip mounting bracket (23); attach with a machine screw (5), lockwasher (4), and plain hexagonal nut (3).
  - (13) Position the bottom plate (9) on the frame of the transmitter-distributor;



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Figure 249. Transmitter-distributor clutch magnet and wiring, exploded view.

1 Machine screw, 10015	13 Insulating strip, 20380	23 Terminal strip mounting bracket, 52866
2 Lockwasher, 10405	14 Machine screw, 10301	24 Machine screw, 10010
3 Plain hexagonal nut, 10512	15 Lockwasher, 10403	25 Lockwasher, 10430
4 Lockwasher, 10429	16 Electrical noise suppressor (Z3), 54577	26 Clutch magnet E7, 53605A
5 Machine screw, 10003	17 Machine screw, 10003	27 Clutch magnet armature spring, 53155
6 Electrical clamp, 20513	18 Lockwasher, 10403	28 Retainer ring, 10949
7 Bushing insulator 20726	19 Grounding lead, 53789A	29 Clutch magnet armature, 52828A
8 Electrical cable 59974A (53887A)*	20 Machine screw, 10003	30 Setscrew, 10203
9 Bottom plate, 59887 (53799)*	21 Lockwasher, 10429	31 Eccentric stud, 52838
10 Machine screw, 10358	22 Filter box mounting bracket, 52869	
11 Lockwasher, 10408		
12 Terminal board (TB5), 52135A		

\* Reference designation in parentheses is applicable to TT-178/FG and TT-179/FG only.

Figure 249.—Continued.

hold with two lockwashers (2) and machine screws (1).

- (14) Install the covers on the transmitter-distributor as described in paragraph 198*b*.
- (15) Install the transmitter-distributor as described in paragraph 197*b*.

## 207. Disassembly and Reassembly of Transmitter-Distributor Frame (fig. 250)

### *a. Disassembly.*

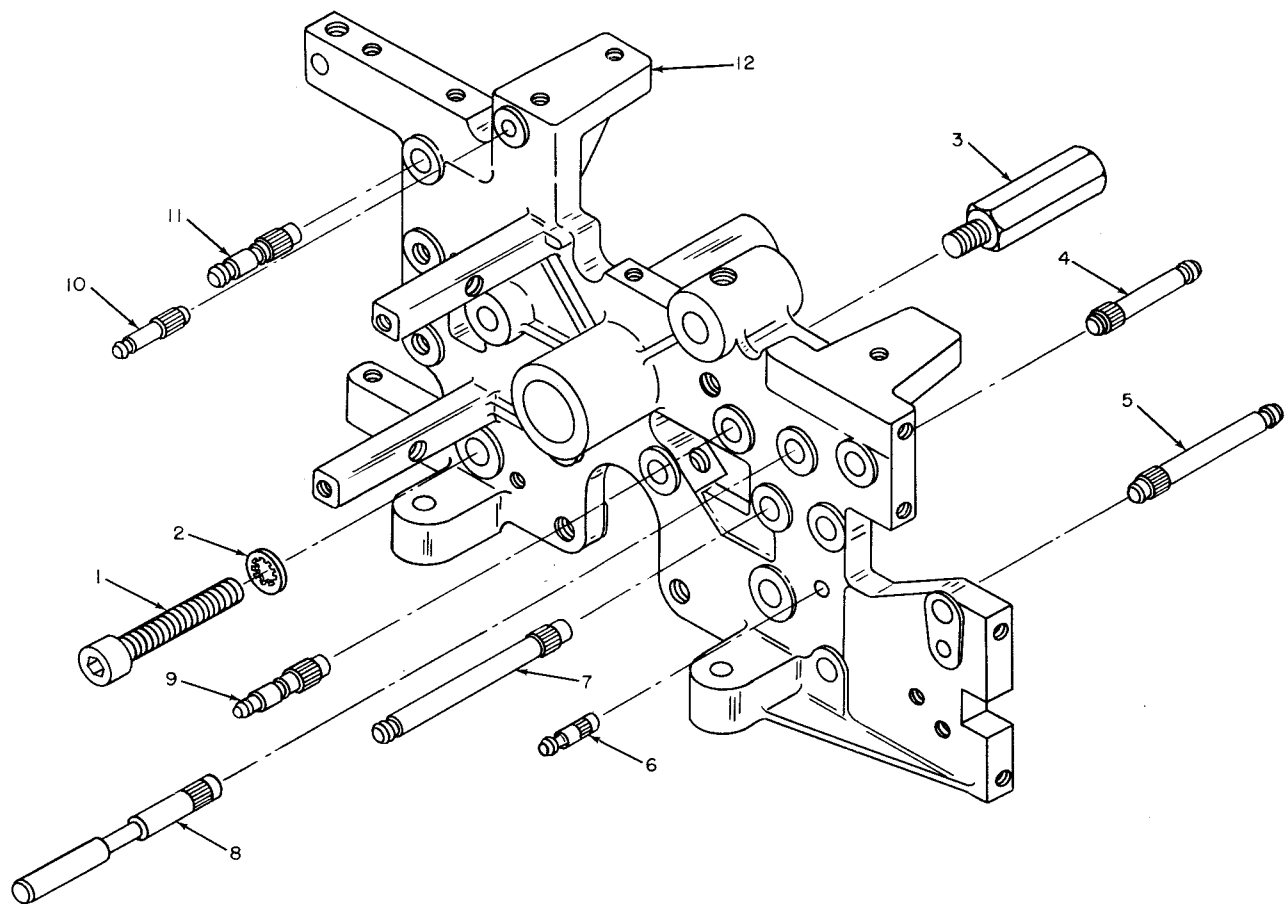
- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197*a*.
- (2) Remove the covers from the transmitter-distributor as described in paragraph 198*a*.
- (3) Remove the tape-out sensing mechanism as described in paragraph 200*a*.
- (4) Remove the transmitter-distributor operating levers as described in paragraph 201*a*.
- (5) Remove the code sensing levers as described in paragraph 202*a*.
- (6) Remove the selector levers as described in paragraph 203*a*.
- (7) Remove the transmitter-distributor camshaft as described in paragraph 204*a*.
- (8) Remove the transmitter contacts as described in paragraph 205*a*.
- (9) Remove the transmitter-distributor clutch magnet and wiring as described in paragraph 206*a*.

- (10) Remove the two cover mounting posts (3) from the frame (12) of the transmitter-distributor.

*b. Repair of Frame.* If any of the spring posts or pivot posts are loose or damaged, replace the damaged post. Support the frame near the post to be removed to prevent distortion of the frame. Press the new post into the frame at a right angle to the plane of the frame. Replace a frame that has worn threads, enlarged holes, or is damaged.

### *c. Reassembly.*

- (1) Install the two cover mounting posts (3) in the frame.
- (2) Install the transmitter-distributor clutch latch wiring as described in paragraph 206*b*.
- (3) Install the transmitter contacts as described in paragraph 205*b*.
- (4) Install the transmitter-distributor camshaft as described in paragraph 204*b*.
- (5) Install the selector levers as described in paragraph 203*b*.
- (6) Install the transmitter-distributor code sensing levers as described in paragraph 202*b*.
- (7) Install the operating levers as described in paragraph 201*b*.
- (8) Install the end-of-tape sensing mechanism as described in paragraph 200*b*.
- (9) Install the covers as described in paragraph 198*b*.
- (10) Install the transmitter-distributor as described in paragraph 197*b*.



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1 Machine screw, 10030  
 2 Lockwasher, 10405  
 3 Post, 52851  
 4 Upper switch bail post, 52873  
 5 Tight tape stud, 52857

6 Spring post, 51133  
 7 Start-stop lever stud, 52854  
 8 Stop post, 52856  
 9 Detent lever stud, 52855

10 Spring post, 50455  
 11 Armature pivot stud, 52837  
 12 Frame, 60246A (52674A, TT-178/FG and TT-179/FG only)

Figure 250. Transmitter-distributor frame, exploded view.

## 208. Removal and Replacement of Perforator Motor

### a. Removal.

- (1) Disconnect the motor plug connector from the receptacle connector in the perforator base.
- (2) Remove the four machine screws (1, fig. 251) and lockwashers (2) that hold the gear case cover (3) to the gear case (8); remove the gear case cover and gear case cover gasket (4).
- (3) Remove the four machine screws (1, fig. 201) and lockwashers (2) and flat washers (3) that hold the motor to the frame; move the drive end of the armature shaft out of the gear

case far enough so that the worm gear clears the gear case.

### b. Replacement.

- (1) Position the motor on the frame so that the worm gear on the motor armature shaft meshes with the worm gear on the main shaft; secure the motor to the frame with four machine screws (1) and lockwashers (2) and flat washers (3).
- (2) Position the gasket (4, fig. 251) and the gear case cover (3) on the gear case (8); secure with four machine screws (1), lockwashers (2).
- (3) Connect the motor plug connector to the receptacle connector in the perforator base.



## 209. Disassembly, Reassembly, and Repair of Motor

*a. Synchronous Motor.* Disassemble and reassemble the synchronous motor as described in paragraph 148.

*Note.* Make sure the worm gear is correct for the operating speed desired (par. 19).

*b. Series-Governed Motor.* Disassemble and reassemble the series-governed motor as described in paragraph 149; see note in *a* above.

*c. Motor-Governor.* Disassemble and reassemble the governor of the series-governed motor as described in paragraph 150.

## 210. Disassembly and Reassembly of Tape Puller Assembly (fig. 252)

### *a. Disassembly.*

- (1) Remove the retainer ring (1) that holds the tape puller arm (11) to the arm pivot stud (18); remove the tape puller arm.
- (2) Remove the machine screw (2 and 4) and lockwashers (3 and 5) from the nut plate (6); remove the tape puller spring (7).
- (3) Remove the tape puller arm roller (8) from roller stud (10) and remove self-locking hexagonal nut (9) from roller stud (10); remove the roller stud.
- (4) Remove the flat washer (12) from arm pivot stud (18).
- (5) Remove two machine screws (13), lockwashers (14), and flat washers (15) that hold the tape puller bracket (22) to the frame.
- (6) Remove the self-locking hexagonal nut (16) and flat washer (17) that hold the arm pivot stud (18) to the tape puller bracket (22); remove the arm pivot stud.
- (7) Remove the self-locking hexagonal nut (19) and flat washer (20) that hold the tape puller stud (21) to the tape puller bracket (22); remove the tape puller stud.

### *b. Reassembly.*

- (1) Install roller stud (10) on the tape puller arm (11) and secure with the self-locking hexagonal nut (9). In-

stall tape puller arm roller (8) on roller stud (10).

- (2) Install the tape puller spring (7) on the tape puller arm (11) with the machine screws (2 and 4), lockwashers (3 and 5) and nut plate (6).
- (3) Install the arm pivot stud (18) on the tape puller bracket (22) with flat washer (17) and self-locking hexagonal nut (16).
- (4) Install the tape puller stud (21) on the tape puller bracket (22) with flat washer (20) and self-locking hexagonal nut (19).
- (5) Install the flat washer (12) and tape puller arm (11) on the arm pivot stud (18) and secure with retainer ring (1).
- (6) Install tape puller bracket (22) on the frame with two machine screws (13), lockwashers (14), and flat washers (15).
- (7) Adjust the tape puller assembly as described in paragraphs 522 and 523.

## 211. Disassembly and Reassembly of Perforator Selector Magnet (fig. 253)

### *a. Disassembly.*

- (1) Unplug the cable and remove the two machine screws (1), flat washers (2), and lockwashers (3); remove the selector magnet assembly from the frame.
- (2) Remove two machine screws (4) and lockwashers (5) holding the potentiometer mounting bracket (8) to the stud posts (14) and (18); remove the assembled potentiometer mounting bracket and potentiometer (13).
- (3) Remove the locking nut (6) and plain hexagonal nut (7) holding the potentiometer (13) to the mounting bracket (8); remove the potentiometer.
- (4) Push the tubing (12) from the solder lugs on the potentiometer (13); unsolder the wires from the two solder lugs of the potentiometer (13) and from the two terminal posts on the selector magnet (21). Remove the tubing (11 and 12) and the wires.

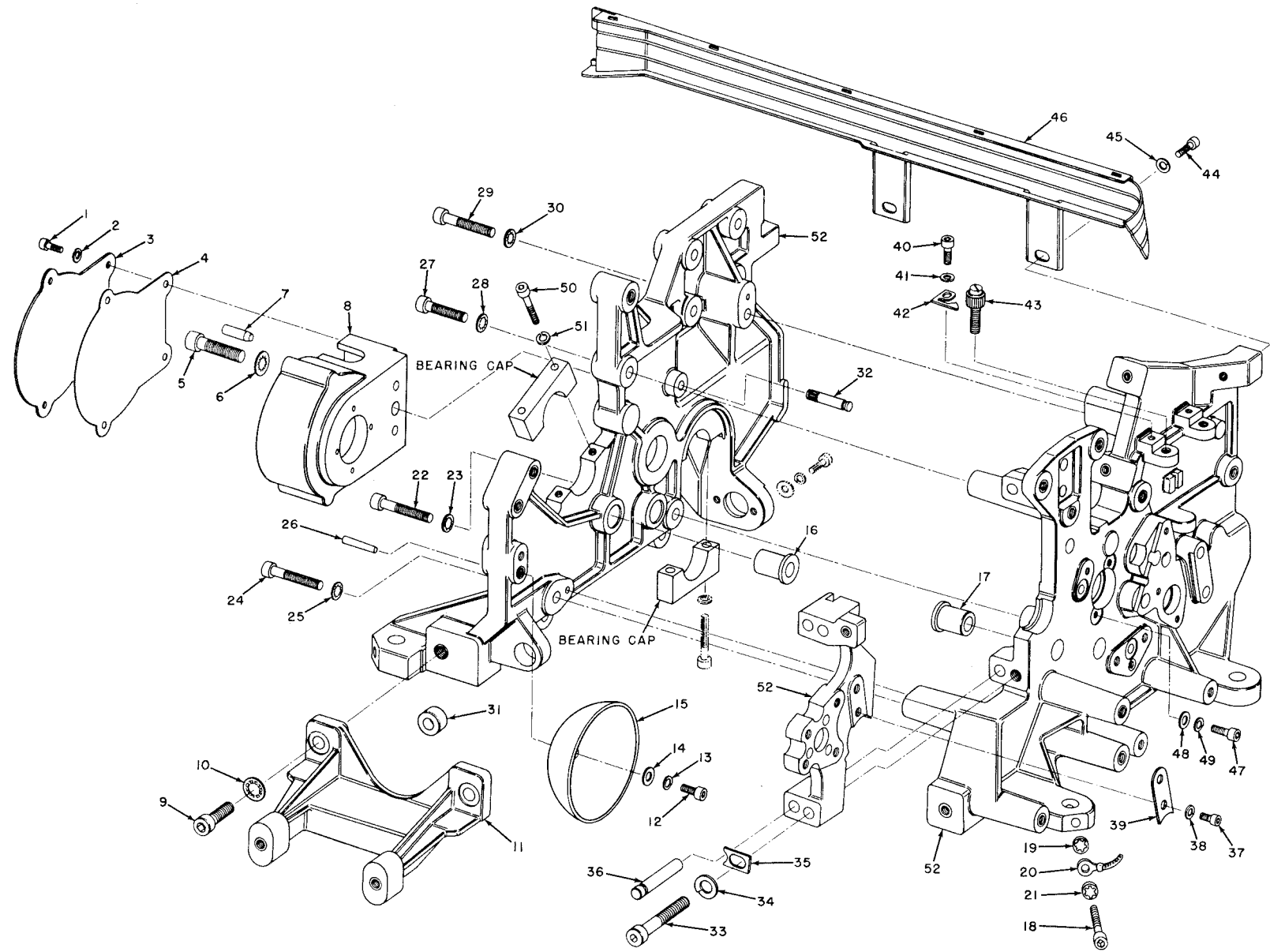
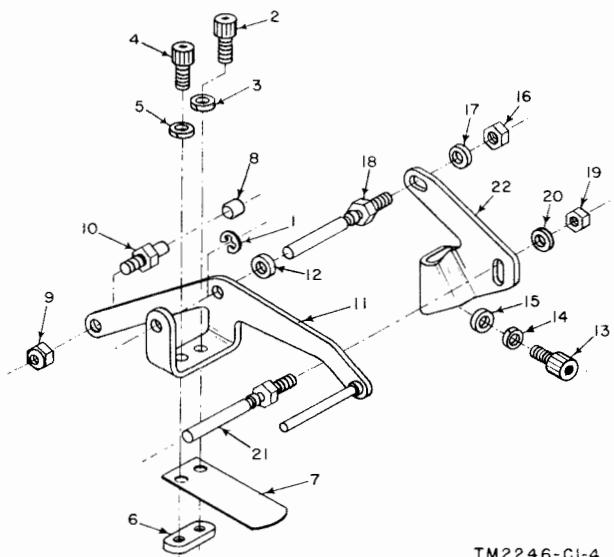


Figure 251. Perforator frame, exploded view.

- |                                     |                                 |   |
|-------------------------------------|---------------------------------|---|
| 1 Machine screw, 10004              | 19 Lockwasher, 10405            | 38 Lockwasher, 10429  |
| 2 Lockwasher, 10429                 | 20 Grounding strap              | 39 Bearing retainer, 56331                                      |
| 3 Gear case cover, 56064            | 21 Lockwasher, 10405            | 40 Machine screw, 10004 (2 rqr)                                 |
| 4 Gasket, 56063                     | 22 Machine screw, 10030         | 41 Lockwasher, 10429  |
| 5 Machine screw, 10021-01           | 23 Lockwasher, 10405            | 42 Anchor plate, 52687  |
| 6 Lockwasher, 10400                 | 24 Machine screw, 10030         | 43 Selector magnet bracket adjustment screw, 52688              |
| 7 Dowel, 10916                      | 25 Lockwasher, 10405            | 44 Machine screw, 10025   |
| 8 Gear case                         | 26 Dowel, 10860                 | 45 Lockwasher, 10430  |
| 9 Machine screw, 10027              | 27 Machine screw, 10035         | 46 Tape guide, 56055  |
| 10 Lockwasher, 10400                | 28 Lockwasher, 10405            | 47 Machine screw, 10004   |
| 11 Transmitter support frame, 56146 | 29 Machine screw, 10030         | 48 Flat washer, 10405   |
| 12 Machine screw, 10008             | 30 Lockwasher, 10405            | 49 Lockwasher, 10429  |
| 13 Lockwasher, 10430                | 31 Bearing, 10727               | 50 Machine screw, 10012   |
| 14 Flat washer, 10467               | 32 Spring post, 54119           | 51 Lockwasher, 10430  |
| 15 Signal bell, 51080               | 33 Machine screw, 10038         | 52 Frame 54720A (59871A, TT-178A/FG, TT-179A/FG, and TT-181/FG) |
| 16 Bearing, 10729                   | 34 Lockwasher, 10427            |   |
| 17 Bearing, 10729                   | 35 Clip, 54713                  |   |
| 18 Machine screw, 10017-01          | 36 Pin, 54714                   |   |
|                                     | 37 Machine screw, 10003 (2 rqr) |   |

Figure 251.—Continued.

- (5) Remove the stud post (14), electrical clamp (15), and lockwasher (16) from the selector magnet (21).
- (6) Unsolder the wires of the selector magnet cable (17) from the terminal posts on the selector magnet (21);

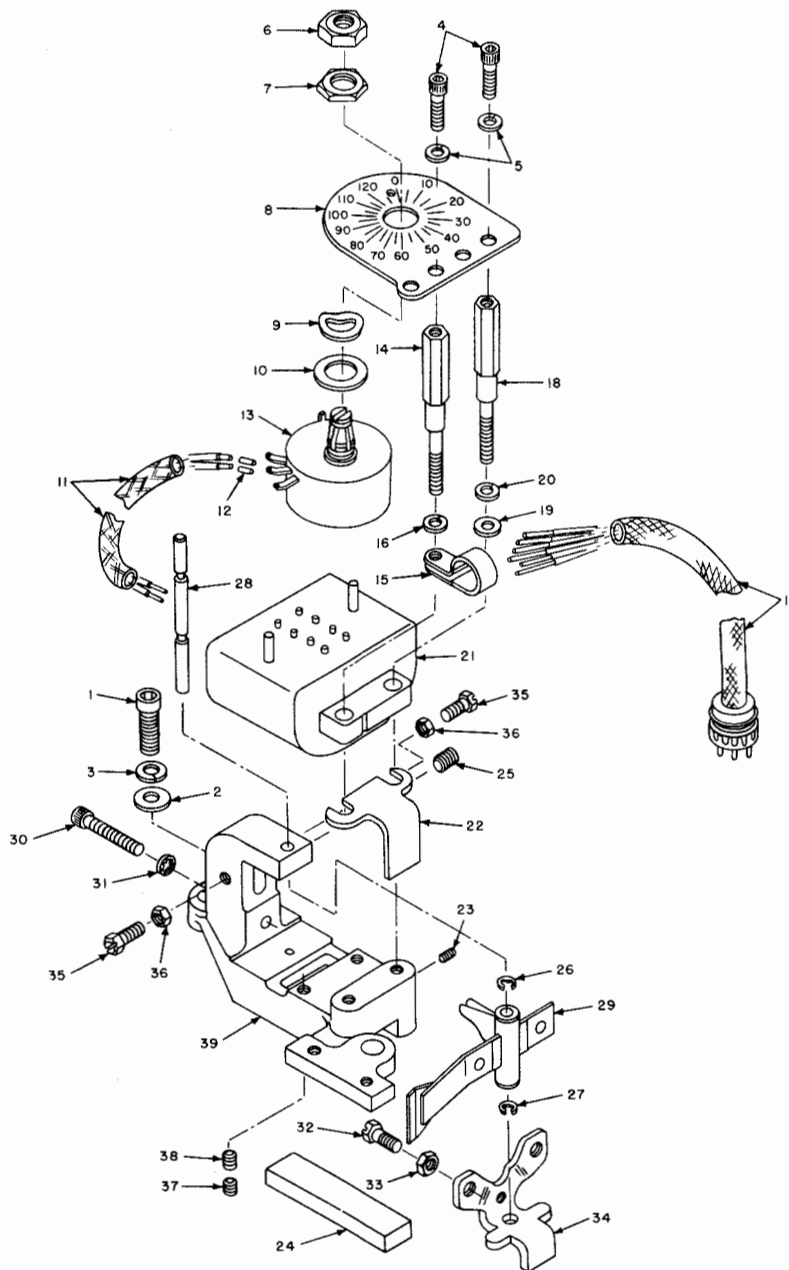


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- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| 1 Retainer ring, 10949              | 12 Flat washer, 50827                |
| 2 Machine screw, 10003              | 13 Machine screw, 10008              |
| 3 Lockwasher, 10429                 | 14 Lockwasher, 10430                 |
| 4 Machine screw, 10003              | 15 Flat washer, 10545                |
| 5 Lockwasher, 10429                 | 16 Self-locking hexagonal nut, 10501 |
| 6 Nut plate, 54884                  | 17 Flat washer, 50827                |
| 7 Tape puller spring, 56540         | 18 Arm pivot stud, 56538             |
| 8 Tape puller arm roller, 50843     | 19 Self-locking hexagonal nut, 10501 |
| 9 Self-locking hexagonal nut, 10501 | 20 Flat washer, 50827                |
| 10 Roller stud, 56539               | 21 Tape puller stud, 56538           |
| 11 Tape puller arm, 56536A          | 22 Tape puller bracket, 56541        |

Figure 252. Tape puller, exploded view.

- (7) Remove the stud post (18), flat washer (19), and lockwasher (20) that hold the selector magnet (21) to the selector magnet bracket (39); remove the selector magnet and bracket (22).
- (8) Remove the setscrew (23) that holds the bar magnet (24) in the selector magnet bracket; scratch-mark the magnet and bracket before removing the bar magnet.
- (9) Remove the setscrew (25) that holds the armature mounting shaft (28) in the selector magnet bracket (39).
- (10) Remove the retainer rings (26 and 27) from the armature mounting shaft (28); remove the armature mounting shaft from the armature (29) and from the selector magnet bracket (39). Remove the armature.
- (11) Remove the machine screw (30) and lockwasher (31) that hold the armature stop bracket (34) on the selector magnet bracket (39); remove the assembled stop bracket and machine screws (32).
- (12) Remove the two machine screws (32) and the plain hexagonal nuts (33) from the armature stop bracket (34). Remove the nuts from the machine screws.
- (13) Remove the two armature leaf spring stop screws (35). Refer to



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- |   |                                  |   |
|---|----------------------------------|---|
| 1 Machine screw, 10018                  | 14 Stud post, 53597              | 28 Armature mounting shaft, 52288         |
| 2 Flat washer, 10464                    | 15 Electrical clamp, 20513       | 29 Armature, 54092A                       |
| 3 Lockwasher, 10420                     | 16 Lockwasher, 10430             | 30 Machine screw, 10010                   |
| 4 Machine screw, 10032                  | 17 Selector magnet cable, 53545A | 31 Lockwasher, 10404                      |
| 5 Lockwasher, 10430                     | 18 Stud post, 53597              | 32 Machine screw, 53183                   |
| 6 Locking nut                           | 19 Flat washer, 10467            | 33 Plain hexagonal nut, 10507             |
| 7 Plain hexagonal nut, 10529            | 20 Lockwasher, 10430             | 34 Armature stop bracket, 52529           |
| 8 Potentiometer mounting bracket        | 21 Selector magnet E9            | 35 Armature leaf spring stop screw, 53183 |
| 9 Lockwasher, 10465                     | 22 Bracket, 52292                | 36 Plain hexagonal nut, 10507             |
| 10 Flat washer, 10468                   | 23 Setscrew, 10220               | 37 Setscrew, 10221                        |
| 11 Tubing, 20837                        | 24 Bar magnet, 52289             | 38 Setscrew, 10221                        |
| 12 Tubing, 20732                        | 25 Setscrew, 10225               | 39 Selector magnet bracket, 52528         |
| 13 Potentiometer R24, (includes item 6) | 26 Retainer ring, 10969          |   |
|   | 27 Retainer ring, 10969          |   |

Figure 253. Perforator selector magnet, exploded view.

figure 212 for locking tab arrangement, if necessary.

- (14) Remove the setscrews (37 and 38, fig. 253) from the selector magnet bracket (39).

*b. Reassembly.*

- (1) Install the setscrews (38 and 37) in the selector magnet bracket (39) with the ends flush with the top surface of the bracket.
- (2) Install the armature leaf spring stop (35) and the locking device provided (36, fig. 253 or 40 and 41, fig. 212).
- (3) Install two plain hexagonal nuts (33) on both machine screws (32); install the machine screws on the armature stop bracket (34).
- (4) Position the armature stop bracket (34) on the selector magnet bracket; hold with a lockwasher (31) and machine screw (30).
- (5) Position the armature (29) in the selector magnet bracket (39); insert the armature mounting shaft (28) through the bracket, armature, and armature stop bracket (34). Install the retainer rings (27 and 26) on the armature mounting shaft (28).
- (6) Hold the armature mounting shaft (28) in the selector magnet bracket (39) with a setscrew (25).
- (7) Assemble the bar magnet (24) on the selector magnet bracket (39), leaving an air gap of .015 inch between the south pole of the bar magnet and the end of the armature stop bracket (34) as instructed in paragraph 411; hold the bar magnet in place with a setscrew (23). The north pole of the bar magnet is designated by a red dot.
- (8) Position the bracket (22) on the selector magnet bracket (39) and on the end of the bar magnet (24) for full surface contact.
- (9) Position the selector magnet (21) on the selector magnet bracket; hold the magnet bracket and the selector magnet with a lockwasher (20), flat washer (19), and the stud post (18).
- (10) Solder the wires of the selector magnet cable (17) to the terminal posts on the selector magnet (21).

- (11) Install the electrical clamp (15) on the selector magnet cable (17). Position the electrical clamp on the selector magnet (21) and hold with a lockwasher (16) and stud post (14). Adjust the position of the selector magnet before tightening the stud posts (18 and 14) as described in paragraph 408.

- (12) Slide the tubing (12) over the ends of the wires in the tubing (11); solder the wires to the solder lugs on the potentiometer (13). Cover the solder connection with the tubing (12).

- (13) Install the potentiometer (13) on the potentiometer mounting bracket (8); secure with a plain hexagonal nut (7) and locking nut (6).

- (14) Position the assembled potentiometer (13) and potentiometer mounting bracket (8) on the stud posts; attach with two lockwashers (5) and machine screws (4).

- (15) Adjust the selector magnet attractive force and armature clearance.

- (16) Adjust the selector magnet attractive force and leaf spring alignment.

- (17) Install the selector magnet bracket (39) on the frame of the perforator with two flat washers (2), lockwashers (3), and machine screws (1). Plug the selector magnet cable (17) into the socket.

- (18) Adjust the alignment of the selector and stop levers with the selector magnet.

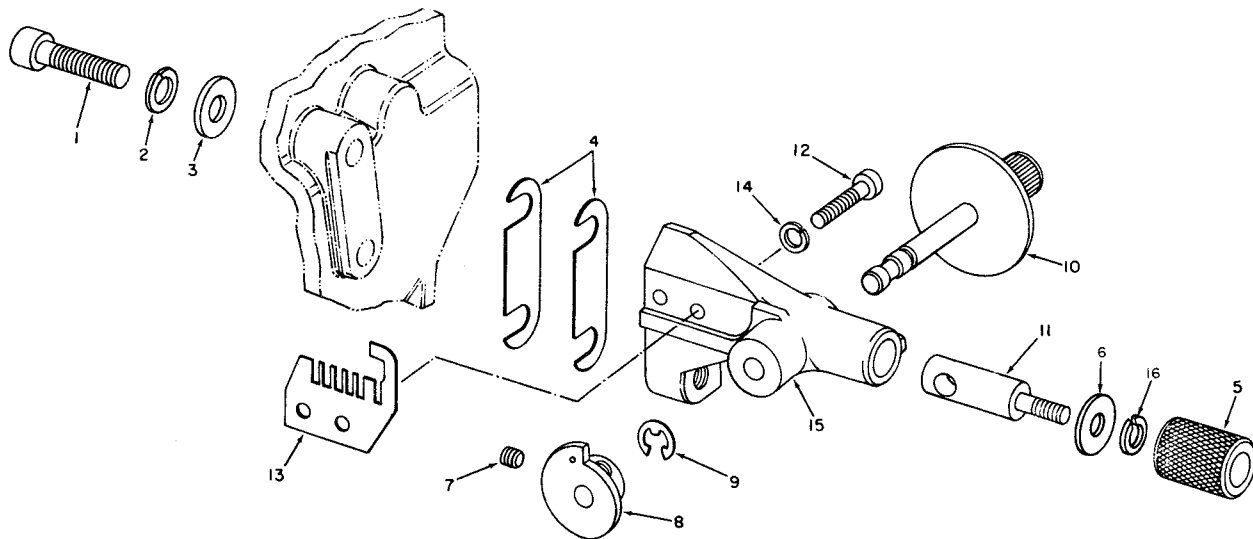
- (19) Adjust the alignment of the selector and Y-levers with the selector magnet.

- (20) Adjust the clearance between the selector levers and the armature blade of the selector magnet.

## **212. Disassembly and Reassembly of Perforator Rangefinder** (fig. 254)

*a. Disassembly.*

- (1) Remove the two machine screws (1), lockwashers (2), and flat washers (3) that hold the rangefinder and comb bracket (15) to the frame; remove the rangefinder assembly and shims (4) from the frame.



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- |  |                                  |   |
|--|----------------------------------|---|
| 1 Machine screw, 10018                                   | 6 Flat washer, 51555             | 12 Machine screw, 10046                   |
| 2 Lockwasher, 10431                                      | 7 Setscrew, 10201                | 13 Selector lever stop comb, 50511        |
| 3 Flat washer, 10464                                     | 8 Rangefinder cam, 50317         | 14 Lockwasher, 10429                      |
| 4 Shim, .005 in. thk, 52577 Shim,<br>.002 in. thk, 52578 | 9 Retainer ring, 10949           | 15 Rangefinder and comb bracket,<br>52326 |
| 5 Knurled nut, 52184                                     | 10 Rangefinder dial, 52381A      | 16 Lockwasher, 52179                      |
|  | 11 Rangefinder dial clamp, 52323 |   |

Figure 254. Perforator rangefinder, exploded view.

- (2) Remove the knurled nut (5), lockwasher (16) and flat washer (6) from the rangefinder dial clamp (11).
- (3) Remove the two setscrews (7) that hold the rangefinder cam (8) on the shaft of the rangefinder dial (10); remove the rangefinder cam from the shaft.
- (4) Remove the retainer ring (9) from the shaft of the rangefinder dial (10); remove the rangefinder dial and rangefinder dial clamp (11) from the rangefinder and comb bracket (15).
- (5) Remove the two machine screws (12) and lockwashers (14) that hold the selector lever stop comb (13) to the rangefinder and comb bracket (15); remove the comb.

*b. Reassembly.*

- (1) Reassemble the rangefinder as indicated in figure 254; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the rangefinder as described in paragraphs 265, 286 through 290, and 409 through 412.

## 213. Removal and Replacement of Code Actuated Switch

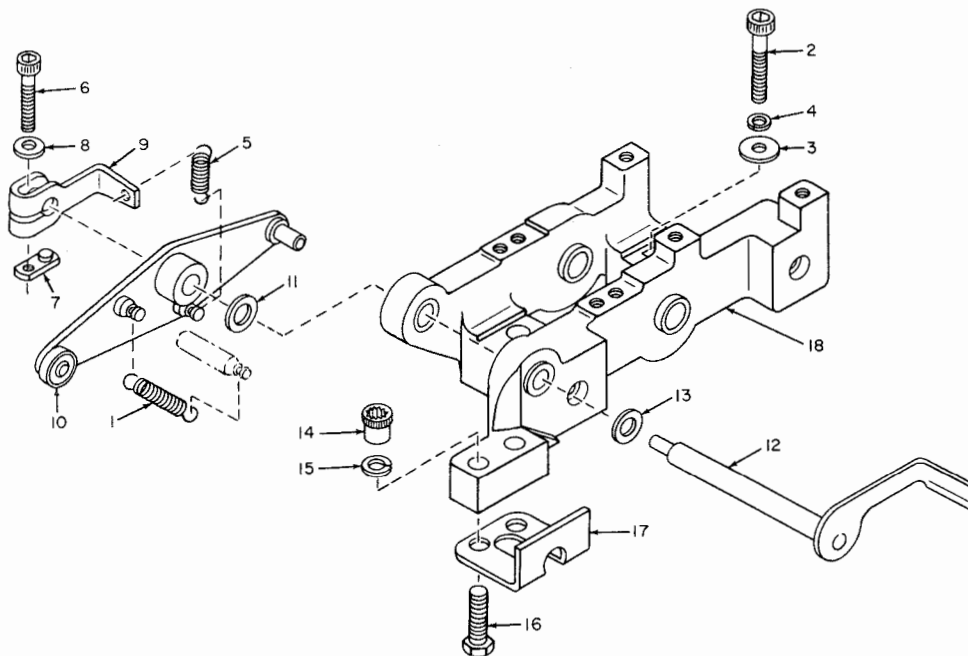
(fig. 255)

*a. Removal.*

- (1) Disconnect the plug that connects the code actuated switch to the perforator base.
- (2) Remove the code actuated switch cam follower spring (1) from the code actuated switch cam follower (10) and the spring post on the perforator frame.
- (3) Remove the two machine screws (2), flat washers (3), and lockwashers (4) that hold the bracket mounting (18) to the perforator frame; remove the code actuated switch, carefully disengaging the code plates from the T-levers.

*b. Replacement.*

- (1) Position the code actuated switch on the perforator frame so that the code plates engage the tails of the T-levers and the cam roller on the code actuated switch cam follower (10) en-



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- |   |  |                                |
|---|--|--------------------------------|
| 1 Code actuated switch cam follower spring, 55678 | 7 Nut plate, 50174                           | 13 Flat washer, 53292          |
| 2 Machine screw, 10042                            | 8 Flat washer, 10459                         | 14 Nut, 10531                  |
| 3 Flat washer, 10464                              | 9 Register lever, 55607                      | 15 Lockwasher, 10043           |
| 4 Lockwasher, 10420                               | 10 Code actuated switch cam follower, 55605A | 16 Machine screw, 10085        |
| 5 Register lever spring, 55679                    | 11 Flat washer, 53292                        | 17 T-lever stop bracket, 55624 |
| 6 Machine screw, 10006                            | 12 Register arm, 55630A                      | 18 Bracket mounting, 55668A    |

Figure 255. Code actuated switch frame assembly, exploded view.

gages the cam on the code actuated switch function shaft; secure with two machine screws (2), lockwashers (4), and flat washers (3).

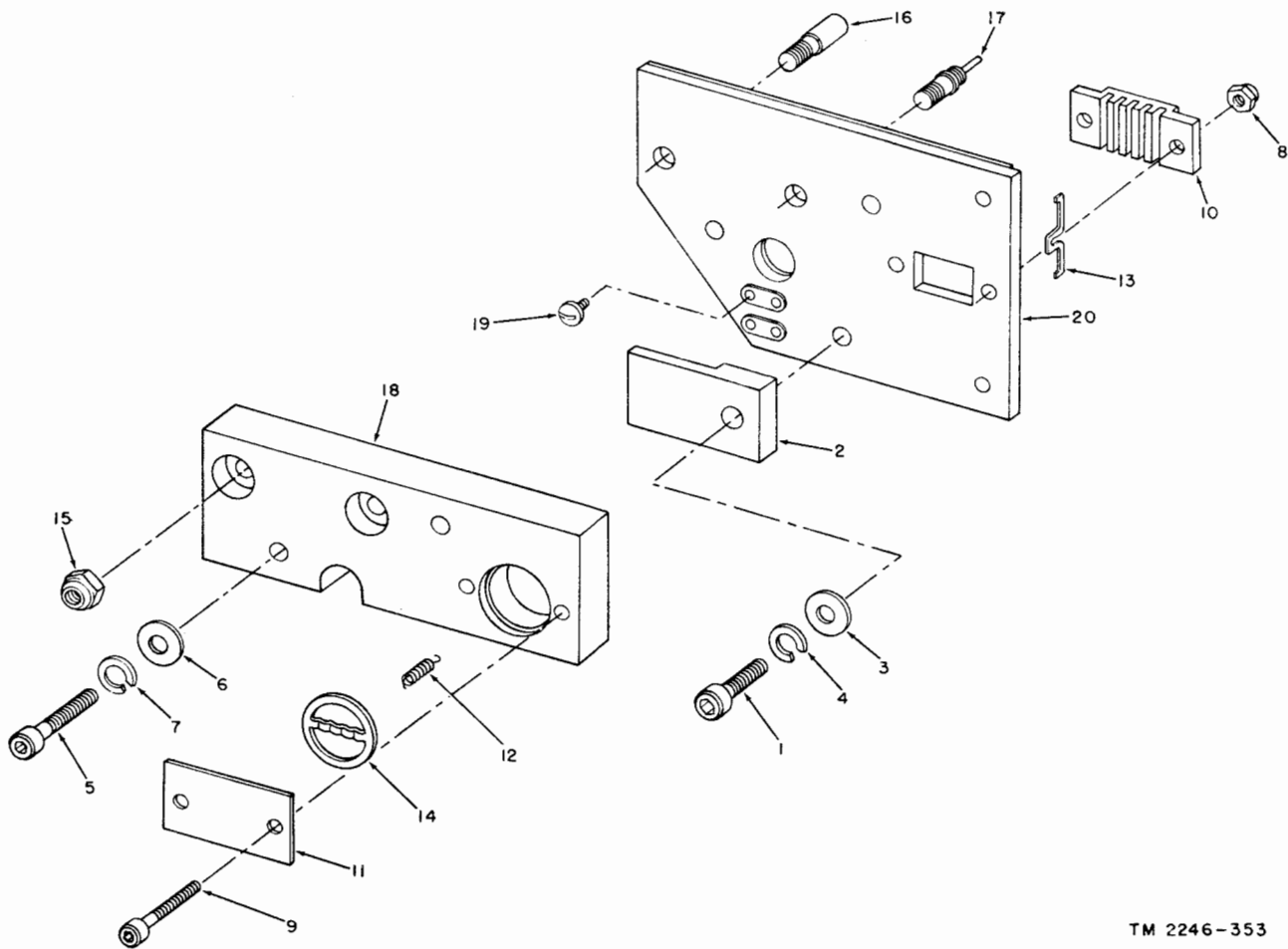
- (2) Install the code actuated switch cam follower spring (1) on the code actuated switch cam follower (10) and the spring post on the perforator frame.
- (3) Connect the plug from the code actuated switch to the perforator base.
- (4) Adjust the code actuated switch as described in paragraphs 415 through 420.

## 214. Disassembly and Reassembly of Code Actuated Switch Printed Commutator (TT-178/FG and TT-179/FG) (fig. 256)

### a. Disassembly.

- (1) Remove the code actuated switch from the perforator as described in paragraph 213a.

- (2) Remove the machine screw (1), flat washer (3), and lockwasher (4) that hold the terminal cover (2) to the printed commutator; remove the terminal cover.
- (3) Remove the two machine screws (5), flat washers (6), and lockwashers (7) that hold the printed commutator assembly to the code actuated switch frame; remove the printed commutator assembly.
- (4) Remove the two self-locking hexagonal nuts (8) and machine screws (9) that hold the contact wiper guide (10) and cover plate (11) to the assembled support block (18) and printed commutator (20); remove the support guide and cover plate.
- (5) Remove the five contact wiper springs (12) that hold the five contact wipers (13) to the spring holder (14); remove the contact wipers and spring holder.



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- |                         |                                     |                                      |
|-------------------------|-------------------------------------|--------------------------------------|
| 1 Machine screw, 10046  | 8 Self-locking hexagonal nut, 10551 | 15 Self-locking hexagonal nut, 10503 |
| 2 Terminal cover, 56138 | 9 Machine screw, 10062              | 16 Female pilot screw, 20856         |
| 3 Flat washer, 10450    | 10 Contact wiper guide, 55636       | 17 Male pilot screw, 20855           |
| 4 Lockwasher, 10429     | 11 Cover plate, 55692               | 18 Support lock, 55634               |
| 5 Machine screw, 10041  | 12 Contact wiper spring, 55641      | 19 Machine screw, 10362              |
| 6 Flat washer, 10405    | 13 Contact wiper, 55321             | 20 Printed commutator, 55638A        |
| 7 Lockwasher, 10429     | 14 Spring holder, 55637             |                                      |

Figure 256. Code actuated switch printed commutator, exploded view (TT-178/FG and TT-179/FG).

- (6) Remove the two self-locking hexagonal nuts (15) that hold the female pilot screw (16) and the male pilot screw (17) to the printed commutator (20); remove the two pilot screws. Remove the support block from the printed commutator.
  - (7) Remove the four machine screws (19) from the contacts on the printed commutator.
- b. Reassembly.
- (1) Install the four machine screws (19) on the contacts of the printed commutator (20).
  - (2) Position the support block (18) on the printed commutator. Position the male pilot screw (17) and female pilot screw (16) on the assembled printed commutator and support block; secure with two self-locking hexagonal nuts (15).
  - (3) Position the spring holder (14) on the support block. Install the five contact wiper springs (12) on the spring holder and install five contact wipers (13) on the opposite ends of the springs.
  - (4) Position the contact wiper (10) and



cover plate (11) on the assembled support block and printed commutator, being careful to align the five contact wipers (13) in the five slots in the contact wiper guide. Secure with two machine screws (9) and self-locking hexagonal nuts (8).

- (5) Position the printed commutator assembly on the code actuated switch frame; secure with two machine screws (5), flat washers (6), and lockwashers (7).
- (6) Position the terminal cover (2) on the printed commutator; secure with a machine screw (1), flat washer (3), and lockwasher (4).
- (7) Install the code actuated switch on the perforator as described in paragraph 213b.

### **215. Disassembly and Reassembly of Code Actuated Switch Printed Commutator (TT-178A/FG, TT-179A/FG, and TT-181/FG)** (fig. 257)

#### *a. Disassembly.*

- (1) Remove the code actuated switch from the perforator as described in paragraph 213a.
- (2) Remove the machine screw (1), flat washer (3), and lockwasher (4) that hold the terminal cover (2) to the printed commutator (20); remove the terminal cover.
- (3) Remove the two machine screws (5), flat washers (6), lockwashers (7) and flat washer (23) that hold the printed commutator assembly to the code actuated switch frame; remove the printed commutator assembly.
- (4) Perform the disassembly procedures as described in paragraph 214a(3) through (5).
- (5) Remove the two self-locking hexagonal nuts (15), lockwashers (16), and flat washers (17) that hold the male pilot screw (19) and the female pilot screw (21) to the printed commutator (20); remove the two pilot screws. Remove the support block (18) from the printed commutator.

- (6) Remove the four machine screws (22) from the contacts on the printed commutator (20).

#### *b. Reassembly.*

- (1) Reassemble the code actuated switch printed commutator as indicated in figure 257; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the code actuated switch on the perforator as described in paragraph 213b.

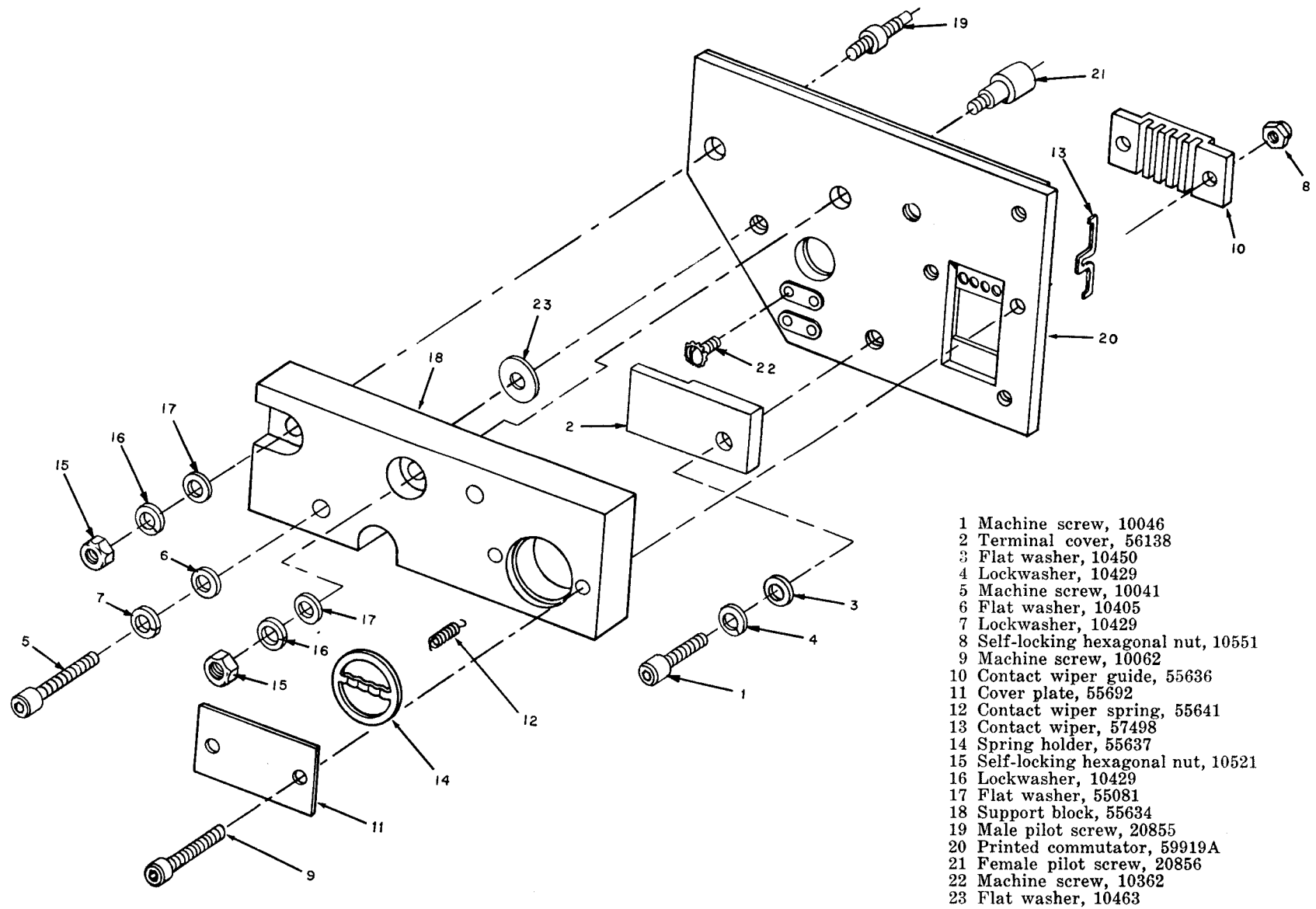
### **216. Disassembly and Reassembly of Code Actuated Switch Code Plates** (fig. 258)

#### *a. Disassembly.*

- (1) Remove the code actuated switch from the perforator as described in paragraph 213a.
- (2) Remove the printed commutator from the code actuated switch as described in paragraph 214a.
- (3) Remove the two self-locking hexagonal nuts (1), machine screws (2) four flat washers (3), and two lockwashers (4) that attach the collars (5) and the two sleeve bearings (23) to the bracket mounting.
- (4) Remove the collars (5) and spacing collars (6) from the two sleeve bearings (23). Remove the T-lever guide plate (7) from the code plate (8). Remove the code plate from the sleeve bearings.
- (5) Remove the remaining spacing collars (9, 12, 15, and 18); the T-lever guide plates (10, 13, 16, and 19); and the code plates (11, 14, 17, and 20).
- (6) Remove the spacing collars (21) and the code plate spacing collars (22) from the sleeve bearings (23).

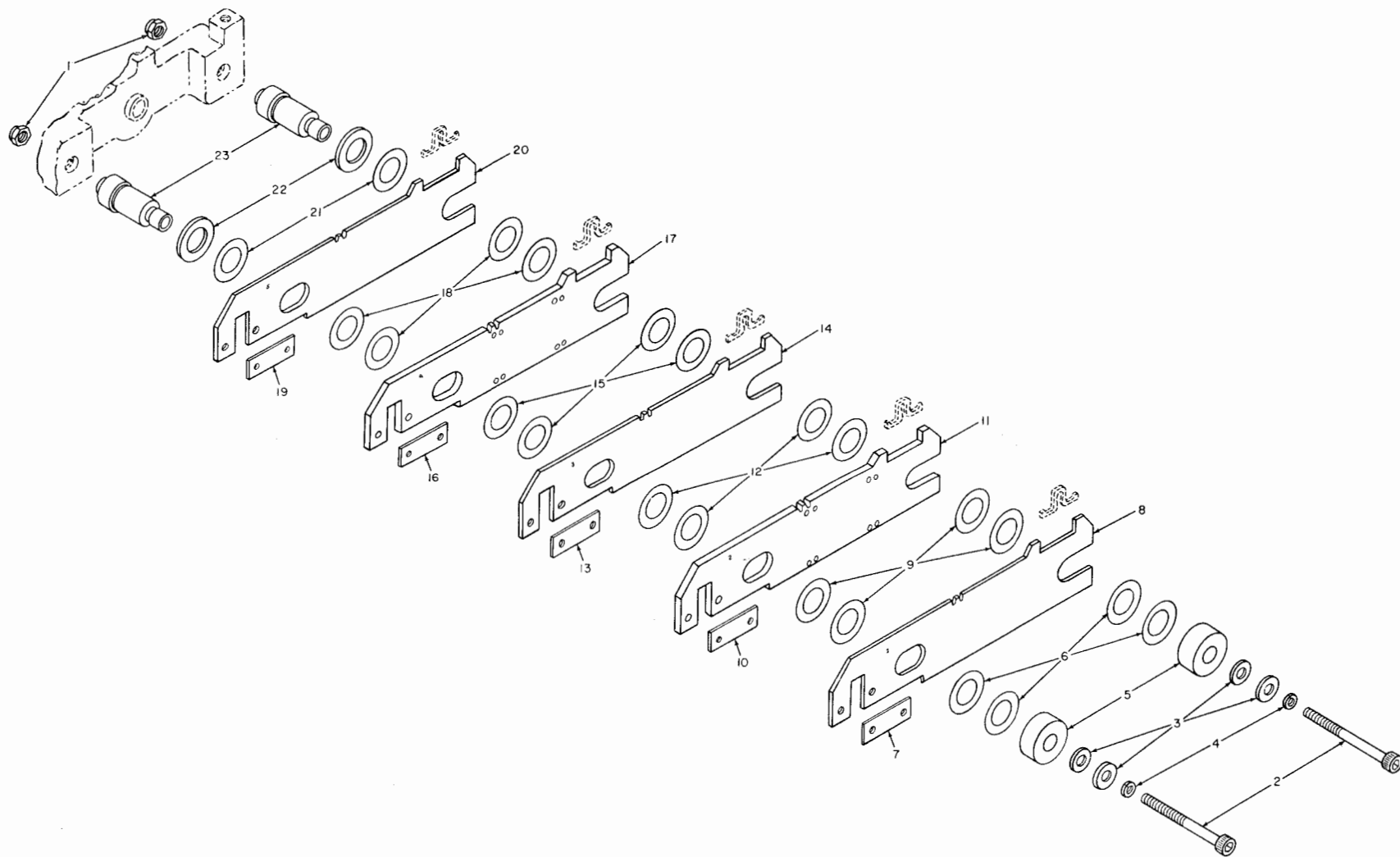
#### *b. Reassembly.*

- (1) Reassemble the code actuated switch code plates as indicated in figure 258; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the printed commutator on the code actuated switch as described in paragraph 214.



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Figure 257. Code actuated switch printed commutator 59880A, exploded view (TT-178A/FG, TT-179A/FG and TT-181/FG).



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- |                                     |                               |                               |                                     |
|-------------------------------------|-------------------------------|-------------------------------|-------------------------------------|
| 1 Self-locking hexagonal nut, 10501 | 7 T-lever guide plate, 55657  | 13 T-lever guide plate, 55657 | 19 T-lever guide plate, 55657       |
| 2 Machine screw, 10060              | 8 Code plate, 55656           | 14 Code plate, 55656          | 20 Code plate, 55656                |
| 3 Flat washer, 58859                | 9 Spacing collar, 55651       | 15 Spacing collar, 55651      | 21 Spacing collar, 55651            |
| 4 Lockwasher, 10430                 | 10 T-lever guide plate, 55657 | 16 T-lever guide plate, 55657 | 22 Code plate spacing collar, 55652 |
| 5 Collar, 55632                     | 11 Code plate, 55644          | 17 Code plate, 55644          | 23 Sleeve bearing, 55694            |
| 6 Spacing collar, 55651             | 12 Spacing collar, 55651      | 18 Spacing collar, 55651      |                                     |

Figure 258. Code actuated switch code plates, exploded view.

- (3) Install the code actuated switch on the perforator as described in paragraph 213.
- (4) Adjust the code actuated switch as described in paragraphs 415 through 420.

### **217. Disassembly and Reassembly of Code Actuated Switch Frame Assembly** (fig. 255)

#### *a. Disassembly.*

- (1) Remove the code actuated switch from the perforator as described in paragraph 213a.
- (2) Remove the printed commutator from the code actuated switch as described in paragraph 214a.
- (3) Remove the code plates as described in paragraph 216a.
- (4) Remove the register lever spring (5) from the code actuated switch cam follower (10) and from the register lever (9).
- (5) Remove the machine screw (6), nut plate (7), and flat washer (8) holding the register lever (9) to the register arm (12); remove the register lever.
- (6) Remove the code actuated switch cam follower (10) and flat washer (11) from the register arm (12).
- (7) Remove the register arm (12) and flat washer (13) from the bracket mounting (18).
- (8) Remove the two nuts (14), lockwashers (15), and machine screws (16) that attach the T-lever stop bracket (17) to the bracket mounting (18); remove the T-lever stop bracket.

#### *b. Reassembly.*

- (1) Reassemble the code actuated switch frame assembly as indicated in figure 255; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the code plates as described in paragraph 216b.
- (3) Install the printed commutator on the code actuated switch as described in paragraph 214b.

- (4) Install the code actuated switch on the perforator as described in paragraph 213b.
- (5) Adjust the code actuated switch as instructed in paragraphs 415 through 420.

### **218. Removal and Replacement of Receiving Multisolenoid**

#### *a. Removal.*

- (1) Disconnect the plug that connects the receiving multisolenoid to the perforator base.
- (2) Remove the retainer ring (20, fig. 263) that secures the manual tape feed-out link (23) to the switch operating lever (25).
- (3) Remove the machine screw (1, fig. 259), lockwasher (2), two machine screws (3), flat washers (4), and lockwashers (5) that hold the mounting bracket (34) to the perforator frame; remove the receiving multisolenoid.

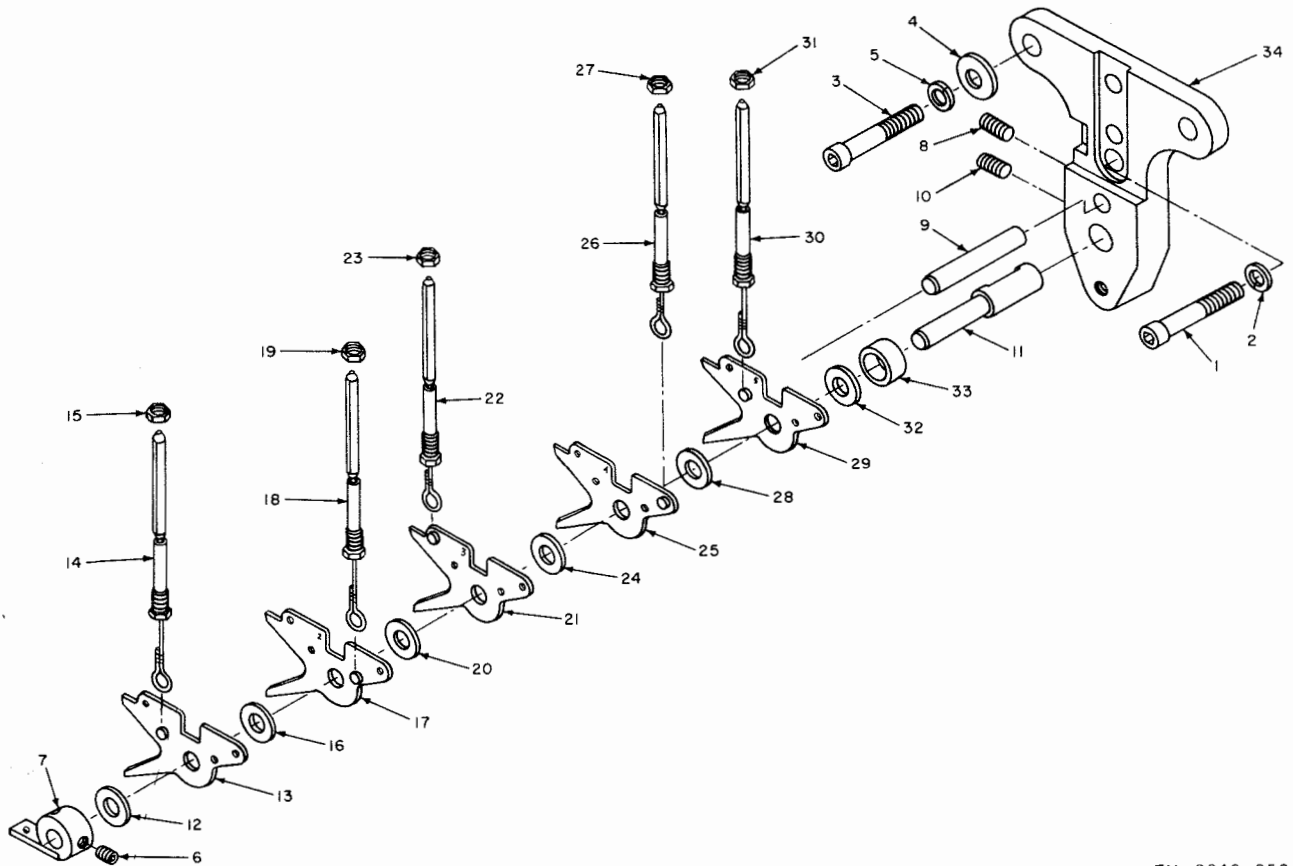
#### *b. Replacement.*

- (1) Position the receiving multisolenoid on the perforator frame; secure with two machine screws (3, fig. 259), lockwashers (5), flat washers (4), a machine screw (1), and lockwasher (2).
- (2) Install the assembled manual tape feed-out link (23, fig. 263) the stud of the switch operating lever (25) and secure in place with the retainer ring (20).
- (3) Connect the plug that connects the receiving multisolenoid to the perforator base.
- (4) Adjust the receiving multisolenoid as described in paragraphs 436 through 438.

### **219. Disassembly and Reassembly of Receiving Multisolenoid Plungers and Y-Levers (TT-178/FG and TT-179/FG)** (fig. 259)

#### *a. Disassembly.*

- (1) Remove the receiving multisolenoid from the perforator as described in paragraph 218a.



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- |                                   |                                  |                                  |
|-----------------------------------|----------------------------------|----------------------------------|
| 1 Machine screw, 10018            | 13 Multisolenoid Y-lever, 56080  | 24 Flat washer, 50147            |
| 2 Lockwasher, 10420               | 14 Multisolenoid plunger, 54916A | 25 Multisolenoid Y-lever, 56083A |
| 3 Machine screw, 10018            | 15 Hexagon nut, 56108            | 26 Multisolenoid plunger, 54916A |
| 4 Flat washer, 10464              | 16 Flat washer, 50147            | 27 Hexagonal nut, 56108          |
| 5 Lockwasher, 10420               | 17 Multisolenoid Y-lever, 56081A | 28 Flat washer, 50147            |
| 6 Setscrew, 10209                 | 18 Multisolenoid plunger, 54916A | 29 Multisolenoid Y-lever, 56084A |
| 7 Collar, 56580A                  | 19 Hexagonal nut, 56108          | 30 Multisolenoid plunger, 54916A |
| 8 Setscrew, 10210 and 10234       | 20 Flat washer, 50147            | 31 Hexagonal nut, 56108          |
| 9 Straight pin, 56078             | 21 Multisolenoid Y-lever, 56082A | 32 Flat washer, 50147            |
| 10 Setscrew, 10210                | 22 Multisolenoid plunger, 54916A | 33 Collar, 51414                 |
| 11 Y-lever pivot post stud, 53269 | 23 Hexagonal nut, 56108          | 34 Mounting bracket, 56133A      |
| 12 Flat washer, 50147             |                                  |                                  |

Figure 259. Receiving multisolenoid plungers and Y-levers, exploded view.

- (2) Remove the two setscrews (6) that hold the collar (7) on the Y-lever pivot post stud (11); remove the collar.
- (3) Remove the setscrew (8) that holds the straight pin (9) in the mounting bracket (34); remove the straight pin.
- (4) Remove the setscrew (10) that holds the Y-lever pivot post stud in the mounting bracket; remove the selector Y-lever pivot post stud (11) from the back of the mounting bracket (34).
- (5) Remove the flat washer (12). Slide the end of the plunger connecting wire off the pin on the multisolenoid Y-lever (13); remove the multisolenoid Y-lever (13).
- (6) Loosen the hexagonal nut (15); remove the multisolenoid plunger (14) from the receiving multisolenoid. Remove the hexagonal nut from the plunger.
- (7) Similarly remove the remaining flat washers (16, 20, 24, 28, and 32); multisolenoid Y-levers (17, 21, 25, and 29); multisolenoid plungers (18, 22, 26, and 30); and hexagonal nuts (19, 23, 27, and 31).

- (8) Remove the flat washer (32) and collar (33).

*b. Reassembly.*

- (1) Position the collar (33) and flat washer (32) on the mounting bracket (34). Slide the Y-lever pivot post stud (11) in the back of the bracket (34) far enough to hold the assembled parts.
- (2) Install a hexagonal nut (31) on the multisolenoid plunger (30). Install the plunger in the multisolenoid. Position the multisolenoid Y-lever (29) on the Y-lever pivot post stud (11); hook the end of the plunger connecting wire to the pin on the multisolenoid Y-lever. Install a flat washer (28).

*Note.* The multisolenoid Y-levers are marked 1, 2, 3, 4, and 5. They are installed in numerical sequence with No. 5 being closest to the mounting bracket. The numbered sides face outward.

- (3) Similarly install the remaining hexagonal nuts (27, 23, 19, and 15); multisolenoid plungers (26, 22, 18, and 14); multisolenoid Y-levers (25, 21, 17, and 13); and flat washers (24, 20, 16, and 12).
- (4) Install the collar (7) on the Y-lever pivot post stud (11); hold with two setscrews (6).
- (5) Install the receiving multisolenoid as described in paragraph 218*b*.
- (6) Adjust the receiving multisolenoid as described in paragraphs 436 through 438.

## **220. Disassembly and Reassembly of Receiving Multisolenoid Plungers and Y-levers (TT-178A/FG, TT-179A/FG and TT-181/FG)**

(fig. 260)

*a. Disassembly.*

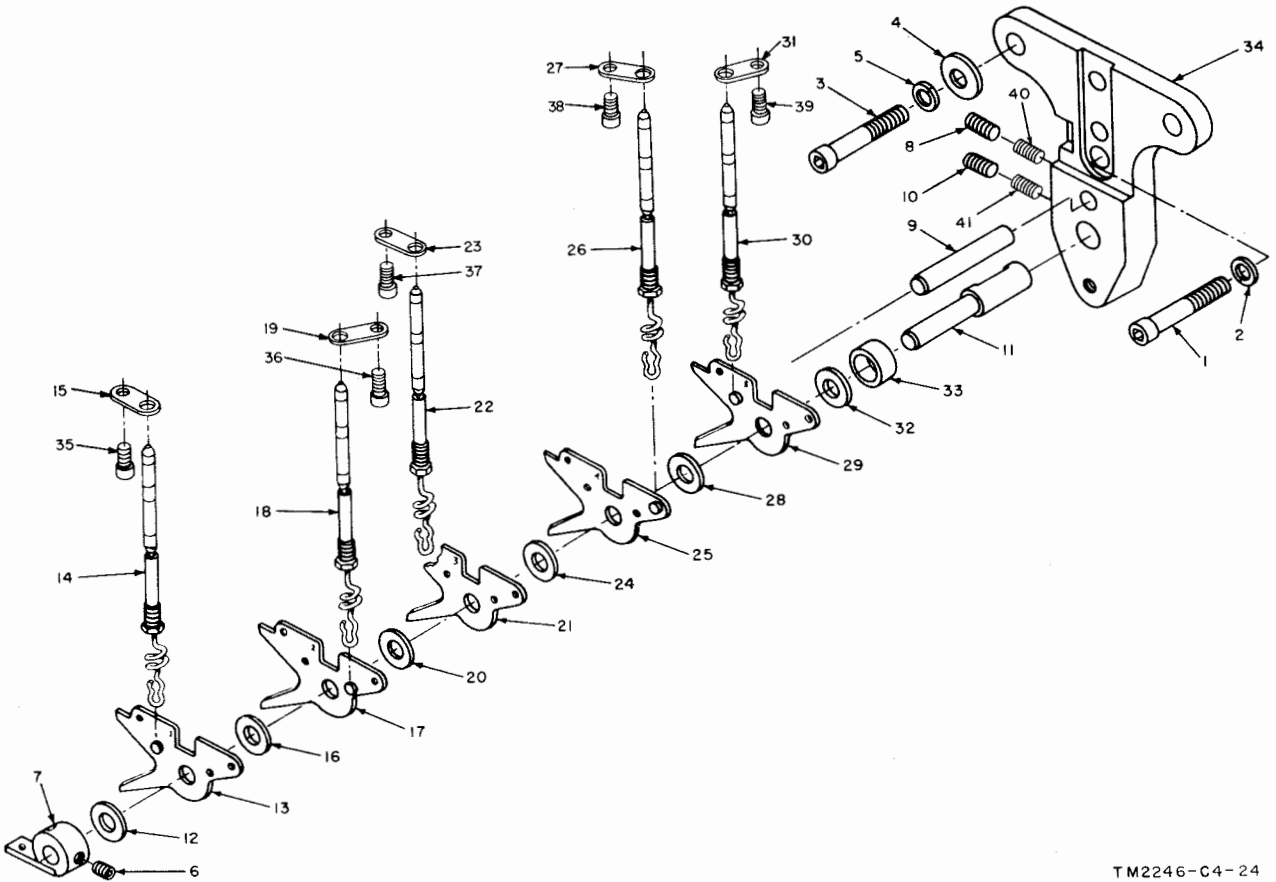
- (1) Remove the receiving multisolenoid from the perforator as described in paragraph 218*a*.
- (2) Remove the setscrews (6) that hold the collar (7) on the Y-lever pivot post stud (11); remove the collar.

- (3) Remove the setscrews (8 and 40) that hold the straight pin (9) in the mounting bracket (34); remove the straight pin.
- (4) Remove the setscrews (10 and 41) that hold the Y-lever pivot post stud in the mounting bracket (34). While removing the Y-lever pivot post stud (11) from the back of the mounting bracket (34), collect the flat washers (12, 16, 20, 24, 28, 32) and collar (33).
- (5) Slide the end of the plunger (14) connecting wire off the pin of the Y-lever (13) and remove the Y-lever (13). Remove the machine screw (35); remove the plunger (14) with the tab (15) from the multisolenoid and remove the tab from the plunger (14) assembly.
- (6) Similarly remove the connecting wires of the plungers (18, 22, 26, and 30) from their respective Y-levers (17, 21, 25, and 29); repeat the process of removing machine screws (36, 37, 38, and 39) and plunger assemblies (18, 22, 26, and 30) from the multisolenoid block. Remove the tabs (19, 23, 27, and 31) from their respective plunger assemblies.

*b. Reassembly.*

- (1) Position the collar (33) and flat washer (32) on the mounting bracket (34). Slide the Y-lever pivot post (11) in the back of the bracket (34) far enough to hold the assembled parts.
- (2) Install the tab (31) on the plunger (30). Install the plunger into the multisolenoid block. Aline the other hole of the tab (31) and install the machine screw (39). Position the multisolenoid Y-lever (29) on the pivot post lever (11) and clip the end of the plunger wire (30) to the pin on Y-lever (29). Install the washer (28).

*Note.* The multisolenoid Y-levers are marked 1, 2, 3, 4, and 5. They are installed in numerical sequence with No. 5 being closest to the mounting bracket. The numbered side faces outward.

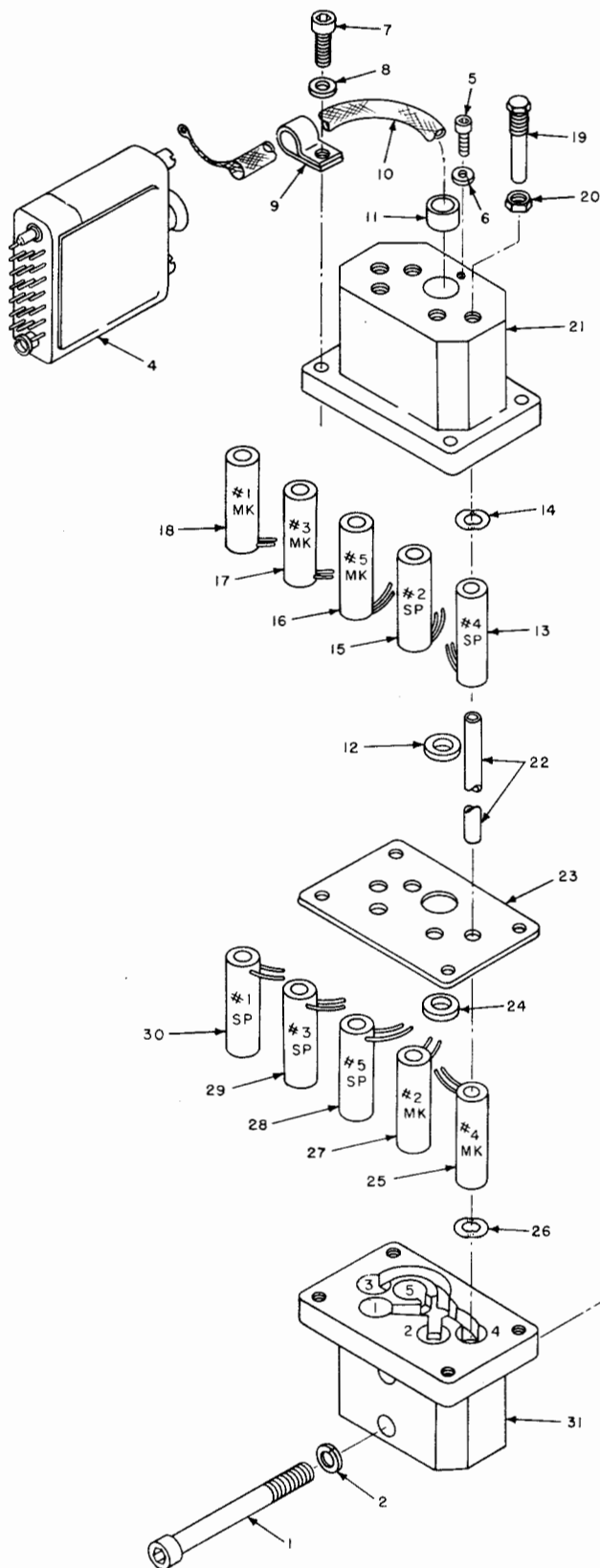


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- |                                   |                                  |                                      |
|-----------------------------------|----------------------------------|--------------------------------------|
| 1 Machine screw, 10018            | 14 Multisolenoid plunger, 59986A | 26 Multisolenoid plunger, 59986A     |
| 2 Lockwasher, 10420               | 15 Tab, 59896                    | 27 Tab, 59896                        |
| 3 Machine screw, 10018            | 16 Flat washer, 50147            | 28 Flat washer, 50147                |
| 4 Flat washer, 10464              | 17 Multisolenoid Y-lever, 56081A | 29 Multisolenoid Y-lever, 56084A     |
| 5 Lockwasher, 10420               | 18 Multisolenoid plunger, 59986A | 30 Multisolenoid plunger, 59986A     |
| 6 Setscrew, 10209                 | 19 Tab, 59896                    | 31 Tab, 59896                        |
| 7 Collar, 56580A                  | 20 Flat washer, 50147            | 32 Flat washer, 50147                |
| 8 Setscrew, 10234                 | 21 Multisolenoid Y-lever, 56082A | 33 Collar, 51414                     |
| 9 Straight pin, 56078             | 22 Multisolenoid plunger, 59986A | 34 Mounting bracket, 56133A          |
| 10 Setscrew, 10234                | 23 Tab, 59896                    | 35 through 39. Machine screws, 10058 |
| 11 Y-lever pivot post stud, 53269 | 24 Flat washer, 50147            | 40 and 41. Setscrews, 10210          |
| 12 Flat washer, 50147             | 25 Multisolenoid Y-lever, 56083A |                                      |
| 13 Multisolenoid Y-lever, 56080A  |                                  |                                      |

Figure 260. Receiving multisolenoid plungers and Y-levers, exploded view (TT-178A/FG, TT-179A/FG, and TT-181/FG).

- (3) Similarly install the remaining plungers (26, 22, 18, and 14) with the tabs (27, 23, 19, and 15) on them; the machine screws (38, 37, 36, and 35) and Y-levers (25, 21, 17, and 13). Install flat washers (28, 24, 20, 16, and 12) after each respective Y-lever.
- (4) Install the collar (7) on the Y-lever pivot post (11); secure with the two setscrews (6).
- (5) Install the multisolenoid on the bracket (34) as described in paragraph 218b.
- (6) Adjust the receiving multisolenoid as described in paragraphs 436 through 438.



- 1 Machine screw, 10056
- 2 Lockwasher, 10431
- 3 Plate clamp, 56077
- 4 Plug connector, 20427
- 5 Machine screw, 10055
- 6 Lockwasher, 10403
- 7 Machine screw, 11500
- 8 Lockwasher, 10403
- 9 Clamp, 20513
- 10 Cable sheath, 54910A
- 11 Cable ferrule, 54922
- 12 Spacing collar, 54908
- 13 Solenoid coil, 56118A
- 14 Spring washer, 54901
- 15 Solenoid coil, 56116A
- 16 Solenoid coil, 56114A
- 17 Solenoid coil, 56112A
- 18 Solenoid coil, 56110A
- 19 Plunger stop, 54923
- 20 Hexagonal nut, 56108
- 21 Support block, 54902
- 22 Mounting guide, 54907
- 23 Mounting plate, 54906
- 24 Spacing collar, 54909
- 25 Solenoid coil, 56113A
- 26 Spring washer, 54901
- 27 Solenoid coil, 56111A
- 28 Solenoid coil, 56119A
- 29 Solenoid coil, 56117A
- 30 Solenoid coil, 56115A
- 31 Support block, 54904

Figure 261. Receiving multisolenoid, exploded view (TT-178/FG and TT-179/FG).

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**221. Disassembly and Reassembly of Receiving Multisolenoid (TT-178/FG and TT-179/FG)**  
(fig. 261)

*a. Disassembly.*

- (1) Remove the receiving multisolenoid as described in paragraph 218a.
- (2) Remove the multisolenoid plungers and Y-levers as described in paragraph 219a.
- (3) Remove the two machine screws (1), lockwashers (2), and plate clamp (3) that hold the multisolenoid support block (31) to the multisolenoid mounting bracket; remove the support block.
- (4) Remove the wires from the plug connector (4); tag the wires to facilitate reconnecting.
- (5) Remove the machine screw (5) and lockwasher (6) that hold the cable ferrule (11) to the support block (21).
- (6) Remove the four machine screws (7) and lockwashers (8) that hold the upper support block (21) to the lower support block (31). Remove the clamp (9) from the cable sheath (10).
- (7) Remove the cable sheath (10) and the cable ferrule (11) from the wires.
- (8) Pry the upper and lower support blocks (21 and 31) apart far enough to insert a tool to remove the spacing collar (12) that holds the wires in place in the upper support block. Separate the support blocks and remove the spacing collar (12).
- (9) Remove the five solenoid coils (13, 15, 16, 17, and 18) and the five spring washers (14).
- (10) Loosen the five hexagonal nuts (20) and remove the plunger stops (19); remove the nuts from the pole pieces.
- (11) Remove the five mounting guides (22) from the lower support block (31).
- (12) Remove the mounting plate (23) from the lower support block (31).
- (13) Remove the spacing collar (24) from the lower support block (31).
- (14) Remove the five solenoid coils (25, 27, 28, 29, and 30) and the five spring

washers (26) from the lower support block (31).

*b. Reassembly.*

- (1) Insert the five spring washers (26) and the five solenoid coils (30, 29, 28, 27, and 25) in the lower support block (31).
- (2) Place the coil wires in the grooves to avoid kinks and loose wires and thread the wires through the spacing collar (24). Hold the wires in position in the lower support block (31) by installing the spacing collar in the center hole of the lower support block.
- (3) Thread the wires through the hole in the mounting plate (23); position the mounting plate on the lower support block (31).
- (4) Position the five mounting guides (22) in the mounting plate (23) and lower support block (31).
- (5) Screw the five hexagonal nuts (20) on the five plunger stops (19); install the plunger stops in the upper support block (21).
- (6) Insert the five spring washers (14) and five solenoid coils (18, 17, 16, 15, and 13) in the upper support block (21).
- (7) Thread the wires from the upper coils in the grooves of the upper support block (21); hold by installing the spacing collar (12) in the center hole of the support block. Thread the wires from all 10 coils through the large unthreaded hole of the upper support block. Bring the upper and the lower support blocks together.
- (8) Thread the wires through the cable ferrule (11) and the cable sheath (10). Insert the end of the cable sheath in the upper support block; slip the cable ferrule over the end of the cable sheath to hold it in the support block.
- (9) Hold the cable ferrule (11) in place with a machine screw (5) and lockwasher (6).
- (10) Place the clamp (9) on the cable; position the clamp on the upper support block (21). Attach the upper

support block to the lower support block (31) with four lockwashers (8) and machine screws (7).

- (11) Connect the wires to the proper terminals of the plug connector (4).
- (12) Position the receiving multisolenoid on the multisolenoid bracket mounting; secure with two machine screws (1), lockwashers (2), and a plate clamp (3).
- (13) Install the multisolenoid plungers and Y-levers as described in paragraph 219*b*.
- (14) Install the receiving multisolenoid on the perforator as described in paragraph 218*b*.
- (15) Adjust the receiving multisolenoid as described in paragraphs 436 through 438.

## **222. Disassembly and Reassembly of Receiving Multisolenoid (TT-178A/FG, TT-179A/FG, and TT-181/FG) (fig. 262)**

### *a. Disassembly.*

- (1) Remove the receiving multisolenoid as described in paragraph 218*a*.
- (2) Remove the multisolenoid plungers and Y-levers as described in paragraph 220*a*.
- (3) Disassemble the support blocks, coils, and wires as described in paragraph 221*a*(3) through (9).
- (4) Remove the five machine screws (32); remove the plunger stops (19) and tabs (20). Remove the tabs (20) from the stops (19).
- (5) Conclude the disassembly procedures as described in paragraph 221*a*(11) through (14).

### *b. Reassembly.*

- (1) Perform the reassembly procedures described in paragraph 221*b*(1) through (4).
- (2) Install the five tabs (20) on the plunger stops (19); install the plunger stops (19) into the upper support block. Install the five machine screws (32) into the holes of the upper support block which should be aligned with the remaining holes in the tabs (20).

- (3) Perform the reassembly procedures described in paragraph 221*b*(6) through (12).
- (4) Install the multisolenoid plungers and Y-levers as described in paragraph 220*b*.
- (5) Install the receiving multisolenoid on the perforator as described in paragraph 218*b*.
- (6) Adjust the receiving multisolenoid as described in paragraphs 436 through 438.

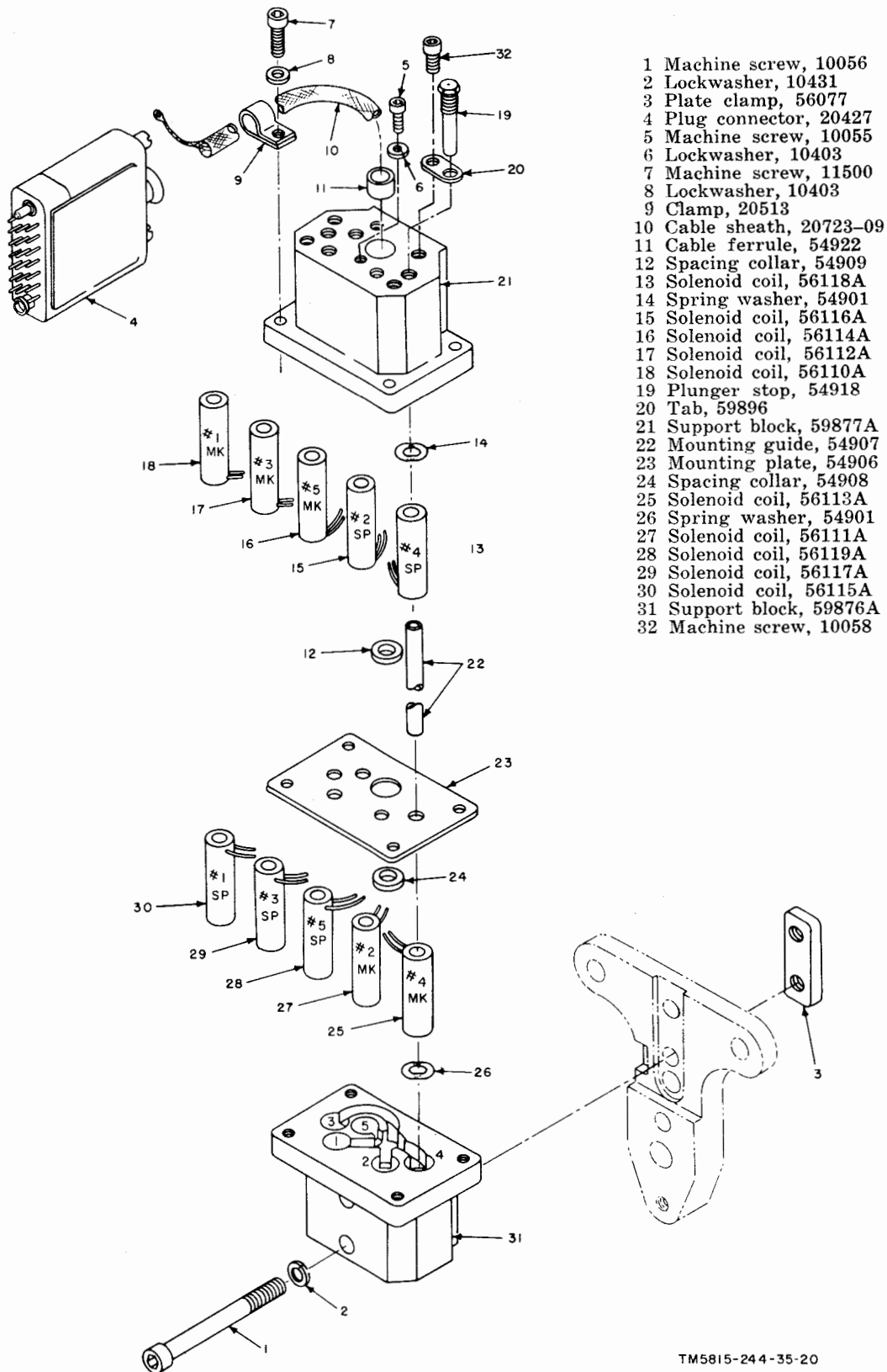
## **223. Removal and Replacement of Manual Tape Feed-Out Mechanism (fig. 263)**

### *a. Removal.*

- (1) Remove the machine screw (1), and lockwasher (2) that hold the rear support plate (38) to the perforator frame.
- (2) Remove the two machine screws (3) and lockwashers (4) that hold the front support plate (28) to the spacing studs (5 and 32).
- (3) Remove the two setscrews (6, fig. 259) that hold the collar (7) to the Y-lever pivot post stud (11); remove the collar and link (23, fig. 263) from the post stud.
- (4) Detach the leads from the manual tape feed-out switch (35).
- (5) Remove the spacing stud (5) that holds the rear support plate (38) to the perforator frame; remove the manual tape feed-out mechanism from the perforator.

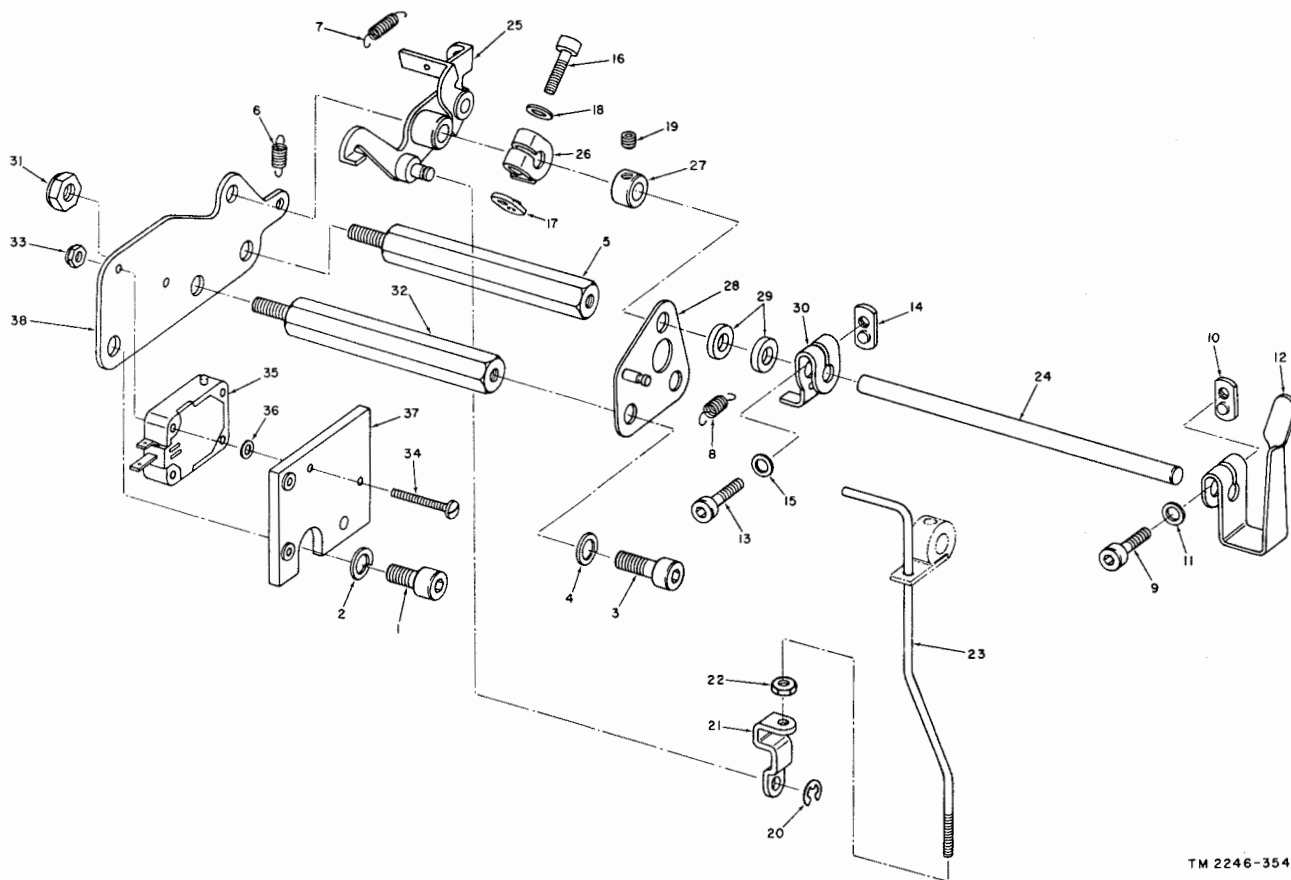
### *b. Disassembly.*

- (1) Remove the spring (6) from the switch operating lever (25) and from the rear support plate (38).
- (2) Remove the disabling latch spring (7) from the switch operating lever and from the kickout pawl on the switch operating lever.
- (3) Remove the manual tape feed-out lever spring (8) from the spring post on the front support plate (28) and from the limit stop lever (30).
- (4) Remove the clamping screw (9), nut plate (10), and flat washer (11) that



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Figure 262. Receiving multisolenoid, exploded view (TT-178A/FG, TT-179A/FG, and TT-181/FG).



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- |  |                                     |   |
|--|-------------------------------------|---|
| 1 Machine screw, 10015                     | 14 Nut plate, 50174                 | 29 Flat washer, 50827   |
| 2 Lockwasher, 10431                        | 15 Flat washer, 10459               | 30 Limit stop lever, 56593  |
| 3 Machine screw, 10024                     | 16 Clamping screw, 10006            | 31 Self-locking hexagonal nut, 10525                                    |
| 4 Lockwasher, 10431                        | 17 Nut plate, 50174                 | 32 Spacing stud, 56577  |
| 5 Spacing stud, 56577                      | 18 Flat washer, 10459               | 33 Self-locking hexagonal nut, 10535                                    |
| 6 Spring, 56591                            | 19 Setscrew, 10201                  | 34 Machine screw, 10201   |
| 7 Disabling latch spring, 56591            | 20 Retainer ring, 10960             | 35 Manual tape feed-out switch S34, 20128                               |
| 8 Manual tape feed-out lever spring, 56594 | 21 Connector link 51783             | 36 Flat washer, 55081   |
| 9 Clamping screw, 10006                    | 22 Plain hexagonal nut, 10520       | 37 Switch cover, 56585A (60060A, TT-178A/FG, TT-179A/FG, and TT-181/FG) |
| 10 Nut plate, 50174                        | 23 Manual tape feed-out link, 56583 | 38 Rear support plate, 56581  |
| 11 Flat washer, 10495                      | 24 Tape feed-out shaft, 56576       |   |
| 12 Manual tape feed-out lever, 52646       | 25 Switch operating lever, 56590    |   |
| 13 Clamping screw, 10006                   | 26 Clamp, 56593                     |   |
|  | 27 Shaft collar, 50391              |   |
|  | 28 Front support plate, 56592A      |   |

Figure 263. Manual tape feed-out mechanism, exploded view.

hold the manual tape feed-out lever (12) to the tape feed-out shaft (24); remove the manual tape feed-out lever.

- (5) Remove the clamping screw (13), nut plate (14), and flat washer (15) that hold the limit stop lever (30) to the tape feed-out shaft (24).
- (6) Remove the clamping screw (16), nut plate (17), and flat washer (18) that

hold the clamp (26) to the tape feed-out shaft (24).

- (7) Remove the setscrew (19) that holds the shaft collar (27) to the tape feed-out shaft (24).
- (8) Remove the retainer ring (20) that holds the connector link (21) to the switch operating lever (25); remove the assembled manual tape feed-out link (23) and connector link. Remove

the connector link and plain hexagonal nut (22) from the manual tape feed-out link.

- (9) Remove the tape feed-out shaft (24), catching the switch operating lever (25), clamp (26), shaft collar (27), front support plate (28), two flat washers (29), and limit stop lever (30) as they fall from the shaft.
- (10) Remove the self-locking hexagonal nut (31) that holds the spacing stud (32) to the rear support plate (38); remove the spacing stud.
- (11) Remove the two self-locking hexagonal nuts (33) and machine screws (34) that hold the switch cover (37) to the rear support plate (38); remove the manual tape feed-out switch (35), two flat washers (36), and the switch cover.

*c. Replacement.*

- (1) Reassemble the manual tape feed-out mechanism as indicated in figure 263; the sequence for assembling and replacing the parts is the reverse of the sequence described in *a* and *b* above.
- (2) Adjust the manual tape feed-out mechanism as described in paragraphs 486 through 488.

## 224. Removal and Replacement of Ribbon Supply Group

(fig. 264)

*a. Removal.*

- (1) Remove the ribbon spools (1) and ribbon from the ribbon spool shaft (27).
- (2) Remove the machine screw (2) and lockwasher (3) that hold the ribbon feed brace (46) to the perforator frame.
- (3) Remove the two machine screws (4) and lockwashers (5) that hold the ribbon feed mounting bracket (50) to the front support frame. Disengage the ribbon feed cam follower (8) from the cam on the receiving multisolenoid function shaft and remove the ribbon supply group from the perforator.

*b. Replacement.*

- (1) Position the ribbon supply group on the perforator, being careful to en-

gage the ribbon feed cam follower (8) with the cam on the receiving multisolenoid function shaft. Secure the ribbon feed mounting bracket (50) to the front support frame with two machine screws (4) and lockwashers (5).

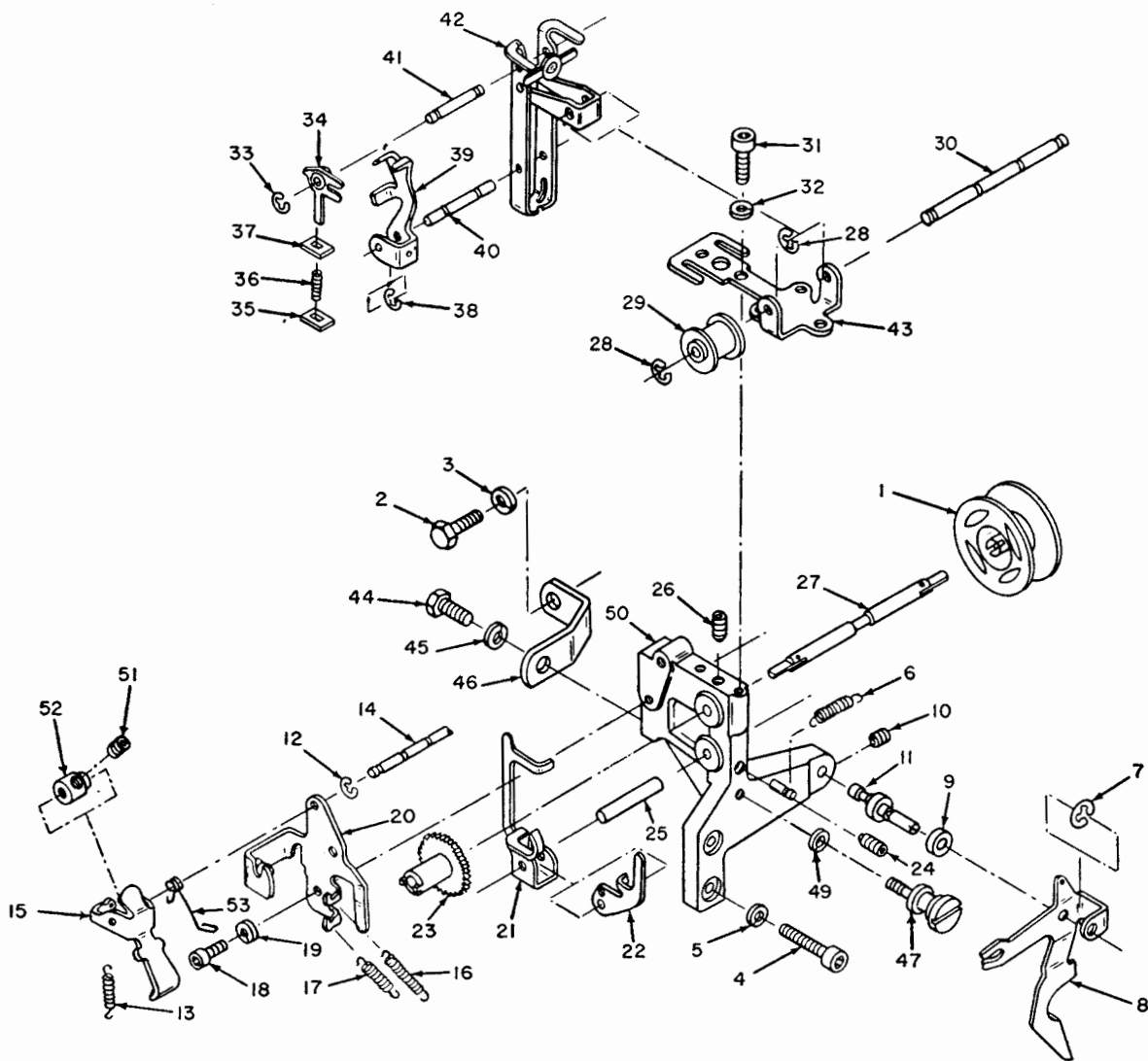
- (2) Position the ribbon feed brace (46) on the perforator frame; secure with a machine screw (2) and lockwasher (3).
- (3) Install the ribbon spools (1) and inking ribbon on the perforator as described in paragraph 16*f* of TM 11-5815-244-12.

## 225. Disassembly and Reassembly of Ribbon Supply Group

(fig. 264)

*a. Disassembly.*

- (1) Remove the ribbon supply group from the perforator as described in paragraph 224*a*.
- (2) Remove the ribbon feed cam follower spring (6) from the ribbon feed cam follower (8) and from the spring post on the ribbon feed mounting bracket (50).
- (3) Remove the stud (47) and lockwasher (49) from the ribbon feed mounting bracket (50).
- (4) Remove the retainer ring (7) that holds the ribbon feed cam follower (8) to the eccentric stud (11); remove the ribbon feed cam follower and flat washer (9).
- (5) Remove the setscrew (10) that holds the eccentric stud (11) to the ribbon feed mounting bracket (50); remove the eccentric stud.
- (6) Remove the four setscrews (51) that hold the ribbon retainer collars (52) to the ribbon retainer shaft (14). Remove the two ribbon retainer lever springs (13) from the ribbon retainer levers (15) and from the holding clip brackets (20). Remove the two ribbon retainer levers and collars from the ribbon retainer shaft (14).
- (7) Remove the two retainer rings (12) that hold the ribbon retainer shaft



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- |   |   |  |
|---|---|--|
| 1 Ribbon spool                            | 21 Left-hand sensing lever, 52597                 | 35 Spring washer, 53427                            |
| 2 Machine screw, 10397                    | 22 Right-hand sensing lever, 52596                | 36 Contact plunger spring, 51593                   |
| 3 Lockwasher, 10431                       | 23 Left-hand ratchet feed detent lever, 52610A    | 37 Spring washer, 53427                            |
| 4 Machine screw, 10028                    | 24 Right-hand ratchet feed detent lever, 52611A   | 38 Retainer ring, 10969                            |
| 5 Lockwasher, 10430                       | 25 Left-hand ribbon feeding detent wheel, 52591A  | 39 Left-hand ribbon feed lever, 52605              |
| 6 Ribbon feed cam follower spring, 52602  | 26 Right-hand ribbon feeding detent wheel, 52590A | 40 Right-hand ribbon feed lever, 52607             |
| 7 Retainer ring, 10949                    | 27 Setscrew, 10210                                | 41 Ribbon feed pawl shaft, 52609                   |
| 8 Ribbon feed cam follower, 56234         | 28 Sensing lever shaft, 52595                     | 42 Reversing arm shaft, 52703                      |
| 9 Flat washer, 50827                      | 29 Setscrew, 10210                                | 43 Driving link lever, 52622                       |
| 10 Setscrew, 10210                        | 30 Ribbon spool shaft, 56231A                     | 44 Roller bracket, 52598                           |
| 11 Eccentric stud, 52585                  | 31 Retainer ring, 10949                           | 45 Machine screw, 10397                            |
| 12 Retainer ring, 10969                   | 32 Ribbon roller, 52608                           | 46 Lockwasher, 10431                               |
| 13 Ribbon retainer lever spring, 52603    | 33 Ribbon roller shaft, 52601                     | 47 Ribbon feed brace, 52581                        |
| 14 Ribbon retainer shaft, 53178           | 34 Machine screw, 10008                           | 48 Stud, 57063                                     |
| 15 Ribbon retainer lever, 57062           | 35 Lockwasher, 10430                              | 49 Lockwasher, 10430                               |
| 16 Ribbon feed detent lever spring, 52604 | 36 Retainer ring, 10969                           | 50 Ribbon feed mounting bracket, 52512A            |
| 17 Sensing lever spring, 52603            | 37 Left-hand ribbon reversing arm, 52705          | 51 Setscrew, 10201                                 |
| 18 Machine screw, 10001                   | 38 Right-hand ribbon reversing arm, 52704         | 52 Ribbon retainer lever collar, 57061             |
| 19 Lockwasher, 10429                      |   | 53 Left-hand sensing lever retracting lever, 57059 |
| 20 Left-hand holding clip bracket, 56226A |   |  |
| Right-hand holding clip bracket, 56228A   |   |  |

Figure 264. Ribbon supply group, exploded view.

- (14) to the holding clip brackets (20). Remove the ribbon retainer shaft (14).
- (8) Remove the two ribbon feed detent lever springs (16) from the holding clip brackets (20) and from the ratchet feed detent levers (22).
  - (9) Remove the two sensing lever springs (17) from the holding clip brackets and from the sensing levers (21). Remove the sensing lever retracting levers (53) from the sensing levers (21).
  - (10) Remove the four machine screws (18) and lockwashers (19) that hold the holding clip brackets (20) to the ribbon feed mounting bracket (50); remove the holding clip brackets.
  - (11) Remove the sensing levers (21) and the ratchet feed detents (22) from the sensing lever shaft (25). Remove the ribbon feeding detent wheel (23) from the ribbon spool shaft (27).
  - (12) Remove the setscrew (24) that holds the sensing lever shaft (25) in the ribbon feed mounting bracket (50); remove the sensing lever shaft.
  - (13) Remove the setscrew (26) that holds the ribbon spool shaft (27) in the ribbon feed mounting bracket (50); remove the ribbon spool shaft.
  - (14) Remove the four retainer rings (28) that hold the ribbon rollers (29) to the ribbon roller shaft (30) and hold the ribbon roller shaft to the roller bracket (43); remove the ribbon rollers from the ribbon roller shaft and remove the ribbon roller shaft from the roller bracket.
  - (15) Remove the two machine screws (31) and lockwashers (32) that hold the roller bracket (43) to the ribbon feed mounting bracket (50); remove the upper ribbon feed and reversing mechanism from the ribbon feed mounting bracket.
  - (16) Remove the two retainer rings (33) that hold the ribbon reversing arms (34) to the reversing arm shaft (41); remove the ribbon reversing arms. Remove the two spring washers (35), contact plunger springs (36), and

spring washers (37) from the ribbon reversing arms.

- (17) Remove the two retainer rings (38) that hold the ribbon feed levers (39) to the ribbon feed pawl shaft (40); remove the ribbon feed levers and remove the ribbon feed pawl shaft. Remove the reversing arm shaft (41) from the driving link lever (42).
- (18) Remove the machine screw (44) and lockwasher (45) that hold the ribbon feed brace (46) to the ribbon feed mounting bracket (50); remove the ribbon feed brace.

*b. Reassembly.*

- (1) Reassemble the ribbon supply group as indicated in figure 264; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the ribbon supply group on the perforator as described in paragraph 224b.
- (3) Adjust the ribbon supply group as described in paragraphs 478 through 483.

## **226. Removal and Replacement of Front Support Assembly**

(fig. 265)

*a. Removal.*

- (1) Remove the ribbon supply group as described in paragraph 224a.
- (2) Remove the three machine screws (1) and lockwashers (2) that hold the front support frame (66) to the perforator frame.
- (3) Remove the two machine screws (3) and lockwashers (4) that hold the bearing block (5) to the front support frame (66).
- (4) Remove the two machine screws (7 and 9) and lockwashers (8 and 10) that hold the chad tube (11) to the front support frame (66); remove the chad tube.
- (5) Drop the front support assembly far enough to allow the punch interference levers to clear the code rings; remove the front support assembly.

*b. Replacement.*

- (1) Position the front support assembly on the perforator frame so that each

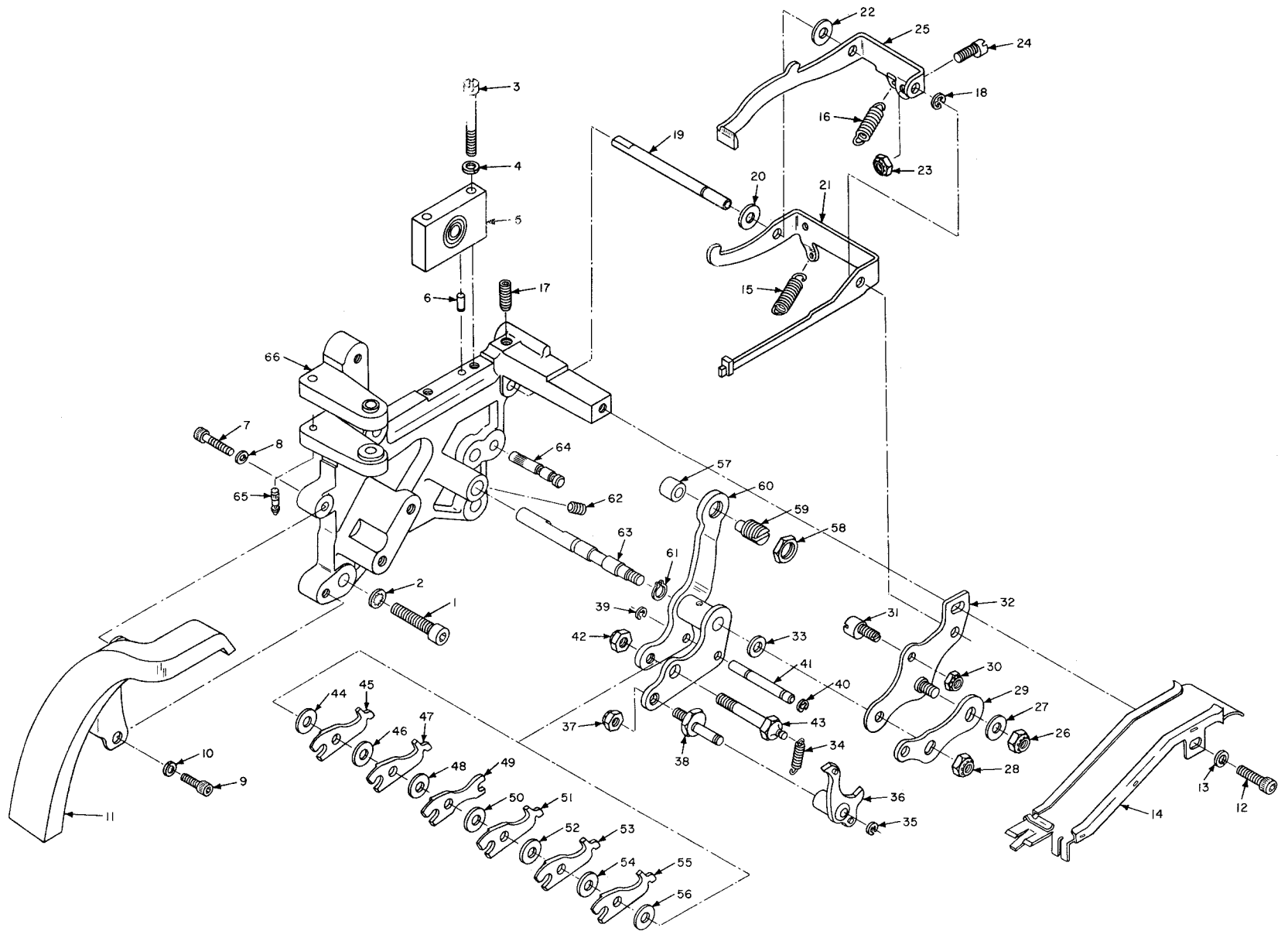


Figure 265. Front support assembly, exploded view.



1 Machine screw, 10035-01	25 Type wheel register lever, 52432	45 Code hole punch lever, 52346
2 Lockwasher, 10405	26 Self-locking hexagonal nut, 10525	46 Flat washer, 52446
3 Machine screw, 10063	27 Flat washer, 10464	47 Code hole punch lever, 52346
4 Lockwasher, 10430	28 Self-locking hexagonal nut, 10525	48 Flat washer, 52446
5 Bearing block	29 Adjusting plate 52493	49 Feed punch lever, 52347
6 Dowel	30 Self-locking hexagonal nut, 10501 (TT-178/FG and TT-179/FG only).	50 Flat washer, 52446
7 Machine screw, 10010	31 Eccentric stop, 52485 (TT-178/ FG and TT-179/FG only).	51 Code hole punch lever, 52346
8 Lockwasher, 10430	32 Support plate, 52321A	52 Flat washer, 52446
9 Machine screw, 10025	33 Flat washer, 52651	53 Code hole punch lever, 52346
10 Lockwasher, 10430	34 Feed pawl spring, 52164	54 Flat washer, 52446
11 Chad tube, 55760A	35 Retainer ring, 10960	55 Code hole punch lever, 52346
12 Machine screw, 10009	36 Feed pawl assembly, 52331A	56 Flat washer, 52446
13 Lockwasher, 10430	37 Self-locking hexagonal nut, 10501	57 Cam roller, 52354
14 Tape chute, 52489A	38 Feed pawl pivot, 52329	58 Plain hexagonal nut, 10526
15 Print hammer lever spring, 52163	39 Retainer ring, 10960	59 Eccentric stud, 52365
16 Register lever spring, 56158	40 Retainer ring, 10960	60 Punch arm assembly, 52337A
17 Setscrew, 10211	41 Code and feed hole punch lever stop pin, 52327	61 Retainer ring, 10971
18 Retainer ring, 10949	42 Self-locking hexagonal nut, 10525	62 Setscrew, 10210
19 Print and register levers shaft, 52486	43 Pivot stud, 52409	63 Punch arm pivot post, 52345
20 Flat washer, 52651	44 Flat washer, 52446	64 Register and print levers spring post
21 Print hammer lever, 52436A		65 Spring post
22 Flat washer, 52651		66 Front support frame, 55130A (includes items 3, 4, 5, 6, 64, 65) and (items 1, 2, 3, and 4 of figure 272).
23 Self-locking hexagonal nut, 10501		
24 Print hammer eccentric stop, 52485		

Figure 265.—Continued.

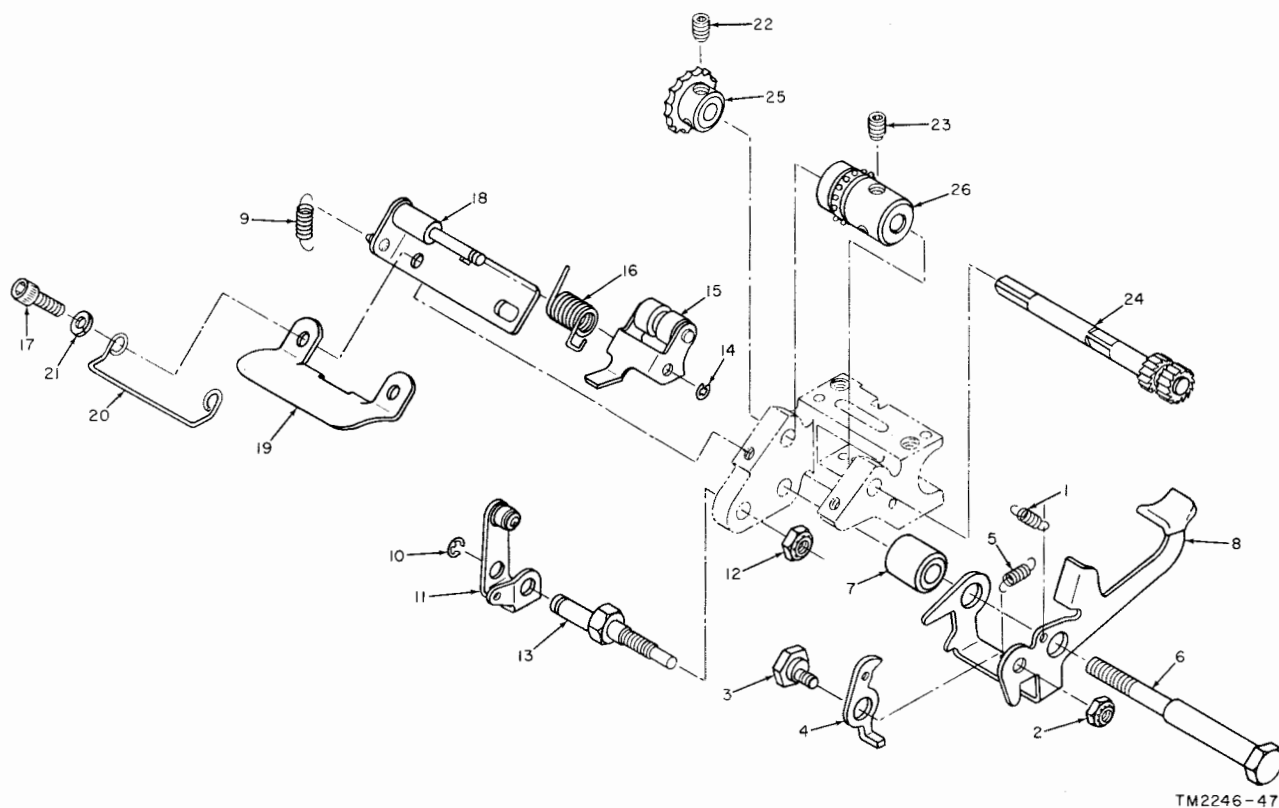
of the punch interference levers engage a code ring in the code-ring cage.

- (2) Position the chad tube (11) on the front support frame (66); secure with two machine screws (9 and 7) and two lock washers (10 and 8).
- (3) Position the bearing block (5) on the front support frame (66); secure with two machine screws (3) and lockwashers (4).
- (4) Secure the front support frame to the perforator frame with three machine screws (1) and lockwashers (2).
- (5) Install the ribbon supply group as described in paragraph 224b.

## 227. Disassembly and Reassembly of Tape Feed Mechanism (fig. 266)

### a. Disassembly.

- (1) Remove the front support assembly from the perforator as described in paragraph 226a.
- (2) Remove the back space pawl spring (1) from the back space lever (8) and from the back space pawl (4).
- (3) Remove the self-locking hexagonal nut (2) that holds the back space pawl (4) to the back space lever (8);
- remove the pivot screw (3) and back space pawl.
- (4) Remove the back space lever spring (5) from the back space lever (8) and from the terminal lug on the code die support.
- (5) Remove the back space pivot stud (6) that holds the back space lever (8) to the front support frame; remove the collar (7) and the back space lever.
- (6) Remove the detent lever spring (9) from the retainer mounting bracket (18) and from the detent lever (11).
- (7) Remove the retainer ring (10) that holds the detent lever (11) to the eccentric stud (13); remove the detent lever.
- (8) Remove the self-locking hexagonal nut (12) that holds the eccentric stud (13) to the code die support; remove the eccentric stud.
- (9) Remove the retainer ring (14) that holds the tape retainer assembly (15) to the stud on the retainer mounting bracket (18); remove the tape retainer assembly and the tape retainer spring (16).
- (10) Remove the two machine screws (17) and lockwashers (21) that hold the retainer mounting bracket (18)



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- |                                     |                                      |                              |
|-------------------------------------|--------------------------------------|------------------------------|
| 1 Back space pawl spring, 52192     | 10 Retainer ring, 10949              | 19 Tape guide, 52519         |
| 2 Self-locking hexagonal nut, 10500 | 11 Detent lever, 52445A              | 20 Tape tear wire, 56164     |
| 3 Pawl eccentric screw, 52643       | 12 Self-locking hexagonal nut, 10501 | 21 Lockwasher, 10429         |
| 4 Back space pawl, 52709            | 13 Eccentric stud, 52342             | 22 Setscrew, 10201           |
| 5 Back space lever spring, 52193    | 14 Retainer ring, 10969              | 23 Setscrew, 10201           |
| 6 Back space pivot stud, 52644      | 15 Tape retainer spring, 52126A      | 24 Ratchet wheel, 52442A     |
| 7 Collar, 52645                     | 16 Tape retainer assembly, 52422     | 25 Detent wheel, 52384       |
| 8 Back space lever, 52654           | 17 Machine screw, 10004              | 26 Tape feed sprocket, 52377 |
| 9 Detent lever spring, 52166        | 18 Retainer mounting bracket, 56298A |                              |

Figure 266. Tape feed mechanism, exploded view.

to the code die support; remove the retainer mounting bracket, tape guide (19), and tape tear wire (20).

- (11) Remove the two setscrews (22) that hold the detent wheel (25) to the ratchet wheel (24). Remove the two setscrews (23) that hold the tape feed sprocket (26) to the ratchet wheel. Remove the ratchet wheel, catching the detent wheel and tape feed sprocket as they fall from the shaft of the ratchet wheel.

*b. Reassembly.*

- (1) Position the tape feed sprocket (26) and detent wheel (25) on the code die support; install the ratchet wheel (24). Align the tapped holes of the tape feed sprocket with the two flats

on the ratchet wheel; secure with two setscrews (23). Align the tapped holes of the detent wheel with the two flats on the shaft of the ratchet wheel; secure with two setscrews (22).

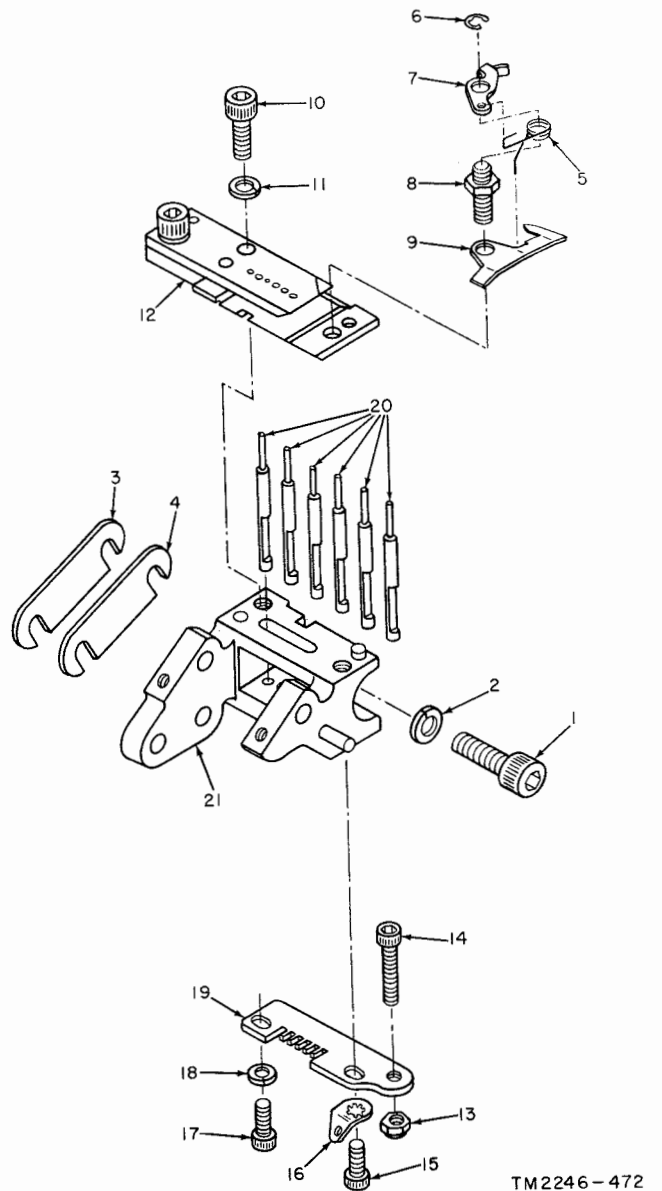
- (2) Position the retainer mounting bracket (18), tape guide (19), and tape tear wire (20) on the code die support; secure with two machine screws (17) and lockwashers (21).
- (3) Position the tape retainer spring (16) and tape retainer assembly (15) on the retainer mounting bracket (18); secure with a retainer ring (14).
- (4) Position the eccentric stud (13) on the code die support; secure with a self-locking hexagonal nut (12).
- (5) Position the detent lever (11) on the

- eccentric stud (13); secure with a retainer ring (10).
- (6) Install the detent lever spring (9) on the retainer mounting bracket (18) and on the detent lever (11).
  - (7) Position the collar (7) and the back space lever (8) on the front support frame; secure with a back space pivot stud (6).
  - (8) Install the back space lever spring (5) on the back space lever (8) and the terminal lug on the code die support.
  - (9) Position the back space pawl (4) and the pawl eccentric screw (3) on the back space lever (8); secure with a self-locking hexagonal nut (2).
  - (10) Install the back space pawl spring (1) on the back space pawl (4) and on the back space lever (8).
  - (11) Adjust the tape feed mechanism as described in paragraphs 472, 473, 476, and 477.
  - (12) Install the front support assembly on the perforator as described in paragraph 226b.

## 228. Disassembly and Reassembly of Punch and Die Support Assembly (fig. 267)

### a. Disassembly.

- (1) Remove the front support assembly from the perforator as described in paragraph 226a.
- (2) Remove the tape feed mechanism as described in paragraph 227a.
- (3) Remove the machine screws (1) and lockwashers (2) that hold the code die support (21) to the front support frame; remove the code die assembly and shims (3 and 4).
- (4) Remove the paper guide lever spring (5) from the paper guide lever (7) and from the indicator (9).
- (5) Remove the retainer ring (6) that holds the paper guide lever (7) to the paper guide lever pivot (8); remove the paper guide lever.



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- |                                   |                                      |
|-----------------------------------|--------------------------------------|
| 1 Machine screw, 10017-01         | 11 Lockwasher, 10430                 |
| 2 Lockwasher, 10431               | 12 Code die assembly, 56256A         |
| 3 Shim, 52577                     | 13 Self-locking hexagonal nut, 10500 |
| 4 Shim, 52578                     | 14 Machine screw, 10006              |
| 5 Paper guide lever spring, 56396 | 15 Machine screw, 10003              |
| 6 Retainer ring, 10969            | 16 Terminal lug, 20795               |
| 7 Paper guide lever, 56163        | 17 Machine screw, 10003              |
| 8 Paper guide lever pivot, 56161  | 18 Lockwasher, 10429                 |
| 9 Indicator, 56397                | 19 Comb, 52355                       |
| 10 Machine screw, 10009           | 20 Code punch bars, 52373A           |
|                                   | 21 Code die support, 52372           |

Figure 267. Punch and die support assembly, exploded view.

- (6) Remove the paper guide lever pivot that holds the indicator (9) to the code die assembly (12); remove the indicator.
- (7) Remove the machine screw (10) and lockwasher (11) that hold the code die assembly (12) to the code die support (21); remove the code die assembly.
- (8) Remove the self-locking hexagonal nut (13) and machine screw (14) from the comb (19). Remove the machine screw (15), terminal lug (16), machine screw (17), and lockwasher (18) that hold the comb to the bottom of the code die support (21); remove the comb and the six code punch bars (20).

*b. Reassembly.*

- (1) Reassemble the punch and die support assembly as indicated in figure 267; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the code die group as described in paragraphs 467 through 471.
- (3) Install the tape feed mechanism as described in paragraph 227b.
- (4) Install the front support assembly on the perforator as described in paragraph 226b.

## **229. Disassembly and Reassembly of Typewheel Group** (fig. 268)

*a. Disassembly.*

- (1) Remove the cotter pin (1) that holds the ribbon guide (3) to the stud on the typewheel lower bellcrank lever (13); remove the flat washer (2), ribbon guide, and flat washer (4).
- (2) Remove the machine screw (5), nut plate (6), and flat washer (7) that hold the typewheel upper bellcrank lever (8) to the reciprocating lever shaft (16); remove the typewheel upper bellcrank lever.
- (3) Remove the typewheel bellcrank lever spring (12) from the typewheel lower bellcrank lever (13) and from the

spring post on the front support frame.

- (4) Remove the machine screw (9), nut plate (10), and flat washer (11) that hold the typewheel lower bellcrank lever (13) to the reciprocating lever shaft (16); remove the typewheel lower bellcrank lever.
- (5) Remove the two setscrews (14) that hold the shaft collar (17) to the reciprocating lever shaft (16). Remove the two setscrews (15) that hold the shaft collar (18) to the reciprocating lever shaft; remove the reciprocating lever shaft, catching the shaft collars as they fall from the shaft.
- (6) Remove the assembled typewheel hub assembly (22) and typewheel (21) from the typewheel post (24). Remove the three machine screws (19) that hold the typewheel clamp plate mounting disk (20) to the typewheel hub assembly; remove the mounting disk and type wheel.
- (7) Remove the setscrew (23) that holds the typewheel post (24) to the front support frame; remove the typewheel post.

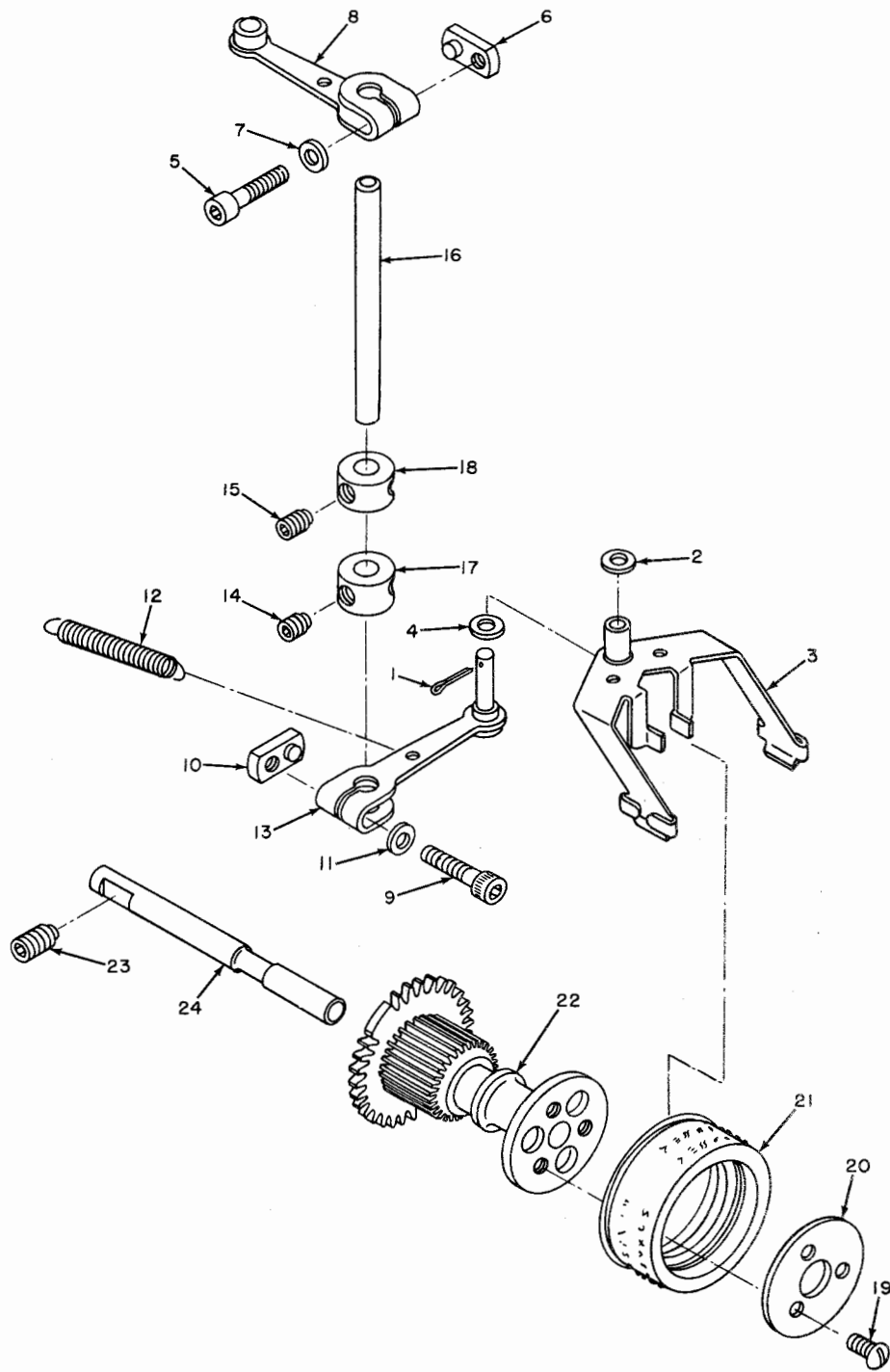
*b. Reassembly.*

- (1) Reassemble the typewheel group as indicated in figure 268; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the typewheel group as directed in paragraphs 458, 459, 460, 461, and 463.

## **230. Disassembly and Reassembly of Punch Interference Levers** (fig. 269)

*a. Disassembly.*

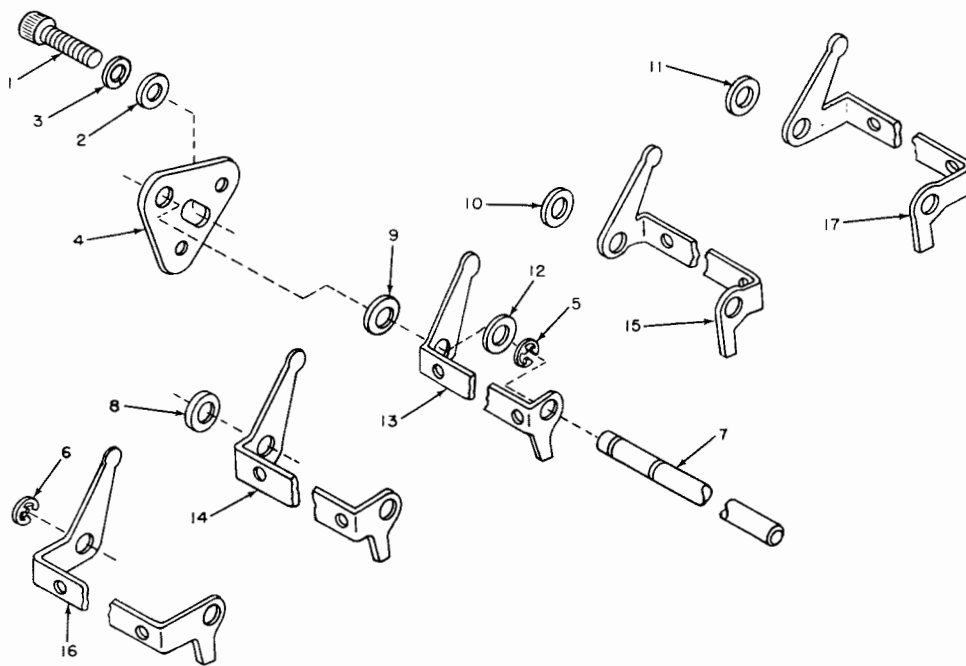
- (1) Remove the front support assembly from the perforator as described in paragraph 226a.
- (2) Remove the machine screw (1), flat washer (2), and lockwasher (3) that hold the interference lever shaft support plate (4) to the front support frame; remove the interference lever shaft support plate and the assembled punch interference levers from the front support assembly.



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- |  |  |   |
|--|--|---|
| 1 Cotter pin, 10806                      | 10 Nut plate, 50174                        | 18 Shaft collar, 50391                        |
| 2 Flat washer, 50320                     | 11 Flat washer, 10459                      | 19 Machine screw, 10305                       |
| 3 Ribbon guide, 52416A                   | 12 Typewheel bellcrank lever spring, 52161 | 20 Typewheel clamp plate mounting disk, 52407 |
| 4 Flat washer, 50320                     | 13 Typewheel lower bellcrank lever, 52480  | 21 Typewheel, 55132, (59916, TT-181/FG only)  |
| 5 Machine screw, 10006                   | 14 Setscrew, 10203                         | 22 Typewheel hub assembly, 55134A             |
| 6 Nut plate, 50174                       | 15 Setscrew, 10203                         | 23 Setscrew, 10210                            |
| 7 Flat washer, 10459                     | 16 Reciprocating lever shaft, 52414        | 24 Typewheel post, 52418                      |
| 8 Typewheel upper bellcrank lever, 52482 | 17 Shaft collar, 50391                     |   |
| 9 Machine screw, 10006                   |  |   |

Figure 268. Type wheel group, exploded view.



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- |   |   |   |
|---|---|---|
| 1 Machine screw, 10009                          | 8 Flat washer, 52430                      | 14 Punch interference lever, No. 3, 52427 |
| 2 Flat washer, 10463                            | 9 Flat washer, 52430                      | 15 Punch interference lever No. 2, 52426  |
| 3 Lockwasher, 10430                             | 10 Flat washer, 52430                     | 16 Punch interference lever No. 5, 52429  |
| 4 Interference lever shaft support plate, 52334 | 11 Flat washer, 52430                     | 17 Punch interference lever, No. 4, 52428 |
| 5 Retainer ring, 10949                          | 12 Flat washer, 50831                     |   |
| 6 Retainer ring, 10949                          | 13 Punch interference lever, No. 1, 52424 |   |
| 7 Interference lever shaft, 52452               |   |   |

Figure 269. Punch interference levers, exploded view.

(3) Remove the two retainer rings (5 and 6) that hold the punch interference levers (13, 14, 15, 16, and 17) to the interference lever shaft (7); remove the punch interference lever shaft to release the five flat washers (8, 9, 10, 11, and 12) and the five punch interference levers.

*b. Reassembly.*

- (1) Position the five punch interference levers (13, 14, 15, 16, and 17) so that the holes in the sides of the levers are aligned. Position a flat washer (8, 9, 10, 11, and 12) between each pair of punch interference levers and between the inner retaining ring groove and punch interference lever. Install the interference lever shaft (7) in the punch interference levers; secure with two retainer rings (5 and 6).
- (2) Position the assembled punch inter-

ference levers and interference lever shaft on the front support assembly. Position the interference lever shaft support plate (4) on the front support frame so that it engages the interference lever shaft; secure with a machine screw (1), lockwasher (3), and flat washer (2).

- (3) Install the front support assembly on the perforator as described in paragraph 226b.
- (4) Adjust the punch interference levers as instructed in paragraph 468.

### 231. Disassembly and Reassembly of Front Support Frame (fig. 265)

*a. Disassembly.*

- (1) Remove the front support assembly from the perforator as described in paragraph 226a.

- (2) Remove the tape feed mechanism from the front support assembly as described in paragraph 227a.
- (3) Remove the punch and die support assembly from the front support assembly as described in paragraph 228a.
- (4) Remove the typewheel group from the front support assembly as described in paragraph 229a.
- (5) Remove the punch interference levers from the front support assembly as described in paragraph 230a.
- (6) Remove the machine screw (12) and lockwasher (13) that hold the tape chute (14) to the front support frame (66); remove the tape chute.
- (7) Remove the print hammer lever spring (15) from the print hammer lever (21) and from the register and print levers spring post (64) on the front support frame (66). Remove the register lever spring (16) from the typewheel register lever (25) and from the spring post on the front support frame.
- (8) Remove the setscrew (17) that holds the print and register levers shaft (19) in the front support frame (66); remove the assembled print hammer lever (21), typewheel register lever (25), and print and register levers shaft from the front support frame.
- (9) Remove the retainer ring (18) that holds the print hammer lever (21) and typewheel register lever (25) to the print and register levers shaft; remove the print and register levers shaft (19) to release the flat washer (20), print hammer lever, flat washer (22), and typewheel register lever.
- (10) Remove the self-locking hexagonal nut (23) that holds the print hammer eccentric stop (24) to the typewheel register lever (25); remove the print hammer eccentric stop.
- (11) Remove the self-locking hexagonal nut (26), flat washer (27), and self-locking hexagonal nut (28) that hold the adjusting plate (29) to the support plate (32); remove the adjusting plate, support plate, flat washer (33), and punch arm assembly (60) from the punch arm pivot post (63).
- (12) On TT-178/FG and TT-179/FG, remove the self-locking hexagonal nut (30) that holds the eccentric stop (31) to the support plate; remove the eccentric stop.
- (13) Remove the feed pawl spring (34) from the pivot stud (43) and from the feed pawl assembly (36).
- (14) Remove the retainer ring (35) that holds the feed pawl assembly (36) to the feed pawl pivot (38); remove the feed pawl assembly.
- (15) Remove the self-locking hexagonal nut (37) that holds the feed pawl pivot (38) to the punch arm assembly (60); remove the feed pawl pivot.
- (16) Remove the two retainer rings (39) and (40) that hold the code and feed hole punch lever stop pin (41) to the punch arm assembly (60); remove the pin.
- (17) Remove the self-locking hexagonal nut (42) that holds the pivot stud (43) to the punch arm assembly (60); remove the pivot stud, catching the seven flat washers (44, 46, 48, 50, 52, 54, and 56); code hole punch levers (45, 47, 51, 53, and 55) and the feed punch lever (49) as they fall from the pivot stud.
- (18) Remove the cam roller (57) from the eccentric stud (59) on the punch arm assembly (60). Remove the plain hexagonal nut (58) and eccentric stud from the punch arm assembly.
- (19) Remove the retainer ring (61) from the punch arm pivot post (63). Remove the setscrew (62) that holds the punch arm pivot post to the front support frame; remove the punch arm pivot post.

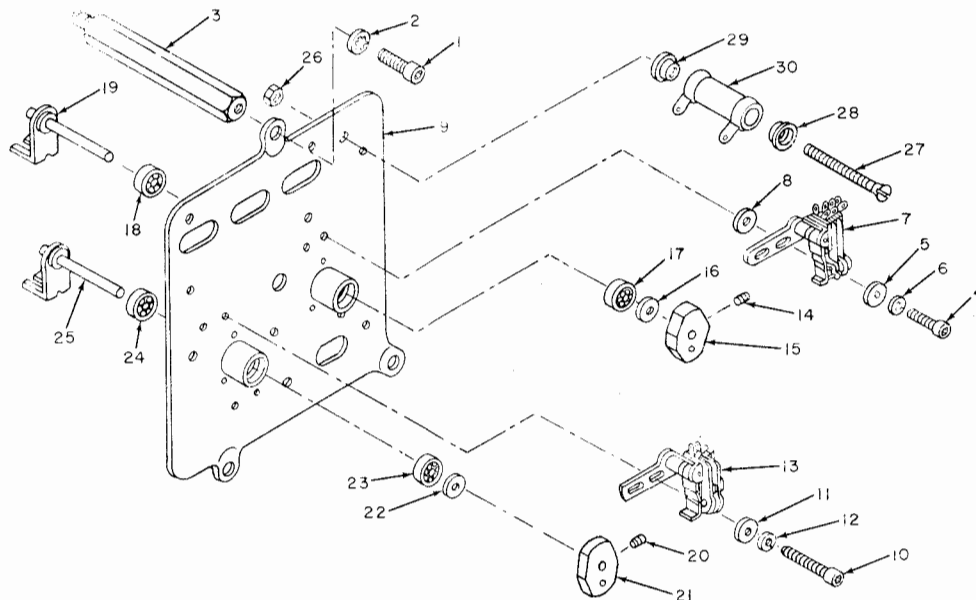
*b. Repair of Front Support Frame.* If any of the spring posts are loose or damaged, replace the damaged post. Support the front support frame near the spring post to be removed to prevent distortion to the frame when pressing out the spring posts. Press the new post into the frame at right angles to the plane of the frame. Replace a frame that has worn

threads, enlarged holes, or is otherwise damaged.

*c. Reassembly.*

- (1) Position the punch arm pivot post (63) in the front support frame (66); secure with a setscrew (62). Install the retainer ring (61) on the punch arm pivot post.
- (2) Install the eccentric stud (59) and plain hexagonal nut (58) on the punch arm assembly (60); install the cam roller (57) on the eccentric stud.
- (3) Position the seven flat washers (56, 54, 52, 50, 48, 46, and 44); five code hole punch levers (55, 53, 51, 47, and 45), and the feed punch lever (49) on the punch arm assembly (60), starting at the front of the punch arm assembly with a flat washer alternated with a code hole punch lever until four flat washers and three code hole punch levers are positioned. Follow with the feed punch lever and continue alternating flat washers and code hole punch levers until all are positioned. Position the pivot stud (43) through the punch arm assembly, flat washers, code hole punch levers, and feed punch lever; secure with a self-locking hexagonal nut (42).
- (4) Position the code and feed hole punch lever stop pin (41) in the punch arm assembly (60), making sure the stop pin engages the notch at the back of the code hole punch levers. Secure with two retainer rings (40) and (39).
- (5) Position the feed pawl pivot (38) on the punch arm assembly; secure with a self-locking hexagonal nut (37).
- (6) Position the feed pawl assembly (36) on the feed pawl pivot (38); secure with a retainer ring (35).
- (7) Install the feed pawl spring (34) on the feed pawl assembly (36) and on the pivot stud (43).
- (8) Position the eccentric stop (31) on the support plate (32); secure with a self-locking hexagonal nut (30).
- (9) Position the punch arm assembly (60), flat washer (33), support plate (32), and adjusting plate (29) on the punch arm pivot post (63); secure with a self-locking hexagonal nut (28). Secure the adjusting plate to the support plate with a flat washer (27) and self-locking hexagonal nut (26).
- (10) Position the print hammer eccentric stop (24) on the typewheel register lever (25); secure with a self-locking hexagonal nut (23).
- (11) Position the typewheel register lever (25), flat washer (22), print hammer lever (21), and flat washer (20) on the print and register levers shaft (19); secure with a retainer ring (18).
- (12) Position the assembled print and register levers shaft (19), print hammer lever (21), and typewheel register lever (25) on the front support frame (66) so that the shaft enters the hole in the front support frame; secure with a setscrew (17).
- (13) Install the register lever spring (16) on the type wheel register lever (25) and on the register and print levers spring post (64) on the front support frame (66). Install the print hammer lever spring (15) on the print hammer lever (21) and on the spring post on the front support frame.
- (14) Position the tape chute (14) on the front support frame (66); secure with a machine screw (12) and lock-washer (13).
- (15) Install the punch interference levers as described in paragraph 230*b*.
- (16) Install the typewheel group as described in paragraph 229*b*.
- (17) Install the punch and die support assembly as described in paragraph 228*b*.
- (18) Install the tape feed mechanism on the front support assembly as described in paragraph 227*b*.
- (19) Install the front support assembly on the perforator as described in paragraph 226*b*.
- (20) Adjust the front support assembly as described in paragraphs 462 through 473.





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- |   |   |  |
|---|---|--|
| 1 Machine screw, 10024  | 10 Machine screw, 10052                                   | 20 Setscrew, 10210                             |
| 2 Lockwasher, 10405   | 11 Flat washer, 10450                                     | 21 Receiving multisolenoid pulsing cam, 56010A |
| 3 Stud, 56154   | 12 Lockwasher, 10429                                      | 22 Flat washer, 50315                          |
| 4 Machine screw, 10052  | 13 Receiving multisolenoid pulsing contacts (S18), 54572A | 23 Ball-bearing, 10755                         |
| 5 Flat washer, 10450  | 14 Setscrew, 10210  | 24 Ball bearing, 10755                         |
| 6 Lockwasher, 10429   | 15 Perforator latch pulsing cam, 56008                    | 25 Camshaft, 56015A                            |
| 7 Perforator latch pulsing contacts S20, 54573A                   | 16 Flat washer, 50315                                     | 26 Self-locking hexagonal nut, 10551           |
| 8 Flat washer, 10450  | 17 Ball bearing, 10755                                    | 27 Machine screw, 10183                        |
| 9 Mounting bracket, 59972A (56060A, TT-178/FG and TT-179/FG only) | 18 Ball bearing, 10755                                    | 28 Washer, 20878                               |
|   | 19 Camshaft, 56015A                                       | 29 Washer, 20878                               |
|   |   | 30 Resistor, 20044                             |

Figure 270. Pulsing contact mounting bracket assembly, exploded view.

## 232. Removal and Replacement of Pulsing Contact Assembly

(fig. 270)

### a. Removal.

- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Remove the filter box cover (par. 233a(2)).
- (3) Remove the three machine screws (1) that hold the mounting bracket (9) to the studs (3).
- (4) Remove the pulsing contact assembly by carefully pulling it forward.

### b. Replacement.

- (1) Position the pulsing contact assembly; be sure that the arms of the camshafts (19) and (25) engage the mounting clutch setscrews on the two function shafts.
- (2) Secure the mounting bracket (9) to the three studs (3) on the perforator

frame with three machine screws (1) and lockwashers (2).

- (3) Replace the filter box cover.
- (4) Install the perforator on the perforator base as described in paragraph 196b.

## 233. Disassembly and Reassembly of Pulsing Contact Assembly Cover and Wiring

(fig. 271)

### a. Disassembly.

- (1) Remove the pulsing contact assembly from the perforator as described in paragraph 232a.
- (2) Remove the three machine screws (1) and lockwashers (2) that hold the filter box cover (3) to the mounting bracket; remove the filter box cover.
- (3) Remove the three machine screws (4) and lockwashers (5) that hold the three standoffs (6) to the mounting

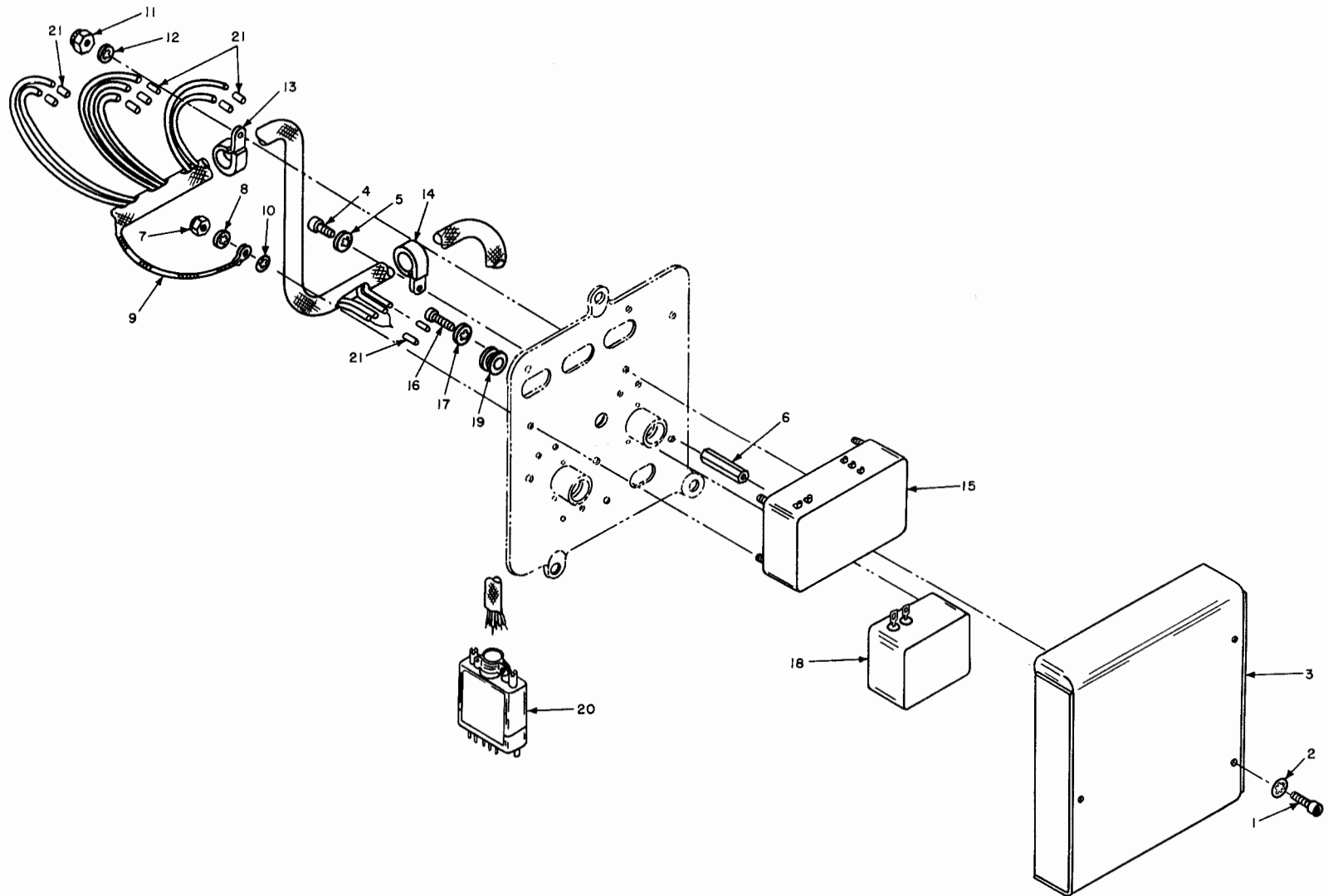


Figure 271. Pulsing contact assembly cover and wiring, exploded view.

1 Machine screw, 10064	9 Cable assembly, 56804A	16 Machine screw, 10064
2 Lockwasher, 10403	10 Lockwasher, 10404	17 Lockwasher, 10403
3 Filter box cover, 59884 (56018)*	11 Self-locking hexagonal nut, 10501	18 Electrical noise suppressor, 59882 (54574)*
4 Machine screw, 10064	12 Lockwasher, 10404	19 Grommet, 21002
5 Lockwasher, 10403	13 Electrical clamp, 20513	20 Plug, 20427
6 Standoff, 59885 (56017)*	14 Electrical clamp, 20514	21 Tubing, 20732
7 Self-locking hexagonal nut, 10501	15 Rf filter, 59881 (54586A)*	
8 Lockwasher, 10404		

\* Reference designations in parentheses are applicable to TT-178/FG and TT-179/FG.

Figure 271—Continued.

bracket; remove the standoffs. Remove the electrical clamp (14) and cable assembly (9) from the mounting bracket.

- (4) Remove the self-locking hexagonal nut (7), lockwasher (8), ground lead from the cable assembly (9), and lockwasher (10) that hold one corner of the RF filter (15) to the mounting bracket. Remove the three self-locking hexagonal nuts (11) and lockwashers (12) that hold the RF filter to the mounting plate. Remove the two electrical clamps (13) and (14) and unsolder the electrical leads from the RF filter; remove the RF filter.
- (5) Remove the two machine screws (16) and lockwashers (17) that hold the electrical noise suppressor (18) to the mounting bracket; unsolder the electrical leads and remove the electrical noise suppressor from the mounting plate.
- (6) Remove the grommet (19) from the mounting bracket.
- (7) Remove the plug (20) from the cable assembly (9).
- (8) Unsolder all the leads from the electrical contacts on the mounting bracket; remove the tubing (21) from the electrical leads. Tag all electrical leads to facilitate reassembly.

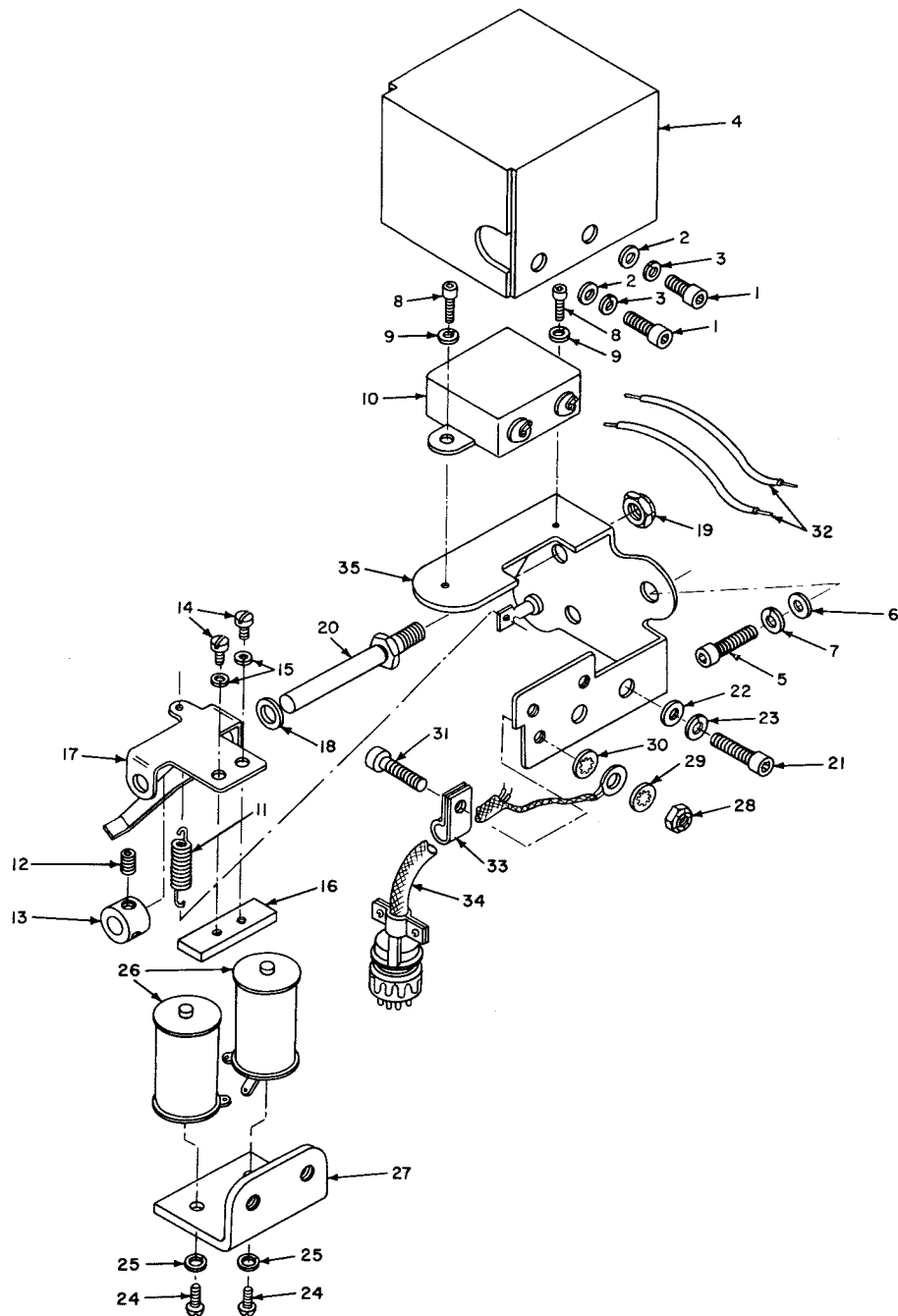
*b. Reassembly.*

- (1) Reassemble the pulsing contact assembly cover and wiring as indicated in figure 271; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the pulsing contact assembly on the perforator as described in paragraph 232*b*.

### 234. Disassembly and Reassembly of Pulsing Contact Mounting Bracket Assembly

*a. Disassembly.*

- (1) Remove the pulsing contact assembly from the perforator as described in paragraph 232*a*.
- (2) Remove the pulsing contact assembly cover and wiring as described in paragraph 233*a*.
- (3) Remove the two machine screws (4, fig. 270), flat washers (5), and lockwashers (6) that hold the perforator latch pulsing contacts (7) to the mounting bracket (9); remove the perforator latch pulsing contacts and two flat washers (8).
- (4) Remove the two machine screws (10), flat washers (11), and lockwashers (12) that hold the receiving multisolenoid pulsing contacts (13) to the mounting bracket; remove the receiving multisolenoid pulsing contacts.
- (5) Remove the setscrew (14) that holds the perforator latch pulsing cam (15) to the camshaft (19); remove the cam and flat washer (16).
- (6) Remove the ball bearing (17) from the mounting bracket (31). Remove the assembled camshaft (19) and ball bearing (18); remove the ball bearing from the camshaft.
- (7) Remove the setscrew (20) from the receiving multisolenoid pulsing cam (21); remove the receiving multisolenoid pulsing cam (21), and flat washer (22) from the camshaft (25).
- (8) Remove the assembled camshaft (25) and ball bearing (24) from the mounting bracket (31). Remove the



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- 1 Machine screw, 10001
- 2 Flat washer, 10458
- 3 Lockwasher, 10429
- 4 Perforator latch cover, 56093
- 5 Machine screw, 10009
- 6 Flat washer, 10467
- 7 Lockwasher, 10430
- 8 Machine screw, 10050
- 9 Lockwasher, 10434 (10432\*)
- 10 Capacitor C20 (20217\*)
- 11 Lever latch spring, 56079
- 12 Setscrew, 10201
- 13 Shaft collar, 50391

- 14 Machine screw, 10254
- 15 Lockwasher, 10435
- 16 Lever latch armature, 56092
- 17 Lever latch, 56094
- 18 Flat washer, 50315
- 19 Self-locking hexagonal nut, 10525
- 20 Latch lever pivot, 56099
- 21 Machine screw, 10009 (10463\*)
- 22 Flat washer, 10467
- 23 Lockwasher, 10430
- 24 Machine screw, 10350
- 25 Lockwasher, 10425 (10435\*)

- 26 Perforator latch coil, 20303 (20308\*)
- 27 Perforator latch coil bracket, 56096A
- 28 Self-locking hexagonal nut, 10500
- 29 Lockwasher, 10403
- 30 Lockwasher, 10403
- 31 Machine screw, 10064
- 32 Wire, 22099
- 33 Clamp, 20519
- 34 Electrical cable P34, 56131A (59851A\*)
- 35 Perforator latch bracket, 56085A (56198A\*)

\* Part reference designation applies to TT-178A/FG, TT-179A/FG, and TT-181/FG.

Figure 272. Perforator latch, exploded view.

ball bearing (23) from the mounting bracket. Remove the ball bearing (24) from the camshaft (25).

- (9) Remove the self-locking hexagonal nut (26) and machine screw (27) securing the resistor (30) to the mounting bracket (9); remove the resistor (30) and two washers (28 and 29).
- (10) Remove the three studs (3) from the perforator frame.

*b. Reassembly*

- (1) Reassemble the pulsing contact mounting bracket assembly as indicated in figure 270; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the pulsing contact assembly cover and wiring (par. 233).
- (3) Install the pulsing contact assembly on the perforator as described in paragraph 232.
- (4) Adjust the pulsing contact assembly as described in paragraph 492.

### **235. Disassembly and Reassembly of Perforator Latch**

(fig. 272)

*a. Disassembly.*

- (1) Remove the two machine screws (1), flat washers (2), and lockwashers (3) holding the perforator latch cover (4) to the perforator latch bracket (35); remove the perforator latch cover.
- (2) Remove the two machine screws (5), flat washers (6), and lockwashers (7) attaching the perforator latch bracket (35) to the frame; remove the assembled perforator latch.
- (3) Remove the two machine screws (8) and lockwashers (9) that hold the capacitor (10) to the perforator latch bracket (35). Unsolder the electrical wires (32) and remove the capacitor (10).
- (4) Unhook the ends of the lever latch spring (11) from the spring post on the perforator latch bracket (35) and from the tab on the lever latch (17); remove the lever latch spring.

- (5) Loosen the two set screws (12) that attach the shaft collar (13) to the latch lever pivot (20); remove the shaft collar, assembled lever latch (17), and lever latch armature (16), and the flat washer (18) from the pivot.

- (6) Remove the two machine screws (14) and lockwashers (15) that attach the lever latch armature (16) to the lever latch (17); remove the armature.

- (7) Remove the self-locking hexagonal nut (19) that attaches the latch lever pivot (20) to the perforator latch bracket (35); remove the latch lever pivot.

- (8) Remove the two machine screws (21), flat washer (22), and lockwashers (23) securing the perforator latch coil bracket (27) to the perforator latch bracket (35). Unsolder the cable leads from the perforator latch coils (26) and remove the assembled coils and perforator latch coil bracket (27).

- (9) Remove the two machine screws (24) and lockwashers (25) that attach the perforator latch coils (26) to the perforator latch coil bracket (27); remove the coils (26).

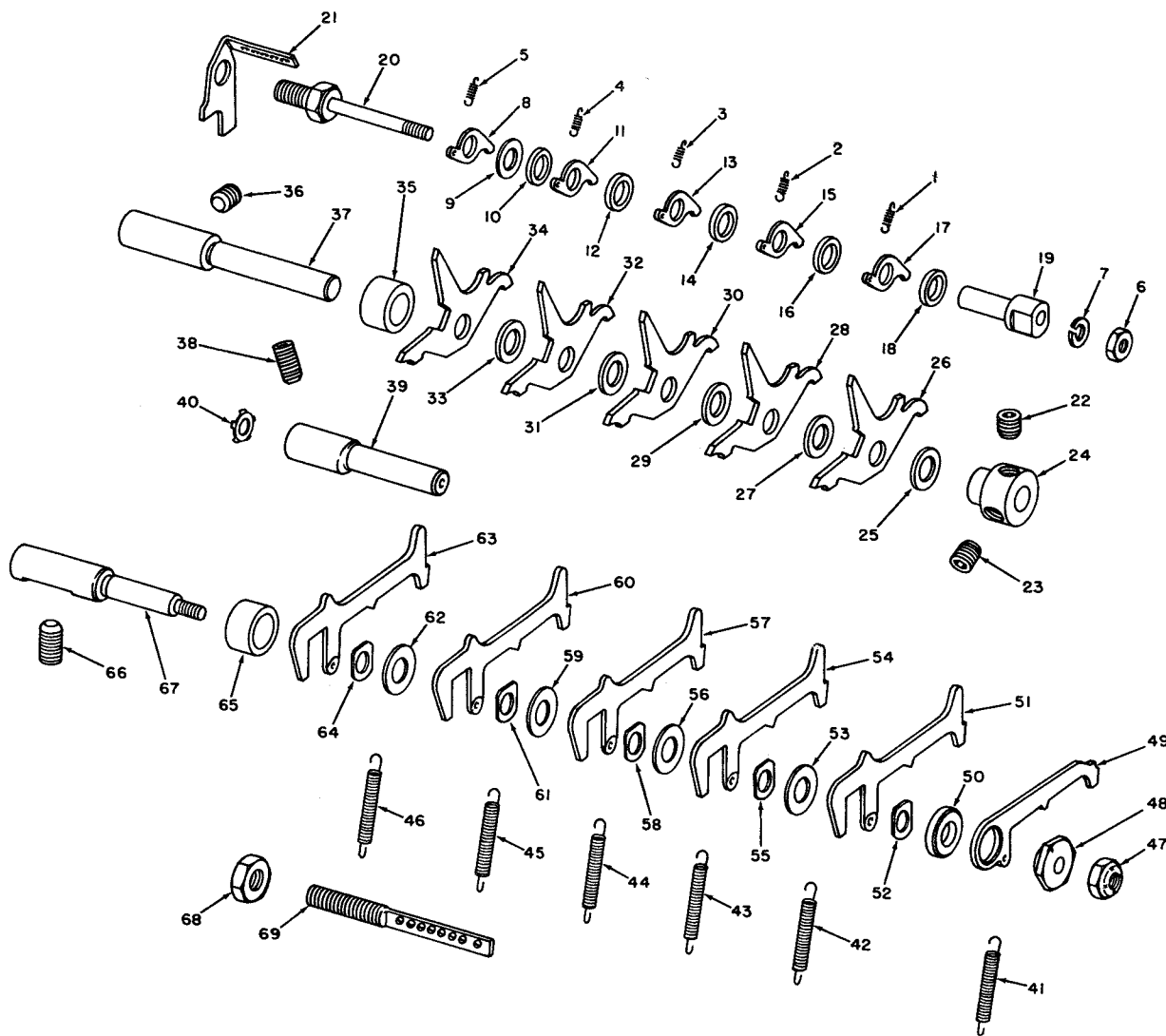
- (10) Remove the self-locking hexagonal nut (28), two lockwashers (29 and 30), and the machine screw (31) that attach the clamp (33) and the cable shield ground terminal to the perforator latch bracket (35); remove the electrical cable (34). Remove the clamp from the electrical cable.

*b. Reassembly.*

- (1) Reassemble the perforator latch assembly as indicated in figure 272; the sequence for assembling the parts is the reverse of the disassembly sequence.

- (2) Adjust the perforator latch as described in paragraphs 448 thru 451.

- (3) Position the perforator latch cover (4) on the perforator latch bracket (35); attach with two lockwashers (3), flat washers (2), and machine screw (1).



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- |   |   |  |
|---|---|--|
| 1 Y-lever detent spring, 55009            | 26 Selector Y-lever, 53540A (includes items 28, 30, 32, and 34) | 49 Selector camshaft locking lever, 50014                    |
| 2 Y-lever detent spring, 55009            | 27 Flat washer, 50148   | 50 Flat washer, 50053  |
| 3 Y-lever detent spring, 55009            | 28 Selector Y-lever   | 51 Selector lever, 51068A (includes items 54, 57, 60 and 63) |
| 4 Y-lever detent spring, 55009            | 29 Flat washer, 50148   | 52 Bearing, 51604A (includes items 55, 58, 61 and 64)        |
| 5 Y-lever detent spring, 55009            | 30 Selector Y-lever   | 53 Flat washer, 50147  |
| 6 Plain hexagonal nut, 10504              | 31 Flat washer, 50148   | 54 Selector lever  |
| 7 Lockwasher, 10434                       | 32 Selector Y-lever   | 55 Bearing   |
| 8 Y-lever detent, 55004                   | 33 Flat washer, 50148   | 56 Flat washer, 50147  |
| 9 Spacer, 55076                           | 34 Selector Y-lever   | 57 Selector lever  |
| 10 Detent spacer, 55001                   | 35 Selector lever pivot post collar, 51416                      | 58 Bearing   |
| 11 Y-lever detent, 55004                  | 36 Setscrew, 10210  | 59 Flat washer, 50147  |
| 12 Detent spacer, 55001                   | 37 Y-lever pivot post stud, 53269                               | 60 Selector lever  |
| 13 Y-lever detent, 55004                  | 38 Setscrew, 10247  | 61 Bearing   |
| 14 Detent spacer, 55001                   | 39 Y-lever stop, 50152  | 62 Flat washer, 50147  |
| 15 Y-lever detent, 55004                  | 40 Retainer ring, 10929   | 63 Selector lever  |
| 16 Detent spacer, 55001                   | 41 Selector lever spring, 50902                                 | 64 Bearing   |
| 17 Y-lever detent, 55004                  | 42 Selector lever spring, 50902                                 | 65 Selector lever pivot post collar, 51416                   |
| 18 Detent spacer, 55001                   | 43 Selector lever spring, 50902                                 | 66 Setscrew, 10211   |
| 19 Y-lever detent eccentric sleeve, 55007 | 44 Selector lever spring, 50902                                 | 67 Selector lever pivot stud, 53268                          |
| 20 Y-lever detent pivot, 55008            | 45 Selector lever spring, 50902                                 | 68 Plain hexagonal nut, 10509                                |
| 21 Y-lever detent spring bracket, 55002   | 46 Selector lever spring, 50902                                 | 69 Selector lever spring post, 50325                         |
| 22 Setscrew, 10209                        | 47 Self-locking hexagonal nut, 10500                            |  |
| 23 Setscrew, 10209                        | 48 Selector camshaft lever eccentric, 50146                     |  |
| 24 Y-lever retaining collar, 55006        |   |  |
| 25 Flat washer, 50148                     |   |  |

Figure 273. Y-levers and selector levers, exploded view.

## 236. Disassembly and Reassembly of Y- and Selector Levers

(fig. 273)

### a. Disassembly.

- (1) Remove the Y-lever detent springs (1, 2, 3, 4, and 5) from the Y-lever detent spring bracket (21) and from the Y-lever detents (8, 11, 13, 15, and 17).
- (2) Remove the plain hexagonal nut (6) and lockwasher (7) securing the Y-lever detent eccentric sleeve (19) to the Y-lever detent pivot (20); slide the assembled eccentric sleeve and detents from the Y-lever detent pivot.
- (3) Remove the Y-lever detents, flat washers (9), and detent spacers (10, 12, 14, 16, and 18) alternately from the Y-lever detent eccentric sleeve (19).
- (4) Remove the Y-lever detent pivot (20) from the frame of the perforator; remove the Y-lever detent spring bracket (21).
- (5) Remove the two setscrews (22 and 23) from the Y-lever retaining collar (24); remove the retaining collar. Remove the flat washers (25, 27, 29, 31, and 33) and the selector Y-levers (26, 28, 30, 32, and 34) from the Y-lever pivot post stud (37). Remove the selector lever pivot post collar (35) from the Y-lever pivot post stud.
- (6) Remove the setscrew (36) that holds the Y-lever pivot post stud (37) in the frame of the perforator; remove the Y-lever pivot post stud.
- (7) Remove the setscrew (38) that holds the Y-lever stop (39) in the frame of the perforator; remove the Y-lever stop. Remove the retainer ring (40) from the Y-lever stop (39).
- (8) Remove the selector lever springs (41-46) from the selector lever spring post (69) and from the selector camshaft locking lever (49), and the five selector levers (51, 54, 57, 60, and 63).
- (9) Remove the self-locking hexagonal nut (47), the selector camshaft lever eccentric (48), and the selector cam-

shaft locking lever (49) from the selector lever pivot stud (67).

- (10) Remove the flat washers (50, 53, 56, 59, and 62), selector levers (51, 54, 57, 60, and 63), and the sliding bearings (52, 55, 58, 61, and 64) alternately. Remove the selector lever pivot post collar (65) from the selector lever pivot stud (67).
- (11) Remove the setscrew (66) holding the selector lever pivot stud (67) in the frame; remove the selector lever pivot stud.
- (12) Remove the plain hexagonal nut (68) from the selector lever spring post (69); remove the post.

### b. Reassembly.

*Note.* If any of the Y-levers, selector levers, or bearings are damaged and must be replaced, replace a complete set. These items are machined as matched sets. The unit will not function properly when operated with unmatched sets.

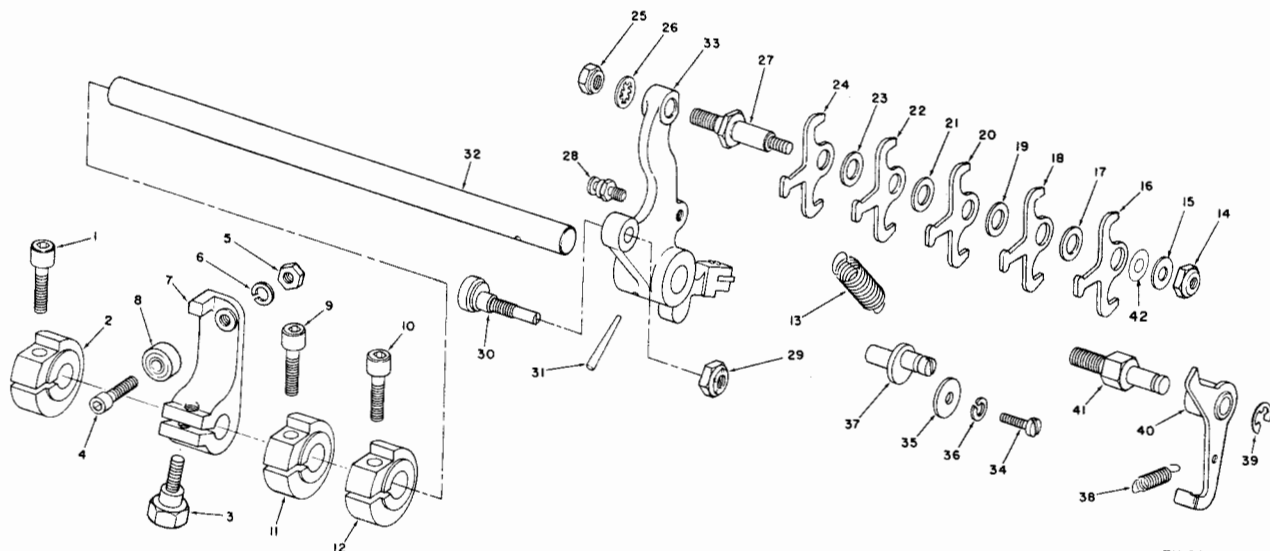
- (1) Reassemble the Y-levers and selector levers as indicated in figure 273; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the selector levers and selector Y-levers as described in paragraphs 409, 410, 411, 412, and 438.

## 237. Removal and Replacement of Sequential Transfer Lever Shaft

(fig. 274)

### a. Removal.

- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Remove the pulsing contact assembly from the perforator as described in paragraph 232a.
- (3) Loosen the machine screw (1) that holds the shaft collar (2) to the transfer lever shaft (32); remove the shaft collar.
- (4) Remove the function clutch latch screw (3) that holds the clutch latch arm (7) to the transfer lever shaft; remove the clutch latch arm.
- (5) Loosen the machine screws (9 and 10) from the shaft collars (11 and 12).



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- |                                      |  |  |
|--------------------------------------|--|--|
| 1. Machine screw, 10010              | 16 T-lever, 56766A (includes items 18, 20, 22, and 24) | 31 Taper pin   |
| 2 Shaft collar, 53973                | 17 Flat washer, 50148                                  | 32 Transfer lever shaft, 54745A (includes items 31 and 33) |
| 3 Function clutch latch screw 52176  | 18 T-lever   | 33 Transfer lever  |
| 4 Machine screw, 10000               | 19 Flat washer, 50148                                  | 34 Machine screw, 55511                                    |
| 5 Plain hexagonal nut, 10504         | 20 T-lever   | 35 Flat washer, 50839                                      |
| 6 Lockwasher, 10434                  | 21 Flat washer, 50148                                  | 36 Lockwasher, 10429                                       |
| 7 Clutch latch arm, 50535            | 22 T-lever   | 37 Transfer lever spring post eccentric, 56076             |
| 8 Ball bearing, 10754                | 23 Flat washer, 50148                                  | 38 Transfer lever trip latch spring, 50904                 |
| 9 Machine screw, 10010               | 24 T-lever   | 39 Retainer ring, 10949                                    |
| 10 Machine screw, 10010              | 25 Plain hexagonal nut, 50651                          | 40 Transfer lever trip latch, 50020A                       |
| 11 Shaft collar, 53973               | 26 Lockwasher, 10404                                   | 41 Transfer lever latch pivot stud, 52319                  |
| 12 Shaft collar, 53973               | 27 T-lever pivot stud, 50650                           | 42 Shim: .002-in., 57072; .003-in., 57073                  |
| 13 Transfer lever spring, 55674      | 28 Transfer lever spring post, 50649                   |  |
| 14 Self-locking hexagonal nut, 10500 | 29 Self locking hexagonal nut, 10501                   |  |
| 15 Flat washer, 50414                | 30 Transfer lever roller stud, 56185                   |  |

Figure 274. Sequential transfer lever shaft, exploded view.

- (6) Remove the transfer lever spring (13) from the transfer lever spring post (28) on the transfer lever (33) and from the spring post on the perforator frame.
- (7) Remove the assembled transfer lever shaft, transfer lever (33), and T-levers by pulling them forward; catch the shaft collars (11 and 12) as they fall from the transfer lever shaft.

b. Disassembly.

- (1) Remove the machine screw (4), plain hexagonal nut (5), and lockwasher (6) that hold the ball bearing (8) to the clutch latch arm (7); remove the ball bearing.
- (2) Remove the self-locking hexagonal nut (14), shims (42), and flat washer (15) that hold the T-levers (16, 18, 20, 22, and 24) to the T-lever pivot stud (27) on the transfer lever (33);

alternately remove the T-levers and flat washers (17, 19, 21, and 23).

- (3) Remove the plain hexagonal nut (25) and lockwasher (26) that hold the T-lever pivot stud (27) to the transfer lever (33); remove the T-lever pivot stud.
- (4) Remove the transfer lever spring post (28) from the transfer lever (33).
- (5) Tap out the taper pin (31) that holds the transfer lever (33) to the transfer lever shaft (32); remove the transfer lever shaft.
- (6) Remove the machine screw (34), flat washer (35), and lockwasher (36) that hold the transfer lever spring post eccentric (37) to the perforator frame; remove the transfer lever spring post eccentric.
- (7) Remove the transfer lever trip latch



spring (38) from the transfer lever trip latch (40) and from the spring post on the perforator frame.

- (8) Remove the retainer ring (39) that holds the transfer lever trip latch (40) to the transfer lever latch pivot stud (41); remove the transfer lever trip latch. Remove the transfer lever latch pivot stud from the perforator frame.

*c. Replacement.*

*Note.* If any of the T-levers are damaged and need to be replaced, replace all five of the T-levers. These levers are supplied in matched sets, and will not function properly when operated in unmatched sets.

- (1) Reassemble the sequential transfer lever shaft as indicated in figure 274; the sequence for assembling and replacing the parts is the reverse of the sequence described in *b* and *a* above.
- (2) Adjust as described in paragraphs 413, 414, 421, 422, 424, 425, and 426.

### **238. Disassembly and Reassembly of Perforator Selector Camshaft**

(fig. 222)

*a. Disassembly.*

- (1) Remove the rangefinder as described in paragraph 212*a*.
- (2) Remove the two machine screws (1) and lockwashers (2) that hold the selector camshaft to the perforator frame.
- (3) Remove the two setscrews (3) that hold the friction clutch disk (6) to the selector camshaft (16).
- (4) Loosen the machine screw (4) that holds the friction clutch adjusting collar (13) to the drive shaft collar (12); turn the friction clutch adjusting collar off the drive shaft collar.
- (5) Remove the two setscrews (5) that hold the drive shaft collar (12) to the selector camshaft (16). Remove the selector camshaft by pulling it forward, free of the perforator frame, catching the friction clutch disk (6), friction plate (7), driving disk (8), friction plate (9), friction clutch plate (10), friction clutch spring (11), drive shaft collar (12), and friction

clutch adjusting collar as they fall from the selector camshaft.

- (6) Remove the retainer (14) that holds the ball bearing (15) to the selector camshaft (16); remove the ball bearing.

*b. Reassembly.*

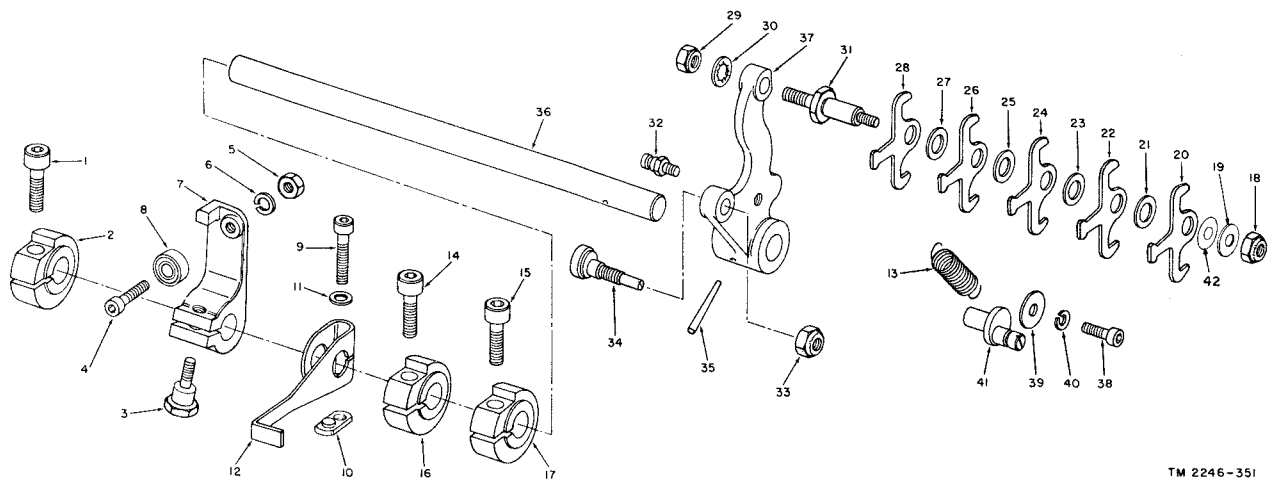
- (1) Reassemble the perforator selector camshaft as indicated in figure 222; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the rangefinder as described in paragraph 212*b*.
- (3) Adjust the selector camshaft friction clutch as described in paragraph 427.

### **239. Removal and Replacement of Simultaneous Transfer Lever Shaft**

(fig. 272)

*a. Removal.*

- (1) Remove the perforator from the perforator base as described in paragraph 196*a*.
- (2) Remove the pulsing contact assembly as described in paragraph 232*a*.
- (3) Remove the machine screw (1) that holds the shaft collar (2) to the transfer lever shaft (36); remove the shaft collar.
- (4) Remove the function clutch latch screw (3) that holds the clutch latch arm (7) to the transfer lever shaft (36); remove the clutch latch arm.
- (5) Remove the machine screw (9), nut plate (10), and flat washer (11) that hold the clutch release lever (12) to the transfer lever shaft (36); remove the clutch release lever.
- (6) Loosen the two machine screws (14) and (15) that hold the shaft collars (16 and 17) to the transfer lever shaft (36).
- (7) Remove the transfer lever spring (13) from the transfer lever spring post (32) on the transfer lever (37) and from the transfer lever spring post eccentric (41).
- (8) Remove the assembled transfer lever shaft (36), transfer lever (37), and T-levers by sliding them out of the



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- |   |  |  |
|---|--|--|
| 1 Machine screw, 10010  | 15 Machine screw, 10010                                | 30 Lockwasher, 10404                                       |
| 2 Shaft collar, 53973   | 16 Shaft collar, 53973                                 | 31 T-lever pivot stud, 50650                               |
| 3 Function clutch latch screw, 52176                            | 17 Shaft collar, 53973                                 | 32 Transfer lever spring post, 50649                       |
| 4 Machine screw, 10000  | 18 Self-locking hexagonal nut, 10500                   | 33 Self-locking hexagonal nut, 10501                       |
| 5 Plain hexagonal nut, 10504                                    | 19 Flat washer, 50414                                  | 34 Transfer lever roller stud, 56185                       |
| 6 Lockwasher, 10434   | 20 T-lever, 56766A (includes items 22, 24, 26, and 28) | 35 Taper pin   |
| 7 Clutch latch arm, 50535                                       | 21 Flat washer, 50148                                  | 36 Transfer lever shaft, 54740A (includes items 35 and 37) |
| 8 Ball bearing, 10754   | 22 T-lever   | 37 Transfer lever  |
| 9 Machine screw, 10041  | 23 Flat washer, 50148                                  | 38 Machine screw, 10003                                    |
| 10 Nut plate, 50174   | 24 T-lever   | 39 Flat washer, 50839                                      |
| 11 Flat washer, 10459   | 25 Flat washer, 50148                                  | 40 Lockwasher, 10429                                       |
| 12 Clutch release lever, 59977 (56032, TT-178/FG and TT-179/FG) | 26 T-lever   | 41 Transfer lever spring post eccentric, 56076             |
| 13 Transfer lever spring, 50903                                 | 27 Flat washer, 50148                                  | 42 Shim: .002-in., 57072; .003-in., 57073                  |
| 14 Machine screw, 10010   | 28 T-lever   |  |
|   | 29 Plain hexagonal nut, 50651                          |  |

Figure 275. Simultaneous transfer lever shaft, exploded view.

bearings toward the front of the perforator, catching the shaft collars (16 and 17) as they fall from the shaft.

*b. Disassembly.*

- (1) Remove the machine screw (4), plain hexagonal nut (5), and lockwasher (6) that hold the ball bearing (8) to the clutch latch arm (7); remove the ball bearing.
- (2) Remove the self-locking hexagonal nut (18), shims (42), and flat washer (19) that hold the T-levers (20, 22, 24, 26, and 28) to the T-lever pivot stud (31) on the transfer lever (37); remove the T-levers and flat washers (21, 23, 25, and 27) alternately.
- (3) Remove the plain hexagonal nut (29) and lockwasher (30) that hold the T-lever pivot stud (31) to the transfer lever (37); remove the T-lever pivot stud.
- (4) Remove the transfer lever spring post (32) from the transfer lever (37).

- (5) Remove the self-locking hexagonal nut (33) that holds the transfer lever roller stud (34) to the transfer lever (37); remove the transfer lever roller stud.

- (6) Remove the taper pin (35) that holds the transfer lever (37) to the transfer lever shaft (36); remove the transfer lever.

- (7) Remove the machine screw (38), flat washer (39), and lockwasher (40) that hold the transfer lever spring post eccentric (41) to the perforator frame; remove the transfer lever spring post eccentric.

*c. Replacement.*

*Note.* If any of the T-levers are damaged and need to be replaced, replace all five of the T-levers. These levers are supplied in matched sets, and will not function properly when operated in unmatched sets.

- (1) Reassemble the simultaneous transfer lever shaft as indicated in figure 275; the sequence for assembling and re-

placing the parts is the reverse of the sequence described in *b* and *a* above.

- (2) Insert the assembled transfer lever shaft (36), transfer lever (37), and T-levers into the front frame bearing of the perforator. Install the two shaft collars (16 and 17) on the end of the shaft and slide the transfer lever shaft into position on the perforator.
- (3) Install the transfer lever spring (13) on the transfer lever spring post (32) on the transfer lever (37) and on the transfer lever spring post eccentric (41) on the perforator frame.
- (4) Tighten the machine screws (14 and 15) to secure the shaft collars (16 and 17) to the transfer lever shaft.
- (5) Position the clutch release lever (12) on the transfer lever shaft (36); secure with a machine screw (9), flat washer (11), and nut plate (10).
- (6) Position the clutch latch arm (7) on the transfer lever shaft (36); secure with the function clutch latch screw (3).
- (7) Position the shaft collar (2) on the transfer lever shaft (36); secure with a machine screw (1).
- (8) Install the pulsing contact assembly as described in paragraph 232*b*.
- (9) Install the perforator on the perforator base as described in paragraph 196*b*.
- (10) Adjust the transfer lever shaft as described in paragraphs 432, 433, 438, 442, 449, 450, 451, and 484.

## 240. Disassembly and Reassembly of Main Shaft

(fig. 276)

### *a. Disassembly.*

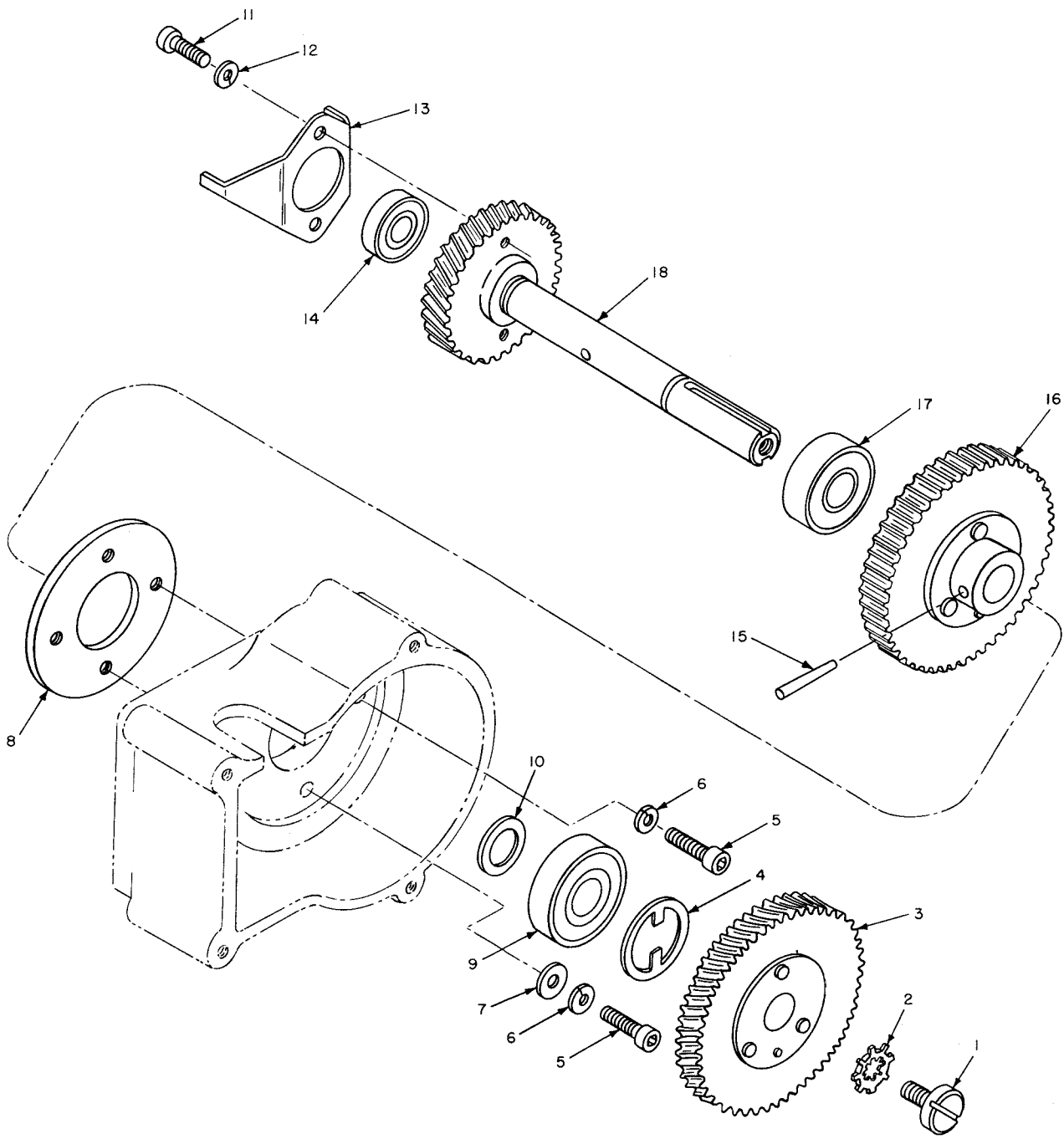
- (1) Remove the perforator from the perforator base as described in paragraph 196*a*.
- (2) Remove the motor as described in paragraph 208*a*.
- (3) Remove the selector camshaft as described in paragraph 238*a*.
- (4) Remove the machine screw (1) and lockwasher (2) that hold the worm

gear (3) to the main shaft (18); remove the worm gear and five gear keys (4).

- (5) Remove the four machine screws (5), four lockwashers (6), and two flat washers (7) that hold the bearing plate (8) and the ball bearing (9) to the gearcase; remove the ball bearing and flat washer (10).
- (6) Tilt the chassis, allowing it to rest on the right side. Remove the two machine screws and lockwashers that hold the bearing cap to the motor support frame; remove the bearing cap.
- (7) Remove the assembled main shaft, power shaft gear (16), and ball bearing (17).
- (8) Remove the two machine screws (11) and lockwashers (12) that hold the friction clutch drive assembly (13) to the gear on the main shaft (18); remove the friction clutch drive assembly and ball bearing (14).
- (9) Tap out the taper pin (15) that holds the power shaft gear (16) to the main shaft (18); remove the power shaft gear and ball bearing (17).

### *b. Reassembly.*

- (1) Position the ball bearing (17) and the power shaft gear (16) on the main shaft (18); secure the power shaft gear with a taper pin (15).
- (2) Position the ball bearing (14) in the bearing seat on the gear end of the main shaft (18); position the friction clutch drive assembly (13) on the main shaft; secure with two machine screws (11) and lockwashers (12). Stake the friction clutch drive assembly over the bearing.
- (3) Position the bearing plate (8) on the main shaft (18). Insert the rear end of the main shaft in the bearing seat opening in the gearcase and position the flat washer (10) and ball bearing (9) on the end of the main shaft.
- (4) Position the bearing cap on the ball bearing (17) and secure to the motor support frame with two machine screws and lockwashers.
- (5) Position the ball bearing (9) well into the bearing seat of the gearcase and



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- |                                  |   |                            |
|----------------------------------|---|----------------------------|
| 1 Machine screw, 50207           | 8 Bearing plate, 54743                      | 14 Ball bearing, 10753     |
| 2 Lockwasher, 10406              | 9 Ball bearing, 10758                       | 15 Taper pin, 10852        |
| 3 Worm gear (See chart, par. 19) | 10 Flat washer, 50746                       | 16 Power shaft gear, 54731 |
| 4 Machine key, 54566             | 11 Machine screw, 10004                     | 17 Ball bearing, 10763     |
| 5 Machine screw, 10005           | 12 Lockwasher, 10429                        | 18 Main shaft, 54734       |
| 6 Lockwasher, 10429              | 13 Friction clutch drive assembly,<br>54732 |                            |
| 7 Flat washer, 10450             |   |                            |

Figure 276. Perforator main shaft, exploded view.

- position the bearing plate (8) on the gearcase; secure both with four machine screws (5), four lockwashers (6), and two flat washers (7).
- (6) Position five gear keys (4) and worm gear (3) on the main shaft (18); secure with a machine screw (1) and lockwasher (2).

*Note.* Make sure the worm gear installed on the main shaft is correct for the operating speed desired (see chart, par. 19). Check that the worm gear is marked for the same speed as the mating worm gear on the motor armature shaft.

- (7) Install the selector camshaft as instructed in paragraph 238*b*.
- (8) Install the motor as instructed in paragraph 208*b*.
- (9) Install the perforator on the perforator base as described in paragraph 196*b*.

## 241. Disassembly and Reassembly of Code Actuated Switch Function Shaft

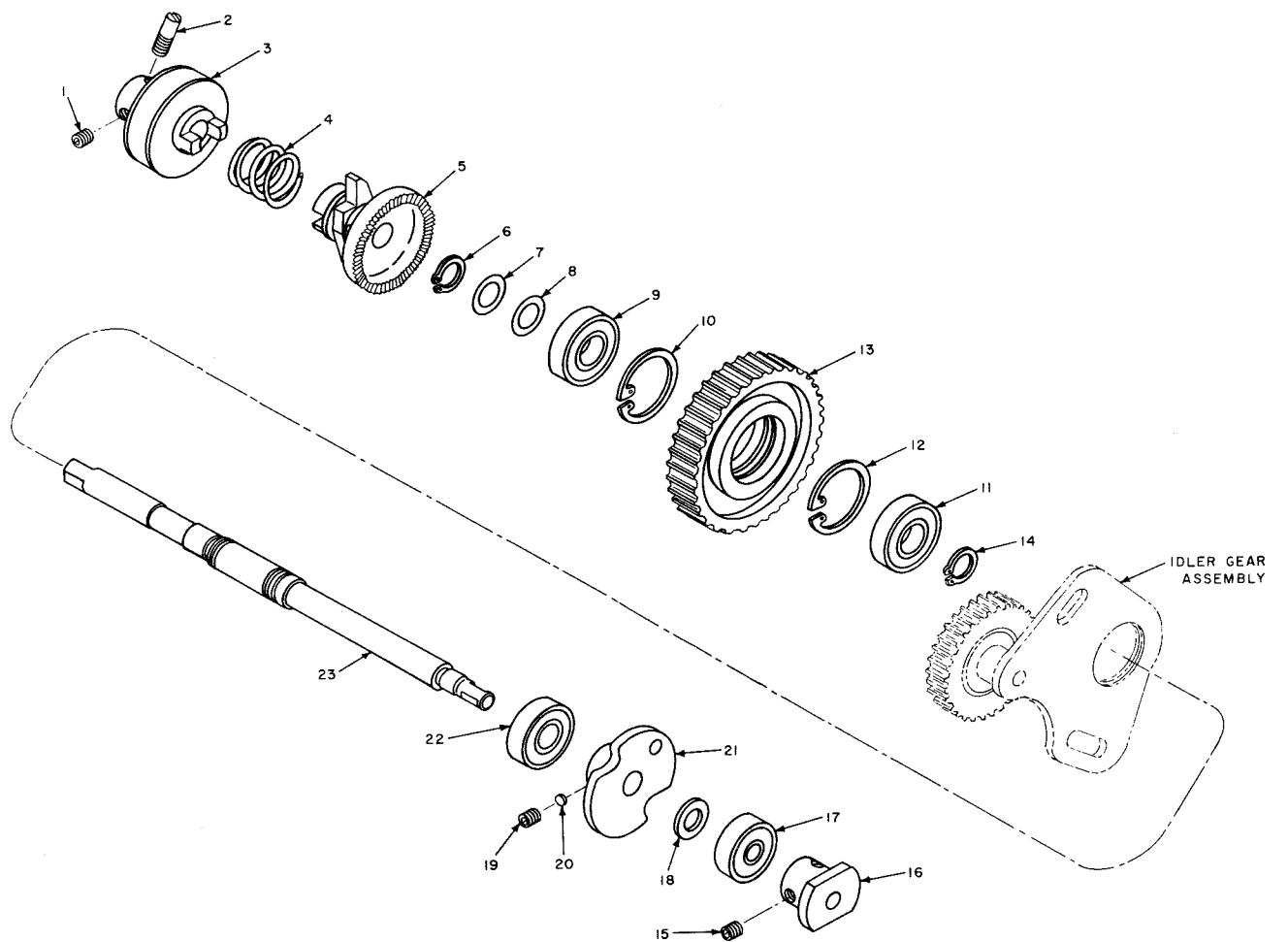
### *a. Disassembly.*

- (1) Remove the perforator from the perforator base as described in paragraph 196*a*.
- (2) Remove the pulsing contact assembly as described in paragraph 232*a*.
- (3) Remove the sequential transfer lever shaft as described in paragraph 237*a*.
- (4) Remove the setscrew (1, fig. 277) and the mounting clutch setscrew (2) that hold the clutch coupling (3) to the code actuated switch function shaft (23); remove the clutch coupling. Remove the clutch spring (4) and the sliding drum clutch (5) from the code actuated switch function shaft.
- (5) Remove the retainer ring (6) that holds the function camshaft gear (13) to the code actuated switch function shaft (23); remove the two flat washers (7 and 8) and the assembled ball bearings (9 and 11) and function camshaft gear.
- (6) Remove the two ball bearings (9 and 11) and retainer rings (10 and 12) from the function camshaft gear (13).

- (7) Remove the retainer ring (14) from the code actuated switch function shaft (23).
- (8) Remove the two setscrews (15) that hold the transfer lever cam (16) to the code actuated switch function shaft (23); remove the transfer lever cam.
- (9) Remove the two machine screws (47, fig. 251), flat washers (48), and lockwashers (49) that hold the ball bearing (17, fig. 277) to the bearing seat in the perforator frame; remove the ball bearing and flat washer (18).
- (10) Remove the two setscrews (19) and mounting seats (20) that hold the code actuated switch cam (21) to the code actuated switch function shaft (23); remove the assembled function shaft and ball bearing (22) by pulling the function shaft to the front; catch the code actuated switch cam as it falls from the shaft. Remove the ball bearing (22) from the shaft.

### *b. Reassembly.*

- (1) Position the ball bearing (22, fig. 277) on the code actuated switch function shaft (23). Insert the function shaft part of the way into the bearing seat hole in the front casting of the perforator. Slide the code actuated switch cam (21) on the shaft and position the shaft on the perforator so that the bearing (22) is properly positioned in the bearing seat. Secure the code actuated switch cam to the function shaft with two mounting seats (20) and setscrews (19).
- (2) Position the flat washer (18) and ball bearing (17) on the code actuated switch function shaft (23) so that the ball bearing is properly seated in the bearing seat on the front perforator casting; secure with two machine screws (47, fig. 251), lockwashers (49), and flat washers (48).
- (3) Position the transfer lever cam (16, fig. 277) on the code actuated switch function shaft (23); secure with two setscrews (15). Make sure that the holes in the cam are aligned with the two flats on the function shaft.



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- |                                   |                                  |   |
|-----------------------------------|----------------------------------|---|
| 1 Setscrew, 10209                 | 9 Ball bearing, 10763            | 17 Ball bearing, 10756                        |
| 2 Mounting clutch setscrew, 56011 | 10 Retainer ring, 11038          | 18 Flat washer, 52283                         |
| 3 Clutch coupling, 51167A         | 11 Ball bearing, 10763           | 19 Setscrew, 10209                            |
| 4 Clutch spring, 50848            | 12 Retainer ring, 11038          | 20 Mounting seat, 52159                       |
| 5 Sliding drum clutch, 50516      | 13 Function camshaft gear, 56061 | 21 Code actuated switch cam, 55608            |
| 6 Retainer ring, 10965            | 14 Retainer ring, 10965          | 22 Ball bearing, 10757                        |
| 7 Flat washer, 55034              | 15 Setscrew, 10209               | 23 Code actuated switch function shaft, 54729 |
| 8 Flat washer, 55034              | 16 Transfer lever cam, 50536     |   |

Figure 277. Code actuated switch function shaft, exploded view.

- (4) Install the retainer ring (14) on the code actuated switch function shaft (23).
- (5) Install the two retainer rings (10 and 12) in the function camshaft gear (13). Install the two ball bearings (9 and 11) on the function camshaft gear (13).
- (6) Install the assembled function camshaft gear (13) and ball bearings on the code actuated switch function shaft (23); secure with two flat washers (8 and 7) and a retainer ring (6).
- (7) Position the sliding drum clutch (5), clutch spring (4), and clutch coupling (3) on the code actuated switch function shaft (23); secure with a mounting clutch setscrew (2) and setscrew (1).
- (8) Install the sequential transfer lever shaft on the perforator as described in paragraph 237b.
- (9) Install the pulsing contact assembly as described in paragraph 232b.
- (10) Adjust the code actuated switch function shaft as described in paragraphs 421 through 426.
- (11) Install the perforator on the base as described in paragraph 196b.

## 242. Disassembly and Reassembly of Idler Gear Bracket (fig. 278)

### a. Disassembly.

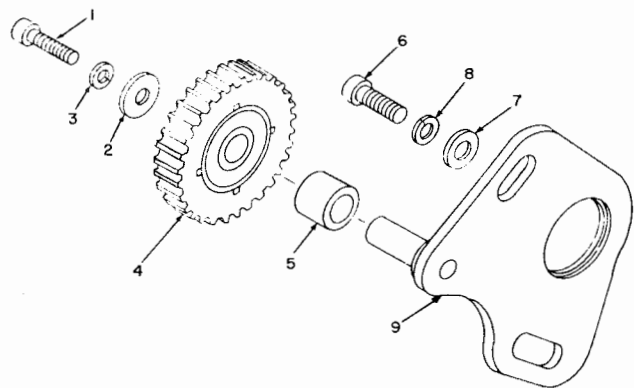
- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Remove the pulsing contact assembly as described in paragraph 232a.
- (3) Disassemble the code actuated switch function shaft as described in paragraph 241a (4) through (7).
- (4) Remove machine screw (1), flat washer (2), and lockwasher (3) that hold idler gear (4) to idler gear bracket (9); remove the idler gear and spacer (5).
- (5) Remove two machine screws (6), flat washers (7), and lockwashers (8) that hold the idler gear bracket to the tape receiver chassis; remove the idler gear bracket.

b. *Reassembly.* Reassemble the idler gear bracket assembly as indicated in figure 278; the sequence for assembling the parts is the reverse of the disassembly sequence. In reassembling, refer to the gear chart in paragraph 19 to determine the appropriate position for spacer (5) and idler gear (4).

## 243. Removal and Replacement of Receiving Multisolenoid Function Shaft

### a. Removal.

- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Remove the outside cover (6, fig. 241), two machine screws (1, fig. 250) and lockwasher (3); remove the transmitter-distributor.
- (3) Remove the pulsing contact assembly from the perforator as described in paragraph 232a.
- (4) Remove the ribbon supply group as described in paragraph 224a.
- (5) Remove two machine screws (1, fig. 282), lockwashers (2) and stop arm shaft support plate (3).
- (6) Remove the self-locking hexagonal nut (18, fig. 275) and flat washer



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- |                        |                              |
|------------------------|------------------------------|
| 1 Machine screw, 10009 | 6 Machine screw, 10024       |
| 2 Flat washer, 10463   | 7 Flat washer, 10464         |
| 3 Lockwasher, 10430    | 8 Lockwasher, 10431          |
| 4 Idler gear, 56172A   | 9 Idler gear bracket, 56171A |
| 5 Spacer, 56074        |                              |

Figure 278. Idler gear bracket, exploded view.

- (19) that hold the T-levers (20, 22, 24, 26, and 28) to the T-lever pivot stud (31) on the transfer lever (37); remove the T-levers and flat washers (21, 23, 25, and 27) alternately.
- (7) Loosen the two screws (6, fig. 278) that hold the idler gear bracket (9) to the perforator frame; pivot the idler gear out of engagement with the double gear.
- (8) Remove the two machine screws (1, fig. 279) and lockwashers (2) that hold the bearing block (26) to the front support frame.
- (9) Remove the two machine screws (37, fig. 251), bearing retainer (39) and lockwashers (38).
- (10) Remove the two machine screws (33), lockwashers (34), and move clips (35) out of engagement with the pins (36); remove the pins.
- (11) Remove the two machine screws (3, fig. 279) and lockwashers (4) that hold the bearing cap to the frame; remove the assembled bearing cap and code ring cage assembly.
- (12) Remove the two machine screws (5) and lockwashers (6) that hold the bearing cap to the rear frame; remove the bearing cap.
- (13) Remove the machine screw (12, fig. 265), lockwasher (13) and remove the tape chute (14).

- (14) Remove the two machine screws (13, fig. 252), lockwashers (14), and flat washer (15) from the tape puller assembly; remove the tape puller assembly.
- (15) Lift the back end of the receiving multisolenoid function shaft slightly and shift the function shaft to the rear far enough so that the print and register cam (24, fig. 279) clears the cam roller on the punch arm assembly; remove the receiving multisolenoid function shaft.

*b. Replacement.*

- (1) Position the receiving multisolenoid function shaft so that the print and register cam (24, fig. 279) engages the cam roller on the punch arm assembly and the bearings properly seat on the perforator frame.
- (2) Position the bearing cap on the rear bearing (22); secure with two machine screws (5) and lockwashers (6).

*Note.* the bearing cap is marked to correspond with the casting. Make certain the markings are aligned.

- (3) Position the assembled code-ring cage and bearing cap on the front frame and insert the pins (36, fig. 251); secure with two machine screws (33), lockwashers (34), and clips (35). Be sure the clips engage the annular ring toward the end of each pin.

*Note.* Position the punch interference levers to engage the slots of the code rings while installing the assembled code ring cage.

- (4) Position the stop arm shaft support plate (3, fig. 282) and secure with the two machine screws (1) and lockwashers (2).
- (5) Install the five T-levers (28, 26, 24, 22 and 20, fig. 275) and the four flat washers (27, 25, 23, and 21) on the T-lever pivot stud (31), starting with a transfer lever and alternating with a flat washer until all are installed. Secure the T-levers to the T-lever pivot stud (31) with a flat washer (19) and self-locking hexagonal nut (18).

- (6) Position the tape chute (14, fig. 265) on the front casting and secure with machine screw (12) and lockwasher (13).
- (7) Position the bearing block (26, fig. 279) on the front support frame; secure with two machine screws (1 and 2).
- (8) Pivot the idler gear bracket (9, fig. 278) so that the idler gear meshes with the proper surface (chart, par. 19) of the double gear on the receiving multisolenoid function shaft; tighten the two screws that secure the idler gear bracket to the frame.
- (9) Install the ribbon supply group as described in paragraph 224*b*.
- (10) Position the transmitter-distributor against the casting and align the friction clutch; secure with the two machine screws (1, fig. 250) and lockwashers (2); replace the outside cover (6, fig. 241).
- (11) Replace the tape puller assembly and secure it with the machine screws (13, fig. 252), lockwashers (14), and flat washer (15). Make the adjustment described in paragraphs 522 and 523.
- (12) Install the pulsing contact assembly as described in paragraph 232*b*.
- (13) Install the perforator on the perforator base as described in paragraph 196*b*.
- (14) Adjust the receiving multisolenoid function shaft as described in paragraphs 443 through 457.

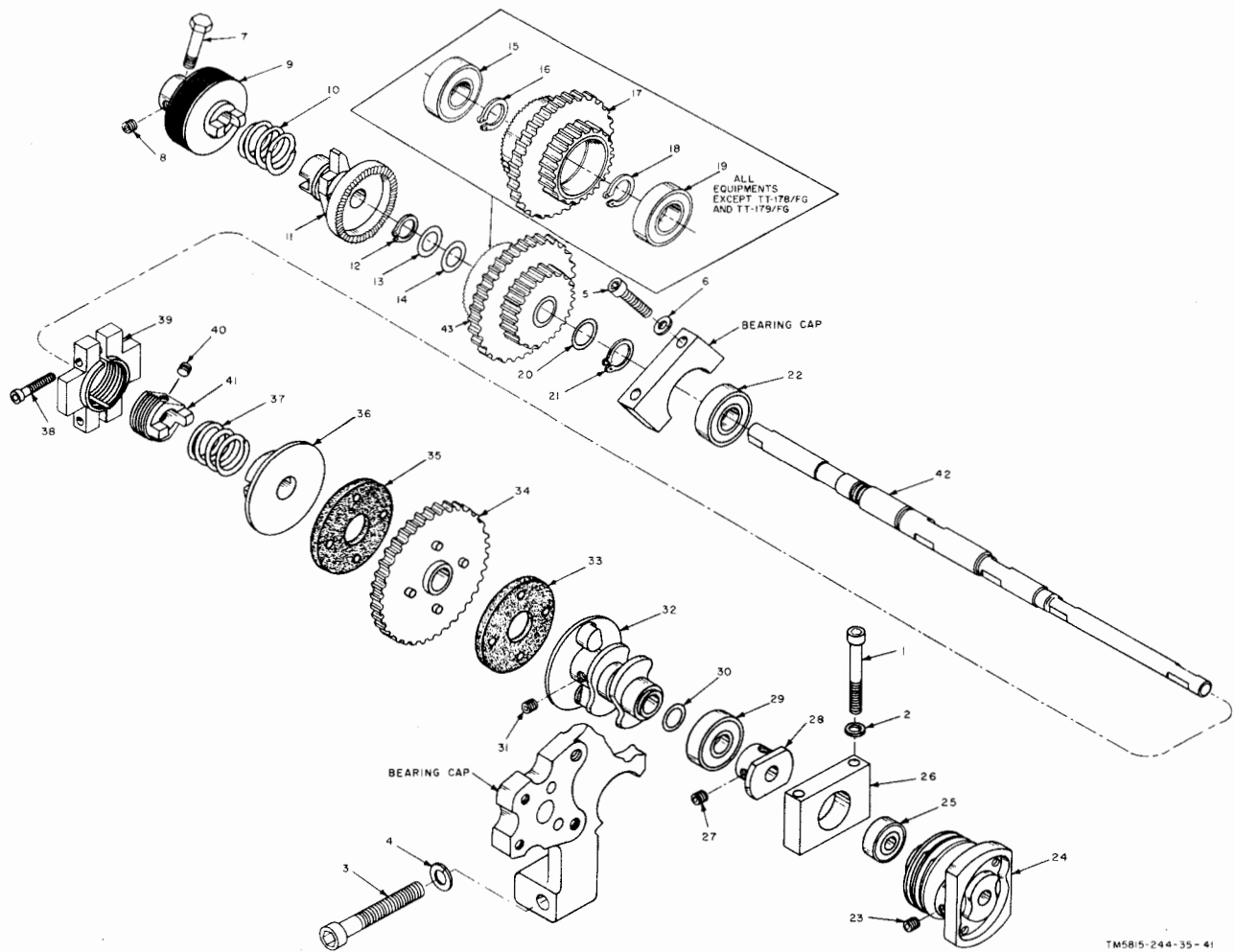
## **244. Disassembly and Reassembly of Receiving Multisolenoid Function Shaft**

(fig. 279)

*a. Disassembly.*

- (1) Remove the receiving multisolenoid function shaft as described in paragraph 243*a*.
- (2) Remove the screws (7 and 8) that hold the sliding clutch coupling (9) to the receiving multisolenoid function shaft (42); remove the sliding clutch coupling, sliding clutch spring (10), and sliding drum clutch (11).





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- |                                    |  |  |
|------------------------------------|--|--|
| 1 Machine screw, 10063             | 17 Double gear, 59878A (60-75 wpm); double gear, 60196A (75-100 wpm) | 31 Setscrew, 10209   |
| 2 Lockwasher, 10403                | 18 Retainer ring, 11038  | 32 Typewheel and function lever cam, 52398                           |
| 3 Machine screw, 10038             | 19 Ball bearing, 10763   | 33 Felt plate, 56764   |
| 4 Lockwasher, 10427                | 20 Flat washer, 55034  | 34 Friction shaft drive gear, 56380A                                 |
| 5 Machine screw, 10012             | 21 Retainer ring, 10965  | 35 Felt plate, 56764   |
| 6 Lockwasher, 10430                | 22 Ball bearing, 10763   | 36 Keyed clutch disk, 56248  |
| 7 Mounting clutch set screw, 59829 | 23 Setscrew, 10209   | 37 Friction clutch spring, 56249                                     |
| 8 Setscrew, 10209                  | 24 Print and register cam, 52456A                                    | 38 Machine screw, 10034  |
| 9 Sliding clutch coupling, 51167A  | 25 Ball bearing, 10753   | 39 Friction adjusting collar, 56833A                                 |
| 10 Sliding clutch spring, 50848    | 26 Bearing block, 55131  | 40 Setscrew, 10208   |
| 11 Sliding drum clutch, 50516      | 27 Setscrew, 10209   | 41 Keyed collar, 56246   |
| 12 Retainer ring, 10965            | 28 Transfer lever cam, 50536   | 42 Receiving multisolenoid function shaft, 54727                     |
| 13 Flat washer, 55034              | 29 Ball bearing, 10756   | 43 Double gear (60-75 wpm), 56128A; double gear (75-100 wpm), 56105A |
| 14 Flat washer, 55035              | 30 Flat washer, 52283  |  |
| 15 Ball bearing, 10763             |  |  |
| 16 Retainer ring, 11038            |  |  |

Figure 279. Receiving multisolenoid function shaft, exploded view.

- (3) Remove the retainer ring (12), spacers (13 and 14), and the assembled double gear (17 or 43). If double gear (17) is included and complete disassembly is required, remove ball bearings (15 and 19) and retainer rings (16 and 18).
- (4) Slide the spacer (20) from the shaft and remove the retainer ring (21) that holds the bearing (22) to the shaft (42) and remove the bearing (22).
- (5) Remove the two setscrews (23) that hold the print and register cam (24)

to the receiving multisolenoid function shaft (42); remove the cam (24), bearing (25), and bearing block (26).

- (6) Remove the two setscrews (27) that hold the transfer lever cam (28) to the shaft (42); remove the transfer lever cam (28), bearing (29), and flat washer (30).
- (7) Remove the two setscrews (31) that hold the typewheel and function lever cam (32) to the shaft (42); remove the cam (32), felt plate (33), friction drive gear (34), felt plate (35), keyed clutch disk (36), and the friction clutch spring (37).
- (8) Remove the two machine screws (38) that hold the friction adjusting collar (39) to the keyed collar (41); remove the friction adjusting collar (39).
- (9) Remove the two setscrews (40) that hold the keyed collar (41) to the receiving multisolenoid shaft (42); remove the collar (41).

*b. Reassembly.*

*Note.* Make sure that the gear installed is correct for the operating speed desired (see chart, par. 19). Make sure that the idler gear will mate with the correct gear surface of the double gear installed on the receiving multisolenoid function shaft as shown in the chart in paragraph 19.

- (1) Reassemble the receiving multisolenoid function shaft as indicated in figure 279; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the receiving multisolenoid function shaft assembly to the perforator as described in paragraph 243b.

## **245. Disassembly and Reassembly of Transmitter-Distributor Drive Shaft** (fig. 280)

*a. Disassembly.*

- (1) Remove the transmitter-distributor from the perforator as described in paragraph 197a.
- (2) Remove the two setscrews (1) that hold the clutch disk (2) to the transmitter-distributor drive shaft (18); remove the clutch disk, felt plate (3),

clutch driver (4), felt plate (5), keyed clutch disk (6), and friction clutch spring (7).

- (3) Loosen the machine screws (8) that hold the friction adjusting collar (9) to the keyed collar (11); turn the friction adjusting collar off the keyed collar.
- (4) Remove the two setscrews (10) that hold the keyed collar (11) to the transmitter-distributor drive shaft (18); remove the keyed collar.
- (5) Remove the two machine screws (12), flat washers (13), and lockwashers (14) that hold the ball bearing (19) to the perforator frame.
- (6) Remove the self-locking hexagonal nut (15) and flat washer (16) that hold the ball bearing (19) to the transmitter-distributor drive shaft (18).
- (7) Remove the two setscrews (17) that hold the driven gear (21) to the transmitter-distributor drive shaft (18); remove the transmitter-distributor drive shaft, releasing the ball bearing (19), shaft collar (20), and driven gear (21).

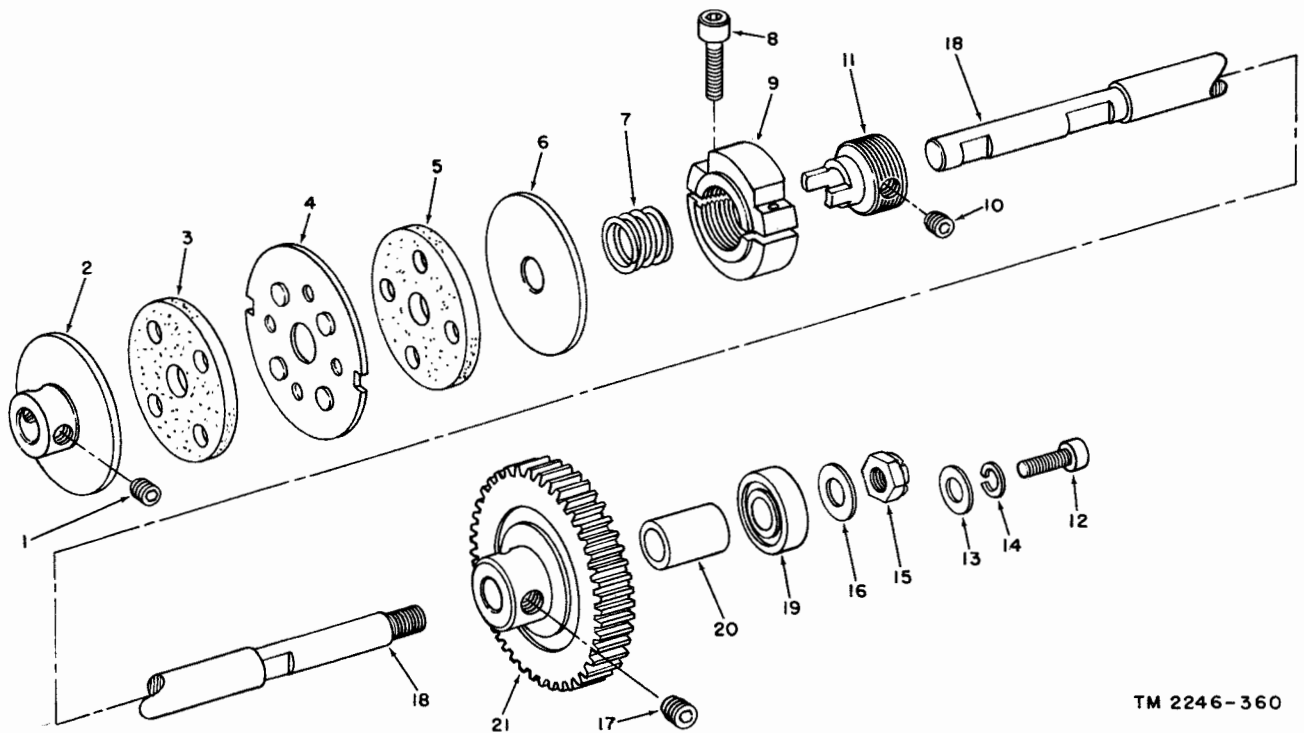
*b. Reassembly.*

- (1) Reassemble the transmitter-distributor drive shaft as indicated in figure 280; the sequence of reassembling the parts is the reverse of the disassembly sequence.
- (2) Install the transmitter-distributor on the perforator as described in paragraph 197b.
- (3) Adjust the transmitter-distributor friction clutch as described in paragraph 517.

## **246. Disassembly and Reassembly of Type-Wheel Reciprocating Mechanism** (fig. 281)

*a. Disassembly.*

- (1) Remove the code-ring locking bail cam follower spring (1) from the code-ring locking bail cam follower (6) and from the function plate (46).
- (2) Remove the machine screw (2), anchor nut (3), flat washer (4), that

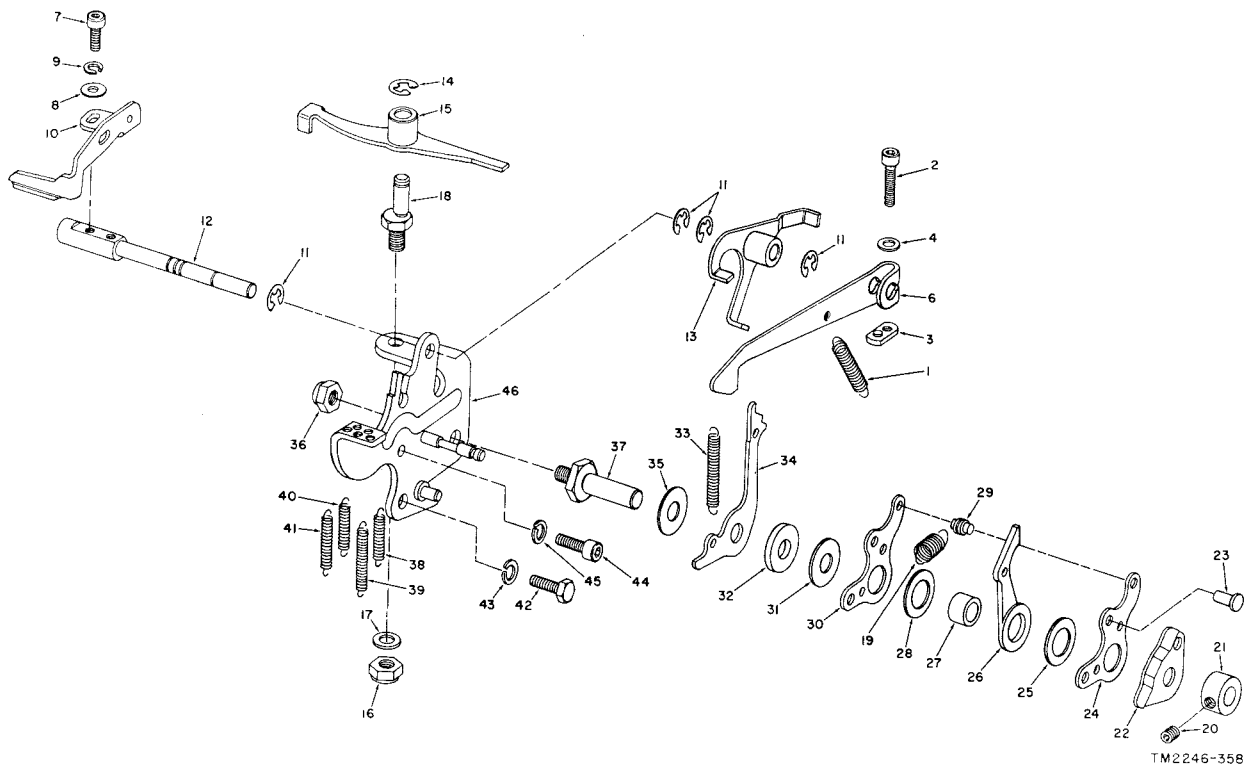


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- |                                 |                                      |  |
|---------------------------------|--------------------------------------|--|
| 1 Setscrew, 10209               | 9 Friction adjusting collar, 56382A  | 17 Setscrew, 10209                               |
| 2 Clutch disk, 50200            | 10 Setscrew, 10208                   | 18 Transmitter-distributor drive-<br>shaft 56106 |
| 3 Felt plate, 56765             | 11 Keyed collar, 54928               | 19 Ball bearing, 10753                           |
| 4 Clutch driver, 51117          | 12 Machine screw, 10004              | 20 Shaft collar, 56107                           |
| 5 Felt plate, 56765             | 13 Flat washer, 10450                | 21 Driven gear, 55005A                           |
| 6 Keyed clutch disk, 54931      | 14 Lockwasher, 10429                 |  |
| 7 Friction clutch spring, 54934 | 15 Self-locking hexagonal nut, 10525 |  |
| 8 Machine screw, 10043          | 16 Flat washer, 10455                |  |

Figure 280. Transmitter-distributor drive shaft, exploded view.

- hold the code-ring locking bail cam follower (6) to the code-ring locking bail shaft (12); remove the code-ring locking bail cam follower.
- (3) Remove the machine screw (7), flat washer (8), and lockwasher (9) that hold the code-ring locking bail (10) to the code-ring locking bail shaft (12); remove the code-ring locking bail.
  - (4) Remove the four retaining rings (11) that hold the code-ring locking bail shaft (12) to the function plate (46) and to the letters-figures shift latch lever (13). Disconnect the spring (33) from the letters-figures shift latch lever. Remove the code-ring locking bail shaft (12) and letters-figures shift latch lever.
  - (5) Remove the retainer ring (14) that holds the typewheel reciprocating transfer lever (15) to the typewheel reciprocating transfer lever eccentric stud (18); remove the typewheel reciprocating transfer lever.
  - (6) Remove the typewheel reciprocating transfer lever eccentric stud (18) from the function plate (46).
  - (7) Remove the typewheel reciprocating transfer lever spring (19) from the spring pin (29) and from the typewheel reciprocating spring lever (26).
  - (8) Remove the two setscrews (20) that hold the shaft collar (21) to the typewheel shift lever stud (37); remove the shaft collar, and retainer plate (22).
  - (9) Remove the drive pin (23) and spring pin (29) from the typewheel reciprocating drive levers (24 and 30). Remove the typewheel reciprocating drive lever (24), flat washer (25),



- |   |   |  |
|---|---|--|
| 1 Code-ring locking bail cam follower spring, 53569 | 17 Flat washer, 52430   | 31 Flat washer, 53261                  |
| 2 Machine screw, 10006                              | 18 Typewheel reciprocating transfer lever eccentric stud, 52399 | 32 Flat washer, 52413                  |
| 3 Anchor nut, 50174                                 | 19 Typewheel reciprocating lever spring, 52167                  | 33 Spring, 52168                       |
| 4 Flat washer, 10459                                | 20 Setscrew, 10209  | 34 Figures-letters shift lever, 52406  |
| 6 Code-ring locking bail cam follower, 52657        | 21 Shaft collar, 50209  | 35 Flat washer, 53261                  |
| 7 Machine screw, 10004                              | 22 Retainer plate, 53652  | 36 Self-locking hexagonal nut, 10525   |
| 8 Flat washer, 10458                                | 23 Drive pin, 52404   | 37 Typewheel shift lever stud, 52417   |
| 9 Lockwasher, 10429                                 | 24 Typewheel reciprocating drive lever, 52362                   | 38 Bell sensing lever spring, 52173    |
| 10 Code-ring locking bail, 52653                    | 25 Flat washer, 52402   | 39 Shift cam follower spring, 52172    |
| 11 Retainer ring, 10949                             | 26 Typewheel reciprocating spring lever, 52405                  | 40 Letters sensing lever spring, 52169 |
| 12 Code-ring locking bail shaft, 52291              | 27 Sleeve bearing, 52401  | 41 Figures sensing lever spring, 52171 |
| 13 Letters-figures shift latch lever, 52411         | 28 Flat washer, 52402   | 42 Machine screw, 10076                |
| 14 Retainer ring, 10949                             | 29 Spring pin, 52403  | 43 Lockwasher, 10430                   |
| 15 Typewheel reciprocating transfer lever, 52478    | 30 Typewheel reciprocating drive lever, 52362                   | 44 Machine screw, 10025                |
| 16 Self-locking hexagonal nut, 10525                |   | 45 Lockwasher, 10430                   |
|   |   | 46 Function plate, 52419A              |

Figure 281. Typewheel reciprocating mechanism, exploded view.

typewheel reciprocating spring lever (26), sleeve bearing (27), flat washer (28), typewheel reciprocating drive lever (30), and two flat washers (31 and 32).

(10) Remove the spring (33) from the figures-letters shift lever (34); remove the figures-letters shift lever and flat washer (35) from the typewheel shift lever stud (37).

(11) Remove the self-locking hexagonal nut (36) that holds the typewheel shift lever stud (37) to the function

plate (46); remove the typewheel shift lever stud (37).

(12) Remove the bell sensing lever spring (38), shift cam follower spring (39), and figures sensing levers spring (41) from the function plate (46) and from the function sensing levers.

(13) Remove the two machine screws (42 and 44) and lockwashers (43 and 45) that hold the function plate (46) to the perforator frame; remove the function plate (46).

*b. Reassembly.*

- (1) Reassemble the typewheel reciprocating mechanism as indicated in figure 281; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Adjust the typewheel reciprocating mechanism as described in paragraphs 428, 429, 439, 452, 453, 454, and 460.

## **247. Disassembly and Reassembly of Function Sensing Mechanism**

(fig. 282)

*a. Disassembly.*

- (1) Remove the two machine screws (1) and lockwashers (2) that hold the stop arm shaft support plate (3) to the perforator frame; remove the stop arm shaft support plate, pulling it free of the selector stop arm shaft.
- (2) Remove the typewheel reciprocating mechanism as described in paragraph 246a.
- (3) Remove the two setscrews (4) that hold the stop arm shaft driven gear (5) to the stop arm shaft; remove the stop arm shaft driven gear and thrust bearing (6).
- (4) Remove the typewheel reciprocating cam follower (7), sensing lever spacer (8), and the assembled bell sensing lever (11) and signal bell clapper (10) from the cam lever assembly (21).
- (5) Remove the setscrew (9) that holds the signal bell clapper (10) to the bell sensing lever (11); remove the signal bell clapper.
- (6) Remove the sensing lever spacer (12), figures sensing lever (13), sensing lever spacer (14), letters sensing lever (15), sensing lever spacer (16) from the cam lever assembly (21).
- (7) Remove the cam lever assembly (21) and laminated spacer (22) from the projection of the rear of the code-ring cage.
- (8) Remove the plain hexagonal nut (17), flat washer (18), and lockwasher (19) that hold the restoring lever eccentric (20) to the stud on the cam

lever assembly (21); remove the restoring lever eccentric.

*b. Reassembly.*

- (1) Reassemble the function sensing mechanism as indicated in figure 282; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the typewheel reciprocating mechanism as described in paragraph 246b.
- (3) Adjust the function sensing lever mechanism as described in paragraphs 428, 429, 440, 455, 456, and 457.

## **248. Removal and Replacement of Code-Ring Cage**

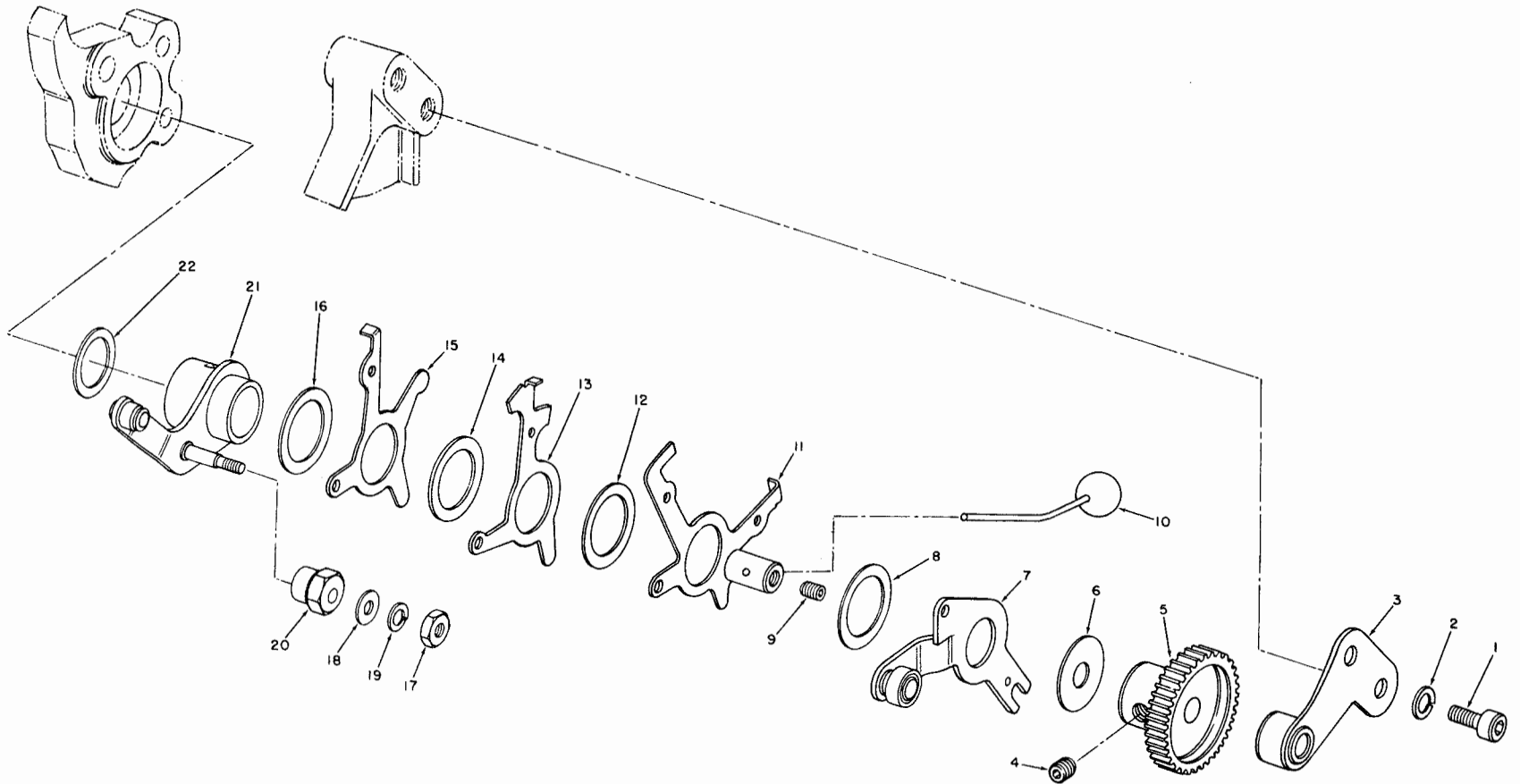
(fig. 283)

*a. Removal.*

- (1) Remove the ribbon supply group from the perforator as described in paragraph 224a.
- (2) Remove the stop arm shaft driven gear as described in paragraph 247a(3).
- (3) Remove the assembled typewheel driven gear (4), square shaft stop arm (6), and stop arm shaft (7).
- (4) Remove the two machine screws (1) and lockwashers (2) that hold the code-ring cage to the perforator frame; remove the code-ring cage.

*b. Disassembly.*

- (1) Remove the two setscrews (3) that hold the typewheel driven gear (4) to the stop arm shaft (7); remove the typewheel driven gear.
- (2) Remove the machine screw (5) that holds the square shaft stop arm (6) to the stop arm shaft (7); remove the square shaft stop arm.
- (3) Remove the 16 stop bar lever springs (8) from the stop bars (9) and from the function stop bars (10). Remove the 29 stop bars and the 3 function stop bars from the code-ring cage.
- (4) Remove the three machine screws (11) and lockwashers (12) that hold the retainer plate (13) to the code selecting guide plate (22); remove the retainer plate.



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- |   |   |                                 |                                     |
|---|---|---------------------------------|-------------------------------------|
| 1 Machine screw, 10012                    | 6 Thrust bearing, 50374                             | 11 Bell sensing lever, 52638A   | 17 Plain hexagonal nut, 10512       |
| 2 Lockwasher, 10430                       | 7 Typewheel reciprocating cam fol-<br>lower, 52477A | 12 Sensing lever spacer, 52649  | 18 Flat washer, 50414               |
| 3 Stop arm shaft support plate,<br>56732A | 8 Sensing lever spacer, 52649                       | 13 Figures sensing lever, 52483 | 19 Lockwasher, 10429                |
| 4 Setscrew, 10209                         | 9 Setscrew, 10203                                   | 14 Sensing lever spacer, 52649  | 20 Restoring lever eccentric, 52664 |
| 5 Stop arm shaft driven gear,<br>52344    | 10 Signal bell clapper, 52682                       | 15 Letters sensing lever, 52484 | 21 Cam lever assembly, 52459A       |
|   |   | 16 Sensing lever spacer, 52649  | 22 Laminated spacer, 52679          |

Figure 282. Function sensing mechanism, exploded view.

- (5) Remove the three machine screws (14), flat washers (17), and lockwashers (18) that hold the adjustable fulcrums (16) to the code selecting guide plate (22); remove the adjustable fulcrums and flat washers (15).
- (6) Remove the three self-locking hexagonal nuts (19) and cage tie bolts (20) that hold the code cage outside guide (23) to the code selecting guide plate (22). Remove the two setscrews (21) that hold the code cage spacer (24) to the code-ring collar (37). Remove the code selecting guide plate and the code cage outside guide from the code cage spacer.
- (7) Disassemble the code ring spacer (25), six ball retainers (26, 28, 30, 32, 34, and 36) five code rings (27, 29, 31, 33, and 35), and the code-ring collar (37).

*c. Replacement.*

- (1) Reassemble the code-ring cage as indicated in figure 283; the sequence for assembling the parts is the reverse of the sequence in *b* and *a* above.
- (2) Install the stop arm shaft driven gear as described in paragraph 247*b*(6).
- (3) Install the ribbon supply group as described in paragraph 224*b*.
- (4) Adjust the code-ring cage as described in paragraphs 428, 429, 430, 431, 439, 441, and 457.

**249. Removal and Replacement of Gearcase**

(fig. 251)

*a. Removal.*

- (1) Remove the perforator from the perforator base as described in paragraph 196*a*.
- (2) Remove the motor as described in paragraph 208*a*.
- (3) Remove the worm gear from the main shaft as described in paragraph 240*a*(4).
- (4) Remove the machine screw (27) and lockwasher (28) that hold the gearcase (8) to the frame (52); remove the gearcase.
- (5) Remove the two dowels (7) from the perforator frame (52) only if they are loose or damaged.

*b. Replacement.*

- (1) Install the two dowels (7) in the perforator frame (52), if they have been removed.
- (2) Position the gearcase on the perforator frame (52), making sure the dowels are properly seated in the holes in the gearcase; secure with a machine screw (27) and lockwasher (28).
- (3) Install the worm gear on the main shaft as described in paragraph 240*b*(6).
- (4) Install the motor as described in paragraph 208*b*.
- (5) Install the perforator on the perforator base as described in paragraph 196*b*.

**250. Removal and Replacement of Transmitter-Distributor Support Frame**

(fig. 251)

*a. Removal.*

- (1) Remove the transmitter-distributor as described in paragraph 197*a*.
- (2) Remove the two machine screws (9) and lockwashers (10) that hold the transmitter-distributor support frame (11) to the frame (52).

*b. Replacement.*

- (1) Position the transmitter-distributor support frame (11) on the frame (52); secure with two machine screws (9) and lockwashers (10).
- (2) Install the transmitter-distributor as described in paragraph 197*b*.

**251. Removal and Replacement of Signal Bell and Selector Magnet Bracket Adjustment Screws**

(fig 251)

*a. Removal.*

- (1) Remove the machine screw (12), lockwasher (13), and flat washer (14) that hold the signal bell (15) to the perforator frame (52); remove the signal bell.
- (2) Remove the two machine screws (40) and lockwashers (41) that hold the two anchor plates (42) to the perforator frame (52); remove the anchor plates.

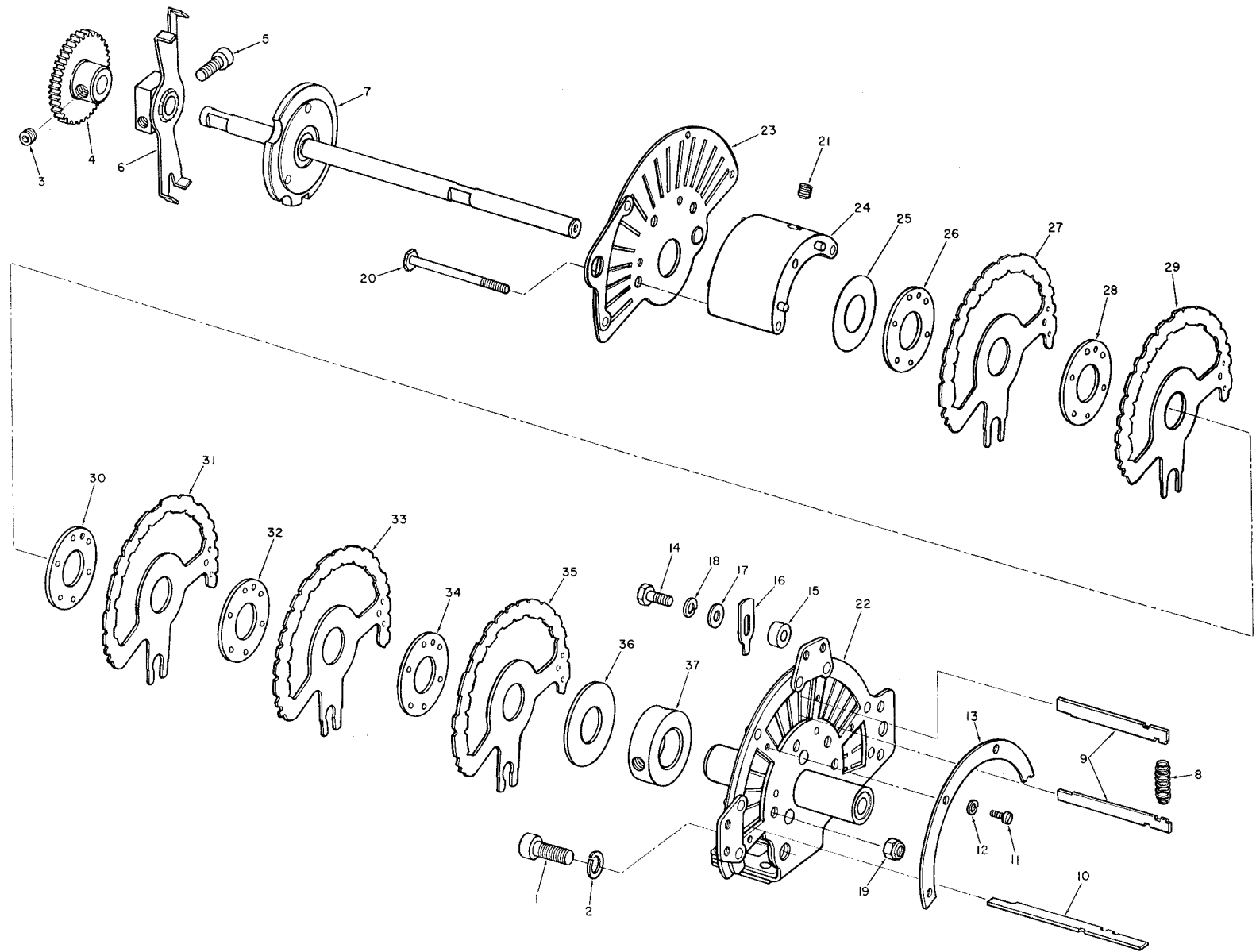


Figure 283. Code-ring cage, exploded view.



1 Machine screw, 10024	14 Machine screw, 10398	25 Code ring spacer, 53453
2 Lockwasher, 10431	15 Flat washer, 53602	26 Ball retainer, 53647
3 Setscrew, 10209	16 Adjustable fulcrum, 52177	27 Code ring, 53641A
4 Typewheel driven gear, 52431A	17 Flat washer, 10458	28 Ball retainer, 53647
5 Machine screw, 10009	18 Lockwasher, 10429	29 Code ring, 53642A
6 Square shaft stop arm, 53802A (includes item 5)	19 Self-locking hexagonal nut, 10500	30 Ball retainer, 53647
7 Stop arm shaft, 54710A	20 Cage tie bolt, 53972	31 Code ring, 53643A
8 Stop bar lever spring, 52940	21 Setscrew, 10209	32 Ball retainer, 53647
9 Stop bar, 50502	22 Code selecting guide plate, 53808A (includes items 23 and 24)	33 Code ring, 53644A
10 Function stop bar, 52333	23 Code cage outside guide	34 Ball retainer, 53647
11 Machine screw, 10317	24 Code cage spacer	35 Code ring, 53645A
12 Lockwasher, 10433		36 Ball retainer, 53647
13 Retainer plate, 56177		37 Code-ring collar, 51397

Figure 283.—Continued.

(3) Remove the two selector magnet bracket adjustment screws (43) from the perforator frame (52).

*b. Replacement.* Replace the parts as indicated in figure 251.

## 252. Miscellaneous Perforator Frame Connecting Hardware (fig. 251)

*a. Perforator Frame Mounting Hardware.* Four machine screws (18), eight lockwashers (19 and 21), and four grounding straps (20) are used to secure the frame (52) to the vibration mounts on the perforator base.

*b. Perforator Frame Connecting Hardware.* Four machine screws (22, 24, 27, and 29) and lockwashers (23, 25, 28, and 30) hold the motor support frame and the selector frame of the perforator together. Two dowels are inserted between the components of the frame to keep the frame in alignment. Remove and replace frame hardware only if it is broken or damaged.

*Note.* The frame (52) is composed of two major units and a number of bearing caps. The individual parts are machined, drilled, and tapped together to insure the correct alignment of the components. For this reason, the frame is supplied only as a unit and must be replaced as such.

## 253. Disassembly and Reassembly of Perforator Tape Reel (fig. 284)

*a. Disassembly.*

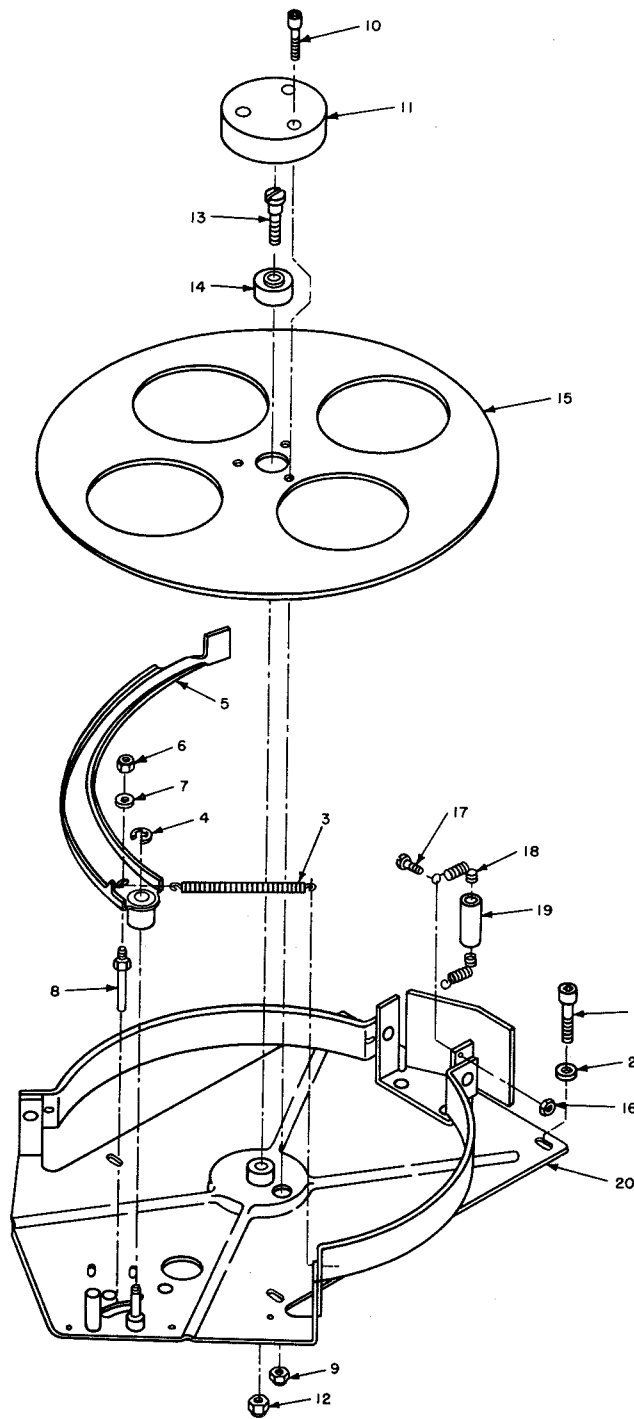
- (1) Disconnect the plug connector that connects the tape reel to the perforator base.
- (2) Remove the four machine screws (1) and lockwashers (2) that hold the tape reel bracket (20) to the power

supply chassis assembly; remove the tape reel assembly.

- (3) Remove the alarm lever spring (3) from the alarm lever (5) and from the tape reel bracket (20).
- (4) Remove the retainer ring (4) that holds the alarm lever (5) to the stud on the tape reel bracket (20); remove the alarm lever.
- (5) Remove the self-locking hexagonal nut (6) and flat washer (7) that holds the switch actuating stud (8) to the alarm lever (5); remove the switch actuating stud.
- (6) Remove the three self-locking hexagonal nuts (9) and machine screws (10) that hold the tape reel hub (11) to the tape reel (15); remove the tape reel hub.
- (7) Remove the self-locking hexagonal nut (12) and screw (13) that hold the ball bearing (14) to the tape reel bracket (20); remove the ball bearing and tape reel (15).
- (8) Remove the two self-locking hexagonal nuts (16) and machine screws (17) that hold the roller support springs (18) to the tape reel bracket (20). Remove the roller support springs and the guide roller (19).

*b. Reassembly.*

- (1) Reassemble the perforator tape reel as indicated in figure 284; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Connect the plug connector from the tape reel to the perforator base.
- (3) Adjust the tape reel assembly as instructed in paragraph 490.



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- |                                     |                                      |   |
|-------------------------------------|--------------------------------------|---|
| 1 Machine screw, 10064              | 9 Self-locking hexagonal nut, 10500  | 16 Self-locking hexagonal nut, 10551                                  |
| 2 Lockwasher, 10403                 | 10 Machine screw, 10006              | 17 Machine screw, 10375   |
| 3 Alarm lever spring, 56109         | 11 Tape reel hub, 52128              | 18 Roller support spring, 56024                                       |
| 4 Retainer ring, 10949              | 12 Self-locking hexagonal nut, 10525 | 19 Guide roller, 56023  |
| 5 Alarm lever, 52542A               | 13 Screw, 52541                      | 20 Tape reel bracket, 60031A, 56030<br>on TT-178/FG and TT-<br>179/FG |
| 6 Self-locking hexagonal nut, 10500 | 14 Ball bearing, 10762               |   |
| 7 Flat washer, 10450                | 15 Tape reel, 56026                  |   |
| 8 Switch actuating stud, 52278      |                                      |   |

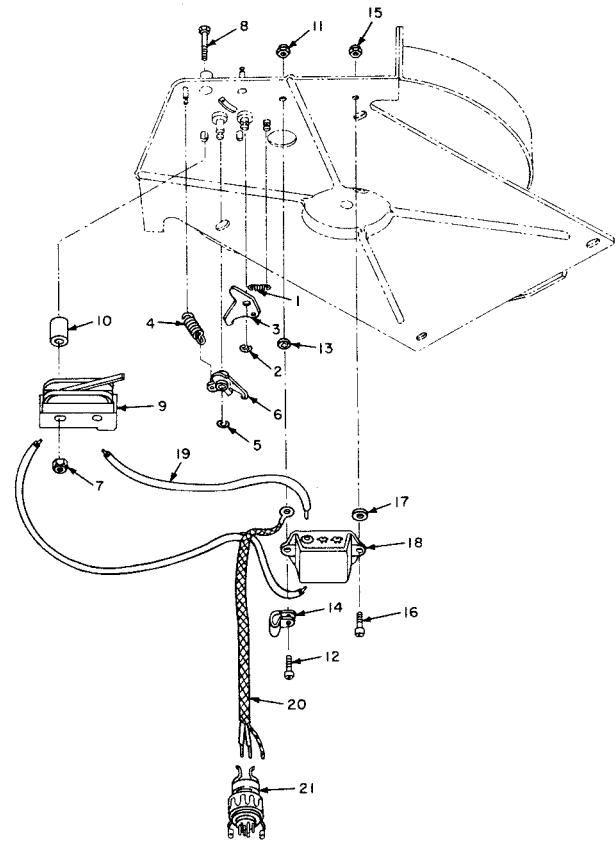
Figure 284. Tape reel, exploded view.

## 254. Disassembly and Reassembly of Tape-Out Alarm Switch and Tape Alarm Buzzer Group

(fig. 285)

### a. Disassembly.

- (1) Remove the tape reel assembly from the power supply chassis as described in paragraph 253a (1) and (2).
- (2) Remove the spring (1) from the switch actuating arm latch (3) and from the spring post on the tape reel bracket.
- (3) Remove the retainer ring (2) that holds the switch actuating arm latch (3) to the stud on the tape reel bracket; remove the switch actuating arm latch.
- (4) Remove the supply reel tension spring (4) from the switch actuating lever (6) and from the spring post on the tape reel bracket.
- (5) Remove the retainer ring (5) that holds the switch actuating lever (6) to the stud on the tape reel bracket; remove the switch actuating lever.
- (6) Remove the two self-locking hexagonal nuts (7) and machine screws (8) that hold the alarm switch (9) to the tape reel bracket. Unsolder the electrical wire (19) and the wire from the cable (20) and remove the alarm switch and two collars (10). Tag the electrical wires to facilitate reassembly.
- (7) Remove the self-locking hexagonal nut (11) and machine screw (12) that hold the electrical clamp (14) and one side of the tape alarm buzzer (18) to the tape reel bracket; remove the electrical clamp and the ground lead from the cable.
- (8) Remove the self-locking hexagonal nut (15) and machine screw (16) that hold the tape alarm buzzer (18) to the tape reel bracket; remove the flat washer (17) and lockwasher (13). Disconnect the electrical wires from the tape alarm buzzer and remove the tape alarm buzzer. Tag the electrical wires to facilitate reassembly.
- (9) Disconnect the plug connector (21) from the cable.



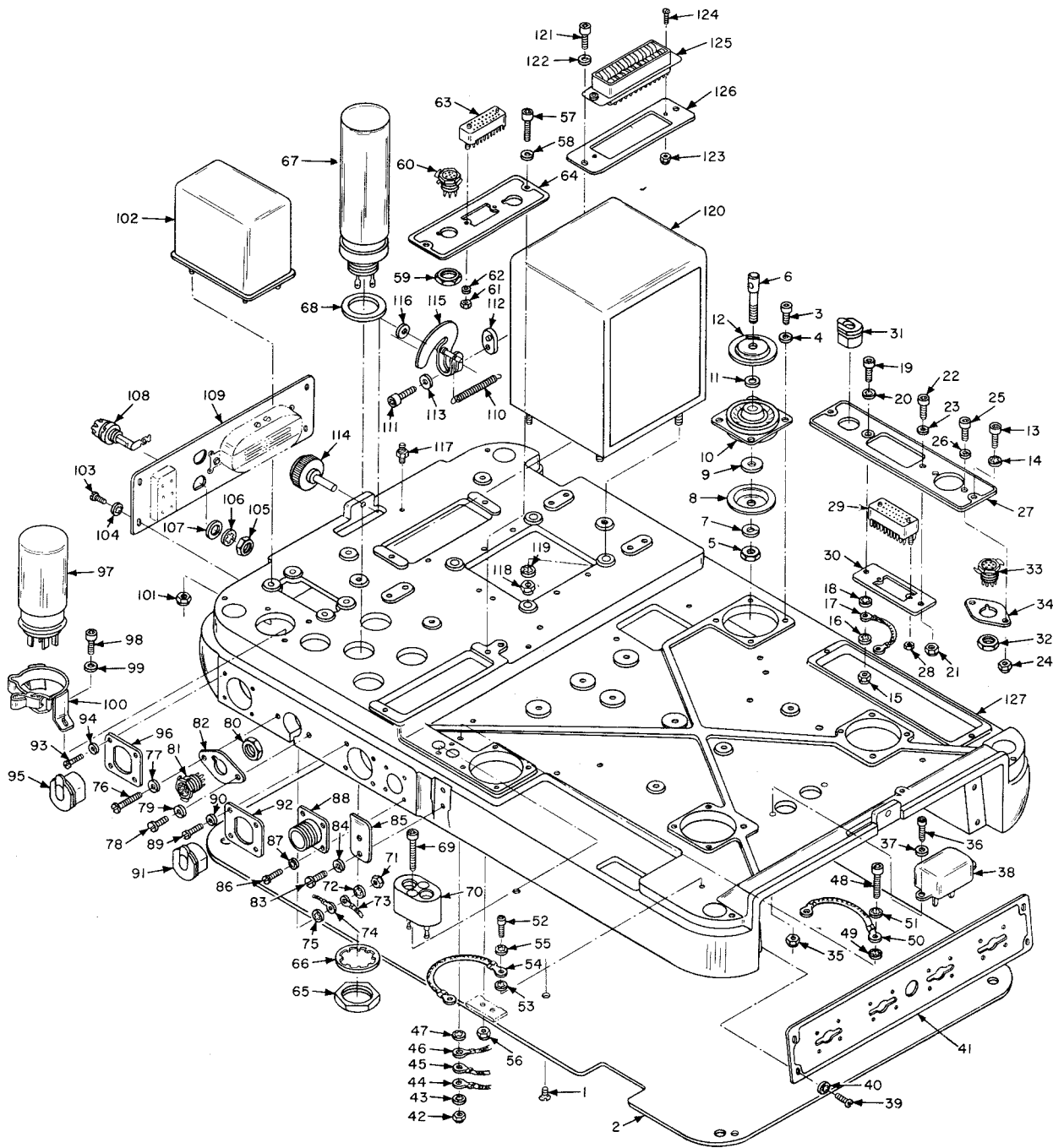
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- |                                     |   |
|-------------------------------------|---|
| 1 Spring, 52212                     | 11 Self-locking hexagonal nut, 10500                    |
| 2 Retainer ring, 10949              | 12 Machine screw, 10004                                 |
| 3 Switch actuating arm latch, 52281 | 13 Lockwasher, 10403                                    |
| 4 Supply reel tension spring, 52266 | 14 Electrical clamp, 20513                              |
| 5 Retainer ring, 10949              | 15 Self-locking hexagonal nut, 10500                    |
| 6 Switch actuating lever, 52279A    | 16 Machine screw, 10004                                 |
| 7 Self-locking hexagonal nut, 10500 | 17 Flat washer, 10467                                   |
| 8 Machine screw, 10082              | 18 Tape alarm buzzer, I5, 20783                         |
| 9 Alarm switch (S16), 20108         | 19 Wire, 22202  |
| 10 Collar, 52272                    | 20 Cable, 56399 (56805A, TT-178/FG, and TT-179/FG only) |
|                                     | 21 Plug connector, 20419                                |

Figure 285. Tape-out alarm switch and tape alarm buzzer group, exploded view.

### b. Reassembly.

- (1) Reassemble the tape-out alarm switch and tape alarm buzzer group as indicated in figure 285; the sequence for assembling the parts is the reverse of the disassembly sequence.
- (2) Install the tape reel assembly on the power supply chassis as described in paragraph 253.
- (3) Adjust the tape reel assembly as directed in paragraph 490.



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Figure 286. Perforator base, exploded view.

1 Machine screw, 10179	43 Lockwasher, 10404	84 Lockwasher, 10430
2 Base plate, 56062	44 Terminal lug, 20838	85 Dust cover guide, 56071
3 Machine screw, 10008	45 Terminal lug, 20838	86 Machine screw, 10335
4 Lockwasher, 10430	46 Terminal lug, 20838	87 Lockwasher, 10408
5 Plain hexagonal nut, 10502 (10534 <sup>a</sup> )	47 Lockwasher, 10404	88 Electrical connector shell, 20438
6 Vibration mount stud, 53557	48 Machine screw, 10028	89 Machine screw, 10375 (10395 <sup>a</sup> )
7 Lockwasher, 10427	49 Lockwasher, 10404	90 Lockwasher, 10429
8 Vibration mount limit stop, 54127	50 Grounding lead, 53651A	91 Bushing insulator, 20835
9 Flat washer, 50862	51 Lockwasher, 10404	92 Mounting plate, 56049
10 Vibration mount, 10911	52 Machine screw, 10008-1	93 Machine screw, 10395
11 Flat washer, 50494	53 Lockwasher, 10404	94 Lockwasher, 10429 (and plain washer, 10458 <sup>a</sup> )
12 Vibration mount limit stop, 54127	54 Grounding lead, 53651	95 Bushing insulator, 20835
13 Machine screw, 10008	55 Lockwasher, 10404	96 Mounting plate, 56049
14 Lockwasher, 10404	56 Self-locking hexagonal nut, 10501	97 Capacitor C7A, C7B
15 Self-locking hexagonal nut, 10501	57 Machine screw, 10037	98 Machine screw, 10003
16 Lockwasher, 10404	58 Lockwasher, 10430	99 Lockwasher, 10429
17 Ground strap (includes terminals 20838 and 20355 and wire)	59 Hexagonal nut	100 Capacitor clamp, 20524
18 Lockwasher, 10404	60 Receptacle connector, J34 (includes item 59) (20262 <sup>a</sup> )	101 Self-locking hexagonal nut, 10501
19 Machine screw, 10008 (11503 <sup>a</sup> )	61 Nut	102 Automatic line return relay, K1 (20303A <sup>a</sup> )
20 Lockwasher, 10404	62 Lockwasher	103 Machine screw, 10376
21 Self-locking hexagonal nut, 10501	63 Receptacle connector, J15 (includes items 61 and 62) (20268 <sup>a</sup> )	104 Lockwasher, 10404
22 Machine screw, 10008	64 Mounting plate, 56052	105 Hexagonal nut
23 Lockwasher, 10430	65 Nut	106 Lockwasher
24 Self-locking hexagonal nut, 10501	66 Lockwasher	107 Rubber washer
25 Machine screw, 10008	67 Fixed capacitors, C12, C13, C14, C15, C18 (includes items 65, 66, and 68) (Capacitors C201, C202, C203, C204, are 20828; C205 is 20223 <sup>a</sup> )	108 Fuseholder F5, F6 (includes items 105, 106, and 107)
26 Lockwasher, 10430	68 Flat washer	109 Switchplate, 56028 (59985A <sup>a</sup> )
27 Mounting plate, 56051	69 Machine screw, 10012	110 Arm locking spring, 55014
28 Plain hexagonal nut	70 Receptacle connector, J12, 53320A (53320 <sup>a</sup> )	111 Machine screw, 10010
29 Receptacle connector, P25 (includes item 28), 20268	71 Self-locking hexagonal nut, 10501	112 Anchor nut, 52073
30 Connector plate, 56044	72 Lockwasher, 10404	113 Flat washer, 10467
31 Bushing insulator, 20713	73 Electrical terminal, 20838	114 Dust cover knob, 55013
32 Hexagonal nut	74 Electrical terminal, 20710	115 Dust cover arm, 55010A (LH), 55015A (RH)
33 Receptacle connector S24 (includes item 32) (20262 <sup>a</sup> )	75 Lockwasher, 10404	116 Flat washer, 10464
34 Socket plate, 56069	76 Machine screw, 10112	117 Spring post, 50649
35 Self-locking hexagonal nut, 10501	77 Lockwasher, 10430	118 Self-locking hexagonal nut, 10525
36 Machine screw, 10010 (10009 <sup>a</sup> )	78 Machine screw, 10252	119 Lockwasher, 10404 (10405 <sup>a</sup> )
37 Flat washer, 10467	79 Lockwasher, 10429 (10430 <sup>a</sup> )	120 Power transformer, T2 (59902 <sup>a</sup> )
38 Fixed capacitor, C19 (20218 <sup>a</sup> )	80 Nut	121 Machine screw, 10025
39 Machine screw, 10376	81 Receptacle connector, J14 (includes item 80) (20262 <sup>a</sup> )	122 Lockwasher, 10430
40 Lockwasher, 10404	82 Socket plate, 56069	123 Nut (10025 <sup>a</sup> )
41 Switchplate, 56055A (59891A <sup>a</sup> )	83 Machine screw, 10252	124 Machine screw
42 Self-locking hexagonal nut, 10501		125 Receptacle connector, 20270 (includes items 123 and 124)
		126 Power supply mounting plate, 56048
		127 Main base, 54652 (54653 <sup>a</sup> )

<sup>a</sup> Applicable to TT-178A/FG, TT-179A/FG and TT-181/FG. Use conversion chart, paragraph 91, section II, chapter III, when changing electrical reference designations.

Figure 286—Continued.

## 255. Disassembly and Reassembly of Vibration Mounts (fig. 286)

### a. Disassembly.

- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Remove the four machine screws (3) and lockwashers (4) that hold each of the four vibration mounts (10) to

the perforator main base (127); remove the four vibration mounts.

- (3) Remove the plain hexagonal nut (5) from one of the vibration mount studs (6); remove the vibration mount stud.
- (4) Disassemble the lockwasher (7), vibration mount limit stop (8), flat washer (19), vibration mount (10), flat washer (11), and vibration mount limit stop (12).

- (5) Repeat (3) and (4) above to disassemble the three remaining vibration mounts.

*b. Reassembly.*

- (1) Reassemble the vibration mounts as indicated in figure 286.
- (2) Install the perforator on the perforator base as described in paragraph 196b.

## **256. Disassembly and Reassembly of Dust Cover Arms and Guides** (fig. 286)

*a. Disassembly.*

- (1) Remove the arm locking spring (110) from the spring post (117) on the main base (127) and from the dust cover arm (115).
- (2) Remove the machine screw (111), anchor nut (112), and flat washer (113) from the dust cover arm (115).
- (3) Remove the dust cover knob (114) to release the dust cover arm (115) and flat washer (116).
- (4) Remove the spring post (117) from the main base (127).
- (5) Repeat (1) through (4) above to similarly disassemble the opposite dust cover arm (115).
- (6) Remove the four machine screws (83) and lockwashers (84) that hold the two dust cover guides (85) to the main base (127); remove the dust cover guides.

*b. Replacement.*

- (1) Position the two dust cover guides (85) on the main base (127); secure with four machine screws (83) and lockwashers (84).
- (2) Install the spring posts (117) in the main base (127).
- (3) Position the dust cover arm (115) and flat washer (116) on the main base (127); install the dust cover knob (114).
- (4) Install the anchor nut (112), machine screw (111), and flat washer (113) to secure the dust cover knob (114) to the dust cover arm (115).
- (5) Install the arm locking spring (110) on the dust cover arm (115) and on

the spring post (117) on the main base (127).

- (6) Repeat (2) through (5) above to assemble the opposite dust cover arm (115).
- (7) Adjust the dust cover arms as directed in paragraph 496.

## **257. Removal and Replacement of Capacitors, Transformers, and Relay** (fig. 286)

*a. Removal.*

- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Tilt the perforator main base (127) and remove the seven machine screws (1) that hold the base plate (2) to the main base; remove the base plate.
- (3) Remove the two machine screws (36) and flat washers (37) that hold the fixed capacitor (38) to the main base (127); unsolder the electrical leads and remove the fixed capacitor. Tag the leads to facilitate reassembly.
- (4) Remove the five nuts (65) and lockwashers (66) that hold the five fixed capacitors (67) to the main base (127); unsolder the electrical leads to the capacitors and remove the capacitors and flat washers (68).
- (5) Loosen the capacitor clamp (100). Unsolder the leads to the capacitor (97); remove the capacitor. Remove the three machine screws (98) and lockwashers (99) that hold the capacitor clamp to the main base (127); remove the capacitor clamp.
- (6) Remove the four machine screws that hold the power supply chassis assembly to the perforator main base (127); remove the power supply chassis assembly. Remove the four self-locking hexagonal nuts (118) and lockwashers (119) that hold the power transformer (120) to the main base (127); remove the electrical leads and remove the power transformer.
- (7) Remove the four self-locking hexagonal nuts (101) that hold the automatic line return relay (102) to the main base (127); unsolder the elec-

trical leads from the automatic line return relay and remove the automatic line return relay.

*b. Replacement.*

- (1) Replace each of the components in the reverse order of the disassembly procedure.
- (2) Tilt the main base (127) and position the base plate (2) on the main base; secure with seven machine screws (1).
- (3) Install the perforator on the perforator main base (127) as described in paragraph 196b.

## **258. Removal and Replacement of Grounding Leads** (fig. 286)

*a. Removal.*

- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Remove the base plate (2) from the main base (127) as described in paragraph 257a(2).
- (3) Remove the self-locking hexagonal nut (42), lockwasher (43), three terminal lugs (44, 45, and 46), and lockwasher (47) from the machine screw (48) that holds the left rear grounding lead (50) to the main base (127); remove the machine screw, lockwasher (49), grounding lead, and lockwasher (51).
- (4) Remove the remaining three machine screws (52); lockwashers (53), grounding leads (54), and lockwashers (55).

*b. Replacement.*

- (1) Install a lockwasher (53), grounding lead (54), lockwasher (55), and machine screw (52) near each of the vibration mount positions except the left rear position.
- (2) Position a lockwasher (49), grounding lead (50), lockwasher (51), and machine screw (48) in the left rear ground screw position on the main base (127). Tilt the main base and position a lockwasher (47), three terminal lugs (46, 45, and 44), and a lockwasher (43) on the machine

screw; secure with a self-locking hexagonal nut (42).

- (3) Install the base plate (2) on the main base (127) as described in paragraph 257b(6).
- (4) Install the perforator on the perforator base as described in paragraph 196b.

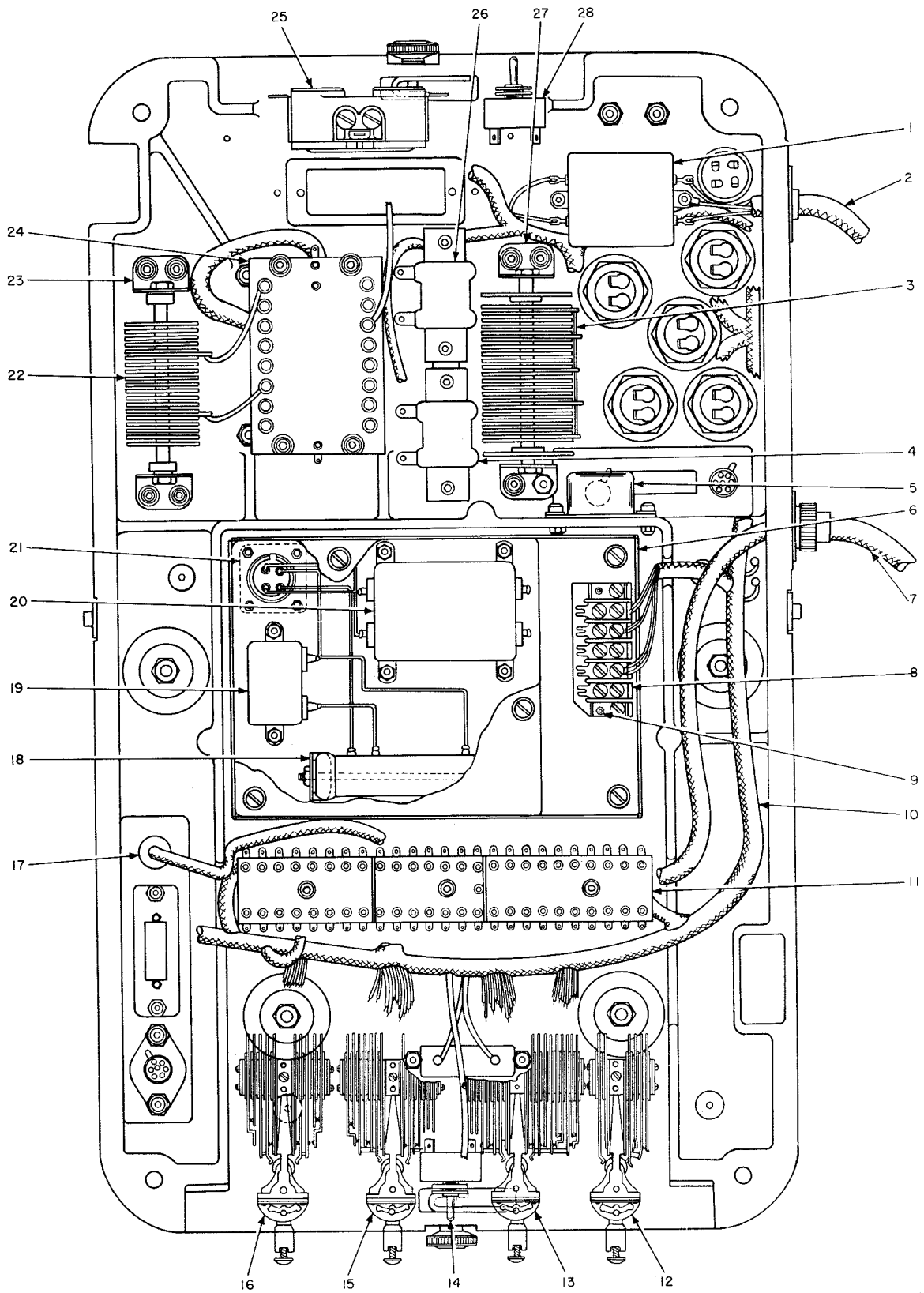
## **259. Removal and Replacement of Front and Rear Switchplates** (fig. 286)

*a. Removal.*

- (1) Remove the base plate (2) from the main base (127) as described in paragraph 257a(2).
- (2) Remove the four machine screws that hold each of the four pileup lever switches to the front switchplate (41).
- (3) Remove the nut that holds the toggle switch to the front switchplate.
- (4) Remove the four machine screws (39) and lockwashers (40) that hold the front switchplate (41) to the main base (127); remove the front switchplate.
- (5) Remove the nut that holds the toggle switch to the rear switchplate (109).
- (6) Remove the two machine screws, lockwashers, and plain hexagonal nuts that hold the convenience outlet to the rear switchplate (109).
- (7) Disconnect the electrical leads from the two fuseholders (108). Remove the two hexagonal nuts (105), lockwashers (106), and rubber washers (107) that hold the fuseholders to the rear switchplate (109); remove the fuseholders.
- (8) Remove the four machine screws (103) and lockwashers (104) that hold the rear switchplate (109) to the main base (127); remove the rear switchplate.

*b. Replacement.*

- (1) Replace each of the components in the reverse order of the disassembly procedure.
- (2) Install the base plate (2) on the main base (127) as described in paragraph 257b(6).



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Figure 287. Perforator base electrical components



1 AC line filter Z7	9 Terminal board mounting plate, 20382	19 Fixed capacitor C10
2 Power cable assembly P10	10 Cable assembly, 54185	20 Filter Z8
3 Metallic rectifier CR3	11 Terminal Board TB6	21 Receptacle connector J11
4 Fixed resistor R11	12 Keyboard control switch S23	22 Metallic rectifier CR4
Fixed resistor R15	13 Perforator control switch S31	23 Metallic rectifier bracket 56101
Fixed resistor R23	14 MOTOR switch S22	24 Terminal board assembly TB8
5 Fixed capacitor C21	15 Line switch key S28	25 Receptacle connector J16
6 Filter box assembly, 56035A	16 ALR MONITOR switch S24	26 Fixed resistor R14
7 Cable assembly P9	17 Bushing insulator, 20713	Fixed resistor R13
8 Terminal board TB7	18 Fixed resistor R12	27 Metallic rectifier bracket 56101
		28 POWER switch S21

Figure 287—Continued.

## 260. Removal and Replacement of Receptacle Connectors from Top of Main Base

(fig. 286)

### a. Removal.

- (1) Remove the perforator from the perforator base as described in paragraph 196a.
- (2) Remove the base plate (2) from the main base (127) as described in paragraph 257a(2).
- (3) Remove the power supply chassis from the main base (127) as described in paragraph 257a(6).
- (4) Remove the two machine screws (69) that hold the receptacle connector (70) to the main base (127); disconnect the electrical leads and remove the receptacle connector.
- (5) Remove the two machine screws (13) and lockwashers (14) that hold the mounting plate (27) to the main base (127).
- (6) Remove the self-locking hexagonal nut (15), lockwasher (16), ground strap (17), lockwasher (18), machine screw (19), and lockwasher (20) that hold the one side of the connector plate (30) to the mounting plate (27). Remove the self-locking hexagonal nut (21), machine screw (22), and lockwasher (23) that hold the other side of the connector plate to the mounting plate.
- (7) Remove the two self-locking hexagonal nuts (24), machine screws (25), and lockwashers (26) that hold the socket plate (34) to the mounting plate (27).
- (8) Remove the cable from the bushing insulator (31) and remove the bushing insulator from the mounting plate (27); remove the mounting plate.
- (9) Disconnect the electrical leads from the receptacle connector (29); remove the two hexagonal nuts (28) that hold the receptacle connector to the connector plate (30). **Remove the receptacle connector.**
- (10) Unsolder the electrical leads from the receptacle connector (33). Remove the hexagonal nut (32) that holds the receptacle connector to the socket plate (34); remove the receptacle connector.
- (11) Remove the two self-locking hexagonal nuts (56), machine screws (57), and lockwashers (58) that hold the mounting plate (64) to the main base (127).
- (12) Unsolder the electrical leads from the receptacle connector (60). Remove the nut (59) that holds the receptacle connector to the mounting plate (64); remove the receptacle connector.
- (13) Unsolder the electrical leads from the receptacle connector (63). Remove the two units (61) and lockwashers (62) that hold the receptacle connector to the mounting plate (64); remove the receptacle connector.
- (14) Remove the two machine screws (121) and lockwashers (122) that hold the power supply mounting plate (126) to the main base (127).
- (15) Disconnect the electrical leads from the receptacle connector (125). Remove the two self-locking hexagonal nuts (123) and machine screws (124) that hold the receptacle connector (125) to the power supply mounting

plate (126); remove the receptacle connector and power supply mounting plate.

*b. Replacement.*

- (1) Replace each of the components in the reverse order of the disassembly procedure.
- (2) Install the power supply chassis on the main base (127) as described in paragraph 257b(2).
- (3) Install the base plate (2) on the main base (127) as described in paragraph 257b(6).
- (4) Install the perforator on the perforator base as described in paragraph 196b.

**261. Removal and Replacement of Receptacle Connectors and Mounting Plates from Left Side of Main Base**  
(fig. 286)

*a. Removal.*

- (1) Remove the base plate (2) from the main base (127) as described in paragraph 257a(2).
- (2) Remove the self-locking hexagonal nut (71), lockwasher (72), two electrical terminals (73 and 74), lockwasher (75), machine screw (76), and lockwasher (77) that hold the left side of the socket plate (82) to the main base (127).
- (3) Remove the machine screw (78) and lockwasher (79) that hold the other side of the socket plate (82) to the main base (127).
- (4) Disconnect the electrical leads from the receptacle connector (81); remove the nut (80) that holds the receptacle connector to the socket plate

(82); remove the receptacle connector.

- (5) Remove the four machine screws (86) and lockwashers (87) that hold the electrical connector shell (88) to the main base (127); disconnect the electrical leads and remove the electrical connector shell.
- (6) Remove the four machine screws (89) and lockwashers (90) that hold the mounting plate (92) to the main base (127); remove the cable from the bushing insulator (91) and remove the bushing insulator from the mounting plate.
- (7) Remove the four machine screws (93) and lockwashers (94) that hold the mounting plate (96) to the main base (127); remove the cable from the bushing insulator (95) and remove the bushing insulator from the mounting plate.

*b. Replacement*

- (1) Replace each of the components in the reverse order of the disassembly procedure.
- (2) Install the base plate (2) on the main base (127) as described in paragraph 257b(6).

**262. Removal and Replacement of Perforator Base Electrical Components**

The electrical components mounted in the perforator base are illustrated in figure 287. These components should not be removed unless they are damaged or inoperative. The reference designations used in the legend apply to TT-178/FG and TT-179/FG. Reference designations used in other models of the equipment may be found in paragraph 91.

**Section VII. PAGE PRINTER ADJUSTMENT PROCEDURES**

**263. General**

This section describes the requirements and adjustment procedures for the page printer. Adjustments are arranged in the proper sequence for a complete readjustment of the page printer. When making individual adjustments,

check and, if necessary, perform all related adjustments. When removing items to make an adjustment refer to section V for removal and replacement instructions. Perform adjustments described in paragraphs 264 through 293 in that order.

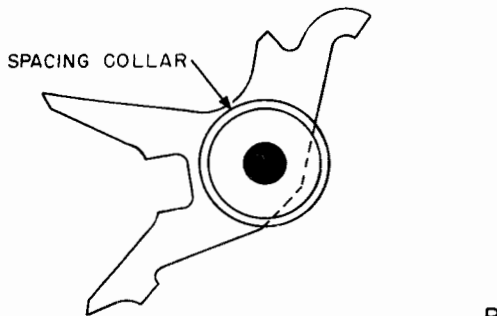
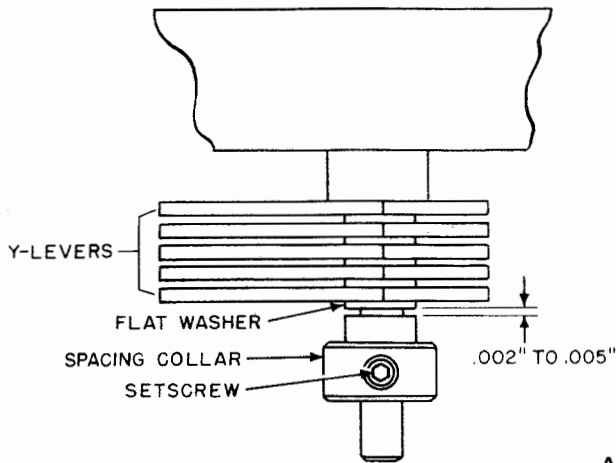


Figure 288. Y-lever spacing collar adjustment requirement.

## 264. Y-Lever Spacing Collar Adjustment (fig. 288)

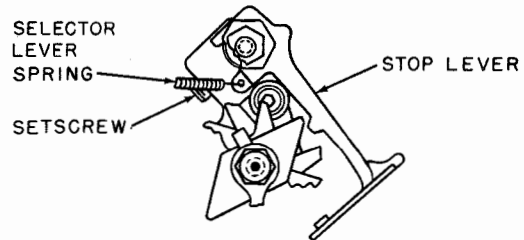
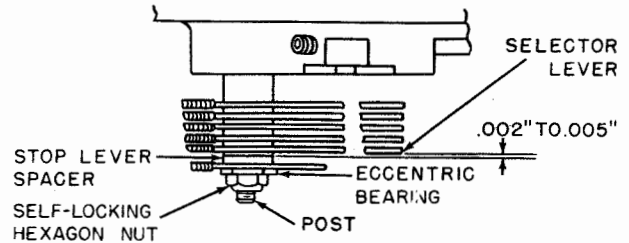
*a. Requirement.* The clearance between the spacing collar and the flat washer should be .002 to .005 inch.

*b. Method of Checking.* Place a feeler gage between the spacing collar and the flat washer.

*c. Adjustment.* Loosen the setscrews in the spacing collar and move the spacing collar in or out to meet the requirement; tighten the setscrews.

## 265. Selector Lever Clearance Adjustment (fig. 289)

*a. Requirement.* There should be a .002- to .005-inch clearance between the stop lever spacer and the first selector lever.



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Figure 289. Selector lever clearance adjustment requirement.

*b. Method of Checking.* Remove the terminal box as described in paragraph 192 and the transfer lever spring. Check the clearance with a flat feeler gage.

*c. Adjustment.* Loosen the setscrew and slide the post in or out to meet the requirement; tighten the setscrew. Replace the terminal box and transfer lever spring.

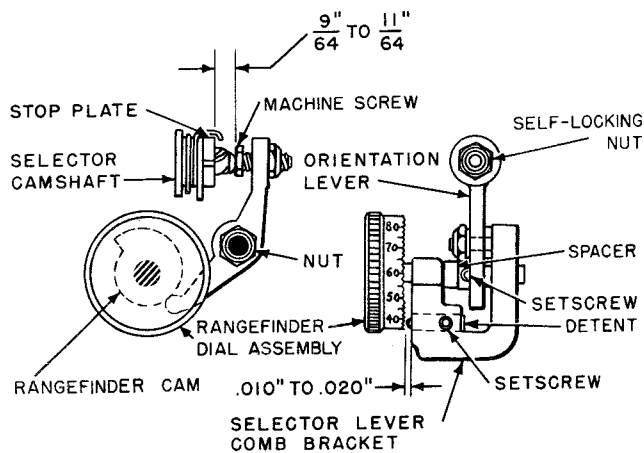
## 266. Rangefinder Dial Assembly Adjustment (fig. 290)

*a. Requirements.*

- (1) When the rangefinder dial is set at 60, the lower end of the orientation lever should be midway between the high and low points of the rangefinder cam, as shown in figure 290.
- (2) There should be .010- to .020-inch clearance between the rangefinder dial and the selector lever comb bracket.
- (3) The detent should be set to hold the rangefinder dial firmly, without excessive tightness.

*b. Adjustments.*

- (1) Loosen both setscrews in the rangefinder cam. Insert a .015-inch flat gage between the rangefinder dial and bracket. Position the cam to meet



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Figure 290. Rangefinder dial assembly adjustment requirements.

requirement (1) above; press the dial toward the bracket and the cam toward the dial; and tighten one of the setscrews. Remove the flat gage and recheck requirements (1) and (2) above. Modify the adjustment, if necessary, and tighten the other setscrew.

- (2) Loosen the setscrew that holds the detent, position the detent to increase or decrease detent pressure, as necessary, and tighten the setscrew.
- (3) Check the related adjustment described in paragraph 267.

### 267. Orientation Lever Adjustment (fig. 290)

*a. Requirement.* There should be a  $\frac{9}{64}$ - to  $\frac{11}{64}$ -inch clearance between the stop plate and the head of the machine screw in the orientation lever when the orientation lever is held against the midpoint of the rangefinder cam.

*b. Adjustment.* Loosen the self-locking nut. Turn the machine screw in or out to meet the requirement, and tighten the nut. Check the related adjustment described in paragraph 266.

### 268. Selector Lever Guide Comb Adjustment (fig. 291)

*a. Requirement.* The selector levers and Y-levers should be alined and there should be no binding between the selector levers and the selector lever guide comb.

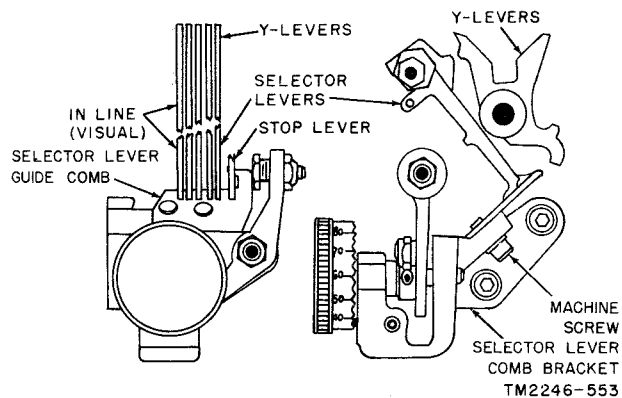


Figure 291. Selector lever guide comb adjustment requirement.

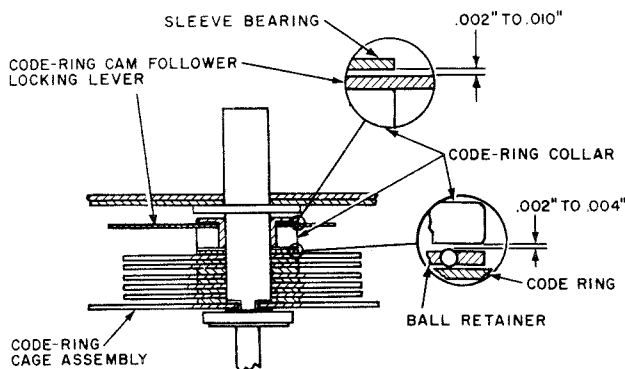
*b. Adjustment.* Loosen the two machine screws that hold the selector lever guide comb; position the comb to meet the above requirements; and tighten the screws. Check the alinement visually and slide each selector lever upward and downward in its slot to check for binding. Check to be sure the page printer meets the adjustment requirements described in paragraphs 291 through 293.

### 269. Code Rings and Code-Ring Cam Follower Locking Lever End Play Adjustment (fig. 292)

Make this adjustment *only* when the code-ring cage has been removed from the machine.

*a. Requirements.*

- (1) There should be a .002- to .004-inch clearance between the code-ring collar and the ball retainer.
- (2) There should be a .002- to .010-inch clearance between the sleeve bearing



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Figure 292. Code rings and code-ring cam follower locking lever end play adjustment requirements.

and the code-ring cam follower locking lever.

*b. Method of Checking.*

- (1) Insert a flat feeler gage from the bottom of the code-ring cage between the code-ring collar and the ball retainer.
- (2) Insert a flat feeler gage from the bottom of the code-ring cage between the sleeve bearing and the code-ring cam follower locking lever.

*c. Adjustment.* Two setscrews secure the code-ring collar and the sleeve bearing to the shaft of the code-ring cage. One setscrew can be easily reached from the bottom of the code-ring cage; the other can be reached between the top center stop bars and through the hole in the code-ring cage spacer.

- (1) Loosen the two setscrews and insert a .003-inch flat feeler gage between the ball retainer and the code-ring collar.
- (2) Hold the flat (.005-inch) feeler gage between the ball retainer and the code-ring collar while shifting the sleeve bearing to meet the requirement in *a*(2) above. Tighten the setscrews and recheck the clearance.

**270. Blank Stop Bar Contact Adjustment (Weather Communications Equipment Only)**

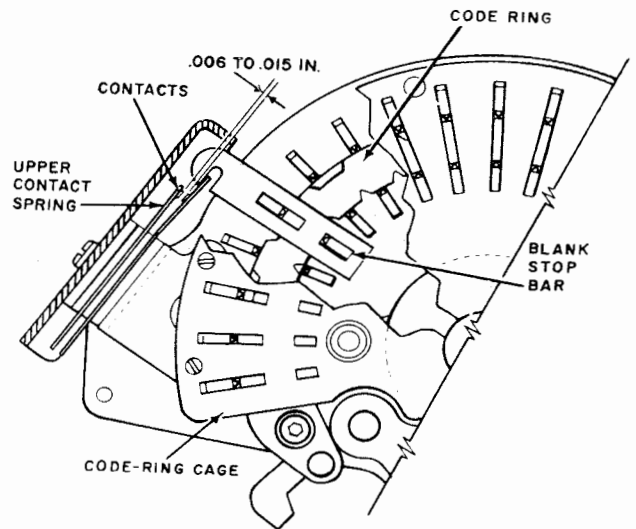
(fig. 293)

*a. Requirements.*

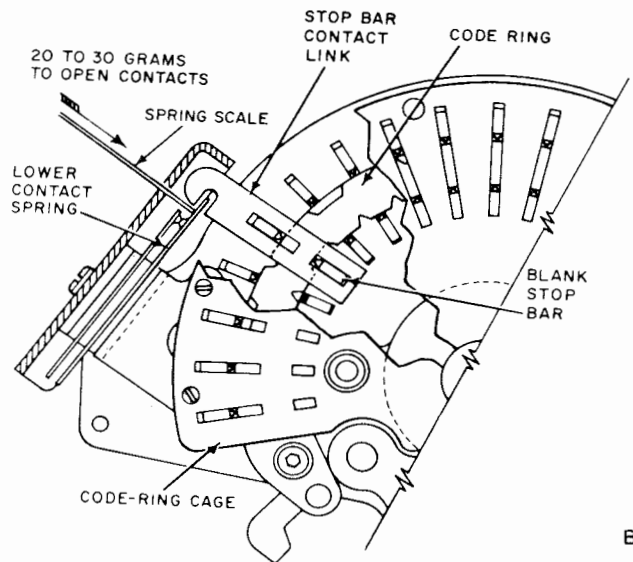
- (1) When any code group (except blank) is received, there should be a .006- to .015-inch gap between the blank contacts.
- (2) When the blank code group is received, the blank contacts should close, and it should take 20 to 30 grams pressure to just open the contacts.

*b. Adjustment.*

- (1) Position the code rings for any code group (except blank) and form the upper contact spring to obtain a .006- to .015-inch gap.
- (2) Position the code rings for the blank code group and form the lower contact spring to obtain the requirement. Recheck the requirement (*a*(1) above).



A



B

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Figure 293. Blank contact adjustment requirements (weather communications equipment only).

**271. Function Sensing Levers End Play Adjustment**

(fig. 294)

*a. Requirement.* There should be a .001- to .005-inch clearance between the flat washer and the line feed sensing lever.

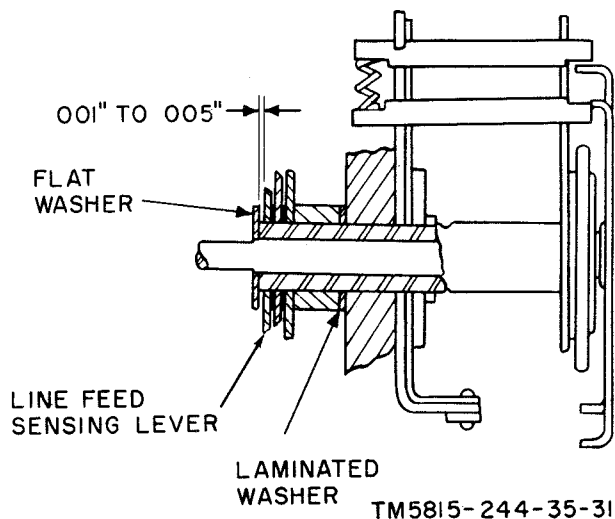


Figure 294. Sensing levers end play adjustment requirement.

*b. Method of Checking.* Check the clearance by inserting a flat feeler gage from the rear of the code-ring cage between the line feed sensing lever and the flat washer.

*c. Adjustment.* Remove the code-ring cage as described in paragraph 176 and peel the necessary laminations from the laminated flat washer. Check the related adjustments described in paragraphs 271 through 293.

## 272. Square Shaft and Function Selecting Arm Claw Adjustment (fig. 295)

*a. Requirement.* There should be a .015- to .046-inch clearance between the function se-

lecting arm claw and the casting, and a .005- to .010-inch clearance between the flat washer and the end of the square shaft.

*b. Method of Checking.* Loosen the four setscrews of the square shaft driven gear and slide the gear toward the motor side of the unit. Check both clearances with feeler gages.

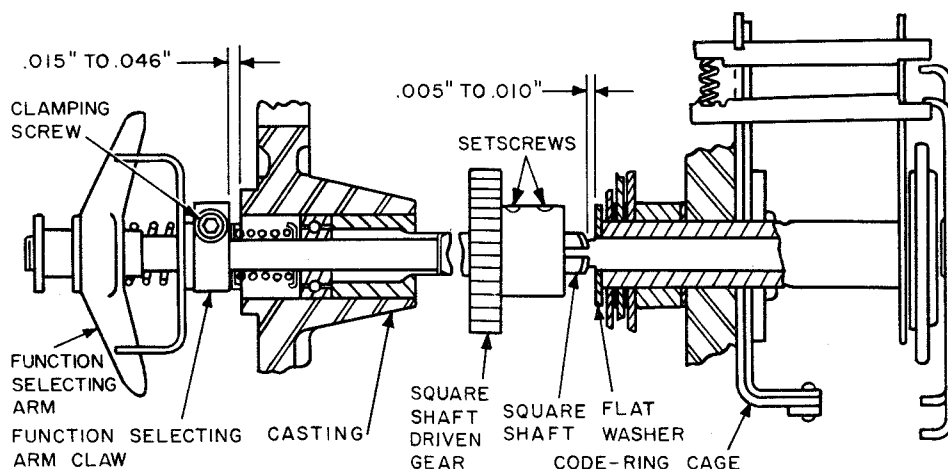
*c. Adjustment.* Loosen the clamping screw on the function selecting arm claw. Place a .030-inch feeler gage between the function selecting arm claw and the casting. Hold the function selecting arm claw against the feeler gage, and position the square shaft to obtain the required clearance between the square shaft and the flat washer. Tighten the clamping screw on the function selecting arm claw. Leave the feeler gage between the function selecting arm claw and the casting and perform the square shaft driven gear adjustment (par. 273).

## 273. Square Shaft Driven Gear Adjustment (fig. 296)

*Note.* Before making this adjustment, be sure the page printer meets the adjustment requirements described in paragraphs 271 and 272.

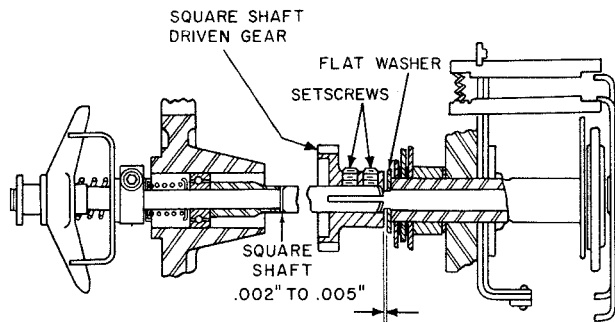
*a. Requirement.* When the .030-inch feeler gage is between the function selecting arm claw and the casting (par. 265), there should be a .002- to .005-inch clearance between the square shaft driven gear and the flat washer.

*b. Adjustment.* Loosen the four setscrews on the square shaft driven gear. Slide the



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Figure 295. Square shaft and function selecting arm claw adjustment requirements.



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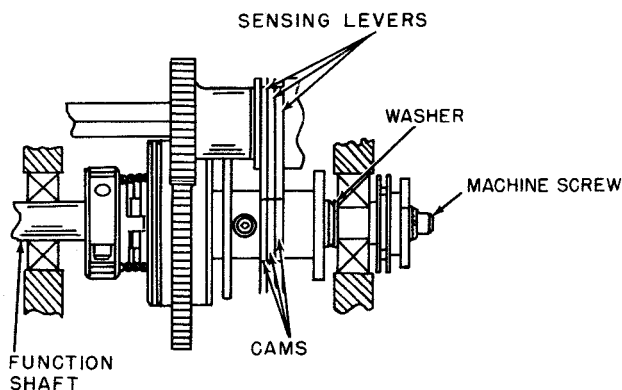
Figure 296. Square shaft driven gear adjustment requirement.

square shaft driven gear to get the required clearance and tighten the four setscrews.

## 274. Alinement of Function Sensing Levers and Cams (fig. 297)

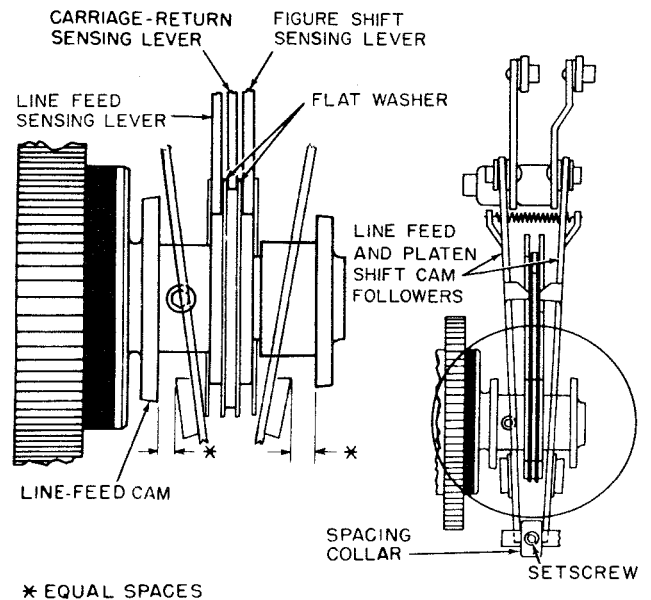
*a. Requirement.* The sensing levers must be in line with their respective cams on the function shaft.

*b. Adjustment.* Remove the assembled function shaft from the page printer and remove the machine screw from the end of the function shaft. Remove the parts from the end of the function shaft until the laminated washer is removed. Peel laminations from the washer to meet the requirement, and replace the parts on the function shaft. Tighten the machine screw and install the assembled function shaft in the page printer. Recheck the requirement and readjust if necessary. Check related adjustments described in paragraphs 271 through 273.



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Figure 297. Function sensing levers and cams.



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Figure 298. Function cam followers spacing collar adjustment requirement.

## 275. Function Cam Followers Spacing Collar Adjustment (fig. 298)

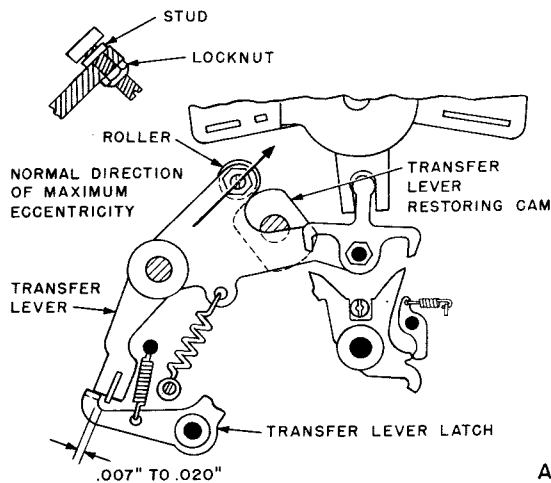
*a. Requirement.* There should be equal clearance between the rollers of the line feed and figures shift cam followers and their respective cams.

*b. Method of Checking.* Operate the page printer manually to set up a code combination other than line feed or figures shift. Remove the terminal box and the paper roller stand as described in paragraph 192. Check the clearances and replace the removed items.

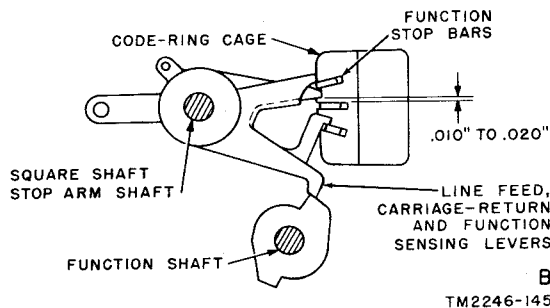
*c. Adjustment.* Loosen the setscrews in the spacing collar and shift the spacing collar to the right or to the left to meet the requirement. Tighten the setscrews. Check the related adjustments described in paragraphs 271 through 274.

## 276. Code-Ring Cage Adjustment

*a. Requirement.* When the page printer is in the stopped position, there should be a .010- to .020-inch clearance between the carriage-return function sensing lever (middle lever, B, fig. 299) and its associated function stop bar and a .005-inch minimum clearance between the line feed sensing lever and the figures shift sensing lever and their associated stop bars.



A



B

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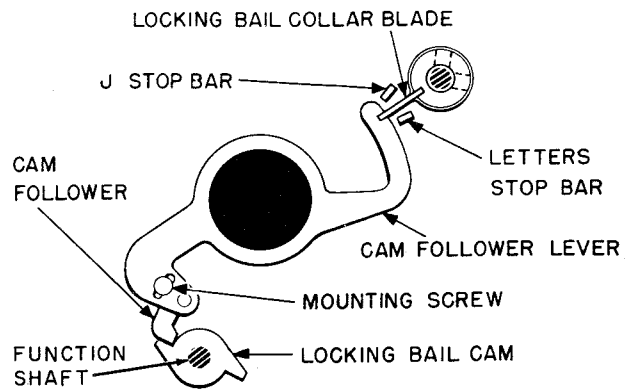
Figure 299. Transfer lever roller stud and code-ring cage adjustment requirements.

*b. Adjustment.* Loosen the machine screws that secure the code-ring cage (fig. 303) and turn the code-ring cage either clockwise or counterclockwise until the above requirements are met. Tighten the machine screws. Check the related adjustments described in paragraphs 277, 281, 282, and 321.

### 277. Code-Ring Locking Bail Cam Follower Adjustment (fig. 300)

*a. Requirement.* The locking bail collar blade should operate directly between the letters and the J stop bars without touching either stop bar.

*b. Adjustment.* Turn the function shaft until the locking bail cam is in the position shown in figure 300 and loosen the mounting



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Figure 300. Code-ring locking bail cam follower adjustment requirement.

screws that holds the cam follower. Adjust the position of the cam follower until the locking bail collar blade is directly between the letters and the J stop bars and tighten the mounting screw. Set up repeated letters and J code groups on the code rings and check the requirement by eye. Readjust, if necessary. Check the related adjustments described in paragraphs 300 and 301.

### 278. Transfer Lever Roller Stud Adjustment

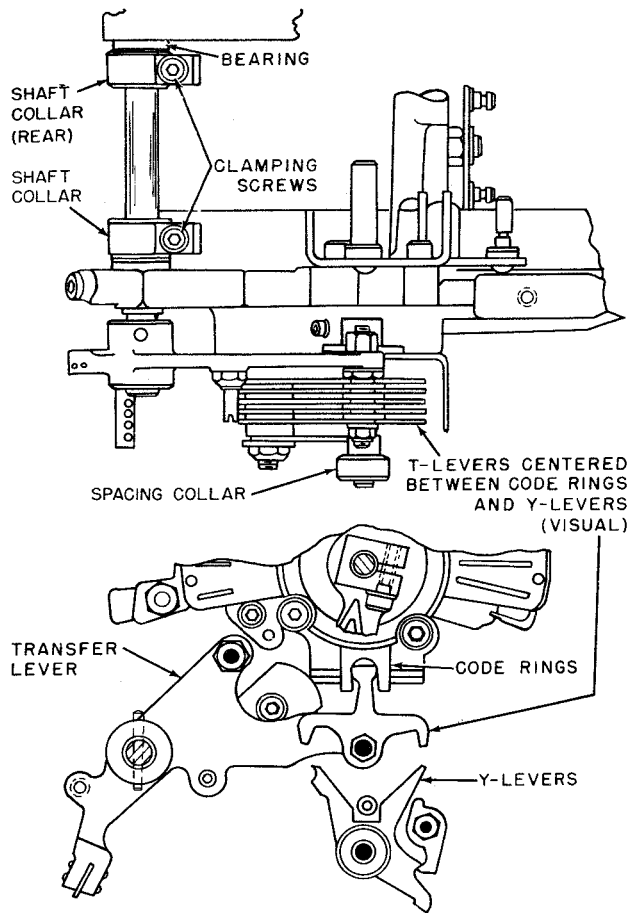
*a. Requirement.* There should be a .007- to .020-inch clearance between the transfer lever and the latching surface of the transfer lever latch when the roller of the transfer lever is on a high portion of the transfer lever, restoring cam (A, fig. 299).

*b. Adjustment.* Loosen the locknut and set the stud for maximum eccentricity in the indicated direction. Rotate the motor of the page printer by hand until the roller is on the high portion of the transfer lever restoring cam. Turn the stud counterclockwise until the required clearance is obtained, and tighten the locknut. Check the related adjustments described in paragraphs 279 and 280.

### 279. T-Levers Alinement (fig. 301)

*a. Requirement.* The T-levers must be alined as closely as possible with their associated Y-levers and code rings. Any offset should be equally divided so that the T-levers are centered between the Y-levers and the code rings.





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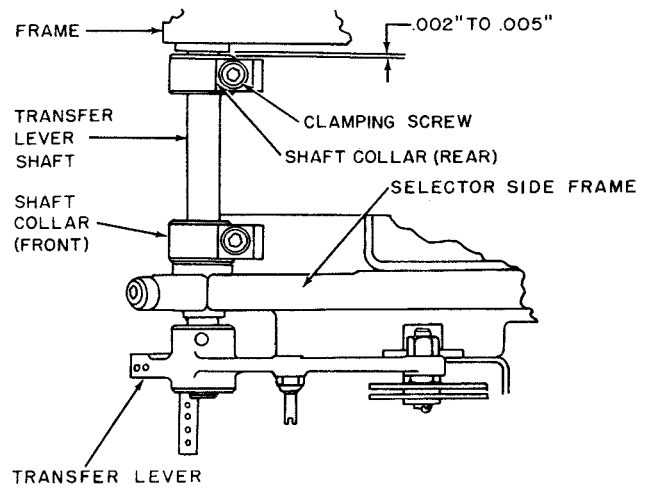
Figure 301. T-levers alignment.

*b. Adjustment.* Loosen the clamping screws of the front and rear collars of the transfer lever and shaft and slide the transfer lever in or out to meet the requirement, hold the transfer lever in position, slide the rear collar tight against the bearing and tighten the clamping screw in the rear collar. Perform the adjustment described in paragraph 280. Check the related adjustment described in paragraph 278.

### 280. Transfer Lever Shaft End Play Adjustment (fig. 302)

*a. Requirement.* There should be a .002- to .005-inch clearance between the rear collar on the transfer lever shaft and the frame.

*b. Adjustment.* Loosen the clamping screw in the front shaft collar. Hold the front collar tightly against the frame, move the transfer lever shaft to meet the requirement, and tighten



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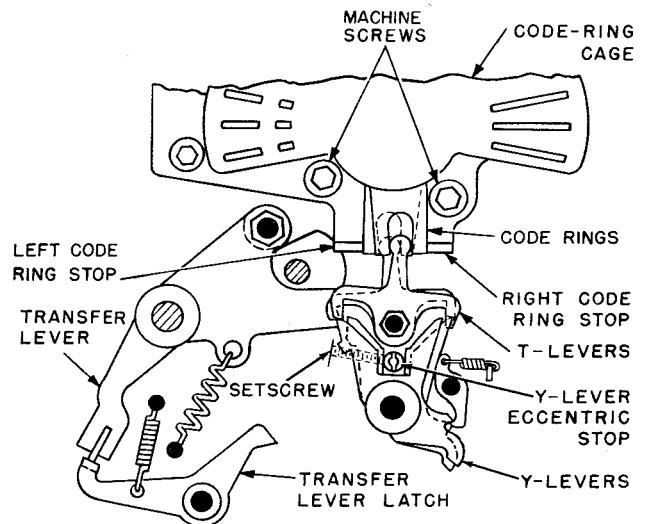
Figure 302. Transfer lever shaft end play adjustment requirement.

the clamping screw. Check related adjustments described in paragraphs 278 and 279.

### 281. Y-Lever Eccentric Stop Preliminary Adjustment (fig. 303)

*a. Requirement.* The Y-lever eccentric stop should be positioned midway between the Y-levers.

*Note.* When making the following adjustment, be careful not to damage the function shaft when inserting the tool into the setscrew.



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Figure 303. Y-lever eccentric stop preliminary adjustment.

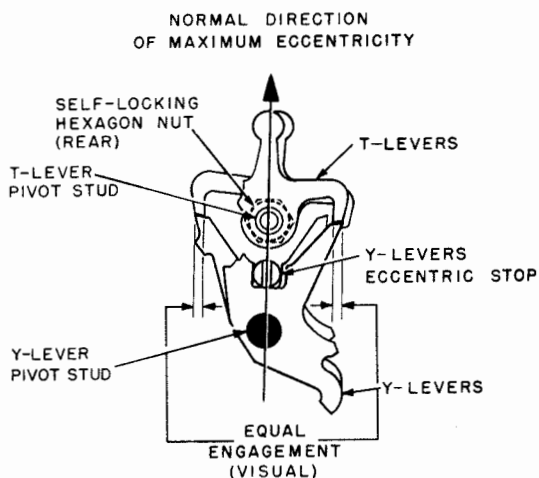
b. *Adjustment.* Set the Y-levers for either the R or Y code combination. Loosen the set-screw which locks the Y-lever eccentric stop. Turn the stop clockwise until it makes contact with the Y-levers that are in the space position, and note the position of the slot in the end of the stop. Then turn the stop counterclockwise until it makes contact with the Y-levers that are in the mark position, and note the position of the slot in the end of the stop. Turn the stop to a position midway between the two noted positions and tighten the holding set-screw. Check related adjustments described in paragraphs 282, 284, 291, and 292.

### 282. T-Lever Pivot Stud Adjustment (fig. 304)

a. *Requirement.* The T-levers should engage the Y-levers an equal amount for both mark and space positions of the Y-levers.

b. *Method of Checking.* When the transfer lever is latched and the function shaft is in the stopped position, set the No. 1 Y-lever to the clockwise position. Trip the transfer lever by pulling the latch down, causing the T-levers to engage the Y-levers. Check the amount of engagement visually.

Turn the motor manually to reposition the



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Figure 304. T-lever pivot stud adjustment requirement.

transfer lever and the T-levers. Set the No. 1 Y-lever to the counterclockwise position, trip the transfer lever, and check the amount of engagement.

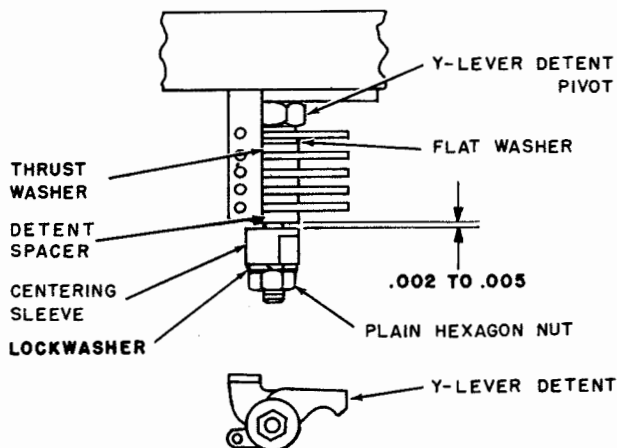
c. *Adjustment.* Loosen the self-locking hexagonal nut on the rear of the T-lever pivot stud. Position the pivot stud until the requirement is met and tighten the nut. Note the normal direction of maximum eccentricity. Check the related adjustments described in paragraphs 281, 283, and 284.

### 283. Y-Levers Detent End Play Adjustment (fig. 305)

a. *Requirement.* There should be .002- to .005-inch clearance between the centering sleeve and the detent spacer.

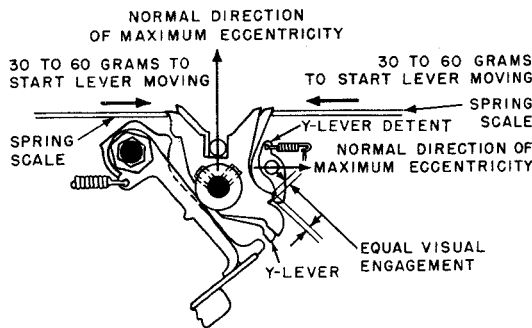
b. *Adjustment.* With the Y-lever detents and detent spacers on the centering sleeve and the centering sleeve on the Y-lever detent post, tighten the plain hexagonal nut and check the clearance between the detent spacer and the centering sleeve. If the clearance is not within the requirement, remove the plain hexagonal nut and lockwasher, slide the centering sleeve from the Y-lever detent post, and peel the laminated spacer to meet the requirement.

*Note.* The spacer adjacent to the laminated spacer may have to be replaced by five laminated spacers to attain the requirement.



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Figure 305. Y-levers detent end play adjustment requirement.



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Figure 306. Y-levers detent and Y-levers adjustment requirements.

### 284. Y-Lever Detents and Y-Levers Adjustment (fig. 306)

*a. Requirements.*

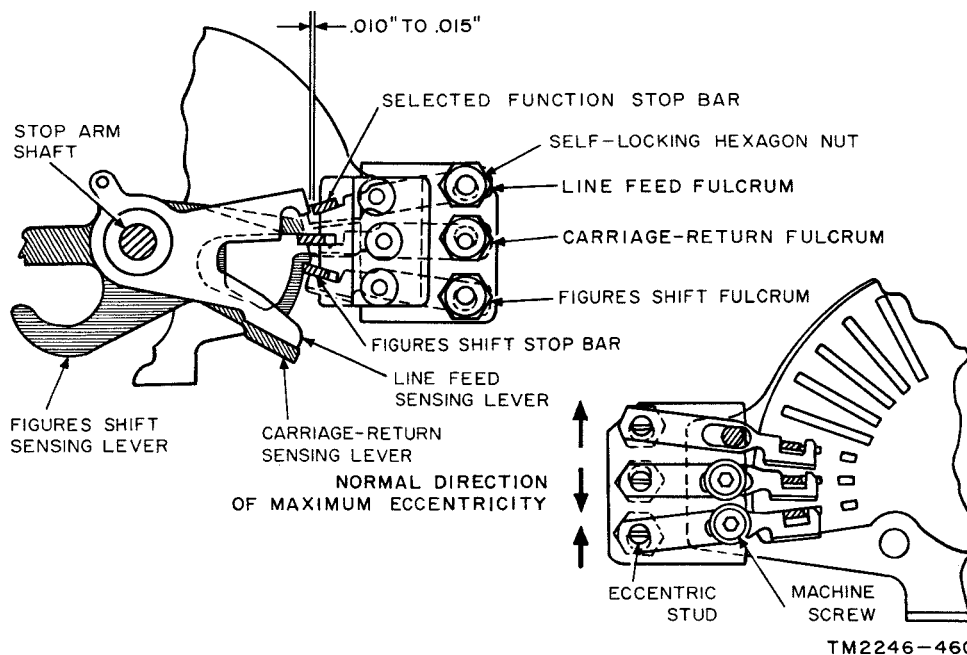
- (1) There should be an equal engagement of each Y-lever detent with its associated Y-lever when the Y-lever is in either mark or space position.
- (2) It should require 30 to 60 grams pull to start a Y-lever moving.

*b. Adjustment.* Loosen the plain hexagonal nut and turn the centering sleeve until both requirements are met; tighten the plain hexagonal nut (fig. 305)

### 285. Stop Bar Fulcrum Adjustment (fig. 307)

*a. Requirement.* There should be a .010- to .015-inch clearance between each selected function stop bar and its associated sensing lever when the sensing lever has dropped and is level with its associated stop bar.

*b. Adjustment.* Position the code rings for the figures shift operation. Turn the motor by hand until the figures shift sensing lever is in line with the figures shift stop bar. Loosen the machine screw that holds the figures shift fulcrum. Loosen the self-locking hexagonal nut that holds the associated eccentric stud. Turn the eccentric stud with a screwdriver until the requirement is met. Hold the eccentric stud, tighten the self-locking nut and tighten the machine screw. Recheck the clearance. Use the same procedure for carriage-return and line feed fulcrum adjustment. Check the related adjustments in paragraphs 269, 271, 277, 278, 299, 300, and 301.



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Figure 307. Stop bar fulcrum adjustment requirement.

## 286. Magnet Bracket Adjustment Screws and Armature Preliminary Adjustments (fig. 308)

*Note.* The following adjustment and the adjustments described in paragraphs 287 through 293 should be performed as a complete series of adjustment procedures.

### a. Preparation.

- (1) Disconnect the selector magnet cable plug from the receptacle in the page printer base.
- (2) Remove the two screws that hold the selector magnet bracket to the page printer casting. Lift the complete selector magnet assembly from the page printer.
- (3) Loosen the magnet screw and cable stud that hold the selector magnet to the selector magnet bracket (fig. 310), slide the magnet and conductor bracket away from the armature, and tighten the magnet mounting screw.

### b. Requirements.

- (1) When the selector magnet bracket is held against the adjustment screws, the threaded holes in the page printer casting should be centered with the associated larger holes in the selector magnet bracket.
- (2) When the condition in requirement (1) above is met, the armature should be held captive in a position which permits the outer selector lever to

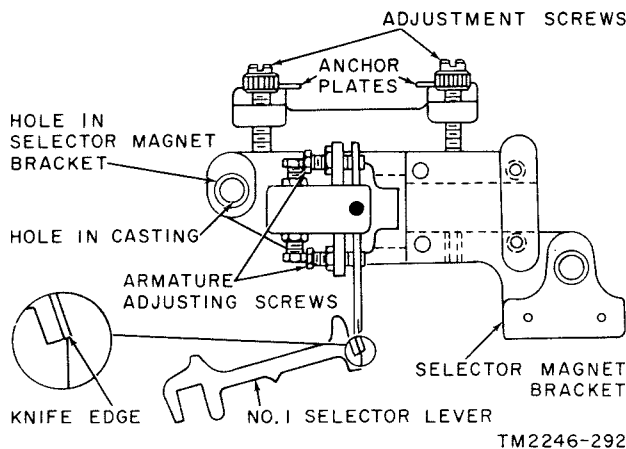


Figure 308. Armature and selector magnet bracket alignment.

barely miss the edge of the armature blade as the selector lever is moved past the blade.

### c. Adjustments.

- (1) Hold the selector magnet bracket against the adjustment screws and turn the adjustment screws as necessary to meet requirement *b* (1) above.
- (2) Loosen the hexagonal nuts on both armature adjusting screws. Hold the armature against one of the screws and turn the same screw inward until requirement *b* (2) above is met. Turn the other screw inward slowly until a *barely perceptible* amount of armature movement remains.

**Caution.** Be careful not to tighten the second adjusting screw against the armature. Failure to observe this precaution may result in a bent armature.

## 287. Armature Stop Bracket and Bar Magnet Clearance Preliminary Adjustment (fig. 309)

*Note.* See note, paragraph 286.

*a. Requirement.* There must be a gap of .015 inch between the south pole of the bar magnet and the armature stop bracket (red dot on magnet indicates north pole).

*b. Adjustment.* Loosen the setscrew that holds the bar magnet in the selector magnet bracket. Position the bar magnet to meet the requirement. Check the related adjustments in paragraphs 286 through 290.

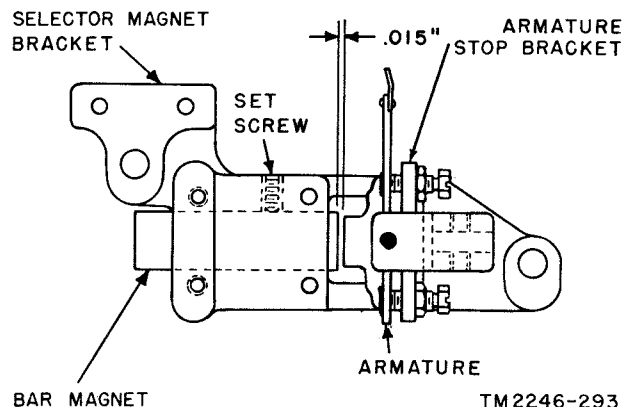


Figure 309. Armature stop bracket and bar magnet preliminary clearance, adjustment.

## 288. Alinement of Selector Magnet Pole Faces and Armature

Note. See note, paragraph 286.

### a. Requirements.

- (1) When the armature adjusting screws are positioned to hold the armature captive as described in paragraph 286b(2) and c(2), there should be a .004-inch clearance between the pole faces of the selector magnet and the toffets (raised disks on armature) (A, fig. 310).

Note. Early models of these teletypewriters sets did not include toffets on the armatures of the selector magnet. Clearance requirements for these sets refer to the portion of the armature that is nearest the pole face.

- (2) The armature poles should be centered with respect to the armature adjusting screws (A, fig. 310).

- (3) Each pole face should be parallel (within .002 inch) with its adjacent armature toffet (B, fig. 310).

### b. Adjustments.

- (1) Loosen the magnet mounting screw and cable stud. Insert a .004-inch flat gage between each pole face and its adjacent toffet. Move the selector magnet toward the armature until both flat gages are held *lightly* between the pole faces and toffets. Position the selector magnet to meet requirement a(2) above. Press the magnet conductor bracket against the end of the bar magnet and tighten the magnet mounting screw and cable stud. Recheck requirements a(1) and (2) above.
- (2) To obtain requirement a(3) above, remove the lock setscrews (B, fig. 310), turn the adjusting setscrews in the direction required to obtain the

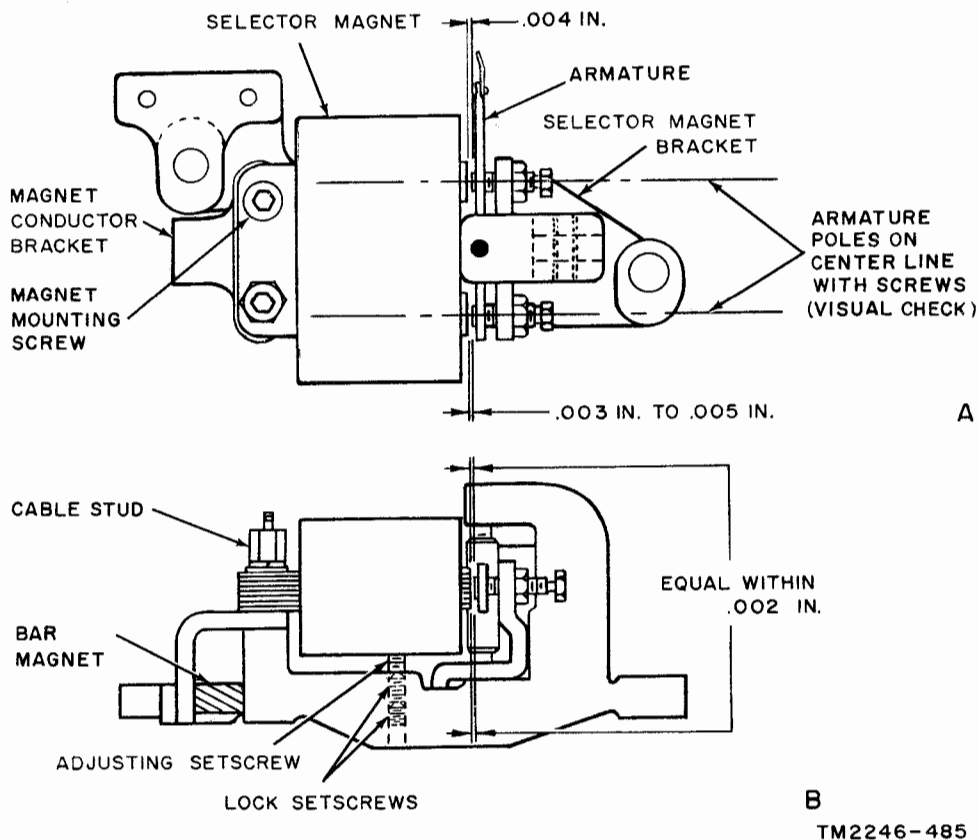
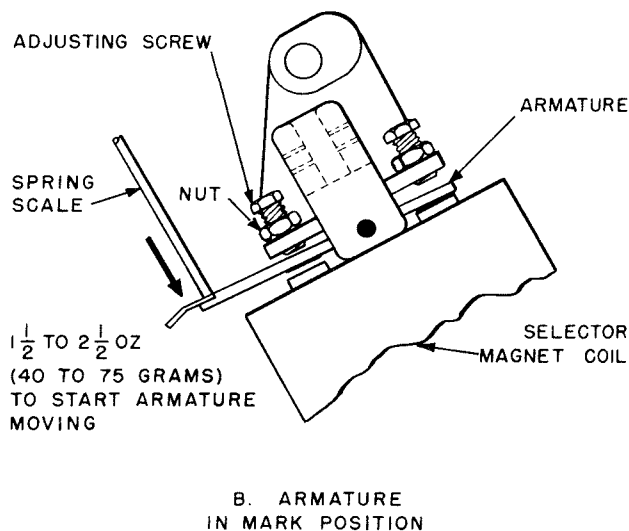
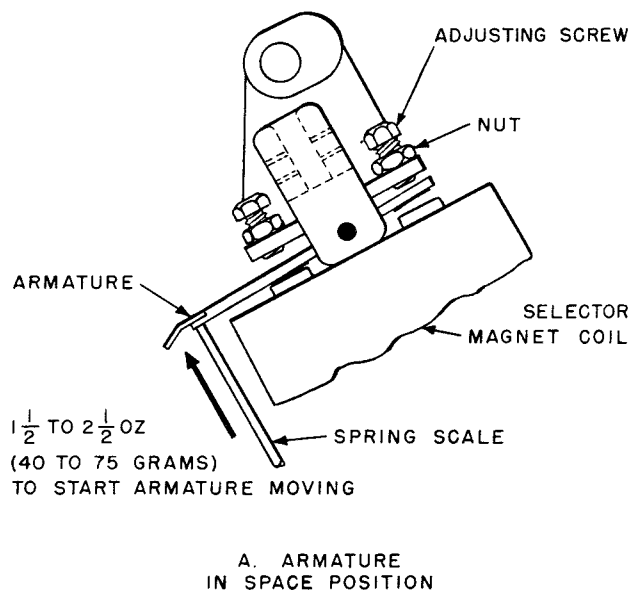


Figure 310. Selector magnet pole faces and armature alinement requirements.

requirement, and replace the lock set-screws.

- (3) Turn both armature adjusting screws *away* from the armature until neither screw touches the armature when it is in either the marking or spacing position.



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Figure 311. Bar magnet attractive force adjustment requirements.

## 289. Bar Magnet Attractive Force Adjustment

Note. See note, paragraph 286.

*a. Requirement.* When the selector magnet bracket is horizontal, a force of 40 to 75 grams, applied at the points shown in figure 311, should be required to move the armature from the mark position to the space position and from the space position to the mark position.

*b. Adjustment.*

- (1) Insert a .004-inch feeler gage between each pole face and the armature. Loosen the nuts on the armature adjusting screws and turn both screws toward the armature until they touch the feeler gages *lightly*.
- (2) Loosen the magnet mounting screw and cable stud (fig. 310). Loosen the setscrew that holds the bar magnet (fig. 309).
  - (a) If the force required in *a* above is less than 40 grams, decrease the gap between the south pole of the bar magnet and the armature stop bracket (fig. 309).
  - (b) If the force required in *a* above is greater than 70 grams, increase the gap between the bar magnet and the armature stop bracket.
- (3) Perform the adjustment described in paragraph 288 and recheck the requirement in *a* above. When all requirements in both paragraphs are met, mount the selector magnet assembly on the page printer, press it tightly against the adjustment screws, and tighten the magnet bracket mounting screws.

## 290. Armature Leaf Spring Adjustment

Note. See note, paragraph 286.

*a. Requirement.* When the selector magnet assembly is mounted on the page printer and no current is applied to the selector magnet, a force of 10 to 35 grams, applied at the points shown in figures 312 and 313, should be required to move the armature from the mark position to the space position and from the

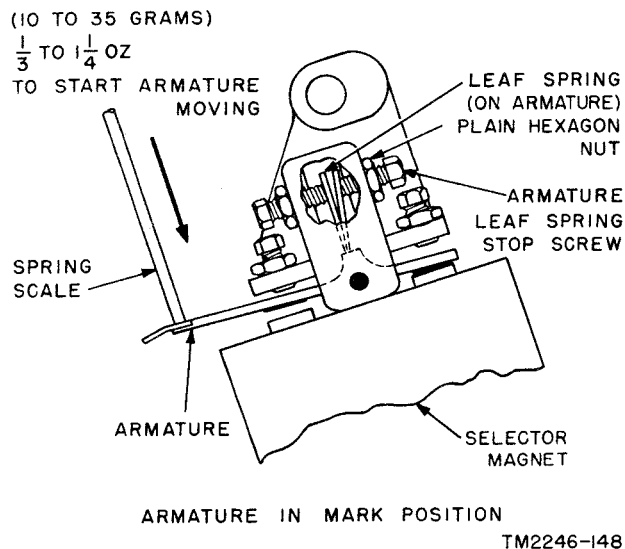


Figure 312. Armature leaf spring adjustment requirement, armature in mark position.

space position to the mark position, and both forces should be within 10 grams of each other.

*b. Adjustment.* Loosen the nuts on the armature leaf spring stop screws. Turn both stop screws toward or away from each other as necessary to meet the above requirements. Tighten the nuts.

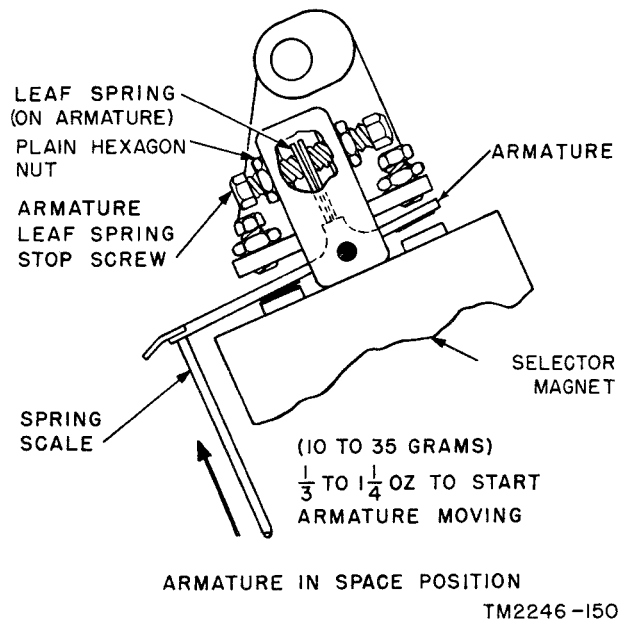


Figure 313. Armature leaf spring adjustment requirement, armature in space position.

## 291. Preliminary Alinement of Armature and Selector Levers and Adjustment of Stop Lever Eccentric Bearing (fig. 314)

*Note.* See note, paragraph 286.

*a. Requirements.* When a .004-inch clearance is present between both pole faces of the selector magnet and the toffets on the armature:

- (1) It should be possible to move each selector lever manually past the nearest edge of the armature blade. The levers should pass as closely as possible without engaging the blade (A, fig. 314).
- (2) The stop lever should *barely engage* the armature blade when moved manually toward the blade (B, fig. 314).

*b. Adjustments.* Place a .004-inch feeler gage between each pole face and its adjacent armature toffet. Loosen the magnet bracket mounting screws, press the selector magnet bracket against the adjustment screws, and

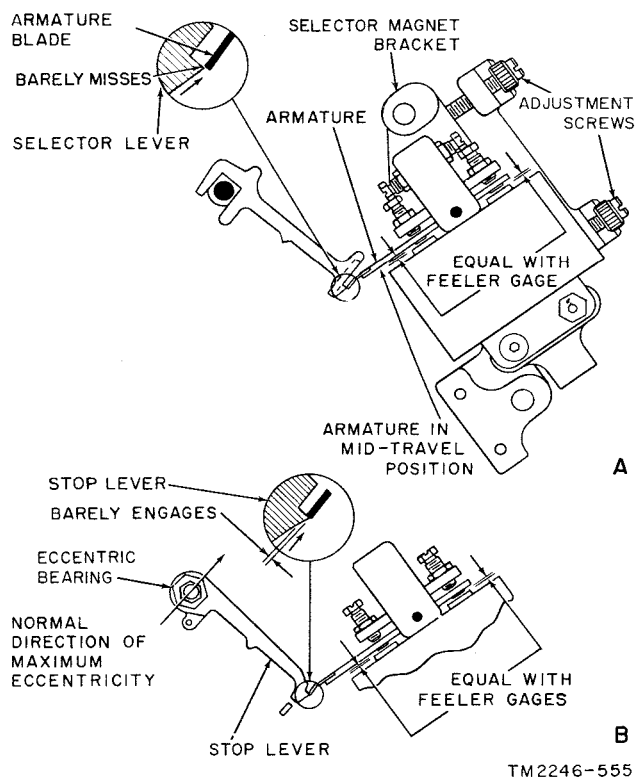


Figure 314. Preliminary alinement of armature with selector and stop levers.

tighten the magnet bracket mounting screws friction tight.

- (1) Turn the adjustment screws in the direction necessary to meet requirement (1) above. Tighten the magnet bracket mounting screws.
- (2) Loosen the nut on the end of the selector lever pivot stud. Turn the eccentric bearing to have maximum eccentricity in the direction shown in B of figure 316, then turn the eccentric bearing in the direction required to meet requirement (2) above. Hold the bearing stationary and tighten the nut.
- (3) Check all related adjustments (pars. 286, 288, 289, 290, 292, and 293).

## 292. Final Alinement of Armature and Selector Levers

(fig. 315)

*Note.* See note, paragraph 286.

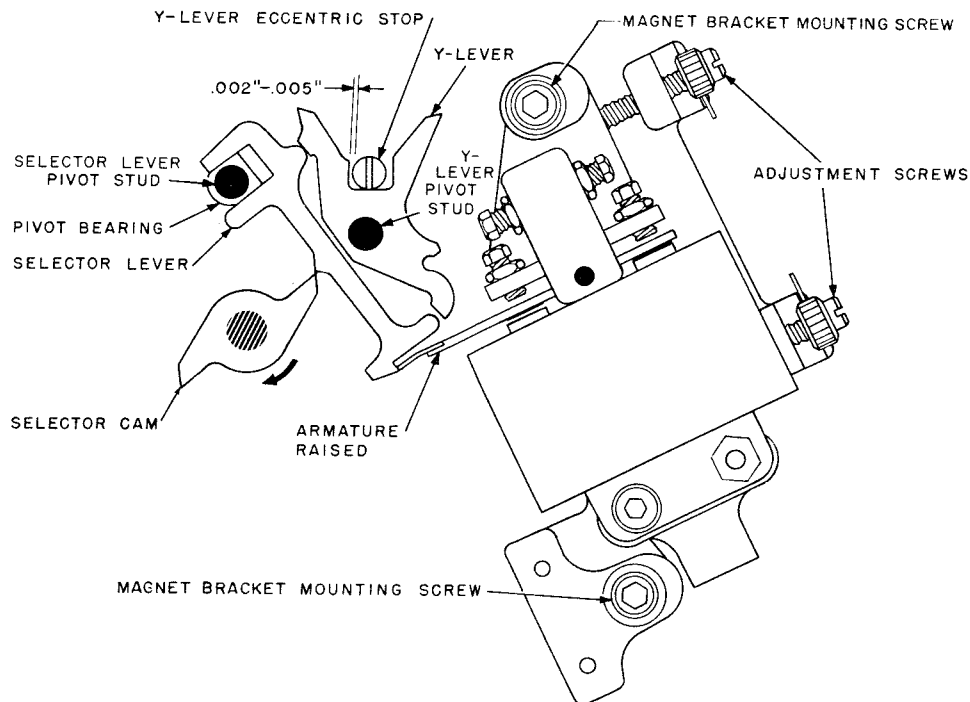
*a. Requirements.* There should be a .002- to .005-inch clearance between each Y-lever and

the left side of the Y-lever eccentric when the armature is in the marking position, the associated selector lever is in contact with the highest point of a lobe of its selector cam, and the Y-lever detent exerts no force against the Y-lever.

### *b. Method of Checking.*

- (1) Insert a .002-inch feeler gage between the Y-lever and the left side of the Y-lever eccentric stop. Turn the motor on and send the letters code group repeatedly to the page printer. The selector camshaft should rotate each time a code group is received.
- (2) Turn the motor off, replace the .002-inch gage with a .006-inch gage, turn the motor on, and send the letters code group repeatedly again. The selector camshaft should *not* rotate. Turn the motor off.

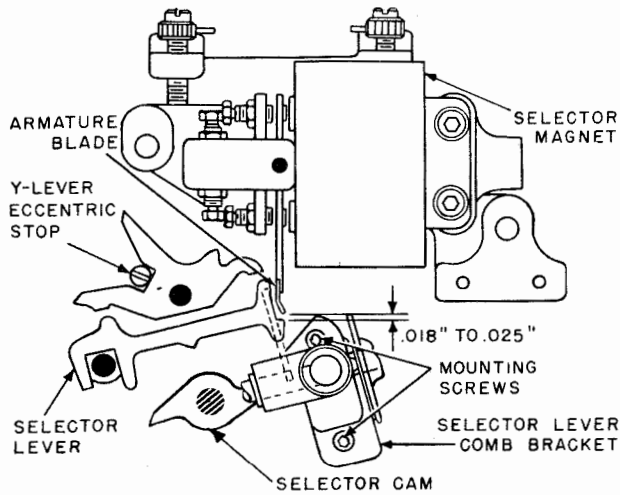
*c. Adjustment.* Loosen the magnet bracket mounting screws slightly, turn the magnet bracket adjustment screws in the direction required to obtain the above requirements, and tighten the mounting screws.



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Figure 315. Selector magnet alinement with selector and Y-levers.





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Figure 316. Armature blade and selector lever clearance requirement.

### 293. Armature Blade and Selector Lever Clearance Adjustment (fig. 316)

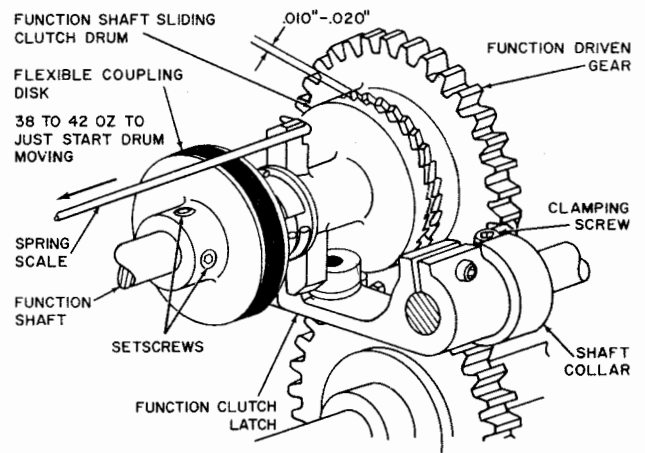
*a. Requirement.* There should be an .018- to .025-inch clearance between the end of the armature blade and the latching surface at the end of each selector lever when the midpoint of the selector lever is adjacent to a low point of its associated selector cam and the armature is in the marking position.

*b. Adjustment.* Loosen the mounting screws that secure the selector lever comb bracket, position the comb bracket vertically to obtain the above requirement, and tighten the mounting screws.

### 294. Function Shaft Clutch Clearance Adjustment (fig. 317)

*a. Requirement.* There should be .010- to .020-inch clearance between the function shaft sliding clutch drum and the clutch teeth on the function driven gear when the function clutch latch engages the function shaft sliding clutch drum.

*b. Adjustment.* Loosen the clamping screw in the shaft collar next to the function clutch latch. Shift the position of the clutch latch along the transfer lever shaft until the requirement is met, and tighten only the clamping screw in the shaft collar, to hold the function



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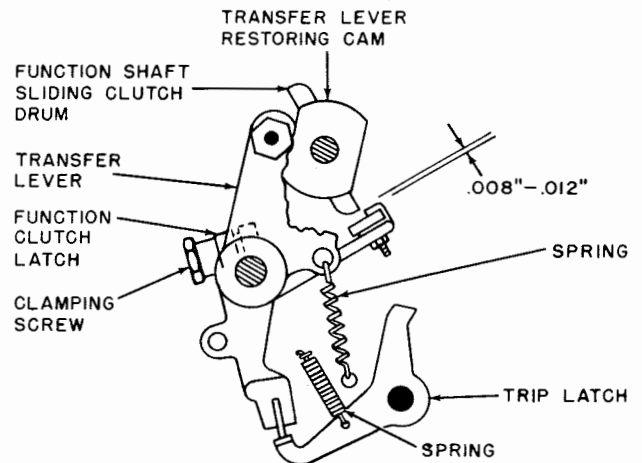
Figure 317. Function shaft clutch clearance, and function shaft clutch tension requirements.

clutch latch in that position. Make the function shaft clutch latch adjustment (par. 295).

### 295. Function Clutch Latch Adjustment (fig. 318)

*a. Requirement.* There should be a .008- to .012-inch clearance between the function clutch latch and the function shaft sliding clutch drum when the clutch is engaged.

*b. Method of Checking.* When the transfer lever is latched and the function shaft is in the stopped position, trip the transfer lever by pulling the lower arm of the trip latch down. The function clutch latch then will be disengaged from the sliding clutch drum. Check the requirement with a feeler gage.



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Figure 318. Function shaft clutch latch adjustment.

c. *Adjustment.* Loosen the clamping screw in the function clutch latch. Position the function clutch latch to meet the requirement and tighten the screw. Check all related adjustments (pars. 279, 280, and 294).

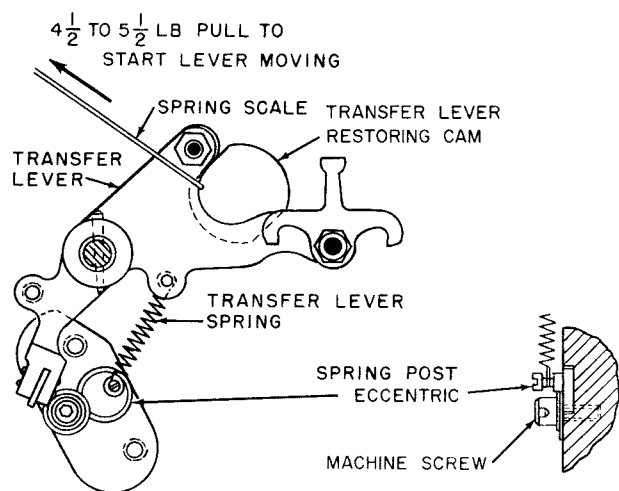
## 296. Transfer Lever Spring Tension Adjustment

a. *Requirement.* It should require a  $4\frac{1}{2}$ - to  $5\frac{1}{2}$ -pound pull, applied in the direction and at the point shown in figure 319, to start the transfer lever roller moving away from a low point of the transfer lever restoring cam.

b. *Method of Checking.*

- (1) Turn the motor manually until the function clutch latch cams the function shaft sliding clutch drum out of engagement with the function driven gear.
- (2) Trip the transfer lever by pulling the lower arm of the trip latch downward (fig. 318).
- (3) Engage the hook end of a spring scale at the point shown in figure 319, pull in the direction indicated, and note the scale reading when the transfer lever starts to move.

c. *Adjustment.* Loosen the machine screw that secures the spring post eccentric, turn the eccentric to obtain the required tension, and tighten the machine screw.



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Figure 319. Transfer lever spring tension requirement.

## 297. Function Shaft Clutch Tension Adjustment (fig. 317)

a. *Requirement.* When the function shaft sliding clutch drum is disengaged by the function clutch latch, it should take a pull of 38 to 42 ounces in the direction shown in figure 319 to start the function shaft sliding clutch drum moving.

b. *Adjustment.* Loosen the two setscrews in the flexible coupling disk, shift the disk in the proper direction to obtain the required spring tension, and tighten the two setscrews.

## 298. Selector Camshaft Friction Clutch Torque Adjustment (fig. 320)

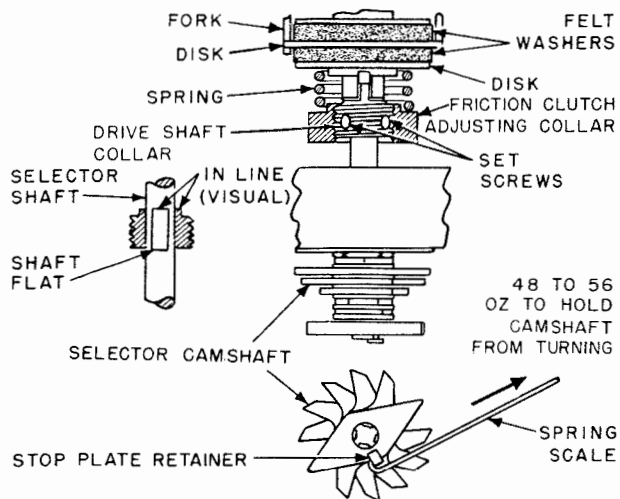
a. *Requirement.* When the motor is running, a force of 48 to 56 ounces, applied as shown in figure 320, should be required to overcome the torque of the selector camshaft friction clutch.

b. *Method of Checking.*

- (1) Turn the motor on.
- (2) After the motor has been running for several minutes, engage the stop plate retainer on the selector camshaft with the hook end of a spring scale, and apply a tension greater than 56 ounces with the scale.
- (3) Move the selector magnet armature away from the stop lever and *slowly* decrease the pull on the spring scale. Note the reading on the scale when the selector camshaft starts to rotate.

c. *Adjustment.*

- (1) Loosen the clamping screw on the friction adjusting collar and turn the adjusting collar in the direction required to either increase or decrease the pressure applied by the spring of the friction clutch. Tighten the clamping screw and recheck the requirement. Refine the adjustment as required to obtain the proper torque.
- (2) If the proper torque cannot be obtained by adjusting the position of the friction adjusting collar on the drive shaft collar, loosen the clamping screw on the friction adjusting collar, screw the adjusting collar away from



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Figure 320. Selector camshaft clutch torque adjustment.

the fork until the two setscrews in the drive shaft collar are exposed. Loosen the setscrews slightly, slide the drive collar either toward the fork to increase torque, or away from the fork to decrease torque, as required, tighten the setscrews in the drive collar, and repeat the adjustment procedure described in (1) above.

- (3) If the proper torque cannot be obtained by performing the procedures described in (1) and (2) above, loosen the two setscrews slightly in the clutch disk that is closest to the fork. Slide the clutch disk either toward the friction clutch adjusting collar to increase torque, or away from the collar to decrease torque, as required, tighten the setscrews in the clutch disk, and repeat the adjustment procedure described in (1) above.
- (4) If the proper torque cannot be obtained by performing the procedures described in (1), (2), or (3) above, loosen the clamping screw in the friction adjusting collar, screw the collar away from the fork, press the center clutch disk toward the spring and remove the felt washer that is closer to the fork. Press the center clutch disk toward the fork and remove the other felt washer. Install new oil-saturated

felt washers between the clutch disks. Be sure the projections on the center clutch disk engage the holes in the felt washers. Screw the friction clutch adjusting collar toward the fork and perform the adjustment procedure described in (1) above.

- (5) If the proper torque cannot be obtained by performing the procedures described in (1) through (4) above, replace the spring of the friction clutch (par. 174) and perform the adjustment described in (1) above.

## 299. Square Shaft Stop Arm Clutch Torque Adjustment

*a. Requirement.* When the motor is running and the function shaft is turning, a pull of 12 to 17 ounces, applied at the point shown in B of figure 321, should be required to hold the square shaft stop arm stationary.

*b. Method of Checking.*

- (1) Turn the motor on and operate the page printer for several minutes.
- (2) Send a blank code group (five spacing code impulses) to the page printer.
- (3) Engage the hook end of a spring scale at the point shown in B of figure 321. Apply a steady pull greater than 17 ounces, send a letters shift code group (five marking code impulses) and hold the lower arm of the transfer lever trip latch downward (away from the transfer lever). Slowly decrease the tension applied by the spring scale and note the reading on the scale when the square shaft stop arm starts to move.

*c. Adjustment.*

- (1) Turn the motor off and loosen the clamping screw on the friction adjusting collar (A, fig. 321). Turn the collar in the proper direction and the proper distance to obtain the correct torque. Tighten the clamping screw and recheck the requirement.
- (2) If the proper torque cannot be obtained by performing the procedure described in (1) above, loosen the clamping screw and turn the friction adjusting collar to release the spring tension. Remove the felt washer from

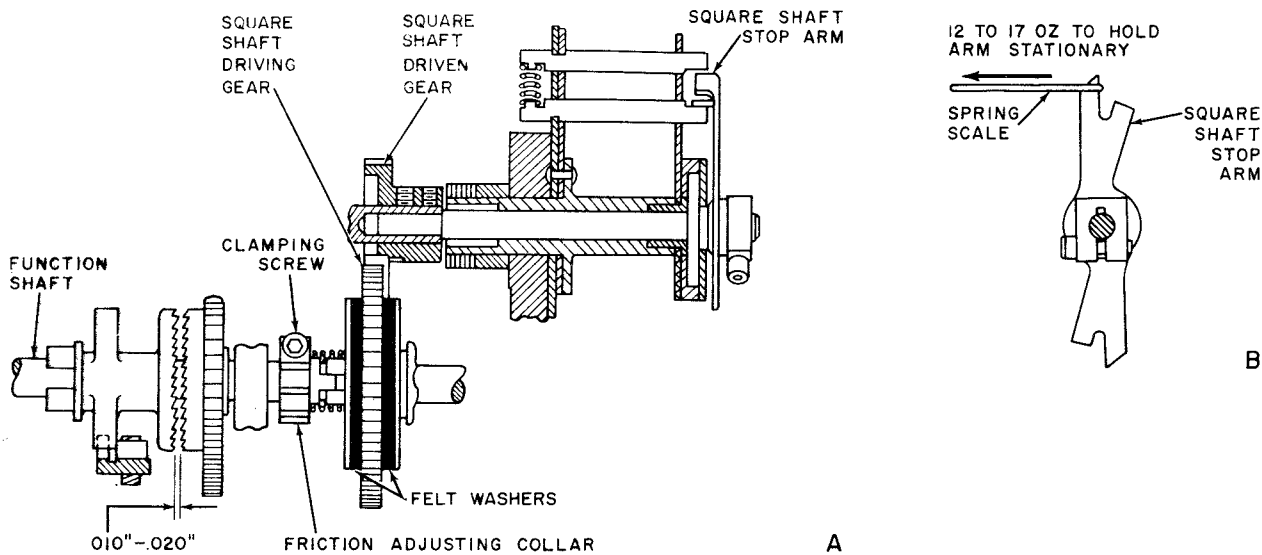


Figure 321. Square shaft stop arm torque adjustments.

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each side of the square shaft driving gear and install new oil-saturated felt washers. Be sure the projections on the square shaft driving gear engage the holes in the felt washers. Perform the adjustment procedure described in (1) above.

- (3) If the proper torque cannot be obtained by performing the procedures described in (1) and (2) above, replace the clutch pressure spring (par. 173) and perform the adjustment procedure described in (1) above.

### 300. Code-Ring Locking Bail Shaft Adjustment (fig. 322)

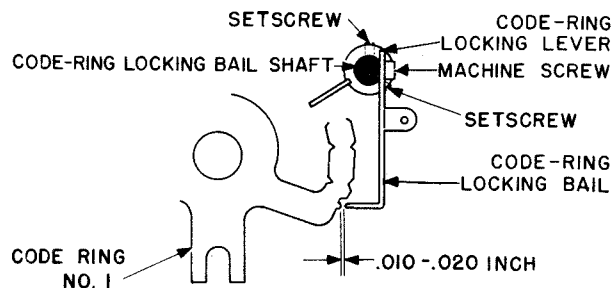
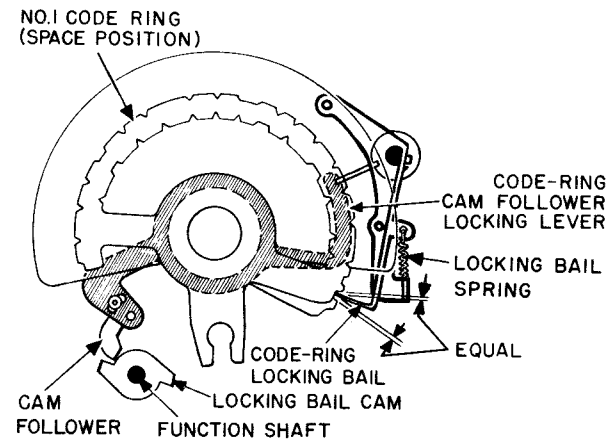
*a. Requirement.* There should be a .010- to .020-inch clearance between the code-ring locking bail and the code ring projections when the function shaft is in the stopped position.

*b. Method of Checking.* Turn the motor manually until the function shaft is in the stopped position, place the No. 1 code ring so that its projection is aligned with the locking edge of the code-ring locking bail. Check the requirement with a feeler gage.

*c. Adjustment.* Loosen the setscrews in the code-ring locking lever. Rotate the code-ring locking bail shaft until the requirement is met and tighten the setscrews. Check the related adjustments (pars. 277 and 291).

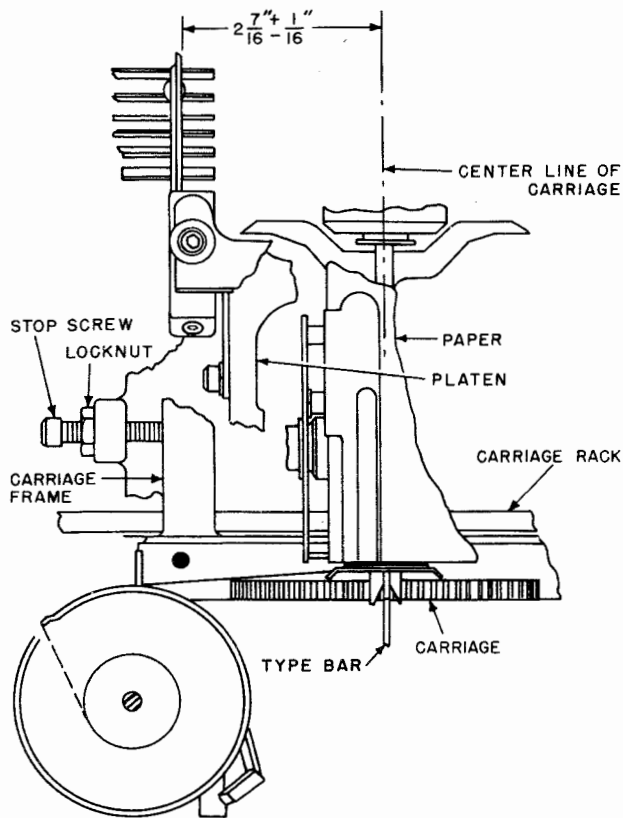
### 301. Code-Ring Locking Bail Adjustment (fig. 322)

*a. Requirement.* The code-ring locking bail should fully engage the notches in the code



TM2246-102

Figure 322. Code-ring locking bail and bail shaft adjustment requirements.



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Figure 323. Type bar carriage positioning adjustment requirement.

rings for both marking and spacing positions in the code rings.

*b. Adjustment.* Set the Y-levers for either the R or Y code combination and trip the transfer lever. Then turn the motor by hand until the locking bail springs pulls the code-ring locking bail into the code rings. Loosen the machine screws that mount the code-ring lock-

ing bail and position the bail until it fully engages the notches in the code rings. Tighten the mounting screws and check the related adjustments (pars. 277 and 300).

### 302. Carriage Positioning Adjustment (fig. 323)

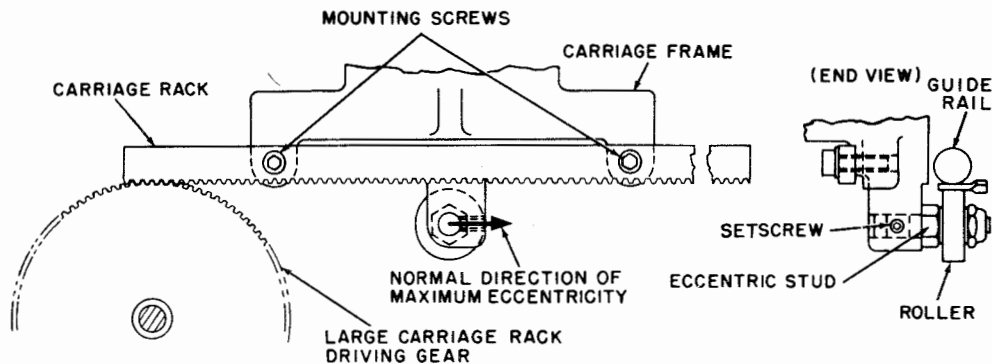
*a. Requirement.* When the carriage is at the left-hand margin, the distance from the center line of the carriage to the right side of the code-ring cage should be  $2\frac{7}{16}$  ( $\pm 1\frac{1}{16}$ ) inches on standard symbol page printers and  $2\frac{7}{32}$  ( $\pm 1\frac{1}{16}$ ) inches on weather symbol page printers.

*b. Adjustment.* Move the carriage to the left-hand margin. Back the stop screw away from the carriage frame and loosen the two machine screws (1, fig. 206) that secure the guide rail. Lift the carriage to disengage the carriage rack from the carriage rack driving gear, position it to meet the requirements, and tighten the two machine screws. Turn the stop screw until it touches the carriage frame. Tighten the locknut.

### 303. Carriage Roller Adjustment (fig. 324)

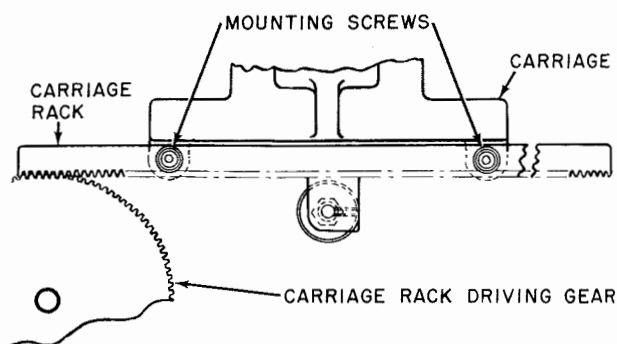
*a. Requirement.* The carriage should roll from one end of the guide rail to the other with no clearance between the carriage rollers and the guide rail.

*b. Adjustment.* Remove the two mounting screws and remove the carriage rack. Loosen the setscrew that holds the eccentric stud of the lower carriage roller and turn the eccentric stud until the requirement is met. Tighten the setscrew and adjust the carriage rack (par. 304).



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Figure 324. Carriage roller adjustment details.



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Figure 325. Carriage rack adjustment.

### 304. Carriage Rack Adjustment

(fig. 325)

*a. Requirement.* There should be a barely perceptible backlash between the carriage driving gear and the carriage rack. The backlash at both ends of the racks must be equal.

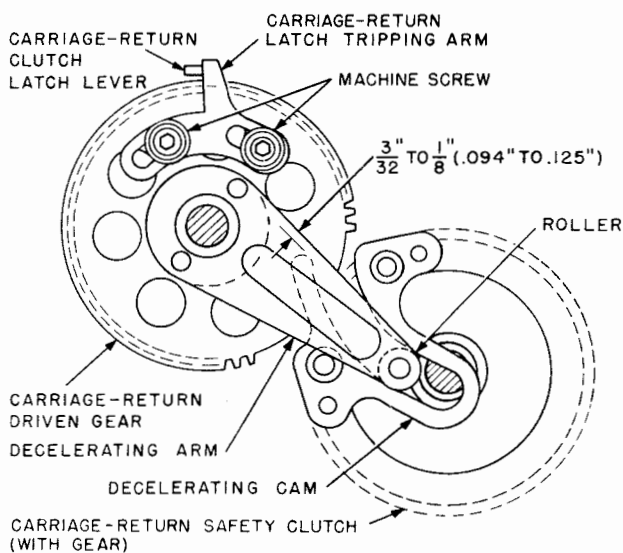
*b. Adjustment.* Move the carriage to the left margin. Loosen the two mounting screws that secure the carriage rack. Position the left end of the carriage rack for minimum backlash; tighten the left mounting screw. Move the carriage to the right margin. Position the right end of the carriage rack for minimum backlash and tighten the right mounting screw. Check the related adjustments (pars. 302 and 303).

### 305. Carriage-Return Latch Tripping Arm Adjustment

*a. Requirement.* The carriage-return latch tripping arm (fig. 326) should trip the carriage-return clutch latch lever the instant the carriage strikes the left margin stop screw.

*b. Adjustments.*

- (1) Move the carriage against the left margin stop screw. This should give a margin of  $1\frac{1}{32}$  inch.
- (2) Loosen the machine screws that hold the carriage-return latch tripping arm to the carriage-return driven gear.
- (3) Disengage the carriage-feed sliding clutch drum from the carriage-feed driving gear (fig. 327). Rotate the carriage-return gears until the protruding end of the decelerating cam is between  $\frac{3}{32}$  and  $\frac{1}{8}$  inch from the top edge of the decelerating arm (fig. 326). It may be necessary to dis-



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Figure 326. Carriage-return latch tripping arm adjustment.

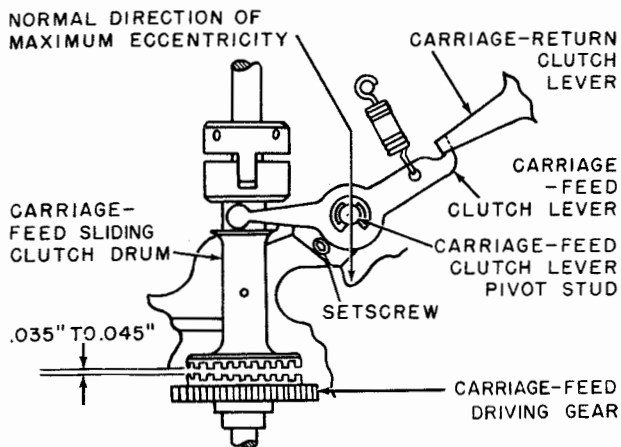
engage the carriage rack from the carriage driving gear to make this adjustment. This can be done by loosening the screws that hold the guide rail to the frame and raising the carriage until the carriage rack is disengaged from the carriage driving gear. When the proper position is reached by the decelerating cam, re-engage the carriage rack and carriage driving gear and tighten the screws in the guide rail.

- (4) Slide the carriage-return latch tripping arm against the carriage-return clutch latch lever until the carriage-return clutch actuating lever (fig. 331) is just unlatched; tighten the machine screws to secure the carriage-return latch tripping arm.
- (5) Check the related adjustments in paragraphs 302 and 304.

### 306. Carriage-Feed Sliding Clutch Drum Adjustment

(fig. 327)

*a. Requirement.* There should be a .035- to .045-inch clearance between the carriage-feed driving gear and the carriage-feed sliding clutch drum when the carriage-return clutch is fully engaged.

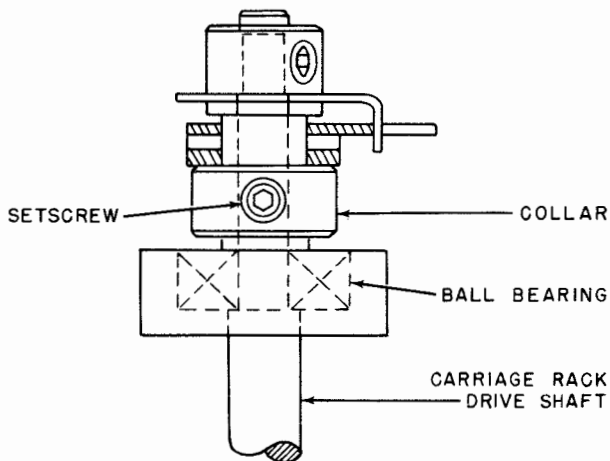


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Figure 327. Carriage feed sliding clutch drum adjustment requirement.

*b. Method of Checking.* Set the carriage one or more spaces from the left-hand margin and turn the motor off. Position the code-rings to select the carriage-return operation, release the transfer lever, and turn the motor by hand until the carriage-return clutch is fully engaged. Check the gap between the carriage-feed sliding clutch drum and the carriage-feed driving gear with a feeler gage.

*c. Adjustment.* Loosen the setscrew to release the carriage-feed clutch lever pivot stud, turn the stud with a screwdriver until the requirement is met, and tighten the setscrew.



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Figure 328. Carriage rack drive shaft position adjustment.

### 307. Carriage Rack Drive Shaft Position Adjustment (fig. 328)

*a. Requirement.* The shoulder on the carriage rack drive shaft should be against the ball bearing, and the collar should be against the opposite side ball bearing.

*b. Method of Checking.* Push and pull the carriage rack drive shaft to check for horizontal play.

*c. Adjustment.* Loosen the setscrew in the collar. Push the carriage rack drive shaft toward the collar until the shoulder of the shaft is against the ball bearing. Hold the shaft and push the collar against the ball bearing; tighten the setscrew.

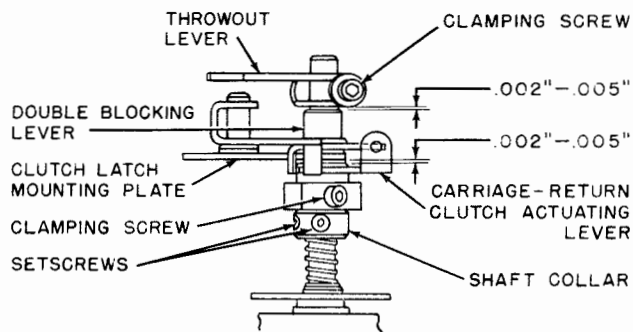
### 308. Carriage-Return Clutch Lever Shaft Clearance Adjustment (fig. 329)

*a. Requirements.*

- (1) There should be a .002- to .005-inch clearance between the carriage-return clutch actuating lever and the clutch latch mounting plate.
- (2) There should be a .002- to .005-inch clearance between the throwout lever and the double blocking lever.

*b. Adjustments.*

- (1) Loosen the clamping screw in the carriage-return clutch actuating lever and loosen the setscrews in the shaft collar. Insert a .003-inch feeler gage between the carriage-return clutch actuating lever and the clutch latch



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Figure 329. Carriage-return clutch lever shaft clearance adjustment requirements.

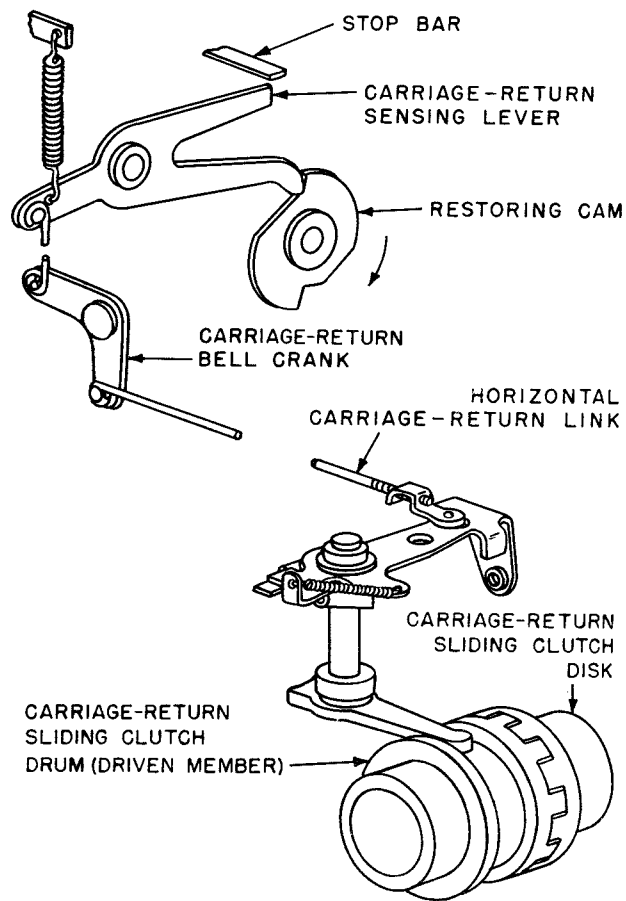
mounting plate, slide the shaft collar upward until it pushes the actuating lever against the gage, tighten the setscrews, and remove the gage.

- (2) Loosen the clamping screw on the throwout lever, place a .003-inch feeler gage between the throwout lever and the double blocking lever, move the throwout lever downward against the gage, tighten the clamping screw, and remove the gage.

### 309. Carriage-Return Clutch Adjustment (fig. 330)

*a. Requirement.* The carriage-return clutch should be pulled into full engagement when the carriage-return sensing lever drops to a low point of its restoring cam.

*b. Method of checking.* Position the carriage one or more spaces from the left-hand



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Figure 330. Carriage-return clutch adjustment.

margin and turn the motor off. Position the code-rings to select the carriage-return operation, release the transfer lever, and turn the motor by hand until the carriage-return sensing lever drops to a low point on the restoring cam. The carriage-return clutch should be fully engaged.

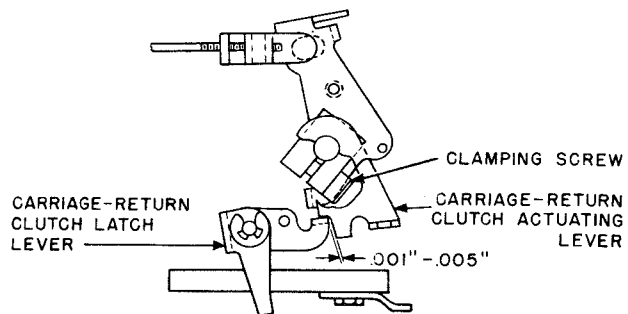
*c. Adjustment.* Detach the horizontal carriage-return link from the carriage-return bellcrank. Turn the link to meet the requirement. Attach the link to the bellcrank, and recheck the requirement.

### 310. Carriage-Return Clutch Actuating Lever Adjustment (fig. 331)

*a. Requirement.* There should be a .001- to .005-inch clearance between the carriage-return clutch actuating lever and the carriage-return clutch latch lever when the carriage is two or more spaces from the left-hand margin and the carriage-return clutch latch lever is in the latched (counterclockwise) position.

*b. Method of Checking.* Position the carriage two or more spaces from the left-hand margin and turn the motor off. Position the code rings to select the carriage-return operation, release the transfer lever, and turn the motor by hand until the carriage-return clutch is fully engaged. Check the clearance with a feeler gage.

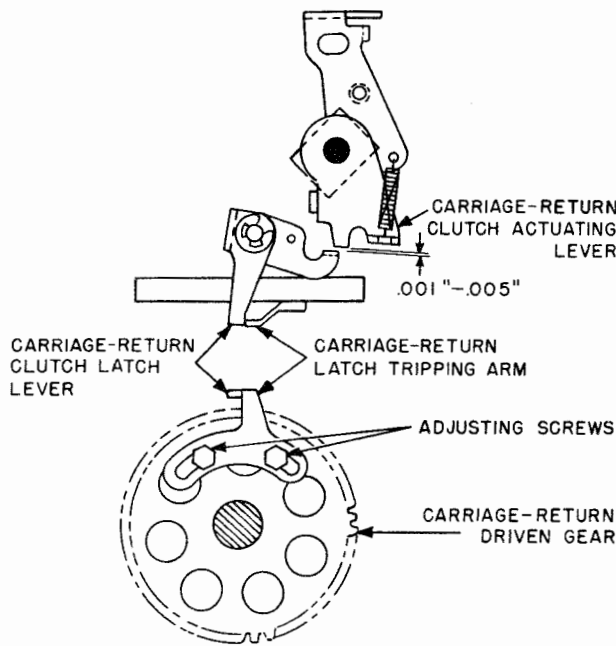
*c. Adjustment.* Loosen the clamping screw, rotate the carriage-return clutch actuating lever to meet the requirement, press the actuating lever downward against the shaft collar, tighten the clamping screw, and recheck the clearance.



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Figure 331. Carriage-return clutch actuating lever adjustment requirement.





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Figure 332. Carriage-return clutch latch lever adjustment requirement.

### 311. Carriage-Return Clutch Latch Lever Adjustment

(fig. 332)

*a. Requirement.* There should be a .001- to .005-inch clearance between the carriage-return clutch actuating lever and the carriage-return clutch latch lever when the carriage is at the left-hand margin.

*b. Method of Checking.* Position the carriage to the left-hand margin, turn the motor off, and check the gap between the carriage-return clutch actuating lever and the carriage-return clutch latch lever with a feeler gage.

*c. Adjustment.* Loosen the two adjusting screws, slide the carriage-return latch tripping arm clockwise or counterclockwise on the carriage-return driven gear to meet the requirement, tighten the adjusting screw, and recheck the gap.

### 312. Throwout Lever Adjustment

(fig. 333)

*a. Requirement.* There should be .010- to .020-inch clearance between the throwout lever and the carriage-return latch tripping arm when the carriage is at the left-hand margin and the teeth of the carriage-return clutch

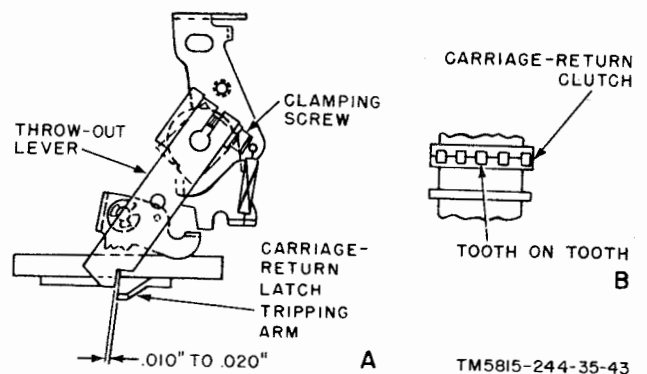


Figure 333. Throwout lever adjustment requirement.

members are pressed against each other (but not in mesh).

*b. Method of Checking.* Turn the motor on and press the CAR RET key to return the carriage to the left-hand margin. Turn the motor off and trip the transfer mechanism. Pull the carriage-return blocking lever downward and hold it down while turning the motor slowly by hand until the teeth of the carriage-return clutch members are positioned as shown in B of figure 333. If the clutch teeth start to engage, hold the sliding member of the carriage-return clutch out of engagement and continue to turn the motor until the teeth are in line. Release the carriage-return sliding clutch drum and check the clearance with a feeler gage.

*c. Adjustment.* Loosen the clamping screw on the throwout lever and position the throwout lever to meet the requirement. Tighten the clamping screw and recheck the requirement.

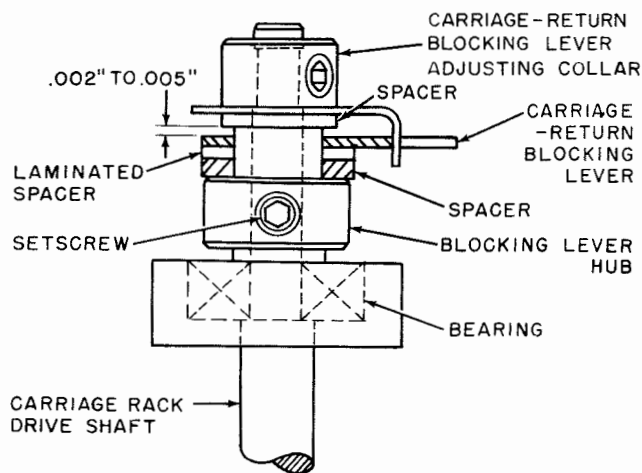
### 313. Carriage-Return Blocking Lever Clearance Adjustment

(fig. 334)

*a. Requirement.* There should be a .002- to .005-inch clearance between the carriage-return blocking lever and the spacer when the carriage-return blocking lever adjusting collar is against the spacer.

*b. Method of Checking.* Check the clearance between the carriage-return blocking lever and the spacer with a feeler gage.

*c. Adjustment.* Remove the carriage-return blocking lever adjusting collar, spacer, carriage-return blocking lever, and laminated spacer. Peel the laminated spacer to get the required clearance when the carriage-return



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Figure 334. Carriage-return blocking lever clearance adjustment.

blocking lever adjusting collar is against the laminated spacer.

### 314. Carriage-Return Blocking Lever Adjusting Collar Adjustment (fig. 335)

*a. Requirement.* There should be a .005- to .015-inch clearance between the carriage-return blocking lever and the adjusting plate when the carriage is one space from the left margin.

*b. Method of Checking.* Position the carriage one space from the left margin, press the CAR RET key and turn the motor by hand until the carriage-return sensing lever drops to a low point of the restoring cam. The double blocking lever will position the adjusting plate over the carriage-return blocking lever. Measure the gap between the adjusting plate and the carriage-return blocking lever with a feeler gage.

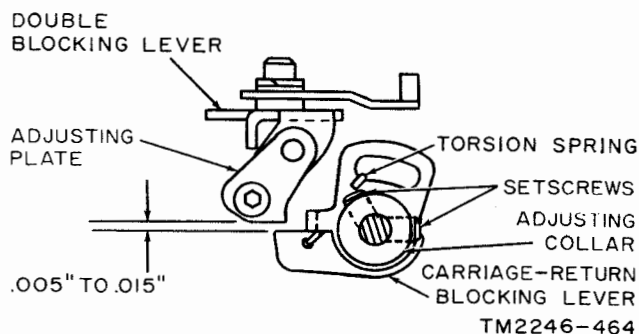


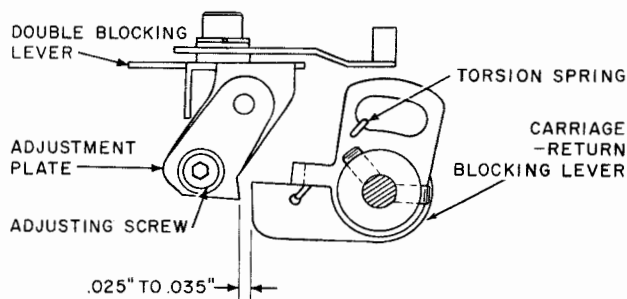
Figure 335. Carriage-return blocking lever adjustment requirement.

*c. Adjustment.* Loosen the two setscrews in the carriage-return blocking lever adjusting collar, rotate the blocking lever until the requirement is met, and tighten the two setscrews. Recheck the carriage-return blocking lever clearance adjustment (par. 313).

### 315. Carriage-Return Adjustment Plate Adjustment (fig. 336)

*a. Requirement.* There should be a .025- to .035-inch clearance between the carriage-return blocking lever and the adjustment plate when the carriage is at the left margin. The carriage-return sliding clutch drum and the carriage-return sliding clutch disk must not touch each other when the carriage-return operation is selected and the carriage is against the left stop screw.

*b. Method of Checking.* Move the carriage to the left margin, turn the motor off, and check the gap between the carriage-return blocking lever and the adjustment plate with a feeler gage.



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Figure 336. Carriage-return adjustment plate adjustment.

*c. Adjustment.* Loosen the adjusting screw, move the adjustment plate to meet the requirement, and tighten the adjusting screw. Select the carriage-return operation and release the transfer lever. Turn the motor by hand and check to see that the carriage-return clutch does not engage.

### 316. Manual Carriage-Return Bracket Adjustment (fig. 337)

*a. Requirement.* There should be a .005- to .015-inch clearance between the trip pawl and

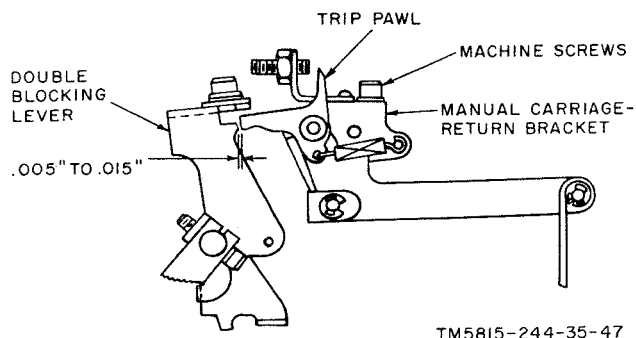


Figure 337. Manual carriage-return bracket adjustment requirement.

the double blocking lever when the trip pawl and the double blocking lever are in their unoperated positions.

*b. Method of Checking.* When the carriage is against its left-hand stop and manual carriage-return mechanism is in the unoperated position, use a feeler gage to check the clearance between the trip pawl and the double blocking lever.

*c. Adjustment.* Loosen the two machine screws on the manual carriage-return bracket and position the bracket to meet the requirement. Tighten the screws and recheck the clearance.

### 317. Manual Carriage-Return Trip Pawl Adjustment

(fig. 338)

*a. Requirement.* The trip pawl should just clear the double blocking lever when the carriage-return clutch is fully engaged.

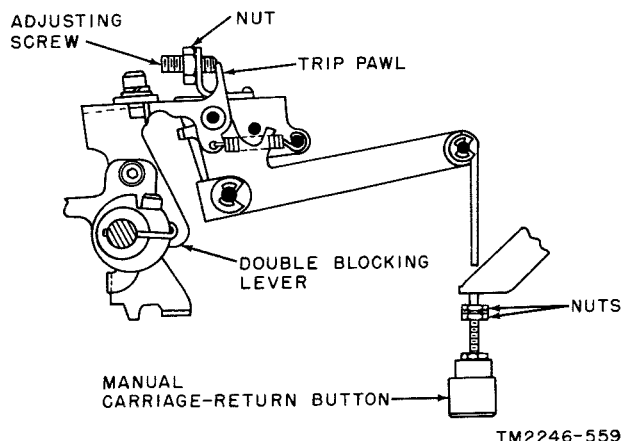


Figure 338. Manual carriage-return trip pawl adjustment.

*b. Adjustment.* Back off the nuts on the carriage-return button link. Loosen the nut on the adjusting screw and push the manual carriage-return button. When the double blocking lever is in the operated position for the carriage-return operation, turn the adjusting screw in or out until the trip pawl just clears the double blocking lever; tighten the nut on the adjusting screw.

### 318. Manual Carriage-Return Lever Adjustment

(fig. 339)

*a. Requirement.* There should be a .002- to .025-inch clearance between the manual carriage-return lever and the pin when the manual carriage-return button has been pushed until stopped by the nuts against the bracket.

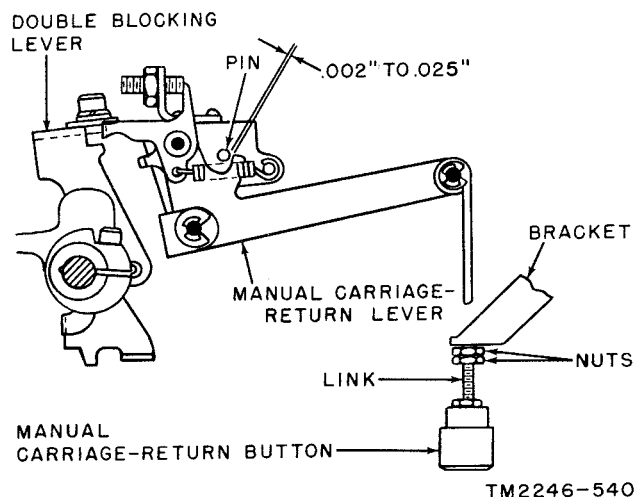


Figure 339. Manual carriage-return lever adjustment.

*b. Adjustment.* Loosen the two nuts on the link. Push the manual carriage-return button until the double blocking lever is in the operated position for the carriage-return. Turn the nuts until the clearance between the manual carriage-return lever and the pin meets the requirement and the nuts are against the bracket. Tighten the two nuts against each other and recheck the clearance.

### 319. Angular Relationship of Function Shaft Parts

(fig. 340)

*Note.* The angular position of each of the parts which are secured to the function shaft with setscrews is not adjustable when the part is secured properly

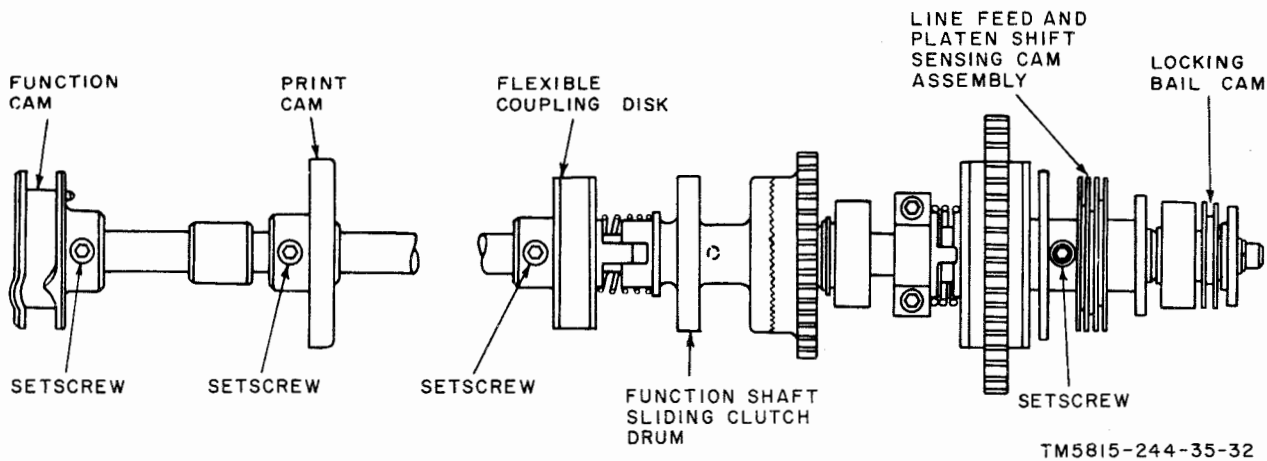


Figure 340. Angular relationship of function shaft parts.

(both setscrews against a flat on the shaft). Use the information in this paragraph to check whether each of the parts is secured properly.

*a. Requirements.*

- (1) When a finger of the function shaft sliding clutch drum is fully engaged with the clutch latch, the code-ring locking bail cam follower should be against a high point of the locking bail cam.
- (2) When a finger of the function shaft sliding clutch drum is fully engaged with the clutch latch, the print cam follower roller should be against a low part of the print cam.
- (3) Immediately after the transfer operation has occurred and the function shaft sliding clutch drum has engaged the function driven gear, each function sensing lever should fall to a low point of its restoring cam within  $\frac{1}{2}$  to  $\frac{2}{3}$  revolution of the motor.
- (4) When a finger of the function shaft sliding clutch drum is fully engaged with the clutch latch, the roller of the function cam follower should be just beyond the high point of the function cam.

*b. Method of Checking.*

- (1) Turn off the motor. Manually rotate the function shaft to make sure that a finger of the function shaft sliding clutch drum has *fully engaged* the clutch latch. Check for requirement a(1) above visually.

*Note.* Be sure the requirement in a(1) above is met before proceeding with the remaining adjustment checks.

- (2) Turn the motor on and press any key lever. When the operation is complete, turn the motor off. Manually try to rotate the function shaft in its normal direction; there should be no movement. Trip the transfer lever latch and rotate the motor by hand; observe the print bail blade to make sure that there is no backward movement before the blade starts its forward travel.
- (3) Turn the motor on and then off. Manually rotate the function shaft to make sure a finger of the function shaft sliding clutch drum has fully engaged the clutch latch. Position the Y-levers for the line feed code combination and trip the transfer lever latch. Slowly rotate the motor by hand until the function shaft sliding clutch drum has engaged the function driven gear. Rotate the motor  $\frac{1}{3}$  to  $\frac{2}{3}$  of a revolution more while checking to make sure that the line feed sensing lever is pulled to the low part of its restoring cam during this operation.
- (4) Turn the motor on and then off. Manually rotate the function shaft to make sure that a finger of the function shaft sliding clutch drum has fully engaged the clutch latch. Trip the

transfer lever latch and rotate the motor by hand; observe the function selecting arm to make sure that there is no outward movement before the function selecting arm starts its inward thrust.

*c. Adjustments.* Be sure that all setscrews are tightened *against the flats* of the function shaft when the parts are repositioned on the function shaft. Proceed as follows:

- (1) Loosen the setscrews in the flexible coupling disk. Hold the sliding clutch drum firmly against the clutch latch and rotate the function shaft to meet requirement *a*(1) above. Tighten the setscrews. (When this adjustment is made be sure to make the adjustments described in (2), (3), and (4) below and in paragraph 320.)
- (2) Loosen the setscrews in the print cam. Hold the finger of the sliding clutch drum firmly engaged with the clutch latch, rotate the print cam to the point where any backward rotation of the print cam starts to move the print cam follower, and tighten the setscrews.
- (3) Loosen the setscrews in the line feed and platen shift sensing cam assembly, rotate the cam assembly to meet the requirement *a*(3) above, and tighten the setscrews.
- (4) Loosen the setscrews in the function cam, rotate the cam to meet requirement *a*(4) above, and tighten the setscrews.

### 320. Function Shaft Clutch Spring Pressure Adjustment (fig. 341)

*a. Requirement.* There should be a .080- to .100-inch clearance between the flexible coupling disk and the function shaft sliding clutch drum when the sliding clutch drum is engaged with the function driven gear.

*b. Method of Checking.* Trip the transfer lever latch and turn the motor by hand until the sliding clutch drum has fully engaged the function driven gear. Insert a flat feeler gage through the clutch spring and between the

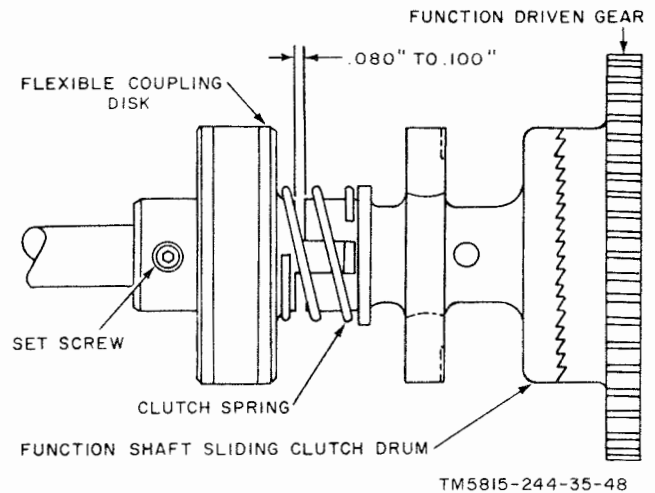


Figure 341. Function shaft clutch spring pressure adjustment.

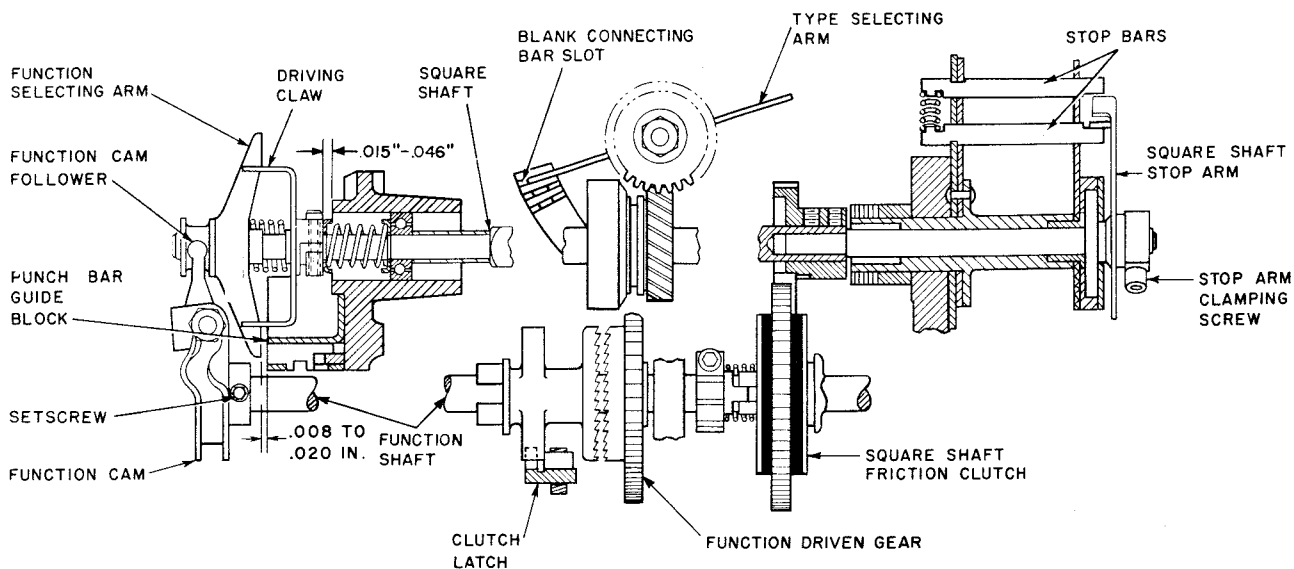
flexible coupling disk and the function shaft sliding clutch drum to determine the clearance.

*c. Adjustment.* Loosen the two setscrews in the flexible coupling disk and shift the flexible coupling disk in the proper direction to obtain the required clearance, tighten the two setscrews. Check the related adjustment (par. 321).

### 321. Function Cam and Function Lever Bracket Adjustments (fig. 342)

*a. Requirements.*

- (1) There should be an .008- to .020-inch clearance between the function selecting arm and the punch bar guide block when the function selecting arm is in the unoperated position.
- (2) The upper end of the function cam follower should be centered with respect to the depth of the groove in the function selecting arm.
- (3) At least three-quarters of the width of the roller on the end of the function cam follower should be engaged in the groove in the function cam but the roller must *not* touch the bottom of the groove.
- (4) The unshift lever must engage the letters shift punch bar but must be free to move without binding.



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Figure 342. Function cam adjustment.

*b. Adjustments.*

- (1) To obtain requirement *a*(1) above, loosen the function cam setscrews slightly, move the cam horizontally on its shaft until the requirement is met, and tighten the setscrews.
- (2) To obtain requirements *a*(2), (3), and (4) above, loosen the two mounting bracket studs that secure the function bracket to the page printer side casting, adjust the position of the bracket to meet all three requirements, and tighten the mounting studs.

### 322. Type and Function Selecting Arms Adjustments (fig. 342)

*a. Requirements.* The positions of the type selecting arm and the function selecting arm must correspond to the position of the square shaft stop arm. There should be a .015- to .046-inch clearance between the frame and the driving claw of the function selecting arm.

*b. Adjustments.*

- (1) *Type selecting arm.* Select the blank combination; move all five code rings counterclockwise. Loosen the stop arm clamping screw and turn the square shaft until the type selecting arm is opposite the blank connecting

bar slot. Be sure that the backlash in the gearing of the type selecting arm is distributed equally on both sides of the connecting bar slot; hold the square shaft in this position and turn the square shaft stop arm until it contacts the blank stop bar; tighten the clamping screw.

- (2) *Function selecting arm.* Loosen the clamping screw in the function selecting arm claw. Select the letter H (third and fifth code rings clockwise, others counterclockwise), and turn the square shaft until its stop arm contacts the H stop bar. Turn the function selecting arm so that one of its fingers is aligned with the motor stop function punch bar. Position the function selecting arm claw to obtain .015- to .046-inch clearance, as shown, and tighten the clamping screw.

### 323. Carriage-Feed Pawl and Manual Space Pushbutton Adjustments

*a. Requirements.*

- (1) When the carriage-feed link is moved to the fully operated position by the carriage-feed lever (fig. 67), there should be a .015- to .035-inch clear-

ance between the latching arm of the carriage-feed pawl and the adjacent tooth of the ratchet wheel (fig. 343).

- (2) The carriage-feed pawl should be in full engagement with a tooth of the ratchet wheel when the page printer is in the stopped position.
- (3) When the manual space pushbutton is depressed fully, there should be a .015- to .035-inch clearance between the latching arm of the carriage-feed pawl and the adjacent tooth of the ratchet wheel.

*b. Method of Checking.*

- (1) Set the platen to the letters shift position, position the code rings for selection of the H code combination, and pull the latching arm of the transfer lever latch downward. Turn the motor manually until the carriage-feed pawl moves to the maximum counterclockwise position (fig. 343) and check the clearance with feeler gages.
- (2) Turn the motor until the page printer is in the stopped position and check the end play in the carriage-feed link

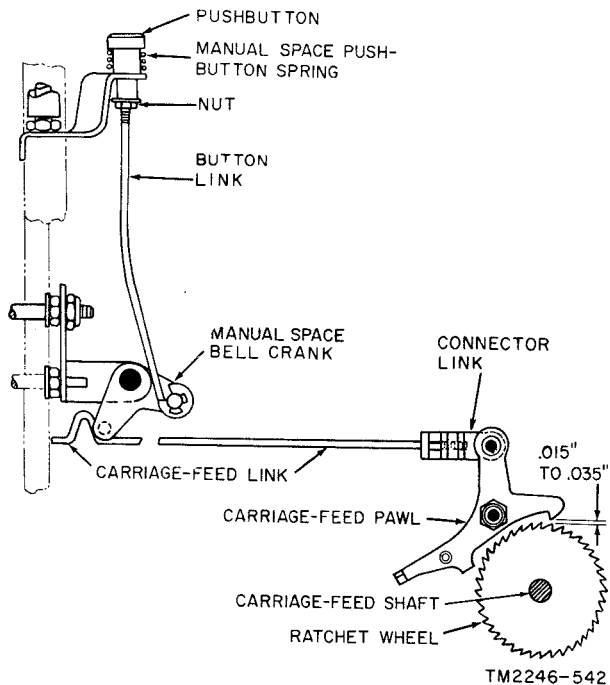


Figure 343. Carriage-feed pawl adjustment requirement.

to check for full engagement of the pawl with the ratchet wheel.

- (3) When the motor is off, press the manual space pushbutton fully inward and check the clearance between the carriage-feed pawl and the ratchet wheel.

*c. Adjustments.*

- (1) Disconnect the connector link from the carriage-feed pawl, turn the proper direction, and number of turns to meet requirement a(1) above and attach the connector link. Check for requirement a(2) above and modify the adjustment, if necessary.
- (2) To adjust for requirement a(3) above, loosen the nut on the button link, turn the button to meet the requirement, and tighten the nut.

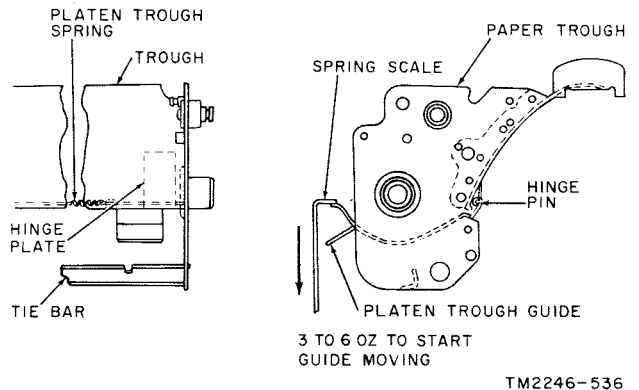


Figure 344. Platen trough spring adjustment

**324. Platen Trough Guide Pressure Adjustment (fig. 344)**

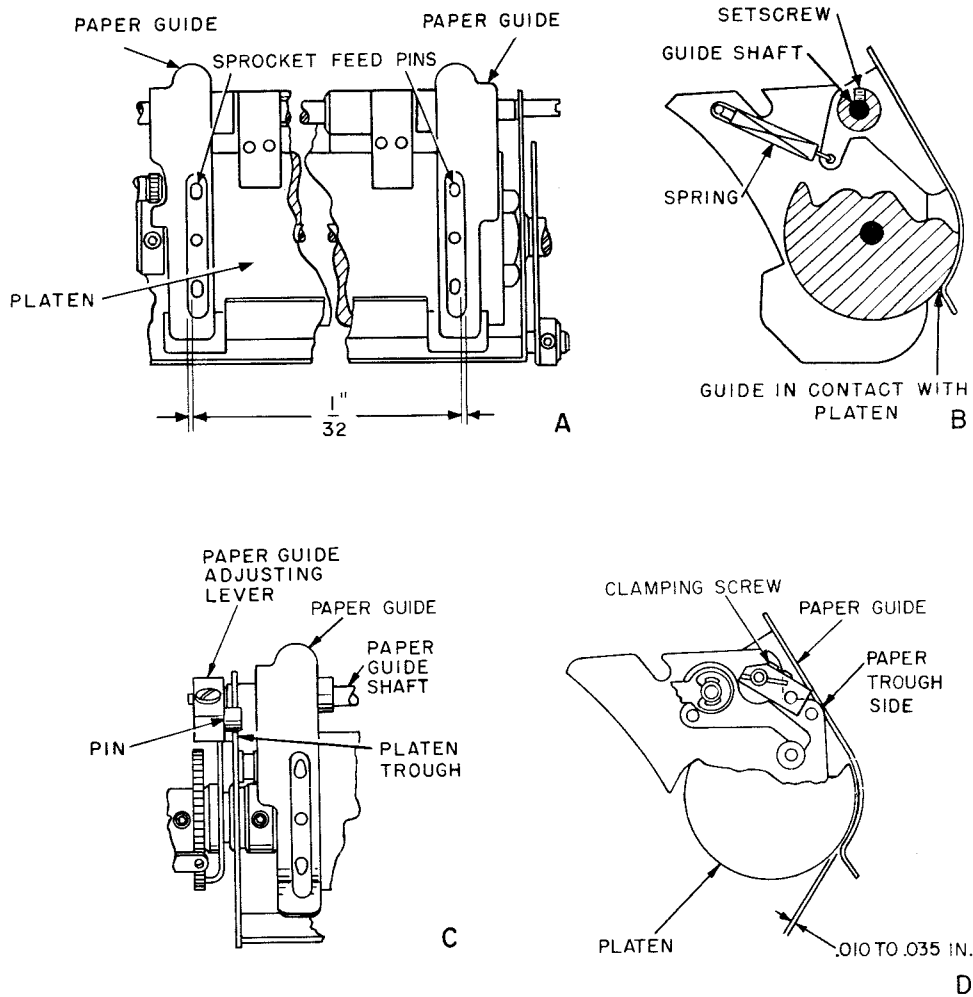
*a. Requirement.* It should require 3 to 6 ounces to start the platen trough guide moving downward.

*b. Adjustment.* Remove the hinge pin, wind or unwind the platen trough springs to meet the requirement, and reinstall the pin.

**325. Paper Guide Adjustments**

*a. Requirements.*

- (1) The outer edge of the holes for the sprocket feed pins should be approximately  $\frac{1}{32}$  inch from the edge of the adjacent paper guide (A, fig. 345).



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Figure 345. Paper guide adjustment requirements.

- (2) Both paper guides of the TT-117/FG and TT-119/FG should be in contact with the platen (B, fig. 345).
- (3) Both paper guides of the TT-117A/FG, TT-118/FG, and TT-119A/FG should be against the platen for friction feeding, and from .010 to .035 inch away from the platen when multiple copy sprocket fed paper is used (D, fig. 345).

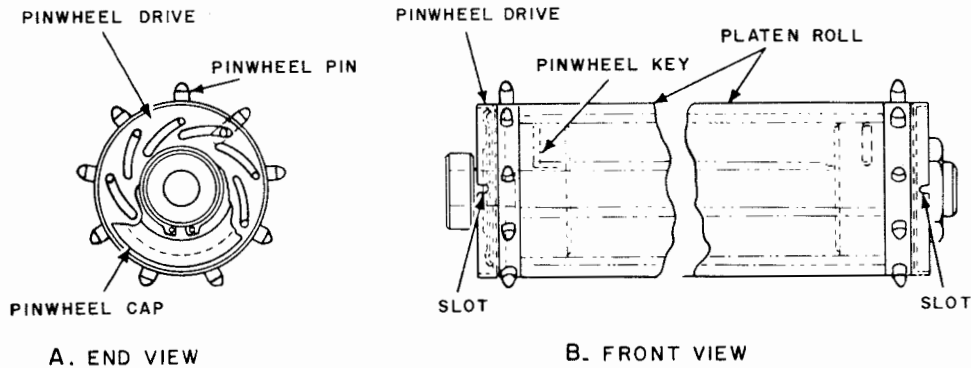
b. Adjustments.

- (1) TT-117/FG and TT-119/FG.
  - (a) Loosen the setscrews in both paper guides.
  - (b) Adjust the position of one paper guide to meet requirement a(1) above and tighten the setscrew.
  - (c) Adjust the position of the other

paper guide to meet requirements a(1) and (2) above the tighten the setscrew.

- (2) TT-117A/FG, TT-118/FG, and TT-119A/FG.
  - (a) Loosen the setscrews in both paper guides and the clamping screw in the paper guide adjusting lever (C and D, fig. 345).
  - (b) Perform adjustments b(1)(b) and (c) above.
  - (c) If the paper is to be friction fed, position the paper guide adjusting lever to have some clearance between the pin on the adjusting lever and the platen trough and tighten the clamping screw.
  - (d) If multiple copy sprocket fed paper





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Figure 346. Sprocket feed pins adjustment.

is to be used, insert a .025-inch gage between the left paper guide and the platen, pivot the paper guide adjusting lever downward until it touches the paper trough, tighten the clamping screw, remove the feeler gage, and check the clearance of both guides.

### 326. Sprocket Feed Pins Adjustment (fig. 346)

*a. Requirement.* The pinwheel pins should be retracted if standard non-perforated paper is to be used and extended for perforated paper.

*b. Adjustment.* Hold the pinwheel drive by inserting a screwdriver or similar instrument into the slot on one side. Turn the platen crank until the sprocket feed pins are in the desired position. Repeat this procedure for the other set of sprocket feed pins.

### 327. Platen Pressure Roller Adjustment (fig. 347)

*a. Requirement.* When the pressure roller lever is in the friction feed notch of the platen lever latch, the pressure roller should press the paper against the platen with enough pressure to prevent slippage between the paper and the platen when the double line feed operation occurs.

*b. Adjustment.* Lock the platen pressure roller lever in the friction feed position and loosen the mounting setscrew. Rotate the roller operating shaft with a 1/4-inch open-end wrench inserted from the rear of the machine to adjust the pressure of the roller against the platen. Tighten the setscrew.

### 328. Platen Frame Positioning and End Play Adjustments (fig. 348)

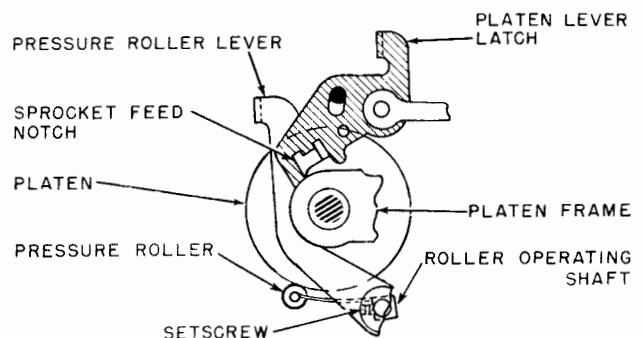
*a. Requirements.*

- (1) The distance from the left edge of the paper to the center of the first printed character should be  $\frac{9}{32}$  ( $\pm \frac{1}{32}$ ) inch for standard symbol page printers and  $1\frac{1}{32}$  ( $\pm \frac{1}{32}$ ) inch for weather symbol page printers.
- (2) When the platen frame is pressed to the left, there should be a .002- to .005-inch clearance between the shoulder of the eccentric pivot in the function side frame and the adjacent bearing in the platen frame.

*b. Adjustments.*

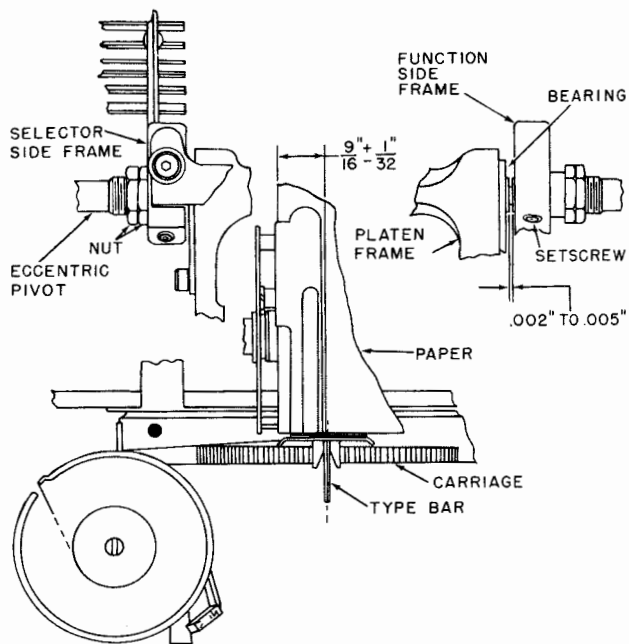
*Note.* Before making this adjustment, be sure the page printer meets the requirement of the carriage positioning adjustment (par. 302).

- (1) Loosen the outer nut on the eccentric pivot in the selector side frame and in the function side frame.



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Figure 347. Platen pressure roller locked in friction feed position.



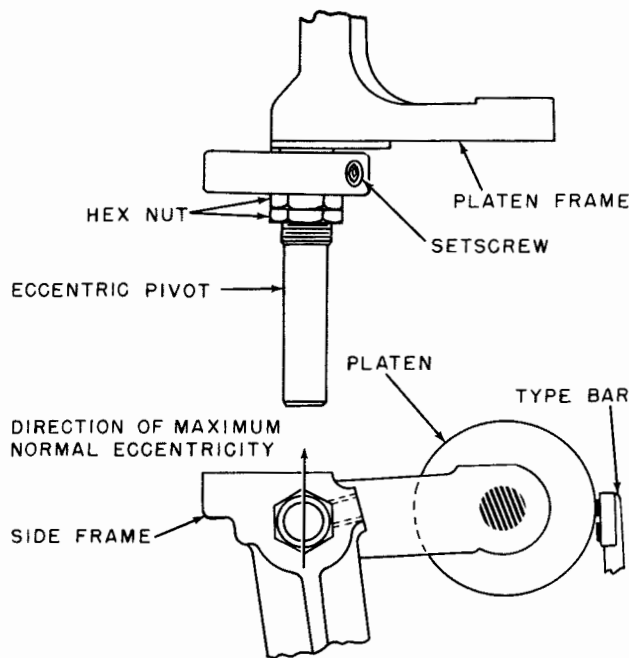
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Figure 348. Platen assembly end play and positioning adjustment requirement (standard symbol page printers).

- (2) Loosen the setscrew that locks each eccentric pivot in the side frame.
- (3) Hold the platen frame against the right eccentric pivot and press the pivot toward the center of the page printer. Adjust the position of the inner nut on the pivot to meet the appropriate requirement in *a*(1) above and tighten the setscrew in the function side frame. Tighten the outer nut against the inner nut.
- (4) Hold the platen frame against the left eccentric pivot and press the pivot toward the center of the page printer. Adjust the position of the inner nut on the pivot to meet requirement *a*(2) above and tighten the setscrew in the selector side frame. Tighten the outer nut against the inner nut.
- (5) Check the related adjustments (pars. 329 and 330).

### 329. Platen Eccentric Pivot Adjustment

*a. Requirement.* Characters should be printed equally dark along the full length of a printed line.



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Figure 349. Character alinement adjustment.

#### *b. Adjustment.*

- (1) Loosen the setscrew in each side frame to release both eccentric pivots.
- (2) Turn each eccentric pivot until maximum eccentricity is in the direction shown in figure 349, press the pivot toward the center of the page printer, and tighten the associated setscrew.
- (3) Turn the motor on and operate the printer to print a full line of the same character. If printing density is lighter at one end of the line, loosen the setscrew in the adjacent side frame, turn the eccentric toward the front of the page printer, press the eccentric inward, tighten the setscrew, and recheck the requirement.
- (4) Check the related adjustments (pars. 327, 328, and 330).

### 330. Platen Shift Preliminary Adjustment (fig. 350)

*a. Requirement.* The platen latch should engage the lug on the aperture gate (fig. 351) when the figures shift mechanism moves the platen to the figures shift position.

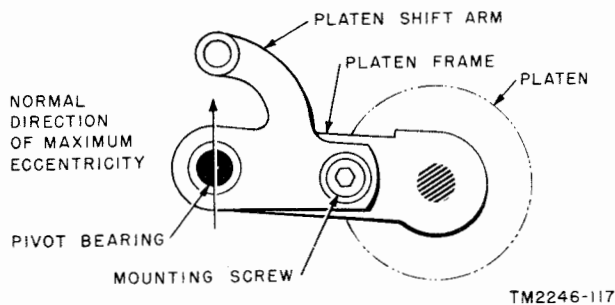


Figure 350. Platen shift preliminary adjustment.

b. *Adjustment.* Loosen the mounting screw that holds the platen shift arm. Position the arm to meet the requirement and tighten the mounting screw. Check the related adjustments (pars. 328 and 329).

### 331. Figures Shift Position Adjustment (fig. 351)

a. *Requirement.* The characters should be printed evenly without being cut off at the top or the bottom when the platen is in the figures shift position.

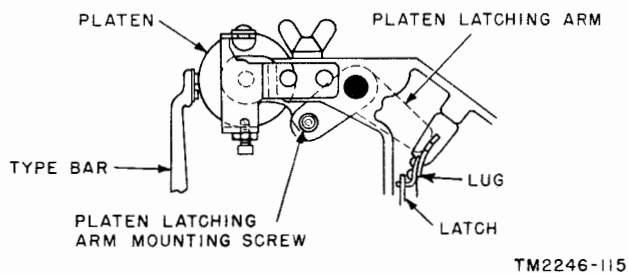


Figure 351. Figures shift position adjustment.

b. *Method of Checking.* When the platen is in the figures shift position, send repeated R and Y signals, and inspect the typed result for cutoff at the top or the bottom of the character.

c. *Adjustment.* Loosen the platen latching arm mounting screw, position the platen latching arm to meet the requirement, and tighten the mounting screw. If all adjustments in sequence are not being made, check the letters shift position adjustment (par. 332) and the platen shift final adjustment (par. 333).

### 332. Letters Shift Position Adjustment (fig. 352)

a. *Requirement.* Characters printed when the platen is in the letters shift position should

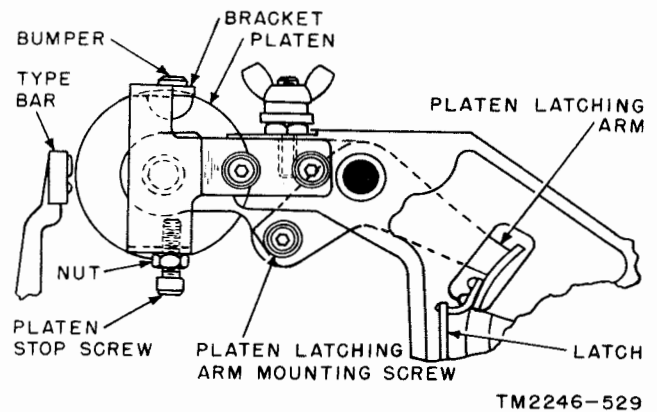


Figure 352. Letters shift position adjustment.

be perfectly aligned with characters printed when the platen is in the figures shift position.

b. *Method of Checking.* With the platen first in the figures position and then in the letters position, send repeated R and Y signals, and inspect the typed result for alinement.

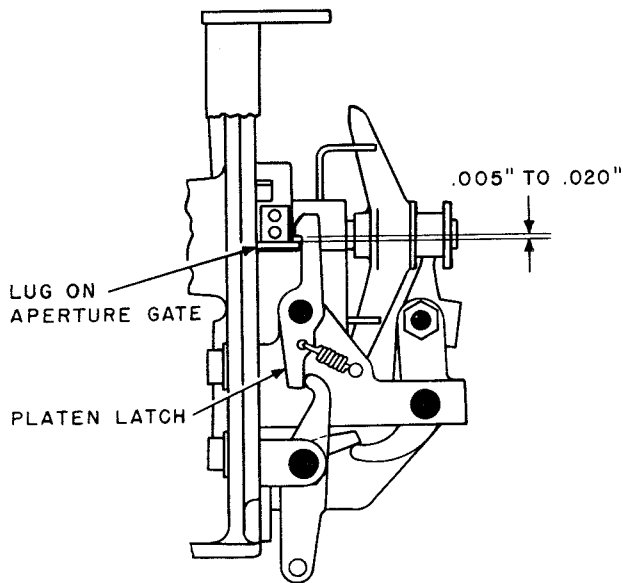
c. *Adjustment.* Loosen the locknut that holds the platen stop screw of the platen bracket. Position the stop screw to meet the requirement in a above. It may be necessary to alter the figures shift position adjustment (par. 331) to be able to aline the characters. Recheck the requirement; readjust, if necessary, until the requirement is met. Tighten the locknut.

### 333. Platen Shift Final Adjustment (fig. 353)

a. *Requirement.* There should be a .005- to .020-inch clearance between the platen latch and the lug on the aperture gate when the roller of the figures shift cam follower is against a high part of the figures shift cam.

b. *Method of Checking.* Select the figures shift operation and turn the motor by hand until the roller of the figures shift cam follower is against a high part of the figures shift cam. Check the requirement with feeler gages.

c. *Adjustment.* Loosen the mounting screw that holds the platen shift arm (fig. 350). Reposition the arm to meet the requirement, and tighten the mounting screw. It may be necessary to readjust the figures shift position adjustment (par. 331) to obtain the required clearance.



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Figure 353. Platen shift final adjustment requirement.

### 334. Platen Blocking Arm Adjustment (fig. 354)

*a. Requirement.* There should be a .005- to .015-inch clearance between the platen blocking arm and the platen lower case latch when the platen is in the letters shift position.

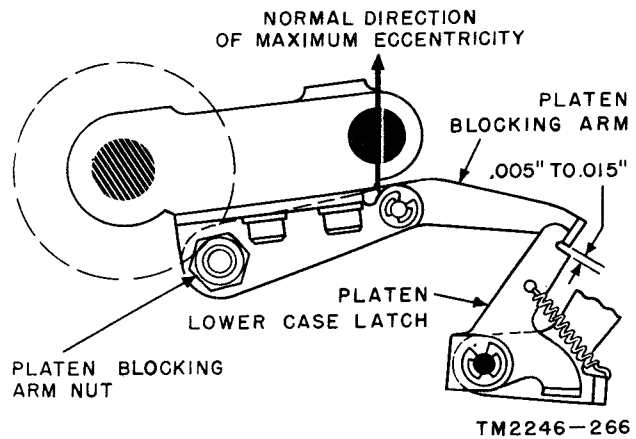
*b. Adjustment.* Loosen the platen blocking arm nut, position the platen blocking arm to obtain the requirement, and tighten the nut.

### 335. Line Feed Connecting Link Adjustment (fig. 355)

*a. Requirements.*

- (1) Selection of the line feed combination should cause the line feed mechanism to index the platen one line space with the single-double line feed lever positioned for single line feed; and two line spaces with the single-double line feed lever positioned for double line feeding.
- (2) When the line feed operation is completed, the line feed pawl should be clear of the detent wheel, allowing the platen to be rotated in either direction.

*b. Adjustment.* Loosen the clamping screws that hold the line feed connecting link, and set the single-double line feed lever to the double



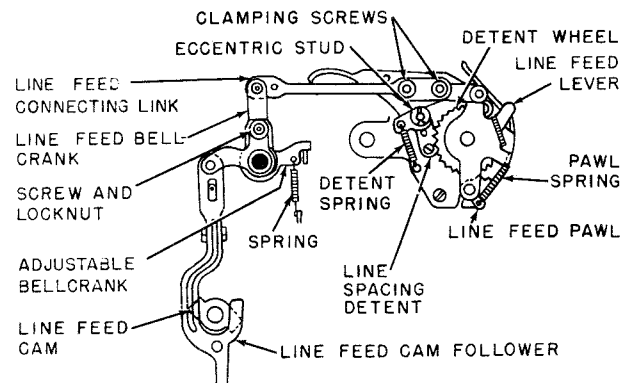
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Figure 354. Platen blocking arm adjustment requirement.

line feed position. Select the line feed combination and rotate the motor by hand until the line feed cam follower is on a high part of its cam. Rotate the line feed lever on which the line feed pawl is mounted until the platen has advanced two line spaces, and tighten the clamping screws to hold the line feed connecting link in this position. Continue to turn the motor until the line feed operation is completed and the parts are restored to their normal position. Be sure that the requirement in *a*(2) above is met. Check visually to see if the line feed detent is resting equally between two teeth on the detent wheel. If it is not, make the line feed bell crank adjustment (par. 336).

### 336. Line Feed Bellcrank Adjustment (fig. 355)

*a. Requirement.* When the single-double line feed lever is in the double line feed posi-



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Figure 355. Line feed, line feed bellcrank, and line spacing detent adjustments.

tion, the platen should be rotated two full line spaces for each line feed operation.

*b. Method of Checking.* Select the line feed combination and turn the motor by hand until the line feed operation is completed. Check visually the number of line spaces the platen was rotated and see if the line feed detent is resting equally between two teeth on the detent wheel.

*c. Adjustment.* Loosen the linefeed bellcrank locknut. Turn the adjustable bellcrank slightly clockwise and tighten the locknut. Check the requirement; readjust if necessary until the requirement is met. It may be necessary to readjust the line feed adjust (par. 335).

### 337. Line Spacing Detent Adjustment

(fig. 355)

*a. Requirement.* The tip of the line feed pawl should be on a radial line between two adjacent teeth of the detent wheel when the line spacing detent is resting equally between two teeth of the detent wheel.

*b. Adjustment.* Loosen the locknut that holds the eccentric stud of the line spacing detent; turn the stud until the requirement is met, and tighten the locknut.

### 338. Manual Unshift Lever Link Adjustment

(fig. 356)

*a. Requirement.* There should be a .020- to .040-inch clearance between the operating end of the lever link and the unshift lever when the manual letters shift mechanism is in the unoperated position.

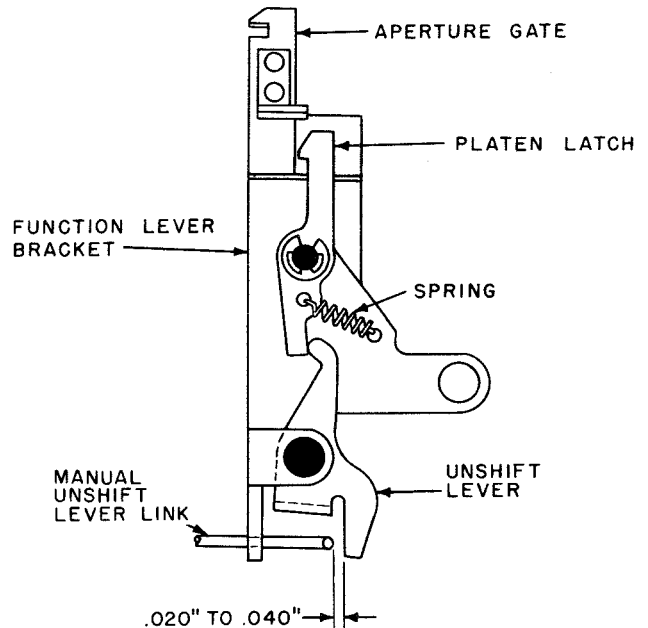
*b. Adjustment.* Disconnect the connector link from the manual unshift bellcrank (14, fig. 234) and loosen its locknut. Turn the connector link until the requirement is met and tighten the locknut. Reattach the connector link to the manual unshift bellcrank.

### 339. Carriage-Feed Shaft Ratchet Wheel Adjustment

(fig. 357)

*a. Requirement.* The hub of the ratchet wheel should be .010 to .020 inch from the flat on the carriage-feed shaft.

*b. Adjustment.* Loosen the setscrews on the ratchet wheel and slide the wheel to meet



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Figure 356. Manual unshift lever link adjustment requirement.

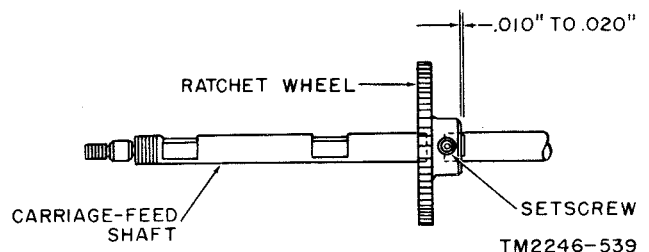
the requirement; tighten the setscrews. Check related adjustments (pars. 306, 307, and 323).

### 340. Carriage-feed Shaft Drive Shaft Collar Adjustment

(fig. 358)

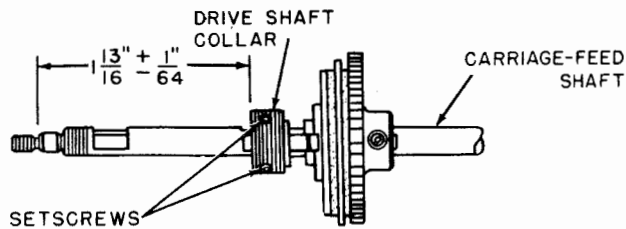
*a. Requirement.* There should be  $1\frac{3}{16}$  inches,  $\pm\frac{1}{64}$  inch, between the drive shaft collar and the shoulder on the carriage-feed shaft.

*b. Adjustment.* Loosen the setscrews in the drive shaft collar and slide the drive shaft collar to meet the requirement; tighten the setscrews. Check related adjustments (pars. 306, 307, 323, 339, and 341).



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Figure 357. Carriage-feed shaft ratchet wheel adjustment requirement.



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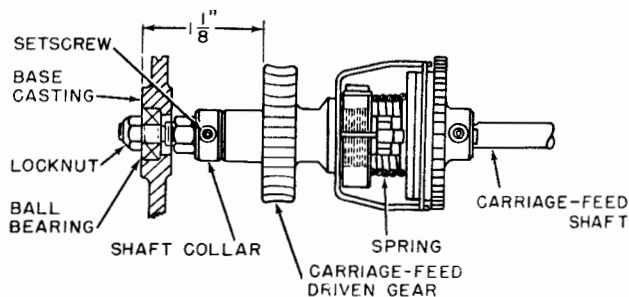
Figure 358. Carriage-feed shaft drive shaft collar adjustment.

### 341. Carriage-Feed Driven Gear Adjustment

(fig. 359)

a. *Requirement.* There should be  $1\frac{1}{8}$  inches,  $\pm\frac{1}{64}$  inch, between the back face of the carriage-feed driven gear and the machined surface on the base casting.

b. *Adjustment.* Loosen the setscrews in the shaft collar, hold the carriage-feed driven gear against the collar, slide the two parts to meet the requirement, and tighten the setscrews in the shaft collar. Check related adjustments (pars. 306, 307, 323, 339, and 340).



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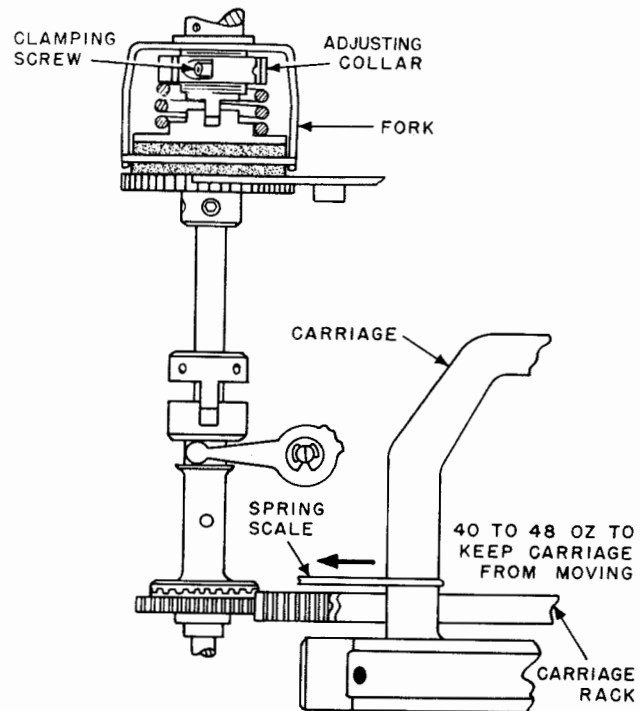
Figure 359. Carriage-feed driven gear adjustment.

### 342. Carriage-Feed Friction Clutch Torque Adjustment

(fig. 360)

a. *Requirement.* It should require a force of 40 to 48 ounces, applied as shown in figure 360, to prevent feeding of the carriage by the carriage-feed mechanism.

b. *Method of Checking.* Turn the motor on and hook a spring scale on the left side of the carriage at a point over the carriage rack. Hold the spring scale firmly and depress the



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Figure 360. Carriage-feed friction clutch torque requirement.

space bar and repeat keys. When the carriage is held stationary by the spring scale, check the scale reading.

c. *Adjustment.* Turn the motor off, loosen the clamping screw in the adjusting collar, turn the adjusting collar to meet the requirement, and tighten the clamping screw. It may be necessary to move the carriage to position the clamping screw for tightening. Recheck the requirement and readjust if necessary.

### 343. Carriage-Return Safety Clutch Torque Adjustment

(fig. 361)

a. *Requirement.* It should require a force of 48 to 56 ounces, applied as shown in figure 361, to prevent the carriage from moving when the carriage-return mechanism is operating.

b. *Method of Checking.* Turn the motor on, move the carriage to the right margin. Hook a spring scale to the right side of the carriage and hold it securely while pressing the CAR RET key. The carriage should move to the left until the pull of the spring scale stops it. Move the spring scale slowly to the left and read it when the carriage starts to move again.

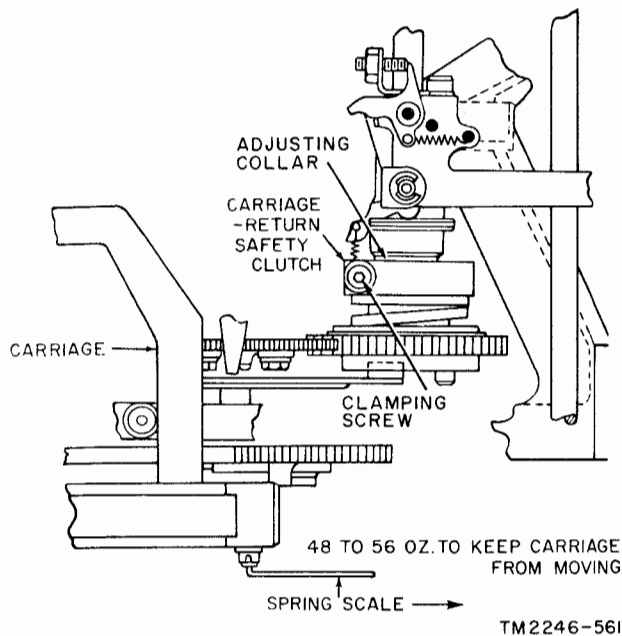


Figure 361. Carriage-return safety clutch torque requirement.

*c. Adjustment.* Turn the motor on, press the CAR RET key, and hold the space bar down until the clamping screw in the adjusting collar of the carriage-return safety clutch is accessible with a straight allen wrench. Turn the motor off and loosen the clamping screw. Turn the motor by hand clockwise to increase the tension; turn it counterclockwise to decrease the tension. Tighten the clamping screw, remove the wrench and recheck the requirement.

### 344. Print Bail Swing, Printing Density and Ribbon Guide Adjustments

(fig. 362)

#### *a. Requirements.*

- (1) *Print bail swing.* The print bail should travel an equal distance to each side of a vertical centerline through the print bail shaft.
- (2) *Printing density.* When the inking ribbon in the page printer is in good condition (not excessively worn or completely dry) characters printed by the page printer should be dark and clear.
- (3) *Ribbon guide.* During the time between printing operations, the top

edge of the ribbon should be .005 to .030 inch below the bottom of the printed characters.

#### *b. Method of Checking.*

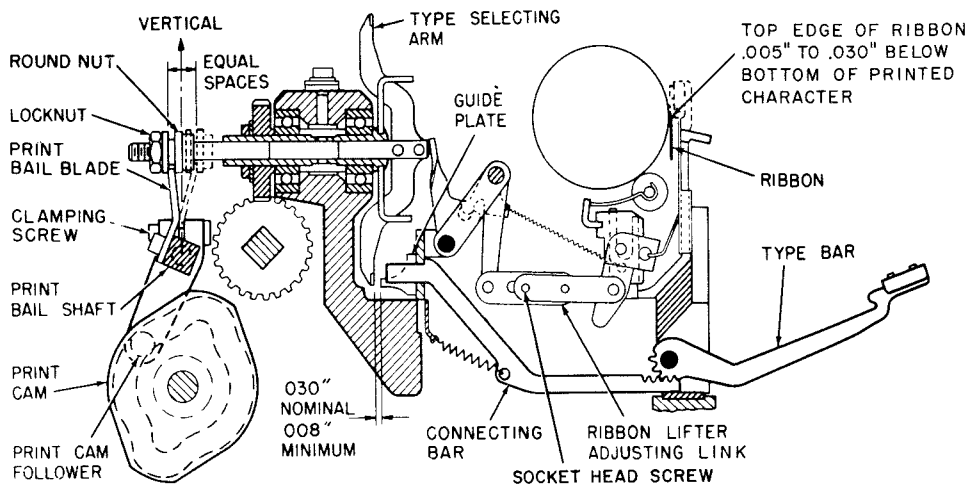
- (1) *Print bail swing.* Check the clearance between the top edge of the print bail and the bottom of the groove in the round nut when the print bail is in the extreme forward and rearward positions. When the clearances are equal, the adjustment is correct.
- (2) *Printing density.* Operate the page printer and examine the printed characters along the full length of a printed line.
- (3) *Ribbon guide.* Operate the page printer and check for requirement a(3) above.

#### *c. Adjustments.*

- (1) *Print bail swing.* Loosen the clamping screw in the print cam follower, turn the print bail shaft to meet the requirement, and tighten the clamping screw.
- (2) *Printing density.* Loosen the locknut on the end of the type selecting arm shaft. To increase printing density, turn the round nut in a direction to move the type selecting arm toward the connecting bars. Turn the round nut in the opposite direction to decrease printing density. Under normal conditions, there should be approximately .030-inch clearance between the type selecting arm and the guide plate when the print cam follower is in the print cam at the point shown in figure 362. The minimum clearance is .008 inch.

*Note.* The printing density adjustment should always be checked when changing the operating speed of the page printer. When changing to a faster operating speed, the type bars will strike the platen with excessive force unless the clearance is increased. When changing to a slower speed, printing may not be dark enough unless the clearance is decreased.

- (3) *Ribbon guide.* Loosen the socket head screws in the ribbon lifter adjusting link. Move the link to meet the requirement and tighten the screws.



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Figure 362. Print bail and ribbon lifter adjustments.

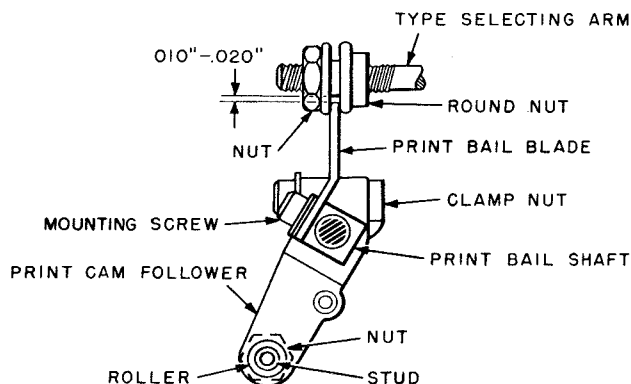
### 345. Print Bail Blade Adjustment (fig. 363)

*a. Requirement.* When the print bail blade is midway between the extreme forward and rearward positions, there should be a .010- to .020-inch clearance between the edge of the print bail blade and the bottom of the round nut groove for the entire length of the blade.

*b. Adjustment.* Loosen the mounting screws that hold the print bail blade, move the print bail blade up or down until the requirement is met, and tighten the mounting screws.

### 346. Ribbon Feed Assembly Mounting Adjustment (fig. 364)

*Note.* Perform this adjustment only when assembling the ribbon feed mechanism to the carriage.



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Figure 363. Print bail blade adjustment requirement.

*a. Requirement.* The ribbon spool drive shafts should be 5 inches apart and parallel within 0.010 inch.

*b. Adjustment.* Loosen the screws that mount the ribbon feed mechanism. Position the mechanism to meet the requirement (*a* above). Tighten the mounting screws and recheck the requirement.

### 347. Ribbon Feed Mechanism Adjustments

*a. Ribbon Spool Shaft Adjustment* (fig. 365).

- (1) *Requirement.* There should be equal engagement between the bevel gear on each end of the ribbon feed shaft and its mating spool shaft gear.
- (2) *Adjustment.* Loosen the setscrews in the driven clutch member, left collar, and right collar on the ribbon feed shaft. Position the shaft in the mounting bracket to meet the above requirement, slide the driven clutch member against the mounting bracket, and tighten the setscrew in the driven clutch member. Insert a .003-inch feeler gage between the driven clutch member and the mounting bracket, hold the shaft to the left, push the right collar to the right to compress the spring friction washer, and tighten the setscrew in the right collar. Adjust the position of the left collar as described in *b* below.



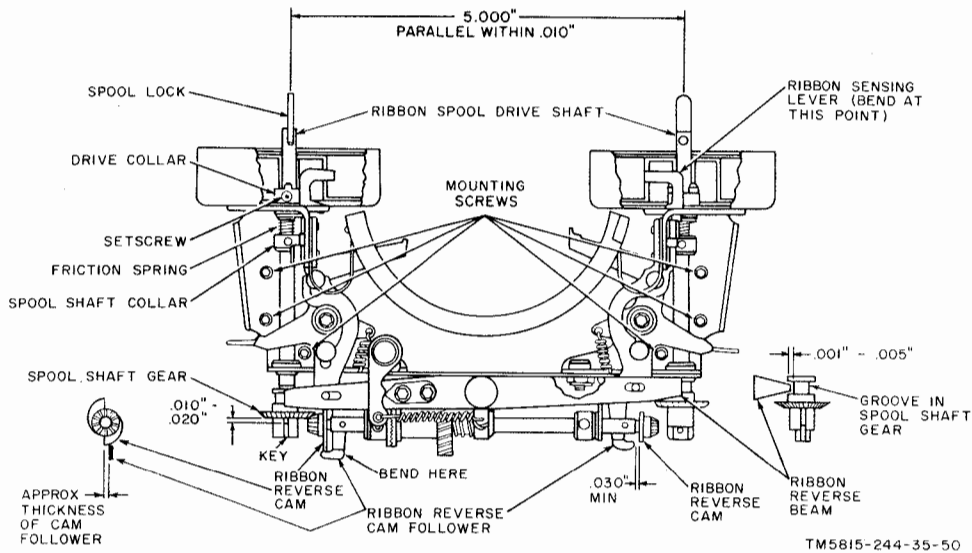


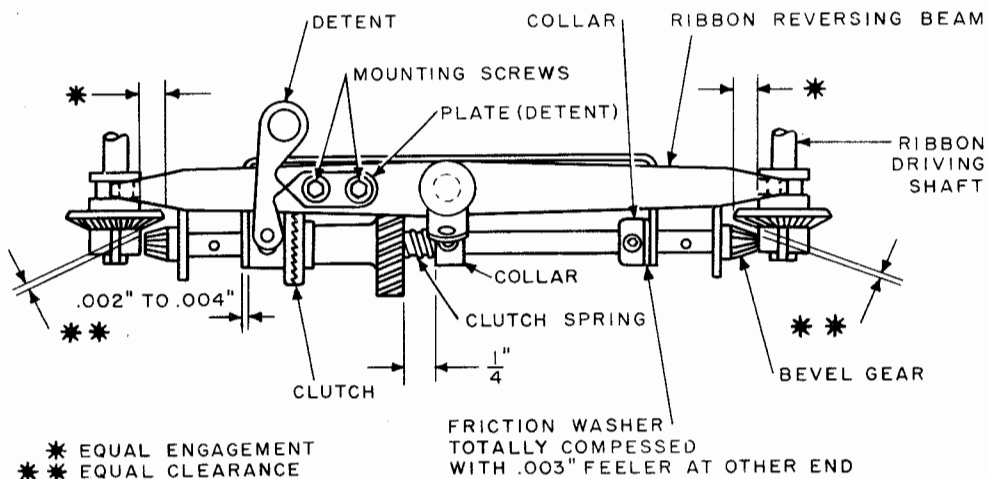
Figure 364. Ribbon mechanism adjustment requirements.

*b. Ribbon Feed Clutch Spring Compression Adjustment (fig. 365).*

- (1) *Requirement.* The teeth of the ribbon feed clutch should slip during the time the carriage is returning to the left margin.
- (2) *Adjustment.* The setscrew in the left collar on the ribbon feed shaft should be loose (a(2) above). Position the left collar approximately  $\frac{1}{4}$  inch from the adjacent surface of the clutch drum and tighten the setscrew in the collar.

*c. Ribbon Spool Drive Collar Adjustment (fig. 364).*

- (1) *Requirement.* There should be a .010- to .020-inch clearance between the top of the slot in the spool shaft gear and the top of the key in the lower end of the ribbon spool shaft when the spool shaft gear is in engagement with the bevel gear on the ribbon feed shaft.
- (2) *Adjustment.* Remove the ribbon spool, loosen the setscrews in the drive collar, press the drive collar against



\* EQUAL ENGAGEMENT  
 \*\* EQUAL CLEARANCE

FRICTION WASHER  
 TOTALLY COMPRESSED  
 WITH .003\"/>

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Figure 365. Ribbon driving shaft and clutch spring adjustments.

the bottom of the spool cup, position the spool shaft to meet the requirement, and tighten the setscrews in the drive collar. Replace the ribbon spool.

### 348. Ribbon Reverse Mechanism Adjustments

#### a. Detent Plate Adjustment (fig. 366).

(1) *Requirement.* Engagement of the detent with the detent plate when an end of the ribbon reverse beam is in the upper position should be equal to the engagement when the same end of the beam is in the lower position.

(2) *Adjustment.* Loosen the two mounting screws that hold the detent plate, position the plate to meet the requirement, and tighten the mounting screws.

#### b. Ribbon Sensing Lever Adjustment (fig. 364).

(1) *Requirement.* There should be a .030-inch *minimum* clearance between the tip of each ribbon reverse cam follower and its associated ribbon reverse cam when the associated ribbon sensing lever is held in its *innermost* position by the inking ribbon on the ribbon spool.

(2) *Adjustment.* Bend the ribbon sensing lever at the point shown in figure 364 to meet the requirement.

#### c. Ribbon Reverse Beam Adjustment (fig. 364).

(1) There should be a .001- to .005-inch clearance between the tip of each end

of the ribbon reverse beam and the inner surface of the groove in the associated spool shaft gear.

(2) *Adjustment.* Bend the end of the ribbon reverse beam to meet the requirement.

#### d. Ribbon Reverse Cam Follower Adjustment (fig. 364).

(1) *Requirement.* When a ribbon reverse cam has cammed its associated cam follower downward just enough to cause the tip of the detent plate to move *below* the tip of the detent, the distance between the *outer* edge of the cam follower and a high point on the cam should be approximately the thickness of the cam follower.

(2) *Adjustment.* Bend the ribbon reverse cam follower to meet the requirement.

### 349. Ribbon Spool Friction Spring Compression Adjustment (fig. 364)

a. *Requirement.* When a ribbon spool drive shaft is in the upper position (bevel gears disengaged), a force of 1 to 2 ounces, applied at right angles to the end of the spool lock, should be required to start the ribbon spool turning in the direction of ribbon feeding. Check the opposite side for this requirement also.

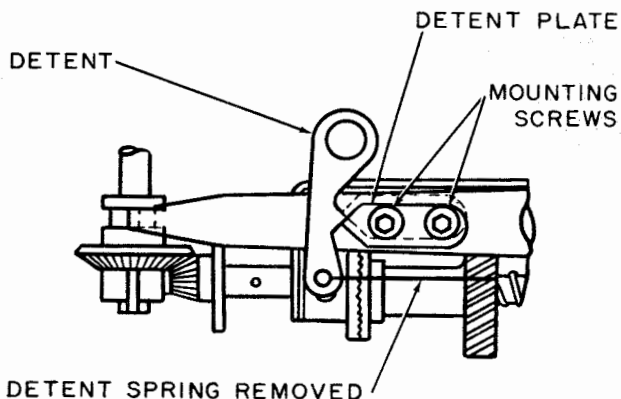
b. Loosen the setscrews in the spool shaft collar, position the collar to increase or decrease compression of the friction spring to meet the requirement, and tighten the setscrews.

### 350. Left-Hand Margin Trip Plate Adjustment (fig. 367)

a. *Requirement.* The clearance between the delaying latch and the stop bar shift stop should be equal to the clearance between the delaying latch and its stop on the stop bar shift link bracket, when the carriage is against the left hand margin stop screw.

b. *Method of Checking.* Turn the motor on and depress the carriage-return key lever. When the carriage has returned to the left-hand margin, turn the motor off and check the clearance visually.

c. *Adjustment.* Loosen the margin trip plate machine screws. Be sure carriage is against the left-hand margin stop screw. Position the



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Figure 366. Ribbon reversing detent plate adjustment.

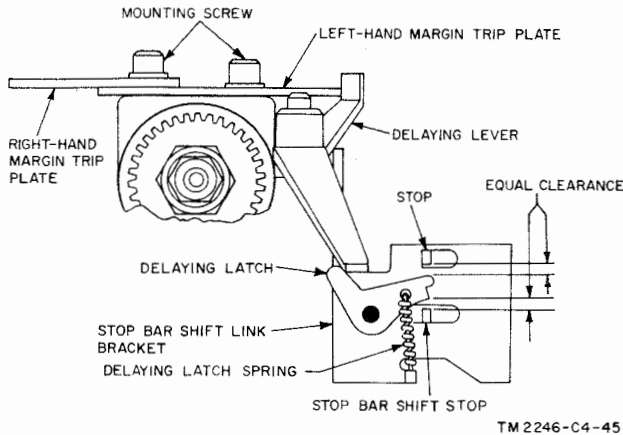


Figure 367. Left-hand margin trip plate adjustment.

left-hand margin trip plate to meet the requirement. Tighten the mounting screws and recheck the requirement.

### 351. Right-Hand Margin Trip Plate Adjustment (fig. 368)

*a. Requirement.* When the carriage is 73 spaces from the left margin of standard symbol page printers or 77 spaces from the left margin of weather symbol page printers, one-half the thickness of the carriage-return sensing lever should engage the carriage-return stop bar.

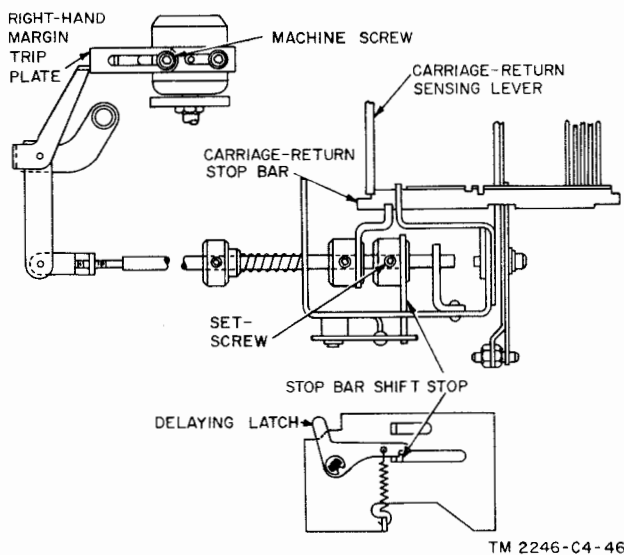


Figure 368. Automatic carriage-return stop bar shift stop adjustment.

**Caution:** The following adjustment is most easily performed while the motor of the page printer is running. When making the adjustment, be careful to keep the fingers away from any of the operating mechanical assemblies.

*b. Adjustment.* Turn the motor on, space the carriage 73 or 77 spaces from the left margin (as applicable). Loosen the machine screw that holds the right-hand margin trip plate, position the trip plate to meet the requirement, and tighten the screw.

### 352. Carriage-Return Stop Bar Shift Stop Adjustment (fig. 368)

*a. Requirement.* When the carriage is 73 spaces from the left-hand margin on standard symbol page printers or 77 spaces from the margin on weather symbol page printers, the delaying latch should be engaged by one-half the thickness of the stop bar shift stop.

*b. Adjustment.* Loosen the setscrew that holds the stop bar shift stop to the stop bar shift link, position the stop to meet the requirement, and tighten the setscrew.

### 353. Carriage-Return Stop Bar Shift Blade Adjustment (fig. 369)

*a. Requirement.* There should be a .015- to .020-inch clearance between the line feed sensing lever and the line feed function stop bar when the carriage is in any but the 72d or 73d (76th or 77th on weather page printers) space positions and the stop bar shift stop is latched by the delaying latch.

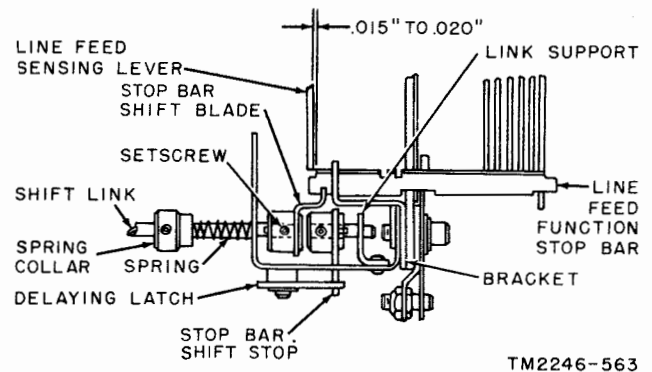


Figure 369. Carriage-return, stop bar shift blade adjustment.

b. *Method of Checking.* Move the shift lever by hand until the stop bar shift stop is latched by the delaying latch; check the gap with a feeler gage.

c. *Adjustment.* Loosen the setscrew in the stop bar shift blade, slide the stop bar shift blade to meet the requirement, and tighten the setscrew.

d. *Final Check.* When the carriage is returned to the left margin, there should be clearance between the bracket and the stop bar shift lever (par. 343). If the stop bar shift lever touches the bracket, loosen the setscrews on the stop bar shift stop and the stop bar shift blade, turn the stop bar shift link to obtain a minimum of .005-inch clearance, and readjust for the requirements of paragraphs 351 and 352, and *a* above.

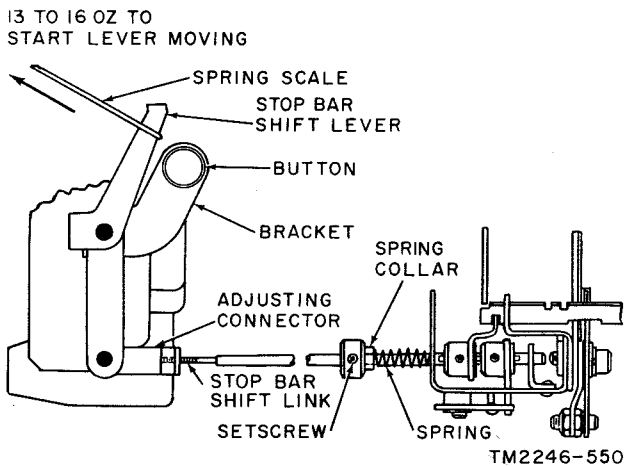


Figure 370. Carriage-return stop bar return spring adjustment.

### 354. Carriage-Return Stop Bar Return Spring Adjustment (fig. 370)

a. *Requirement.* It should require 13 to 16 ounces to start the stop bar shift lever moving when the carriage is in the 73d position.

b. *Adjustment.* Loosen the setscrew and slide the spring collar to meet the requirement; tighten the setscrew.

### 355. Margin Signal Bell Adjustment (fig. 371)

a. *Requirement.* The margin signal bell should ring when the carriage moves to the

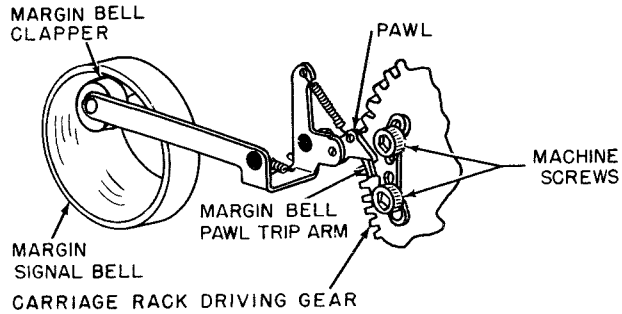


Figure 371. Margin bell adjustment.

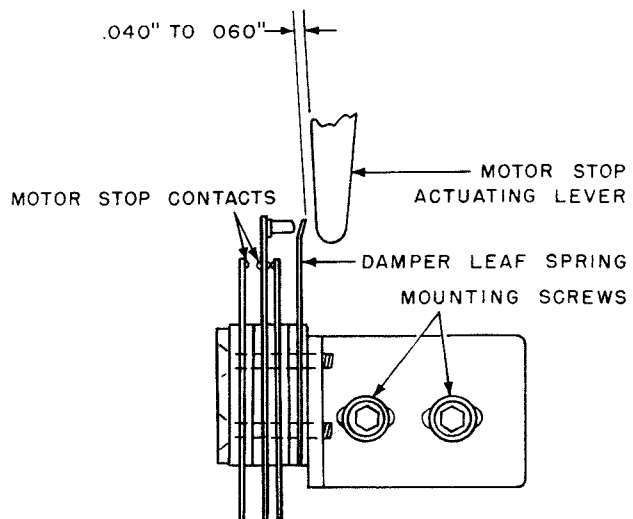
66th space from the left margin on standard symbol page printers or to the 70th space on weather symbol page printers.

b. *Adjustment.* Loosen the machine screws, move the margin bell pawl trip arm to meet the requirement, and tighten the screws.

### 356. Motor Stop Contacts Bracket Adjustment (fig. 372)

a. *Requirement.* There should be a .040- to .060-inch clearance between the motor stop actuating lever and the damper leaf spring when the motor stop actuating lever is in the unoperated position.

b. *Adjustment.* Loosen the two mounting screws and position the motor stop contact bracket to obtain the requirement; tighten the two mounting screws.



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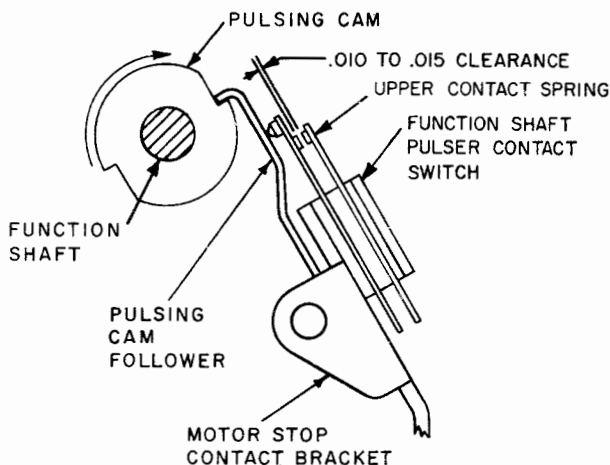
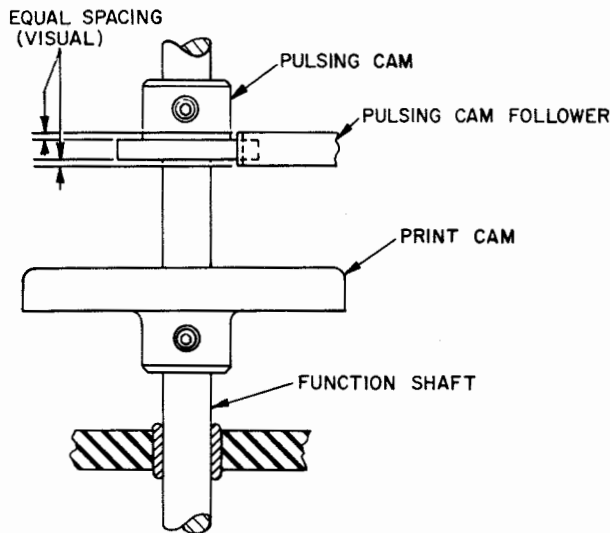
Figure 372. Motor stop contact bracket adjustment.

### 357. Function Shaft Pulsing Cam and Contact Adjustment (Weather Page Printers Only) (fig. 373)

*Note.* Make the adjustment listed in paragraph 356 before making this adjustment.

#### a. Requirements.

- (1) The motor stop contacts (fig. 372) should make before the function shaft pulser contacts (fig. 373) break.
- (2) There should be a .010- to .015-inch clearance between the function shaft pulser contacts when the pulsing cam



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Figure 373. Function shaft pulsing cam and contact adjustment (weather equipment only).

follower is on the low part of the pulsing cam.

b. *Method of Checking.* With the machine operating, shift the platen to the figures position. Depress the BLANK and the H key levers, in that order; the motor should stop. Any other combinations of key lever depressions should not stop the motor. Shift the platen to the letters position and select the BLANK—H combination. The motor should not stop.

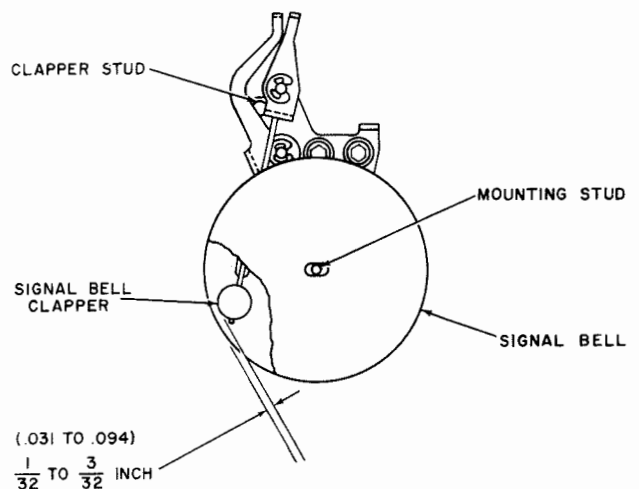
#### c. Adjustments.

- (1) With the machine in the stop position, loosen the set screws that hold the pulsing cam. Position the pulsing cam so that the pulsing cam follower is on the high portion of the pulsing cam and centered on the surface of the pulsing cam.
- (2) Release the transfer latch and turn the motor by hand until the pulsing cam follower is on the low part of the cam. Form the upper contact spring to meet the requirement.

### 358. Signal Bell Preliminary Adjustment (fig. 374)

a. *Requirement.* The clapper should contact the clapper stud when the weighted end of the clapper is  $\frac{1}{32}$  to  $\frac{3}{32}$  inch from the signal bell.

b. *Method of Checking.* Move the clapper against the clapper stud manually. Check the clearance.



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Figure 374. Signal bell preliminary adjustment.

c. *Adjustment.* Loosen the locknut that holds the signal bell to the bracket. Hold the bell so that the stud is in the center of the elongated hole and tighten the locknut. Bend the clapper rod to meet the requirement. Then make the adjustment described in paragraph 359.

### 359. Signal Bell Final Adjustment (fig. 375)

#### a. Requirements.

- (1) There should be a  $\frac{1}{16}$ - to  $\frac{3}{32}$ -inch clearance between the signal bell clapper and the clapper stop when the clapper is held to the right by the spring. The signal bell should not ring when the page printer is in the letters position and the S code group is received.
- (2) The signal bell should sound loud and clear when the machine is in the figures shift position and the S code group is received.

#### b. Adjustments.

- (1) Remove the upper locknut and the signal bell. Loosen the lower locknut. Make sure the signal bell clapper is held all the way to the right by the spring and position the clapper stop to meet the requirement.

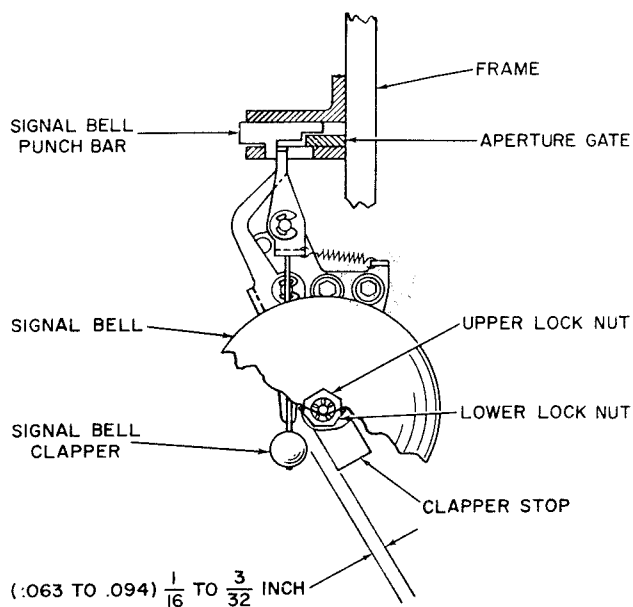


Figure 375. Signal bell adjustment.

- (2) Replace the signal bell and the upper locknut. Position the signal bell in the direction necessary to obtain the requirement in a(2) above. Tighten the upper locknut.

### 360. Key Lever Locking Bar Adjustment (fig. 376)

a. *Requirement.* There should be a .005- to .030-inch clearance between the key lever locking bar and the key levers.

b. *Adjustment.* Loosen the three screws and move the key lever locking bar up or down to meet the requirement. Check both ends of the key lever locking bar and tighten the screws; recheck the clearance.

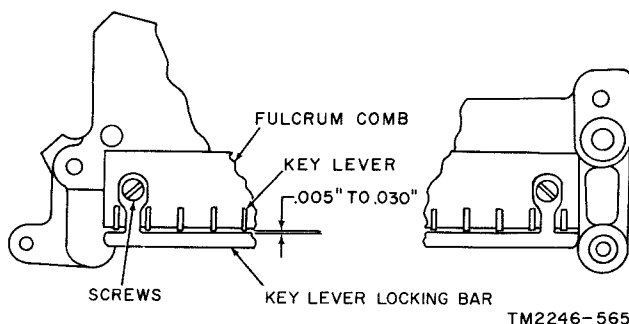


Figure 376. Key lever locking bar adjustment.

### 361. Selector Lever Pivot Post Adjustment (fig. 377)

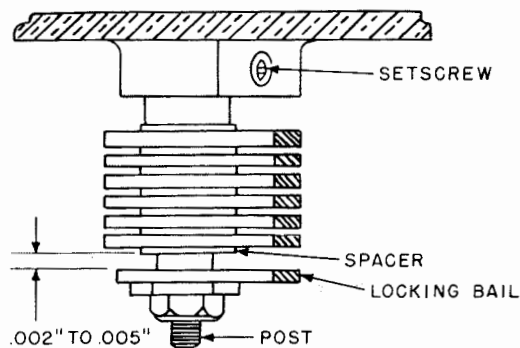
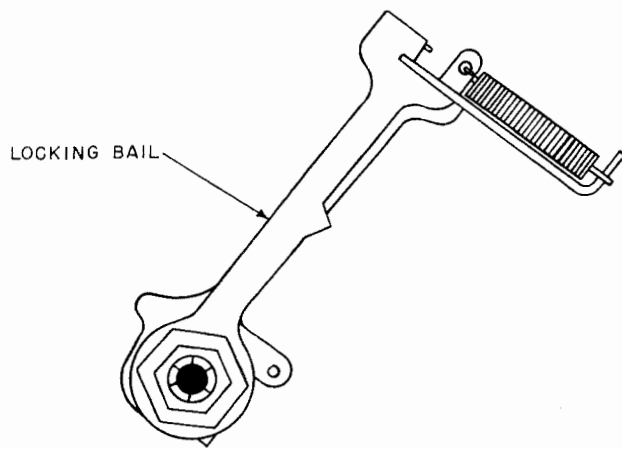
a. *Requirements.* There should be a .002- to .005-inch clearance between the spacer and the locking bail.

b. *Adjustment.* Loosen the setscrew and move the selector lever pivot post in or out to meet the requirement; tighten the setscrew.

### 362. Sensing Levers Clearance and Alinement Adjustment (fig. 378)

a. *Requirement.* Each sensing lever should be in alinement with its associated code bar and there should be a .001- to .003-inch clearance between the spacer and the inner sensing lever.

b. *Adjustment.* Peel the laminated washer until the sensing levers and code bars are in



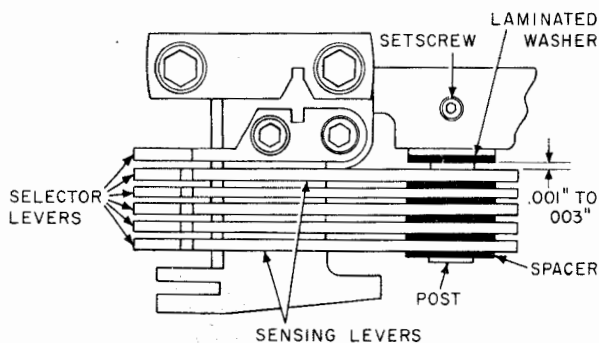
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Figure 377. Selector lever pivot post adjustment.

line. Move the post in or out to obtain the .001- to .003-inch clearance; tighten the setscrew.

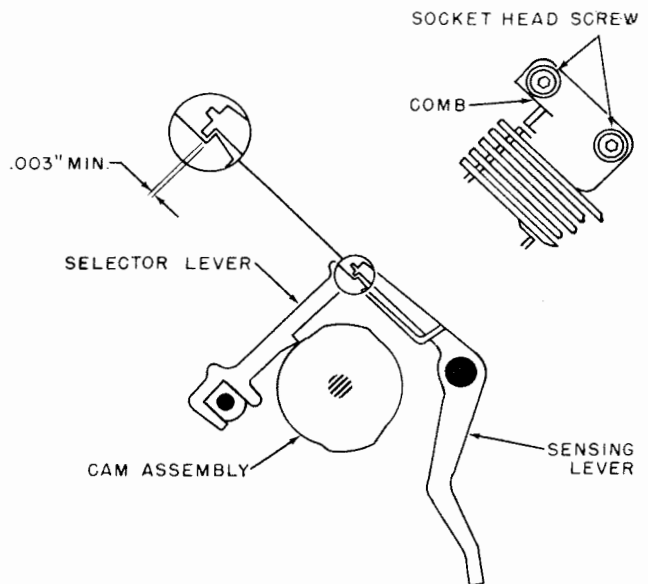
### 363. Selector Levers and Sensing Levers Adjustment (fig. 377)

a. Requirement. When each selector lever is against a low part of its associated cam, there



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Figure 378. Sensing levers clearance alinement adjustment.



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Figure 379. Selector levers and sensing levers adjustment.

should be a minimum of .003-inch clearance between the selector lever and its associated sensing lever.

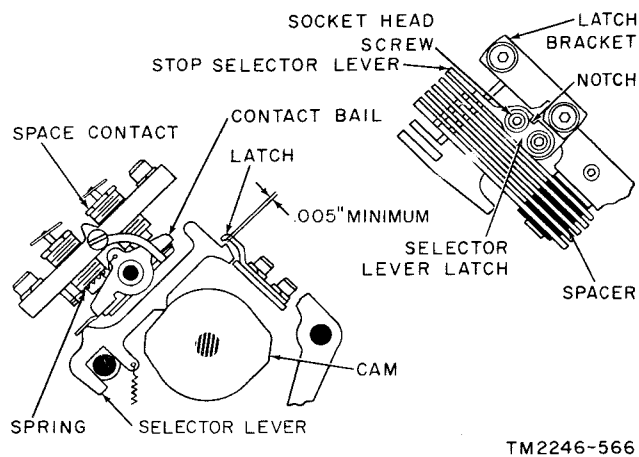
b. Adjustment. Adjust the comb to obtain the minimum clearance for each of the five selector levers. Make this adjustment whenever making the minimum clearance adjustment described in paragraph 391c(1).

### 364. Stop Selector Lever Latch and Transmitter Contact Adjustment (fig. 380)

a. Requirement.

- (1) The stop selector lever latch should be adjusted to give the correct stop pulse length. There should be a .005-inch minimum clearance between the stop selector lever and stop selector lever latch when the stop selector lever is on a low point of its cam.
- (2) There should be no breaks in line current between successive marking impulses sent by the sequential keyboard transmitter.

b. Method of Checking. Use Distortion Test Set TS-383/GG to measure the signals transmitted by the page printer.



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Figure 380. Stop selector lever latch adjustment.

c. Adjustment.

- (1) Loosen the socket head screws that secure the selector lever latch. Turn the motor on and push the REPEAT key and blank key. With a screwdriver in the notch of the selector lever latch and latch bracket, move the selector lever latch to obtain the required stop signal length on a TS-383/GG. Move it to the left to decrease and to the right to increase the pulse length; tighten the screws and recheck the signal length.
- (2) Remove the transmitter contact cover and back off the stationary mark contact.
- (3) Connect a milliammeter across the sequential contact when the send plug (P21 on TT-117/FG and TT-119/FG; P5 on all other models) is disconnected.
- (4) Depress the letters key and turn the motor by hand. Watch the milliammeter. It will show either breaks between marking impulses or no marking impulses at all if the contact is backed off far enough.
- (5) Screw the mark contact down a short distance, depress the letters key, and turn the motor by hand. Watch the milliammeter again.
- (6) Repeat this procedure until all breaks between the marking code impulses are eliminated.

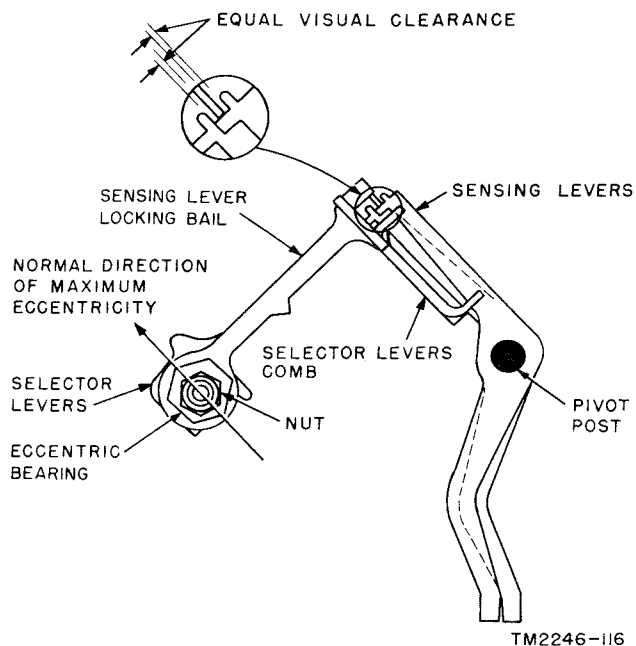


Figure 381. Sensing lever locking bail adjustment.

### 365. Sensing Lever Locking Bail Adjustment (fig. 381)

a. Requirement. There should be equal clearance between the sensing lever locking bail latching surface and the sensing levers latching surface for the mark and space positions.

b. Method of Checking. Depress either the R- or Y-key lever. Turn the transmitter camshaft clockwise by hand until the sensing lever locking bail engages the sensing levers; check the clearance visually.

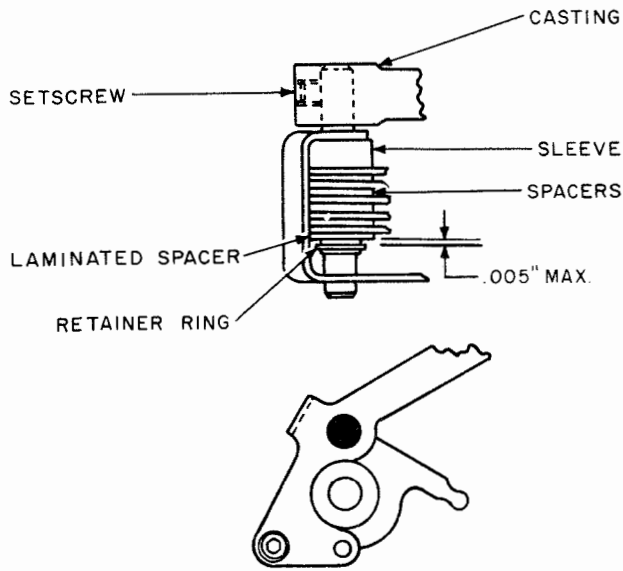
c. Adjustment. Loosen the nut on the selector lever post. With the sensing lever locking bail engaged with the sensing levers, turn the eccentric bearing clockwise or counterclockwise until the requirement is met, and tighten the nut.

### 366. Switch Arm End-Play Adjustment (fig. 382)

a. Requirement. There should be some, but not more than .005-inch clearance between the retainer ring and the laminated spacer.

b. Adjustment. Peel the laminated spacer until the requirement is met.



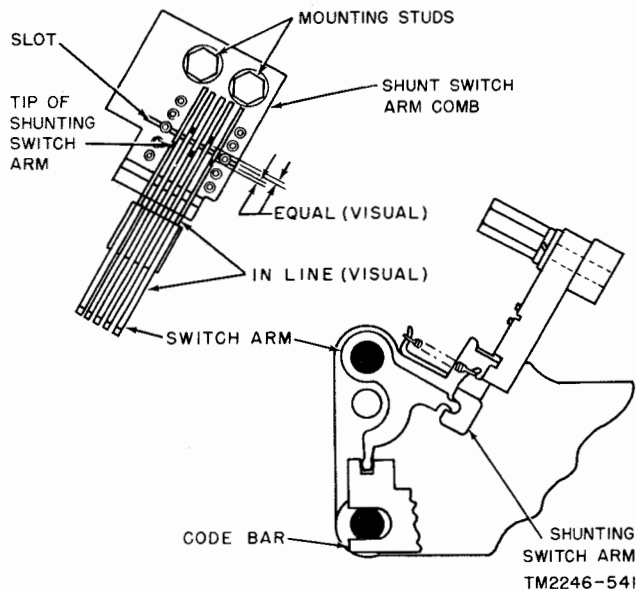


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Figure 382. Switch arm end-play adjustment.

### 367. Shunt Switch Arm Comb Adjustment (fig. 383)

*a. Requirement.* Each shunting switch arm should be in line with its associated switch arm. There should be an equal space between the shunting switch arm contacts and the slot in the shunt switch arm connector when the R or Y is selected.

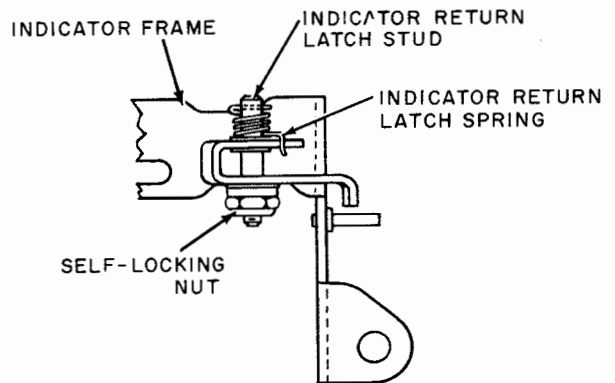
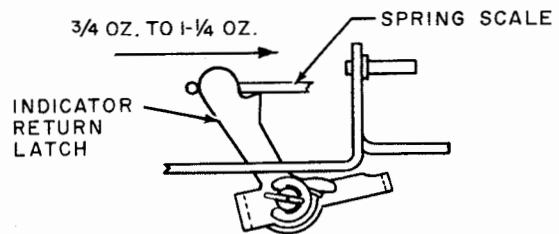


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Figure 383. Shunt switch arm comb adjustment.

*b. Method of Checking.* With the unit in the stop position and the motor off, push the R or Y key lever.

*c. Adjustment.* Loosen the two mounting studs. Move the shunt switch arm comb to line up the shunting switch arm contacts and the shunt switch arm connector. With the R or Y selected, move the shunt switch arm comb until equal clearance is obtained between the slot and the shunting switch arm contacts; tighten the mounting studs.



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Figure 384. Indicator return latch spring adjustment.

### 368. Indicator Return Latch Spring Adjustment (fig. 384)

*a. Requirement.* A force of  $\frac{3}{4}$  to  $1\frac{1}{4}$  ounce should be required to start the indicator return latch moving.

*b. Adjustment.* Loosen the self-locking nut and turn the indicator return latch stud with a screwdriver to meet the requirement. Tighten the self-locking nut and recheck the spring requirement.

**369. Line Indicator Adjustments (TT-117/FG and TT-119/FG)**  
(fig. 385)

a. *Clearance Adjustment.*

- (1) *Requirement.* There should be a .001- to .005-inch clearance between the inner retainer ring and the bearing.
- (2) *Adjustment.* Remove the outer retainer ring. Peel the laminated spacer to meet the requirement. Replace the retainer ring and recheck the clearance.

b. *Spring Adjustment.*

- (1) *Requirement.* The indicator carriage should return to the left-hand margin from one space out when the carriage return is selected. It should require 2½ to 3½ ounces to rotate the ratchet one space.
- (2) *Method of Checking.* Move the indicator carriage one space out. Select the carriage return; the indicator carriage should move to the left-hand margin.
- (3) *Adjustment.* Remove both retainer rings on the right-hand side and move the line indicator drive shaft to the right. Hold the indicator drive spring

while moving the line indicator drive shaft. Rotate the indicator return spring housing clockwise to increase the spring tension and counterclockwise to decrease the spring tension. Replace the line indicator drive shaft and indicator return spring housing, making sure that the tab on the indicator return spring housing goes into the slot on the bracket to prevent the indicator return spring housing from turning. Replace the retainer rings and recheck the tension.

**370. Line Indicator Adjustments (TT-117A/FG, TT-118/FG, and TT-119A/FG)**  
(fig. 386)

a. *Requirements.*

- (1) There should be a .002- to .005-inch clearance between the retainer ring and the laminated spacers on the line indicator drive shaft.
- (2) The indicator carriage should return to the left-hand margin from only one space out when the carriage-return is selected.

b. *Method of Checking.* Move the indicator carriage one space out. Select the carriage-return; the indicator carriage should move to the left-hand margin.

c. *Adjustments.*

- (1) Remove the spring washer that holds the bearing. Remove the bearing through the hole in the indicator frame. Peel the laminated washers to meet the requirement. Replace the bearing and secure the spring washer. Recheck the requirement.

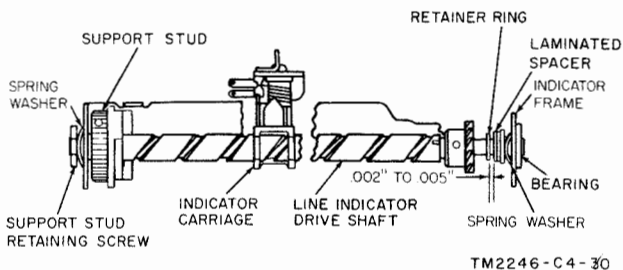
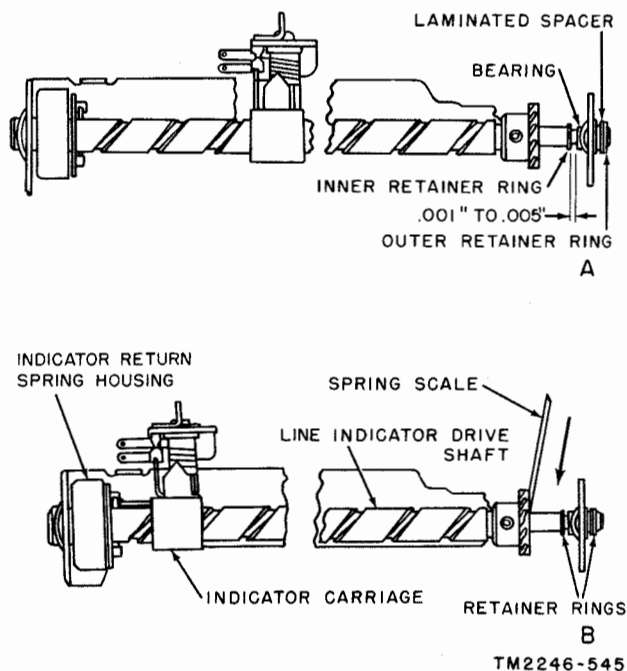


Figure 385. Line indicator return adjustments.

Figure 386. Line indicator adjustments (TT-117A/FG, TT-118/FG, and TT-119A/FG).

- (2) With the indicator carriage fully in the left-hand margin position, loosen the support stud retaining screw until the support stud stops unwinding (clockwise). Then wind the support stud clockwise, 22 ( $\pm 2$ ) turns. Refer to the hole in the knurled edge of the support stud when counting turns. Tighten the support stud retaining screw; be careful not to let the drive shaft spring unwind. Recheck the requirement.

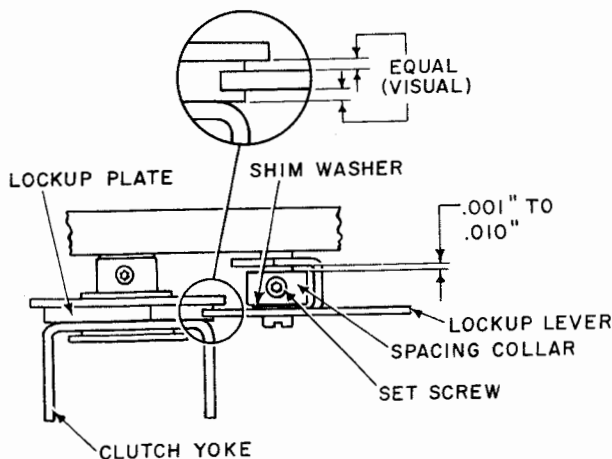
### 371. Lockup Lever Alinement Adjustment (TT-117/FG and TT-119/FG) (fig. 387)

#### a. Requirements.

- (1) The lockup lever should be free to rotate but should not have more than a .010-inch end play.
- (2) The lockup lever should be centered on the lockup plate.

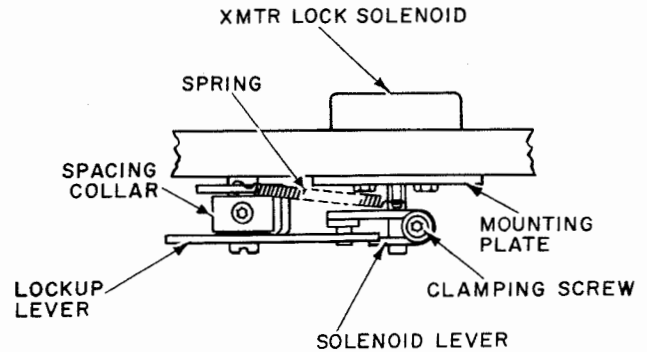
#### b. Adjustments.

- (1) Loosen the setscrews that hold the spacing collar. Install the necessary shim washers between the spacing collar and the lockup lever to meet the requirement.
- (2) Loosen the setscrew on the spacing collar, slide the lockup lever axially to meet the requirement, and tighten the setscrew.



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Figure 387. Lockup lever alinement adjustment (TT-117/FG and TT-119/FG).



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Figure 388. Lockup solenoid lever adjustment (TT-117/FG and TT-119/FG).

### 372. Lockup Solenoid Lever Adjustment (TT-117/FG and TT-119/FG) (fig. 388)

#### a. Requirement.

- (1) The lockup lever should rest against the solenoid lever when the transmitter lock solenoid is not energized.
- (2) The full width of the lockup lever should contact the pin on the solenoid lever.

#### b. Adjustment.

- (1) Loosen the clamping screw and position the solenoid lever axially to meet the requirements.
- (2) Tighten the clamping screw. Check the requirements by taking up the end play of the lockup lever in both directions.

### 373. Lockup Lever Adjustment (TT-117/FG and TT-119/FG) (fig. 389)

#### a. Requirements.

- (1) When the transmitter lock solenoid is energized, the lockup lever should engage the transmitter lockup plate with minimum clearance, and the pin on the solenoid lever should be in the corner of the lockup lever (B, fig. 389).
- (2) When the transmitter cam shaft is held from rotating by the lockup lever, there should be a .010-inch minimum clearance between the cam stop lever and the transmitter cam shaft, and the

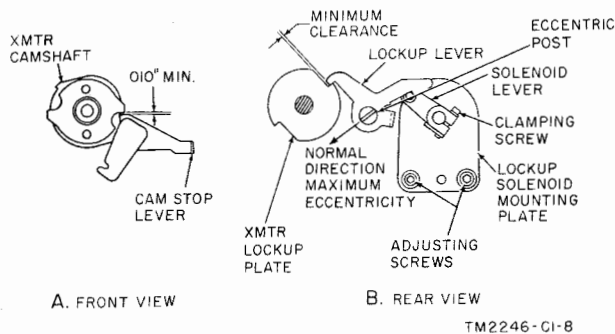


Figure 389. Lockup lever adjustment (TT-117/FG and TT-119/FG).

sensing lever locking bail should be in the fully restored position.

*b. Method of Checking.*

- (1) Energize the solenoid and rotate the transmitter lockup plate until it is held by the lockup lever. Check for the minimum clearance, and then rotate the transmitter lockup plate and check the opposite side.
- (2) Energize the solenoid and turn the transmitter lockup plate until it is held by the lockup lever.
  - (a) A .010-inch feeler gage should go between the cam stop lever and the transmitter cam shaft.
  - (b) Release the solenoid; turn the transmitter cam shaft very slowly by hand; the sensing lever locking bail should not move away from the sensing levers; it should either start moving toward the sensing levers or remain stationary momentarily, and then start moving toward the sensing levers.

*c. Adjustment.*

- (1) Loosen the setscrew that holds the eccentric post and the clamping screw that holds the solenoid lever; hold the solenoid lever so the pin rests lightly in the corner of the lockup lever and turn the transmitter lockup plate until it is held by the lockup lever. While holding the solenoid lever, turn the eccentric to meet the minimum clearance requirement and energize the solenoid. Tighten the setscrew and the clamping screw. Deenergize the solenoid and rotate the transmitter

lockup plate a few times; check the clearance on both sides.

- (2) If, after checking as outlined in *b*(2) above, the requirement is not met, the clutch yoke is not properly seated on the flats of the shaft. Reposition the yoke and recheck. Refer to paragraphs 361 and 365 for related adjustments.

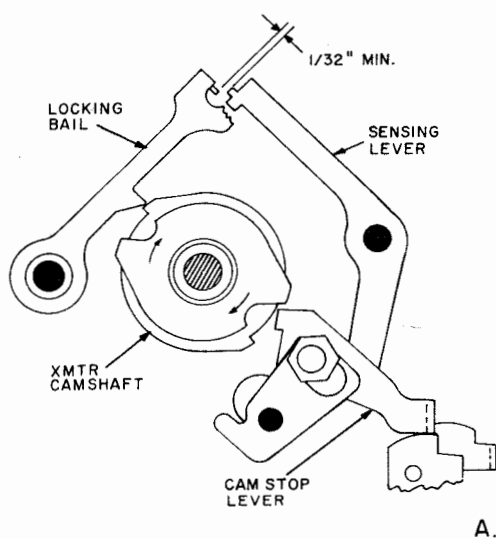
**374. Transmitter Camshaft Locking Mechanism Adjustments (TT-117A/FG, TT-118/FG, and TT-119A/FG)**  
(fig. 390)

*a. Requirements.*

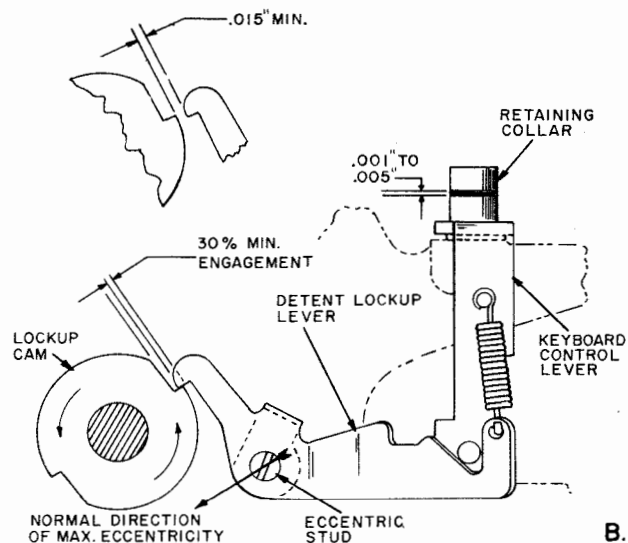
- (1) With the transmitter camshaft in the controlled keyboard stop position and the keyboard control lever in the unlocked (keyboard) position, there should be a minimum of a 0.020-inch distance between the locking surfaces of the lockup cam and the detent lockup lever (C and D, fig. 390).
- (2) With the keyboard control lever in the locked (tape) position and the cam and detent lockup lever engaged, there should be a minimum of a  $\frac{1}{32}$ -inch clearance between the sensing levers and the blade of the locking bail (A, fig. 390).
- (3) With the keyboard control lever in the locked (tape) position, at least 30 per cent of the locking surface of the lockup cam should be engaged with the locking surface of the detent lockup lever (D, fig. 390).
- (4) With the keyboard control lever in the unlocked (keyboard) position, there should be a minimum of a 0.015-inch clearance between the highest part of the lockup cam and the detent lockup lever (D, fig. 390).
- (5) There should be a clearance of 0.001 to 0.005-inch end play between the keyboard control lever hub and its retaining collar (B, fig. 390).

*b. Adjustments.*

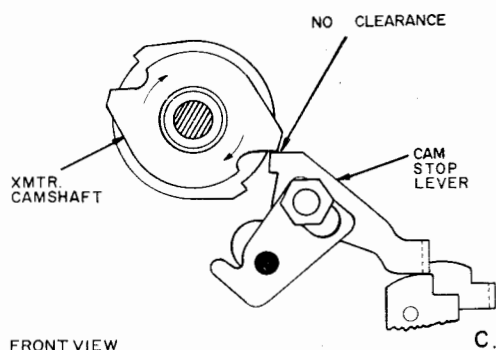
- (1) With the transmitter camshaft and the keyboard control lever in the position described in *a*(1) above and with the eccentric stud (B, fig. 390) in the



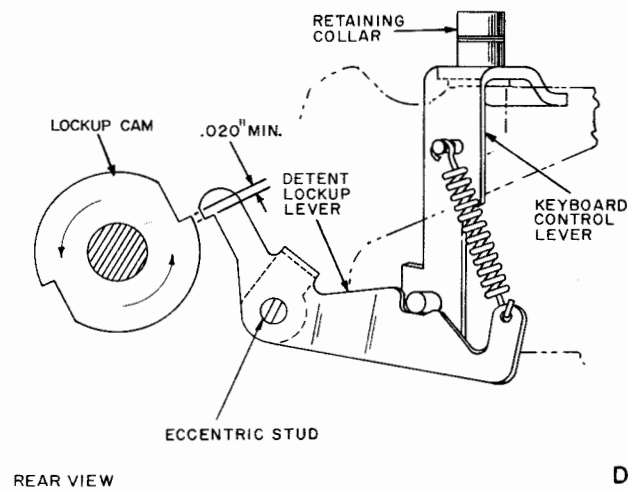
A.



B.



C.



REAR VIEW

D.

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Figure 390. Transmitter camshaft locking mechanism adjustments (TT-117A/FG, TT-118/FG, TT-119A/FG).

normal position of maximum eccentricity, rotate the eccentric stud in either direction to obtain a visual estimate of a .020-inch over travel between the two locking surfaces.

- (2) Move the keyboard control lever to the right (lockup position). Release the transmitter camshaft from the controlled stop position and rotate the camshaft until the detent lockup lever stops it. With a wire gage, check for a  $\frac{1}{32}$ -inch minimum clearance between

the sensing levers locking bail and the sensing levers. If the requirement is not met, repeat the adjustment given in b (1) above.

- (3) The requirements given in a(3) and a(4) above are met by adding or removing spacers between the keyboard control lever and the keyboard casting.
- (4) Loosen the setscrews and reposition the retaining collar to meet the requirement given in a (5) above.

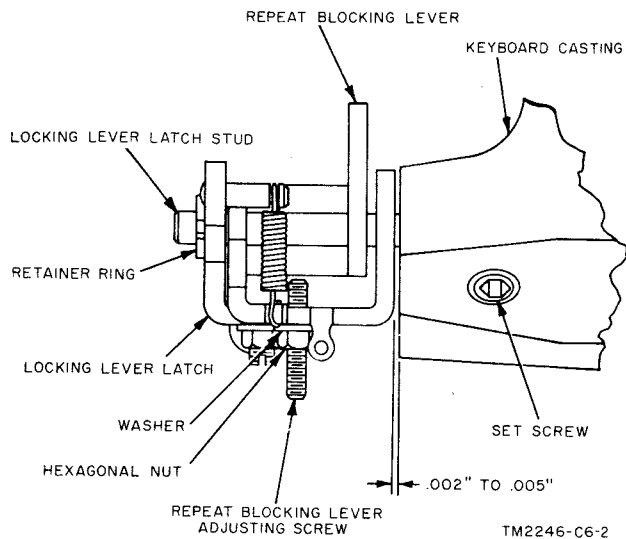


Figure 391. Locking lever latch end play adjustment.

### 375. Locking Lever Latch End Play Adjustment (fig. 391)

*a. Requirement.* There should be a .002- to .005-inch clearance between the locking lever latch and the keyboard casting.

*b. Adjustment.* Loosen the setscrew and position the locking lever latch stud to meet the requirement. Tighten the setscrew and recheck the requirement.

### 376. Universal Bar Adjustment (fig. 392)

*a. Requirements.* There should be a .005- to .015-inch clearance between the cam stop lever and the locking lever latch when any key lever or the space bar is depressed.

*b. Adjustment.* Loosen the locknut and turn

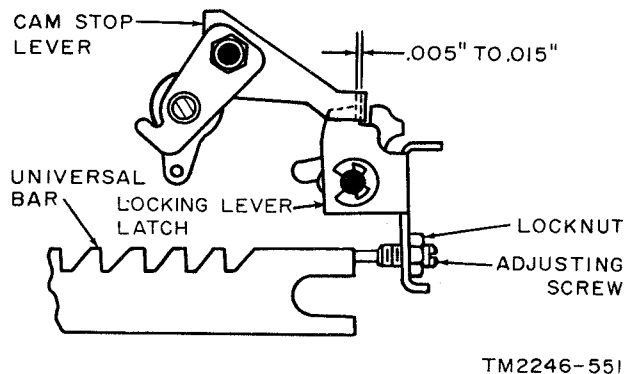


Figure 392. Universal bar adjustment.

the universal bar adjusting screw in or out to meet the requirement; tighten the locknut.

### 377. Ratchet Wheel and Ratchet Detent Adjustment (fig. 393)

*a. Requirement.* There should be a .005- to .010-inch clearance between the ratchet wheel and its detent when the indicator carriage is all the way to the left, with maximum clearance of .025 inch between the ratchet wheel and line indicator drive shaft.

*b. Method of Checking.* With the indicator carriage all the way to the left, check the clearance between the detent and the ratchet wheel with a feeler gage. Check the clearance between the ratchet wheel and the shoulder on the line indicator drive shaft; use a feeler gage.

*c. Adjustment.* Loosen the ratchet wheel setscrews and slide the ratchet wheel on the line indicator drive shaft to meet the .025-inch maximum clearance, and rotate the ratchet wheel until .005- to .010-inch clearance is obtained. Tighten the setscrews and recheck the clearance.

*Note.* The adjustment in paragraph 390 should be performed before proceeding with the following adjustments.

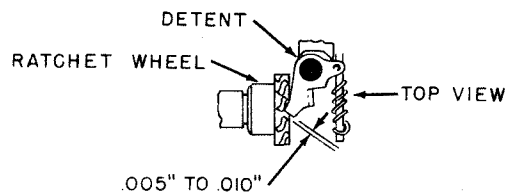
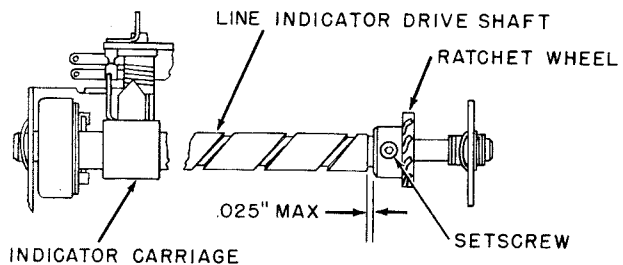


Figure 393. Ratchet wheel and ratchet wheel detent adjustment.

### 378. Restoring Solenoid Adjustment (L1) (fig. 394)

*a. Requirement.* There should be a .010- to .030-inch clearance between the ratchet wheel tooth and the ratchet wheel detent when the restoring solenoid is energized and the link arm assembly is stopped by the stop plate.

*b. Method of Checking.* Energize the restoring solenoid and check the clearance with a feeler gage.

*Note.* To energize the restoring solenoid (L1), have the power on and the motor off. Turn the transmitter shaft slowly until the restoring solenoid becomes energized.

*c. Adjustments.* With the restoring solenoid (L1) bracket in the approximate center of its elongated adjusting slot, loosen the indicator frame mounting screw and raise or lower the indicator frame to obtain  $\frac{1}{64}$ -inch travel before the ratchet pawl engages the ratchet wheel. Tighten the indicator frame mounting screw. Loosen the two nuts that hold the stop plate. Loosen the stop plate mounting stud that holds the restoring solenoid mounting bracket and slide the restoring solenoid mounting bracket to its extreme counterclockwise position.

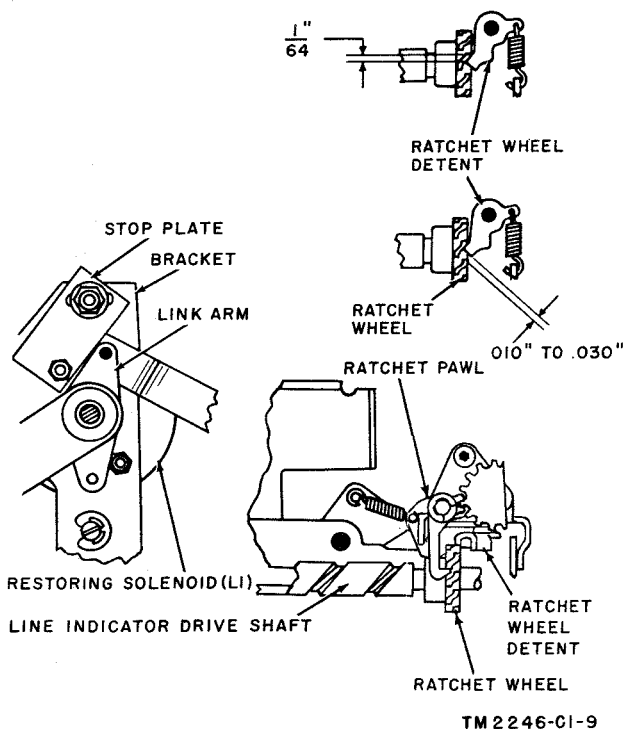


Figure 394. Restoring solenoid and ratchet pawl stop plate adjustments.

Tighten the stop plate mounting studs. Energize the restoring solenoid (L1). Position the stop plate against the link arm assembly to obtain the .010- to .030-inch clearance between the ratchet wheel tooth and the ratchet wheel detent. After the requirement is met, check paragraph 392.

**Caution:** The restoring solenoid cannot be energized more than 5 minutes at one time. To energize the restoring solenoid, have the power on and the motor off. Turn the transmitter cam-shaft slowly until the restoring solenoid becomes energized.

### 379. Stop Pawl Engagement Adjustment (fig. 395)

*a. Requirements.*

- (1) There should be a .001- to .010-inch clearance between the inner surface of the ratchet wheel teeth and the surface of the stop pawl when  $\frac{1}{2}$ -ounce pressure is applied to lessen the clearance (A, fig. 395).
- (2) There should be a clearance not to exceed .032-inch between the inner surface of the ratchet wheel teeth and the surface of the stop pawl when  $\frac{1}{2}$ -ounce pressure is applied in a direction to increase the clearance (B, fig. 395).

*b. Method of Checking.*

- (1) Apply  $\frac{1}{2}$ -ounce pressure to the stop pawl with the push-end of an 8-ounce spring scale in a direction to lessen the clearance; check the clearance with a feeler gage.
- (2) Apply  $\frac{1}{2}$ -ounce pressure to the stop pawl with the pull-end of the same scale in a direction to increase the clearance; check clearance with a feeler gage.

*c. Adjustment.* Remove the retainer ring and move the spacer washers as required to meet the requirements of a(1) and (2) above. Replace the retainer ring and recheck the requirement.

### 380. Stop Pawl Adjustable Plate Adjustment (fig. 396)

*a. Requirement.* There should be a .010- to .030-inch clearance between the stop pawl and

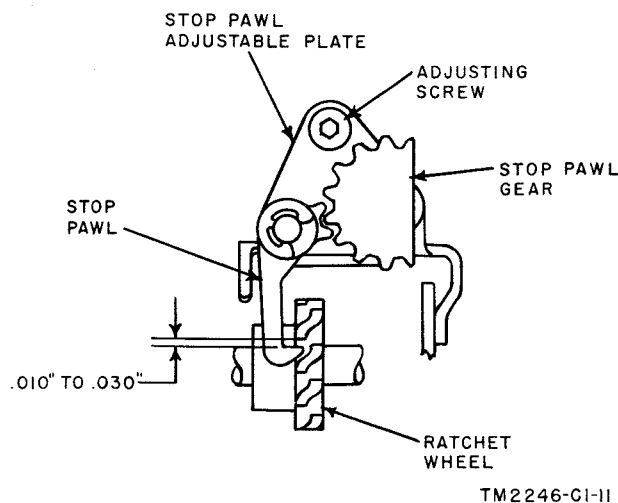
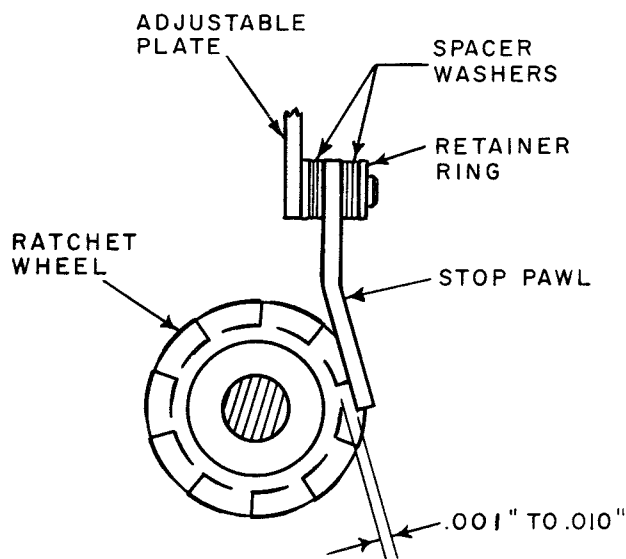


Figure 396. Stop pawl adjustable plate adjustment.

A

### 381. Ratchet Pawl Stop Lever Adjustment (fig. 397)

*a. Requirement.* The clearance between the stop pawl gear and the stop pawl adjustable plate should not be greater than .020 inch (A, fig. 397).

*b. Method of Checking.* With the end play of the stop pawl gear shaft taken up in the direction of the stop gear, measure the clearance between the stop pawl gear and the stop pawl adjustable plate.

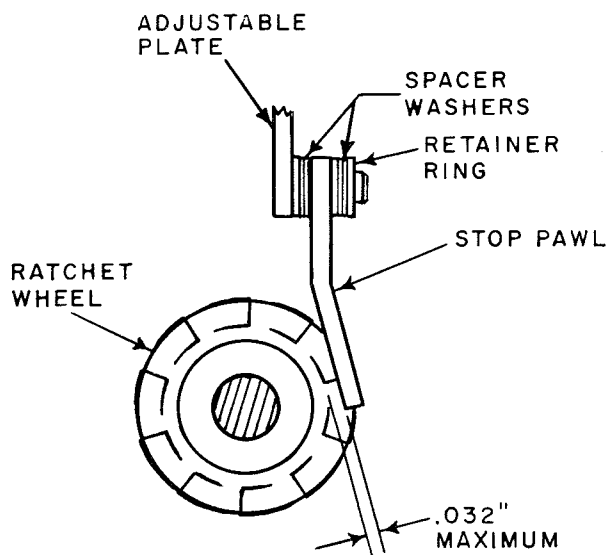
*c. Adjustment.* Loosen the clamping screw, position the ratchet pawl stop lever to meet the requirement, and tighten the clamping screw.

### 382. Ratchet Wheel Stop Pawl Adjustment (fig. 397)

*a. Requirement.* When the restoring solenoid is energized, the engagement of the stop pawl with the ratchet wheel should be between .010 to .025 inch (B, fig. 397).

*b. Method of Checking.* Energize the restoring solenoid, take up the backlash in a direction to lessen the engagement, and use a feeler gage to check the engagement.

*c. Adjustment.* Energize the restoring solenoid, loosen the clamping screw on the ratchet pawl stop lever, position the ratchet pawl stop lever on the stop pawl gear shaft to obtain the requirement, and tighten the clamping screw. Recheck the related adjustment (par. 381).



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Figure 395. Stop pawl engagement adjustment.

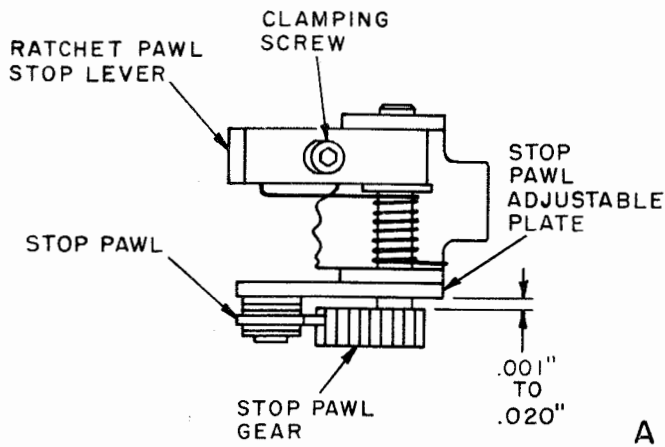
B

the mating edge of the ratchet wheel tooth when the restoring solenoid is energized.

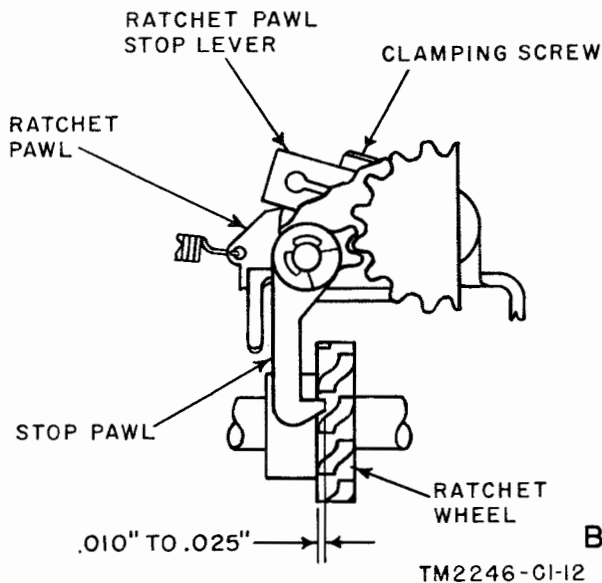
*b. Method of Checking.* Energize the restoring solenoid and measure the clearance.

*c. Adjustment.* Loosen the adjusting screw and move the stop pawl adjustable plate to meet the requirement; tighten the screw.





A



B

Figure 397. Ratchet pawl stop lever and stop pawl gear adjustment.

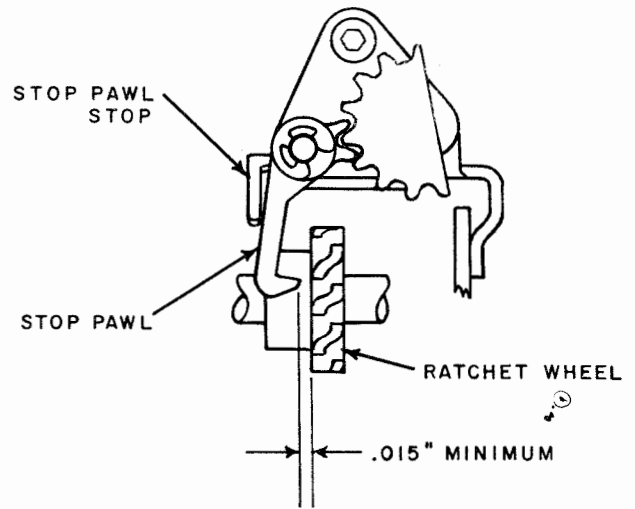
### 383. Stop Pawl Stop Adjustment (fig. 398)

*a. Requirement.* There should be a .015-inch minimum clearance between the ratchet wheel teeth and the stop pawl when the restoring solenoid is deenergized and the stop pawl is against the stop pawl stop.

*b. Adjustment.* Bend the stop pawl stop to meet the above requirement.

### 384. Carriage-Return Latch Lever Adjustment (fig. 399)

*a. Requirement.* The indicator return latch must engage the carriage-return latch lever



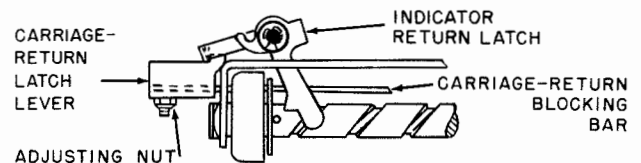
TM2246-CI-13

Figure 398. Stop pawl stop adjustment.

just before the cam stop lever (fig. 392) moves clockwise.

*b. Method of Checking.* With the indicator carriage five or more spaces out, push the carriage-return key lever and, at the same time, hold the indicator carriage from moving back. Visually check for the requirement.

*c. Adjustment.* Loosen the adjusting nut and slide the carriage-return latch lever on the carriage-return blocking bar to meet the requirement; tighten the adjusting nut.



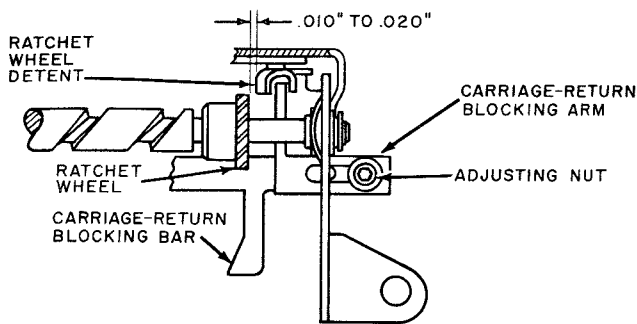
TM2246-544

Figure 399. Carriage-return latch lever adjustment.

### 385. Carriage-Return Blocking Arm Adjustment (fig. 400)

*a. Requirement.* There should be a .010- to .020-inch clearance between the ratchet wheel detent and the ratchet wheel when the carriage-return latch lever is in engagement with the indicator return latch.

*b. Method of Checking.* With the indicator carriage at least five spaces away from the left, depress the carriage-return key; at the same time, hold the indicator carriage to keep



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Figure 400. Carriage-return blocking arm adjustment.

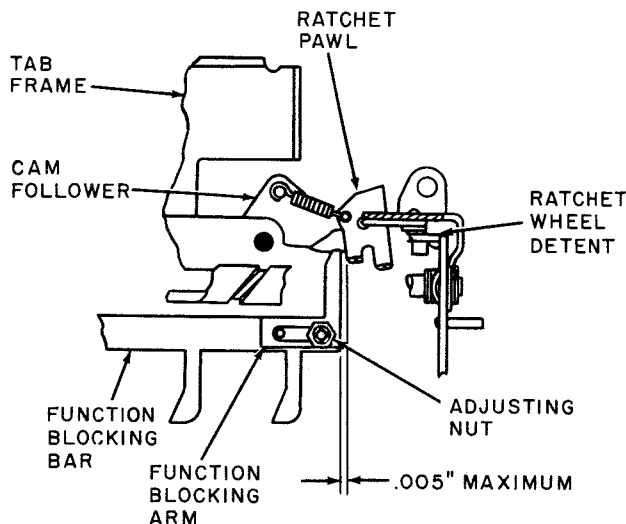
it from returning to the left. Check the clearance with the feeler gage. Release the indicator carriage and check for engagement of the ratchet wheel detent with the ratchet wheel.

*c. Adjustment.* Loosen the adjusting nut and slide the carriage-return blocking arm on the carriage-return blocking bar to meet the requirement; tighten the adjusting nut.

### 386. Function Blocking Arm Adjustment (fig. 401)

*a. Requirement.* When the restoring solenoid is energized, and the ratchet pawl is against the feed pawl stop lever, there should be some clearance not more than .005 inch between the function blocking arm and the ratchet pawl.

*b. Method of Checking.* With the restoring solenoid energized, check the clearance between



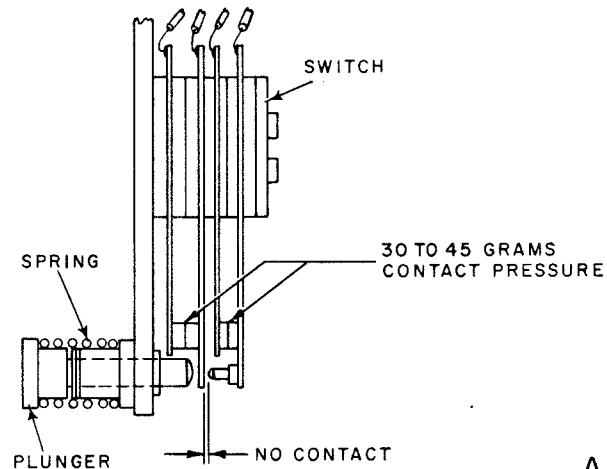
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Figure 401. Function blocking arm adjustment.

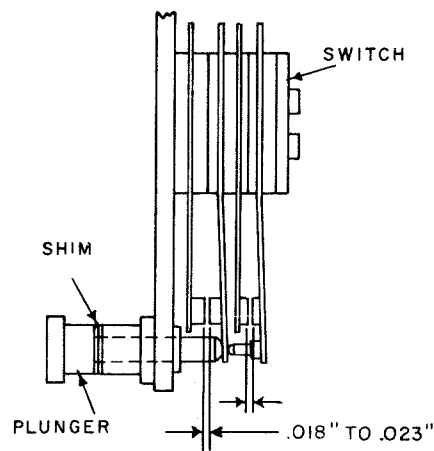
the ratchet pawl and the function blocking arm; use a feeler gage.

*c. Adjustment.* Loosen the adjusting nut and slide the function blocking arm to meet the requirement. Be sure that the function blocking bar is all the way to the left; tighten the adjusting nut.

**Caution:** The restoring solenoid cannot be energized more than 5 minutes at one time. To energize the restoring solenoid, have the power on and the motor off. Turn the transmitter cam-shaft slowly until the restoring solenoid becomes energized.



A



B

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Figure 402. Lower pulse switch contacts adjustment.

### 387. Lower Pulse Switch Contact Adjustment

(fig. 402)

#### a. Requirements.

- (1) There should be 30 to 45 grams of pressure between the contacts.
- (2) There should be a .018- to .023-inch clearance between the contacts closer to the plunger, and a .011- to .015-inch clearance between the outer pair of contacts when the plunger is held tight against the bushing.

#### b. Adjustments.

- (1) Bend the spring contact to meet the requirement in a(1) above.
- (2) Remove or add shims under the head of the plunger to meet the .018- to .023-inch clearance requirement. Bend the spring contact of the outer pair of contacts to meet the .011- to .015-inch requirement.

### 388. Switch Cam Lever Adjustment

#### a. Requirements.

- (1) The clockwise movement of the switch cam lever (fig. 403) should be restrained by the pin of the switch cam follower when the restoring solenoid is energized.
- (2) There should be a .002- to .010-inch end play of the cam stop lever shaft (A, fig. 404).

#### b. Method of Checking.

- (1) With the restoring solenoid energized, attempt to turn the switch cam lever in a clockwise direction; it should not move.
- (2) With the end play of the cam stop

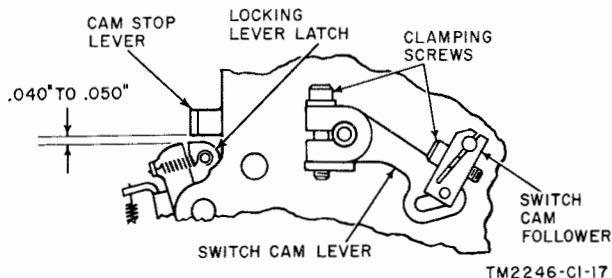


Figure 403. Switch cam lever adjustment.

lever shaft taken up in a direction of the cam stop lever, insert a feeler gage between the bearing surface and the cam stop lever.

#### c. Adjustments.

- (1) Loosen the clamping screw of the switch cam follower. With the restoring solenoid energized, loosen the clamping screw of the switch cam lever and rotate the switch cam lever clockwise until it is stopped by the pin of the switch cam follower. Tighten the switch cam lever clamping screw. Tighten the clamping screw of the switch cam follower.
- (2) Loosen the clamping screw of the switch cam lever and position the cam stop lever shaft to meet the requirement above. Tighten the clamping screw and recheck adjustment (1) above.

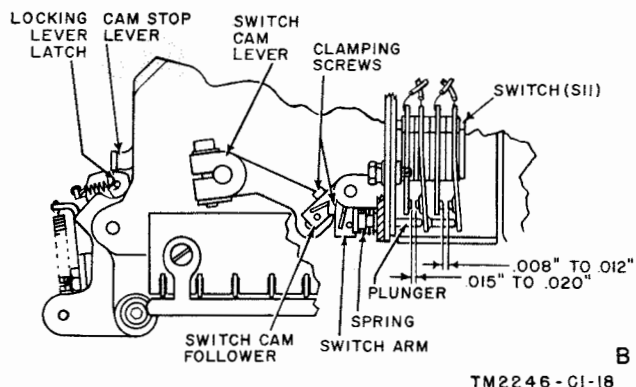
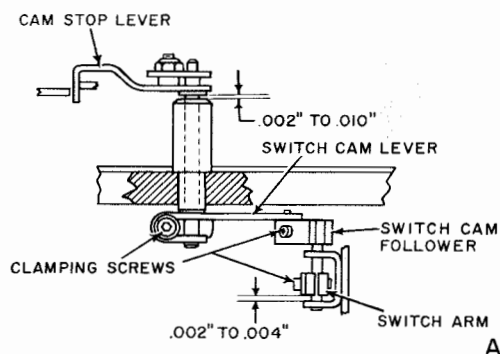


Figure 404. Lower pulse switch adjustment.

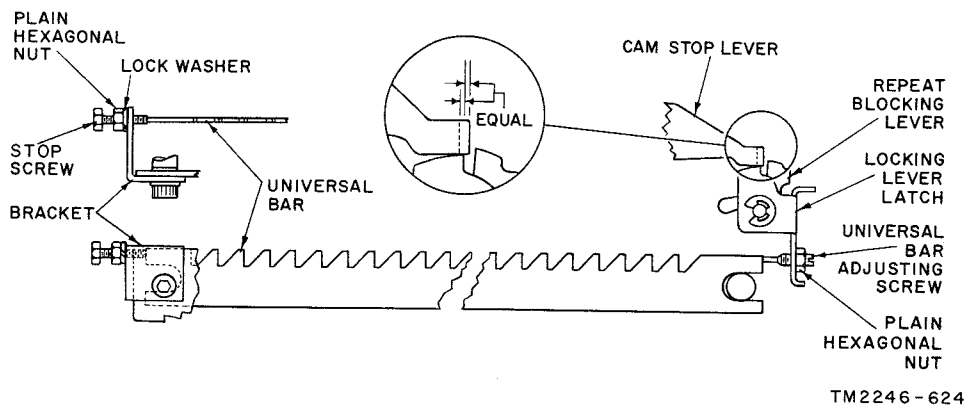


Figure 405. Universal bar stop screw adjustment.

### 389. Lower Pulse Switch Adjustment

#### a. Requirements.

- (1) When the switch cam lever is held tight against its bearing and the switch cam follower is held against the switch cam lever, there should be .002 to .004 inch end play in the switch arm shaft (A, fig. 404).
- (2) With the cam stop lever resting on the locking lever latch, there should be a .015- to .020-inch clearance between the contacts closest to the plunger and an .008- to .012-inch clearance between the outer pair of contacts (B, fig. 404).

#### b. Adjustments.

- (1) Loosen the switch arm clamping screw and meet the requirement in a(1) above.
- (2) Rotate the switch arm to meet the requirement in a(2) above. Tighten the switch arm clamping screw. Re-check the requirement in a(1) above.

### 390. Universal Bar Stop Screw Adjustment

(fig. 405)

a. *Requirement.* When the universal bar is to the left against the stop screw, and the universal bar adjusting screw in the locking lever latch is held against the right end of the universal bar, the upper edge of the locking lever latch should engage one-half the mating edge of the cam stop lever.

b. *Adjustment.* Loosen the plain hexagonal nut, position the stop screw to meet the requirement, and tighten the nut.

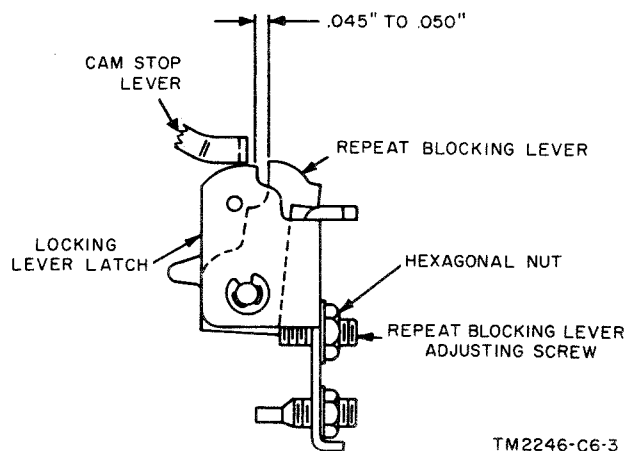
### 391. Repeat Blocking Lever Adjustment (TT-117A/FG, TT-118/FG and TT-119A/FG)

(fig. 406)

a. *Requirement.* A .045- to .050-inch clearance should exist between the facing edges of the repeat blocking lever and the locking lever latch when the cam stop lever is at rest in the restored position.

b. *Method of Checking.* Rotate the motor by hand until the cam stop lever is in the restored position and the transmitter camshaft no longer turns. Check the clearance.

c. *Adjustment.* Loosen the hexagonal nut that locks the repeat blocking lever adjusting screw. Turn the adjusting screw in or out until the requirement is met. Tighten the hexagonal nut.



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Figure 406. Repeat blocking lever adjustment.

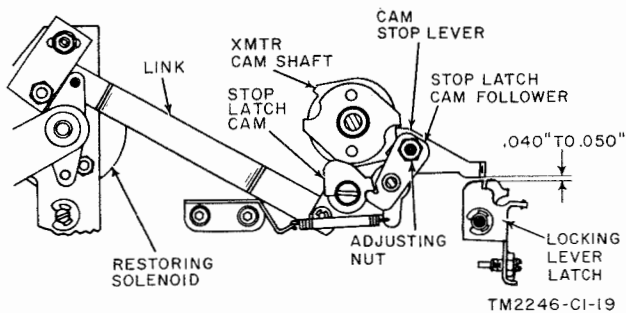


Figure 407. Cam stop lever adjustment.

### 392. Cam Stop Lever Adjustment (fig. 407)

*a. Requirement.* There should be a .040- to .050-inch clearance between the cam stop lever and the locking lever latch when the restoring solenoid is energized.

*b. Method of Checking.* Energize the restoring solenoid and check the clearance; use a feeler gage.

*c. Adjustment.* Loosen the adjusting nut. Energize the restoring solenoid. Pivot the stop latch cam follower until it touches the stop latch cam. Apply a light pressure on the stop latch cam follower, and position the cam stop lever to meet the requirement. Tighten the adjusting nut and recheck the clearance.

### 393. Tab Lever Shaft Adjustment (fig. 408)

*a. Requirement.* The tab levers should move without binding.

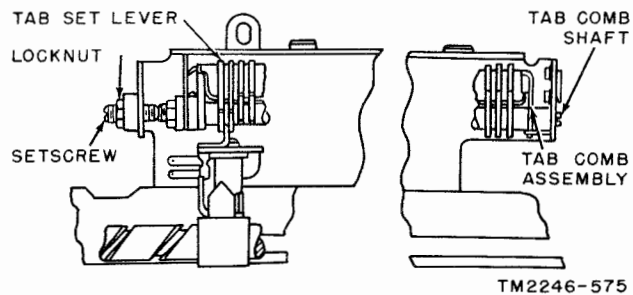


Figure 408. Tab lever shaft adjustment.

*b. Adjustment.* Loosen the locknut on the setscrew, turn the setscrew in or out until the tab levers move without binding and with a minimum amount of end play, and tighten the locknut.

### 394. Tab Set Levers Mounting Adjustment (fig. 409)

*a. Requirement.* There should be equal clearance between the top of the tab stop arm and the bottom of the tab set levers when the tabulator locking lever is in the down position, and the tab stop arm is at either end of the line indicator drive shaft.

*b. Method of Checking.* Remove the indicator cover (par. 130a(1)). Move the tab stop arm to the left by selecting the carriage-return. Measure the clearance between tab stop arm and tab set levers. Space the carriage to the 66th tab set lever and measure the

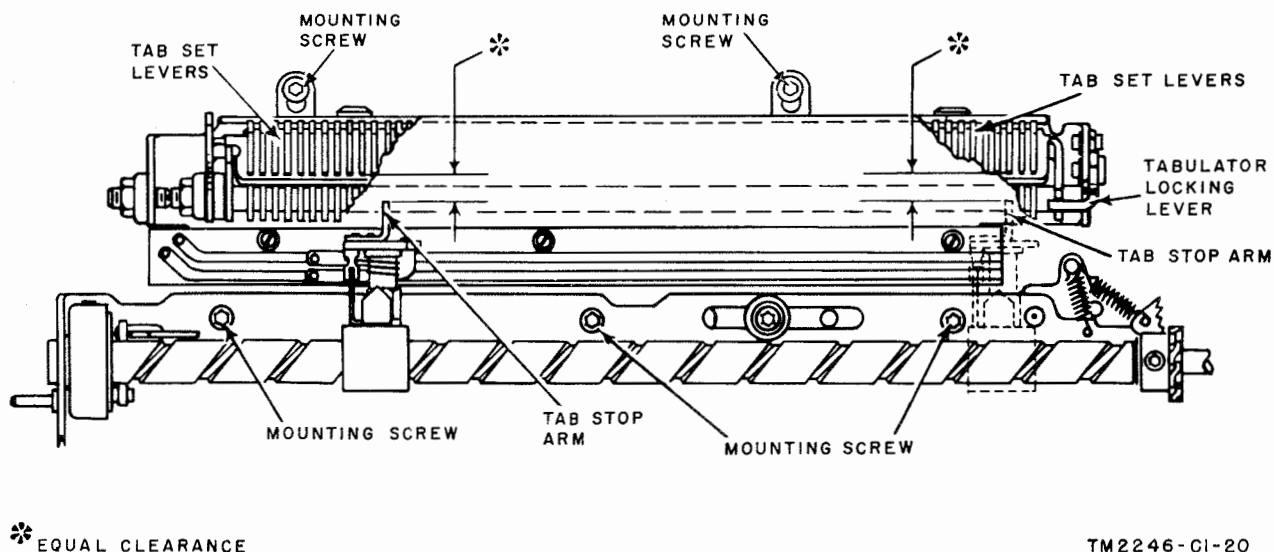


Figure 409. Tab set levers mounting adjustment.

clearance between the tab stop arm and the tab set lever.

*c. Adjustment.* Loosen the five mounting screws and position the tab set lever bracket. Tighten the three mounting screws and recheck the clearance.

### 395. Tab Mounting Guide Adjustment (fig. 410)

*a. Requirement.* The stop arm should be against the No. 5 tab set lever when the indicator carriage has been spaced out four spaces and the tab mounting guide is in the operated position.

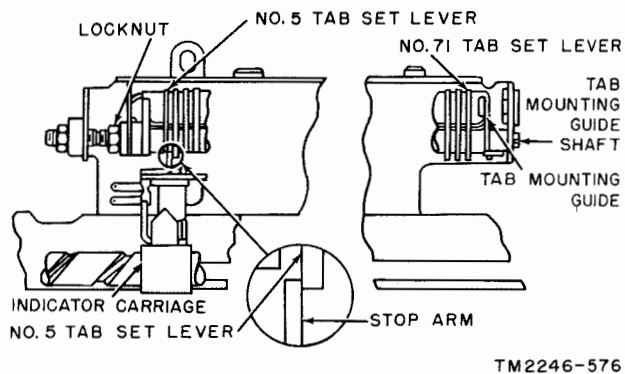


Figure 410. Tab mounting guide adjustment.

*b. Adjustment.* With the motor off, move the indicator carriage out four spaces. Push the No. 5 tab set lever down. Loosen the locknut on the tab mounting guide shaft. Turn the tab mounting guide in the operate (down) position while holding the locknut. Turn the tab mounting guide shaft with a screw driver until the requirement is met; tighten the locknut. Check the No. 71 tab set lever.

*Note.* The sliding contacts have to pivot in and make contact with the tab switch assembly when the indicator carriage is spaced out to the corresponding selected tab set lever and the repeat key is pushed down. Check at both ends of the tab mounting guide assembly.

### 396. Repeat Adjustment (fig. 411)

*a. Requirement.* When the keyboard is locked up in a tab stop position, the keyboard must not repeat when the repeat key is raised slowly.

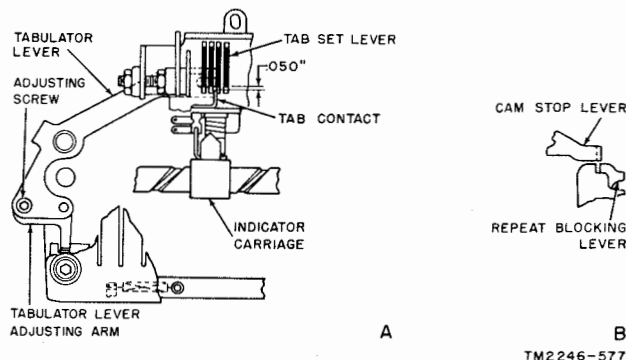


Figure 411. Repeat adjustment.

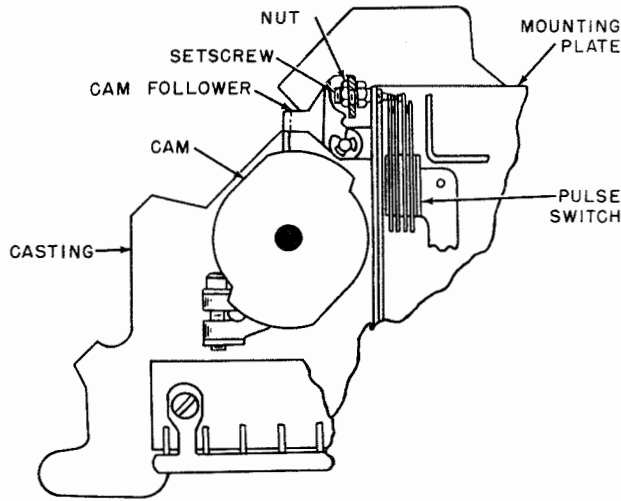
*b. Method of Checking.* With a tab set lever engaged and the tab contacts closed, slowly lift the repeat key. The repeat blocking lever must block the cam stop lever from falling off before the tab contacts disengage. (If the above does not happen the result is a repeat condition.)

*c. Adjustment.* Loosen the adjusting screw. Set the first five tab stops in the down position and space the carriage out until it is beneath the five tabs. Insert a .050 feeler gage in position, to obtain the .050-inch clearance shown in A, figure 411, take up the end play of the tabulator lever adjusting arm and the tabulator lever in the directions shown. Tighten the adjusting screw.

### 397. Upper Pulse Switch Adjustment (fig. 412)

*a. Requirement.* With the keyboard counter cam follower on the high portion of the cam, the contacts of the pulse switch should be closed with sufficient followthrough to insure proper contact. When the keyboard counter cam follower is on the low portion of the cam, there should be a .010-inch minimum clearance between the contacts of the pulse switch.

*b. Adjustment.* With the keyboard counter cam follower on the high portion of the cam, loosen the nut and turn the setscrew until the contacts of the pulse switch are just touching; then turn the setscrew one-half turn clockwise and tighten the nuts. Check both low portions of the cam for the .010-inch minimum clearance requirement. Carefully bend the spring contacts to obtain this requirement.



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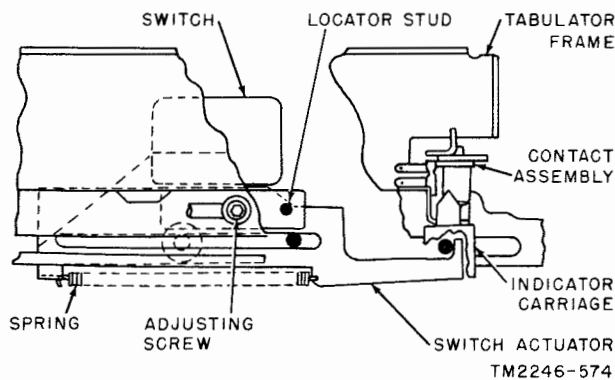
Figure 412. Upper pulse switch adjustment.

### 398. Switch Actuator Mechanism Adjustment (fig. 413)

*a. Requirement.* There should be continuity through the switch. (The end-of-line indicator lamp should light when the indicator carriage is spaced out to the 66th character.) (70th character on weather machines.)

*b. Method of Checking.* Space the indicator carriage out to the 66th character (70th character on weather machines). Check the continuity through the switch. If the keyboard is installed and the power is on, the end-of-line lamp should be on.

*c. Adjustment.* With the indicator carriage at the 66th space (70th space on weather machines), loosen the adjusting screw and slide the switch assembly only enough to the right or



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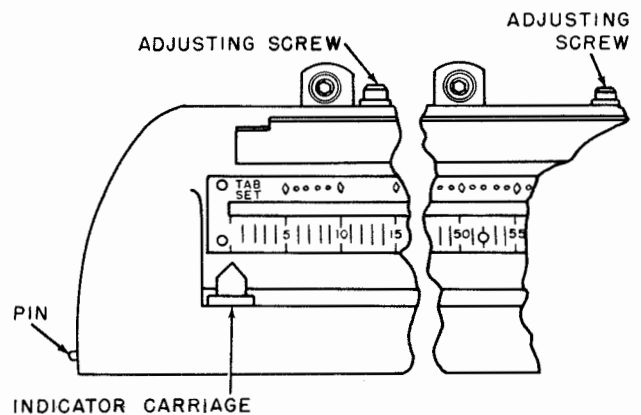
Figure 413. Switch actuator mechanism adjustment.

left to obtain continuity; tighten the adjusting screw. Space the indicator out to the 65th character (69th character on weather machines); there should be no continuity through the switch. Space the indicator out to the 66th character (70th character on weather machines); there should be continuity through the switch.

### 399. Indicator Cover Adjustment (fig. 414)

*a. Requirement.* The indicator carriage should be pointed to 0 when the carriage is at the left-hand margin.

*b. Adjustment.* With the indicator carriage at the left-hand margin, loosen the two adjust-



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Figure 414. Indicator cover adjustment.

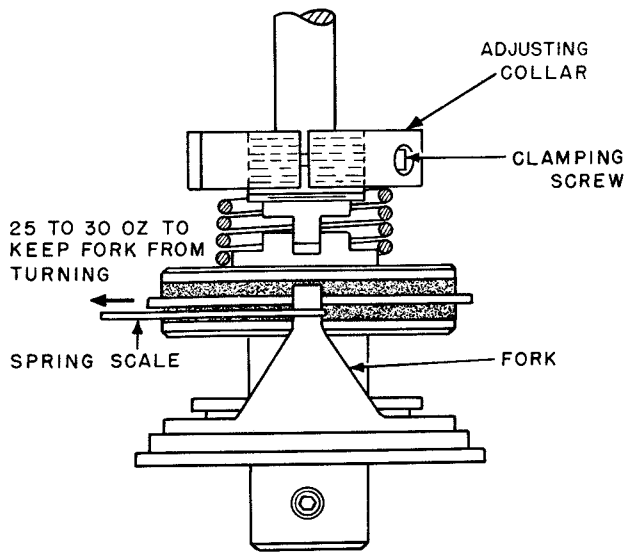
ing screws. Slide the indicator cover to the right or left until the indicator is at 0 on the cover; tighten the adjusting screws.

### 400. Keyboard-Transmitter Friction Clutch Adjustment (fig. 415)

*a. Requirement.* It should require 25 to 30 ounces to keep the fork from turning when the motor is running.

*b. Method of Checking.* With the motor on, hook a spring scale on the fork. Depress the space bar and read the scale.

*c. Adjustment.* With the motor off, loosen the clamping screw. Turn the adjusting collar in or out to meet the requirement; tighten the clamping screw. Turn the motor on and recheck the tension.



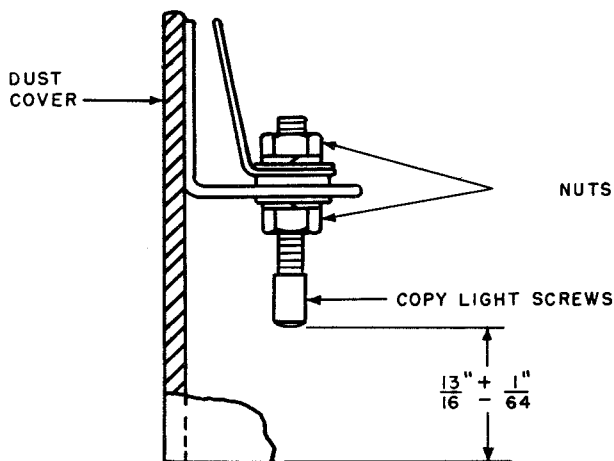
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Figure 415. Keyboard transmitter friction clutch torque requirement.

### 401. Dust Cover Copy Light Screws Adjustment (fig. 416)

*a. Requirement.* There should be  $1\frac{3}{16}$  inch,  $\pm\frac{1}{64}$  inch, between the bottom of the copy light screws and the bottom edge of the dust cover.

*b. Adjustment.* Loosen either the top or bottom nut and turn each copy light screw to meet the requirement; tighten the nut.



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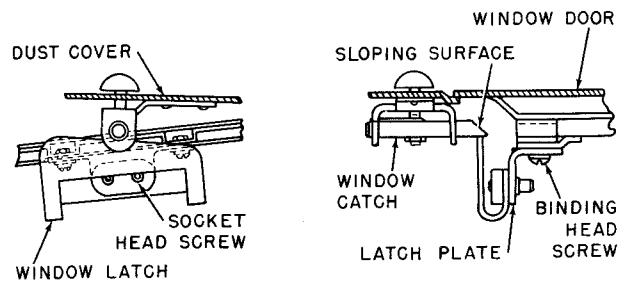
Figure 416. Dust cover copy light screws adjustment.

### 402. Dust Cover Window Door Adjustment (fig. 417)

*a. Requirement.* The window door on the dust cover should close smoothly and be tight when closed.

*b. Adjustments.*

- (1) Loosen the binding head screws and move the window latch until it is parallel (visually) with the edge of the dust cover and strikes the window catch approximately in the middle of the sloping surface; tighten the binding head screws.
- (2) With the window door closed, loosen the socket head screws and slide the window latch until its edge just touches the window catch; tighten the socket head screws. Check by opening and closing the window door a few times and pulling up on the corners of the window door. If it does not operate smoothly, or if the corners have excessive play, readjust.



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Figure 417. Dust cover window door adjustment.

### 403. Dust Cover Knob Adjustment (fig. 418)

*a. Requirement.* There should be a .002- to .012-inch clearance between the knob and the casting.

*b. Adjustment.* Loosen the adjustment screw and insert a feeler gage between the casting and the knob. Push the dust cover catch and knob toward each other until all clearance is removed. Tighten the adjustment screw and remove the feeler gage. Check to make sure the dust cover catch does not hit the casting when the knob is turned.



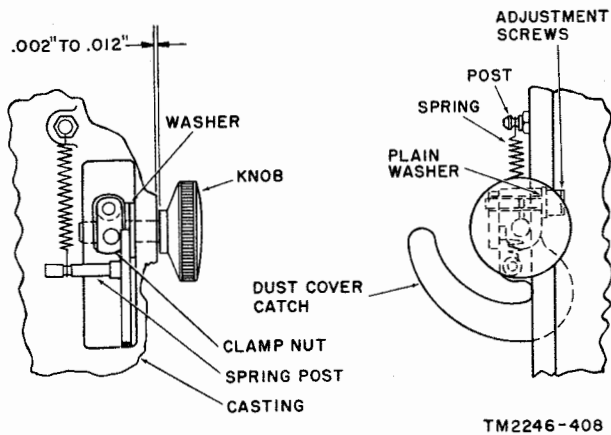


Figure 418. Dust cover knob adjustment.

#### 404. Manual Carriage-Return Pushbutton Adjustment (fig. 419)

a. Requirement. When the dust cover is installed, there should be some clearance (not

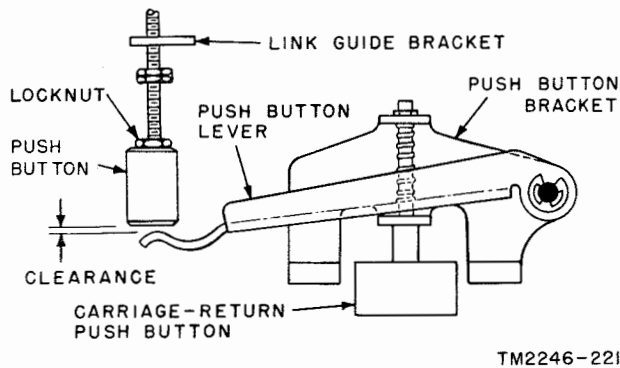


Figure 419. Manual carriage-return pushbutton adjustment.

more than  $\frac{1}{16}$  inch) between the pushbutton and the pushbutton lever.

b. Adjustment. Loosen the locknut and turn the pushbutton in or out until the requirement is met; tighten the locknut.

#### 405. Letters Pushbutton Adjustment (fig. 420)

a. Requirement. When the dust cover is installed, the shaft of the letters pushbutton should clear the bellcrank link button. When the letters pushbutton is pressed, it should operate the platen latch.

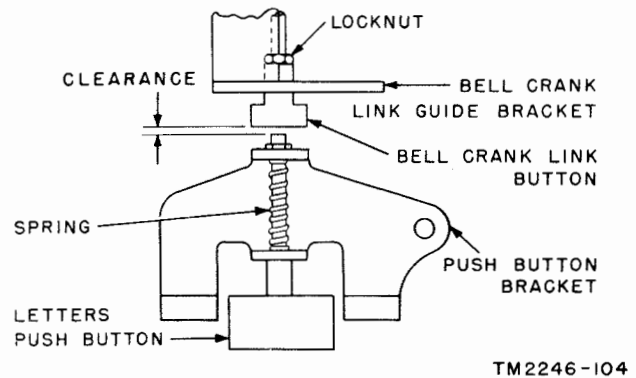


Figure 420. Letters pushbutton adjustment.

b. Adjustment. Loosen the locknut and screw the bellcrank link button in or out to meet the requirement; tighten the locknut. If difficulty is encountered in the operation of the platen latch when the letters pushbutton is pressed, check the adjustment described in paragraph 338.

### Section VIII. PERFORATOR ADJUSTMENT PROCEDURES

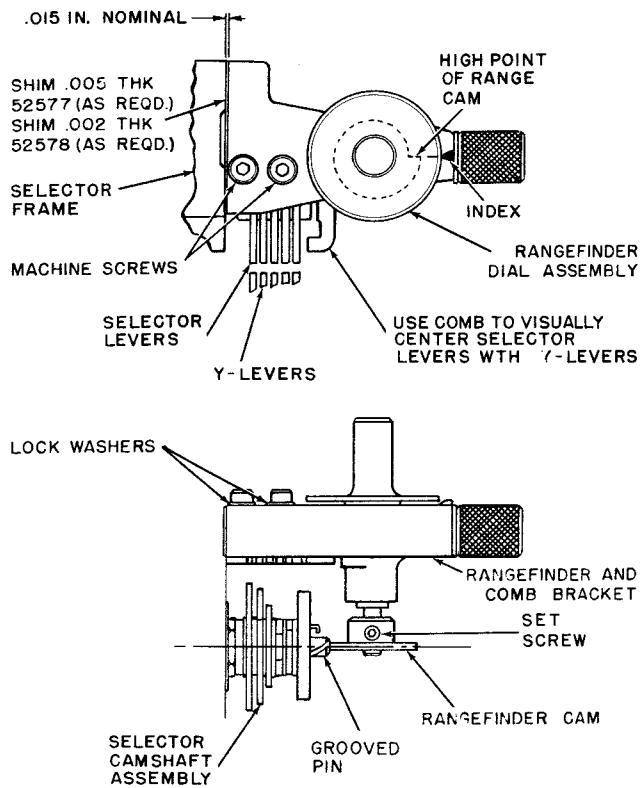
#### 406. General

This section contains requirements and adjustment procedures for the maintenance and optimum performance of the perforator. Adjustments are arranged in sequence if a complete readjustment of a machine is undertaken. When making individual adjustments, check and perform, if necessary, all related adjustments. When removing items to make adjustment, refer to paragraphs 125 through 194.

#### 407. Rangefinder Cam and Selector Lever Stop Comb Adjustment (fig. 421)

a. Requirements.

- (1) The selector levers should be centered (visual check) with their corresponding Y-levers.
- (2) The dial must read 55 to 65 when the rangefinder cam high point is in line



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Figure 421. Rangefinder cam and selector lever stop comb adjustment.

with the index mark on the rangefinder and comb bracket.

*b. Adjustments.*

- (1) Loosen the machine screws and position the selector lever stop comb to visually center the selector levers with the Y-levers; tighten the screws. If the selector lever stop comb cannot be adjusted to meet requirement, loosen the machine screws that hold the rangefinder bracket. Add or remove the shims to provide the desired clearance. Tighten the screws and recheck the clearance.
- (2) Loosen the setscrews in the rangefinder cam. Center the rangefinder cam visually with the grooved pin in the selector camshaft assembly. Set the rangefinder dial assembly at 60 and tighten the knurled nut. Rotate the rangefinder cam until the high

point is in line with the index mark; tighten the setscrews.

### 408. Selector Magnet Adjustments

The chart below gives the references for each of the individual adjustments related to the selector magnet assembly.

Adjustment	Par. ref.	Fig. ref.
Selector lever clearance adjustment.....	265	289
Armature and selector magnet bracket alinement.....	286	308
Armature stop bracket and bar magnet preliminary clearance.....	287	309
Selector magnet pole faces and armature alinement.....	288	310
Bar magnet attractive force and armature clearance adjustment.....	289	311
Bar magnet attractive force and leaf spring adjustment.....	290	312, 313

### 409. Selector Lever and Stop Lever Alinement with Armature Blade (Preliminary)

(fig. 422)

*a. Requirement.* With a .004-inch clearance between the selector-magnet coil pole faces and the armature toffets, selector levers should just pass the knife edge of the armature blade. The stop lever should just engage the knife edge of the armature blade.

*b. Adjustment.* Place .004-inch feeler gages between the pole faces and the armature toffets. Place the selector magnet bracket on the unit and replace the selector magnet bracket mounting screws to exert friction to hold the selector magnet bracket to the casting. While manually moving the selector levers past the armature blade, position the selector magnet adjustment screws until the requirement is met. Tighten the selector magnet bracket mounting screws. Loosen the eccentric bearing self-locking hexagonal nut and turn the stop lever eccentric bearing until the stop lever just engages the knife edge of the armature. Tighten the self-locking hexagonal nut while holding the eccentric bearing stationary. (Check related adjustments, paragraphs 288, 289, 290, and 411.)

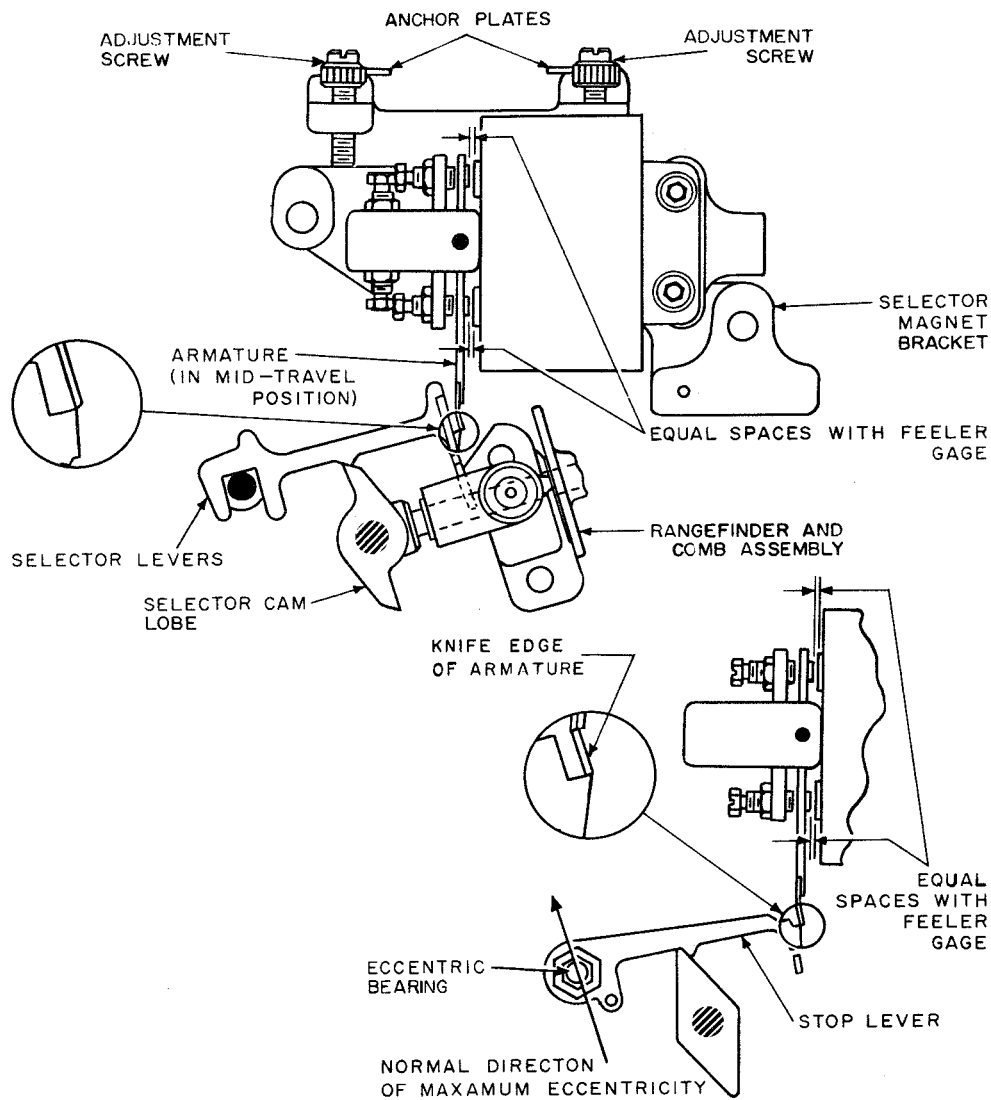


Figure 422. Selector levers and stop lever alinement with armature blade.

#### 410. Selector Magnet Alinement with Selector Levers and Y-Levers (fig. 423)

*Note.* This adjustment is to be made after adjustment paragraph 414.

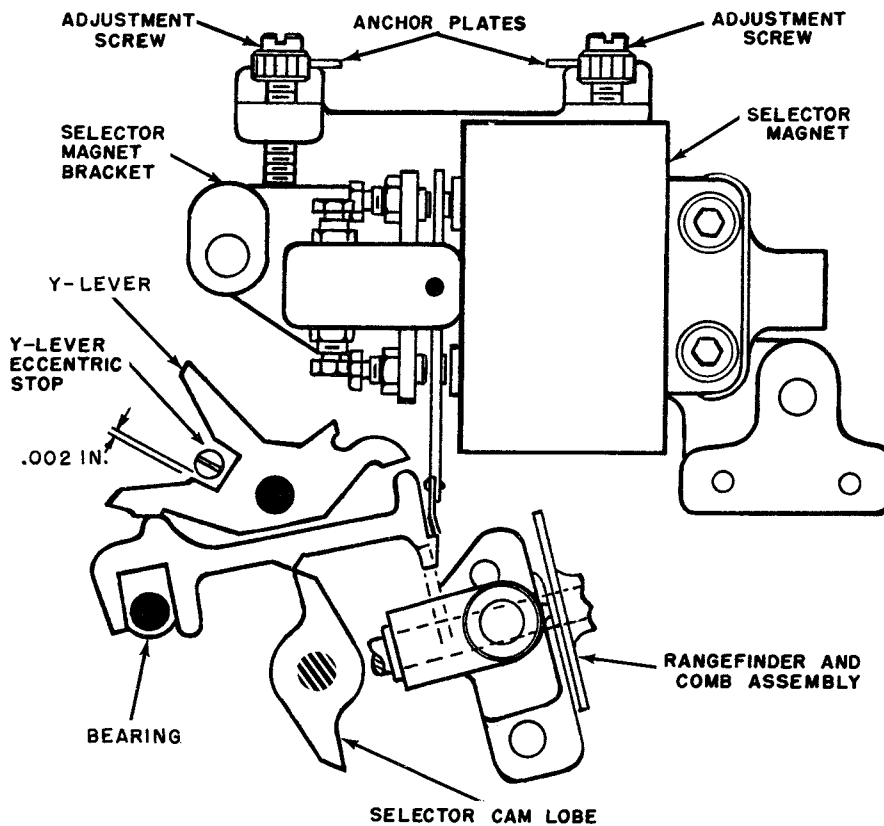
*a. Requirement.* The selector camshaft should not rotate with a .006-inch feeler gage between the Y-lever and the bottom of the Y-lever eccentric stop when the letters code group is received by the selector mechanism, and the motor is running. The selector camshaft should rotate when a .002-inch feeler gage is inserted at that position.

*b. Adjustment.* Adjust the selector magnet bracket adjustment screws until the above requirement is met.

#### 411. Selector Magnet Armature Blade and Selector Lever Clearance (fig. 316)

*a. Requirement.* The gap between the armature blade and the selector levers should be between .018- to .025-inch.

*b. Adjustment.* Position the selector lever comb bracket vertically so that the requirement is met.



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Figure 423. Selector magnet alignment with selector levers and Y-levers.

#### 412. Y-Lever Detent and Y-Levers Adjustments

Refer to the chart below for references to these perforator adjustments which are identical to the same adjustments for the page printer.

Adjustment	Par. ref.	Fig. ref.
Y-lever detent end-play adjustment.....	283	305
Y-lever detents and Y-lever adjustment.....	284	306

#### 413. Sequential Transfer Lever Shaft Adjustment (fig. 424)

*a. Requirement.* The T-levers should be in line, visually, with the Y-levers.

*b. Adjustment.* With the rear collar loose, loosen the clamping screw of the front shaft

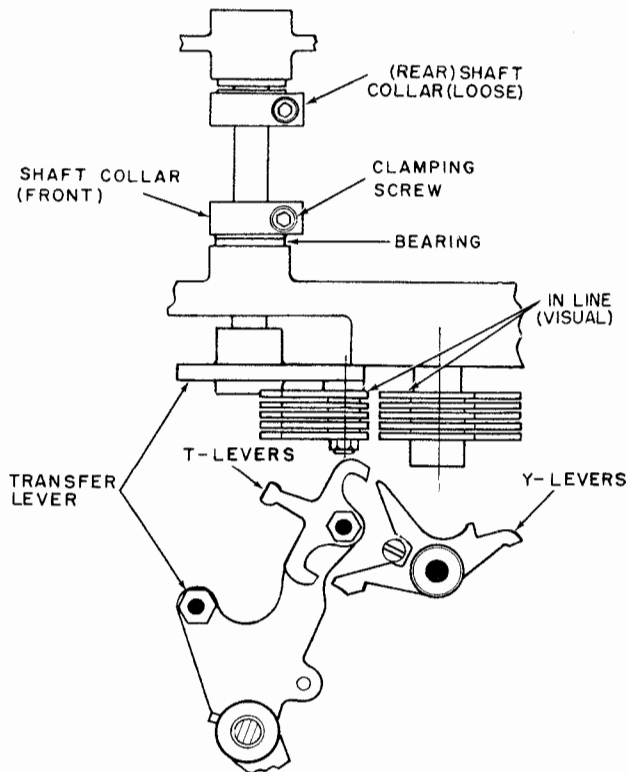
collar and slide the transfer lever in or out to meet the requirement. Holding the transfer lever in position, slide the front shaft collar tight against the bearing and tighten the clamping screw. (Check related adjustments, paragraph 414.)

#### 414. Sequential Transfer Lever Shaft End-Play Adjustment (fig. 425)

*Note.* This adjustment is to be made after the adjustment described in paragraph 413.

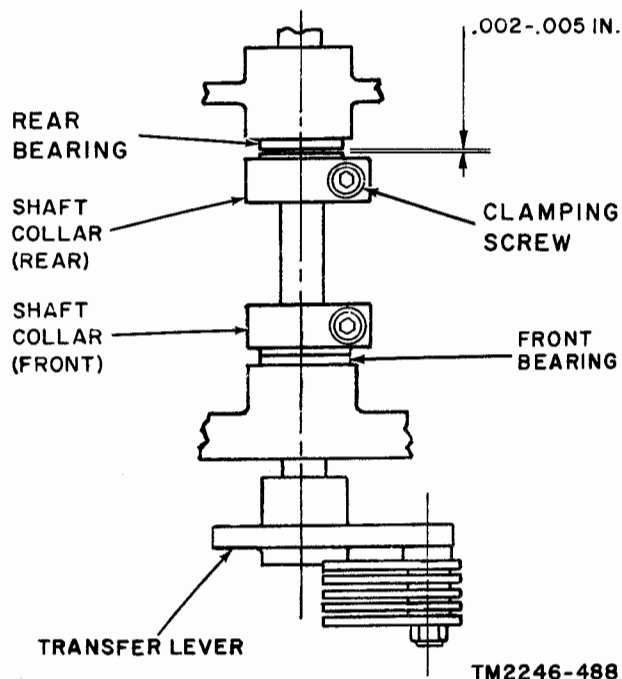
*a. Requirement.* There should be a .002- to .005-inch clearance between the rear collar and the rear bearing when the front collar is tight against the front bearing.

*b. Adjustment.* Move the front collar against the front bearing. Loosen the clamping screw and slide the rear collar to meet the requirement and tighten the clamping screw.



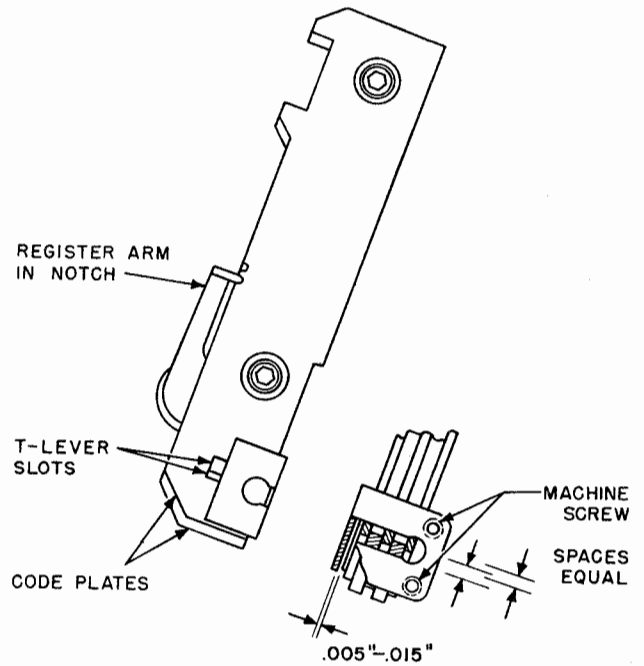
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Figure 424. Sequential transfer lever shaft adjustment.



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Figure 425. Sequential transfer lever shaft end play adjustment.



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Figure 426. T-lever stop bracket adjustment.

#### 415. T-Lever Stop Bracket Adjustment (fig. 426)

a. *Requirement.* There should be a .005- to .015-inch clearance between the code plates and the T-lever stop bracket. The T-lever slots of the code plates should be equally aligned in the T-lever stop bracket hole when an R or Y code combination is set up in code plates.

b. *Adjustment.* Insert a feeler gage between the first code plate and the T-lever stop bracket. Set up an alternate mark-space condition with the code plates, and rotate the code actuated function shaft to move the register arm into the restraining notches of the code plates. Adjust the T-lever stop bracket so that any two adjacent T-lever slots are equally spaced, visually, in the T-lever stop bracket hole.

#### 416. Contact Wiper Guide Adjustment (fig. 427)

a. *Requirement.* The contact wipers should be centrally positioned on the printed commutator rubbing surfaces.

b. *Adjustment.* Loosen the hexagonal nuts and move the contact wiper guide to equally space the contact wiper on the printed commu-

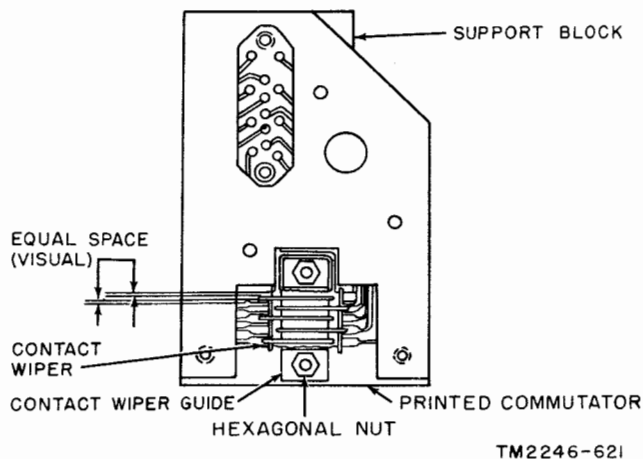


Figure 427. Contact wiper guide adjustment.

tator rubbing surfaces. Tighten the hexagonal nut.

#### 417. Register Arm Adjustment

(fig. 428)

*a. Requirement.* There should be a .020- to .035-inch clearance between the register arm and the code plate when the code actuated switch cam follower is in the detent position of the code actuated switch cam.

*b. Adjustment.* Loosen the register lever machine screw and position the register arm

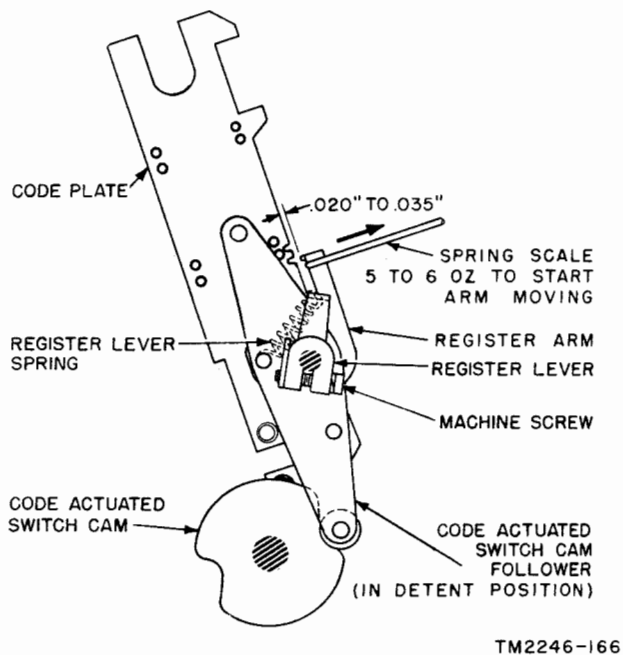


Figure 428. Register arm adjustment.

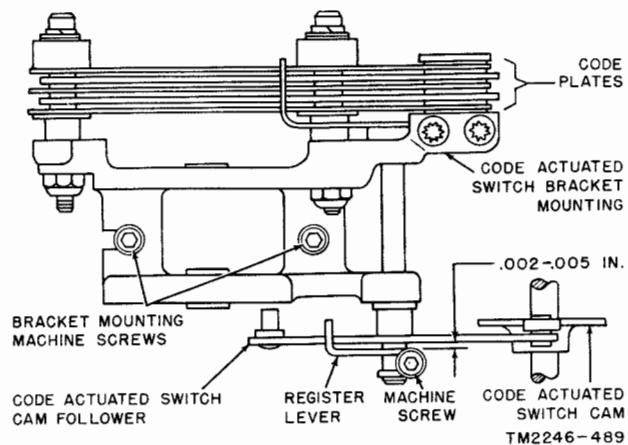


Figure 429. Register lever adjustment.

to meet the requirement. Tighten the machine screw.

#### 418. Register Lever Adjustment

(fig. 429)

*a. Requirement.* There should be a .002- to .005-inch clearance between the register lever and the code actuated switch cam follower.

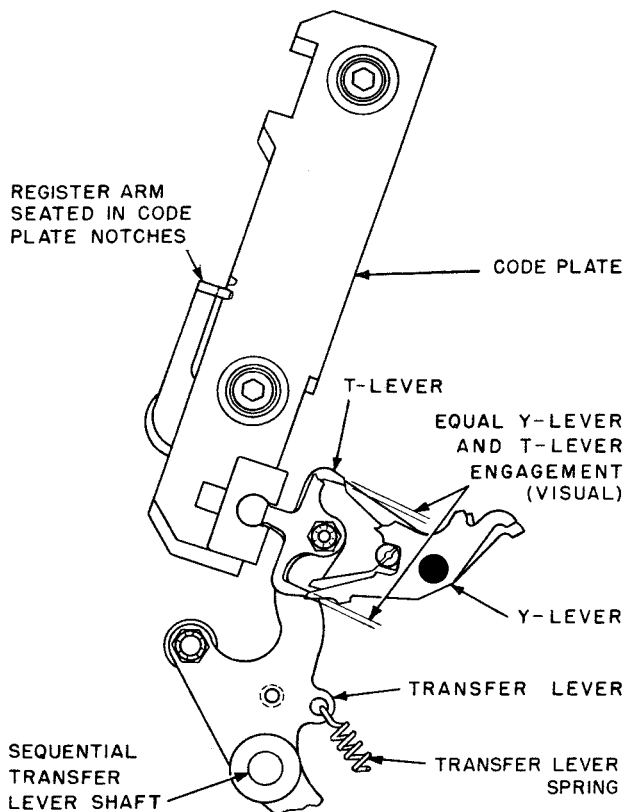
*b. Adjustment.* Loosen the machine screw in the register lever and slide the register lever to meet the requirement; tighten the machine screw.

#### 419. Code Actuated Switch Bracket Mounting Adjustment

(fig. 430)

*a. Requirement.* The T-levers, when transferred, should have equal engagement with the Y-levers and be in line with the code bars without binding. The register arm should drop smoothly into the notches.

*b. Adjustment.* Loosen the bracket mounting machine screws and set the Y-levers in alternate mark and space positions. Release the transfer latch and move the code actuated switch bracket mounting so that the notches in the code plates are in line. Turn the motor by hand until the register arm drops into notches; the T-levers should have equal engagement with the Y-levers. Move the code actuated switch bracket mounting to adjust and to align the code plates and T-levers; tighten the bracket mounting machine screws.



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Figure 430. Code actuated switch bracket mounting adjustment.

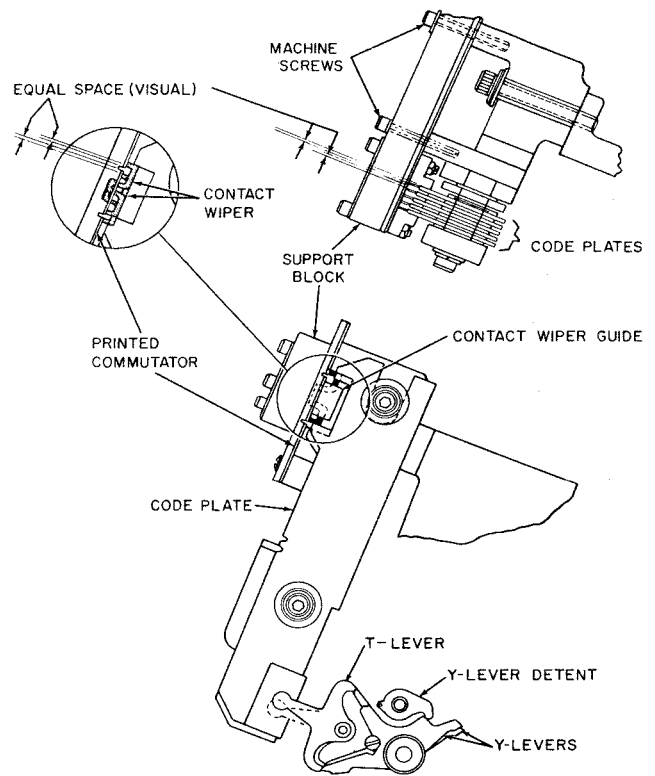
## 420. Printed Commutator Adjustment

(fig. 431)

*a. Requirement.* The contact wipers should be in line with the code plates. There should be an equal space between the contact wiper tips and the slot in the printed commutator when R or Y is selected.

*b. Method of Checking.* Set the Y-levers in alternate mark and space positions and release the transfer lever by pulling the transfer lever latch downward. Turn the motor by hand until the register arm is in the notches of the code plates.

*c. Adjustment.* Loosen the machine screws and, with the code plates in R or Y code group position and the register arm in the notches, position the printed commutator to meet the requirements. Tighten the machine screws.



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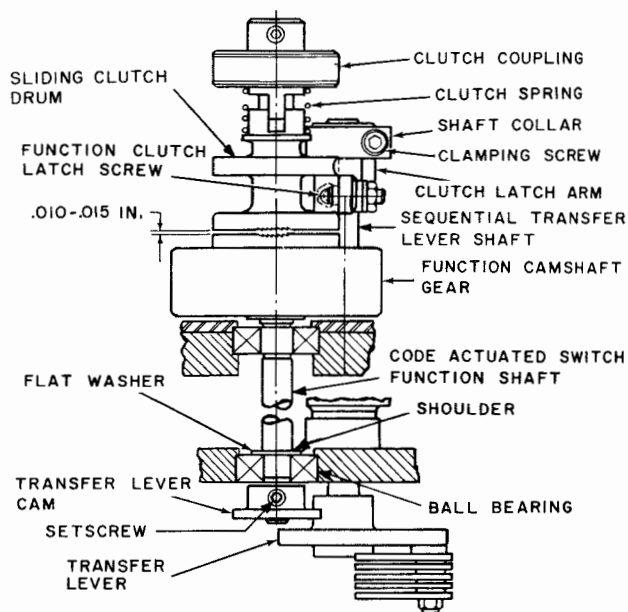
Figure 431. Printed commutator adjustment.

## 421. Code Actuated Switch Function Shaft Adjustment

*a. Requirement.* The shoulder on the code actuated switch function shaft should be tight against the flat washer, and the transfer lever cam should be tight against the opposite sides of the ball bearing.

*b. Method of Checking.* Push and pull on the transfer lever cam and check for clearance between the transfer lever cam and the ball bearing.

*c. Adjustment.* Loosen the transfer lever cam setscrews and slide the code actuated switch function shaft until it pushes the flat washer tight against the ball bearing. Hold the code actuated switch function shaft and slide the transfer lever cam tight against the ball bearing; tighten the transfer lever cam setscrews and check the requirement.



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Figure 432. Code actuated switch function shaft adjustment.

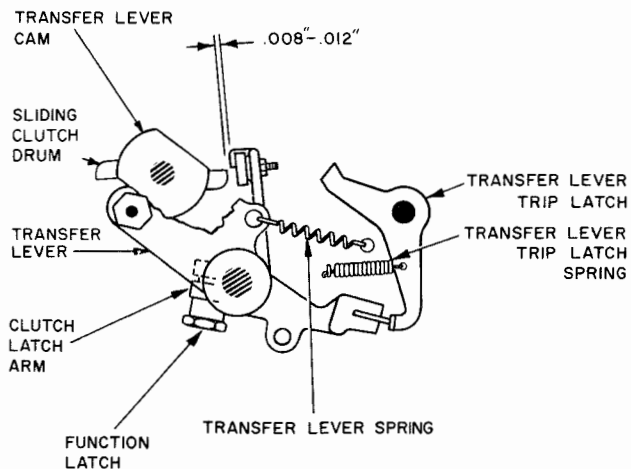
## 422. Code Actuated Switch Function Shaft Clutch Adjustment (fig. 432)

*a. Requirement.* There should be a .010- to .015-inch clearance between the sliding clutch drum and the function camshaft gear when the clutch latch arm is engaged by the sliding clutch drum.

*b. Adjustment.* Loosen the clamp screw in the shaft collar and loosen the function clutch latch screw in the clutch latch arm. Shift the position of the clutch latch arm on the sequential transfer lever shaft until the requirement is met. Slide the shaft collar up tight against the clutch latch arm, and tighten only the clamping screw in the shaft collar so as to locate the position of the clutch latch arm. Adjust the code actuated switch function shaft clutch latch arm (par. 423).

## 423. Code Actuated Switch Function Shaft Clutch Latch Arm Adjustment (fig. 433)

*a. Requirement.* There should be a .008- to .012-inch clearance between the clutch latch arm and the sliding clutch drum when the clutch latch arm is disengaged.



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Figure 433. Code actuated switch function shaft clutch latch arm adjustment.

*b. Method of Checking.* With the transfer lever latched and the code actuated switch function shaft in the stopped position, trip the transfer lever by pulling the transfer lever latch down. The clutch latch arm then will be disengaged from the sliding clutch drum. Check the requirement with a feeler gage.

*c. Adjustment.* Loosen the function clutch latch screw in the clutch latch arm. Position the clutch latch arm to meet the requirement; tighten the function clutch latch screw.

## 424. Code Actuated Switch Cam Adjustment (fig. 434)

*a. Requirement.* There should be a .002- to .008-inch clearance between the sliding clutch drum finger and the function clutch latch arm when the code actuated switch cam follower is in an indent of the code actuated switch cam.

*b. Method of Checking.* Cause the code actuated switch function shaft to rotate under power from the motor. Cause the sliding clutch drum to engage the clutch latch arm by moving the selector magnet armature in the path of the stop lever. Turn the motor off and rotate the code actuated switch function shaft counterclockwise. Measure the clearance when the code actuated switch cam follower is in an indent of the code actuated switch cam.

*c. Adjustment.* With the machine in stop position, loosen the setscrews of the code actuated switch cam. Be sure the code actuated



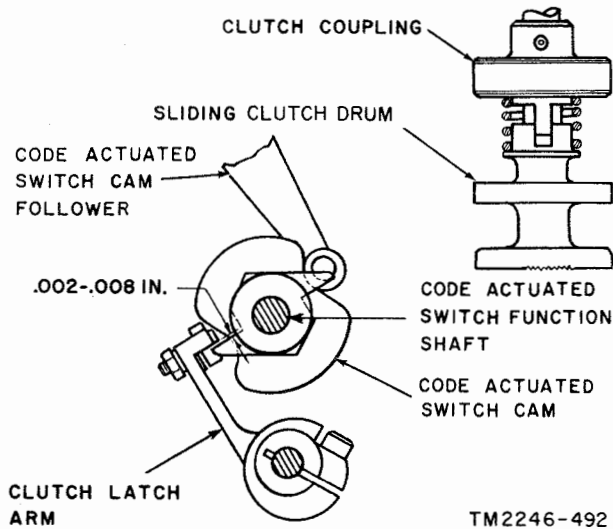


Figure 434. Code actuated switch cam adjustment.

switch cam follower is in the indent of the code actuated switch cam. Turn the code actuated switch function shaft to meet the required clearance; tighten the code actuated switch cam setscrews. Recheck the clearance; check both sides of the sliding clutch drum.

#### 425. Code Actuated Switch Function Shaft Clutch Pressure Adjustment (fig. 435)

a. *Requirement.* It should require 38 to 42 ounces to just start the sliding clutch drum moving to separate the clutch teeth.

b. *Adjustment.* Loosen the socket setscrews in the clutch coupling and shift the clutch coupling in the proper direction to obtain the required spring tension for the sliding clutch drum; tighten the socket setscrews of the clutch coupling.

#### 426. Sequential Transfer Lever Roller Stud Adjustment (fig. 436)

a. *Requirement.* There should be a .007- to .020-inch clearance between the transfer lever and the transfer lever trip latch when the transfer lever roller is on the high portion of the transfer lever cam.

b. *Adjustment.* Loosen the nut and set the transfer lever roller stud for maximum eccentricity. Manually rotate the code actuated switch function shaft until the roller is on the

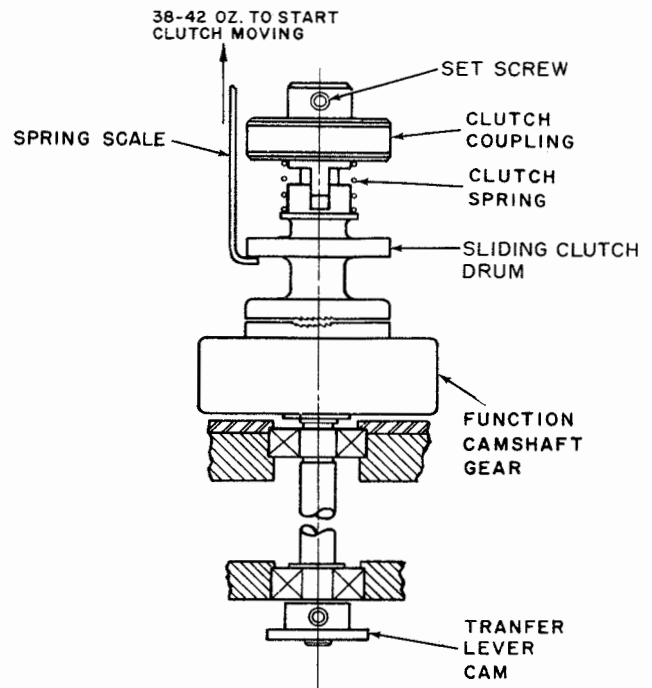


Figure 435. Code actuated switch function shaft clutch pressure adjustment.

high portion of the transfer lever cam. Turn the transfer lever roller stud in either direction until the requirement is met. Tighten the nut and recheck the clearance.

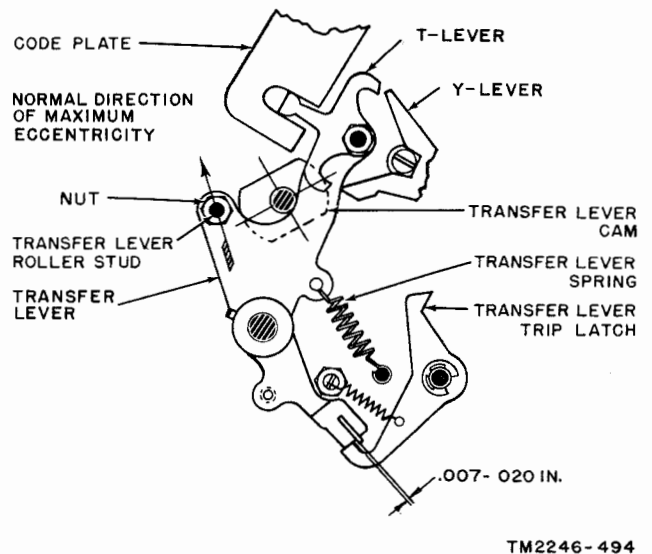


Figure 436. Sequential transfer lever roller stud adjustment.

## 427. Selector Camshaft Clutch Torque Adjustment

(fig. 320)

*a. Requirement.* A pressure of 48 to 56 ounces should be required to start the camshaft rotating.

*b. Method of Checking.* Place the hook end of the spring scale on the stop plate retainer of the selector camshaft and pull the spring scale to apply a tension greater than 56 ounces. Move the armature of the selector magnet to the space position (away from the stop lever); decrease the pull on the spring scale and note the scale reading when the selector camshaft starts to rotate.

*c. Adjustment.* Loosen the clamping screw of the friction clutch adjusting collar and screw the friction clutch adjusting collar on the drive shaft collar to obtain the desired tension. Tighten the clamping screw.

## 428. Code Ring Actuating Load Adjustment

(fig. 437)

*Note.* The code-ring cage should be removed for this adjustment.

*a. Requirement.* A force of 12 ounces maximum should be required to move each code ring from the mark to the space position and from the space to the mark position.

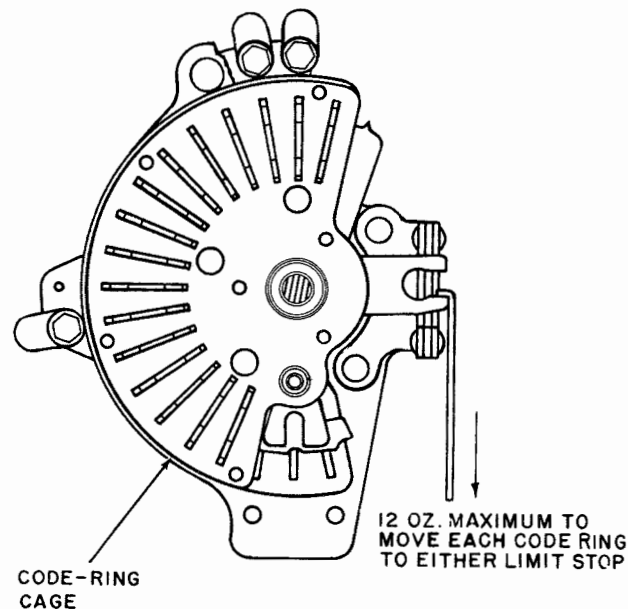


Figure 437. Code ring actuating load adjustment.

*b. Adjustment.* Remove any burr on the working surfaces of the cage. Replace distorted code rings with a new set.

## 429. Sensing Levers Stacking Clearance Adjustment

*a. Requirements.*

(1) The code selecting guide plate hub should extend slightly beyond the typewheel reciprocating cam follower (A, fig. 438). It should not extend beyond .003 inch.

(2) The cam lever assembly hub should extend slightly beyond the sensing lever spacer (B, fig. 438). It should not extend beyond .003 inch.

*b. Adjustments.*

(1) Remove enough laminations from the laminated spacer to meet the requirement specified in *a*(1) above.

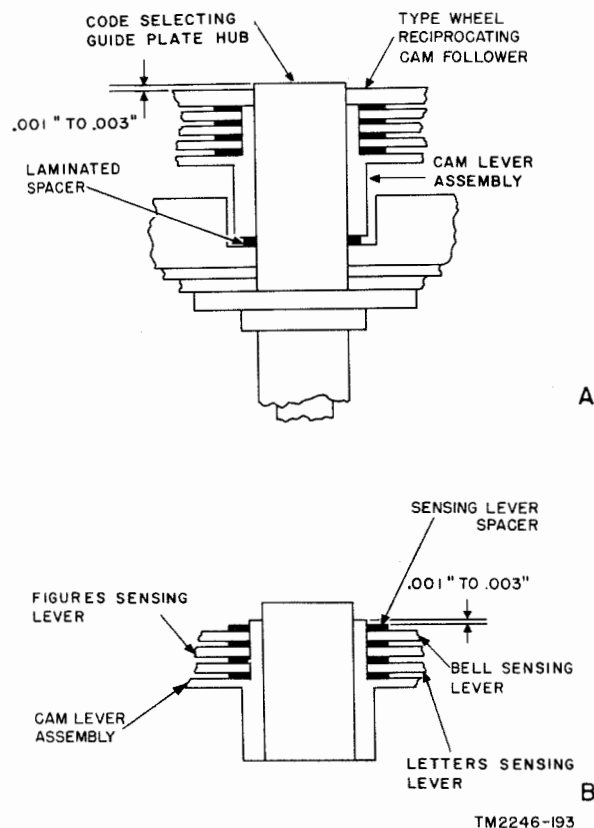


Figure 438. Sensing levers stacking clearance adjustment.

- (2) Remove enough laminations from the sensing lever spacer to meet requirement specified in *a*(2) above. When checking, be sure no clearances are present between the sensing levers and the spacers.

*Note.* Spacers are made of brass laminations bonded together. Each lamination is .022 inch thick. Recheck the adjustment requirements carefully to avoid removal of too many laminations. Use a knife blade to separate each lamination for removal.

### 430. Code-Ring End Play Adjustment (fig. 292)

*a. Requirement.* The clearance between the ball retainer and the code-ring collar should be .002 to .004 inch.

*b. Method of checking.* Check the clearance by inserting a flat feeler gage from the bottom of the code-ring cage between a code ring and a ball of the ball retainer.

*c. Adjustment.* Insert an Allen wrench through the top stop bars, through the hole in the code cage spacer, into a setscrew in the code-ring collar. Loosen the setscrews and move the code-ring collar toward or away from the code ring to meet the requirement. Tighten the setscrews in the code-ring collar and recheck the requirement.

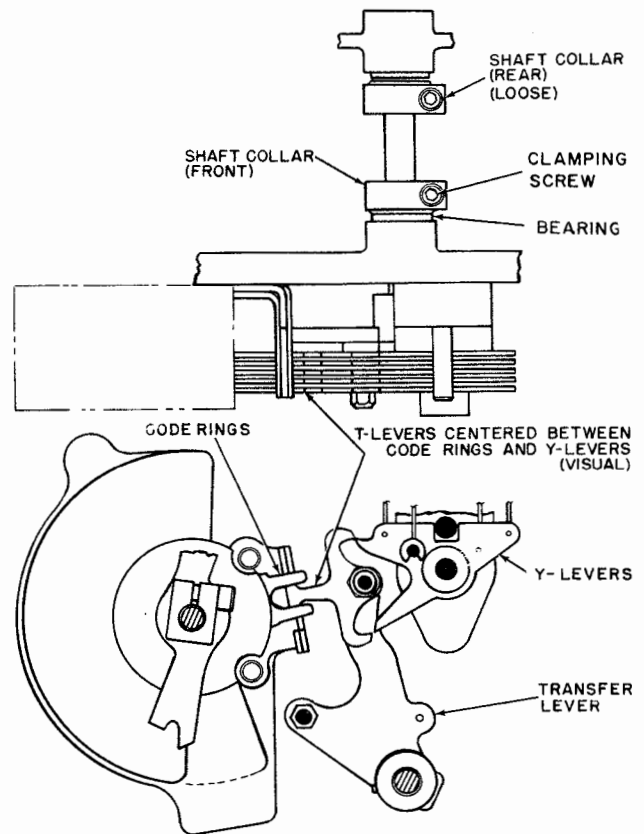
### 431. Stop Arm Shaft End Play Adjustment (fig. 292)

*a. Requirement.* There should be a .002- to .005-inch clearance between the stop arm shaft gear and the thrust bearing.

*b. Adjustment.* Loosen the two setscrews and slide the stop arm shaft gear axially to meet the requirement; tighten the setscrews.

### 432. Simultaneous Transfer Lever Adjustment (fig. 439)

*a. Requirement.* The T-levers are to be in line with both the Y-levers and the code rings. Any offset should be equally divided so that the T-levers are centered between the Y-levers and the code rings.



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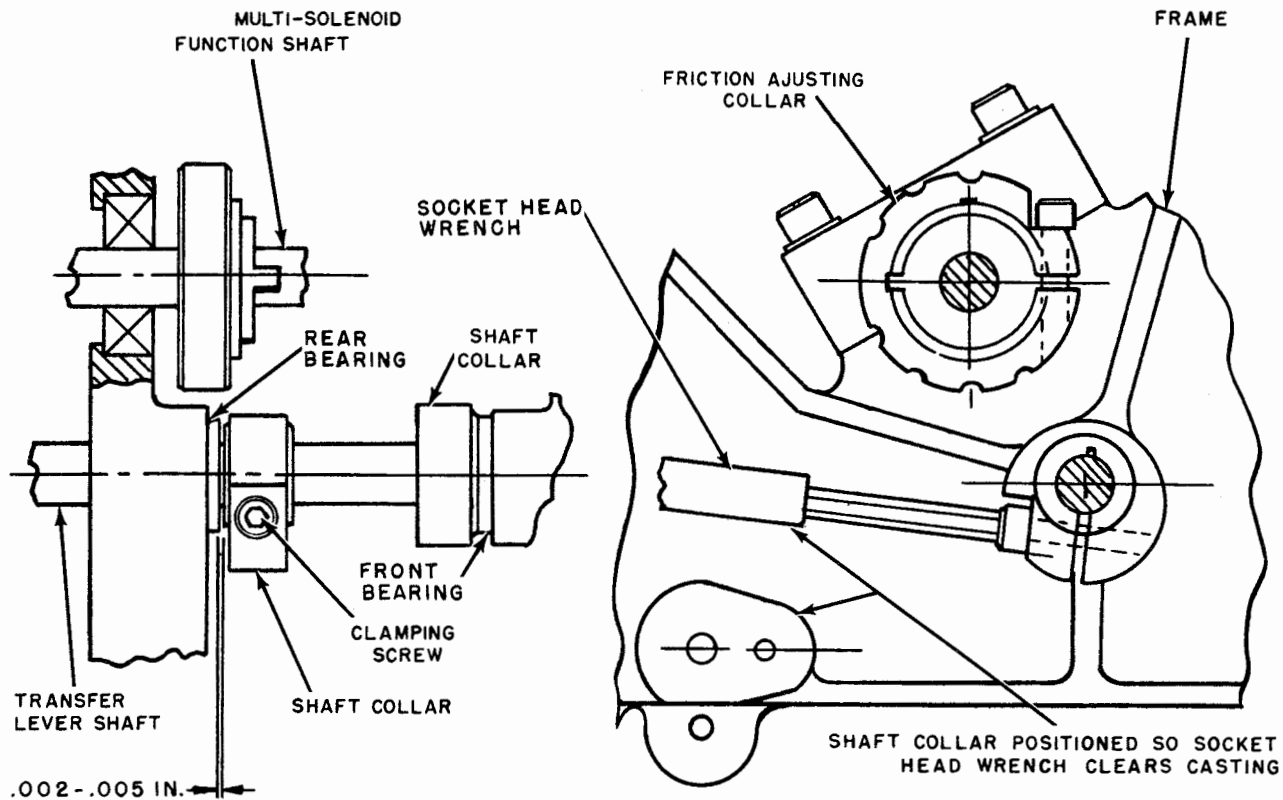
Figure 439. Simultaneous transfer lever adjustment.

*b. Adjustment.* With the rear shaft collar loose, loosen the clamping screw of the front shaft collar and slide the transfer lever in or out to meet the requirement. Holding the transfer lever in position, slide the front shaft collar tight against the bearing and tighten the clamping screw.

### 433. Simultaneous Transfer Lever Shaft End Play Adjustment (fig. 440)

*a. Requirement.* There should be a .002- to .005-inch clearance between the rear shaft collar and the rear bearing when the front shaft collar is tight against the front bearing and the socket head wrench can be inserted into the adjustment screw in the position shown.

*b. Adjustment.* Loosen the clamping screw and slide the front shaft collar right against the front bearing. With a feeler gage between the



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Figure 440. Simultaneous transfer lever shaft end play adjustment.

rear shaft collar and the rear bearing, tighten the clamping screw in the position shown.

#### 434. Multisolenoid Support Block Adjustment (TT-178/FG and TT-179/FG)

(fig. 441)

*a. Requirement.* There should be equal clearance between the first multisolenoid Y-lever and either side of the straight pin when the first multisolenoid plunger is held stationary in its midtravel position by the space and mark adjusting screws.

*b. Adjustment.* Loosen the locknuts, that hold the mark and space adjusting screws for the first multisolenoid Y-lever plunger. Turn both the adjusting screws until they project equally from the support block, and the plunger is held stationary inside the support block. Be careful when turning the adjusting screws so that they touch the plunger very lightly. Loosen the machine screws and position the

support block either up or down until the gap is equal between the first multisolenoid Y-lever and either side of the straight pin. Tighten the machine screws, and perform the adjustment described in par. 436.

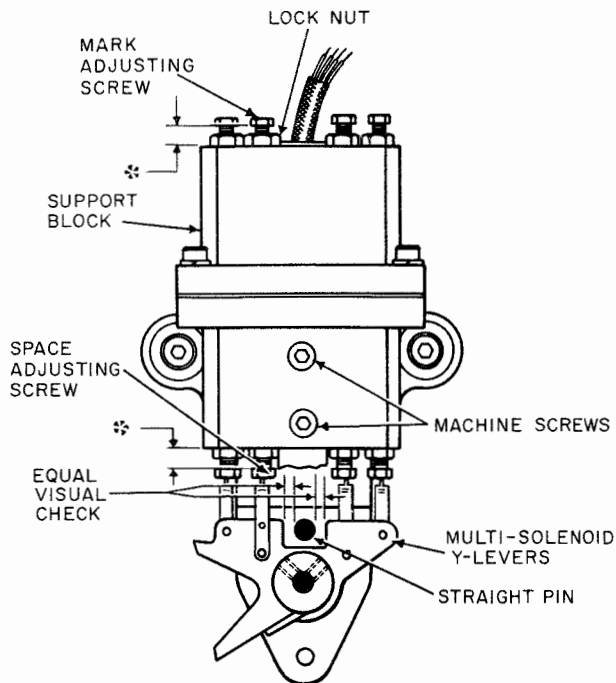
#### 435. Multisolenoid Support Block Adjustment (TT-178A/FG, TT-179A/FG and TT-181/FG)

(fig. 442)

*a. Requirement.* Refer to paragraph 434a.

*b. Adjustment.*

- (1) Turn the mark and space adjusting screws of the first multisolenoid Y-lever plunger until they have equal clearances above and below their respective support blocks. Be sure that the plunger inside the support blocks is stationary after equalization is reached. Be careful when turning the adjusting screws so that they touch the plunger lightly.



\*EQUAL TM2246-C1-21  
 Figure 441. Multisolenoid support block adjustment.

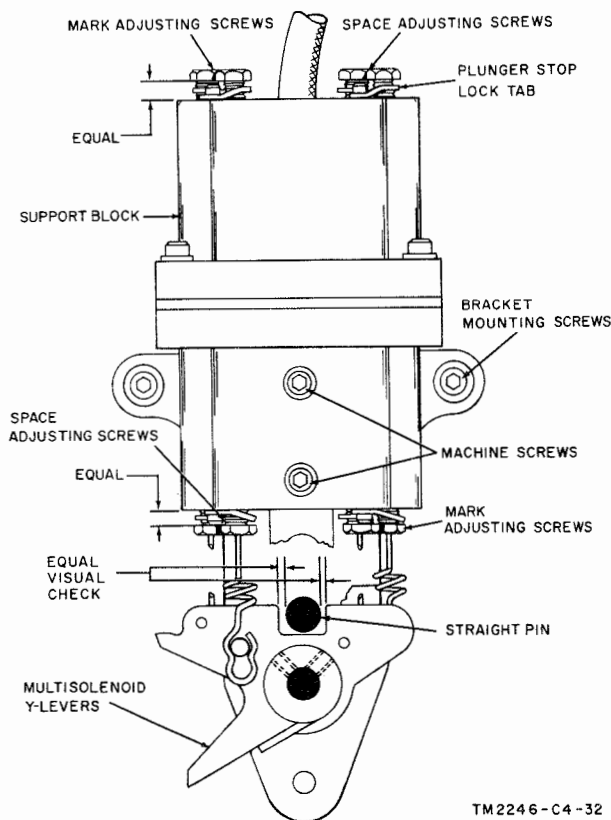


Figure 442. Multisolenoid support block adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG).

- (2) Loosen the two machine screws to position the support block either up or down, thereby pivoting the first Y-lever until the gap is equal between the shoulders of the Y-lever and either side of the straight pin. Tighten the machine screws and perform the adjustment described in paragraph 436.

### 436. Multisolenoid Y-Levers Adjustment (fig. 443)

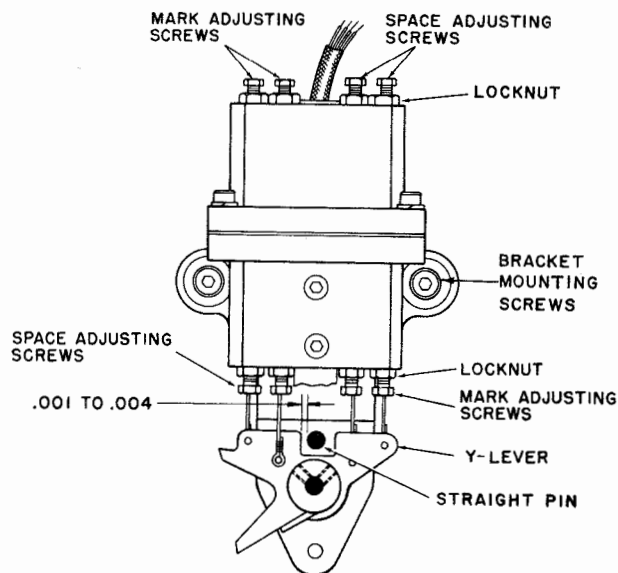
#### a. Requirements.

- (1) When a Y-lever is in the mark position, there should be a clearance of .001 to .004 inch between each Y-lever and the straight pin.
- (2) When a Y-lever is in the space position, there should be a clearance of .001 to .004 inch between the Y-lever and straight pin.

#### b. Adjustments.

*Note.* When adjusting multisolenoid Y-levers on the TT-178A/FG, TT-179A/FG, and TT-181/FG, refer to figure 442. It is not necessary to loosen the locking tabs when turning the mark or space adjusting screws.

- (1) To decrease the clearance, loosen the locknut and back out the mark adjusting screw. To increase the clearance, loosen the locknut and run in the mark adjustment screw. When the require-



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Figure 443. Multisolenoid Y-levers adjustment.

ment is met, tighten the locknut. Recheck and readjust if necessary.

- (2) To decrease the clearance, loosen the locknut and back out the space adjusting screw. To increase the clearance, loosen the locknut and run in the space adjusting screw. When the requirement is met, tighten the locknut. Recheck and readjust, if necessary.

### 437. Multisolenoid Mounting Bracket Adjustment

*a. Requirement.* The T-levers should engage the Y-levers an equal amount for both mark and space positions of the Y-levers.

*b. Method of Checking.* With the transfer lever latched, set the No. 1 Y-lever in a mark position (B, fig. 444). Trip the transfer lever to cause the T-levers to engage the Y-levers. Visually check the amount of engagement. Reposition the transfer lever and the T-levers. Set the No. 1 Y-lever in a space position (A, fig. 444). Trip the transfer lever and visually check the amount of engagement.

*c. Adjustment.* Loosen the three multisolenoid bracket mounting screws (fig. 443) and position the bracket until the requirement is met; tighten the mounting screws.

### 438. T-Lever Pivot Stud Adjustment (fig. 444)

*a. Requirement.* There should be no clearance between the code-ring tails and their corresponding stops in either marking or spacing positions.

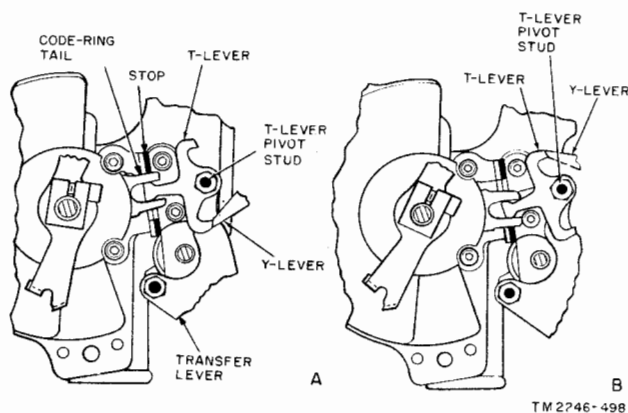


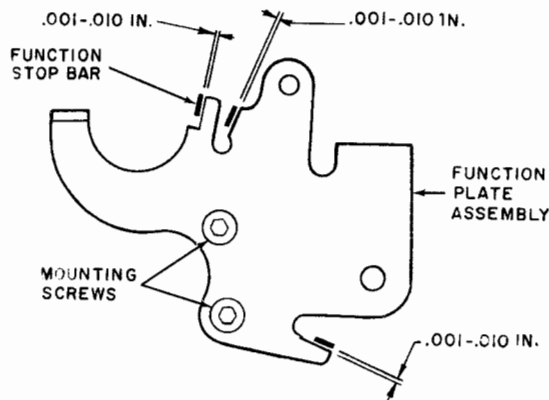
Figure 444. Multisolenoid mounting bracket and T-lever pivot stud adjustment.

*b. Method of Checking.* With the transfer lever latched, set the Y-levers for either the R or Y code combinations. Then trip the transfer lever to cause the code rings to be shifted according to the Y-lever settings. Check the requirement visually.

*c. Adjustment.* Loosen the T-lever pivot stud locknut and position the T-lever pivot stud until the requirement is met; tighten the locknut. Recheck the multisolenoid mounting bracket adjustment (par. 437); readjust if necessary.

### 439. Function Plate and Stop Bars Clearance Adjustment (fig. 445)

*a. Requirement.* There should be a .001- to .010-inch clearance between the function plate and any of the three function stop bars.



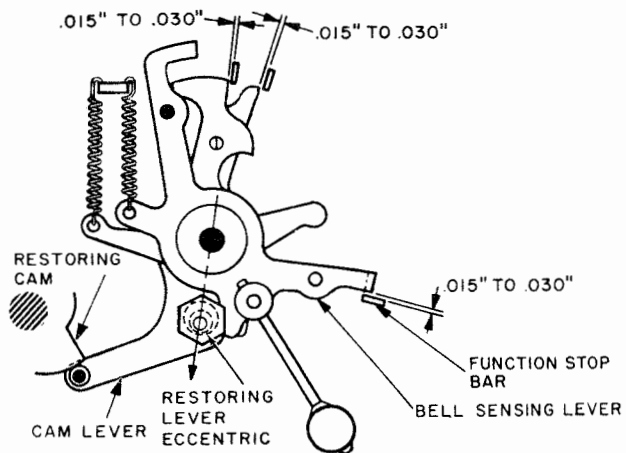
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Figure 445. Function plate and stop bars clearance adjustment.

*b. Adjustment.* Loosen the two mounting screws on the function plate. Turn the plate clockwise or counterclockwise until the requirement is met; tighten the mounting screws and recheck the requirement.

### 440. Function Sensing Levers Clearance Adjustment (fig. 446)

*a. Requirement.* There should be a .015- to .030-inch clearance between the function stop bars and their associated sensing levers when the high point of the restoring cam is against the cam lever and none of the stop bars is in the selected positions.



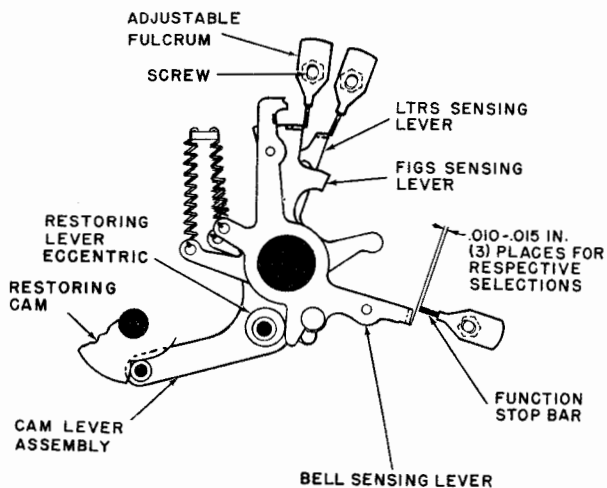
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Figure 446. Function sensing levers clearance adjustment.

*b. Adjustment.* Turn the motor by hand until the cam lever is against the high point of the restoring cam. Loosen the restoring lever eccentric locknut and turn the restoring lever eccentric until the requirement is met; tighten the locknut and recheck the clearance.

#### 441. Function Stop Bars Adjustable Fulcrum Alinement (fig. 447)

*a. Requirement.* There should be a .010- to .015-inch clearance between the tops of the function sensing lever and the associated stop



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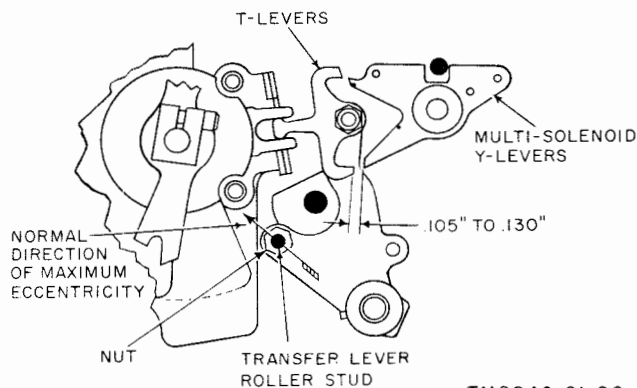
Figure 447. Function stop bars adjustable fulcrum alinement.

bar when the cam lever is against the low point of the restoring cam and each function stop bar is individually moved to the selected position.

*b. Adjustment.* Loosen the screws and adjust each adjustable fulcrum to meet the requirement. Tighten the screws and recheck the clearance.

#### 442. Transfer Lever Roller Stud Adjustment (fig. 448)

*a. Requirement.* There should be a .105- to .130-inch clearance between the T-levers and the multisolenoid Y-levers when they are both rotated counterclockwise until positively stopped and the transfer lever roller stud is on the high part of the cam.



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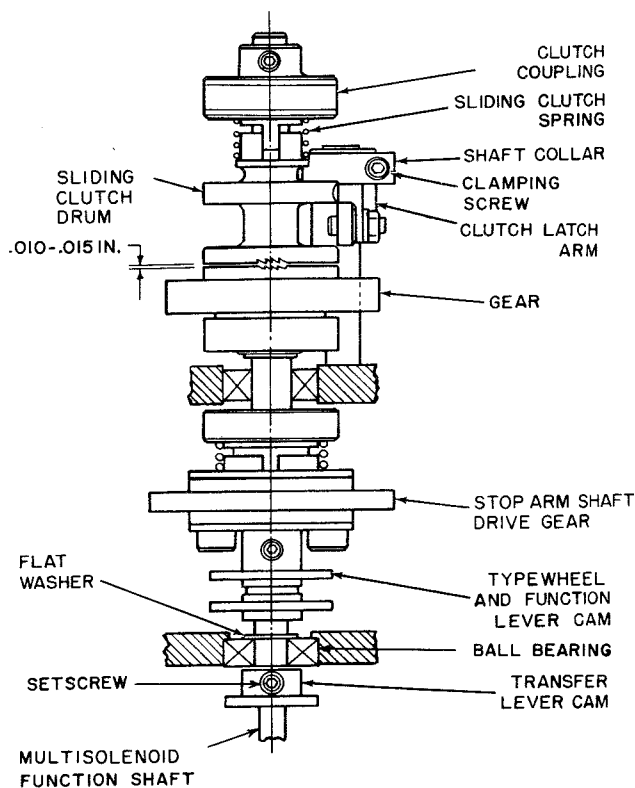
Figure 448. Transfer lever roller stud adjustment.

*b. Adjustment.* Loosen the nut on the transfer lever roller stud. Hold the T-levers and Y-levers in a counterclockwise position against their positive stops. Turn the transfer lever roller stud until the requirement is met. Tighten the nut.

#### 443. Multisolenoid Function Shaft End Play Adjustment (fig. 449)

*a. Requirement.* The flat washer and the transfer lever cam should be tight against the opposite sides of the ball bearing.

*b. Method of Checking.* Push and pull on the transfer lever cam and check for clearance between the transfer lever cam and the ball bearing.



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Figure 449. Multisolenoid function shaft end play and clutch adjustment.

*c. Adjustment.* Loosen the transfer lever cam setscrews and slide the multisolenoid function shaft until it pushes the flat washer tight against the ball bearing. Hold the multisolenoid function shaft and slide the transfer lever cam tight against the ball bearing. Tighten the transfer lever cam setscrews and check the requirement.

#### 444. Multisolenoid Function Shaft Clutch Adjustment (fig. 449)

*a. Requirement.* There should be a .010- to .015-inch clearance between the sliding clutch drum and the gear when the clutch latch arm is engaged by the sliding clutch drum.

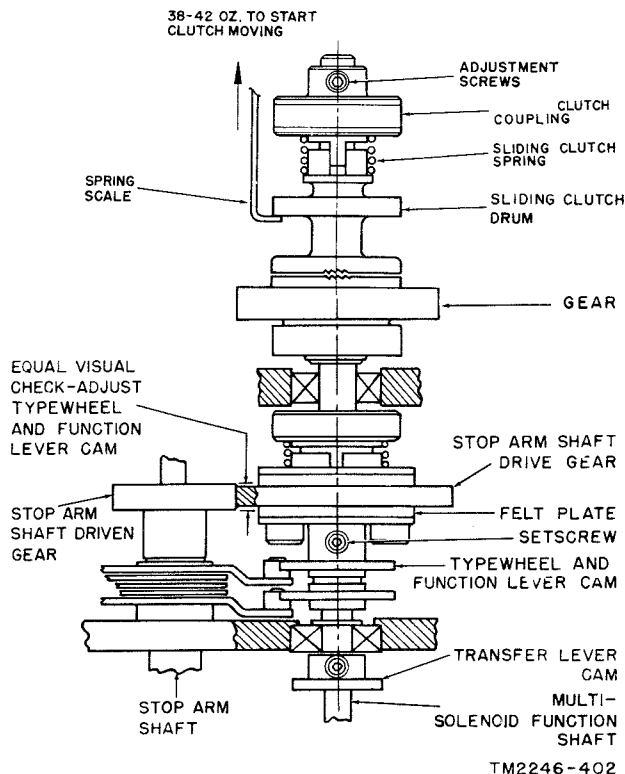
*b. Adjustment.* Loosen the clamping screw in the shaft collar and loosen the hexagonal screw of the clutch latch arm. Shift the position of the clutch latch arm axially until the requirement is met. Slide the shaft collar up tight against the clutch latch arm and tighten

only the clamping screw in the shaft collar so as to locate the position of the clutch latch arm. Adjust the clutch latch arm (par. 447).

#### 445. Friction Shaft Drive Gear Alinement (fig. 450)

*a. Requirement.* The friction shaft drive gear on the multisolenoid function shaft should be centered with the stop arm shaft driven gear.

*b. Adjustment.* Loosen the typewheel and function lever cam setscrews. While maintaining a pressure on the felt plate, move the typewheel and function lever cam to meet the requirement; tighten the setscrews.



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Figure 450. Friction shaft drive gear alinement.

#### 446. Multisolenoid Function Shaft Clutch Pressure Adjustment (fig. 450)

*a. Requirement.* It should require 38 to 42 ounces to start the sliding clutch drum moving.

*b. Adjustment.* Loosen the screws in the clutch coupling; shift the coupling in the proper



direction to obtain the required tension for the clutch; tighten the screws.

#### 447. Clutch Latch Arm Adjustment

(fig. 451)

*a. Requirement.* There should be a .008- to .012-inch clearance between the clutch arm latch and the sliding clutch drum when the clutch is engaged.

*b. Method of Checking.* With the clutch release lever latched and the long function shaft in the stopped position, trip the clutch release lever by moving the lever latch. The clutch latch arm then will be disengaged from the sliding clutch drum finger. Check the requirement with a feeler gage.

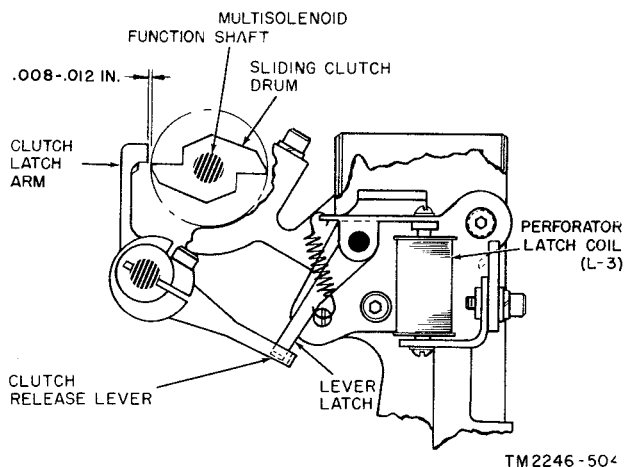


Figure 451. Clutch latch arm adjustment.

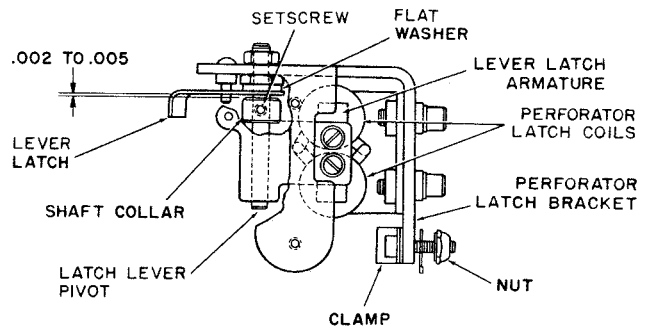
*c. Adjustment.* Loosen the clamping screw of the clutch latch arm. Position the clutch latch arm to meet the requirement; tighten the clamping screw.

#### 448. Lever Latch Shaft Collar Adjustment

(fig. 452)

*a. Requirement.* There should be a .002- to .005-inch clearance between the lever latch and the shaft collar.

*b. Adjustment.* Loosen the setscrews in the shaft collar and insert a feeler gage between the shaft collar and the lever latch. Slide the shaft collar until the lever latch is tight against the flat washer. Tighten the setscrews and remove the feeler gage.



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Figure 452. Lever latch shaft collar adjustment.

#### 449. Perforator Latch Coil Bracket Adjustment

(fig. 453)

*a. Requirement.* There should be a .015- to .020-inch clearance between the lever latch armature and the perforator latch coils when the perforator latch coils are not energized and the lever latch is against the spring post.

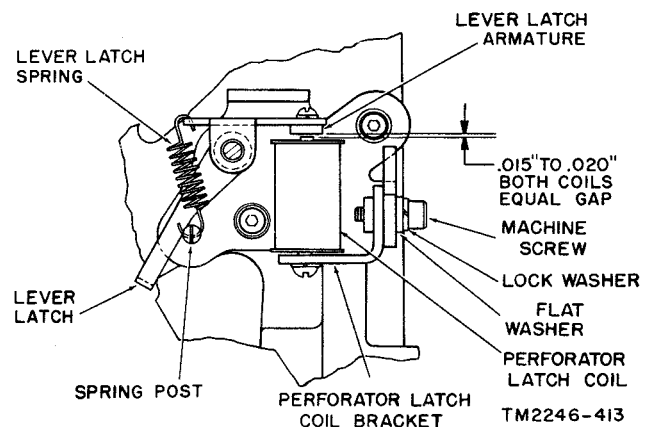
*b. Method of Checking.* With the power off, check the gap between the lever latch armature and the perforator latch coils with a feeler gage.

*c. Adjustment.* Loosen the machine screws and, with a feeler gage inserted between the perforator latch coils and the lever latch armature, slide the perforator latch coil bracket to meet the requirement.

#### 450. Clutch Release Lever Adjustment

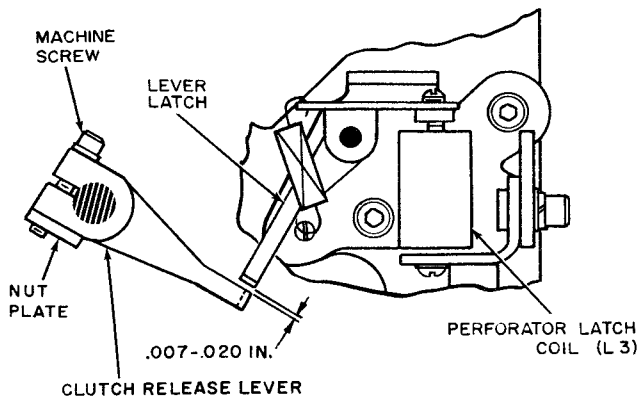
(fig. 454)

*a. Requirement.* There should be a .007- to .020-inch clearance between the clutch release



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Figure 453. Perforator latch coil bracket adjustment.



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Figure 454. Clutch release lever adjustment.

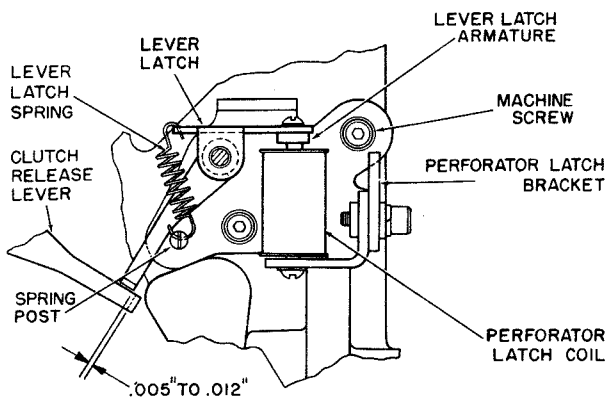
lever and the lever latch when the transfer roller is on the high part of the transfer lever cam.

*b. Adjustment.* With the transfer lever roller on the high part of the transfer lever cam, loosen the clamping screw and rotate the clutch release lever until the requirement is met; tighten the clamping screw.

### 451. Perforator Latch Bracket Adjustment (fig. 455)

*a. Requirement.* There should be a .005- to .012-inch clearance between the lever latch and the clutch release lever when the perforator latch coils are energized.

*b. Method of Checking.* With the perforator latch coils energized, check the gap between the lever latch and the clutch release lever with a feeler gage.



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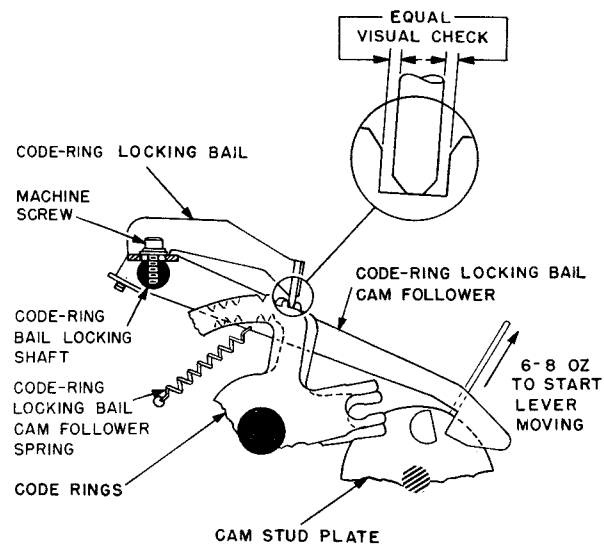
Figure 455. Perforator latch bracket adjustment.

*c. Adjustment.* Loosen the machine screws and move the perforator latch bracket to make the adjustment.

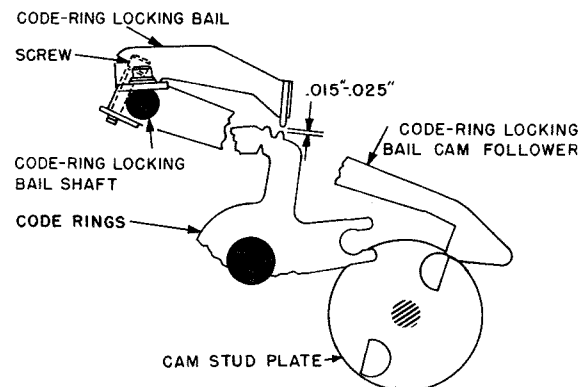
### 452. Code-Ring Locking Bail Adjustment (fig. 456)

*a. Requirement.* When in the locking position the code-ring locking bail should rest against the bottom of the locking notches in the code rings for both mark and space positions of the code rings.

*b. Adjustment.* Loosen machine screws in the code-ring locking bail. Position the code-ring locking bail until the requirement is met. Tighten the machine screws and recheck the requirement.



A



B

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Figure 456. Code-ring locking bail adjustment.

### 453. Code-Ring Locking Bail Cam Follower Clearance Adjustment

(B, fig. 456)

*a. Requirement.* There should be a .015- to .025-inch clearance between the code-ring locking bail and the high part of the code ring when the code-ring locking bail cam follower is against the top of the cam stud.

*b. Adjustment.* With the code-ring locking bail cam follower against the cam stud, loosen the cam follower screw and position the code-ring locking bail cam follower to meet the clearance requirement. Tighten the cam follower screw and recheck the clearance.

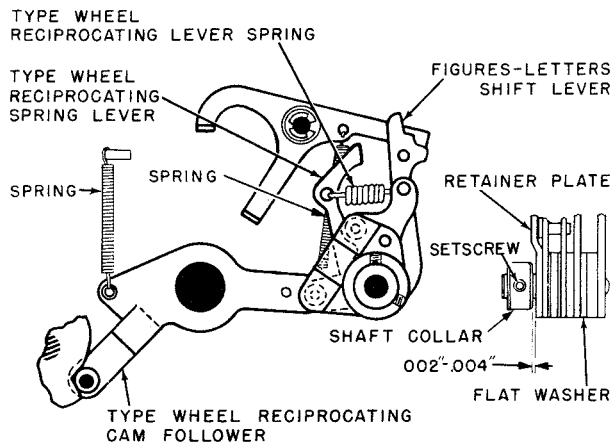


Figure 457. Typewheel shift levers end play adjustment.

### 454. Typewheel Shift Levers End-Play Adjustment

(fig. 457)

*a. Requirement.* There should be a .002- to .004-inch clearance between the retainer plate and the shaft collar when the levers of the lever assembly are held together.

*b. Adjustment.* Loosen the setscrews in the shaft collar. Holding the levers together, position the shaft collar to meet the requirement; tighten the setscrews. Recheck the clearance and readjust if necessary.

### 455. Signal Bell Clapper Adjustment

(fig. 458)

*a. Requirement.* The signal bell should ring with a clear tone when the S code group is received while the machine is in the figures shift position.

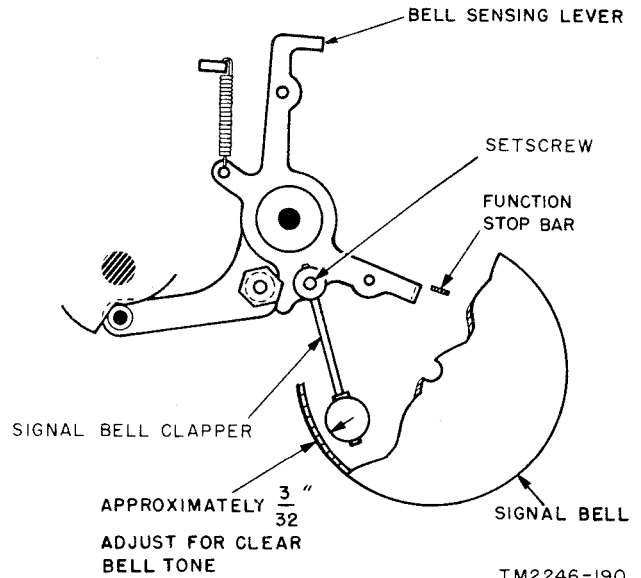


Figure 458. Signal bell clapper adjustment.

*b. Adjustment.* Loosen the setscrew in the bell sensing lever. Position the signal bell clapper approximately  $\frac{3}{32}$  inch from the signal bell to meet the requirement.

### 456. Stop Arm Bearing Brackets Adjustment

(fig. 459)

*a. Requirement.* The stop arm shaft should turn freely in its bearing brackets.

*b. Adjustments.*

- (1) Loosen the setscrews of the typewheel driving gear. Loosen the stop arm bearing bracket screws. Loosen the square shaft stop arm clamping screw.
- (2) Rotate the stop arm shaft slowly, causing the typewheel hub to turn. If

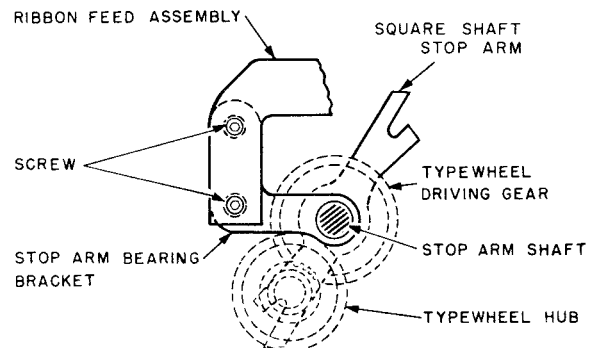


Figure 459. Stop arm bearing brackets adjustment.

the stop arm shaft binds, position the front and rear stop arm bearing brackets until the stop arm shaft rotates freely. Tighten the four bearing bracket screws and recheck for bind.

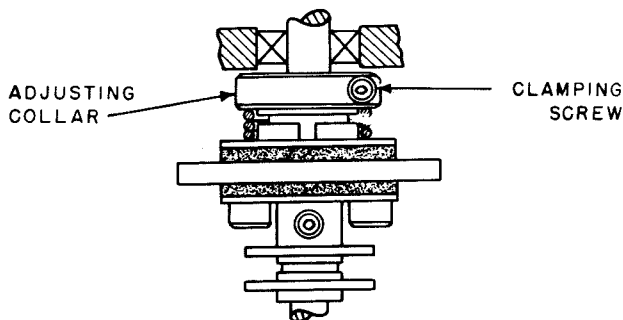
- (3) Replace the typewheel driving gear in accordance with paragraphs 429 and 445. Reposition the square shaft stop arm in accordance with paragraph 457.

### 457. Stop Arm Torque Adjustment

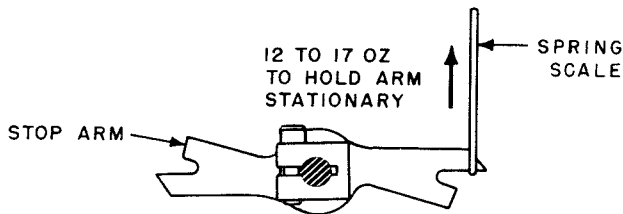
(fig. 460)

*a. Requirement.* With the motor running and the function shaft rotating, a pull of 12 to 17 ounces is required to hold the stop arm stationary.

*b. Adjustment.* With the motor off, loosen the clamping screw on the friction adjusting collar. Turn the friction adjusting collar in or out to meet the requirement; tighten the clamping screw and recheck the tension.



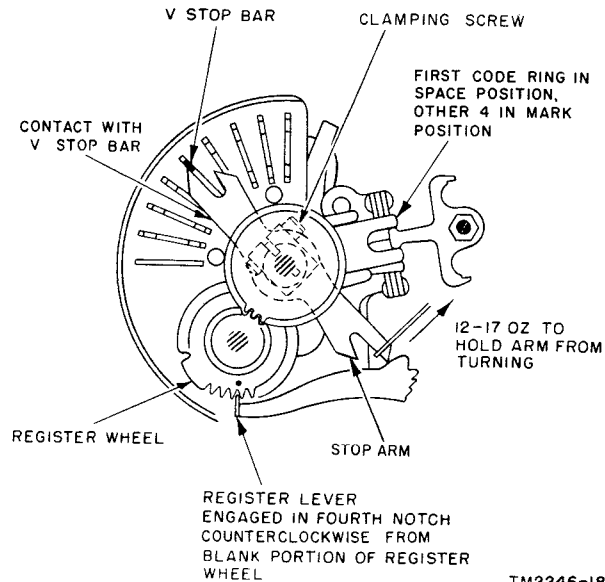
A



B

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Figure 460. Stop arm torque adjustment.



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Figure 461. Stop arm and register wheel alinement.

### 458. Stop Arm and Register Wheel Alinement

(fig. 461)

*a. Requirement.* With the stop arm against the left side of the selected V stop bar, the register lever should engage the fourth notch counterclockwise from the blank portion of the register wheel.

*b. Adjustments.*

- (1) Operate the code rings manually, placing the first code ring in the space position and the other four in the mark position. This will allow the V stop bar to be selected.
- (2) Loosen the clamping screw in the stop arm. Manually turn the typewheel driving gear until the register lever engages the fourth notch counterclockwise from the blank portion of the register wheel. When this requirement is met, tighten the clamping screw.

### 459. Typewheel and Register Wheel Alinement

(fig. 462)

*Note.* The stop arm and register wheel must be alined (par. 458) before this adjustment is made.

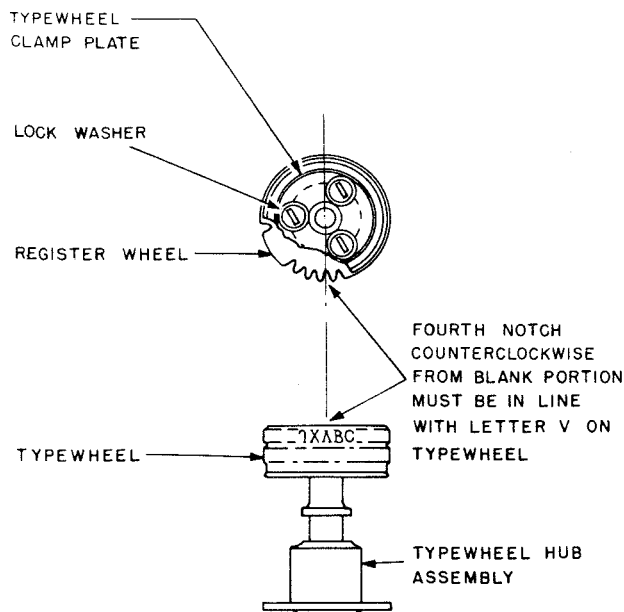


Figure 462. Typewheel and register wheel alinement.

a. *Requirement.* The letter V on the typewheel must be alined with the fourth notch counterclockwise from the blank portion of the register wheel.

b. *Adjustment.* Loosen the screws of the typewheel clamp plate mounting disk and turn the typewheel until the requirement is met; tighten the screws.

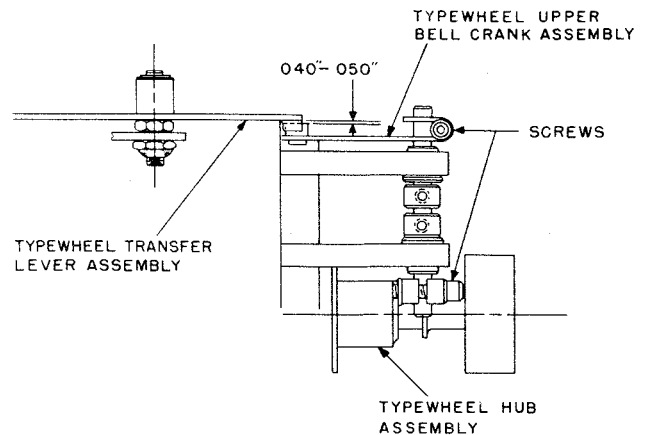
#### 460. Typewheel Transfer and Bellcrank Levers End Clearance Adjustments

a. *Requirements.*

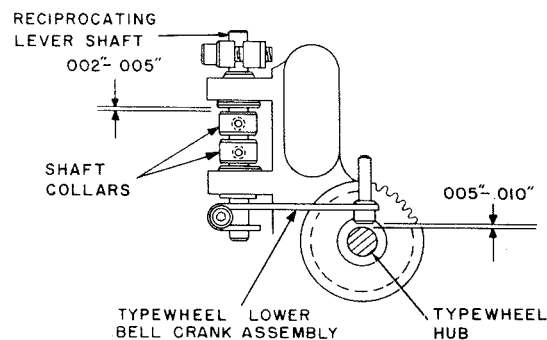
- (1) There should be a .040- to .050-inch clearance between the typewheel transfer lever and the upper bellcrank assembly (A, fig. 463).
- (2) There should be a .005- to .010-inch clearance between the typewheel lower bell crank assembly and the hub of the typewheel (B, fig. 463).
- (3) There should be a .002- to .005-inch clearance between the upper shaft collar and the frame (B, fig. 463).

b. *Adjustments.*

- (1) Loosen the screw in the upper bellcrank assembly and position the assembly to give the required clearance;



A



B

Figure 463. Typewheel and bellcrank levers end clearance adjustments.

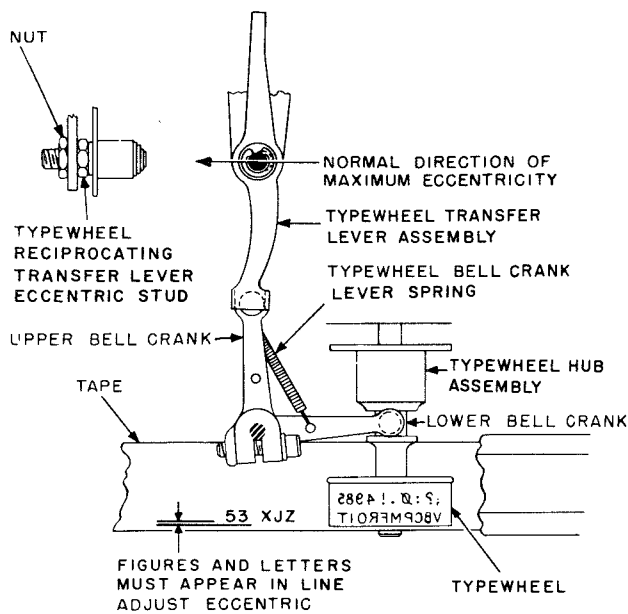
tighten the screw and recheck the clearance.

- (2) Loosen the screw in the lower bellcrank assembly. Adjust for the required clearance between the lower bellcrank assembly and the typewheel hub; tighten the screw and recheck the clearance.
- (3) Loosen the setscrew in the upper shaft collar and position the shaft collar to give the proper clearance, tighten the setscrew and recheck the clearance.

#### 461. Typewheel Figures-Letters Alinement

(fig. 464)

a. *Requirement.* The printing of figures and letters on the tape must appear in a straight line of print.



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Figure 464. Typewheel figures-letters alinement.

b. *Adjustment.* Loosen the nut on the typewheel reciprocating transfer lever eccentric stud of the transfer lever assembly and adjust the type wheel reciprocating transfer lever eccentric stud until the requirement is met; tighten the nut and recheck the requirements.

#### 462. Print and Register Levers Shaft End-Play Adjustment (fig. 465)

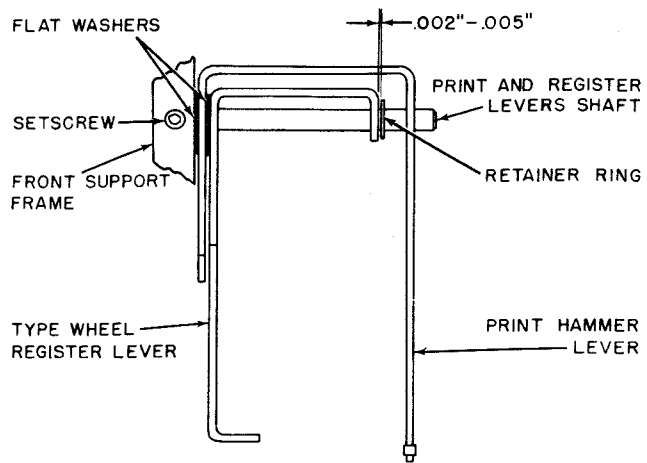
a. *Requirement.* There should be a .002- to .005-inch clearance between the retainer ring and the typewheel register lever.

b. *Adjustment.* Loosen the setscrew in the front support frame. Insert a feeler gage between the retainer ring and the typewheel register lever. Move the print and register levers shaft toward the front support frame. Tighten the setscrew.

#### 463. Copy Alinement Adjustment (fig. 466)

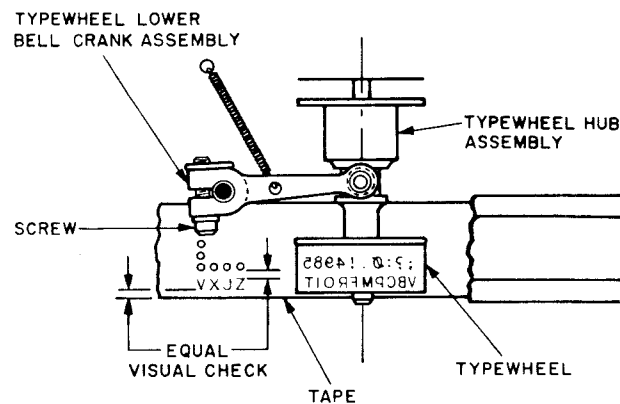
a. *Requirement.* The copy should be equally spaced between the first line of the punched code holes and the edge of the tape.

b. *Adjustment.* Loosen the screw in the typewheel lower bellcrank assembly and adjust the typewheel hub assembly until the requirement is met; tighten the screw. After this ad-



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Figure 465. Print and register levers shaft end-play adjustment.



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Figure 466. Copy alinement adjustment.

justment, always recheck the feed hole spacing and detent eccentric stud alinement adjustment (par. 475).

#### 464. Print Hammer Lever Alinement in Operated Position (fig. 467)

a. *Requirement.* When the print hammer lever is in the printing (upper) position, there should be approximately .010-inch clearance between the print hammer lever and the typewheel.

b. *Adjustment.* Loosen the locking nut on the print hammer eccentric stop. Rotate the print cam to the position shown. Adjust the print hammer eccentric stop until the requirement is met. Tighten the locking nut and check

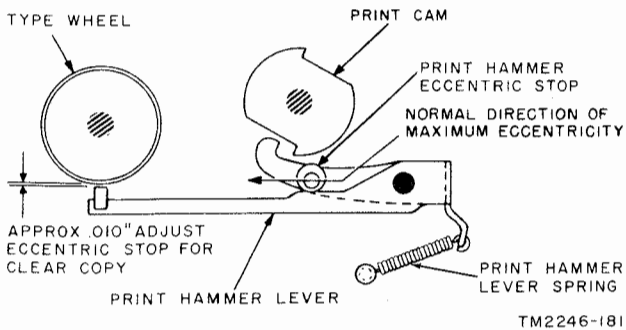


Figure 467. Print hammer lever alinement in operated position.

the printed copy; if the printing is too light or too heavy, readjust the print hammer eccentric stop slightly. (Check related adjustment, paragraph 465.)

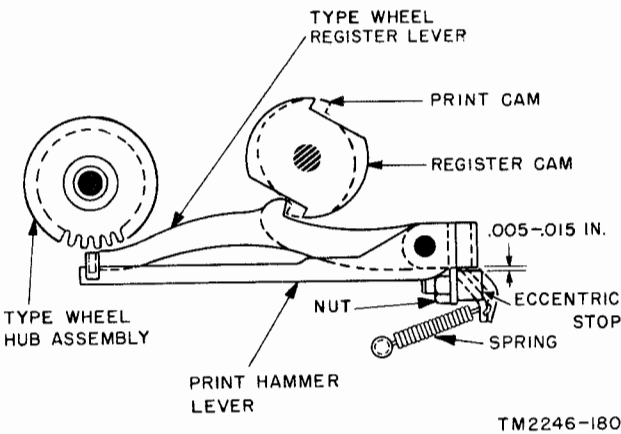


Figure 468. Typewheel register lever alinement in operated position.

#### 465. Typewheel Register Lever Alinement in Operated Position (fig. 468)

*a. Requirement.* There should be a .005- to .015-inch clearance between the typewheel register lever and the eccentric stud.

*b. Adjustment.* Loosen the locknut and position the eccentric stud until the requirement is met; tighten the locknut and recheck the clearance. (Check related adjustment, paragraph 464.)

#### 466. Code Hole Punch Levers Clearance Adjustment (fig. 469)

*a. Requirement.* There should be a .001- to .003-inch clearance between the last flat washer

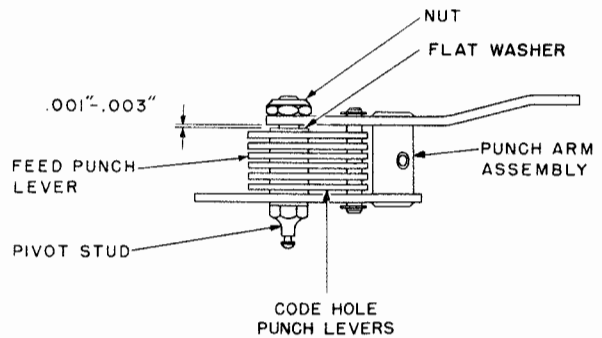


Figure 469. Code hole punch levers clearance adjustment.

in the pivot stud and the punch arm.

*b. Adjustment.* Loosen the nut and adjust the pivot stud for proper clearance; tighten the nut and recheck the requirement.

#### 467. Code Punch Bars and Code Hole Punch Levers Alinement and Clearance Adjustment (fig. 470)

*a. Requirements.*

- (1) There should be a .001- to .006-inch clearance between each code punch lever and the flat surfaces of its associated code punch bar.
- (2) There should be a .001- to .003-inch clearance between the comb and the flat surface of each code punch bar.

*b. Adjustments.*

- (1) Loosen the screws that hold the code die assembly to the front support frame. Insert or remove enough

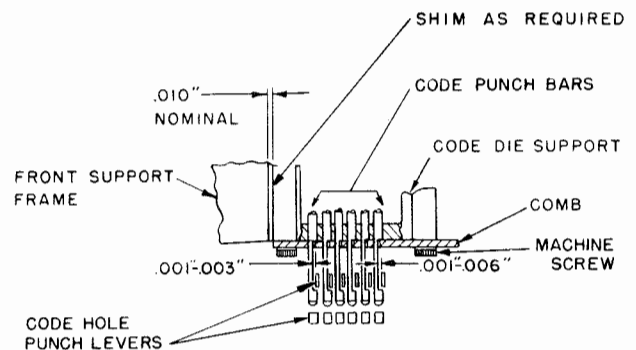


Figure 470. Code punch bars and code hole punch levers alinement and clearance adjustment.

shims to meet the requirement in *a* (1) above; tighten the screws and recheck the clearance.

- (2) Loosen the machine screws holding the comb to the code die support. Position the comb until requirement in *a* (2) above is met; tighten the machine screws and recheck the clearance.

#### 468. Punch Interference and Code Hole Punch Levers Alinement Adjustment (fig. 471)

*a. Requirement.* The code hole punch lever blocking arms of the interference levers should be alined for equal spacing as shown.

*b. Adjustment.* Loosen the setscrew in the front support frame and position the interference levers to meet the requirement; tighten the setscrew and recheck the requirement.

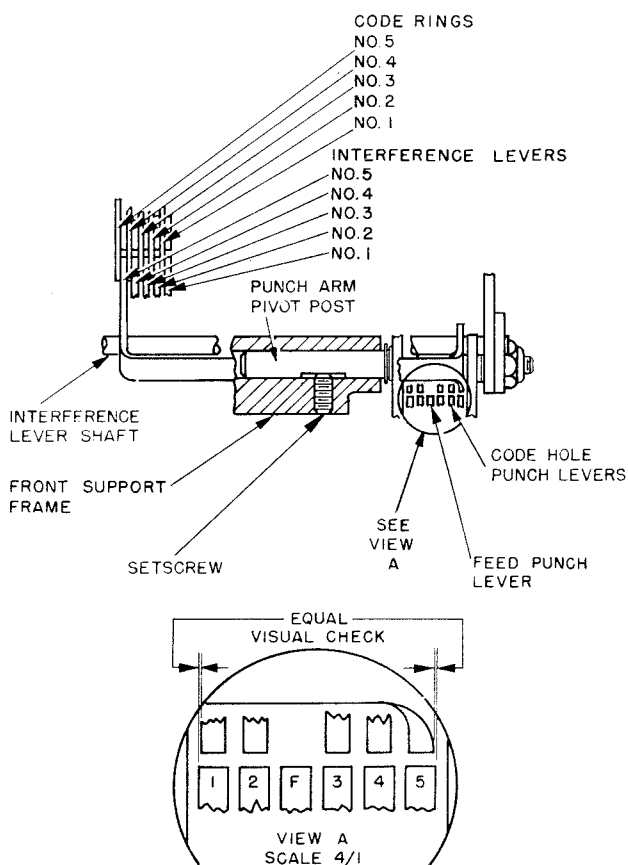


Figure 471. Punch interference and code hole punch levers alinement adjustment.

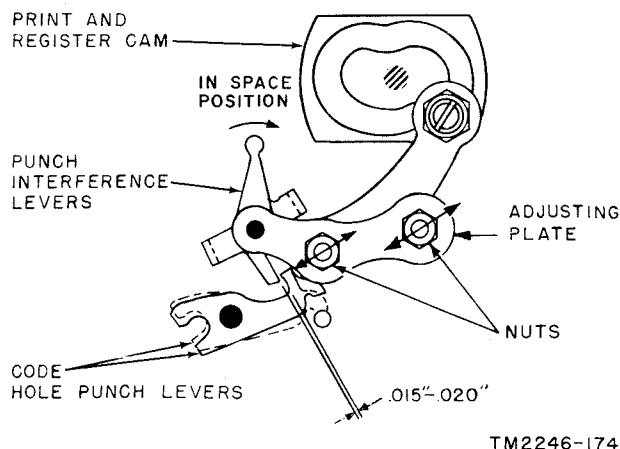


Figure 472. Punch and interference levers clearance adjustment.

#### 469. Code Hole Punch and Interference Levers Clearance Adjustment (fig. 472)

*a. Requirement.* There should be a .015- to .020-inch clearance between the code hole punch levers and interference levers when the interference levers are in the space position.

*b. Adjustment.* Loosen the nuts and position the adjusting plate until the requirement is met; tighten the nuts and recheck the clearance.

#### 470. Code Hole Punch Levers and Cam Roller Clearance Adjustment (fig. 473)

*a. Requirement.* There should be a .005- to .010-inch clearance between the code hole punch levers and the lower edge of the notch in the code punch bars when the punch arm assembly is at its maximum counterclockwise position.

*b. Adjustment.* Loosen the locknut and adjust the eccentric stud until the requirement is met. The eccentric stud is to be adjusted for minimum clearance between the cam roller and the print and register cam. Tighten the locknut and recheck the clearance.

#### 471. Tape Feed Detent Lever Alinement (fig. 474)

*a. Requirement.* A pull of 9 to 15 ounces should be required to start the detent lever moving away from the detent wheel.

*b. Method of Checking.* With the eccentric stud adjusted for maximum eccentricity as



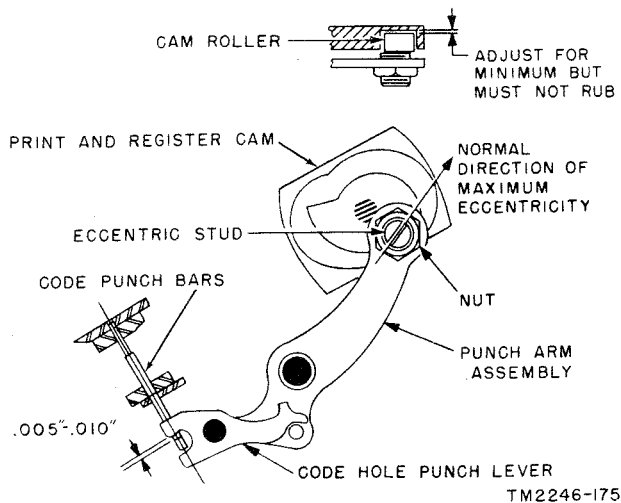


Figure 473. Code hole punch levers and cam roller clearance adjustment.

shown, check the pull with a spring scale. If the pull is less than minimum, replace the spring. (Check related adjustment, paragraph 475.)

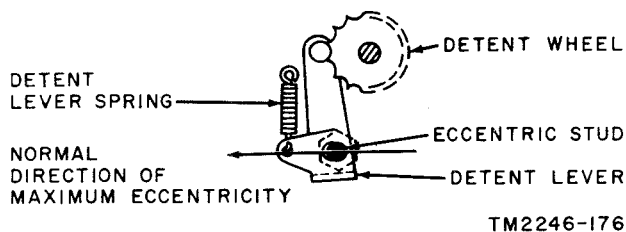


Figure 474. Tape feed detent lever alignment.

## 472. Feed Pawl Alinement (fig. 475)

*a. Requirement.* There should be a .010- to .025-inch clearance between the feed pawl and the ratchet wheel when the print and register cam is in the stop position.

*b. Adjustment.* Loosen the locknut on the feed pawl pivot and turn the feed pawl pivot until the requirement is met; tighten the locknut and recheck the clearance.

## 473. Feed Pawl and Ratchet Wheel Clearance Adjustment (fig. 476)

*a. Requirement.* The feed pawl should turn the ratchet one tooth for each operation.

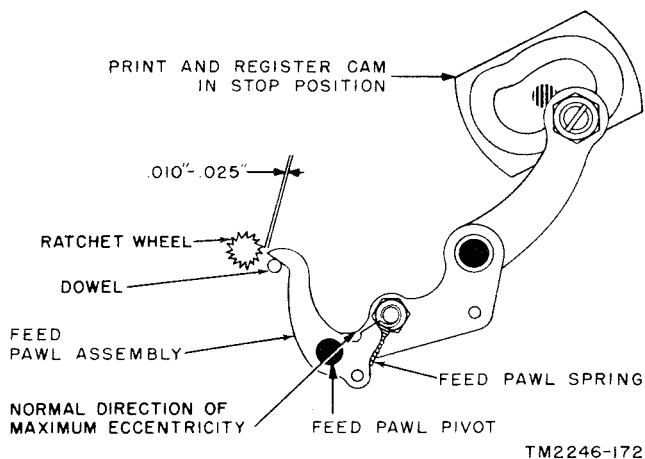


Figure 475. Feed pawl alignment.

*b. Adjustment.* Release the lever latch and turn the motor by hand until the feed pawl turns the ratchet wheel one tooth. Turn the machine screw in or out so that the feed pawl will just clear the ratchet tooth when the motor is turned by hand to complete the cycle. Recheck this step to be sure that there is a complete feed of one tooth by the feed pawl.

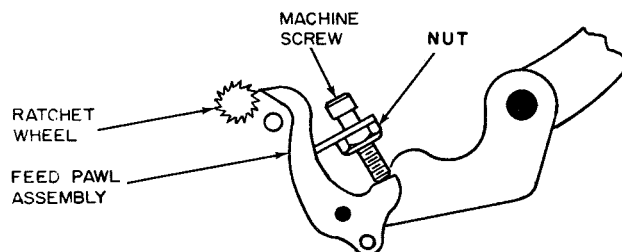
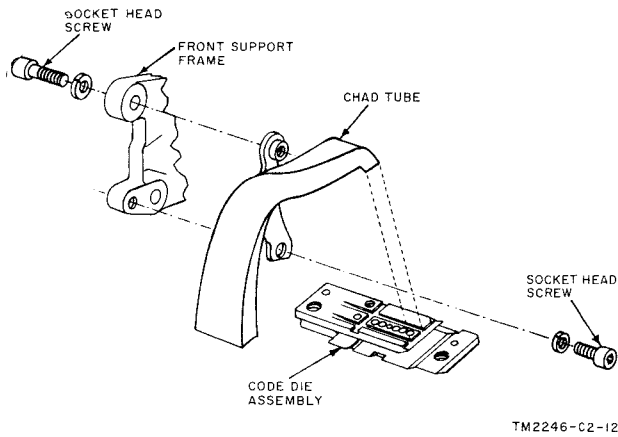


Figure 476. Feed pawl and ratchet wheel clearance adjustment.

## 474. Chad Tube Locating Adjustment (fig. 477)

*a. Requirement.* The chad tube should be centered over the holes in the code die assembly. The chad tube should be engaged in the grooves of the code die assembly whenever a grooved assembly is provided.

*b. Adjustment.* Loosen the two socket head screws that hold the chad tube to the front support frame. Position the tube and tighten the two screws.



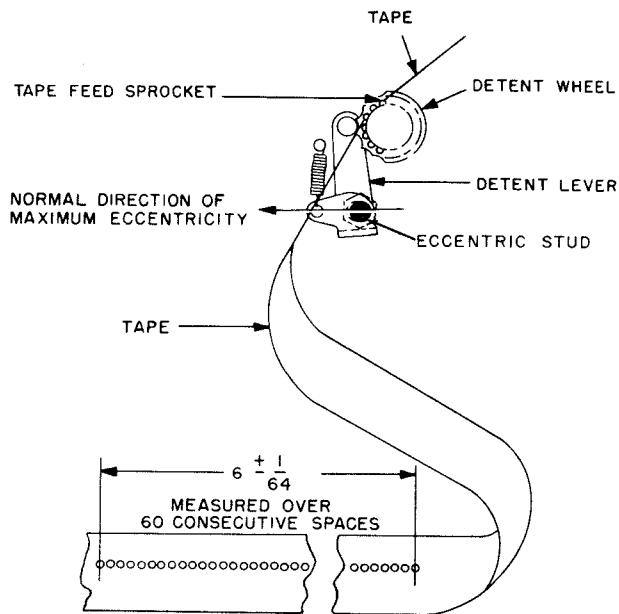
TM2246-C2-12

Figure 477. Chad tube locating adjustment.

### 475. Feed Hole Spacing and Detent Eccentric Stud Alinement (fig. 478)

*a. Requirement.* The punched feed holes in the messages tape should be spaced evenly; 10 holes per inch.

*b. Adjustment.* Measure the distance between 60 consecutive holes. The distance should be 6 inches plus or minus  $\frac{1}{64}$  inch. If the requirement is not met, loosen the eccentric stud locknut, turning the eccentric stud clock-



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Figure 478. Feed hole spacing and detent eccentric stud alinement.

wise to decrease spacing, or counterclockwise to increase spacing, until the requirement is met. Tighten the locknut and recheck the requirement. Repeat this procedure until the requirement is met.

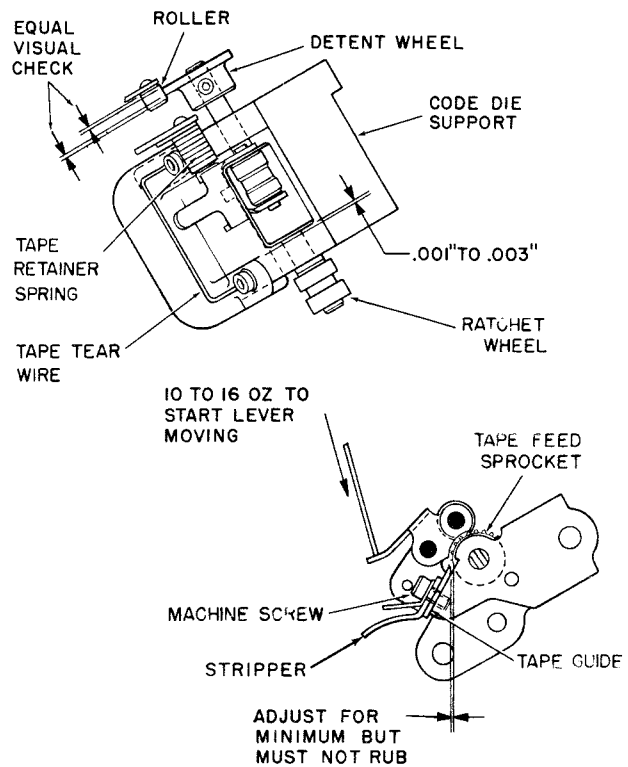
### 476. Tape Feed Sprocket and Retaining Adjustment (fig. 479)

*a. Requirements.*

- (1) There should be minimum clearance between the stripper and the tape feed sprocket.
- (2) There should be a .001- to .003-inch clearance between the tape feed sprocket and the code die support.
- (3) The detent wheel should be centered with the roller on the detent lever.

*b. Adjustments.*

- (1) Loosen the two machine screws holding the stripper and move the stripper up or down until the tape feed sprocket will turn without rubbing



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Figure 479. Tape feed sprocket and retaining adjustment.

against the stripper; tighten the machine screws.

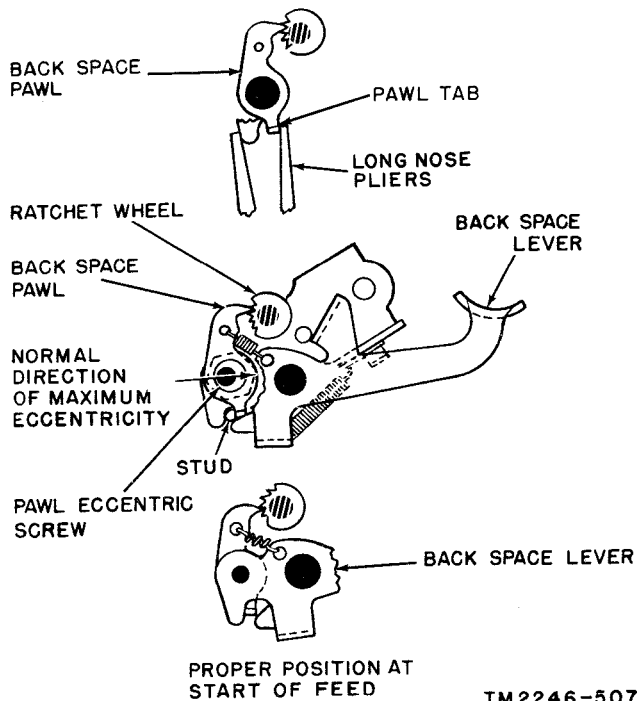
- (2) Loosen the two setscrews in the tape feed sprocket. Push the ratchet wheel against the code die support and move the tape feed sprocket axially on the ratchet wheel shaft to obtain the required clearance; tighten the two setscrews.
- (3) Loosen the setscrew on the detent wheel and move the detent wheel to center it with the roller on the detent lever; tighten the setscrew.

#### 477. Back Space Mechanism Alinement

(fig. 480)

*a. Requirement.* With a full depression of the backspace lever, the tape should backspace one character.

*b. Adjustment.* Loosen the pawl eccentric screw locknut and rotate the pawl eccentric screw to meet the requirement. If the requirement cannot be obtained by rotating the pawl eccentric screw, bring into close adjustment and bend the pawl tab with a long-nosed pliers.



TM 2246-507

Figure 480. Backspace mechanism alinement.

#### 478. Sensing Levers Retracting Levers Adjustment (Not Applicable to Order No. 26563-P-52)

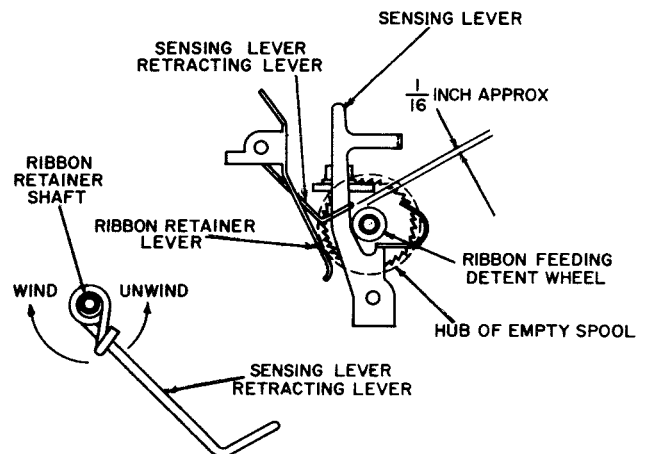
(fig. 481)

*a. Requirements.*

- (1) There should be approximately  $\frac{1}{16}$ -inch clearance between the lower extension of the sensing lever retracting lever and the ribbon feeding detent wheel, when the sensing lever is all the way forward against the ribbon feeding detent wheel.
- (2) The sensing lever must be free to move all the way forward against the ribbon feeding detent wheel, when the ribbon retainer lever is against the hub of the empty spool. When the ribbon retainer lever is held back, the sensing lever must be retracted sufficiently to allow removal of the empty ribbon spool.

*Method of Checking.*

- (1) Remove the ribbon spool. With the sensing lever all the way forward against the ribbon feeding detent wheel, check the clearance visually.
- (2) Place an empty ribbon spool on the ribbon spool shaft. With the ribbon retainer lever against the empty ribbon spool, check to see that the sensing lever moves all the way forward



TM 2246-C2-13

Figure 481. Sensing levers retracting levers adjustment.

against the ribbon feeding detent wheel. Then hold the ribbon retainer lever back and check to see that the sensing lever is retracted sufficiently to allow removal of the empty ribbon spool.

*c. Adjustments.*

- (1) Reform the lower extension of the sensing lever retracting lever to meet the requirement of *a*(1) above.
- (2) Remove the ribbon retainer lever, the ribbon retainer lever spring, and the ribbon retainer lever collar. With the sensing lever retracting lever still on the ribbon retainer shaft, wind or unwind the coiled portion of the sensing lever retracting lever until the requirement of *a*(2) above is met. To check the requirement while making the adjustment, place the ribbon retainer lever on the ribbon retainer shaft without a collar. When the requirement has been met, reassemble the ribbon retainer lever, the ribbon retainer lever collar, the ribbon retainer lever spring, and make the ribbon retainer levers adjustment (par. 479).

*Note.* Unwinding the coiled portion of the sensing lever retracting lever causes the sensing lever to be retracted farther. Winding will allow the sensing lever to move farther forward.

**479. Ribbon Retainer Levers Adjustment (Not Applicable to Order No. 26563-P-52)**

(fig. 482)

*a. Requirements.*

- (1) The ribbon retainer levers should be positioned so that there is a slight clearance between the ribbon retainer levers and the inside of the ribbon spool when the ribbon spool is in full engagement with the ribbon feeding detent wheel.
- (2) The ribbon retainer levers should prevent the ribbon spools from becoming disengaged from the ribbon feeding detent wheels.

*b. Methods of Checking.*

- (1) Visually check for clearance.

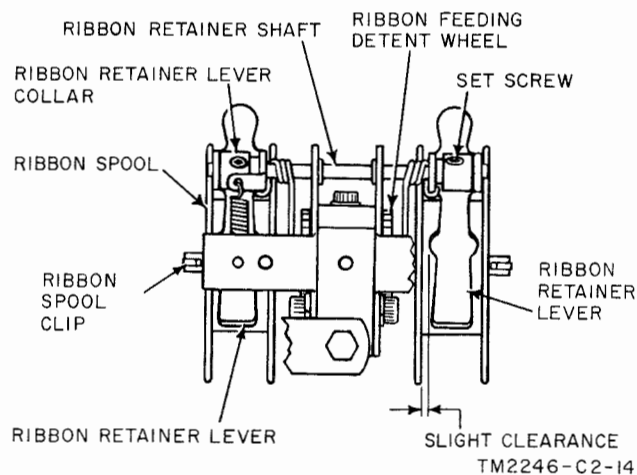


Figure 482. Ribbon retainer levers adjustment.

- (2) Unlock the ribbon spool clips and pull outward on the ribbon spool. When the outward motion of the spool is stopped by the ribbon retainer lever, check for the requirement by turning the ribbon spool. The spool should not turn unless the ribbon feeding detent wheel turns with it.

*c. Adjustment.* Loosen the two setscrews in each of the ribbon retainer lever collars and position the retainer levers to meet the requirements. Tighten the setscrews and recheck the requirements.

*Note.* After this adjustment has been made, check to make sure that the sensing levers (par. 480) move all the way forward under the reversing arms, without binding.

**480. Empty Spool Sensing Levers Adjustment (Not Applicable to Order No. 26563-P-52)**

(fig. 483)

*a. Requirement.* The empty spool sensing levers must move forward through the hole in the empty ribbon spool.

*b. Method of Checking.* Place an empty ribbon spool on the ribbon spool shaft. Lock the spool in with the ribbon spool clip. Rotate the spool slowly. The sensing lever should move forward in the center of the hole in the empty ribbon spool. Check both sensing levers.

*c. Adjustment.* Remove the empty ribbon spool and bend the lower extension of the empty spool sensing lever to the right or left

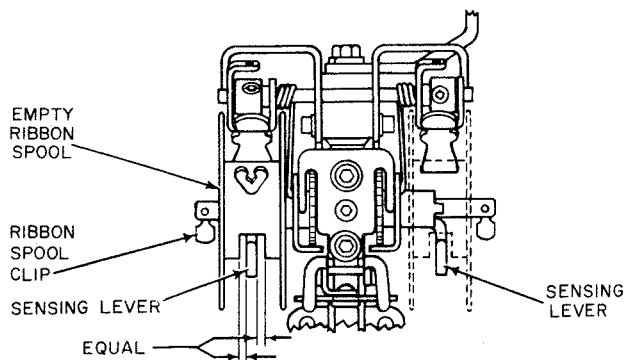


Figure 483. Empty spool sensing levers adjustment.

to meet the requirement. Adjust both sensing levers.

### 481. Ratchet Feed Detent Adjustment (fig. 484)

*a. Requirement.* There should be a minimum overtravel of .010 inch of the ribbon feeding detent wheel when the ribbon feed cam follower is on the high part of the cam.

*b. Adjustment.* Loosen the setscrew holding the eccentric stud and turn the eccentric stud counterclockwise to meet the requirement; tighten the setscrew.

*Note.* The sensing levers should be held out of engagement with the ribbon reversing arm. A rubber band can be used.

### 482. Sensing Lever Adjustment (fig. 485)

*a. Requirement.* When the cam follower is against the low side of the cam, there should be not more than .005-inch clearance between the ribbon reversing arm and the empty spool sensing lever.

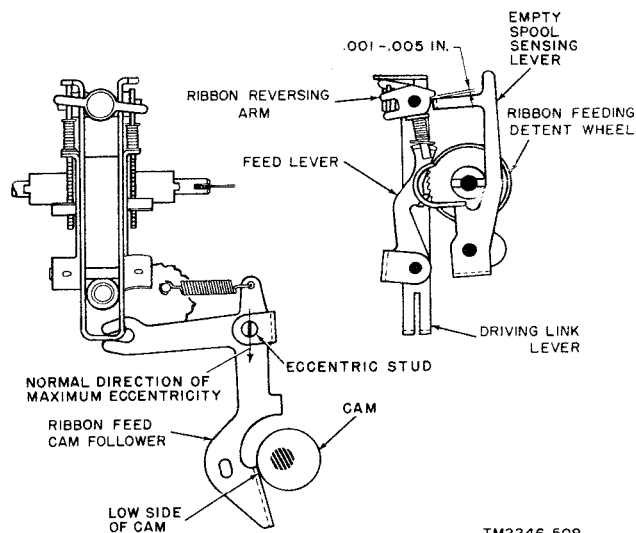


Figure 485. Sensing lever adjustment.

*b. Adjustment.* Bend the ear on the empty spool sensing lever to meet the requirement.

*Note.* The ear should engage the ribbon reversing arm approximately 50 percent of the thickness of the empty spool sensing lever.

### 483. Ribbon Feed Lever Adjustment (fig. 486)

*a. Requirement.* The feed lever should engage the ribbon feeding detent wheel with not more than a .005-inch clearance between the feed lever and the bottom of the tooth in the ribbon feeding detent wheel.

*b. Adjustment.* If the feed lever does not meet the requirement, carefully bend the toggle limiting tabs.

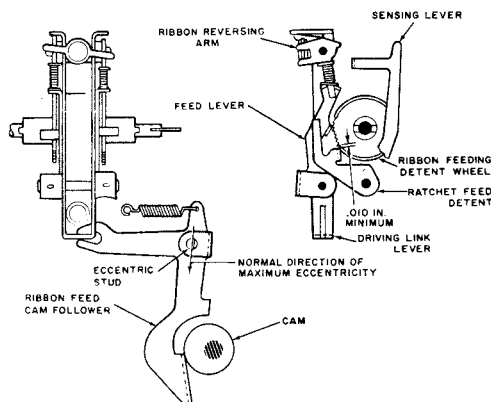
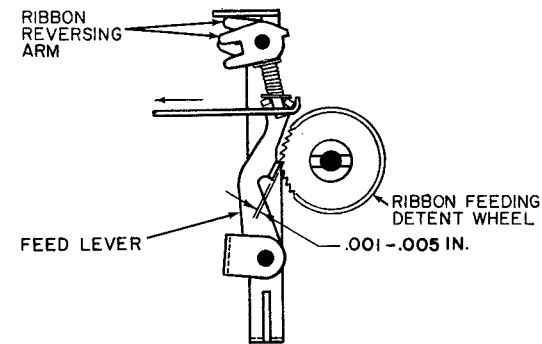
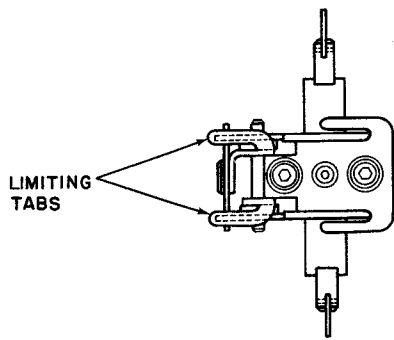
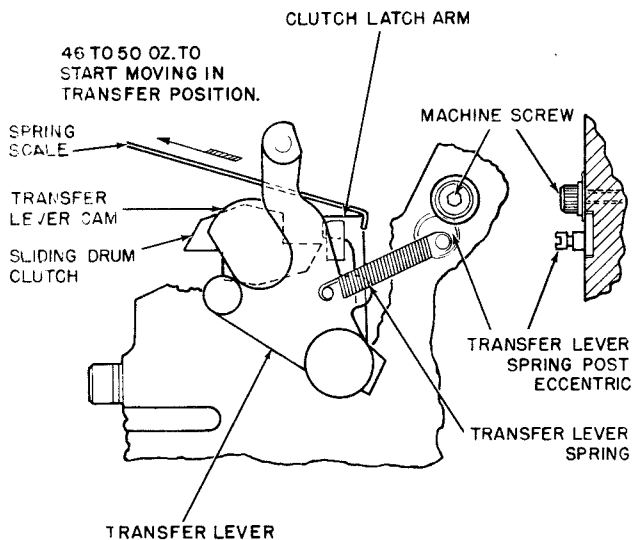


Figure 484. Ratchet feed detent adjustment.



TM2246-510

Figure 486. Ribbon feed lever adjustment.



TM2246-511

Figure 487. Simultaneous transfer lever spring adjustment.

#### 484. Simultaneous Transfer Lever Spring Adjustment

(fig. 487)

*a. Requirement.* It should require 46 to 50 ounces to start the clutch latch arm moving when the transfer lever is in the transferred position.

*b. Adjustment.* Loosen the machine screw and turn the transfer lever spring post eccentric to meet the requirement; tighten the machine screw.

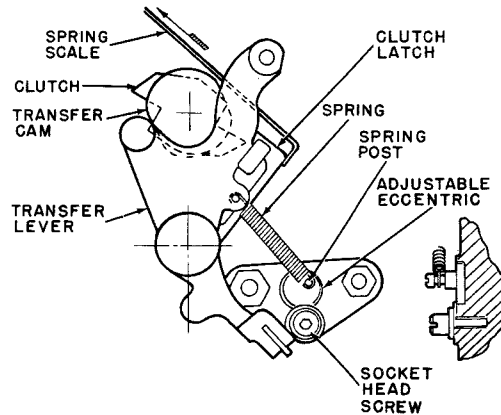
#### 485. Sequential Transfer Lever Spring Adjustment

(fig. 488)

*a. Requirement.* It should require 34 to 38 ounces to start the clutch latch arm moving when the transfer lever is in the transferred position.

*b. Adjustment.* Loosen the machine screw and turn the transfer lever spring stop eccentric to meet the requirement; tighten the machine screw.

34-38 OZ. TO START MOVING IN TRANSFER POSITION.



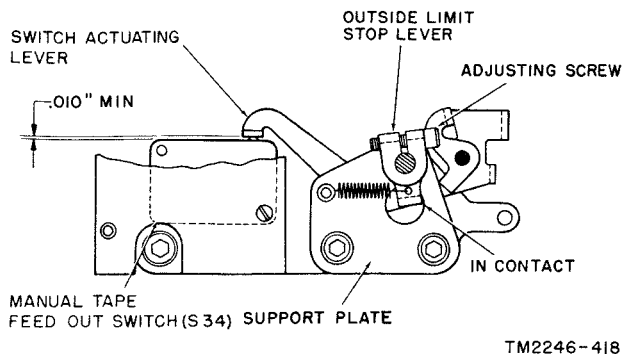
TM2246-512

Figure 488. Sequential transfer lever spring adjustment.

#### 486. Switch Operating Lever Adjustment

(fig. 489)

*a. Requirement.* There should be a minimum of a .010-inch clearance between the switch operating lever and the manual tape feed-out switch when the limit stop lever is in



TM2246-418

Figure 489. Switch operating lever adjustment.

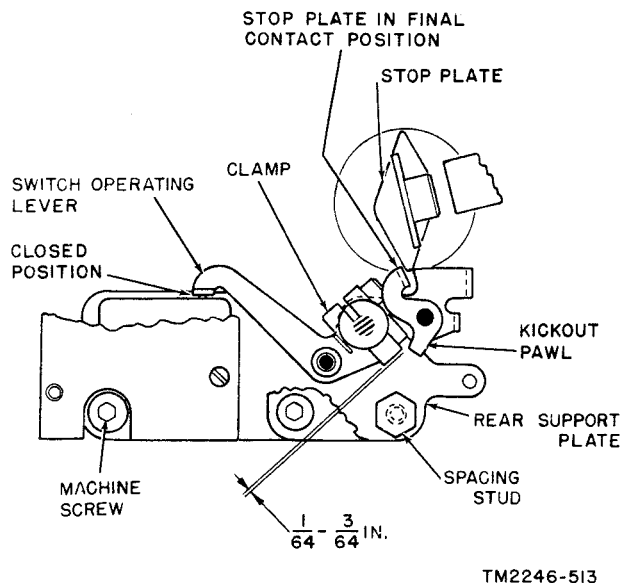
contact with the right side of the hole in the front support plate.

b. *Method of Checking.* The manual tape feed-out switch should be closed.

c. *Adjustment.* Loosen the machine screw and set the gap with a feeler gage. Turn the limit stop lever until it is in contact with the right side of the hole in the front support plate; tighten the machine screw.

#### 487. Kickout Pawl Adjustment (fig. 490)

a. *Requirement.* When the switch operating lever is in the closed position and the stop plate is just ready to be disengaged from the kickout pawl, there should be a  $\frac{1}{64}$ -to  $\frac{3}{64}$ -inch clearance between the kickout pawl and the clamp.



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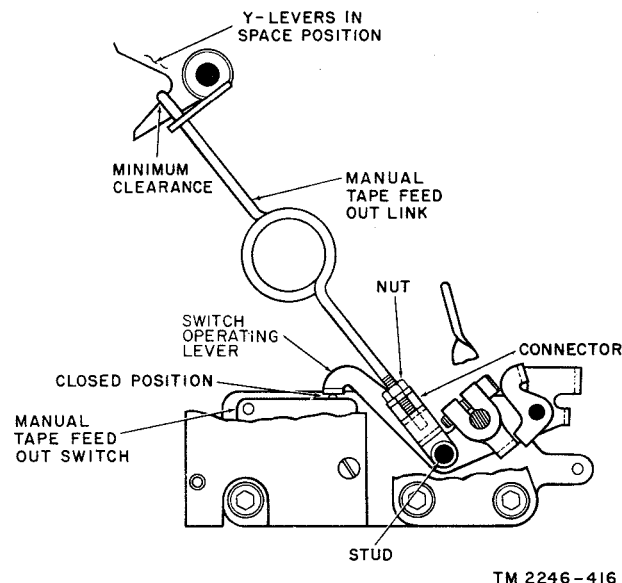
Figure 490. Kickout pawl adjustment.

b. *Adjustment.* Loosen the clamping screw and the screw in the spacing stud. Loosen the spacing stud and place the switch operating lever in closed position. Then turn the motor by hand until the stop plate is in its final contact position, the position of the stop plate just before it loses contact with the kickout pawl. Move the rear support plate until a gap of  $\frac{1}{64}$  to  $\frac{3}{64}$  inch is set between the inside clamp and the kickout pawl. Tighten the spacing stud, the clamping screw, and the spacing stud screw.

#### 488. Manual Tape Feed-Out Link Adjustment (fig. 491)

a. *Requirement.*

- (1) There should be a maximum of a .010-inch clearance between the connector and the retainer ring on the stud.
- (2) The Y-levers should be completely in the space position and the manual tape feed-out link slightly extended before the manual tape feed-out switch is operated.
- (3) All Y-levers should be engaged simultaneously by the manual tape feed-out link.



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Figure 491. Manual tape feed-out link adjustment.

*b. Adjustment.*

- (1) Add washer or washers and peel as required.
- (2) Remove the connector from the stud and back off the nut. Set the Y-levers in the space position and then move the switch operating lever until the manual tape feed-out switch operates. Turn the connector until it can be placed on the stud with just a slight pressure exerted by the manual tape feed-out link holding the Y-levers in the space position. Tighten the nut against the connector and replace the retainer ring on the stud.
- (3) Bend the hooked end of the manual tape feed-out link to engage all the Y-levers simultaneously. Recheck requirement in *a*(1) above.

### 489. Manual Tape Feed-Out Lever Adjustment (fig. 492)

*a. Requirement.* There should be approximately the same amount of travel of the manual tape feedout lever from the vertical to the open position of the switch operating lever as there is from the vertical to the closed position.

*b. Adjustment.* Loosen the machine screw on the manual tape feed-out lever. Position the manual tape feed-out lever approximately at an intermediate position between the open and

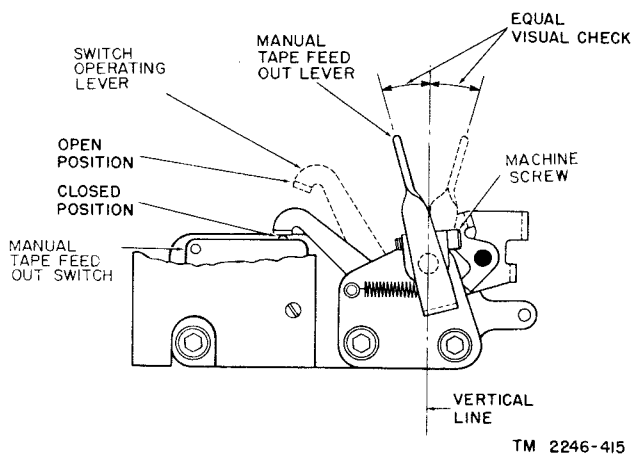


Figure 492. Manual tape feed-out lever adjustment.

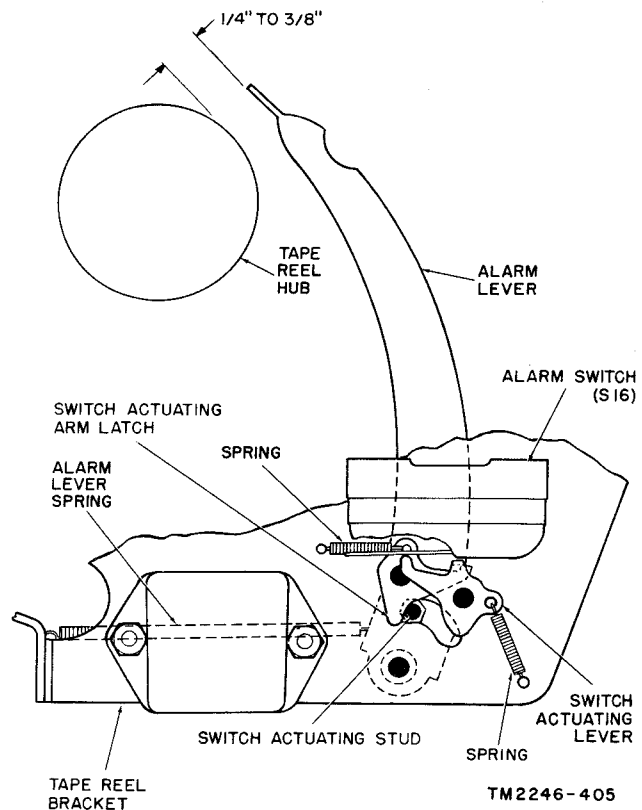


Figure 493. Alarm lever adjustment.

closed position of the switch operating lever and tighten the machine screw.

### 490. Alarm Lever Adjustment (fig. 493)

*a. Requirement.* The buzzer should sound when the alarm lever is moved to within  $\frac{1}{4}$  to  $\frac{3}{8}$  inch of the supply reel hub.

*b. Adjustment.* Loosen the nut on the switch actuating stud. Adjust the switch actuating stud to trip the switch actuating arm latch when the alarm lever is in the position shown above; tighten the nut.

### 491. Tape Guide Locating Adjustment (fig. 494)

*a. Requirements.* The tape guide should just touch the tape reel bracket as shown and the tape guide should be horizontal with the perforator base.

*b. Adjustment.* Loosen the tape guide machine screws and position the tape guide to meet the requirement.



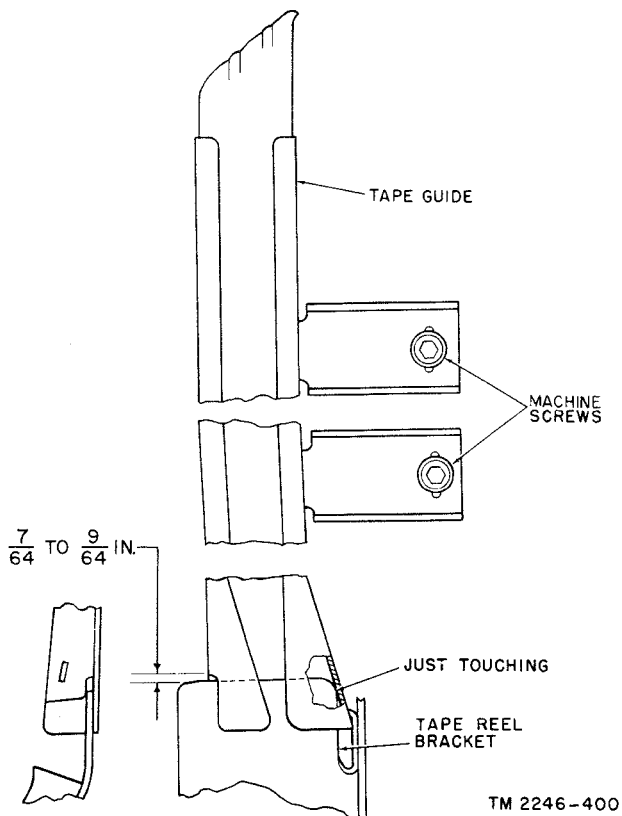


Figure 494. Tape guide locating adjustments.

#### 492. Perforator Latch Pulsing Cam Adjustment (fig. 495)

##### a. Requirements.

- (1) With the machine in the stop position, the notch on the perforator latch pulsing cam should be aligned with the end of the cam follower (A, fig. 496).
- (2) There should be an additional clearance of .005 to .008 inch between the cam follower stop and the cam follower after the contacts have just touched, and then the perforator latch pulsing cam rotated so that the cam follower is on the high part of the perforator latch pulsing cam (B, fig. 496).

##### b. Adjustments.

- (1) Loosen the setscrew in the perforator latch pulsing cam and rotate the perforator latch pulsing cam until the notch is aligned with the end of the cam follower; tighten the setscrew.

- (2) Rotate the perforator latch pulsing cam until the cam follower is on the high part of the perforator latch pulsing cam. Loosen the two machine screws and move the perforator latch pulsing contact (S20 on TT-178/FG and TT-179/FG; S218 on all other models) until contacts just touch. Check the clearance between the cam follower stop and the cam follower. To this clearance add .005 to .008 inch. Move the perforator latch pulsing contacts toward the perforator latch pulsing cam until the clearance plus the .005 to .008 inch is between the cam follower stop and the cam follower; tighten the machine screws. Check the requirement in a(1) above to make sure the cam follower is still aligned with the notch on the perforator latch pulsing cam.

*Note.* There should be between .002- to .005-inch end play in the perforator latch pulsing cam shaft.

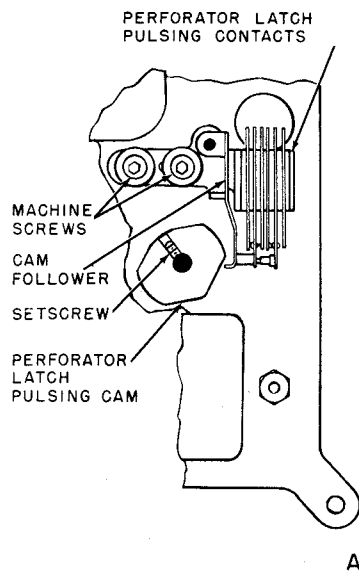
#### 493. Receiving Multisolenoid Pulsing Cam Adjustment (fig. 496)

##### a. Requirements.

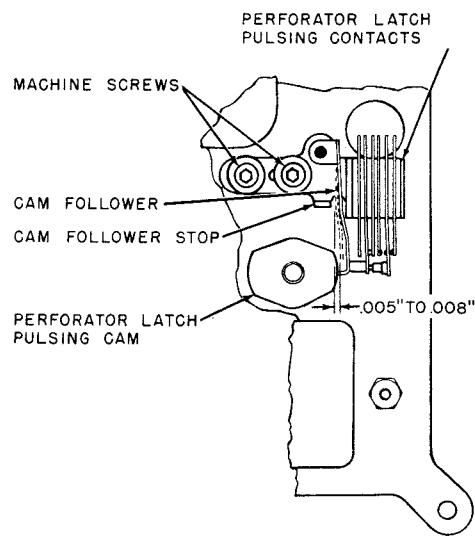
- (1) With the machine in the normal stop position, the setscrew of the receiving multisolenoid pulsing cam should be aligned with the mating end of the cam follower. In the normal stop position, the contact closest to the cam should be open .020 to .030 inch while the contact away from the cam should be open .010 to .015 inch.
- (2) There should be an additional clearance of .005 to .008 inch between the cam follower stop and the cam follower after contacts just touched, and then the receiving multisolenoid pulsing cam rotated so the cam follower is on the high part of the receiving multisolenoid pulsing cam (B, fig. 496).

##### b. Adjustment.

- (1) Loosen the setscrew in the receiving multisolenoid cam. Rotate the receiving multisolenoid cam to meet the re-



A



B

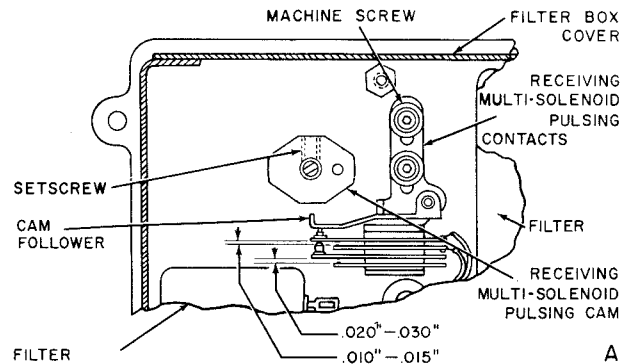
TM2246-514

Figure 495. Perforator latch pulsing cam adjustment.

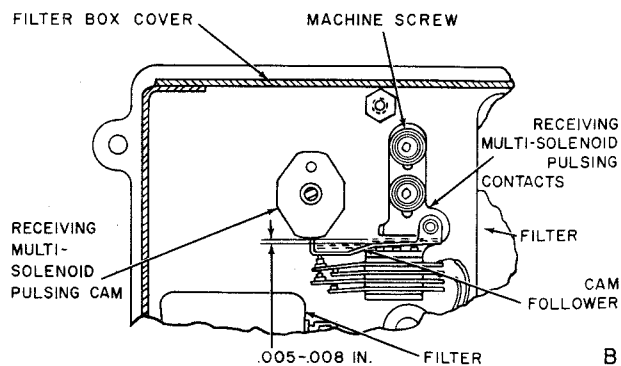
quirement; tighten the setscrew. Bend the contacts to meet the requirement or replace with new receiving multi-solenoid pulsing contacts (S18 on TT-178/FG and TT-179/FG; S217 on all other models).

- (2) Rotate the receiving multisolenoid cam until the cam follower is on the high part of the receiving multisolenoid cam. Loosen the two machine screws and move the receiving multi-solenoid pulsing contacts until the contacts just touch. Check the clearance between the cam follower stop and the cam follower, and to this clearance add .005 to .008 inch. Move the receiving multisolenoid pulsing contacts toward the receiving multi-solenoid pulsing cam until the clearance plus the .005 to .008 inch is between the cam follower stop and the cam follower. Tighten the machine screws. Check the requirement in a(1) above to see if the cam follower is still aligned with the notch in the receiving multisolenoid pulsing cam.

*Note.* There should be between .002- to .005-inch end play in the receiving multi-solenoid pulsing cam shaft.



A



B

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Figure 496. Receiving multisolenoid pulsing cam adjustment.

#### 494. Dust Cover Knob and Copy Light Screws Adjustments

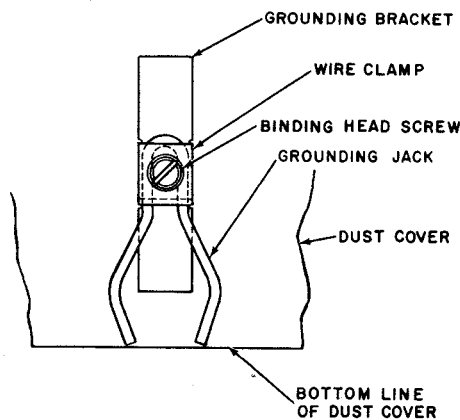
Refer to the chart below for references to these perforator adjustments which are identical to the same adjustments for the page printer.

Adjustment	Par. ref.	Fig. ref.
Dust cover knob adjustment.....	403	418
Dust cover copy light screws adjustment.....	401	416

#### 495. Dust Cover Grounding Jack Adjustment (fig. 497)

a. *Requirement.* The grounding jack should be even with or just above the bottom line of the dust cover.

b. *Adjustment.* Loosen the binding head screw and slide the grounding jack to meet the requirement; tighten the binding head screw.



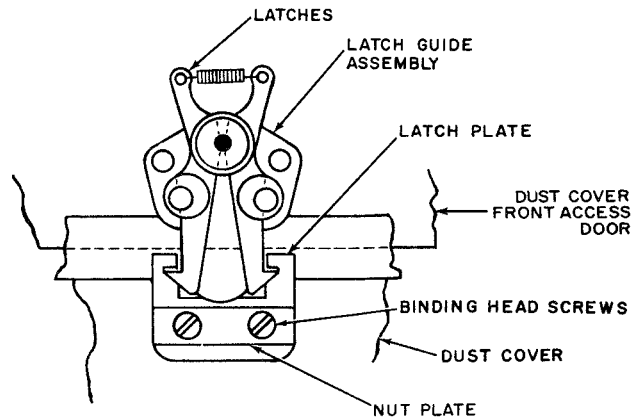
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Figure 497. Dust cover ground jack adjustment.

#### 496. Dust Cover Latch Adjustment (fig. 498)

a. *Requirement.* The dust cover front door should close smoothly and be tight when closed.

b. *Adjustment.* Loosen the binding head screws and move the latch plate until it just touches the contacting surfaces of the two latches evenly. Tighten the binding head screws. Operate the dust cover door a few times to see if it meets the requirement; readjust if necessary.



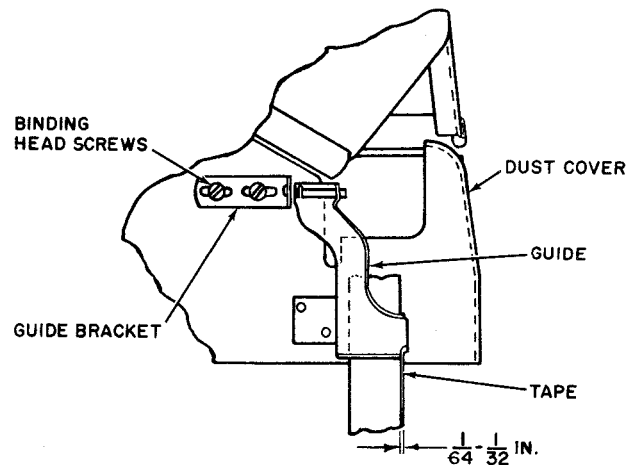
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Figure 498. Dust cover latch adjustment.

#### 497. Dust Cover Tape Guide Adjustment (fig. 499)

a. *Requirement.* There should be  $\frac{1}{64}$ - to  $\frac{1}{32}$ -inch clearance between the edge of the tape coming from the reperforator and the ear on the guide.

b. *Adjustment.* Loosen the binding head screws and slide the guide bracket to meet the requirement; tighten the binding head screws.



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Figure 499. Dust cover tape guide adjustment.

#### 498. Transmitter Contact Bail End Play Adjustment (fig. 500)

a. *Requirement.* There should be a .002- to .005-inch clearance between the retainer ring on the post and the transmitter contact bail.

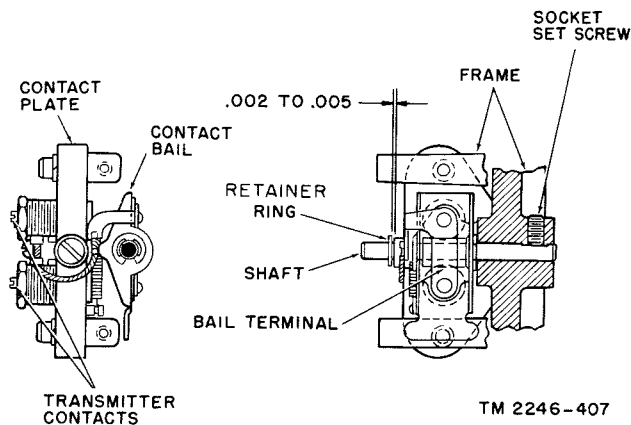


Figure 500. Transmitter contact bail end play adjustment.

b. *Adjustment.* Loosen the socket setscrew and move the post axially to meet the requirement; tighten the socket setscrew.

### 499. Selector Lever End Play Adjustment (fig. 501)

a. *Requirement.* There should be a .002- to .005-inch clearance between the spacer and the first selector lever.

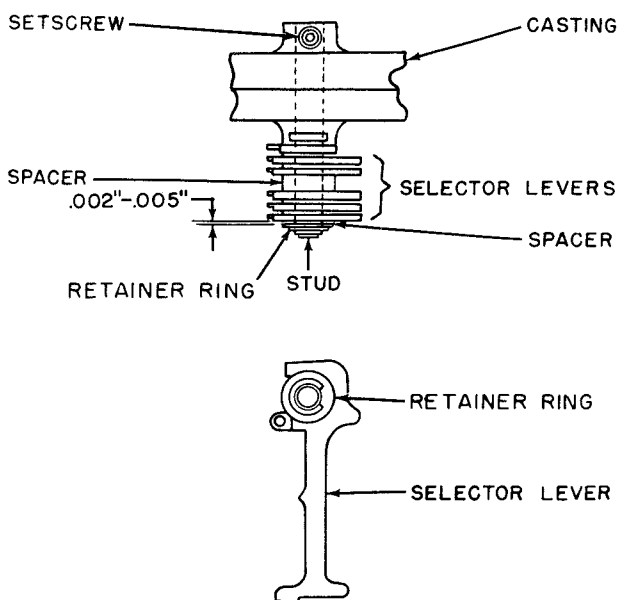


Figure 501. Selector lever end play adjustment.

b. *Adjustment.* Loosen the setscrew and slide the stud in or out to meet the requirement. Tighten the setscrew.

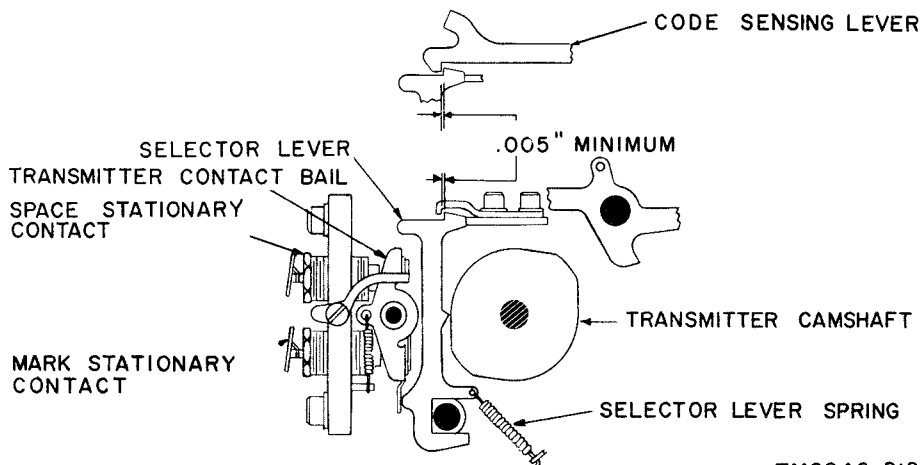
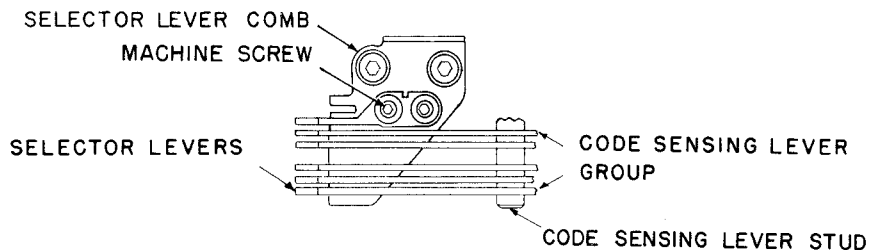


Figure 502. Selector lever engagement and stop selector lever latch adjustment.

## 500. Selector Lever Engagement

(fig. 502)

*a. Requirement.* There should be a minimum of a .005-inch clearance between the latching surface of each code sensing lever and the latching surface of its mating selector lever.

*b. Adjustment.* Loosen the two screws that mount the selector lever comb and position the selector lever comb until the requirement is met. Check the clearance at each of the five selector levers and readjust if necessary.

## 501. Clutch Magnet Armature Eccentric Stud Adjustment

(fig. 503)

*a. Requirement.*

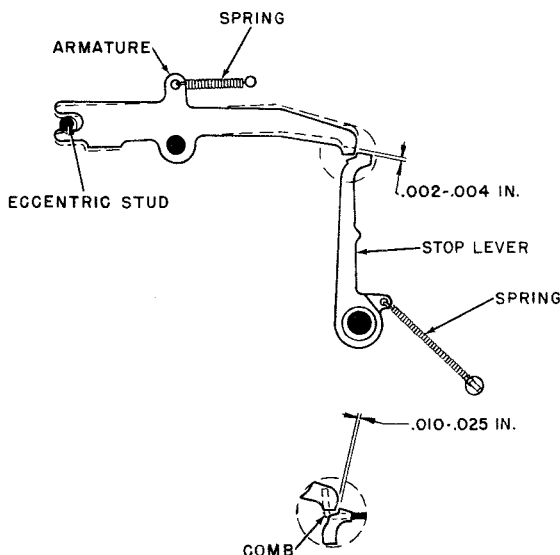
(1) There should be a .002- to .004-inch clearance between the top of the stop lever and the clutch magnet armature when the clutch magnet armature is in its operated position.

(2) There should be a .010- to .025-inch clearance between the locking edges of the levers.

*b. Adjustment.*

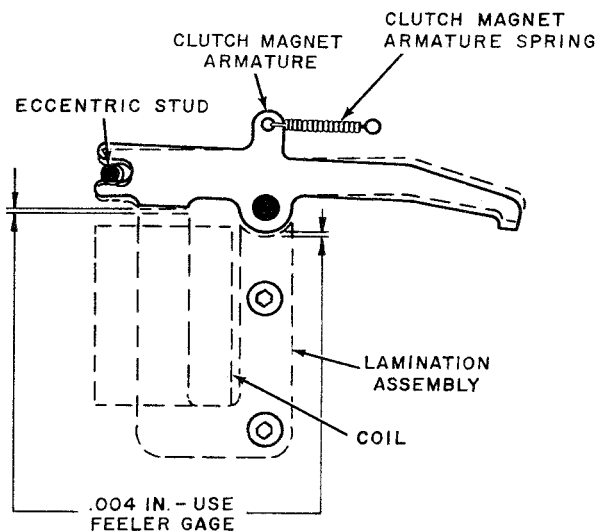
(1) Loosen the setscrew in the casting above the eccentric stud and position the eccentric stud until the requirement is met.

(2) Position the selector lever comb to meet the requirement.



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Figure 503. Clutch magnet armature eccentric stud adjustment.



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Figure 504. Clutch magnet adjustment.

## 502. Clutch Magnet Adjustment

(fig. 504)

*a. Requirement.* There should be a .003- to .004-inch clearance between the laminated clutch magnet cores and the clutch magnet armature when the clutch magnet armature is in its operated position.

*b. Adjustment.* Loosen the two screws mounting the clutch magnet and position the cores to meet the requirement; tighten the screws. Use perforator tape as feeler gage.

## 503. Stop Selector Lever Latch Adjustment

(fig. 502)

*a. Requirement.* There should be minimum breaks in the send circuit between successive marking impulses.

*b. Method of Checking.* With the power connected to the transmitter-distributor and a voltmeter set for at least 115 volts dc connected across the mark and common contact, slowly rotate the motor by hand. Watch the voltmeter; any indication of voltage will show breaks between marking impulses.

*c. Adjustment.* With the voltmeter connected as described in *b* above, and a tape per-

forated with the letters code group inserted in the transmitter-distributor, back off the marking stationary contact until breaks in the send circuit are indicated on the meter. Screw the contact a short distance toward the transmitter contact bail. Rotate the motor by hand and watch the meter for breaks in the circuit. Repeat this procedure until all breaks between successive marking impulses are of an absolute minimum duration. Recheck adjustment in paragraph 500.

#### 504. Tape Guide Adjustment

(fig. 505)

*a. Requirement.* There should be a .002- to .005-inch clearance between the tape guide and the tape cover.

*b. Adjustment.* Back the setscrews away from the guide retaining screws. Adjust the tape guide retaining screws to meet the requirement when the tape guide is held against the heads of the tape guide retaining screw; tighten the setscrews against the tape guide retaining screws.

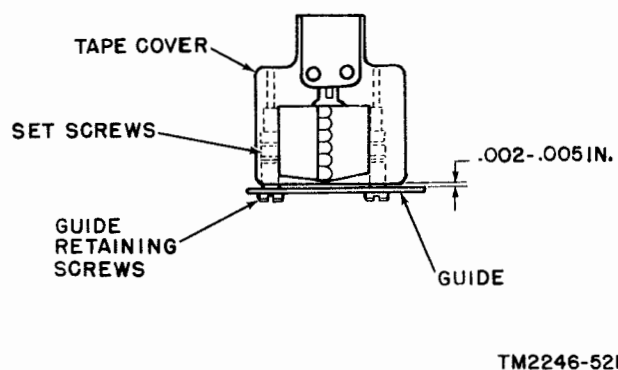


Figure 505. Tape guide adjustment.

#### 505. Tape Cover and Tape Guide Adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG)

(fig. 506)

*a. Requirement.* There should be a .003-inch maximum clearance between the tape guide and the tape cover.

*b. Adjustment.* Back the setscrews away from the adjustment screws. Adjust the adjustment screws to meet the requirement when the tape guide is held against the heads of the screws. Tighten the setscrews against the ad-

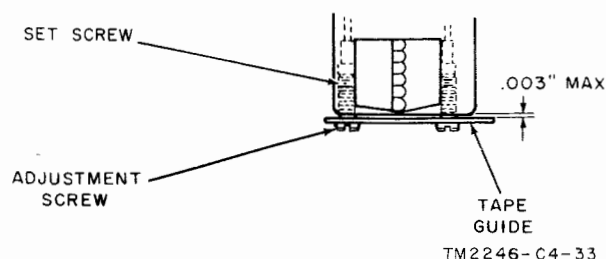


Figure 506. Tape cover and tape guide adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG).

justment screws. Check related adjustments (pars. 506, 511, 513, and 516).

*Note.* To make this adjustment, remove the tape cover from the top cover.

#### 506. Top Cover Preliminary Adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG)

(fig. 507)

*a. Requirement.* The tape cover should be parallel with the tape guide in the top cover.

*b. Adjustment.* Loosen the setscrew and turn the eccentric screw clockwise or counterclockwise to meet the requirement. Check related adjustment (par. 508).

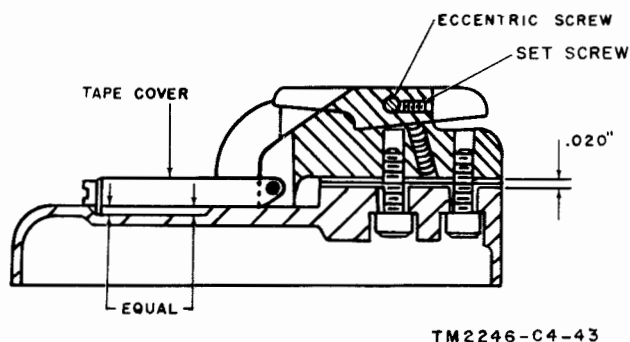


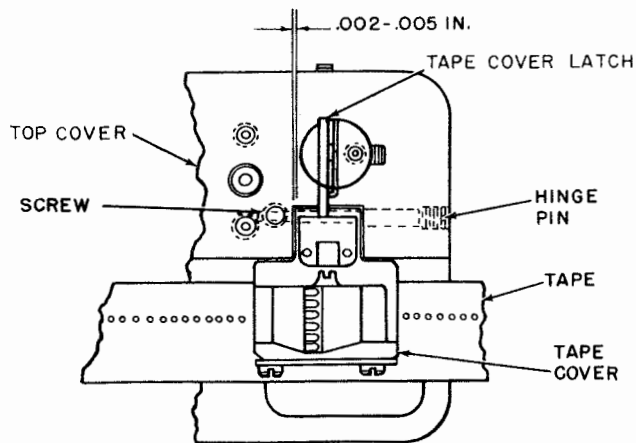
Figure 507. Top cover preliminary adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG).

#### 507. Tape Cover Clearance Adjustment

(fig. 508)

*a. Requirement.* There should be a .002- to .005-inch clearance between the tape cover and the top cover when the tape cover is pushed to the right against the shoulder of the hinge pin.

*b. Adjustment.* Loosen the screw and insert a feeler gage between the tape cover and the top cover. Use a screwdriver to turn the hinge pin until the shoulder is tight against the tape



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Figure 508. Tape cover clearance adjustment.

cover; tighten the screw and remove the feeler gage.

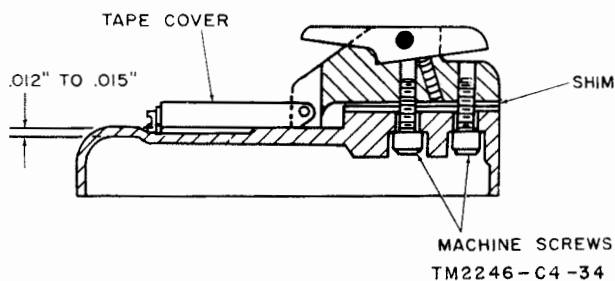
### 508. Tape Cover Clearance Adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG)

(fig. 509)

*a. Requirement.* There should be a .012- to .015-inch clearance between the tape cover and the top cover of the transmitter-distributor.

*b. Adjustment.* Loosen the machine screws and add or remove the shims to meet the requirement. Tighten the machine screws and recheck the clearance. Check related adjustment (par. 510).

*Note.* To make this adjustment, remove the top cover from the transmitter-distributor.



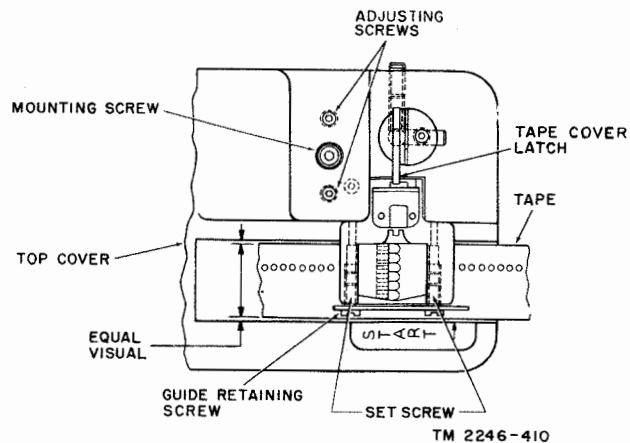
MACHINE SCREWS  
TM2246-C4-34

Figure 509. Tape cover clearance adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG).

### 509. Top Cover Alinement

(fig. 510)

*a. Requirement.* There should be equal clearance between the edges of a piece of  $\frac{7}{8}$ -inch tape and the tape guide in the top cover



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Figure 510. Top cover alinement.

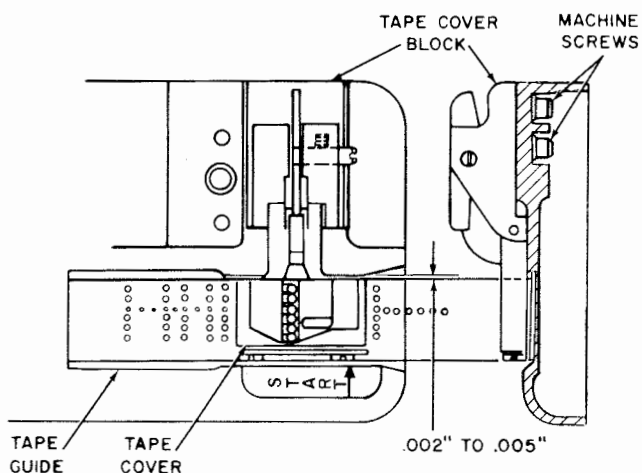
when the feed pins are fully in the tape feed holes.

*b. Adjustment.* Move the start-stop lever to the start position. Loosen the three mounting screws and reposition the top cover until the requirement is met; tighten the three mounting screws.

### 510. Tape Cover Block Adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG)

(fig. 511)

*a. Requirement.* There should be a .002- to .005-inch clearance between the edge of the tape guide of the top cover and the message tape when the code holes of a message tape perforated with LTRS code combination is centered with the holes in the tape cover.



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Figure 511. Tape cover block adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG).

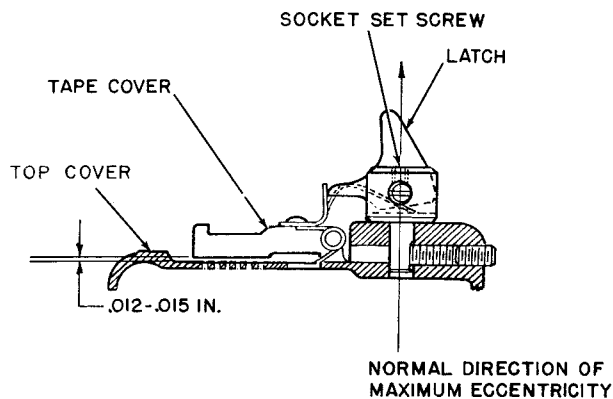
b. *Method of Checking.* Perforate a message tape with the LTRS code combination and position the message tape .002 to .005 inch from the tape guide. The holes of the tape cover should be centered over the perforations in the message tape.

c. *Adjustment.* Loosen the two machine screws and position the tape cover block to meet the requirement. Check related adjustment (par. 513).

### 511. Tape Cover Latch Adjustment (fig. 512)

a. *Requirement.* There should be a .012- to .015-inch clearance between the bottom of the tape cover and the surface of the top cover when the tape cover is latched.

b. *Adjustment.* Loosen the socket setscrew and turn the tape cover latch eccentric to meet the requirement; tighten the socket setscrew.



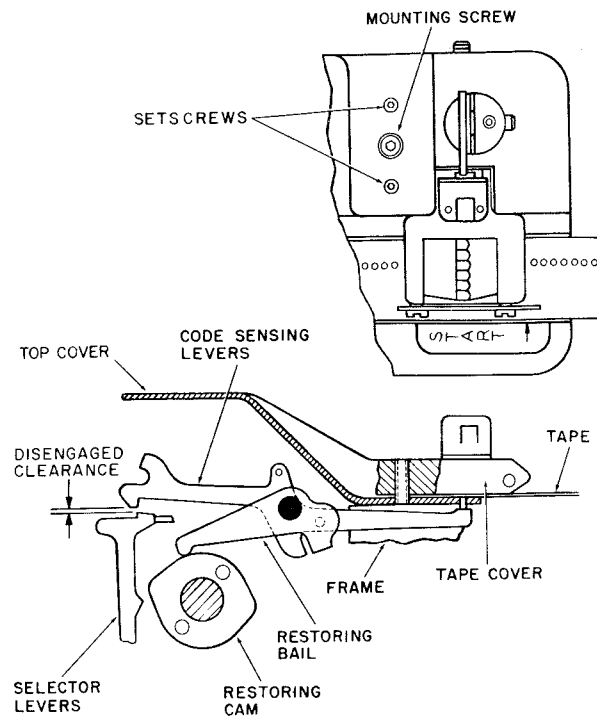
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Figure 512. Tape cover latch adjustment.

### 512. Selector Lever and Code Sensing Lever Clearance Adjustment (fig. 513)

a. *Requirement.* The engagement and disengagement of the code sensing levers with the selector levers should be equal.

b. *Method of Checking.* Place a piece of blank tape under the tape cover and move the start-stop lever to the start position. Turn the motor by hand until the restoring bail is on the low portion of the restoring cam and the sensing levers are against the tape. Check clearance between the code sensing levers and



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Figure 513. Selector lever and code sensing lever clearance adjustment.

the selector levers by eye. Lift the tape cover and remove tape and check engagement of the code sensing levers and selector levers by eye. The clearance and engagement should be equal.

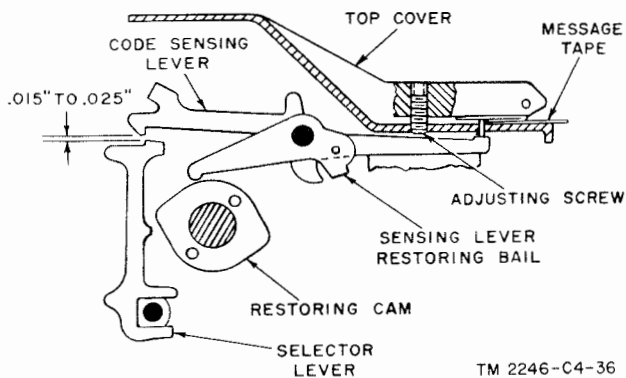
c. *Adjustment.* Loosen the front mounting screw in the top cover and turn the two adjusting screws up or down to meet the requirement. Tighten the front mounting screw and recheck requirement. To increase the clearance turn the adjusting screws up. To decrease clearance turn adjusting screws down.

### 513. Selector Lever and Code Sensing Lever Clearance Adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG) (fig. 514)

a. *Requirement.* There should be a .015- to .025-inch clearance between the top of the selector levers and the tip of the code sensing levers, when the sensing lever restoring bail is on the low part of the restoring cam, and the sensing levers are held downward in the space position by a blank piece of message tape.

b. *Method of Checking.* With a piece of blank message tape inserted under the tape





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Figure 514. Selector lever and code sensing lever clearance adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG).

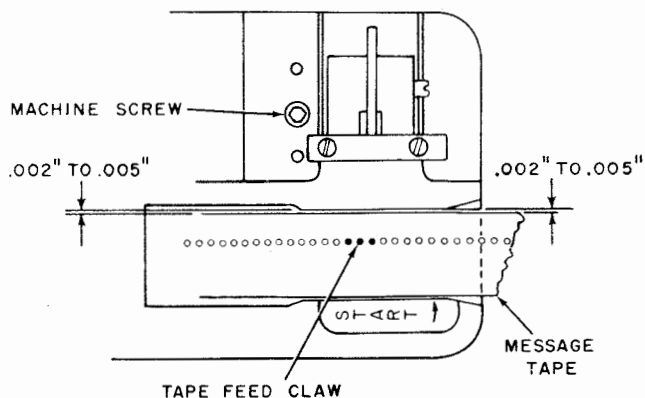
cover, move the stop-start lever to the START position. Rotate the transmitter-distributor camshaft until the sensing lever restoring bail is against the low part of the restoring cam, and the sensing levers are against the message tape. Check the clearance.

*c. Adjustment.* With the top cover held in place with only the two rear mounting screws, fold a piece of blank message tape, as shown in figure 490, and position it under the tape cover so one thickness of message tape is over the sensing lever pins and three thicknesses are under the front part of the tape cover. Manually energize the clutch magnet armature lever and turn the transmitter-distributor camshaft until the sensing lever restoring bail is on the low part of the cam and the sensing levers are against the message tape. Hold down the tape cover tight against the top cover and turn the adjusting screws in the top cover up or down until the requirement is met. Replace and tighten the front mounting screw. Recheck the clearance. Check related adjustments (par. 514 and 516).

*Note.* Turn the adjusting screws clockwise to decrease the clearance, or counterclockwise to increase the clearance.

#### 514. Top Cover Adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG) (fig. 515)

*a. Requirement.* With the tape feed claw engaging the feed holes of the message tape, the edge of the message tape should be .002 to .005 inch from the guide of the top cover.



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Figure 515. Top cover adjustment (TT-178A/FG, TT-179A/FG, and TT-181/FG).

*b. Adjustment.* Loosen the three machine screws that mount the top cover and position the top cover to meet the requirement. Tighten the mounting machine screws and recheck the requirement.

#### 515. Tape-out Lever Spring Adjustment (fig. 516)

*a. Requirement.* With the tight tape lever held in the up position, it should require a force of 84 to 98 grams to move the tape-out lever below the tape chute.

*b. Adjustment.* Wind the torsion spring about the tape-out lever pivot to meet the requirement.

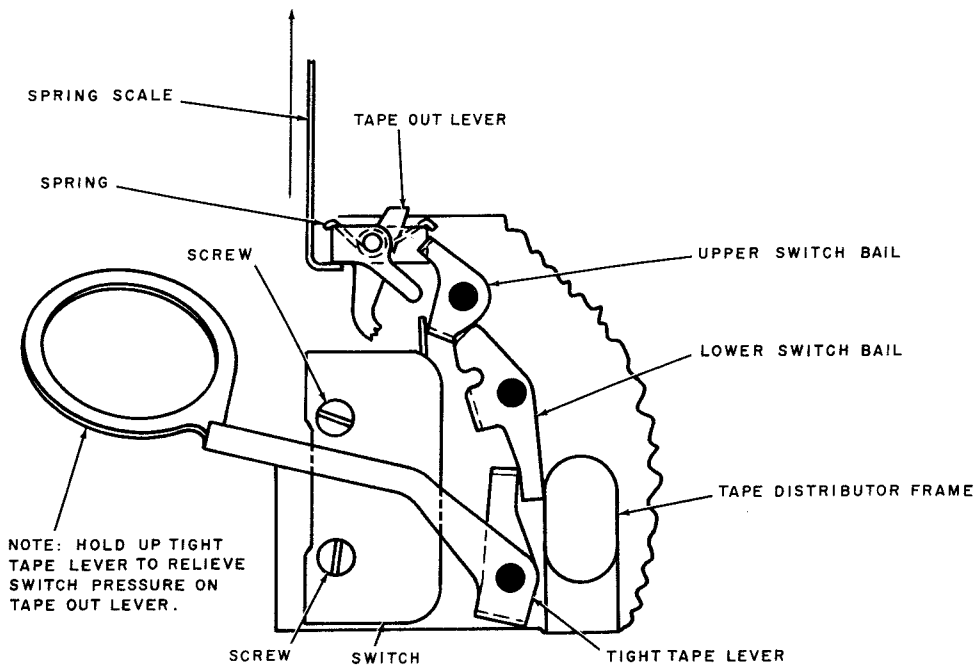
#### 516. Upper Switch Bail Adjustment (fig. 517)

*a. Requirement.*

- (1) With the start-stop lever detent and the start-stop lever in the position shown, there should be a clearance of .005 to .025 inch between the tape-out lever and the upper switch bail.
- (2) The start-stop switch should be actuated in the center positions of the lever.

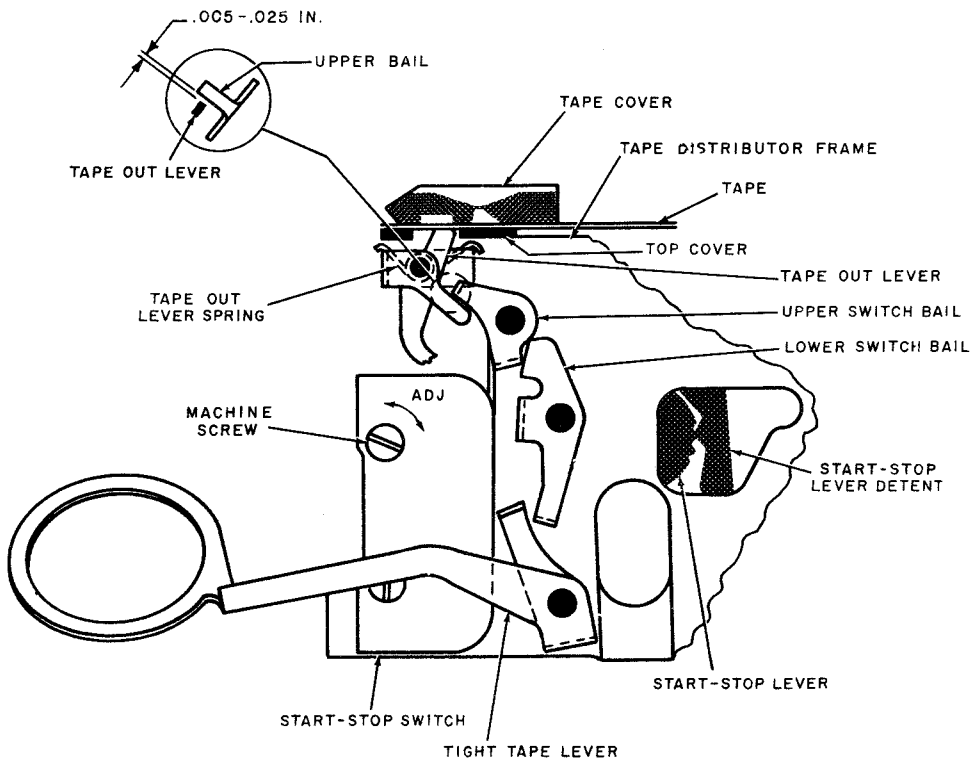
*b. Adjustment.*

- (1) Obtain required clearance by bending the upper switch bail.
- (2) Loosen the two start-stop switch machine screws and position the switch to meet the requirement; tighten the machine screws.



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Figure 516. Tape-out lever spring adjustment.



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Figure 517. Upper switch bail adjustment.

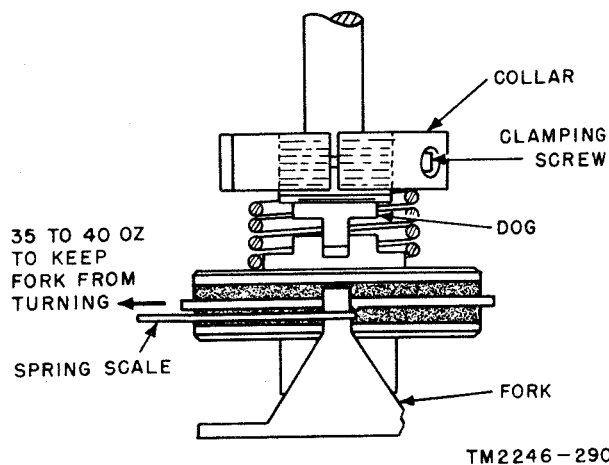


Figure 518. Transmitter-distributor friction clutch adjustment.

### 517. Transmitter-distributor Friction Clutch Adjustment

(fig. 518)

a. *Requirement.* It should require a pull of 35 to 40 ounces to prevent the transmitter-distributor friction clutch from turning when the motor is on.

b. *Method of Checking.* Install a piece of punched tape in the transmitter-distributor. Hook a spring scale on the clutch fork. Move the transmitter-distributor control lever to the start position and, while holding the scale rigidly, read the scale.

c. *Adjustment.* Loosen the clamping screw on the clutch collar and turn the collar until the clutch spring exerts moderate pressure on the clutch disk. Tighten the clamping screw on the collar and check the requirement. Re-adjust until the proper setting is attained.

### 518. Motor Governor Contacts Alignment

(fig. 519)

a. *Requirement.*

- (1) The contacts should be visually centered and adjusted for maximum area of engagement.
- (2) A maximum force of 8 ounces should be required to turn the gear assembly at any point within the operating range of the motor.

b. *Adjustment.*

- (1) Loosen the contact arm spring mounting screw and position the contact

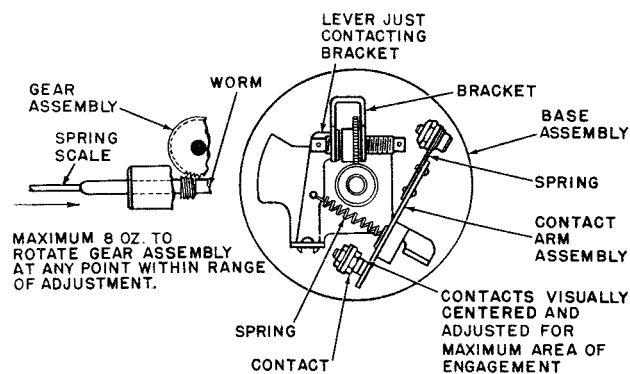


Figure 519. Motor governor contacts alignment.

arm assembly to meet the requirement.

- (2) Check for dirt or bind between the worm and the gear assembly.

### 519. Governor Assembly Locating Adjustment (AN-FGC-25X)

(fig. 520)

a. *Requirement.* There should be a clearance of  $\frac{1}{16} \pm \frac{1}{32}$  inch between the slipping on the governor assembly and the motor brush holder.

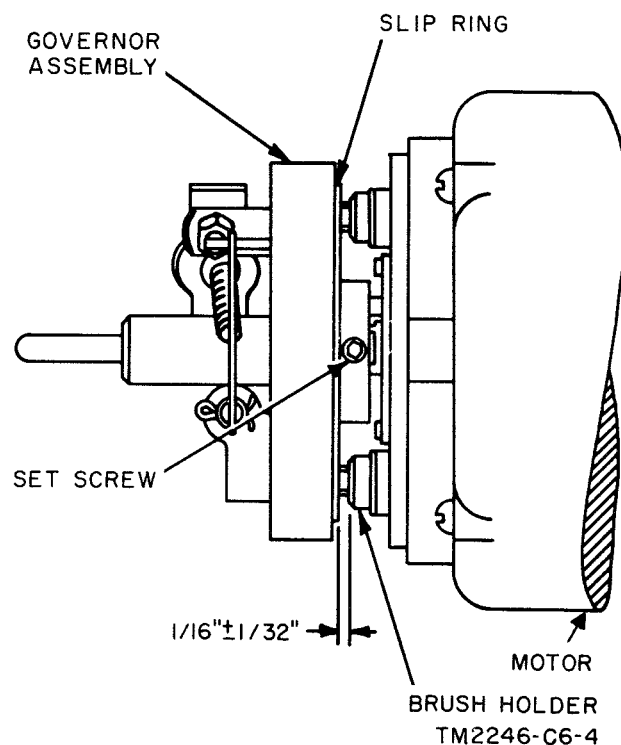


Figure 520. Governor assembly adjustment.

*b. Adjustment.* Loosen the two setscrews and position the governor assembly to meet the requirement. Tighten one setscrew friction-tight; then tighten the other setscrew and retighten the first. This procedure will insure that the governor assembly remains properly in line with the motor shaft.

*Note.* The governor sliprings must be clean and smooth to insure good brush contact. The area between the sliprings must be clean and free of any foreign material.

## 520. Governor Target Assembly Adjustment (AN-FGC-25X)

(fig. 521)

*a. Requirement.* There should be some clearance, but not more than .020 inch, between the governor target assembly and the motor governor cover.

*b. Adjustment.* Loosen the setscrew and position the governor target assembly to meet the requirement. Tighten the setscrew.

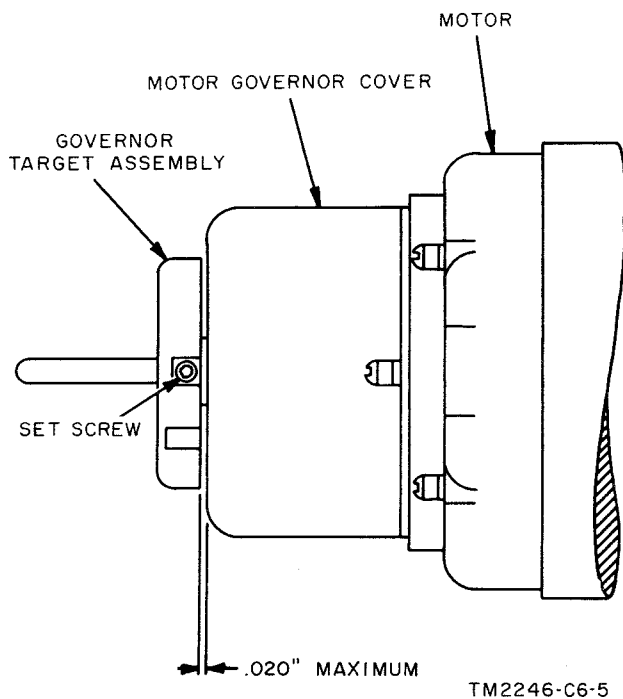


Figure 521. Governor target assembly adjustment.

## 521. Tape Storage Guide Adjustment (fig. 522)

*a. Requirement.* The tape entering the tape storage guide should be centered in the opening of the tape storage guide.

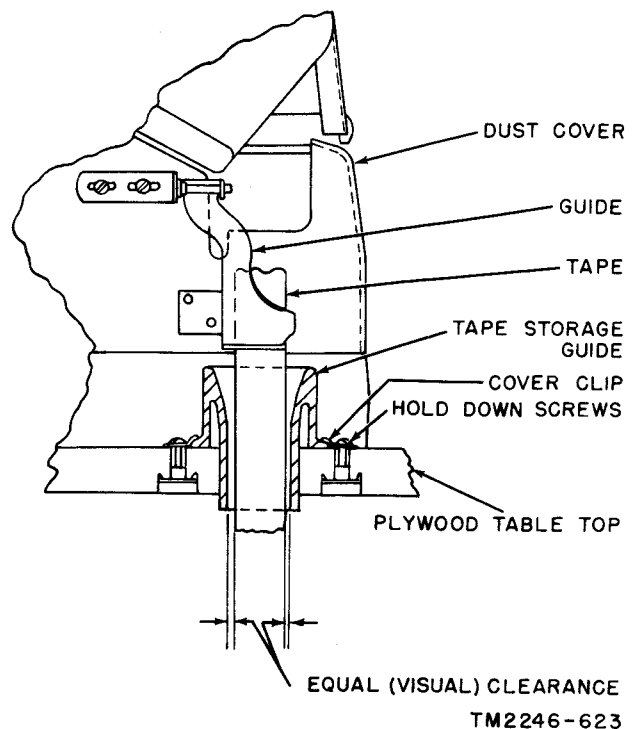


Figure 522. Tape storage guide adjustment.

*b. Adjustment.* Loosen the four holddown screws and move the tape storage guide to meet the requirement. Tighten the holddown screws.

## 522. Tape Puller Bracket Adjustment (fig. 523)

*a. Requirement.* The tape puller arm roller should have some clearance but not more than .010 inch between the edge of the tape puller arm roller and the bottom of the punch cam.

*b. Adjustment.* Loosen the two machine screws and position the tape puller bracket to meet the requirement. Tighten the machine screws.

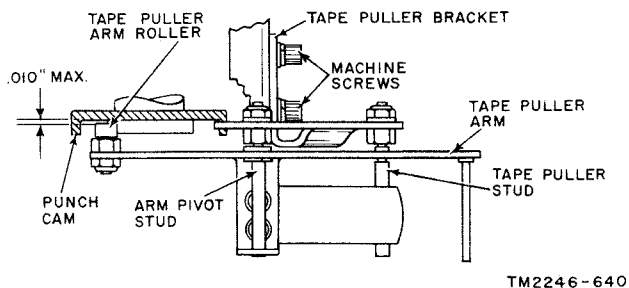


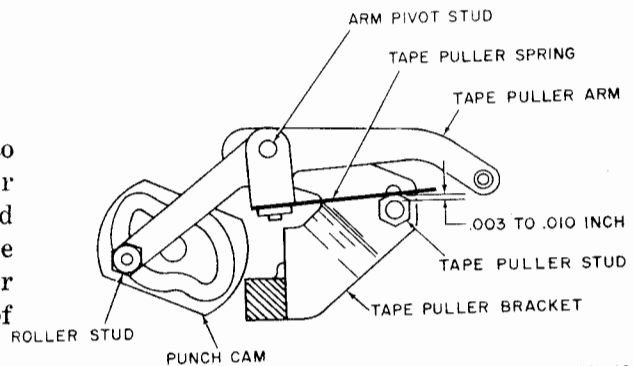
Figure 523. Tape puller bracket adjustment.

### 523. Tape Puller Arm Adjustment

(fig. 524)

a. *Requirement.* There should be a .003- to .010-inch clearance between the tape puller spring and the tape puller stud when the feed pawl has just cleared the feed ratchet and the feed operation is completed. The tape puller arm roller should be held toward the center of the punch cam.

b. *Adjustment.* Move the tape puller stud to the bottom of the slot of the tape puller bracket and tighten the tape puller stud nut. Move the arm pivot stud to the right of the slot and tighten the arm pivot stud nut friction tight. Release the transfer lever latch and turn the motor by hand until the feed pawl just clears the feed ratchet and the feed operation is completed. Move the arm pivot stud to the left until there is .003- to .010-inch clearance between the tape puller spring and the tape puller stud. The .003- to .010-inch gap should be measured when the tape puller arm roller is held toward the center of the punch cam. If the clearance is greater than the requirement, when the arm pivot stud is moved all the way



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Figure 524. Tape puller arm adjustment.

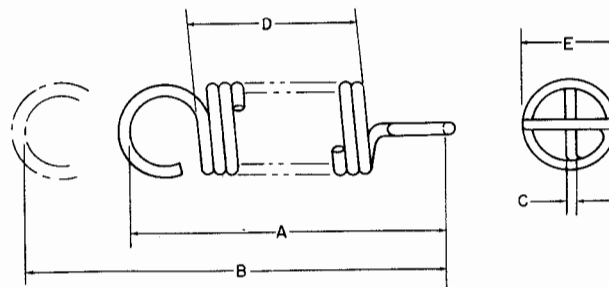
to the right, loosen the tape puller stud nut and move the tape puller stud upward against the tape puller spring. Tighten the tape puller stud nut. Then move the arm pivot stud to the left until the requirement is met. Tighten the arm pivot stud nut.

*Note.* To check for completion of the feed operation, turn the feed ratchet backwards while turning the motor slowly. At the point where the feed ratchet is just free to turn backwards, the feed operation is completed.

## Section IX. SPRING DATA

### 524. Crossed-End Spring Data

(fig. 525)



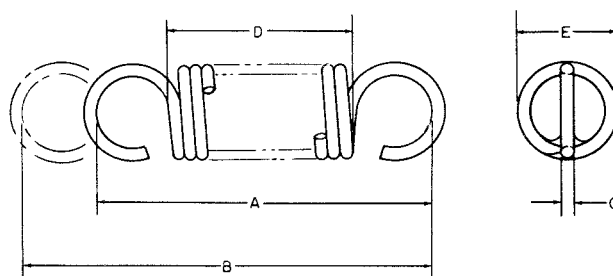
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Figure 525. Crossed-end spring.

Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension, extended strength	C Wire thickness (in.)	D Number of coils	E Outer diameter (in.)
50196	Trip pawl	$\frac{9}{16}$	$\frac{5}{8}$	1 oz $\pm$ $\frac{1}{4}$ oz	0.010 $\pm$ .0003	30	0.125
50333	Line feed pawl	$\frac{5}{8}$	$\frac{3}{4}$	2 $\frac{1}{2}$ oz $\pm$ $\frac{1}{2}$ oz	.010 $\pm$ .0003	40	.125
50904	Transfer lever latch	$\frac{11}{16}$	$\frac{13}{16}$	2 $\frac{1}{2}$ oz $\pm$ $\frac{3}{4}$ oz	.012 $\pm$ .0003	31	.156
50906	Carrier-return bellcrank	$\frac{11}{16}$	$\frac{13}{16}$	4 $\frac{1}{2}$ lbs $\pm$ 6 oz	.034 $\pm$ .0005	8 $\frac{1}{2}$	.250
50911	Carriage-feed clutch lever	$\frac{25}{32}$	$\frac{15}{16}$	40 oz $\pm$ 4 oz	.025 $\pm$ .0005	15	.200
50912	Paper roller latch	$\frac{1}{2}$	$\frac{21}{32}$	17 $\frac{1}{2}$ oz $\pm$ $\frac{1}{2}$ oz	.018 $\pm$ .0005	12 $\frac{3}{4}$	.156
50915	Function cam follower support lever.	$\frac{21}{32}$	$\frac{23}{32}$	4 lbs 2 oz $\pm$ 6 oz	.038 $\pm$ .0008	7 $\frac{1}{4}$	.250
50916	Delaying latch	$\frac{3}{8}$	$\frac{1}{2}$	7 oz $\pm$ 1 oz	.013 $\pm$ .0003	12 $\frac{1}{4}$	.125
50919	Function blocking bar	$\frac{1}{2}$	$\frac{5}{8}$	2 $\frac{1}{2}$ oz $\pm$ $\frac{1}{4}$ oz	.011 $\pm$ .0003	26	.125
50941	Key lever	$\frac{1}{2}$	$\frac{5}{8}$	20 oz $\pm$ 2 oz	.020 $\pm$ .0003	8 $\frac{3}{4}$	.187
50946	Double blocking lever	$\frac{19}{32}$	$\frac{11}{16}$	28 oz $\pm$ 3 oz	.024 $\pm$ .0003	11 $\frac{3}{4}$	$\frac{3}{16}$
51136	Universal code bar return	$\frac{11}{16}$	1	15 to 20 grams	.009 $\pm$ .0003	45 max	.150
51544	Locking lever latch	$\frac{25}{32}$	1 $\frac{1}{8}$	1 $\frac{1}{2}$ oz $\pm$ $\frac{1}{4}$ oz	.010 $\pm$ .0003	56	.125
51754	Line feed sensing lever	$\frac{37}{64}$	$\frac{7}{8}$	34 oz $\pm$ 4 oz	.018 $\pm$ .0003	21 $\frac{1}{4}$	.125
51755	Adjustable bellcrank	$\frac{15}{16}$	1 $\frac{5}{16}$	28 oz $\pm$ 2 $\frac{1}{2}$ oz	.023 $\pm$ .0003	28	.187
51851	Platen spacing detent	$\frac{21}{32}$	$\frac{25}{32}$	54 oz $\pm$ 6 oz	.026 $\pm$ .0005	16	.160
52161	Typewheel bellcrank lever	1 $\frac{3}{32}$	1 $\frac{3}{8}$	4 $\frac{1}{2}$ -5 oz	.016 $\pm$ .0003	45	.187
52167	Typewheel reciprocating lever	$\frac{23}{32}$	$\frac{13}{16}$	30-36 oz	.033 $\pm$ .0005	8	.250
52169	Letters sensing lever	$\frac{13}{16}$	1	33-36 oz	.022 $\pm$ .0003	26 $\frac{1}{4}$	.141
52171	Figures sensing lever	$\frac{15}{16}$	1 $\frac{3}{16}$	26-30 oz	.020 $\pm$ .0003	33	.141
52172	Shift cam follower	1 $\frac{5}{32}$	1 $\frac{5}{16}$	38-42 oz	.026 $\pm$ .0003	33	.162
52173	Bell sensing lever	$\frac{3}{4}$	1	24-28 oz	.019 $\pm$ .0003	28	.141
52602	Ribbon feed cam follower	$\frac{13}{32}$	1	32-35 oz	.025 $\pm$ .0003	19	.197
52604	Ribbon feed detent lever	$\frac{11}{16}$	$\frac{7}{8}$	1 $\frac{1}{4}$ -1 $\frac{1}{2}$ oz	.009 $\pm$ .0003	48 $\frac{3}{4}$	.125
53149	Platen lever latch	$\frac{25}{32}$	$\frac{7}{8}$	19-21 oz	.020 $\pm$ .0003	27	.156
53152	Code sensing lever	$\frac{33}{64}$	$\frac{45}{64}$	12 oz $\pm$ 1 oz	.012 $\pm$ .0003	29	.085
53153	Tape feed claw	$\frac{1}{2}$	$\frac{21}{32}$	2 $\frac{3}{4}$ -3 $\frac{1}{4}$ oz	.012 $\pm$ .0003	23	.125
53154	Tape feed retracting lever	$\frac{15}{32}$	$\frac{3}{4}$	11-13 oz	.014 $\pm$ .0003	12	.156
53155	Clutch magnet armature	$\frac{17}{32}$	$\frac{25}{32}$	4-6 oz	.012 $\pm$ .0003	22 $\frac{1}{4}$	.125
53313	Ratchet wheel detent	$\frac{19}{64}$	$\frac{1}{2}$	2 $\frac{1}{2}$ -3 oz	.010 $\pm$ .0003	10	.125
53569	Code-ring locking bail cam follower.	$\frac{15}{16}$	1 $\frac{1}{16}$	11 oz $\pm$ 1 oz	.018 $\pm$ .0003	32	.191
53974	Space bar	$\frac{15}{32}$	$\frac{5}{8}$	86 oz $\pm$ 8 oz	.028 $\pm$ .0005	4 $\frac{3}{4}$	.218
55009	Y-lever detent	$\frac{1}{4}$	.342	90-130 grams	.009 $\pm$ .0003	12 $\frac{3}{4}$	.083
55014	Dust cover arm	1 $\frac{1}{16}$	1 $\frac{5}{8}$	5 lbs 10 oz $\pm$ 10 oz	.028 $\pm$ .0005	27 $\frac{1}{2}$	.187
55135	Paper guide	$\frac{7}{8}$	1 $\frac{1}{32}$	3 oz $\pm$ $\frac{1}{2}$ oz	.012	31 $\frac{1}{2}$	.156
55641	Wiper	$\frac{5}{16}$	$\frac{3}{8}$	40-65 grams	.008 $\pm$ .0003	14 $\frac{1}{4}$	.084
55941	Tab crank arm	$\frac{9}{32}$	1 $\frac{1}{32}$	4 $\frac{3}{4}$ oz $\pm$ $\frac{1}{4}$ oz	.010	5 $\frac{3}{4}$	.125
55959	Cam follower	$\frac{13}{32}$	$\frac{1}{2}$	6 $\frac{1}{2}$ oz $\pm$ $\frac{1}{2}$ oz	.013	11	.125
56258	Blocking lever	$\frac{31}{64}$	$\frac{3}{4}$	6-8 oz	.013 $\pm$ .0003	7 $\frac{3}{4}$	.168
56586	Disabling latch	$\frac{1}{2}$	1 $\frac{9}{32}$	2 oz $\pm$ $\frac{1}{4}$ oz	.010	22 $\frac{3}{4}$	$\frac{1}{8}$
56591	Feed-out lever	$\frac{1}{2}$	$\frac{5}{8}$	6 oz $\pm$ 1 oz	.015	14 $\frac{3}{4}$	$\frac{5}{32}$
56594	Manual tape feed-out lever	$\frac{5}{8}$	$\frac{3}{4}$	40 oz $\pm$ 4 oz	.023	12 $\frac{3}{4}$	$\frac{5}{32}$
51735	Detent lockup lever	$\frac{15}{16}$	1 $\frac{1}{16}$	28 oz $\pm$ 2 $\frac{1}{2}$ oz	.022 $\pm$ .0003	30 $\frac{3}{4}$	.187

## 525. Parallel-end Spring Data (fig. 526)

Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension, extended strength	C Wire thickness (in.)	D Number of coils	E Outer diameter (in.)
50231	Margin bell clapper	$\frac{1}{16}$	$\frac{3}{4}$	8 oz $\pm$ 1 oz	0.016 $\pm$ .0003	28	0.125
50232	Margin bell trip pawl	$\frac{5}{8}$	$\frac{1}{16}$	1 oz $\pm$ $\frac{1}{4}$ oz	.010 $\pm$ .0003	36	.125
50334	Governor adjusting	$\frac{15}{16}$	1	32 oz $\pm$ 3 oz	.026 $\pm$ .0005	26	.156
50403	Reversing detent	1	$1\frac{1}{4}$	5 oz $\pm$ $\frac{3}{4}$ oz	.013 $\pm$ .0003	58	.125
50447	Ribbon sensing lever	$\frac{13}{32}$	$\frac{15}{32}$	2 oz $\pm$ $\frac{1}{2}$ oz	.010 $\pm$ .0003	11	.156
50595	Connecting bar	$\frac{9}{16}$	$\frac{7}{8}$	3 $\frac{1}{2}$ oz $\pm$ $\frac{1}{4}$ oz	.011 $\pm$ .0003	30	.138
50901	Line feed and figures shift cam follower.	$\frac{9}{16}$	$\frac{7}{8}$	8 oz $\pm$ $\frac{1}{2}$ oz	.012 $\pm$ .0003	33	.095
50903	Transfer lever	$1\frac{3}{32}$	$1\frac{1}{4}$	5 lbs 13 oz $\pm$ 3 oz	.042 $\pm$ .0005	14	.281
50920	Signal bell clapper	$\frac{23}{32}$	$\frac{27}{32}$	1 $\frac{1}{2}$ oz $\pm$ $\frac{1}{4}$ oz	.010 $\pm$ .0003	45	.125
50921	Print cam follower	$\frac{7}{8}$	$1\frac{1}{16}$	6 $\frac{1}{2}$ lbs $\pm$ 8 oz	.039 $\pm$ .0005	11 $\frac{3}{4}$	.250
50943	Tabulator bar	$\frac{7}{8}$	$1\frac{1}{16}$	2 $\frac{1}{4}$ oz $\pm$ $\frac{1}{8}$ oz	.015 $\pm$ .0003	40	$\frac{5}{32}$
50944	Blocking lever	$\frac{13}{32}$	$\frac{9}{16}$	2 $\frac{1}{2}$ oz $\pm$ $\frac{1}{2}$ oz	.010 $\pm$ .0003	20	.125
51548	Contact bail	$\frac{7}{16}$	$\frac{9}{16}$	11 oz $\pm$ 1 oz	.015 $\pm$ .0003	16	$\frac{1}{8}$
51574	Sensing lever locking bail	$\frac{5}{8}$	$\frac{27}{32}$	2 $\frac{1}{2}$ oz $\pm$ $\frac{1}{4}$ oz	.012 $\pm$ .0003	28	.156
51575	Cam stop lever	$\frac{13}{16}$	$1\frac{3}{16}$	3 oz $\pm$ $\frac{1}{2}$ oz	.012 $\pm$ .0003	40	.156
51645	Platen shift bellcrank	$1\frac{1}{4}$	$1\frac{1}{2}$	8 oz $\pm$ 1 oz	.016 $\pm$ .0003	57	.156
52163	Print hammer lever	$\frac{7}{8}$	$1\frac{1}{16}$	18-22 oz	.025 $\pm$ .0003	16 $\frac{1}{2}$	.250
52164	Tape feed pawl	$\frac{19}{32}$	$\frac{3}{4}$	9 $\frac{1}{2}$ -10 $\frac{1}{2}$ oz	.016 $\pm$ .0003	19	.156
52166	Detent lever	$\frac{7}{16}$	$\frac{1}{2}$	25 oz $\pm$ 2 oz	.020 $\pm$ .0003	10 $\frac{1}{4}$	.156
52168	Figures-letters lever	$1\frac{7}{32}$	$1\frac{7}{16}$	3 $\frac{1}{4}$ -3 $\frac{3}{4}$ oz	.012 $\pm$ .0003	74	.125
52192	Backspace pawl	$\frac{9}{32}$	$\frac{11}{32}$	5 $\frac{1}{2}$ oz $\pm$ 1 oz	.011 $\pm$ .0003	5	.125
52193	Backspace lever	$\frac{15}{32}$	$\frac{9}{16}$	9-11 oz	.016 $\pm$ .0003	11 $\frac{1}{4}$	.156
52266	Supply reel tension	$\frac{5}{8}$	$\frac{13}{16}$	11-13 oz	.018 $\pm$ .0003	25	.187
52576	Alarm lever	3 $\frac{7}{8}$	4 $\frac{9}{16}$	18-22 oz	.025 $\pm$ .0003	139	.197
52603	Ribbon retaining lever	$\frac{5}{8}$	1	2 $\frac{1}{4}$ -2 $\frac{3}{4}$ oz	.012 $\pm$ .0003	27	.165
53148	Dust cover latch	$\frac{9}{16}$	$\frac{5}{8}$	12-14 oz	.022 $\pm$ .0003	11 $\frac{3}{4}$	.187
54948	Blank holder	$\frac{7}{16}$	$\frac{5}{8}$	2 lbs $\pm$ 4 oz	.027 $\pm$ .0003	9	.172
55143	Stripper	$\frac{19}{32}$	$\frac{11}{16}$	42 grams, $\pm$ 4 grams	.009 $\pm$ .0003		.120
55678	Code actuated switch cam follower.	$1\frac{3}{64}$	$1\frac{3}{16}$	64 oz $\pm$ 6 oz	.035 $\pm$ .0005	17	.250
55679	Register lever	$\frac{3}{4}$	$\frac{13}{16}$	32 oz $\pm$ 3 oz	.025 $\pm$ .0005	14	.187
55840	Link arm	$\frac{3}{4}$	$1\frac{1}{8}$	4 oz $\pm$ $\frac{1}{2}$ oz	.012	40	.125
55877	Switch actuator	2 $\frac{1}{8}$	3 $\frac{3}{16}$	1 $\frac{1}{4}$ oz $\pm$ $\frac{1}{4}$ oz	.008	150	.125
56079	Lever latch	$\frac{15}{16}$	$1\frac{3}{16}$	16 oz $\pm$ 1 $\frac{1}{2}$ oz	.020 $\pm$ .0003	26	.187
56158	Register lever	$\frac{3}{4}$	$1\frac{1}{16}$	11 oz $\pm$ 1 oz	.020 $\pm$ .0003	14 $\frac{1}{2}$	.250
56159	Paper guide lever	$\frac{1}{2}$	$\frac{5}{8}$	35 grams $\pm$ 5 grams	.010 $\pm$ .0003	25	.125

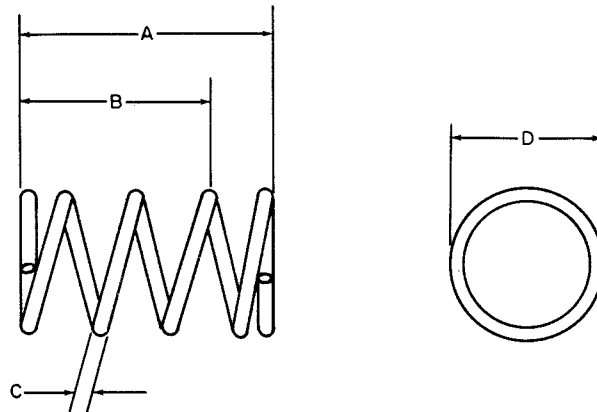


TM 2246-579

Figure 526. Parallel-end spring.

## 526. Compression Spring Data (fig. 527)

Reference No.	Name	A Free length (in.)	B Compressed length (in.)	Required tension, compressed length	C Wire thickness (in.)	Number of coils	D Diameter (in.)
50416	Ribbon drive rack gear	$1\frac{17}{32} \pm \frac{1}{32}$	$\frac{3}{8}$	$1\frac{1}{2}$ oz $\pm$ $\frac{1}{2}$ oz	$0.015 \pm .0003$	$7\frac{1}{2} \pm \frac{1}{4}$	$\frac{7}{32}$ ID
50848	Clutch	$\frac{3}{4} \pm \frac{1}{16}$	$\frac{7}{16}$	2 lbs 10 oz $\pm$ 4 oz	$.045 \pm .0005$	$4\frac{3}{4} \pm \frac{1}{4}$	.578 ID
50917	Function selecting arm	$\frac{9}{16} \pm \frac{3}{64}$	$1\frac{1}{32}$	6 oz $\pm$ $\frac{1}{2}$ oz	$.024 \pm .0003$	$5 \pm \frac{1}{4}$	.390 ID
51593	Contact plunger	$\frac{5}{8} \pm \frac{3}{64}$	$\frac{9}{16}$	7 oz $\pm$ 1 oz	$.012 \pm .0003$	$10\frac{3}{4}$	.125 ID
51855	Governor adjusting pressure	$\frac{5}{8} \pm \frac{1}{32}$	.047		$.014 \pm .0003$	6	
52940	Stop bar	$\frac{37}{64} \pm \frac{1}{64}$	.375	8 oz $\pm$ $\frac{1}{2}$ oz	$.016 \pm .0003$	112	.183 OD
52953	Stop bar return	$\frac{9}{16} \pm \frac{3}{64}$	$\frac{1}{4}$	14 oz $\pm$ 2 oz	$.018 \pm .0003$	$9 \pm \frac{1}{2}$	$1\frac{15}{64}$ OD
53308	Range dial detent	$\frac{3}{8}$	$\frac{3}{16}$	12 oz $\pm$ 2 oz	$.010 \pm .0003$	11	.058 ID
53558	Pushbutton	$\frac{3}{4} \pm \frac{1}{32}$	$\frac{5}{8}$	7 oz $\pm$ 1 oz	$.020 \pm .0003$	$10 \pm \frac{1}{2}$	.187 ID
53961	Spool friction	$\frac{1}{2} \pm \frac{1}{32}$	$\frac{1}{4}$	20 oz $\pm$ 4 oz	$.021 \pm .0003$	$7\frac{3}{4}$	.198 ID
54932	Friction clutch	$\frac{1}{2} \pm \frac{3}{64}$	$\frac{9}{32}$	14 lbs 8 oz $\pm$ 12 oz	$.067 \pm .0005$	$3\frac{1}{2}$	
54933	Clutch pressure	$\frac{1}{2} \pm \frac{3}{64}$	$\frac{9}{32}$	10 lbs 8 oz $\pm$ 12 oz	$.067 \pm .001$	$3\frac{1}{2}$	.687 ID
54934	Friction clutch	$\frac{3}{8} \pm \frac{1}{32}$	$\frac{5}{16}$	8 lbs $\pm$ 12 oz	$.080 \pm .001$	$3\frac{3}{4}$	.687 ID
54957	Platen crank	$\frac{3}{4}$			.025	11	.260 OD
55518	Manual space pushbutton	$\frac{5}{8}$			.025	$9\frac{1}{2}$	.343 ID
56091	Selector magnet cover	$\frac{5}{16} \pm \frac{3}{64}$	$\frac{5}{16}$		$.012 \pm .0003$	5	.125 ID
56249	Driver clutch	$\frac{1}{2} \pm \frac{3}{64}$	$\frac{9}{32}$	10 lbs 8 oz $\pm$ 8 oz	$.076 \pm .001$	$3\frac{1}{2}$	.891 ID
56279	Square shaft bearing	$1\frac{17}{32} \pm \frac{1}{32}$	$\frac{5}{16}$	32 oz	$.028 \pm .0005$	$6\frac{1}{2}$	.257 ID



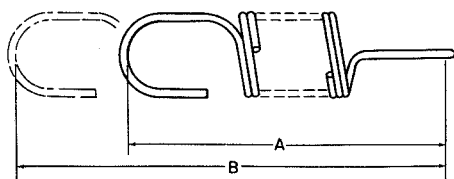
TM 2246-581

Figure 527. Compression spring.



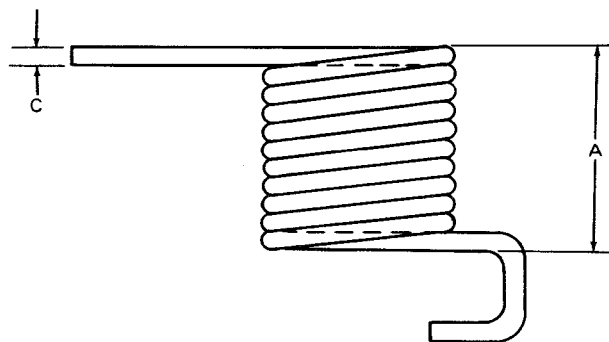
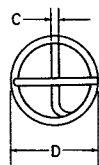
## 527. Special Spring Data

Fig. No.	Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension, extended length	C Wire thickness (in.)	Number of coils	D Diameter (in.)
528	50902	Selector lever	1	1 1/4	8 oz. ± 1/2 oz.	0.012 ± .0003	53 max.	0.085 OD
529	52422	Tape retainer	3/8			.033 ± .0005	10	.265 ID
530	52551	Clip	1/2			.045 ± .0005		1.72 ID
531	53156	Tape-out lever	1 1/16 ± 1/16			.016 ± .0003	52	.188 OD
532	53888	Right-hand dust cover stay.	1/4			.0625 ± .0005	1	
533	53889	Left-hand dust cover stay.	1/4			.0625 ± .0005	1	
534	54967	Platen trough	1 3/16			.027	43 1/2	.179 OD
535	54991	Window	7/16			.047 ± .0005	9	.171 ID
536	54996	Cover door latch				.030 ± .0005	3 turns	3/16 OD
537	55882	Shunt switch arm	5/8	4 7/64	100 grams ± 10 grams.	.010 ± .0003		3/16 OD
538	55942	Detent	1 5/32	9/16	10 oz. ± 1 oz.	.015 ± .0003	12 max.	.125 OD
539	55958	Ratchet pawl	1 9/32	1 1/16	2 1/2 oz. ± 1/2 oz.	.011	19	.125 OD
540	55969	Contact pivot post	3/16		1-2 oz.	.015 ± .0003	4	.281 ID
541	55974	Indicator return latch	3/32			.015 ± .0003	3	.218 ID
542	55999	Keyboard counter cam follower.	3/16			.015 ± .0003	6 1/4	3/16 ID
543	56024	Roller support	1 5/32 ± 1/64			.014 ± .0003		.125 OD
544	56269	Carriage-return blocking lever.				.018 ± .0003	2	.500 ID
545	56323	Tape cover latch				.020 ± .0003	2	1 1/16 ID
546	56324	Tape cover	5/32			.024 ± .0003	6	5/32 ID
547	60021	Indicator drive shaft	7 3/8			.014 ± .0003	461	.112 ID
548	53649	Blank push bar return	1 5/32 ± 1/64			.020 ± .0003	2	7/32 ID



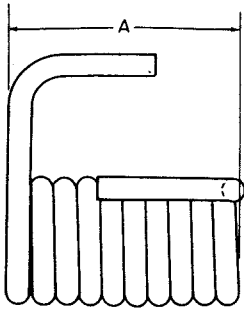
TM 2246-582

Figure 528. Selector lever spring.



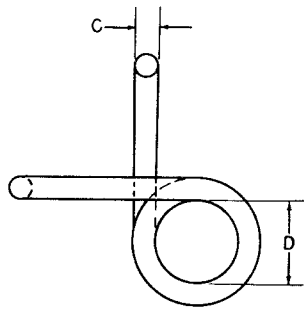
TM 2246-583

Figure 529. Tape retainer spring.



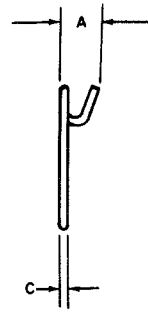
TM2246-584

Figure 530. Clip spring.



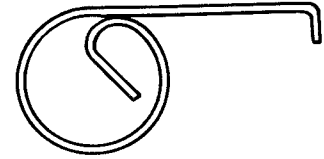
TM2246-585

Figure 531. Tape-out lever spring.



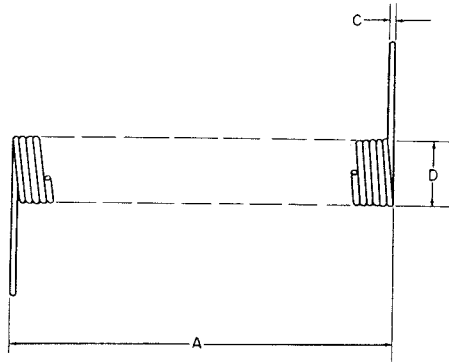
TM2246-586

Figure 532. Right-hand dust cover stay spring.



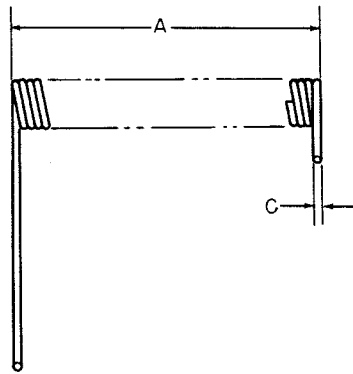
TM2246-587

Figure 533. Left-hand dust cover stay spring.



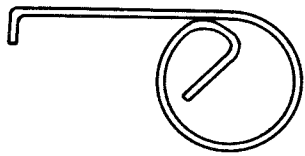
TM2246-588

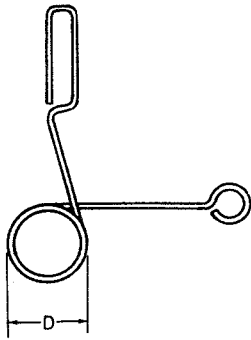
Figure 534. Platen trough spring.



TM2246-589

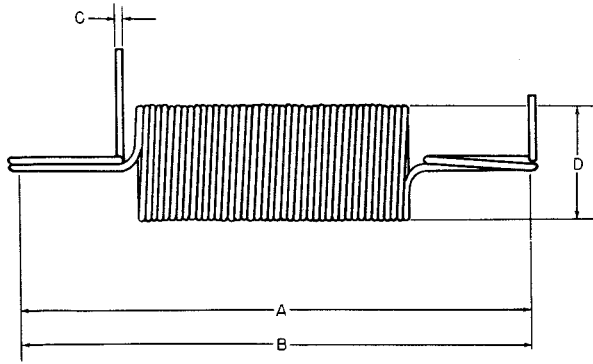
Figure 535. Window spring.





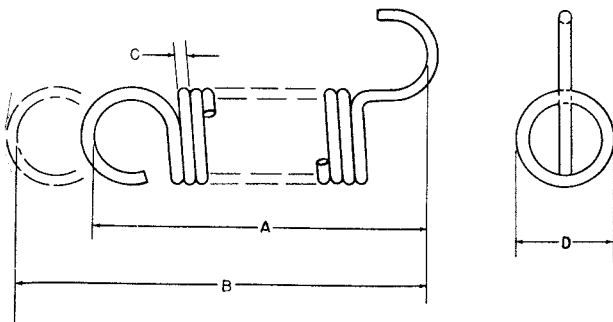
TM2246-590

Figure 536. Cover door latch spring.



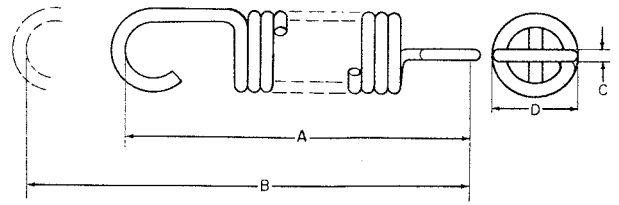
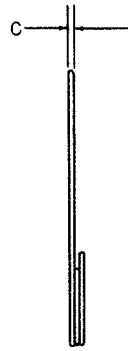
TM2246-591

Figure 537. Shunt switch arm spring.



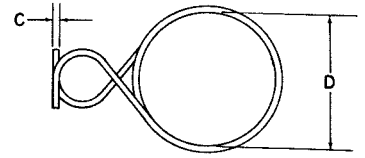
TM2246-592

Figure 538. Detent spring.



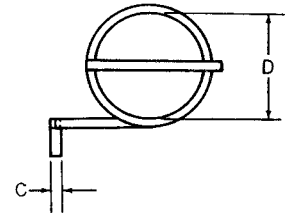
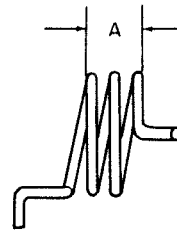
TM2246-593

Figure 539. Ratchet pawl spring.



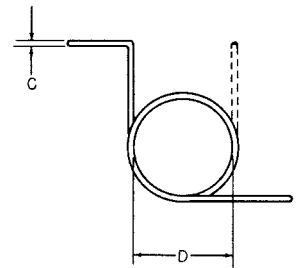
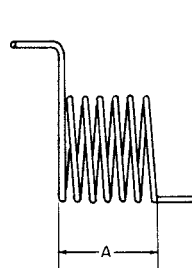
TM2246-594

Figure 540. Contact pivot post spring.



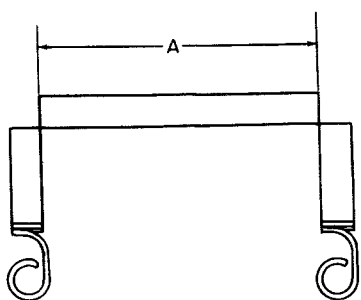
TM2246-595

Figure 541. Indicator return latch spring.



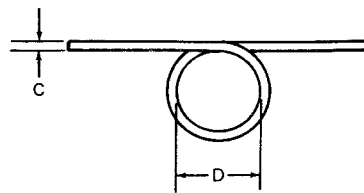
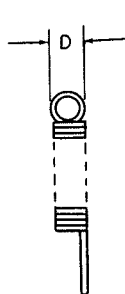
TM2246-596

Figure 542. Keyboard counter cam follower spring.



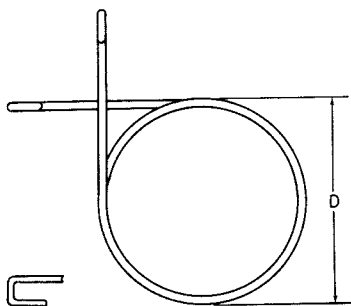
TM2246-597

Figure 543. Roller support spring.



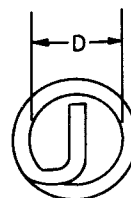
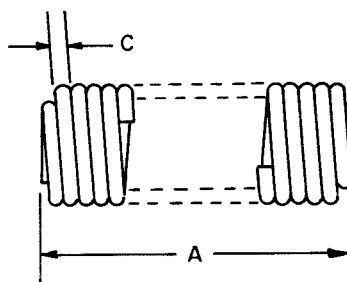
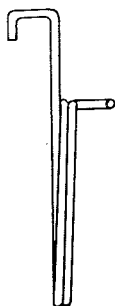
TM2246-600

Figure 546. Tape cover spring.



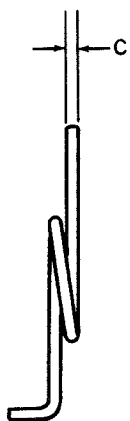
TM2246-598

Figure 544. Carriage-return blocking lever spring.



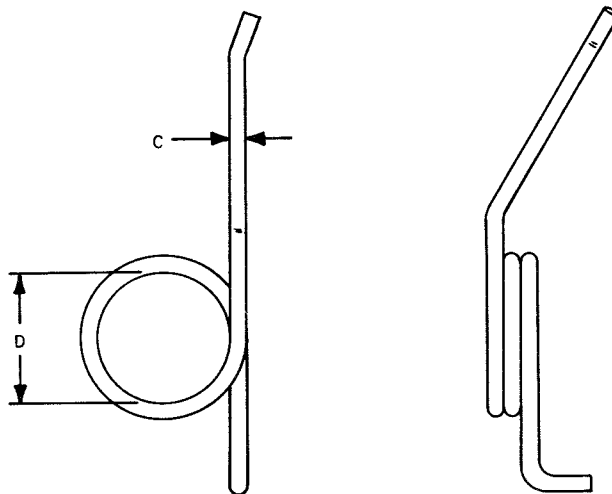
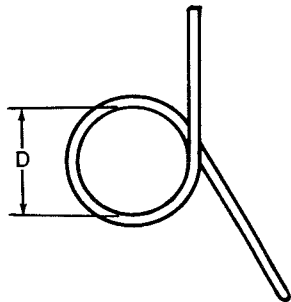
TM2246-C4-37

Figure 547. Indicator drive shaft spring  
(TT-117A/FG, TT-118/FG, and TT-119A/FG).



TM2246-599

Figure 545. Tape cover latch spring.



TM 2246-C4-48

Figure 548. Blank push bar return spring  
(TT-118/FG).

(Figures 549 through 560 inside back cover)

## Section X. FINAL TEST

### 528. Test Reference Chart

The following chart lists the paragraphs containing information required for final testing.

Item	Paragraph
Test equipment.....	104
Local test arrangement.....	12
Performance test.....	15
Troubleshooting chart.....	124
Bias and distortion tests.....	529, 530

### 529. Sending Tests

Signals transmitted by the keyboard-transmitter and by the transmitter-distributor can be analyzed by the Distortion Test Set TS-383/GG to detect any deviation from normal signals. This permits maintenance personnel to determine what adjustments and corrections, if any, must be made in the sending units to enable them to send correct, undistorted signals. Consult the applicable technical manual for detailed use of the distortion test set. Set up the test as follows.

a. Connect the teletypewriter set in the local test condition described in paragraph 16.

b. Adjust the control switches on the perforator (fig. 12) as follows:

- (1) Keyboard control switch to—KEYBD.
- (2) Perforator control switch to—REPERF.
- (3) Line switch key to—TEST.
- (4) ALR MONITOR switch to—OFF.

c. Connect the receive cord from the test set into the receive test jack on the back perforator panel. This connects the test set in series with the teleprinter.

d. Test the signals sent from the keyboard-transmitter and from the transmitter-distributor as described in the distortion test set manual. The signal bias of the keyboard-transmitter or transmitter-distributor must not exceed 5 percent.

### 530. Receiving Tests

a. *Preparation.*

- (1) Connect the teletypewriter set in the local test condition described in paragraph 12.

(2) Adjust the perforator control switches (fig. 12) as follows:

- (a) Keyboard control switch to KEYBD.
- (b) Perforator control switch to REPERF.
- (c) Line switch key to TEST.
- (d) ALR MONITOR switch to OFF.

(3) Plug the send plug of the test set into the send test jack on the back perforator panel. This connects the distortion test set in series with the teletypewriter set. Signals transmitted by the test set can be received by the page printing mechanism or perforator.

(4) Adjust the motor speed of the page printing mechanism and perforator motors as described in paragraph 13.

(5) Send the test message from the test set with undistorted signals, receiving the message on both the perforator and the page printing mechanism.

b. *Range Test.*

(1) Adjust the page printing mechanism and the perforator as follows:

- (a) On equipments with serial numbers below 300, unsolder a lead to the bias potentiometer and connect an ammeter in series with the potentiometer. Loosen the locknut on the bias potentiometer shaft and turn the shaft with a screwdriver until a reading of 8.2 ma is obtained for 20 ma operation or a reading of 12 ma is obtained for 60 ma operation. Tighten the locknut and recheck the adjustment. Adjust the perforator and page printing mechanism bias potentiometer in this manner. Disconnect the ammeter and resolder the lead.

- (b) On equipments with serial numbers above 300, binding posts for checking the bias potentiometer setting are provided at the rear of the page printing mechanism on the terminal box. On the perforator, the binding posts are provided at the top of the patch panel. To adjust

the bias potentiometer setting for either unit, disconnect the strap that connects the binding posts and connect an ammeter across the posts. Loosen the locknut on the shaft of the bias potentiometer and turn the shaft with a screwdriver until a reading of 8.2 ma is obtained for 20-ma operation or a reading of 12 ma is obtained for 60-ma operation. Tighten the locknut and recheck the adjustment. Disconnect the ammeter and reconnect the strap between the binding posts.

- (2) Arrange the test set to transmit undistorted signals.
- (3) While still receiving the test message, determine the upper limit and the lower limit of the page printing mechanism and perforator range with the rangefinder dial.
- (4) Calculate the difference between the upper and lower good copy limits. The difference should be at least 72 units of the dial for 368.1 opm (60-wpm) or 60 units per 600 opm (100-wpm) operation.
- (5) Set the rangefinder dials at the midpoint between the two limits of the range.

*c. Bias Tolerance Test.* The page printing mechanism and the perforator should print good copy when receiving signals containing controlled amounts of distortion. The bias tolerance of a properly adjusted receiving unit operating at 368.1 opm, should be a minimum of 40 percent. The bias tolerance of the properly adjusted set operating at 600 opm should be a minimum of 35 percent. The formula given in (5) below is used to compute the bias tolerance. When signal distortion test sets are arranged to transmit signals with a bias distortion, the set changes the beginning time of each impulse with respect to the beginning time of the start impulse. When adjusted to transmit signals with a *marking bias* the test set advances the beginning of each marking impulse. When adjusted to transmit signals with a *spacing bias*, the set retards the be-

ginning of each marking impulse. The bias tolerance of the receiving units may be tested as follows:

- (1) Connect the teletypewriter set, as described in *a* above.
- (2) Set the bias potentiometer as described in *b*(2) above.
- (3) Adjust the test set to transmit test signals with a marking bias of 35 percent. Use these signals to determine the upper range limit with the rangefinder.
- (4) Adjust the test set to transmit test signals with a 35 percent spacing bias. Determine the lower limit of the range.
- (5) Compute the bias tolerance for both the page printing mechanism and the perforator, using the following formula:

$$\text{Bias tolerance} = 35 + \frac{\left( \text{upper limit} \right) - \left( \text{lower limit} \right)}{2 \left( \text{marking bias} \right) - \left( \text{spacing bias} \right)}$$

*d. End Distortion Test.* The receiving unit should operate properly while receiving signals containing end distortion within certain minimum limits. The end distortion tolerances of a properly adjusted receiving unit operating at 368.1 opm should be a minimum of 35 percent. When signal distortion test sets are adjusted to transmit signals with end distortion, the set changes the ending time of each marking impulse with respect to the beginning time of each start impulse. When adjusted to transmit signals with a spacing end distortion, the set advances the end of each marking code impulse with respect to the beginning time of the start impulse. When adjusted to transmit test signals with a marking end distortion, the test set retards the end of each marking code impulse. The end distortion tolerance of the page printing mechanism and perforator may be tested in the following manner:

- (1) Connect the teletypewriter set as described in *a* above. Adjust the test set to transmit test message signals.
- (2) Set the bias potentiometer at the optimum setting as described in *b*(2) above.
- (3) Adjust the test set to transmit test signals with 35 percent spacing end distortion. Using the test signals,

determine the upper range limits with the rangefinder.

- (4) Adjust the test set to transmit test signals with a 35 percent marking end distortion. Determine the lower limit of the range.
- (5) Compute the end distortion tolerance of the receiving unit using the following formula:

$$\text{End distortion tolerance} = 35 + \frac{\left( \begin{array}{c} \text{Upper limit} \\ \text{spacing end} \\ \text{distortion} \end{array} \right) - \left( \begin{array}{c} \text{Lower limit} \\ \text{marking end} \\ \text{distortion} \end{array} \right)}{2}$$

*e. Internal Bias.* Internal bias of a receiving unit is a computed measurement of the

effect of maladjustment, wear, or some other mechanical fault within the mechanism. It is used as a measure of the mechanical efficiency of the receiving unit. The internal bias of the page printing mechanism perforator is found by calculating the difference between the bias tolerance orientation point (midpoint between the high and low range limits (*c* above) and the end distortion orientation point (*d* above)). If the difference between the two orientation points exceeds six points, some mechanical fault is present and the page printing mechanism should be rechecked for maladjustment or other mechanical fault.

## CHAPTER 5

### SHIPMENT AND LIMITED STORAGE

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#### 531. Disassembly

Prepare the teletypewriter set for storage in the following steps:

- a. Disconnect the signal and power cords.
- b. Disconnect all cords and cables connecting the page printing mechanism to the perforator.
- c. Remove the paper roll or fanfold forms from the page printing mechanism and the tape roll from the perforator.
- d. Empty the chad bin and spent tape box.
- e. Remove the extra copyholder from the page printing mechanism.
- f. Remove the page printer and the perforator from the table.
- g. Remove the spent tape guide and tape storage guide from the table.
- h. Remove the line relay adapter box from the table.
- i. Move the carriage to the left-hand margin; lock it in place with the carriage lock at the left of the carriage guide rail. Lock the platen in place with the lock at the upper right of the page printer frame.
- j. Remove the two self-locking hexagonal nuts that hold the blocking plate in the machine operating position (B, fig. 7). Remove the blocking plate and rotate it to the shipping position (A, fig. 7); make sure that the blocking plate is in full engagement between two of the teeth on the carriage-return driving gear. Replace and tighten the self-locking hexagonal nuts.

#### 532. Packing

Pack the equipment for storage as follows:

- a. Secure the page printer to the shipping base board and place it in the shipping and storage case.
- b. Secure the perforator to the shipping base board and place it in the shipping and storage case.
- c. Seal both of the cases with gummed tape.
- d. Wrap the cases with a vapor barrier material and insert each case into a second shipment and storage box.
- e. If the equipment is to be stored for a considerable length of time, place a sufficient amount of desiccant near the equipment to prevent any damage by moisture. Use silica gel or other approved desiccant.
- f. If the shipment is to be over a great distance or extremely rough terrain, the units should be placed in wooden containers.

*Note.* When packing equipment, refer to paragraph 4b and reverse the procedure described in (5) through (8).

- g. Pack the running spares, instruction books, spent tape guide, tape storage guide, copyholder, and line relay adapter box in a cardboard carton; place the carton in the spent tape and chad bin. Position the chad bin in the bottom of the table.
- h. Install the necessary filler strips on the table and position the table in the shipping and storage case; seal the case with gummed tape.
- i. Place the table package in a wooden box if it is to be shipped a great distance or over rough terrain.



## APPENDIX

### REFERENCES

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1. The following publications are applicable to the field and depot maintenance of Teletypewriter Sets AN/FGC-25, AN/FGC-25X, AN/FGC-26 and AN/FGC-57.

TM 11-5815-244-12—Operation and Organizational Maintenance, Teletypewriter Sets AN/FGC-25, AN/FGC-25X, AN/FGC-26, and AN/FGC-57.

TM 11-2208—Test Sets TS-2/TG, TS-2A/TG, TS-2B/TG and TS-2C/TG (Teletypewriter Signal Distortion).

TM 11-2217—Distortion Test Sets TS-383/GG, TS-383A/GG, and TS-383B/GG.

TM 11-5527—Multimeters TS-352/U, TS-352A/U, and TS-352B/U.

TM 11-5500—Multimeter TS-297/U.

2. In addition to the above, TM 11-5815-203-15, Teletypewriter Components of Teletypewriter Central Office AN/FGC-30, is also applicable to Teletypewriter Set AN/FGC-57.

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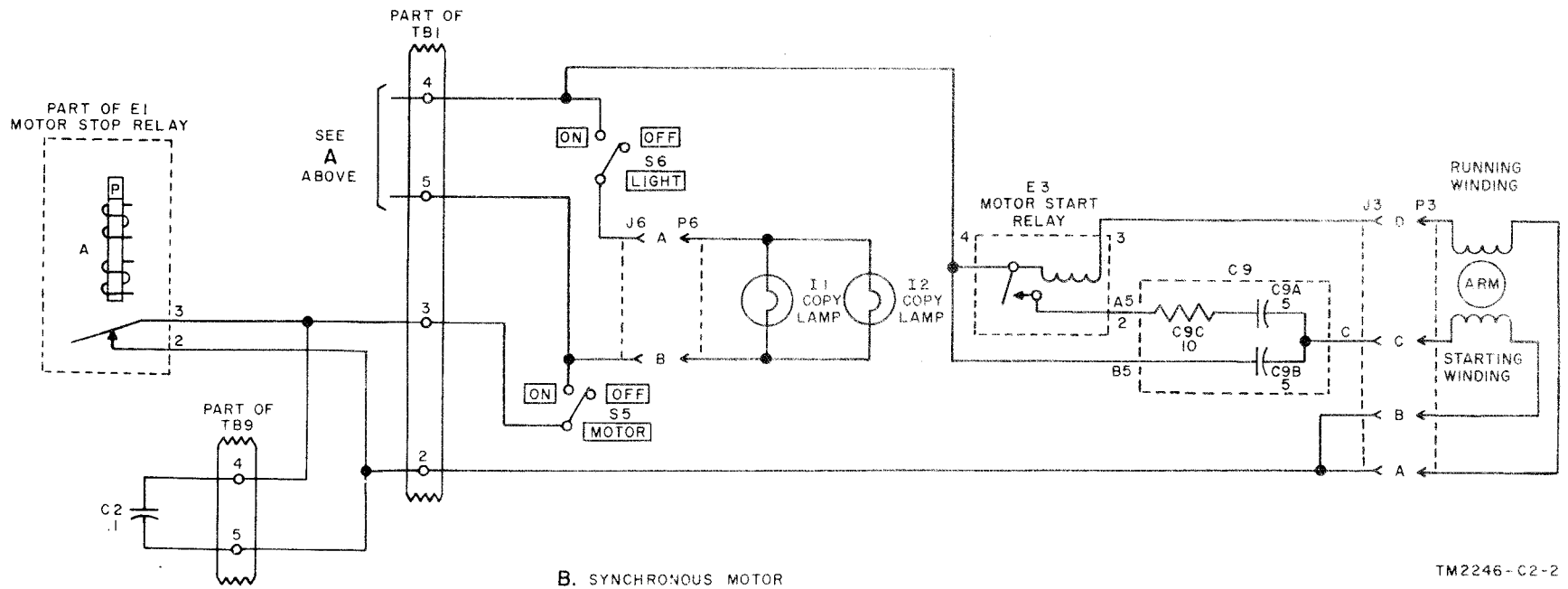
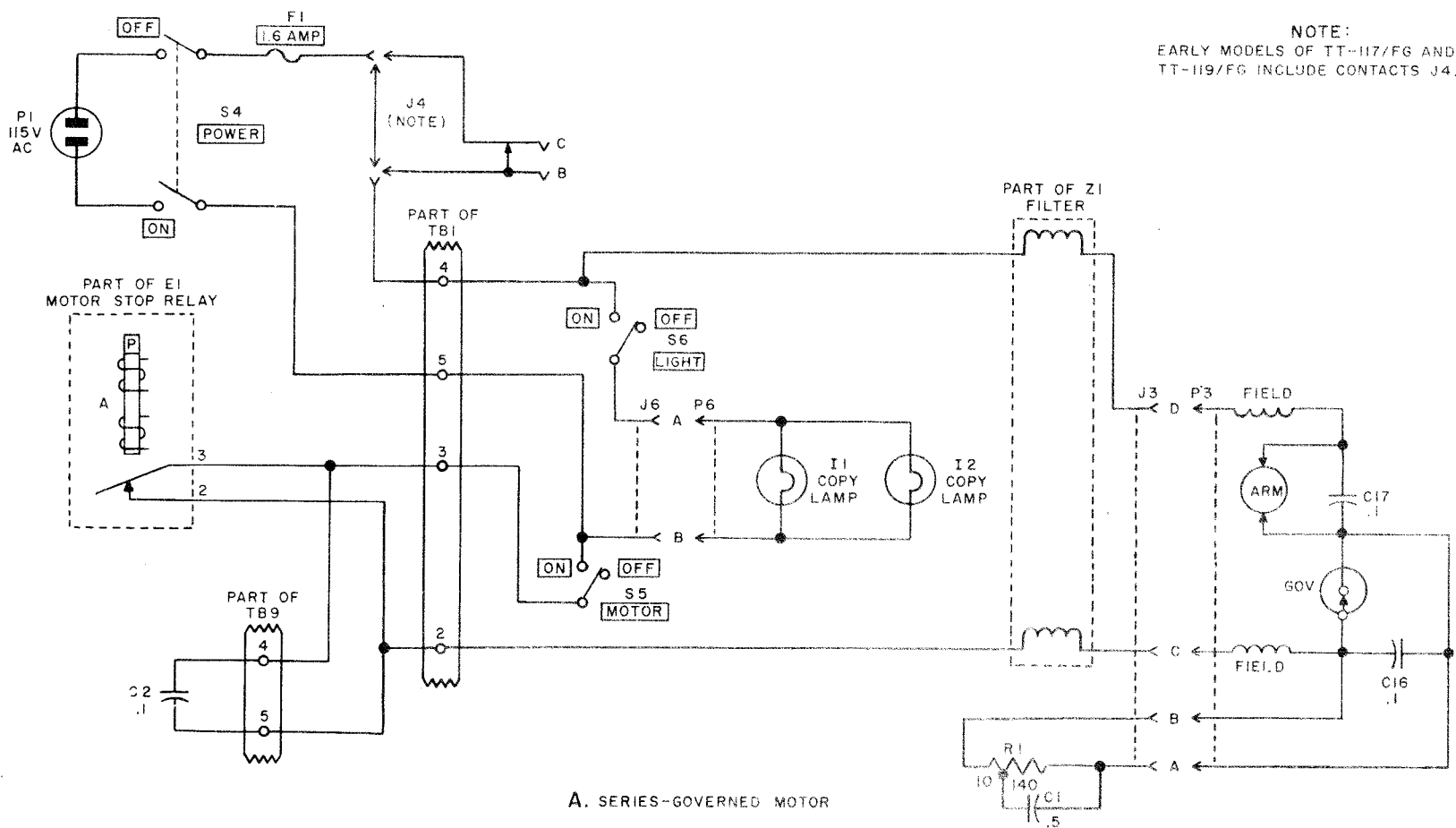
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For explanation of abbreviations used, see Ar 320-50.



TM2246-C2-2

Figure 138. Page printer motor and copy lamps circuits, simplified schematic diagram.

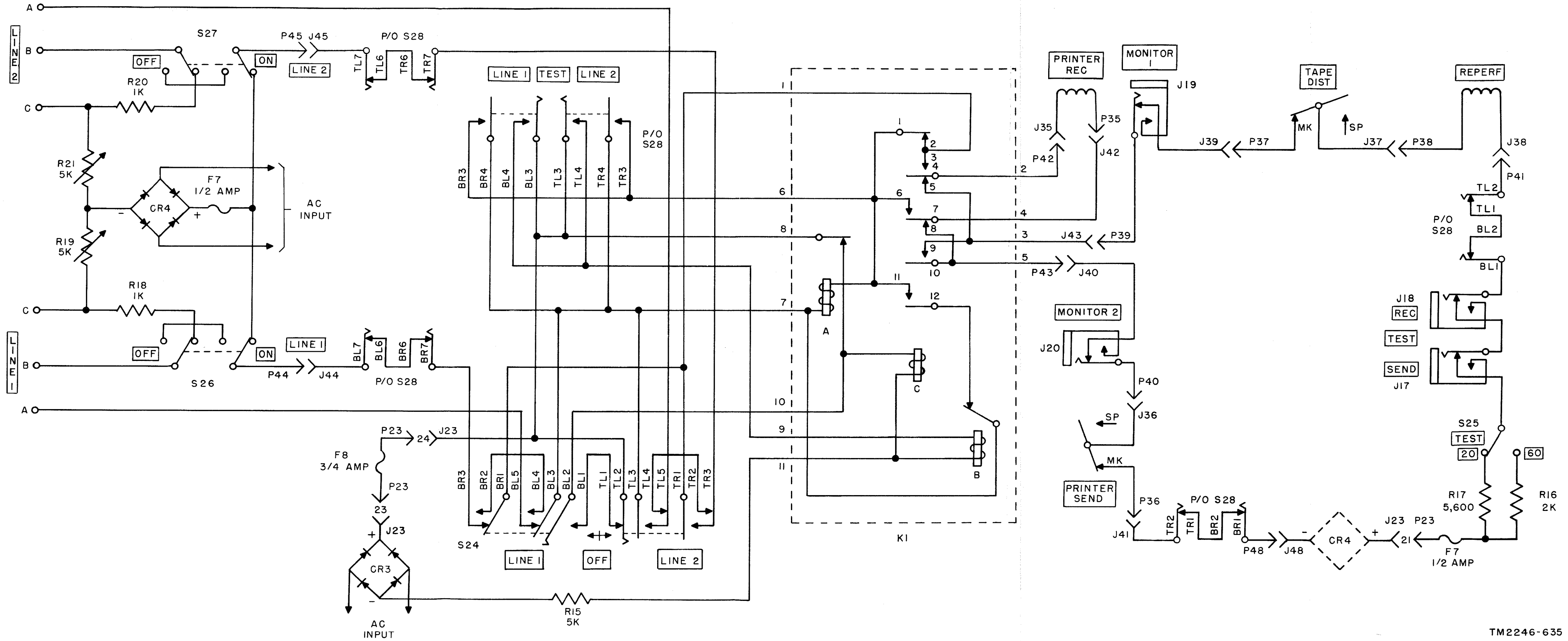
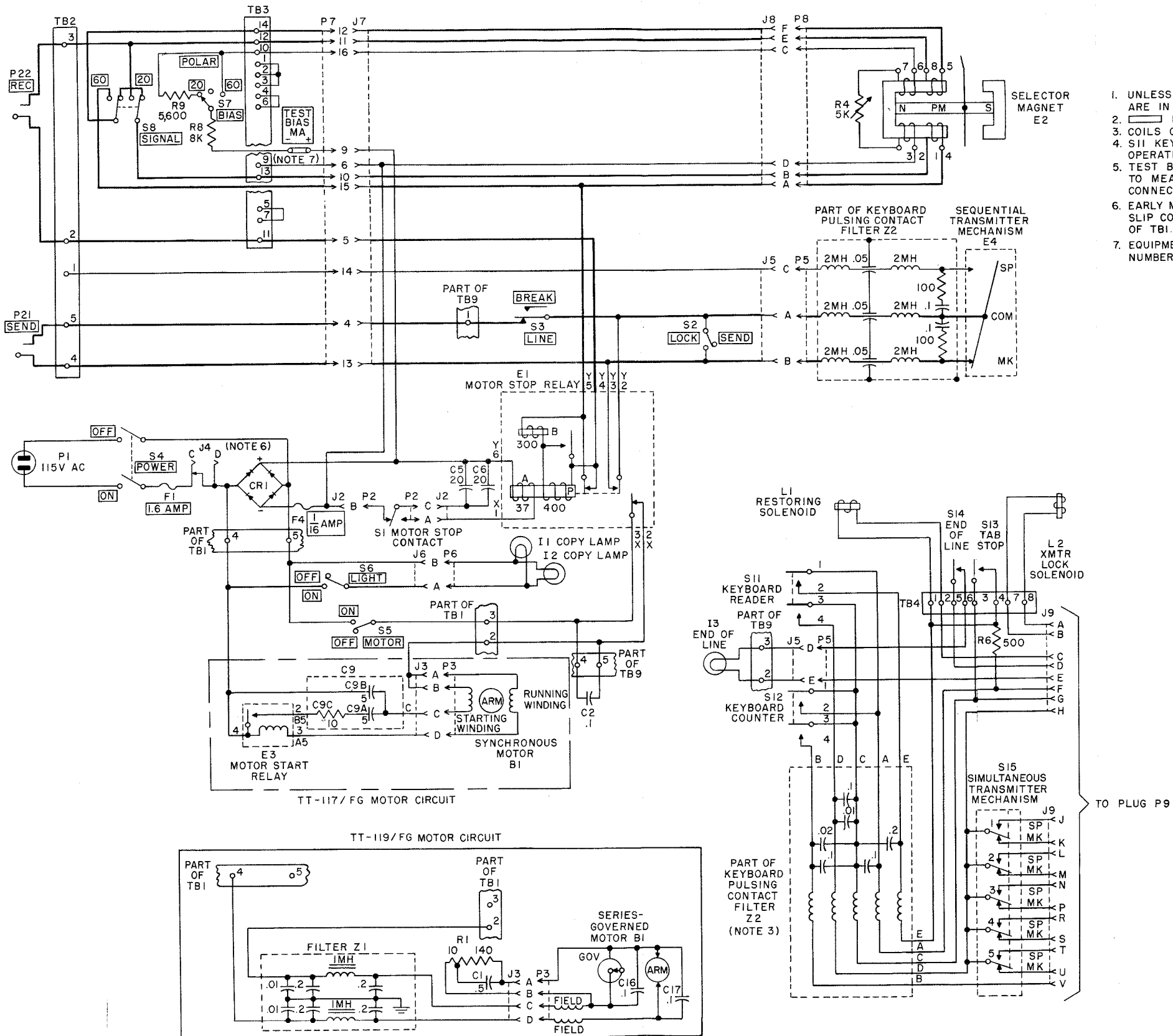
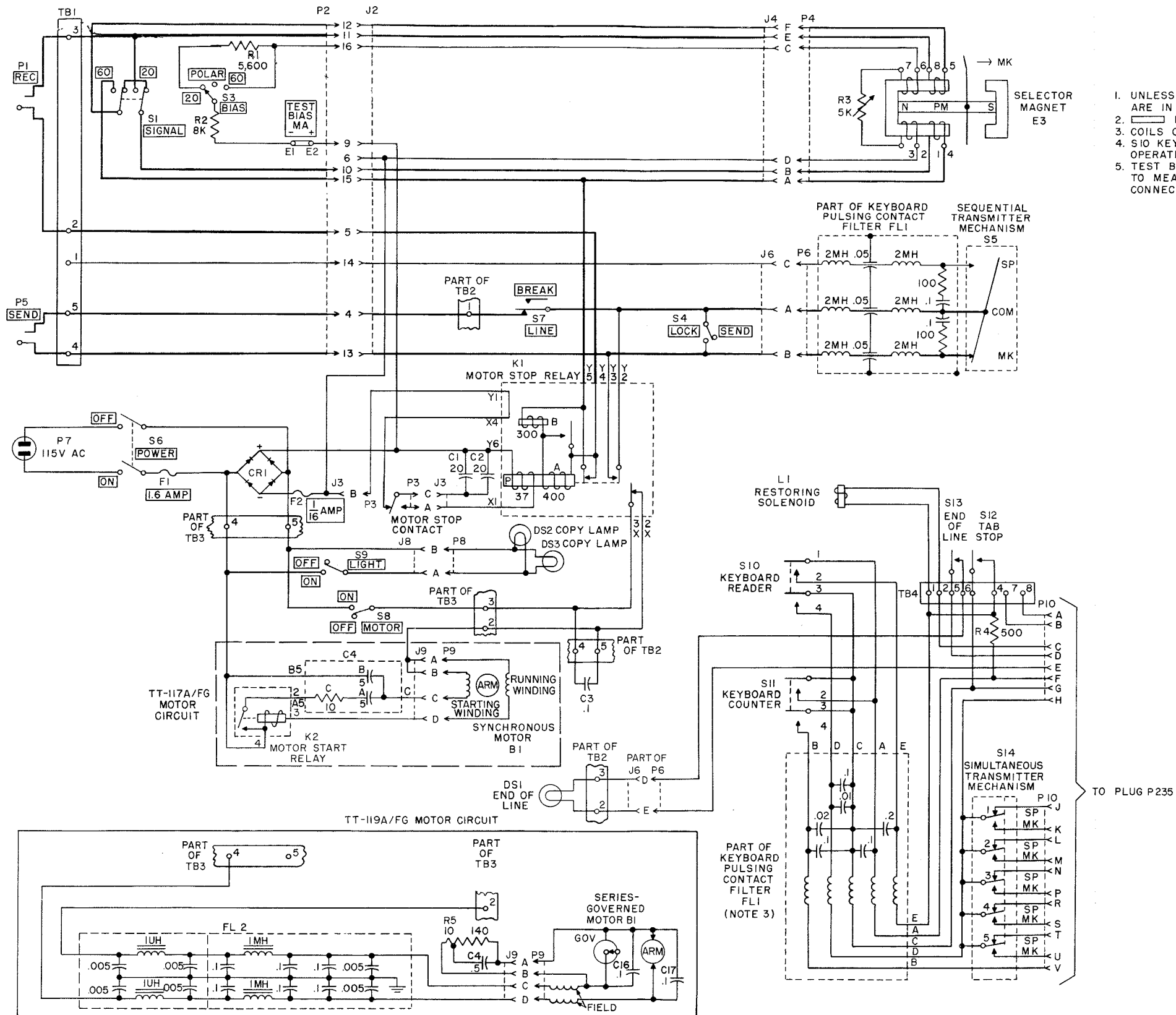


Figure 147. Automatic line return circuit, complete schematic diagram.



- NOTES:**
1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF
  2. INDICATES EQUIPMENT MARKING
  3. COILS OF FILTER Z2 ARE 1MH
  4. S11 KEYBOARD READER CONTACTS KEY LEVER OPERATED
  5. TEST BIAS MA PROVIDES AMMETER CONNECTION POINT TO MEASURE BIAS CURRENT; NORMALLY CONNECTED WITH STRAP
  6. EARLY MODELS OF TT-117/FG AND TT-119/FG INCLUDE J4 SLIP CONTACTS CONNECTED BETWEEN F1 AND TERMINAL 4 OF TBI. J4 NOT INCLUDED IN LATER MODELS.
  7. EQUIPMENTS ON ORDER NO. 26563-PHILA-52 WITH SERIAL NUMBERS BELOW 300 DO NOT CONTAIN THESE TERMINALS.

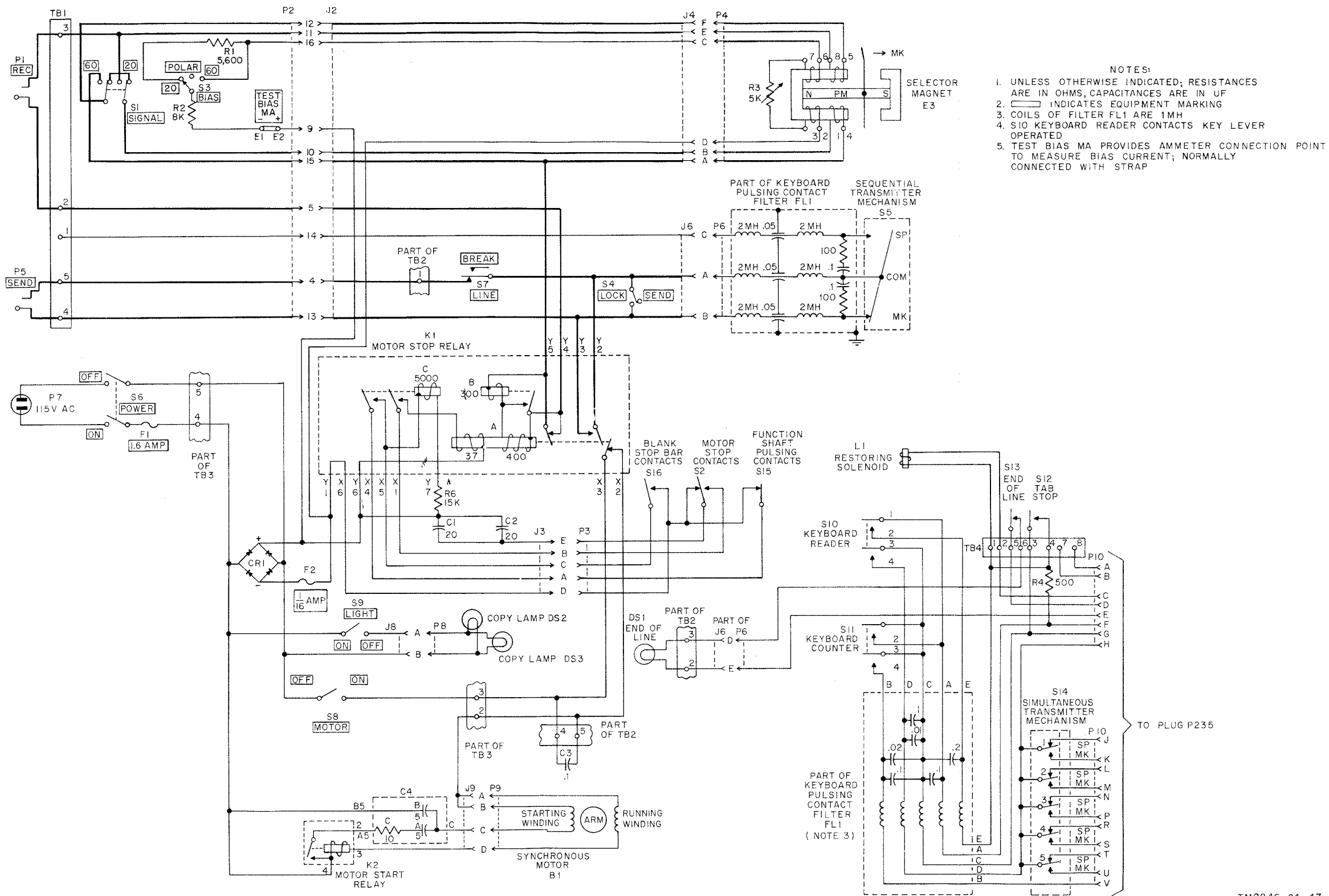
Figure 549. Page printer schematic diagram (TT-117/FG and TT-119/FG).



- NOTES:**
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF
  2. [Symbol] INDICATES EQUIPMENT MARKING
  3. COILS OF FILTER FL1 ARE 1MH
  4. S10 KEYBOARD READER CONTACTS KEY LEVER OPERATED
  5. TEST BIAS MA PROVIDES AMMETER CONNECTION POINT TO MEASURE BIAS CURRENT; NORMALLY CONNECTED WITH STRAP

Figure 550. Page printer, schematic diagram (TT-117A/FG and TT-119A/FG).





- NOTES:
1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF
  2. INDICATES EQUIPMENT MARKING
  3. COILS OF FILTER FL1 ARE 1MH
  4. S10 KEYBOARD READER CONTACTS KEY LEVER OPERATED
  5. TEST BIAS MA PROVIDES AMMETER CONNECTION POINT TO MEASURE BIAS CURRENT; NORMALLY CONNECTED WITH STRAP

Figure 551. Page printer, schematic diagram (weather communications, TT-118/FG).

Figure 551

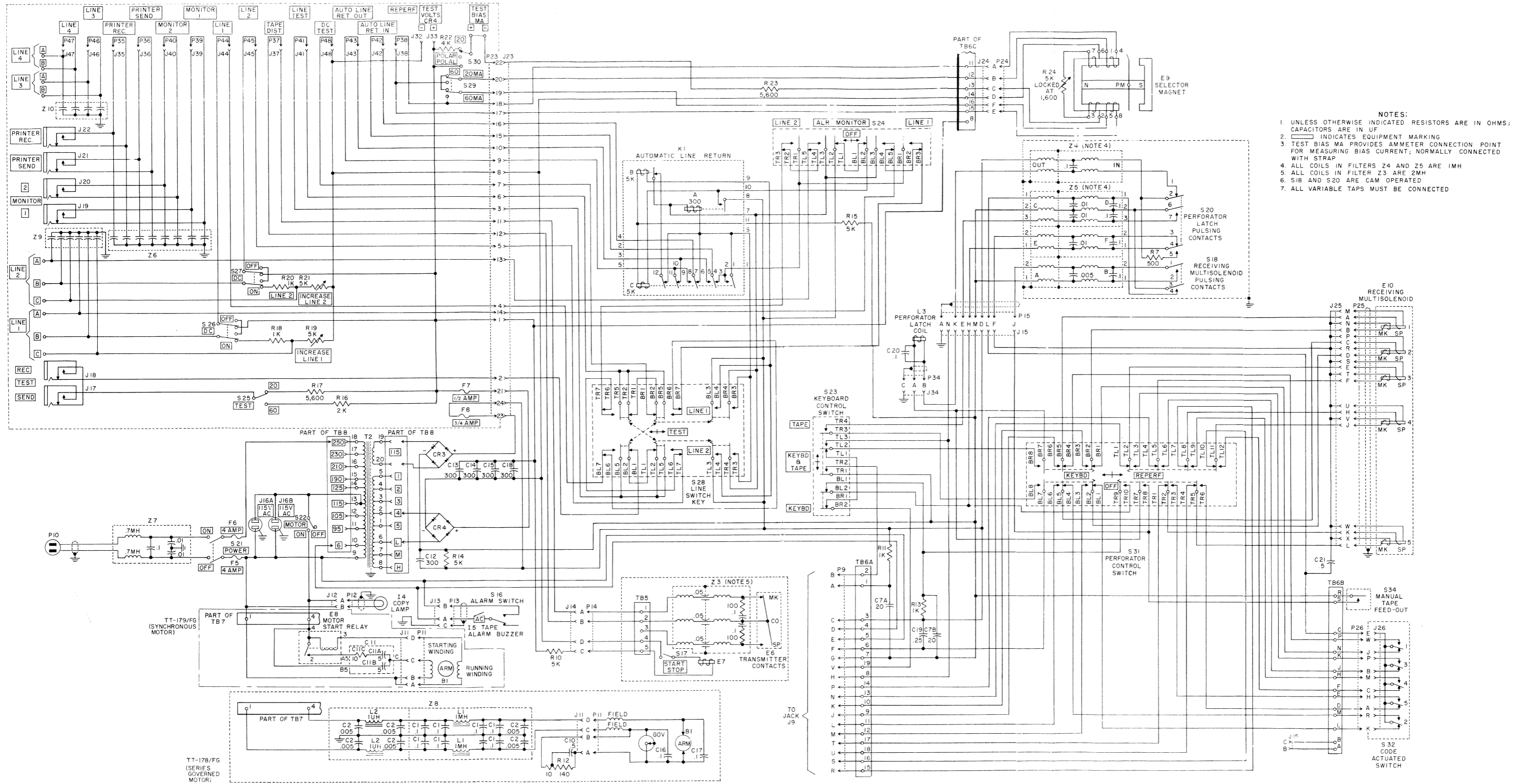
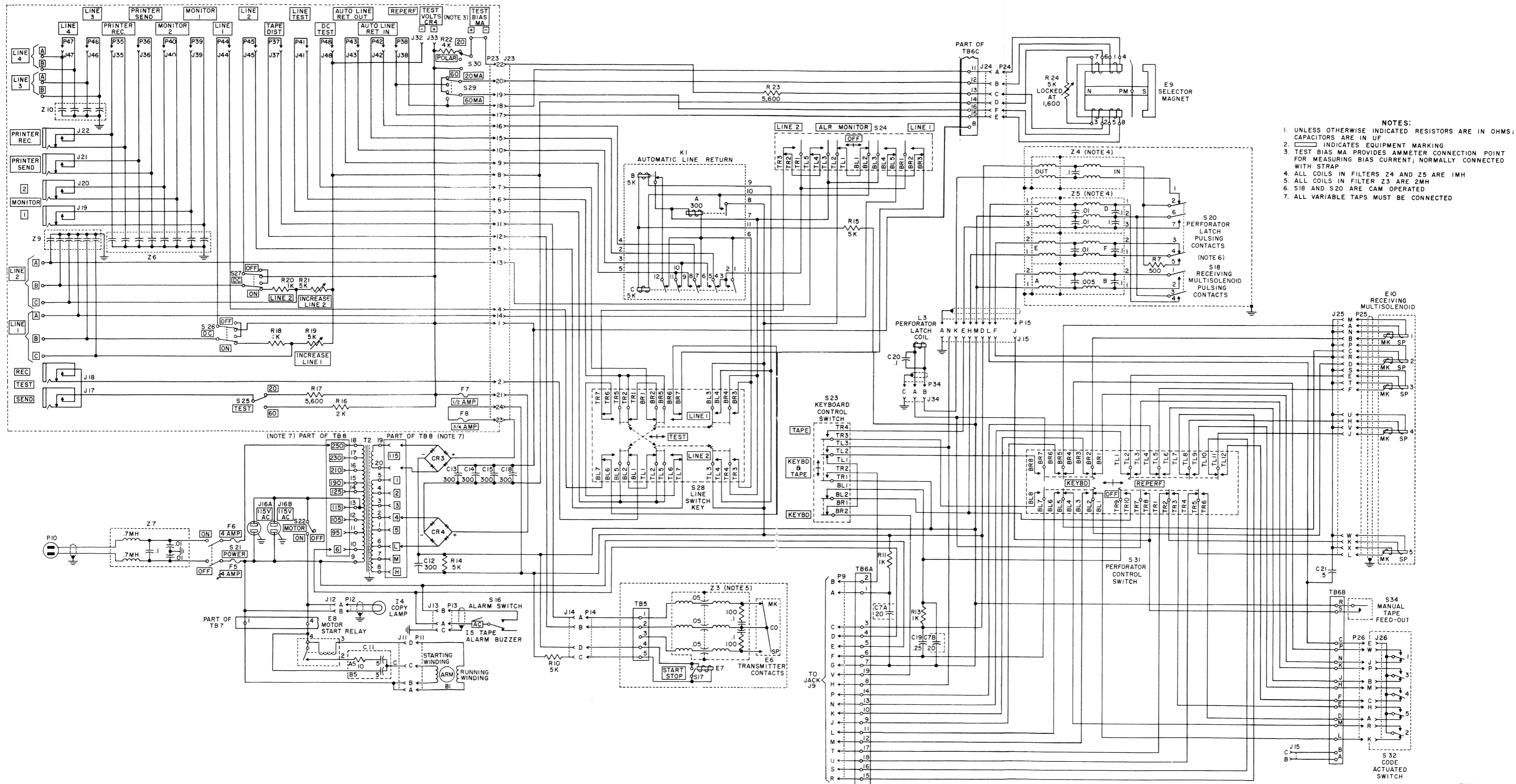
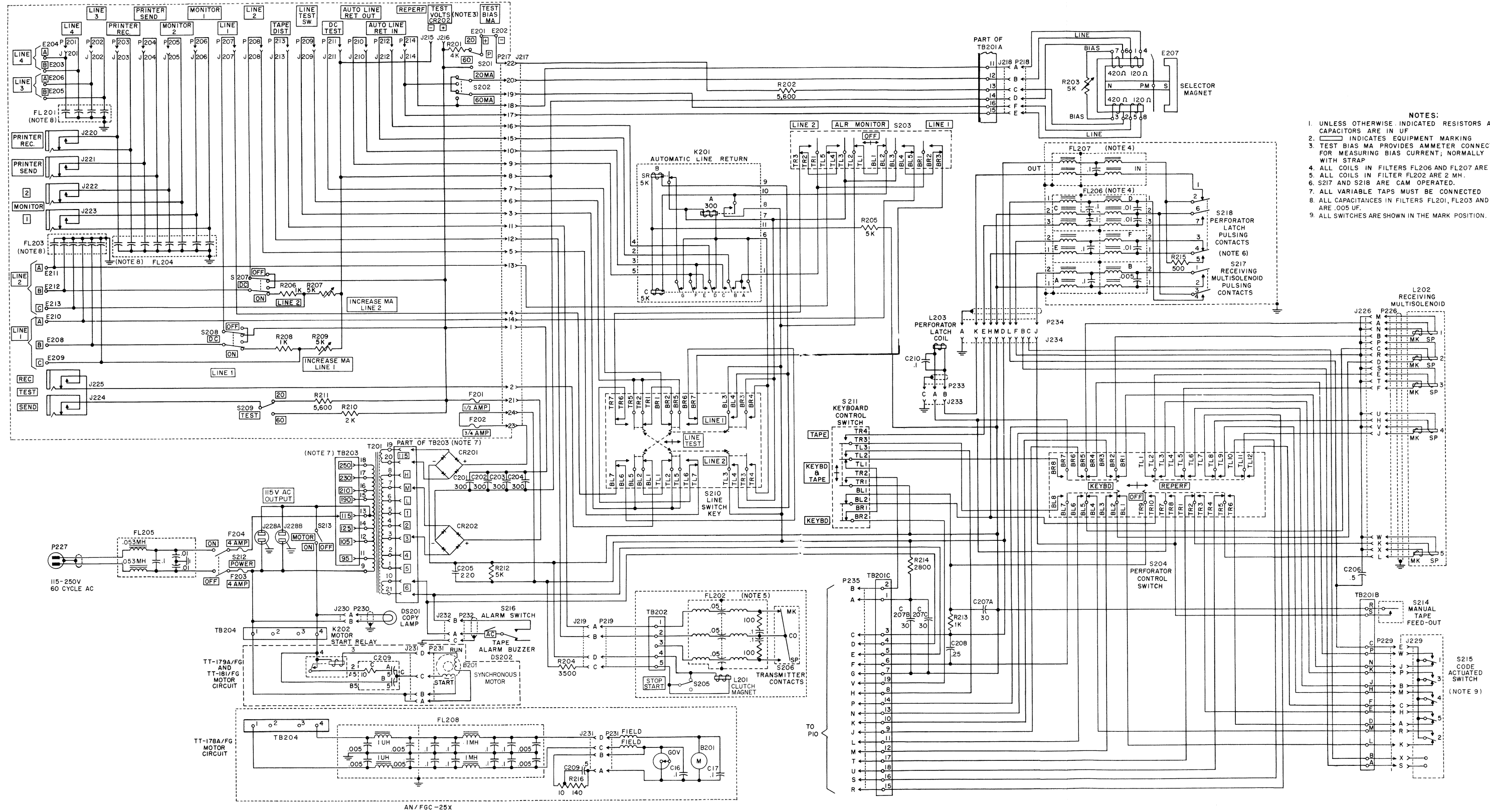


Figure 552. Perforator, schematic diagram (TT-178/FG and TT-179/FG with exception of Order No. 08710-P-55).





- NOTES:
1. UNLESS OTHERWISE INDICATED RESISTORS ARE IN OHMS; CAPACITORS ARE IN UF
  2. [Symbol] INDICATES EQUIPMENT MARKING
  3. TEST BIAS MA PROVIDES AMMETER CONNECTION POINT FOR MEASURING BIAS CURRENT; NORMALLY CONNECTED WITH STRAP
  4. ALL COILS IN FILTERS Z4 AND Z5 ARE 1M $\Omega$
  5. ALL COILS IN FILTER Z3 ARE 2M $\Omega$
  6. S18 AND S20 ARE CAM OPERATED
  7. ALL VARIABLE TAPS MUST BE CONNECTED

Figure 553. Perforator, schematic diagram (TT-179/FG on Order No. 08710-Phila-55).



- NOTES:
1. UNLESS OTHERWISE INDICATED RESISTORS ARE IN OHMS; CAPACITORS ARE IN UF
  2.    INDICATES EQUIPMENT MARKING
  3. TEST BIAS MA PROVIDES AMMETER CONNECTION POINT FOR MEASURING BIAS CURRENT; NORMALLY CONNECTED WITH STRAP
  4. ALL COILS IN FILTERS FL206 AND FL207 ARE 1 MH.
  5. ALL COILS IN FILTER FL202 ARE 2 MH.
  6. S217 AND S218 ARE CAM OPERATED.
  7. ALL VARIABLE TAPS MUST BE CONNECTED
  8. ALL CAPACITANCES IN FILTERS FL201, FL203 AND FL204, ARE .005 UF.
  9. ALL SWITCHES ARE SHOWN IN THE MARK POSITION.

Figure 554. Perforator, schematic diagram (TT-178A/FG, TT-179A/FG, and TT-181/FG).

- NOTES:**
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
  2.  DENOTES SHIELDED CONNECTION.
  3.  INDICATES EQUIPMENT MARKING.
  4. CRI CONNECTIONS IN EARLY MODELS OF TT-117/FG AND TT-119/FG (INCLUDE J4).
  5. CRI CONNECTIONS IN LATER MODELS OF TT-117/FG AND TT-119/FG (DO NOT INCLUDE J4).
  6. TT-117/FG ONLY (SYNCHRONOUS MOTOR).
  7. TT-119/FG ONLY (SERIES-GOVERNED MOTOR).

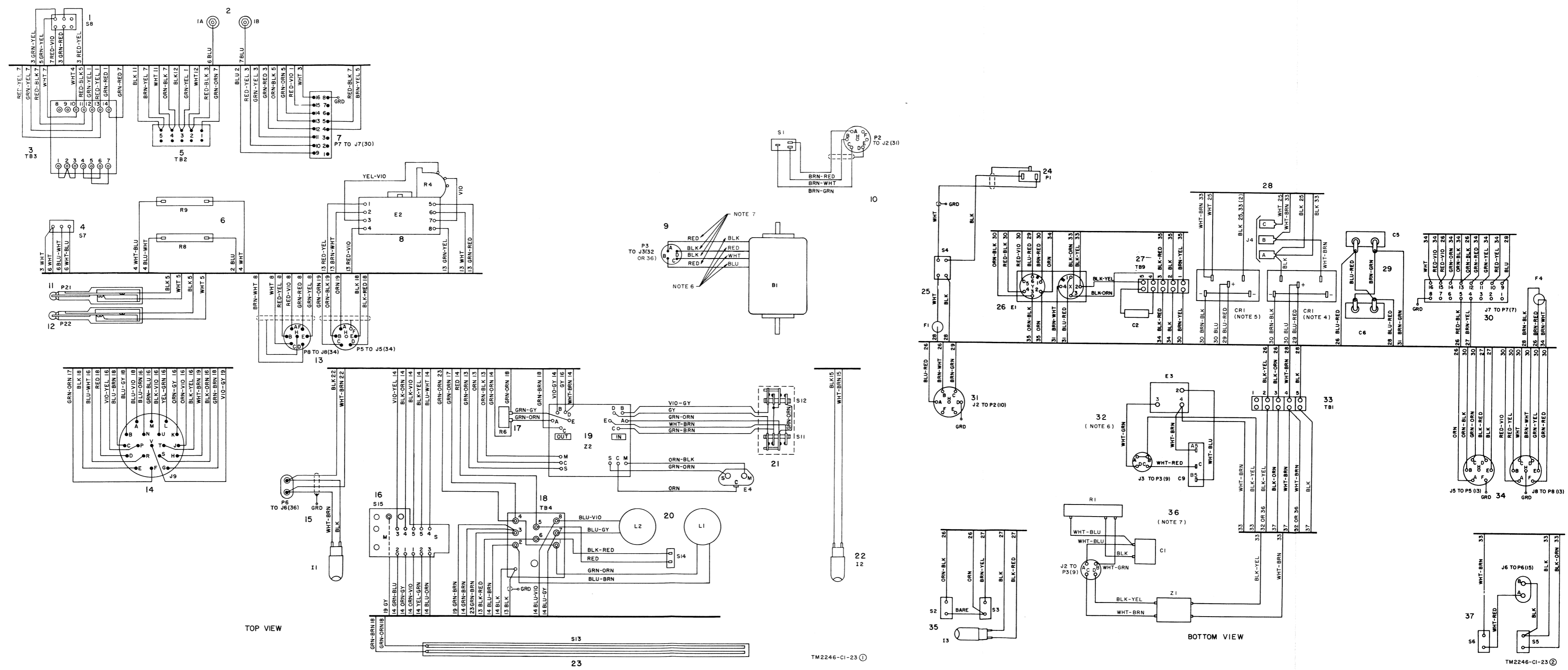


Figure 555. Page printer, wiring diagram (TT-117/FG and TT-119/FG).

Figure 555

- NOTES:**
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
  2. (---) DENOTES SHIELDED CONNECTION.
  3. (---) INDICATES EQUIPMENT MARKING.
  4. PLUG P9 SHOWN CONNECTED FOR SERIES-GOVERNED MOTOR POWER.
  5. PLUG P3 SHOWN CONNECTED FOR SYNCHRONOUS MOTOR POWER.
  6. STATION 36 IS SHOWN WIRED TO TB3 AS WITH TELETYPEWRITERS EQUIPPED WITH SERIES-GOVERNED MOTORS.
  7. STATION 32 IS SHOWN WIRED TO TB3 AS WITH TELETYPEWRITERS EQUIPPED WITH SYNCHRONOUS MOTORS.

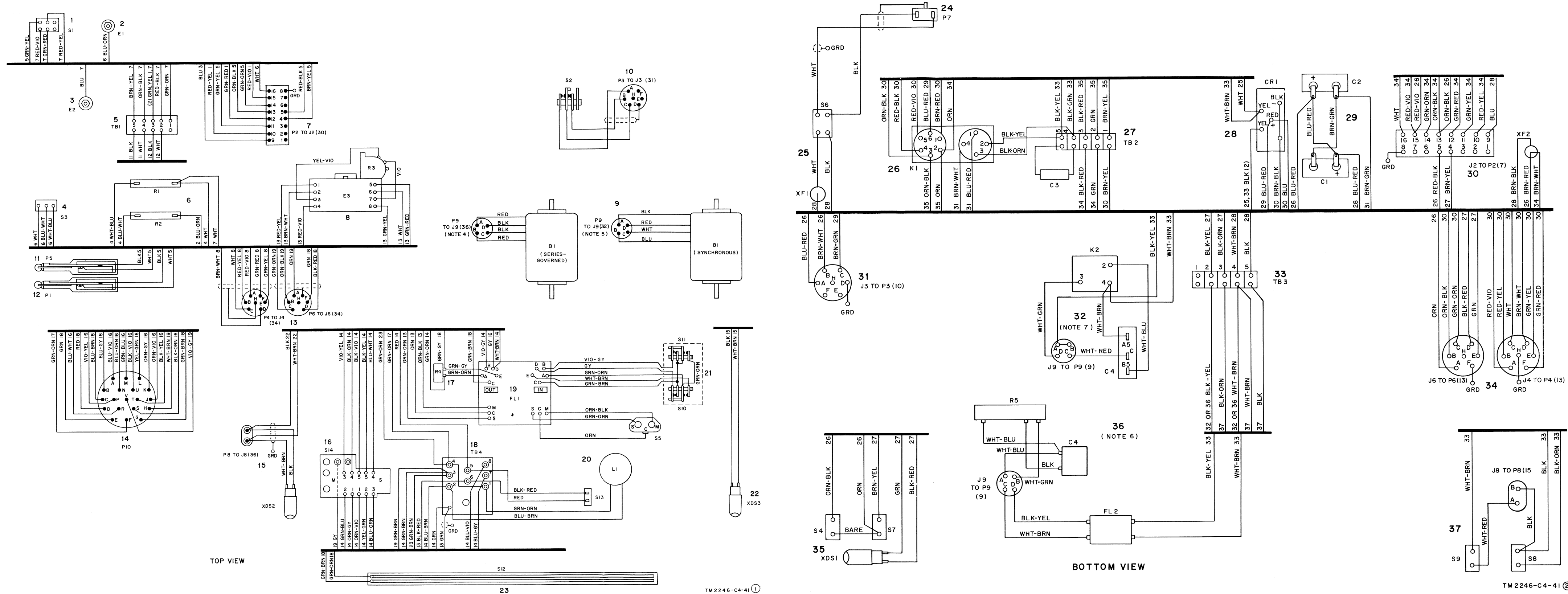


Figure 556. Page printer, wiring diagram (TT-117A/FG and TT-119A/FG).

Figure 556



- NOTES:**
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
  2. (---) DENOTES SHIELDED CONNECTION.
  3. (---) INDICATES EQUIPMENT MARKING.
  4. SWITCHES S15 AND S16 MECHANICALLY OPERATED BY LEVER ACTION.
  5. SWITCH S2 MECHANICALLY OPERATED BY PULSING CAM.

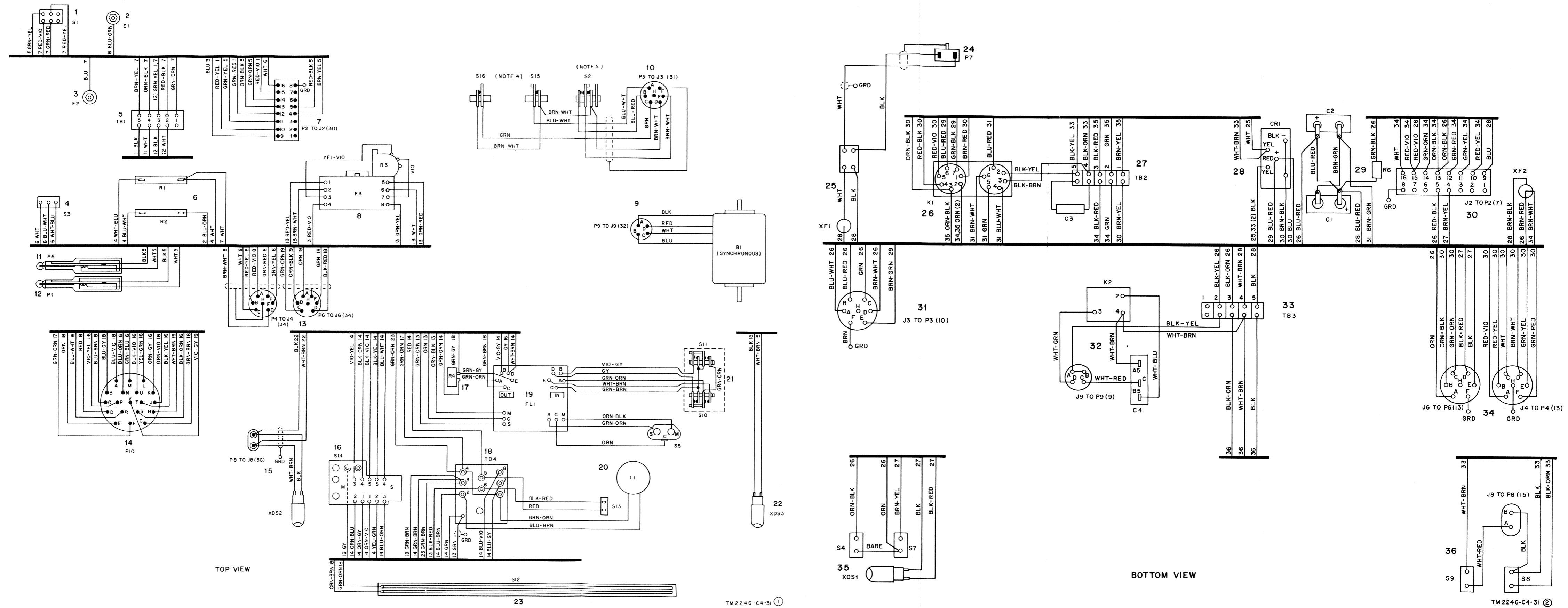
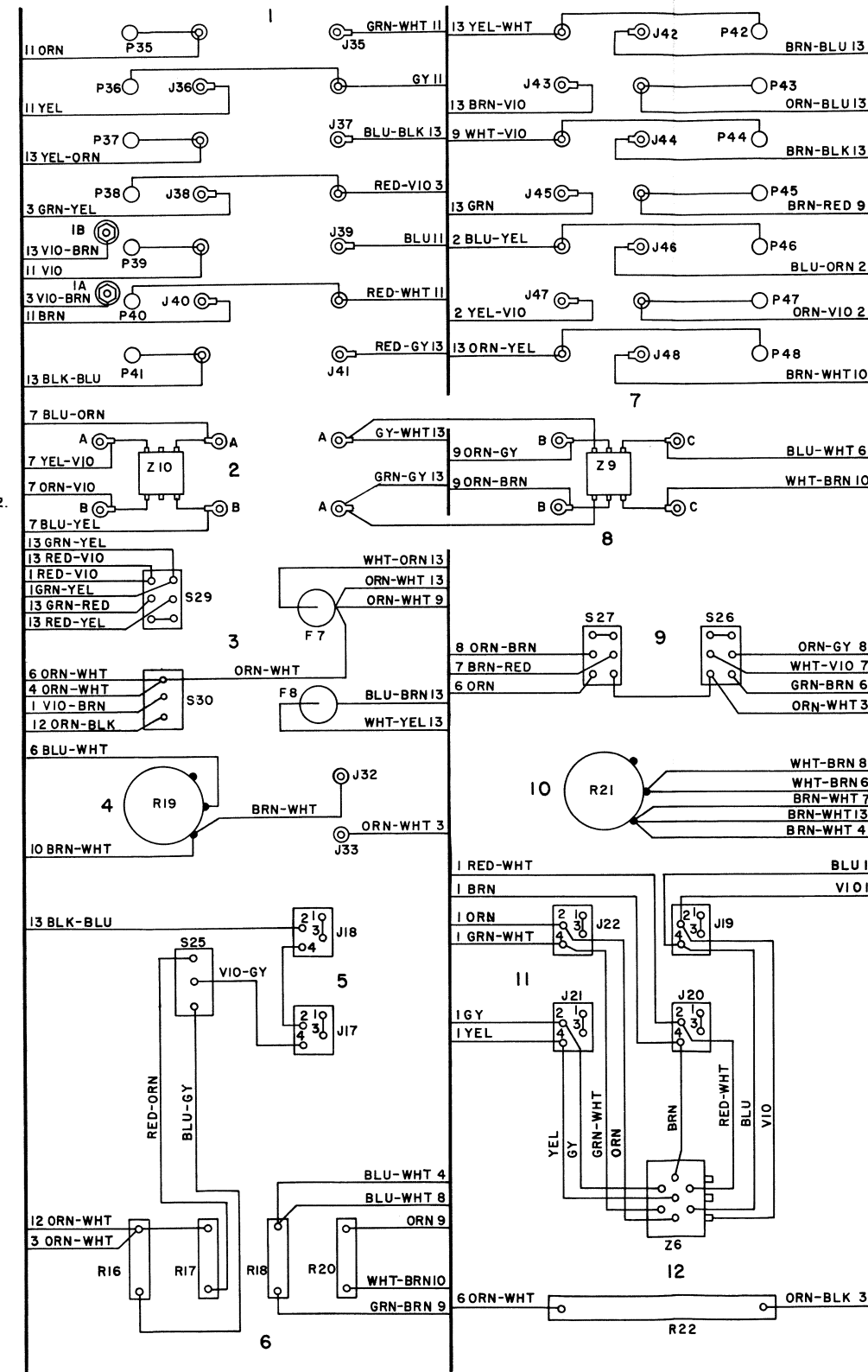


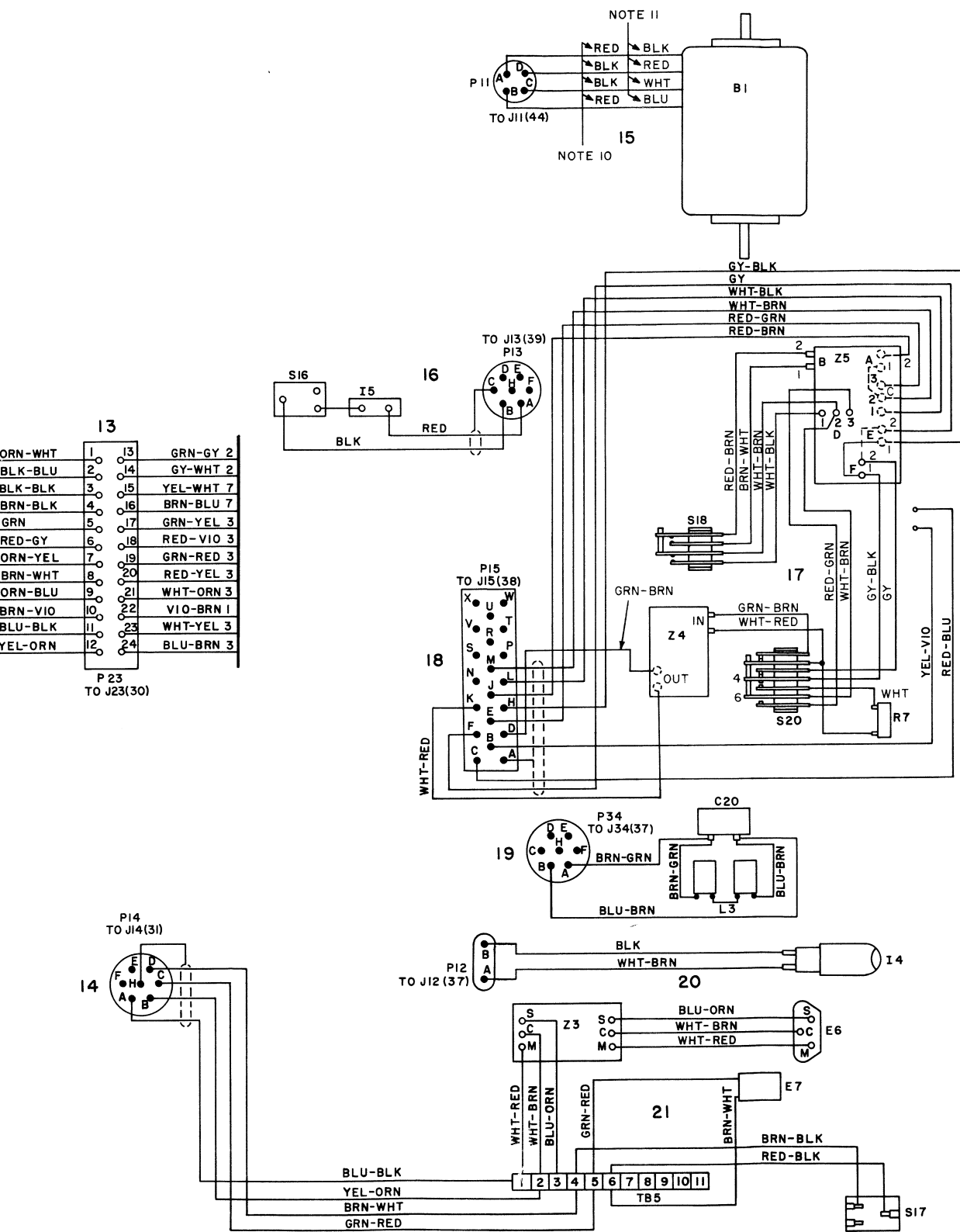
Figure 557. Page printer, wiring diagram (weather communications, TT-118/FG).

Figure 557

- NOTES:**
- THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
  - DENOTES SHIELDED CONNECTION.
  - INDICATES EQUIPMENT MARKING.
  - PLUG AND JACK CROSS REFERENCES AT STATIONS 1 AND 7 ARE DETERMINED BY LOCAL PATCHING CONDITIONS.
  - J17 AND J18 ARE TEST SEND AND RECEIVE JACKS.
  - J19 AND J20 ARE PROVIDED FOR MONITOR EQUIPMENT.
  - J21 AND J22 (STATION 11) ARE PROVIDED FOR INSERTION OF PAGE PRINTER PLUGS P21 & P22.
  - J32 AND J33 ARE FOR TEST VOLTS CR4.
  - S23 IS SHOWN IN THE KEYBD & TAPE POSITION.
  - PART OF TT-178/FG (SERIES-GOVERNED MOTOR).
  - PART OF TT-179/FG (SYNCHRONOUS MOTOR).

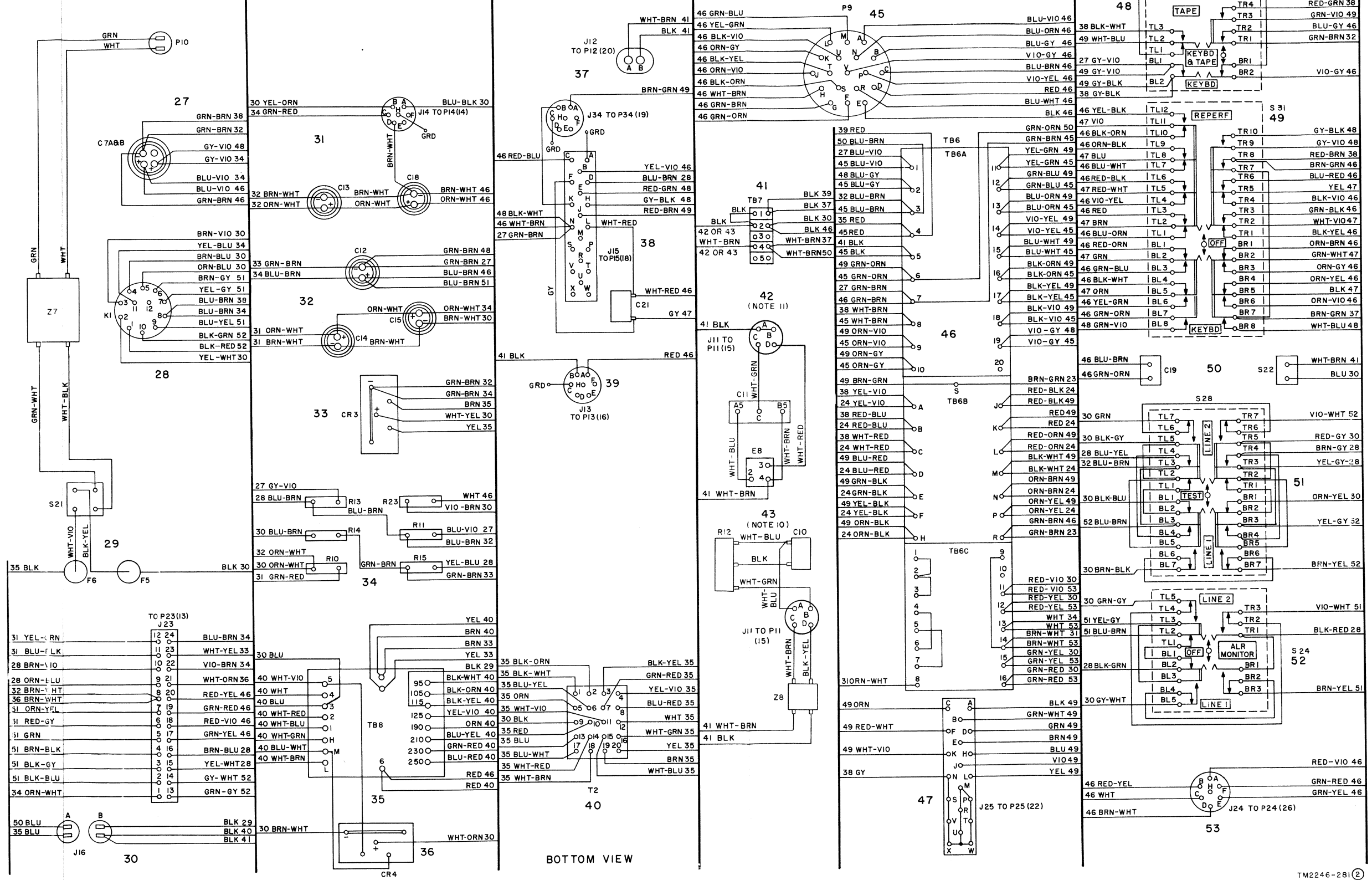


TOP VIEW



BOTTOM VIEW

Figure 558. Perforator, wiring diagram (TT-178/FG and TT-179/FG).



TOP VIEW

Figure 558. Perforator, wiring diagram (TT-178/FG and TT-179/FG).



- NOTES:**
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
  2. DENOTES SHIELDED CONNECTION.
  3. INDICATES EQUIPMENT MARKING.
  4. PLUG AND JACK CROSS REFERENCES AT STATIONS I AND 7 ARE DETERMINED BY LOCAL PATCHING CONDITIONS.
  5. J17 AND J18 ARE TEST SEND AND RECEIVE JACKS.
  6. J19 AND J20 ARE PROVIDED FOR MONITOR EQUIPMENT.
  7. J21 AND J22 (STATION II) ARE PROVIDED FOR INSERTION OF PAGE PRINTER PLUGS P21 & P22.
  8. J12 AND J33 ARE FOR TEST VOLTS CR4.
  9. S23 IS SHOWN IN THE KEYBD & TAPE POSITION.

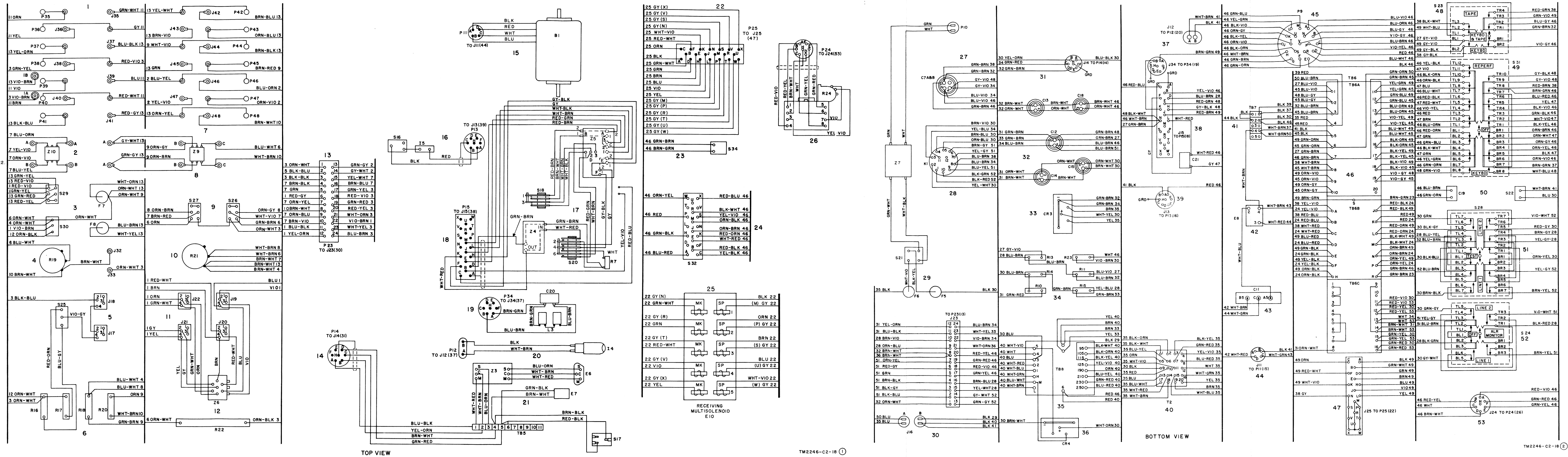
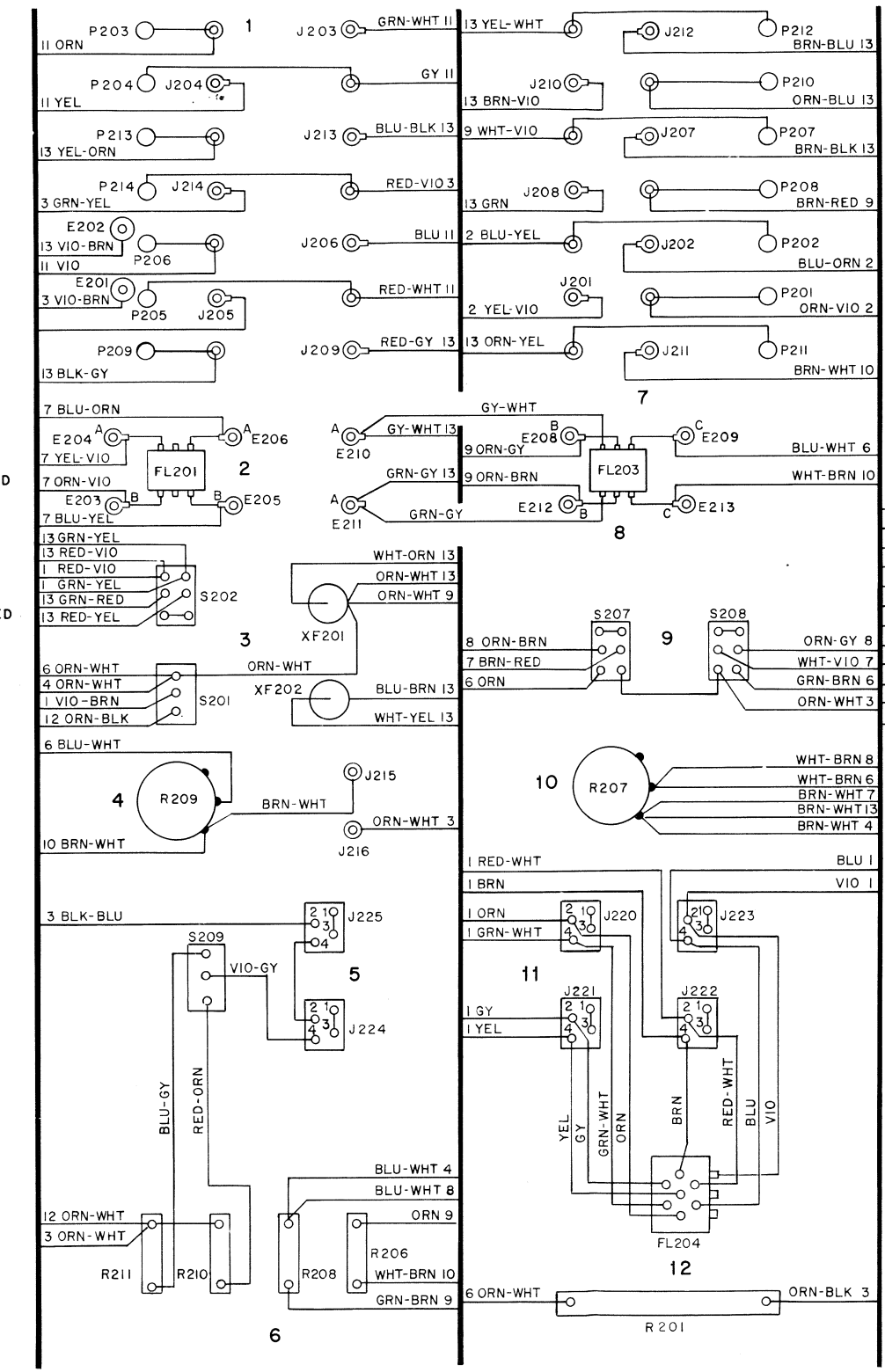


Figure 559. Perforator, wiring diagram (TT-179/FG furnished on Order No. 08210-Phila-55).

Figure 559

- NOTES**
- THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
  - DENOTES SHIELDED CONNECTION.
  - INDICATES EQUIPMENT MARKING.
  - PLUG AND JACK CROSS REFERENCES AT STATIONS I AND 7 ARE DETERMINED BY LOCAL PATCHING CONDITIONS.
  - J224 AND J225 ARE TEST SEND AND RECEIVE JACKS.
  - J223 AND J222 ARE PROVIDED FOR MONITOR EQUIPMENT.
  - J221 AND J220 (STATION II) ARE PROVIDED FOR INSERTION OF PAGE PRINTER PLUGS P5 AND P1.
  - J215 AND J216 ARE FOR TEST VOLTS CR202.
  - S211 IS SHOWN IN THE KEYBD. & TAPE POSITION.
  - PART OF TT-178A/FG (SERIES-GOVERNED MOTOR).
  - PART OF TT-179A/FG AND TT-181/FG (SYNCHRONOUS MOTOR).



3 ORN-WHT	1	3	GRN-GY 2
5 BLK-BLU	2	4	GY-WHT 2
1 BLK-GY	3	5	YEL-WHT 7
7 BRN-BLK	4	6	BRN-BLU 7
7 GRN	5	7	GRN-YEL 3
1 RED-GY	6	8	RED-VIO 3
7 ORN-YEL	7	9	GRN-RED 3
10 BRN-WHT	8	20	RED-YEL 3
7 ORN-BLU	9	21	WHT-ORN 3
7 ORN-BLU	9	22	WHT-ORN 3
7 BRN-VIO	10	22	VIO-BRN 1
1 BLU-BLK	11	23	WHT-YEL 3
1 YEL-ORN	12	24	BLU-BRN 3

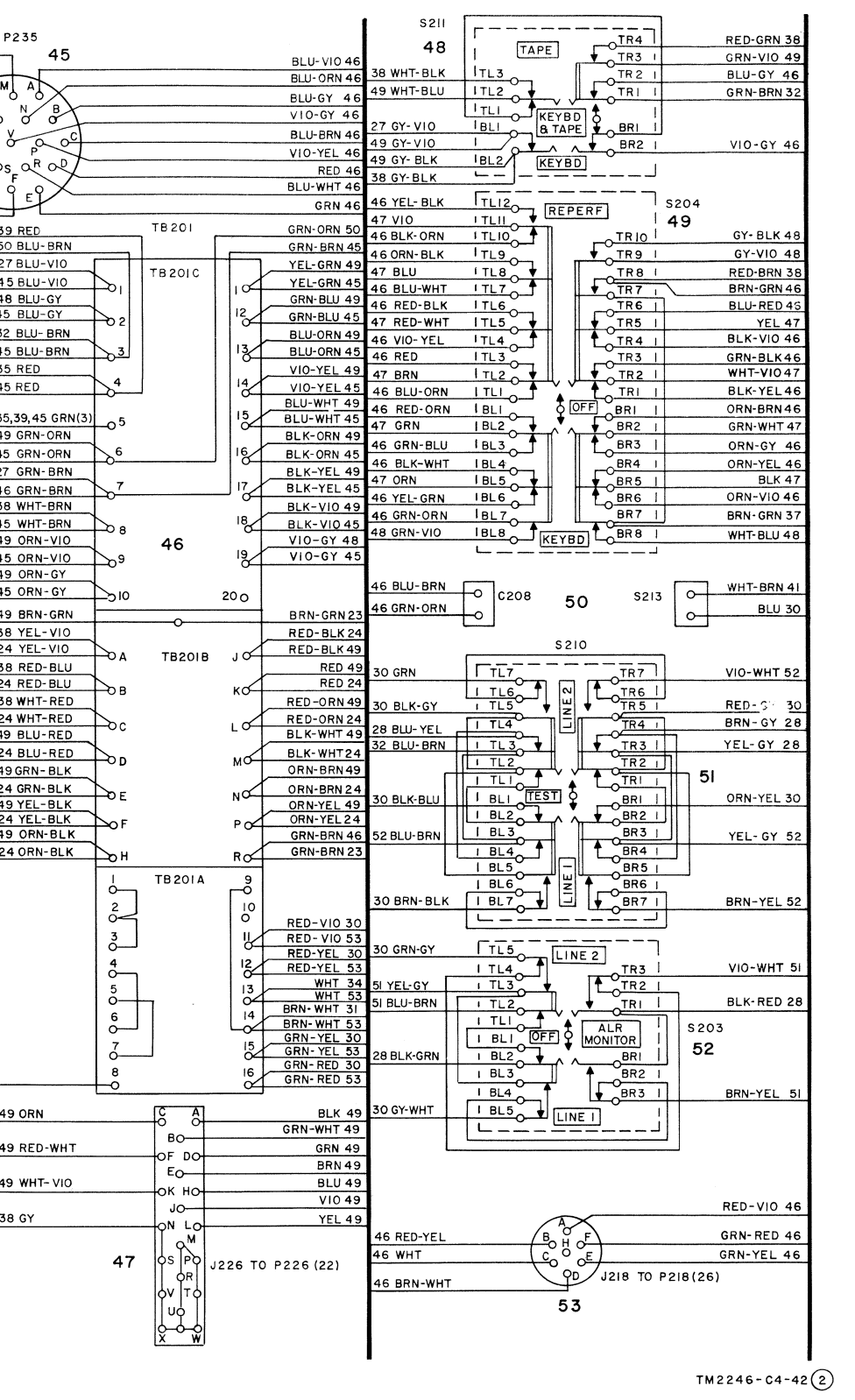
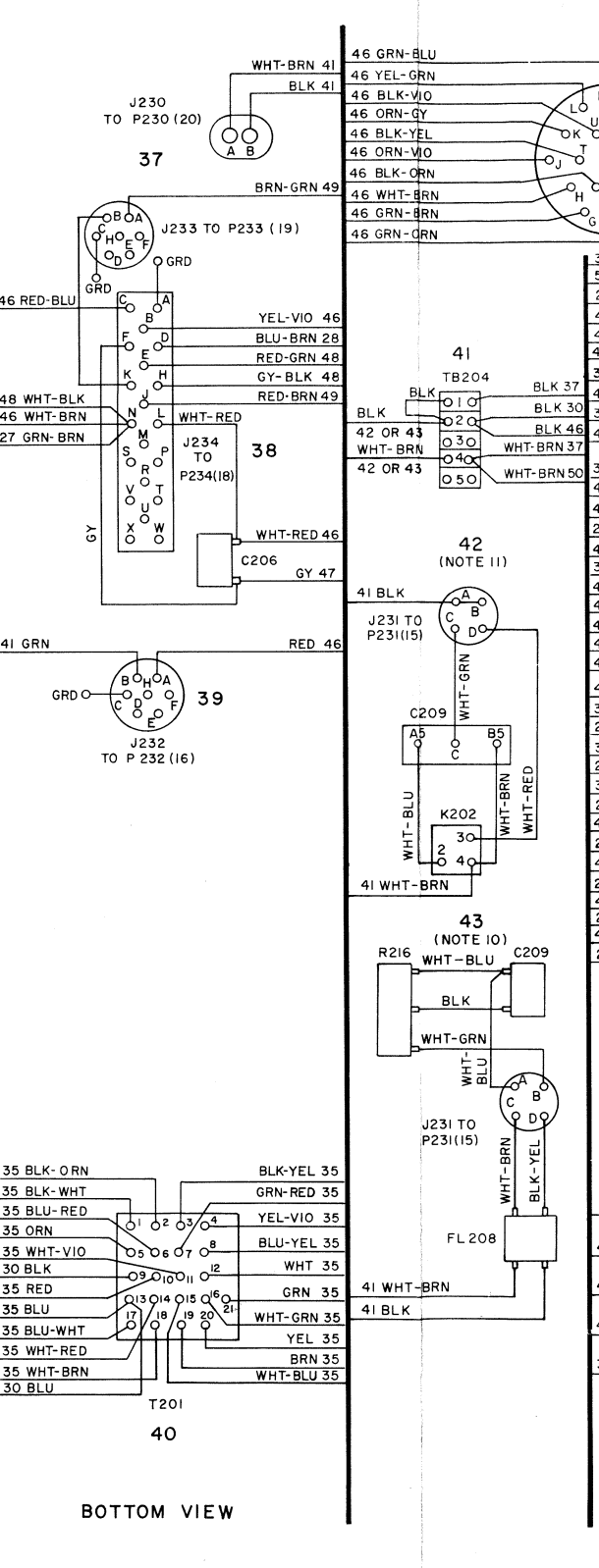
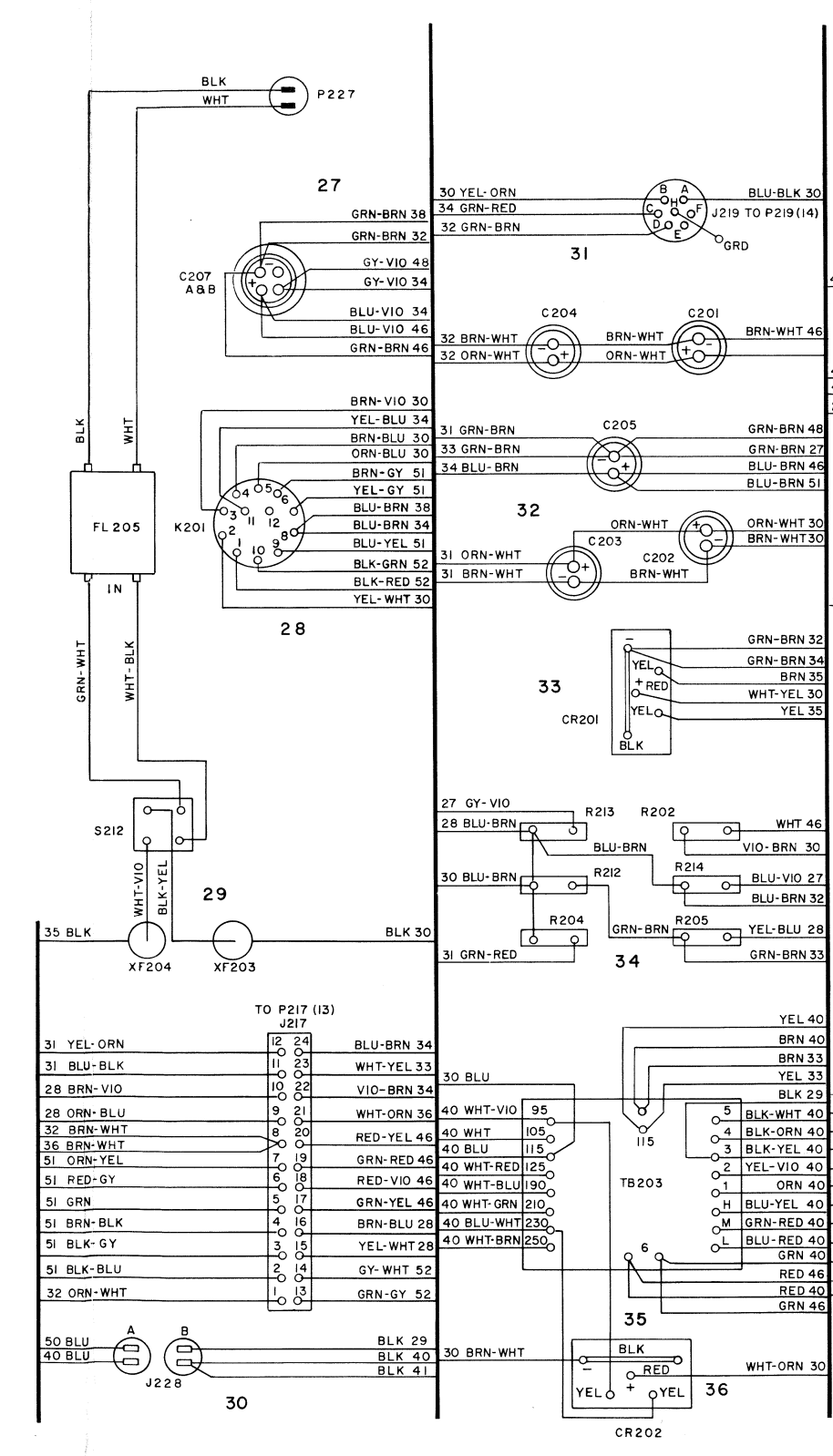
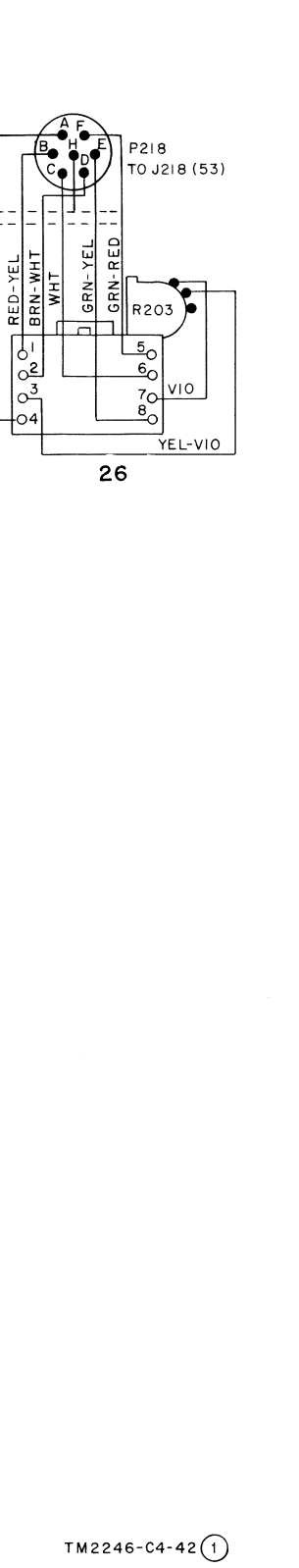
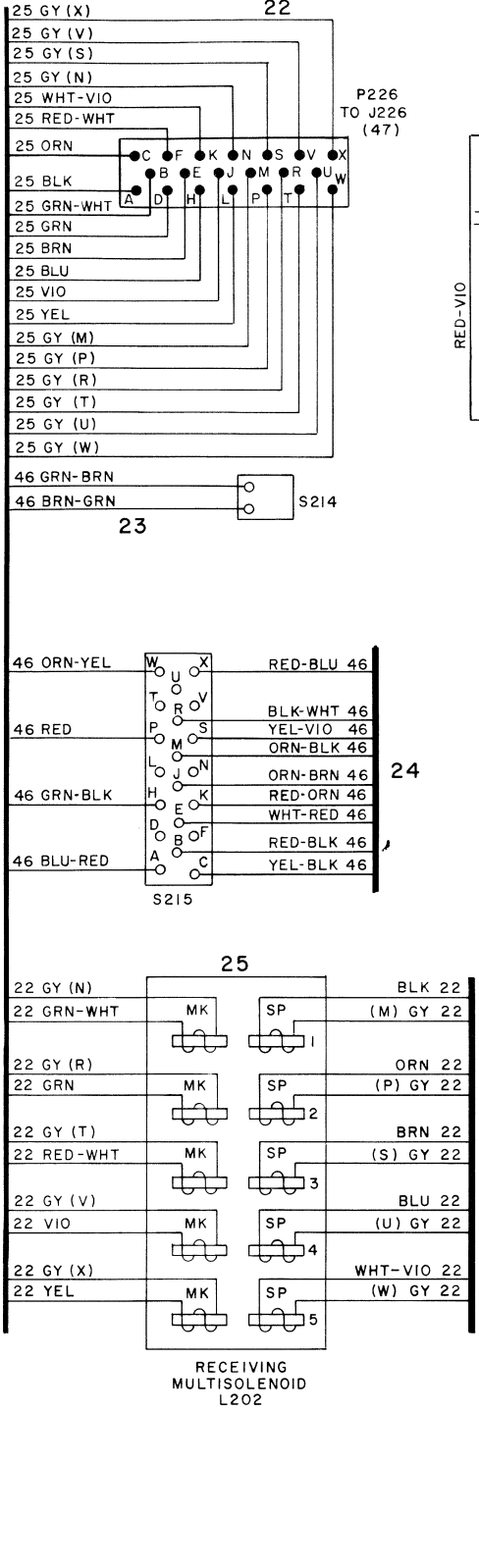
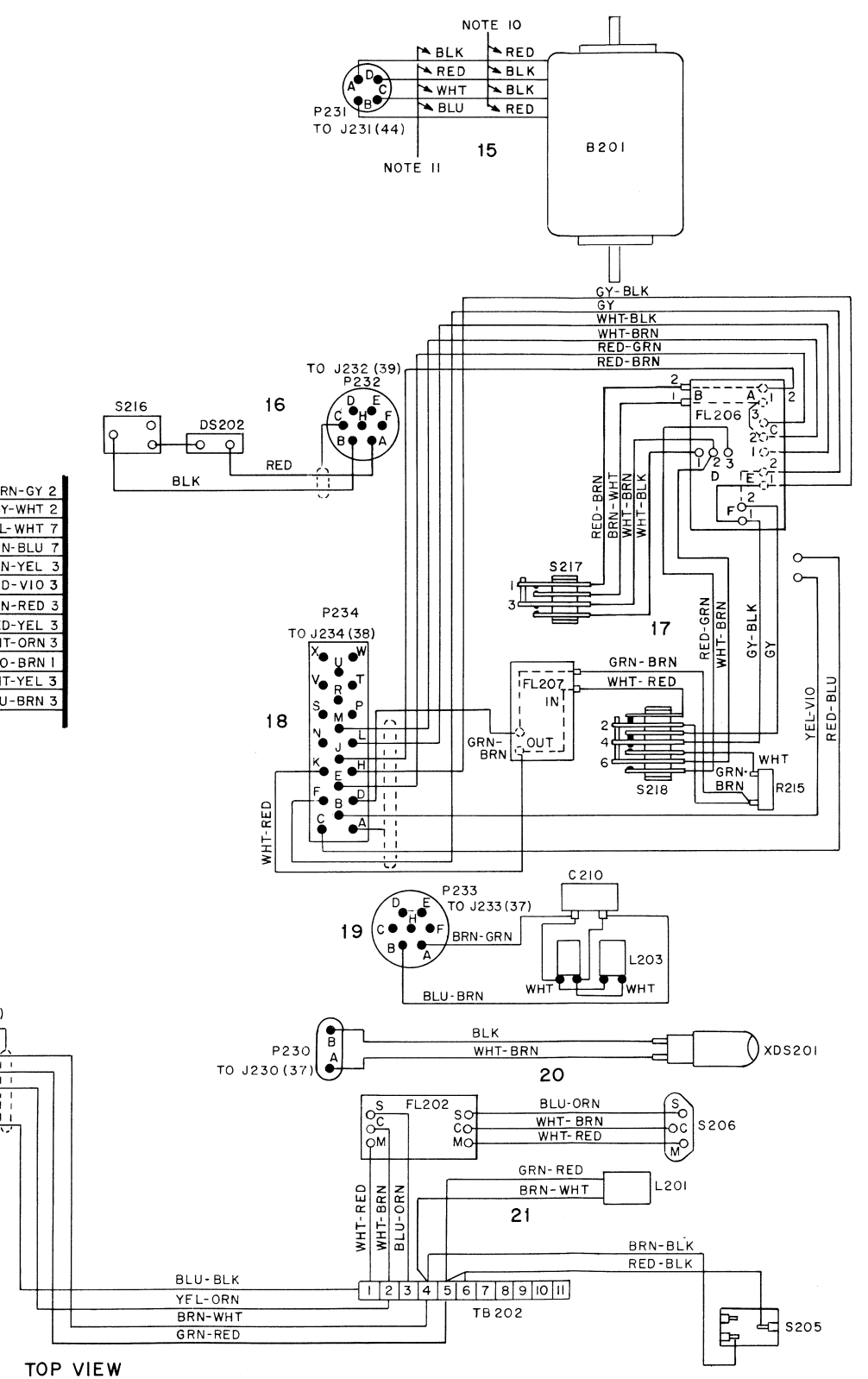


Figure 560. Perforator wiring diagram (TT-178A/FG, TT-179A/FG, and TT-181/FG).

Figure 560