TM 11-2230

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TELETYPEWRITER SETS

ANF/GC-20, AN/FGC-20X
AN/FGC-21

DEPARTMENT OF THE ARMY • MAY 1956

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

TECHNICAL MANUAL }
No. 11-2230 }

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *31 May 1956*

TELETYPEWRITER SETS AN/FGC-20, AN/FGC-20X, AND AN/FGC-21

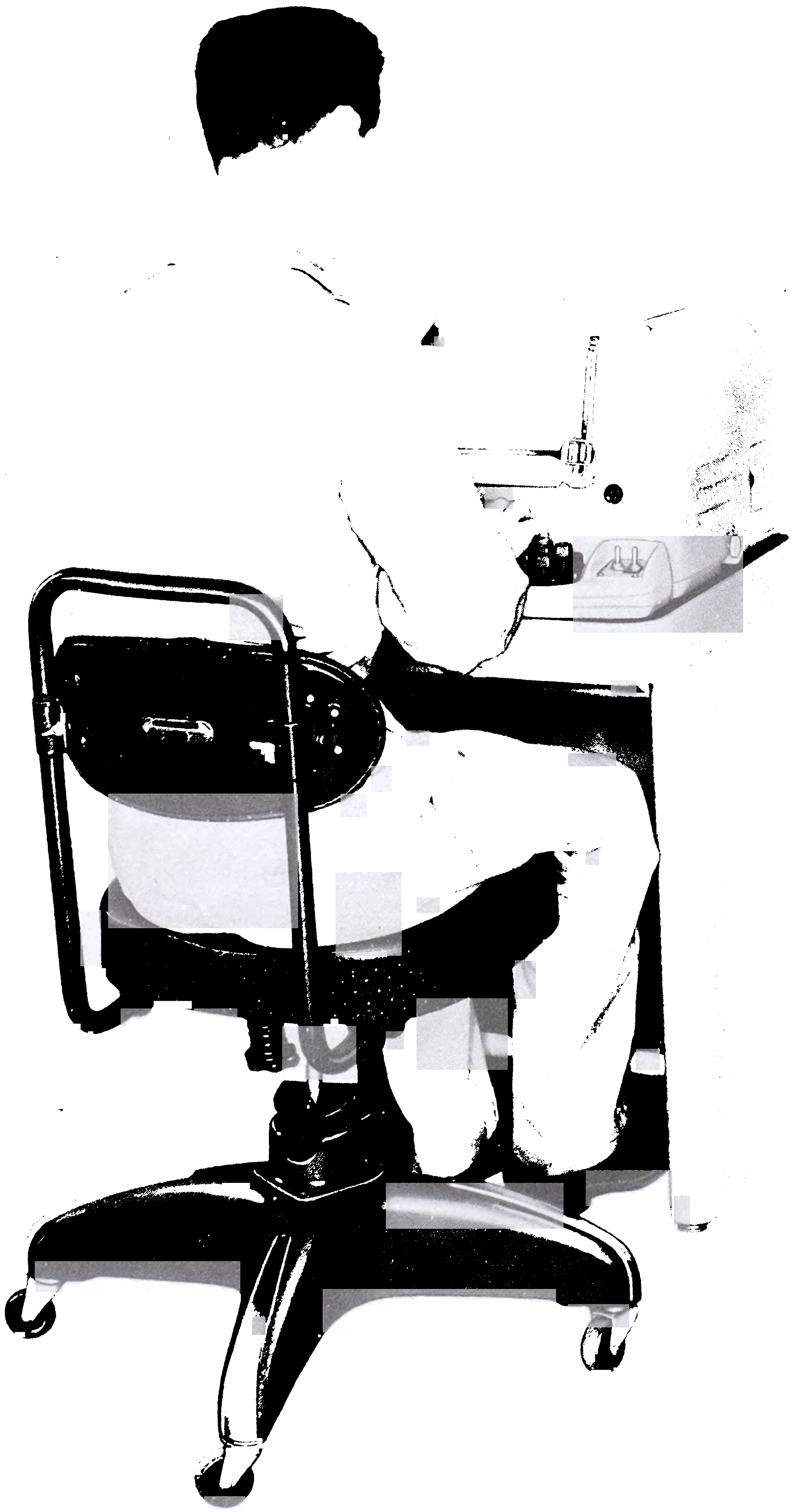

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Figure 1. Teletypewriter Set AN/FGC–20, installed.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for the installation, operation, theory, maintenance, and repair of Teletypewriter Sets AN/FGC–20 (fig. 1), AN/FGC–20X, and AN/FGC–21.

b. Forward comments on this manual directly to Commanding Officer, The Signal Corps Publications Agency, Fort Monmouth, N. J.

2. Forms and Records

a. Unsatisfactory Equipment Reports

(1) Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to the Office of the Chief Signal Officer, as prescribed in AR 700–38.

(2) Fill out and forward DD Form 535 (Unsatisfactory Report) to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in AR 700–38 and in AF TO 00–35D–54.

b. Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army); Navy Shipping Guide, Article 1850–4 (Navy); and AFR 71–4 (Air Force).

c. Preventive Maintenance Forms

(1) Prepare DA Form 11–252 (Operator First Echelon Maintenance Check List for Signal Corps Equipment (Teletypewriter) (fig. 89) in accordance with instructions on the back of the form.

(2) Prepare DA Form 11–253 (Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Teletypewriter)) (fig. 90) in accordance with instructions on the back of the form.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Teletypewriter Sets AN/FGC–20 (fig. 2), AN/FGC–20X, and AN/FGC–21 are fixed-station, page-printing teletypewriters which transmit, monitor, and receive messages in communication centers and weather stations. Two or more teletypewriters can be interconnected directly and operated with or without the use of associated equipment. Such arrangements are shown in figure 3.

b. Each teletypewriter set requires an input power source of 95- to 125- or 190- to 250-volts alternating current (ac) when Power Supply PP–978/FG is used, and can send and receive at approximately 60, 66, 75, or 100 words per minute (wpm) in response to 20- or 60-milliampere (ma) neutral or 20- to 30-ma polar signals. The equipment prints one to six copies on paper roll, fanfold paper, or sprocket-fed forms 8½ inches wide. Any of the equipments may be modified for *receive only* operation (fig. 4) by removing the keyboard and reconnecting the wires.

4. Technical Characteristics of Teletypewriters TT–98/FG, TT–99/FG, and TT–100/FG

Type of installation	Fixed-station; send and receive; direct wire or radioteletype.
Symbols	TT–98/FG and TT–100/FG: standard communications. TT–99/FG: weather communications.
Type of characters	English.
Characters per line	Standard, 72. Weather, 76.
Type of paper feed	Friction or sprocket.
Signaling code	Five-unit, start-stop; stop impulse length equals start impulse length multiplied by 1.42.

Types of signal	Neutral (20 or 60 ma), polar, or polal.
Speed (send and receive)	368.1, 404, 460, or 600 opm.
Power demand (series-governed motor only).	Approx 150 watts.
(synchronous motor only).	Approx 120 watts.
Motor type	TT–98/FG: series-governed. TT–99/FG, TT–100/FG: synchronous.
Motor speed	3,600 revolutions per minute.
Motor power requirements	105 to 125 volts, 60-cycle, single phase ac.
Paper capacity	Adjustable to accommodate standard one-, two-, or three-copy roll; fanfold paper; or sprocket-fed forms 8½ inches wide.

Figure 2. Teletypewriter Set AN/FGC–20 (AN/FGC–20X and AN/FGC–21 are similar in appearance).

Signal bias tolerances:	
Transmitted signals	±5% maximum at 368.1 opm.
Received signals (tolerance):	
368.1 or 404 opm	40% marking or spacing bias.
600 opm	35% marking or spacing bias.
End distortion tolerance (received signals):	
368.1 or 404 opm	35% marking or spacing end distortion.
600 opm	30% marking or spacing end distortion.
Range adjustment	Scale calibrated 0 to 120; 100 scale units equal width of 1 unit signal pulse (22 milliseconds at 368.1 opm).
Suppression of interference with radio reception.	Teletypewriter does not interfere with radio reception at frequencies between .35 and 150 mc when located 1 ft or more from radio antenna.
Safety shielding	Points at which potentials of 30 volts or more exist are shielded against accidental contact by personnel.
Surrounding temperature limits:	
Equipment in use	32° F. (0° C.) to 132° F. (55.6° C.).
Equipment in storage	−80° F. (−62.2° C.) to 160° F. (71.1° C.).
Minimum barometric pressure (operating).	16.88-inches mercury (equivalent to approx 15,000-ft altitude).
Other climatic conditions	Equipment withstands high humidity and moisture as encountered in tropics; is fungiproofed and resistant to corrosion.

5. Common Names

The nomenclature assigned to each teletypewriter set and component is listed below. A common name is indicated after each item.

Nomenclature	Common name
Teletypewriter Set AN/FGC–20, AN/FGC–20X, and AN/FGC–21.	Teletypewriter set.
Teletypewriter TT–98/FG, TT–99/FG, or TT–100/FG.	Teleprinter.
Power Supply PP–978/FG	Power supply.
Table FN–59/FG	Table.

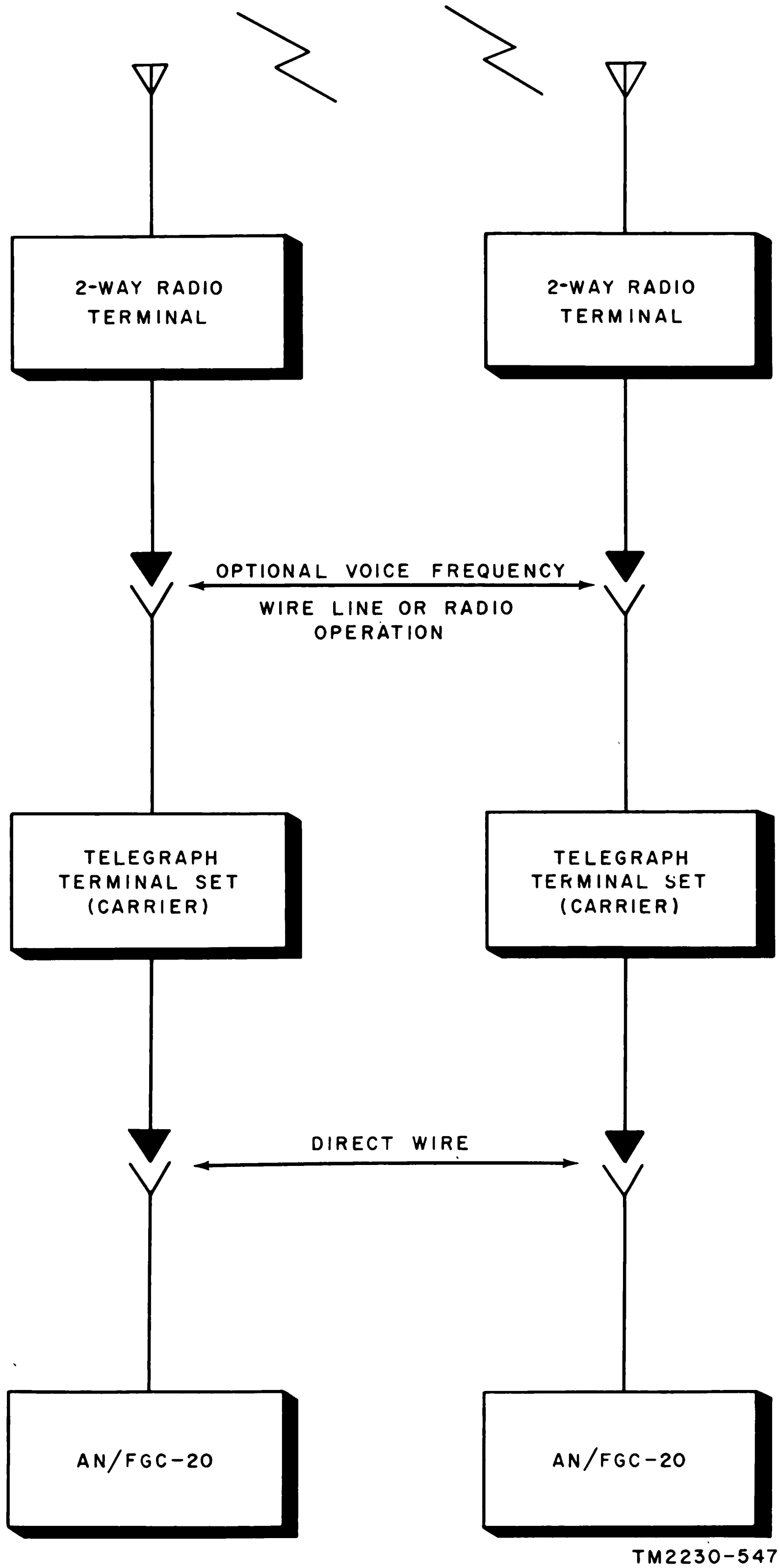


Figure 3. Carrier, direct wire, or radio system, block diagram.

6. Table of Components of Teletypewriter Sets AN/FGC-20, AN/FGC-20X, and AN/FGC-21

Component	Required No.	Dimensions (in.)			Volume (cu ft)	Weight (lb)
		Depth	Width	Height		
Teletypewriter TT-100/FG [a]	1	20 9/16	17 1/8	11 1/4	3.	54
Teletypewriter TT-98/FG [b]	1	20 9/16	17 1/8	11 1/4	3.	54
Teletypewriter TT-99/FG [c]	1	20 9/16	17 1/8	11 1/4	3.	54
Power Supply PP-978/FG	1	4	9	4	. 083	7
Teletypewriter Table FN-59/FG	1	22 1/4	18 3/4	27	8.	22
Recording paper (roll)	1	4 1/2 (dia)	8 1/2		. 078	3. 5
Ribbon, inking	1	2 1/4 (dia)		3/4		
Worm gear (100 wpm)	1	2 (dia)		3/4		
Worm (100 wpm)	1	1/2 (dia)		1 1/4		
Running spares (par. 11)	1 Set					4

[a] Teletypewriter Set AN/FGC-20.
[b] Teletypewriter Set AN/FGC-20X.
[c] Teletypewriter Set AN/FGC-21.

Note. This list is for general information only. See appropriate supply manuals for information on requisitioning of spare parts.

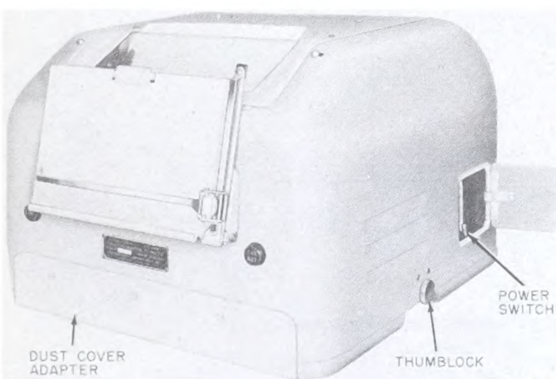


Figure 4. Teletypewriter TT-98/FG, modified for receive only operation.

7. Description of Teletypewriter Set

a. The teletypewriter set consists of a teleprinter that includes a keyboard, a power supply, and a table to support them.

b. A dust cover is installed over the teleprinter and power supply to protect the operating mechanisms from dust and dirt. The dust cover, table, and exterior portions of the set are painted gray.

8. Description of Teleprinter

a. A teleprinter keyboard is in front of and below the dust cover. The TT-98/FG and TT-100/FG have a standard keyboard with square, gray keytops; the TT-99/FG has a weather-symbol keyboard with black, round keytops. A keyboard guard is mounted around the front of the keyboard. Four control switches are mounted in the keyboard guard, two on either side of the guard.

b. The teleprinter dust cover (fig. 5) has three access doors. These openings make it possible to replenish the paper supply, change the inking ribbon, adjust the range, and to operate the POWER ON OFF switch (fig. 4). A copy holder, mounted on the front of the dust cover, holds the copy in line of easy vision of the operator.

9. Description of Power Supply
(fig. 6)

The power supply is a plug-in, full-wave rectifier that provides a source of dc for the signal line and local test circuits and adjusted ac for the ac circuits. It consists of an input transformer, a four-section selenium rectifier stack, two output filter capacitors, a 5,000-ohm resistor, and a 1/8-ampere fuse that protects the output side of the rectifier. Plug-in taps are provided in the primary winding of the input transformer that permit operation with input voltages of 95- to 125- and 190- to 250-volt, 60-cycle ac. Plug-in taps also permit coarse and fine adjustment in the secondary winding.

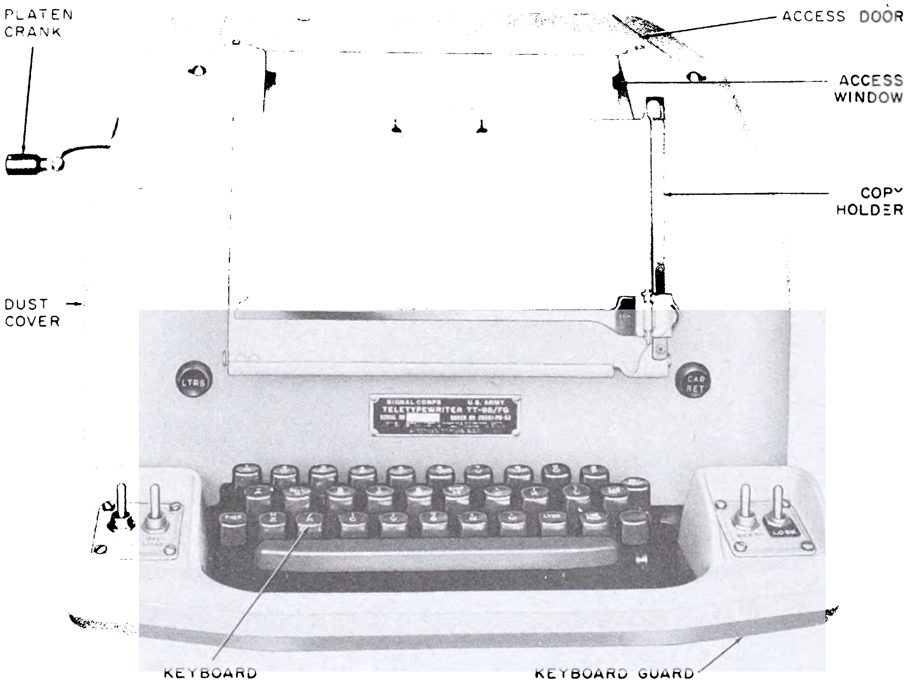


Figure 5. Teleprinter.

10. Description of Table
(fig. 7)

a. The table is constructed so that the teleprinter can be mounted at a height convenient to the seated operator. Except for the composition top, it is of metallic construction. Two spring-loaded guide pins are mounted in the table top to locate the teleprinter on the table.

b. A fanfold form rack is provided in the table. Fanfold forms are placed in the rack, and the top form is threaded through the guide chute and slot provided in the table top.

11. Running Spares
(fig. 8)

The following running spares are supplied with each teletypewriter set:

1 roll of recording paper.
1 inking ribbon.
2 fuses, ⅛-ampere, 250-volt.
1 fuse, 1.6-ampere, 250-volt.
1 fuse, 1/32 ampere, 250-volt.
1 lamp, incandescent, 15 watts, 115 volts.

Note.—This list is for general information only. See appropriate supply manuals for information pertaining to allowable spare parts.

12. Differences in Models

Teletypewriter set	Keyboard		Motor	
	Standard communications	Weather symbols	Synchronous (ac only)	Series-governed (ac or dc)
AN/FGC–20	X		X	
AN/FGC–20X	X			X
AN/FGC–21		X	X	

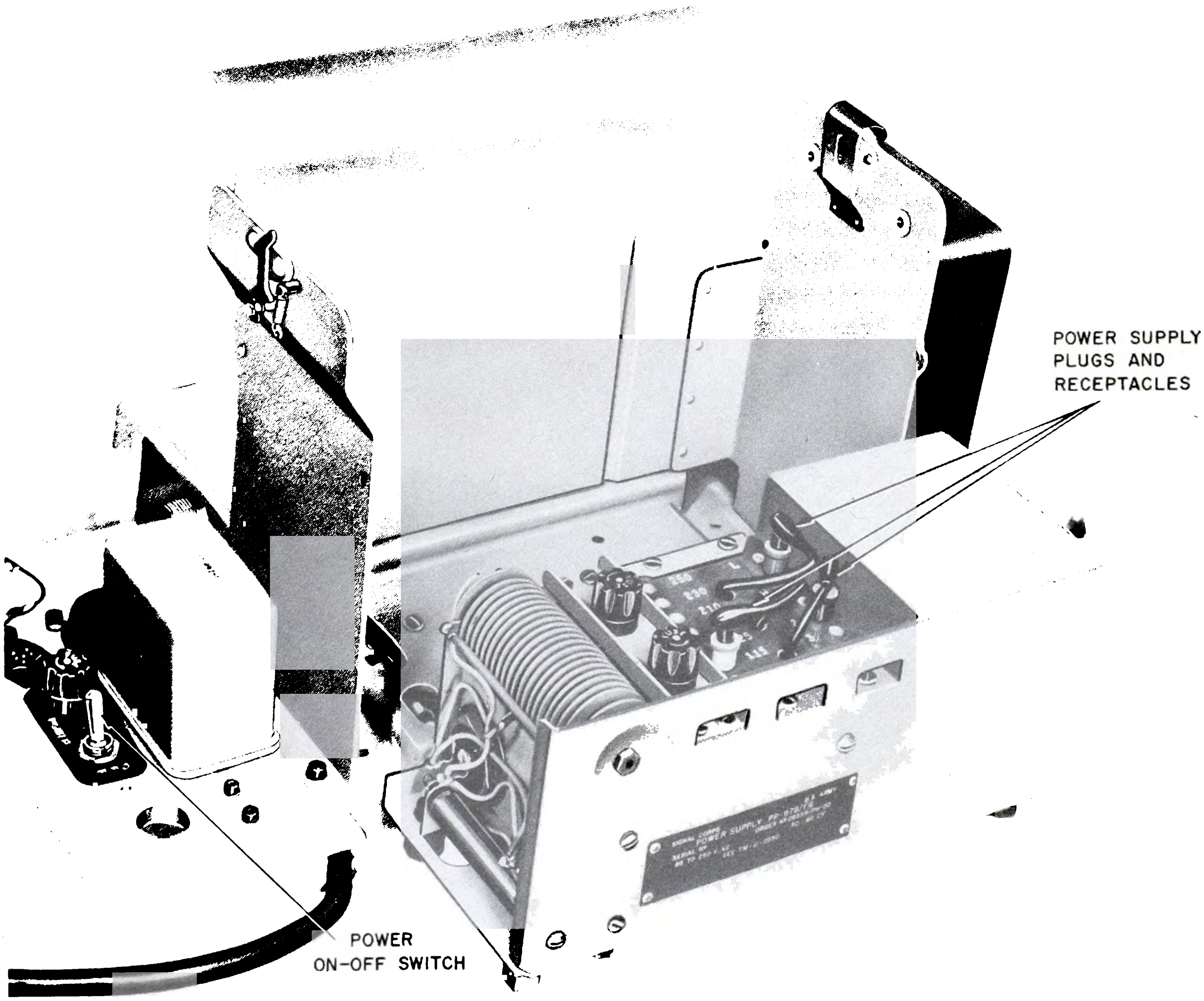


Figure 6. Power supply.

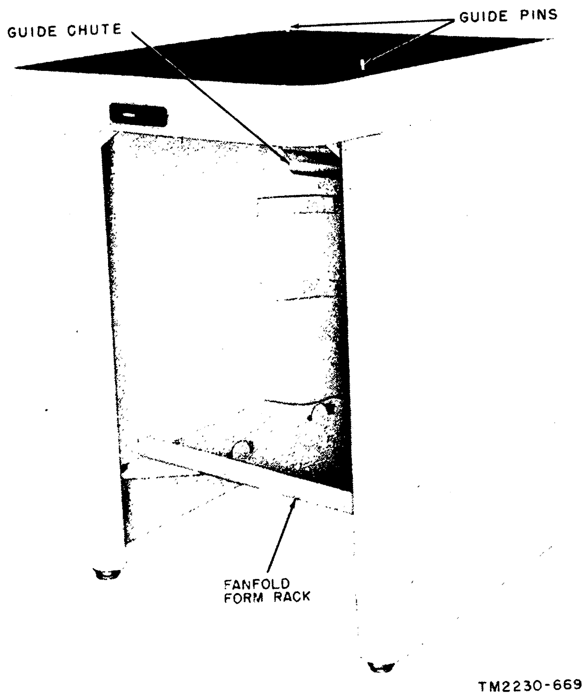
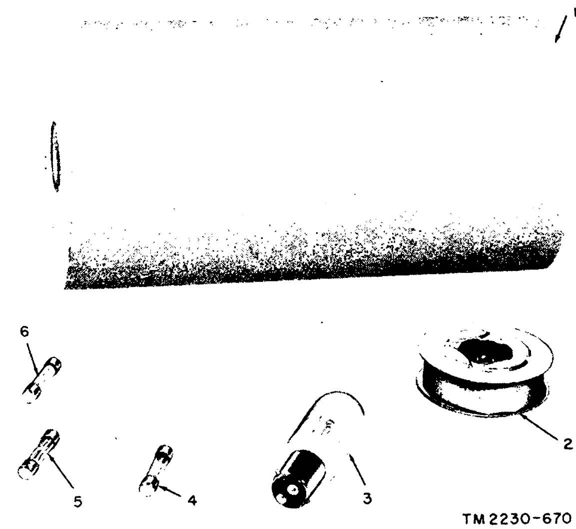


Figure 7. Table.



1 Roll recording paper
2 Inking ribbon
3 Lamp, incandescent
4 Fuse, 1/16-ampere, 250-volt
5 Fuse, 1/4-ampere, 250-volt
6 Fuse, 1.6-ampere, 250-volt

Figure 8. Running Spares.

CHAPTER 2
INSTALLATION

Section I. SERVICE ON RECEIPT OF EQUIPMENT

13. Siting

Selection of a suitable location requires consideration of accessibility for equipment maintenance, convenience of operating personnel, illumination needs, the flow of message traffic in the communication center, and free access to the back of the teletypewriter set. Select a location which provides the required power outlet, 95- to 125-volts or 190- to 250-volts, 60-cycle single phase ac.

14. Unpacking
(figs. 9 and 10)

a. Packaging Data.

(1) When packed for export shipment, each teletypewriter set is packed in two wooden crates as follows:

Crate No.	Height (in.)	Width (in.)	Depth (in.)	Volume (cu. ft)	Unit weight (lb)	Contents
1	20¼	27⅛	37	11. 8	66	Teleprinter.
2	30¼	20¾	25	8. 1	28	Table.

(2) When packed for domestic shipment, each teletypewriter set is packed in two corrugated cartons as follows:

Crate No.	Height (in.)	Width (in.)	Depth (in.)	Volume (cu. ft)	Unit weight (lb)	Contents
1	16½	23	32	7	61	Teleprinter.
2	28¾	20	23⅜	8. 1	22	Table.

b. Removing Contents, Export Packaging.

Caution: Be careful when uncrating equipment. Do not thrust tools into the interior of the shipping container; it may damage the equipment. Unpack the table first. It provides a place to mount the teleprinter when unpacked.

(1) Remove the nails from the case cover and remove the cover. Use a nail puller.

(2) Carefully lift the cartoned equipment from the wooden box.

(3) Open the carton by slitting three of the edges to permit the fourth edge to act as a hinge.

(4) Carefully cut the sealed barrier and remove the equipment from the inner carton.

c. Removing Contents, Domestic Packaging. Refer to *b* (above); observe the Caution instructions and perform steps (3) and (4).

15. Checking

a. Check the contents with the packing slip.

b. Examine the equipment carefully and report damaged equipment in accordance with instructions contained in paragraph 2.

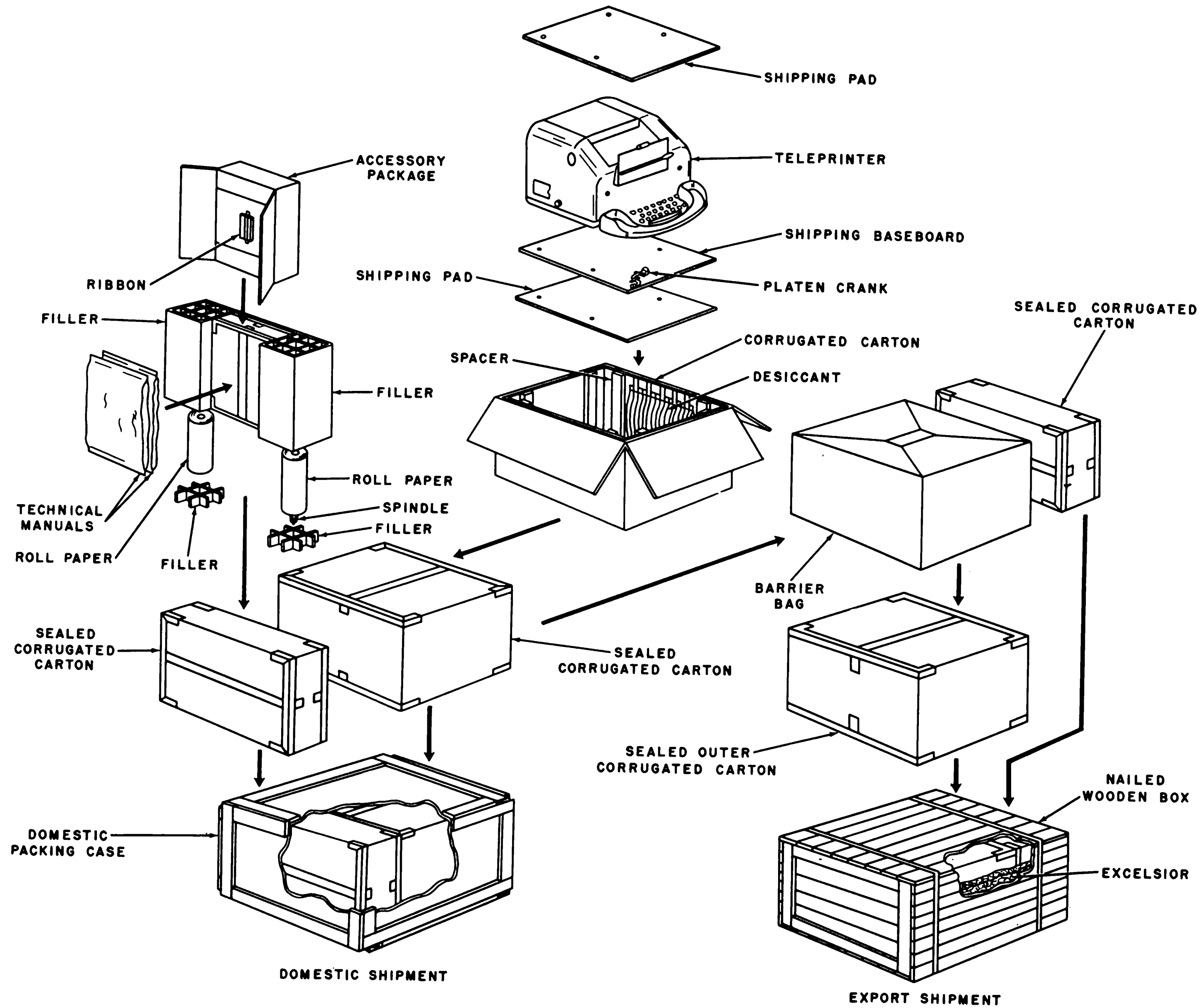


Figure 9. Teleprinter and accessories packaged for domestic and export shipment.

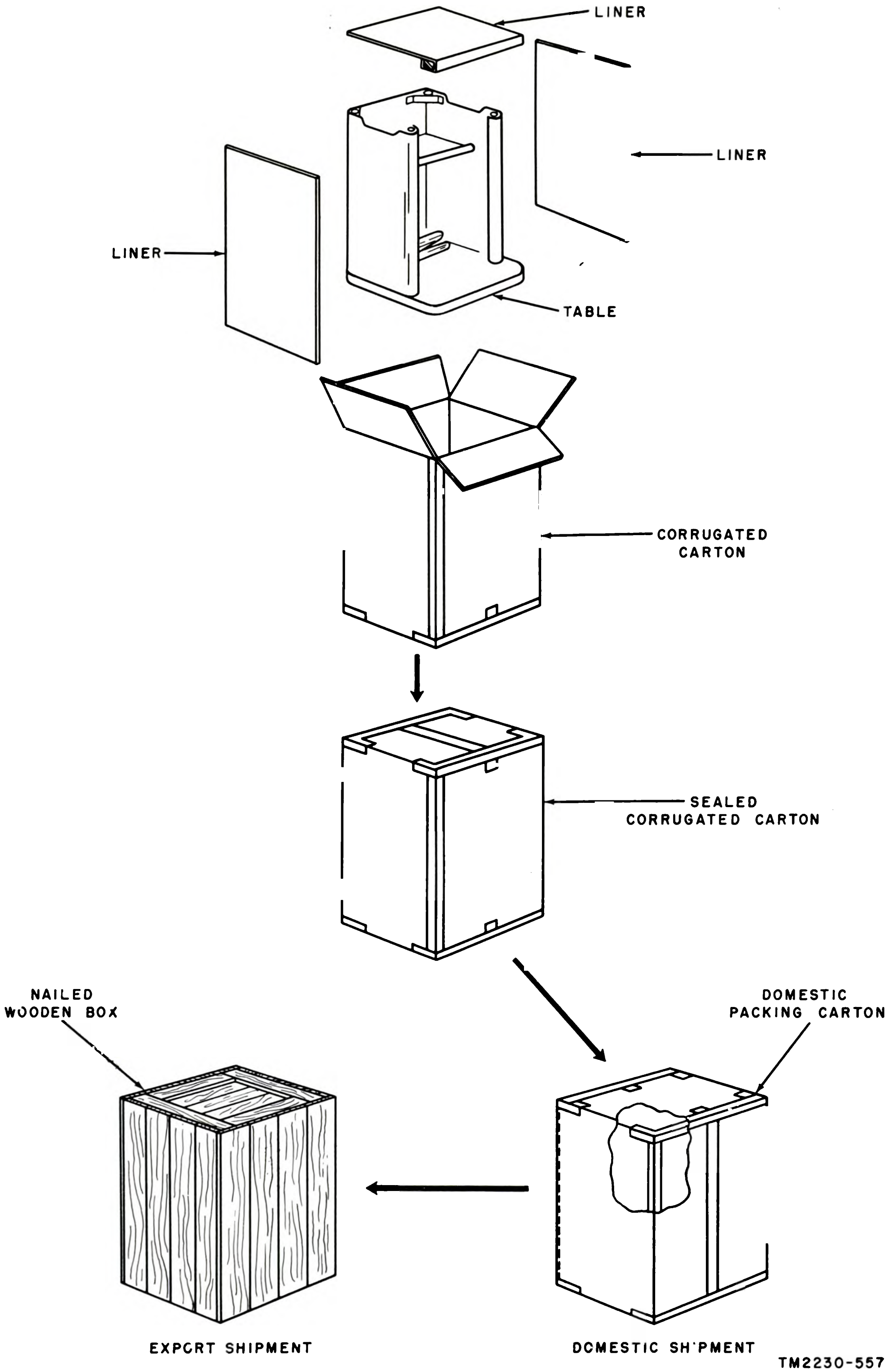


Figure 10. Table packaged for domestic and export shipment.

16. Fuse Check

(figs. 11–13)

Check the following fuses before applying power to the unit:

Quantity	Fuse	Ampere rating
1	Power input fuse (F1, fig. 11)	1. 6
1	Power supply output fuse (F1, fig. 12)	¼
1	Bias fuse (F4, fig. 13)	$\frac{1}{16}$

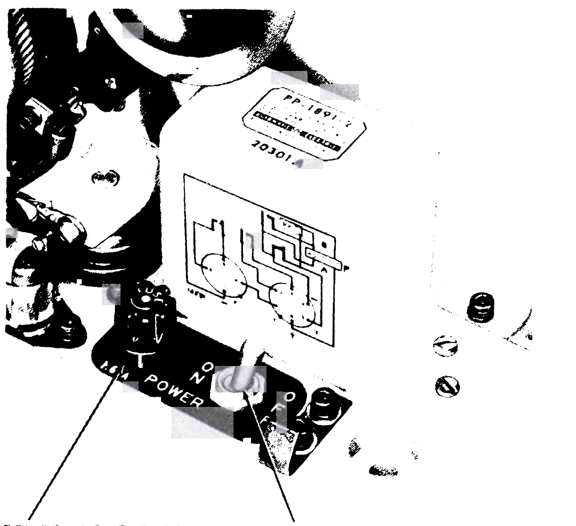


Figure 11. Power input fuse and POWER switch location.

17. Ground and Power Connections

Set the POWER, MOTOR, LIGHT, and DC POWER switches to their OFF positions and plug the teleprinter power cord into an ac power outlet. Connect a temporary protective ground lead to one of the thumblocks (fig. 4) on either side of the base casting.

18. Preparation

Service the teleprinter as follows:

a. Install the required type of paper (par. 31*a* or *b*).

b. Check serviceability of inking ribbon; install a new inking ribbon if necessary (par. 31*c*).

c. Release the platen lock and the carriage lock (fig. 14).

19. Local Test, Preliminary Checks and Adjustments

a. Open the door of Power Supply PP–978/FG and adjust the primary and secondary taps as described below:

(1) Place the primary winding lead (center flexible lead, fig. 12) into the numbered jack corresponding, as close as possible, to the input voltage available. If the input voltage is midway between numbers, use the higher numbered jack.

(2) Place the secondary winding coarse lead into the M jack and the secondary fine winding lead into the number 3 jack.

(3) Turn the LINE SELECTOR switch to the TEST position (fig. 13).

(4) Turn the LINE CURRENT rheostat clockwise to its mechanical stop.

(5) Loosen the DC POWER switch clamp screw and move the DC POWER switch to the ON position. Tighten the DC POWER switch clamp screw.

(6) Turn the POWER switch to the ON position.

(7) Test the dc output voltage of the power supply by placing the leads of a voltmeter into the positive and negative test jacks (fig. 13) of the terminal and switchbox. The output voltage reading should be 120 volts.

(8) Rearrange the secondary winding fine and secondary winding coarse leads (fig. 12) until this voltage is obtained. Proceed as follows:

(*a*) If the voltage output is greater than 120 volts, move the secondary winding fine lead to a lower number. If, upon reaching the lowest number (number 1), the voltage is still too high, move the secondary winding coarse lead to the L jack and the secondary winding fine lead to a number that will give the required 120 volts.

(*b*) If the voltage output is less then 120 volts, move the secondary winding fine lead to a higher number. If, upon reaching the highest number (number 5), the voltage is still too low, move the secondary winding coarse lead to the H jack and the secondary winding fine

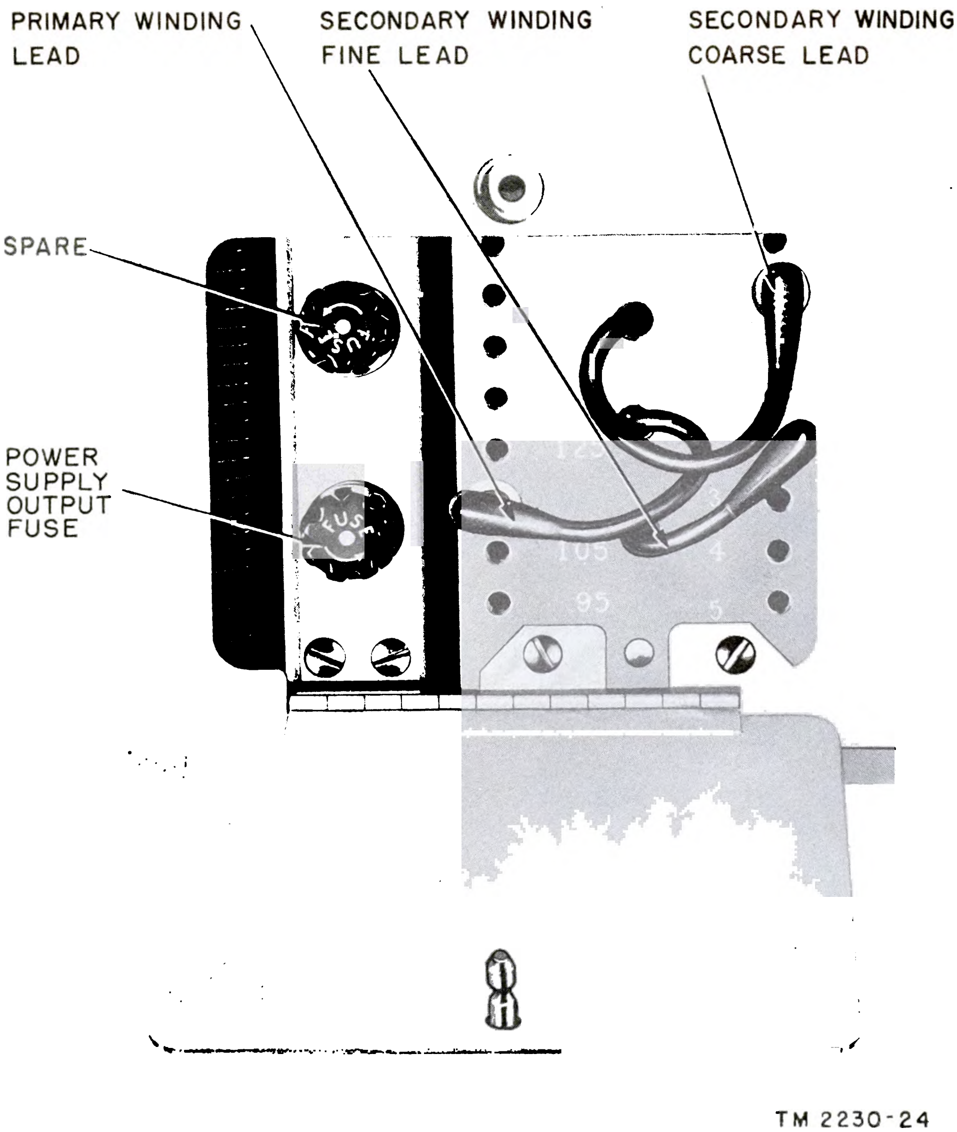


Figure 12. Power supply fuse and leads.

lead to a number that will give the required 120 volts.

b. Place the teleprinter into a local 60 ma test circuit by setting the LINE SELECTOR switch (fig. 13) to the TEST position. Set the POWER and MOTOR switches to their ON position and allow the motor to run for several minutes. If a series-governed motor is used, check the motor speed as described in paragraph 20. Check the motor-stop plug to make sure it is plugged in.

c. Adjust the rangefinder dial assembly (fig. 13) by turning the dial slowly to the maximum and minimum good copy positions while sending repeated R and Y code groups from the keyboard. Set the dial midway between the two readings.

d. Check the operation of the teleprinter in response to each of the internal and external controls listed in paragraphs 29 and 30.

e. If the teletypewriter set is to be installed into a system requiring an equipment operating speed of 404, 460, or 600 opm (66, 75, or 100 wpm), install the proper speed gears and revise the printing bail adjustment as instructed in paragraph 250. The above revisions should be made before the test run.

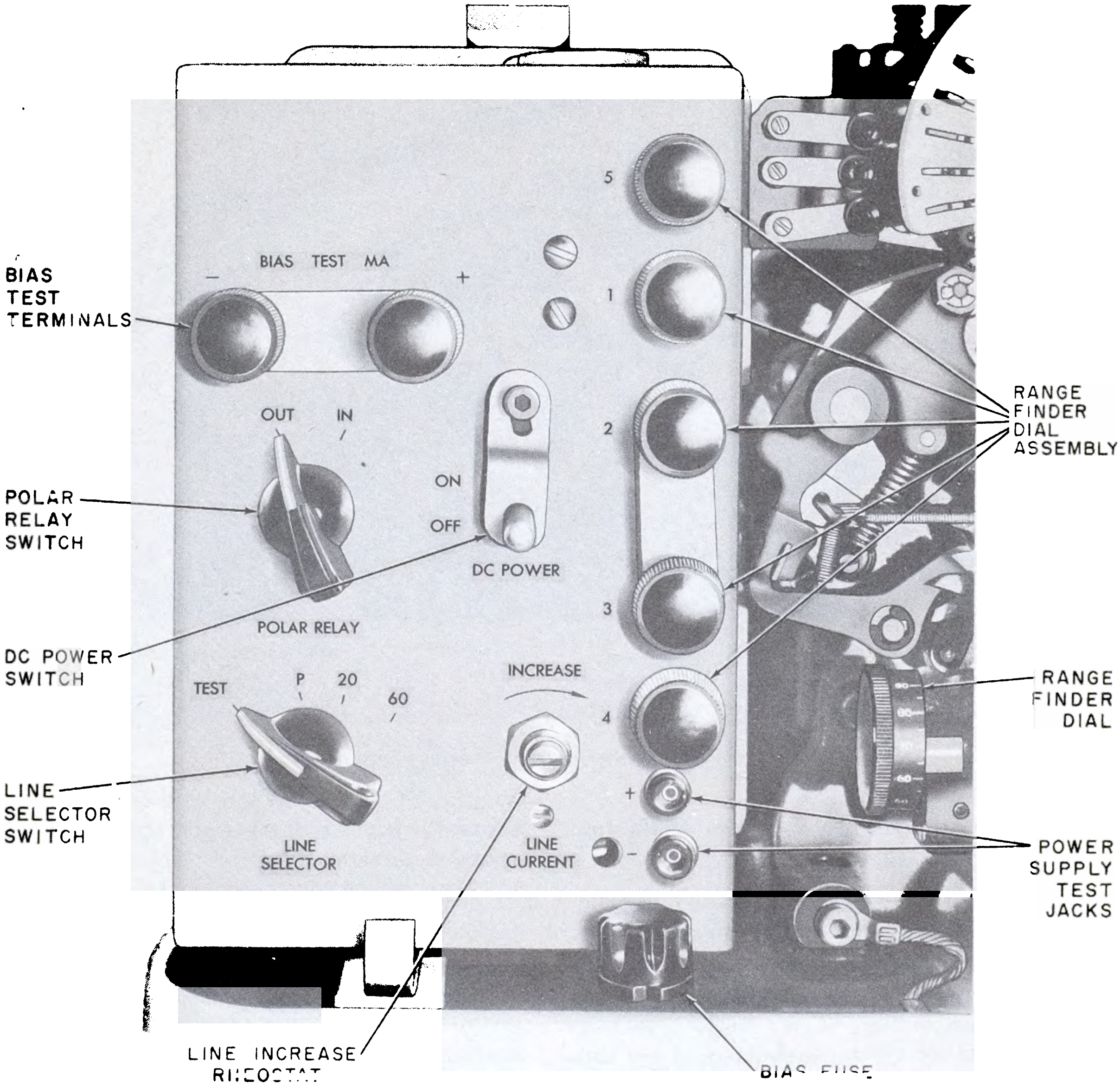


Figure 13. Bias fuse, range finder dial assembly, and terminals at terminal and switchbox.

20. Motor Speed Adjustment

Adjust the speed of series-governed motors as follows:

a. Strike a 180 vibrations per second (vps) tuning fork against the palm of the hand causing it to vibrate. Do not strike the tuning fork against a metal or solid object or the fork may be damaged.

b. View white target spots at the end of the motor governor subassembly through the vibrating shutters of the tuning fork. Viewing the revolving spots through the shutters creates a stroboscopic effect which causes the target spots to appear stationary if the motor speed is adjusted correctly.

c. If the spots appear to be moving clockwise (which indicates the motor speed is too fast), pull the end of the motor-governor adjustment worm (item 4, fig. 99) outward. Hold it out until the apparent clockwise motion of the target spots, as

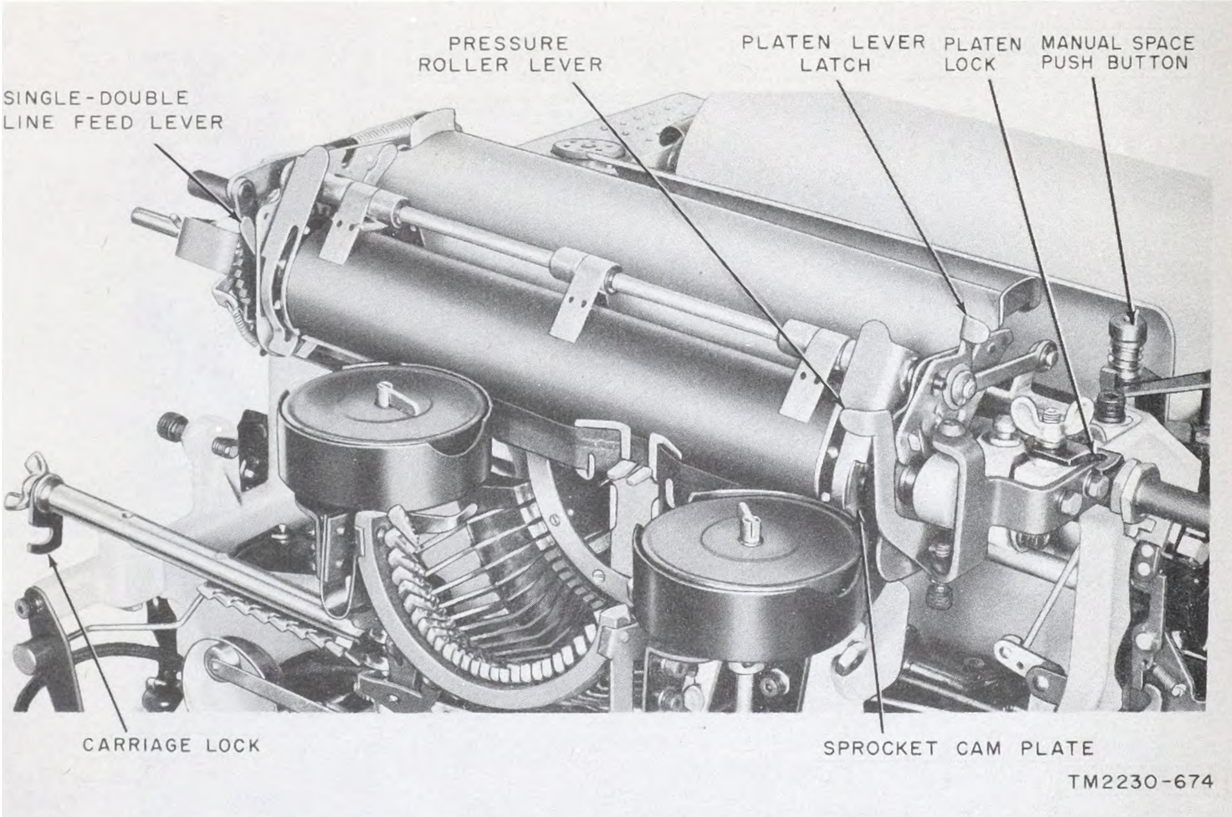


Figure 14. Teleprinter, dust cover removed, showing platen and carriage locks.

viewed through the vibrating shutters of the tuning fork, has practically stopped.

d. If the target spots appear to be moving counterclockwise (which indicates the motor speed is too slow), push the end of the motor-governor adjustment worm inward until the apparent counterclockwise motion of the target spots, as viewed through the vibrating shutters of the tuning fork has practically stopped. To avoid over adjustment, release the motor-governor adjustment worm slightly before the target spots come to a complete standstill.

e. Check the target spots with a tuning fork again; readjust if necessary.

21. Friction Clutch and Transfer Lever Tension Spring, Lubrication and Adjustment

To prevent distortion of the friction clutch felts and the transfer lever tension spring, the equipment is shipped with the friction clutches and the transfer lever tension spring in the released position. Before operating the equipment, lubricate and adjust the friction clutches and tighten the tension spring as directed below.

Name of part	Lubrication reference		Adjustment reference
	Item and fig.	Par.	Par.
Selection camshaft friction clutch.	17, fig. 93	93*c*	205
Square shaft friction clutch.	18, fig. 93	93*c*	206
Carriage feed friction clutch.	2, fig. 91	93*c*	248
Keyboard transmitter friction clutch.	11, fig. 91	93*c*	269
Carriage return safety clutch.	10, fig. 91	93*f*	249
Page printer transfer lever spring.			204

22. Polar Relay Switch

(fig. 13)

When polar operation of the selector magnet is desired, rotate the POLAR RELAY switch (fig. 13) to the IN position. To operate the selector magnets directly from the line, rotate the POLAR RELAY switch to the OUT position.

23. Receive Only Modifications
(fig. 15)

When the teleprinter is to be operated as a receive only machine, proceed as follows:

a. Remove the keyboard guard (par. 167) and associated wiring to the terminal blocks. Move the lead from terminal 1 of terminal block TB2 to terminal 3 (A, fig. 15).

(1) For receive only operation without the motor stop feature and with the copy light controlled by the POWER switch, move the lead from terminal 5 to terminal 2 and the lead from terminal 1 to terminal 2 of terminal block TB1.

(2) For receive only operation with the motor stop feature and with the copy light controlled by the motor stop feature, move the lead from terminal 5 to terminal 3 of terminal block TB1 (B, fig. 15) and the lead from terminal 1 to terminal 2.

(3) For receive only operation with the motor stop feature and with the copy light controlled by the POWER switch, move the lead from terminal 5 to terminal 3 of terminal block TB1 (C, fig. 15) and the lead from terminal 1 to terminal 3.

b. Remove the keyboard plug from the keyboard jack and remove the keyboard (par. 106).

c. Remove the two machine screws and lockwashers from the keyboard transmitter drive shaft bearing cap. Remove the two machine screws and lockwashers from the transmitter drive shaft mounting bracket, and remove the keyboard transmitter drive shaft from the teleprinter. Replace the bearing cap with the two machine screws and lockwashers.

d. Install the receive only dust cover adapter on the dust cover.

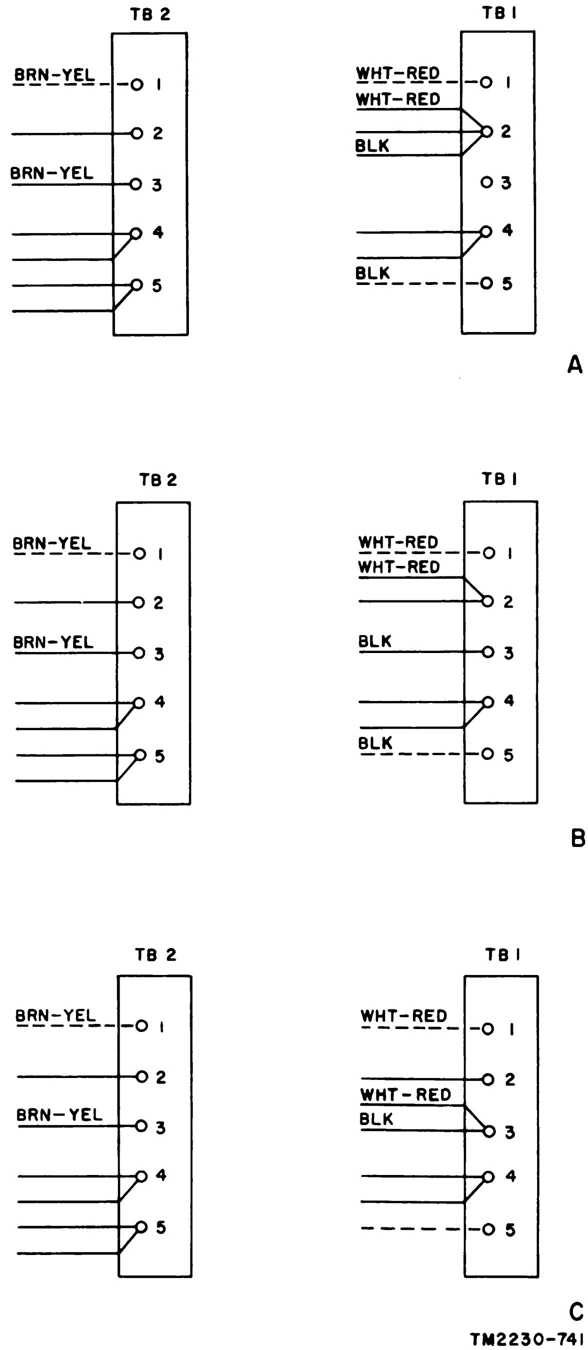


Figure 15. Wiring changes for receive only operation.

Section III. SIGNAL CONNECTIONS

24. General

The teleprinter may be installed to meet several operational requirements. This variety of operational possibilities is achieved by varying the connections of the signal lines to the teleprinter.

25. Signal Line Connections

a. Connect the protective ground of the power cord to a common ground terminal, if available, or to a water pipe, or any other good ground connection point.

b. Set the POWER, LIGHT, MOTOR, and DC POWER switches to their OFF positions and plug the teleprinter power input cord into an ac power outlet. Make the fuze check (par. 16) and the power supply adjustments (par. 19*a*).

c. To prepare the teleprinter for operation, unlock the carriage and platen (fig. 14), install the paper (par. 31*a* or *b*), check the ribbon and ribbon spools (par. 31*c*), and set the SEND-LOCK switch to the SEND position.

d. Local test the teleprinter as instructed in paragraph 19*b* through *e*.

e. Adjust the LINE CURRENT rheostat (fig. 13) to the extreme counterclockwise (maximum resistance) position and set the LINE SELECTOR switch in accordance with the type of signals to be used. Arrange the circuitry of the teleprinter for the type of operation desired and connect the set as instructed in the applicable subparagraphs below.

(1) Neutral, half-duplex operation (A, fig. 16).

(*a*) Strap terminals 2 and 3 of the terminal and switch box with the strap provided.

(*b*) For local supply of signal circuit power, set the DC POWER switch to the ON position. Set it to the OFF position for distant current supply.

(*c*) Connect the signal lines to terminals 1 and 4 of the terminal and switchbox. If the distance station is to supply power for the signal circuit, connect the positive signal line to terminal 1

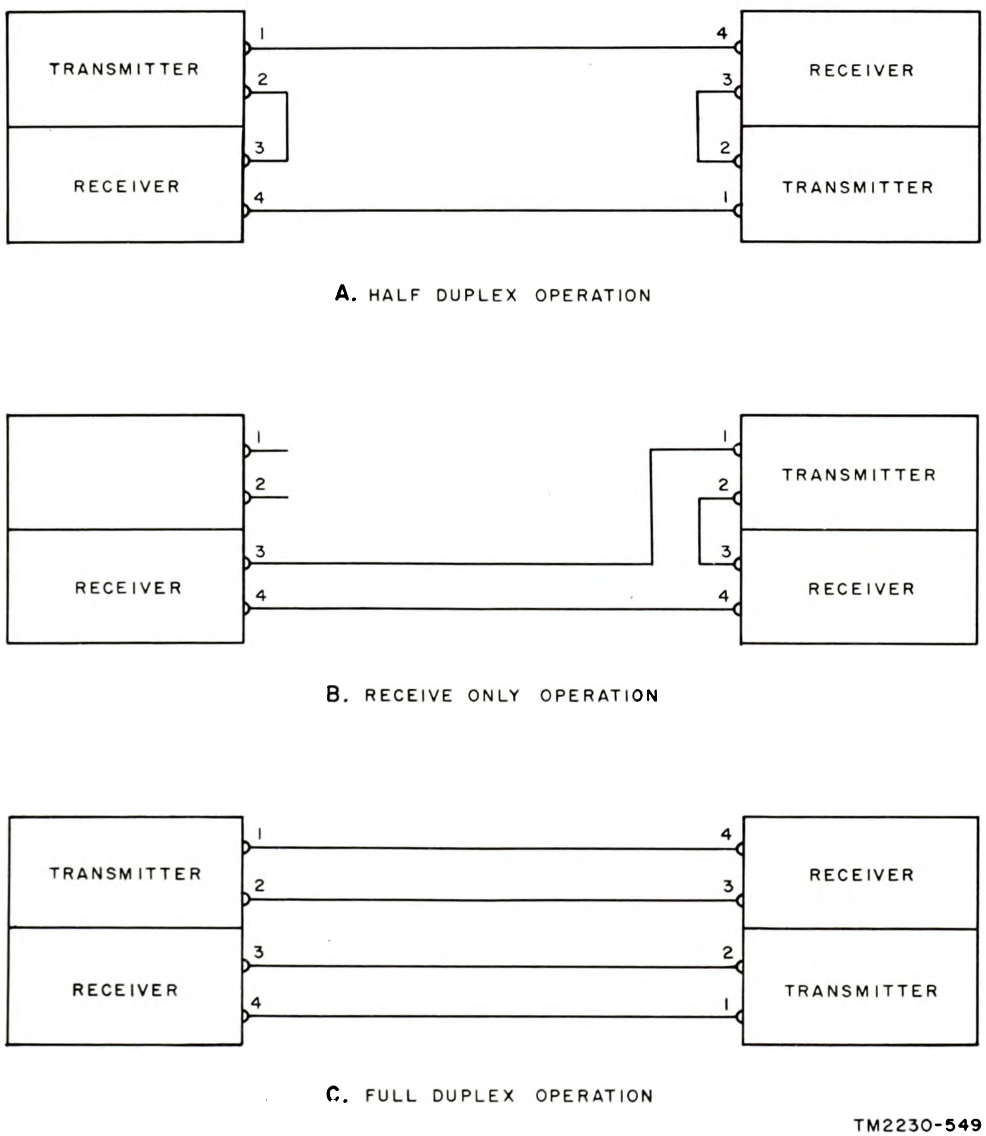


Figure 16. Signal line connections.

and the negative signal line to terminal 4. This polarity arrangement also applies if both stations supply series-aiding battery.

(2) Neutral or polar, receive-only operation (B, fig. 16).

(*a*) Disconnect the strap between terminals 2 and 3 of the terminal and switchbox.

(*b*) Connect the positive signal line to terminal 3 and the negative signal line to terminal 4.

(*c*) Line current normally is supplied and adjusted at the sending station. The only resistance in the receive circuit at the receive station is the resistance of the selector magnets.

(3) Neutral, full-duplex operation (C, fig. 16).

(*a*) Send circuit: Disconnect the strap between terminals 2 and 3 of the terminal and switchbox and connect the send signal lines to terminals 1 and 2. Set the DC POWER switch to the ON position to supply power for the send circuit. Send circuit current is adjusted with the LINE CURRENT rheostat.

(*b*) Receive circuit: Connect the positive signal line to terminal 3 and the negative line to terminal 4 of the terminal and switchbox. When full-duplex operation is used, each station normally supplies and controls the line current in the send circuit.

26. Circuit Line-up

a. To secure the best possible operation, it is necessary to adjust the teleprinter to meet the conditions of the signal lines. Circuit line-up for these teleprinters 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 source of line current.

b. The circuit from which the circuit line-up is directed is called the control station. Generally, the station of higher authority is the control station. Line-up 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 signal line in a teleprinter system usually is supplied by the station in the network which has the transmitting device on that signal line. If two or more stations have transmitting devices on the signal line, the station of highest authority usually supplies the power. Two or more stations may supply signal line current. These teleprinters are designed to supply signal line current as the main source of supply or on a series aiding basis.

d. Polar or neutral signals can be received by the teleprinter but only neutral signals can be sent from the keyboard transmitter. Polar signals must be 30 ma while neutral signals may be either 20 or 60 ma.

e. Line current is normally adjusted as follows:

(1) Turn the POWER switch to the ON position.

(2) If the set is to supply signal line current, set the DC POWER switch to the ON position.

(3) The control station turns its LINE CURRENT rheostat to maximum counterclockwise (maximum resistance) position.

(4) The noncontrol station turns its LINE CURRENT rheostat 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) The noncontrol station then adds resistance gradually to bring the signal line current down to the predetermined level.

(7) If enough current cannot be supplied to the signal line in this manner, proceed as follows:

(*a*) Turn the POWER switch to the OFF position.

(*b*) Disconnect the signal line from terminal 1 of the terminal and switchbox and reconnect it to terminal 5 of the terminal and switchbox. This decreases the internal resistance of the teleprinter by 1,000 ohms and allows more current to flow through the circuit.

(*c*) Repeat the steps described in (3) through (6), above.

(*d*) If sufficient current cannot be attained on the signal line in this manner, another teleprinter in the circuit will have to supply power on a series-aiding basis. This can be accomplished by having another teleprinter in the circuit turn the LINE CURRENT rheostat counterclockwise to its maximum resistance position, turn the DC POWER switch to the ON position, and then adjust the LINE CURRENT rheostat to decrease the resistance until the proper signal line current is attained.

(e) If the current decreases instead of increasing, reverse the signal line connections.

f. The rangefinder dial assembly (fig. 13) is adjusted as follows:

(1) Noncontrol stations transmit repeated R and Y signal code groups. The control station turns its rangefinder dial assembly to the maximum and minimum good copy positions. Determine the midway point between the two settings and set the rangefinder dial assembly at this point. When the setting is complete, the control station signals the noncontrol stations with two five-second break signals.

(2) The control station now transmits repeated R and Y signal code groups while the noncontrol stations adjust the rangefinder dial assemblies in the same manner.

27. Changing Teleprinter Operating Speed

a. The equipment is shipped by the manufacturer with gear sets for 368.1 opm (60 wpm) (installed), and 600 opm (100 wpm).

b. The extra gear set (for 600 opm) is mounted on the worm gear cover plate. The speed, in operations per minute, is stamped on the sides of the main shaft driven gears and on the cylindrical portions of the worm gears. Check both gears to make sure they are correct for the operating speed desired. If operation at 404 opm (66 wpm) or 460 opm (75 wpm) is desired, it is necessary to obtain the proper gear sets through usual supply channels.

c. To change the operating speed, check the printing bail adjustment as instructed in paragraph 250, and change only the worm gear on the motor armature shaft and the main shaft driven gear. Remove the teleprinter worm gear as directed in paragraph 113*a*(1) through (3). Remove the teleprinter main shaft driven gear as directed in paragraph 142*a*(3). Install the new teleprinter main shaft driven gear as directed in paragraph 142*b*(5). Install the new teleprinter worm gear as directed in paragraph 113*b*(6) through (8).

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. CONTROLS

28. General

The following charts list all controls used in operation of the teleprinter. Operating personnel should become thoroughly familiar with the location and operation of each control before operating the equipment.

29. Keyboard Controls

(figs. 17 and 18)

Control	Function
MOTOR switch	Used to turn motor ON and OFF for starting and stopping the teleprinter.
LIGHT switch	Used to turn copy lamp ON and OFF.
SEND-LOCK switch	In the LOCK position, prevents keyboard transmission. In the SEND position, allows keyboard transmission.
LINE-BREAK switch	When held in BREAK position, opens signal line. Used to start motors when turned off by motor, stop feature.
FIGS key	When struck, shifts the platen to upper-case position.
LTRS key	When struck after use of FIGS key, returns platen to lower-case position.
LINE FEED key	When struck, moves the paper up one or two line spaces on the platen, depending on the position of the single-double line feed lever.
CAR WET key	When struck, returns the carriage (type basket) to the left margin of paper.
BELL key	When struck, after first striking the FIGS key, rings the signal bell.
STOP key	When struck, after first striking the FIGS key, turns off the motor.
REPEA Tkey	When the REPEAT key, together with any character or function key except CAR WET are struck and held down, the character or function is repeated until the REPEAT key is released.
Alphabet keys	When struck, each alphabet key causes the transmission of a code group which causes the printing of the letter, punctuation mark, or symbol shown on the key top.
Blank key	Transmits blank code group. Used as part of motor stop operation in weather communications machines; prints hyphen in upper case.
Space bar	When struck, causes carriage to move one space to the right without printing, permitting spacing between words in a message.

30. Teleprinter Controls

(figs. 19 and 20)

Control	Function
Platen crank	Rolls the paper from the platen so the message can be torn off.
Manual CAR RET button.	When pressed, causes the carriage to return to the left margin.
Manual LTRS button	When pressed after receiving the FIGS code group, causes platen to shift to the letters position.

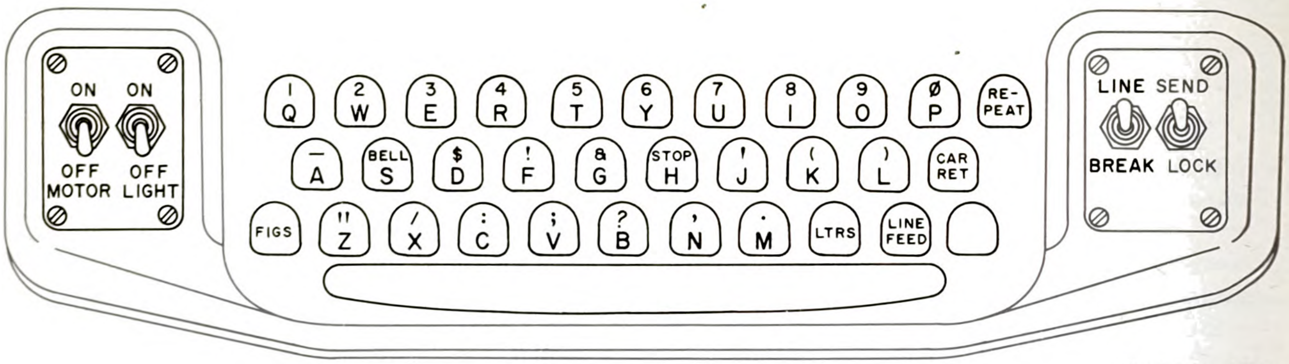


Figure 17. Standard communications keyboard.

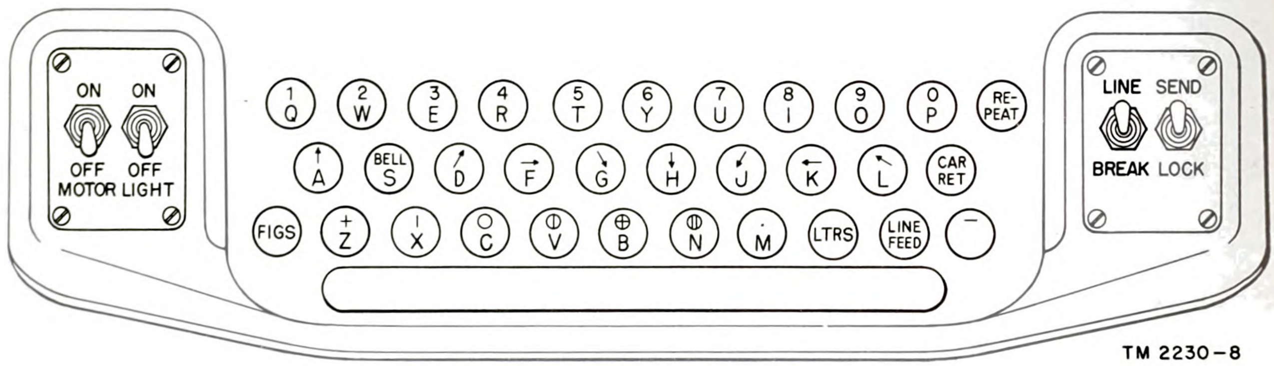


Figure 18. Weather communications keyboard.

Control	Function
Single-double line feed lever.	In forward position, causes the platen to move one space. In the rear position, causes the platen to move two spaces.
Pressure roller lever	When pulled forward, releases pressure on the paper. In the rear position, holds paper tightly against the platen.
Platen lever latch	Locks the pressure roller lever in either the applied or released position.
Sprocket cam plate	Feeds out the sprocket feed pins for use with sprocket-fed forms.
Manual space push-button.	When pressed, causes the carriage to move from the left to the right.

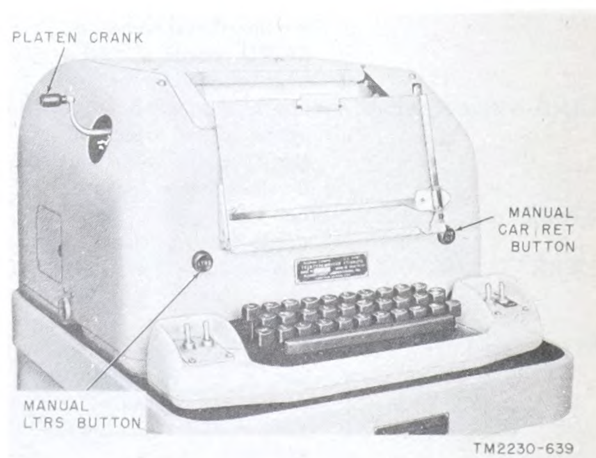


Figure 19. Teleprinter controls.

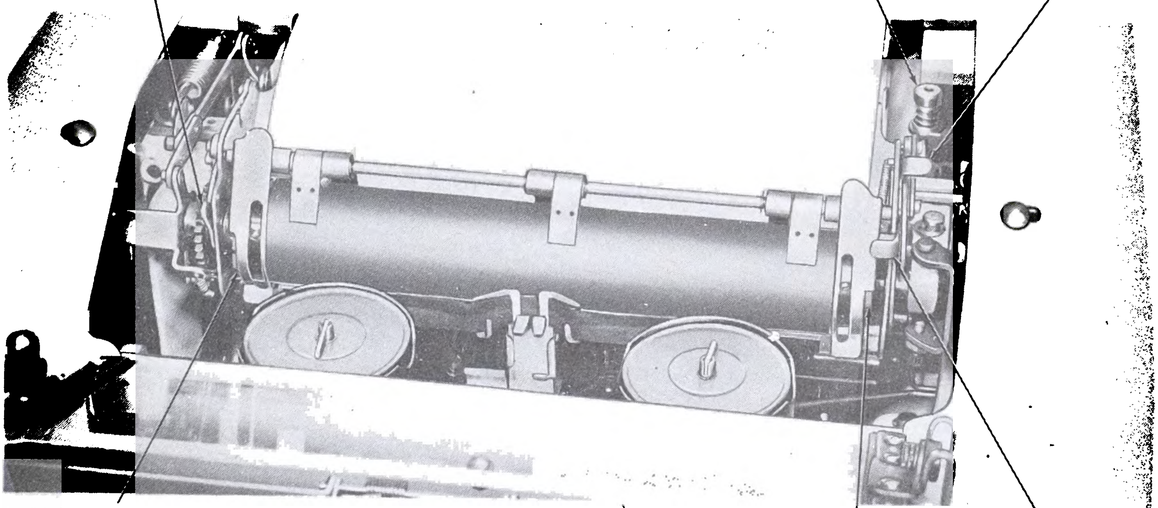


Figure 20. Platen controls and manual space pushbutton.

Section II. OPERATION UNDER NORMAL CONDITIONS

31. Preliminary Starting Procedures

a. Loading and Checking Roll Paper. The dust cover need not be removed when loading or unloading a paper roll or before checking the amount of paper on the roll.

(1) *Loading roll paper* (fig. 21).

(*a*) Unlatch the copyholder from the dust cover by pulling the top edge of the copyholder away from the dust cover.

(*b*) Move the latch buttons (located on both sides of the dust cover window) away from each other to release the dust cover window.

(*c*) Move the top access door up and away from the dust cover.

(*d*) Press down on the paper roller latch and pull the paper roller shaft upward.

(*e*) Insert the paper roller shaft into a paper roll.

(*f*) Replace the paper roller shaft so that the paper unrolls from the bottom of the roll.

(*g*) Feed the paper into the rear of the platen assembly; thread it between the platen and the platen pressure roller. Turn the platen crank counterclockwise until several inches of paper stand up, almost vertically, in front. Operate the pressure roller lever and center the paper on the platen; make sure that the paper is feeding straight and free from creases, twists, or wrinkles.

(*h*) Close the top access door and latch the dust cover window; allow the paper to extend out over the top. Latch the copyholder.

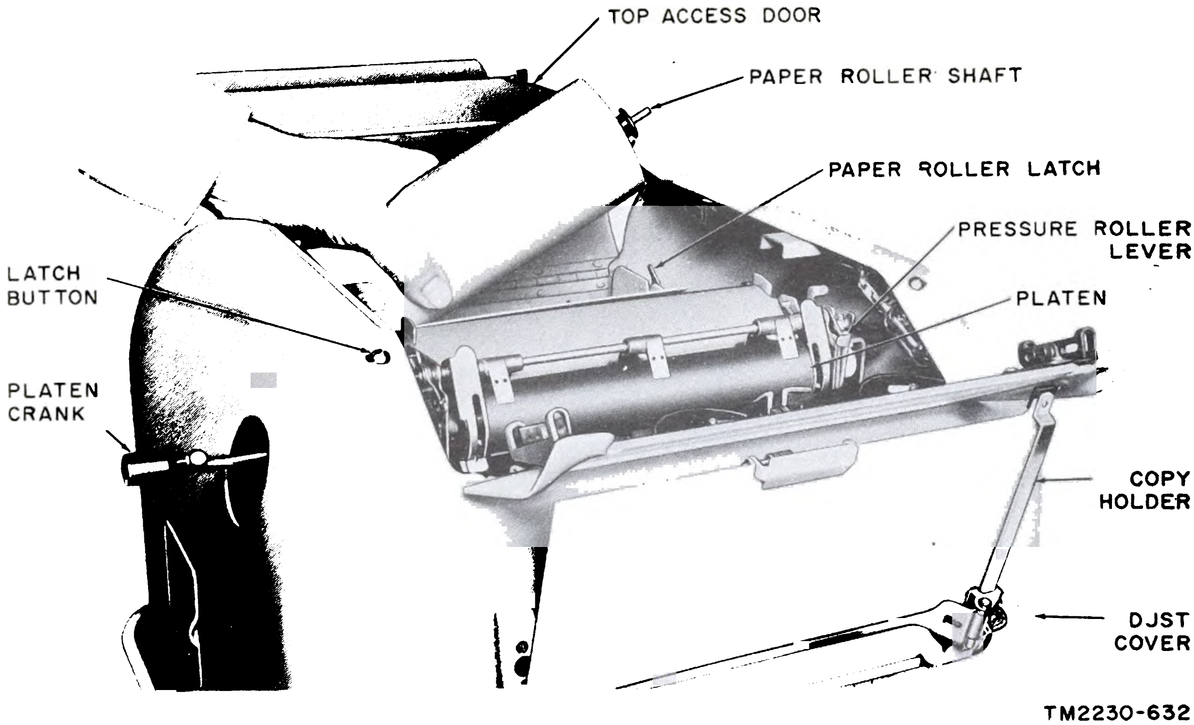


Figure 21. Loading paper roll.

(2) *Checking paper.*

(*a*) Check the paper periodically during operation of the teleprinter to make sure it is centered properly, free from creases, or wrinkles, and that it leaves the machine through the paper exit slit in the top of the dust cover. To straighten the paper, open the dust cover window and push downward on the pressure roller lever at the right end of the platen, center and straighten the paper; return the pressure roller lever to its original position. Close the dust cover window.

(*b*) When the end of the paper is near, a red stripe will appear at the center or side of the paper. The paper roll should be replaced. This warning allows enough time to finish the message being received and a new supply of paper to be obtained.

b. Installing Fanfold Paper (figs. 22 and 23).

(1) Open the top access door and the dust cover window.

(2) Insert a screwdriver or like object into a slot in the sprocket cam plate (fig. 20) at the ends of the platen and turn the sprocket cam plate to extend the sprocket feed pins (fig. 22).

(3) Release the pressure roller lever.

(4) Place a box of fanfold paper on the fanfold form rack (fig. 23) provided under

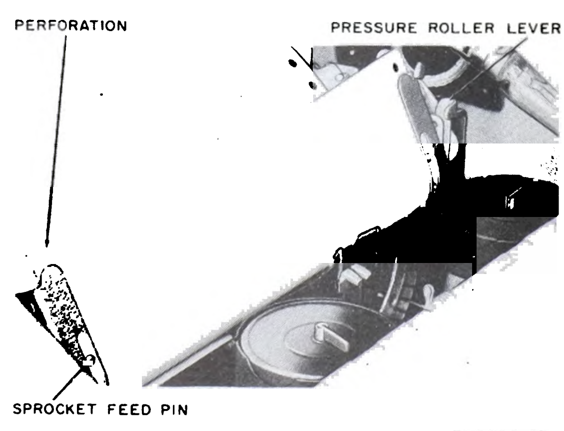


Figure 22. Fanfold paper threaded into platen.

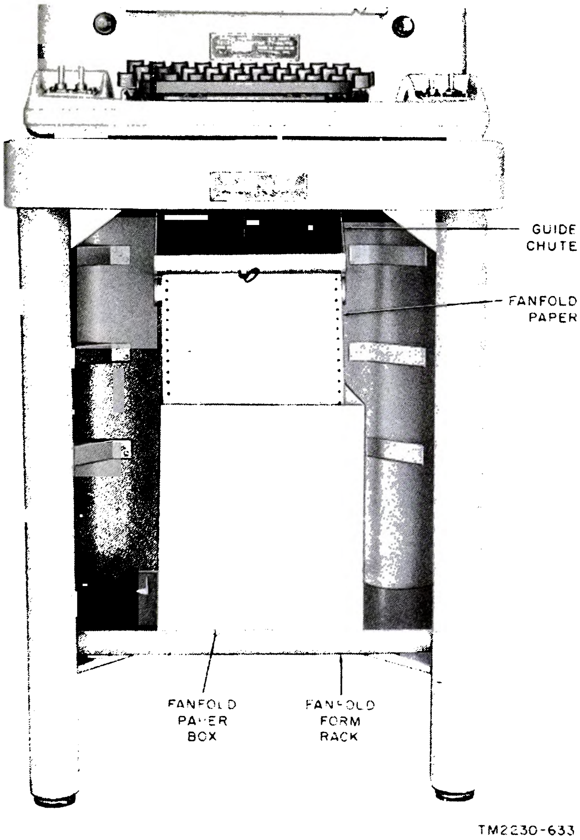


Figure 23. Fanfold paper placed in table.

the table top directly in front of the operator.

(5) Thread the loose ends of the paper at the top of the box through the guide chute in the table.

(6) Bring the paper over the top of the teleprinter and thread it into the rear of the platen assembly, between the platen and the platen pressure roller. Straighten the paper and make sure the sprocket feed pins mesh properly with the perforations at the edges of the paper (fig. 22).

(7) Close the top access door and the dust cover window.

c. Changing Inking Ribbon (fig. 24). It is not necessary to remove the dust cover from the teleprinter when replacing the inking ribbon. The top access door and the dust cover window, when open, allow enough room for inking ribbon changing. The carriage may be spaced to the center of the opening by depressing the manual space pushbutton.

(1) Remove the old inking ribbon as follows:

(*a*) Open the top access door and the dust cover window. Wind one of the printing ribbon spools by hand, twirling the appropriate ribbon spool lock until the opposite printing ribbon spool is empty.

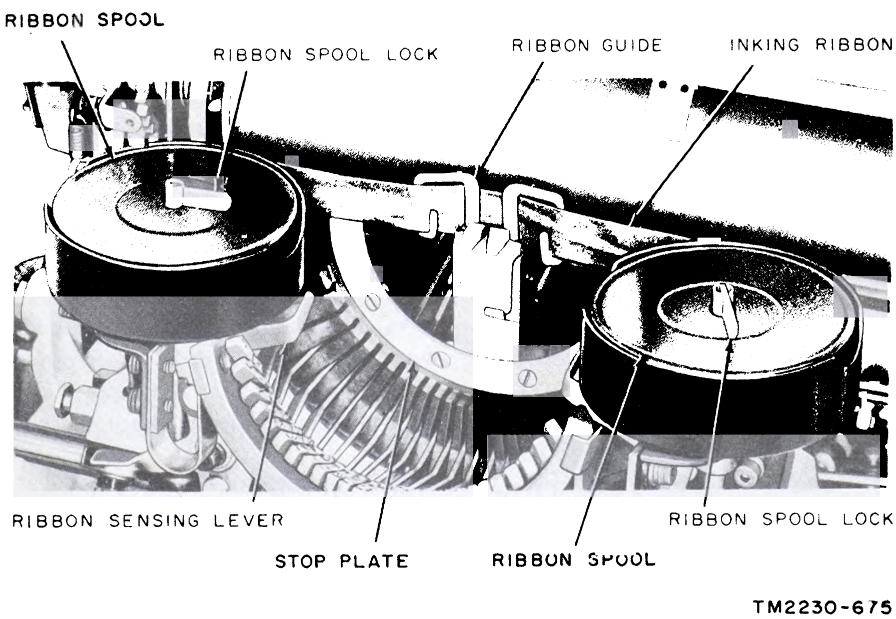


Figure 24. Inking ribbon mechanism.

(b) Remove the old inking ribbon from the slots in the ribbon guide.

(c) Lift the ribbon spool locks to the upright (unlocked) position.

(d) Lift the ribbon sensing lever at the unwound ribbon spool. Lift out the unwound ribbon spool and detach the inking ribbon from it. Save the empty ribbon spool. Release the ribbon sensing lever.

(e) Lift out the full ribbon spool and discard it. Also discard the worn inking ribbon.

(2) Install a new inking ribbon as follows:

(a) Lift the right-hand ribbon sensing lever.

(b) Place a new inking ribbon in the right-hand ribbon drive mounting. It must turn counterclockwise (when viewed from the top) to unwind. The left-hand ribbon drive mounting must turn clockwise (when viewed from the top) to unwind. Aline the two holes in the ribbon spool with the lugs on the ribbon spool driven shaft collar.

(c) Pull about 12 inches of inking ribbon through the slotted opening in the rear of the ribbon drive mounting and fasten the loose end of the inking ribbon to the empty ribbon spool. Choose the spearhead fastener that will allow the inking ribbon to wind; turn in the same direction as the full ribbon spool turns when it unwinds. Stab the spearhead through the inking ribbon about 1 inch from the end. Be sure the ribbon is not twisted at any point between the two ribbon spools.

(d) Lift the left-hand ribbon sensing lever. Place the unwound ribbon spool in the ribbon drive mounting as directed for the full ribbon spool; thread the inking ribbon through the slotted opening at the back of the ribbon drive mounting. Release the ribbon sensing lever.

(e) Insert the inking ribbon in the slots in the ribbon guide; make sure that it is flat and free from twists. The inking ribbon should pass in front of the stop plate.

(f) Turn the two ribbon spool locks to the horizontal (locked) position.

(g) Tighten the inking ribbon manually by turning one ribbon spool with one hand while holding the other ribbon spool rigid.

(3) After each inking ribbon installation, and at reasonable intervals thereafter, make the following inking ribbon checks.

(a) Inking ribbon must be taut and free from twists, wrinkles, creases, holes, and tears. It must lie flat in the slots on the backs of the ribbon drive mountings and in the ribbon guide.

(b) Both ribbon spools must turn in the same direction while the teleprinter is typing.

(c) Both ribbon spools must be seated horizontally in the ribbon drive mountings, and the ribbon spool locks must be set horizontally.

(d) Both ribbon spools must reverse direction when a ribbon spool is emptied.

32. Types of Operation

The type of operation used is determined by the signal line requirements and the signal line connections to the teleprinter. It is necessary for the operator to know the type of operation for which the machine was installed.

a. *Half-duplex Operation.* In half-duplex operation, the message typed on the keyboard will be recorded on all teleprinters, including the originating teleprinter. Only one teleprinter may send at a time. Controls listed in paragraphs 29 and 30 apply.

b. *Receive-only Operation.* The operator of a receive-only teleprinter has no control over the reception of the machine. Controls listed in paragraph 30 apply.

c. *Full-duplex Operation.* In full-duplex operation, both machines may send at the same time; however, the sending machine does not record the message it is sending. Controls listed in paragraphs 29 and 30 apply.

33. Performance Test

Operate the teleprinter and check for the following:

a. The margin signal bell should ring when the 66th character is printed. The automatic line feed and carriage return should operate after the 72d character (76 on weather machines) is printed. Carriage return should take place when the carriage return code impulse is received.

b. Observe the action of the ribbon feed mechanism while printing. The inking ribbon must be lifted and fed each time a character is typed.

c. Check the space bar, FIGS key, and LTRS key to see that they function properly.

d. With the platen in the figures (raised) position, press the LTRS button on the teleprinter dust cover. The platen should move to the letters position.

e. When the carriage is toward the center of the platen, press the CAR RET button on the dust cover. The carriage should return to the left margin.

34. Stopping Procedure

a. A teleprinter operator at any sending station can stop the motors of all teleprinters in the circuit by transmitting the figures code group, placing all machines in the figures position, and then transmitting either the stop code group for standard communication circuits, or a blank code group and then a stop code group for weather communication circuits. The motors of all machines in the circuit will be stopped and remain in a standby condition. They may be started from any station by briefly placing the LINE-BREAK switch in the BREAK position, opening the signal circuit momentarily.

b. To stop a teleprinter and close it to traffic, set the MOTOR and LIGHT switches to the OFF positions. If the teleprinter does not supply line current, place the POWER switch to the OFF position also.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

35. General

a. Operation and maintenance of this teleprinter equipment in arctic, tropical, or desert regions creates a number of problems peculiar to those regions. Moisture condensation due to extreme humidity causes short circuits and crossfire. Deterioration of parts due to rust and corrosion often results in a complete breakdown of the equipment. Dust, dirt, or sand encountered in desert regions will affect operation and may cause equipment failure.

b. To prevent corrosion, keep the equipment as dry as possible. In cold regions, heat the shelter in which the teleprinter is installed whenever possible. Use all possible measures to prevent quick changes in room temperature which might cause moisture condensation.

36. Operation in Arctic Climates

a. Provide a reliable source of heat whenever possible. A temperature of at least 40° F. should be maintained in the room containing operating teleprinter equipment.

b. The standard lubricants specified in paragraph 81 provide the proper lubrication for low temperature operation.

c. Allow the motor to run for a warmup period of approximately 15 minutes.

37. Operation in Tropical Climates

Heat and humidity are the major climatic problems which must be overcome to permit reliable operation of this equipment in tropical areas.

a. High humidity may cause condensation of moisture on the equipment whenever the temperature of the equipment is lower than that of the surrounding area. Equipment corrosion and the presence of fungi are inevitable results of this condition unless preventive measures are taken. A continuously lighted bulb placed under the equipment at the operating site can minimize corrosion and growth of fungus.

b. The disadvantages of excessive heat may be partially or wholly overcome by providing as much ventilation as possible around the teleprinter, particularly around the motor and power supply. Increased friction caused by lack of lubrication and dirty mechanisms also results in unnecessary heat.

38. Operation in Desert Climates

Operational problems in desert areas are much the same as those in tropical areas, except for the lack of humidity. Dryness may dictate more frequent lubrication. Dirt and dust can damage bearings and moving parts of mechanisms. Whenever it becomes necessary, measures similar to those given for operation under tropical conditions are applied to insure efficient operation of the equipment.

a. Protect the equipment against dust, dirt, and sand.

b. Provide adequate ventilation to prevent overheating.

c. See that proper lubricants are used to protect the equipment. To eliminate dirt and dust, dustproof the shelter in which the equipment is installed. If necessary cover the inside walls with heavy paper.

d. Make frequent preventive maintenance checks.

CHAPTER 4
THEORY

Section I. THEORY OF TELETYPEWRITER SETS AN/FGC-20, AN/FGC-20X, AND AN/FGC-21

39. General

This chapter contains a complete explanation of the theory of operation of Teletypewriter Sets AN/FGC-20, AN/FGC-20X, and AN/FGC-21. The first section covers the overall fundamentals of teletypewriter communication and the means by which these sets operate in circuits with other teletypewriter sets as well as the interfunctioning of their components. Paragraphs 45 through 74 describe the function of the teleprinter, and paragraphs 75 through 79 explain in detail the electrical circuits of the teleprinter.

40. Basic Teletypewriter System

Figure 25 shows a basic circuit for operating two interconnected teletypewriter sets on a neutral basis. Impulses sent from either sending contact operate the selector magnets in both teletypewriter sets. In neutral operation, the selector magnets are operated when the current flows and are released when no current flows. The signal code group determines the character to be transmitted or received. In a basic circuit such as this, each station has a means of sending and a means of reception. Additional stations, keyboard transmitters, or receiving units can be added to this basic circuit as required.

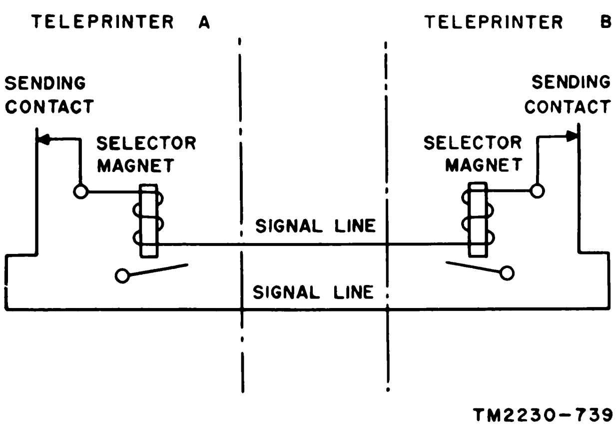


Figure 25. Basic circuit for operating interconnected teleprinters.

41. Standard Start-stop, Five-unit Code

Thirty-two signals comprise the standard start-stop, five-unit teletypewriter code (fig. 26). The first 26 code groups are used for letters of the alphabet. The last six code groups cause the functions (par. 60) to operate.

42. Sequential Signaling Code

a. The signaling code used in teletypewriter communication is not the same as the Morse code of manual telegraphy. In Morse code operation, the code for different characters consists of varying numbers of units or elements that have unequal lengths (dots and dashes). In standard teletypewriter operation, the code for different characters always consists of five units or elements of equal length. These equal-length units are called marking and spacing impulses. Figure 27 shows the five-unit code group for the letter X. Codes for other characters are made by combining the five elements in different combinations. Using all the possible combinations available yields 32 different five-unit groups; therefore, it is possible to transmit 32 different code groups in the standard start-stop code.

b. Standard start-stop signals are transmitted by neutral or polar operation. In neutral operation current flows through the circuits in one direction only. Marking impulses are current impulses, and spacing impulses are no-current impulses. In polar operation, current flows through the circuit in both directions. Marking impulses are current impulses in one direction, spacing impulses are current impulses in the opposite direction, that is, of opposite polarity.

c. The teleprinter can receive both neutral and polar impulses. The keyboard transmitter is

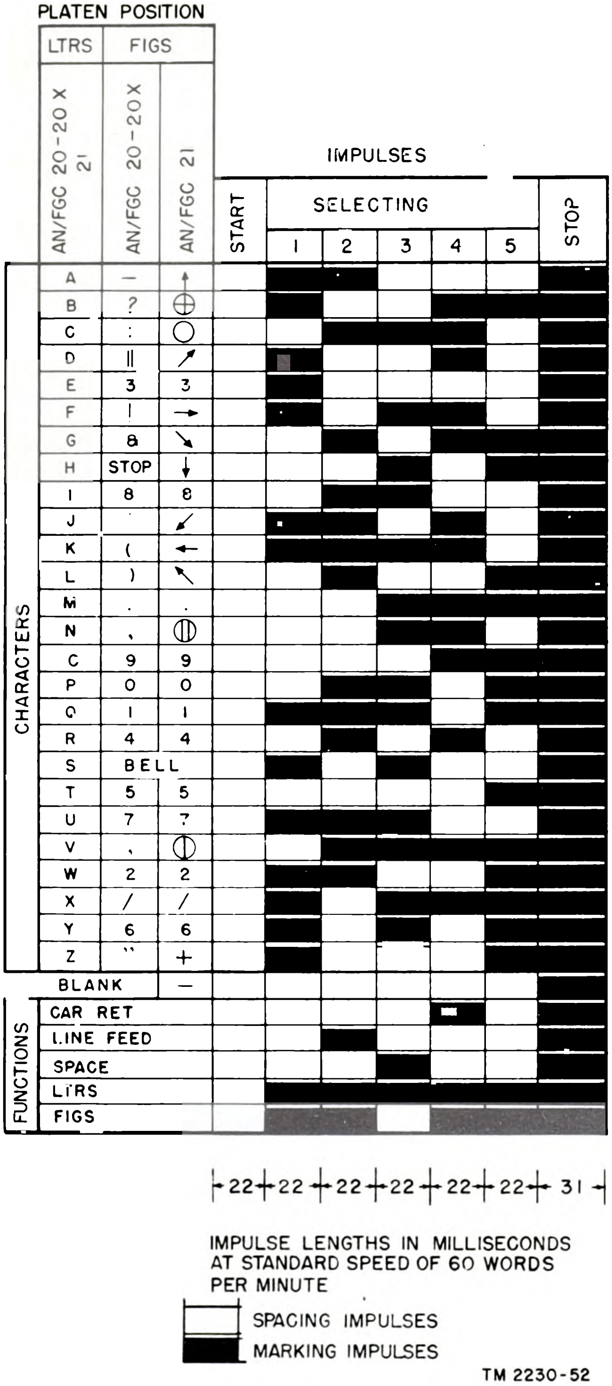


Figure 26. Standard start-stop, five-unit code chart.

wired to send neutral impulses. Polar signals can be transmitted only if the keyboard transmitter is rewired.

43. Basic Principle of Operation

a. The basic principle of teletypewriter transmission is the transformation of a mechanical or position relationship into an electrical and time relationship. The basic principle of teletypewriter reception is the transformation of an electrical and time relationship into a mechanical relationship. At the keyboard transmitter, the mechanical relationship is set up by pressing a key lever. The key lever positions five code bars on the keyboard transmitter. At the receiving end, a corresponding code ring must be operated to position it in the proper mark or space position.

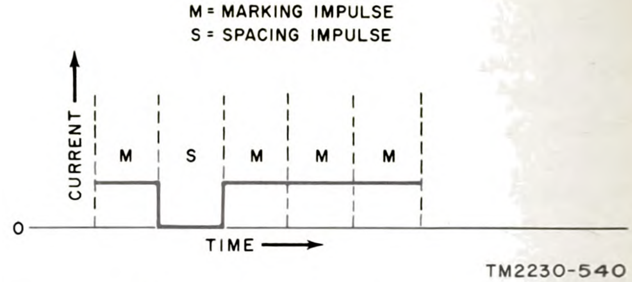


Figure 27. Five-unit, start-stop code group for the letter X.

b. The time sequence of code impulses is formed when the five impulses that represent a character are transmitted in succession. The electrical form of this five-unit code is composed of five elements of marking or spacing impulses. In the keyboard transmitter, the mechanical form of the code is composed of five code bars, which are positioned to the right for marking and to the left for spacing. The code bars, aided by other linkages and a power drive, convert the mechanical form of the code into transmitted electrical form (fig. 28).

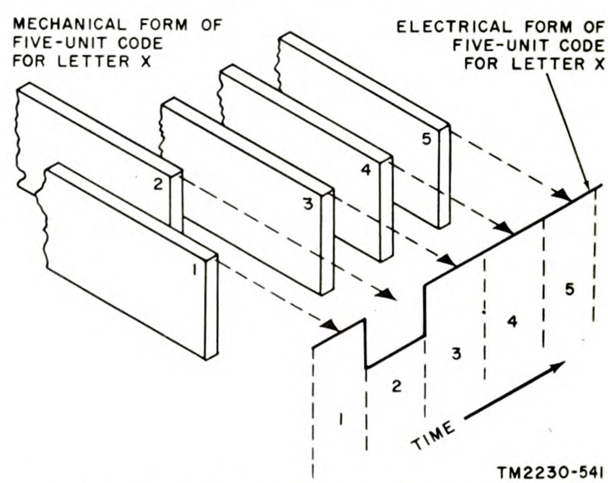


Figure 28. Relationship between mechanical and electrical forms of five-unit code.

c. The first code bar of the keyboard transmitter controls the transmission of the first code impulse, the second code bar controls the second code impulse, and so on for the five code impulses.

44. Synchronism

Starting and stopping the receiving unit in synchronism with the keyboard transmitter is accomplished by transmitting two additional impulses along with the five-unit code impulses for each character. The start impulse is a spacing impulse sent immediately preceding the five-unit code impulses (fig. 29). The stop impulse is a marking impulse sent immediately following the five-unit code impulses. The start impulse causes the receiving unit to operate when the keyboard transmitter starts. The stop impulse causes the receiving unit to stop when the keyboard transmitter stops. Thus, even if the receiving unit is not synchronized with the keyboard transmitter, it will be brought to a stop before the next signal to start in step again is received. The length of the start impulse is equal to that of one of the other five impulses, and the stop impulse is 1.42 times as long. The receiving shaft speed is greater than the transmitter shaft speed, which gives the receiving unit enough time to complete its function.

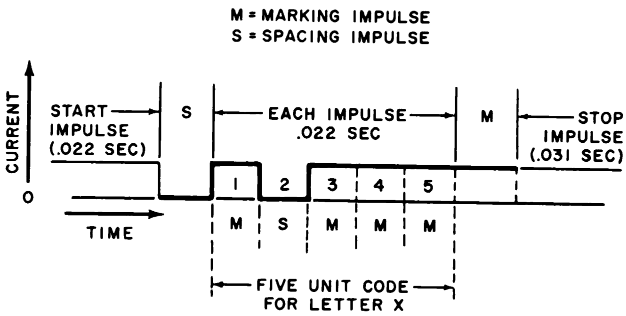


Figure 29. Standard start-stop, five-unit code signal for the letter X, plus start and stop impulses.

Section II. THEORY OF TELETYPEWRITER TT–98/FG, TT–99/FG, AND TT–100/FG

45. General

a. The teleprinter consists of a keyboard transmitter and a receiving unit. The keyboard transmitter and receiving unit are mounted on a common base. Each unit is electrically capable of operating independently, depending on the type of operation desired.

b. The keyboard transmitter is capable of transmitting standard five-unit, start-stop code to the signal line. The teleprinter can receive only standard start-stop, five-unit code.

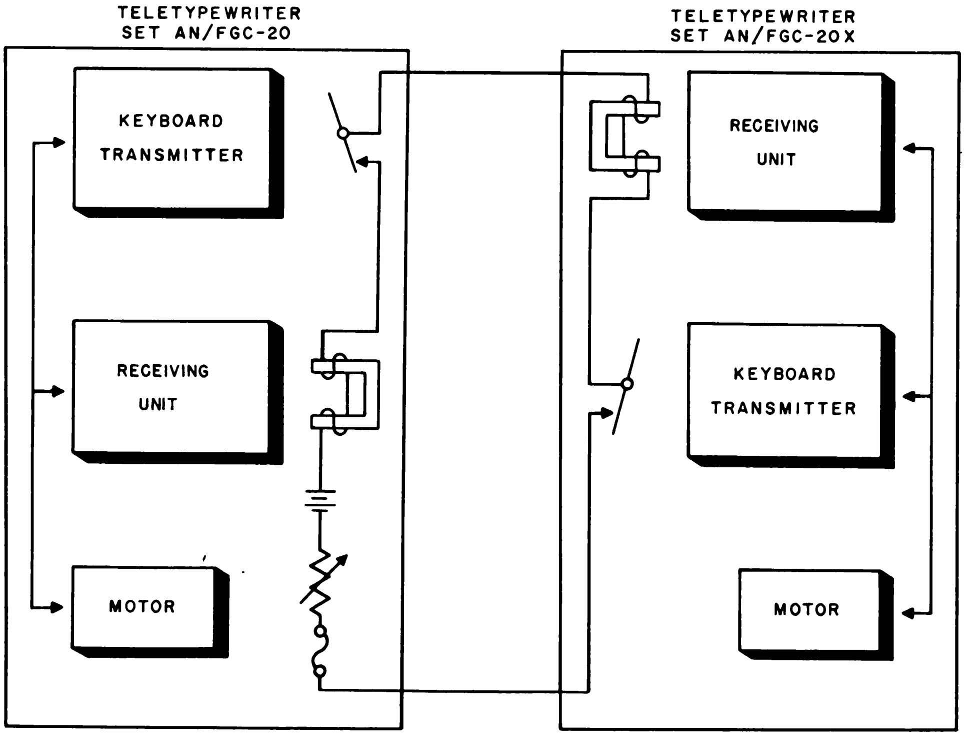


Figure 30. Interconnected teleprinters, block diagram.

46. Basic Principle of Operation

a. When connected with another teleprinter in a half-duplex circuit (fig. 30), the keyboard transmitter operates sending contacts to transmit electrical start-stop, five-unit signal codes. The selector magnets at the receiving unit respond to these signals to position the selector mechanisms which control the characters printed by the teleprinter.

b. 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. However, there are always small variations in speed between independent motors which cause interoperating units to get out of step unless there differences are compensated for. Compensation is accomplished by clutch action. This action causes the mechanism of the receiving units to start at the beginning of each code group and to stop at the end of each code group. Starting the two mechanisms together at the beginning of each code group prevents accumulation of small speed variations of the motors from affecting the code sequence.

47. Motors

Transmitting and receiving mechanisms of a teleprinter are driven by an electric motor located at the right-hand side of the machine. Teletypewriters TT–99/FG and TT–100/FG are powered by synchronous motors and Teletypewriter TT–98/FG by a series-governed motor.

a. Synchronous Motors. The synchronous motor (A, fig. 86) used in Teletypewriters TT–99/FG and TT–100/FG is used with single phase, 115-volt ac at a frequency of 60 cycles. This 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 starting winding is in parallel with C9 (capacitors C9A and C9B and resistor C9C), and in series with the motor start relay E3. The initial starting current causes relay E3 to close its contacts and shift the phase in the starting winding circuit to provide the initial torque necessary to start armature rotation. As the motor armature gains speed, the current that flows through the motor (and also the relay coil) decreases. When a predetermined current value is reached, the relay deenergizes, its contacts open, and the starting winding circuit remains completed through capacitor C9B. The motor armature continues to accelerate until it reaches 3,600 rpm.

b. Series-governed Motor. The series-governed motor (B, fig. 86) used in Teletypewriter TT–98/FG operates on 105- to 125-volt 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, the contacts of motor stop relay (A, fig. 86), MOTOR switch S5 and overload protection fuse F1. The governor contacts normally are closed (B, fig. 86), but they are open when the motor speed increases above the allowable maximum. This places resistor R1 in series with the motor and causes the current and thus the speed of the motor to decrease. When the proper speed is reached, the governor contacts close again. Resistor R1, in combination with capacitor C1, also acts as a spark suppressor for the governor contacts. Motor filter Z1 suppresses radio frequencies generated by the governor contacts and the motor commutator. The suppression of these frequencies minimizes interference with associate electronic equipment. The contacts of motor stop relay (A, fig. 86) are opened to stop the motor when the upper case H code group is transmitted. The contacts remain in open until the line current is broken (by the operation of LINE BREAK switch S3) at any teleprinter in the circuit; the contacts close when the line circuit is closed again by releasing LINE BREAK switch S3. MOTOR switch S5 is in the ON position during all periods of operation and is placed in the OFF position only when the equipment is shut down completely.

48. Governor

a. 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 contact points are connected in series with the field coils and motor armature through two slip rings (located on the back of the motor governor assembly). The rings are contacted by two electrical contact brushes in the motor housing. The movable electrical contact of the governor assembly (fig. 31) is flexible and is held against the stationary electrical contact by a spring. When the motor speed exceeds 3,600 rpm, the centrifugal force acting on the movable electrical contact is greater than the tension of the spring. The movable electrical contact then moves away from the stationary electrical contact. The speed at which this movement will occur depends on the tension applied to the spring by a governor adjustment lever. This lever should be adjusted by manipulating the governor worm while the motor is running.

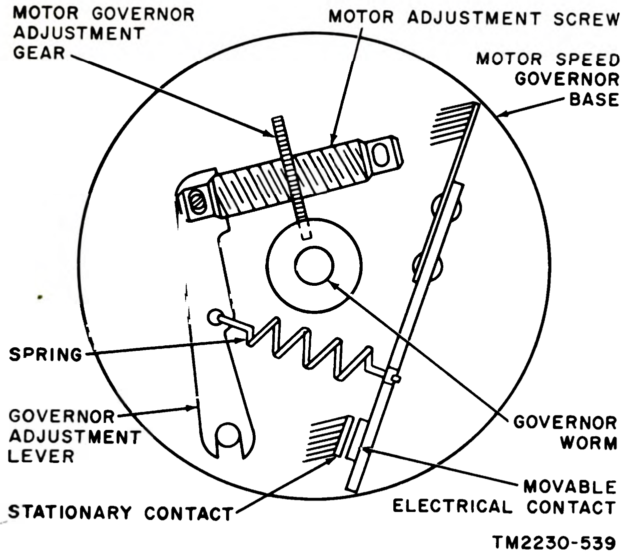


Figure 31. Governor, series-governed motor, functional view.

b. The governor worm has two integral threaded portions, one right hand and one left hand. Complete instructions for adjusting the motor speed of the series-governed motors are given in paragraph 20.

49. Main Shaft and Power Distribution (fig. 32)

The mechanisms of the teleprinter are driven through gears on the main shaft that are rotated by the motor. These gears turn the plate and disk of the friction clutch for the keyboard transmitter shaft. The gears also turn the driving forks of friction clutches for the selector camshaft, the carriage feed shaft, the driving shaft of a positive clutch for the carriage return mechanism, and the driving gear for the function shaft. The speeds of rotation shown for the various parts are those that occur at standard 368.1 opm. When other drive gear sets are used, the speeds of the shafts are proportionately higher although the motor speed remains constant.

50. Keyboard-transmitter Camshaft

Power for the keyboard-transmitter camshaft is received through a friction clutch (fig. 33) on the keyboard drive shaft. The clutch makes rapid start and stop actions possible. The fork on the driven shaft engages the notches on the center clutch disk of the clutch. Two felt friction plates on the driving shaft are held against the center clutch disk by spring pressure. The spring pressure can be increased or decreased by tightening or loosening the clutch collar. The friction between the center clutch disk and the friction plates on the driving shaft is sufficient to rotate the driven shaft through its driving fork (under normal workload). If the cam stop lever (fig. 35) is in a position to block the transmitter camshaft, the friction between the center clutch disk and the friction plates is overcome. The center disk is stopped and remains stationary between the two felt friction washers. When the cam stop lever is mechanically moved out of the path of the transmitter camshaft, the camshaft resumes rotation for the next code group.

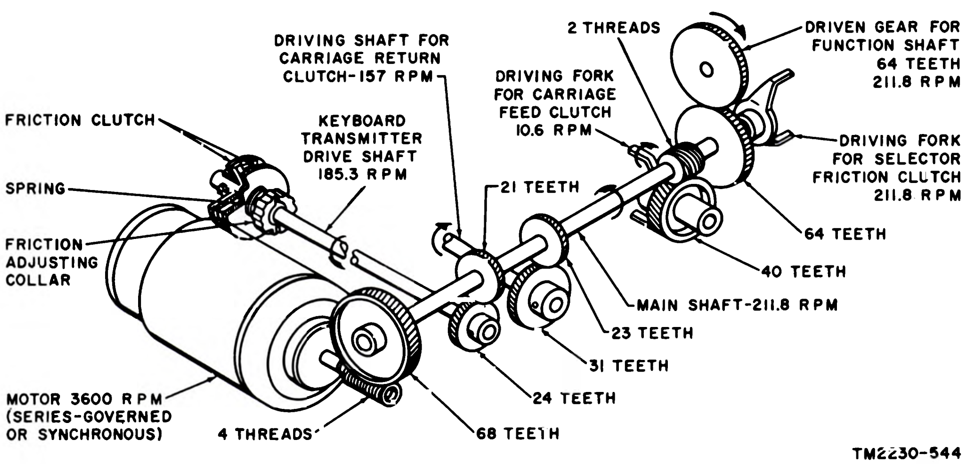


Figure 32. Mechanical power distribution with standard 368.1 opm drive gear set in use.

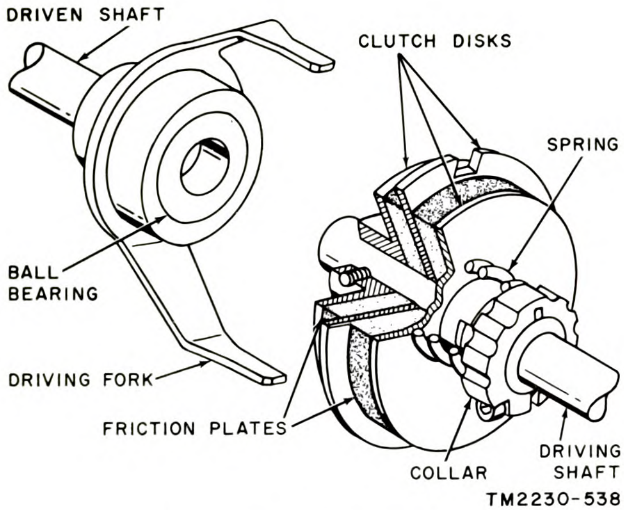


Figure 33. Friction clutch.

51. Keyboard-transmitter Operation

a. The keyboard-transmitter mechanism (fig. 34) consists of key levers, code bars, and sensing levers that are used in selecting the code group to be transmitted, a transmitter camshaft, selector levers, and transmitting contacts for transmitting the selected code group; a universal bar, cam stop lever, and a friction clutch that are used in starting and stopping transmission.

b. The clutch yoke is mounted on the keyboard-transmitter camshaft. The friction clutch and transmitter shaft driven gear are mounted on the keyboard-transmitter drive shaft (fig. 32). The transmitter shaft driven gear (24 teeth) derives its force from the transmitter shaft driving gear (21 teeth) on the main shaft of the teleprinter. The transmitter camshaft is held stationary when the camstop lever is held by the locking lever latch (fig. 35).

52. Transmitting Mechanism

a. The five code bars used to set up the mechanical form of the code are located under the key levers (fig. 36). They run the width of the keyboard transmitter and can be engaged by pressing any key lever. Each code bar is notched in one of two ways at the point where it is engaged by each key lever. The sides of these notches are slanted to the right or to the left. The downward

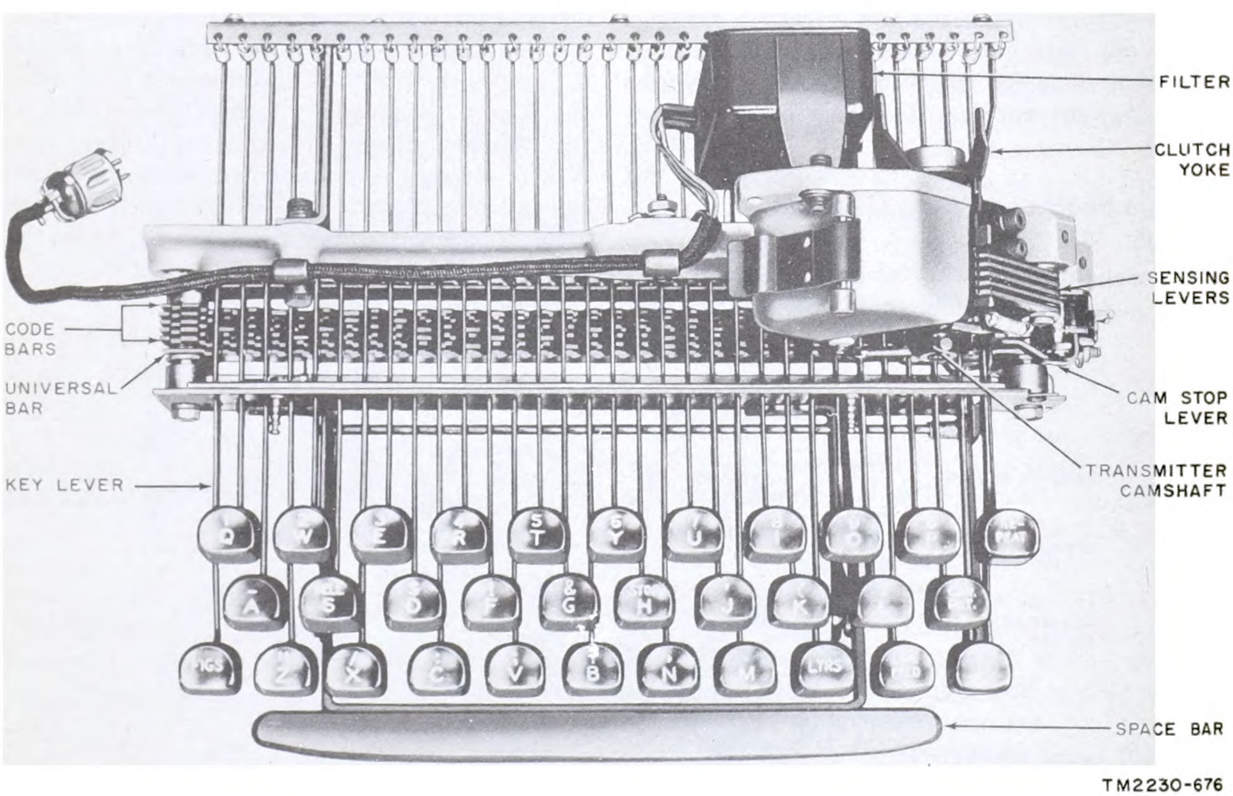


Figure 34. Keyboard transmitter parts.

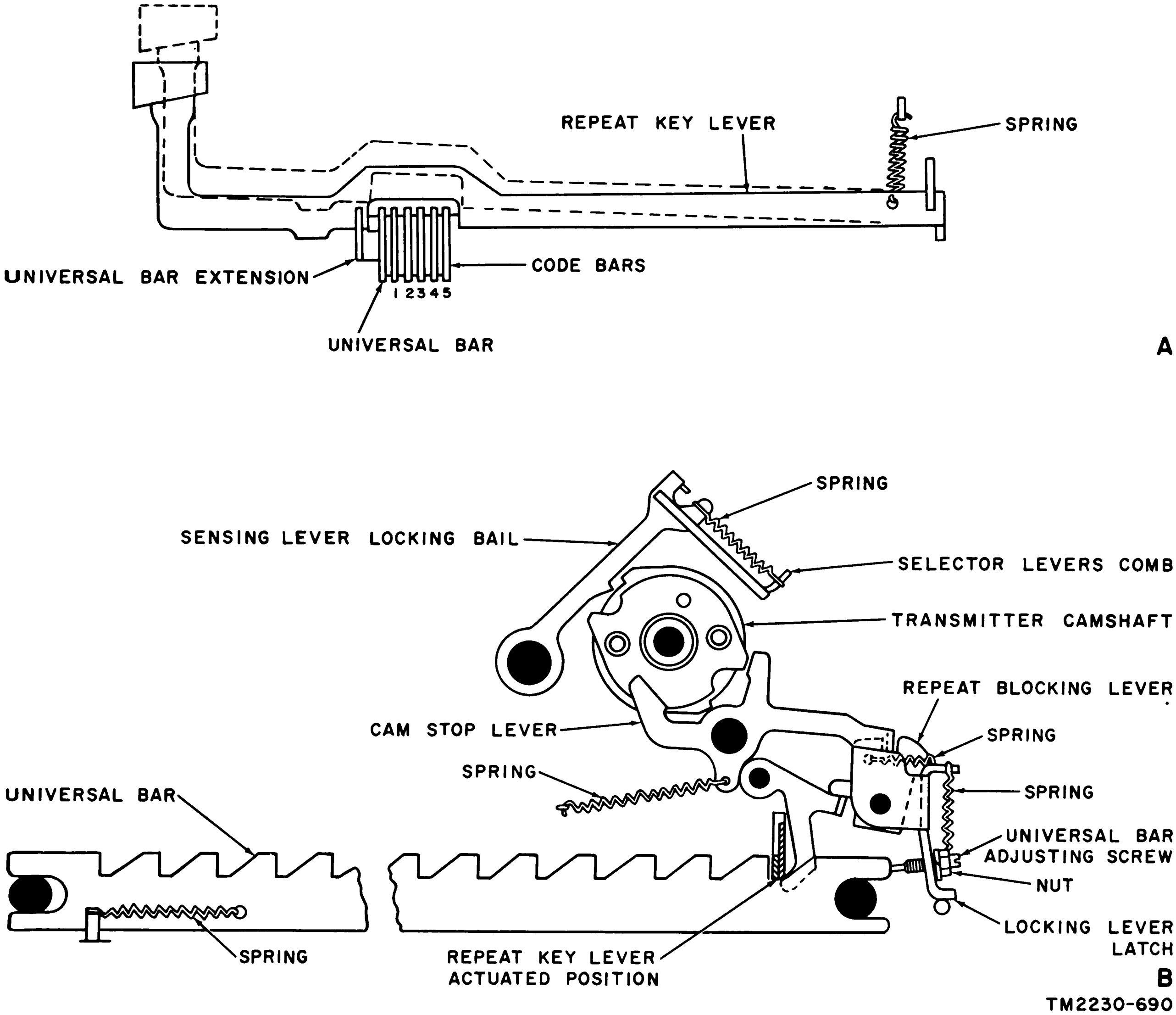


Figure 35. Transmitter camshaft control mechanism.

movement of a key lever pushes the code bars either to the right or left. The notches are cut so that the first code bar will move to the right (A, fig. 37) if the first unit of the code for the key pressed is a marking signal. If the second unit of the code is to be a spacing signal, the movement of the second code bar will be to the left (B, fig. 37).

b. The positions of the code bars are transformed into electrical signals by the positioning of the transmitter contact. The positioning of the transmitter contact is controlled by the code bars, the five rotating cams on the transmitter camshaft, the five selector levers, and the five sensing levers (figs. 36 and 37). Each code bar moves only its associated sensing lever. Any selector lever, however, will actuate the transmitter contact when the selector lever is moved by its associated cam. The five cams are positioned so that they operate their associated selector levers and transmitter contact in sequence as the transmitter camshaft rotates. To send marking signals, a code bar shifted to the right turns its mating sensing lever counterclockwise so that the end of the sensing lever engages and latches the upper end of the selector lever. When the lobe of the mating cam raises the midpoint of the selector lever, its lower end slides on the bearing shoe and closes the transmitter contact. To send spacing signals, a code bar shifted to the left turns its mating sensing lever clockwise so that the end of the sensing lever does not latch the upper end of

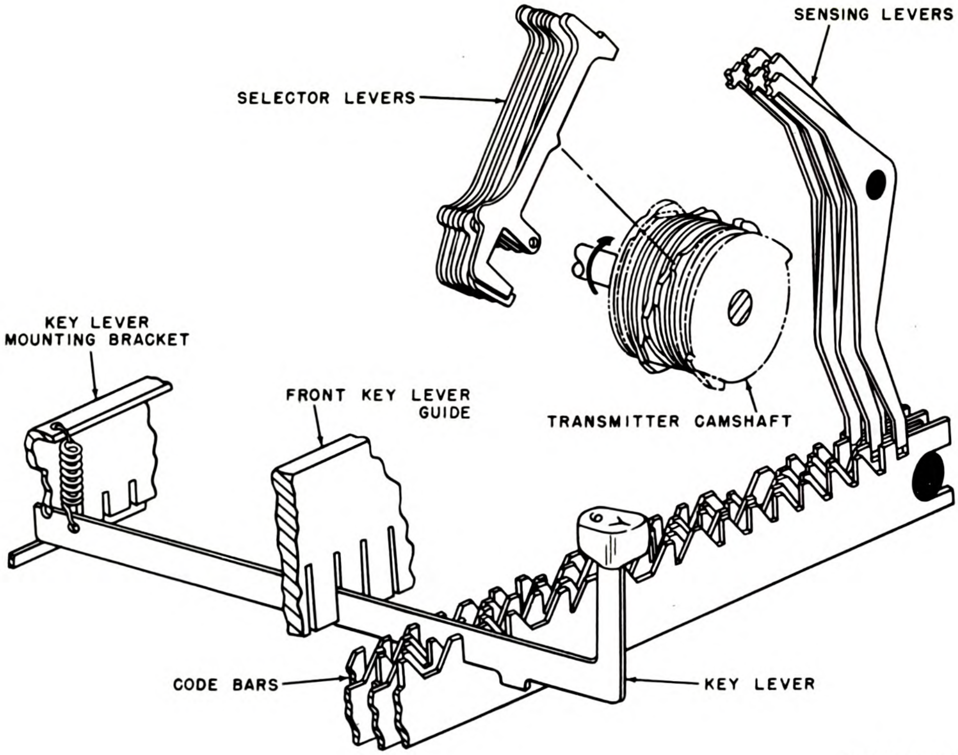


Figure 36. Setting up mechanical form of code by operating key lever.

the selector lever. When the lobe of the mating cam raises the midpoint of the selector lever, its upper end moves and permits the contact bail spring to open the transmitter contact.

c. When a key lever is pressed, the sensing levers (fig. 36) are locked in position until the code group is completed. Pressing another key lever right away will not interfere with the settings. This locking is accomplished by the sensing lever locking bail (fig. 35), which drops and engages the upper ends of the sensing levers.

53. Starting and Stopping Transmitter Camshaft

The chart below lists the sending operation sequence for sequential signals whenever a key lever (other than the repeat key) is struck.

Sequence	*Sending operation for sequential signals*	
1	Key lever or space bar pressed.	
2	Universal bar shifted to right.	Five code bars shifted 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	No. 6 selector lever (permanently latched) drops off stop cam.	
7	Contact bail spring turns transmitter contact counterclockwise.	
8	Start impules sent.	
9	First five-unit code impulse cam raises No. 1 selector lever.	
10	If latched by sensing lever, lower end of selector lever No. 1 turns transmitter contact clockwise; if not latched by sensing lever, contact bail spring turns transmitter contact counterclockwise.	
11	Mark impulse or space impulse sent, depending on whether transmitter contact turned clockwise or counterclockwise.	
12	Second, third, fourth, and fifth code impulses sent by corresponding parts of the transmitter mechanism as for the first code impulse.	
13	Cam stop lever restoring cam raises cam stop lever.	
14	Cam stop lever latched in up position by repeat blocking lever if universal bar is still shifted or by locking lever latch if universal bar has been released by key lever.	
15	Stop cam raises No. 6 selector lever (permanently latched).	

Sequence	Sending operation for sequential signals
16	Lower end of No. 6 selector lever turns transmitter contact clockwise.
17	Stop impulse sent.
18	Tooth on camshaft strikes cam stop lever and camshaft stops revolving (having completed a one-half revolution).
19	Key lever must be released before above sequence can be repeated for any other or the same key lever to allow locking lever latch to return under cam stop lever.

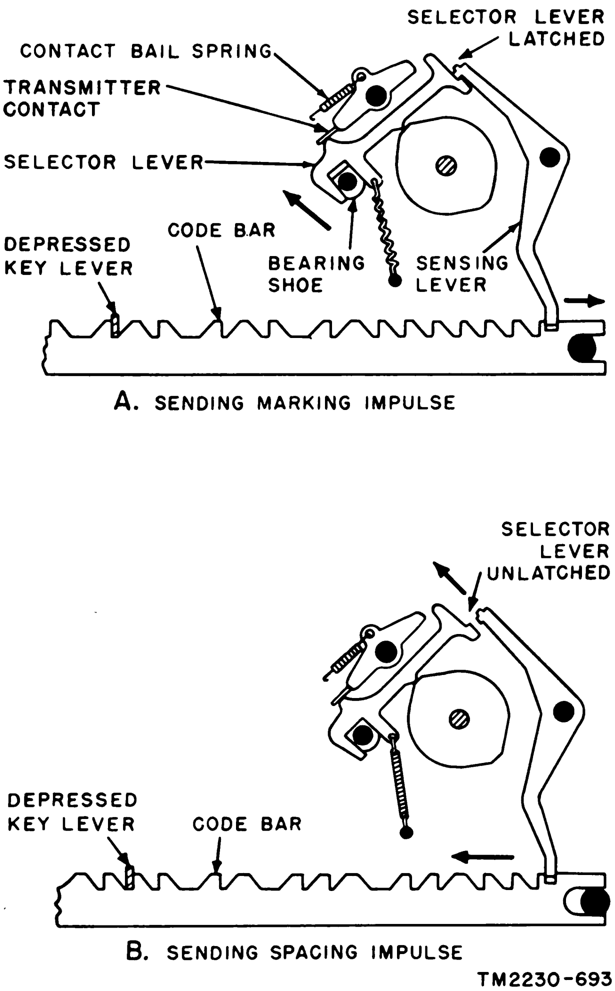


Figure 37. Operation of transmitting mechanism.

54. Character Repeat Feature

The chart below lists the sequence of operations when the repeat key is pressed.

Sequence	Sending operation for sequential repeat signals.
1	REPEAT key pressed.
2	Same sequence of operations takes place as in paragraph 53 up to point where cam stop lever restoring cam raises can stop lever. REPEAT-key is either released or still pressed at this point. Rest of sequence is identical with the chart in paragraph 53. If REPEAT key is still depressed, sequence given below takes place.

Sequence	Sending operation for sequential repeat signals
3	Repeat lever holds repeat blocking lever.
4	Restoring cam moves clear of cam stop lever.
5	Cam stop lever drops again.
6	Stop cam raises No. 6 selector lever (permanently latched).
7	Lower end of No. 6 selector lever turns transmitter contact clockwise.
8	Stop impulse sent.
9	Tooth on transmitter camshaft passes cam stop lever.
10	Transmitter camshaft continues to turn and sequence above starts again.

55. Receiving Code Impulses

a. *Polar Selector Magnet Operations.*

(1) A polar selector magnet (A, fig. 39) consists of a permanent bar magnet, an armature, a potentiometer, and two line and two bias windings mounted on a U-shaped silicon 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 78.

(2) The armature (B1, fig. 39) 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 it sets up unbalances the permanent magnet field and causes the armature to move on the central pivot. Current flow in the windings increases the magnetic attraction on one end of the armature, while decreasing the magnetic attraction on the opposite

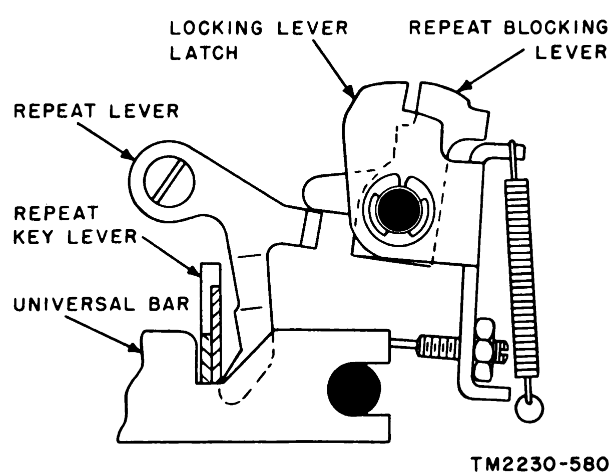


Figure 38. Repeat mechanism.

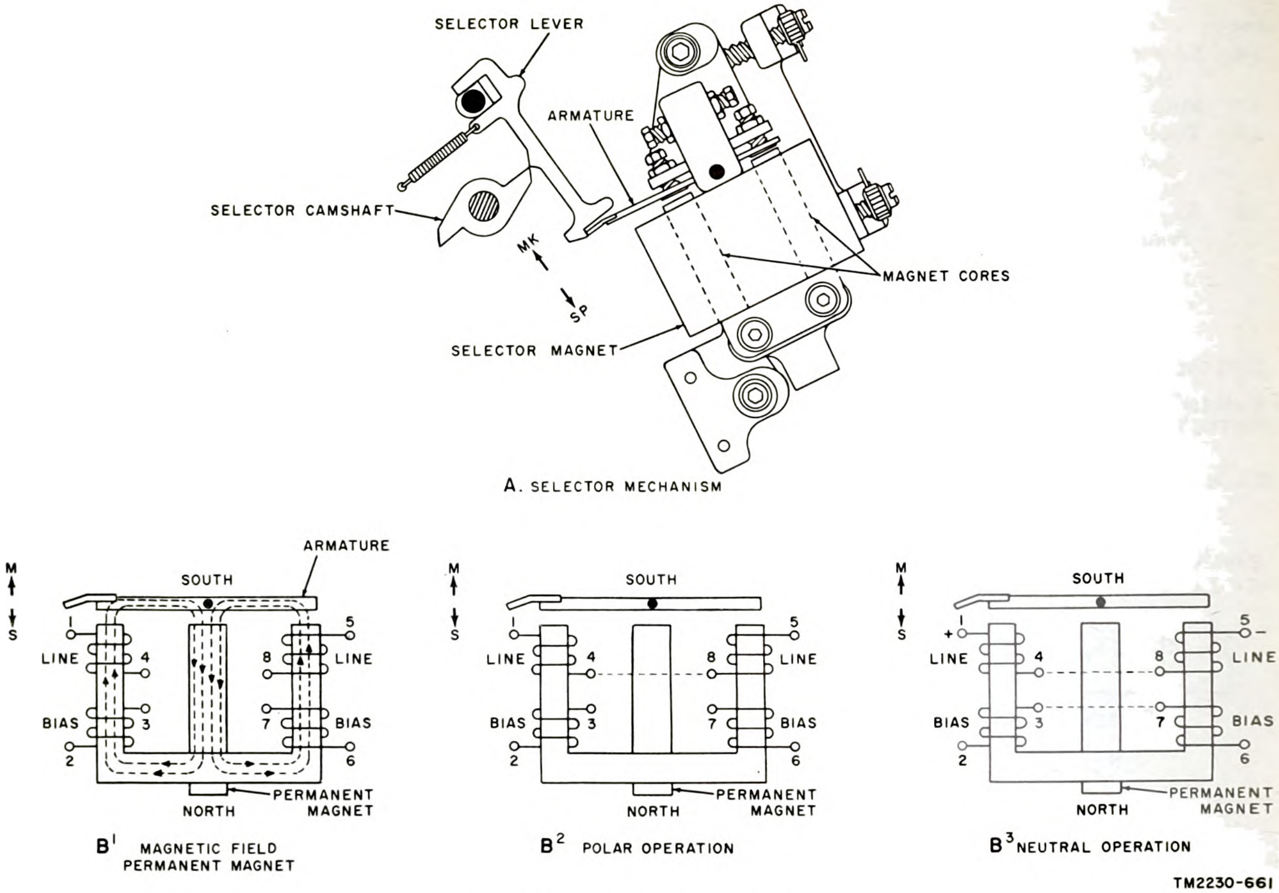


Figure 39. Polar selector magnet.

end. This makes the armature sensitive to slight current flows in the windings.

(3) When operating in polar circuits, the bias windings are not used. The line windings are connected in series for 30-ma operation (B2, fig. 39).

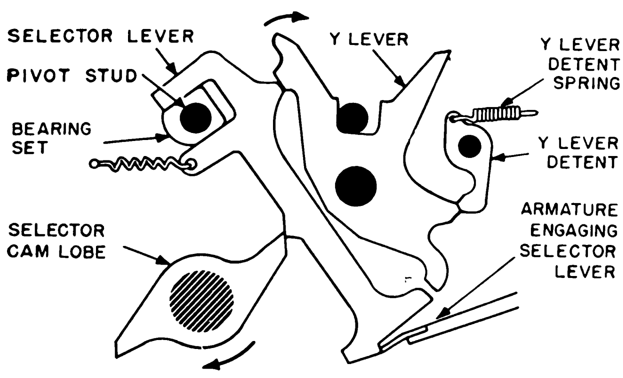
(*a*) During a marking impulse, current flows through the line windings. Terminals 1 and 8 are positive and terminals 4 and 5 are negative. The magnetic field set up by the line winding around the left arm opposes the field of the permanent magnet, and little pull is present on the left side of the armature. The magnetic field set up by the line winding around the right arm of the core aids the field of the permanent magnet; therefore, the right end of the armature is pulled toward the right arm of the U-shaped core. The left end of the armature, which includes the armature blade, moves to the marking position away from the left arm of the core and into the path of the selector levers.

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

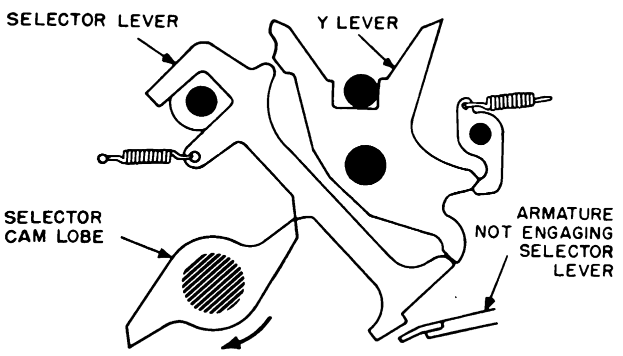
(4) When operating in neutral circuits (B3, fig. 39), the bias windings must be used. They are wired in series and are energized constantly. Terminals 3 and 6 are positive and terminals 2 and 7 are negative. The magnetic field set up by the left bias winding *aids* the magnetic field of the permanent magnet. The field of the right bias winding *opposes* the field of the permanent magnet. 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 left (blade) end of the armature to be pulled toward the left core, away from the selector levers. Current flows in both line windings during reception of a neutral marking impulse. The current value in a line winding normally is twice the bias current value. The field set up by the energized line winding around the left core *opposes* the combined magnetic fields of the left bias winding and the permanent magnet. The energized line winding around the right core *aids* the field of the permanent magnet and *opposes* the field of the right bias winding. Therefore, a marking impulse in the line windings causes the right end of the armature to be pulled toward the right core arm, and the left (blade) end to be moved into the path of the selector levers (marking position). Neutral operation of this selector magnet is possible in both 20- and 60-ma circuits. The line windings are connected in series for 20-ma neutral operation, and in parallel for 60-ma neutral operation. Adjustment of the bias current value to obtain greatest machine range is accomplished with a potentiometer which is connected in series in the bias circuit.

b. Transformation of Electrical Impulses Into Mechanical Settings. The selector mechanisms (figs. 40 and 41) of the teleprinter transform electrical code impulses into mechanical settings. Primarily, the mechanisms record 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. This position is then recorded



A. RECORDING MARKING IMPULSE



B. RECORDING SPACING IMPULSE

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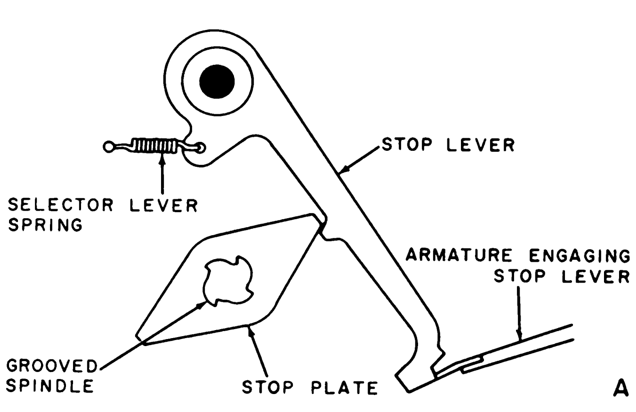
Figure 40. Impulse recording portion of the selector mechanism.



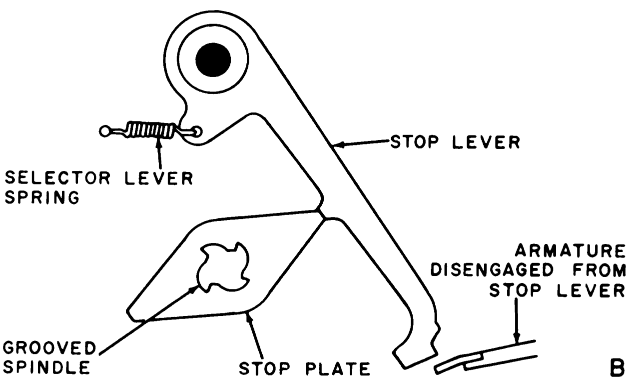


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Figure 41. Selector camshaft and stop plate.

by the subsequent positioning of the selector mechanism of the teleprinter.

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 movement is caused by five selector cam lobes operating in conjunction with five selector levers and the armature. The five Y-levers are mounted on a common Y-lever pivot stud, and the five selector levers are mounted on the selector lever pivot stud. The five selector cam lobes are mounted on a shaft with the cam lobes projecting at angles from the camshaft. One selector cam lobe operates in conjunction with only one selector lever and one Y-lever. There are five planes, 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 impulses of the five-unit code. The first set records the first impulse of the five-unit code. The second set records the second impulse, the third set the third impulse, etc.

(2) During the time a marking impulse is received (A, fig. 40), the selector magnet armature is moved into the path of a selector lever. Near the middle of this time period, the selector cam lobe corresponding to the impulse being received (the first cam lobe for the first impulse and the second cam lobe for the second impulse, etc.) will rotate to the position shown and raise the selector lever. Movement of the lower end of the selector lever is prevented by the armature. The lever moves at its upper end by sliding on the bearing set. This action causes the selector lever to push 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 by the clockwise positioning of a Y-lever.

(3) During the time a spacing impulse is received (B, fig. 40), the selector magnet armature is moved away from the selector levers. Near the middle of this time 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 and it is free to move. This movement causes the selector lever to push against the lower portion of the Y-lever, turning it counterclockwise (unless it is already in that position). A spacing impulse thus is recorded by the counterclockwise positioning of a Y-lever. The Y-lever detent holds the Y-lever in the space position.

(4) Each five-unit code impulse, in turn, is recorded by a clockwise (marking) or a counterclockwise (spacing) setting of five corresponding Y-levers.

d. Synchronization.

(1) The cam lobes are synchronized with the incoming electrical impulses. To synchronize, the cam lobes are set into motion from a stopped position at the start of each code group and stopped at the end of each code group. The selector camshaft is driven from the end of the main shaft by a friction clutch similar to that on the keyboard transmitter. When no messages are being received, current flows in the windings of the selector magnet. The camshaft is prevented from turning by the interoperation of the selector magnet armature, stop lever, and stop plate (fig. 41). When the armature is raised, it engages the stop lever (mounted on the selector lever pivot stud) which prevents the stop plate and selector camshaft from turning (A, fig. 41). When the start (no-current) impulse for a code group is received, the armature disengages the stop lever, releasing it and the stop plate (B, fig. 41). The selector camshaft (fig. 39), driven by the friction clutch, immediately starts to turn. The first selector cam lobe (fig. 40) is engaged with its selector lever by the time the next impulse (first five-unit impulse) is received.

(2) Each of the remaining selector cam lobes engages its corresponding selector lever, one after the other, when the corresponding electrical impulse is received. This sequence is controlled by the angular displacement of the cam lobes and the speed at which the selector camshaft rotates. All five cam lobes operate their selector levers within one-half revolution of the selector camshaft. After the last five-unit impulse is received, the stop impulse raises the selector magnet armature to engage the stop lever. The selector camshaft is limited to making only one-half revolution per code group. The other end of the stop plate which then comes around is held by the stop lever to stop the camshaft.

56. Transfer Operation

To select the character which is to be printed, the five code rings of the typing unit must be positioned according to the incoming code group. The incoming code group is stored in the five Y-levers in clockwise and counterclockwise settings. The Y-lever settings are transferred to the code rings, positioning them.

a. The selector code rings (A, fig. 42) are positioned about the stop arm shaft for clockwise or counterclockwise movement. Each code ring has a slotted tail that mates with a corresponding one of a set of five inverted T-levers. The T-levers are mounted on a common pivot stud on the end of the transfer level. Turning a T-lever causes the mating code ring to turn. The T-levers are mounted in the same planes as their corresponding Y-levers. Turning the transfer lever causes the end of the T-lever to become engaged with the end of the Y-lever. The prongs of the T-lever are farther apart than those of the Y-lever; therefore, only one end of each lever will engage at any time. When the transfer operation takes place, the transfer lever turns and moves all the T-levers against the Y-levers. This action transfers the five settings of the Y-levers to the corresponding code rings. Each Y-lever set clockwise (for a marking signal) is engaged by its T-lever on the right side which places the mating code ring in the clockwise position. Each Y-lever set counterclockwise (for a spacing signal) is engaged by its T-lever on the left side; this places the mating code ring in the counterclockwise 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 cam or, latch tripping cam, mounted on the selector camshaft (fig. 42) trips the transfer lever latch causing the transfer lever to be pulled down by the transfer lever spring.

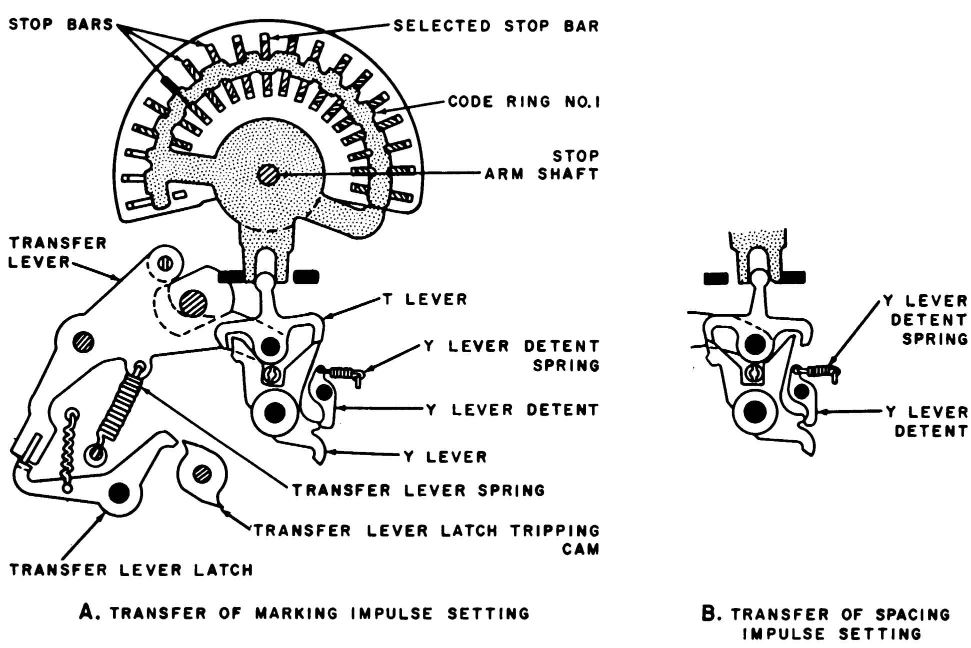


Figure 42. Transfer mechanism operation.

The tripping action takes place after the selecting operation is completed and before the selector camshaft is stopped. This action is controlled by the timing of the latch tripping cam with respect to the five selector cams and the stop plate.

c. The five code impulses operate the corresponding parts of the selector mechanism and the transfer operation takes place. The five code rings are locked in position by a code ring locking bail (fig. 43). A locking bail cam on the function shaft drives a cam follower after the transfer operation takes place. The code ring cam follower locking lever engages the code ring locking bail through a code ring locking lever on the code ring locking bail shaft. To prevent the code ring from moving in either direction, the code ring locking bail engages each code ring either on one or the other side of a small projection, depending on the position (clockwise or counterclockwise) of the code ring. The code rings are locked until the function camshaft has almost completed its one-half revolution. The cam follower then raises the code ring locking bail and the code rings are free to receive the next code group. Each code ring has notches cut into its inner and outer edges to correspond with 35 crossing stop bars. Three of these stop bars (fig. 44) are duplicate function stop bars and are used for the functions carriage return, figures, and line feed.

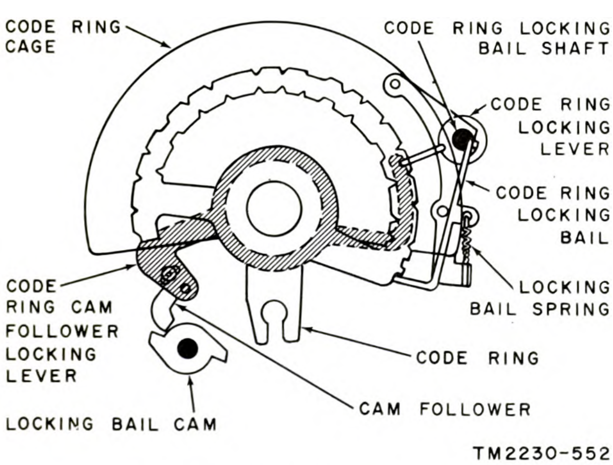


Figure 43. Code ring locking mechanism.

d. The notches in the first code ring are arranged so that when the code ring is set in the clockwise (marking) position there will be a low point opposite the stop bars for the code groups that have a marking impulse as the first code impulse and a high point for the code groups that have a spacing impulse as the first code impulse. The reverse is true when the code ring is set in the counterclockwise (spacing) position. The second code ring is notched in accordance with the second impulse for each code group, the third code ring for the third code impulse, etc. When the code rings have been set as a result of the transfer operation, there will be only one position along the inner or outer radius of the code rings where there will be a notch in each of the five rings under a stop bar. Exceptions to this are the carriage return, figures, and line feed functions for which duplicate stop bars are provided (fig. 44).

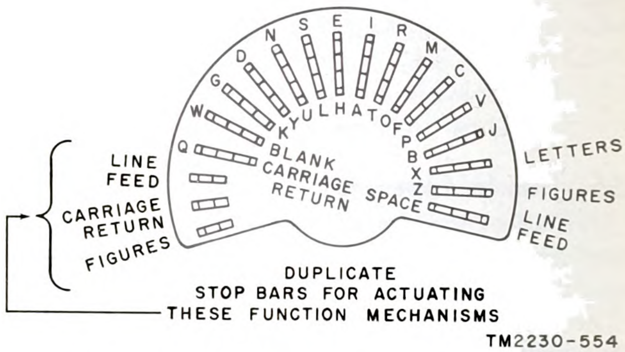


Figure 44. Characters and functions operated by stop bars.

e. The pressure of the stop bar spring pushes the stop bar into the notches (fig. 45) to arrest the rotation of the stop arm shaft. The stop bar is pushed out by the sloping surface at the side of a notch in at least one code ring when the code rings are reset by the transfer operation (unless the same code group is repeated). This action releases the stop arm shaft so that it turns until it strikes a newly selected stop bar.

f. The stop arm shaft must be positioned *accurately* to select the proper characters and functions. Little bouncing can be tolerated when the square shaft stop arm is arrested by a stop bar. To prevent excessive bouncing, an antibounce clutch (fig. 46) is installed on the stop arm shaft.

g. The 35 stop bars (figs. 42 and 44) are arranged in two semicircular rows on the code ring cage. The ends of the stop bars in the outer row move radially inward when selected. The ends of the stop bars in the inner row move radially outward when selected. The square shaft stop arm has one inner and one outer projection (on each end) for engaging the corresponding rows of stop bars. These projections are separated angularly by a space equal to one and one-half times the space between stop bars. The inner

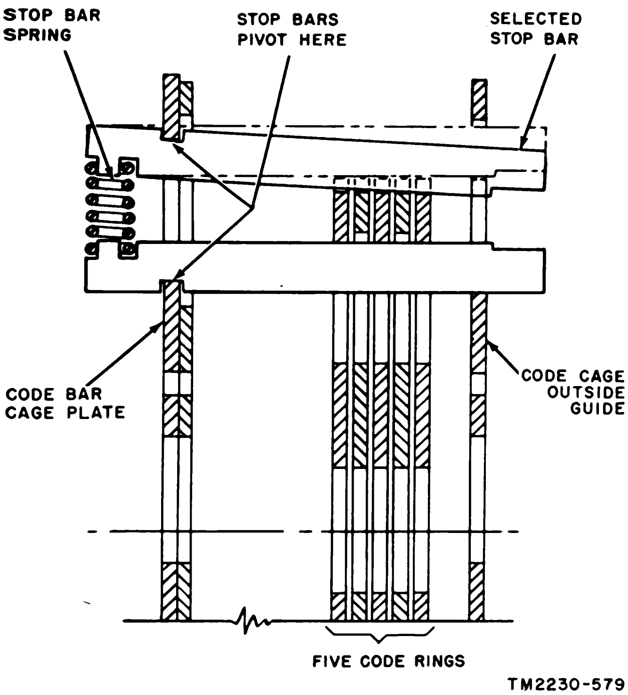


Figure 45. Code ring cage; stop bar pushed into alined code ring notches.

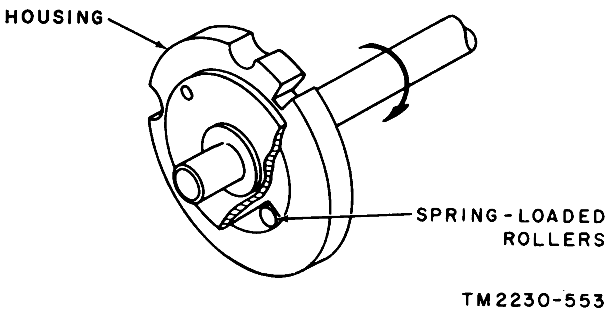


Figure 46. Antibounce clutch for stop arm.

stop bars arrest the square shaft stop arm halfway between outer stop bar positions. Thus, there are 32 different stop positions available. The three duplicate stop bars, (carriage return, figures, and line feed) do not project from the code ring cage into the path of the square shaft stop arm.

57. Range-finder Mechanism

a. Because of transmission line characteristics such as inductance and capacitance, teletypewriter signal waveforms become distorted. A device is provided that permits an adjustment for best operation with distorted signals. For a detailed discussion on the nature and effects of distortion, refer to TM 11-680, Teletypewriter Circuits and Equipment (Fundamentals).

b. Distortion consists of rounding the corners and sloping the sides of the wave forms. Some impulses become shortened and others lengthened. This effect shifts some of the later code impulses of a signal with respect to the starting impulse. To permit the selector mechanism to work properly, the selector cams are designed so that they operate for only about 5 milliseconds (compared to the full standard code impulse length of 22 milliseconds). The relationship of the cam operating points with respect to the start impulse is made adjustable.

c. A selector cam requires only about 20 percent of an impulse length to perform its function, which makes it possible to shift the selecting interval ahead or behind the midpoint of the impulse. The cam will operate during the selecting interval of the receiving impulse. The relationship between the stop plate and the selector cam is made adjustable to orient the cams within the impulse. 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 position of the stop plate with respect to the selector camshaft (fig. 47). Increasing the angle causes the selector cams to operate later in the impulse. Decreasing the angle causes the cams to operate earlier. The position of the stop plate may be adjusted by preventing the stop plate from rotating while rotating the selector camshaft. This will cause the grooved spindle on which the stop plate is mounted to move outward. The position of the stop plate may be adjusted in the opposite direction by turning the grooved spindle inward.

e. Movement of the orientation lever is controlled by the range-finder dial assembly and the range-finding cam. Turning the range-finder dial assembly clockwise increases the time between the selector cam operating points and the start impulse. Turning it counterclockwise decreases the time.

58. Function Shaft Operation

Figure 48 shows the mechanism that provides the intermittent drive which rotates the square shaft stop arm and type selecting arm to the next selected position, actuates the printing and other functional operations, and raises the transfer lever so that the next code group can be received. It consists primarily of the function shaft which is power-driven intermittently one-half revolution

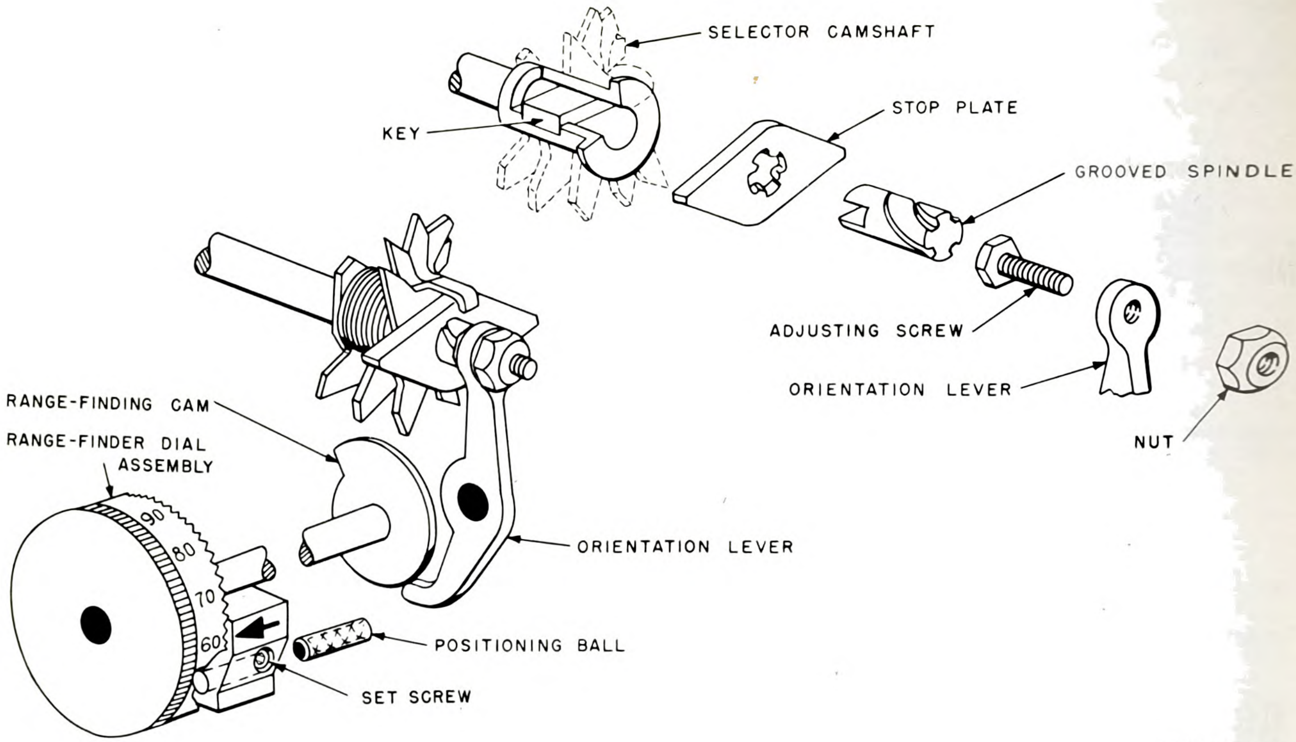


Figure 47. Range-finder mechanism.

every time a complete code group is received. The function shaft sharts to revolve automatically as soon as the transfer operation takes place.

a. The function shaft driven gear runs free on the function shaft. It is driven continuously by its mating function shaft driving gear on the main shaft. The driven gear has clutch teeth on its face, which can be engaged with the function shaft sliding clutch drum. The function shaft sliding clutch drum is keyed to the function shaft by the mating flexible coupling disk. The function shaft and function shaft sliding clutch drum must turn together. The clutch drum is spring-loaded for engaging the clutch teeth on the function shaft driven gear. The flexible coupling disk absorbs the shocks of clutching and unclutching. The ball bearing on the function clutch latch acting against one of the stop arms on the function shaft sliding clutch drum holds it in the disengaged position. The function shaft sliding clutch drum is unlatched (for engagement) when the function clutch latch is turned downward.

b. The function clutch latch and transfer lever are fastened to the transfer lever shaft so that the two move simultaneously. At the time the transfer operation occurs, the function shaft sliding clutch drum becomes engaged and causes the function shaft to revolve. After the function shaft has turned a few degrees, the transfer lever restoring cam lifts the transfer lever which becomes relatched by the transfer lever latch. This action also raises the function clutch latch. When the function shaft makes about one-half revolution the other stop arm on the function shaft sliding clutch drum also makes one-half revolution. The arm strikes the ball bearing on the function clutch latch and pulls the function shaft sliding clutch drum out of engagement. The function clutch latch holds the stop arm on the function shaft sliding clutch drum from further rotation. (In this disengaging operation, the ball bearing on the function clutch latch acts as a cam surface.) The function shaft turns only one-half revolution at a time and does so each time the transfer operation takes place.

59. Printing

a. The 26 type bars that do the actual printing are arranged about an arc on the carriage. Each can pivot to strike the platen and is geared to a mating connecting bar. Tapping a type selecting arm against the connecting bar causes the type bar to strike against the platen (fig. 49). The connecting bar is geared to the particular type bar

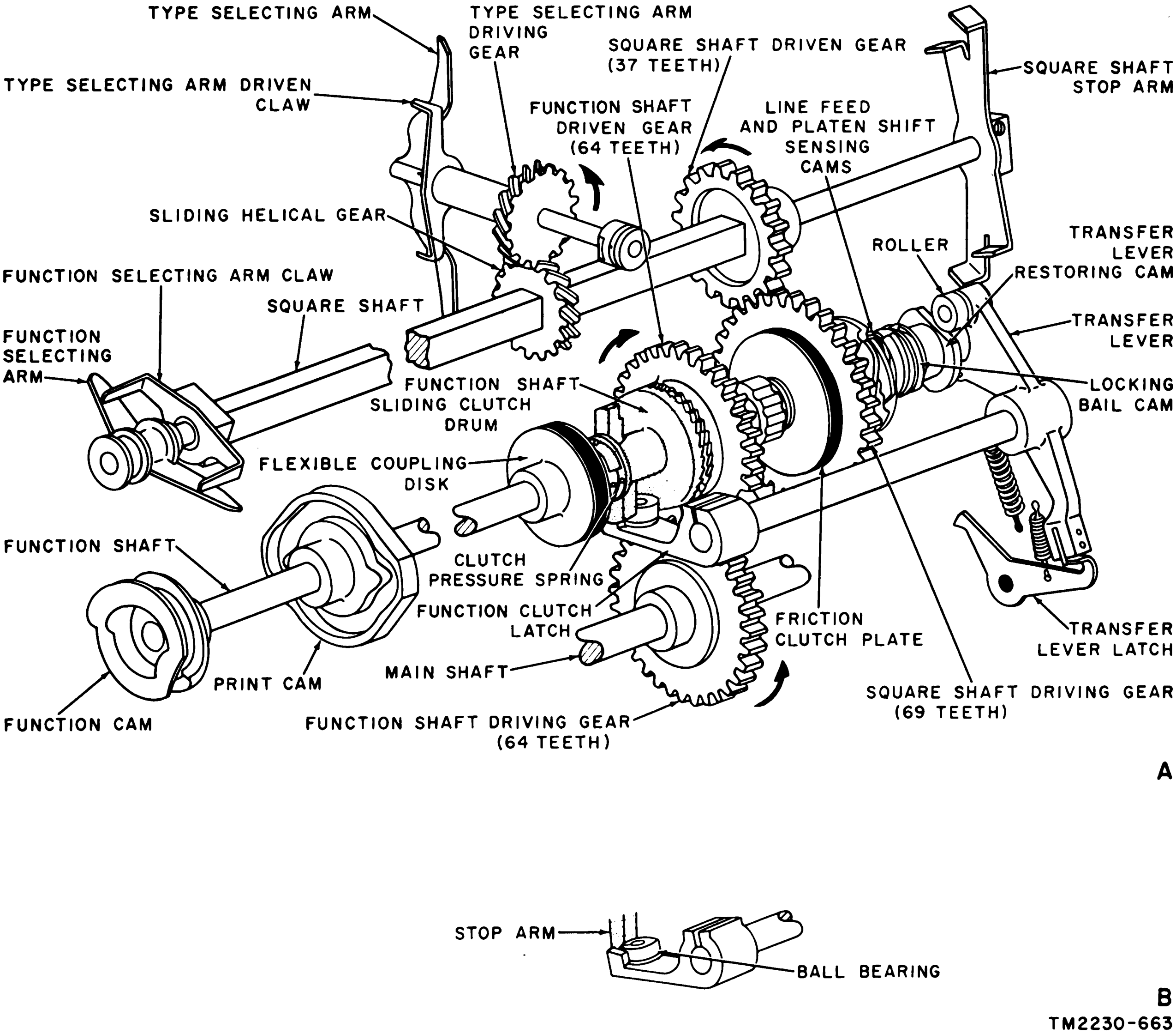


Figure 48. Function shaft operation.

desired. Choosing the desired type bar is a matter of rotating the type selecting arm to the position behind the desired connecting bar. Each of 26 positions corresponds to a different character. The type selecting arm is rotated by the type selecting arm driving gear which is rotated by the sliding helical gear. The selecting arm is stopped at the desired position by the square shaft stop arm. The stop arm is stopped by the selector mechanism, which uses code rings set up by the incoming code impulses.

b. The revolving square shaft stop arm is arrested at the desired position by striking against a stop bar which has been moved into its path. There are 32 such stop bars arranged in a semicircle about the axis of the square shaft stop arm. The positions of 26 of these correspond to the 26 type bar positions. (The other six are functions covered in later paragraphs of this section.) Each stop bar is located in the proper position for a corresponding type bar. The particular stop bar corresponding to the letter to be printed is selected by positioning the code rings according to the code for that letter. This positioning is done by the selector magnet armature in accordance with the incoming code impulses, which operate in conjunction with a series of levers and cams.

c. The square shaft is driven by the function shaft. As the function shaft makes a one-half revolution, the square shaft could make almost a complete turn. However, as it is never neces-

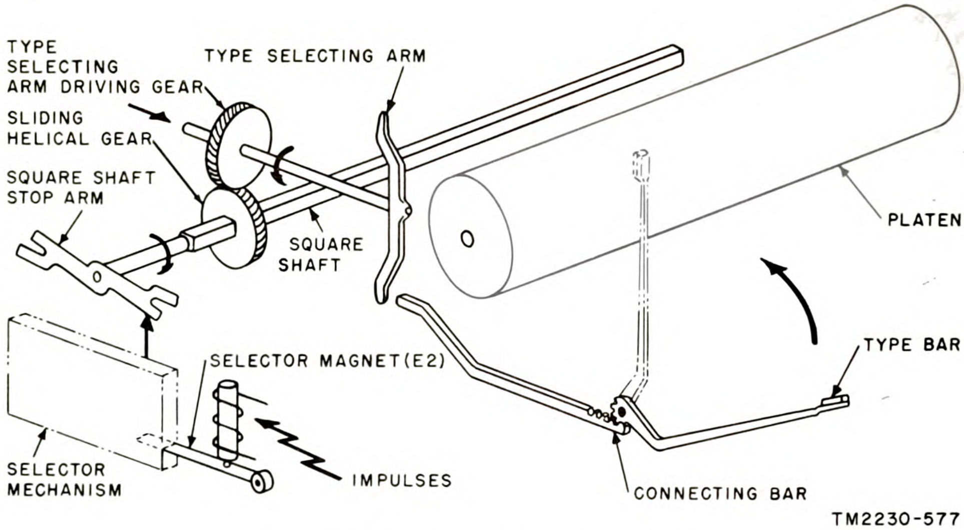


Figure 49. Typing unit basic components.

sary for the square shaft stop arm to turn more than a one-half revolution before striking a stop bar, the drive must be able to slip before the function shaft completes its one-half turn. The square shaft driving gear (fig. 48) is not keyed to the function shaft but is driven through a spring-loaded friction clutch. The clutch permits the square shaft driving gear to slip on the function shaft when the square shaft stop arm is arrested. Another reason for using a friction drive with the square shaft driving gear is the fact that after the square shaft stop arm is arrested, the function shaft must continue to turn to actuate the printing or other functioning mechanism.

d. The mechanism that prints a character (fig. 50) operates after the type selecting arm has been positioned. The arm is positioned behind the proper connecting bar before the function shaft completes one-half revolution. The type selecting arm is turned by the square shaft through the sliding helical gear, type selecting arm driving gear, and the type selecting arm driven claw. The type selecting arm can be moved axially in and out. The print cam is fixed to the function shaft and lifts the print cam follower each time the function shaft makes a one-half turn.

e. The print bail blade engages with the groove of the round nut on the shaft of the type selecting arm and is fixed to the print bail blade shaft of the cam follower. It rocks forward and backward as the print cam follower rises and falls. This action causes the type selecting arm to plunge

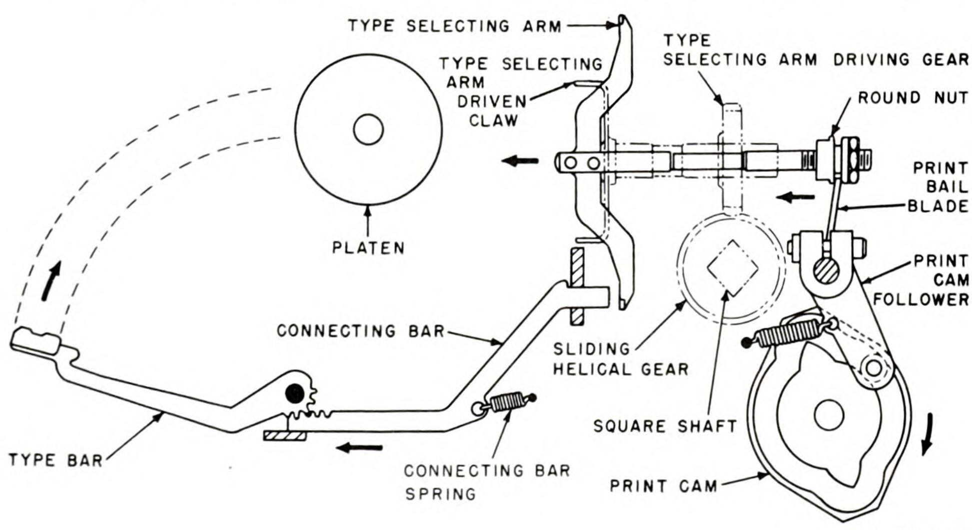


Figure 50. Cross section of teleprinter, showing operation of printing mechanism.

forward to strike the connecting bar and causes the type bar to swing toward the platen. The type selecting arm does not push the connecting bar and type bar all the way to the platen; it merely strikes the connecting bar and gives the type bar enough momentum to carry the movement through. The movement of the print bail blade is such that the type selecting arm is drawn all the way back before the type bar reaches the platen. After the type bar bounces away from the platen, the connecting bar spring pulls the connecting bar and type bar back to their normal positions.

f. The type selecting arm can stop in 32 different positions, but there are only 26 type bars on the carriage. Therefore, there are six positions of the type selecting arm where no connecting bar and type bar will be struck, even though the print cam operates the print bail blade. Five of these six positions are used for performing other necessary operating functions. The sixth is for the blank impulse.

60. Operations of Teleprinter

The teleprinter performs two types of operations. The first operation, the printing of letters and characters is described in paragraph 59. The second type of operation, called functions (pars. 61–70), consists of rotating the platen for line feed, shifting and unshifting the platen, returning the carriage, spacing across the line, stopping the motor, and ringing the signal bell. The letters (unshift), spacing, motor stop, and signal bell are operated by the function cam and function selecting arm (fig. 51). The figures (shift), line feed,

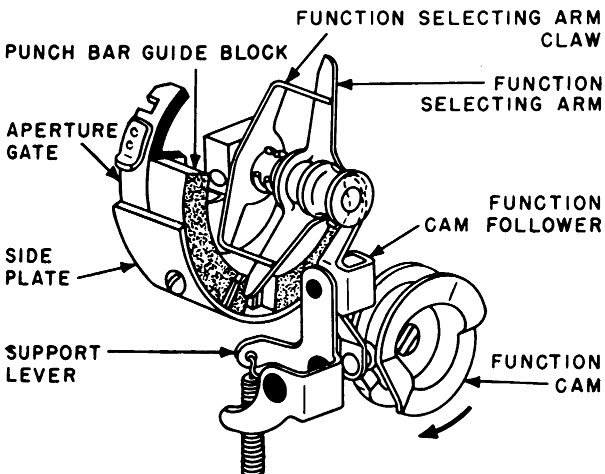


Figure 51. Function selecting arm mechanism.

and carriage return are controlled by the function stop bars in the code ring cage.

61. Function Cam and Function Selecting Arm Controlled Functions

a. The function selecting arm is mounted on the end of the square shaft and rotates with the shaft to 32 positions. It moves axially in and out to operate the function punch bars mounted in the punch bar guide block (fig. 51). However, axial movement does not occur in all 32 positions as with the type selecting arm. The function cam moves the lower end of the function cam follower each time the function shaft makes one-half revolution. If the function selecting arm is not blocked against axial movement, the function cam follower pivots about its midpoint so that its upper end pushes the arm inward. However, if the function selecting arm is blocked to prevent axial movement, the function cam follower pivots at its upper end and forces the support lever, by which it is mounted at its midpoint, to move. 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 moves.

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. The forward surface of the guide block is cut away in three areas (fig. 52). When the function selecting arm is turned to a position in front of any of the high portions of the punch bar guide block surface (shown shaded in all views), it cannot be moved axially. It can be moved axially only when it is turned to a position in front of one of the cutaway areas. All the function punch bars are mounted in grooves located in the cutaway areas where axial movement for operating them is possible. With three exceptions (the letters H, and S, and spacing), the areas which are not cut away correspond to the position to which the function selecting arm is turned when printed characters are selected.

c. The letters H and S print only in the letters position of the platen. In the figures position of the platen, they do not print and their position under the function selecting arm is used for operating the punch bars for the motor stop and signal bell functions. These two punch bars must, there-

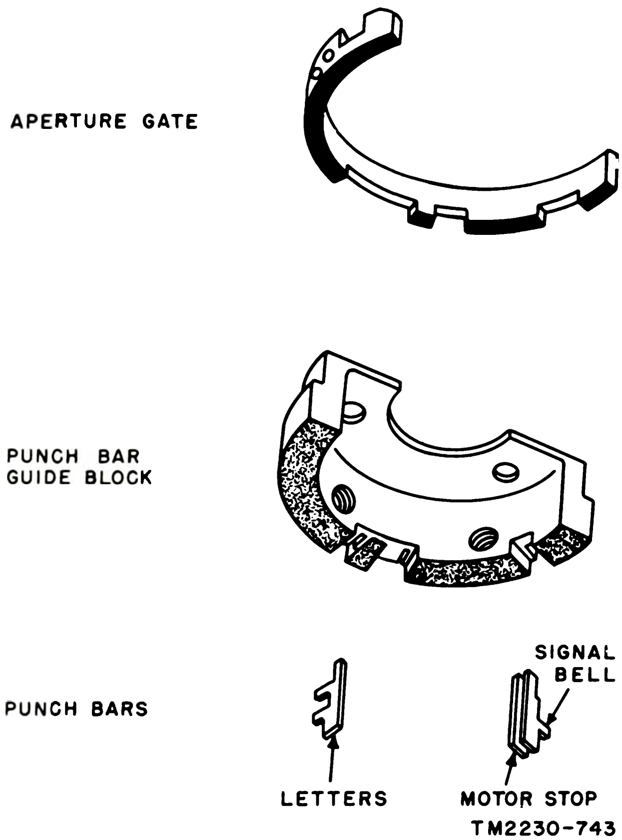


Figure 52. Punch bar guide block, aperture gate, and function punch bars.

fore, be operable in the figures position of the platen and must be inoperable in the letters position to block the function selecting arm. This operation is accomplished by the aperture gate which slides in a groove formed by the punch bar guide block and the side plate. The position of the aperture gate is controlled by the position of the platen. The aperture gate has cutaway portions. In the letters shift, position, the cutaway portions are located so that the motor stop and signal bell punch bars are blocked. In the figures shift position the punch bars are free to move (fig. 53).

d. Figure 54 shows the 32 positions to which the function selecting arm is rotated over the punch bar guide block. It also shows how the cutaway portions of the aperture gate combine with the cutaway portion of the guide block to allow the function selecting arm to move axially, or to be

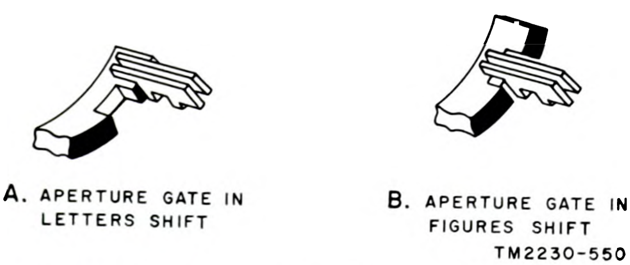


Figure 53. Motor stop and signal bell punch bars in blocked and unblocked positions.

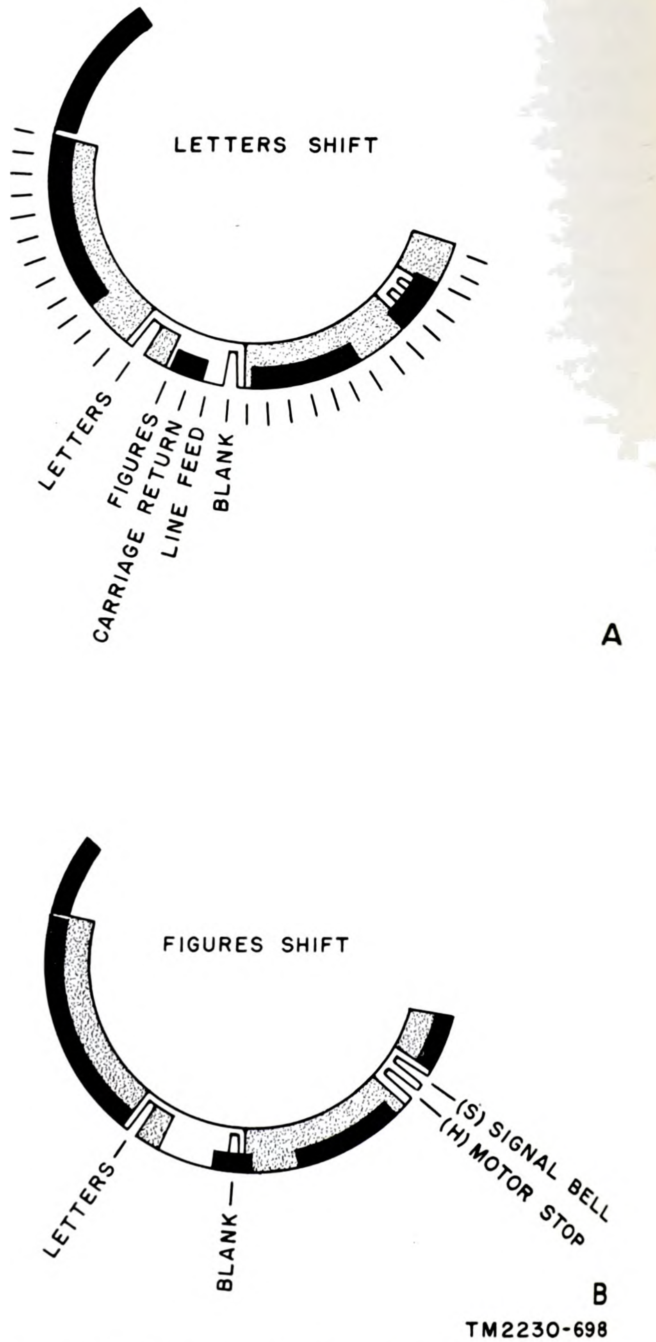


Figure 54. Location of function selecting arm positions, showing aperture gate in blocked and unblocked positions.

blocked 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.

62. Carriage Feed Operation

a. To prevent characters from being printed one on top of another (strikeovers), the carriage is moved automatically one letter space to the right each time a character is printed or the space bar is depressed. The carriage (fig. 55) rolls along the guide rail and slides on the square shaft. It is driven by the carriage rack driving gear when the carriage feed pawl is disengaged from the ratchet wheel. The carriage feed driving gear is driven by the main shaft through a friction clutch. The ratchet wheel is released when the carriage feed link, attached to the ratchet feed pawl, is pulled. The friction clutch then takes hold, the gears turn, and the carriage feed and return driving rack and the carriage are moved to the right. The carriage feed link pivots the carriage feed pawl and is operated by the function cam (fig. 51) through the support lever which operates the carriage feed lever. The support lever is turned by lifting the function cam follower whenever the function selecting arm is blocked (as it is for all printed character positions and the space position). The carriage can move only one space each time the feed mechanism is operated. The carriage feed mechanism is operated when the carriage feed pawl is repositioned immediately after one tooth of the ratchet wheel is spaced.

b. A manual carriage feed mechanism (fig. 56) is provided to allow the carriage to move to the right without receiving the space impulse. It consists of a vertical link which connects the manual space push button to a manual space bell crank. When the push button is depressed, the bell crank is rotated against the loop in the carriage feed link, which pulls the carriage feed pawl out of engagement with the ratchet wheel on the carriage feed shaft. The main shaft now drives the carriage feed driving gear and carriage rack

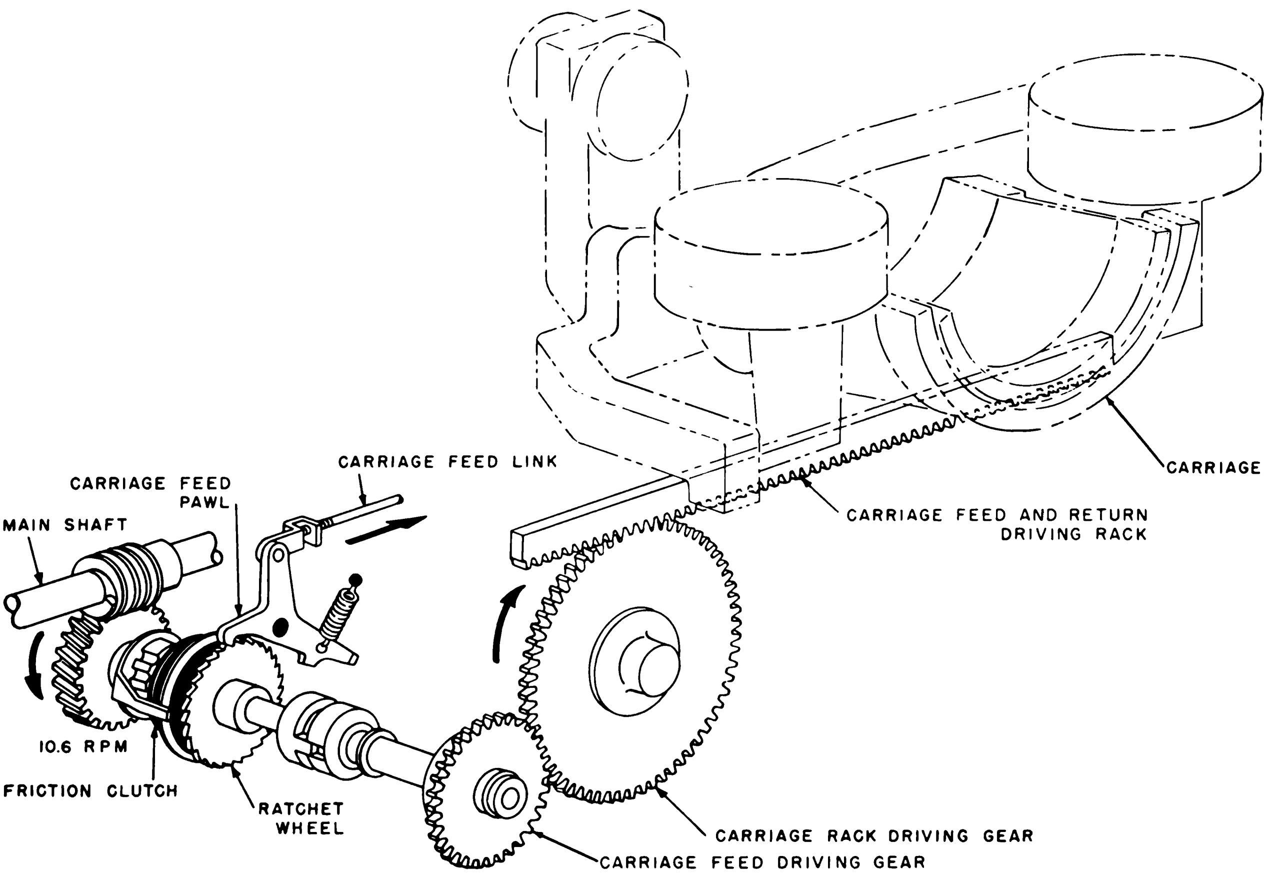


Figure 55. Carriage feed mechanism.

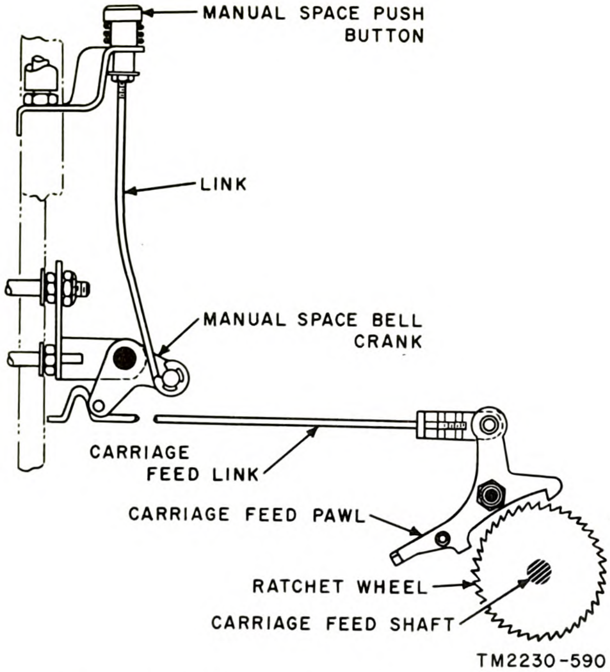


Figure 56. Manual carriage feed mechanism.

driving gear which moves the carriage to the right until the manual space push button is released.

63. Carriage Return Operation

a. The carriage is moved to the left by reversing the direction of rotation of the carriage rack driving gear (A, fig. 57). This movement is accomplished by uncoupling the carriage feed clutch drum from the carriage feed driving gear and engaging the carriage return clutch drum. Both clutches are operated simultaneously, one disengaged, the other engaged. The carriage return clutch lever, which moves with the double blocking lever, engages the carriage return sliding clutch drum. At the same time, it turns the carriage feed clutch lever to disengage the carriage feed clutch drum.

b. The sequence of operation of the carriage return mechanism is described in the following chart and is shown in figures 57 and 58.

Sequence	*Carriage return operations*		
1	Carriage return signal received.		
2	Transfer lever released.		
3	Code rings aligned for carriage return stop bar		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 bell crank turned.		
8	Horizontal carriage return link pulled.		
9	Carriage return clutch actuating lever turned and 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 bell crank and horizontal carriage return link moved back.
12	Carriage return driving gear turns carriage return driven gear and carriage rack driving gear to move carriage to left.	Carriage feed driving gear idles	Function shaft stops (after completing ½ turn).
13	Carriage nears left end of travel		Carriage return stop bar latches carriage return sensing lever on next signal.
14	Decelerating arm engages decelerating cam.		
15	Carriage return driven gear teeth clear carriage return drive 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 reengaged.
21	Carriage stopped at left margin.		

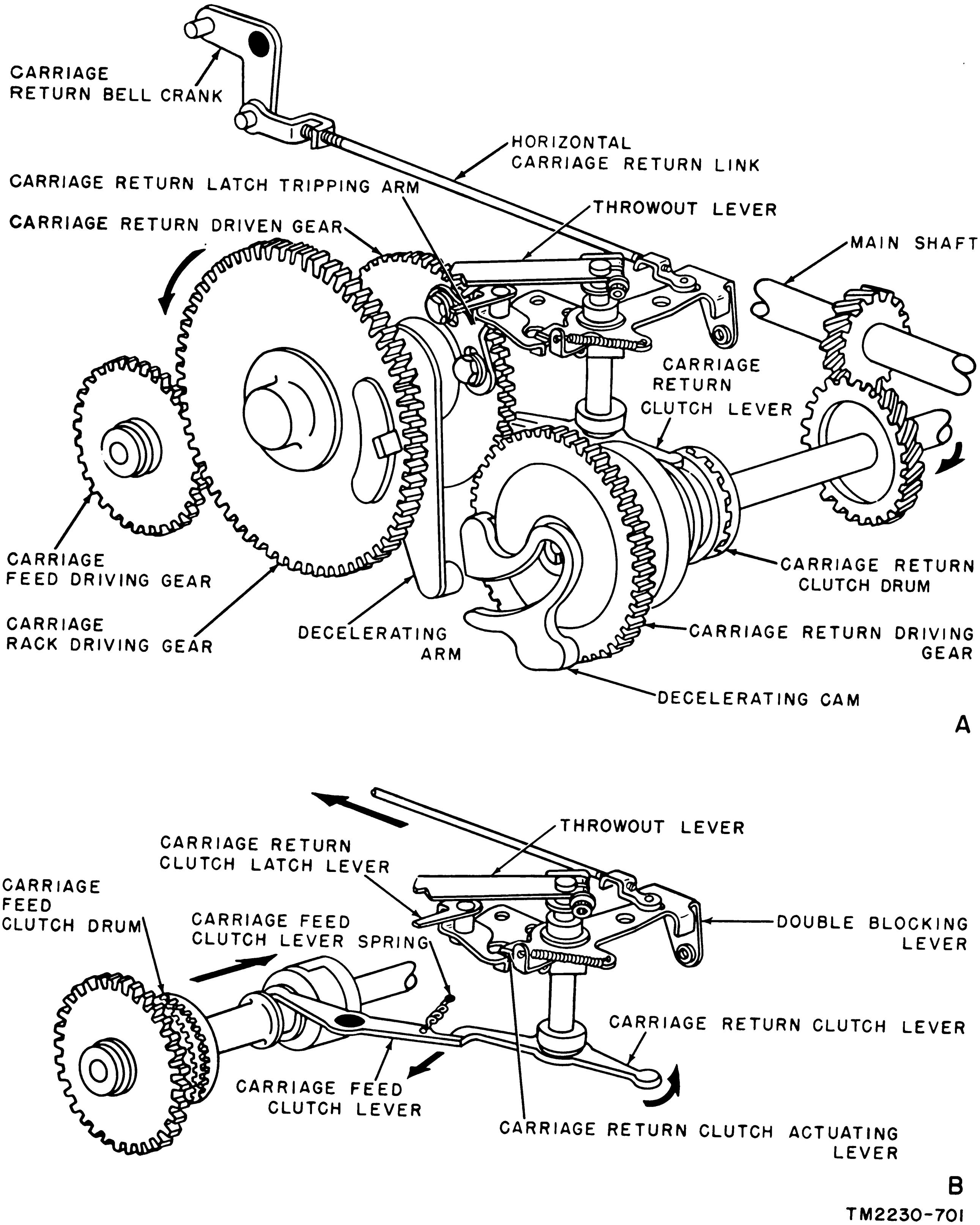


Figure 57. Carriage return driving mechanism.

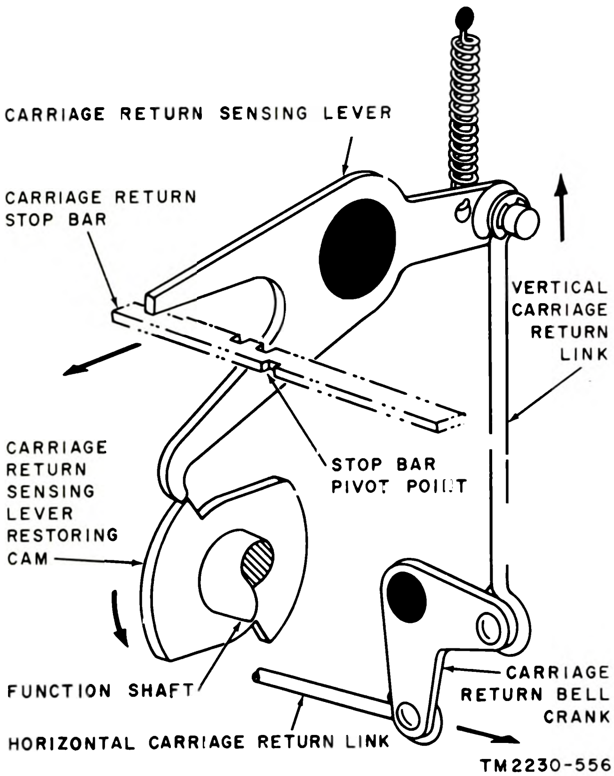


Figure 58. Carriage return operating mechanism as seen from the rear of the teleprinter.

c. A manual carriage return mechanism (fig. 59) allows the operator to return the carriage to the left-hand margin without receiving a carriage return signal. Pushing the manual CAR RET push button on the right front of the dust cover causes the push button lever to pivot. The manual carriage return lever trip pawl moves the double blocking lever counterclockwise and the carriage return mechanism operates. To prevent damage to the operating 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 push button is released, the manual carriage return mechanism is pulled back by the trip pawl spring to its unoperated position against the stop pin.

64. 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 a sudden stop of the carriage, the carriage return driving gear is powered by a friction clutch. This friction clutch allows the carriage return driving gear to slip when the travel is blocked. The carriage return driving gear itself

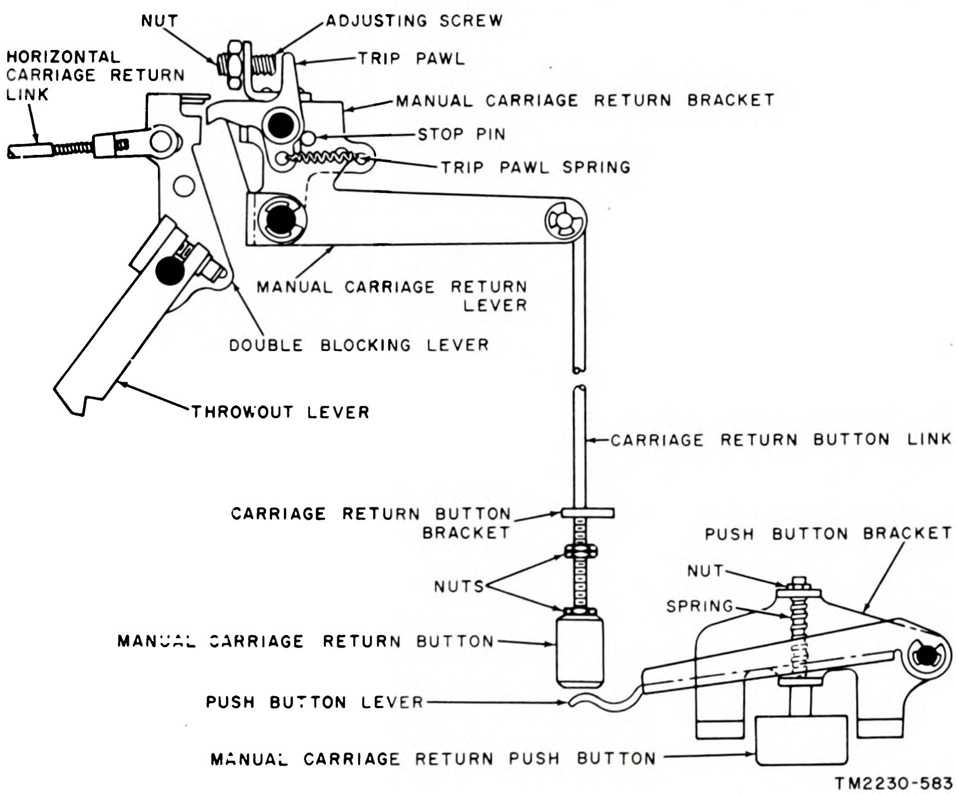


Figure 59. Manual carriage return mechanism.

is free to turn, but it is coupled to the carriage return sliding clutch drum (fig. 60) through friction plates on both sides. By means of an adjusting collar, which compresses the spring, pressure for creating the necessary friction is obtained.

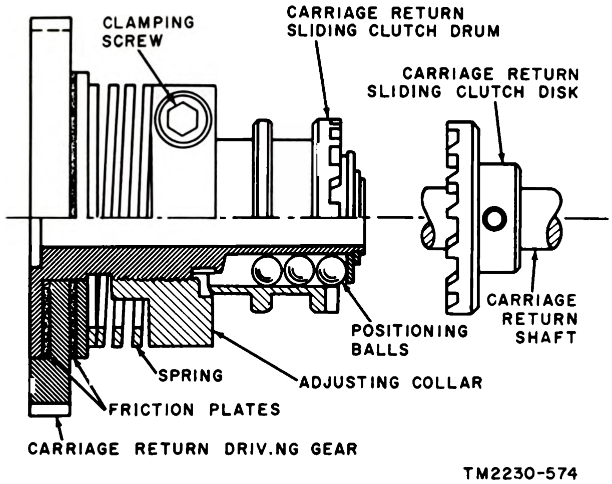


Figure 60. Carriage return safety clutch.

65. Line Feed Operation

a. The platen is turned to feed the paper by the operation of the line feed mechanism. The amount of spaces (one or two) depends on the position of the single-double line feed lever.

b. The platen either can be held in a given position or be turned one or two line spaces at a time by the detent wheel attached to it (fig. 61). To keep the platen from turning while printing, the detent wheel is held by the line spacing detent (fig. 62). When line feeding, the detent wheel is turned one space or two spaces by the line feed pawl (fig. 61). The line feed lever (fig. 62) on which the line feed pawl is mounted pivots about the platen shaft. Moving the upper end of the line feed lever toward the rear of the machine causes the line feed pawl to engage and turn the detent wheel with sufficient force to overcome the grip of the line spacing detent. After the platen has been turned, the line spacing detent engages the next tooth or the second tooth of the detent wheel. This action holds the platen in the advanced position. The line feed lever is actuated by turning the adjustable bell crank which pulls the connecting link. Whenever the line feed stop bar is operated, the adjustable bell crank is operated by the parts shown on the lower left-hand side of figure 93.

c. The operations of the line feed mechanism are described in the following chart:

Sequence	*Line feed operation*	
1	Line feed code group received	
2	Transfer lever released	
3	Code rings aligned to accept the line feed stop bar.	Function shaft starts to turn.
4	Line feed stop bars operate	
5	Line feed sensing lever released by function stop bar.	
6	Line feed sensing lever drops to low point of line feed sensing lever restoring cam.	
7	Line feed sensing lever thrusts line feed cam follower laterally.	
8	Line feed cam follower roller engages (turning) line feed operating cam.	
9	Line feed cam follower pulled down by line feed operating cam lobe.	
10	Adjustable bell crank turns	

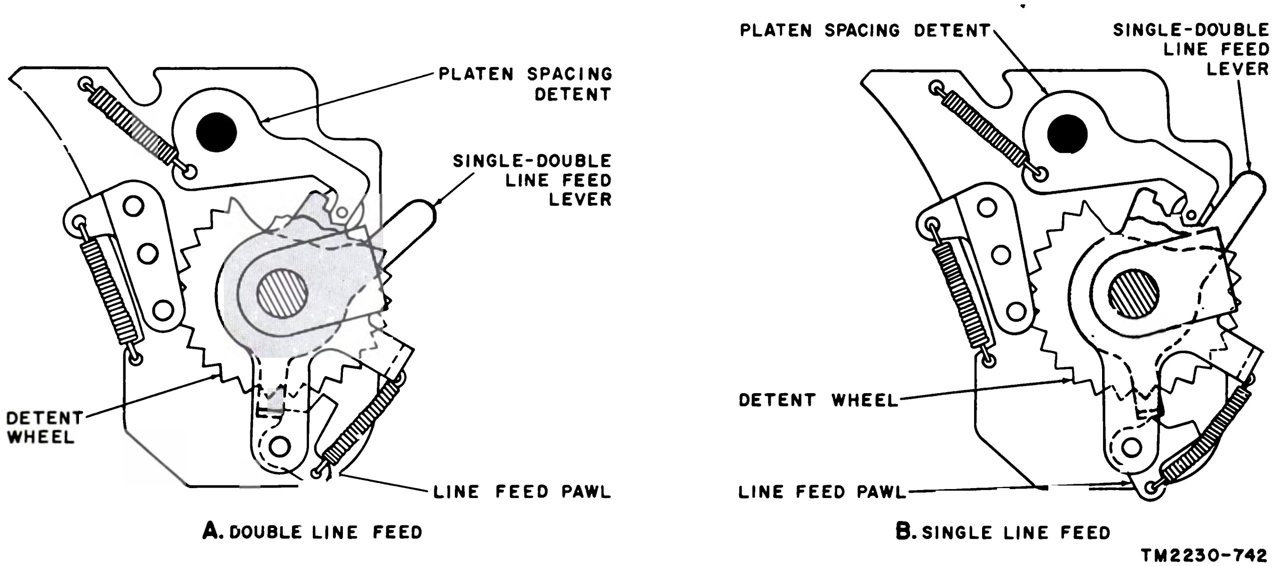


Figure 61. Single-double line feed mechanism.

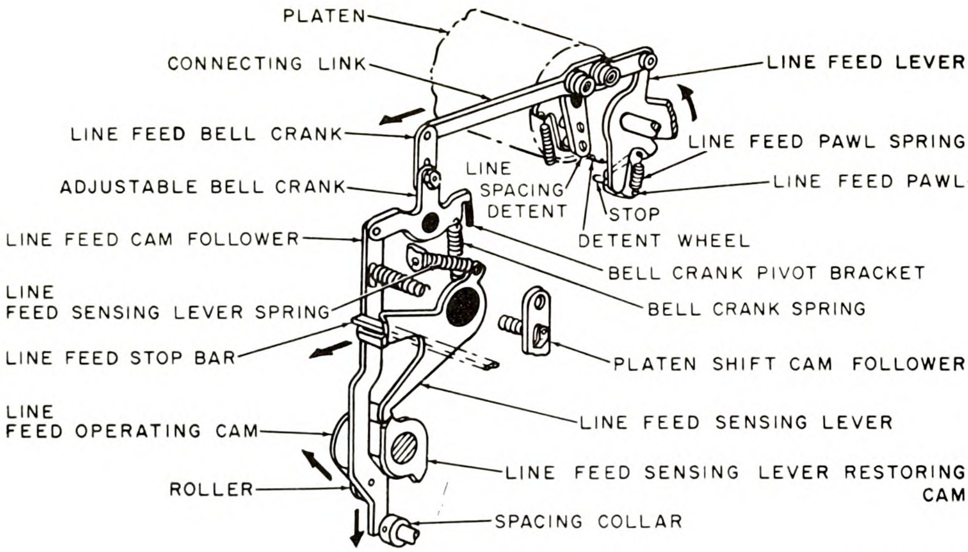


Figure 62. Line feed operating mechanism.

Sequence	*Line feed operation*
11	Connecting link pulled
12	Connecting lever turns
13	Line feed pawl engages detent wheel
14	Detent wheel platen and turn one or two line spaces
15	Line feed sensing lever restoring cam raises line feed sensing lever.
16	Line feed cam follower rolls off line feed operating cam lobe.
17	Adjustable bell crank and connecting line return to original position (spring return).
18	Line feed lever turned back
19	Line feed pawl disengages detent wheel
20	Line feed operating cam releases line feed cam follower.
21	Line feed cam follower shifts laterally to original position (spring action). Function shaft stops turning.
22	Line feed sensing lever blocked by line feed stop bar on next signal (unless line feed group is repeated).

66. Figures Shift Mechanism

a. The platen is shifted or raised in position to print figures and other upper-case characters by the operation of the figures shift mechanism.

b. The operations of the figures shift mechanism (figs. 63 and 64) are described in the following chart:

Sequence	*Figures shift operation*	
1	Figures code group received	
2	Transfer lever released	
3	Code rings aligned for figures stop bar.	Function shaft starts turning.
4	Figures stop bar operates	
5	Figure shift sensing lever drops to low part of figures sensing lever restoring cam.	
6	Figure shift sensing lever moves platen shift cam follower laterally.	
7	Platen shift cam follower roller engages (turning) platen shift operating cam.	
8	Platen shift cam follower pulled down by platen shift operating cam.	
9	Platen shift bell crank turns	
10	Platen shift link pulled	
11	Platen support frame tilts upward	
12	Platen latching arm and aperture gate move down and latch.	
13	Figures sensing lever restoring cam raises figure shift sensing lever.	
14	Platen shift cam follower disengages from platen shift operating cam.	
15	Platen shift operating cam releases platen shift cam follower.	
16	Platen shift cam follower moves laterally to original position by spring tension.	
17	Function shaft stops turning	
18	Platen remains latched in figures position until letters code group is received.	

67. Letters Mechanism

a. The platen is returned to the letters position from the figures position by the operation of the letters mechanism (fig. 65). The sequence of operations of the letters mechanism is described in the following chart:

Sequence	*Letter mechanism operation*
1	Platen is in figures position
2	Letters code group received
3	Function selection arm positioned over letters punch bar.
4	Function cam pivots function cam follower about support lever.

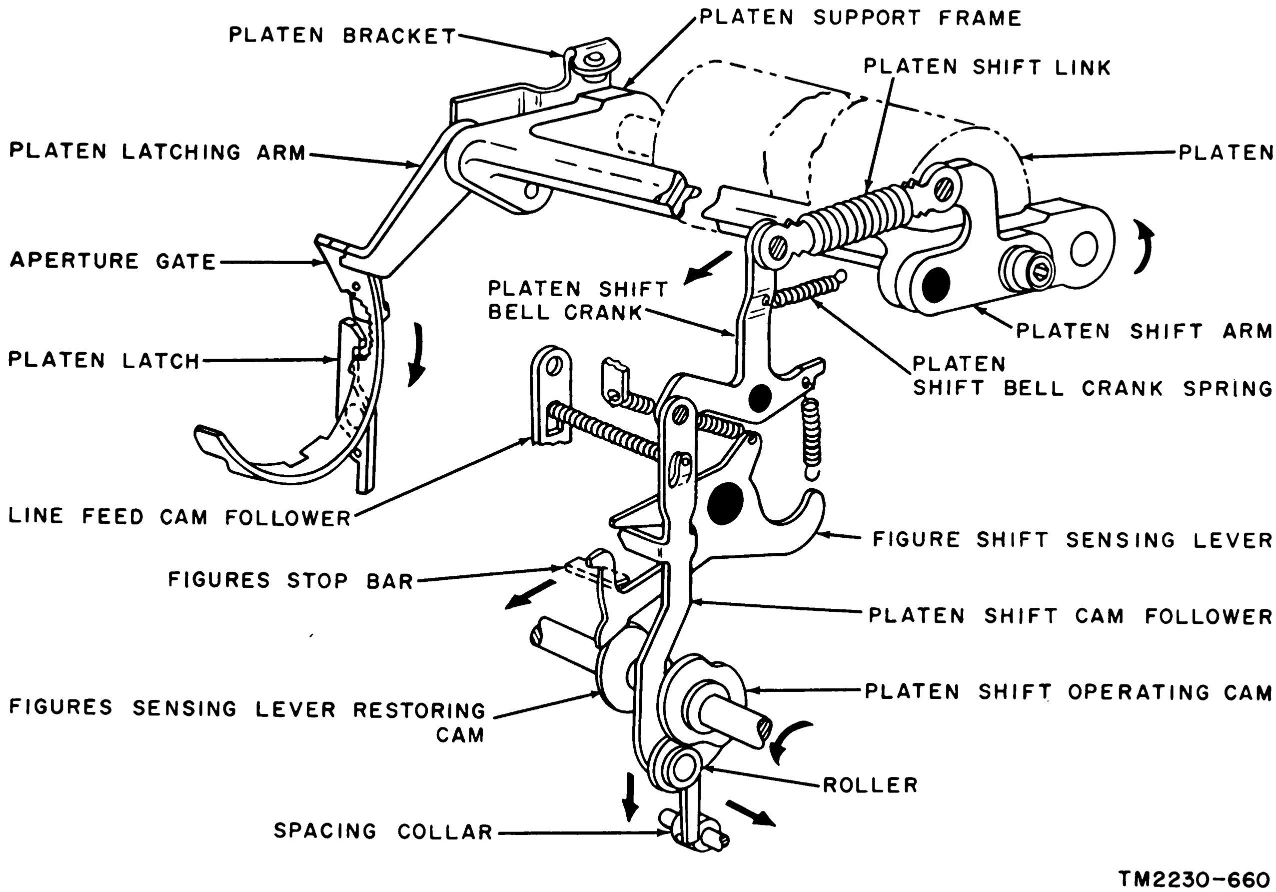


Figure 63. Figures shift mechanism.

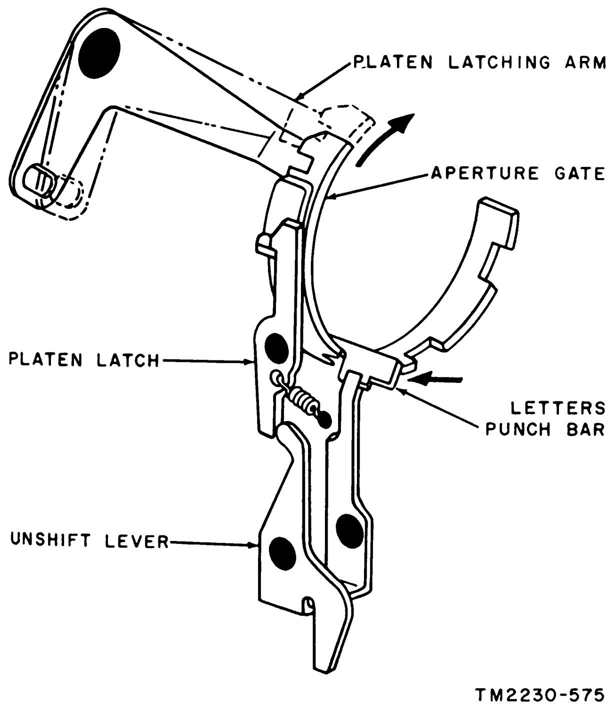
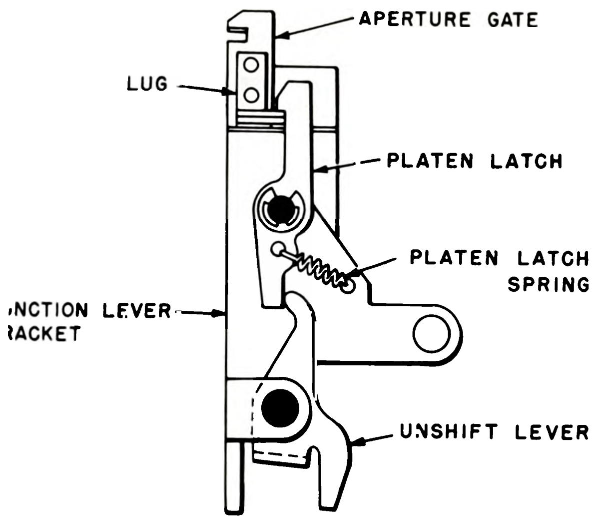


Figure 64. Aperture gate latched.

Sequence	*Letter mechanism operation*
5	Function selecting arm plunges axially
6	Letters punch bar pushed in
7	Unshift lever turns
8	Platen latch turns
9	Aperture gate releases
10	Platen drops
11	Platen blocking arm latched by platen lower case latch.
12	Function cam pivots function cam follower about support lever.
13	Function selecting arm pulled back
14	Letters punch bar, unshift lever, and platen latch return to original position (spring return).

b. The letters platen blocking mechanism (fig. 66) is operated by the movement of the platen. When the platen moves into the letters position, the platen blocking arm bracket moves the platen blocking arm, and causes it to become latched by the platen lower-case latch. With the platen blocking arm latched, the platen cannot move from the letters position until a figures code group is received. When the figures code group is received, the figure shift sensing lever moves the



ɩgure 65. Platen latching mechanism (letters position).

aten lower-case latch away from the platen ocking arm. The platen now is free to move ı the figures position.

c. The manual letters mechanism (fig. 67) is ıpplied to allow the operator to unshift the platen om the figures position without receiving the tters signal code group. When the manual tters push button (A, fig. 67), on the left front f the dust cover, is pressed, it causes the manual nshift bell crank to rotate. The manual unıift lever link moves to the right (when viewed om front). The manual unshift lever link rikes the unshift lever extension (B, fig. 67), and ıuses it to rotate. The platen latch moves out f engagement with the lug on the aperture gate; ıe platen then drops into letters position by its wn weight. When the manual letters push button is released, the entire mechanism is returned to its original position through the action of the platen latch spring and manual unshift bell crank spring.

68. Signal Bell Operation

The signal bell sounds to alert the operator when the code group for the signal bell is received while the platen is in the figures position (figs. 51 and 68). The sequence of operation of the signal bell is shown in the following chart:

Sequence	*Signal bell operation*
1	Signal bell code group received with platen in figures position.
2	Function selecting arm positioned over signal bell punch bar.
3	Function cam pivots function cam follower about support lever.
4	Function selecting arm plunged axially
5	Signal bell punch bar moved in
6	Signal bell clapper moves
7	Signal bell clapper hits clapper stop post
8	Signal bell clapper momentum carries it farther to strike signal bell.
9	Function cam pivots function cam follower about support lever.
10	Function selecting arm pulled back
11	Signal bell punch bar and signal bell clapper return to original position against clapper stop (spring return).

69. Motor Stop Operation

a. The type of motor stop mechanism in Teletypewriters TT–98/FG and TT–100/FG (standard communication symbols) differs from the motor stop mechanism provided in Teletypewriter TT–99/FG (weather symbols). The motor stop relay circuits for both types are illustrated and explained in paragraphs 75 through 79.

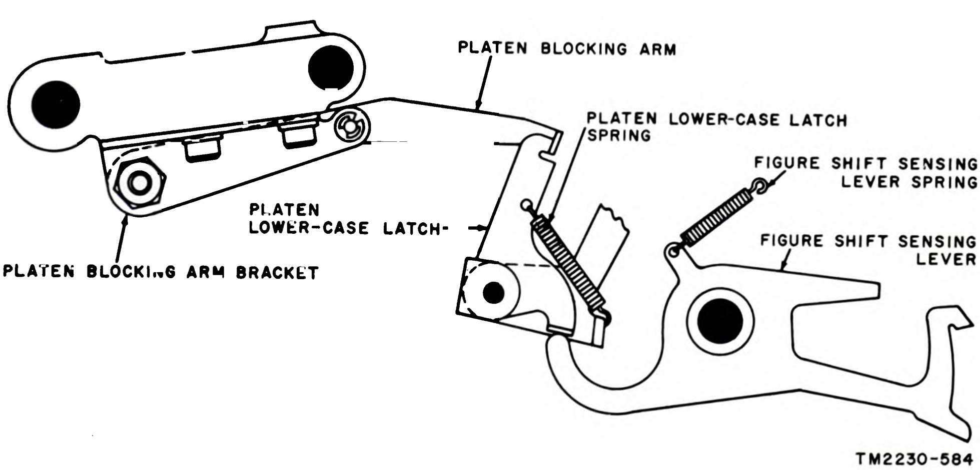


Figure 66. Platen blocking mechanism (letters position).

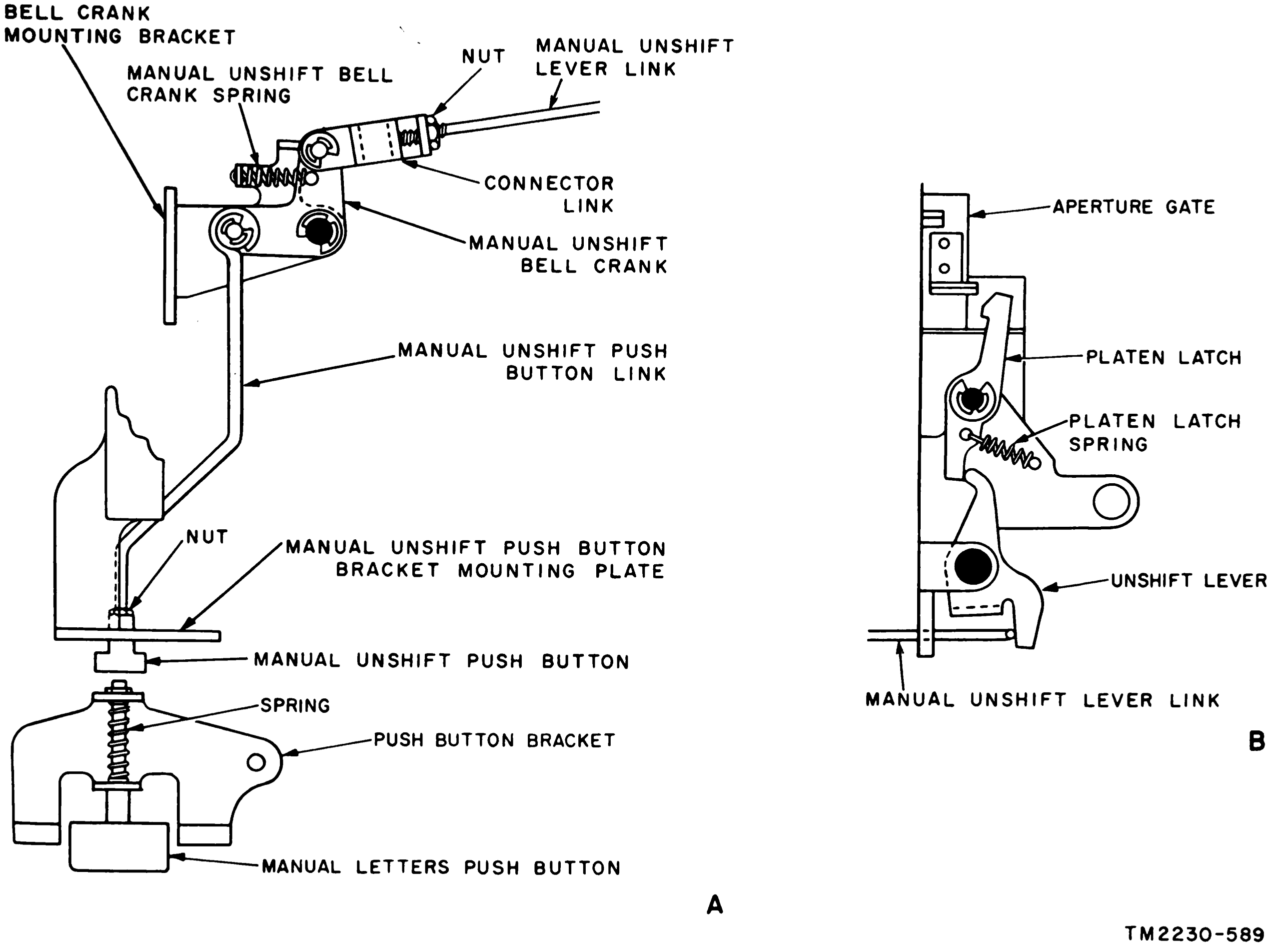


Figure 67. Manual letters mechanism.

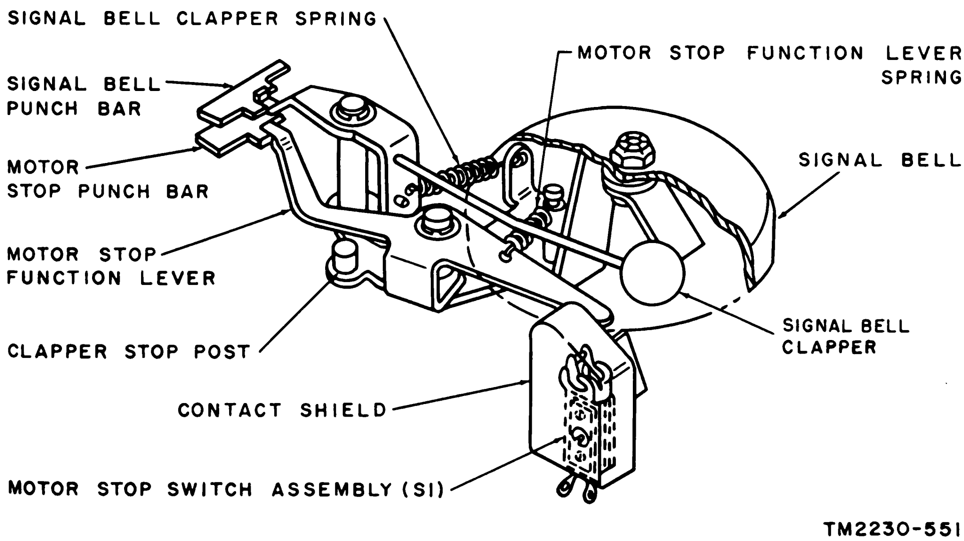


Figure 68. Signal bell and motor stop actuating mechanisms.

b. The motor stop mechanisms in both types of machines use hermetically sealed relay units. The mechanism in the standard communications machines contains two relays: A and B. The mechanism in the weather symbol machines contains three relays: A, B, and C. Relays A and B in each of the mechanisms perform the same function; in the weather symbol machines, the third relay is necessary because the blank key prints a symbol when the platen is in the figures position.

(1) The following is the *motor stop sequence chart* for the TT–98/FG and TT–100/FG (figs. 52 and 68):

Sequence	*Motor stop operation, standard communication symbol machines*
1	Press the FIGS key
2	Press the H key
3	Function selecting arm positioned over motor stop punch bar.
4	Function cam lifts follower. (Follower pivots about supporting lever.)
5	Function selecting arm plunged axially
6	Motor stop punch pushed in
7	Motor stop actuating lever pivots
8	Motor stop contacts close momentarily, energizing relays A and B.
9	Motor circuit opened; motor stops; keyboard circuit locked out.
10	Relays A and B energized as long as line current is maintained.
11	When next break in line current occurs, relay B releases; relay A remains energized.
12	On next closing of line current, relay A releases
13	Motor stop relay contacts close; and keyboard circuit is restored.
14	Motor starts

(2) The following is the *motor stop sequence chart* for the TT–99/FG.

Sequence	*Motor stop operation weather symbol machines*
1	Press the FIGS key
2	Press the blank key and relay C is energized
3	Press the H key. Relays A and B energized through contacts of relay C.

Note.—Relay C is deenergized if any character or function other than H is operated following pressing of blank key.

4	Refer to the sequence chart ((1) above), steps 3 through 14.

70. Automatic Carriage Return and Line Feed Operation

Automatic carriage return and line feed is initiated when the carriage reaches the right-hand margin. At the 73d character of standard communication machines or 76th character in weather machines, the right-hand margin trip plate rotates the stop bar shift lever (fig. 69). This rotation causes the stop bar shift link, stop bar shift blade, and stop bar shift stop to move in a horizontal direction 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 is actuated by the right-hand margin trip plate. The mechanism is held in this operated position by the delaying latch which engages the stop bar shift stop. The carriage return and line feed sensing levers are now free to operate. Both carriage return and line feed take place on the next operation of the function shaft. When the carriage reaches the left-hand margin, the left-

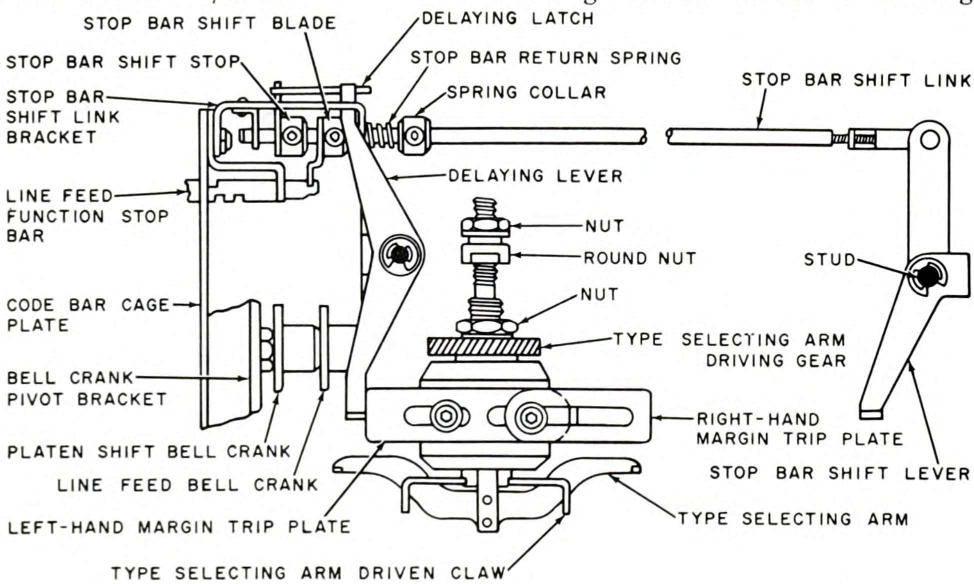


Figure 69. Automatic carriage return and line feed control.

hand margin trip plate rotates the delaying lever. This moves the delaying latch away from the stop bar shift stop. The stop bar return spring then returns the automatic carriage return and line feed mechanism to its normal unoperated position. The function stop bars move back under their associated sensing levers.

71. Inking Ribbon Lifter Operation

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 and lowered to print each character. The ribbon guide (fig. 70) through which the inking ribbon is threaded can slide up and down on its mounting and is lifted when the ribbon vibrator bell crank is turned.

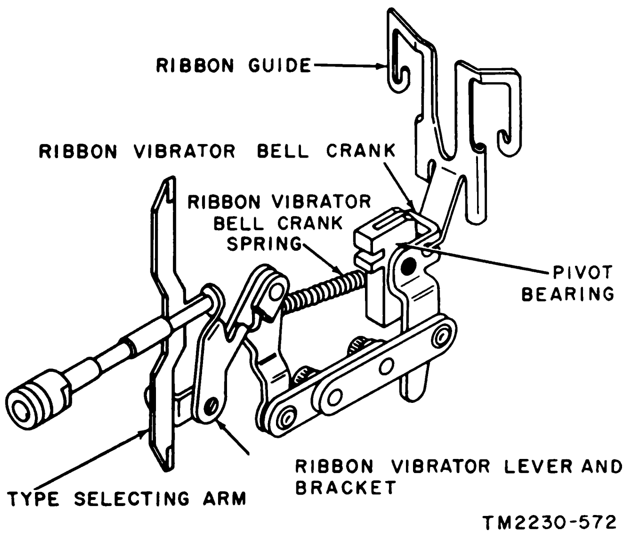


Figure 70. Inking ribbon lifter mechanism.

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

Sequence	*Inking ribbon lifter operation*	
1	Type selecting arm turns to selected position	
2	Type selecting arm plunges 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.	

72. Inking Ribbon Feeding Operation

a. To provide uniformly printed impressions, the inking ribbon is pulled a short distance through the ribbon guide each time a character is printed. The inking ribbon feed mechanism (fig. 71) is mounted on the carriage. Both ribbon spools are mounted on ribbon spool drive shafts.

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

Sequence	*Inking ribbon feed mechanism operation*
1	Carriage fed one space to right (when printing or spacing operation takes place).
2	Helical gear turns bevel gears on one end (depending on direction of ribbon feed) and the 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.

73. Inking Ribbon Reversing Operation

a. After the inking ribbon is wound entirely on one ribbon spool, the direction of inking ribbon feed must be reversed so as to rewind the inking ribbon on the empty ribbon spool. This reversing operation is done automatically by the inking ribbon feed mechanism (fig. 72) when the last turn of inking ribbon is unwound from the paying-out ribbon spool.

b. The chart below lists the inking ribbon reversing operation sequences.

Sequence	*Inking ribbon reversing operation*
1	Starting with left bevel gears meshed and right bevel gears unmeshed, whenever carriage moves to right, left ribbon spool is driven, taking up inking ribbon; right ribbon spool idles, paying out inking ribbon.
2	Eventually, almost entire inking ribbon is unwound from right ribbon spool.
3	Window in 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 ½ 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 ribbon spool now is driven, taking up inking ribbon, and left ribbon spool idles, paying out inking ribbon.

74. 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. When the carriage approaches the end of its travel, the bell is operated by the carriage return latch tripping arm, which

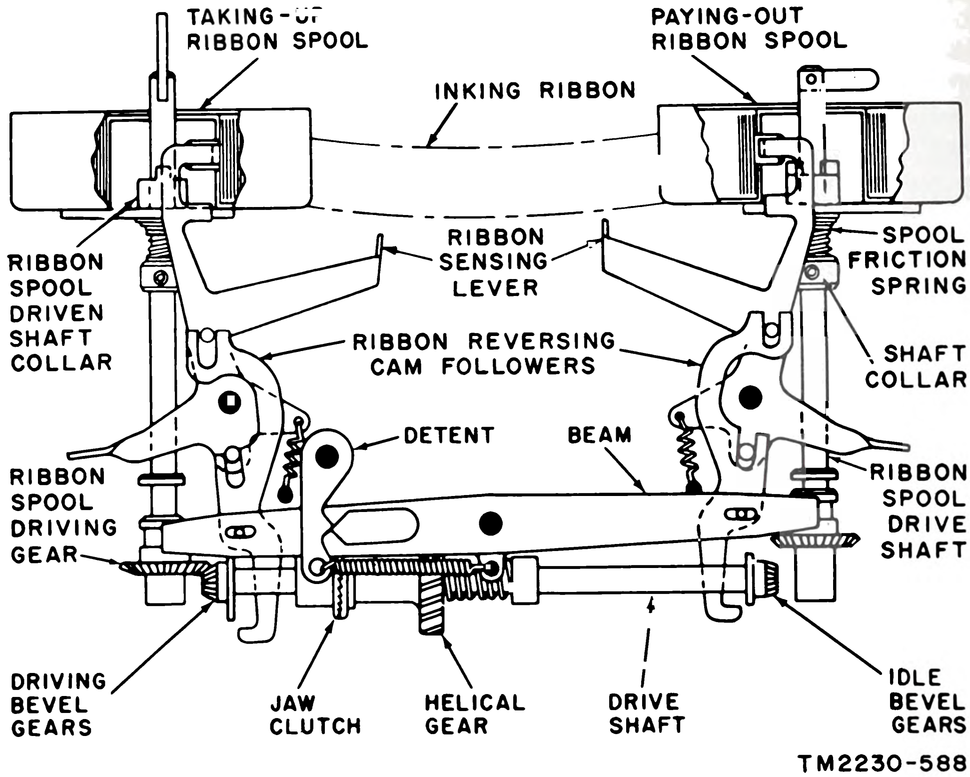


Figure 71. Ribbon feed mechanism.

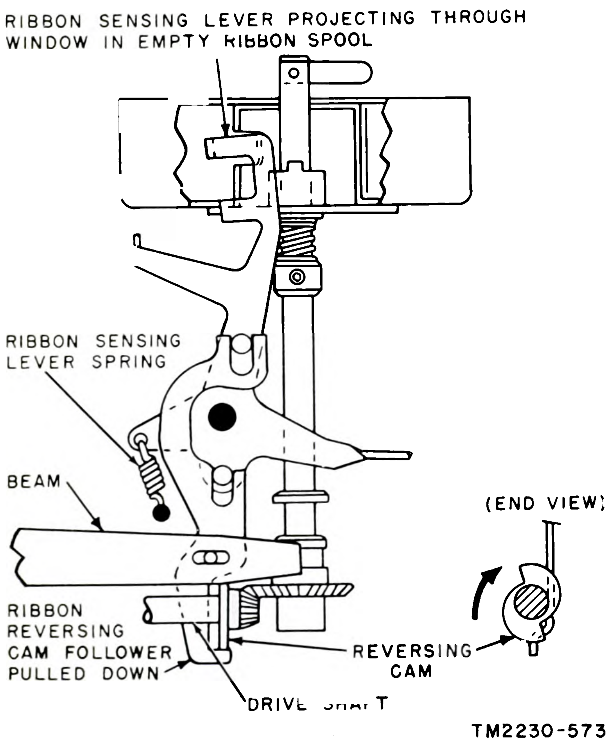


Figure 72. Inking ribbon reversing mechanism.

is attached to the carriage return driven gear (fig. 73).

b. As the carriage return driven gear turns to feed the carriage, the carriage return latch tripping arm lifts the pawl which causes it 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 snaps back. The momentum of the

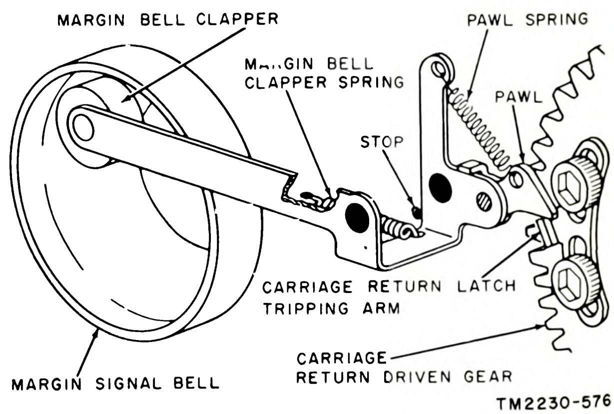


Figure 73. Margin bell.

margin bell clapper carries it past its stop to strike the upper side of the margin signal bell; this rings the bell. The pawl is pivoted and is held to the margin bell clapper by a pawl spring. This action permits the carriage return latch tripping arm to move past the pawl when the carriage return driven gear comes around for carriage return.

Section III. ELECTRICAL CIRCUITS OF TELETYPEWRITER TT–98/FG, TT–99/FG, OR TT–100/FG

75. General

The circuits in the teleprinters are divided into four main groups: power circuits, signal circuits, local dc circuits, and motor circuits. Figures 74 through 86 are schematic diagrams of the teleprinter circuits. Figures 253 through 257 are the wiring diagram and a complete schematic diagram of the teleprinters.

76. Power Circuit

a. Ac Input (fig. 74). The ac input circuit provides power for the motor B1 or B2 and copy lamps I 1 and I 2 and power that is rectified by rectifier CR1 to energize the motor stop relay E1 and selector magnet E2 bias winding circuits. POWER switch S4 controls the power input circuit. The circuit is protected by fuse F1 in the line to rectifier CR1. The circuit begins with the upper pin of plug P1, through the contacts of POWER switch S4, through fuse F1, through shunt contact C of J4A. If Power Supply PP–978/FG is removed, the contacts of J4A close and the circuit is traced to contact B, and from contact B to rectifier CR1. The circuit continues through the rectifier to the contacts of POWER switch S4 and back to the lower pin of plug P1. If Power Supply PP–978/FG is installed, the circuit is traced from contact C of jack J4A and plug P4 through the adjustable tap to the primary winding of transformer T1, out the fixed primary tap to contact B of plug P4 and jack J4A and to rectifier CR1, as above. Contacts C and B o

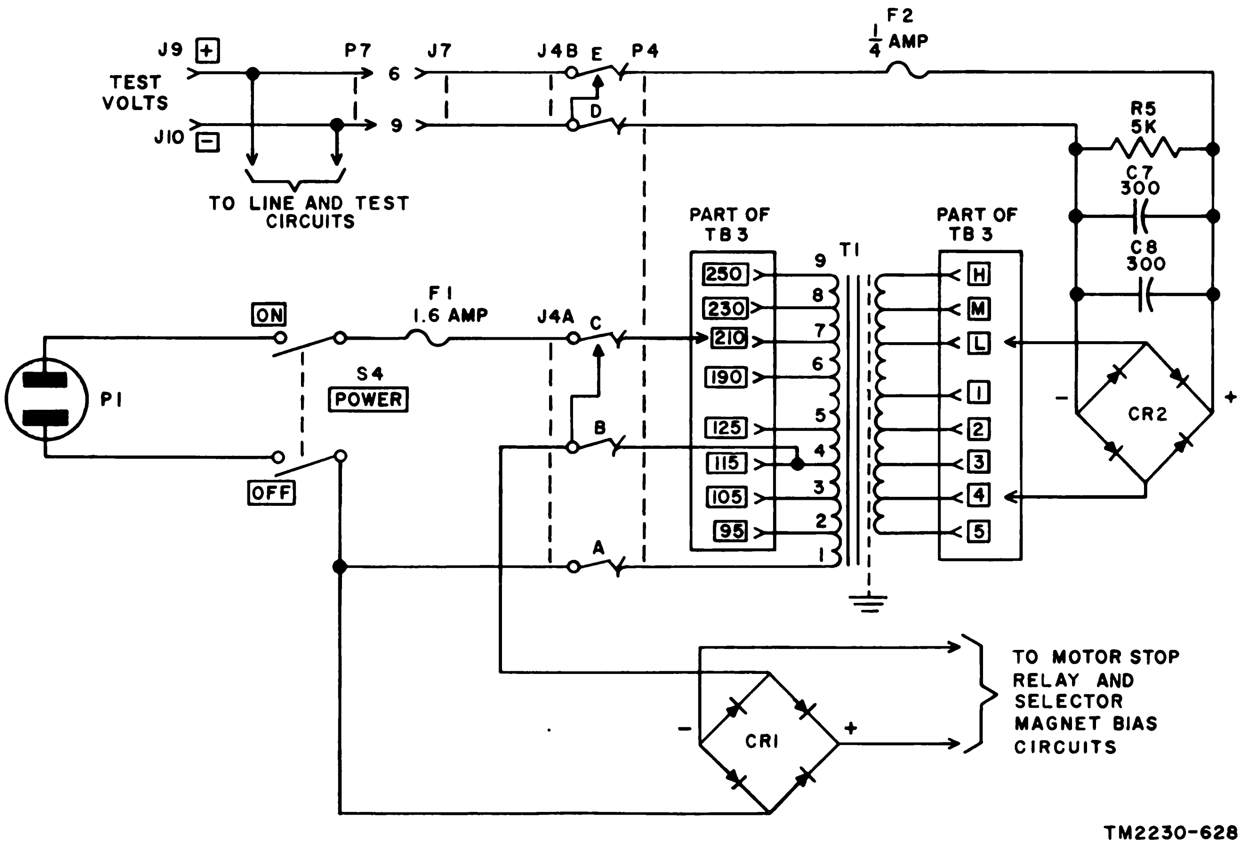


Figure 74. Ac input and power supply circuit, simplified schematic.

jack J4A close the circuit whenever Power Supply PP–978/FG is removed.

b. Power Supply Circuit (fig. 74). The ac from the primary winding of transformer T1 is induced into the secondary winding, and applied to rectifier CR2. Rectifier CR2 supplies dc to the line test circuits. Capacitors C7 and C8 and resistor R5 filter the dc output of rectifier CR2. The output line is protected by fuse F2. The input to rectifier CR2 is adjusted by means of adjustable taps to transformer T1 secondary windings. The power supply circuit is traced from the adjustable tap of the secondary winding of transformer T1 through rectifier CR2, back to the secondary winding of transformer T1 through a second adjustable tap. The output line goes from the positive side of rectifier CR2 through fuse F2 to contact E of plug P4 and jack J4B, to pin 6 of jack J7 and plus P7, to jack J9 marked (+). The line and test circuits are in parallel with jacks J9 and J10. The circuit continues through the line and test circuits and/or jack J10 marked (–) to pin 9 of plug P7 and jack J7, through contact D of jack J4B and plug P4 to the negative side of rectifier CR2.

77. Signal Circuits

The signal circuits consist of all circuits that carry code impulses. This group includes the send, receive, and test circuits.

a. Send Circuit (fig. 75).

(1) The send circuit transmits neutral keyboard signals. This circuit is connected to external signal lines at terminal posts 1 or 5, and 2 of the terminal and switch box. Basically, the circuit converts the mechanical movement of code bars to electrical impulses. SEND–LOCK switch S2 closes transmitter contacts E4 when the teleprinter is to receive only. LINE-BREAK switch S3 opens the line to signal or break in on a message. A set of shorting contacts in motor stop relay E1 closes transmitter contacts E4 so that the line remains closed during the motor stop function.

(2) With SEND–LOCK switch S2 in the SEND position (open), LINE–BREAK switch S3 in the LINE position, motor stop relay E1 in the nonoperated position, and transmitter contacts E4 in the mark position, the circuit goes from terminal post 2 on the terminal and switch box, through LINE CURRENT resistor R10, through the contacts of DC POWER switch S11 which is closed, to terminal 6 of plug P7 and jack J7, to terminal E of jack J4B and plug P4, through fuse F2 to the positive side of rectifier CR2. The circuit continues from the negative side of rectifier CR2, to terminal D of plug P4 and jack J4B to terminal 9 of jack J7 and plug P7, through the contacts of DC POWER switch S11, to contact 3 of LINE SELECTOR switch S7 in any position other than the TEST position. The circuit continues through the switch rotor to contact 2, to terminal 7 of plug P7 and jack J7, to terminal 3 of terminal board TB2, to LINE–BREAK switch S3 which is in the LINE position. The circuit continues to terminal 2 of terminal board TB2, to terminal B of jack J5 and plug P5, through the transmitter filter Z2, to the mark contact of transmitter contacts E4. The circuit continues through the common contact of transmitter contacts E4, through transmitter filter Z2, to terminal A of plug P5 and jack J5, to terminal 13 of jack J7 and plug P7. The circuit is completed through contact 8 of LINE SELECTOR switch S7, through the switch rotor to contact 7, to terminal 5 of the terminal and switch box or through resistor R3 to terminal 1 of the terminal and switch box.

b. Receive Circuit (fig. 76). This circuit receives impulses from the signal line and controls selector magnet E2 which, in turn, governs the position of the mechanical parts within the selector mechanism. The receive circuit terminates in terminals 3 and 4 of the terminal and switch box. Either 20- or 60-ma signals may be received without line relay K1 to operate selector magnet E2. LINE SELECTOR switch S7 adapts the circuit to the level of the signal line current. This switch places the windings of selector magnet E2 in parallel for 60-ma operation and in series for 20-ma operation. Each LINE SELECTOR switch S7 position setting is described separately in (1) through (3) below. The teleprinter can also receive signals with the line winding of the line relay. This circuit is described in paragraph 78*b*.

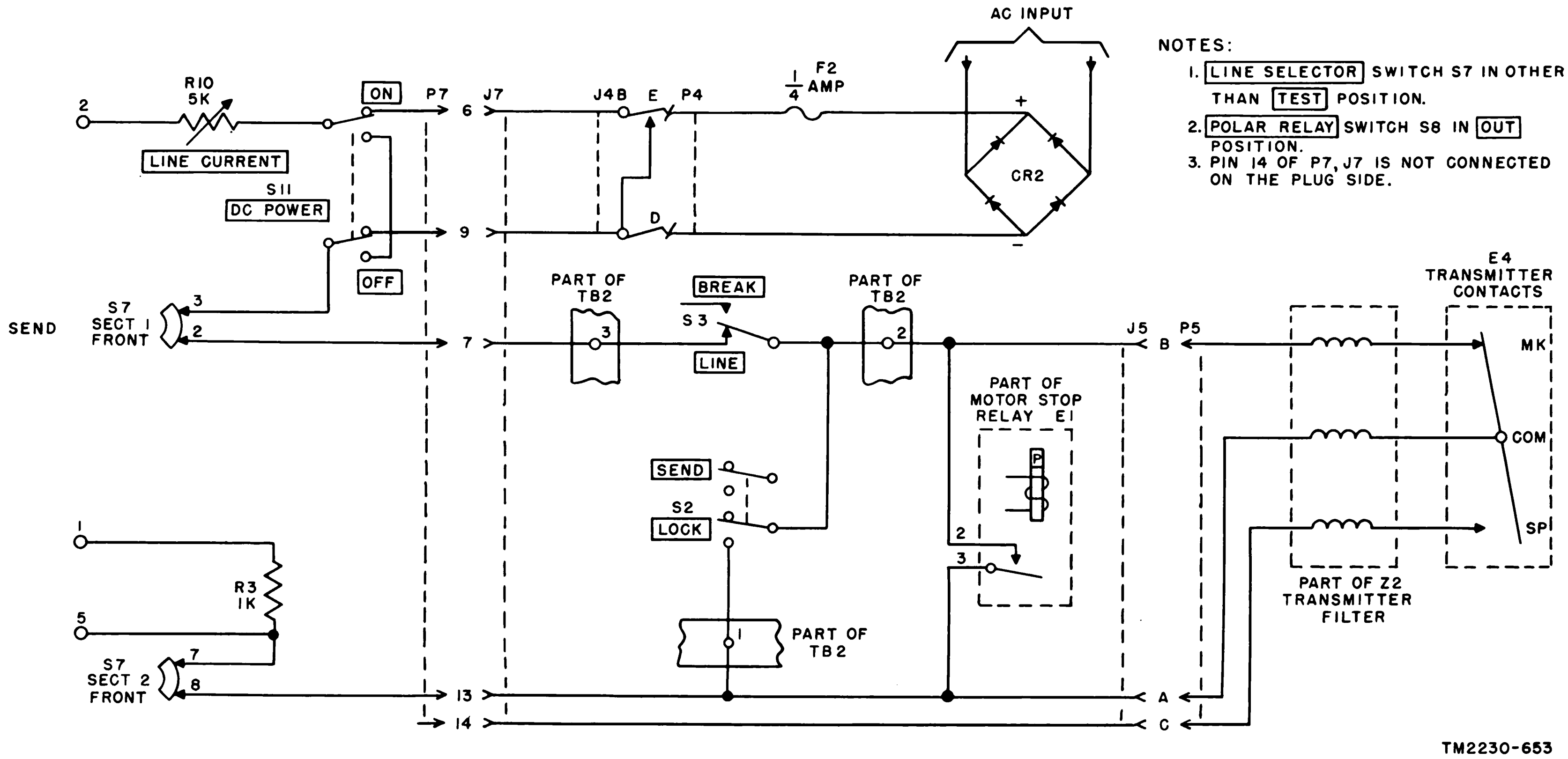
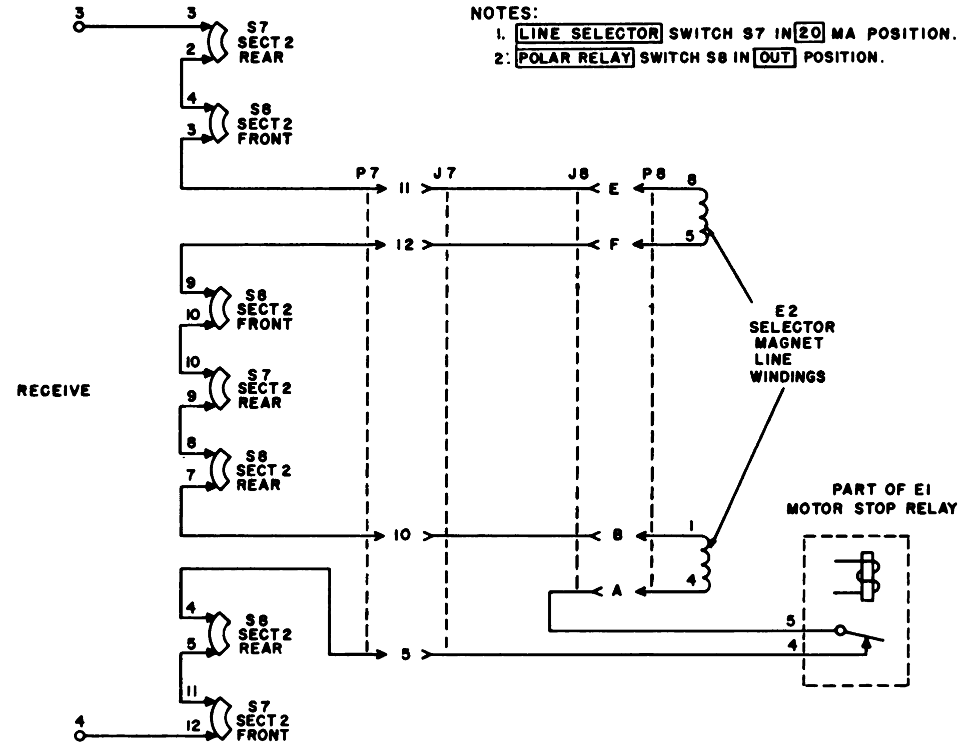


Figure 75. Teleprinter send circuit, simplified schematic.

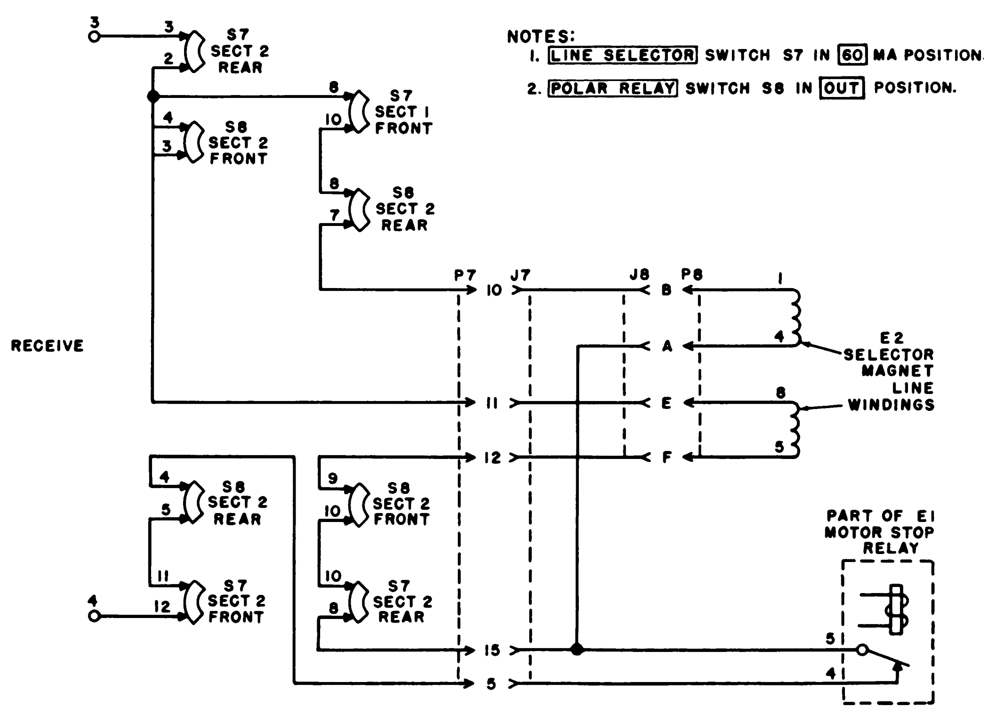
(1) *LINE SELECTOR switch S7 in 20 ma position and motor-stop relay E1 in nonoperated position* (fig. 76). With terminal 3 on the terminal and switch box, the circuit is traced to contact 3 on LINE SELECTOR switch S7 which is in the 20 ma position, through the switch rotor to contact 2, to contact 4 of POLAR RELAY switch S8, which is in the OUT position, through the switch rotor to contact 3. From contact 3, the circuit continues to terminal 11 of plug P7 and jack J7, to terminal E of jack J8 and plug P8, through the 8–5 line winding of selector magnet E2, through terminal F of plug P8 and jack J8, through terminal 12 of jack J7 and plug P7, through contact 9 of POLAR RELAY switch S8, through the switch rotor to contact 10. The circuit continues to contact 10 of LINE SELECTOR switch S7, through the switch rotor to contact 9, to contact 8 of POLAR RELAY switch S8, through the switch rotor to contact 7, to terminal 10 of plug P7 and jack J7. The circuit continues to terminal B of jack J8 and plug P8, through the 1–4 line winding of selector magnet E2, to terminal A of plug P8 and jack J8, to terminal 5 of motor stop relay E1, through a float and closed contact to terminal 4 of motor stop relay E1, to terminal 5 of jack J7 and plug P7, to contact 4 of POLAR RELAY switch S8. The circuit is completed through the switch rotor to contact 5, then to contact 11 of LINE SELECTOR switch S7, through the switch rotor to contact 12, and is terminated at terminal 4 of the terminal and switch box.

(2) *LINE SELECTOR switch S7 in 60 ma or P (polar) position, and motor-stop relay E1 in nonoperated position* (B, fig. 76). With terminal 3 on the terminal and switch box, the circuit goes to contact 3 of LINE SELECTOR switch S7, which is in either P (polar) or the 60 ma position, through the switch rotor is contact 2. At this point, the circuit divides. One part is traced to contact 8 of LINE SELECTOR switch S7, through the switch rotor to contact 10, to contact 8 of POLAR RELAY switch S8 which is in the OUT position, through the switch rotor to contact 7, to terminal 10 of plug P7 and jack J7, to terminal B of jack J8 and plug P8, through the 1–4 line winding of selector magnet E2, to terminal A of plug P8 and jack J8. The circuit continues to terminal 5 of motor stop relay E1 which is in the nonoperated position, through to a float and closed contact to terminal 4 of relay E1, to terminal 5 of jack J7 and plug P7, to contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 5, to contact 11 of LINE SELECTOR switch S7, through the switch rotor to contact 12, and the circuit ends in terminal 4 of the terminal and switch box. From the point where the circuit divides, it can also be traced to contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 3, to terminal 11 of plug P7 and jack J7, to terminal E of jack J8 and plug P8, through the 8–5 line winding of selector magnet E2, to terminal F of plug P8 and jack J8, to terminal 12 of jack J7 and plug P7, to contact 9 of POLAR RELAY switch S8, through the switch rotor to contact 10, to contact 10 of LINE SELECTOR switch S7, through the switch rotor to contact 8, to terminal 15 of plug P7 and jack J7, to terminal 5 of motor stop relay E1. Terminal 5 of motor stop relay E1 meets with terminal 4 of relay E1 and the circuit continues to terminal 5 of jack J7 and plug P7, to contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 5, to contact 11 of LINE SELECTOR switch S7 through the switch rotor to contact 12, and the circuit ends in terminal 4 of the terminal and switch box.

(3) *POLAR RELAY switch S8 in the IN position, LINE SELECTOR switch S7 in other than TEST position, and motor-stop relay in nonoperated position* (fig. 76). Beginning with terminal 3 of the terminal and switch box, the circuit can be traced to contact 3 of LINE SELECTOR switch S7, in any position other than TEST, through the switch rotor to contact 2. From contact 2, the circuit continues to contact 12 of POLAR RELAY switch S8, which is in the IN position, through the switch rotor to



A. TELEPRINTER RECEIVE WITHOUT RELAY, 20 MA



B. TELEPRINTER RECEIVE WITHOUT RELAY, 60 MA

TM2230-630

Figure 76. Teleprinter receive circuit, without line relay.

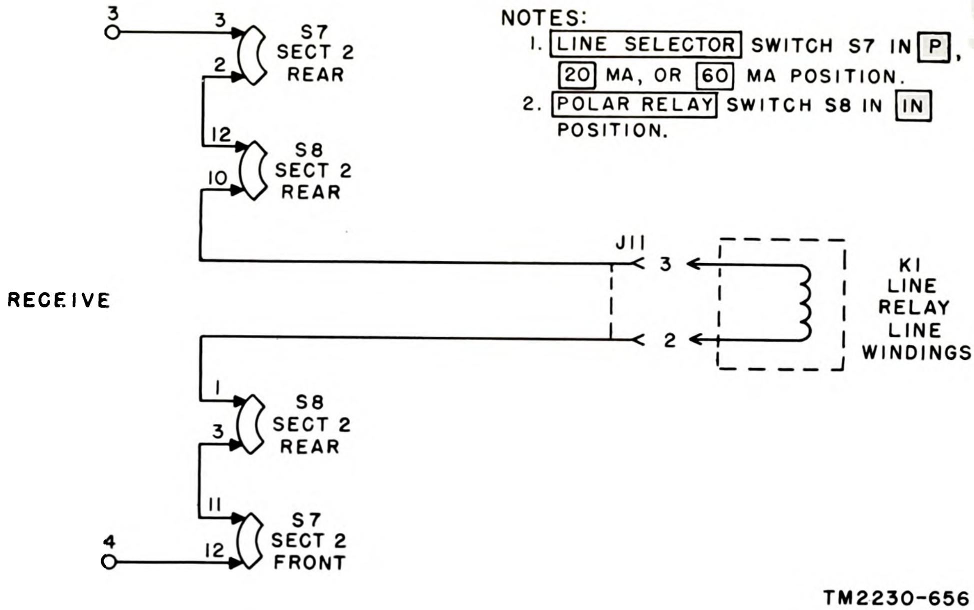


Figure 77. Teleprinter receive circuit, with line relay, simplified schematic.

contact 10. The circuit continues to terminal 3 of jack J11, through the line winding of line relay K1 to terminal 2 of jack J11. From terminal 2 of jack J11 the circuit continues through contact 1 of POLAR RELAY switch S8, through the switch rotor to contact 3. From contact 3, the circuit continues to contact 11 of LINE SELECTOR switch S7, through the switch rotor to contact 12, and terminates at terminal 4 of the terminal and switch box.

78. Local Dc Circuits

a. Test Circuit without Relay (fig. 78).

(1) The test circuit without a relay provides a means of placing the transmitting and receiving mechanism of the teleprinter into a local 60-ma neutral circuit for testing purposes without affecting the external signal circuits. LINE SELECTOR switch S7 must be in the TEST position.

(2) The circuit can be traced from the positive side of rectifier CR2 through fuse F2, to terminal E of plug P4 and jack J4B, to terminal 6 of jack J7 and plug P7. It continues through ohm resistor R6 to contact 11 of LINE SELECTOR switch S7, which is in the TEST position, through the switch rotor to contact 2 where the circuit divides. One part is traced to contact 4 of POLAR RELAY switch S8 in the OUT position, through the switch rotor to contact 5, to terminal 11 of plug P7 and jack J7, to terminal E of jack J8 and plug P8, to 8–5 line winding of selector magnet E2, to terminal F of plug P8 and jack J8, to terminal 12 of jack J7 and plug P7, to contact 9 of POLAR RELAY switch S8, through the switch rotor to contact 10, to contact 6 of LINE SELECTOR switch S8, through the switch rotor to contact 7, to terminal 15 of plug P7 and jack J7. The circuit joins here with the other part of the circuit that started from contact 2 of LINE SELECTOR switch S7 and terminated at termnial A of plug P8 and jack J8. This places the two line windings of selector magnet E2 in parallel; the two parts of the circuit now join to go to terminal 5 of motor stop relay E1, through a float and closed contact to terminal 4 of relay E1, to terminal 5 of jack J7 and plug P7, to contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 5, to contact 11 of LINE SELECTOR switch S7, through the switch rotor to contact 8, to terminal 13 of plug P7 and jack J7, to terminal A of jack J5 and plug P5, through transmitter filter Z2, to the common terminal of transmitter contacts E4, which are in

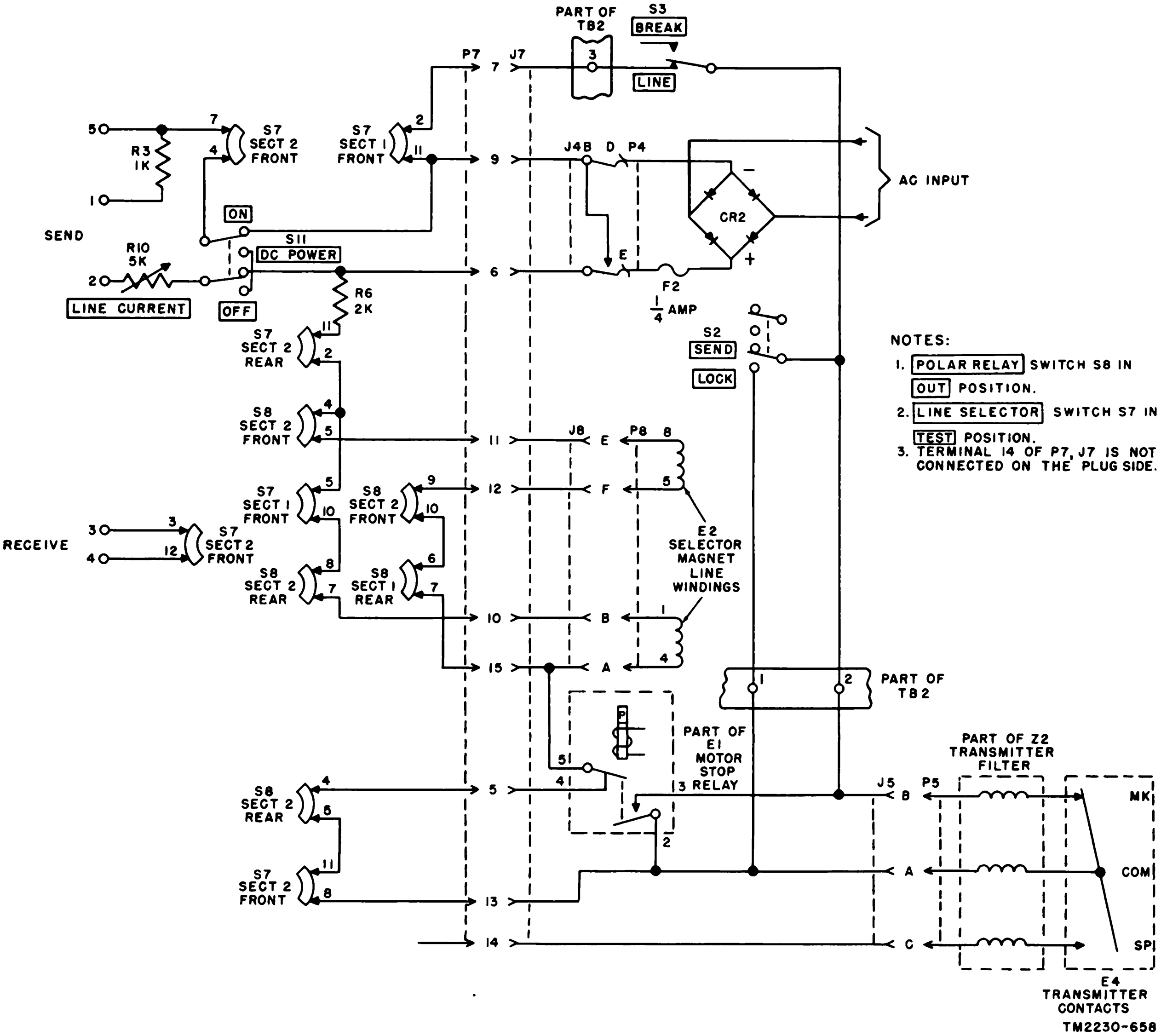


Figure 78. Test circuit without relay, simplified schematic.

the mark position. The circuit continues through transmitter filter Z2, to terminal B of plug P5 and jack J5, to terminal 2 of terminal board TB2, to LINE–BREAK switch S3 which is in the LINE position, to terminal 3 of terminal board TB2, to terminal 7 of jack J7 and plug P7, to contact 2 of LINE SELECTOR switch S7, through the switch rotor to contact 11. The circuit is completed through terminal 9 of plug P7 and jack J7, to terminal D of jack J4B and plug P4, to the negative side of rectifier CR2.

(3) The signal circuits connected to the terminals of the terminal and switch box remain closed when LINE SELECTOR switch S7 is in the TEST position. If DC POWER switch S11 is in the ON position, the send circuit can be traced from terminal 5 of the terminal and switch box or terminal 1 through resistor R3 to contact 7 of LINE SELECTOR switch S7, through the switch rotor to contact 4, through the contacts of DC POWER switch S11 to terminal 9 of plug P7 and jack J7, to terminal D of jack J4B and plug P4, from the negative to the positive side of rectifier CR2, through fuse F2, to terminal E of plug P4 and jack J4B, to terminal 6 of jack J7 and plug P7, through the

contacts of DC POWER switch S11, through LINE CURRENT resistor R10 to terminal 2 of the terminal and switch box. If DC POWER switch S11 is in the OFF position, the send circuit can be traced from terminal 5 on the terminal and switch box or terminal 1 through resistor R3, to contact 7 of LINE SELECTOR switch S7, through the switch rotor to contact 4, through the contacts of DC POWER switch S11, through LINE CURRENT resistor R10 to terminal 2 on the terminal and switch box. The receive circuit can be traced from terminal 3 of the terminal and switch box, to contact 3 of LINE SELECTOR switch S7, through the switch rotor to contact 12, to terminal 4 on the terminal and switch box.

b. Test Circuit with Line Relay (fig. 79).

(1) The test circuit with line relay K1 tests the local dc circuits the same as the test circuit without a relay, described in *a* above. The line relay K1 line winding is inserted into the circuit in place of the line windings of selector magnet E2.

(2) The circuit can be traced from the positive side of rectifier CR2 through fuse F2 to terminal E of plug P4 and jack J4B to terminal 6 of jack J7 and plug P7, through resistor R6 to contact 11 of LINE SELECTOR switch S7, which is in the TEST position, through the switch rotor to contact 2, to contact 12 of POLAR RELAY switch S8, which is in the IN position, through the switch rotor to contact 10, to terminal 3 of jack J11, through the line winding of line relay K1. The circuit continues to terminal 2 of jack J11, to contact 1 of POLAR RELAY switch S8, through the switch rotor to contact 3, to contact 11 of LINE SELECTOR switch S7, through the switch rotor to contact 8, to terminal 13 of plug P7 and jack J7, to terminal A of jack J5 and plug P5, through transmitter filter Z2, to the common terminal of transmitter contacts E4, which are in the mark position. The circuit can be traced through the mark contact, through transmitter filter Z2, to terminal B of plug P5 and jack

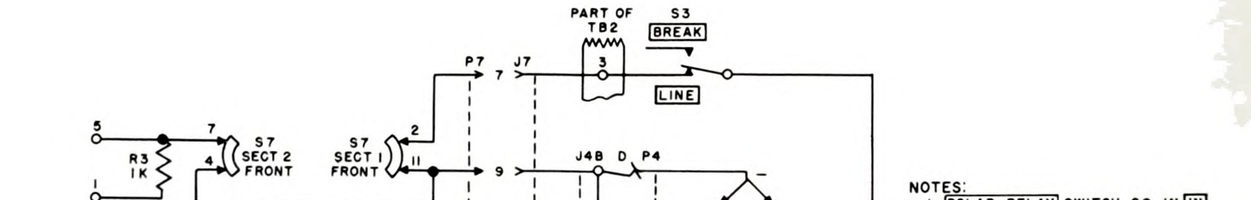


Figure 79. Test circuit with line relay, simplified schematic.

J5, to terminal 2 of terminal board TB2, through the contacts of LINE-BREAK switch S3, which is in the LINE position. The circuit is completed through terminal 3 of terminal board TB2, to terminal 7 of jack J7 and plug P7, to contact 2 of LINE SELECTOR switch S7, through the switch rotor to contact 11, to terminal 9 of plug P7 and jack J7, to terminal D of jack J4B and plug P4 to the negative side of rectifier CR2.

(3) The signal circuits connected to the terminal of the terminal and switch box remain closed when LINE SELECTOR switch S7 is in the TEST position. The circuits are identical with those traced in *a*(3) above.

c. Selector Magnet Bias Circuits, Without Relay.

(1) The selector magnet bias circuits provide dc from rectifier CR1 to the bias windings of selector magnet E2. When LINE SELECTOR switch S7 is in the 60 ma position, 12 ma are supplied to the bias windings of selector magnet E2. When LINE SELECTOR switch S7 is in the 20 ma position, 8 ma are supplied to the bias windings of selector magnet E2. When LINE SELECTOR switch S7 is is in the P (POLAR) position, the bias circuit is disconnected and no current flows through the bias windings. The bias windings are connected through variable BIAS resistor R4 which is locked. This circuit includes a strap arrangement marked BIAS TEST MA which has a means for inserting a milliammeter to measure the current in the circuit. In neutral operation, the bias circuit controls the movement of the selector magnet E2 armature to the space position.

(2) With LINE SELECTOR switch S7 (fig. 80) in the 20 ma position, the circuit is traced from the negative side of rectifier CR1, through fuse F4, to terminal D of jack J8 and plug P8, through the 2–3

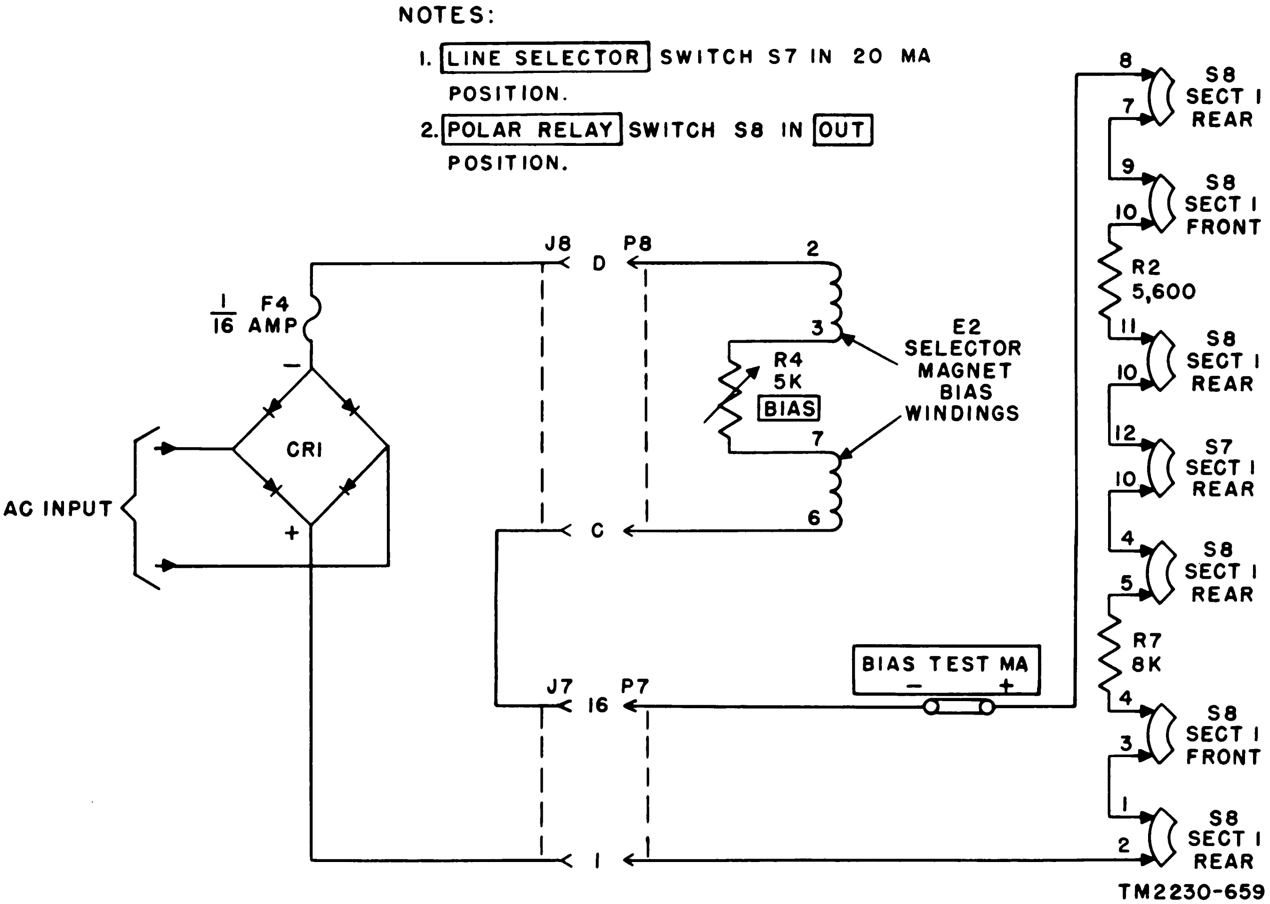


Figure 80. Selector magnet bias (20 ma) circuit, without relay, simplified schematic.

bias winding of selector magnet E2, through BIAS resistor R4, through the 7–6 bias winding of selector magnet E2, to terminal C of plug P8 and jack J8, to terminal 16 of jack J7, and plug P7, through the BIAS TEST MA strap. The circuit continues to contact 8 of POLAR RELAY switch S8 which is in the OUT position, through the switch rotor to contact 7, to contact 9 of POLAR RELAY switch S8, through the switch rotor to contact 10, through resistor R2 to contact 11 of POLAR RELAY switch S8, through the switch rotor to contact 10, to contact 12 of LINE SELECTOR switch S7 which is in the 20 ma position, through the switch rotor to contact 10. The circuit is completed through contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 5, through resistor R7 to contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 3, to contact 1 of POLAR RELAY switch S8, through the switch rotor to contact 2, to terminal 1 of plug P7 and jack J7, to the positive side of rectifier CR1.

(3) With LINE SELECTOR switch S7 (fig. 81) in the 60-ma position, the circuit is traced from the negative side of rectifier CR1 through fuse F4, to terminal D of jack J8 and plug P8, through the 2–3 bias winding of selector magnet E2, through BIAS resistor R4, through the 7–6 bias winding of selector magnet E2, to terminal C of plug P8 and jack J8, to terminal 16 of jack J7 and plug P7, through the BIAS TEST MA strap, to contact 8 of POLAR RELAY switch S8, which is in the OUT position, through the switch rotor to contact 7. The circuit continues to contact 9 of LINE SELECTOR switch S7, which is in the 60-ma position, through the switch rotor to contact 10, to contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 5, through resistor R7 to contact 4 of POLAR RELAY switch S8, through the switch rotor to contact 3, to contact 1, through the switch rotor to contact 2, to terminal 1 of plug P7 and jack J7, to the positive side of rectifier CR1.

d. Relay Bias Circuits.

(1) When line relay K1 is in the circuit, the selector magnet bias windings are not used and the bias winding of line relay K1 is supplied with dc from rectifier CR2. The position of LINE SELECTOR switch S7 varies the dc supplied to the bias winding from 10 to 15 ma.

(2) With LINE SELECTOR switch S7 (fig. 82) in the 20-ma position, the circuit is traced from the positive side of rectifier CR2 through fuse F2, to terminal E of plug P4 and jack J4B, to terminal 6 of jack J7 and plug P7, to contact 3 of POLAR RELAY switch S8 which is in the IN position, through the switch rotor to contact 1, to contact 3 of POLAR RELAY switch S8, and through the switch rotor to contact 5. The

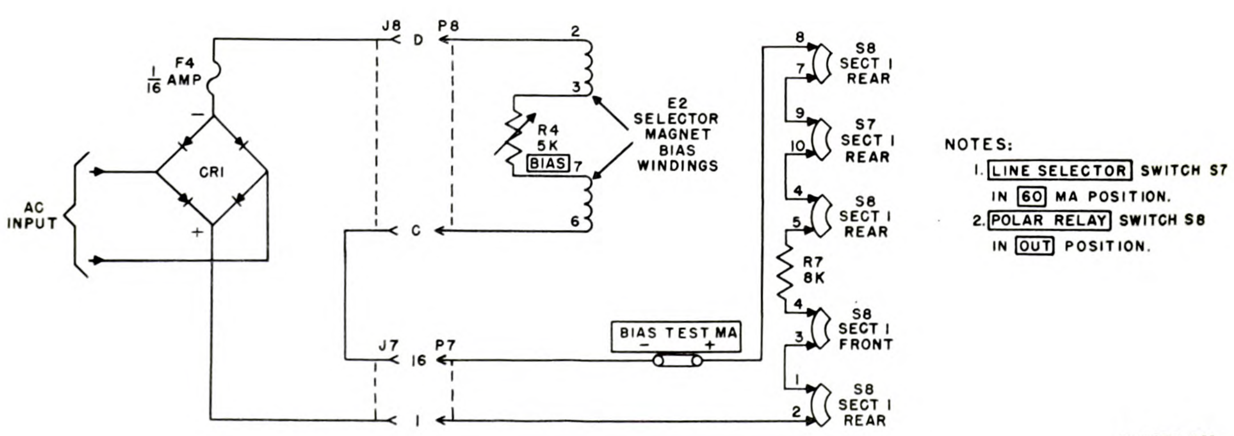


Figure 81. Selector magnet bias (60-ma) circuit, without relay, simplified schematic.

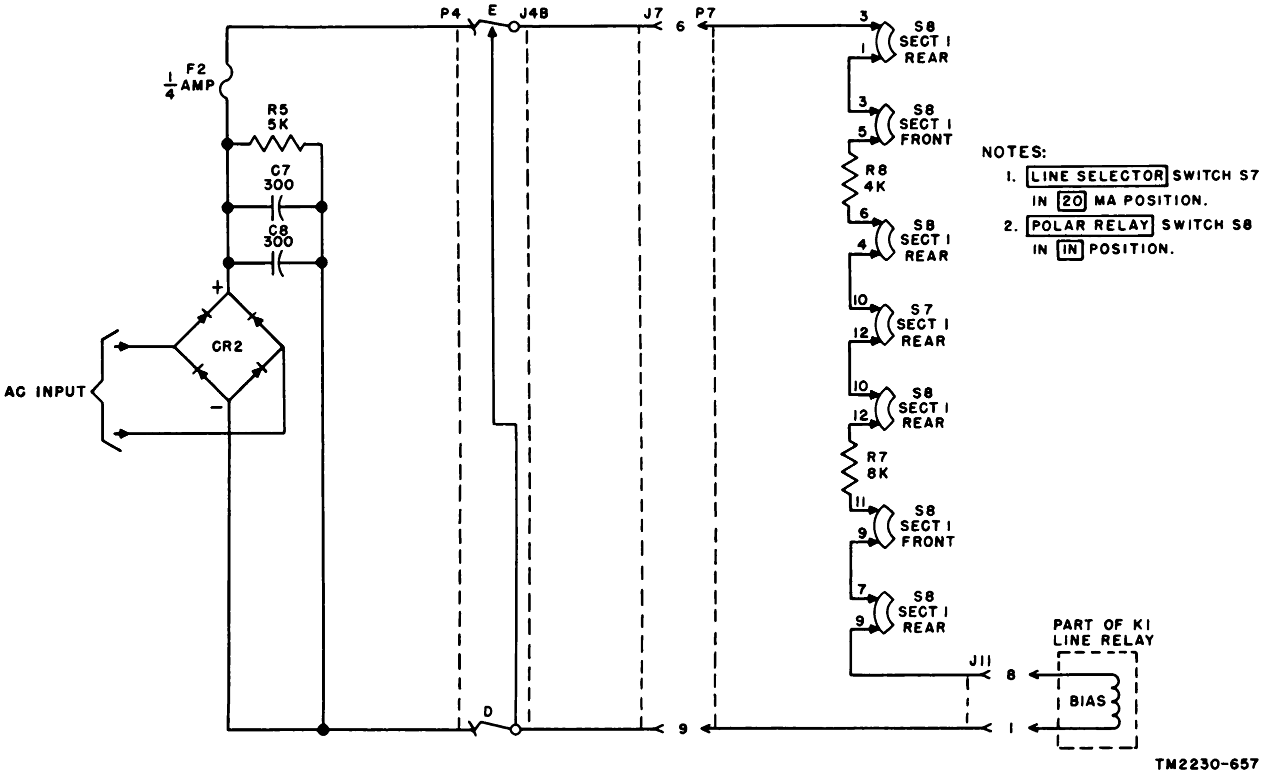


Figure 82. Line relay bias (20-ma) circuit, simplified schematic.

circuit continues through resistor R8 to contact 6 of POLAR RELAY switch S8, through the switch rotor to contact 4, to contact 10 of LINE SELECTOR switch S7 which is in the 20-ma position, through the switch rotor to contact 12, to contact 10 of POLAR RELAY switch S8, through the switch rotor to contact 12, through resistor R7 to contact 11 of POLAR RELAY switch S8. The circuit is completed through the switch rotor to contact 9, to contact 7 of POLAR RELAY switch S8, through the switch rotor to contact 9, to terminal 8 of jack J11, through the bias winding of line relay K1, to terminal 1 of jack J11, to terminal 9 of plug P7 and jack J7, to terminal D of jack J4B and plug P4 to the negative side of rectifier CR2. Capacitors C8 and C7 and resistor R5 filter the rectifier CR2 output.

(3) With LINE SELECTOR switch S7 (fig. 83) in the 60 or TEST position, the circuit is traced from the positive side of rectifier CR2 through fuse F2, to terminal E of plug P4 and jack J4B to terminal 6 of jack J7 and plug P7, to contact 3 of POLAR RELAY switch S8 which is in the IN position, through the switch rotor to contact 1, to contact 3, through the switch rotor to contact 5. The circuit continues through resistor R8 to contact 6 of POLAR RELAY switch S8, through the switch rotor to contact 4, to contact 10 of LINE SELECTOR switch S7, through the switch rotor to contact 9, to contact 7 of POLAR RELAY switch S8, through the switch rotor to contact 9, to terminal 8 of J11, through the bias winding of line relay K1, to terminal 1 of J11, to terminal 9 of plug P7 and jack J7, to terminal D of jack J4B and plug P4, to the negative side of rectifier CR2. Capacitors C7 and C8 and resistor R5 filter the rectifier output.

e. Selector Magnet Receive With Relay Circuit (fig. 84).

(1) When the line relay is used and the teleprinter is receiving signals, the line windings of selector magnet E2 are connected in parallel across the mark and space contacts of line relay K1. Either energized line winding moves the line relay armature to the mark or space contacts.

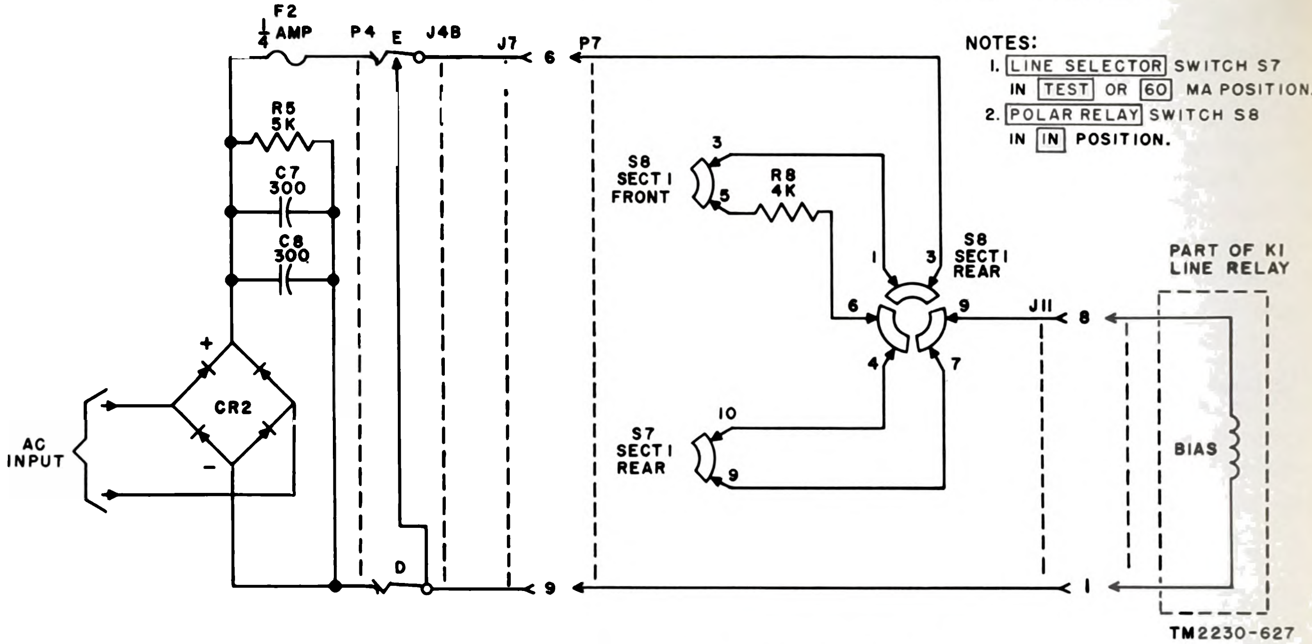


Figure 83. Line relay bias (60-ma) circuit, simplified schematic.

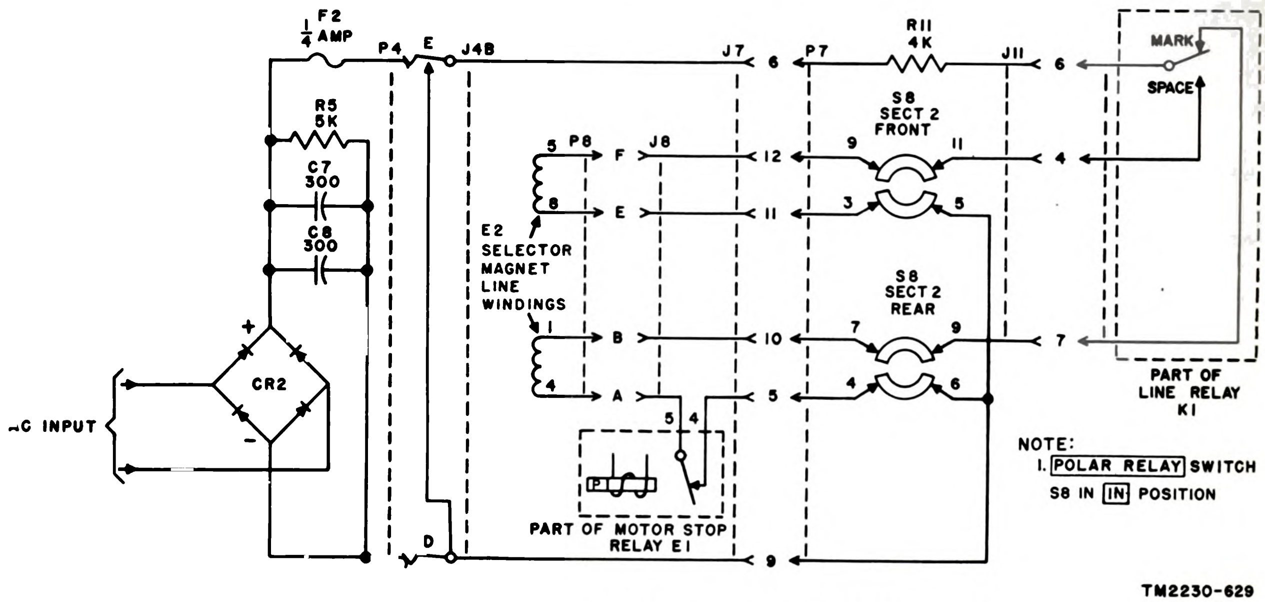


Figure 84. Selector magnet receive with relay circuit, simplified schematic.

The circuit is the same with LINE SELECTOR switch S7 in any position other than polar.

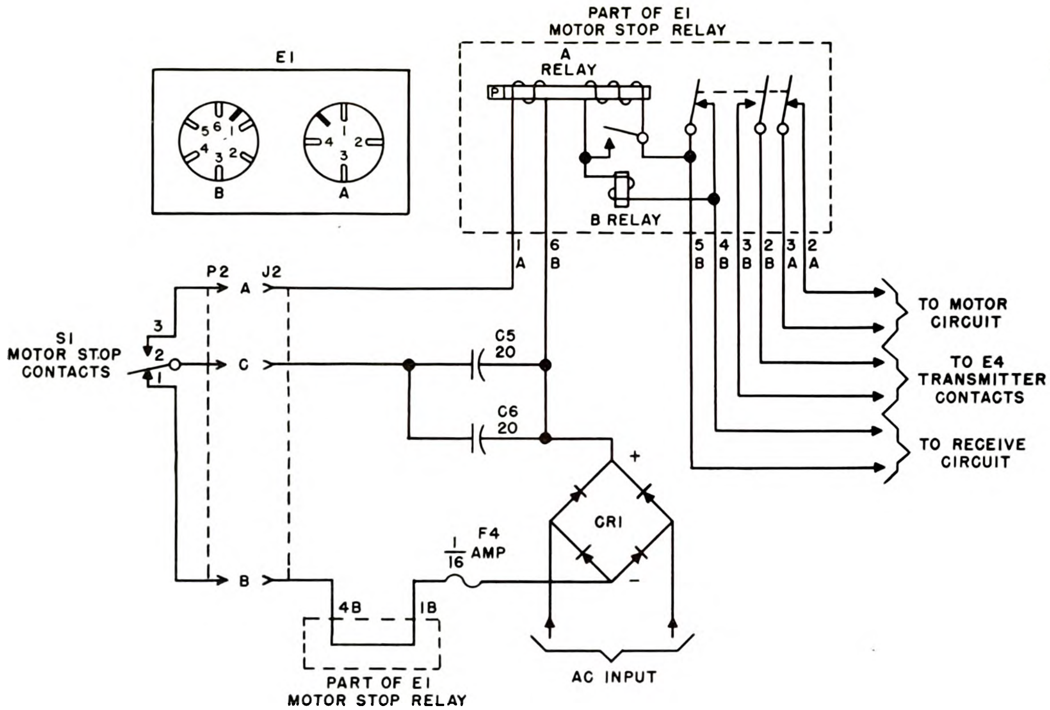
(2) The circuit can be traced from the negative side of rectifier CR 2 to terminal D of plug P4 and jack J4B, to terminal 9 of jack J7 and plug P7, to contact 6 of POLAR RELAY switch S8, which is in the IN position, through the switch rotor to contact 4, to terminal 5 of plug P7 and jack J7, to terminal 4 of motor stop relay E1 which is in the nonoperated position, through the normally closed contact and float to terminal 5, to terminal A of jack J8 and plug P8, through the 4–1 line winding of selector magnet E2, to terminal B of plug P8 and jack J8, to terminal 10 of jack J7 and plug P7. The circuit continues to contact 7 of POLAR RELAY switch S8, through the

switch rotor to contact 9, terminal 7 of jack J11, through the mark contact of line relay K1 which is in the mark position, to terminal 6 of jack J11, through resistor R11, to terminal 6 of plug P7 and jack J7, to terminal E of jack J4B and plug P4, through fuse F2, to the positive side of rectifier CR2. If the armature of line relay K1 is in the space position, the circuit can be traced from the negative side of rectifier CR2, to terminal D of plug P4 and jack J4, to terminal 9 of jack J7 and plug P7, to contact 5 of POLAR RELAY switch S8 which is in the IN position, through the switch rotor to contact 3, to terminal 11 of plug P7 and jack J7. The circuit continues to terminal E of jack J8 and plug P8, through the 8–5 line winding of selector magnet E2, to terminal F of plug P8 and jack J8, to terminal 12 of jack J7 and plug P7, to contact 9 of POLAR RELAY switch S8, through the switch rotor to contact 11, to terminal 4 of jack J11, through the space contact of line relay K1. The circuit terminates through terminal 6 of jack J11, through resistor R11, to terminal 6 of plug P7 and jack J7, to terminal E of jack J4B and plug P4, through fuse F2, to the positive side of rectifier CR2. Capacitors C8 and C7, and resistor R5, filter the rectifier CR2 output.

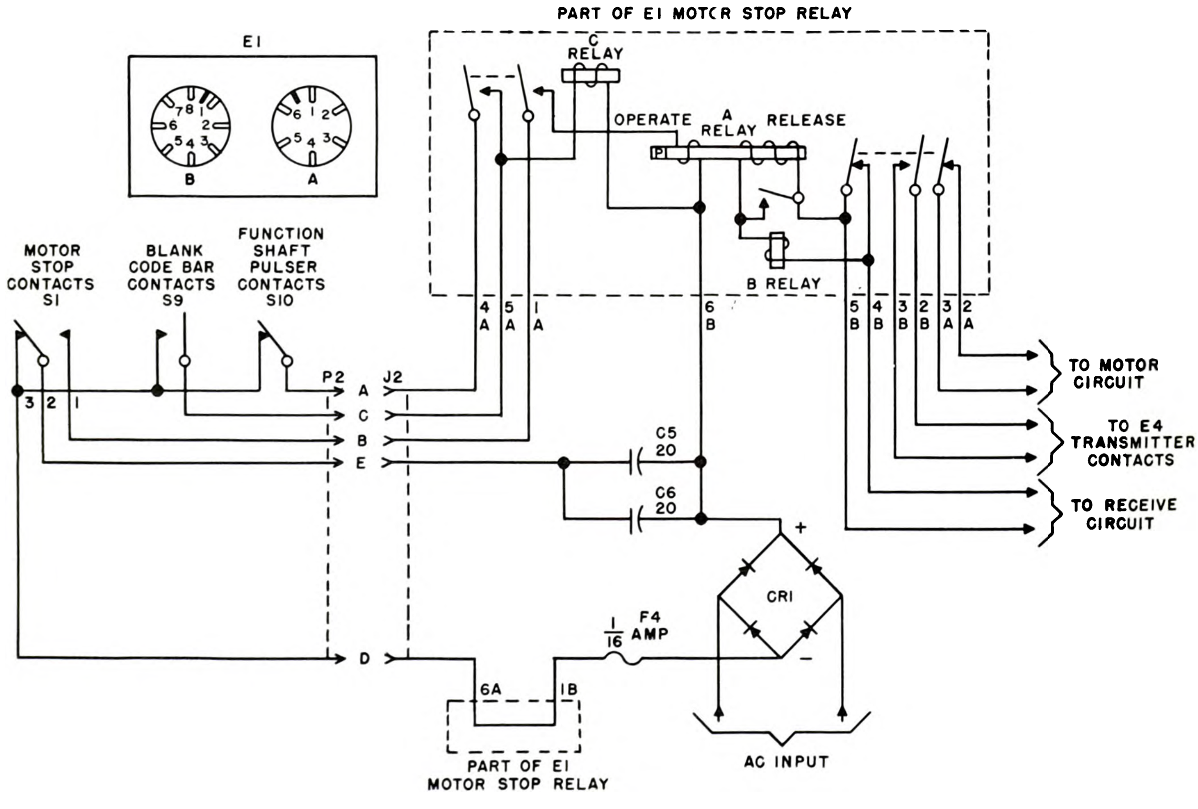
f. Motor Stop Circuits (fig. 85).

(1) The motor stop relay is a sealed unit consisting of two relays designated A and B on Teletypewriters TT–98/FG and TT–100/FG. The motor stop relays have communication symbols and a sealed unit consisting of the same two relays with an additional relay designated C on Teletypewriter TT–99/FG which has weather symbols. The bottom views of the relays are in the upper left corner of each motor stop relay circuit. In the normal operating condition, capacitors C5 and C6 are charged from rectifier CR1 when float 2 of motor stop contacts S1 is against contact 1. The motor stop function is an electromechanical function which is actuated by pressing the H key when the teleprinter is in the figures position. This causes the function selecting 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 float 2 of motor stop contacts S1, moving the float from contact 1 to contact 3 momentarily. As the float makes contact with contact 3, it closes a circuit, discharging capacitors C5 and C6 through the operating winding of relay A motor stop relay E1.

(2) On the TT–98/FG and TT–100/FG, the discharge path of the capacitors C5 and C6 is traced from the negative side of capacitors C5 and C6 to terminal C of jack J2 and plug P2, through float 2 and contact 3 of motor stop contacts S1 to terminal A of plug P2 and jack J2, to terminal 1A of motor stop relay E1, through the operating winding of relay A to terminal 6B of motor stop relay E1, back to the positive side of capacitors C5 and C6 and then to the positive side of the rectifier. 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 pull the contacts to it without the operating winding being energized. However, once the contacts have been operated, the permanent magnet, by itself, is capable of holding them. Capacitors C5 and C6, discharging through the operating winding of relay A, aid the permanent magnet and operate the contacts. When this happens, the set of contacts connected to terminals 2A and 3A of motor stop relay E1, which are connected in series to the motor circuit, opens. This causes the motor to stop. A second set of contacts connected to terminals 2B and 3B of E1 closes. These contacts, connected in parallel across transmitter contacts E4, shunt transmitter contacts E4 and keep current on the line regardless of the position of transmitter contacts E4. A third set of contacts, connected to terminals 4B and 5B of motor stop relay E1



A. TT-98/FG AND TT-100/FG MOTOR STOP CIRCUIT



B. TT-99/FG MOTOR STOP CIRCUIT

TM2230-651

Figure 85. Motor stop circuits, simplified schematic.

and in series with the teleprinter receive circuit, opens. This causes the current in the teleprinter receive circuit to pass through the winding of relay B and the release winding of relay A momentarily. Relay B is 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 float 2 of motor stop contacts S1 to return to contact 1, which opens the circuit through the operating winding of relay A and recharges capacitors C5 and C6. The receive current continues to flow through relay B. To start the motor, the contacts 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 of relay B and also through the release winding of relay A. This causes the contacts of relay A to release to their normal position. When this occurs, the first set of contacts closes, completing the motor circuit and starting the motor. The second set of contacts opens, removing the shunt across transmitter contacts E4. The third set of contacts closes, allowing the receive current to be shunted across the winding of relay B and the release winding of relay A.

(3) On the TT–9/FG, weather symbols are printed when the H key is pressed and the teleprinter is in the figures position. To use this position for both the motor stop operation and printing of the weather symbols, the operator must transmit a blank signal when the teleprinter is in the figures position to energize the winding of relay C of motor stop relay E1 before pressing the H key. This selects the blank stop bar in the code ring cage. The contacts in relay C close; one pair closes the circuit to the operating winding of relay A. If any consecutive code group other than blank and H code are sent in the figures position, function shaft pulser contacts S10 open, deenergizing relay C and restoring the machine to normal operation. Function shaft pulser contacts S10 are controlled by the rotation of the function shaft which rotates one-half revolution for each code group, opening the contacts once each one-half revolution. The circuit for the discharge of the capacitors can be traced from the negative side of the capacitors to terminal E of jack J2 and plug P2, through float 2 and contact 1 of motor stop contact S1, to terminal B of plug P2 and jack J2, to float 1A and its contact that is closed to the operating winding of relay A, to terminal 6B of motor stop relay E1, to the positive side of capacitors C5 and C6, and then to the receiver. The operation of the motor stop relay is identical with that described for teleprinters without weather symbols ((2) above).

79. Ac Circuits

Motor B1 or B2 and copy lamps I 1 and I 2 circuits (fig. 86) operate on 115 volts, 50 to 60 cycles ac supplied through plug P1 which is normally connected to a 115-volt convenience outlet. The ac for the copy lamps I 1 and I 2 circuits is controlled by LIGHT switch S6. The power for motor B1 or B2 circuit is controlled by MOTOR switch S5. The TT–100/FG and TT–99/FG are equipped with synchronous motor B2, and the TT–98/FG is equipped with series-governed motor B1. Motors B1 and B2 circuits and copy lamps I 1 and I 2 circuits are described in (1) through (3) below. The ac circuit supplies the power to motor B1 or B2 to

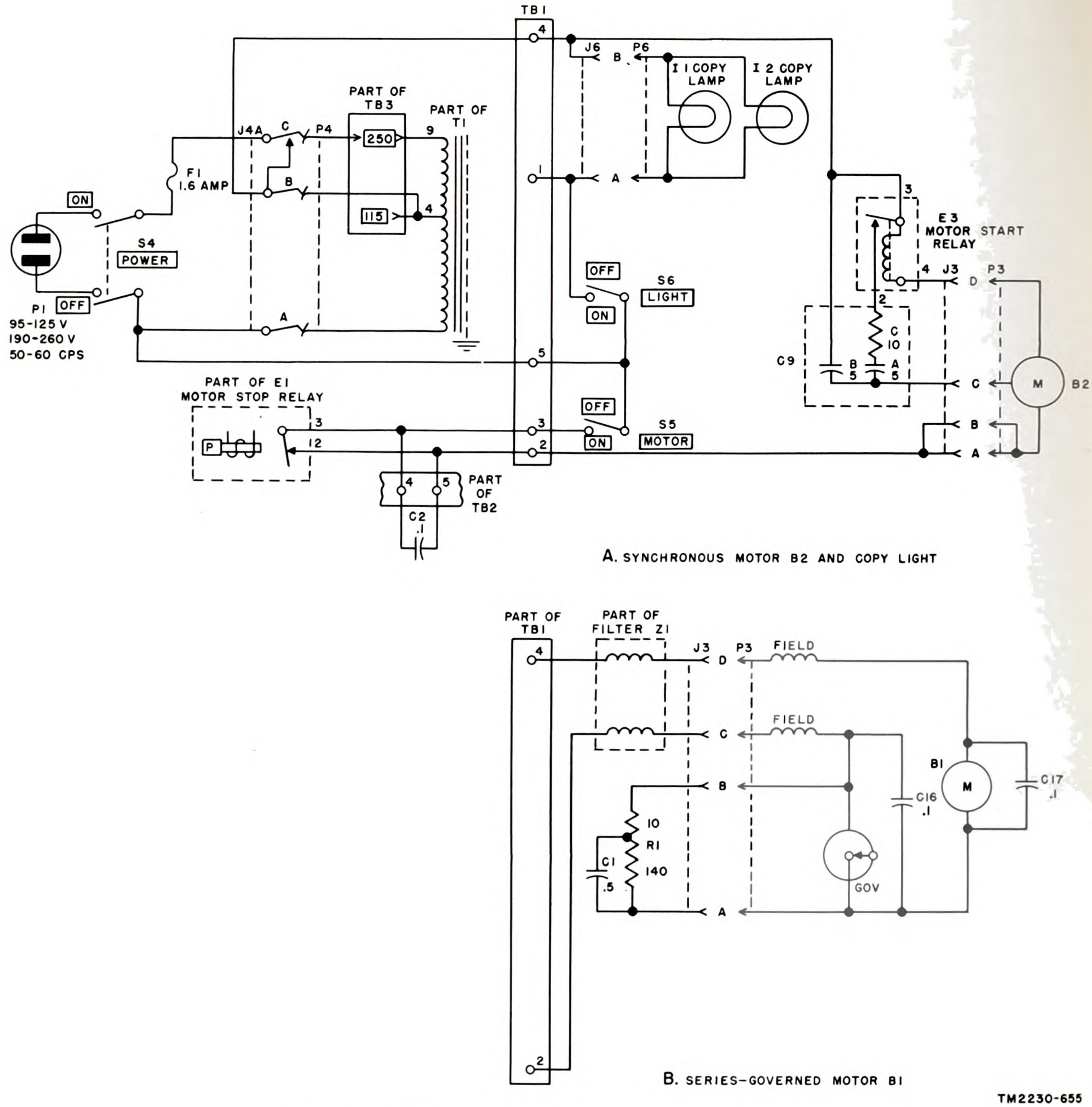


Figure 86. Motor and copy lamp circuits, simplified schematic.

operate the teleprinter. The ac circuit to copy lamps I 1 and I 2 illuminates the copy for the teleprinter operator.

a. Copy Lamps I 1 and I 2 Circuit (A, fig. 86). The circuit may be traced from the upper pin of plug P1 through the contacts of POWER switch S4, through fuse F1, through the C–B shunt contacts of J4A, to terminal 4 of terminal board TB1. Through terminal B of jack J6 and plug P6, through copy lamps I 1 and I 2 which are in parallel, through terminal A of plug P6 and jack J6 and through the contacts of LIGHT switch S6. The circuit is completed through terminal 5 of terminal board TB1, through the contacts of POWER switch S4, to the lower pin of plug P1.

b. Series-Governed Motor B1 Circuit (B, fig. 86). The circuit begins at the upper pin of plug P1, through POWER switch S4, through fuse F1, through the C–B shunt contacts of J4A to terminal 4 of terminal board TB1, through filter Z1, through terminal D of jack J3 and plug P3, through one of the field windings of series-governed motor B1, through the armature, through the governor contacts, through the other field winding, through terminal C of plug P3 and jack J3. The circuit continues through filter Z1, through terminal 2 of terminal board TB1, through the normally closed contacts 2 and 3 of motor stop relay E1, through terminal 3 of terminal board TB1. The circuit is completed through MOTOR switch S5, through terminal 5 of terminal board TB1, through the contacts of POWER switch S4 to the lower pin of plug P1. When series-governed motor B1 reaches the proper speed, centrifugal force overcomes the pull of the movable electrical contact spring, and the governor contacts open. The circuit is traced from terminal D of plug P3 through one of the field windings of series-governed motor B1, through the armature, through terminal A of plug P3 and jack J3, through resistor R1 to terminal B of jack J3 and plug P3, through the other field winding to terminal C of plug P3 and jack J3. Adding resistor R1 reduces the current through the field windings and the motor speed decreases until governor contacts close and shunt resistor R1. Current through the motor increases until the governor contacts again open. This procedure continues as long as series-governed motor B1 is running. Series-governed motor B1 is electrically suppressed from radio-frequency (rf) interference by capacitors C1, C16, and C17 and filter Z1. Capacitor C2 suppresses the rf interference caused by operation of contacts 2 and 3 of motor stop relay E1.

c. *Synchronous Motor B2 Circuit.* The circuit begins at the upper pin of plug P1, through the contacts of POWER switch S4, through fuse F1, through the C–B shunt contacts of J4A, through terminal 4 of terminal board TB1, to terminal 3 of motor start relay E3. Here the circuit divides. One path is traced through the winding of motor start relay E3, through terminal D of jack J3 and plug P3, through motor B2, through terminal A of plug P3 and jack J3. The second path is traced through capacitor C9B, through terminal C of jack J3 and plug P3, through motor B2 through terminal B of plug P3 and jack J3. At this point, the two paths join and the circuit is continued through terminal 2 of terminal board TB1, to motor stop relay E1, through contact 2 and float 3 of motor stop relay E1, to terminal 3 of terminal board TB1, through MOTOR switch S5, to terminal 5 of terminal board TB1, through the contacts of POWER switch S4 to the lower pin of plug P1. When MOTOR switch S5 is first turned on, a surge of current passes through the winding of motor start relay E3, causing the relay to operate. When motor start relay E3 is operated, it places capacitor C9B in parallel with capacitor C9A and resistor C9C. This shifts the phase of the current, giving the additional torque necessary to rotate the motor armature and builds up its speed rapidly. Once the motor has reached its proper speed (3,600 rpm) the current passing through the winding of motor start relay E3 decreases to a value that allows motor start relay E3 to release. The current through the starting winding of synchronous motor B2 is reduced because it now passes only through capacitor C9B. Capacitor C9A and resistor C9C are disconnected from the circuit when motor start relay E3 is released. Capacitor C2 suppresses the rf interference caused by operation of contacts 2 and 3 of motor stop relay E1.

CHAPTER 5
MAINTENANCE

Section I. TOOLS AND MATERIALS

80. Tools

a. Tool Equipment TE–50–B is required for maintenance of the teletypewriter set.

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

Item	*Signal Corps stock No.*
Reamer, hand 6/0	6R8686/0
Reamer, hand 5/0	6R8685/0
Reamer, hand 4/0	6R8684/0
Reamer, hand 3/0	6R8683/0
Punch, pin .03″ dia point	41–P–3550 (Ordnance Corps)
Punch, pin 1/16″ dia point	6R7517
Pliers, retainer ring	6R4709
Puller, wheel	6R7396–1
Undercutter, mica	6R46290

81. Maintenance Materials

The required maintenance materials are listed in the following table.

Item	*Stock No.*
Orange stick	6Z7360
Brush, toothbrush style	53–B–121610 (QMC)
Cheesecloth, bleached, 36 in. wide	6Z1989
Cloth, crocus, 9 x 11 in. sheets	6Z2000
Cleaning Compound, liquid form	Federal stock No. 7930–395–9542
Paper, cleaning, Bell Seal Bond, 1/4 x 2 1/2 in.	6M750
Sandpaper, flint, #4/0 9 x 10 in	6Z7500–0000
Solvent, Dry Cleaning (SD), Federal Spec P–S–661a.	51–S–4385–1 (QMC)
Compound, Antiseize	CE–52–2724.5000.080 (C of E)
Brush, sash, 1 x 5/8 in	6Z1567
Tape TL–192	6N8692
Tape TL–83	6N8583
Grease (WECo Spec. KS–7471)	6G650
Oil, lubricating (WECo Spec. KS–7470).	6G1325
Oil, General Purpose, Low Temperature (OGP).	14–0–2564–200 (QMC)
Moisture and Fungusproofing Kit MK–2/GSM.	6Z6609–2

Warning: Prolonged breathing of Cleaning Compound fumes is dangerous. Make sure adequate ventilation is provided. Cleaning Compound is flammable; do not use near a flame.

82. Test Equipment

The following test equipment is required for maintenance:

a. Multimeter TS–352/U. This unit is used to test the circuits of the teleprinter.

b. Meter Voltmeter ME–30A/U. This unit is used to test the circuits of the teleprinter and measure the ripple voltage of the rectifier.

c. Test Set TS–2/TG (fig. 87). This is a portable, motor-driven unit that transmits signals of constant distortion. It is used to test the selecting performance of teleprinters. For complete instructions for using this test set, refer to TM 11–2208, Test Sets TS–2/TG, TS–2A/TG, and TS–2B/TG (Teletypewriter Signal Distortion).

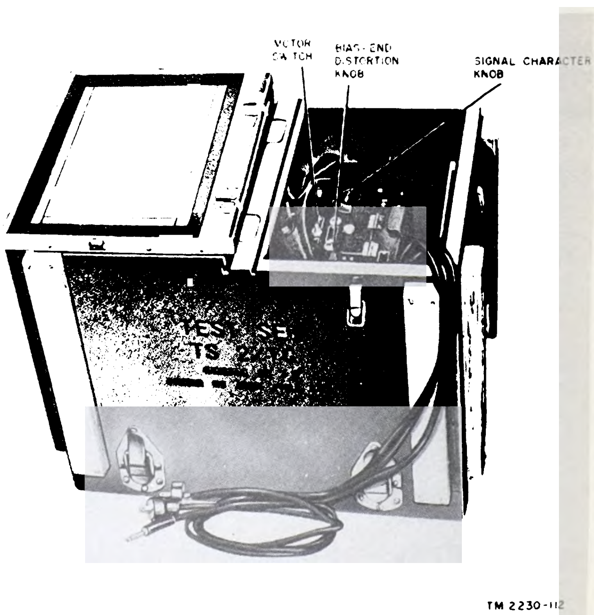


Figure 87. Test Set TS–2/TG, with check cover open.

d. Distortion Test Set TS–383/GG (fig. 88). This is a motor-driven unit, used for analyzing signals transmitted by a teleprinter sending unit and for testing the effect of distortion on receiving mechanisms. For complete instructions for the use of this test set, refer to TM 11–2217, Distortion Test Set TS–383/GG and TS–383A/GG.

83. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working condition so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance should be performed according to a regular schedule.

84. Use of Preventive Maintenance Forms

a. Use of Operator's Preventive Maintenance Form (fig. 89).

(1) DA Form 11–252 (fig. 89) is a preventive maintenance check list to be used by the operator as directed by his commander.

(2) Items not applicable to Teletypewriter Sets AN/FGC–20, AN/FGC–20X, and AN/FGC–21 are lined out on figure 89. References in the ITEM block in the figure are to paragraphs in this manual which contain additional maintenance information pertinent to the particular item.

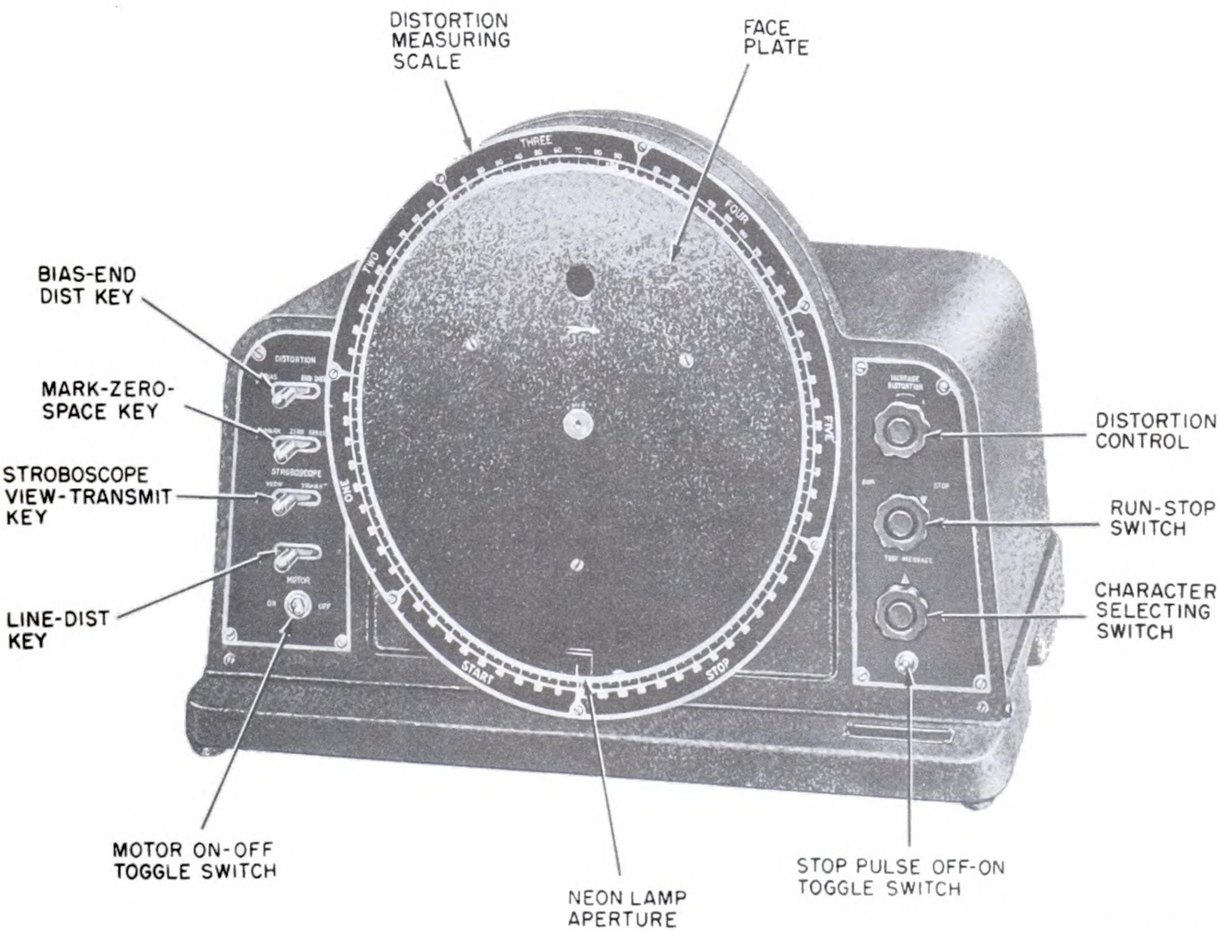


Figure 88. Distortion Test Set TS–383/GG.

b. Use of Technician's Preventive Maintenance Form (fig. 90).

(1) DA Form 11–253 is a preventive maintenance checklist to be used by the repairman as directed by his commander.

(2) Items not applicable to Teletypewriter Sets AN/FGC–20, AN/FGC–20X, and AN/FGC–21 are lined out on figure 90. References in the ITEM block in the figure are to paragraphs in this manual which contain additional maintenance information pertinent to the particular item.

Section II. PREVENTIVE MAINTENANCE

85. General Cleaning Instructions

Most preventive maintenance techniques pertain to specific areas of preventive maintenance. 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 solvent (SD) and dirt from the part with a clean, dry cloth.

(2) A flushing action normally is best when cleaning electrical contacts. Dip an orange stick 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 certain that adequate ventilation is provided. Cleaning Compound is flammable, do not use near a flame.

c. If available, use vacuum cleaning equipment for removing loose dust, paper lint, and dirt from teleprinters. Compressed dry air may be used, but the pressure must be kept low enough to prevent equipment damage.

86. Special Cleaning Instructions

a. Parko-lubrized and Parkerized Parts. Do not keep parko-lubrized and parkerized parts (those parts with a black finish) in solvent (SD) for any extended period because the protective, impregnated oils and waxes will be removed. Clean all parko-lubrized and parkerized parts with an oil-soaked, lint-free cloth. Treat the parts after cleaning with Oil, General Purpose, Low Temperature, Lubricating (OGP).

Note. The instructions given in *b* through *h* below cover parts that cannot be cleaned by the general scrubbing method.

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

c. Ball Bearings. All ball bearings used on the teletypewriter set are sealed. Do not attempt to clean or lubricate them, other than wiping them with a clean, dry cloth. Discard any bearings that do not spin freely.

d. Platen subassembly. 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 off with a clean, dry cloth.

e. Motor.

(*1*) *Cleaning external parts.*

(*a*) Use a clean, dry sash brush to remove dust and dirt.

(*b*) Remove all oil and gummy deposits with a clean, lint-free cloth dampened with solvent (SD).

(*2*) *Cleaning internal parts.*

(*a*) Disassemble the motor.

(*b*) Remove all dust and dirt from the motor with a clean, dry, sash brush.

Caution: Be careful not to damage the windings.

(*c*) 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).

(*d*) 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.

(3) *Cleaning Commutator.*

(*a*) If there is excessive sparking under the motor brushes when the motor is run-

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
TELETYPEWRITER

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
TELETYPEWRITER SET AN/FGC-20	318

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ⓧ Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	INSPECT UNIT FOR PRESENCE OF ~~TOOLS, ACCESSORIES, AND~~ RUNNING SPARES. PAR 12	✓	✓	✓	✓			
2	~~TIGHTEN ALL LOOSE SCREWS, BOLTS, AND NUTS ON CHESTS, TELETYPEWRITER COVER, COMPONENT PANEL.~~							
3	CLEAN INSIDE AND OUTSIDE OF ~~CHESTS AND~~ TELETYPEWRITER COVER OF DIRT, GRIME, GREASE, RUST, OIL, GUMMY DEPOSIT. PAR 87	✓	✓	✓	✓			
4	INSPECT THE COVER OF THE TELETYPEWRITER FOR CRACKED OR BROKEN GLASS, LOOSE SCREWS, BROKEN OR DAMAGED HINGES, DAMAGED COPYHOLDER, SCRATCHES. PAR 87	✓	ⓧ	✓	✓			
5	INSPECT ALL ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING AND PROPER CONTACT, CORROSION, GREASE, OIL. PAR 86	✓	✓	✓	✓			
6	~~TIGHTEN ALL LOOSE ELECTRICAL CONNECTIONS.~~							
7	~~TIGHTEN ALL LOOSE SCREWS, LUGS, MOUNTING BOLTS ON TERMINAL BLOCKS, AND SLIP CONNECTORS.~~							
8	CLEAN EXTERIOR OF KEYS, SWITCHES, AND TERMINAL BLOCKS OF DIRT, GREASE, GRIME, MOISTURE. PAR 87	✓	✓	✓	✓			
9	INSPECT EACH KEY OR SWITCH FOR PROPER MECHANICAL ACTION; FREEDOM OF MOVEMENT, POSITIVE ACTION, SPRING TENSION; LOOK FOR BROKEN, MISSING OR ILLEGIBLE KEY TOPS. PAR 87	✓	✓	ⓧ	✓			

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
10	INSPECT ~~CHESTS~~ FOR DIRT, CRACKS, MISSING OR BROKEN SCREWS, RUST, DAMAGE, WORN LORD MOUNTINGS. PAR 87		12	INSPECT TERMINAL BLOCKS FOR CRACKS, BREAKS, DIRT, LOOSE CONNECTIONS, LOOSE SCREWS AND MOUNTINGS. PAR 86	
11	INSPECT ALL WIRING AND CABLING FOR CRACKS, ROTTING INSULATION, FRAYED, CUT, OR GOUGED JACKETING, KINKS, PROPER SUPPORT WHERE REQUIRED, LOOSE TERMINATIONS, BROKEN CONDUCTORS. PAR 86		13	OPERATE THE TELETYPEWRITER AND CHECK FOR SMOOTH OPERATION, CLEAR PRINTING, SIGNS OF WEAR, EVIDENCE OF MOTOR OVERHEATING. PAR 19	

14 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-252 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM2230-677

Figure 89. DA Form 11-252.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

TELETYPEWRITER

INSTRUCTIONS: *See other side*

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
TELETYPEWRITER SET AN/FGC-20	318

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ⓧ Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	INSPECT UNIT FOR PRESENCE OF ~~TOOLS, ACCESSORIES, AND~~ RUNNING SPARES. PAR 12	✓	15	INSPECT THE CONTACTS OF SWITCHES AND KEYS FOR PITTING, CORROSION AND WEAR. PAR 88	✓
2	TIGHTEN ALL LOOSE SCREWS, BOLTS, AND NUTS ON CHESTS, TELETYPEWRITER COVER, COMPONENT PANEL. PAR 88	✓	16	ADJUST SPRING TENSION OF CONTACT SPRINGS, KEY AND SWITCH CONTACTS WHERE NECESSARY. PAR 88	✓
3	CLEAN INSIDE AND OUTSIDE OF ~~CHESTS AND~~ TELETYPEWRITER COVER OF DIRT, GRIME, GREASE, RUST, OIL, GUMMY DEPOSIT. PAR 88	✓	17	CLEAN CONTACTS OF SWITCHES AND KEYS OF DIRT, GREASE, DUST, CORROSION. PAR 88	✓
4	INSPECT THE COVER OF THE TELETYPEWRITER FOR CRACKED OR BROKEN GLASS, LOOSE SCREWS, BROKEN OR DAMAGED HINGES, DAMAGED COPYHOLDER, SCRATCHES. PAR 88	✓	18	CLEAN THE TYPING UNIT AND TYPE-BAR CARRIAGE VERY CAREFULLY OF GREASE, DUST, DIRT, OIL; *(care should be exercised to prevent dirt from getting into the bearings).* PAR 88	✓
5	INSPECT ALL ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING AND PROPER CONTACT, CORROSION, GREASE, OIL. PAR 88	✓	19	INSPECT THE TYPING UNIT FRAME CASTING, TYPE-BAR CARRIAGE FRAME CASTING, KEYBOARD CASTING, MOTOR BASE FOR CRACKS, LOOSE OR MISSING SCREWS, OTHER DAMAGE. PAR 88	✓
6	TIGHTEN ALL LOOSE ELECTRICAL CONNECTIONS. PAR 88	✓	20	INSPECT THE TYPING UNIT, TYPE-BAR CARRIAGE, KEYBOARD, FOR LOOSE OR MISSING SCREWS, FREE MOVEMENT OF ALL MOVING PARTS, BENT, BROKEN, DISTORTED, OR WORN SHAFTS, GEARS, SPRINGS, BEARINGS, CAMS, CLUTCHES. PAR 88	✓
7	TIGHTEN ALL LOOSE SCREWS, LUGS, MOUNTING BOLTS ON TERMINAL BLOCKS, AND SLIP CONNECTORS. PAR 88	✓	21	ADJUST ANY ITEMS ON TYPING UNIT WHICH REQUIRE ADJUSTMENT. PAR 171 THROUGH 274	ⓧ
8	CLEAN EXTERIOR OF KEYS, SWITCHES, AND TERMINAL BLOCKS OF DIRT, GREASE, GRIME, MOISTURE. PAR 88	✓	22	INSPECT EACH ~~BELL CRANK,~~ CODE BAR, TYPE-BAR, TO DETERMINE THAT ALL PARTS MOVE FREELY AND ARE NOT BENT OR BROKEN, THERE ARE NO MISSING OR DAMAGED PALLETS. PAR 88	✓
9	INSPECT EACH KEY OR SWITCH FOR PROPER MECHANICAL ACTION; FREEDOM OF MOVEMENT, POSITIVE ACTION, SPRING TENSION; LOOK FOR BROKEN, MISSING OR ILLEGIBLE KEY TOPS. PAR 88	✓	23	INSPECT GEARS, SHAFTS, BEARINGS OF TYPE-BAR CARRIAGE FOR SIGNS OF EXCESSIVE WEAR, LOOSE PARTS, DAMAGE. PAR 88	✓
10	~~INSPECT CHESTS FOR DIRT, CRACKS, MISSING OR BROKEN SCREWS, RUST, DAMAGE, WORN LOOP MOUNTINGS.~~		24	ADJUST ANY UNITS ON THE TYPE-BAR CARRIAGE THAT REQUIRE ADJUSTMENT. PAR 171 THROUGH 274	✓
11	INSPECT ALL WIRING AND CABLING FOR CRACKS, ROTTING INSULATION, FRAYED, CUT, OR GOUGED JACKETING, KINKS, PROPER SUPPORT WHERE REQUIRED, LOOSE TERMINATIONS, BROKEN CONDUCTORS. PAR 88	✓	25	INSPECT THE MOTOR FOR SIGNS OF OVERHEATING, WORN BRUSHES, PROPER BRUSH SPRING TENSION. PAR 88	✓
12	INSPECT TERMINAL BLOCKS FOR CRACKS, BREAKS, DIRT, LOOSE CONNECTIONS, LOOSE SCREWS AND MOUNTINGS. PAR 88	✓	26	CLEAN THE MOTOR AND GOVERNOR ASSEMBLY OF DIRT, GREASE, FOREIGN MATTER. PAR 88	✓
13	OPERATE THE TELETYPEWRITER AND CHECK FOR SMOOTH OPERATION, CLEAR PRINTING, SIGNS OF WEAR, EVIDENCE OF MOTOR OVERHEATING. PAR 19	✓	27	CLEAN OIL, GREASE, DUST, DIRT FROM KEYBOARD, KEY TOPS, KEY LEVERS, AND AROUND THE TRANSMITTING MECHANISM. PAR 88	✓
			28	INSPECT THE MOISTURE AND FUNGUS PROOFING. PAR 96	✓
14	SOLDER ANY LOOSE OR BROKEN SOLDER CONNECTIONS. PAR 88	ⓧ	29	INSPECT GENERAL CONDITION OF LUBRICATION AND LUBRICATE AS REQUIRED ACCORDING TO LATEST DEPARTMENT OF THE ARMY LUBRICATION ORDER. PAR 89 THROUGH 93	✓

30 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-253 *(Formerly DA AGO)* REPLACES DA AGO FORM 419 1 DEC 50 WHICH IS OBSOLETE

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Figure 90. DA Form 11-253.

ning, disassemble the motor and clean the commutator with a cloth dampened with Cleaning Compound. Reassemble and run the motor.

(b) If there is still excessive sparking, remove the armature from the motor and clean the commutator lightly with No. 0000 sandpaper. Wrap the sandpaper around the armature and turn the armature in a lathe or between fixed centers; hold the sandpaper lightly by hand.

Caution: Do not use emery cloth.

(4) *Undercutting mica separators between commutator segments.* Excessive sparking between the commutator and the motor brushes results when the copper segments of the commutator are worn down below the level of the mica separators. Undercut the mica.

Caution: After the mica has been undercut, see that no particles of metal remain in the slots. Such metal particles may short the commutator segments.

f. Selector-Magnet Coils. Clean the coils of the selector magnet with a cloth dampened with solvent (SD). Remove rust from the pole pieces with No. 0000 sandpaper; then recoat them with a thin film of lacquer.

g. Wiring and Electrical Parts. Remove dust and dirt with a clean, dry sash brush. Remove all oil and gummy deposits with a clean cloth.

h. Felt Friction Plates and Washers. Do not clean dirty or gritty friction plates with solvent (SD). Discard them. When overhauling the equipment, repalce all felt washers with new ones regardless of their condition.

87. Operator's Maintenance

a. Dust Cover.

(1) Inspect the cover thoroughly. Look for dents, cracks, marred painted surfaces, rust, corrosion, 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 cover with a piece of cheesecloth slightly moistened with water. To remove oil, grease, or gummy stains on the outer surface of the cover, slightly moisten the cloth with solvent (SD).

b. Table.

(1) Inspect the table for breaks or cracks. Look for marred painted surfaces, missing or loose screws, dust, and dirt.

(2) Clean the outer or painted surfaces of the table by using cheesecloth moistened with water or solvent (SD).

c. Keyboard Transmitter.

(1) Inspect the keyboard transmitter for cracked key levers. Examine the keyboard guard casting for cracks or breaks.

(2) Check each keytop to be sure it is fastened securely to the key levers.

(3) Clean the keytops and space bar with a damp cloth.

d. Miscellaneous. Perform all additional maintenance checks listed in DA Form 11–252 (Operator's Check List for Signal Corps Equipment—Teletypewriter).

88. Technician's Maintenance

This maintenance must be performed by qualified technicians. To service a teletypewriter set thoroughly, take the equipment out of service and partially disassemble it as described below. Be sure to notify all other stations that the teletypewriter set will be out of service temporarily. Arrange for a suitable table or bench on which to place the components as they are removed.

a. Preparation. Remove the equipment from service as follows:

(1) Disconnect power from the equipment.

(2) Remove the dust cover.

(3) Remove the teleprinter from the base casting.

(4) Remove the keyboard transmitter.

b. Teleprinter Base.

(1) Clean the base thoroughly with a clean cloth. Wipe away all deposits of oil or grease that may have dropped from the mechanical assemblies. Use a cleaning brush to brush away all loose dirt and paper lint from the hard-to-reach places such as connecting jacks, switches, and terminal blocks. If grimy 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, keys and switches as described in *g*, *h*, and *i* below.

eyboard Transmitter.

) Inspect the keyboard for the following:

(*a*) Cracks and other damage to the keyboard-transmitter guard assembly and any mechanical linkages.

(*b*) Loose, missing, or broken screws, nuts, bolts, fastenings, and electrical connections. Frayed or broken wire insulation and oil-soaked wiring or insulation.

(*c*) Levers, pawls, latches, code bars, springs, and bearings. Check to see that all parts move freely and are not damaged or broken.

(*d*) Missing, broken, or illegible keytops.

(*e*) Missing, broken, or distorted springs.

(*f*) Worn, burned, or dirty contacts and insulation in the transmitting contact assembly.

) Do not tighten parts that require clearance or tension adjustments. Tighten all screws and bolts that are not part of an adjustment.

) Clean the keyboard transmitter as follows:

(*a*) Clean the keytops with a piece of cloth moistened with water.

(*b*) Blow out or brush away dust and debris that may have accumulated in the keyboard transmitter and around the mechanical levers connecting it to the keyboard.

(*c*) Burnish or file contacts if they are dirty, built-up, or pitted.

4) Lubricate the keyboard transmitter in accordance with instructions in paragraphs 89 through 93. Remove excess lubricant.

Motor.

1) The motor should turn freely, smoothly, and quietly when turned by hand and when under power. Check the motor unit for evidences of overheating. This may be indicated by discoloration or by an odor of burned insulating material. Check the governor, governor cover, and target of governed motors for looseness. Tighten the mounting screws firmly to correct any looseness.

2) Clean the exterior of the motor only. If the commutator of a series-governed motor is marked or dirty, clean it as instructed in paragraph 116. Remove all dust, dirt, grease, and corrosion from the outside of the motor. Check to see that the governor is clean and the wires leading to the motor are intact and clean.

(3) Apply any lubricant necessary to the governor lubrication points listed in paragraphs 89 through 93.

e. Power Supply and Switch and Terminal Box.

(1) Inspect for loose connections, damaged or broken parts, and defective or burned-out wiring. Look for evidence of overheating. Note whether the transformer and rectifying stack appear to be discolored. Check the spare ⅛-ampere fuse in the spare fuse holder.

(2) Tighten all loose screws, bolts, nuts, and cable clamps. 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 or gummy deposits with a cloth dampened with a small quantity of solvent (SD). Remove all rust spots. Repaint all exposed metal surfaces, and arrange to restore weatherproof coatings.

f. Main Frame Mechanisms. These mechanisms include the selector, platen, carriage, and main frame groups.

(1) Perform all maintenance checks listed on DA Form 11–253 that pertain to any of the above assemblies.

(2) Examine all operating mechanical assemblies for signs of wear, lack of lubrication, accumulations of dirt or grime, and undesired looseness of any operating parts.

(3) 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 routine servicing.

(4) Check the condition of the ribbon. Replace it if necessary. If the top edge of the ribbon appears frayed and the rest of the ribbon is serviceable, check the ribbon lifter adjustment described in paragraph 250.

(5) 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 the pallets lightly with the pallet cleaning brush slightly moistened with solvent (SD). Check the small center areas of letters, such as o, q, d, g, and b, to be sure no dirt remains.

(6) After performing all other maintenance checks listed on DA Form 11–253, lubricate the assemblies in accordance with paragraphs 89 through 93. Remove all excess lubricant.

g. Cords, Cables, and Wiring.

(1) Check all visible wiring for cracked or deteriorated insulation, frayed, or cut insulation at connecting or supporting points, kinks, and strain caused by improper placement.

(2) Tighten loose fasteners, clamps, and wiring connections. Repair loose or broken connections. Remove corrosion, rust, dirt, and dust from ground connections. Make sure that the outer insulating cover on cords and cables is wiped clean. Do not use oil or solvent (SD) on rubber insulation.

(3) Adjustment of wiring normally is confined to arranging it so that it does not interfere with operation of mechanical parts. It may be necessary to resolder certain connections or to replace some wiring or conductors when they become worn or damaged.

h. Terminal Boards.

(1) Inspect the terminal boards for cracks, breakage, and loose connecting 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. Use tools of the correct size. Be extremely careful not to strip the threads by exerting too much force. Solder loose or broken connections.

(2) Wipe off moisture with a clean cloth and brush the dust and dirt from the terminal board with a clean dry brush. When necessary, terminal strips may be cleaned with a cloth moistened with solvent (SD). Be careful that the solvent does not come in contact with the insulation of any of the wires leading to the terminal strip. Remove and clean corroded or loose connections. Use Cleaning Compound to clean electrical contact surfaces on all connecting devices.

i. Keys and Switches.

(1) Inspect the mechanical action of each key and switch. Look for dirt or corrosion. Operate each key or 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, and mounting bolts. Remove loose connections that are dirty or corroded, and clean them before tightening or soldering connections.

(2) Wipe off all moisture. Carefully clean the exterior surfaces of keys and switches with a dry, stiff brush. Clean corroded and dirty contact surfaces with No. 0000 sandpaper, crocus cloth, or a contact file. Polish them with a burnishing tool after cleaning. If contacts are pitted or burned, use a contact file to restore the surfaces and then polish them with a burnishing tool.

j. Reassembly and Performance Test.

(1) Reassemble the teleprinter.

(2) Place the LINE SELECTOR switch in the TEST position and plug the power input cord into the outlet from which it was removed earlier.

(3) Make a performance test of the set as described in paragraph 99.

Section III. LUBRICATION

89. Recommended Lubricants

The only lubricants recommended for teleprinters are—

a. Oil, lubricating (WECo Spec. KS–7470), Signal Corps stock No. 6G1325 (1 qt can).

b. Grease (WECo Spec. KS–7471), Signal Corps stock No. 6G650 (1 lb. container).

90. Recommended Lubrication Schedule

The following chart shows the recommended intervals for checking the lubrication of teleprinters. When checking, lubricate only those points that require lubrication. *Do not overlubricate.*

Teleprinter operating speed (wpm)	Operating periods (number of days)			
	Up to 8 hours per day	8 to 12 hours per day	12 to 16 hours per day	16 to 24 hours per day
60	30	20	15	10
66	27	18	13	9
75	24	16	12	8
100	18	12	9	6

91. Preparation for Lubrication

To lubricate the teleprinter thoroughly, remove it from service and partially disassemble it as outlined in *a* below.

a. Disassembly. Disassemble the teleprinter 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 plug and the motor stop plug connections from the base.
(5) Unscrew the motor power lead from its base coupling.
(6) Lift the entire mechanism from the base.
(7) Remove the keyboard transmitter.
(8) Remove the keyboard transmitter contact cover.
(9) Remove the governor cover (series-governed motors only).

b. Old Lubricants. Remove all old grease and oil with a clean, dry, lint-free cloth. Wrap the cloth around the end of a screw driver or an orange stick to remove old lubricants from hard-to-reach places.

92. General Lubrication Instructions

a. Methods of Applying Grease. Use the grease gun supplied with Tool Equipment TE–50–B, to apply grease to the gears and racks.

(1) Fill the grease gun as follows:
  (*a*) Unscrew the lubricant tube from the cap casting.
  (*b*) Place the open end of the lubricant tube over the opening in the filling washer in the can of lubricant. Press down on the lubricant tube until it is filled. If the cans of lubricant on hand are not equipped with filling washers, press the metal follower against the back end of the lubricant tube and fill the tube by using a clean wooden paddle or the fingers. Tamp the lubricant down solidly in the tube by pounding the closed end sharply against the palm of the hand. Continue to add lubricant, and tamp it until the tube is completely filled.
  (*c*) Screw the lubricant tube back into the cap casting just enough to hold the tube in place. Insert a rod, screwdriver, pencil, or similar object through the perforated end of the lubricant tube and press the metal follower into the tube to expel any air that may be trapped inside. When the lubricant begins to ooze past the threads, tighten the lubricant tube into the cap casting.
  (*d*) Operate the handle back and forth several times until the lubricant is pumped from the nozzle. The grease gun then is ready for use. If the lubricant does not flow from the nozzle in a solid stream when the handle is operated, all the air has not been expelled from the tube. Invert the gun and pound the cap casting end against the palm of the hand to jar the lubricant into the pump cylinder.

(2) To grease the gears and racks, hold the nozzle of the grease gun against the gear and rack teeth at an angle of about 45°. Operate the handle until enough grease is ejected and, at the same time, turn the gear or move the nozzle along the rack to form a continuous ribbon of grease.

b. Methods of Applying Oil. Apply oil with the oiler furnished with Tool Equipment TE–50–B or with a piece of wire approximately 0.025 inch in diameter.

(1) To fill the oiler, unscrew the top and remove the pump. Fill the tube with the proper lubricant and replace the pump. Tighten the top. After filling the oiler, or when starting to use the oiler after it has been standing for some time, operate the pump handle until the oil is forced out of the nozzle; then adjust the stop beneath the pump handle for desired flow of oil. Turn the adjusting stop in a counterclockwise direction to reduce the flow of oil and in a clockwise

direction to increase the flow of oil. Move the adjustable stop beneath the pump handle to one side to make the stop inoperative.

(2) When wire is used, dip the wire ½ inch into the oil and touch the lubrication point to apply 1 or 2 drops of oil. In this way, the quantity of oil applied is more easily controlled and overlubrication can be avoided. Use only the oil recommended in paragraph 89. Apply just enough oil to the moving parts to cover rubbing surfaces. However, a small additional amount of oil will help to prevent corrosion and to wash away the products of wear. When the teleprinter has been completely lubricated, wipe away excess oil and dirt.

93. Detailed Lubrication Instructions

(figs. 91–99)

The points to be lubricated, the type of lubricant to be used, and the quantity to be applied are listed in the charts in *b* through *f* below. The item numbers are arranged according to the method of application, so that the teleprinter can be treated by one lubricant or by one method at a time in a systematic way. Item numbers shown in figures 91 through 99 for the parts to be lubricated correspond with the item numbers listed in the charts in *b* through *f* below.

a. Ball Bearings. All ball bearings in the teleprinter are sealed and do not require lubrication.

b. Gears and Racks. Wipe the old grease from the gears and racks with a clean, dry, lint-free cloth. Apply fresh grease as follows:

Fig. No.	Item No.	Name of part	Method and quantity
91	13	Carriage return driven gears	Apply sparingly all around gear teeth.
92	10	Main shaft driving gears (inside cover)	Work grease around gears, and cover gear teeth liberally.
93	2	Carriage rack driving gears	Apply sparingly all around gear teeth.
93	6	Function shaft driven gear	Apply sparingly all around gear teeth.
93	7	Square shaft driving gear	Apply sparingly all around gear teeth.
93	20	Function shaft driving gear	Apply sparingly all around gear teeth.
93	23	Carriage feed worm gear	Apply sparingly all around gear teeth.
93	25	Carriage return shaft drive gears	Apply sparingly all around gear teeth.
93	26	Transmitter shaft drive gears	Apply sparingly all around gear teeth.
95	9	Ribbon drive gears	Apply sparingly all around gear teeth.
95	12	Guide rail	Apply sparingly to rack teeth.
96	4	Carriage feed and return driving rack	Apply sparingly to rack teeth.

c. Friction Clutches. Apply oil as shown in the chart below. 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 that secures the spring positioning collars, turn the friction clutches by turning the motor by hand (or in the case of the transmitter friction clutch with keyboard transmitter 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 teleprinter 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 paragraph 21.

Fig. No.	Item No.	Name of part	Method and quantity
91	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.
91	11	Keyboard transmitter friction clutch	10 to 15 drops on each washer along periphery of felt friction plates; apply sparingly to spring and driving collar.

Fig. No.	Item No.	Name of part	Method and quantity
93	17	Selector friction clutch	10 to 15 drops on each washer along periphery of felt friction plates; apply sparingly to spring and driving collar.
93	18	Square shaft driving friction clutch	10 to 15 drops on each washer along periphery of felt friction plates; apply sparingly to spring and driving collar.

d. Oil Holes. Apply oil at the following oil holes:

Fig. No.	Item No.	Name of part	Method and quantity
93	4	Function shaft sliding clutch drum	At least 5 drops in hole on either side.
93	13	Code ring cage	At least 5 drops in hole on top of central bearing sleeve (underneath stop bars).
93	21	Carriage feed driven gear	At least 5 drops in hole in hub.
96	7	Type selecting arm bearing cap	At least 5 drops in hole in bearing cap.

e. Sleeve Bearings. Apply oil at the following bearings:

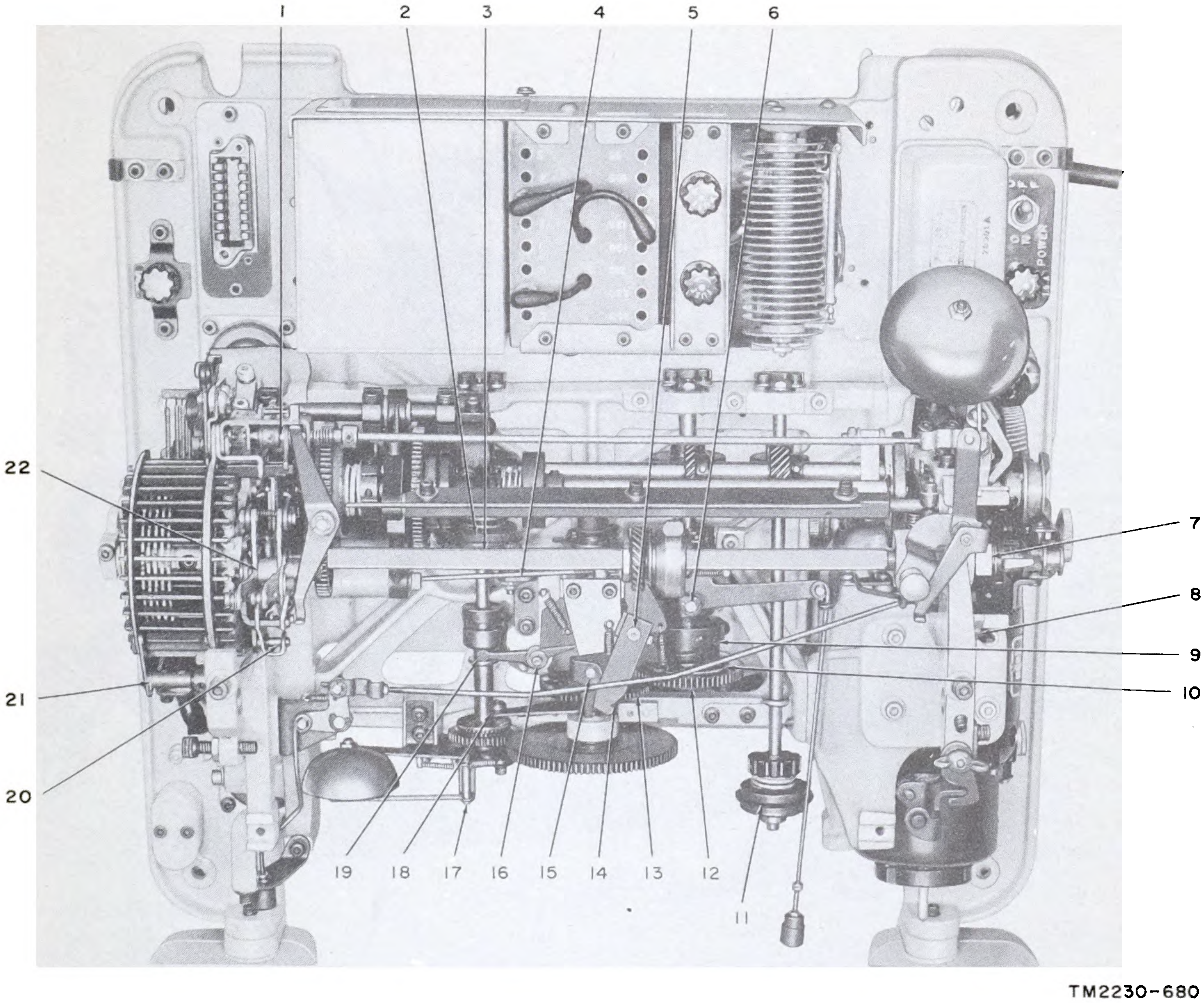
Fig. No.	Item No.	Name of part	Method and quantity
91	7	Square shaft bearings	Several drops at either end of both bearings.
91	8	Platen frame pivot bearings	Several drops between pivot and bearings.
91	14	Carriage rack drive shaft bearing	Several drops at both ends of bearings.
92	5	Function selecting arm bearing	Several drops at both ends of bearings.
92	6	Printing bail blade shaft bearings	Several drops at either end of both bearings.
93	19	Transfer lever shaft bearings	Several drops at either end of both bearings.
98	6	Stop latch post	Several drops at either end.
95	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
91	1	Stop bar shift blade	Apply sparingly to latching surface.
91	3	Square shaft	Thin film all sides, entire length.
91	4	Carriage feed pawl and ratchet wheel	Apply sparingly to teeth; 2 drops at each pawl pivot.
91	5	Carriage return operating mechanism	2 drops at each pivot point.
91	6	Manual carriage return mechanism	Apply sparingly to all pivots and rubbing surfaces.
91	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.
91	10	Carriage return safety clutch felt plates	Several drops around periphery of each washer.
91	12	Decelerating cam	Thin film on working surface.
91	15	Carriage return clutch latch lever	2 drops on pivot; thin film on working surfaces.
91	16	Carriage feed clutch lever	2 drops at pivot; thin film at each end.
91	17	Margin bell clapper and pawl	1 or 2 drops at each pivot point and at tip of pawl.
91	18	Carriage feed clutch	Apply sparingly to clutch teeth.
91	19	Carriage feed sliding clutch drum	Apply sparingly to rubbing surfaces.
91	20	Platen lower case latch	1 drop at pivot, apply sparingly to latching surface.
91	21	Code ring locking bail shaft	1 drop at blade and cam follower locking lever.
91	22	Function bell crank pivots	Several drops between levers and washers.
92	1, 2	Paper guide link	1 drop at each end.

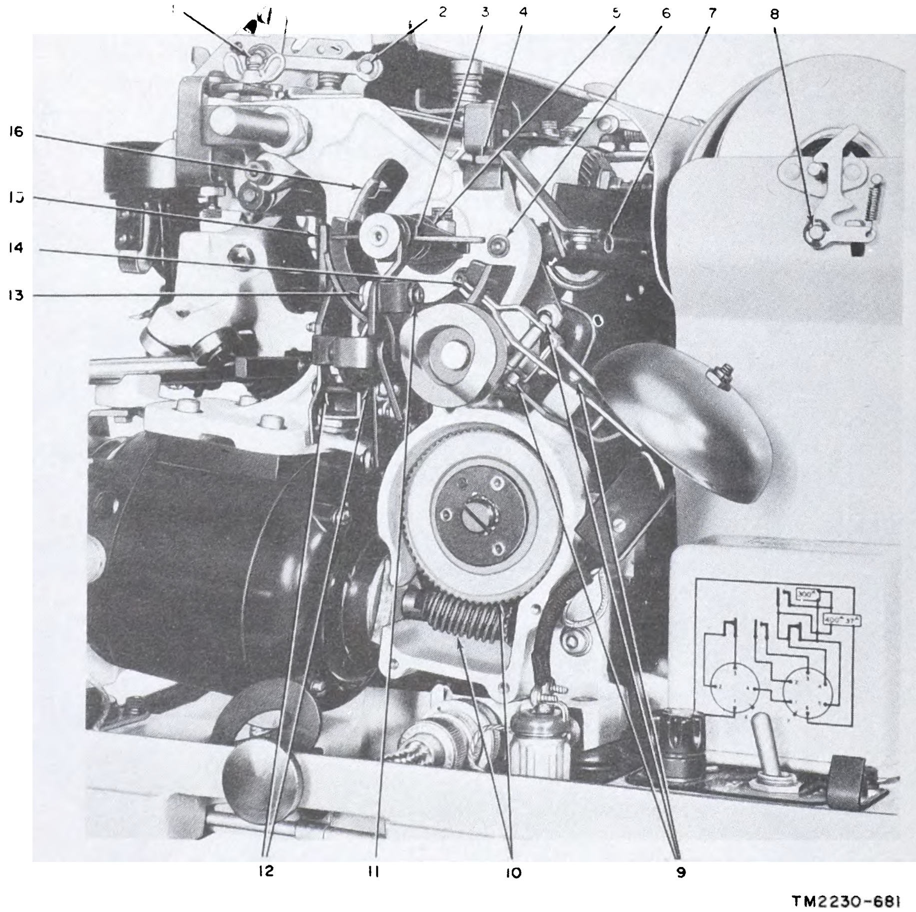
Fig. No.	Item No.	Name of part	Method and quantity
92	3	Function selecting arm	Apply sparingly to all working surfaces.
92	4	Stop bar shift lever	1 drop at pivot.
92	7	Stop bar shift link	Thin film.
92	8	Paper roller latch	1 drop at pivot.
92	9	Motor stop actuating lever and signal bell clapper pivots.	2 drops at each pivot point.
92	11	Function cam follower	Apply sparingly to cam groove and bearing of roller.
92	12	Unshift and carriage feed levers	2 drops at each pivot.
92	13	Support lever	2 drops at each pivot.
92	14	Function punch bars	Several drops between bars and guide block.
92	15	Platen latch	2 drops at pivot; thin film on working surface, each end.
92	16	Aperture gate	2 drops in notch; several drops between gate and guide block.
93	1	Printing bail blade	Thin film both sides, along entire edge.
93	3	Clutch spring	Apply sparingly to clutch spring.
93	5	Function driven gear	Several drops at bearing and clutch teeth.
93	8	Delaying lever	1 drop at pivot.
93	9	Line feed and figures connecting links	2 drops at each end of both links.
93	10	Line feed and figures bell crank pivots	Several drops each.
93	11	Line feed and figures cam follower pivots	2 drops each.
93	12	Delaying latch	1 drop at pivot; apply sparingly to latching surface.
93	14	Code rings	Thin film all along inner and outer working surfaces of each code bar.
93	15	Line feed and figures cam followers	Apply sparingly to rollers, pivots, and all rubbing surfaces.
93	16	Line feed, figures and sensing lever restoring cams.	Thin film on all exposed surfaces.
93	22	Clutch latch	Apply sparingly to roller and latching surfaces.
93	24	Carriage return blocking mechanism	1 or 2 drops at pivot; apply sparingly to latch surfaces.
93	27	Print cam follower	Apply sparingly to cam groove and bearing of roller and to spring hook.
94	1	Stop bars in code ring cage	2 drops at each end of all 35 stop bars.
94	2	Platen eccentric pivot	1 or 2 drops at pivot points.
93	3	Code ring locking shaft	1 drop at each pivot.
94	4	Detent wheel	Several drops at lever point; thin film on detent wheel teeth.
94	5	Single-double line feed lever	1 drop at pivot and detent surface.
94	6	T-lever	2 drops on bearing surface.
94	7	Code ring locking bail latching surface	Thin film on latching surface.
94	8	T-levers and separating washers	Apply sparingly to all rubbing and bearing surfaces.
94	9	Y-levers and detents	Apply sparingly to all rubbing and bearing surfaces.
94	10	Selector lever guide comb	Apply sparingly to all rubbing surfaces.
94	11	Selector magnet armature knife edge	Apply sparingly.
94	12	Selector levers, pivot bearings, and separating washers.	Apply sparingly to all rubbing and bearing surfaces.
94	13	Orientation lever pivot and range-finding cam	1 or 2 drops. Thin film on cam surface.
94	14	Grooved pin in end of selector camshaft	Several drops between pin and camshaft.
94	15	Selector cams and stop plate	Thin film on working surfaces.
94	16	Transfer lever latch	2 drops on pivot; thin film on latching surface.
94	17	Transfer lever restoring cam	1 drop on cam surface.
94	18	Transfer lever roller	Apply sparingly to working surfaces.
94	19	Antibounce clutch	Several drops in clutch.
95	2	Line feed pawl	2 drops at pivot.
95	3	Sprocket feet pins	1 drop on each pin.
95	5	Beam detent	1 drop at pivot; apply sparingly to latching surfaces.
95	6	Ribbon feed clutch	Apply sparingly to clutch teeth.

Fig. No.	Item No.	Name of part	Method and quantity
95	7	Ribbon drive shaft	Apply sparingly to bearings, cam surfaces, and gear teeth at both ends.
95	8	Ribbon sensing levers	1 or 2 drops at each bearing and pin.
95	9	Ribbon spool driving gears	Apply sparingly to annular groove, teeth, and driving jaws.
95	10	Ribbon spool drive shafts	1 or 2 drops at bearings top and bottom.
95	11	Ball bearing and guide rail	Apply sparingly to rolling surfaces.
95	13	Manual letters mechanism	Apply sparingly to all pivots and rubbing surfaces.
95	14	Carriage return bell crank and vertical link	2 drops at each pivot.
95	15	Armature shaft	1 drop at pivot.
96	1	Ribbon shaft lock	1 drop at handle pivots.
96	2	Ribbon guide	Thin film on sliding surfaces.
96	3	Hinge pin	2 or 3 drops at each pivot; apply sparingly to gear teeth.
96	5	Ribbon lifter bell crank	1 or 2 drops at pivots.
96	6	Connecting bars guide plate	1 or 2 drops at each guide plate.
96	8	Type selecting arm	Apply sparingly between arm and claw.
96	9	Ribbon lifter bracket	1 or 2 drops at each pivot.
96	10	Ribbon lifter pivot bearing	Thin film on sliding surfaces.
97	1	Key levers	1 drop at each pivot.
97	2	Space bar pivots	1 drop each.
97	3	Code bar and studs	Thin film all along notched edge of each bar. 2 or 3 drops in each groove.
98	1	Selector levers, bearings, and separating washers	Apply sparingly to all rubbing and bearing surfaces.
98	2	Transmitter camshaft contact pivot	2 or 3 drops between arm and pivot studs.
98	3	Sensing lever locking bail	1 or 2 drops on bail surface and between lever and comb.
98	4	Transmitter camshaft	Thin film on all cam lobes and stop teeth.
98	5	Sensing levers	Apply sparingly at working surfaces at each end of pivot.
98	7	Locking lever latch stud	2 or 3 drops at pivot points; thin film on latching surface.
98	8	Front key lever guide	1 drop in each key lever guide slot.
99	1	Governor adjustment lever	1 or 2 drops at each end.
99	2	Governor adjustment screw	Apply sparingly to entire thread.
99	3	Motor governor adjustment gear	Apply sparingly to gear teeth.
99	4	Governor worm	2 or 3 drops in governor hub opening.



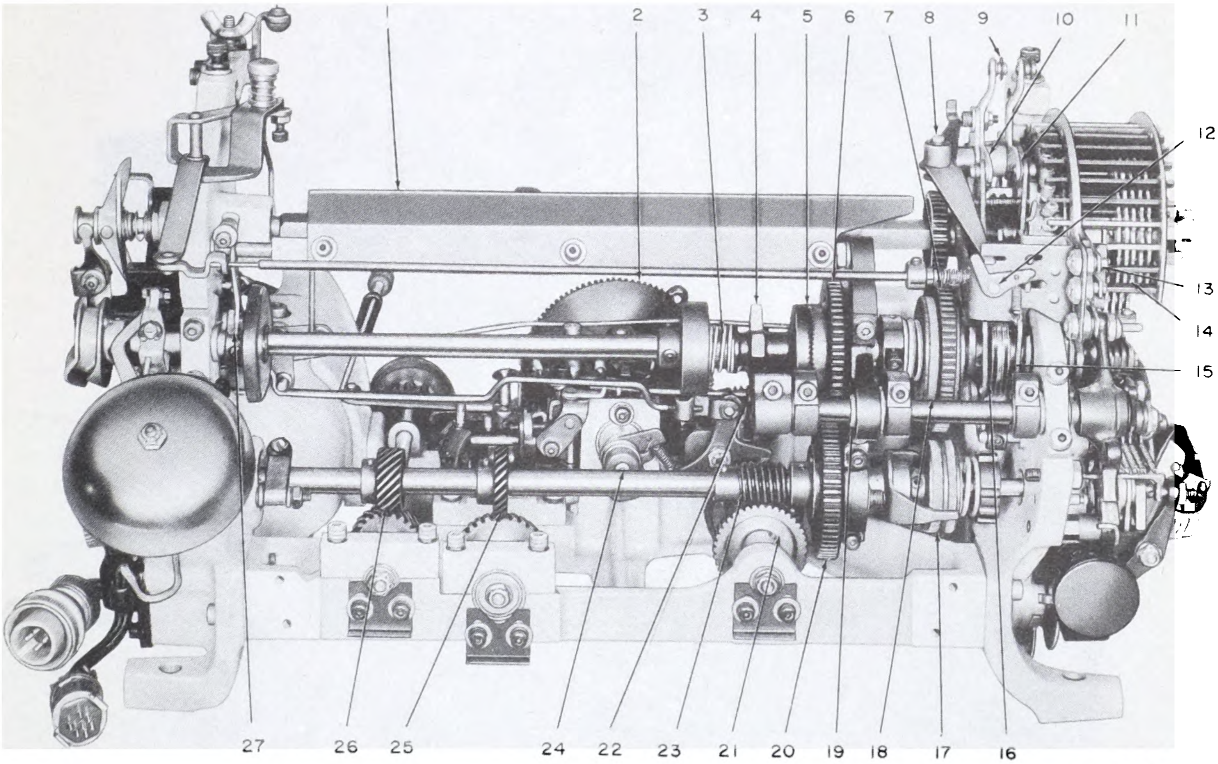
1 Stop bar shaft blade
2 Carriage feed friction clutch
3 Square shaft
4 Carriage feed pawl and ratchet wheel
5 Carriage return operating mechanism
6 Manual carriage return mechanism
7 Square shaft bearing
8 Platen frame pivot bearing
9 Carriage return sliding clutch drum
10 Carriage return safety clutch felt plate
11 Keyboard-transmitter friction clutch
12 Decelerating cam
13 Carriage return driven gear
14 Carriage rack drive shaft bearing
15 Carriage return clutch latch lever
16 Carriage feed clutch lever
17 Margin bell clapper and pawl
18 Carriage feed clutch
19 Carriage feed sliding clutch drum
20 Platen lower case latch
21 Code ring locking bail shaft
22 Function bell crank pivot

Figure 91. Carriage and platen of teleprinter, removed to show lubrication points.



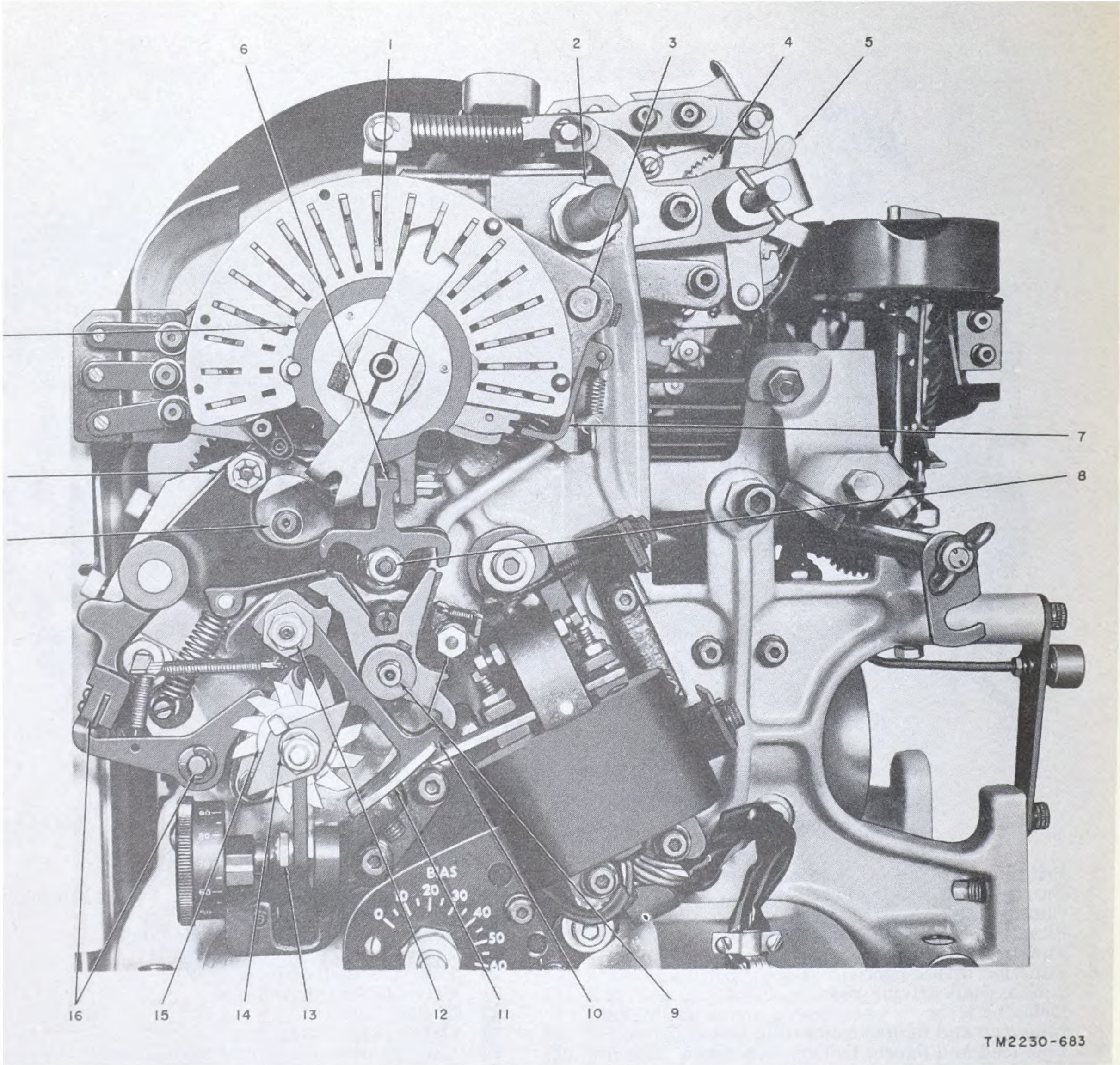
1 Paper guide link
2 Paper guide link
3 Function selecting arm
4 Stop bar shift lever
5 Function selecting arm bearing
6 Printing bail blade shaft bearing
7 Stop bar shift link
8 Paper roller latch
9 Motor stop actuating lever and signal bell clapper pivot
10 Main shaft driving gear (inside cover)
11 Function cam follower
12 Unshift and carriage feed lever
13 Support lever
14 Function punch bar
15 Platen latch
16 Aperture gage

Figure 92. Teleprinter, motor side, showing lubrication points.



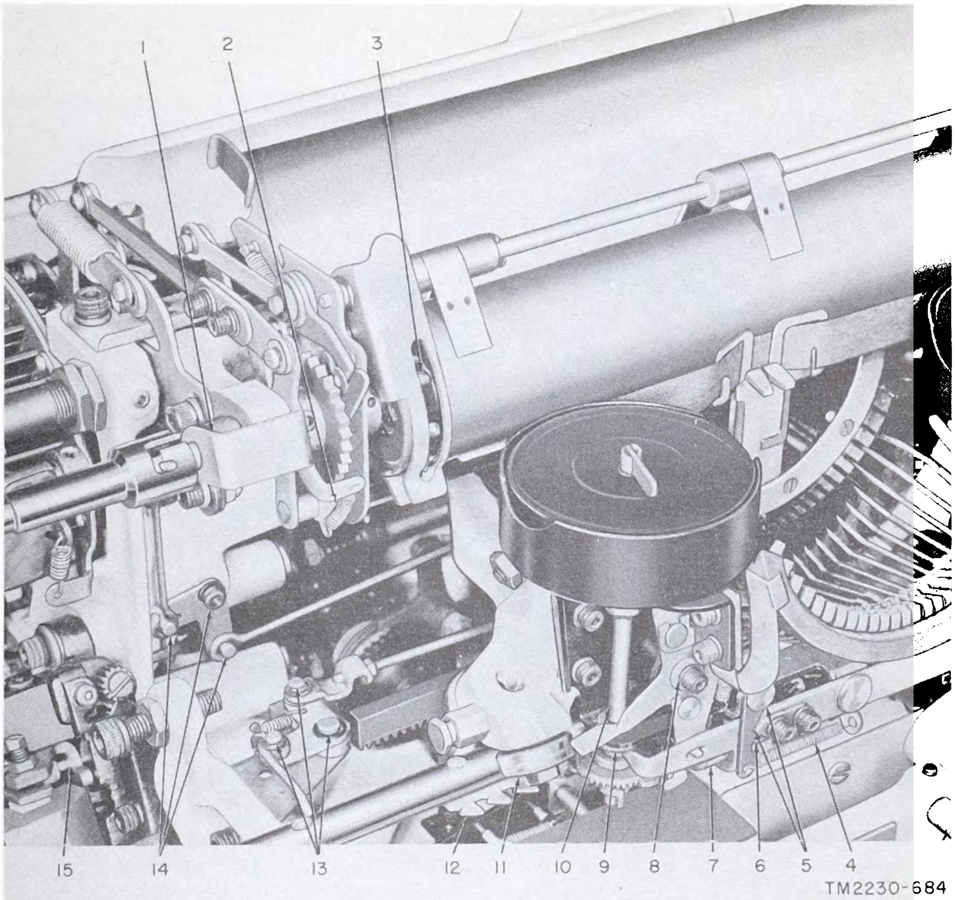
1	Printing bail blade	15	Line feed and figures cam followers
2	Carriage rack driving gear	16	Line feed, figures, and sensing lever restoring cams
3	Clutch spring	17	Selector friction clutch
4	Function shaft sliding clutch drum	18	Square shaft driving friction clutch
5	Function driven gear	19	Transfer lever shaft bearing
6	Function driven gear	20	Function shaft driving gear
7	Square shaft driving gear	21	Carriage feed driven gear
8	Delaying lever	22	Clutch latch
9	Line feed and figures connecting links	23	Carriage feed worm gear
10	Line feed and figures bell crank pivots	24	Carriage return blocking mechanism
11	Line feed and figures cam follower pivots	25	Carriage return drive shaft drive gear
12	Delaying latch	26	Transmitter shaft drive gear
13	Code ring cage	27	Print cam follower
14	Code ring		

Figure 93. Teleprinter, rear view, showing lubrication points.



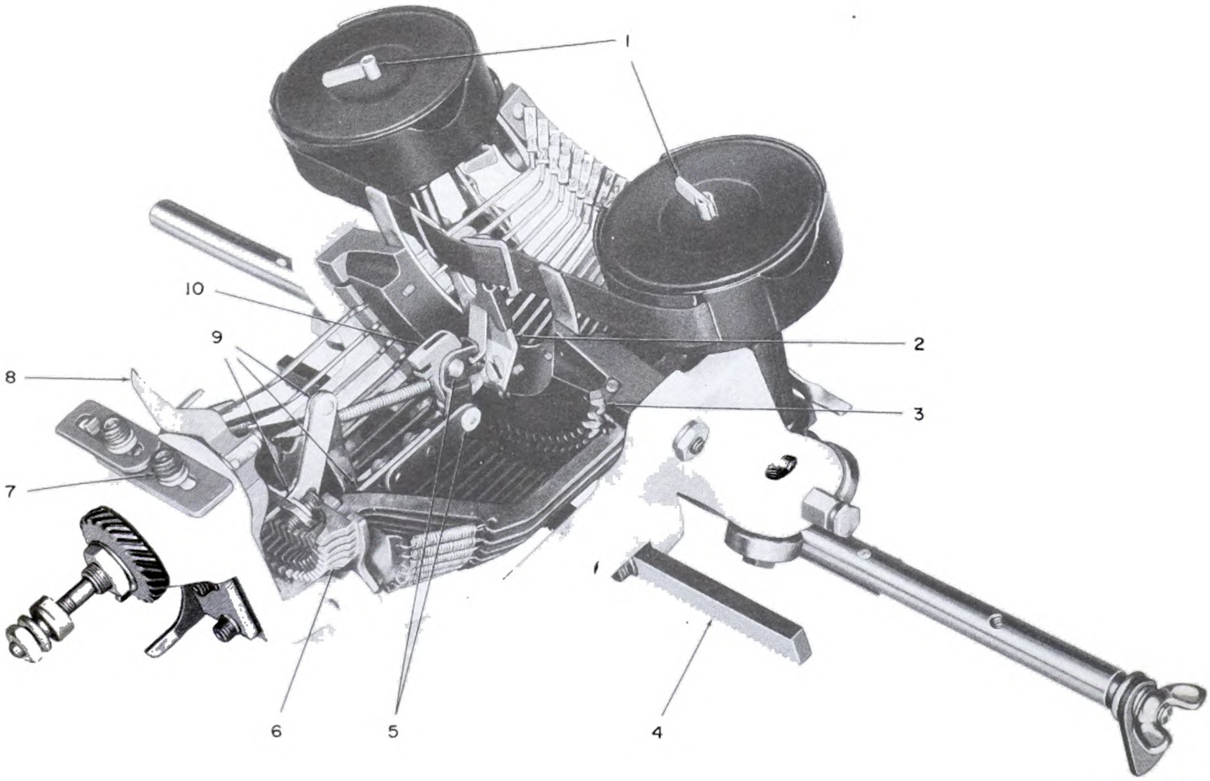
1 Stop bars in code ring cage
2 Platen eccentric pivot
3 Code ring locking shaft
4 Detent wheel
5 Single-double line feed lever
6 T-lever
7 Code ring locking bail latching surface
8 T-lever and separating washer
9 Y-lever and detent
10 Selector lever guide comb
11 Selector magnet armature knife edge
12 Selector lever, pivot bearing, and separating washer
13 Orientation lever pivot and range-finder cam
14 Grooved pin in end of selector camshaft
15 Selector cam and stop plate
16 Transfer lever latch
17 Transfer lever restoring cam
18 Transfer lever roller
19 Antibounce clutch

Figure 94. Teleprinter, selector side, showing lubrication points.



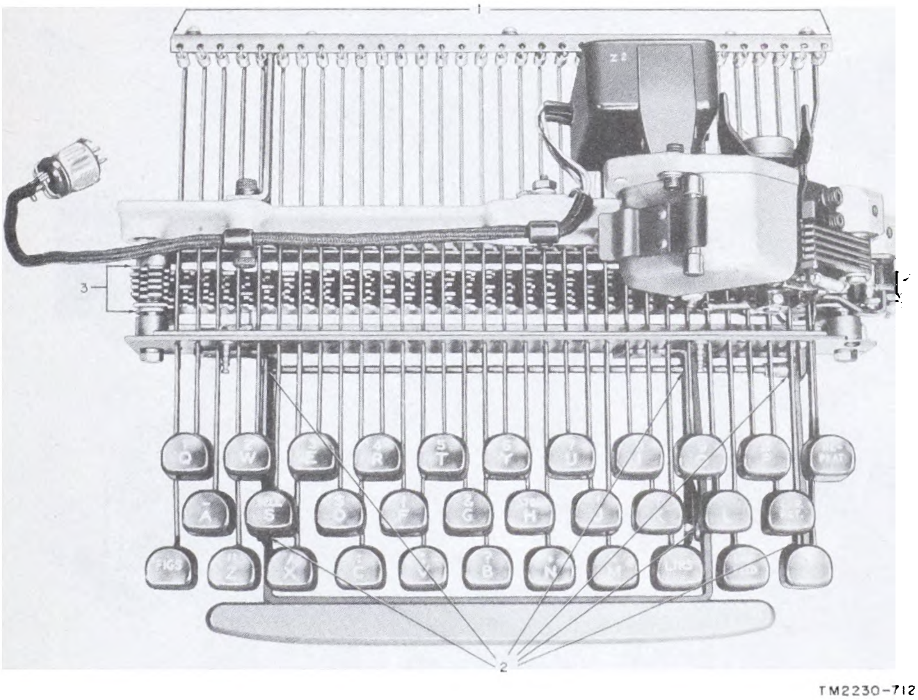
1 Platen shaft bearing
2 Line feed pawl
3 Sprocket feed pin
4 Ribbon drive gear
5 Beam detent
6 Ribbon feed clutch
7 Ribbon drive shaft
8 Ribbon sensing lever
9 Ribon spool driving gear
10 Ribbon spool drive shaft
11 Ball bearing and guide rail
12 Guide rail
13 Manual letters mechanism
14 Carriage return bell crank and vertical link
15 Armature shaft

Figure 95. Teleprinter, left front view, showing lubrication points.



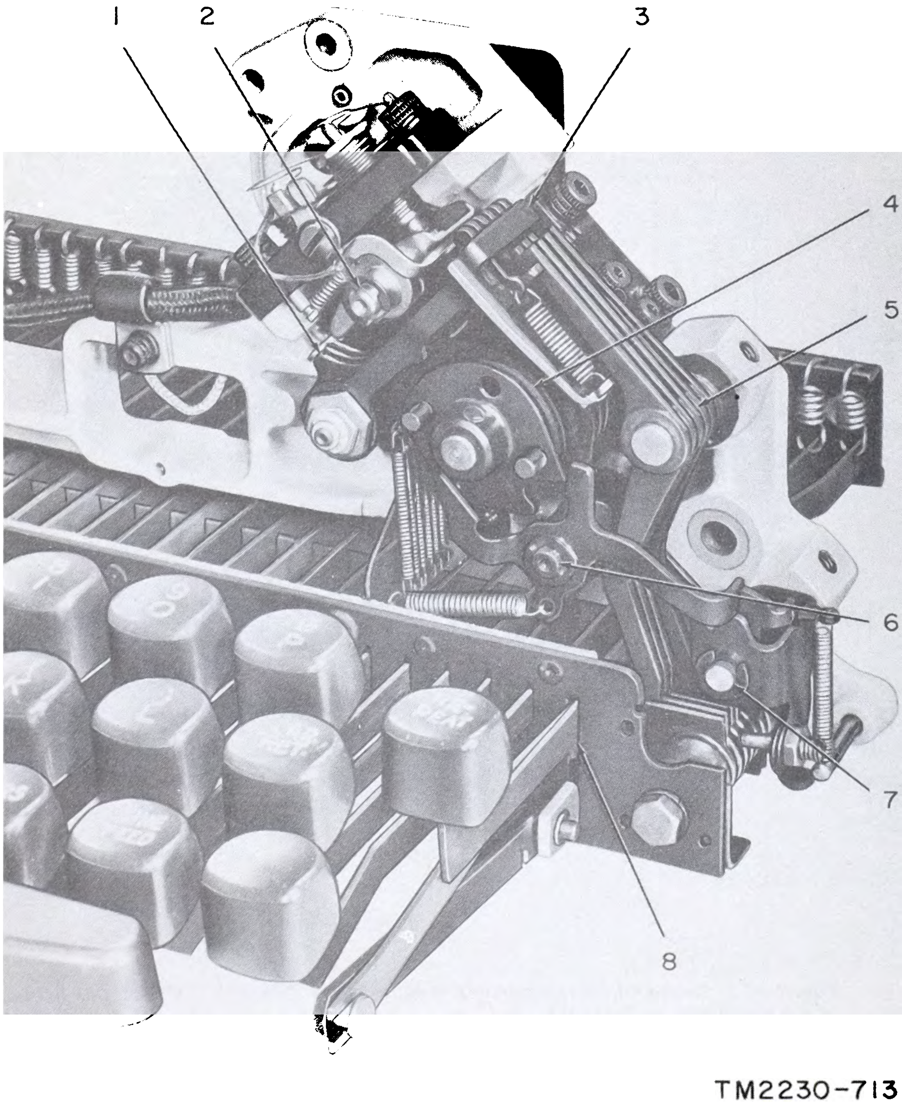
1 Ribbon shaft lock
2 Ribbon guide
3 Hinge pin
4 Carriage feed and return driving rack
5 Ribbon lifter bell crank
6 Connecting bar guide plate
7 Type selecting arm bearing cap
8 Type selecting arm
9 Ribbon lifter bracket
10 Ribbon lifter pivot bearing

Figure 96. Teleprinter, rear view, showing lubrication points.



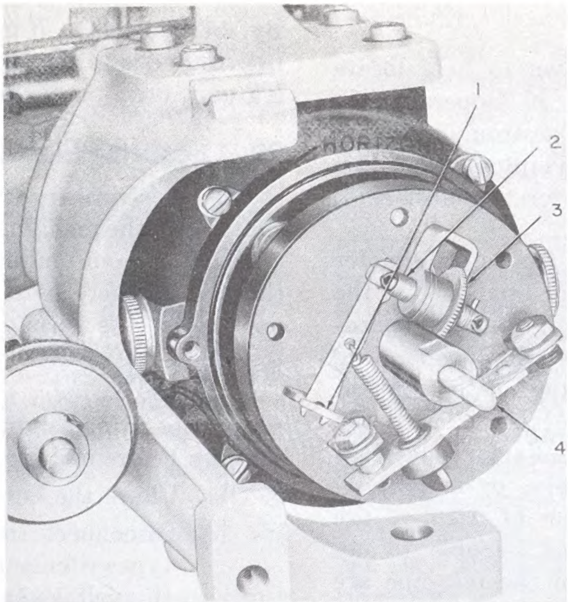
1 Key lever
2 Space bar pivot
3 Code bar and stud

Figure 97. Keyboard transmitter, top view, showing lubrication points.



1 Selector lever, bearing, and separating washer
2 Transmitter camshaft contact pivot
3 Sensing lever locking bail
4 Transmitter camshaft
5 Sensing lever
6 Stop latch cam post
7 Locking lever latch stud
8 Front key lever guide

Figure 98. Keyboard transmitter, right front view, showing lubrication points.



1 Governor adjustment lever
2 Governor adjustment screw
3 Motor governor adjustment gear
4 Governor worm

Figure 99. Governor of series-governed motor, showing lubrication points.

Section IV. WEATHERPROOFING

94. Weatherproofing Procedures

Teletypewriter Sets AN/FGC–20, AN/FGC–20X, and AN/FGC–21 have been moistureproofed and fungiproofed at the time of manufacture. During overhaul of the equipment, moistureproof and fungiproof the equipment in accordance with current directives.

95. Special Lubrication Precautions

When operating the equipment under adverse climatic conditions, pay special attention to all lubrication instructions. In extremely dry areas, protect the equipment against dust and sand. Carefully clean all lubrication points before applying fresh lubricants.

96. Rustproofing and Painting

a. If the finish on painted portions of the teleprinter 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 the teleprinter, because very small particles of steel wool may enter the electrical parts and cause internal shorting and grounding of circuits.

b. When retouching 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. Place protective masking over areas that do not require paint or where paint may cause damage; then spray paint the entire surface.

97. General

This section gives information to help locate and correct sources of trouble in inoperative or malfunctioning teleprinters. The troubleshooting charts (par. 101) lists the symptoms, possible causes, and corrective actions for the most common troubles.

a. Knowledge Requirements. The troubleshooter must have a thorough understanding of the operation of the receiving unit and keyboard-transmitter. The symptoms of many operating failures often indicate the location of the fault to personnel who are thoroughly familiar with the operation of the mechanisms. Faulty operation can be caused by wear, damage, or maladjustment of any of a large number of parts in the unit. The troubleshooter must be able to determine quickly which parts of the machine are affected, whether the trouble is electrical or mechanical, and the exact cause of the trouble.

b. Sectionalizing Trouble. Sectionalizing trouble in the teleprinter means the determination of whether the trouble is caused by a fault in the electrical circuits or the mechanical assemblies, and localizing the trouble to one of the operating components of the teleprinter. Further sectionalization can then be done to determine the malfunctioning part of the faulty component.

c. Localizing Trouble. After the source of trouble has been sectionalized to one of the operating components, the next procedure is to isolate the particular mechanical or electrical element at fault. The troubleshooting charts list the more specific causes for common troubles. Use these charts when attempting to isolate the trouble.

98. Sectionalizing Trouble to Major Component

When trouble occurs, substitute a teleprinter known to operate properly, if one is available. If the line circuit then operates properly, it may be concluded that the trouble is in the teleprinter removed from the line; if the circuit does not operate properly, the trouble may be found in distant equipment or in the line. If another teleprinter is not available, make other tests (pars. 99 and 100) to determine whether the trouble is on the line or in the teleprinter. If the trouble is found to be in the teleprinter, its location may be facilitated by sending to and receiving from another teleprinter, or by using a local test circuit. By this procedure, it may be ascertained whether the trouble is in the keyboard transmitter, receiving unit, or in parts common to both sections.

99. Localizing Electrical Troubles

Most electrical troubles are found at the various contacts in the machine. Electrical circuits in the teleprinter have binding posts and connectors at the points where most tests must be made. Do not disturb the wiring more than necessary when testing or inspecting.

a. Power Supply Checks. To be sure that proper operating conditions exist, check the power supplies before making other tests.

(1) Check the line-current supply.

(2) Disconnect the power cord of the teletypewriter and use a voltmeter to check the voltage supply.

b. Use of Test Circuit. Place the LINE SELECTOR switch in the TEST position. This connects a teleprinter in a local test circuit that is convenient for determining whether the sending or receiving circuits are defective and for making tests of operating performance.

(1) When power is applied, current should flow and the teleprinter should run closed, indicating that the sending and receiving circuits are complete. If no current flows, one or both of these circuits probably are open. To test the continuity of the send circuit, remove transmitter plug P5 (figs. 253 and 254) and short circuit the sending circuit at terminals A and B of jack J5. If this action causes the machine to run closed, an open circuit is present in the transmitter. To test the receive circuit, apply a continuity test as described in *c* below.

(2) To test for short circuits within a faulty teleprinter when no open circuit is indicated, send the letters R and Y from the keyboard transmitter. If the receiving mechanism does not appear to receive impulses from the transmitter, the sending circuit may be shorted internally. If the receiving mechanism runs open when current flows in the test circuit, the receiving circuit may be shorted internally. To further localize the cause of such a short circuit, refer to *d* below.

c. Continuity Testing. The continuity test is used to locate an open circuit by trying to complete a circuit through suspected parts. Multimeter TS–297/U or a lamp connected to a battery that will conveniently indicate a closed circuit may be used for this test. When making continuity tests, make sure parallel current paths are disconnected. Make the tests by connecting the test leads so that current can only go through the suspected circuit. Be sure no other part of the circuit is shunting the part being tested. If necessary, disconnect certain leads. Check all likely causes in this manner. If, after checking all probable causes, the fault cannot be located, make a continuity check of the whole circuit. Test from one terminal to a halfway point in the circuit; if continuity is indicated, check the other half. Continue this process of dividing the circuit into smaller parts until the open circuit definitely is located.

d. Testing Capacitors. Capacitors may cause trouble by being shorted or by leaking. To test, discharge the capacitor with an insulated shorting jumper, disconnect one lead, and connect the capacitor to an ohmmeter (using the highest reading scale).

(1) A good capacitor will be indicated by the ohmmeter pointer first moving up the scale rapidly, then returning slowly toward the infinity mark.

(2) A capacitor in an open circuit will give a reading of infinite ohms; shorted capacitors will give readings of constant value between zero and infinity, depending on the resistance of the short.

Caution: Be extremely careful when handling charged capacitors. A severe electrical shock may be received from the capacitor or from leads connected to a power supply in operation.

100. Localizing Mechanical Troubles

Although many mechanical troubles can occur in a teleprinter, no difficulty should be experienced in locating the fault if the sequence of operations is carefully checked through its various steps.

a. Method of Checking Operating Sequences. A convenient way of checking the operating sequences is to disconnect power from the motor (with DC POWER switch in the ON position and LINE SELECTOR switch in TEST position. Turn the motor by hand to make the mechanical components of the teleprinter work slowly. Press any key on the keyboard transmitter and, as the motor is turned slowly, each impulse can be checked at the keyboard transmitter, the selector mechanism, and on a line-current meter. Continued turning of the motor will permit the troubleshooter to observe the transfer, type selecting, printing, and all other operations to be observed as desired. (To disengage the function-shaft clutch drum completely may require more momentum than can be gained manually.) This allows every procedure of the operating cycle to be checked. This procedure 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 sending of each impulse then can be checked visually against the operation of the receiving mechanism. To *send,* depress the key for the signal desired and turn the motor.

101. Troubleshooting Charts

The most common failures in the teleprinters, together with the probable cause of the trouble and the corrective actions to be taken, are listed in *a* and *b* below. Both electrical and mechanical troubles are listed in the order of importance. Although several probable causes are given for most troubles, all of these may not occur at the same time. The troubleshooter must determine which cause applies to the particular situation being investigated.

Caution: Be sure the LINE CURRENT control is in the counterclockwise position before connecting power.

a. Keyboard Transmitter Trouble Chart.

Condition	Probable trouble	Correction
Cannot send sequential signals from keyboard transmitter.	Send plug disconnected	Connect plug.
	Keyboard transmitter contacts out of adjustment.	Adjust contacts (par. 266).
	Keyboard-transmitter plug disconnected.	Connect keyboard-transmitter plug.
	Keyboard-transmitter friction clutch out of adjustment.	Adjust friction clutch (par. 269).
	Cam stop lever binding	Clean cam stop lever.

a. *Keyboard Transmitter Trouble Chart*—Continued

Condition	Probable trouble	Correction
Transmitter camshaft rotates continuously.	Locking lever latch spring missing or broken.	Replace locking lever latch spring.
	Universal bar adjusting screw out of adjustment.	Adjust setting of universal bar adjusting screw (par. 268).
	Repeat blocking lever spring broken or missing.	Replace repeat blocking lever spring.
Sequential transmitter mechanism transmits garbled copy.	Friction clutch dry or out of adjustment.	Lubricate (par. 92) and adjust (par. 269). Replace felt disks if necessary.
	Sequential transmitter contacts dirty or out of adjustment.	Clean and adjust transmitter contacts (par. 266).
	Contact bail spring weak	Replace contact bail spring.
	Binding in selector levers or sensing levers.	Clean and adjust sensing levers and selector levers (par. 265).
	Sensing lever locking bail spring weak or missing.	Replace sensing lever locking bail spring.
Keyboard transmitter operates properly, but causes noise on local radio receivers.	Faulty rf filter	Check filter; replace if defective.
	Faulty rf filter connections	Check and replace defective bonding straps; tighten connections.

b. *Page Printing Mechanism Trouble Chart.*

Condition	Probable trouble	Correction
Motor fails to start	POWER fuse blown	Replace fuse 1.6 amp (fig. 11).
	Failure of power source	Correct defect or use another power source.
	Motor stop contacts dirty or do not close.	Clean and burnish motor stop contacts (par. 85).
	Dirty commutator on motor	Clean commutator (pars. 86*e* and 116).
	Defective motor brushes	Replace brushes (par. 115).
	Open in field or armature winding	Replace motor.
	Dry friction clutches or mechanical binding.	Locate and correct trouble in mechanism.
Motor runs but speed is erratic	Governor contacts dirty or pitted	Clean, burnish, or replace contacts.
	Governor spring broken	Replace spring.
	Motor stop contacts weak or broken	Install new motor stop contacts.
	Dirty commutator on motor	Clean commutator.
Receiving unit runs open (mechanism runs when line current should be steady marking).	Line circuit fuse blown	Replace fuse.
	External line circuit open or shorted	Check line from teleprinter terminals for continuity or short.
	No line current or low line current	Correct or replace source of voltage. Adjust line increase resistor.
	Space instead of mark impulses received	Reverse line leads.
	Receiving circuit open or shorted	Check for continuity or short and repair fault.
	Sending circuit open	Check circuit continuity and repair fault.
	Selector magnet armature not holding stop lever.	Readjust selector mechanism (pars. 172–200).
	Transfer lever latch spring broken	Replace transfer lever latch spring.
	Selector camshaft stop plate or stop lever worn or broken.	Replace stop plate or stop lever.
Receiving unit prints errors or scrambles letters and functions.	Range-finder dial assembly improperly set.	Adjust range-finder dial assembly.
	Sending contacts dirty or pitted	Clean, burnish, or replace sending contacts.

Condition	Probable trouble	Correction
Receiving unit prints errors or scrambles letters and functions—Continued	Selector camshaft or transmitter camshaft friction clutch slipping.	Adjust friction clutch (par. 206).
	Dirty, binding, or sticking selector mechanism.	Clean or adjust selector parts (pars. 172–200).
	Worn or broken Y- or T-levers	Replace defective levers.
	Selector camshaft stop plate loose	Replace worn parts.
	Selector lever spring broken	Replace selector lever spring.
	Square shaft friction clutch slipping	Adjust friction clutch (par. 206).
	Selector magnet mounting loose	Readjust and tighten mounting screws (pars. 172–200).
	Type arm or function selecting arm loose.	Readjust and tighten selecting arms (par. 228).
Receiving unit prints same character or performs same function regardless of signals being sent.	Transfer lever latch spring or transfer lever spring broken.	Replace a broken spring.
	Antibounce clutch jammed	Replace antibounce clutch.
	Function selecting arm sticking in punch bar guide block.	Clean and readjust if necessary.
Certain characters (or functions) will not print (or operate).	Stop bar sticking	Clean stop bar guide plate and code rings.
	Stop bar spring broken or missing	Replace spring.
Receiving unit operates, but range (range-finder measurement) is narrow.	Line current too high or too low	Readjust line current.
	Bias potentiometer improperly set	Check and adjust the resistance of the bias potentiometer.
	Motor speed incorrect at transmitter	Have transmitter motor speed checked.
	Selector mechanism improperly adjusted.	Make complete adjustment of selector mechanism (pars. 172–200).
Receiving unit prints, but causes noise on local radio receivers.	Faulty rf filter	Check filter; replace if defective.
	Faulty rf filter connections	Check and replace defective bonding straps; tighten connections.
Receiving unit prints but sticks in print position.	Type bar connecting spring weak or missing.	Replace type bar connecting spring.
	Print mechanism binding	Clean and adjust print mechanism.
Platen will not shift	Figures sensing lever spring broken	Replace spring.
	Platen shift arm mounting loose	Readjust arm and tighten mounting screws (par. 239).
	Figures shift sensing lever or cam follower bent or broken.	Replace defective parts.
Platen will not unshift	Function aperture gate stuck	Clean function group parts.
	Signal bell or motor stop punch bar stuck in operated position.	Clean function group parts.
Platen cannot be prevented from returning to figures or is erratic.	Cam follower stop collar on mounting stud dirty or improperly placed.	Clean and adjust collar (par. 182).
	Line feed and figures shift cam follower spring broken.	Replace broken line feed and figures shift cam follower spring.
Carriage will not feed	Carriage feed link improperly adjusted.	Readjust link (par. 241).
	Carriage feed clutch slipping	Readjust clutch; replace felts if necessary (par. 248).
	Driving collar loose	Tighten setscrews.
	Carriage feed clutch lever spring broken.	Replace spring.
	Ribbon-driving mechanism jammed	Readjust ribbon-driving mechanism (par. 253).
Carriage does not feed properly	Carriage return link improperly adjusted.	Adjust link (par. 216).

Condition	Probable trouble	Correction
Carriage does not feed properly—Con.	Carriage feed pawl spring broken	Replace spring.
Carriage return function inoperative	Carriage return link improperly adjusted.	Adjust link (par. 216).
	Carriage return sensing lever spring broken.	Replace spring.
	Carriage return clutch mechanism out of adjustment.	Adjust carriage return mechanism (pars. 215–223).
Carriage does not make complete return.	Latch-tripping arm improperly adjusted.	Readjust latch-tripping arm (par. 212).
	Mechanism binding	Clean and adjust carriage mechanism.
Line feed function does not operate	Line feed sensing lever spring broken	Replace spring.
	Line feed pawl spring broken	Replace spring.
	Line feed detent stuck	Clean detent parts.
Line feed occurs on every operation or is erratic.	Cam follower stop collar and stud dirty or stop collar improperly placed.	Clean collar and stud and reset collar if necessary.
	Line feed and figures shift cam follower spring broken.	Replace spring.
Signal bell does not ring	Clapper bent	Straighten clapper.
	Signal bell punch bar sticks	Clean function group parts.
Motor stop fails to operate	Motor stop contact bracket improperly adjusted.	Readjust position of bracket (par. 261).
	Motor stop contacts bent or broken	Replace defective parts.
	Motor stop function lever binding	Clean and lubricate pivot and bearings.
	Motor stop punch bar sticks	Clean function group parts.
Only part of characters print	Ribbon lifter not raising far enough	Adjust ribbon lifter (par. 250).
	Stop screw for platen arm not properly adjusted.	Adjust platen arm stop screw (par. 238).
Printing too light or too heavy	Round nut on type selecting arm properly adjusted.	Adjust round nut (par. 250).
Lines are not printed straight	Platen arm stop screw loose	Tighten stop screw.
	Platen casting eccentric mounting screw not properly adjusted.	Adjust platen casting eccentric mounting screws (par. 234).
Margins printing unevenly	Carriage return blocking mechanism improperly adjusted.	Adjust carriage return blocking mechanism (par. 220).
Ribbon lifter not working properly	Broken lifter tension spring	Replace spring.
	Dirty, bent, or broken parts	Clean and replace broken parts.
Ribbon does not feed or does not reverse.	Ribbon spool not seated correctly on driving collar or collar loose on shaft.	Check seating of spool and tighten collar setscrew.
	No spring tension on ribbon feed clutch	Reset collar for proper spring tension (par. 254).
	Bevel gears not meshing	Replace weak detent spring.
	Ribbon reversing sensing lever bent, dirty, or has broken spring.	Clean, adjust, and replace parts as necessary.
Margin bell does not ring properly	Margin bell pawl tripping arm improperly set or pawl broken.	Reset arm or replace broken part.
	Pawl spring broken	Replace pawl spring.
	Clapper spring broken	Replace clapper spring.
	Clapper bent	Straighten clapper.
Paper tension roller cannot be released.	Pin on roller bent or broken	Replace defective pin.
	Paper release mechanism binding	Clean and adjust mechanism (par. 233).
Receiving unit emits grinding or whining noise.	Motor drive gears improperly meshed	Adjust position of motor.
	Fouled bearings in motor, main shaft, or function shaft.	Clean and lubricate or replace bearings if necessary.
	Motor shaft or main shaft bent	Replace bent shaft.

Section VI. REMOVAL AND REPLACEMENT OF TELEPRINTER COMPONENTS

102. General

a. This section describes replacement procedures required to overhaul completely a defective or inoperative teleprinter. Procedures include replacement of all parts of the unit except those parts for which the procedure is obviously simple.

b. All repairs should be made by personnel thoroughly trained in teleprinter maintenance. Equipment operating with minor faults may fail complete as the result of efforts by inexperienced personnel to correct apparently simple defects.

c. Follow the inspection, cleaning, and lubrication instructions given in paragraphs 85 through 93. Whenever repairs are made, the teleprinter should be completely readjusted in accordance with paragraphs 171 through 274.

103. General Disassembly Procedure

a. Preparation for Disassembly. Take the following preparatory procedures before starting to disassemble the teleprinter.

(1) Arrange a clean place on a bench or table to work. Be certain that dust or dirt will not fall or be blown into the mechanism while it is being disassembled.

(2) Obtain several small, clean cardboard, wood, or metal containers to store removed parts.

(3) Arrange the necessary tools and materials so that they will be readily accessible during the progress of the repair work.

b. Disassembly Procedure.

(1) Disconnect the power and signal line connections from the teleprinter.

(2) Remove the dust cover.

(3) Remove the inking ribbon and paper from the teleprinter.

(4) Disassemble the various parts and assemblies; use the correct tool for each specific operation. Do not disassemble the teleprinter or its assemblies beyond the point necessary to thoroughly inspect and clean the mechanism, and to repair and replace any parts.

(5) When small parts are disassembled, place them in a container and mark them to identify their origin. Vary the sequence of disassembly to meet **any** particular situation. Use the procedure that will require the least amount of time without sacrificing quality.

104. General Reassembly Procedures

Reassemble all parts, subassemblies, and units in accordance with the following provisions:

a. Replace all worn or broken parts that cause malfunctioning of the teleprinter and adjust them according to the directions in the appropriate paragraphs. 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. Many of the threaded holes are tapped into aluminum or magnesium alloy castings and will be stripped if too much force is used. When installing screws in aluminum or magnesium alloy castings, treat them with Antiseize Compound (CE–52–2724.5000.080) before installation.

c. Be careful to replace the correct springs in the friction clutches. The springs are similar in appearance; they are not identical. Improper assembly could result in faulty operation and cause premature failure of the clutches.

d. Be sure to install tapered pins so that the taper of the hole in the shaft and the hole in the part being pinned is 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 a part on a shaft by means of setscrews, remove the setscrews from the part. Sight down the tapped hole in the part to make sure the hole is in line with the flat on the shaft. Many parts are secured to the shaft by means of two setscrews. In such cases, be sure *both* tapped holes are alined with flats on the shaft.

f. Some bent and distorted parts may be restored to shape and re-used, 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.

105. Removal and Replacement of Teleprinter Chassis

(fig. 100).

a. Removal.

(1) Remove the selector magnet and keyboard transmitter plugs from the receptacle connectors at the left of the printer base. 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 printer base.

(3) Tilt the left side of the printer base upward and disconnect the cannon-type plug connector from the receptacle connector in the 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 printer base. Lift the ends of the four grounding leads free from the mounting screws.

(5) Remove the teleprinter chassis from the base by lifting upward and forward.

b. Replacement.

(1) Position teleprinter chassis on the four vibration mounts on the teleprinter base.

(2) Install the four lockwashers, ground leads, and plain washers on the four socket head screws; install the four screws to hold the teleprinter chassis to the vibration mounts.

(3) Tilt the left side of the teleprinter base upward and connect the cannon-type plug connector to the receptacle connector in the teleprinter base.

(4) Connect the motor stop plug to the receptacle connector at the right rear of the teleprinter base.

(5) Connect the keyboard transmitter and selector magnet plugs to the receptacle connectors at the left of the teleprinter base.

106. Removal and Replacement of Keyboard Transmitter

a. Removal.

(1) Remove the teleprinter from the teleprinter base (par. 105*a*).

(2) Remove the two socket head screws and lockwashers that hold the keyboard frame to the teleprinter frame, and remove the keyboard-transmitter assembly.

b. Replacement.

(1) Position the keyboard transmitter on the teleprinter frame. Engage the keyboard transmitter clutch yoke with the transmitter friction clutch and secure the keyboard frame to the teleprinter frame with two socket head screws and lockwashers.

(2) Replace the teleprinter on the teleprinter base (par. 105*b*).

107. Disassembly and Reassembly of Transmitter Contacts

(fig. 101)

a. Disassembly.

(1) Remove the two machine screws (1) and internal tooth lockwashers (2). Remove the contact cover (3).

(2) Remove the two machine screws (4) and two lockwashers (5) that attach the contact mounting (15) to the keyboard frame.

(3) Unhook the end of the contact bail spring (6) from the spring post on the contact mounting (15) and the other end from the hole in the transmitter contact (9).

(4) Remove the machine screw (7), internal tooth lockwasher (8), and the two electrical terminal lugs from the side of the contact mounting (15).

(5) 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).

(6) Unsolder the two spiraled electrical wires (14) from the top of the transmitter contacts (13). Remove the spiraled electrical wire and transmitter contact terminal assemblies from the contact mounting (15).

(7) Remove the two transmitter contacts (13) from the contact mounting (15).

b. Reassembly.

(1) Install the two transmitter contacts (13) in the contact mounting (15) at approximately the correct contact spacing (par. 266).

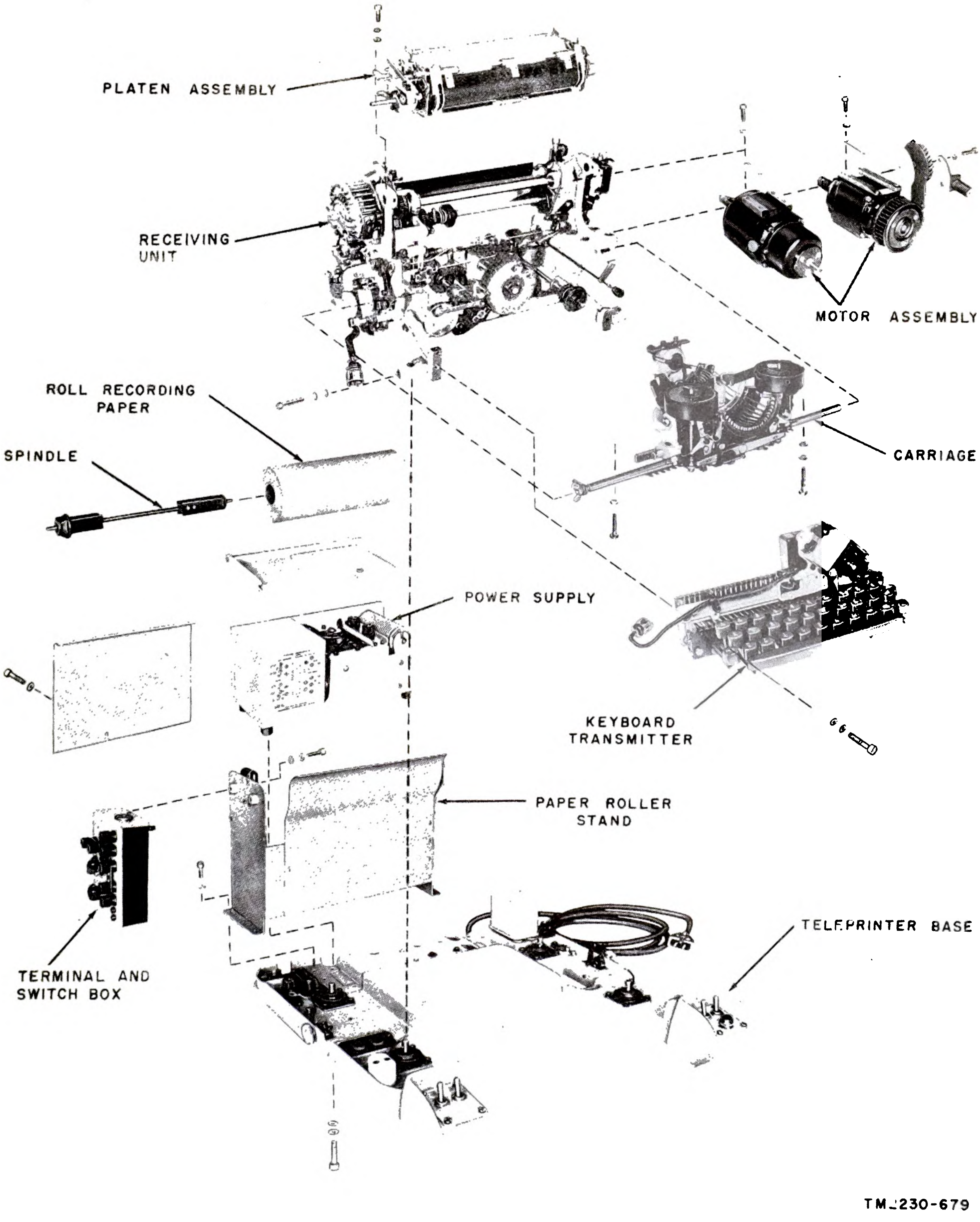


Figure 100. Teleprinter, functional groups.

(2) Position the two transmitter contact terminals (12) and the spiraled electrical wires (14). Solder the ends of the spiraled electrical wires in the slots in the top of the contact plungers.

(3) Insert the transmitter contact terminals (12) in the threads of the transmitter contacts (13), ½ to 1½ threads above the contact mounting (15). Position the two internal tooth lockwashers (11) and hold the transmitter contact terminals (12) in place with the two machine screws (10), but do not tighten them.

(4) Fasten the terminal lugs on the side of the contact mounting (15) with the internal tooth lockwasher (8) and the machine screw (7).

(5) Hook one end of the contact bail spring (6) in the hole in the transmitter contact (9) and the other end on the spring post on the contact mounting (15).

(6) Position the contact mounting (15) on the frame of the machine so that the contacts are in correct alinement. Attach the contact mounting (15) with two lockwashers (5) and two machine screws (4). Adjust the contact (13) as directed in paragraph 266 and tighten the machine screws (10).

(7) Position the contact cover (3) over the contact mounting (15); secure the cover to the frame with two internal tooth lockwashers (2) and machine screws (1).

Disassembly and Reassembly of Keyboard-transmitter Sensing and Selector Levers

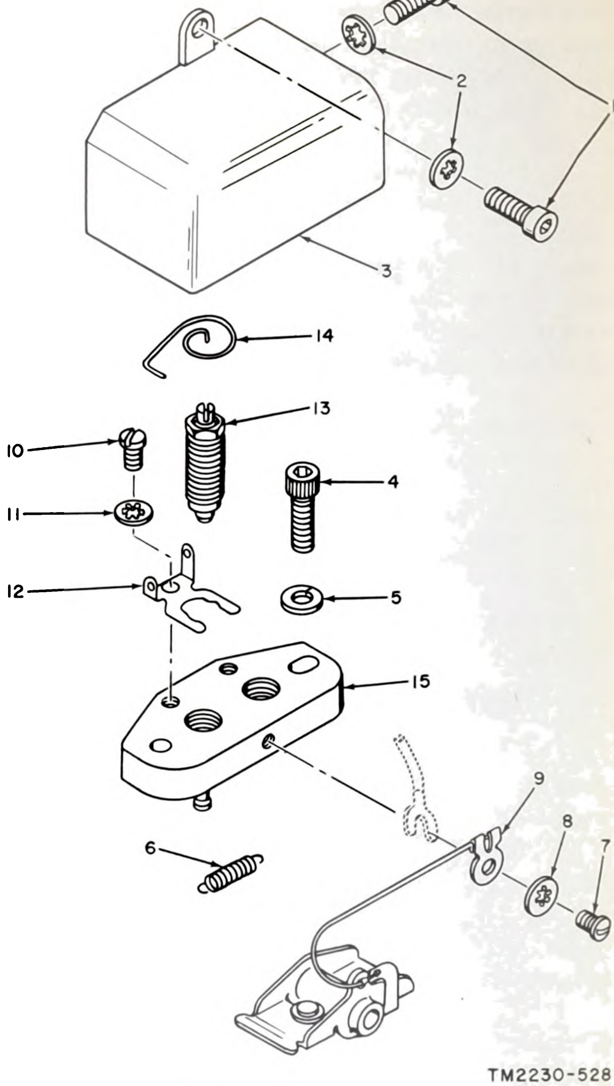
(fig. 102)

Disassembly.

(1) Remove the keyboard transmitter from the teleprinter (par. 106*a*).

(2) Remove the setscrew (1) and remove the sensing lever pivot stud (2). Catch the flat washers (3, 4, 6, 8, 10, 12, and 14) and sensing levers (5, 7, 9, 11, and 13) as they are released by the stud.

(3) Remove the six selector lever springs (15) from the selector levers and from the selector lever spring bracket (43). Remove the sensing lever locking bail spring (16) from the sensing lever locking bail (19) and from the selector lever spring bracket (43).



1 Machine screw (10001)
2 Internal tooth lockwasher (10403)
3 Contact cover (54681A)
4 Machine screw (10009)
5 Lockwasher (10430)
6 Contact bail spring (51548)
7 Machine screw (10308)
8 Internal tooth lockwasher (10403)
9 Transmitter contact (E4 51582A)
10 Machine screw (10301)
11 Internal tooth lockwasher (10403)
12 Transmitter contact terminal (51597)
13 Transmitter contact (51588A)
14 Electrical wire (51610)
15 Contact mounting (5159A)

Figure 101. Transmitter contacts, exploded view.

(4) Remove the self-locking hexagonal nut (17). Remove the sensing lever locking bail bearing (18) and locking lever.

(5) Remove the spacing collar (20) and the six selector levers (21, 24, 27, 30, 33, and

36), the six bearing shoes (22, 25, 28, 31, 34, and 37), and the six flat washers (23, 26, 29, 32, 35, and 38) from the selector lever pivot post, alternating selector lever, bearing shoe, and flat washer until all are removed.

(6) Remove the self-locking hexagonal nut (39) and remove the selector lever pivot post (40).

(7) Remove the two socket-head machine screws (41) and lockwashers (42). Remove the selector lever spring bracket (43).

(8) Remove the two socket-head screws (44) and lockwashers (45) and remove the adjusting plate (46) and the selector levers comb (50).

(9) Remove the two socket-head screws (47) and lockwashers (48). Remove the stop selector lever latch (49).

b. Reassembly.

(1) Fasten the stop selector lever latch (49) onto the selector levers comb (50) with two socket-head screws (47) and lockwashers (48).

(2) Fasten the selector levers comb (50) and the adjusting plate (46) onto the keyboard frame with two socket-head screws (44) and lockwashers (45).

(3) Fasten the selector lever spring bracket (43) onto the keyboard frame with two machine screws (41) and lockwashers (42).

(4) Insert the selector lever pivot post (40) in the hole in the keyboard frame. Secure it with a self-locking hexagonal nut (39).

(5) Position the flat washers (38, 35, 32, 29, 26, and 23), the bearing shoes (37, 34, 31, 28, 25, and 22), and the selector levers (36, 33, 30, 27, 24, and 21) on the selector lever pivot post. Alternate a flat washer, bearing shoe, and selector lever until all are on. Install the spacing collar (20).

(6) Install the sensing lever locking bail (19) and sensing lever locking bail bearing (18) on the selector lever pivot post. Secure them with a self-locking hexagonal nut (17).

(7) Install the six selector lever springs (15) on the selector levers and on the selector lever spring bracket (43). Install the sensing lever locking bail spring (16) on the sensing lever locking bail and on the selector lever spring bracket (43).

(8) Position the five sensing levers (13, 11, 9, 7, and 5) and the flat washers (14, 12, 10, 8, 6, 4, and 3) on the sensing lever pivot stud (2). Alternate a flat washer and a sensing lever until all are assembled. Add an extra washer or washers at the end as required. Position the assembled stud, sensing levers, and flat washers on the keyboard frame. Secure them with a setscrew (1).

(9) Install the keyboard transmitter on the teleprinter (par. 105*b*).

(10) Adjust the selector and sensing levers (pars. 264–267).

109. Disassembly and Reassembly of Transmitter Camshaft and Transmitter Filter

(fig. 103)

a. Disassembly.

(1) Remove the keyboard transmitter from the teleprinter (par. 106*a*).

(2) Remove the sensing and selector levers (par. 108).

(3) Remove the two setscrews (1) that attach the clutch yoke (2) to the transmitter camshaft (3). Remove the clutch transmitter camshaft and transmitter camshaft from the keyboard frame (32).

(4) Remove the machine screws (4), flat washers (5), and lockwashers (6). Remove the ball bearing (7), collar (8), and the ball bearing (9) from the keyboard frame (32).

(5) Remove the retainer ring (10) that secures the cam stop lever (11) to the cam stop lever post (14). Remove the lever.

(6) Remove the plain hexagonal nut (12) and lockwasher (13) that secures the cam stop lever post (14) to the keyboard frame (32). Remove the post.

(7) Remove the plain hexagonal nut (15), lockwasher (16), grounding lug of the cable assembly (30), and lockwasher (17) from the machine screw (18). Remove the machine screw and lockwasher (19), releasing the cable clamp (20).

(8) Remove the cap nut (21) and lockwasher (22) from the machine screw (25), releasing the cable clamp (23).

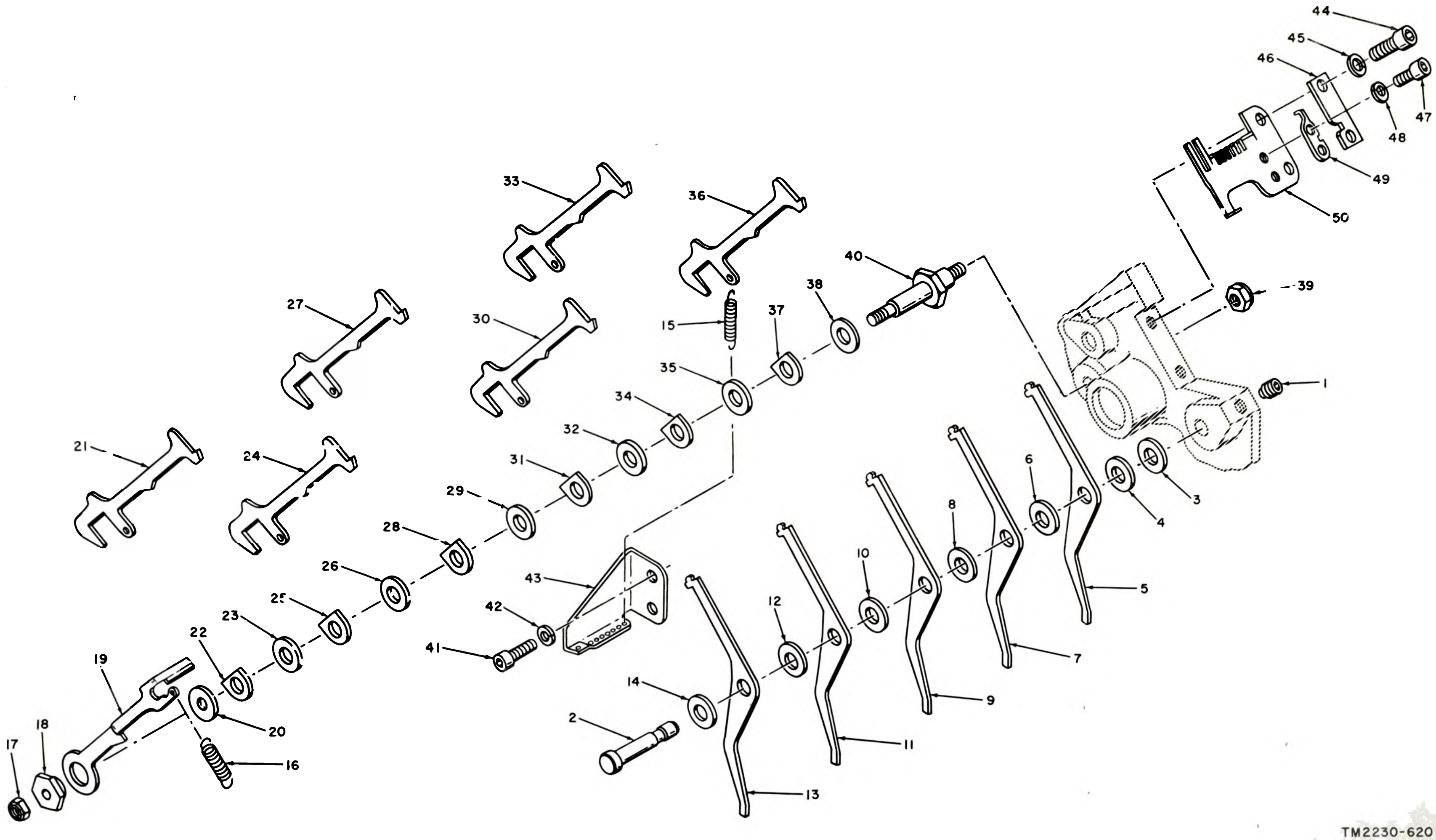


Figure 102. Keyboard-transmitter sensing and selector levers, exploded view.

1 Setscrew (10209)
2 Sensing lever pivot stud (51562)
3 Flat washer (50147)
4 Flat washer (50147)
5 Sensing lever (51573A)
6 Flat washer (50147)
7 Sensing lever (51573A)
8 Flat washer (50147)
9 Sensing lever (51573A)
10 Flat washer (50147)
11 Sensing lever (51573A)
12 Flat washer (50147)
13 Sensing lever (51573A)
14 Flat washer (50147)
15 Selector lever spring (50902)
16 Sensing lever locking bail spring (51574)
17 Self-locking hexagonal nut (10500)
18 Sensing lever locking bail bearing (51557)
19 Sensing lever locking bail (51567)
20 Spacing collar (51555)
21 Selector levers (51598A)
22 Bearing shoe (50019A)
23 Flat washer (50147)
24 Selector lever (51598A)
25 Bearing shoe (50019A)
26 Flat washer (50147)
27 Selector lever (51598A)
28 Bearing shoe (50019A)
29 Flat washer (50147)
30 Selector lever (51598A)
31 Bearing shoe (50019A)
32 Flat washer (50147)
33 Selector lever (51598A)
34 Bearing shoe (50019A)
35 Flat washer (50147)
36 Selector lever (51598A)
37 Bearing shoe (50019A)
38 Flat washer (50147)
39 Self-locking, hexagonal nut (10512)
40 Selector lever pivot post (51561)
41 Machine screw (10003)
42 Lockwasher (10429)
43 Selector lever spring bracket (51559)
44 Socket-head screw (10008)
45 Lockwasher (10430)
46 Adjusting plate (55869)
47 Socket-head screw (10002)
48 Lockwasher (10429)
49 Stop selector lever latch (55870)
50 Selector levers comb (51558)

Figure 102—Continued.

(9) Remove the cable clamps (20 and 23) from the cable assembly (30). Remove the machine screw (25) and lockwasher (24) from the keyboard frame.

(10) Remove the machine screw (26) and lockwasher (27) that secures the transmitter filter (31) to the key bar mounting bracket. Remove the machine screw (28) and lockwasher (29) that secures the filter to the keyboard frame (32). Remove the filter with the cable assembly.

(11) Unsolder the leads of the cable assembly from the lugs on the filter. Mark them to facilitate reassembly.

Reassembly.

(1) Connect the leads of the cable assembly (30) to the transmitter filter (31). Solder the connections.

(2) Fasten the transmitter filter (31) on the keyboard frame (32) to the frame with a machine screw (28) and lockwasher (29) and to the key bar mounting bracket with a machine screw (26) and lockwasher (27).

(3) Place the cable clamps (23 and 20) on the cable assembly (30).

(4) From the rear, insert a machine screw (25) with a lockwasher (24) through the upper mounting hole on the key bar mounting bracket and the keyboard frame (32). Position the cable clamp (23) on the screw and secure it with the cap nut (21) and lockwasher (22).

(5) Fasten the cable clamp (20) to the keyboard frame with a machine screw (18) with lockwasher (19) inserted through the clamp and the frame. At the rear of the frame, install a lockwasher (17), the grounding lug of the cable assembly (30), a lockwasher (16), and plain hexagonal nut (15). Tighten the nut.

(6) Position the cam stop lever post (14) in the keyboard frame (32). Secure it with a lockwasher (13) and plain hexagonal nut (12).

(7) Place the cam stop lever (11) on the cam stop lever post (14) and secure it with a retainer ring (10).

(8) Install the ball bearing (9), the collar (8), and the ball bearing (7) into the bearing opening in the keyboard frame (32). Secure the bearings and collar in the frame with the two flat washers (5), lockwashers (6), and machine screws (4).

(9) 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).

(10) Reassemble the sensing and selector levers (par. 108).

(11) Install the keyboard on the teleprinter (par. 106).

110. Disassembly and Reassembly of Key Levers and Code Bars

a. Disassembly.

(1) Remove the keyboard transmitter from the teleprinter (par. 106*a*).

(2) Remove the two machine screws (1, fig. 104) and lockwashers (2). Remove the space bar (3).

(3) Remove the two retainer rings (4 and 5). Remove the spring (7), space bar arm shaft (61), and space bar assembly.

(4) Remove the three machine screws (9) and lockwashers (10). Remove the key lever locking bar (11).

(5) Remove the 31 key lever springs (12) and the space bar springs (13).

(6) Remove the assembled keytops (14) and short key levers (15), keytops and medium key levers (16), and keytops and long key levers (17). Remove the keytops from the key levers only if either is damaged.

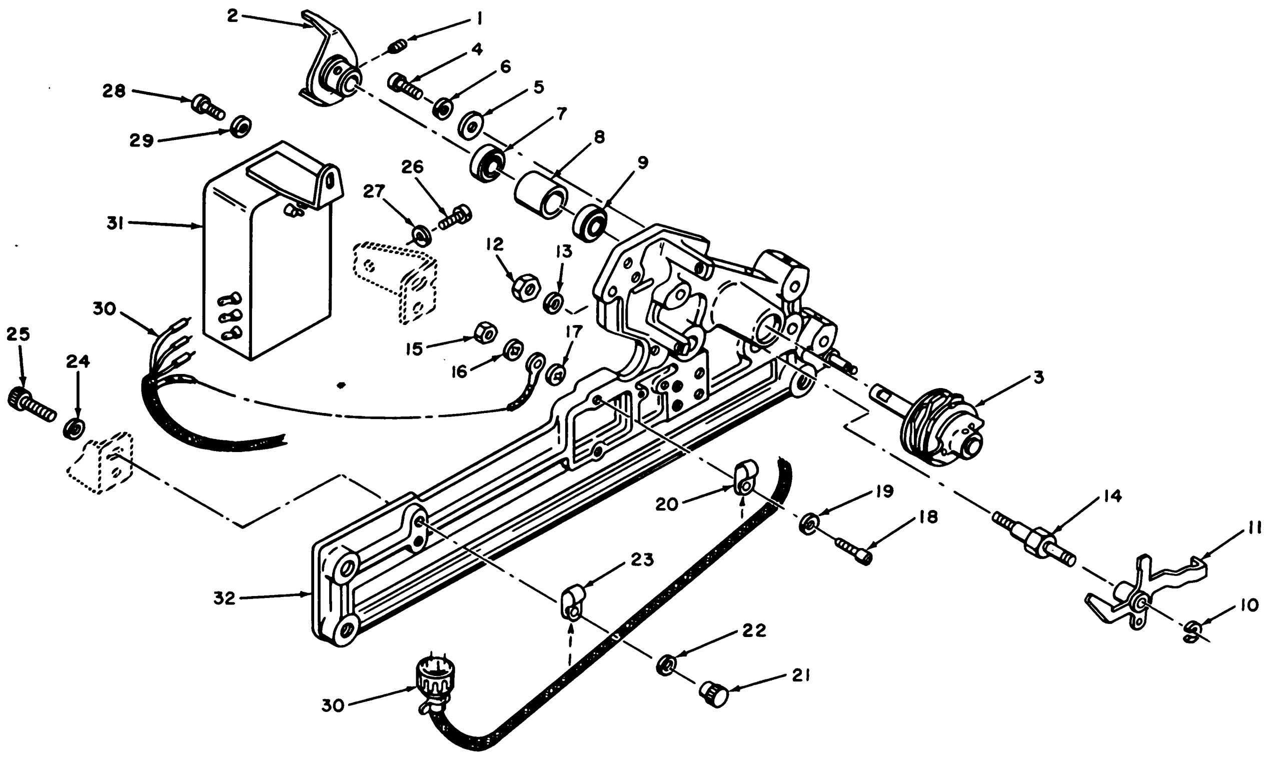
(7) Remove the space bar lever (18) and the repeat key lever (19).

(8) Remove the three machine screws (20) and lockwashers (21). Remove the cap nut (21, fig. 103), lockwasher (22), cable clamp (23), lockwasher (24), and machine screw (25). Remove the key lever mounting bracket (22, fig. 104).

(9) Remove the universal code bar return spring (23). Remove the two machine screws (24) and lockwashers (25) and remove the front key lever guide (26).

(10) Remove the two machine screws (27) and lockwashers (28). Remove the code bar guide studs (29).

(11) Remove the middle key lever guide (30), the code bars (31–35), and the universal bar (36).



1	Setscrew (10209)	17	Lockwasher (10403)
2	Clutch yoke (50484A)	18	Machine screw (10041)
3	Transmitter camshaft (51545A)	19	Lockwasher (10429)
4	Machine screw (10003)	20	Cable clamp (20519)
5	Flat washer (10450)	21	Cap nut (10547)
6	Lockwasher (10429)	22	Lockwasher (10431)
7	Ball bearing (10753)	23	Cable clamp (20518)
8	Collar (51599)	24	Lockwasher (10405)
9	Ball bearing (10753)	25	Machine screw (10015)
10	Retainer ring (10949)	26	Machine screw (10003)
11	Cam stop lever (51549A)	27	Lockwasher (10429)
12	Plain hexagonal nut (10501)	28	Machine screw (10003)
13	Lockwasher (10430)	29	Lockwasher (10403)
14	Cam stop lever post (51563)	30	Cable assembly (53288A and 20419)
15	Plain hexagonal nut (10512)	31	Transmitter filter Z2 (52305A)
16	Lockwasher (10403)	32	Keyboard frame (51441A)

Figure 103. Transmitter camshaft and filter, exploded view.

b. Reassembly.

(1) Position the universal bar (36), and the five code bars on the code bar guide studs (21). Arrange the five code bars in their proper sequence, with code bar No. 1 (35) next to the universal bar, followed by the remaining code bars (34–31) and the middle key lever guide (30).

(2) Position the assembled code bar guide studs and code bars on the keyboard-transmitter frame. Secure them with two machine screws (27) and lockwashers (28).

(3) Attach the front key lever guide (26) to the code bar guide studs (29) with two machine screws (24) and lockwashers (25). Install the universal code bar return spring (23).

(4) Install the key lever mounting bracket (22) on the keyboard casting with three machine screws (20), lockwashers (21), the machine screw (25, fig. 103), lockwasher (24), cable clamp (23), lockwasher (22), and cap nut (21).

(5) Install the repeat key lever (19, fig. 104) and the space bar lever (18).

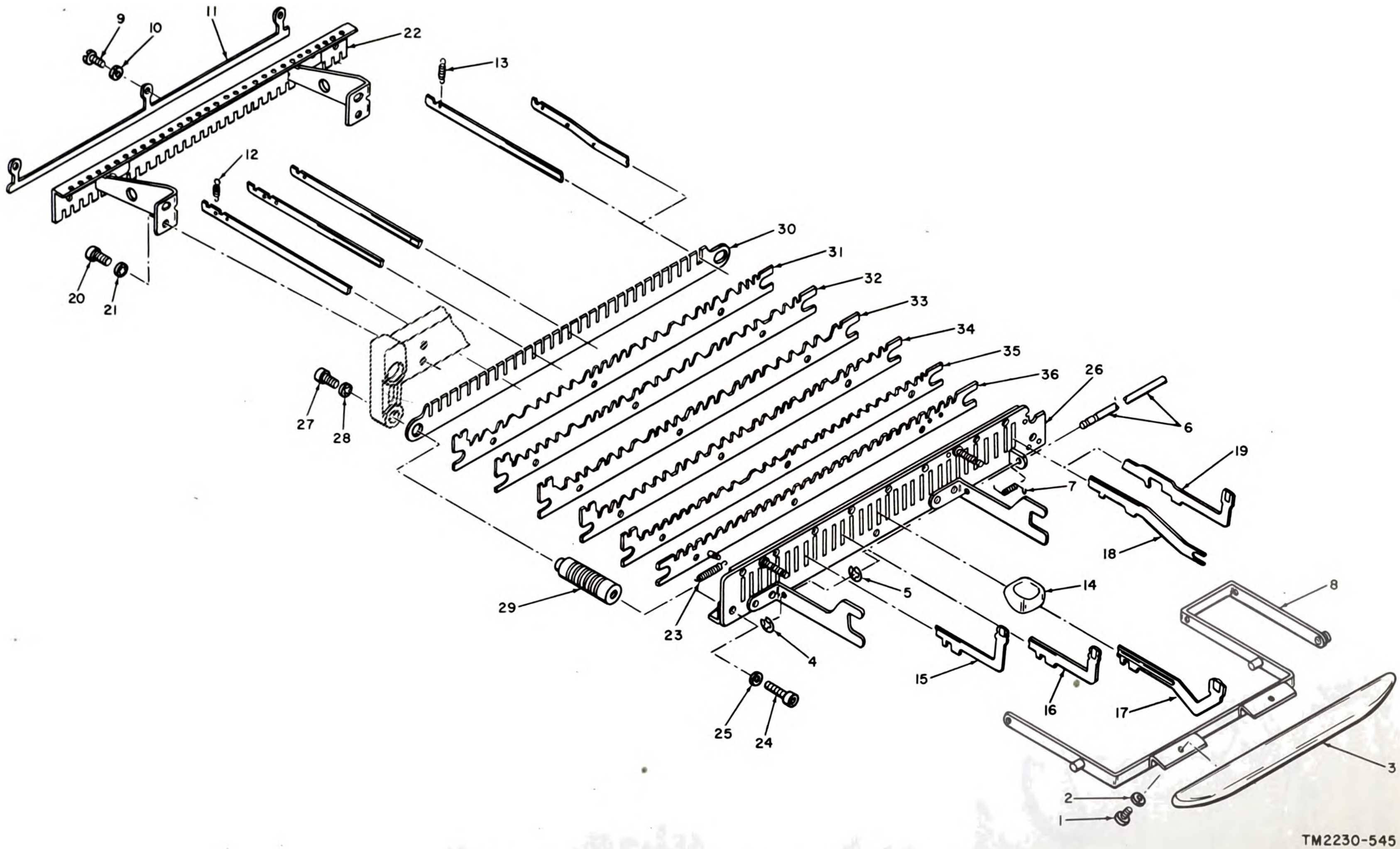


Figure 104. Key levers and code bars, exploded view.

1 Machine screw (10001)
2 Lockwasher (10429)
3 Space bar (53944A)
4 Retainer ring (10969)
5 Retainer ring (10969)
6 Space bar arm shaft (55862)
7 Spring (56688)
8 Space bar arm assembly (55875A)
9 Machine screw (10304)
10 Lockwasher (10429)
11 Key lever locking bar (53210)
12 Key lever spring (50941)
13 Space bar spring (53974)
14 Keytop (54001 or 50777)
15 Short key lever (55917)
16 Medium key lever (55918)
17 Long key lever (53969)
18 Space bar lever (55916)
19 Repeat key lever (55915)
20 Machine screw (10015)
21 Lockwasher (10405)
22 Key lever mounting bracket (54963A)
23 Universal code bar return spring (51136)
24 Machine screw (10397)
25 Lockwasher (10431)
26 Front key lever guide (55860A)
27 Machine screw (10017)
28 Lockwasher (10431)
29 Code bar guide stud (55866)
30 Middle key lever guide (53915)
31 Code bar (53299)
32 Code bar (53298)
33 Code bar (53297)
34 Code bar (53296)
35 Code bar (53295)
36 Universal bar (51134A)

Figure 104—Continued7

(6) Install the assembled long key levers (17) and keytops (14) from left to right in the order shown in figure 17 or 18. Similarly install the assembled medium key levers (16) and short key levers (15) and keytops from left to right.

(7) Install the 31 key lever springs (12) and the space bar springs (13).

(8) Install the key lever locking bar (11) on the key lever mounting bracket (22) with three machine screws (9) and lockwashers (10).

(9) Position the space bar arm assembly (8) on the front key lever guide (26) and install the spring (7). Install the space bar arm shaft (6) through the holes in the space bar arm assembly and the arms of the front key lever guide. Secure it with retainer rings (4 and 5).

(10) Install the space bar (3) on the space bar arm assembly (8). Secure it with two machine screws (1) and lockwashers (2).

(11) Install the keyboard transmitter on the teleprinter (par. 106*b*).

(12) Adjust the key levers, code bars, and universal bar (pars. 263 and 268).

Disassembly and Reassembly of Transmitter Camshaft Locking Mechanism

(fig. 105)

Disassembly.

(1) Remove the keyboard transmitter from the teleprinter (par. 106*a*).

(2) Remove the sensing levers (par. 108*a*(2)).

(3) Unhook the locking lever latch spring (1) from the pin in the keyboard frame and from the spring tab on the locking lever latch (10). Remove the spring.

(4) Remove the setscrew (2) that holds the locking lever latch stud (5) in the keyboard frame.

(5) Unhook the repeat blocking lever spring (3) from the repeat blocking lever (6) and from the spring post on the locking lever latch (10). Remove the spring.

(6) Remove the retainer ring (4) from the end of the locking lever latch stud (5).

(7) Remove the assembled locking lever latch, repeat blocking lever, and the locking lever latch stud from the keyboard frame. Disassemble the parts. Remove the lockwasher (7), the plain hexagonal nut (8), and the universal bar adjusting screw (9) from the locking lever latch.

(8) Remove the repeat lever pivot stud (11), flat washer (12), and repeat lever (13) from the keyboard frame.

b. Reassembly.

(1) Install the flat washer (12) and the repeat lever (13) on the keyboard frame with the repeat lever pivot stud (11).

(2) Screw the plain hexagonal nut (8) onto the universal bar adjusting screw (9). Install a lockwasher (7) on the adjusting screws and screw the adjusting screw to its old approximate position on the locking lever latch (10) and lock it with the plain hexagonal nut (8).

(3) Place the repeat blocking lever (6) in the locking lever latch (10). Position both the lever and latch on the locking lever latch stud (5). Install the locking lever latch stud and assembled lever and latch on the keyboard frame.

(4) Install the retainer ring (4) on the end of the locking lever latch stud (5).

(5) Hook the ends of the repeat blocking lever spring (3) to the spring post on the locking lever latch (10) and on the tab on the repeat blocking lever (6).

(6) Install the setscrew (2) in the keyboard frame and tighten to hold the locking lever latch stud (5) securely. Allow free movement of the locking lever latch (10).

(7) Hook the ends of the locking lever latch spring (1) on the spring tab on the top of the locking lever latch (10) and on the pin in the casting.

(8) Install the sensing levers (par. 108*b*(8)).

(9) Install the keyboard transmitter on the teleprinter (par. 106*b*).

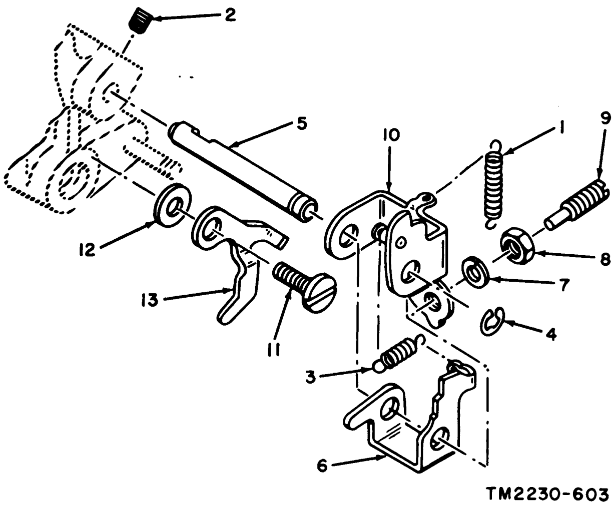
(10) Adjust the locking mechanism (par. 268).

112. Removal and Replacement of Motor

a. Removal.

(1) Lift the left side of the teleprinter and disconnect the motor plug connector from the receptacle connector in the base.

(2) Remove the four machine screws (1, fig. 106) and lockwashers (2). Remove the



1 Locking lever latch spring (51544)
2 Setscrew (10209)
3 Repeat blocking lever spring (50944)
4 Retainer ring (10949)
5 Locking lever latch stud (51564)
6 Repeat blocking lever (51569)
7 Lockwasher (10409)
8 Plain hexagonal nut (10507)
9 Universal bar adjusting screw (50658)
10 Locking lever latch (51570A)
11 Repeat lever pivot stud (51568)
12 Flat washer (50414)
13 Repeat lever (52914)

Figure 105. Keyboard-transmitter camshaft locking mechanism, exploded view.

worm gear bracket (9), gear cover (6), and gasket (3).

(3) Remove the four machine screws (1, fig. 107) and lockwashers (2). Remove the assembled motor by moving it sideways away from the frame.

(4) Remove the shims (3) from the right and left spacer plates (6 and 7).

b. Replacement.

(1) Position the shims (3, fig. 107) 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 frames and secure it with four machine screws (1) and lockwashers (2, fig. 107).

Note.—There should be minimum backlash between the motor driven and driving gears. Use shims (3) as required.

(3) Place the gasket (3, fig. 106), gear cover (6), and worm gear bracket (9) on the printer frame. Secure them with four machine screws (1) and lockwashers (2).

(4) Lift the left side of the teleprinter and connect the motor plug connector to the receptacle in the base.

113. Disassembly and Reassembly of the Synchronous Motor

(fig. 107)

a. Disassembly.

(1) Remove the motor from the teleprinter (par. 112*a*).

(2) Remove the four machine screws (4) and lockwashers (5). Remove the spacer plates (6 and 7).

(3) Remove the machine screw (8) and lockwasher (9). Hold the blower wheel (12) to prevent the motor shaft from turning while removing the screw. Remove the worm gear (10).

(4) Remove the setscrew (11) and remove the blower wheel (12) from the armature shaft.

(5) Tap the pin (13) from the armature shaft and remove the two grease seals (14) from the shaft.

(6) Remove the plug connector (15) from the motor leads and remove the plastic tubing (16) from the leads.

(7) Remove the four high hexagonal nuts (17), through bolts (18), and lockwashers (19). Remove the motor end castings (20 and 21).

(8) Remove the motor armature (22) from the motor stator (23).

b. Reassembly.

(1) Position the motor armature (22) in the motor stator (23).

(2) Position the front end casting (21) and the rear end casting (20) on the motor stator (23). Secure them with four through bolts (18), lockwashers (19), and high hexagonal nuts (17). Be sure to thread the motor leads through the proper opening in the front end frame before installing the armature.

(3) Install the plastic tubing (16) on the motor leads, and install the plug connector (15) on the leads.

(4) Position the grease seals (14) on the shaft of the motor armature (22) and install the pin (13).

(5) Position the blower wheel (12) on the armature shaft and secure it with the setscrew (11).

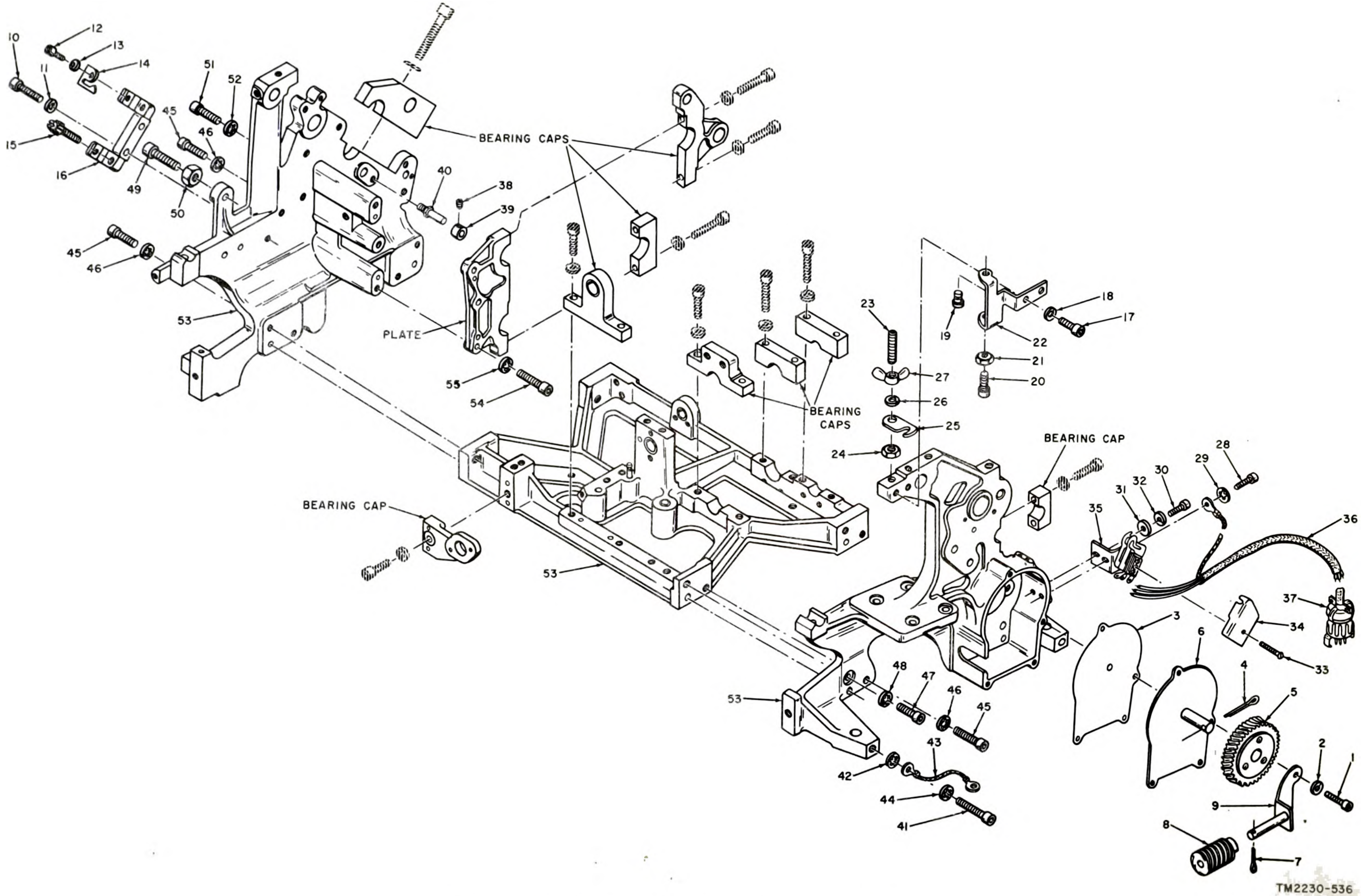
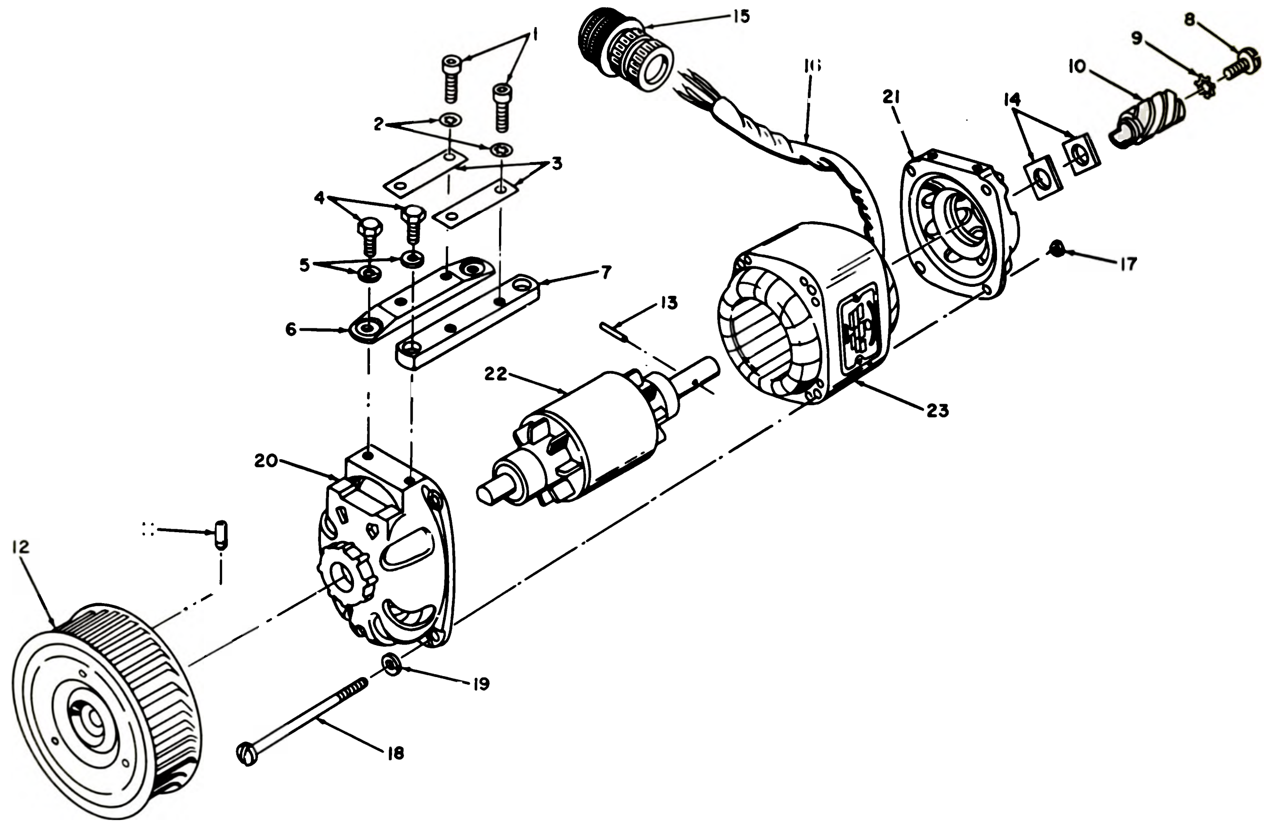


Figure 106. Teleprinter frame assembly, exploded view.

1 Machine screw (10004)
2 Lockwasher (10429)
3 Gasket (50725)
4 Cotter pin (10805)
5 Main shaft driven gear (50597A)
6 Gear cover (50853A)
7 Cotter pin (10805)
8 Worm gear (50596)
9 Worm gear bracket (50858A)
10 Machine screw (10010)
11 Lockwasher (10430)
12 Machine screw (10004)
13 Lockwasher (10429)
14 Anchor plate (52687)
15 Adjustment screw (52688)
16 Bracket (52527)
17 Machine screw (10076)
18 Lockwasher (10430)
19 Bumper (20762)
20 Machine screw (10009)
21 Plain hexagonal nut (10516)
22 Platen bracket (51464)
23 Setscrew (10212)
24 Plain hexagonal nut (10509)
25 Platen lock (50598)
26 Lockwasher (10431)
27 Plain wingnut (10508)
28 Machine screw (10003)
29 Lockwasher (10403)
30 Machine screw (10003)
31 Flat washer (10459)
32 Lockwasher (10429)
33 Machine screw (10386)
34 Contact shield (53116)
35 Motor stop switch assembly S1 (53428A)
36 Cable assembly (54083A)
37 Plug (20419)
38 Setscrew (10201)
39 Spacing collar (51717)
40 Cam follower stop stud (51719)
41 Machine screw (10042)
42 Lockwasher (10405)
43 Electrical lead (53651)
44 Lockwasher (10405)
45 Machine screw (10018–01)
46 Lockwasher (10405)
47 Machine screw (10024)
48 Lockwasher (10405)
49 Machine screw (10021)
50 Plain hexagonal nut (10502)
51 Machine screw (10026–01)
52 Lockwasher (10405)
53 Frame assembly (55700A) (includes bearing caps, three main castings, plate, dowels, and spring posts)
54 Machine screw (10018)
55 Lockwasher (10405)

Figure 106—Continued-



1 Machine screw (10017.011)
2 Lockwasher (10405)
3 Shim (51509 or 51510)
4 Machine screw (10399)
5 Lockwasher (10430)
6 Right spacer plate (53478)
7 Left spacer plate (53479)
8 Machine screw (50207)
9 Lockwasher (10406)
10 Worm gear (50350)
11 Setscrew (10210)
12 Blower wheel (20839)
13 Pin (50359)
14 Grease seal (50949)
15 Plug connector (53514A)
16 Plastic tubing (20814)
17 High hexagonal nut (part of 52470A which included items 18, 19, 20, 21, 22, and 23)
18 Through bolt
19 Lockwasher
20 Rear end casting (53502A) (includes items 3, 4, 5, 6, 7, 14, 17, 18, 19, 20, 21, 22, and 23)
21 Front end casting
22 Motor armature (53361A) (includes item 13)
23 Motor stator (53362A)

Figure 107. Synchronous motor, exploded view.

(6) Position the worm gear (10) on the armature shaft. Secure it with the machine screw (8) and lockwasher (9).

Note.—Be sure to install the correct gear for the operating speed desired (par. 27). Make sure that the mating gear is marked for the same speed.

(7) Position the left spacer plate (7) and the right spacer plate (6) on the motor. Secure them with the four machine screws (4) and lockwashers (5).

(8) Replace the motor (par. 112*b*).

114. Disassembly and Reassembly of Series-Governed Motor

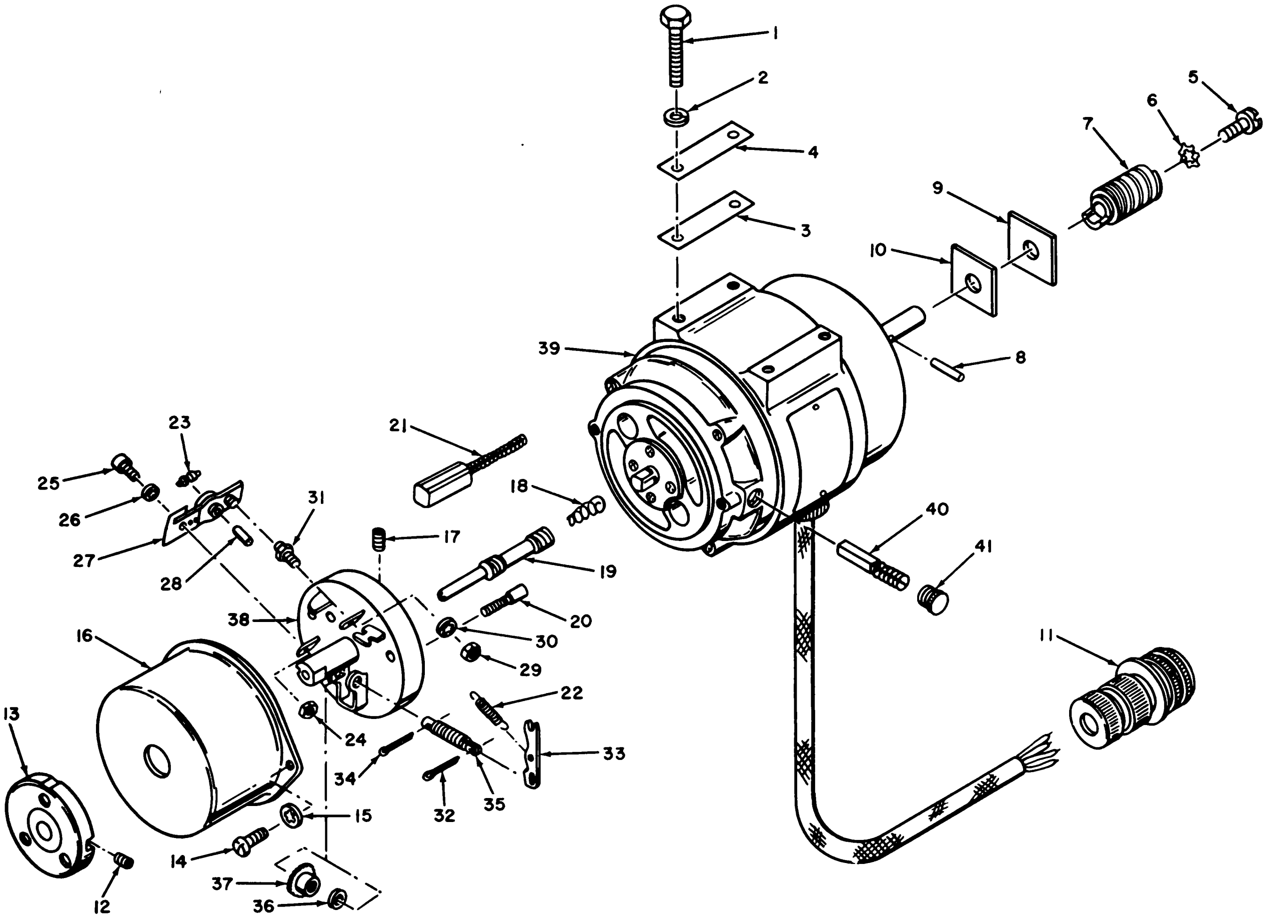
(fig. 108)

a. Disassembly.

(1) Remove the series-governed motor from the teleprinter (par. 112*a*).

(2) Remove the machine screw (5) and lockwasher (6). Remove the worm gear (7).

(3) Remove the pin (8) and the grease seals (9 and 10) from the motor armature shaft.



1	Machine screw (10079)	22	Spring (50334)
2	Lockwasher (10431)	23	Grooved pin (50302)
3	Shim (51509)	24	Self-locking hexagonal nut (10500)
4	Shim (51510)	25	Machine screw (10001)
5	Machine screw (50207)	26	Lock washer (10403)
6	Lockwasher (10406)	27	Electrical contact (50281A)
7	Worm gear (50350)	28	Sleeve (50293)
8	Pin	29	Plain hexagonal nut (10507)
9	Grease seal (50949)	30	Lockwasher (10404)
10	Grease seal (50949)	31	Electrical contact (50338)
11	Plug connector (53512A)	32	Cotter pin (10800)
12	Setscrew (10204)	33	Governor adjustment lever (50301)
13	Motor governor target (50303A)	34	Cotter pin (10800)
14	Machine screw (10321)	35	Governor adjustment screw (50299)
15	Lockwasher (10412)	36	Flat washer (50148)
16	Motor governor cover (50311)	37	Motor governor adjustment gear (50278A)
17	Setscrew (10203)	38	Motor speed governor base (51249A)
18	Spring (51855)	39	Series-governed motor (51861A) (includes items 3, 4, 8, 9, 10, 40, and 41)
19	Governor worm (56555A)	40	Electrical contact brush (20769 and 11070)
20	Electrical contact brush (51154)	41	Brush cap (51155)
21	Electrical contact brush (51543)		

Figure 108. Series-governed motor, exploded view.

(4) Unsolder the cable leads to the plug connector (11) and remove the plug connector.

(5) Remove the setscrew (12) and the motor governor target (13).

(6) Remove the two machine screws (14) and lockwashers (15) and remove the motor governor cover (16).

(7) Remove the two setscrews (17) that hold the motor speed governor base (38) to the

motor armature shaft. Remove the assembled motor governor.

(8) Remove the spring (18) and the governor worm (19) from the motor governor.

(9) Remove the electrical contact brush (20) from the motor governor.

(10) Remove the two electrical contact brushes (21) from the series-governed motor (39).

b. Reassembly. Check the motor governor electrical contact brushes. Clean them if they are dirty or glazed. Replace them if they are worn, chipped, or saturated with oil.

(1) Position the two electrical contact brushes (21) in the series-governed motor (39).

(2) Install the electrical contact brush (20) in the motor speed governor base (38).

(3) Install the governor worm (19) and spring (18) in the motor speed governor base (38).

(4) Secure the assembled motor governor on the motor armature shaft with the two setscrews (17).

(5) Install the motor governor cover (16) and secure it with two machine screws (14) and lockwashers (15).

(6) Position the motor governor target (13) on the shaft of the motor speed governor base (38). Secure it with setscrew (12).

(7) Solder the leads of the cable to the plug connector (11).

(8) Install the grease seals (10 and 9) on the motor armature shaft. Install the pin (8) in the motor armature shaft.

(9) Install the worm gear (7) onto the motor armature shaft with the machine screw (5) and lockwasher (6).

(10) Install the series-governed motor on the teleprinter (par. 112*b*).

(11) Adjust the series-governed motor (par. 20).

115. Replacement of Series-Governed Motor Brushes

The contact surfaces of the motor brushes must be curved to fit the commutator. Shape the surface of the brush as follows:

a. Disassemble the motor (par. 113*a* or 114*a*).

b. Wrap a piece of No. 0000 sandpaper around the armature and under the brush holder, with the abrasive side out. Allow the normal pressure of the brush spring to press the brush against the sandpaper.

c. Pull back and forth, following the curvature of the commutator, until the brush has the same curvature as the commutator. The last stroke of sandpaper should be in the direction of normal armature rotation.

d. Remove the brush and bevel the edges slightly with sandpaper.

e. Wipe the brush with a piece of cloth slightly moistened with cleaning compound.

f. Clean the brush holder with a cloth moistened with cleaning compound and wrapped around a small screwdriver blade or similarly shaped tool.

g. Reinsert the brushes in their holders.

h. Reassemble the motor (par. 113*b* or 114*b*).

116. Repair of Motor Commutator

Resurface the commutator as follows:

a. Remove the motor (par. 112).

b. Disassemble the motor (par. 114).

c. Mount the motor armature in a lathe so that the shaft does not run out of line more than 0.0005 inch. Make a series of light cuts across the commutator with a sharp cutting tool. Do not cut closer than ⅛-inch from the leads soldered to the commutator. Continue the cuts until enough metal is removed to eliminate the pits, grooves, and rough spots in the surfaces. Do not remove more metal than is necessary.

d. Polish the commutator with a strip of fine sandpaper (No. 000 or No. 0000) held in flat contact with the commutator as it revolves in the lathe.

Caution: Do not attempt to smooth a rough commutator with sandpaper unless a lathe is available. Do not use emery cloth or carborundum paper. Particles of these abrasives may cause trouble in electrical circuits.

e. After the commutator is resurfaced, do not touch the commutator with the hands; see that the surfaces of the mica separators are below the surfaces of the copper segments of the commutator (*b* above).

f. Reassemble the motor (par. 114).

g. Replace the motor (par. 112).

117. Disassembly and Reassembly of Motor Governor

(fig. 108)

a. Disassembly.

(1) Remove the motor governor from the series-governed motor (par. 114*a*(5)–(9)).

(2) Remove the spring (22) from the governor adjustment lever (33) and from

the grooved pin (23). Remove the grooved pin.

(3) Remove the self-locking hexagonal nut (24), machine screw (25), and lockwasher (26). Remove the electrical contact (27) and remove the sleeve (28) from the contact.

(4) Remove the plain hexagonal nut (29) and lockwasher (30). Remove the electrical contact (31).

(5) Remove the cotter pin (32). Remove the governor adjustment lever (33).

(6) Remove the cotter pin (34) from the opposite end of the governor adjustment screw (35). Turn out the governor adjustment screw from the mounting on the motor speed governor base (38). Catch the flat washer (36) and the motor governor adjustment gear (37) as they fall from the motor speed governor base.

b. Reassembly. If necessary, clean or burnish the governor contact points 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) Position the motor governor adjustment gear (37) and flat washer (36) on the motor speed governor base (37). Secure them by turning in the governor adjustment screw (35). Install the cotter pin (34) on the end of the governor adjustment screw.

(2) Position the governor adjustment lever (33) on the end of the governor adjustment screw (35). Secure it with a cotter pin (32).

(3) Position the electrical contact (31) on the motor speed governor base (38) and secure it with a plain hexagonal nut (29) and lockwasher (30).

(4) Position the electrical contact (27) and sleeve (28) on the motor speed governor base (38). Secure them with a machine screw (25), lockwasher (26), and self-locking hexagonal nut (24).

(5) Position the grooved pin (23) on the electrical contact (27). Install the spring (22) on the grooved pin and on the governor adjustment lever (33).

(6) Install the motor governor on the series-governed motor (par. 114*b*(1)–(6)).

(7) Adjust the speed of the series-governed motor (par. 20).

118. Removal and Replacement of Platen Trough Assembly

a. Removal.

(1) Remove the two machine screws (1, fig. 109) flat washers (2) and lockwashers (3) that hold the bracket link (12) to the teleprinter frame.

(2) Remove the two retainer rings (5 and 10) that hold the connecting links (6 and 11) to the studs on the platen assembly.

(3) Remove the two setscrews (1, fig. 110) that hold the eccentric pivots (4) to the two ends of the teleprinter frame. Remove the assembled eccentric pivots, the plain hexagonal nuts (2), and spacing collars (3) from each of the eccentric pivots.

(4) Lift the platen assembly from the teleprinter frame.

b. Replacement.

(1) Position the platen assembly on the teleprinter frame.

(2) Install the spacing collar (3, fig. 110) and the two plain hexagonal nuts (2) on each of the eccentric pivots (4). Position the pivots in the holes in the frame casting so that the eccentric stud on the end of the pivot engages the bearing in the platen support frame (30). Secure each of the eccentric pivots with two setscrews (1).

(3) Position the connecting links (6 and 11, fig. 109) on the studs on the platen assembly. Secure them with the two retainer rings (5 and 10).

(4) Aline the holes in the bracket link (12, fig. 109) with the tapped holes in the teleprinter frame. Secure the bracket link to the frame with the two machine screws (1), flat washers (2), and lockwashers (3).

(5) Adjust the platen assembly (pars. 235 and 236).

119. Removal and Replacement of Platen Frame Assembly

a. Disassembly.

(1) Remove the platen assembly from the teleprinter (par. 118*a*).

(2) Remove the machine screw (5, fig. 110) and lockwasher (6). Remove the platen latching arm (7).

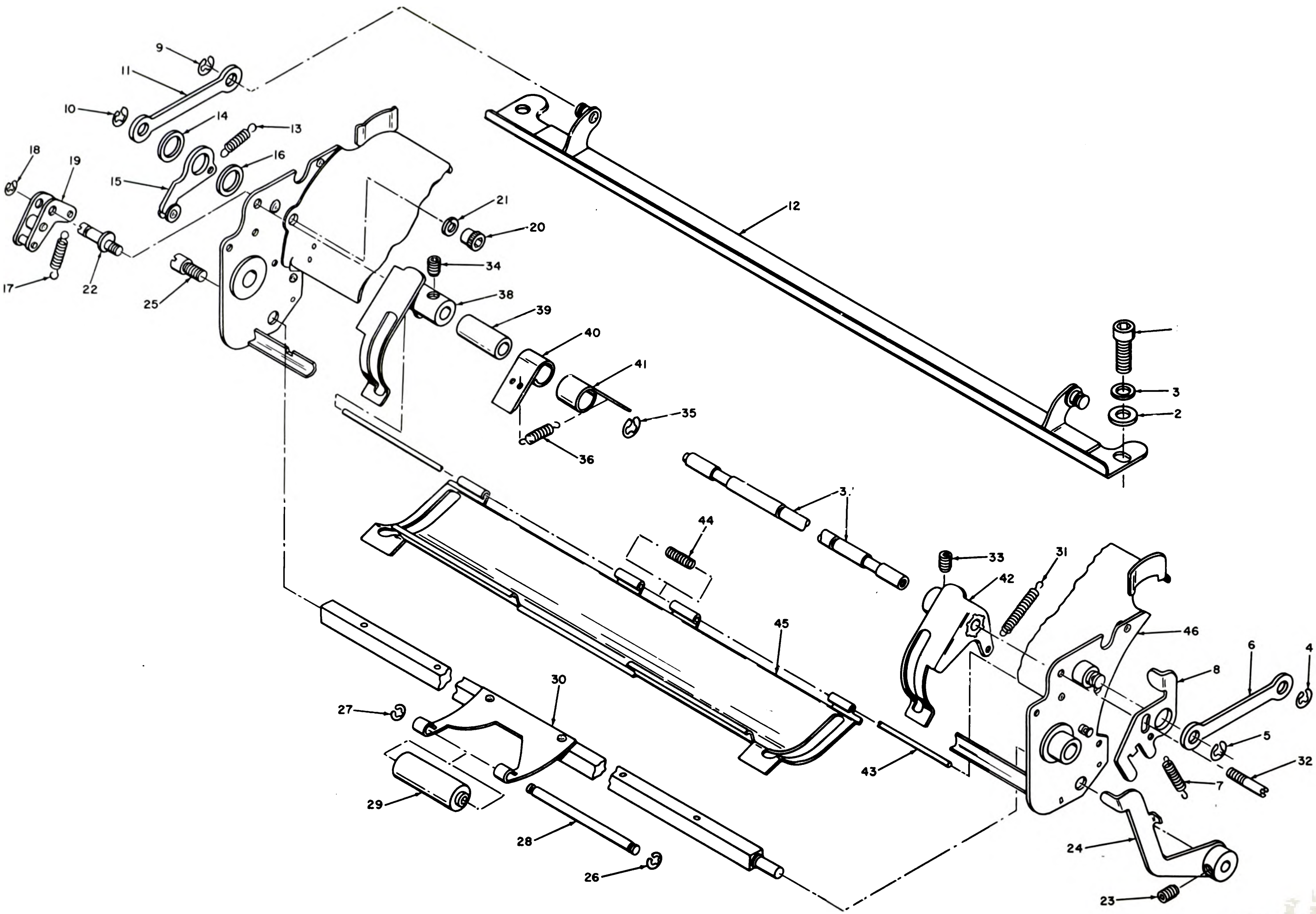


Figure 109. Platen trough assembly, exploded view.

1 Machine screw (10024)
2 Flat washer (10464)
3 Lockwasher (10431)
4 Retainer ring (10949)
5 Retainer ring (10949)
6 Connecting link (50215)
7 Platen lever latch spring (53149)
8 Platen lever latch (54951)
9 Retainer ring (10949)
10 Retainer ring (10949)
11 Connecting link (50215)
12 Bracket link (53138A)
13 Platen spacing detent spring (51851)
14 Flat washer (51768)
15 Platen spacing detent (53202A)
16 Flat washer (51768)
17 Platen detent spring (51851)
18 Retainer ring (10960)
19 Line spacing detent (50108A)
20 Plain round nut (10537)
21 Lockwasher (10429)
22 Platen detent eccentric stud (52931)
23 Setscrew (10201)
24 Pressure roller lever (54954A)
25 Pressure roller operating shaft screw (50238)
26 Retainer ring (51099)
27 Retainer ring (51099)
28 Platen pressure roller shaft (54968)
29 Platen pressure roller (50161A)
30 Platen pressure roller operating shaft (55530A)
31 Paper guide spring (52169)
32 Pivot screw (55139)
33 Setscrew (10201)
34 Setscrew (10201)
35 Retainer ring (10949)
36 Stripper spring (55143)
37 Paper guide shaft (55152)
38 Paper guide (55144A)
39 Sleeve (55041)
40 Paper stripper (55151)
41 Paper stripper (55151)
42 Paper guide (55141A)
43 Hinge pin (55146)
44 Platen trough spring (54967)
45 Paper trough guide (54962)
46 Platen trough (55136A) (includes items 43, 44, and 45)

Figure 109—Continued.

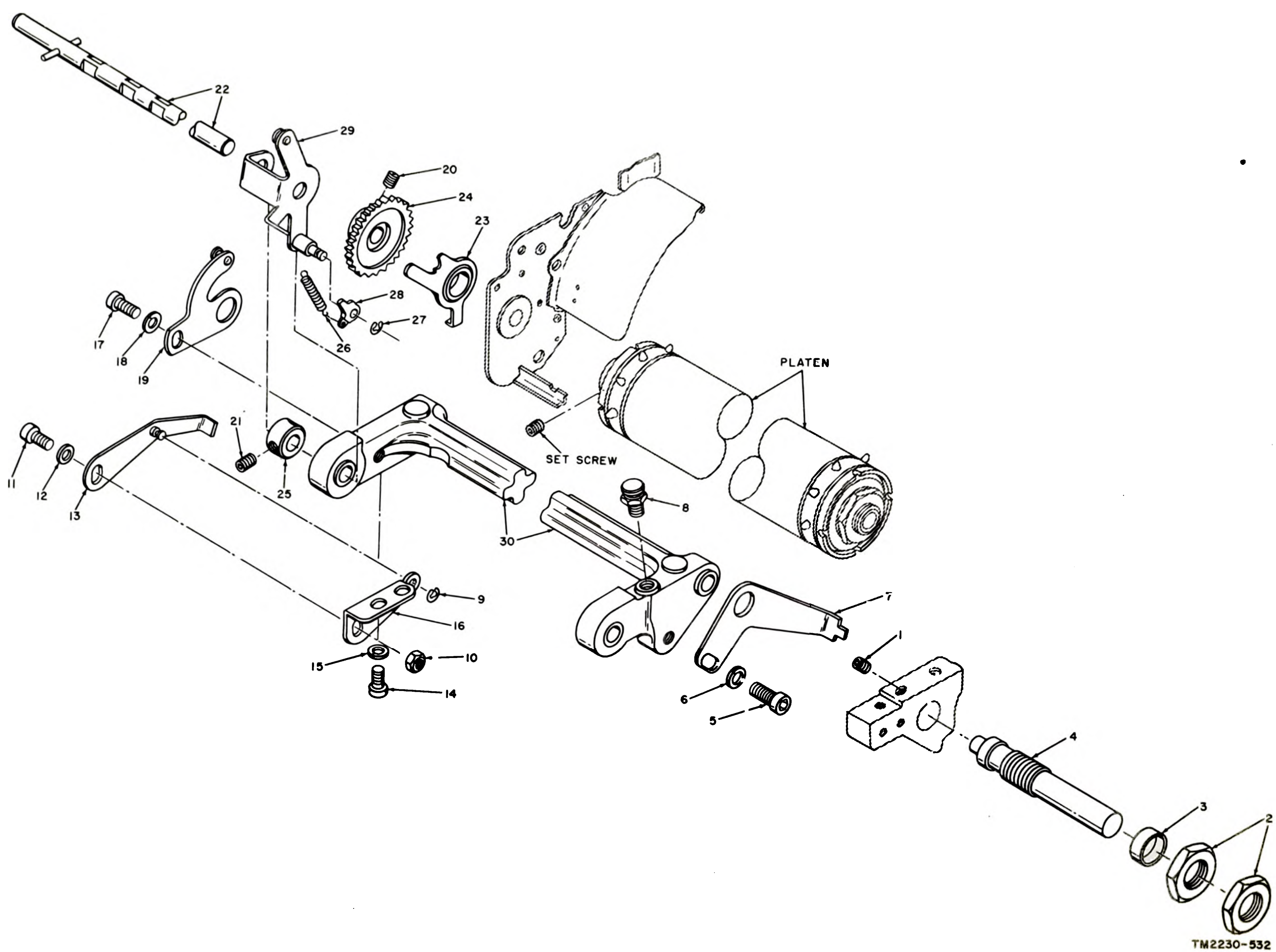


Figure 110. Platen frame assembly, exploded view.

1 Setscrew (10211)
2 Plain hexagonal nut (10524)
3 Spacing collar (55174)
4 Eccentric pivot (55173)
5 Machine screw (10015)
6 Lockwasher (10431)
7 Platen latching arm (50214)
8 Platen locking stud (50762)
9 Retainer ring (10969)
10 Self-locking hexagonal nut (10501)
11 Machine screw (10008)
12 Flat washer (10467)
13 Platen blocking arm (53095A)
14 Machine screw (10008)
15 Lockwasher (10430)
16 Platen blocking arm bracket (52307)
17 Machine screw (10015)
18 Lockwasher (10431)
19 Platen shift arm (53134A)
20 Setscrew (10209)
21 Setscrew (10209)
22 Platen shaft (54955A)
23 Single-double line feed lever (51762A)
24 Detent wheel (52807)
25 Shaft collar (50209)
26 Line feed pawl spring (50333)
27 Retainer ring (10969)
28 Line feed pawl (50165)
29 Line feed lever (53137A)
30 Platen support frame (53305A)

Figure 110—Continued.

(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) and remove the platen blocking arm (13).

(6) Remove the two machine screws (14) and lockwashers (15). Remove the platen blocking arm bracket (16).

(7) Remove the machine screw (17) and lockwasher (18). Remove the platen shift arm (19).

(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 (1, fig. 112) that secure the platen to the platen shaft (22, fig. 110). 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) Disconnect 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) and remove the line feed pawl (28) from the line feed lever.

b. Reassembly.

(1) Position the line feed pawl (28) on the pivot stud on the line feed lever (29). Secure the line feed lever on the pivot stud with the retainer ring (27).

(2) Hook one end of the line feed pawl spring (26) in the line feed pawl (28) and the other end in the line feed lever (29).

(3) Position the line feed lever (29), shaft collar (25), detent wheel (24), single-double line feed lever (23), platen, and platen trough on the platen shaft (22) as the shaft is inserted through the bushings in the platen support frame (30).

(4) Secure the shaft collar (25) to the platen shaft with the two setscrews (21).

(5) Secure the detent wheel (24) on the platen shaft with the two setscrews (20).

(6) Position the platen shift arm (19) on the platen support frame (30). Attach it with a lockwasher (18) and machine screw (17).

(7) Attach the platen blocking arm bracket (16) on the platen support frame (30) with the two lockwashers (15) and machine screws (14).

(8) Position the pivot stud of the platen blocking arm (13) in the platen blocking arm bracket (16). Attach it with a lockwasher (12), machine screw (11), and self-locking hexagonal nut (10).

(9) Secure the pivot stud of the platen blocking arm (13) in place with a retainer ring (9).

(10) Install the platen locking stud (8) in the platen support frame (30).

(11) Position the platen latching arm (7) on the platen support frame (30). Attach it with a lockwasher (6) and machine screw (5).

(12) Replace the platen assembly (par. 118*b*).

(13) Adjust the platen assembly (pars. 234–245).

120. Disassembly and Reassembly of Platen Trough

(fig. 109)

a. Disassembly.

(1) Remove the platen trough from the platen frame (par. 118*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) Disconnect 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). Remove the connecting link (11) and the bracket link (12).

(5) Disconnect the platen spacing detent spring (13) from the platen spacing detent (15) and from the spring post on the platen trough (46).

(6) Remove the flat washer (14), platen spacing detent (15), and flat washer (16) from the platen trough.

(7) Disconnect the platen detent spring (17) from the line spacing detent (19) and 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) and remove the platen detent eccentric stud (22).
(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 and spacer.
(11) Remove the pressure roller operating shaft screw (25). Slide the platen pressure roller operating shaft (30) 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 shaft and the platen pressure roller (29) from the platen pressure roller operating shaft (30).
(13) Unhook 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) Unhook the three stripper springs (36) from the six paper strippers (40 and 41).
(17) Remove the four retainer rings (35) and remove the paper guide shaft (37). 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). Remove the platen trough spring (44) and the paper trough guide (45).

b. Reassembly.

(1) Position the paper trough guide (45) on the platen trough (46). Insert the hinge pin (43) far enough to install the platen trough spring (44) and insert the hinge pin the rest of the way.
(2) Position the paper guide (42), six paper strippers (41 and 40), three sleeves (39), and paper guide (38) on the paper guide shaft (37). Install the four retainer rings (35) to hold the paper strippers (40 and 41) in position.
(3) Install the three stripper springs (36) on the paper strippers (40 and 41).
(4) Position the paper guides (38 and 42) on the paper guide shaft (37). Secure them with the two setscrews (33 and 34).
(5) Position the assembled paper guide shaft (37) and paper guides on the platen trough (46). Secure the assembly with a pivot screw (32).
(6) Attach the two paper guide springs (31) to the paper guides (38 and 42) and to the platen trough (46).
(7) Position the platen pressure roller (29) between the arms of the platen pressure roller operating shaft (30). Insert the platen pressure roller shaft (28) through the arms and roller. Secure it with two retainer rings (26 and 27).
(8) Position the platen pressure roller operating shaft (30) on the platen trough (46) and secure it by installing the pressure roller operating shaft screw (25).
(9) Position the pressure roller lever (24) and spacer on the platen pressure roller operating shaft (30). Secure it with a setscrew (23).
(10) Position the platen detent eccentric stud (22) on the platen trough (46). Secure it with a lockwasher (21) and plain round nut (20).
(11) Position the line spacing detent (19) on the platen detent eccentric stud (22). Secure it with a retainer ring (18).
(12) Attach the platen detent spring (17) to the line spacing detent (19) and to the spring post on the platen trough (46).
(13) Position a flat washer (16), platen spacing detent (15), and flat washer (14), on the stud on the platen trough (46).
(14) Attach the platen spacing detent spring (13) to the platen spacing detent (15) and to the spring post on the platen trough (46).
(15) Position the connecting link (11) on the bracket link (12) and on the stud on the platen trough. Secure it with the two retainer rings (10 and 9).
(16) Place the platen lever latch (8) on the stud on the platen trough (46). Attach

the platen lever latch spring (7) to the platen lever latch (8) and to the platen trough.

7) Position the connecting link (6) on the bracket link (12) and on the stud on the right side of the platen trough (46). Secure it with the two retainer rings (5 and 4).

8) Adjust the platen trough (pars. 229, 230, 232, 233, 237, 238, 240, and 241).

9) Install the platen trough on the platen frame (par. 119*b*).

Disassembly and Reassembly of Platen Crank

(fig. 111)

isassembly.

) Push the platen crank (6) in and turn it clockwise to remove it from the platen shaft. Remove the spring (5).

) Remove screw (1) that holds platen crank knob (2) onto the platen crank (6). Remove the platen crank knob, plain washer (3), and lockwasher (4).

Note.—The screw (1) is staked to the platen crank (6).

b. Reassembly.

(1) Position the lockwasher (4), plain washer (3), and platen crank knob (2) on the platen crank (6). Attach them to the platen crank with the scr϶w (1).

(2) To fasten the platen crank (6) onto the platen shaft at the bayonet-type connection, place spring (5) in the bayonet socket of the platen crank (6). Push the bayonet socket onto th϶ pin on the platen shaft and twist the crank counterclockwise.

122. Disassembly and Reassembly of Platen

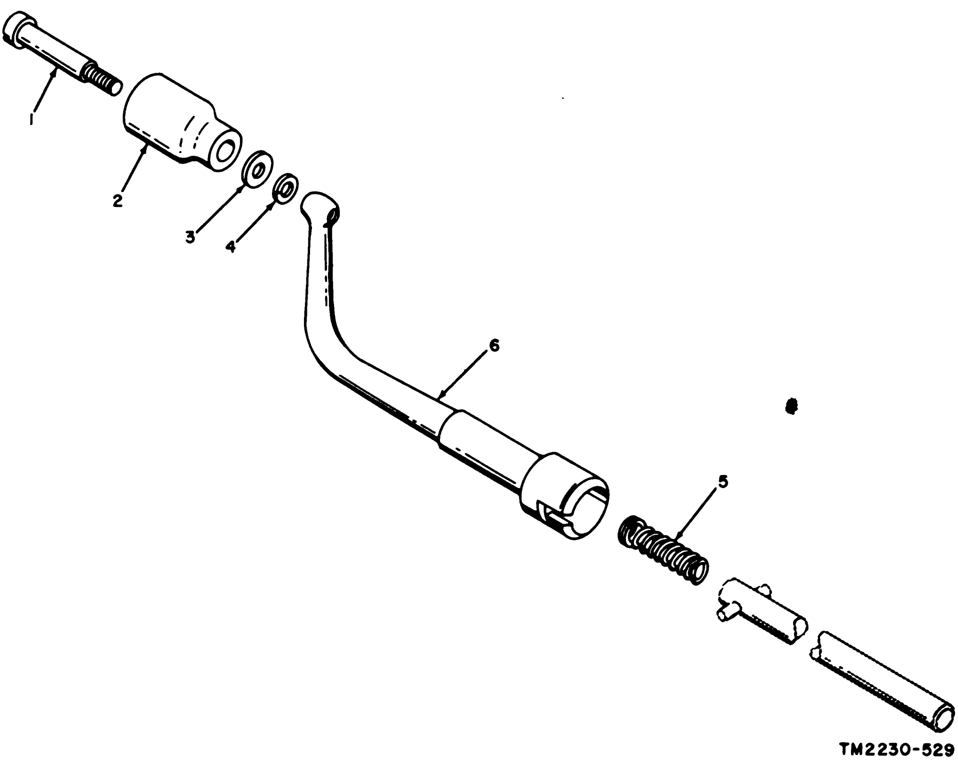
(fig. 112)

a. Disassembly.

(1) Remove the platen from the platen assembly (par. 119*a*(1)–(10)).

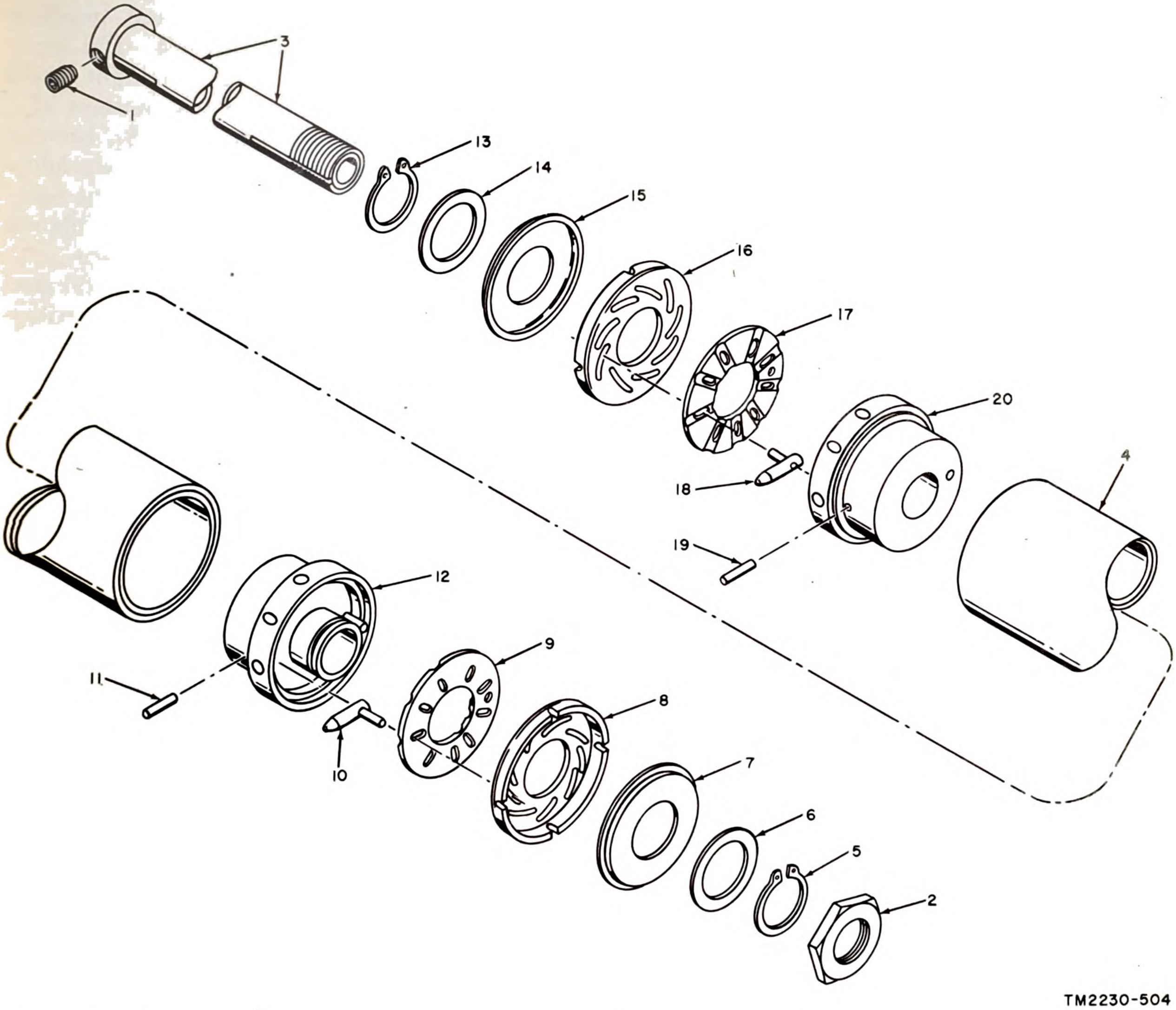
(2) Remove the plain hexagonal nut (2) from the shaft (3). Remove the pinwheel body (12) and the platen roller (4) from the pinwheel body (20).

(3) Remove the retainer ring (5), flat washer (6), sprocket friction plate (7), sprocket cam plate (8), inside guide (9), sprocket



ew (54959)
ten crank knob (54961)
in washer (10454)
4 Lockwasher (10409)
5 Spring (54957)
6 Platen crank (54960A) (includes items 1, 2, 3, 4, and 5)

Figure 111. Platen crank, exploded view.



1 Setscrew (10209)
2 Plain hexagonal nut (52806)
3 Shaft (52755A)
4 Platen roller (55079A)
5 Retainer ring (11046)
6 Flat washer (55169)
7 Sprocket friction plate (55160)
8 Sprocket cam plate (55158)
9 Inside guide
10 Sprocket feed pin (55170A)
11 Locking pin (55161)
12 Pinwheel body (55180A) (includes items 9 and 10)
13 Retainer ring (11046)
14 Flat washer (55169)
15 Sprocket friction plate (55160)
16 Sprocket cam plate (55158)
17 Inside guide
18 Sprocket feed pin (55170A)
19 Locking pin (55161)
20 Pinwheel body (55180A) (includes items 17 and 18)

Figure 112. Platen, exploded view.

feed pins (10), and locking pin (11) from the pinwheel body (12).

(4) Remove the retainer ring (13), flat washer (14), sprocket friction plate (15), sprocket cam plate (16), inside guide (17), sprocket feed pins (18) and locking pin (19) from the pinwheel body (20).

b. Reassembly.

(1) To assemble the pinwheel body (20), insert the nine sprocket feed pins (18) in the holes in the pinwheel body and position the inside guide (17) on the pins in the side of the sprocket feed pins.

(2) Position the inside guide (17) on the pinwheel body (20). The head of the dowel pin should be flush with, or 0.005 inch below, the outer edge of the pinwheel body (20).

(3) Position the sprocket cam plate (16) on the pins in the side of the sprocket feed pins (18).

(4) Place the sprocket friction plate (15) and the flat washer (14) on the sprocket cam plate. Hold the assembled parts in place in the pinwheel body (20) with the retainer ring (13).

(5) Assemble the parts in the pinwheel body (12) in the same manner as for the pinwheel body (20).

(6) Slide the assembled pinwheel body (20) onto the shaft (3). Position the hole in the pinwheel body over the slot in the shaft and bottom the locking pin (19) in the slot.

(7) Slide the platen roller (4) over the assembled pinwheel body (20) and up against the shoulder.

(8) Slide the assembled pinwheel body (12) over the threaded end of the shaft (3). Insert the locking pin (11) through the pinwheel body (12) and into the slot in the shaft. Do not drive the pin all the way down. Hold the platen tube with the slot up and slide the pinwheel body into the platen roller. Bottom the locking pin (11) 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 (par. 231).

(11) Replace the platen in the platen assembly (par. 119*b*(3)–(12)).

123. Removal and Replacement of Carriage

(fig. 113)

a. Removal.

(1) Move the carriage to the left margin stop and mark the two teeth on the fiber carriage rack driving gear that engage the last tooth on the carriage feed and return driving rack.

(2) Remove the machine screw (1) and lockwasher (2) that hold the guide rail (18) to the teleprinter 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.

(3) Remove the two socket-head machine screws (3), flat washers (4), and lockwashers (5) that hold the right hand margin trip plate (6), flat washers (7), left hand margin trip plate (8), 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.

(4) Remove the two machine screws (9) and lockwashers (10) that hold the carriage rear support bracket (11) to the carriage frame (28). Slide the assembled support and sliding helical gear to the function side of the square shaft and remove the carriage rear support.

(5) Remove the carriage from the teleprinter frame by lifting it forward and upward.

b. Replacement.

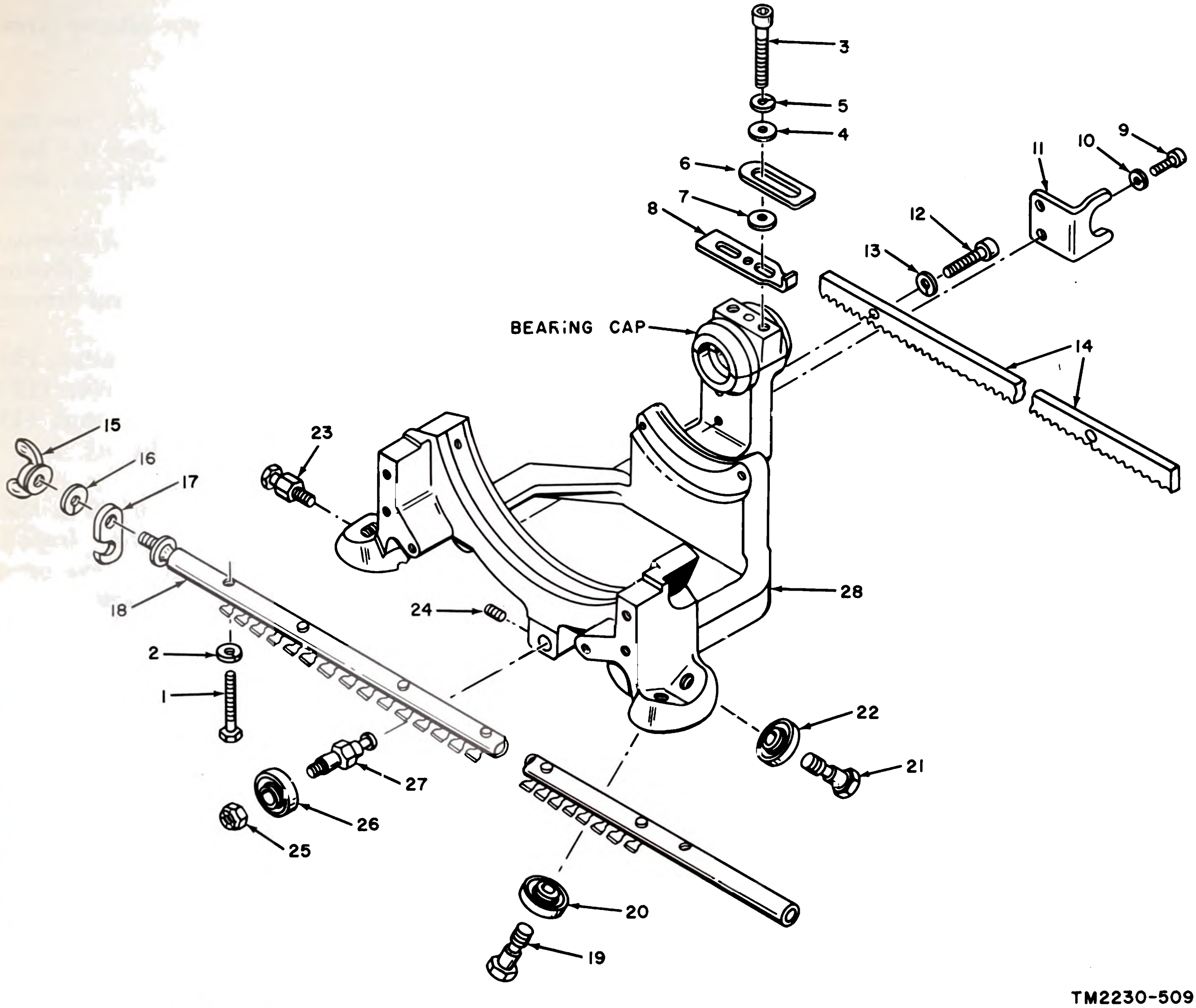
(1) Position the carriage on the teleprinter frame so that the two marked teeth on the fiber carriage rack driving gear mesh with the last tooth at the left of the carriage feed and return driving rack.

(2) Aline the carriage guide rail (18) with the two tapped holes in the teleprinter frame and secure it with a machine screw (1) and lockwashers (2) on the left side and a similar screw and two lockwashers on the right side. Attach the carriage return button bracket between the two lockwashers on the right side. Place the ribbon lifter groove on the ribbon lifter rail beneath the platen.

(3) Position the carriage rear support bracket (11) on the sliding helical gear with the forks of the support alined with the flatted portions of the gear mounting. Slide the sliding helical gear so that the holes in the support bracket are alined with the tapped holes in the carriage frame and secure it with the two machine screws (9) and lockwashers (10).

Caution: Do not force the support into place.

(4) Depress the blank key and turn the teleprinter 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).



1	Machine screw (10319)	15	Plain wing nut (10508)
2	Lockwasher (10430)	16	Lockwasher (10431)
3	Machine screw (10013)	17	Platen lockup arm (50598)
4	Flat washer (10467)	18	Carriage guide rail (50394A) (includes items 15, 16, and 17)
5	Lockwasher (10430)	19	Cap screw (50591)
6	Right-hand margin trip plate (52257)	20	Ball bearing (10752)
7	Flat washer (10467)	21	Cap screw (50591)
8	Left-hand margin trip plate (52253)	22	Ball bearing (10752)
9	Machine screw (10004)	23	Carriage locking stud (50594)
10	Lockwasher (10429)	24	Set screw (10204)
11	Carriage rear support bracket (50571)	25	Self-locking hexagonal nut (10501)
12	Machine screw (10011)	26	Ball bearing (10752)
13	Lockwasher (10430)	27	Roller mounting stud (50593)
14	Carriage feed and return driving rack (50592)	28	Carriage frame (50545A)

Figure 113. Carriage frame assembly, exploded view.

Note.—Be sure that the ribbon vibrator lever (8, fig. 115) is behind and not under the tape selecting arm (3, fig. 114).

(5) Place the bearing cap on the carriage frame. Position the left hand margin trip plate (8), two flat washers (7), and the right hand margin trip plate (6) on the bearing cap; and secure them with the two machine screws (3), lockwashers (5), and flat washers (4).

(6) Adjust the carriage (pars. 209, 210, 211, and 255).

Disassembly and Reassembly of Type Selecting Arm

(fig. 114)

Disassembly.

1) Remove the type selecting arm (par. 123*a*(1)–(3)).

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 internal-tooth lockwasher (5) from the type selector arm driven claw (12).

4) Remove the type selector arm driving gear (6) from the type selector arm 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).

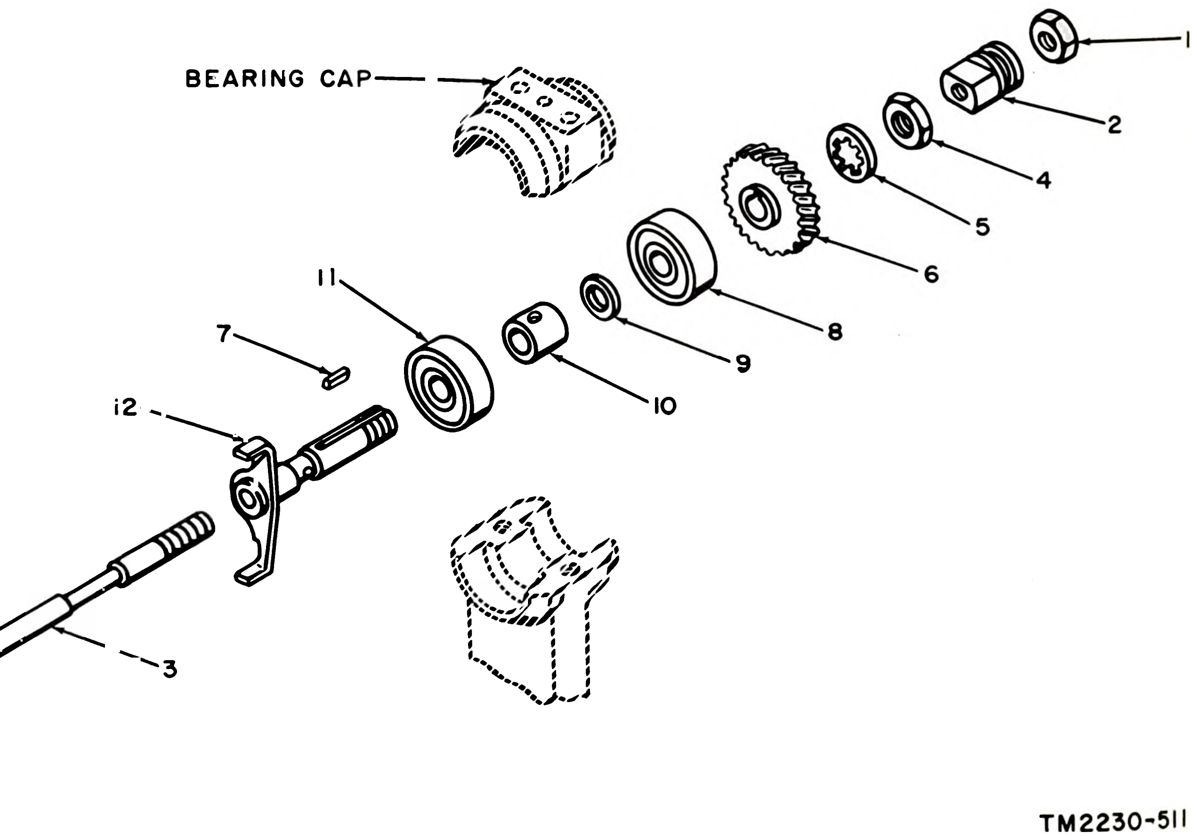
b. Reassembly.

(1) Assemble the ball bearing (11), spacing collar (10), flat washer (9), and the ball bearing (8) on the type selector arm driven claw (12).

(2) Insert the machine key (7) in the keyway and install the type selector arm driving gear (6) on the type selector arm driven claw (12).

(3) Place the internal-tooth lockwasher (5) on the type selector arm driven claw (12) and draw the plain hexagonal nut (4) tight against the internal-tooth lockwasher.

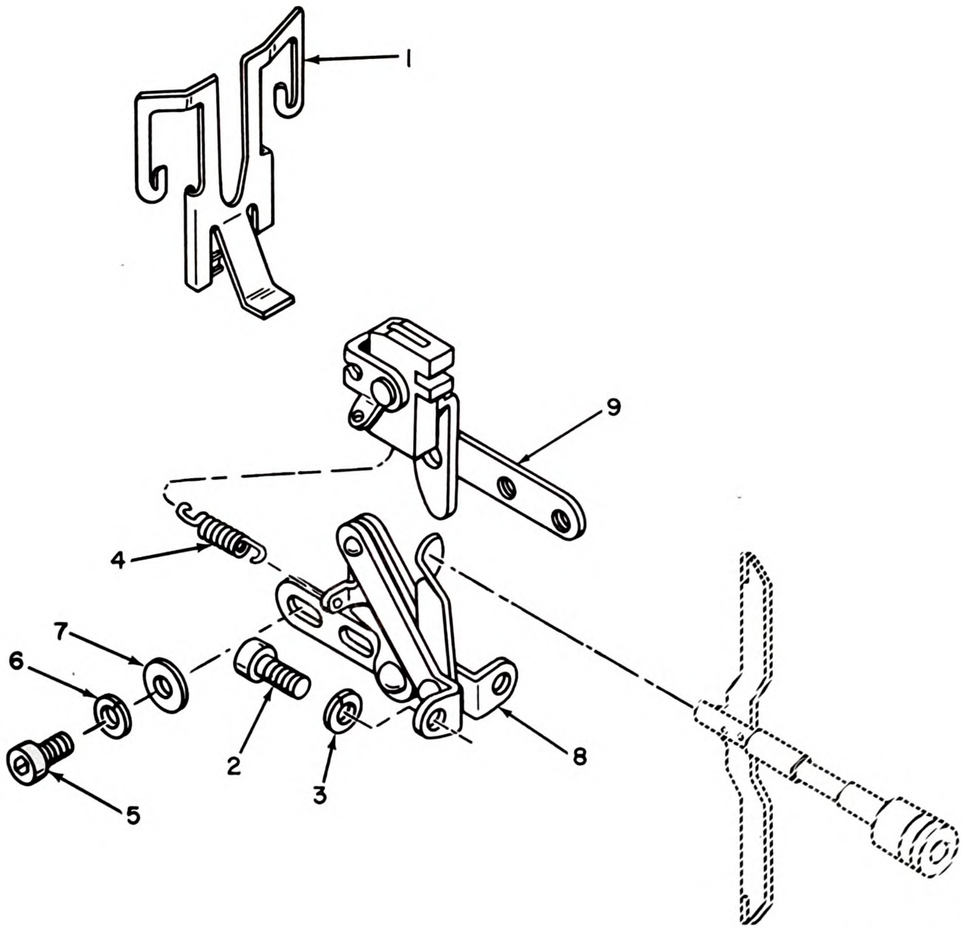
(4) Insert the type selecting arm (3) in the type selector arm driven claw. Install the round nut (2) and the plain hexagonal nut (1) on the type selecting arm.



ain hexagonal nut (10509)
ound nut (50564)
ype selecting arm (50560A)
ain hexagonal nut (50559)
ternal-tooth lockwasher (10401)
ype 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 114. Type selecting arm, exploded view.



1 Ribbon guide (55036)
2 Machine screw (10001)
3 Lockwasher (10429)
4 Ribbon vibrator bell crank spring (51544)
5 Machine screw (10050)
6 Lockwasher (10432)
7 Flat washer (50320)
8 Ribbon vibrator lever and bracket assembly (55790A)
9 Ribbon vibrator bell crank assembly (55795A)

Figure 115. Ribbon guide and vibrator assembly, exploded view.

(5) Install the type selecting arm (par. 123*b*(4)–(6)).

(6) Adjust the type selecting arm (pars. 228, 250, 255, and 256).

125. Disassembly and Reassembly of Ribbon Guide and Vibrator

(fig. 115)

a. Disassembly.

(1) Unhook the ribbon guide (1) from the ribbon vibrator bell crank assembly (9). Remove the ribbon guide (1) from the ribbon guide mounting bracket.

(2) Remove the two machine screws (2) and lockwashers (3) that attach the ribbon vibrator lever and bracket assembly (8) to the guide plate. Remove the assembled ribbon lifter.

(3) Remove the ends of ribbon vibrator bell crank spring (4) from the ribbon vibrator lever and bracket assembly (8) and from the ribbon vibrator bell crank assembly (9).

(4) Remove the two machine screws (5), lockwashers (6), and flat washers (7) that attach the ribbon vibrator bell crank assembly (9) to the ribbon vibrator lever and bracket assembly (8).

b. Reassembly.

(1) Position the ribbon vibrator lever and bracket assembly (8) on the ribbon vibrator bell crank assembly (9). Attach

it with two flat washers (7), lockwashers (6), and machine screws (5).

(2) Hook the ends of the ribbon vibrator bell crank spring (4) in the spring holes in the tabs on the ribbon vibrator bell crank assembly (8).

(3) Position the ribbon vibrator lever and bracket assembly (8) on the guide plate. Attach it with two lockwashers (3) and machine screws (2).

(4) Slide the ribbon guide (1) onto the ribbon guide mounting bracket and hook the tab on the ribbon guide to the ribbon vibrator bell crank assembly (9).

(5) Adjust the ribbon guide and vibrator (par. 250).

Disassembly and Reassembly of Ribbon Feed Mechanism

(fig. 116)

Disassembly.

(1) Remove the ribbon from the ribbon vibrator (1, fig. 115).

(2) Lift the locking latch (30) 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). Remove the ribbon feed mechanism.

(4) Remove the four machine screws (4), lockwashers (5), and retainer plates (6) and remove the type bar backstop cushion (7).

(5) Remove the two self-locking hexagonal nuts (8) from the machine screws (9). Lift the ribbon drive subassembly (14) from the pins on the ribbon sensing levers (20) and from the two ribbon drive mountings (29).

(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). Remove the detent plate (13).

(8) Remove the two ribbon sensing lever springs (15) that are attached to the two ribbon sensing levers (20).

(9) Remove the two machine screws (16), flat washers (17), and lockwashers (18). Remove the ribbon sensing levers and slide off the two ribbon reversing cam followers (19).

(10) Remove the setscrews (21) and remove the two ribbon spool driven shaft collars (22).

(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 flat washers (25), spool friction springs (26), and shaft collars (27) from the shafts as the shafts are removed.

(12) Slide the two ribbon spool driving gears (28) from the two ribbon spool drive shafts.

b. Reassembly.

(1) Slide the two ribbon spool driving gears (28) onto the two ribbon spool drive shafts (24).

(2) Insert the ends of the two ribbon spool drive shafts (24) through the bushings in the left and right ribbon drive mountings. Reassemble the shaft collars (27), spool friction springs (26), and the flat washers (25) on the ribbon spool drive shafts.

(3) Push the ribbon spool drive shafts (24) all the way. Position the two ribbon spool driven shaft collars (22) on the two ribbon spool drive shafts and fasten with the setscrews (21).

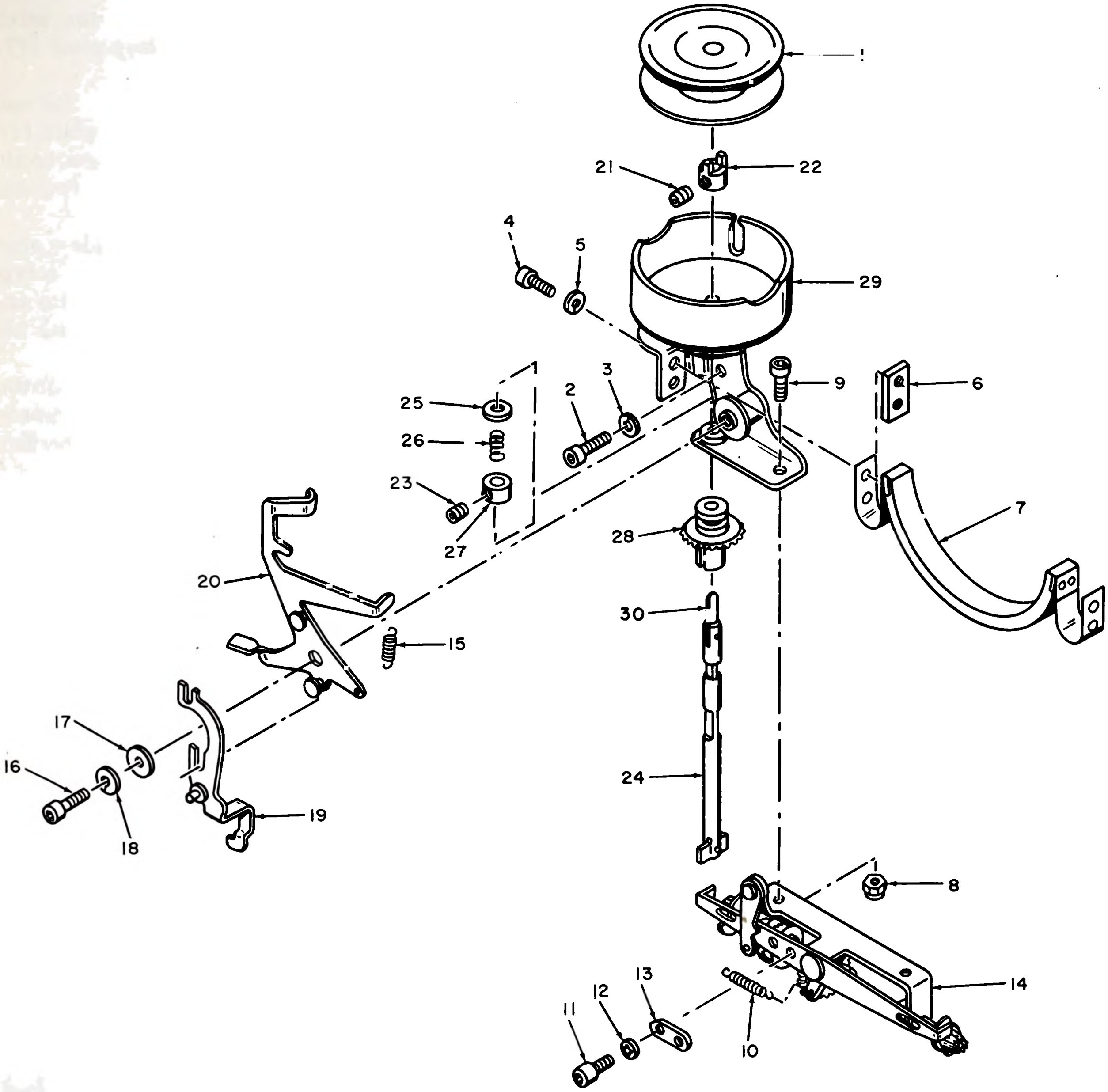
(4) Position the shaft collars (27) over the flats on the shaft and secure them in place with the setscrews (23).

(5) Position the two ribbon reversing cam followers (19) on the two ribbon sensing levers (20) and position the ribbon sensing levers on the posts on the two ribbon drive mountings (29). Fasten the ribbon sensing levers with the two flat washers (17), lockwashers (18), and machine screws (16).

(6) Attach the two ribbon sensing lever springs (15) to the ribbon drive mountings and to the ribbon sensing levers (20).

(7) Position the ribbon reversing detent plate (13) on the ribbon drive subassembly (14). Fasten it in place with the two lockwashers (12) and machine screws (11).

(8) Hook the ribbon reverse detent spring



TM2230-502

1 Printing ribbon spool (10900)
2 Machine screw (10004)
3 Lockwasher (10429)
4 Machine screw (10001)
5 Lockwasher (10429)
6 Retainer plate (50434)
7 Type bar backstop cushion (50429A)
8 Self-locking nut (10500)
9 Machine screws (10003)
10 Ribbon reversing detent spring (50403)
11 Machine screw (10002)
12 Lockwasher (50403)
13 Ribbon reversing detent plate (50393)
14 Ribbon drive subassembly (50400A) (includes items 11, 12, and 13)
15 Ribbon sensing lever spring (50447).
16 Machine screw (10003)
17 Flat washer (50414)
18 Lockwasher (10429)
19 Ribbon reversing cam follower (50423A) (left hand) (50424A) (right hand)
20 Ribbon sensing lever (55026A) (left hand) (55028A) (right hand)
21 Setscrew (10201)
22 Ribbon spool driven shaft collar (50392)
23 Setscrew (10201)
24 Ribbon spool drive shaft (50435A)
25 Flat washer (50315)
26 Spool friction spring (53561)
27 Shaft collar (50391)
28 Ribbon spool driving gear (50448)
29 Ribbon drive mounting (50451A) (left hand) (50453A) (right hand)
30 Locking latch

Figure 116. Ribbon feed mechanism, exploded view.

(10) to the ribbon detent lever and frame of the ribbon drive subassembly (14).

Position the ribbon drive subassembly (14) on the pins on the two ribbon sensing levers (20) and on the two ribbon drive mountings. Attach them with the machine screws (9) and self-locking nuts (8), but do not tighten securely.

Position the type bar backstop cushion (7) on the two ribbon drive mountings (29). Fasten it with the two retainer plates (6), four lockwashers (5), and four machine screws (4).

Position the assembled ribbon feed mechanism on the frame of the carriage and fasten it in place with the lockwashers (3) and machine screws (2).

Install the printing ribbon spools (par. 31*d*).

Adjust the ribbon feed mechanism (pars. 252, 253, and 254).

isassembly and Reassembly of Type Bar Group

(fig. 117)

sassembly.

Remove the ribbon feed mechanism (Par. 126*a*(1)–(3)).

Remove the 26 springs (1) from the guide plate (18) and from the connecting bars (4).

Push the hinge pin (2) out of the type bar segment (14).

Remove the 26 type bars (3) and the 26 connecting bars (4) from the type bar segment (14) and from the mounting plate (17).

Remove the two plain hexagonal nuts (5) and lockwashers (6). Remove the setscrews (7) from the type bar segment (14) and the carriage frame. Remove the type bar segment from the carriage frame.

Remove the type bar segment machine key (8) from the carriage frame.

Remove the two machine screws (9). Remove the ribbon guide mounting bracket (10).

Remove the four machine screws (11). Remove the type bar bumper stop plate (12) and the type bar bumper plate shim (13).

Remove the two machine screws (15) and lockwashers (16). Remove the guide plate (18) and the mounting plate (17).

b. Reassembly.

(1) Position the guide plate (18) on the carriage frame and the mounting plate (17) on the guide plate. Attach them to the frame with the two lockwashers (16) and machine screws (15).

(2) Position the type bar bumper plate shim (13) and the stop plate (12) on the type bar segment (14). Attach the shim and plate to the type bar segment with the four machine screws (11).

(3) Position the ribbon guide mounting bracket (10) on the type bar segment (14). Attach it with the two machine screws (9).

(4) Position the type bar segment machine key (8) on the carriage frame.

(5) Position the type bar segment (14) on the type bar segment machine key (8). Attach it to the carriage frame with the two setscrews (7). Lock the setscrews in place with a lockwasher (6) and plain hexagonal nut (5).

(6) Position the 26 connecting bars (4) and the 26 type bars (3) in the type bar segment (14), with the connecting bars (4) against the guide plate (18). Numbers 1 to 26 are stamped in both connecting bars and type bars of communication symbol machines, and numbers 1 to 27 on weather machines. Install the bars in matched pairs with the No. 1 set on the left hand side of the carriage.

(7) Thread the hinge pin (2) in the type bar segment through the holes in the 26 type bars.

(8) Install the 26 springs (1) on the connecting bars (4) and on the mounting plate (17).

(9) Install the ribbon feed mechanism (par. 126*b*(11), (12), and (13)).

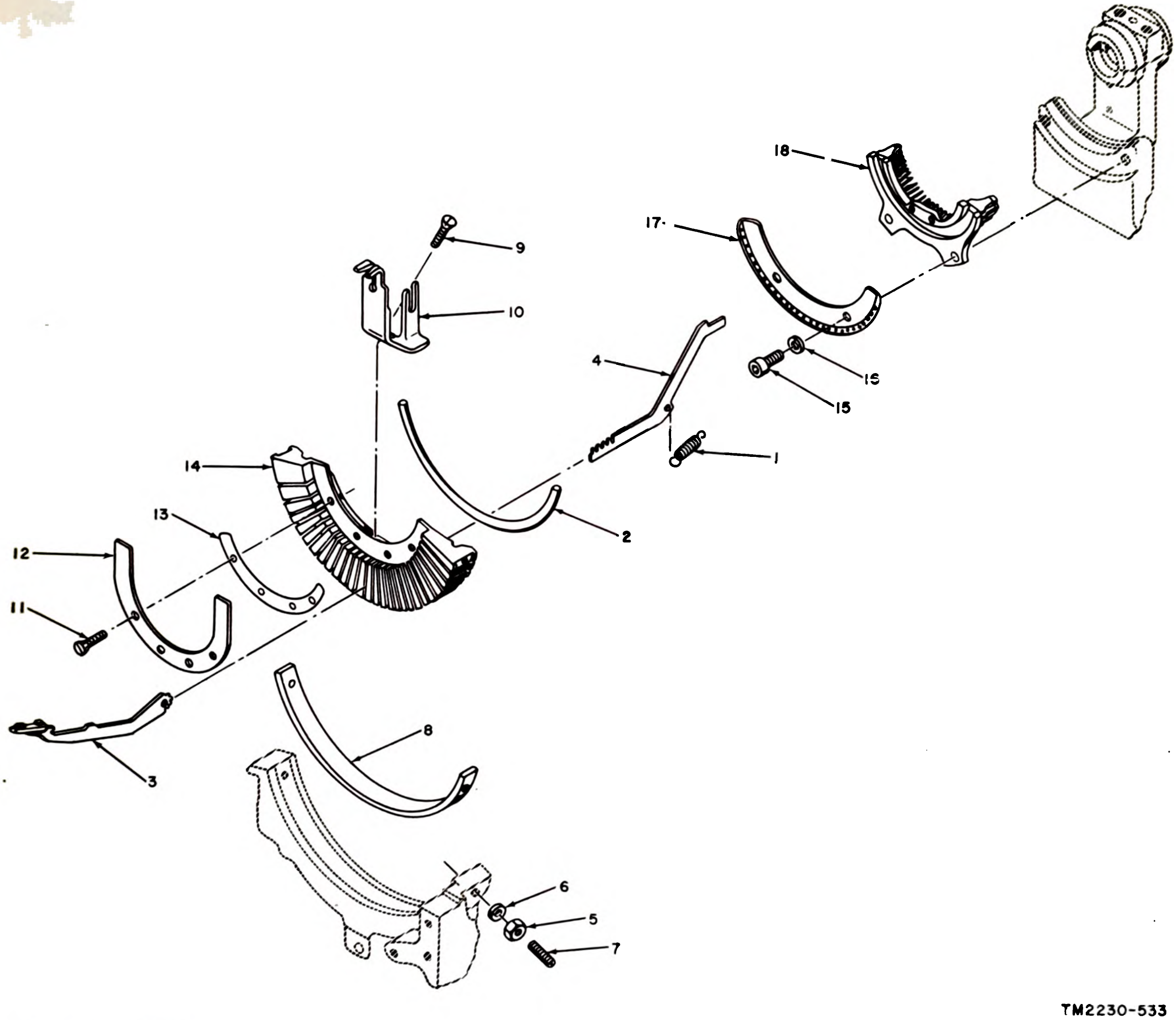
128. Disassembly and Reassembly of Carriage Frame

(fig. 113)

a. Disassembly.

(1) Remove the carriage from the teleprinter (par. 123*a*).

(2) Remove the two machine screws (12) and lockwashers (13) and remove the carriage feed and return driving rack (14).



1	Spring (50595)	10	Ribbon guide mounting bracket (55147)
2	Hinge pin (50572)	11	Machine screw (51132)
3	Type bar	12	Stop plate (55791)
4	Connecting bar	13	Type bar bumper plate shim (51244 to 51247)
5	Plain hexagonal nut (10509)	14	Type bar segment (50549)
6	Lockwasher (10431)	15	Machine screw (10025)
7	Set screw (10214)	16	Lockwasher (10430)
8	Type bar segment machine key (50550)	17	Mounting plate (50548)
9	Machine screw (10306)	18	Guide plate (50547)

Figure 117. Type bar group, exploded view.

(3) Remove the plain wing nut (15), lockwasher (16), and platen lockup arm (17) from the threaded end of the carriage guide rail (18). Remove the carriage guide rail from the rollers.

(4) Remove the two cap screws (19) and remove the two ball bearings (20).

(5) Remove the two cap screws (21). Remove the ball bearings (22).

(6) Remove the carriage locking stud (23) from the carriage frame (28).

(7) Remove the set screw (24). Remove the assembled roller mounting stud (27) and ball bearing (26).

(8) Remove the self-locking hexagonal nut (25) and the ball bearing (26) from the roller mounting stud (27).

Reassembly.

(1) Install the ball bearing (26) on the roller mounting stud (27). Secure it with a self-locking hexagonal nut (25).

(2) Insert the roller mounting stud in the carriage frame (28). Fasten it in place with a setscrew (24).

(3) Install the carriage locking stud (23) in the carriage frame (28).

(4) Install the two ball bearings (22) on the two cap screws (21). Install the assembled cap screws and bearings in the carriage frame (28).

(5) Install the two ball bearings (20) on the two cap screws (19). Install the assembled cap screws and ball bearings on the carriage frame (28).

(6) Slide the carriage guide rail (18) into position between the five ball bearings, with the teeth engaging the gear on the ribbon drive mounting.

(7) Place the platen lockup arm (17) and lockwasher (16) on the threaded end of the carriage guide rail (18). Fasten them with a plain wingnut (15).

(8) Position the carriage feed and return driving rack (14) on the carriage frame (28). Attach it with the two lockwashers (13) and machine screws (12).

(9) Install the type carriage on the teleprinter (par. 123*b*).

(10) Adjust the carriage (pars. 209, 210, 211, and 255).

Disassembly and Reassembly of Selector Magnet

Note.—Two selector magnet assemblies are used on teleprinters, one utilizing a magnet with terminals (118) and the other a magnet without terminals (fig.

Disassembly—Terminal Magnet (fig. 118).

(1) Remove the two machine screws (1), flat washers (2), and lockwashers (3). Remove the selector magnet assembly from the frame of the teleprinter.

(2) Remove the two cotter pins (4). Remove the cover (5) and the two cover springs (6).

(3) Remove the two machine screws (7) and lockwashers (8). Remove the assembled potentiometer (14) and bracket (11).

(4) Remove the locking nut (9) and the plain hexagonal nut (10) from the threaded bushing of the potentiometer (14). Remove the potentiometer mounting bracket (11) from the potentiometer.

(5) Unsolder the two electrical leads in the tubing (12), from the terminal posts on the selector magnet (24), and from the terminal lugs on the potentiometer (14). Tag the leads. Remove the tubing from the electrical cable assembly. Remove the two pieces of insulating tubing (13) from the electrical leads at the potentiometer.

(6) Remove the self-locking hexagonal nut (15) from the selector magnet cable stud (18). Remove the electrical clamp (16) from the selector magnet cable stud.

(7) Unsolder the six electrical wires of the selector magnet cable (17) from the six terminal posts of the selector magnet (24) and tag the leads. Remove the selector magnet cable from the electrical clamp (16).

(8) Remove the selector magnet cable stud (18), flat washer (19), lockwasher (20), machine screw (21), flat washer (22), and lockwasher (23). Remove the selector magnet (24) and the magnet bracket (25).

(9) Remove the setscrew (26) that holds the bar magnet (27) in the selector magnet bracket (42); mark the magnet and bracket before removing the magnet from the selector magnet bracket.

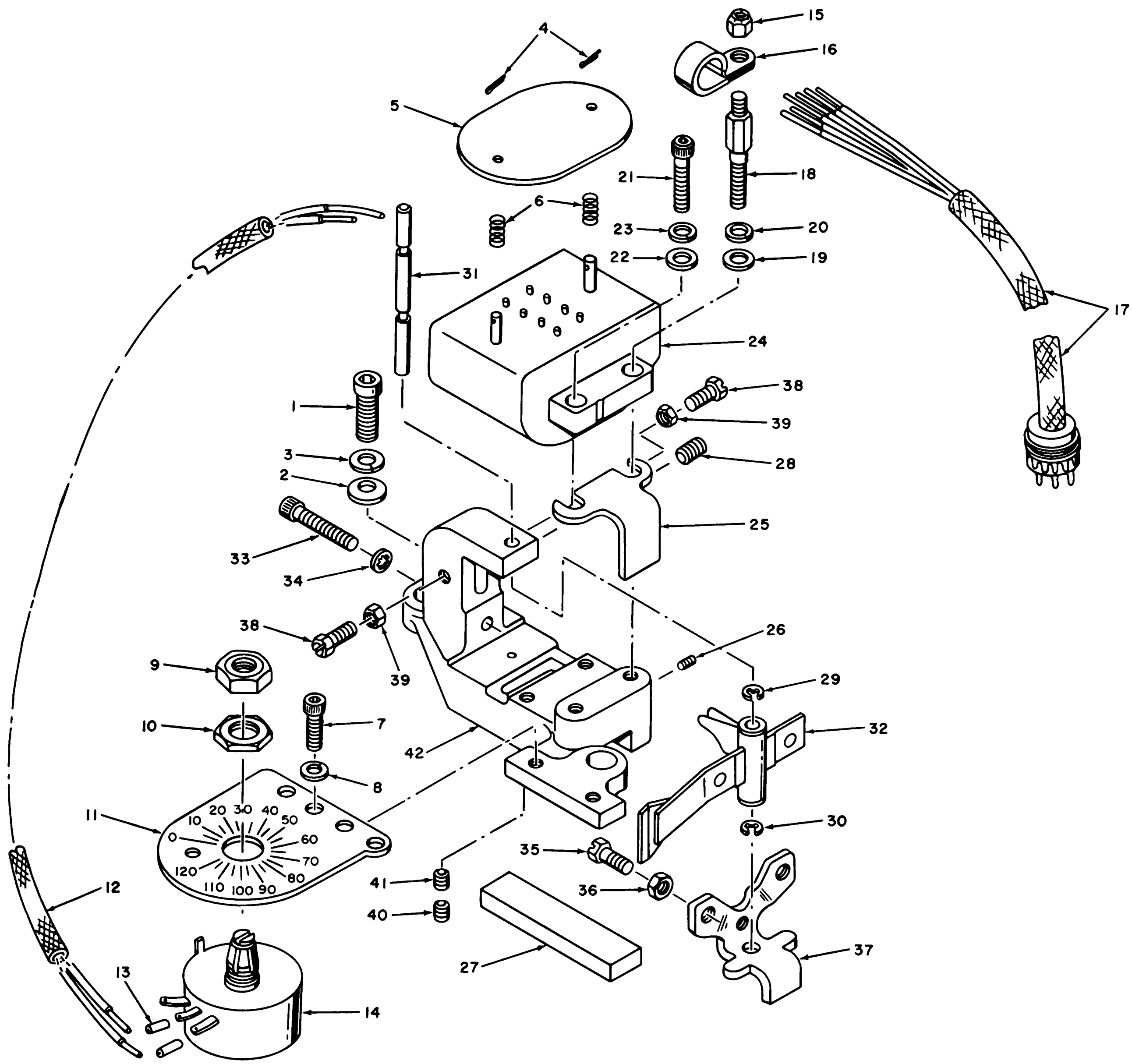
(10) Remove the setscrew (28) that holds the armature lever mounting shaft (31) in the selector magnet bracket (42).

(11) Remove the retainer rings (29 and 30) from the armature mounting shaft (31). Slide the armature lever mounting shaft from the armature (32) and from the selector magnet bracket (42). Remove the armature from the selector magnet bracket.

(12) Remove the machine screw (33) and lockwasher (34). Remove the assembled armature stop bracket (37).

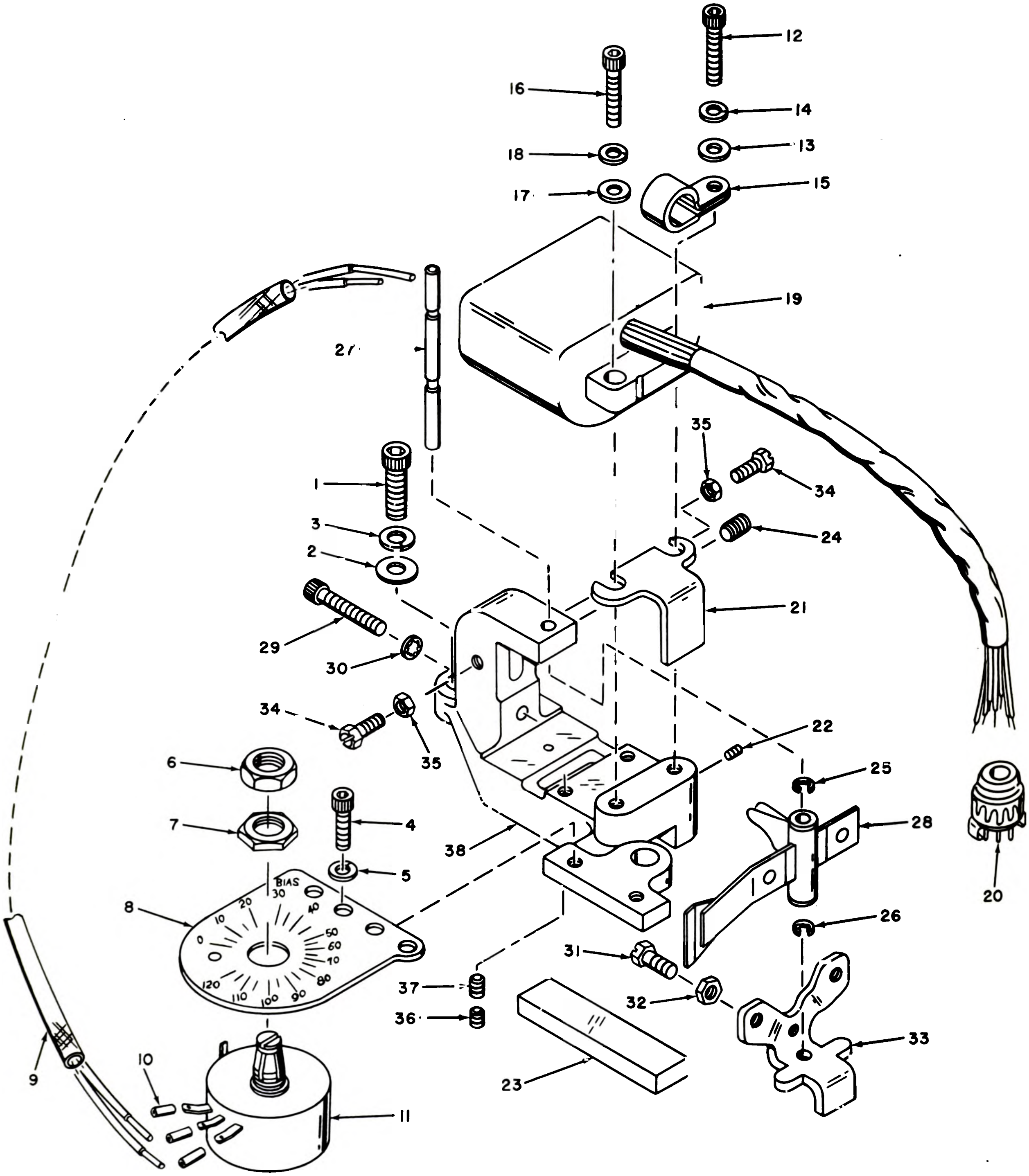
(13) Remove the two machine screws (35) and plain hexagonal nuts (36) from the armature stop bracket (37).

(14) Remove the two armature leaf spring stop screws (38) and plain hexagonal nuts (39) from the selector magnet bracket (42).



1 Machine screw (10018)
2 Flat washer (10464)
3 Lockwasher (10420)
4 Cotter pin (10806)
5 Cover (56089)
6 Cover spring (56091)
7 Machine screw (10032)
8 Lockwasher (10430)
9 Locking nut
10 Plain hexagonal nut (10529)
11 Potentiometer mounting bracket (53333)
12 Tubing
13 Insulating tubing
14 Potentiometer (20025) (includes item 9)
15 Self-locking hexagonal nut (10501)
16 Electrical clamp (20513)
17 Selector magnet cable (53545A)
18 Selector magnet cable stud (56127)
19 Flat washer (50315)
20 Lockwasher (10430)
21 Machine screw (10011)
22 Flat washer (50315)
23 Lockwasher (10430)
24 Selector magnet (56126A)
25 Bracket (52292)
26 Setscrew (10220)
27 Magnet (52289)
28 Setscrew (10225)
29 Retainer ring (10969)
30 Retainer ring (10969)
31 Armature lever mounting shaft (52288)
32 Armature (54092A)
33 Machine screw (10010)
34 Lockwasher (10404)
35 Machine screw (53183)
36 Plain hexagonal nut (10507)
37 Armature stop bracket (52529)
38 Armature leaf spring stop screw (53183)
39 Plain hexagonal nut (10507)
40 Setscrew (10235)
41 Setscrew (10221)
42 Selector magnet bracket (52528)

Figure 118. Terminal selector magnet, exploded view.



1 Machine screw (10018)
2 Flat washer (10464)
3 Lockwasher (10420)
4 Machine screw (10032)
5 Lockwasher (10430)
6 Locking nut
7 Plain hexagonal nut (10529)
8 Potentiometer mounting bracket (53333)
9 Tubing
10 Tubing
11 Potentiometer (20025) (includes item 6)
12 Machine screw (10011)
13 Flat washer (50315)
14 Lockwasher (10430)
15 Electrical clamp (20513)
16 Machine screw (10011)
17 Flat washer (50315)
18 Lockwasher (10430)

Figure 119. Nonterminal selector magnet, exploded view.

(15) Remove the setscrews (40 and 41) from the selector magnet bracket (42).

b. Disassembly—Nonterminal Magnet (fig. 119).

(1) Remove the two machine screws (1), flat washers (2), and lockwashers (3). Remove the selector magnet assembly from the teleprinter.

(2) Remove the two machine screws (4) and lockwashers (5). Remove the assembled potentiometer (11) and potentiometer mounting bracket (8).

(3) Unsolder the electrical leads in the tubing (9) from the two terminal posts on the selector magnet (19) and from the terminal lugs of the potentiometer (11). Tag the leads. Remove the tubing from the electrical cable assembly. Remove the pieces of insulating tubing (10) from the electrical leads at the potentiometer.

(4) Remove the machine screw (12), flat washer (13), lockwasher (14). Remove the electrical clamp (15) from the selector magnet electrical leads. Remove the machine screw (16), flat washer (17), and lockwasher (18). Remove the selector magnet and the magnet bracket (21).

(5) Remove the electrical connector (20) from the electrical leads. Tag the leads.

(6) Remove the setscrew (22), mark the magnet (23), the magnet bracket (38), and remove the magnet.

(7) Remove the setscrew (24) from the magnet bracket (38).

(8) Remove the retainer rings (25 and 26). Slide the armature mounting shaft from the armature (28) and from the magnet bracket (38). Remove the armature from the magnet bracket.

(9) Remove the machine screw (29) and lockwasher (30). Remove the assembled armature stop bracket (37) and machine screws (31).

(10) Remove the two machine screws (31) and plain hexagonal nuts (32) from the armature stop bracket (33).

(11) Remove the two armature leaf spring screws (34) and plain hexagonal nuts (35) from the magnet bracket (38).

(12) Remove the setscrews (36 and 37) from the magnet bracket (38).

c. Reassembly—Terminal Magnet (fig. 118).

(1) Install the four setscrews (41 and 40) in the selector magnet bracket (42). Place the leading ends flush with the surface of the mounting bracket.

(2) Install the plain hexagonal nuts (39). Screw them about halfway up the threads of the armature leaf spring stop screws (38). Install the machine screws in the selector magnet bracket (42).

(3) Screw the plain hexagonal nuts (36) onto the machine screws (35). Install the machine screws in the armature stop bracket (37), with the ends of the machine screws approximately flush with the face of the armature stop bracket.

(4) Position the armature stop bracket (37) on the selector magnet bracket (42). Fasten it in place with a machine screw (33) and lockwasher (34).

(5) Position the armature (32) in the selector magnet bracket (42). Insert the armature mounting shaft (31) through the selector magnet bracket, armature, and armature stop bracket (37). Install the retainer rings (30 and 29) on the armature mounting shaft.

(6) Hold the armature mounting shaft (31) in the selector magnet bracket (42) with a setscrew (28).

(7) Assemble the bar magnet (27) on the selector magnet bracket (42). Leave an air gap of .015 inch between the south pole of the bar magnet and the armature stop bracket (37) (par. 194). Fasten the bar magnet in place with a setscrew (26)

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19 Selector magnet (53550A)
20 Electrical connector (20419)
21 Magnet bracket (52292)
22 Setscrew (10220)
23 Bar magnet (52289)
24 Setscrew (10225)
25 Retainer ring (10969)
26 Retainer ring (10969)
27 Armature lever mounting shaft (52288)
28 Armature (54092A)
29 Machine screw (10010)
30 Lockwasher (10404)
31 Machine screw (53183)
32 Plain hexagonal nut (10507)
33 Armature stop bracket (52529)
34 Armature leaf spring stop screw (53183)
35 Plain hexagonal nut (10507)
36 Setscrew (10221)
37 Setscrew (10235)
38 Selector magnet bracket (52528)

Figure 119—Continued.

The north pole of the magnet is designated by a red dot.

(8) Position the bracket (25) on the selector magnet bracket (42) and on the end of the bar magnet for a full surface contact.

(9) Position the selector magnet (24) on the selector magnet bracket (42). Fasten the magnet bracket (25) and the selector magnet on the selector magnet bracket with a lockwasher (23), flat washer (22), machine screw (21), lockwasher (20), flat washer (19), and selector magnet cable stud (18). Adjust the position of the selector magnet before tightening the mounting machine screw (21) and the selector magnet cable stud (18) (par. 195).

(10) Insert the selector magnet cable (17) through the electrical clamp (16). Solder the ends of the six electrical wires in the cable and the two potentiometer wires to the proper terminals on the selector magnet.

(11) Position the electrical clamp (16) on the studs on the selector magnet cable stud (18) and fasten it with a self-locking hexagonal nut (15).

(12) Slide the two pieces of insulating tubing (13) over the ends of the wires in the tubing (12). Solder the two cable wires to the two terminal lugs on the potentiometer (14). Slide the two pieces of insulating tubing over the soldered connections.

(13) Install the potentiometer (14) on the potentiometer mounting bracket (11). Fasten it in place with a plain hexagonal nut (10). Install and draw up the locking nut (9) fingertight.

(14) Fasten the assembled potentiometer (14) and potentiometer mounting bracket (11) to the selector magnet bracket (42) with two lockwashers (8) and machine screws (7).

(15) Place the two cover springs (6) on the studs on the selector magnet (24). Install the cover (5) on the studs and secure it with two cotter pins (4).

(16) Adjust the selector magnet attractive force and armature clearance (par. 196).

(17) Adjust the selector magnet attractive force and leaf spring alinement (par. 197).

(18) Install the selector magnet bracket (42) on the frame of the teleprinter with the two machine screws (1), flat washers (2), and lockwashers (3).

(19) Adjust the alinement of the selector and stop levers with the selector magnet (par. 198).

(20) Adjust the alinement of the selector and P-levers with the selector magnet (par. 199).

(21) Adjust the clearance between the selector levers and the armature blade of the selector magnet (par. 200).

d. Reassembly—Nonterminal Magnet (fig. 119).

(1) Install the four setscrews (37 and 36) in the selector magnet (38), with the leading ends of the screws flush with surface of the mounting bracket.

(2) Screw the plain hexagonal nuts (35) about halfway up the threads on the armature leaf spring stop screws (34). Install the machine screws in the selector magnet bracket (38).

(3) Install the plain hexagonal nuts (32) on the machine screws (31). Install the machine screws in the armature stop bracket (33) with the end of the machine screws approximately flush with the face of the armature stop bracket.

(4) Position the armature stop bracket (33) on the selector magnet bracket (38). Fasten it with a machine screw (29) and lockwasher (30).

(5) Position the armature (28) in the selector magnet bracket (38). Insert the armature lever mounting shaft (27) through the selector magnet bracket, armature, and armature stop bracket. Install the retainer rings (25 and 26) on the armature mounting shaft.

(6) Fasten the armature lever mounting shaft (27) in the selector magnet bracket with a setscrew (24).

(7) Assemble the bar magnet (23) on the selector magnet bracket (38). Leave an air gap of 0.015 inch between the south pole of the bar magnet and the end of the armature stop bracket (par. 194). Fasten the bar magnet with a setscrew (26). The north pole of the magnet is designated by the red dot.

(8) Position the bracket (21) on the selector

magnet bracket (38) and on the end of the bar magnet for full surface contact.

(9) Position the selector magnet (19) on the selector magnet bracket (38). Fasten one side of the selector magnet to the bracket with a lockwasher (18), flat washer (17), and machine screw (16). Place the electrical clamp (15) on the electrical leads from the selector magnet. Secure the other side of the selector magnet to the selector magnet bracket and fasten the electrical clamp to the selector magnet with a lockwasher (14), flat washer (13), and machine screw (12).

(10) Solder the potentiometer electrical leads to the terminals of the selector magnet (19).

(11) Slide the pieces of tubing (10) over the ends of the wires in the tubing (9). Solder the cable wires to the terminal lugs on the potentiometer (11). Slide the pieces of insulating tubing over the solder joints.

(12) Position the potentiometer (11) on the potentiometer mounting bracket (8) and secure it with a plain hexagonal nut (7). Install and draw the locking nut (6) fingertight.

(13) Attach the assembled potentiometer (11) and potentiometer mounting bracket (8) on the selector mounting bracket (38), with two lockwashers (5) and machine screws (4).

(14) Adjust the selector magnet attractive force and armature clearance as instructed in paragraph 196.

(15) Adjust the selector magnet attractive force and leaf spring alinement (par. 197).

(16) Install the selector magnet bracket (38) on the teleprinter frame with two machine screws (1), flat washers (2), and lockwashers (3).

(17) Adjust the alinement of the selector and stop levers with the selector magnet (par. 198).

(18) Adjust the alinement of the selector and Y-levers with the selector magnet (par. 199).

(19) Adjust the clearance between the selector levers and the armature blade of the selector magnet (par. 200).

130. Disassembly and Reassembly of Range Finder

(fig. 120)

a. Disassembly.

(1) Remove the two socket-head machine screws (1) and lockwashers (2). Remove the assembled selector lever comb bracket (18).

(2) Remove the two socket-head machine screws (3) and lockwashers (4). Remove the selector lever guide comb (5).

(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 range finding cam (13) to the shaft of the range finder dial assembly (15). Pull the dial assembly from the range finding 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) Insert the positioning ball (17) in the selector lever comb bracket (18). Fasten it loosely with a setscrew (16).

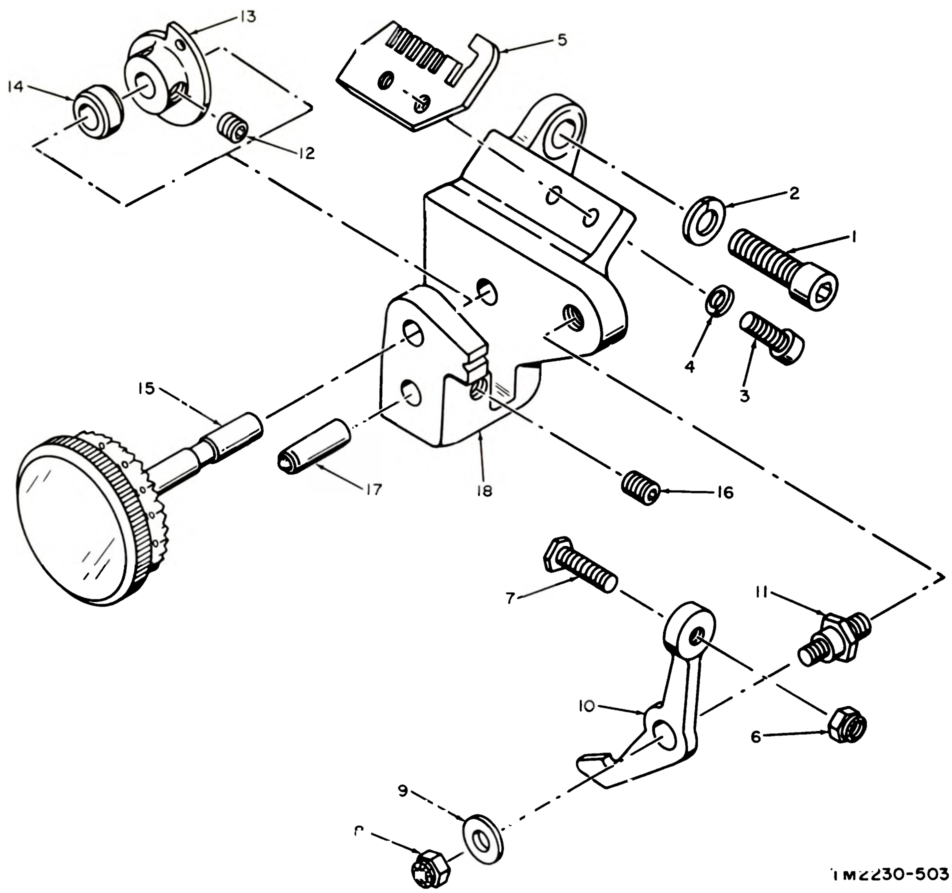
(2) Start the end of the shaft of the range finder dial assembly (15) in the hole in the selector lever comb bracket (18). Position the spacer (14) and the range finding cam (13) on the shaft and complete the dial assembly installation. Hold the range finding cam on the shaft loosely with the two setscrews (12).

(3) Install the orientation lever stud (11) on the selector lever comb bracket (18).

(4) Install the machine screw (7) in the orientation lever (10) at approximately the correct position and lock it with the self-locking hexagonal nut (6).

(5) Position the orientation lever (10) on the orientation stud (11). Secure it with a flat washer (9) and a self-locking hexagonal nut (8).

(6) Attach the selector lever guide comb (5)



1	Machine screw (10018)	10	Orientation lever (53112)
2	Lockwasher (10431)	11	Orientation lever stud (53111)
3	Machine screw (10004)	12	Setscrew (10201)
4	Lockwasher (10429)	13	Range finding cam (50317)
5	Slector lever guide comb (50511)	14	Spacer (51424)
6	Self-locking hexagonal nut (10500)	15	Range finder dial assembly (52920A)
7	Machine screw (10307)	16	Setscrew (10203)
8	Self-locking hexagonal nut (10500)	17	Positioning ball (53306A)
9	Flat washer (50414)	18	Selector lever comb bracket (53109)

Figure 120. Range finder, exploded view.

to the selector lever comb bracket (18) with the two lockwashers (4) and machine screws (3). Push the ends of the levers with a small screwdriver while maneuvering the lever stop into position.

(7) Attach the selector lever comb bracket to the frame of the teleprinter with the two lockwashers (2) and machine screws (1).

(8) Adjust the range finder as instructed in paragraphs 174, 175, and 176.

131. Disassembly and Reassembly of Selector Levers and Y-Levers

(fig. 121)

a. Disassembly.

(1) Unhook the ends of the six selector lever springs (1) from the anchor post (2), from the stop lever (35) and from the five selector levers (32). Remove the six springs.

(2) Remove the plain hexagonal nut (3) from the anchor post (2); and remove the anchor post from the teleprinter 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 nut (5), lockwasher (6), and centering sleeve (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).

(6) Remove the five selector levers (32) from the bearings (37, 39, 41, 43, and 45).

(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 teleprinter frame.

(10) Remove the setscrew (49) that holds the selector lever pivot stud (50) to the teleprinter frame. Remove the selector lever pivot stud.

(11) Remove the setscrew (51) that holds the Y-lever pivot stud (52) to the teleprinter frame. Remove the Y-lever pivot stud.

(12) Remove the transfer lever assembly (par. 132*a*).

(13) Remove the setscrew (53) that holds the Y-lever eccentric stop (54) to the teleprinter frame. Remove the Y-stop lever.

b. Reassembly.

Note. When replacing either Y-levers or selector levers, replace an entire set. Do not use a combination of new and old levers.

(1) Install the Y-lever eccentric stop (54) in the teleprinter frame. Fasten it with a setscrew (53).

(2) Install the Y-lever pivot stud (52) in the teleprinter frame. Fasten it with a setscrew (51).

(3) Install the selector lever pivot stud (50) in the teleprinter frame. Fasten it with a setscrew (49).

(4) Position the Y-lever detent spring bracket (48) on the teleprinter frame. Secure it by installing the Y-lever detent pivot (47).

(5) Install the collar (46), the bearings (45, 43, 41, 39, and 37), and the flat washers (44, 42, 40, and 38) alternately, and the flat washer (36) and stop lever (35) on the selector lever pivot stud (50). Secure the assembly with an eccentric bearing (34) and self-locking hexagonal nut (33). Do not tighten the nut.

(6) Position the five selector levers (32) in their original positions on the five bearings.

(7) Assemble the collar (31), the Y-levers (30, 28, 26, 24, and 22), and flat washers (29, 27, 25, 23, and 21) alternately on the Y-lever pivot stud (52). Install the collar (20) on the Y-lever pivot stud (52). Fasten it with the setscrew (19).

(8) Install the thrust washers (8, 10, 12, 14, and 16) and the Y-lever detents (9, 11, 13, 15, and 18) alternately, with a flat washer (17) before the last detent (18), on the centering sleeve.

(9) Install the centering sleeve (7) on the Y-lever detent pivot (47). Secure it with a lockwasher (6) and plain hexagonal nut (5).

(10) Hook the ends of the five Y-lever detent springs (4) to the holes in the Y-lever detents and in the Y-lever detent spring bracket (48).

(11) Install the selector spring anchor post (2) in the teleprinter frame. Lock the post with a plain hexagonal nut (3).

(12) Hook the six selector lever springs (1) in the holes in the selector spring anchor post (2) and to the five selector levers (32), and the stop lever (35).

(13) Adjust the selector levers and Y-levers as instructed in paragraphs 172, 173, 174, 189, 191, and 198.

132. Disassembly and Reassembly of Transfer Lever Assembly

(fig. 122)

a. Disassembly.

(1) Remove the base from the teleprinter base (par. 105).

(2) Disconnect the transfer lever spring (1) from the transfer lever assembly (31) and from the spring post eccentric (38).

(3) Remove the self-locking hexagonal nut

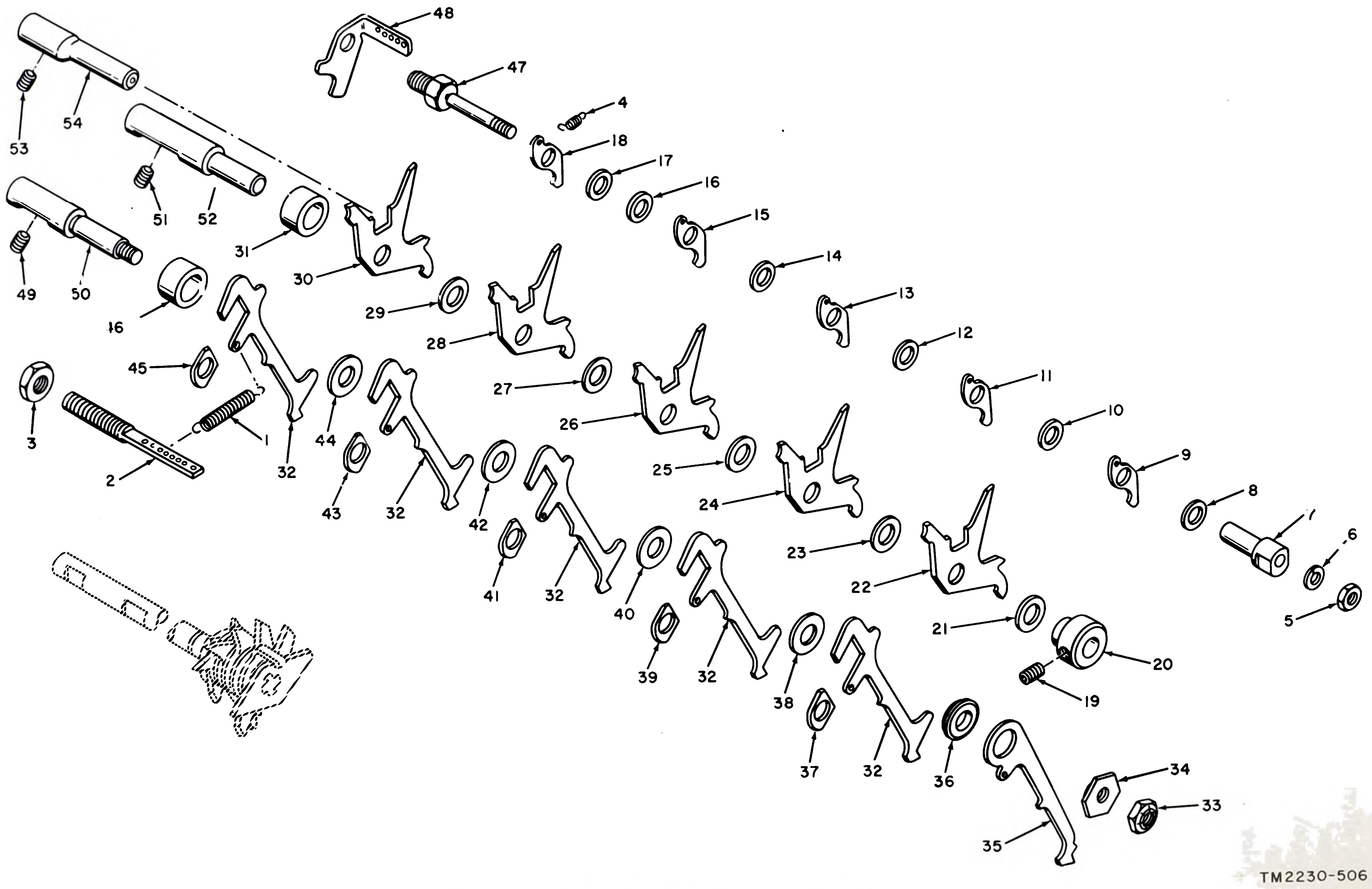
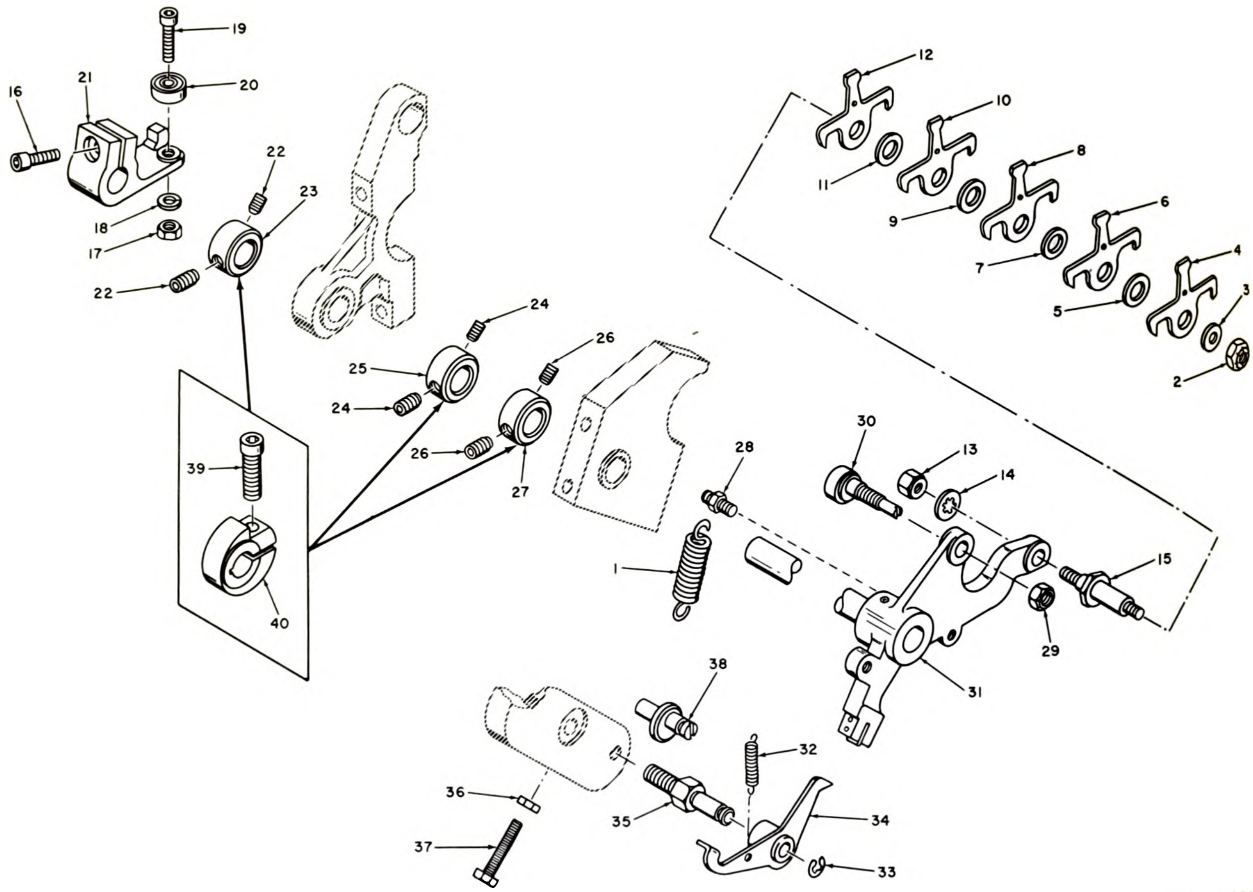


Figure 121. Selector levers and Y-levers, exploded view.

1 Selector lever spring (50902)
2 Anchor post (50325)
3 Plain hexagonal nut (10509)
4 Y-lever detent spring (55009)
5 Plain hexagonal nut (10504)
6 Lockwasher (10434)
7 Centering sleeve (55007)
8 Thrust washer (55001) (set of 5; consists of items 8, 10, 12, 14, and 16)
9 Y-lever detent (55004) (set of 5; consists of items 9, 11, 13, 15, and 18)
10 Thrust washer
11 Y-lever detent
12 Thrust washer
13 Y-lever detent
14 Thrust washer
15 Y-lever detent
16 Thrust washer
17 Flat washer (55076)
18 Y-lever detent
19 Setscrew (10209)
20 Spacing collar (55006)
21 Flat washer (50148) (set of 5; consists of items 21, 23, 25, 27, and 29)
22 Y-lever (53540A) (set of 5; consists of items 22, 24, 26, 28, and 30)
23 Flat washer
24 Y-lever
25 Flat washer
26 Y-lever
27 Flat washer
28 Y-lever
29 Flat washer
30 Y-lever
31 Collar (51416)
32 Selector lever (51068A) (set of 5)
33 Self-locking hexagonal nut (10500)
34 Eccentric bearing (55024)
35 Stop lever (50014)
36 Flat washer (50053)
37 Bearing (50019A) (set of 5; consists of items 37, 39, 41, 43, and 45)
38 Flat washer (50147) (set of 4; consists of items 38, 40, 42, and 44)
39 Bearing
40 Flat washer
41 Bearing
42 Flat washer
43 Bearing
44 Flat washer
45 Bearing
46 Collar (51416)
47 Y-lever detent pivot (55008)
48 Y-lever detent spring bracket (55002)
49 Set screws (10211)
50 Selector lever pivot stud (53268)
51 Setscrew (10211)
52 Y-lever pivot stud (53269)
53 Setscrew (10211)
54 Y-lever eccentric stop (50152)

Figure 121—Continued.



1 Transfer lever spring (50903)
2 Self-locking hexagonal nut (10500)
3 Flat washer (50414)
4 T-lever (51066A) (includes items 6, 8, 10, and 12)
5 Flat washer (51048) (includes items 7, 9, and 11)
6 T-lever
7 Flat washer
8 T-lever
9 Flat washer
10 T-lever
11 Flat washer
12 T-lever
13 Plain hexagonal nut (50651)
14 Lockwasher (10404)
15 T-lever pivot stud (50650)
16 Machine screw (10008)
17 Plain hexagonal nut (10504)
18 Lockwasher (10434)
19 Machine screw (10000)
20 Ball bearing (10754)
21 Clutch latch (50535)
22 Setscrew (10209)
23 Shaft collar (50327)
24 Setscrew (10209)
25 Shaft collar (50327)
26 Setscrew (10209)
27 Shaft collar (50327)
28 Spring stud (50649)
29 Self-locking hexagonal nut (10501)
30 Transfer lever roller stud (56185A)
31 Transfer lever assembly (52394) (without flats) or (52434A) (with flats)
32 Spring (5094)
33 Retainer ring (10949)
34 Transfer lever latch (50020A)
35 Transfer lever latch stud (52319)
36 Plain hexagonal nut (10505)
37 Machine screw (10076)
38 Spring post eccentric (56076)
39 Machine screw (10014)
40 Shaft collar (53973)

Figure 122. Transfer lever shaft, exploded view.

(2) and flat washer (3), that hold the T-levers (4, 6, 8, 10, and 12) to the T-lever pivot stud (15). Alternatively 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 (31). Remove the T-lever pivot stud.

(5) Remove the machine screw (16) and remove the assembled clutch latch (21).

(6) Remove the plain hexagonal nut (17), lockwasher (18), and machine screw (19). Remove the ball bearing (20).

Note—Equipments may be supplied with either solid shaft collars (23, 25, and 27) or split shaft collars (40). Solid shaft collars require two socket-head setscrews. The shaft of the transfer lever assembly (31) has flat surfaces to accommodate the setscrews. Split shaft collars require one socket-head machine screw (39).

(7) Remove the setscrews (22) from shaft collar (23). Remove the shaft collar (23) from the shaft of the transfer lever assembly (31). If the split shaft collar (40) is used, remove machine screw (39) and remove shaft collar from the shaft of the transfer lever assembly (31).

(8) Remove setscrews (24 and 26) from shaft collars (25 and 27). If the split shaft collars (40) are used, remove machine screws (39).

(9) Pull the transfer lever assembly (31) out of the bearings in the teleprinter frame. Catch the shaft collars (25 and 27) as they fall from the shaft of the transfer lever assembly (31).

(10) Remove the spring stud (28) from the transfer lever assembly (31).

(11) Remove the self-locking hexagonal nut (29). Remove the transfer lever roller stud (30).

(12) Remove the spring (32) from the transfer lever latch (34) and from the spring post.

(13) Remove retainer ring (33) and remove the transfer lever latch (34).

(14) Remove the transfer lever latch stud (35) from the teleprinter frame.

(15) Loosen the plain hexagonal nut (36). Remove the machine screw (37). Remove spring post eccentric (38).

b. Reassembly.

(1) Position the spring post eccentric (38) in the hole in the teleprinter frame. Screw the plain hexagonal nut (36) onto machine screw (37). Screw the machine screw (37) into the teleprinter frame sufficiently to hold spring post eccentric (38) in place. Tighten the plain hexagonal nut (36) against the teleprinter frame to lock machine screw (37) in place.

(2) Install the transfer lever latch stud (35) on the teleprinter frame.

(3) Place transfer lever latch (34) on the transfer lever latch stud (35) and secure it with the retainer ring (33).

(4) Connect spring (32) to the transfer lever latch (34) and to the spring post.

(5) Install the transfer lever roller stud (30) on the transfer lever assembly with a self-locking hexagonal nut (29).

(6) Install the spring stud (28) on the transfer lever assembly (31).

(7) Insert the shaft of the transfer lever assembly (31) through the first bearing sufficiently to install the two shaft collars (27 and 25 or 40) on the shaft. Position the transfer lever assembly (31) in the bearings.

(8) Install setscrews (24, 25, and 26; or machine screw 39) in shaft collars (25, 27, or 40). Position the collars (25 and 27, or 40) on the transfer lever shaft.

(9) Place the shaft collar (23 or 40) on the shaft of the transfer lever assembly (31).

(10) Install the ball bearing (20) on the clutch latch (21) with a machine screw (19), lockwasher (18), and plain hexagonal nut (17).

(11) Install the assembled clutch latch (21) and ball bearing (20) on the shaft of the transfer lever assembly (31). Fasten it with a machine screw (16).

(12) Attach the T-lever pivot stud (15) to the transfer lever assembly (31) with a lockwasher (14) and plain hexagonal nut (13).

(13) Install the T-levers (12, 10, 8, 6, and 4) and the flat washers (11, 9, 7, and 5) on the T-lever pivot stud (15). Alternate T-levers and flat washers until all are installed. Secure with a flat washer (3) and a self-locking hexagonal nut (2)

(14) Install the transfer lever spring (1) on the transfer lever and on the spring post eccentric (38).

(15) Adjust the transfer lever shaft and the clutch latch as instructed in paragraphs 186, 187, 188, 190, 201, 202, and 204.

(16) Replace the teleprinter on the base as instructed in paragraph 105b.

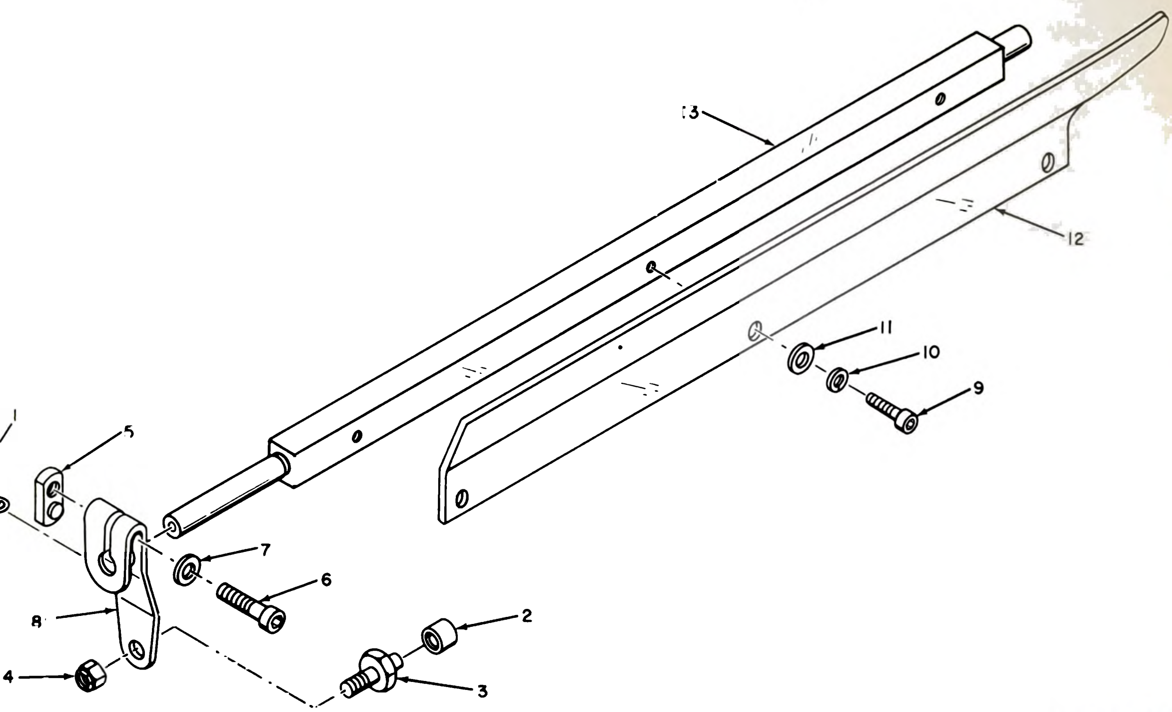
133. Disassembly and Reassembly of Print Bail Blade Shaft

(fig. 123)

a. Disassembly.

(1) Remove the teleprinter from the base as instructed in paragraph 105*a*.

(2) Remove the transfer lever shaft as instructed in paragraph 132*a*.



int cam follower spring (50921)
ishing (50843)
id (50886)
cknut (10501)
it (50174)
achine screw (10006)
in washer (10459)

8 Print cam follower (50948)
9 Machine screw (10004)
10 Lockwasher (10429)
11 Washer (10450)
12 Print bail blade (50533)
13 Print bail blade shaft (50534)

Figure 123. Print bail blade shaft, exploded view.

) Remove the two setscrews that hold the print cam to the function shaft. Slide the print cam to the selector side of the page printer. *Be careful not to lose the bushing on the cam follower stud.*

) Unhook the print cam follower spring (1) from the print cam follower (8) and from the spring post on the teleprinter frame.

) Remove two screws and lockwashers that hold the middle bearing cap to the frame assembly. Remove the middle bearing cap by sliding it toward the selector side.

) Remove the assembled shaft (13), print bail blade (12), and print cam follower (8) by moving it toward the selector side, free of the bearing.

) Remove the bushing (2), locknut (4), and stud (3) from the print cam follower.

) Remove the nut (5), screw (6), and washer (7) that hold the print cam follower (8) to the shaft (13) and remove the follower.

) Remove the three screws (9), lockwashers (10), and washers (11) that hold the print bail blade (12) to the shaft (13) and remove the blade.

b. Reassembly.

(1) Position the print bail blade (12) on the shaft (13). Fasten it with three screws (9), lockwashers (10), and washers (11).

(2) Position the print cam follower (8) on the shaft (13). Fasten with a machine screw (6), plain washer (7), and nut (5).

(3) Position the stud (3) on the cam follower and secure it with a locknut (4). Install the bushing (2) on the stud.

(4) Insert the end of the shaft in the bushing in the function side of the teleprinter frame.

(5) Position the bearing cap on the opposite end of the shaft. Secure the bearing cap to the frame with two screws and lockwashers.

(6) Attach the print cam follower spring (1) to the cam follower and the spring post on the teleprinter frame.

(7) Slide the print cam to engage the print cam follower (8). Secure the cam to the function shaft with two setscrews.

(8) Install the transfer lever shaft as instructed in paragraph 132*b*.

(9) Adjust the print bail blade shaft (pars. 250 and 251).

(10) Replace the teleprinter on the printer base (par. 105*b*).

134. Disassembly and Reassembly of Signal Bell

(fig. 124)

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 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) Position the motor stop function lever (13) on the center stud on the signal bell bracket (14) and secure it with the retainer ring (12).

(2) Connect the spring (11) to the spring post on the signal bracket (14) and to the motor stop function lever (13).

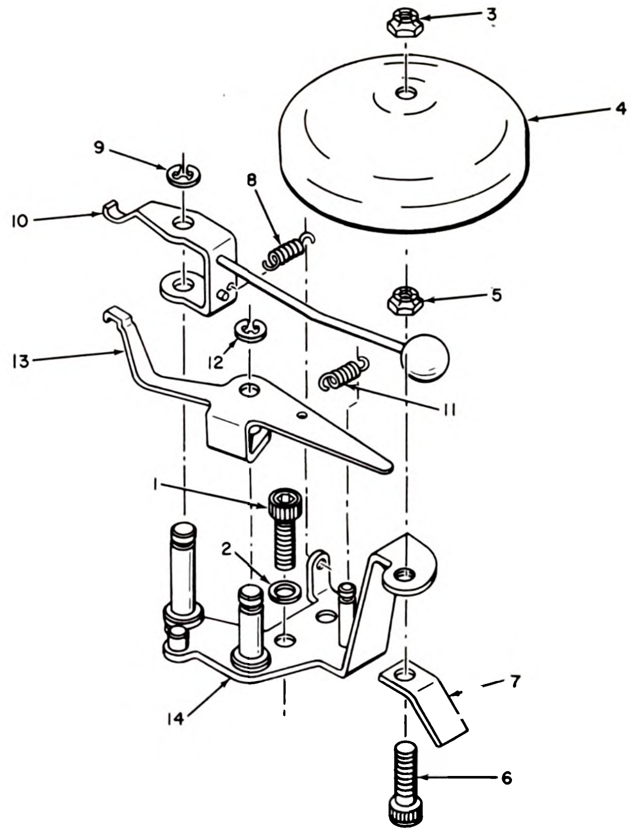
(3) Position the signal bell clapper (10) on the stud on the signal bell bracket (14) and secure it with the retainer ring (9).

(4) Attach the spring (8) to the signal bell clapper (10) and to the signal bell bracket (14).

(5) Position the clapper stop (7) on the signal bell bracket (14). Secure it with a screw (6) and locknut (5).

(6) Position the signal bell (4) on the screw (6). Secure it with a locknut (3).

(7) Position the signal bell bracket (14) on



1 Machine screw (10008)
2 Lockwasher (10430)
3 Locknut (10501)
4 Signal bell (50180)
5 Locknut (10501)
6 Machine screw (10010)
7 Clapper stop (51102)
8 Spring (50920)
9 Retainer ring (10949)
10 Clapper (50879A)
11 Spring (50919)
12 Retainer ring (10949)
13 Motor stop function lever (50874)
14 Signal bell bracket (53157A)

Figure 124. Signal bell, exploded view.

the teleprinter frame. Be sure that the bell clapper (10) and function lever (13) are engaged properly with their punch bars. Secure with two screws (1) and lockwashers (2).

(8) Adjust the signal bell (par. 260).

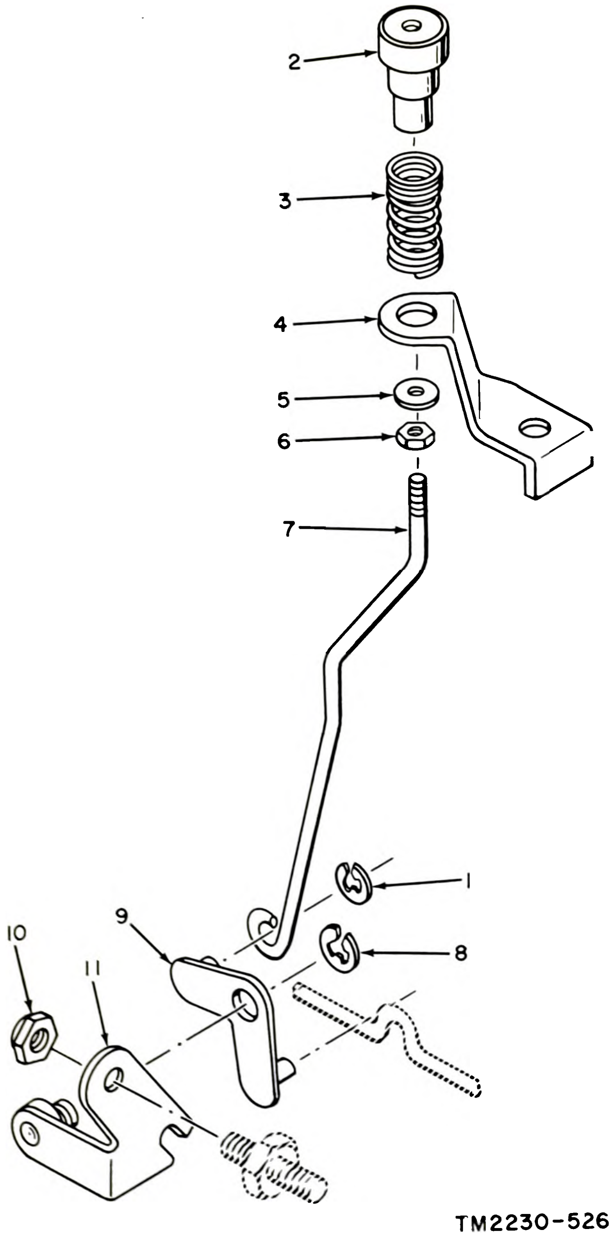
135. Disassembly and Reassembly of Manual Space Mechanism

(fig. 125)

a. Disassembly.

(1) Remove the retainer ring (1) that holds the link (7) to the manual space bell crank (9).

(2) Remove the stud that holds the bracket



1 Retainer ring (10960)
2 Manual space push button (55508)
3 Manual space push button spring (55518)
4 Bracket (55503)
5 Washer (52988)
6 Nut (10520)
7 Link (55506)
8 Retainer ring (10949)
9 Manual space bell crank (55510A)
10 Self-locking hexagonal nut (10501)
11 Bracket (55515A)

Figure 125. Manual space mechanism, exploded view.

(4) to the function side of the frame as instructed in paragraph 147*a*(1) through (3). Remove the assembled push button and link.

(3) Remove the manual space push button (2) from the link (7). Remove the manual space push button spring (3), bracket (4), and washer (5).

(4) Remove the nut (6) from the link (7).

(5) Remove the retainer ring (8) and the manual space bell crank (9).

(6) Remove the self-locking hexagonal nut (10) and bracket (11).

b. Reassembly.

(1) Position the bracket (11) on the teleprinter frame. Secure with a self-locking hexagonal nut (10).

(2) Secure the manual space bell crank (9) to the bracket (11) with the retainer ring (8).

(3) Install the nut (6) on the link (7).

(4) Install the washer (5), bracket (4), manual space push button spring (3), and manual space push button (2) on the link (7).

(5) Position the bracket (4) on the teleprinter frame. Secure it as instructed in paragraph 147*b*(6) through (9).

(6) Secure the link (7) to the manual space bell crank (9) with the retainer ring (1).

(7) Adjust the manual space mechanism as instructed in paragraph 226.

136. Disassembly and Reassembly of Function Mechanism

(fig. 126)

a. Disassembly.

(1) Remove the self-locking hexagonal nut (10, fig. 125). Remove the manual space bracket (11, fig. 125).

(2) Remove the mounting bracket stud (1), lockwasher (2), mounting bracket stud (3), and lockwasher (4) that hold the function bracket (24) to the function side of the teleprinter frame.

(3) Remove the retainer ring (5) and the assembled function bracket mechanism.

(4) Remove the platen latch spring (6) from the platen latch (8) and from the spring post on the function bracket (24).

(5) Remove the retainer ring (7) and remove the platen latch (8).

(6) Remove the supporting lever spring (9) from the support lever (17) and from the stud on the function bracket (24).

(7) Remove the retainer ring (10). Remove

the pin (11) and the assembled function cam follower (14) and support lever (17).

(8) Remove the cam follower roller (12) from the function cam follower (14).

(9) Remove the retainer ring (13). Remove the function cam follower (14).

(10) Remove the self-locking hexagonal nut (15) and the function cam follower pivot stud (16).

(11) Remove the two setscrews (18) that hold the shaft collar (20) to the pivot (19). Remove the pivot, and catch the shaft collar carriage feed lever (21), spacer (22), and unshift lever (23) as they fall from the pivot.

(12) Remove the two machine screws (25) and lockwashers (26). Remove the guide block (33).

(13) Remove the two machine screws (27) and lockwashers (28) that hold the side plate (29) to the punch bar guide block (33). Remove the side plate, aperture gate (30), signal bell punch bar (31), and letter and motor stop punch bars (32) from the punch bar guide block (33).

b. Reassembly.

(1) Position the letter and motor stop punch bars (32), signal bell punch bar (31), and aperture gate (30) in the punch bar guide block (33). Position the side plate (29) on the guide block and fasten it with the two machine screws (27) and lockwashers (28).

(2) Fasten the punch bar guide block (33) to the function side of the teleprinter frame with the two machine screws (25) and lockwashers (26).

(3) Insert the pivot (19) in the drilled hole in the function bracket (24). Install the unshift lever (23), spacer (22), carriage feed lever (21), and shaft collar (20) on the pivot. Insert the pivot all the way into the bracket and secure the shaft collar (20) to the pivot with the two setscrews (18).

(4) Position the function cam follower pivot stud (16) on the support lever (17). Secure it with a self-locking hexagonal nut (15).

(5) Position the function cam follower (14) on the function cam follower pivot stud (16) and secure it with a retainer ring (13).

(6) Install the cam follower roller (12) on the function cam follower (14).

(7) Position the assembled function cam follower (14) and support lever (17) on the function bracket (24). Install the pin (11) and secure it to the bracket with a retainer ring (10).

(8) Hook the supporting lever spring (9) to the support lever (17) and to the spring post on the function bracket (24).

(9) Position the platen latch (8) on the stud on the function bracket (24) and secure it with a retainer ring (7).

(10) Hook the platen latch spring (6) to the platen latch (8) and to the spring post on the function bracket (24).

(11) Position the carriage feed link on the carriage feed lever (21). Secure it with a retainer ring (5).

(12) Position the function bracket on the function side of the teleprinter frame. Secure it with a mounting bracket stud (3), lockwasher (4), mounting bracket stud (1), and lockwasher (2).

(13) Secure the manual space bracket on the bracket mounting stud (1) with the self-locking hexagonal nut (10).

(14) Readjust as required following applicable adjustments (pars. 171–274).

137. Disassembly and Reassembly of Line Feed and Platen Shift

(fig. 127)

a. Disassembly.

(1) Remove the retainer ring (1) and the delaying lever (2).

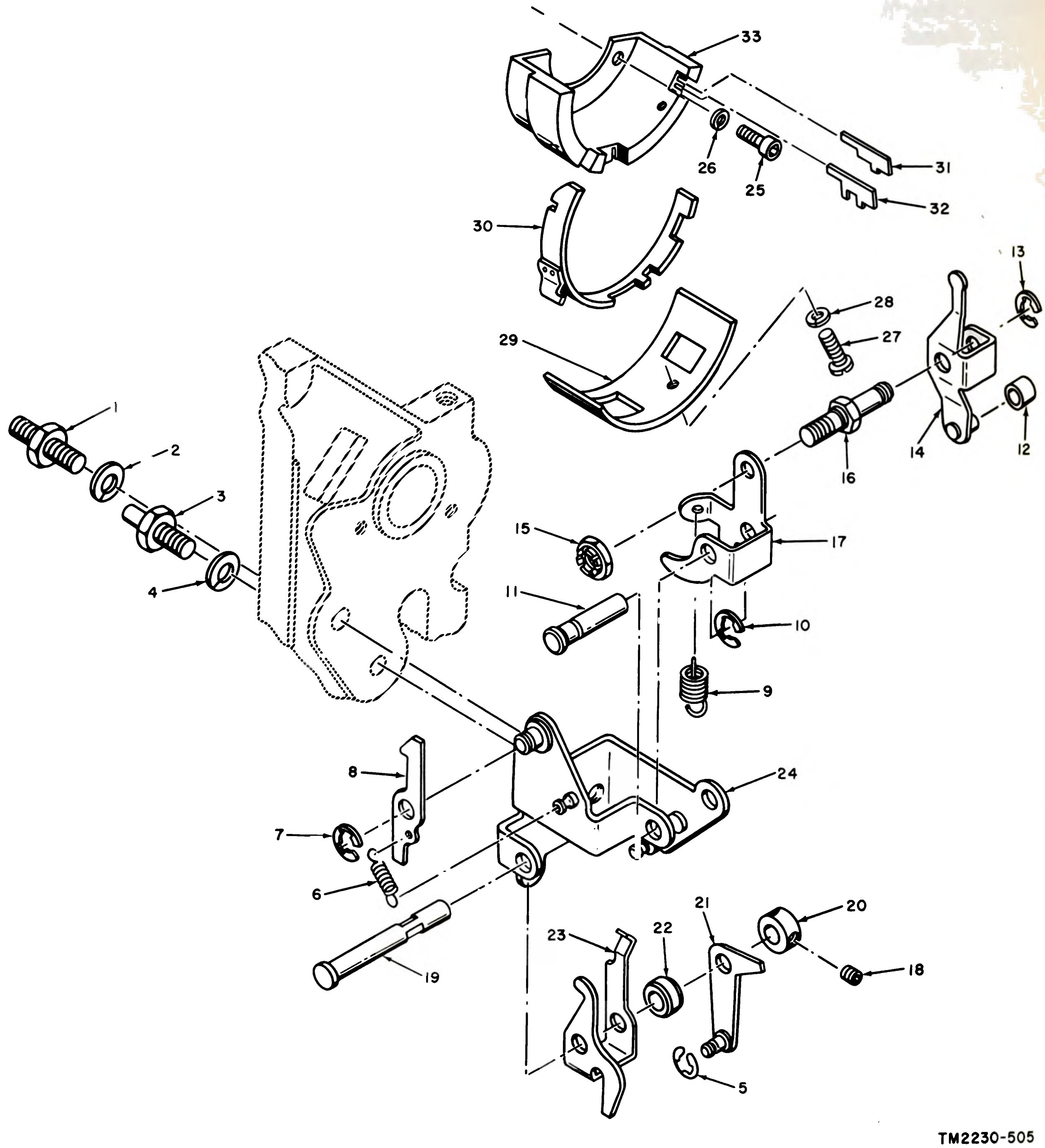
(2) Remove the delaying latch spring (3) from the delaying latch (5) and from the stop bar shift link bracket (9).

(3) Remove the retainer ring (4) and the delaying latch (5) from the pivot stud on the stop bar shift link bracket (9).

(4) Remove the machine screw (6) and lockwasher (7) from the bell crank pivot bracket (37). Catch the flat washer (8) as it drops out.

(5) Remove the adjustable bell crank spring (10) from the adjustable bell crank (17) and from the bell crank pivot bracket (37).

(6) Remove the line feed and figure shitt cam follower spring (11) from the platen shift



1 Mounting bracket stud (55501)
2 Lockwasher (10431)
3 Mounting bracket stud (55502)
4 Lockwasher (10431)
5 Retainer ring (10960)
6 Platen latch spring (52501)
7 Retainer ring (10949)
8 Platen latch (50821)
9 Supporting lever spring (50915)
10 Retainer ring (10949)
11 Pin (53131)
12 Cam follower roller (50843)
13 Retainer ring (10949)
14 Function cam follower (50822A)
15 Self-locking hexagonal nut (10501)
16 Function cam follower pivot stud (52553)
17 Support lever (50760)
18 Setscrew (10201)
19 Pivot (50829)
20 Shaft collar (50391)
21 Carriage feed lever (53129A)
22 Spacer (51424)
23 Unshift lever (52454)
24 Function bracket (52543A)

Figure 126. Function mechanism, exploded view.

cam follower (27) and from the line feed cam follower (13).

(7) Remove the retainer ring (12) from the pivot stud on the line feed bell crank (24). Slide the line feed cam follower (13) down to unhook it from the function shaft. Remove the line feed cam follower.

(8) Remove the self-locking hexagonal nut (14), flat washer (16), and machine screw (15). Remove the adjustable bell crank (24).

(9) Remove the retainer ring (18) from the pivot stud on the line feed bell crank (24).

(10) Remove the two machine screws (19), flat washers (20), and lockwashers (21). Remove the connecting link (23) from the connecting link (22).

(11) Remove the line feed bell crank (24).

(12) Remove the platen shift bell crank spring (25) from the platen shift bell crank (30) and from the platen bracket link.

(13) Remove the setscrew (38, fig. 106) that holds the spacing collar (39) to the cam follower stop stud (40). Remove the spacing collar and the cam follower stop stud.

(14) Remove the retainer ring (26, fig. 127) from the pivot stud on the platen shift bell crank (30). Slide the platen shift cam follower (27) down to clear the function shaft. Remove the function shaft (par. 139*a*). Remove the platen shift cam follower.

(15) Remove the retainer ring (28) from the pivot stud on the platen shift bell crank (30). Remove the platen shift link (29) from the pivot stud.

(16) Remove the platen shift bell crank (30).

(17) Remove the carriage return bell crank spring (31) from the bell crank pivot bracket (37) and from the carriage return sensing lever.

(18) Remove the platen lower case latch spring (32) from the platen lower case latch (34) and from the bell crank pivot bracket (37).

(19) Remove the retainer ring (33) from the pivot post on the bell crank pivot bracket (37). Remove the platen lower case latch (34).

(20) Remove the two machine screws (35) and lockwashers (36). Remove the bell crank pivot bracket (37).

b. Reassembly.

(1) Attach the bell crank pivot bracket (37, fig. 127) to the teleprinter frame with the two lockwashers (36) and machine screws (35).

(2) Secure the platen lower case latch (34) on the pivot stud of the bell crank pivot bracket (37) with a retainer ring (33).

(3) Hook one end of the platen lower case latch spring (32) to the bell crank pivot bracket (37) and the other end to the platen lower case latch (34).

(4) Hook one end of the carriage return bell crank spring (31) to the carriage return sensing lever and the other end to the bell crank pivot bracket (37).

(5) Secure the platen shift link (29) on the pivot stud of the bell crank pivot bracket (37) with a retainer ring (28).

(6) Position the platen shift cam follower (27) on the function shaft. Hook the eye in the top of the cam follower onto the pivot stud on the platen shift bell crank (30). Secure it with retainer ring (26). Replace the function shaft (par. 139*b*).

(7) Install the cam follower stop stud (40, fig. 106) on the teleprinter frame. Position the spacing collar (39) on the cam follower stop stud and secure it with a setscrew (38).

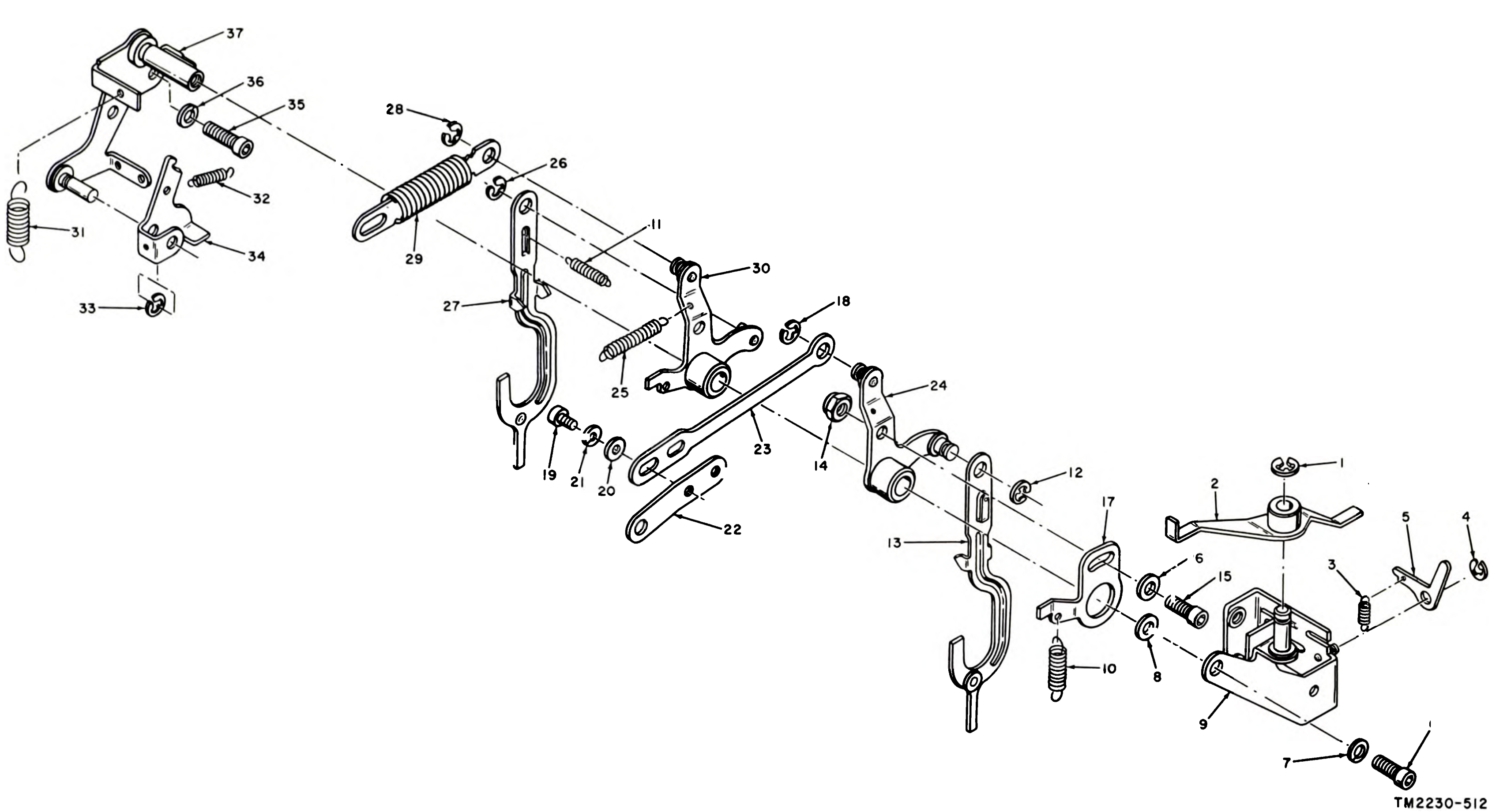
(8) Hook one end of the platen shift bell crank spring (25, fig. 127) on the platen shift bell crank (30) and the other end on the platen bracket link.

(9) Position the line feed bell crank (24) on the bell crank pivot bracket (37).

(10) Attach the connecting link (23) to the connecting link (22) with the lockwashers (21), flat washers (20), and machine screws (19).

25 Machine screw (10004)
26 Lockwasher (10429)
27 Machine screw (10304)
28 Lockwasher (10429)
29 Side plate (50735)
30 Aperture gate (50743A)
31 Signal bell punch bar (50881)
32 Letter and motor stop punch bar (50755)
33 Punch bar guide block (51428)

Figure 126—Continued.



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 bell crank (53462)	30	Platen shift bell crank (53135A)
6	Machine screw (10003)	18	Retainer ring (10949)	31	Carriage return bell crank spring (50906)
7	Lockwasher (10429)	19	Machine screw (10002)	32	Platen lower case latch spring (50920)
8	Flat washer (10450)	20	Flat washer (10450)	33	Retainer ring (10960)
9	Stop bar shift link bracket (52955A)	21	Lockwasher (10429)	34	Platen lower case latch (52748)
10	Adjustable bell crank spring (51755)	22	Connecting link (51771)	35	Machine screw (10025)
11	Line feed and figure shift cam follower spring (50901)	23	Connecting link (50474)	36	Lockwasher (10430)
12	Retainer ring (10949)	24	Line feed bell crank (53136A)	37	Bell crank pivot bracket (52303A)
		25	Platen shift bell crank spring (51645)		

Figure 127. Line feed and platen shift mechanism, exploded view.

(11) Place the end of the connecting link (23) over the pivot stud on the line feed bell crank (24). Secure it with a retainer ring (18).

(12) Position the adjustable bell crank (17) on the line feed bell crank (24). Secure it with a machine screw (15), flat washer (16), and self-locking hexagonal nut (14).

(13) Position the line feed cam follower (13) on the function shaft. Hook the eye in the top of the line feed cam follower on the pivot stud on the line feed bell crank (24). Secure it with the retainer ring (12).

(14) Install the line feed and figure shift cam follower spring (11) between the platen shift cam follower (27) and the line feed cam follower (13).

(15) Attach the adjustable bell crank spring (10) to the adjustable bell crank (17) and to the bell crank pivot bracket (37).

(16) Position the flat washer (8) under the stop bar shift link bracket (9). Hold the stop bar shift link bracket on the bell crank pivot bracket (37) with a lockwasher (7) and machine screw (6).

(17) Position the delaying latch (5) on the pivot stud on the stop bar shift link bracket. Secure it with retainer ring (4).

(18) Hook the delaying latch spring (3) to the delaying latch (5) and to the stop bar shift link bracket (9).

(19) Secure the delaying lever (2) on the mounting stud on the top of the stop bar shift link bracket (9) with a retainer ring (1).

(20) Adjust the line feed and platen shift mechanism as instructed in paragraphs 241, 242 and 256 through 259.

138. Disassembly and Reassembly of Square Shaft

(fig. 128)

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 instructed in paragraph 136*a*(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), the function selecting arm claw (4), spring retainer (5), square shaft bearing spring (6), and spring retainer (7).

(5) Move the square shaft (13) axially toward the function side, to dislodge the ball bearing (8) from its seat in the teleprinter frame. Remove the ball bearing (8) and spacing collar (9) from the shaft.

(6) Pull the square shaft (13) through the opening in the teleprinter frame. Catch the square shaft driven gear (11) and sliding helical gear (12) as they fall from the shaft.

b. Reassembly.

(1) Insert the square shaft (13) into the opening in the function side of the teleprinter frame. Install the sliding helical gear (12), with the flatted portion of the gear toward the rear of the teleprinter, and the square shaft driven gear (11) on the square shaft.

(2) Install the end of the square shaft (13) on the stop arm shaft so that the stop arm shaft fits into the hole in the end of the square shaft. Position the square shaft driven gear (11) on the slotted end of the square shaft and secure it with the setscrews (10).

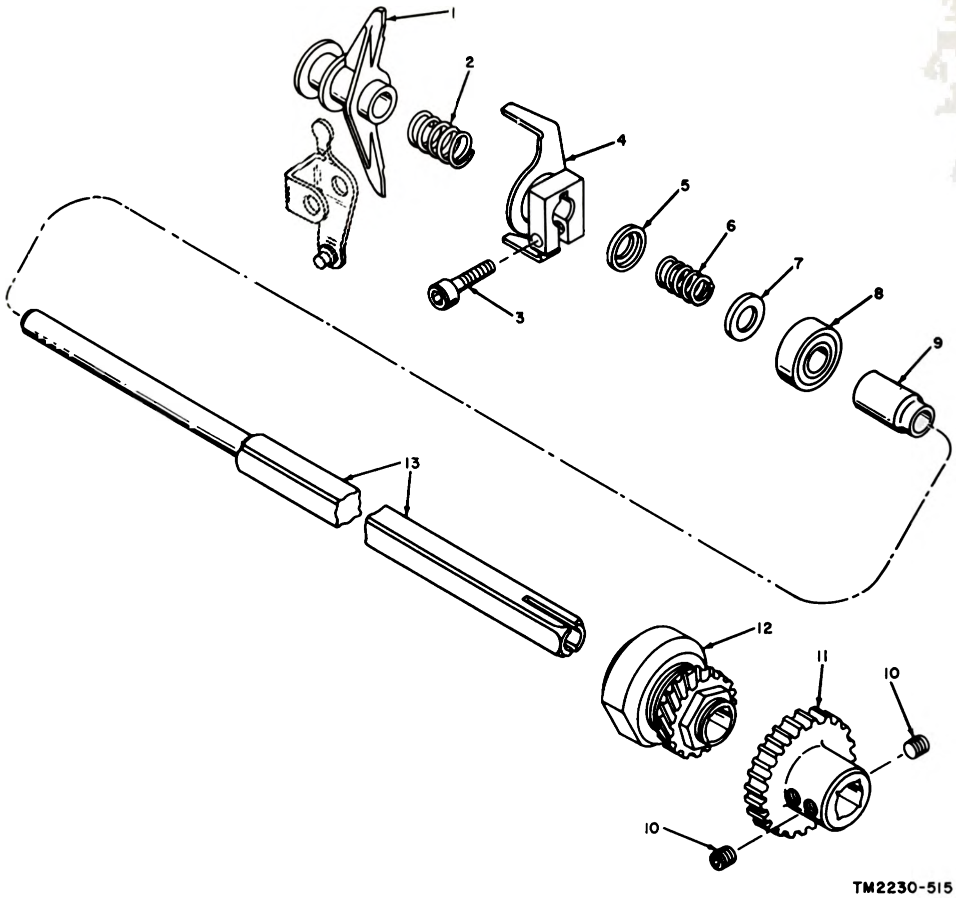
(3) Install the spacing collar (9), ball bearing (8), spring retainer (7), square shaft bearing spring (6), and spring retainer (5) on the square shaft (13).

(4) Position the function selecting arm claw (4) on the square shaft (13) and secure it with a machine screw (3).

(5) Install the function selecting arm spring (2) and function selecting arm (1) on the square shaft (13).

(6) Replace the assembled function cam follower support lever and function cam follower as instructed in paragraph 136*b*(7).

(7) Adjust the square shaft as described in paragraphs 180, 181, and 228.



1	Function selecting arm (50936)	7	Spring retainer (56277)
2	Function selecting arm spring (50917)	8	Ball bearing (10753)
3	Machine screw (10009)	9	Spacing collar (56278)
4	Function selecting arm claw (50841A) (includes item 3)	10	Set screw (10209)
5	Spring retainer (56277)	11	Square shaft driven gear (50383)
6	Square shaft bearing spring (56279)	12	Sliding helical gear (50565A)
		13	Square shaft (50456)

Figure 128. Square shaft, exploded view.

139. Removal and Replacement of Teleprinter Function Shaft

(fig. 129)

a. *Removal.*

(1) Remove the teleprinter from the base as instructed in paragraph 105*a*.

(2) Remove the signal bell and motor stop function lever from the function side of the teleprinter frame (par. 134*a*).

(3) Remove the transfer lever shaft (par. 132*a*).

(4) Remove the figures shift and line feed cam follower spring (par. 137*a*(8)).

(5) Remove the line feed cam follower (par. 137*a*(8)).

(6) Remove the cam follower stop stud (par. 137*a*(14)).

(7) Remove the platen shift cam follower (par. 137*a*(15)).

(8) Remove the two machine screws (1) and lockwashers (2) and remove the bearing cap.

(9) Remove the machine screw (3), lockwasher (4), machine screw (5), and lockwasher (6). Slide the center bearing cap toward the selector side of the teleprinter to clear the print bail blade shaft and remove the center bearing cap.

(10) Remove the two machine screws (7) and lockwashers (8) and 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 engage-

ment with the bushing on the print cam follower.

(12) Remove the assembled function shaft (46) by pulling it upward and outward from the three bearing supports in the teleprinter frame.

b. Replacement.

(1) Position the assembled function shaft (46) on the teleprinter frame, with the bearings resting in the bearing supports on the frame.

(2) Install the bearing cap on the selector side of the teleprinter frame with two machine screws (7) and lockwashers (8).

(3) Position the center bearing cap on the center frame with the print bail blade shaft in position. Secure it with machine screw (5), lockwasher (6), machine screw (3), and lockwasher (4).

(4) Install the bearing cap on the function side of the teleprinter frame with two machine screws (1) and lockwashers (2).

(5) Move the print cam (42) into engagement with the bushing on the print cam follower. Secure it by tightening the two setscrews (41).

(6) Install the platen shift cam follower (par. 137*b*(6)).

(7) Install the cam follower stop stud (par. 137*b*(7)).

(8) Install the line feed cam follower (par. 137*b*(13)).

(9) Install the figures shift and line feed cam follower spring (par. 137*b*(14)).

(10) Install the transfer lever shaft (par. 132*b*).

(11) Install the signal bell and motor stop function lever from the function side of the teleprinter frame (par. *134b*).

(12) Adjust the function shaft as instructed in paragraphs 182, 203, 206, and 227.

(13) Install the teleprinter on the base as instructed in paragraph 105*b*.

140. Disassembly and Reassembly of Function Shaft

(fig. 129)

a. Disassembly.

(1) Remove the function shaft from the teleprinter (par. 139*a*).

(2) Remove the machine screw (9), lockwasher (10), and flat washer (11). Remove the transfer lever restoring cam (12), 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). Remove the line feed and platen shift sensing cam (20), friction plate (21), square shaft driving gear (22), friction plate (23), friction clutch plate (24), and clutch pressure spring (25).

(4) Remove the clamping screw (26) and turn off the friction adjusting collar (27).

(5) Remove the two setscrews (28) and remove the driving collar (29).

(6) Remove the ball bearing (30) from the function shaft (46).

(7) Remove the retainer ring (31). Remove the flat washer (32), function driven gear (33), and flat washers (34 and 35) from the function shaft.

(8) Remove the retainer ring (36). Remove the function shaft sliding clutch drum (37) and clutch spring (38).

(9) Remove the two setscrews (39) and remove the flexible coupling disk (40).

(10) Remove the two setscrews (41) and remove the print cam (42).

(11) Remove the two setscrews (43) and remove the function cam (44).

(12) Remove the sleeve bearing (45) from the function shaft (46).

b. Reassembly.

(1) Install the sleeve bearing (45) on the function shaft (46).

(2) Position the function cam (44) on the function shaft (46). Secure it with the two setscrews (43).

(3) Position the print cam (42) on the function shaft (46). Secure it with the two setscrews (41).

(4) Position the flexible coupling disk (40) on the function shaft (46). Secure it with the two setscrews (39).

(5) Position the clutch spring (38) and the function shaft sliding clutch drum (37) on the function shaft (46) so that the clutch drum engages the flexible coupling disk (40). Secure it with retainer ring (36).

(6) Install the two flat washers (35 and 34), function driven gear (33), and flat

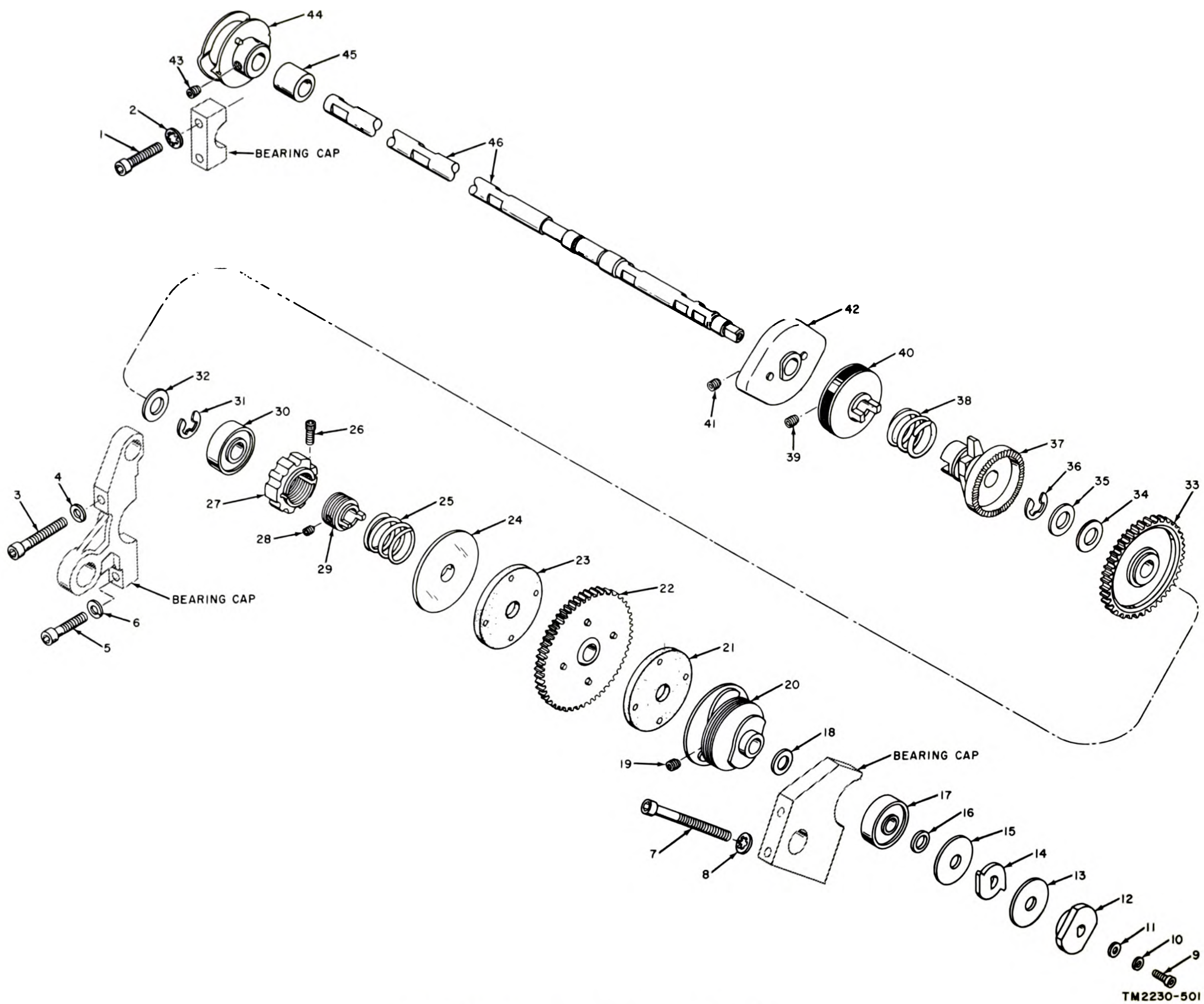


Figure 129. Function shaft, exploded view.

1 Machine screw (10011)
2 Lockwasher (10404)
3 Machine screw (10012)
4 Lockwasher (10430)
5 Machine screw (10011)
6 Lockwasher (10430)
7 Machine screw (10014)
8 Lockwasher (10404)
9 Machine screw (10003)
10 Lockwasher (10429)
11 Flat washer (10458)
12 Transfer lever restoring cam (53878)
13 Flat washer (53885)
14 Locking bail cam (53881)
15 Flat washer (53885)
16 Flat washer (51552)
17 Ball bearing (10756)
18 Flat washer (50552)
19 Setscrew (10208)
20 Line feed and platen shift sensing cam (56618A)
21 Friction plate (56273)
22 Square shaft driving gear (56274A)
23 Friction plate (56273)
24 Friction clutch plate (54929)
25 Clutch pressure spring (54933)
26 Clamping screw (10052)
27 Friction adjusting collar (54926)
28 Setscrew (10208)
29 Driving collar (54927)
30 Ball bearing (10757)
31 Retainer ring (10959)
32 Flat washer (50515)
33 Function driven gear (50512)
34 Flat washer (51847)
35 Flat washer (50515)
36 Retainer ring (10959)
37 Function shaft sliding clutch drum (50516)
38 Clutch spring (50848)
39 Setscrew (10209)
40 Flexible coupling disk (51167A)
41 Setscrew (10209)
42 Print cam (50753A)
43 Setscrew (10209)
44 Function cam (50752)
45 Sleeve bearing (50852)
46 Function shaft (55522)

Figure 129—Continued.

washer (32) on the function shaft (46). Install the retainer ring (31).

(7) Position the ball bearing (30) on the function shaft (46).

(8) Position the driving collar (29) on the function shaft (46). Secure it with the setscrews (28).

(9) Install the friction adjusting collar (27) and secure it with a machine screw (26).

(10) Position the clutch pressure spring (25) and the friction clutch plate (24) on the function shaft (46) so that the friction clutch plate engages the driving collar (29). Position the friction plate (23), square shaft driving gear (22), friction plate (21), and the line feed and platen shift sensing cam (20) on the function shaft (46). Secure the line feed and platen shift sensing cam to the shaft with the two setscrews (19).

(11) Position the flat washer (18), ball bearing (17), flat washer (16), flat washer (15), locking bail cam (14), flat washer (13), and transfer lever restoring cam (12) on the function shaft (46). Secure them with a machine screw (9), lockwasher (10), and flat washer (11).

(12) Install the function shaft on the teleprinter frame (par. 139*b*).

141. Disassembly and Reassembly of Selector Camshaft

(fig. 130)

a. Disassembly.

(1) Remove the orientation lever from the range finder (par. 130*a* (3)).

(2) Remove the two socket-head machine screws (1) and lockwashers (2) that hold the selector camshaft ball bearing (15) to the selector side of the page printer frame.

(3) Remove the two setscrews (3) that hold the friction clutch disk (6) to the selector camshaft (18).

(4) Remove the socket-head machine screw (4). Turn the friction clutch adjusting collar (13) off of the friction clutch drive shaft collar (12) far enough to remove the two setscrews (5) from the drive shaft collar and remove the setscrews.

(5) Remove the selector camshaft assembly (18) 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) and remove the ball bearing (15).

(7) Bend the tab on the end of selector camshaft (18), to release stop plate (17). Pull the grooved spindle and stop plate out of the assembly and turn the grooved spindle (16) counterclockwise to separate it from the stop plate.

b. Reassembly.

(1) Position the ball bearing (15) on the selector camshaft (18) and install retainer ring (14).

(2) Insert the selector camshaft (18) in the opening in the teleprinter frame. Install the friction clutch adjusting collar (13), drive shaft collar (12), friction clutch spring (11), friction clutch plate (10), friction plate (9), driving disk (8), friction plate (7), and friction clutch disk (6) on the selector camshaft.

(3) Fasten the bearing retainer on the teleprinter frame with the two socket-head machine screws (1) and lockwashers (2).

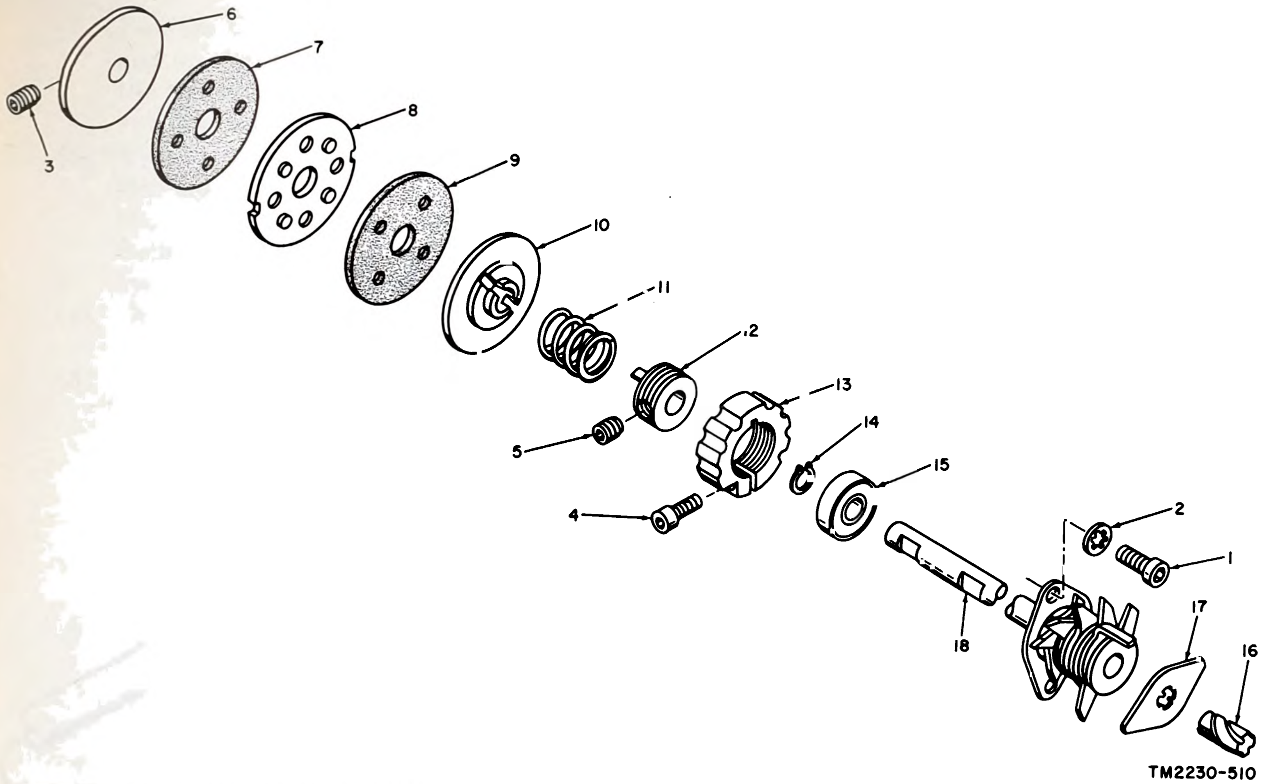
(4) Position the friction clutch drive shaft collar (12) on the selector camshaft (18) so that the holes in the collar line up with the flats on the selector camshaft. Secure the collar with the two setscrews (5).

(5) Position the friction clutch disk (6) on the selector camshaft (16) so that the holes in the disk line up with the flats on the selector camshaft. Secure the clutch disk with the two setscrews (3).

(6) Turn the friction clutch adjusting collar (13) onto the drive shaft collar (12). Adjust it as instructed in paragraph 205 and tighten the socket-head machine screw (4) to lock the adjustment.

(7) Install the stop plate (17) on the groove spindle with the center punch mark to the outside of the machine. Bend the tab of the selector camshaft (18) to prevent the stop plate from leaving the grooved spindle.

(8) Install the orientation lever on the range finder (par. 130*b*(5)).



1 Socket-head machine screw (10003)
2 Lockwasher (10403)
3 Setscrew (10209)
4 Machine screw (10052)
5 Setscrew (10208)
6 Friction clutch disk (50200)
7 Friction plate (50013)
8 Driving disk (51117)
9 Friction plate (50013)
10 Friction clutch plate (54931)
11 Friction clutch spring (54932)
12 Drive shaft collar (54928)
13 Friction clutch adjusting collar (54926)
14 Retainer ring (10462)
15 Selector camshaft ball bearing (10753)
16 Grooved spindle (50133)
17 Stop plate (50134)
18 Selector camshaft (50125A)

Figure 130. Selector camshaft, exploded view.

142. Removal and Replacement of Main Shaft

a. Removal.

(1) Remove the teleprinter from the base (par. 105*a*).

(2) Remove the gear cover, worm gear bracket, and gasket from the teleprinter frame (par. 112).

(3) Remove the machine screw (1, fig. 131) and lockwasher (2). Loosen the four motor mounting screws and remove the main shaft driven gear (3).

(4) Remove the drive keys (4) from the main shaft driven gear (13).

(5) Remove the two machine screws (5), lockwashers (6), and flat washers (7) and remove the ball bearing (8).

(6) Remove the two machine screws (9) and lockwashers (10) and remove the bearing cap from the teleprinter frame.

(7) Remove the range finder orientation lever (10, fig. 120) from the range finder mechanism (par. 130*a*(3)).

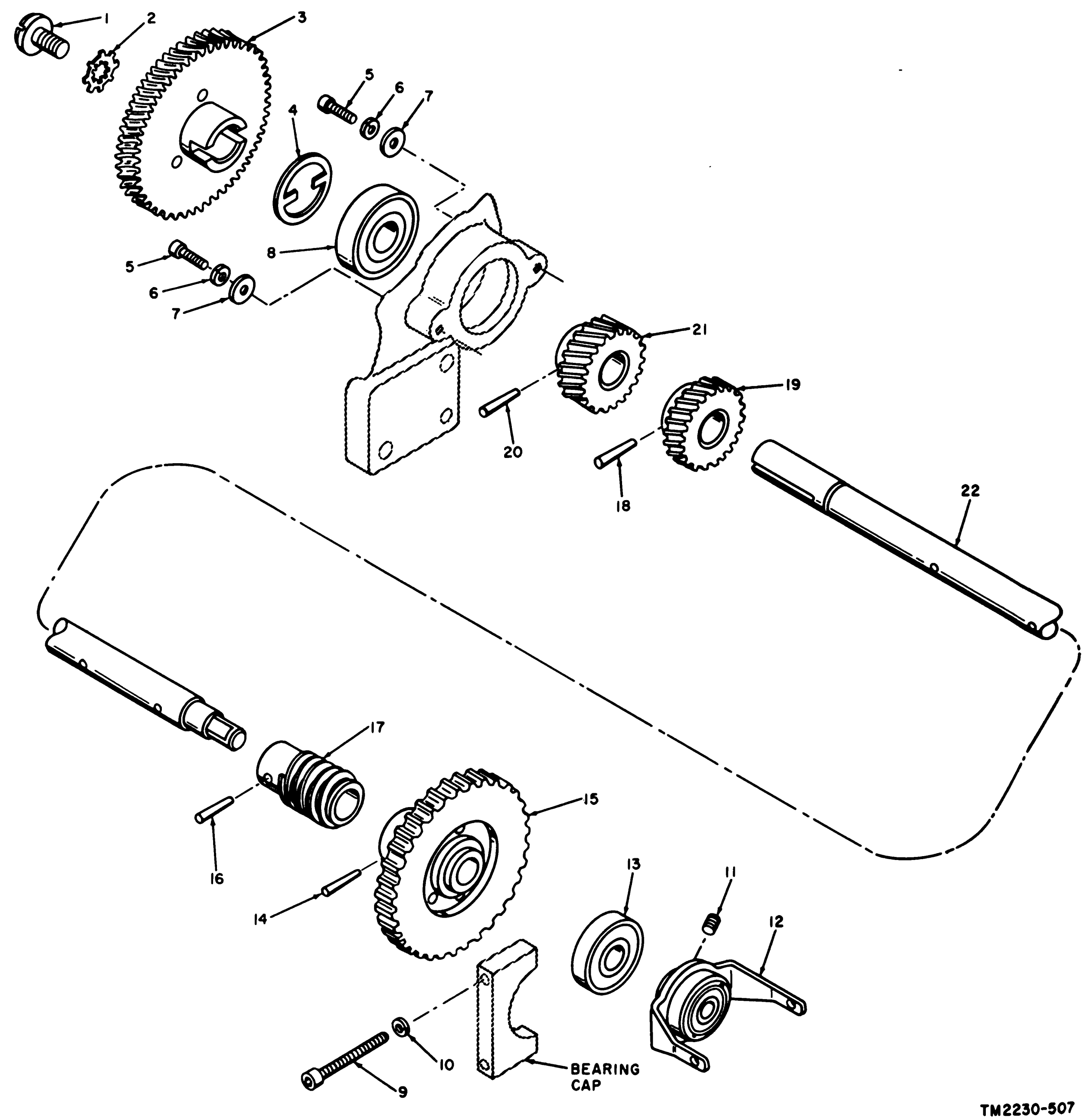
(8) Remove the two socket-head screws (1, fig. 130) and lockwashers (2). Pull the selector camshaft (18) out of the frame far enough to allow the selector friction clutch fork (12, fig. 131) to clear the driving disk (8, fig. 130) on the selector camshaft.

(9) With the function shaft in the stop position, remove the main shaft (22, fig. 131).

b. Replacement.

(1) Insert the left end of the main shaft (22, fig. 131) in the hole in the function side of the teleprinter frame.

(2) Position the ball bearing (13) in the bearing seat in the selector side of the frame.



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)
8 Ball bearing (10758)
9 Machine screw (10012)
10 Lockwasher (10430)
11 Setscrew (10209)
12 Selector friction clutch fork (50484A)
13 Ball bearing (10757)
14 Taper pin (10852)
15 Function shaft driving gear (50354A)
16 Taper pin (10850)
17 Carriage feed worm gear (50268)
18 Taper pin (10852)
19 Carriage-return shaft drive gear (55167)
20 Taper pin (10852)
21 Transmitter shaft drive gear (55166)
22 Main shaft (54563)

Figure 131. Teleprinter main shaft, exploded view.

Position the bearing cap on the bearing and on the frame. Secure the cap with the two socket-head machine screws (9) and lockwashers (10).

(3) Install the ball bearing (8) on the function side of the main shaft (22) and in the bearing seat in the teleprinter frame. Secure it with two machine screws (5), lockwashers (6), and flat washers (7).

(4) Position the five drive keys (4) on the main shaft driven gear (3).

(5) Install the main shaft driven gear (3) on the main shaft (22) and secure it with a machine screw (1) and lockwasher (2).

Note.—Be sure to install the correct gear for the operating speed desired (par. 27).

(6) Install the range finder orientation lever (10, fig. 120) on the range-finder mechanism (par. 130*b*).

(7) Move the selector camshaft (18, fig. 130) in so that the driving disk (8) of the friction clutch engages the selector friction clutch fork (12, fig. 131) on the main shaft (22).

(8) Install the two socket-head machine screws (1, fig. 130) and lockwashers (2) that hold the selector camshaft (18) to the selector side of the teleprinter frame.

(9) Install the gasket, gear cover, and worm gear bracket on the teleprinter frame (par. 112*b*(3)).

(10) Install the teleprinter on the base (par. 105*b*).

143. Disassembly and Reassembly of Main Shaft

(fig. 131)

a. Disassembly.

(1) Remove the main shaft as instructed in paragraph 142*a*.

(2) Remove the two setscrews (11) and the clutch fork (12).

(3) Remove the ball bearing (13) from the main shaft.

(4) Drive out the taper pin (14) and remove the function shaft driving gear (15).

(5) Drive out the taper pin (16) and remove the worm gear (17) from the main shaft (22).

(6) Drive out the taper pin (18) and remove the carriage-return shaft drive gear.

(7) Remove the taper pin (20) and remove the transmitter shaft drive gear (21).

b. Reassembly.

(1) Position the transmitter shaft drive gear (21) on the main shaft (22). Secure it with a taper pin (20).

(2) Position the carriage-return shaft drive gear (19) on the main shaft (22). Secure it with a taper pin (18).

(3) Position the carriage feed worm gear (17) on the main shaft (22). Secure it with a taper pin (16).

(4) Position the function shaft driving gear (15) on the main shaft (22). Secu e it with a taper pin (14).

(5) Position the ball bearing (13) on the main shaft (22).

(6) Position the selector friction clutch fork (12) on the main shaft (22). Secure it with the two setscrews (11).

(7) Install the main shaft as instructed in paragraph 142*b*.

144. Removal and Replacement of Code Ring Cage

a. Removal.

(1) Remove the two machine screws (1, fig. 132) and lockwashers (2) that hold the code ring cage to the selector side of the teleprinter frame.

(2) Remove the four setscrews (10, fig. 128) and the assembled stop arm shaft and stop arm (4, fig. 132).

(3) Remove the three machine screws (6), flat washers (7), and lockwashers (8) that hold the two line feed carriage return fulcrums (9), the figures fulcrum (10), and the bracket (13) to the function stop bar support guide (15); remove the three fulcrums and the bracket. Remove the sensing levers (par. 108*a*).

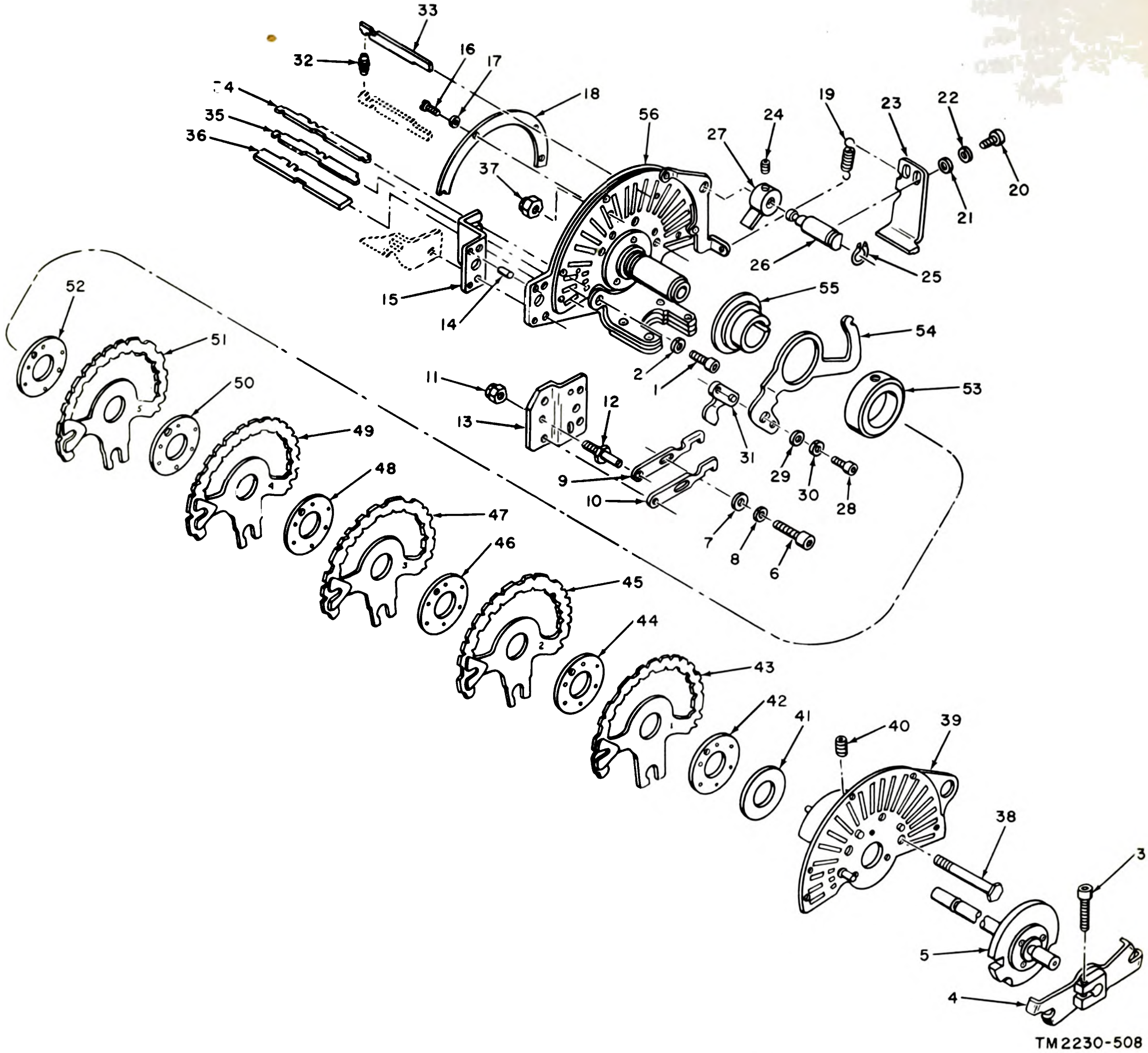
(4) Remove the code ring cage by pulling it away from the teleprinter casting.

b. Replacement.

(1) Position the code ring cage on the selector side of the teleprinter frame. Replace the sensing levers (108*b*).

(2) Position the two line feed carriage return fulcrums (9), the figures fulcrum (10), and the bracket (13) on the code ring cage. Secure them with the three machine screws (6), flat washers (7), and lockwashers (8).

(3) Insert the stop arm shaft (5) in the opening in the center of the code ring



1	Machine screw (10024)	24	Setscrew (10201)
2	Lockwasher (10431)	25	Retainer ring (10451)
3	Machine screw (10009)	26	Code ring locking bail shaft (53871)
4	Square shaft stop arm (53802A) (includes item 3)	27	Code ring locking lever (53875A)
5	Stop arm shaft (50377A)	28	Machine screw (10001)
6	Machine screw (10005)	29	Flat washer (10459)
7	Flat washer (10458)	30	Lockwasher (10429)
8	Lockwasher (10429)	31	Cam follower (53882)
9	Line feed carriage return fulcrum (56178)	32	Stop bar spring (52940)
10	Figures fulcrum (56176)	33	Stop bar (50502)
11	Self-locking hexagonal nut (10500)	34	Line feed stop bar (53530A) (includes item 35)
12	Eccentric stud (55738)	35	Carriage return stop bar
13	Bracket (55737)	36	Figures stop bar (56179)
14	Dowel	37	Self-locking hexagon nut (10500)
15	Function stop bar support guide	38	Cage tie bolt (53972)
16	Machine screw (10317)	39	Code cage outside guide (53809A) (includes items 14, 15, and 56)
17	Lockwasher (10433)	40	Setscrew (10223)
18	Retainer plate (56177)	41	Flat washer (53453)
19	Locking bail spring (50941)	42	Ball retainer (53647A)
20	Machine screw (10004)	43	Code ring (53641A)
21	Flat washer (10459)	44	Ball retainer (53647A)
22	Lockwasher (10429)	45	Code ring (53642A)
23	Code ring locking bail (53884)		

Figure 132. Code ring cage, exploded view.

cage and in the hole in the square shaft driven gear (11, fig. 128). Secure the stop arm shaft to the gear with the four setscrews (10).

(4) Install the two machine screws (1, fig. 132) and lockwashers (2) that hold the code ring cage to the selector side of the teleprinter frame.

(5) Adjust the code ring cage as instructed in paragraphs 178, 184, 185, 192, and 206 through 208.

145. Disassembly and Reassembly of Code Ring Cage

(fig. 132)

a. Disassembly.

(1) Remove the code ring cage from the teleprinter (par. 144*a*).

(2) Remove the machine screw (3) and the square shaft stop arm (4).

(3) Remove the three self-locking hexagonal nuts (11) and the eccentric studs (12).

(4) Remove the two dowels (14) from the function stop bar support guide (15) and from the code bar cage plate (56). Remove the function stop bar support guide.

(5) Remove the three machine screws (16) and lockwashers (17). Remove the retainer plate (18).

(6) Unhook the locking bail spring (19) from the code ring locking bail (23) and from the code bar cage plate (56).

(7) Remove the two machine screws (20), flat washers (21), and lockwashers (22). Remove the code ring locking bail (23).

(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) and the code ring locking bail shaft (26). Catch the code ring locking lever (27) as it falls off of the shaft.

(10) Remove the machine screw (28), flat washer (29), and lockwasher (30). Remove the cam follower (31).

(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), the carriage return stop bar (35), and the figures stop bar (36).

(12) Remove the setscrew (40), three self-locking hexagonal nuts (37), and cage tie bolts (38). Remove the code cage outside guide.

(13) Remove the flat washer (41) from the stud on the code bar 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 bar cage plate, alternately remove a ball retainer and a code ring until all are removed.

(14) Remove the code ring collar (53), code ring cam follower locking lever (54), and the sleeve bearing (55) from the code bar cage plate (56).

b. Reassembly.

(1) Install the sleeve bearing (55), code ring cam follower locking lever (54), and code ring collar (53) on the stud on the code bar cage plate (56).

(2) 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 bar cage plate (56). Alternate a ball retainer and a code ring and, starting with a ball retainer and No. 5 code ring, install the code rings in descending numerical order. Install the flat washer (41).

(3) Position the code cage outside guide (39) on the code cage spacer (53) and on the code bar cage plate (57). Secure it with three cage tie bolts (38), self-locking hexagonal nuts (37), and a setscrew (40).

46 Ball retainer (53647A)
47 Code ring (53643A)
48 Ball retainer (53647A)
49 Code ring (53644A)
50 Ball retainer (53647A)
51 Code ring (53645A)
52 Ball retainer (53647A)
53 Code ring collar (53868)
54 Code ring cam follower locking lever (53869)
55 Sleeve bearing (53867)
56 Code bar cage plate

Figure 132—Continued.

(4) 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.

(5) Position the cam follower (31) on the code ring cam follower locking lever (54). Secure it with a machine screw (28), lockwasher (30), and flat washer (29).

(6) 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 it with a retainer ring (25).

(7) 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).

(8) Position the code ring locking bail (23) on the code ring locking bail shaft (26). Secure it with the two machine screws (20), lockwashers (22) and flat washers (21).

(9) Install the locking bail spring (19) on the code ring locking bail (23) and on the code bar cage plate (56).

(10) Position the retainer plate (18) on the code bar cage plate (56). Secure it with the three machine screws (16) and lockwashers (17).

(11) Position the two dowels (14) in the function stop bar support guide (15) and in the code bar cage plate (56).

(12) Position the three eccentric studs (12) on the bracket (13). Secure them with the three self-locking hexagonal nuts (11).

(13) Position the square shaft stop arm (4) on the stop arm shaft (5) and secure it with a machine screw (3).

(14) Install the code ring cage on the teleprinter as instructed in paragraph 144*b*.

146. Disassembly and Reassembly of Function Sensing Lever Group

(fig. 133)

a. Disassembly.

(1) Remove the square shaft as instructed in paragraph 138*a*.

(2) Remove the line feed and the platen shift mechanism (par. 137*a*).

(3) Remove the retainer ring (1) from the pivot stud on the connector link (2). Disconnect the connector link from engagement with the double blocking lever.

(4) Remove the retainer ring (3) from the pivot stud on the carriage return bell crank (9). Remove the horizontal carriage return link (4) from the stud.

(5) Remove the retainer rings (5 and 6) from the pivot studs and remove the vertical carriage return link (7) from the pivot studs.

(6) Remove the retainer ring (8) from the carriage return bell crank pivot (10). Remove the carriage return bell crank (9) from the carriage return bell crank pivot.

(7) Remove the carriage return bell crank pivot (10).

(8) Remove the flat washer (11) from the stop arm shaft.

(9) Disconnect the line feed sensing lever spring (12) from the line feed sensing lever (13) and from the bell crank pivot bracket.

(10) Remove the line feed sensing lever (13) from the stop arm shaft.

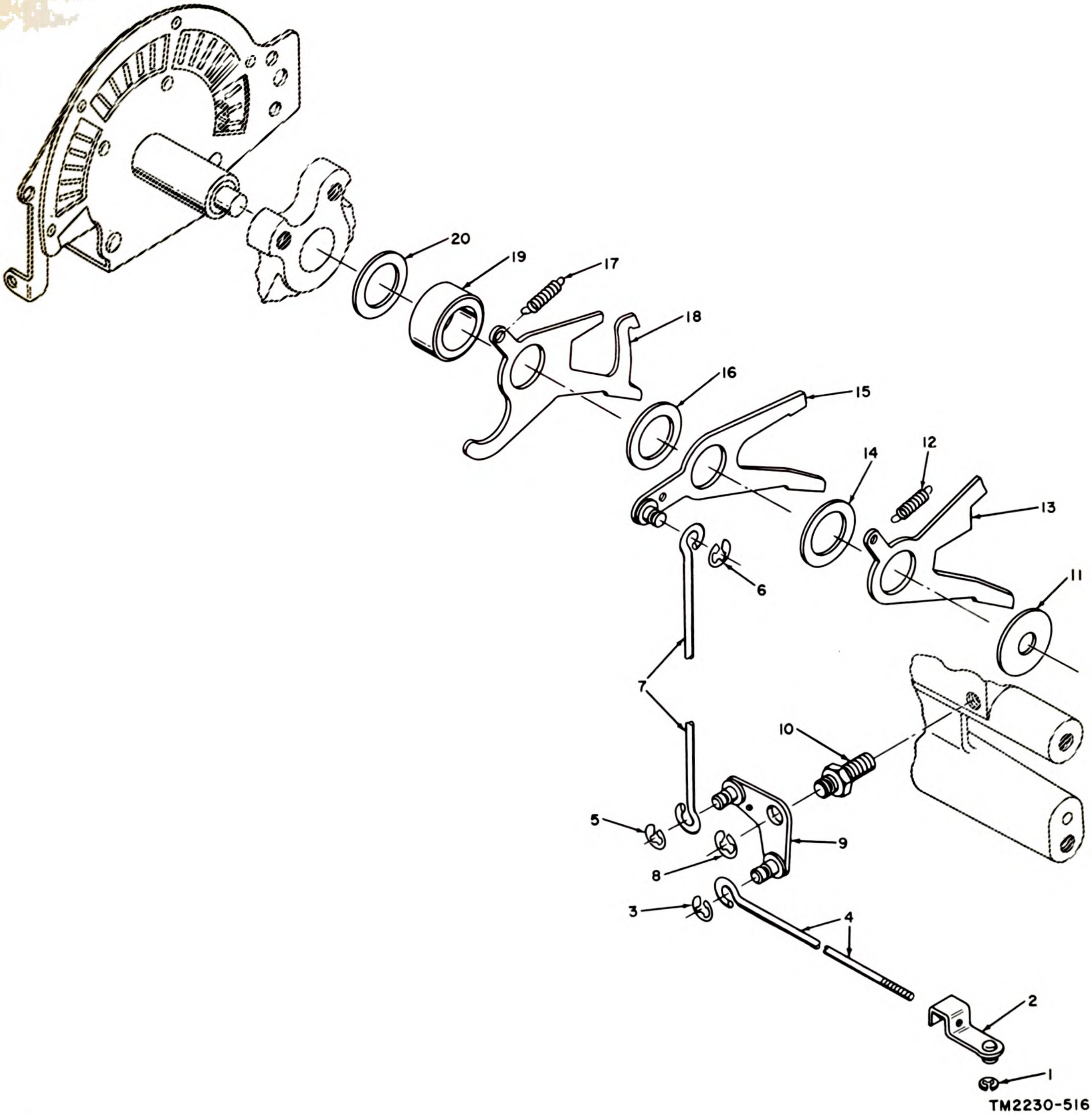
(11) Remove the flat washer (14), carriage return sensing lever (15), and flat washer (16).

(12) Remove the figure shift sensing lever spring (17) from the figure shift sensing lever (18) and from the bell crank pivot bracket.

(13) Remove the figure shift sensing lever (18), spacing collar (19), and tolerance takeup flat washer (20) from the stop arm shaft.

b. Reassembly.

(1) Place the tolerance takeup flat washer (20), spacing collar (19), and figure shift sensing lever (18) on the stop arm shaft.



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 (10949)
9 Carriage return bell crank (52121A)
10 Carriage return bell crank 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)

Figure 133. Function sensing lever group, exploded view.

(2) Hook the figure shift sensing lever spring (17) to the figure shift sensing lever (18) and to the bell crank pivot bracket.

(3) Place the flat washer (16), carriage return sensing lever (15), flat washer (14), and line feed sensing lever (13) on the stop arm shaft.

(4) Hook the line feed sensing lever spring (12) to the line feed sensing lever (13) and to the bell crank pivot bracket.

(5) Install the flat washer (11) on the shaft.

(6) Install the carriage return bell crank pivot (10) on the frame of the machine.

(7) Position the carriage return bell crank (9) on the carriage-return bell crank pivot (10). Secure it with a retainer ring (8).

(8) Place the vertical carriage return link (7) on the pivot studs on the carriage return bell crank (9) and the carriage return sensing lever (15). Secure the link on the pivot studs with the retainer rings (5 and 6).

(9) Position the horizontal carriage return link (4) on the remaining pivot stud on the carriage return bell crank (9) and secure it with a retainer ring (3).

(10) Install the connector link (2) on the horizontal carriage return link (4). Adjust the length of the horizontal carriage return link as instructed in paragraphs 303 and 304.

(11) Position the pivot stud of the connector link (2) in the hole in the double blocking lever and secure it in place with a retainer ring (1).

(12) Install the line feed and the platen shift (par. 137*b*).

(13) Install the square shaft (par. 138*b*).

147. Disassembly and Reassembly of Manual Unshift Mechanism

(fig. 134)

a. Disassembly.

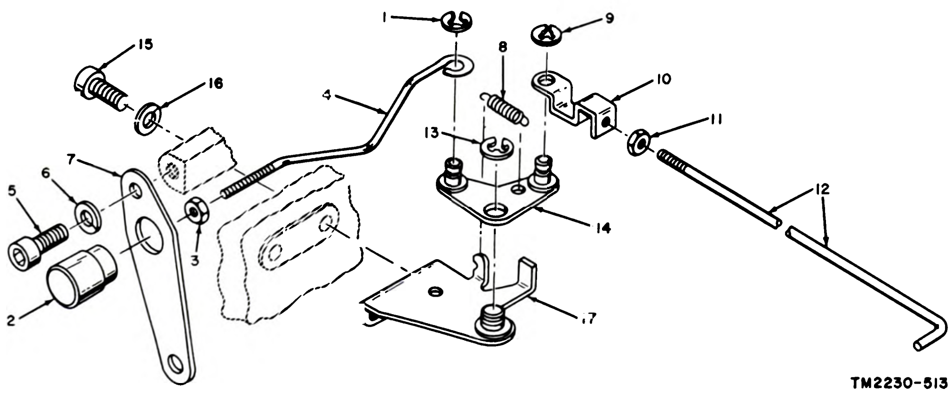
(1) Remove the retainer ring (1), assembled manual unshift push button link (4), and manual unshift push button (2).

(2) Remove the manual unshift push button (2) and plain hexagonal nut (3) from the manual unshift push button link.

(3) Remove the two machine screws (5) and lockwashers (6) and remove the manual unshift push button bracket mounting plate.

(4) Remove the manual unshift bell crank spring (8) from the manual unshift bell crank (14) and from the bell crank mounting bracket (17).

(5) Remove the retainer ring (9) that holds the connector link (10) to the manual unshift bell crank (14). Remove the connector link and the plain hexagonal nut (11) from the manual unshift lever



1 Retainer ring (10960)
2 Manual unshift push button (55513)
3 Plain hexagonal nut (10520)
4 Manual unshift push button link (53413)
5 Machine screw (10008)
6 Lockwasher (10430)
7 Manual unshift push button bracket mounting plate (53386)
8 Manual unshift bell crank spring (50916)
9 Retainer ring (10960)
10 Connector link (51783)
11 Plain hexagonal nut (10520)
12 Manual unshift lever link (56267)
13 Retainer ring (10949)
14 Manual unshift bell crank (52121A)
15 Machine screw (10025)
16 Lockwasher (10430)
17 Bell crank mounting bracket (53415A)

Figure 134. Manual unshift mechanism, exploded view.

link (12). Pull the manual unshift lever link through the opening in the function side of the teleprinter frame.

(6) Remove the retainer ring (13) and the manual unshift bell crank (14).

(7) Remove the two machine screws (15) and lockwashers (16). Remove the bell crank mounting bracket (17).

b. Reassembly.

(1) Position the bell crank mounting bracket (17) on the selector side of the teleprinter frame and secure it with the two machine screws (15) and lockwashers (16).

(2) Place the manual unshift bell crank (14) on the bell crank mounting bracket (17) and secure it with a retainer ring (13).

(3) Insert the manual unshift lever link (12) through the function side of the teleprinter frame. Install the plain hexagonal nut (11) and connector link (10) on the manual unshift lever link. Position the connector link on the manual unshift bell crank (17) and secure it with a retainer ring (9).

(4) Attach the manual unshift bell crank spring (8) to manual unshift bell crank (14) and to the bell crank mounting bracket (17).

(5) Position the manual unshift push button bracket mounting plate (7) on the teleprinter frame and secure it with the two machine screws (5) and lockwashers (6).

(6) Install the plain hexagonal nut (3) and manual unshift push button (2) on the manual unshift push button link (4).

(7) Insert the manual unshift push button link (4) through the hole in the manual unshift push button bracket mounting plate (7) and hook it onto the manual unshift bell crank (14). Secure it with a retainer ring (1).

(8) Adjust the manual unshift mechanism (par. 244).

148. Disassembly and Reassembly of Automatic Carriage Return Mechanism

(fig. 135)

a. Disassembly.

(1) Remove the retainer ring (1) that holds the automatic carriage return link connector link (5) to the stop bar shift lever (3).

(2) Remove the retainer ring (2) and the stop bar shift lever (3).

(3) Remove the stud (4) from the function side of the teleprinter frame.

(4) Remove the connector link (5) from the stop bar shift link (9).

(5) Remove the set screw (6) from the spring collar (13).

(6) Remove the setscrew (8) from the stop bar shift blade (11).

(7) Remove the setscrew (7) from the stop bar shift stop (10).

(8) Remove the stop bar shift link (9) by moving it toward the function side of the teleprinter. 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) Position the spring collar (13) and the stop bar return spring (12) on the stop bar shift link (9). Insert the end of the link (9) into the hole on the stop bar shift link bracket at the selector side of the teleprinter. Slide the stop bar shift blade (11) and the stop bar shift stop (10) into position on the stop bar shift link.

(2) Secure the stop bar shift stop (10) to the stop bar shift link (9), with the setscrew (7).

(3) Secure the stop bar shift blade (11) to the stop bar shift link (9), with the setscrew (8).

(4) Secure the spring collar to the stop bar shift link (9), with the setscrew (6).

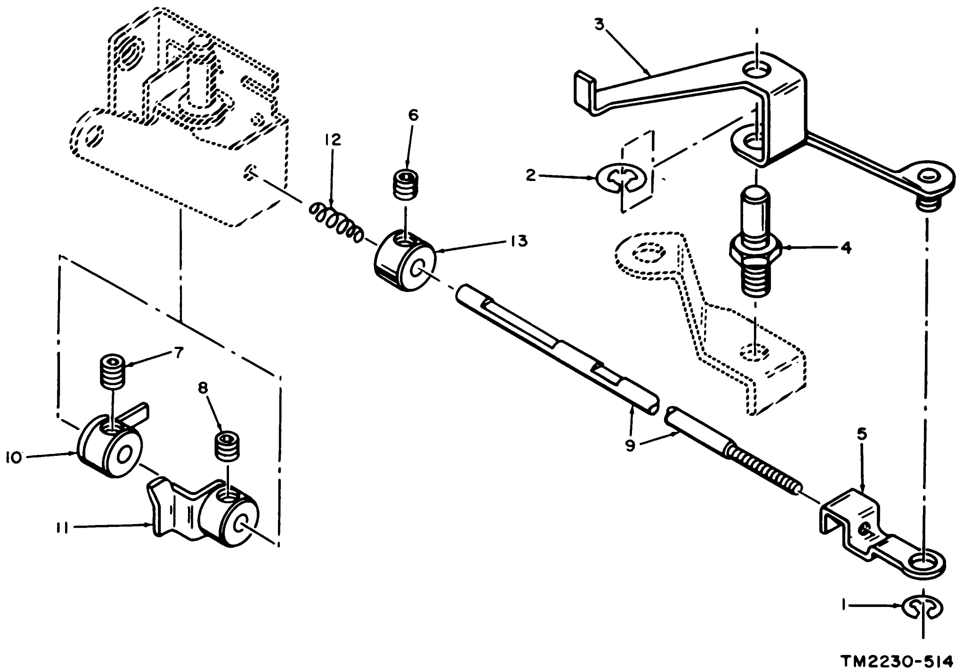
(5) Install the connector link (5) on the stop bar shift link (9).

(6) Install the stud (4) on the function side of the teleprinter frame.

(7) Position the stop bar shift lever (3) on the stud (4) and secure it with a retainer ring (2).

(8) Position the connector link (5) on the stud on the stop bar shift lever (3) and secure it with a retainer ring (1).

(9) Adjust the automatic carriage-return mechanism as instructed in paragraphs 256 through 258.



1	Retainer ring (10960)	8	Setscrew (10201)
2	Retainer ring (10949)	9	Stop bar shift link (55733)
3	Stop bar shift lever (52945A)	10	Stop bar shift stop (55740A)
4	Stud (52948)	11	Stop bar shift blade (55735A)
5	Connector link (51783)	12	Stop bar return spring (52953)
6	Setscrew (10201)	13	Spring collar (55736)
7	Setscrew (10201)		

Figure 135. Automatic carriage return mechanism, exploded view.

149. Disassembly and Reassembly of Manual Carriage Return Button Mechanism

(fig. 136)

a. Disassembly.

(1) Remove the machine screw (1) and two lockwashers (2) that hold the carriage return button bracket (8) to the teleprinter frame.

(2) Remove the two machine screws (3) and lockwashers (4) and remove the manual carriage return button mechanism.

(3) Remove the retainer ring (5) and remove the assembled manual carriage return button (6) and carriage return button 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) Disconnect 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). Remove the manual carriage return lever (12).

(8) Remove the adjusting screw (13) and plain hexagonal nut (14) from the manual carriage return bracket (15).

b. Reassembly.

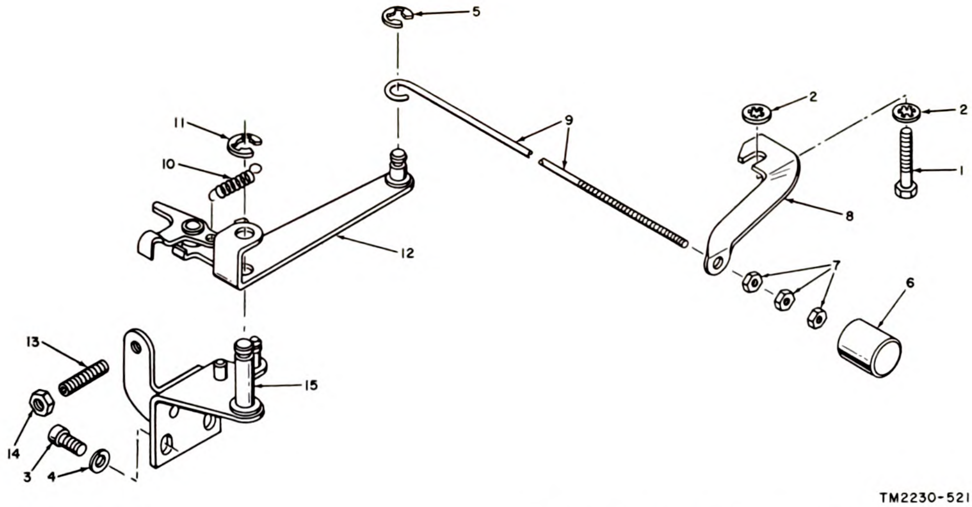
(1) Install the plain hexagonal nut (14) on the adjusting screw (13), and screw the assembled plain hexagonal nut and adjusting screw into the threaded hole in the manual carriage return bracket (15).

(2) Place the manual carriage return lever (12) on the manual carriage return bracket (15) and secure it with a retainer ring (11).

(3) Hook the trip pawl spring (10) onto the manual carriage return lever (12) and manual carriage return bracket (15).

(4) Place the carriage return button bracket (8) and the three plain hexagonal nuts (7) on the carriage return button link (9).

(5) Install the manual carriage return button (6) on the carriage return button link (9).



1	Machine screw (10320)	9	Carriage return button link (55517)
2	Lockwasher (10404)	10	Trip pawl spring (50196)
3	Machine screw (10008)	11	Retainer ring (10949)
4	Lockwasher (10430)	12	Manual carriage return lever (52791A)
5	Retainer ring (10960)	13	Adjusting screw (10206)
6	Manual carriage return button (55513)	14	Plain hexagonal nut (10505)
7	Plain hexagonal nut (10520)	15	Manual carriage return bracket (52790A)
8	Carriage return button bracket (55514)		

Figure 136. Manual carriage return button mechanism, exploded view.

(6) Position the carriage return button link (9) on the manual carriage return lever (12). Secure it with a retainer ring (5).

(7) Position the manual carriage return bracket (15) on the teleprinter frame. Secure it with the two machine screws (3) and lockwashers (4).

(8) Position the manual carriage return bracket (15) on the teleprinter frame and secure it with a machine screw (1) and two lockwashers (2).

(9) Adjust the manual carriage return mechanism (pars. 223 and 224).

150. Disassembly and Reassembly of Carriage Feed Mechanism

(fig. 137)

a. Disassembly.

(1) Remove the retainer ring that holds the carriage feed link (3) to the carriage feed lever. Remove the carriage feed link from the carriage feed lever.

(2) Remove the retainer ring (1). Remove the assembled carriage feed link (3) and connector link. Remove the connector link from the carriage feed link.

(3) Disconnect the carriage feed pawl spring (4) from the carriage feed pawl (9) and the spring stud on the teleprinter frame.

(4) Remove the two machine screws (5) and lockwashers (6). Remove the assembled space pawl mounting bracket and carriage feed pawl (9).

(5) Remove the self-locking hexagonal nut (7) and flat washer (8). Remove the carriage feed pawl (9) and space pawl flat washer (10).

(6) Disconnect the carriage feed clutch lever spring (12) from the carriage feed clutch lever (14) and the spring post on the teleprinter frame.

(7) Remove the retainer ring (13). Remove the carriage feed clutch lever (14).

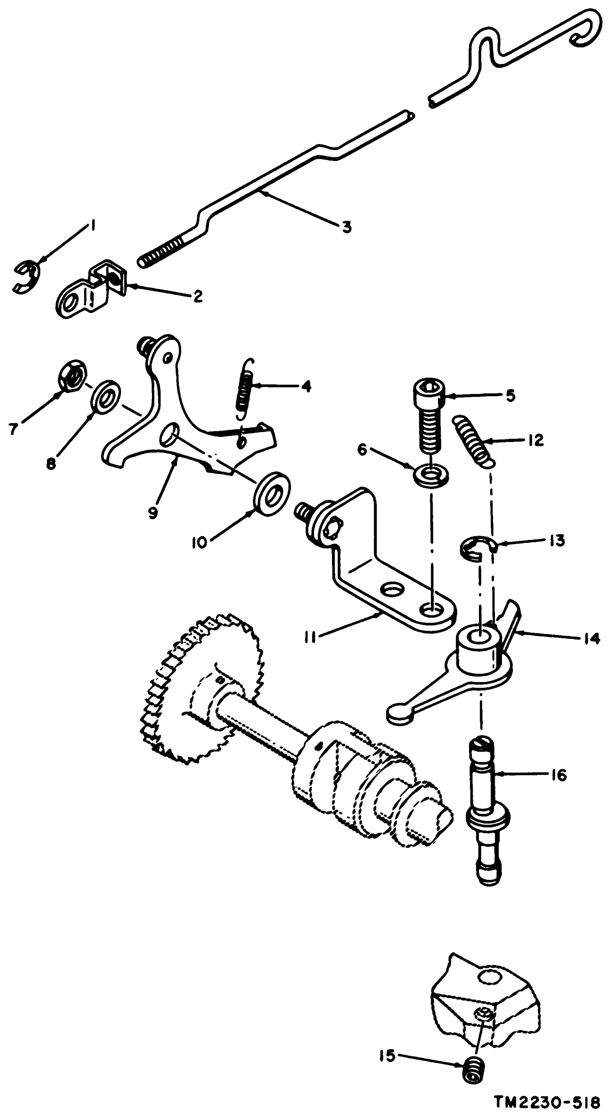
(8) Remove the setscrew (15) and the carriage feed clutch lever pivot stud (16).

b. Reassembly.

(1) Secure the carriage feed clutch lever pivot stud (16) in the drilled hole in the teleprinter frame with a setscrew (15).

(2) Place the carriage feed clutch lever (14) on the carriage feed clutch lever pivot stud (16) and secure it with a retainer ring (13).

(3) Attach the carriage feed clutch lever spring (12) to the spring post on the teleprinter frame and to the carriage feed clutch lever (14).



1 Retainer ring (10960)
2 Connector link (51783)
3 Carriage feed link (55504)
4 Carriage feed pawl spring (50912)
5 Machine screw (10025)
6 Lockwasher (10430)
7 Self-locking hexagonal nut (10500)
8 Flat washer (10450)
9 Carriage feed pawl (54490A)
10 Space pawl flat washer (50827)
11 Space pawl mounting bracket (55788A)
12 Carriage feed clutch lever spring (50911)
13 Retainer ring (10949)
14 Carriage feed clutch lever (50005A)
15 Set screw (10204)
16 Carriage feed clutch lever pivot stud (52318)

Figure 137. Carriage feed mechanism, exploded view.

(4) Place the space pawl flat washer (10) and the carriage feed pawl (9) on the space pawl mounting bracket (11). Secure them with a flat washer (8) and a self-locking hexagonal nut (7).

(5) Position the assembled space pawl mounting bracket (11) and carriage feed pawl (9) on the teleprinter frame. Secure the bracket with the two machine screws (5) and lockwashers (6).

(6) Attach the carriage feed pawl spring (4) to the carriage feed pawl (9) and to the spring post on the frame.

(7) Install the connector link (2) on the carriage feed link (3). Position the connector link on the carriage feed pawl (9) and secure it with a retainer ring (1).

(8) Position the other end of the carriage feed link (3) on the carriage feed lever and secure it with a retainer ring.

(9) Adjust the carriage feed mechanism (par. 225 and 226).

151. Removal and Replacement of Carriage Return Operating Mechanism

(fig. 138)

a. Removal.

(1) Remove the manual unshift lever link (par. 147*a*(5)).

(2) Remove the horizontal carriage return link (par. 146*a*(4)).

(3) Remove the two machine screws (1) and lockwashers (2) and remove the assembled carriage return operating mechanism.

b. Replacement.

(1) Position the assembled carriage return operating mechanism on the teleprinter frame so that the carriage return clutch lever (22) engages the annular groove in the carriage return sliding clutch drum. Secure the carriage return mechanism to the teleprinter with the two machine screws (1) and lockwashers (2).

(2) Install the horizontal carriage return link (par. 146*b*(9)).

(3) Install the manual unshift lever link (par. 147*b*(3)).

(4) Adjust the carriage return operating mechanism (pars. 212, 214, 220–222, and 260).

152. Disassembly and Reassembly of Carriage Return Operating Mechanism

(fig. 138)

a. Disassembly.

(1) Remove the carriage return mechanism from the teleprinter (par. 151*a*).

(2) Remove the machine screw (3), flat washer (5), and clamp nut (4). Remove the throwout lever (6).

(3) Remove the carriage return clutch actuating lever spring (7) that connects the double blocking lever (12) and the carriage return clutch actuating lever (18).

(4) Remove the assembled double blocking lever and adjusting plate (11) from the shaft of the carriage return clutch lever (22).

(5) Remove the machine screw (8), flat washer (9), and lockwasher (10). Remove the adjusting plate (11).

(6) Remove the double blocking lever spring (13) that connects the carriage return clutch latch lever (15) and the clutch latch mounting plate (16).

(7) Remove the retainer ring (14) and the carriage return clutch latch lever (15).

(8) Remove the clutch latch mounting plate (16) from the shaft of the carriage return clutch lever.

(9) Remove the machine screw (17) and the carriage return clutch actuating lever (18).

(10) Remove the two setscrews (19). Remove the shaft collar (20) and spring (21).

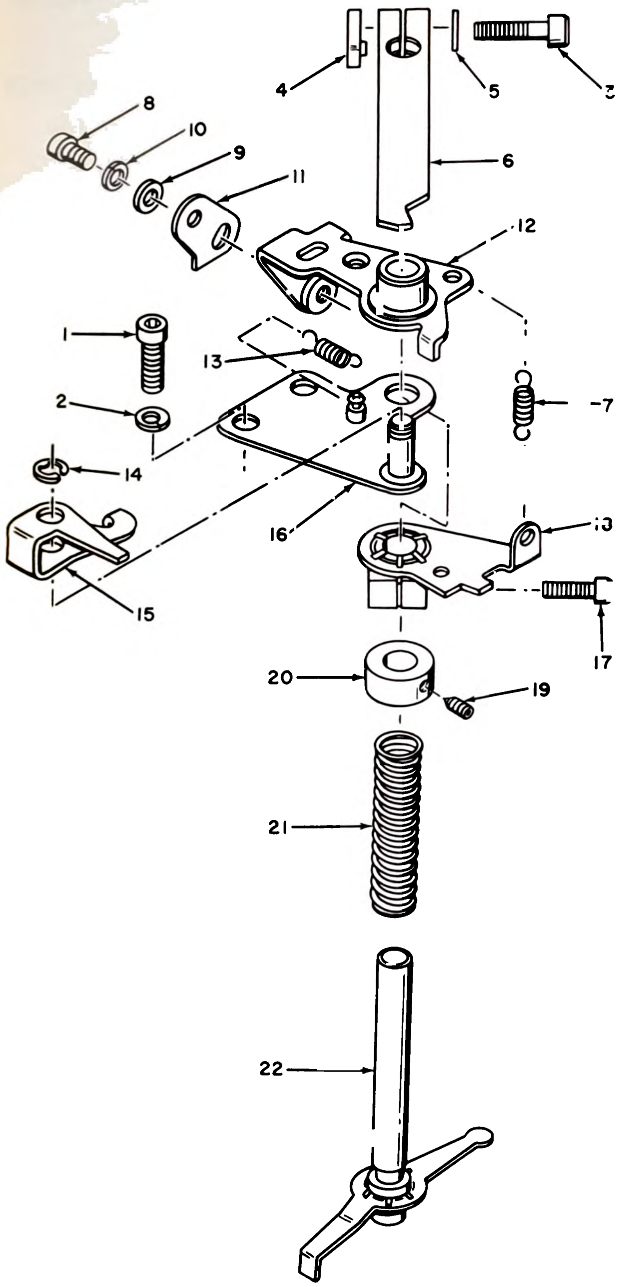
b. Reassembly.

(1) Position the spring (21) and shaft collar (20) on the shaft of the carriage return clutch lever (22). Secure them with the two setscrews (19).

(2) Position the carriage return clutch actuating lever (18) on the shaft of the carriage return clutch lever. Secure it with a machine screw (17).

(3) Install the clutch latch mounting plate (16) on the shaft of the carriage return clutch lever (22).

(4) Position the carriage return clutch latch lever (15) on the stud on the clutch latch mounting plate (16) and secure it with a retainer ring (14).



1 Machine screw (10008)
2 Lockwasher (10430)
3 Machine screw (10011)
4 Clamp nut (52073)
5 Flat washer (10467)
6 Throwout lever (53283)
7 Carriage return clutch actuating lever spring (56258)
8 Machine screw (10003)
9 Flat washer (10458)
10 Lockwasher (10429)
11 Adjusting plate (56237)
12 Double blocking lever (56265A)
13 Double blocking lever spring (50946)
14 Retainer ring (10949)
15 Carriage return clutch latch lever (50011)
16 Clutch latch mounting plate (53163A)
17 Machine screw (10009)
18 Carriage return clutch actuating lever (56241A)
19 Set screw (10209)
20 Shaft collar (50209)
21 Spring (52259)
22 Carriage return clutch lever (56243A)

Figure 138. Carriage return operating mechanism, exploded view.

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(5) Attach the double blocking lever spring (13) to the carriage return clutch latch lever (15) and the spring post on the clutch latch mounting plate (16).

(6) Position the adjusting plate (11) on the double blocking lever (12). Secure it with machine screw (8), lockwasher (10), and flat washer (9).

(7) Attach the carriage return clutch actuating lever spring (7) to the double blocking lever (12) and the carriage return clutch actuating lever (18).

(8) Position the throwout lever (6) on the shaft of the carriage return clutch lever. Secure it with a clamp nut (4), flat washer (5), and machine screw (3).

(9) Replace the carriage return mechanism (par. 151*b*).

153. Disassembly and Reassembly of Carriage Rack Drive Shaft

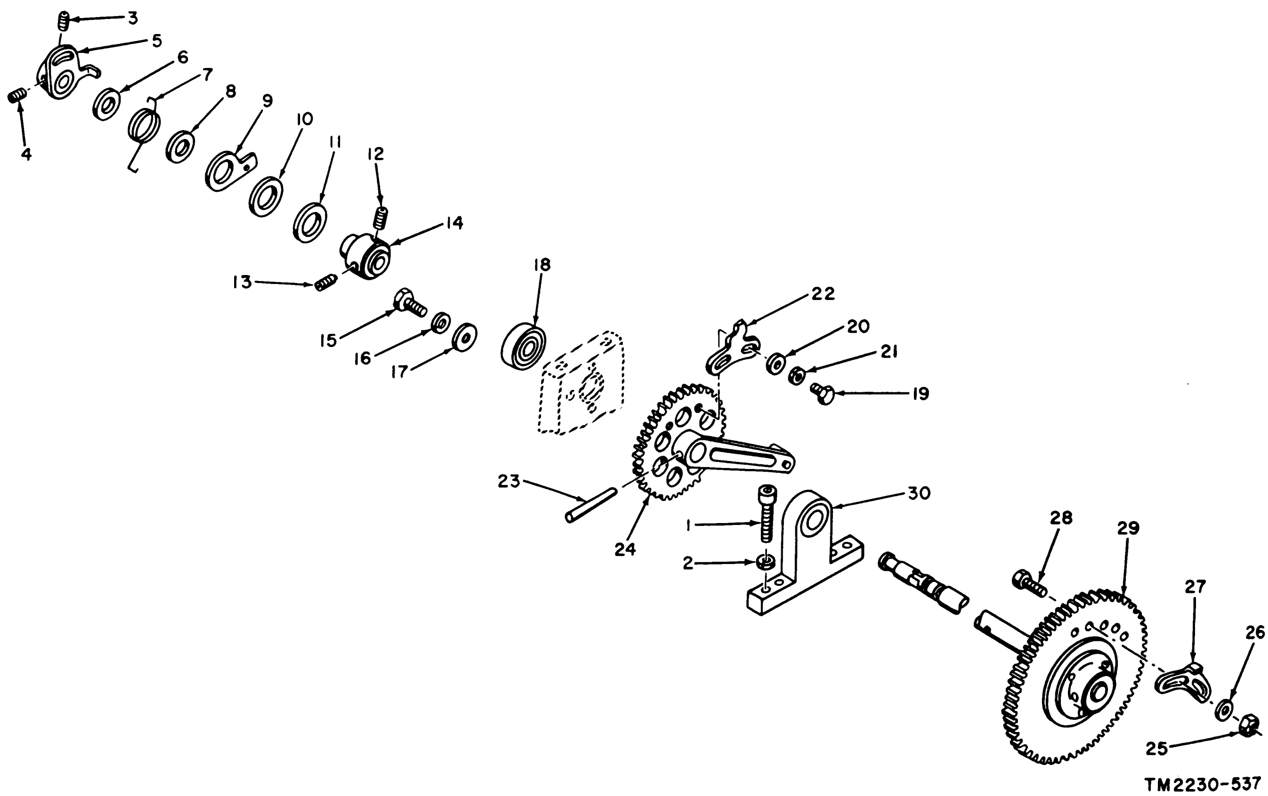
(fig. 139)

a. Disassembly.

(1) Remove the carriage from the teleprinter (par. 123*a*).

(2) Remove the two machine screws (1) and lockwashers (2) that hold the bearing cap (30) to the front of the teleprinter frame.

(3) Remove the two setscrews (3 and 4). Remove the carriage return blocking lever adjusting collar, flat washer (6),



1 Machine screw (10011)	16 Lockwasher (10429)
2 Lockwasher (10430)	17 Flat washer (10458)
3 Setscrew (10209)	18 Ball bearing (10759)
4 Setscrew (10223)	19 Machine screw (10303)
5 Carriage return blocking lever adjusting collar (55090A)	20 Flat washer (10458)
6 Flat washer (56254)	21 Lockwasher (10429)
7 Carriage return blocking lever spring (56269)	22 Carriage return latch tripping arm (55524)
8 Flat washer (53783)	23 Taper pin (10851)
9 Carriage return blocking lever (56238)	24 Carriage return driven gear (50138A)
10 Flat washer (51681)	25 Self-locking hexagonal nut (10500)
11 Flat washer (10468)	26 Flat washer (10450)
12 Setscrew (10209)	27 Margin bell pawl trip arm (50124)
13 Setscrew (10223)	28 Machine screw (10080)
14 Collar (51668)	29 Carriage rack drive shaft and gear (55520A)
15 Machine screw (10003)	30 Bearing cap

Figure 139. Carriage rack drive shaft, exploded view.

carriage return blocking lever spring (7), flat washer (8), carriage return blocking lever (9), and two flat washers (10 and 11).

(4) Remove the two setscrews (12 and 13) and remove the collar (14).

(5) Remove the machine screw (15), lockwasher (16), and flat washer (17) that secure the ball bearing (18) to the teleprinter frame.

(6) Pull the assembled carriage rack drive shaft and gear forward until it clears the ball bearing (18) in the teleprinter frame and remove the ball bearing from the frame.

(7) Remove the two machine screws (19), flat washers (20), and lockwashers (21). Remove the carriage return latch tripping arm (22).

(8) Remove the taper pin (23) and the carriage return driven gear (24).

(9) Remove the two self-locking hexagonal nuts (25), flat washers (26), and machine screws (28). Remove the margin bell pawl trip arm (27).

(10) Remove the carriage rack drive shaft and gear (29) from the bearing cap (30).

b. Reassembly.

(1) Install the bearing cap (30) on the carriage rack drive shaft and gear (29).

(2) Position the margin bell pawl trip arm (27) on the carriage rack drive shaft and gear (29). Secure it with the two machine screws (28), flat washers (26), and self-locking hexagonal nuts (25).

(3) Position the carriage return driven gear (24) on the shaft of the carriage rack drive shaft and gear (29). Secure it with a taper pin (23).

(4) Position the carriage return latch tripping arm (22) on the carriage return driven gear. Secure it with the two machine screws (19), lockwashers (21), and flat washers (20).

(5) Insert the shaft of the carriage rack drive shaft and gear (29) through the bearing seat in the teleprinter frame. Install the ball bearing (18) on the shaft and press it into the bearing seat. Secure it with a machine screw (15), lockwasher (16), and flat washer (17).

(6) Position the collar (14) on the shaft of the carriage rack drive shaft and gear and secure it with the two setscrews (12 and 13).

(7) Install two flat washers (11 and 10), the carriage return blocking lever (9), flat washer (8), carriage return blocking lever spring (7), and flat washer (6), on the shaft of the carriage rack drive shaft and gear (29). Position the carriage return blocking lever adjusting collar (5) on the shaft and secure it with the two setscrews (3 and 4).

(8) Position bearing cap (30) on the teleprinter frame. Fasten it with the two machine screws (1) and lockwashers (2).

(9) Install the carriage on the teleprinter (par. 123*b*).

(10) Adjust the carriage rack drive shaft (pars. 212, 214, 220–222, and 260).

154. Disassembly and Reassembly of Margin Signal Bell

(fig. 140)

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).

(5) Remove the locknut (7), machine screw (8), and lockwasher (9) and remove the margin signal bell (10).

b. Reassembly.

(1) Fasten the margin signal bell (10) to the margin bell bracket (11) with a machine screw (8), lockwasher (9), and locknut (7).

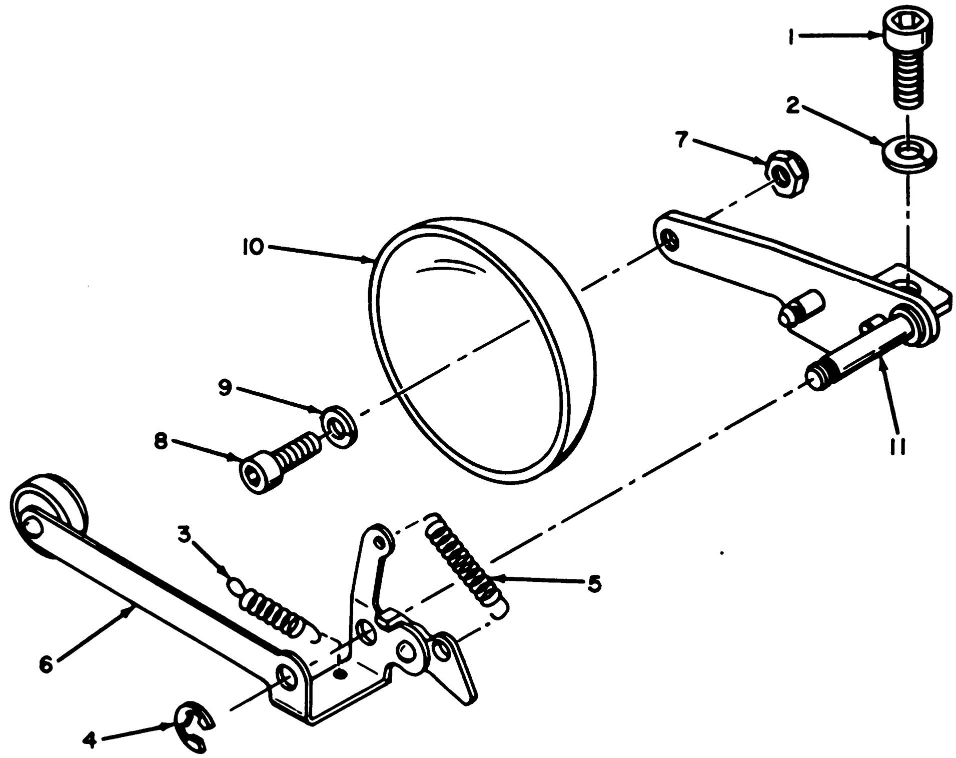
(2) Install the spring (5) on the margin bell clapper (6).

(3) Position the margin bell clapper (6) on the margin bell bracket (11). Secure it with a retainer ring (4).

(4) Attach the spring (3) to the margin bell clapper (6) and to the margin bell bracket (11).

(5) Attach the margin bell bracket assembly to the teleprinter frame with the two machine screws (1) and lockwashers (2).

(6) Adjust the margin signal bell (par. 260).



1	Machine screw (10008)	7	Locknut (10500)
2	Lockwasher (10430)	8	Machine screw (10003)
3	Spring (50231)	9	Lockwasher (10429)
4	Retainer ring (10960)	10	Margin signal bell (10403)
5	Spring (50232)	11	Margin bell bracket (53164A)
6	Margin bell clapper (50244A)		

Figure 140. Margin signal bell, exploded view.

155. Removal and Replacement of Carriage Feed Shaft

(fig. 141)

a. Removal.

(1) Remove the keyboard transmitter from the teleprinter (par. 106*a*).

(2) Remove the platen from the teleprinter (par. 118*a*).

(3) Remove the carriage feed mechanism from the teleprinter (par. 149*a*).

(4) Remove the machine screw (1) and lockwasher (2) and remove the assembled bearing block and ball bearing (6).

(5) Remove the two machine screws (3), flat washers (4), and lockwashers (5). Remove the ball bearing (6).

(6) Remove the two machine screws (7), flat washers (8), and lockwashers (9) and remove the bearing retainer (10).

(7) Remove the self-locking hexagonal nut (11), pull the shaft far enough forward to clear the ball bearing, and remove the carriage feed shaft from the teleprinter.

(8) Remove the ball bearing from the bearing seat in the teleprinter frame.

b. Replacement.

(1) Position the ball bearing (12) in the bearing seat in the teleprinter frame.

(2) Insert the assembled carriage feed shaft through the ball bearing in the bearing seat on the teleprinter frame and secure it with the self-locking hexagonal nut (11).

(3) Position the bearing retainer (10) on the teleprinter frame. Secure it with the two machine screws (7), lockwashers (9), and flat washers (8).

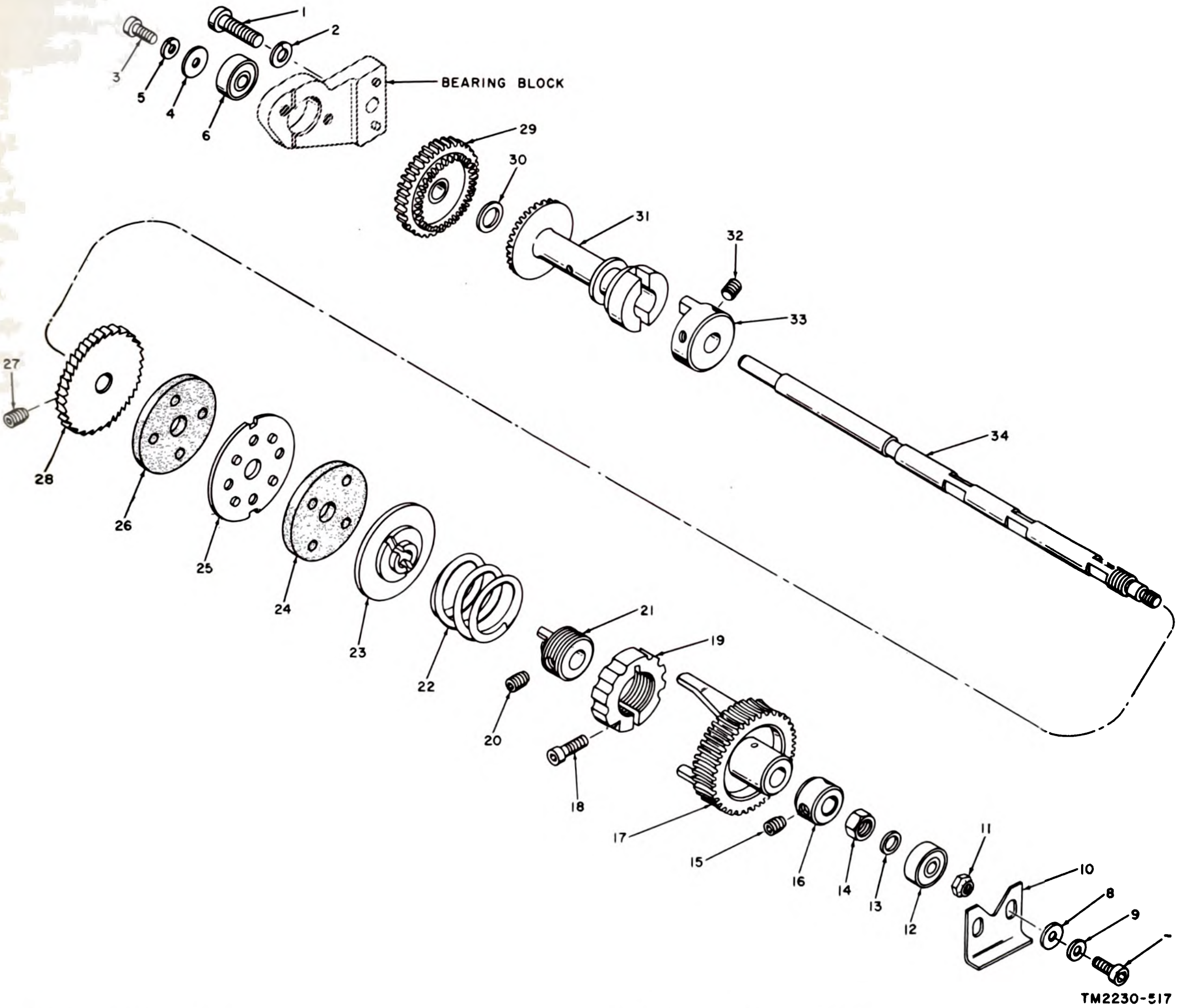
(4) Position the ball bearing (6) in the bearing block and secure it with two machine screws (3), lockwashers (5), and flat washers (4).

(5) Position the assembled ball bearing and

bearing block on the carriage feed shaft (34). Position the bearing block so that the drilled hole in the bearing block is alined with the tapped hole in the teleprinter frame and secure it with the machine screw (1) and lockwasher (2).

(6) Install the carriage feed mechanism on the teleprinter (par. 149*b*).

(7) Install the platen on the teleprinter (par. 118*b*).



1 Machine screw (10017)	18 Clamping screw (10052)
2 Lockwasher (10405)	19 Adjusting collar (54926)
3 Machine screw (10003)	20 Set screw (10208)
4 Flat washer (10450)	21 Drive shaft collar (54928)
5 Lockwasher (10429)	22 Friction clutch spring (54934)
6 Ball bearing (10755)	23 Friction clutch plate (54931)
7 Machine screw (10003)	24 Friction plate (50013)
8 Flat washer (10459)	25 Clutch driving disk (51117)
9 Lockwasher (10429)	26 Friction plate (50013)
10 Bearing retainer (55020)	27 Setscrew (10209)
11 Self-locking hexagonal nut (10500)	28 Ratchet wheel (50201)
12 Ball bearing (10755)	29 Carriage feed driving gear (50884A)
13 Flat washer (51408)	30 Flat washer (50887)
14 Adjusting nut (51079)	31 Carriage feed sliding clutch drum (50331)
15 Setscrew (10209)	32 Setscrew (10209)
16 Shaft collar (50209)	33 Shaft collar (50336)
17 Carriage feed driven gear (54930A)	34 Carriage feed shaft (50525)

Figure 141. Carriage feed shaft, exploded view.

(8) Install the keyboard transmitter on the teleprinter (par. 106*b*).

(9) Adjust the carriage feed shaft (pars. 213 and 245–248).

156. Disassembly and Reassembly of Carriage Feed Shaft

(fig. 141)

a. Disassembly.

(1) Remove the carriage feed shaft (par. 155*a*).

(2) Remove the 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).

(3) Slide the carriage feed driven gear (17) from the clutch driving disk (25) and from the carriage feed shaft (34).

(4) Loosen the clamping screw (18) and back off and remove the adjusting collar (19).

(5) Remove the two setscrews (20) and remove the drive shaft collar (21).

(6) Remove the 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).

(7) Remove the two setscrews (27) and remove the ratchet wheel (28).

(8) Remove carriage feed driving gear (29), the flat washer (30), and the carriage feed sliding clutch drum (31), from the carriage feed shaft (34).

(9) Remove the two setscrews (32) and remove the shaft collar (33).

b. Reassembly.

(1) Position shaft collar (33) on the carriage feed shaft (34). Install the setscrews (32), and seat them in the groove of the carriage feed shaft.

(2) Slide the carriage feed sliding clutch drum (31), a flat washer (30), and the carriage feed driving gear (29) onto the carriage feed shaft (34).

(3) Position the ratchet wheel (28) on the carriage feed shaft (34) and fasten it with two setscrews (27).

(4) Install the friction plate (26), clutch driving disk (25), friction plate (24), friction clutch plate (23), and the friction clutch spring (22), on the carriage feed shaft (34). Position the holes in the friction plates on the pins on the clutch driving disk.

(5) Position drive shaft collar (21) on the carriage feed shaft (34) and fasten it with two setscrews (20).

(6) Screw the adjusting collar (19) onto the drive shaft collar (21). Tighten friction clutch spring (22) to approximately correct tension (par. 248) and install the clamping screw (18) to prevent the adjusting collar from turning.

(7) Slide the carriage feed diven gear (17) onto the carriage feed shaft (34). Position the two arms of the gear in the slots in the circumference of the clutch driving disk (25).

(8) Position the shaft collar (16) on the carriage feed shaft (34) and secure it with two setscrews (15). Install the adjusting nut (14) on the carriage feed shaft (34).

(9) Install and adjust the carriage feed shaft (par. 155*b*).

157. Disassembly and Reassembly of Carriage Return Shaft

(fig. 142)

a. Disassembly.

(1) Remove the carriage feed clutch lever (par. 150*a*(7)).

(2) 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.

(3) Remove the two machine screws (1), flat washers (2), and lockwashers (3), and remove the bearing retainer (4).

(4) Remove the two machine screws (5) and lockwashers (6) that hold the bearing cap to the teleprinter frame. Remove the bearing cap.

(5) Remove the two machine screws (7) and lockwashers (8) that hold the bearing cap to the teleprinter frame. Remove the bearing cap.

(6) Remove the self-locking hexagonal nut (9) and flat washer (10). Remove the ball bearing (11).

(7) Lift the front of the carriage return shaft (24) slightly and slide the oilite bearing (21) toward the rear of the shaft, far enough to clear the bearing seat in the teleprinter frame.

(8) Loosen the machine screw that holds carriage return clutch actuating lever to the carriage return clutch lever. Tilt the carriage return shaft (24) far enough forward 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 teleprinter.

(9) Remove the retainer ring (12) and remove the assembled carriage return safety clutch (16) and decelerating cam (14).

(10) Remove the two machine screws (13) and remove the decelerating cam (14).

(11) Remove the two dowel pins (15) from the carriage return safety clutch (16).

(12) Remove the two spacers (17 and 18) from the carriage return shaft (24).

(13) Tap the taper pin (19) out of the carriage return sliding clutch disk (20) and the carriage return shaft (24) and remove the carriage return sliding clutch disk and the oilite bearing (21).

(14) Tap the taper pin (22) out of the carriage return shaft driven gear (23) and the carriage return shaft (24) and 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 it with a taper pin (22).

(2) Position the oilite 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).

Note. If a new decelerating cam (14) is used, secure the new cam to the carriage return safety clutch (16) with two machine screws (13). Drill from the back of the clutch, through the holes in the clutch, to provide holes in the cam for the dowel pins (15).

(4) Install the two dowel pins (15) in the carriage return safety clutch (16).

(5) Attach the decelerating cam (14) to the carriage return safety clutch (16) 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 the assembly with a retainer ring (12).

(7) Slide the oilite bearing (21) toward the rear of the carriage return shaft (24) so that it clears the bearing seat in the teleprinter casting. Position the assembled carriage return shaft on the teleprinter so that the two marked teeth on 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 oilite bearing (21) into position on the shaft.

(9) Position the ball bearing (11) on the carriage return shaft (24) and secure with a flat washer (10) and self-locking hexagonal nut (9).

(10) Attach the front bearing cap on the teleprinter frame with two machine screws (7) and lockwashers (8).

(11) Mount the rear bearing cap on the teleprinter frame and secure it with two machine screws (5) and lockwashers (6).

(12) Secure the bearing retainer (4) to the teleprinter frame with two machine screws (1), lockwashers (3), and flat washers (2).

(13) Install the carriage feed clutch lever (par. 150*b*(2)).

(14) Adjust the carriage return shaft (pars. 216 and 223).

158. Disassembly and Reassembly of Carriage Return Safety Clutch

(fig. 143)

a. Disassembly.

(1) Remove the carriage return shaft (par. 157*a*(1)–(11)).

(2) Remove the carriage return safety clutch from the carriage return shaft (par. 157*a* (13).

(3) Remove the retainer ring (1) and the flat washer (2) from the end of the sleeve (13).

(4) Remove the 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.

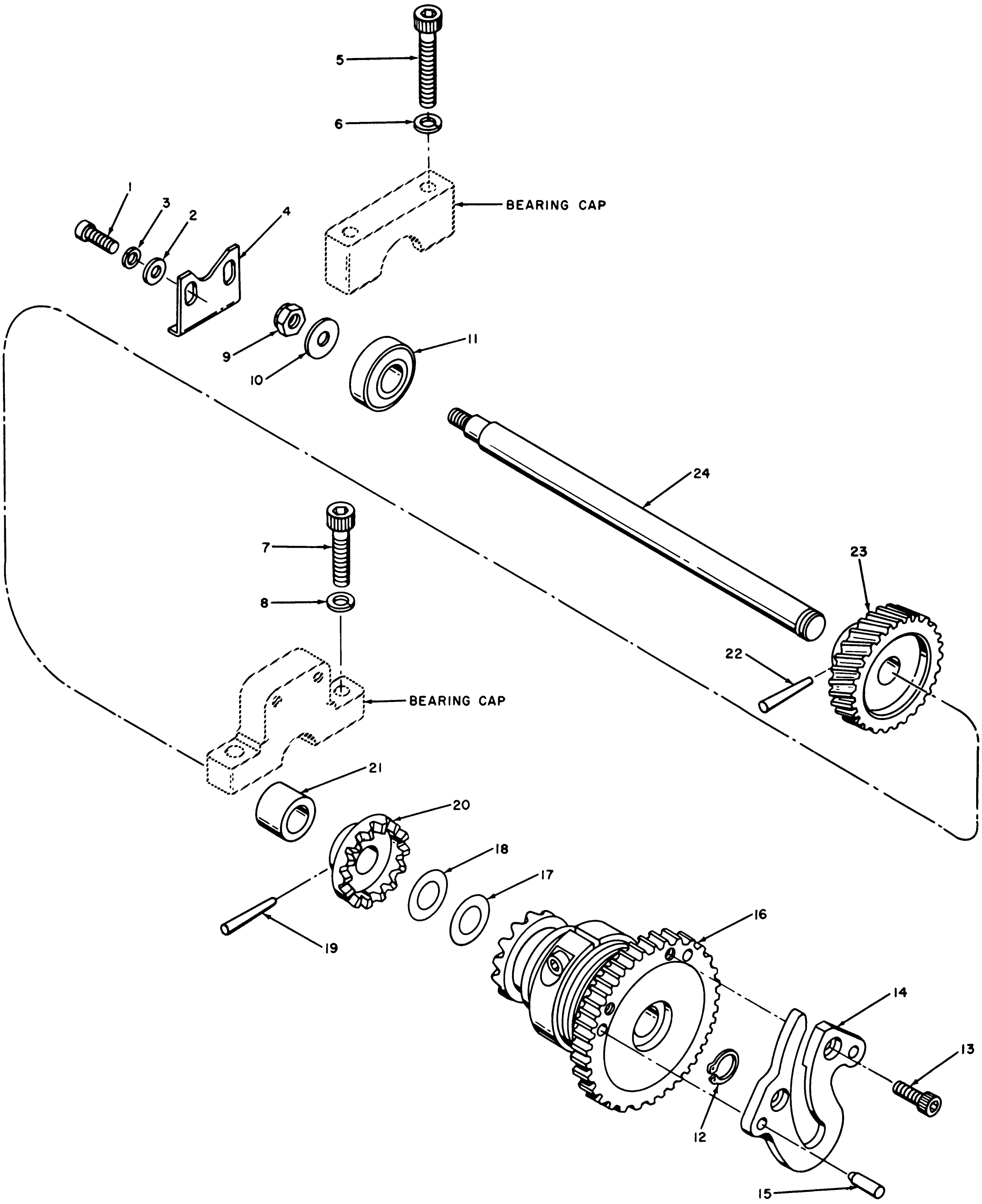


Figure 142. Carriage return shaft, exploded view.

(5) Remove the machine screw (5) from the adjusting collar (6). Remove the adjusting collar from the threaded portion of the sleeve.

(6) Remove the spring (7) and the ball retainer ring (8) from the sleeve.

(7) Remove the clutch disk (9), friction plate (10), carriage return driving gear (11), and friction plate (12) from the sleeve.

b. Reassembly.

Note.—The carriage return sliding clutch drum (3) and the sleeve (13) are matched parts. If replacement of one is necessary, replace both with a matched set.

(1) Assemble the friction plate (12), carriage return driving gear (11), friction plate (10), and clutch disk (9), on sleeve (13).

(2) Position the ball retainer ring (8) and spring (7) on sleeve (13).

(3) Start the adjusting collar (6) on the threaded portion of sleeve (13). Turn it into spring (7) but do not draw it up tight.

(4) Start the machine screw (5) in adjusting collar (6). Do not tighten it.

(5) Position the carriage return sliding clutch drum (3) on sleeve (13). Drop the nine positioning balls (4) into the three grooves.

(6) Place the flat washer (2) on the end of the sleeve (13) and install the retainer ring (1).

(7) Install the carriage return safety clutch in the carriage return shaft (par. 157*b*(6)).

(8) Adjust the carriage return safety clutch (pars. 216 and 249).

(9) Install the carriage return shaft (pars. 157*b*(7)–(14)).

159. Disassembly and Reassembly of Keyboard-Transmitter Drive Shaft

(fig. 144)

a. Disassembly.

(1) Remove the keyboard transmitter from the teleprinter (par. 106*a*).

(2) Remove the two machine screws (1) and lockwashers (2) that hold the bearing cap to the teleprinter frame and remove the bearing cap.

(3) Remove the two machine screws (3) and lockwashers (4) that hold the mounting bracket (26) to the teleprinter frame.

(4) Remove the two setscrews (5) that hold the friction clutch disk (6) to the transmitter drive shaft (25). Remove the friction clutch disk (6), friction plate (7), clutch driver plate (8), friction plate (9), friction clutch plate (10), and friction clutch spring (11).

(5) Remove the clamping screw (12) and release the pressure of the friction clutch.

(6) Remove the two setscrews (14). Remove the drive shaft collar (15).

(7) Remove the two machine screws (16), flat washers (17), and lockwashers (18). Remove the bearing retainer (19).

(8) Remove the self-locking hexagonal nut (20) and spacer (21). Remove the ball bearing (22).

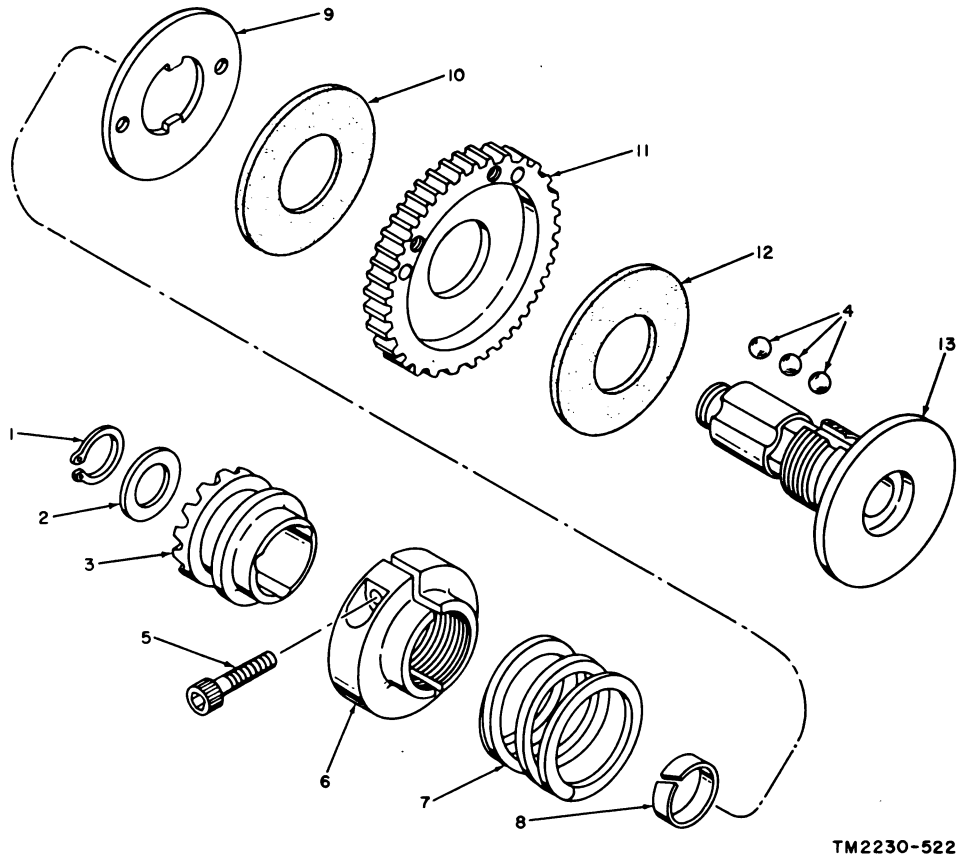
(9) Tilt the transmitter drive shaft enough forward to clear the gear on the main shaft and remove the assembled transmitter drive shaft and transmitter shaft driven gear (24).

(10) Remove the taper pin (23) and remove the transmitter shaft driven gear (24) and the mounting bracket (26).

---

1 Machine screw (10003)
2 Flat washer (10459)
3 Lockwasher (10429)
4 Bearing retainer (55020)
5 Machine screw (10012)
6 Lockwasher (10430)
7 Machine screw (10011)
8 Lockwasher (10430)
9 Self-locking hexagonal nut (10500)
10 Flat washer (10458)
11 Ball bearing (10759)
12 Retainer ring (10451)
13 Machine screw (10001)
14 Decelerating cam (50364)
15 Dowel pin (10917)
16 Carriage return safety clutch (51642A)
17 Spacer (52117)
18 Spacer (52118)
19 Taper pin (10852)
20 Carriage return sliding clutch disk (50211)
21 Oilite bearing (10711)
22 Taper pin (10852)
23 Carriage return shaft driven gear (55164)
24 Carriage return shaft (55171)

Figure 142—Continued.



1	Retainer ring (10453)	8	Ball retainer ring (51651)
2	Flat washer (50306)	9	Clutch disk (51678)
3	Carriage return sliding clutch drum	10	Friction plate (50260)
4	Positioning ball (10908)	11	Carriage return driving gear (50257)
5	Machine screw (10010)	12	Friction plate (50260)
6	Adjusting collar (51697)	13	Sleeve (51643A, includes item 3)
7	Spring (55042)		

Figure 143. Carriage return safety clutch, exploded view.

b. Reassembly.

(1) Position the mounting bracket (26) and the transmitter shaft driven gear (24) on the transmitter drive shaft (25). Secure the transmitter shaft driven gear with a taper pin (23).

(2) Position the assembled transmitter shaft driven gear and transmitter drive shaft on the teleprinter.

(3) Position the ball bearing (22) on the transmitter drive shaft (25). Secure the bearing with a spacer (21) and a self-locking hexagonal nut (20).

(4) Attach bearing retainer (19) to the teleprinter frame with the two machine screws (16), lockwashers (18), and flat washers (17).

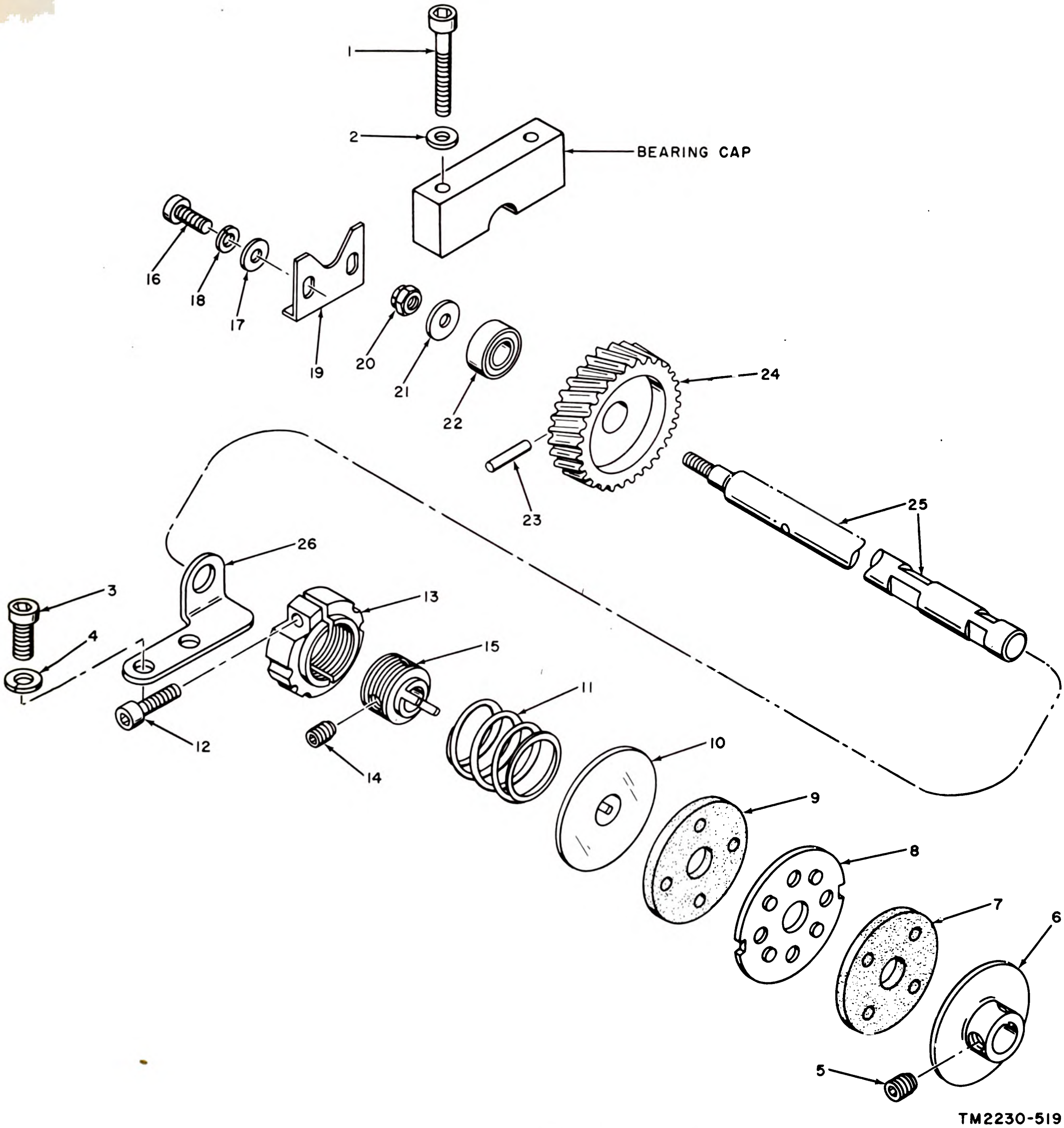
(5) Position the drive shaft collar (15) on the transmitter drive shaft (25) and secure it with the setscrews (14).

(6) Turn the friction adjusting collar (13) onto the drive shaft collar (15) and secure it with a clamping screw (12).

(7) Position the friction clutch spring (11), friction clutch plate (10), friction plate (9), clutch driver plate (8), friction plate (7), and friction clutch disk (6) on the transmitter drive shaft (25). Secure the friction clutch disk to the transmitter drive shaft with two setscrews (5).

(8) Attach the mounting bracket (26) to the teleprinter frame with two machine screws (3) and lockwashers (4).

(9) Fasten the bearing cap onto the teleprinter frame with two machine screws (1) and lockwashers (2).



1	Machine screw (10012)	14	Setscrew (10208)
2	Lockwasher (10430)	15	Drive shaft collar (54928)
3	Machine screw (10025)	16	Machine screw (10003)
4	Lockwasher (10430)	17	Flat washer (10459)
5	Setscrew (10209)	18	Lockwasher (10429)
6	Friction clutch disk (50200)	19	Bearing retainer (55020)
7	Friction plate (50013)	20	Self-locking hexagonal nut (10500)
8	Clutch driver plate (51117)	21	Spacer (50414)
9	Friction plate (50013)	22	Ball bearing (10755)
10	Friction clutch plate (54931)	23	Taper pin (10854)
11	Friction clutch spring (54932)	24	Transmitter shaft driven gear (55163)
12	Clamping screw (10052)	25	Transmitter drive shaft (55172)
13	Friction adjusting collar (54926)	26	Mounting bracket (55787)

Figure 144. Keyboard-transmitter drive shaft, exploded view.

(10) Install the keyboard transmitter on the teleprinter (par. 106*b*).

(11) Adjust the keyboard-transmitter friction clutch (par. 269).

160. Disassembly and Reassembly of Gear Cover Group

(fig. 106)

a. Disassembly.

(1) Remove the gear cover (6) and worm gear bracket (9) (par. 112*a*(2)).

(2) Remove the cotter pin (4) and remove the main shaft driven gear (5).

(3) Remove the cotter pin (7) and remove the worm gear (8).

b. Reassembly.

(1) Position the worm gear (8) on the worm gear bracket (9). Secure it with the cotter pin (7).

(2) Position the main shaft driven gear (5) on the stud on gear cover (6). Secure it with the cotter pin (4).

Note. Make sure the gears installed are correct for the operating speed desired and that the gear speeds match (pars. 27 and 113).

(3) Install gear cover and worm gear bracket on the teleprinter (par. 112*b*(3)).

161. Disassembly and Reassembly of Selector Magnet Bracket

(fig. 106)

a. Disassembly.

(1) Remove the two machine screws (10) and lockwashers (11). Remove the assembled bracket and adjustment screws (15).

(2) Remove the two machine screws (12) and lockwashers (13). Remove the two anchor plates (14).

(3) Remove the two adjustment screws (15) from the bracket (16).

b. Reassembly.

(1) Install adjustment screws (15) in the bracket (16).

(2) Position the anchor plates (14) on the bracket (16). Secure them with the two machine screws (12) and the lockwashers (13).

(3) Fasten the assembled bracket (16) and the adjustment screws (15) onto the teleprinter frame with the two machine screws (10) and lockwashers (11).

162. Disassembly and Reassembly of the Platen Bracket

(fig. 106)

a. Disassembly.

(1) Remove the two machine screws (17) and lockwashers (18). Remove the platen bracket (22).

(2) Remove the bumper (19) from the platen bracket (22).

(3) Remove the machine screw (20) and plain hexagonal nut (21) from the platen bracket (22).

b. Reassembly.

(1) Install the plain hexagonal nut (21) on the machine screw (20). Install the assembled plain hexagonal nut and machine screw on the platen bracket (22).

(2) Install the bumper (19) in the platen bracket (22).

(3) Fasten the platen bracket (22) onto the teleprinter frame with the two machine screws (17) and lockwashers (18).

163. Disassembly and Reassembly of Platen Lock Mechanism

(fig. 106)

a. Disassembly.

(1) Remove the setscrew (23), plain wingnut (27), and platen lock (25) from the teleprinter frame.

(2) Remove the plain hexagonal nut (24), platen lock (25), and lockwasher (26) from the setscrew (23).

(3) Remove the plain wingnut (27) from the setscrew (23).

b. Reassembly.

(1) Position the plain wingnut (27) on the setscrew (23).

(2) Position the lockwasher (26) and platen lock (25) on the setscrew (23). Secure them with a plain hexagonal nut (24).

(3) Install the assembled setscrew (23), platen lock (25), and plain wingnut (27), on the teleprinter frame.

164. Disassembly and Reassembly of Motor Stop Switch Assembly

(fig. 106)

a. Disassembly.

(1) Remove the motor stop switch plug (37) from the socket in the teleprinter base.

(2) Remove machine screw (30), flat washer (31), and lockwashers (32) that hold the right side of the switch bracket to the teleprinter frame. Remove machine screw (28) and lockwasher (29) that hold the ground lead and the left side of the switch bracket to the teleprinter frame. Remove the ground lead and the motor stop switch assembly (35).

(3) Remove the machine screw (33) and remove the contact shield (34).

b. Reassembly.

(1) Attach the contact shield (34) to the motor stop switch assembly (35) with the machine screw (33).

(2) Position the bracket of the motor stop switch assembly (35) on the teleprinter frame. Position the lockwasher (29) and the ground lead on machine screw (28) and install the screw to hold the left side of the motor stop switch bracket to the teleprinter frame. Secure the right side of the bracket to the teleprinter frame with the machine screw (30), lockwasher (32), and flat washer (31).

(3) Install the motor stop switch plug (37) in the socket in the teleprinter base.

(4) Adjust the motor stop switch assembly (par. 261).

165. Removal and Replacement of Miscellaneous Teleprinter Frame Connecting Hardware

(fig. 106)

a. Teleprinter Frame Mounting Hardware. Four machine screws (41), eight lockwashers (42), and four electrical leads (43) are used to secure the teleprinter frame to the vibration mounts on the teleprinter base.

b. Teleprinter Frame Connecting Hardware. Eight machine screws (45, 49, and 51) and lockwashers (46, 50, and 52) hold the sides of the teleprinter frame to the bottom frame. Dowels are inserted between the components of the frame to keep the frame in alinement. Remove and replace frame hardware only if it is broken or damaged.

Note.—The teleprinter frame consists of three major units and a number of bearing caps, all of which are machined together to insure correct alinement of the components. The teleprinter frame must be replaced only as a complete unit.

166. Disassembly and Reassembly of Paper Roller Stand, Terminal Box, and Power Supply

(fig. 145)

a. Disassembly.

(1) Pull the paper roller latch (4) to the rear and remove the paper roller shaft (1).

(2) Remove the paper roller latch spring (2) from paper roller latch (4) and from the spring post on the paper roller stand (19).

(3) Remove the retainer ring (3) and remove the paper roller latch (4).

(4) Remove the machine screw (5), flat washer (7), and lockwasher (8), and remove the rear paper deflector (6).

(5) Remove the two self-locking hexagonal nuts (9), machine screws (10), and flat washers (11) and remove the paper stand cross brace (12).

(6) Remove the two machine screws (13), flat washers (14), and lockwashers (15). Lift the terminal box far enough to clear the multiple jack on the teleprinter base under the terminal box and remove the terminal box.

(7) Remove the locknut (3, fig. 124) that holds the signal bell (4, fig. 124) and remove signal bell.

(8) Remove the four machine screws (17) and lockwashers (18). Remove the paper roller stand (19).

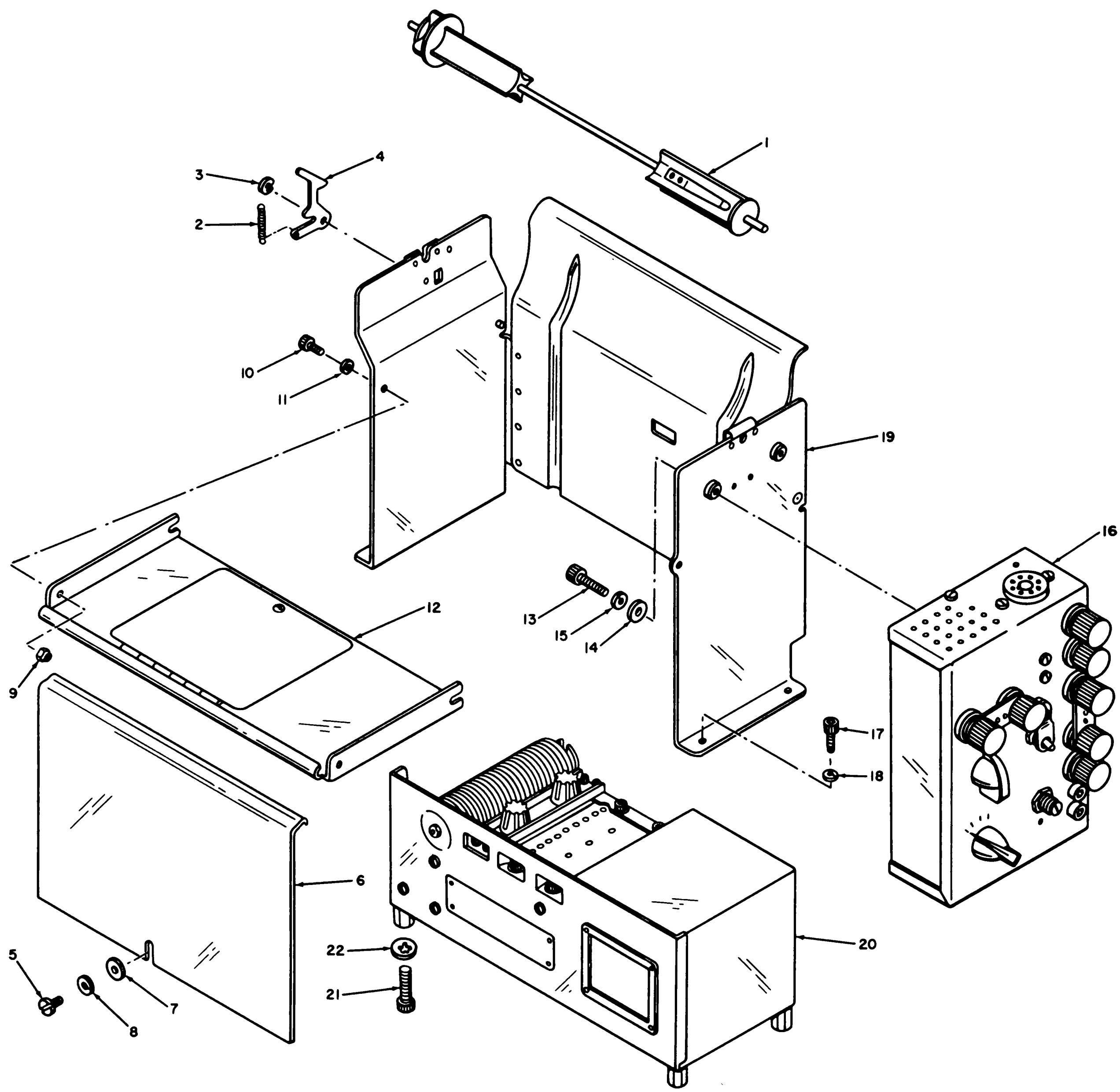
(9) Remove the four machine screws (21) and lockwashers (22) and remove the power supply (20).

b. Reassembly.

(1) Position the power supply (20) on the teleprinter base. Secure it with four machine screws (21) and lockwashers (22).

(2) Position the paper roller stand (19) on the printer base. Secure it with the four machine screws (17) and lockwashers (18).

(3) Position the terminal box (16) on the paper roller stand so that the plug at the base of the terminal box is inserted in the multiple contact jack in the printer base. Secure the terminal box to the paper roller stand with two machine screws (13), lockwashers (15), and flat washers (14).



1 Paper roller shaft (50605A)
2 Paper roller latch spring (50912)
3 Retainer ring (10949)
4 Paper roller latch (52938)
5 Machine screw (10111)
6 Rear paper deflector (55537)
7 Flat washer (10450)
8 Lockwasher (10429)
9 Self-locking hexagonal nut (10500)
10 Machine screw (10003)
11 Flat washer (10450)
12 Paper stand cross brace (53447A)
13 Machine screw (10103)
14 Flat washer (10467)
15 Lockwasher (10430)
16 Terminal box (56685A)
17 Machine screw (10008)
18 Lockwasher (10430)
19 Paper roller stand (56695A)
20 Power supply (52025A)
21 Machine screw (10042)
22 Lockwasher (10405)

Figure 145. Paper roller stand, terminal box, and power supply, exploded view.

(4) Position the paper stand cross brace (12) on the paper roller stand (19) so that the notches in the front of the brace engage the studs on the paper roller stand. Secure it with the two machine screws (10), flat washers (11), and self-locking hexagonal nuts (9).

(5) Position the rear paper deflector (6) on paper roller stand (19) and secure it with the machine screw (5), lockwasher (8), and flat washer (7).

(6) Position the paper roller latch (4) on the stud on the paper roller stand (19) and secure it with a retainer ring (3).

(7) Attach the spring (2) to the paper roller latch (4) and to the spring stud on paper roller stand (19).

(8) Insert paper roller shaft (1) in the hole in paper roller stand (19). Pull back the paper roller latch (4), insert the other end of the paper roller shaft (1) in the notch in the paper roller stand, and release the paper roller latch.

(9) Replace the signal bell (4, fig. 124). Replace the locknut (3, fig. 124). Adjust the signal bell (par. 260).

167. Disassembly and Reassembly of Keyboard Guard and Vibration Mounts

(fig. 146)

a. Disassembly.

(1) Remove the four machine screws (3), lockwashers (2), and flat washers (1), and remove the two cover plates (4).

(2) Remove the two hexagonal nuts that hold the toggle switches to the switch plate (7). Remove the four machine screws (5) and lockwashers (6), and remove the switch plate.

(3) Remove the two hexagonal nuts that hold the two toggle switches to switch plate (10). Remove the four machine screws (8) and lockwashers (9), and remove the switch plate.

(4) Remove the two machine screws (11), lockwashers (12), two machine screws (13), and lockwashers (14), and remove the spacer plates (15) and the keyboard guard.

(5) Remove the teleprinter from the printer base (par. 105*a*).

(6) Remove the four machine screws (19) and lockwashers (20), and remove the four vibration mounts.

(7) Remove the plain hexagonal nuts (21) from the vibration mount studs (22) and remove the studs.

(8) Remove the lockwasher (23), vibration mount limit stop (24), flat washer (25) vibration mount (28), flat washer (27), and vibration mount limit stop (26).

(9) Repeat the procedure in subparagraphs (6), (7), and (8) above to disassemble the three remaining vibration mounts.

b. Reassembly.

(1) Assemble a vibration mount limit stop (26), flat washer (27), vibration mount (28), flat washer (25), and vibration mount limit stop (24).

(2) Insert a vibration mount stud (22) through the assembly. Install a lockwasher (23) and plain hexagonal nut (21) on the stud.

(3) Repeat the procedure in subparagraphs (1) and (2) above to reassemble the remaining three vibration mounts.

(4) Position the four vibration mounts on the teleprinter base (29). Secure each with four machine screws (19) and lockwashers (20).

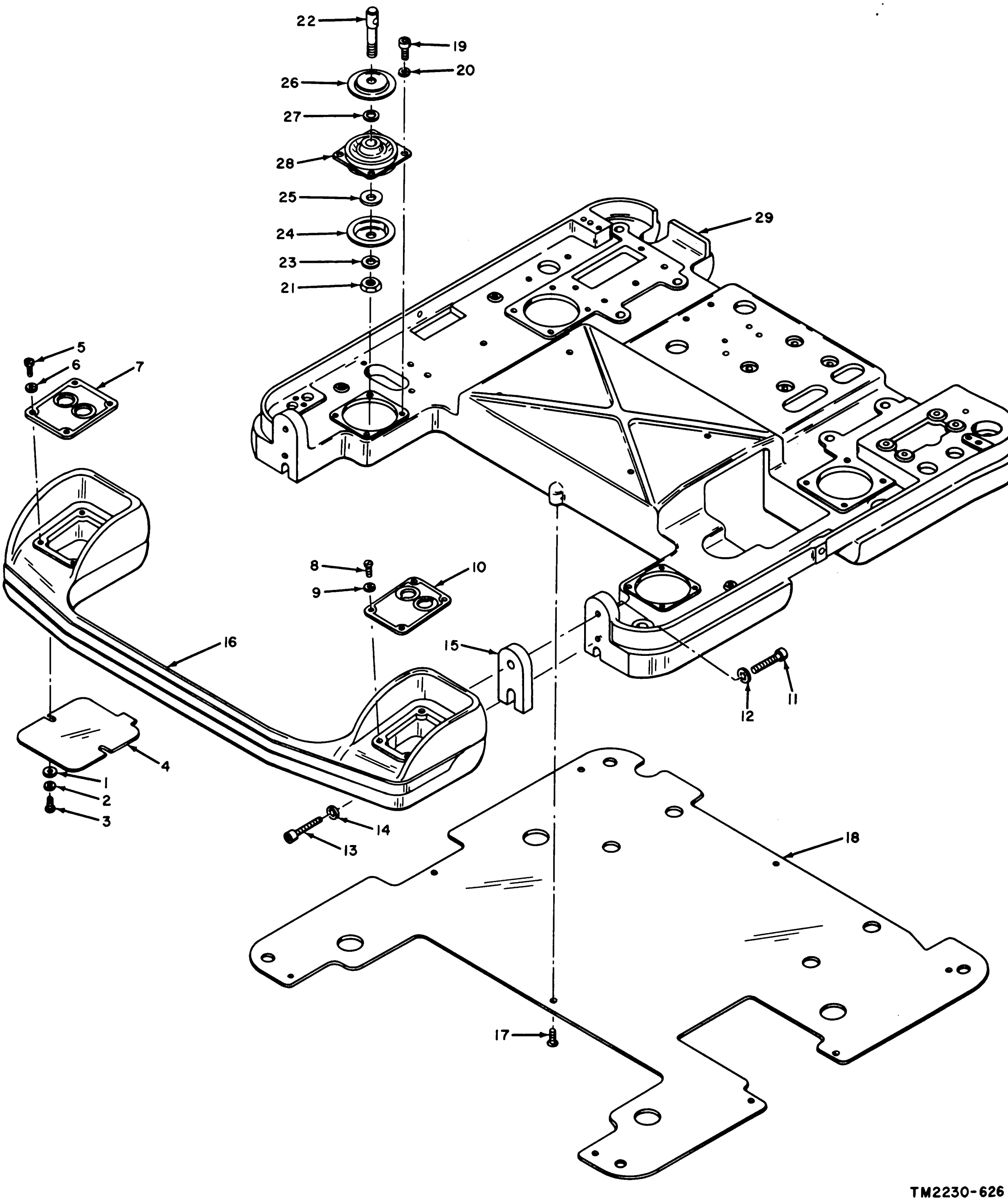
(5) Replace the teleprinter on the printer base (par. 105*b*).

(6) Position the spacer plates (15) and the keyboard guard (16) on the teleprinter base (29). Secure them with the two machine screws (11), lockwashers (12), machine screws (13), and lockwashers (14).

(7) Position switch plate (10) on the keyboard guard (16). Secure it with the four machine screws (8) and lockwashers (9). Position the two toggle switches on the switch plate. Secure them with the two hexagonal nuts.

(8) Position the switch plate (7) on the keyboard guard (16). Secure it with four machine screws (5) and lockwashers (6). Position the toggle switches on the switch plate. Secure them with the two hexagonal nuts.

(9) Attach the two cover plates (4) to the keyboard guard (16) with the four machine screws (3), lockwashers (2), and flat washers (1).



1 Flat washer (10450)
2 Lockwasher (10429)
3 Machine screw (10393)
4 Cover plate (53171)
5 Machine screw (10393)
6 Lockwasher (10429)
7 Switch plate (52998)
8 Machine screw (10393)
9 Lockwasher (10429)
10 Switch plate (54661)
11 Machine screw (10013–01)
12 Lockwasher (10404)
13 Machine screw (10013–01)
14 Lockwasher (10404)
15 Spacer plate (54952)
16 Keyboard guard (52997)

Figure 146. Teleprinter base and keyboard guard, exploded view.

168. Disassembly and Reassembly of the Dust Cover Arms and Guides

(fig. 147)

a. Disassembly.

(1) Disconnect the dust cover arm springs (10) from the spring posts on the dust cover arms (15) and from the spring posts (17) on the teleprinter base.

(2) Remove the machine screws (11), nut plate (13), and flat washers (12); remove the dust cover knobs.

(3) Remove the flat washers (16) and dust cover arms from the teleprinter base.

(4) Remove the four machine screws (38), flat washers (40), and lockwashers (39) that hold the two dust cover guides (41) to the teleprinter base. Remove the dust cover guides.

(5) Remove the spring posts (17) from the teleprinter base.

b. Reassembly.

(1) Install the spring posts (17) on the teleprinter base.

(2) Position the two dust cover guides (41) on the printer base. Secure them with four machine screws (38), lockwashers (39), and flat washers (40).

(3) Position the dust cover arms (15) and flat washers (16) on the teleprinter base. Install the locking knobs (14).

(4) Secure the locking knobs (14) to the dust cover arms (15) with machine screws (11), nut plates (13), and flat washers (12).

(5) Install the dust cover arm springs (10) on the dust cover arms (15) and on the spring posts on the teleprinter base.

169. Disassembly and Reassembly of Teleprinter Base Components

(fig. 147)

a. Disassembly.

(1) Remove the teleprinter from the teleprinter base (par. 105*a*).

(2) Remove the eight machine screws (17, fig. 146) and remove the teleprinter base plate (18).

(3) Remove the four self-locking hexagonal nuts (36). Disconnect the electrical leads and remove the motor stop relay (37).

(4) Remove the hexagonal nut (42). Disconnect the electrical leads and remove the fuse holder (43), lockwasher (44), and rubber washer (45). Remove the hexagonal nut that holds the toggle switch to the switch plate and remove the switch plate (46).

(5) Remove the two machine screws (1) that hold the receptacle connector (2) to the teleprinter base. Unsolder the leads and remove the receptacle connector.

(6) Remove the two machine screws (7) and lockwashers (8), unsolder the electrical leads from the selector magnet and keyboard jacks, and remove the switch plate.

(7) Remove the two machine screws (18) and lockwashers (19), unsolder the leads from the fuse holder, and remove the bracket.

(8) Remove the two machine screws (21) and lockwashers (22). Disconnect the electrical leads and remove the assembled receptacle connector (25) and mounting plate (26). Remove the two self-locking hexagonal nuts (23) and machine screws (24) and separate the receptacle connector from the mounting plate.

(9) Remove the self-locking hexagonal nut (27), machine screw (28), lockwasher (29), terminal lug (30), lockwasher (31), and lockwasher (32) that hold the one side of the mounting plate (35) to the teleprinter base. Remove the machine screw (33) and lockwasher (34) that hold the other side of the mounting plate to the teleprinter base; unsolder the leads to the motor stop switch jack and remove the mounting plate.

(10) Remove the four machine screws (3) and

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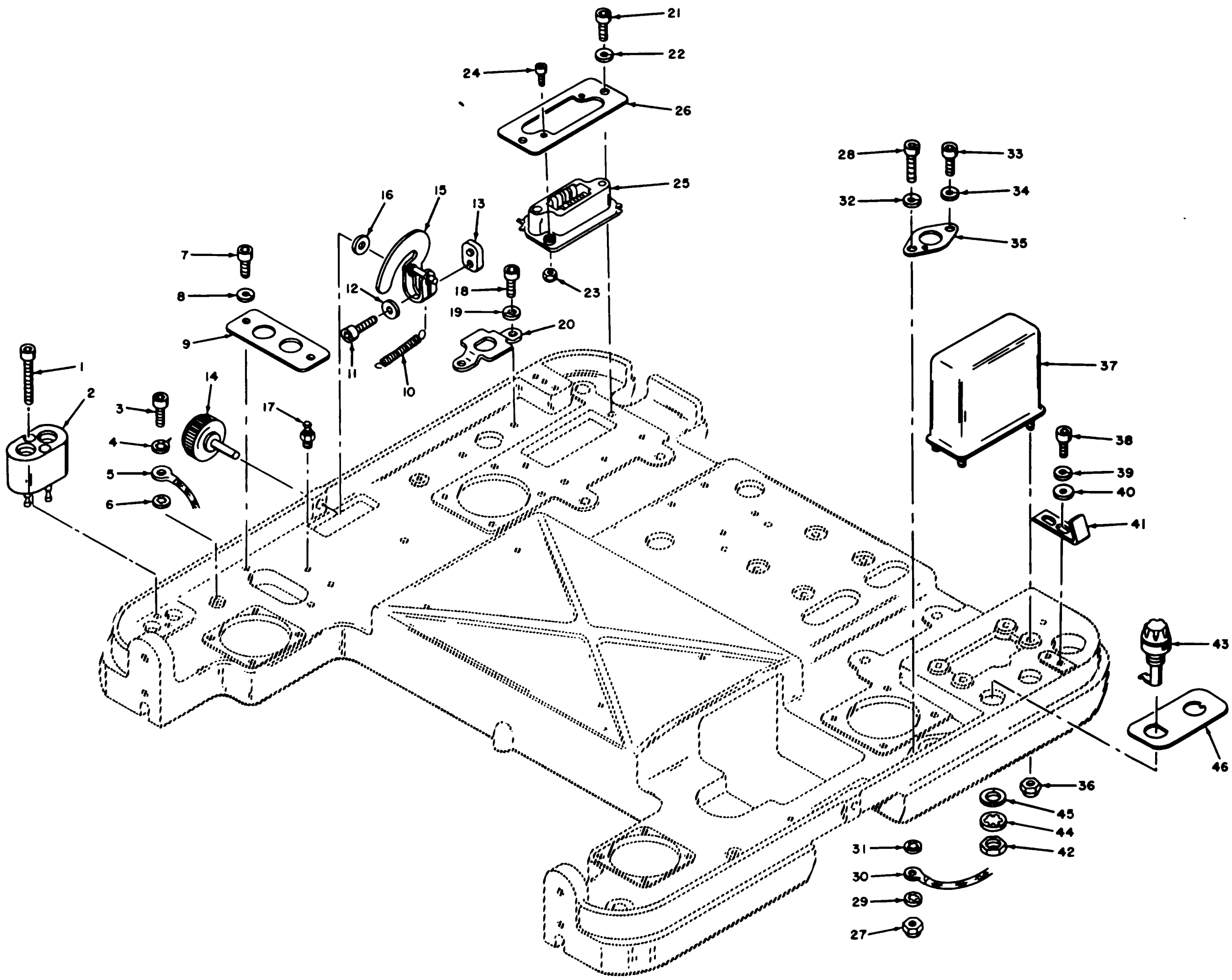
17 Machine screw (10179)
18 Teleprinter base plate (53421)
19 Machine screw (10008)
20 Lockwasher (10430)
21 Plain hexagonal nut (10502)
22 Vibration mount stud (53557)
23 Lockwasher (10427)
24 Vibration mount limit stop (54127)
25 Flat washer (50494)
26 Vibration mount limit stop (54127)
27 Flat washer (50494)
28 Vibration mount (10911)
29 Teleprinter base (55783)

Figure 146—Continued.



1	Machine screw (10013)	25	Receptacle connector (20263)
2	Receptacle connector (53320A)	26	Mounting plate (53092)
3	Machine screw (10008)	27	Self-locking hexagonal nut (10501)
4	Lockwasher (10404)	28	Machine screw (10010)
5	Grounding lead (53651A)	29	Lockwasher (10404)
6	Lockwasher (10404)	30	Terminal lug
7	Machine screw (10008)	31	Lockwasher (10404)
8	Lockwasher (10430)	32	Lockwasher (10430)
9	Switch plate (53563)	33	Machine screw (10008)
10	Dust cover arm spring (55014)	34	Lockwasher (10430)
11	Machine screw (10010)	35	Mounting plate (53172)
12	Flat washer (10467)	36	Self-locking hexagonal nut (10501)
13	Nut plate (52073)	37	Motor stop relay E1 (20301A)
14	Locking knob (55013)	38	Machine screw (10008)
15	Dust cover arm (55010A (LH) and 55015A (RH))	39	Flat washer (10467)
16	Flat washer (50315)	40	Lockwasher (10430)
17	Spring post (50649)	41	Dust cover guide (55021)
18	Machine screw (10008)	42	Hexagonal nut
19	Lockwasher (10430)	43	Fuse holder (20458 (includes items 42, 44, and 45)) and cap (20460)
20	Mounting bracket (53806)	44	Lockwasher
21	Machine screw (10008)	45	Rubber washer
22	Lockwasher (10430)	46	Switch plate S4 (53563)
23	Self-locking hexagonal nut (10550)		
24	Machine screw (10056)		

Figure 147. Teleprinter base components, exploded view.

remove the four grounding leads and eight lockwashers (4) and (6).

b. Reassembly.

(1) Position four lockwashers (6), grounding leads (5), and lockwashers (4) on the teleprinter base and secure them with four machine screws (3).

(2) Position the motor stop switch jack on the mounting plate (35) and connect the electrical leads to the jack. Position the mounting plate on the teleprinter base. Secure the rear side with a machine screw (33) and a lockwasher (34). Secure the front side with a machine screw (28), two lockwashers (32 and 33), terminal lug (30), a lockwasher (29), and self-locking hexagonal nut (27).

(3) Attach the receptacle connector (25) to the mounting plate (26) with two machine screws (24) and self-locking hexagonal nuts (23). Solder the electrical leads to the receptacle connector. Install the assembled receptale connector and mounting plate on the teleprinter base. Secure it with two machine screws (21) and lockwashers (22).

(4) Install the fuse holder on the mounting bracket (20) and solder the electrical leads. Attach the mounting bracket to the teleprinter base and with two machine screws (18) and lockwashers (19).

(5) Position the keyboard and selector magnet jacks on the switch plate (9) and solder the electrical leads to the jacks. Attach the assembled switch plate and jacks to the teleprinter base with two machine screws (7) and lockwashers (8).

(6) Position the receptacle connector (2) on the printer base and solder the electrical leads to the receptacle connector. Secure the receptacle connector to the teleprinter base with two machine screws (1).

(7) Position the toggle switch on the switch plate (46). Secure it with a hexagonal nut. Position the fuse holder (43) on the switch plate. Position the switch plate on the teleprinter base. Secure it with a rubber washer (45), lockwasher (44), and a plain hexagonal nut (42). Connect the electrical leads to the fuse holder.

(8) Attach the motor stop relay (37) to the teleprinter base with four self-locking hexagonal nuts (36). Connect the electrical leads to the motor stop relay.

(9) Attach the teleprinter base plate (18, fig. 146) to the teleprinter base (29) with eight machine screws (17).

(10) Install the teleprinter on the teleprinter base (par. 105*b*).

170. Removal and Replacement of Teleprinter Base, Terminal Box, and Motor Suppression Filter Assembly Electrical Components

The electrical components mounted in the teleprinter base, the terminal box, and the motor suppression filter assembly are illustrated in figures 148, 149, and 150. Do not remove these components unless they are damaged or inoperative.

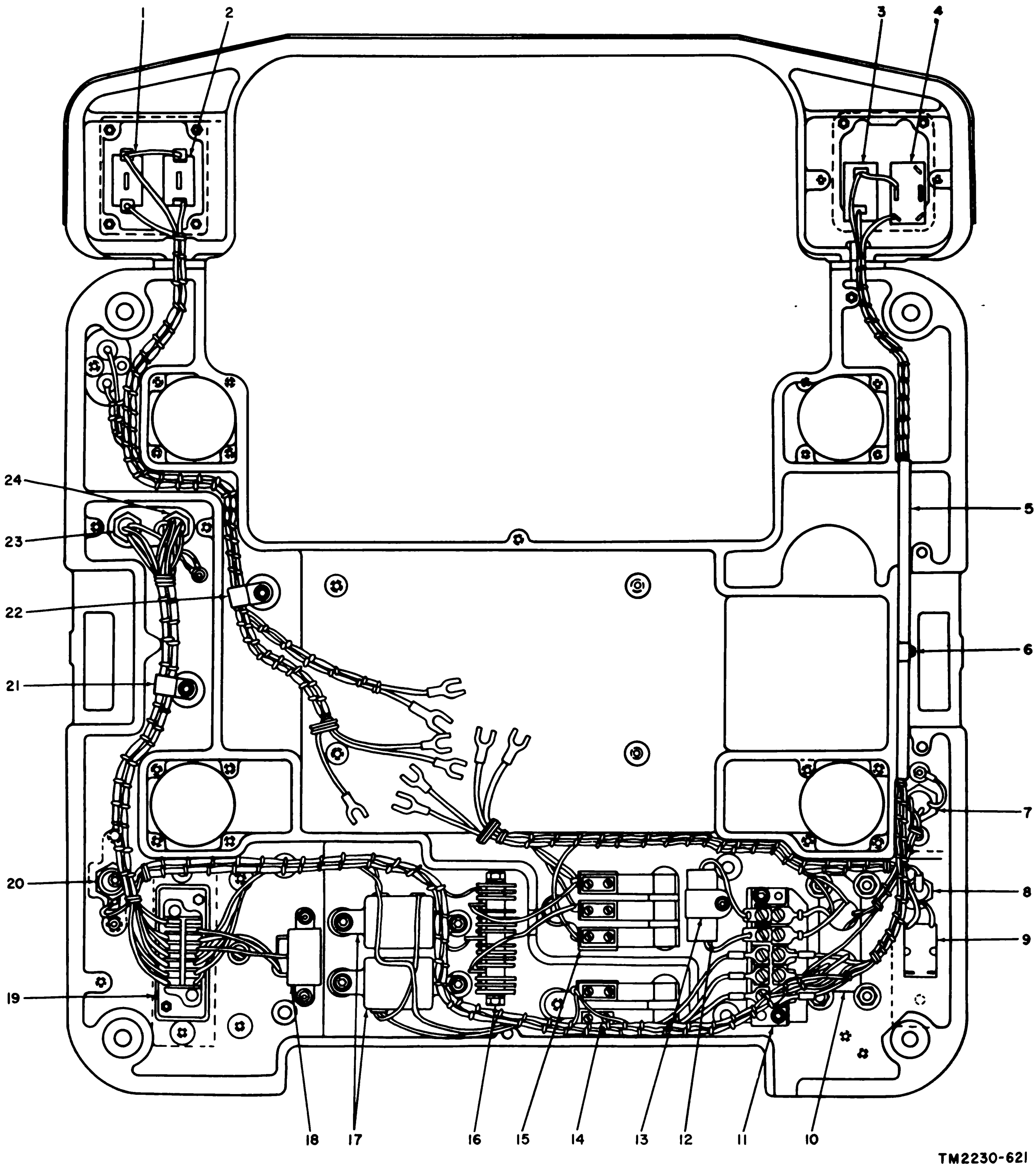


Figure 148. Teleprinter base electrical components.

1 Toggle switch S5 (20119)
2 Toggle switch S6 (20119)
3 Toggle switch S3 (20116)
4 Toggle switch S2 (20121)
5 Cable shield
6 Electrical clamp (20517)
7 Motor stop jack J2 (20115)
8 Fuse F1
9 Toggle switch S4 (20115)
10 Motor stop relay E1 (20301)
11 Terminal strip TB2 (20385)
12 Capacitor C2 (20212)
13 Electrical clamp (20508)
14 Electrical contact J4B (53416A)
15 Electrical contact J4A (53414A)
16 Metallic rectifier CR1 (54356A)
17 Capacitors C5 and C6 (20213)
18 Filter Z3 (54582)
19 Receptacle connector J7 (20263)
20 Fuse F4
21 Electrical clamp (20514)
22 Electrical clamp (20513)
23 Selector magnet jack J8
24 Transmitter contact jack J5

1 Connector J11 (20275)
2 Resistors R7, R6, and R8 (20039, 20042, and 20038)
3 Resistors R3, R11, and R2 (20041, 20038, and 20040)
4 Positive terminal
5 Negative terminal
6 Switch S8 (20139)
7 Switch S7 (20130)
8 Connector P7 (20420)
9 Resistor R5 (20015)
10 Negative jack J10 (20852)
11 Positive jack J9 (20852)
12 No. 4 terminal
13 No. 3 terminal
14 Switch S11 (20121)
15 No. 2 terminal
16 Switch S12 (56636A)
17 No. 1 terminal
18 No. 5 terminal

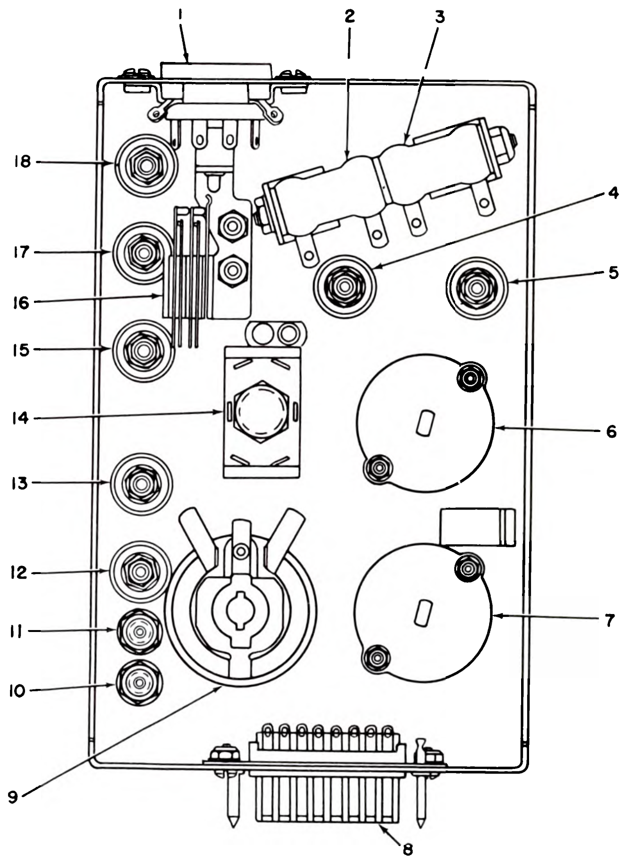


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Figure 149. Terminal box electrical components.

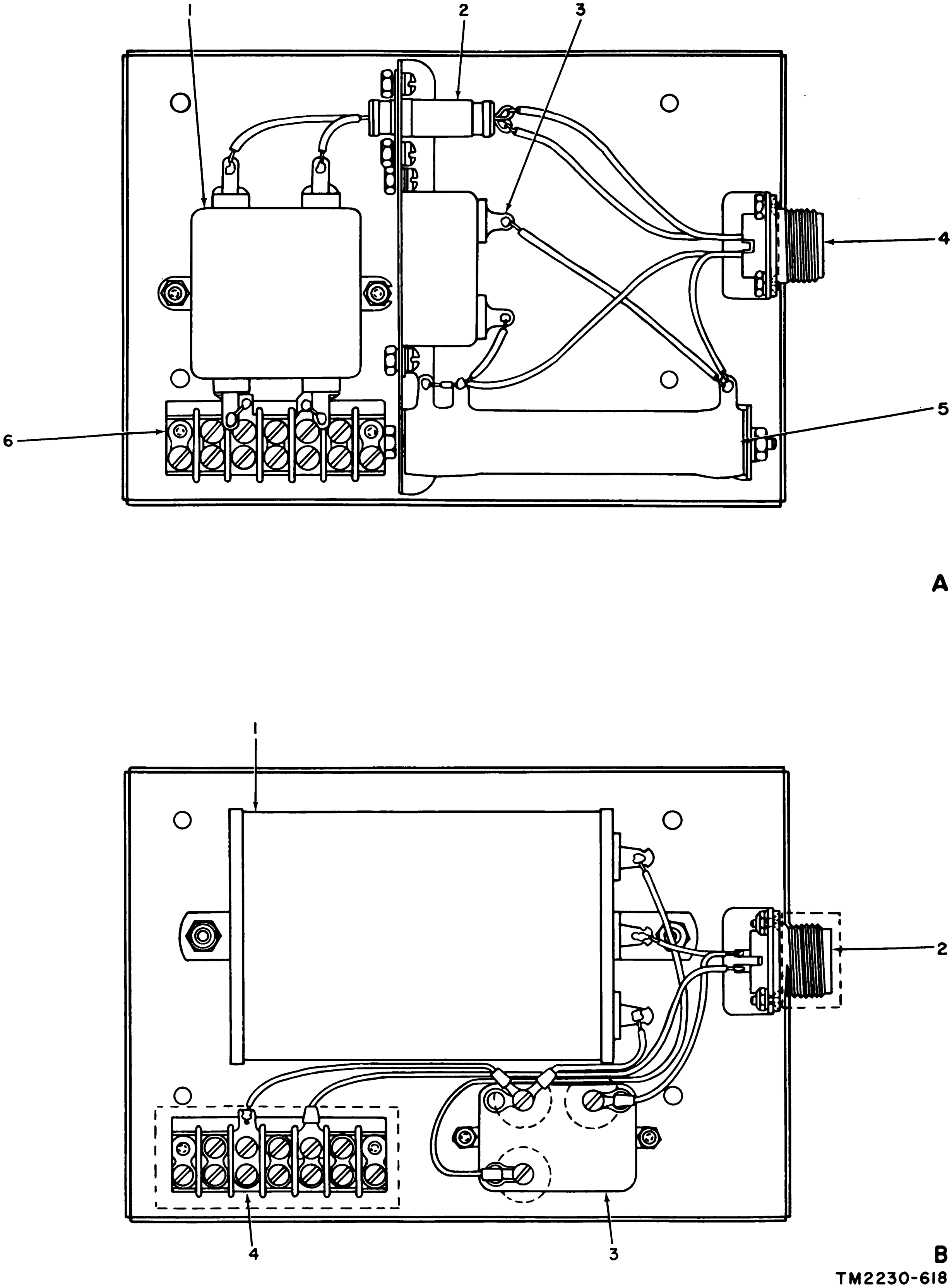


Figure 150. Motor suppression filter assembly electrical components.

Section VII. TELEPRINTER ADJUSTMENT PROCEDURES

171. General

This section contains the requirements and adjustment procedures for the teleprinter. Complete the individual checks, and if required make the necessary adjustments. Adjustments are arranged in sequence for a complete readjustment of the teleprinter. When making individual adjustments, check all related adjustments. When removing items to make an adjustment refer to section VI for removal and replacement instructions. Perform adjustments described in paragraphs 172 through 200 in the order presented.

172. Y-Lever Spacing Collar Adjustment
(fig. 151)

a. Requirement. The clearance between the spacing collar and the flat washer should be .002 to .005 inch.

b. Method of Checking. Place a 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 as required; tighten the setscrews.

173. Selector Lever Clearance Adjustment
(fig. 152)

a. Requirement. There should be a .002- to .005-inch clearance between the flat washer and the first selector lever.

b. Method of Checking. Remove the terminal box (par. 166*a*(3)) and the transfer lever spring. Check the clearance with a flat feeler gage.

c. Adjustment. Loosen the setscrew and slide the selector lever pivot stud in or out as required; tighten the setscrew. Replace the terminal box (par. 166*b*(3)) and transfer lever spring.

174. Rangefinder Dial Assembly Adjustment
(fig. 153)

a. Requirement.

(1) When the rangefinder dial assembly is set at 60, the lower end of the orientation lever should be midway between the high and low points of the rangefinding cam (fig. 153).

(2) There should be a .010- to .020-inch clearance between the rangefinder dial assembly and the selector lever comb bracket.

(3) The detent should be set to hold the rangefinder dial assembly firmly without excessive tightness.

b. Adjustment.

(1) Loosen the setscrew in the rangefinding cam. Rotate the rangefinding cam to

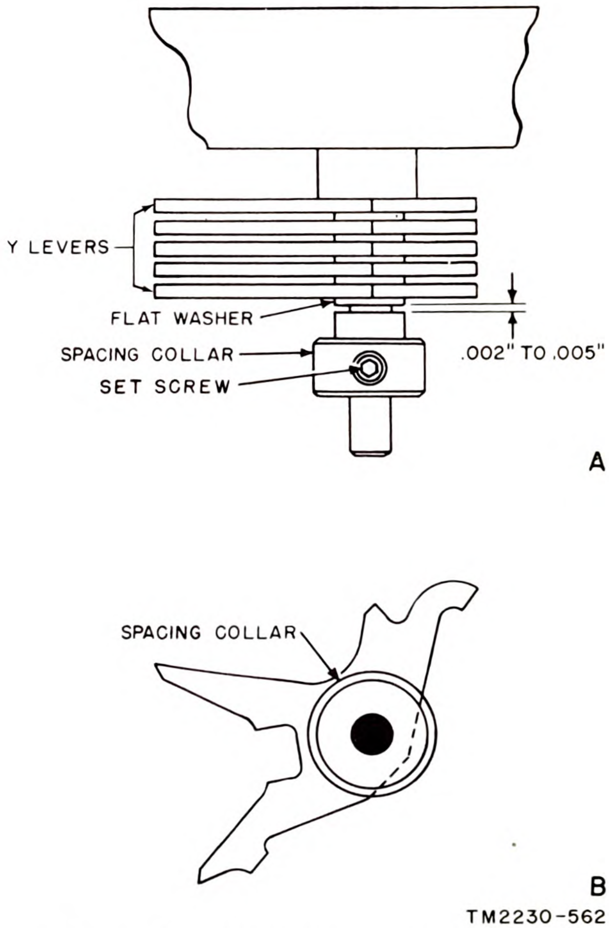


Figure 151. Y-lever spacing collar adjustment.

A	
1	Filter Z1 (20210)
2	Capacitor C3 (20208)
3	Capacitor C1 (20200)
4	Receptacle J3 (20264)
5	Resistor R1 (51628)
6	Terminal board TB1 (20370)

B	
1	Capacitor C9 (53343)
2	Receptacle J3 (20264)
3	Starting relay E3 (20114)
4	Terminal board TB1 (20370)

Figure 150—Continued.

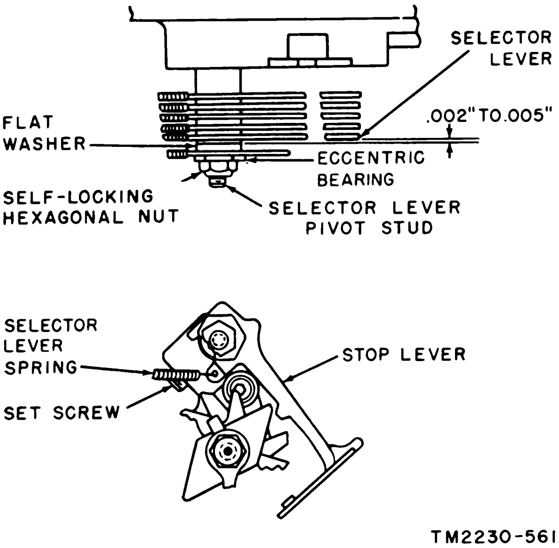


Figure 152. Selector lever clearance adjustment.

meet the requirement (a(1) above). Tighten the setscrew.

(2) Loosen the setscrew in the rangefinder dial assembly. Without rotating the rangefinding cam, hold it tight against the spacer. Set the .010- to .020-inch gap between the rangefinder dial assembly and the selector lever comb by sliding the rangefinder dial assembly axially. Tighten the setscrew in the rangefinder dial assembly.

(3) Loosen the setscrew that holds the detent. Slide the detent against the rangefinder dial assembly to obtain the required detent action. Tighten the setscrew that holds the detent.

(4) Check the related adjustment (par. 175).

175. Orientation Lever Adjustment

(fig. 153)

a. Requirement. There should be a .140- to .171-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 range finding cam.

b. Adjustment. Loosen the self-locking hexagonal nut of the machine screw. Turn the machine screw in or out to meet the requirement. Tighten the self-locking hexagonal nut. Check the related adjustment (par. 174).

176. Selector Lever Guide Comb Adjustment

(fig. 154)

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.

b. Method of Checking. With an L Allen wrench, loosen the selector lever guide comb mounting screws. Position the selector lever guide comb slots parallel to a side of the selector levers. Slide each selector lever up and down in its slot to check for binding. Tighten the mounting screws and recheck for smooth operation.

c. Adjustment. Loosen the two selector lever guide comb mounting screws and position the selector lever guide comb to meet the requirement. Tighten the mounting screws. Recheck, and readjust if necessary. Check related adjustments (pars. 198, 199 and 200).

177. Code Ring End Play Adjustment

(fig. 155)

a. Requirement. The clearance between the ball retainer and the code ring collar should be .002 to .004 inch.

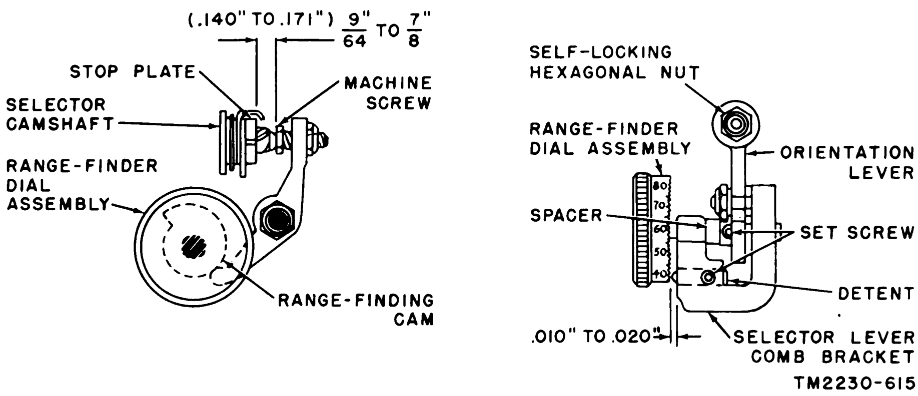


Figure 153. Rangefinder dial assembly.

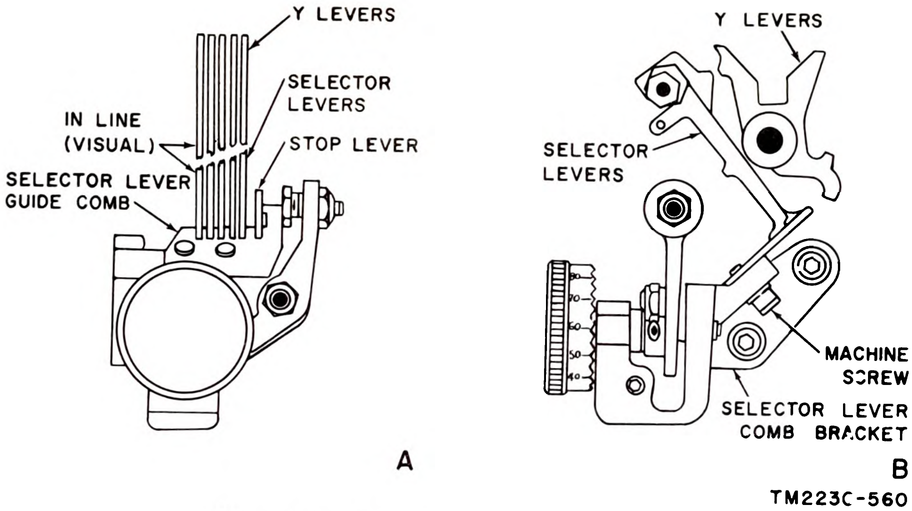


Figure 154. Selector lever guide comb adjustment.

b. Method of Checking. Check the clearance from the bottom of the code ring cage by inserting a flat feeler gage 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. Recheck related adjustments (pars. 183, 184, 192, 206, 207, and 208).

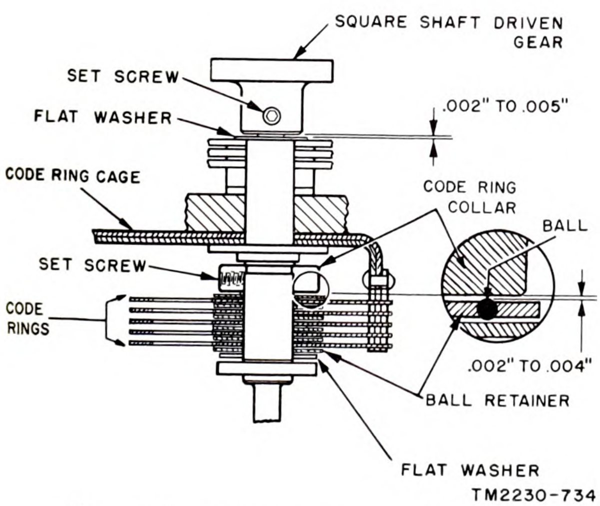


Figure 155. Code ring end play adjustment.

178. Sensing Levers End Play Adjustment

(fig. 156)

a. Requirement. There should be a .001- to .005-inch clearance between the flat washer and the line feed sensing lever.

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 (par. 144) and peel the necessary laminations from the tolerance take-up flat washer. Reassemble, recheck, and remove additional laminations if necessary. Check related adjustments (pars. 179–206).

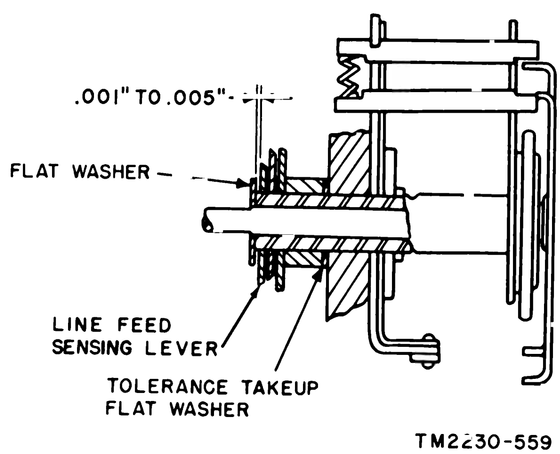


Figure 156. Sensing levers end play adjustment.

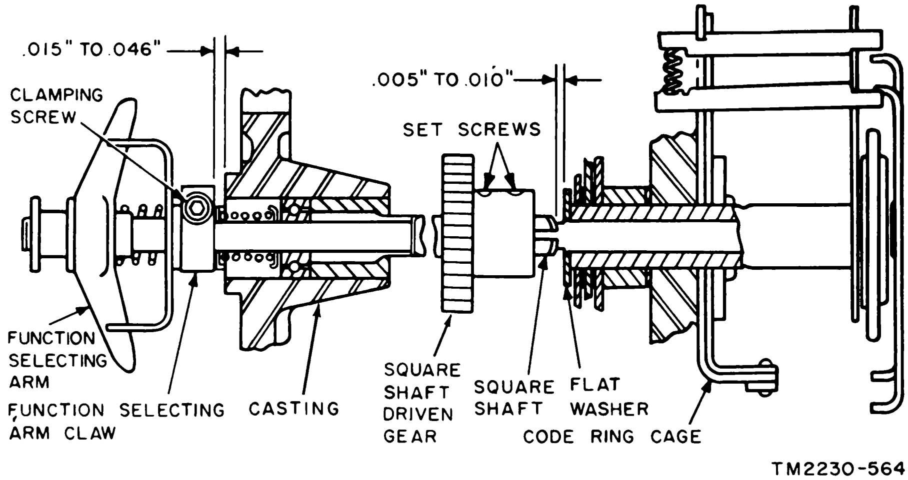


Figure 157. Square shaft and function selecting arm claw adjustment.

179. Square Shaft and Function Selecting Arm Claw Adjustment

(fig. 157)

a. Requirement. There should be a .015- to .046-inch clearance between the function selecting 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 it toward the motor side (left side when viewed from rear) 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. Move the square shaft toward the code ring cage 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 for the next adjustment (par. 180).

180. Square Shaft Driven Gear Adjustment

(fig. 158)

a. Requirement. With the .030-inch feeler gage between the function selecting arm claw and the casting (par. 179), 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. With a .030-inch feeler gage between the function selecting arm claw and the casting, slide the square shaft driven gear to get the required clearance between the square shaft driven gear and the flat washer. Tighten the four setscrews. Check related adjustments (pars. 178 and 179).

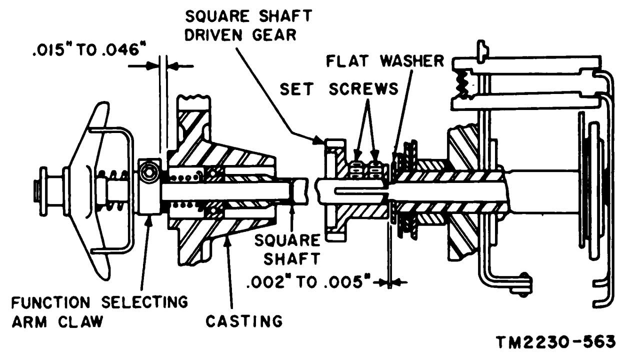


Figure 158. Square shaft driven gear adjustment.

181. Line Feed and Platen Shift Sensing Cam Alinement

(fig. 159)

a. Requirement. The sensing levers must be in line with the line feed and platen shift sensing cams.

b. Adjustment. Remove the assembled function shaft from the machine (par. 139*a*). Remove the machine screw from the end of the function shaft. Remove the parts from the end of the function shaft until the laminated flat washer is reached. Peel the laminated flat washer to meet the requirement. Replace the parts on the function shaft. Tighten the machine screw and install the assembled function shaft (par. 139*b*) in the

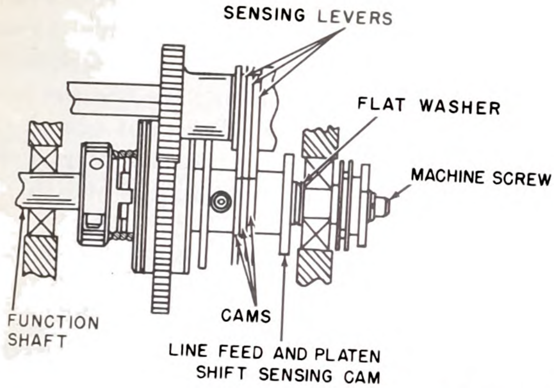


Figure 159. Line feed and platen shift sensing cam alinement.

teleprinter. Recheck the requirement and readjust if necessary. Check related adjustments (pars. 178–180).

182. Cam Followers and Spacing Collar Adjustment

(fig. 160)

a. Requirement. There should be equal clearance between the rollers of the line feed and platen shift cam followers and their cams.

b. Method of Checking. Select a code combination other than line feed or figures shift. Remove the terminal box and the paper roller stand (par. 165*a*). Check the adjustment and replace the removed items.

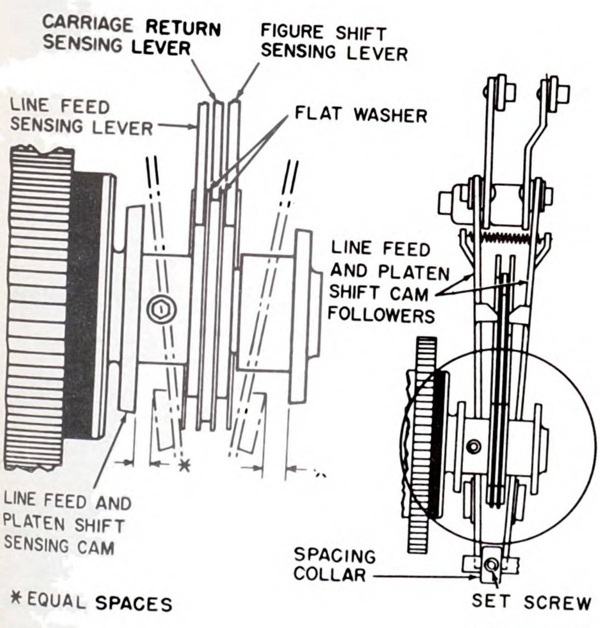


Figure 160. Cam followers and spacing collar adjustment.

c. Adjustment. Loosen the setscrew spacing collar. Shift the spacing collar r left until the requirement is met. Tight setscrews. Check related adjustments 178–181).

183. Code Ring Cage Adjustment

(fig. 161)

a. Requirement. There should be a .0 0.20-inch clearance between the function levers and their corresponding function sto when the teleprinter is in the stopped posi

b. Adjustment. Loosen the machine that mount the code ring cage (fig. 166). the code ring cage either clockwise or co clockwise until the requirement is met. T the machine screws.

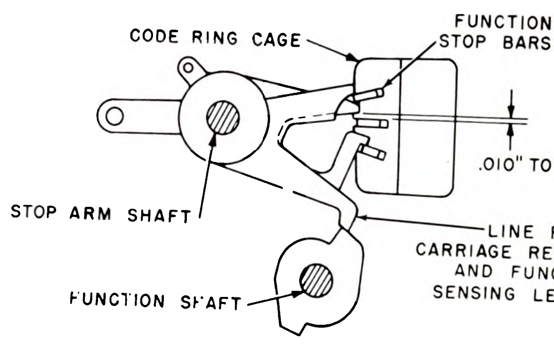


Figure 161. Code ring cage adjustment.

184. Cam Follower Adjustment

(fig. 162)

a. Requirement. The code ring locking l blade should operate directly between the let and J stop bars without touching either stop

b. Adjustment. With the function shaft in position shown in figure 162, loosen the mach screw that holds the cam follower. Position

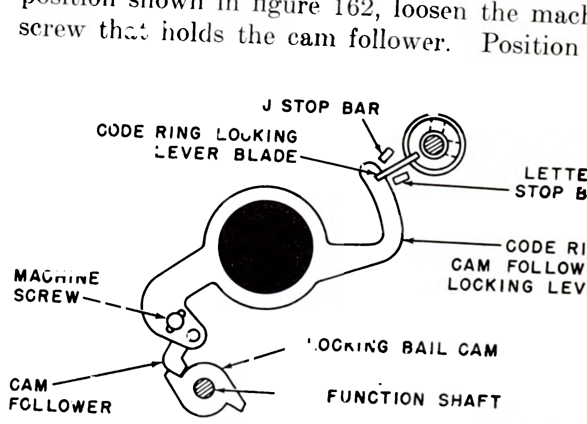


Figure 162. Code ring locking bail cam follower adjustme

cam follower until the code ring locking lever blade is directly between the letters and the J stop bars. Tighten the machine screw. Set up repeated letters and J code groups on the code rings and visually check the requirement. Readjust, if necessary. Check related adjustments (pars. 177 and 183).

185. Transfer Lever Roller Stud Adjustment

(fig. 163)

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.

b. Adjustment. Loosen the locknut and set the stud for maximum eccentricity. Rotate the motor of the teleprinter 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. Tighten the locknut. Check related adjustments (pars. 186 and 187).

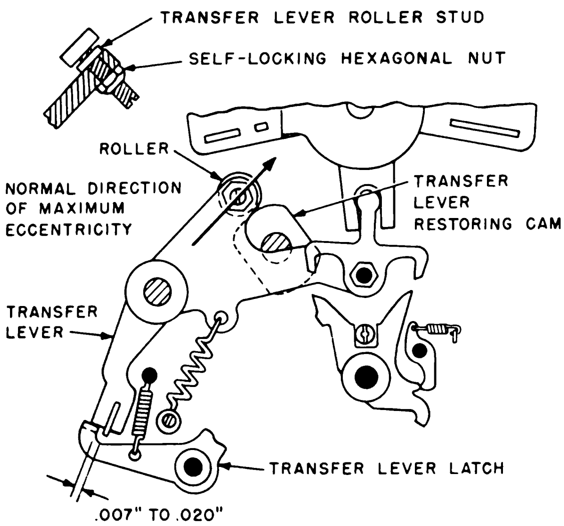


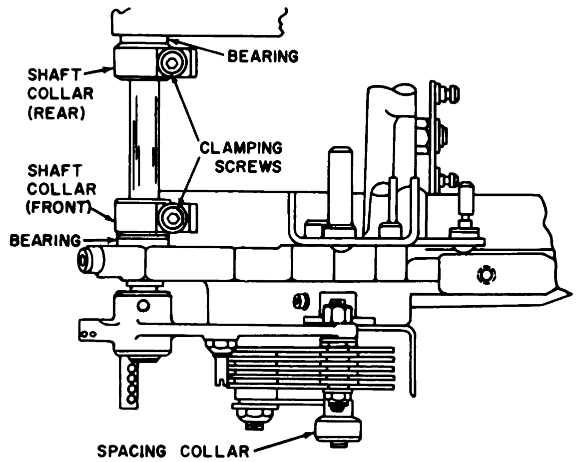
Figure 163. Transfer lever roller stud adjustment.

186. T-Levers Alinement

(fig. 164)

a. Requirement. The T-levers must be in line 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.

b. Adjustment. Loosen the clamping screw of the rear collar of the transfer lever shaft. Loosen the clamping screw of the front collar 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 rear bearing and tighten the clamping screw. Keep holding the transfer lever in position; slide the rear collar tight against the front bearing and tighten the clamping screw. Check related adjustments (pars. 185 and 187).



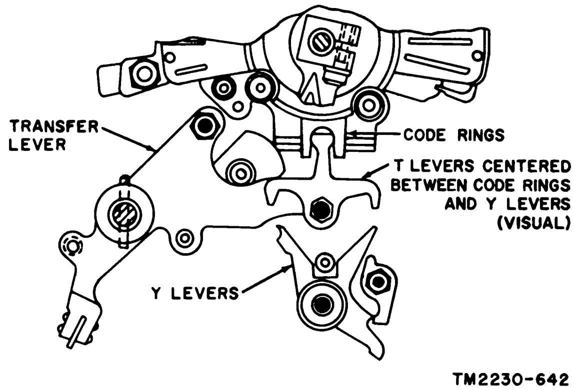


Figure 164. T-levers alinement.

187. Transfer Lever Shaft End Play Adjustment

(fig. 165)

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 rear shaft collar clamping screw. Hold the front collar tight against the frame. Move the rear shaft collar to meet the requirement and tighten the clamping screw. Check related adjustments (pars. 185 and 186).

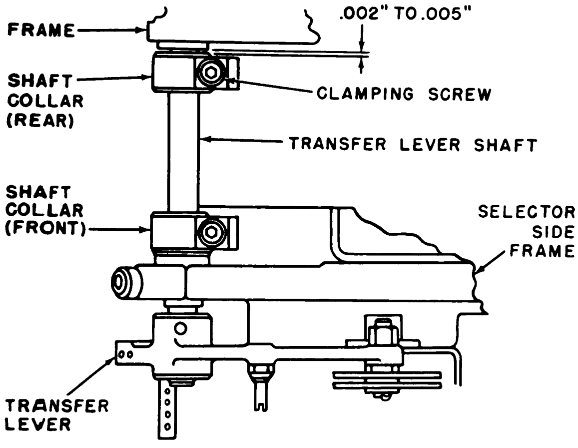


Figure 165. Transfer lever shaft end play adjustment.

188. Y-Lever Eccentric Stop Preliminary Adjustment

(fig. 166)

a. Requirement. The Y-lever eccentric stop should be positioned midway between the Y-levers.

b. Adjustment. Set the Y-levers for either the R or Y code combination. Loosen the set screw that locks the Y-lever eccentric stop. Trip the transfer lever by pulling the latch down. This action causes the T-levers to engage the Y-levers. Turn the eccentric stop clockwise until it makes contact with the Y-levers that are in the space position. Note the position of the slot in the end of the stop. Turn the stop counterclockwise until it makes contact with the Y-levers that are in the mark position. 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 setscrew.

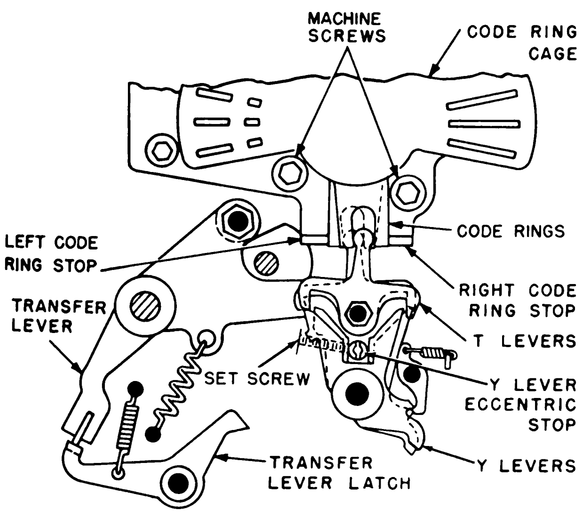


Figure 166. Y-lever eccentric stop preliminary adjustment.

189. T-Lever Pivot Stud Adjustment

(fig. 167)

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 and the function shaft in the stopped position, set the No. 1 Y-lever in a mark position. Trip the transfer lever by pulling the latch down. This action causes the T-levers to engage the Y-levers. Visually check the amount of engagement. Rotate the motor by hand to reposition the transfer lever and the T-levers. Set the No. 1 Y-lever in a space position. Trip the transfer lever and check the amount of engagement by eye.

c. Adjustment. Loosen the plain hexagonal nut on the rear of the T-lever pivot stud. Position the T-lever pivot stud until the requirement is met and tighten the nut. Note the normal direction of maximum eccentricity. Check related adjustments (pars. 188, 190 and 191).

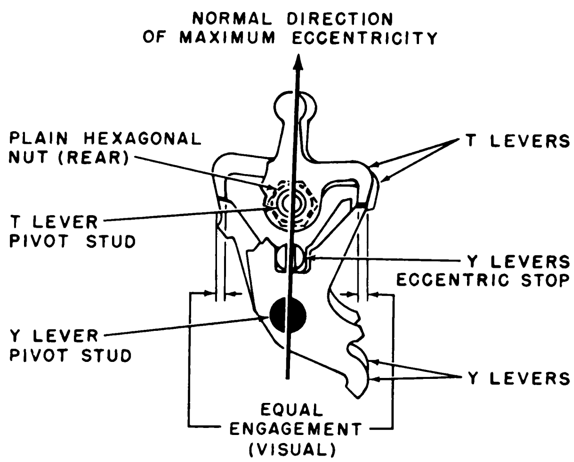


Figure 167. T-lever pivot stud adjustment.

190. Y-Levers Detent End Play Adjustment

(fig. 168)

a. Requirement. There should be a .002- to .005-inch clearance between the centering sleeve and the thrust washer.

b. Method of Checking. With Y-lever detents and thrust washers on the centering sleeve and the centering sleeve on the Y-lever detent pivot, tighten the plain hexagonal nut. Check the clearance between the thrust washer and the centering sleeve.

c. *Adjustment.* Remove the plain hexagonal nut and lockwasher, slide the centering sleeve from the Y-lever detent post, and peel the flat washer to meet the requirement. Replace the plain hexagonal nut and lockwasher and recheck the clearance.

Note. The flat washer may have to be replaced by laminated spacers to attain the requirement.

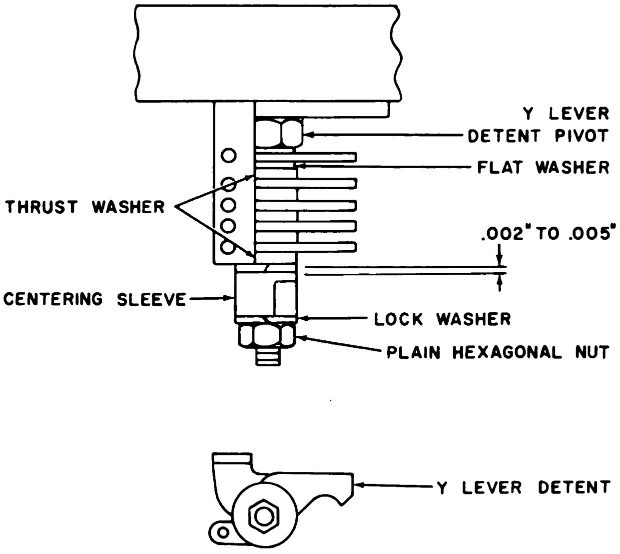


Figure 168. Y-levers detent end play adjustment.

191. Y-Lever Detents and Y-Levers Adjustment

(figs. 169 and 170)

a. *Requirements.*

1. There should be an equal engagement of the Y-lever detent with the Y-lever when the Y-lever is in either the mark or space position.

(2) It should require 30 to 60 grams pull to start a Y-lever moving (fig. 169).

b. *Adjustment.* Loosen the plain hexagonal nut (fig. 168) and turn the centering sleeve until both requirements are met; tighten the plain hexagonal nut.

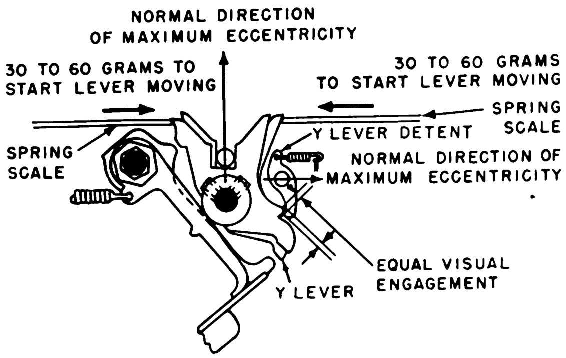


Figure 169. Y-levers detent and Y-levers adjustment.

192. Fulcrum Adjustment

(fig. 170)

a. *Requirement.* There should be a .010- to .015-inch clearance between the selected function stop bar and the function sensing lever when the sensing lever has dropped and is level with its associated stop bar.

b. *Adjustment.* Select figures, then turn the motor by hand until the figures shift sensing lever is in line with the figures stop bar. Loosen the machine screw that holds the figures fulcrum. Loosen the self-locking hexagonal nut that holds the eccentric stud. Turn the eccentric stud with a screw driver until the requirement is met. Hold the eccentric stud and tighten the self-locking hexagonal nut. Tighten the machine screw. Recheck the clearance. Use the same procedure for carriage return and line feed adjustment. Check related adjustments (pars. 177, 178, 184, and 185).

Note. Disassemble the selector magnet to proceed with the following adjustments. Assemble only as needed.

193. Armature and Selector Magnet Bracket Alinement

(fig. 171)

a. *Requirement.* The magnet bracket must be positioned on the teleprinter casting so the larger holes in the magnet bracket and mounting holes in the casting are alined. The armature position must permit No. 1 selector lever to just pass the knife edge of the armature.

b. *Adjustment.* Position the magnet bracket on the teleprinter casting so the holes in the casting are virtually centered with the larger holes in the magnet bracket. Hold the magnet bracket against the adjusting screws and position the adjusting screws in or out to meet the requirement. Adjust the armature with armature adjusting screws until No. 1 selector lever just passes the knife edge of the armature when the selector lever is manually moved toward the knife edge. Either adjusting screw can be used. Hold the armature against the screw and screw in or out until the

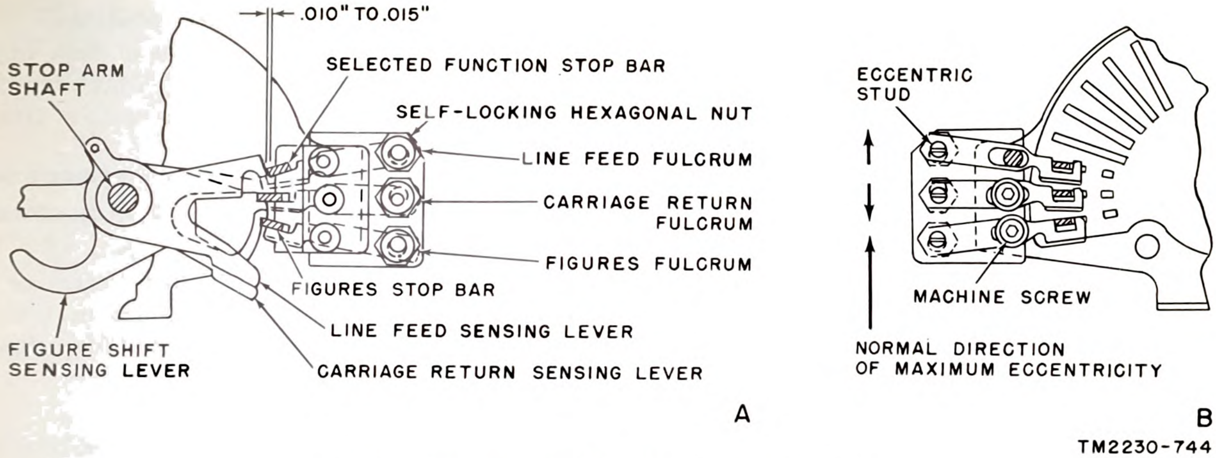


Figure 170. Stop bar adjustable fulcrum adjustment.

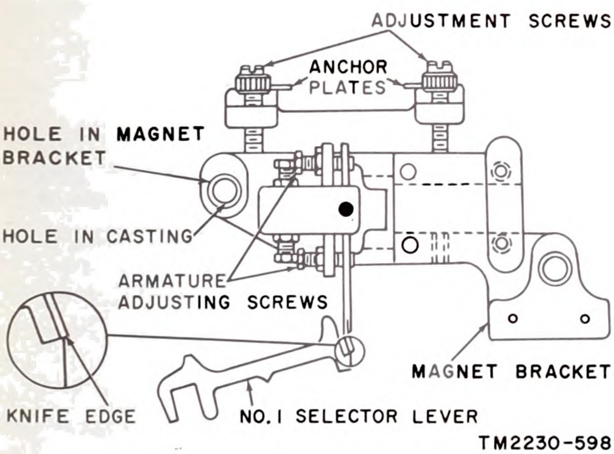


Figure 171. Armature and selector magnet bracket alinement.

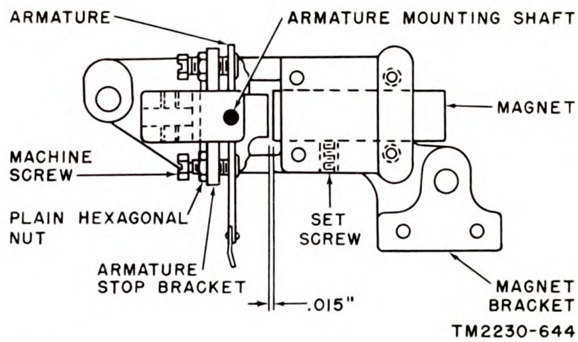


Figure 172. Armature stop bracket and bar magnet preliminary clearance.

requirement has been met. Remove the magnet bracket from the selector casing. Position the other armature adjusting screw until only a small amount of movement remains between the armature adjusting screw and the armature. This procedure will avoid bending the armature by overtightening an armature adjusting screw.

Note. Remove the selector magnet for adjustments (pars. 194–197).

194. Armature Stop Bracket and Bar Magnet Preliminary Clearance

(fig. 172)

a. Requirement. There must be a .015-inch gap between the south pole of the magnet and the armature stop bracket.

b. Adjustment. Assemble the magnet on the magnet bracket so that the requirement is met. Tighten the setscrew. The north pole of the magnet is designated by a red dot on the side of the magnet. Check related adjustment (pars. 193 and 195–197).

195. Selector Magnet Pole Faces and Armature Alinement

(fig. 173)

a. Requirement. There should be a gap of .004 inch between the pole faces of the selector magnet and the toffets on the armature.

b. Method of Checking. Mount the bracket and the selector magnet on the magnet bracket with the machine screw. A friction tightness on the mounting will allow the selector magnet to be positioned. Use two .004-inch gages, one between either side of the pole face and armature toffets. Make sure the .004-inch clearances are equal and that the surfaces on the armature toffets and the pole faces are parallel to each other to within .002-inch.

c. Adjustment. Remove the setscrews and position the adjusting setscrews (located under the selector magnet) in or out to meet the requirement. Replace the setscrews. Back out the armature

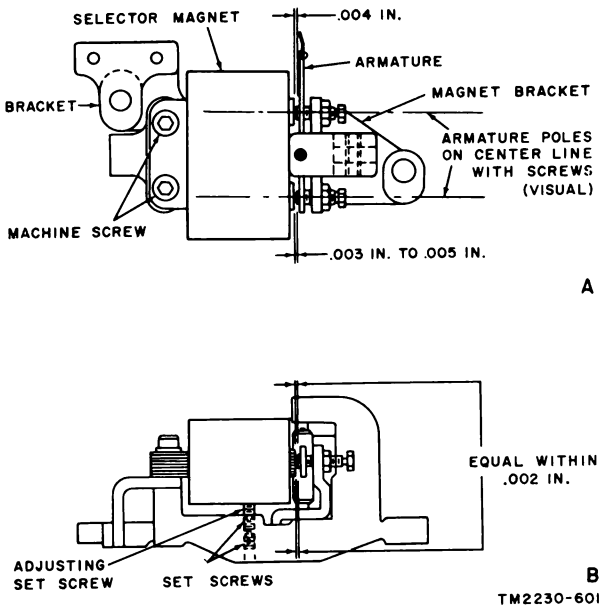


Figure 173. Selector magnet pole faces and armature alinement.

adjusting screw so that the armature in either the mark or space position does not touch adjusting screws. Check related adjustments (pars. 193, 194, and 196–199).

196. Magnet Attractive Force and Armature Clearance Adjustment

(fig. 174)

a. Requirement. A pull of 40 to 75 grams should be exerted by the magnet on the armature.

b. Method of Checking. With the selector magnet deenergized, use a spring scale to the measure pull required to start the armature moving in each direction. Pull the armature toward the selector magnet in the space position. Pull away from the selector magnet in the mark position.

c. Adjustment. Place a .004-inch feeler gage between each pole face and each toffet on the armature. Set the adjusting screws back down on the armature. Make sure that the screws are not too tight or they will bend the armature. Loosen the selector magnet mounting screws and magnet setscrew. Close or open the gap at the south pole of the bar magnet to obtain the requirement. Perform the adjustment in paragraph 195*c*, and recheck the above requirement.

197. Magnet Attractive Force and Leaf Spring Adjustment

(figs. 175 and 176)

a. Requirement. It should require 10 to 35 grams of tension to move the armature from the mark-to-space or space-to-mark positions. The tensions should be within 10 grams of each other.

b. Adjustment. Position the armature leaf spring stop screws until the requirement is met.

198. Selector and Stop Levers Alinement with Armature (Preliminary Adjustment)

(fig. 177)

a. Requirement. With a .004-inch clearance between the pole faces and the armature toffets, selector levers should just pass the knife edge of the armature.

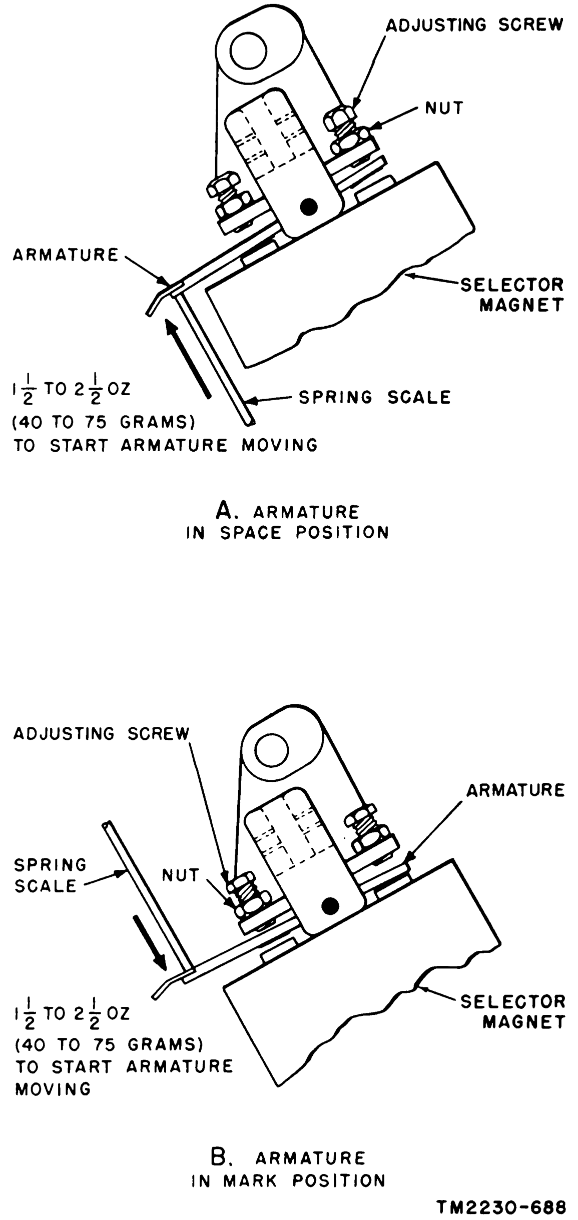


Figure 174. Magnet attractive force and armature clearance adjustment.

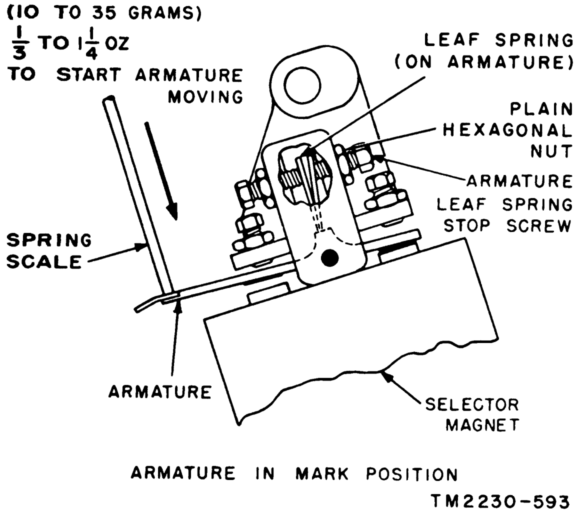


Figure 175. Magnet attractive force and leaf spring adjustment, armature in mark position.

b. Adjustment. Place .004-inch feeler gages between the pole faces and the armature toffets. Place the selector magnet on the unit. Replace the magnet bracket mounting screws to exert friction to hold the magnet bracket to the casting. While manually moving the selector lever past the knife edge of the armature, position the magnet bracket adjusting screws until the requirement is met. Tighten the magnet bracket mounting screws. Loosen the self-locking hexagonal nut on the end of the selector lever pivot stud.

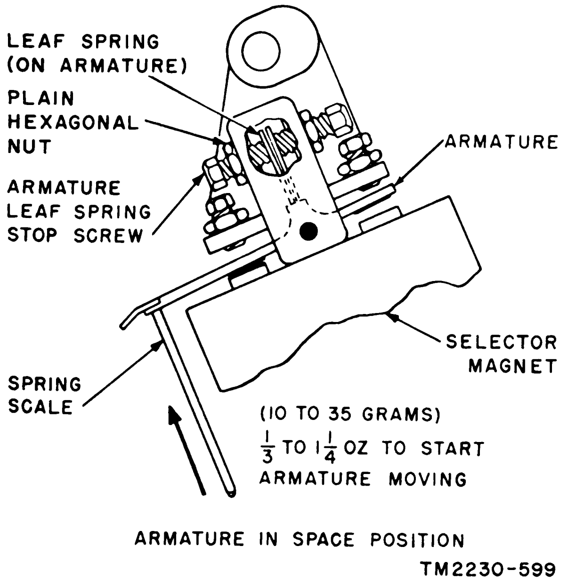


Figure 176. Magnet attractive force and leaf spring adjustment, armature in space position.

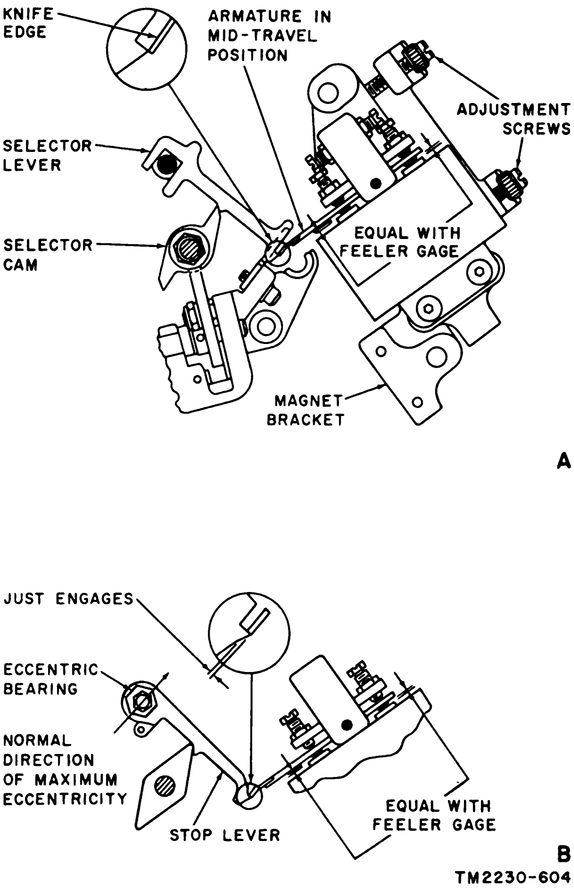


Figure 177. Selector and stop levers alinement with armature (preliminary adjustment).

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 (pars. 193, 195, 196, 197, and 200).

199. Selector Magnet Alinement with Selector and Y-Levers

(fig. 178)

Note.---This adjustment is to be made only after the adjustment in paragraph 198 has been made.

a. Requirement. The selector camshaft should not rotate with a .006-inch or greater feeler gage. The selector camshaft should rotate when a .002-inch feeler gage is inserted between the Y-lever and the left side of Y-lever eccentric stop (when the letters code group is received by the selector mechanism and the motor is running).

b. Adjustment. Adjust the magnet bracket adjusting screws until the above requirement is met.

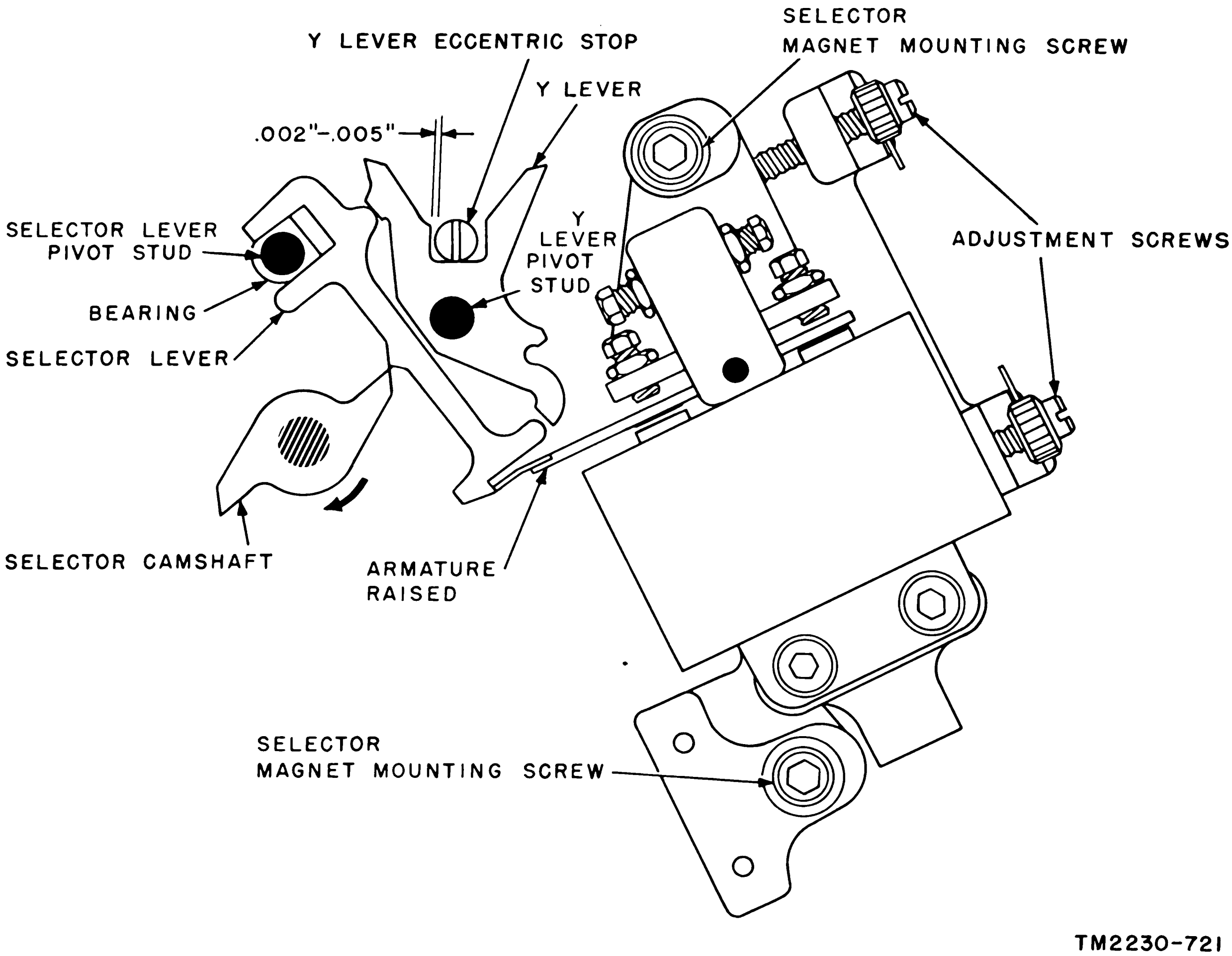


Figure 178. Selector magnet alinement with selector and Y-levers.

200. Selector Magnet Armature Blade and Selector Lever Clearance

(fig. 179)

a. Requirement. With the machine in a standby condition, the gap between the armature blade and the selector levers should be between .015 and .020 inch.

b. Adjustment. Position the selector lever comb bracket vertically so that the requirement is met.

201. Function Shaft Clutch Clearance Adjustment

(fig. 180)

a. Requirement. There should be a .010- to .020-inch clearance between the function shaft sliding clutch drum and the clutch teeth of the function driven gear when the 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. Tighten only the clamping screw in the shaft collar to hold the function clutch latch in that position. Make the function shaft clutch latch adjustment (par. 202).

202. Function Clutch Latch Adjustment

(fig. 181)

a. Requirement. There should be a .008- to .012-inch clearance between the clutch latch and the function shaft sliding clutch drum when the clutch is engaged.

b. Method of Checking. With the transfer lever latched and the function shaft in the stop position, trip the transfer lever by pulling the trip latch down. The clutch latch then will be disengaged from the sliding clutch drum. Check the requirement with feeler gage.

c. Adjustment. Loosen the clamping screw in the clutch latch. Position the clutch latch to meet the requirement; tighten the clamping screw. Check related adjustments (pars. 186, 187 and 201).

203. Function Shaft Clutch Tension Adjustment

(fig. 180)

a. Requirement. With the function shaft sliding clutch drum disengaged, by the clutch latch, it should take a pull of 38 to 42 ounces on a spring scale to start the function shaft sliding clutch drum moving.

b. Adjustment. Loosen the two setscrews in the flexible coupling disk. Shift the flexible coupling

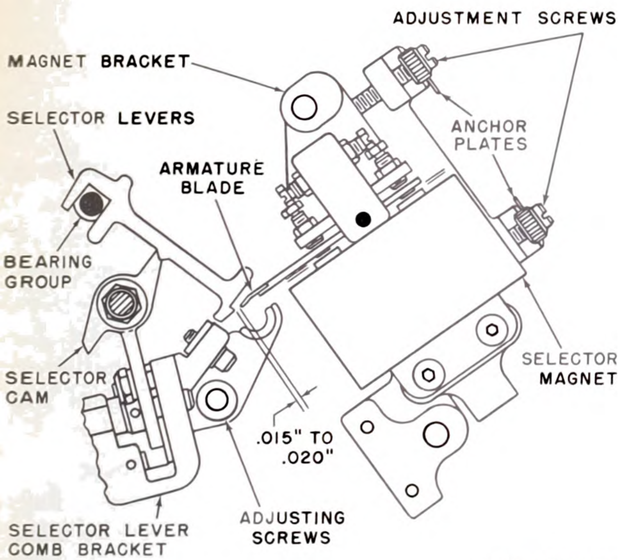


Figure 179. Selector magnet armature blade and selector lever clearance.

disk in the proper direction to obtain the required spring tension; tighten the two setscrews.

204. Transfer Lever Spring Adjustment

(fig. 182)

a. Requirement. It should require 4½ to 5½ pounds pull to just start the transfer lever moving when it is in the transferred position.

b. Adjustment. Loosen the locknut and machine screw and turn the spring post eccentric to meet the requirement; tighten the machine screw and locknut.

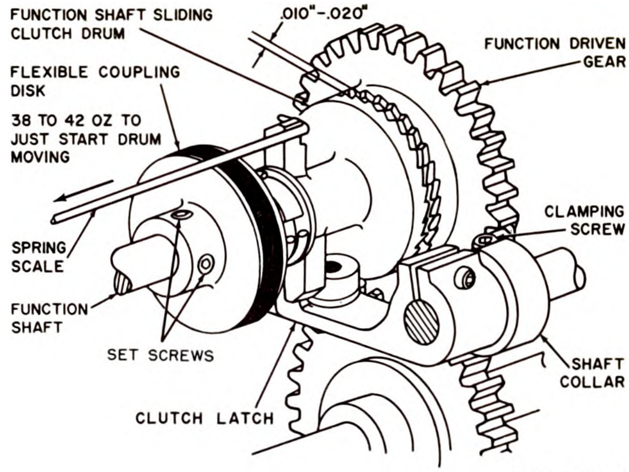


Figure 180. Function shaft clutch clearance, and function shaft clutch tension adjustment.

205. Selector Camshaft Clutch Load Adjustment

(fig. 183)

a. Requirement. A pressure of 48 to 56 ounces is required to start the camshaft rotating.

b. Method of Checking. Place the hook end of spring scale on the stop plate retainer of the selector camshaft. Pull the spring scale in excess of 56 ounces. Move the armature of the selector magnet to the space position, away from stop lever. Decrease the pull on the spring scale until the selector camshaft starts to rotate, read the scale.

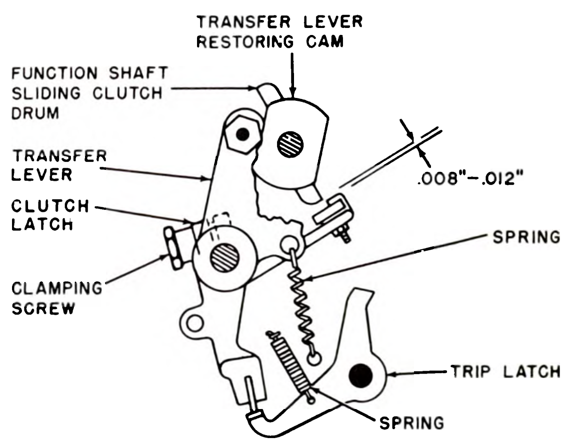


Figure 181. Function shaft clutch latch adjustment.

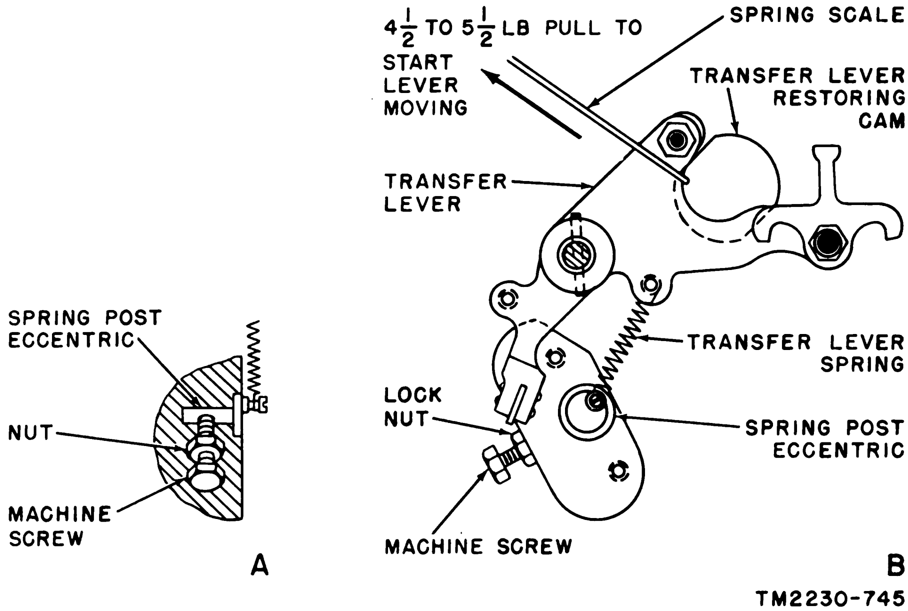


Figure 182. Transfer lever spring adjustment.

c. Adjustment. Loosen the clamping screw of the friction clutch adjusting collar. Screw the friction clutch adjusting collar on the drive shaft collar to obtain the desired tension. Tighten the clamping screw.

206. Square Shaft Stop Arm Torque Adjustment
(fig. 184)

a. Requirement. With the motor running and the function shaft rotating, a pull of 12 to 17 ounces is required to hold the square shaft stop arm stationary.

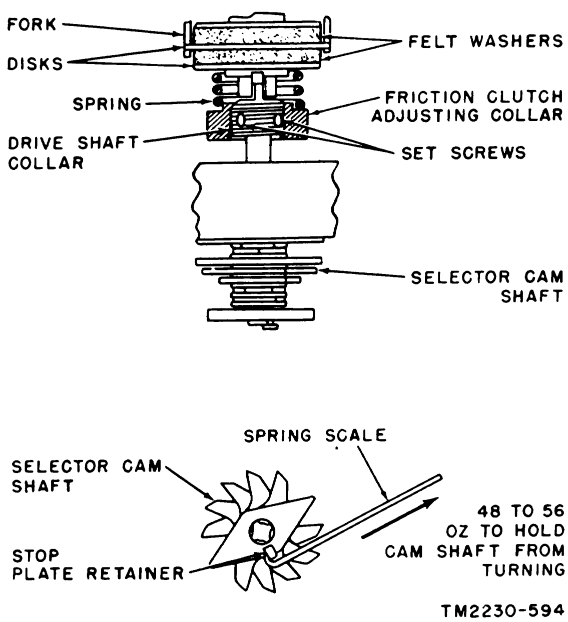


Figure 183. Selector camshaft clutch load adjustment.

b. Method of Checking. Place the hook end of the spring scale on an end of the square shaft stop arm and pull to excess of 17 ounces. Receive other than the last code group and decrease the pull on the spring scale until the square shaft stop arm starts to move. Check the reading of the scale.

c. Adjustment. With the motor off, loosen the clamping screw of the friction adjusting collar. Turn the friction adjusting collar in or out to meet the requirement; tighten the clamping screw and recheck the tension.

207. Code Ring Locking Bail Shaft Adjustment
(A, fig. 185)

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. With the function shaft in the stopped position, place the No. 1 code ring so that its projection is directly underneath the locking edge of the code ring locking bail. Check the requirement with a feeler gage.

c. Adjustment. Loosen the code ring locking lever setscrews. Rotate the code ring locking bail shaft until the requirement is met; tighten the code ring locking lever setscrews. Check related adjustments (pars. 184 and 198).

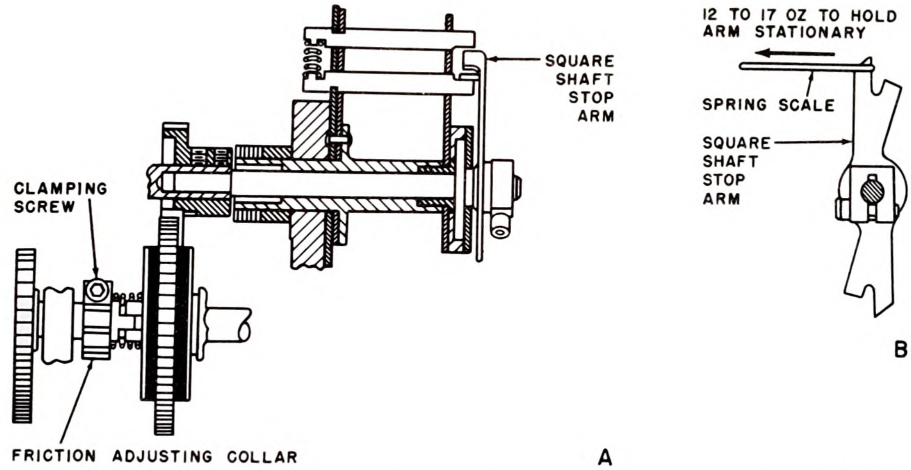


Figure 184. Square shaft stop arm torque adjustments.

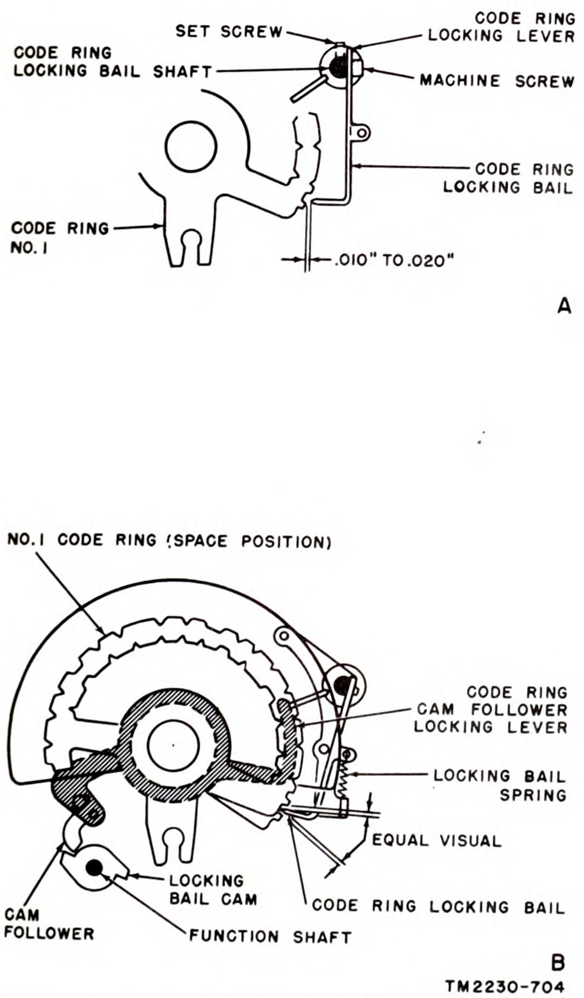


Figure 185. Code ring locking bail shaft and locking bail adjustments.

208. Code Ring Locking Bail Adjustment

(B, fig. 185)

a. Requirement. The code ring locking bail should fully engage the notches in the code rings for both marking and spacing positions of the code rings.

b. Adjustment. Set the Y-levers for either 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 code ring locking bail mounting screws. Position the code ring locking bail up or down until it fully engages the notches in the code rings. Tighten the mounting screws. Check related adjustments (pars. 184 and 207).

209. Carriage Positioning Adjustment

(fig. 186)

a. Requirement. There should be 2 7/16 inches (plus or minus 1/16-inch) between the rear side of the code bar cage plate and the center line of the carriage when the carriage is at the left-hand margin.

b. Adjustment. With the carriage at the left-hand margin and the machine screw backed away from the carriage frame, loosen the two guide rail mounting screws. Lift the carriage to disengage the carriage rack from the carriage rack driving gear and position it to meet the requirement. Tighten the two guide rail mounting screws. Screw the machine screw in until it touches the carriage frame. Tighten the plain hexagonal nut.

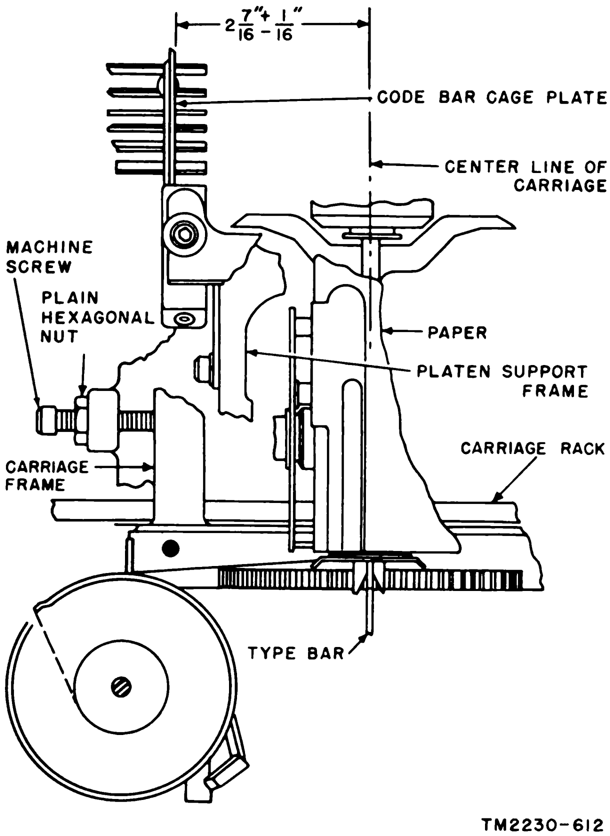


Figure 186. Carriage positioning adjustment.

210. Ball Bearing Adjustment

(fig. 187)

a. Requirement. The carriage should roll from one end of the guide rail to the other with no clearance between the ball bearing and the guide rail.

b. Adjustment. Remove the carriage rack. Loosen the setscrew that holds the roller mounting stud of the ball bearing. Turn the roller mounting stud until the requirement is met; tighten the setscrew. Adjust the carriage rack (par. 220).

211. Carriage Rack Adjustment

(fig. 188)

a. Requirement. There should be minimum backlash between the carriage rack driving gear and the carriage rack.

b. Adjustment. Move the carriage to the left margin. Loosen the two carriage rack machine screws and position the carriage rack for minimum backlash; tighten the machine screw nearer the carriage rack driving gear. Move the carriage to the right margin. Position the carriage rack for minimum backlash and tighten the second machine screw. There should be equal but minimum backlash on both ends of the carriage rack. Check related adjustments (pars. 209 and 210).

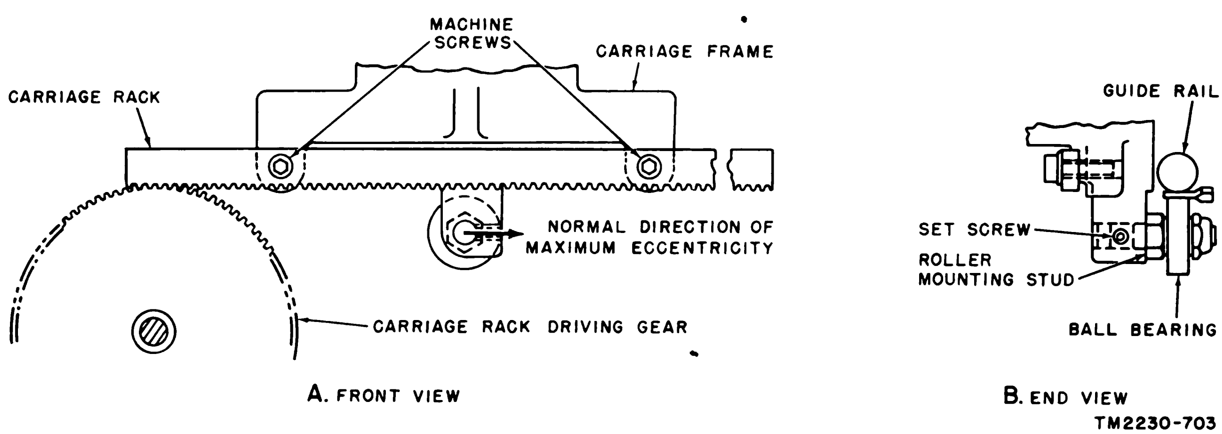


Figure 187. Ball bearing adjustment.

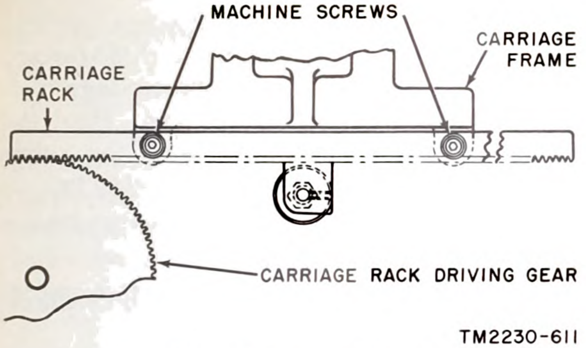


Figure 188. Carriage rack adjustment.

212. Carriage Return Latch Tripping Arm Adjustment

(fig. 189)

a. Requirement. The carriage return latch tripping arm should trip the carriage return clutch latch lever as the carriage strikes the left margin machine screw.

b. Adjustment.

(1) Move the carriage to the left, against the left margin machine screw. This movement should leave a margin of 1⁹⁄₃₂ inch.

(2) Loosen the machine screws that hold the carriage return latch tripping arm to the carriage return driving gear.

(3) Disengage the carriage feed clutch. Rotate the carriage return gears until the protruding end of the decelerating cam is between ³⁄₃₂ and ⅛ inch from the top edge of the decelerating arm. It may be necessary to disengage the carriage rack from the carriage driving gear to permit sufficient rotation to get the proper adjustment. Loosen the screws that hold the guide rail to the frame so the carriage rack disengages the carriage rack driving gear. When the proper position is reached by the decelerating cam, the carriage rack and carriage rack driving gear should be re-engaged. Tighten the screws in the guide rail.

(4) Slide the carriage return latch tripping arm, on the machine screws, against the carriage return clutch latch lever until the carriage return clutch actuating lever is just unlatched; tighten the machine screws. The carriage feed sliding clutch drum should engage the carriage feed driving gear fully. Loosen the setscrews in the shaft collar. Position the carriage feed sliding clutch drum, and tighten the setscrews.

(5) Check related adjustments (pars. 209 and 211).

213. Carriage Feed Sliding Clutch Drum Adjustment

(fig. 190)

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.

b. Method of Checking. With the carriage one or more spaces from the left-hand margin, turn the motor off. Set up the carriage return function and release the transfer lever. Turn the motor by hand until the carriage return clutch is

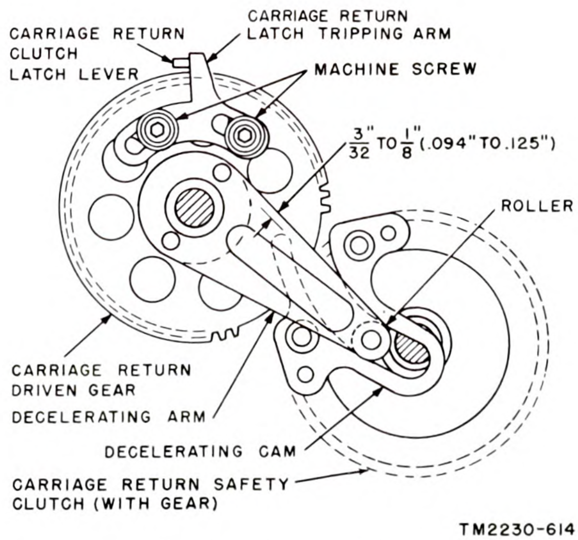


Figure 189. Carriage return tripping arm adjustment.

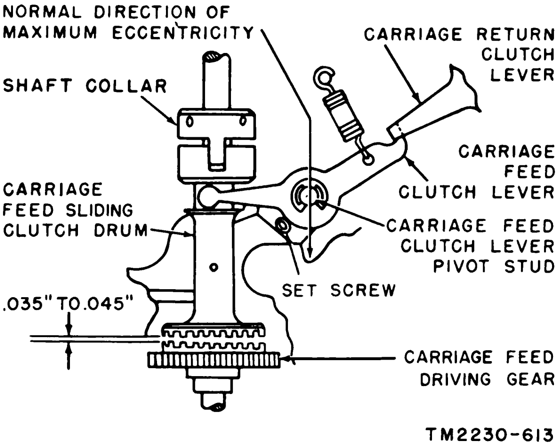


Figure 190. Carriage feed sliding clutch drum adjustment.

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 and turn the carriage feed clutch lever pivot stud with a screwdriver until the requirement is met; tighten the setscrew.

214. Carriage Rack Drive Shaft Position Adjustment

(fig. 191)

a. Requirement. The shoulder on the carriage rack drive shaft should be tight against the ball bearing. The collar should be tight against the ball bearing.

b. Method of Checking. Push and pull the carriage rack drive shaft lengthwise to determine whether there is play between the carriage rack drive shaft and the ball bearing.

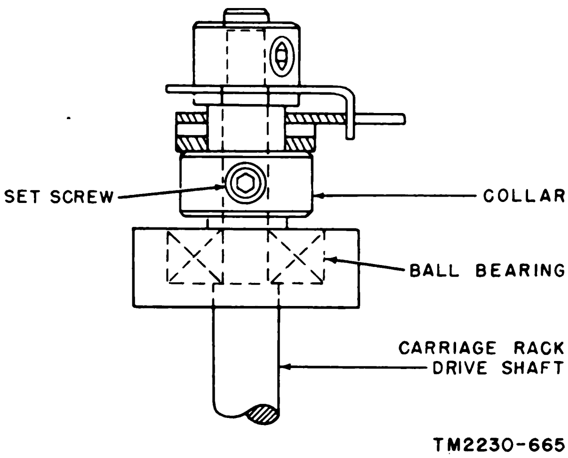


Figure 191. Carriage rack drive shaft position adjustment.

c. Adjustment. Loosen the setscrew on the collar. Push the carriage rack drive shaft toward the collar until the shoulder of the carriage rack drive shaft is against the ball bearing. Hold the carriage rack drive shaft and push the collar against the ball bearing; tighten the setscrew.

Note.—The adjustments listed in paragraphs 215 through 222 should be made together.

215. Carriage Return Clutch Lever Shaft Clearance Adjustment

(fig. 192)

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.

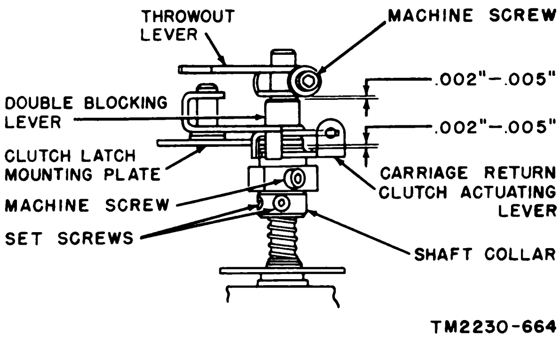


Figure 192. Carriage return clutch lever shaft clearance adjustment.

b. Adjustments.

(1) Loosen the clamping screw on the carriage return clutch actuating lever. Loosen setscrews on the shaft collar. With a feeler gage between the carriage return clutch actuating lever and the clutch latch mounting plate, slide the shaft collar up until the requirements are met; tighten the setscrews.

(2) Loosen the clamping screw on the throwout lever. Place a feeler gage between the throwout lever and the double blocking lever and tighten the clamping screw.

216. Carriage Return Clutch Adjustment

(fig. 193)

a. Requirement. The carriage return clutch should be pulled into full engagement when the carriage return sensing lever drops to the low point of its restoring cam.

b. Method of Checking. With the carriage one or more spaces from the left-hand margin, turn the motor off. Set up the carriage return function and release the transfer lever. Turn the motor by hand until the carriage return sensing lever drops to the lowest 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 bell crank. Turn the connector link in or out to meet the requirement. Attach the connector link to the carriage return bell crank, and recheck the requirement.

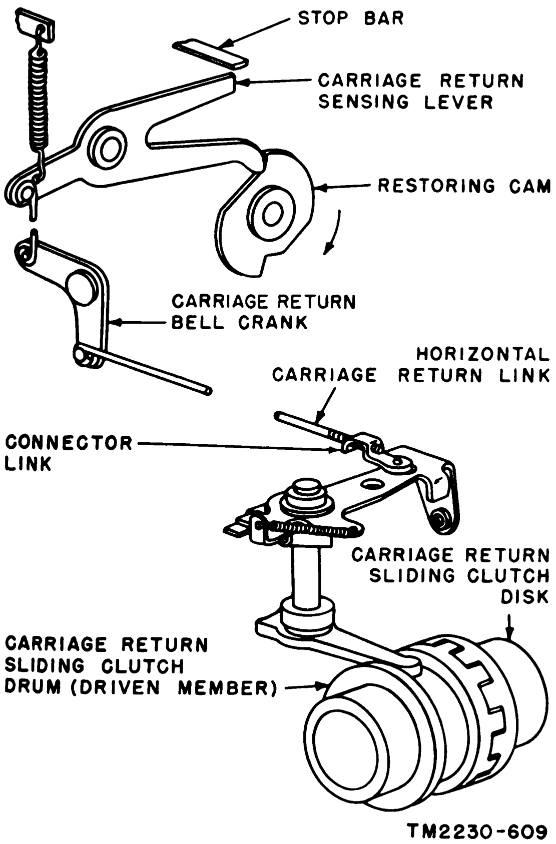


Figure 193. Carriage return clutch adjustment.

217. Carriage Return Clutch Actuating Lever Adjustment

(fig. 194)

a. Requirement. There should be a .002- 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 out from the left-hand margin. The carriage return clutch latch lever should be in the latched (up) position.

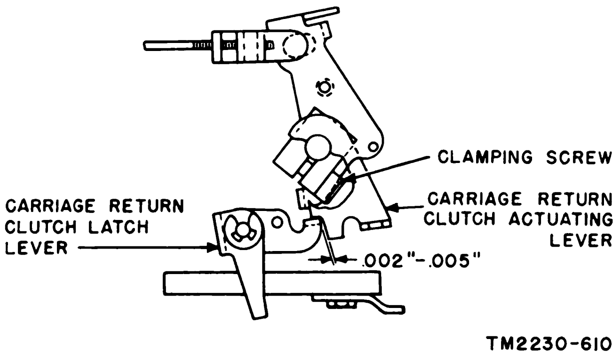


Figure 194. Carriage return clutch actuating lever adjustment.

b. Method of Checking. With the carriage two or more spaces out from the left-hand margin, turn the motor off. Set up the carriage return function and release the transfer lever. 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 and rotate the carriage return clutch actuating lever to meet the requirement. Check with a feeler gage, and tighten the clamping screw.

218. Carriage Return Clutch Latch Lever Adjustment

(fig. 195)

a. Requirement. There should be a .002- to .005-inch clearance between the carriage return

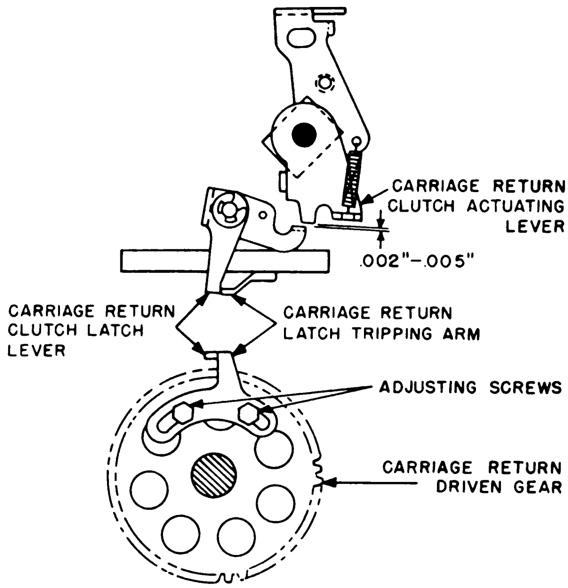


Figure 195. Carriage return clutch latch adjustment.

clutch actuating lever and the carriage return clutch latch lever when the carriage is all the way to the left-hand margin.

b. Method of Checking. With the carriage all the way to the left-hand margin turn the motor off. 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 screws and recheck the gap.

219. Throwout Lever Adjustment

(fig. 196)

a. Requirement. The carriage return latch tripping arm should engage the throwout lever when the carriage return clutch is ½ to ¾ disengaged.

b. Adjustment. Loosen the clamping screw of the throwout lever. Space the carriage out from the left margin three or more spaces and set up the carriage return function. Turn the motor slowly by hand until carriage return clutch is ½ to ¾ disengaged. Rotate the clutch throwout lever until it just touches carriage return latch tripping arm. Tighten the clamping screw holding the throwout lever. Check related adjustment (pars. 215–218 and 220–222).

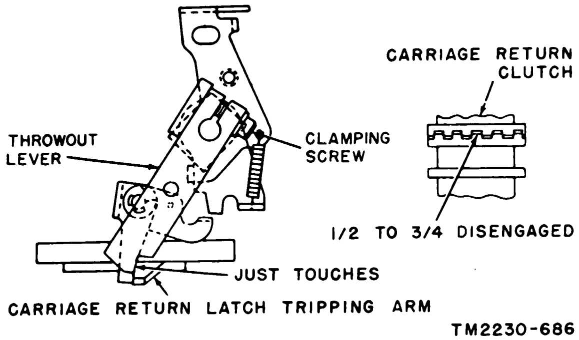


Figure 196. Throwout lever adjustment.

220. Carriage Return Blocking Lever Clearance Adjustment

(fig. 197)

a. Requirement. There should be a .002- to .005-inch clearance between the carriage return blocking lever and the flat washer when the carriage return blocking lever adjusting collar is tight against the flat washer.

b. Method of Checking. Check the clearance between the carriage return blocking lever and the flat washer with a feeler gage.

c. Adjustment. Loosen the set screw in the carriage return blocking lever adjustment collar. Remove the adjusting collar, the flat washer, and the carriage return blocking lever. Peel the laminated spacer to get the required clearance. Replace the collar, the washer and the blocking lever. The carriage return blocking lever adjusting collar should be tight against the flat washer. Recheck the clearance. Repeat the adjustment procedure if necessary.

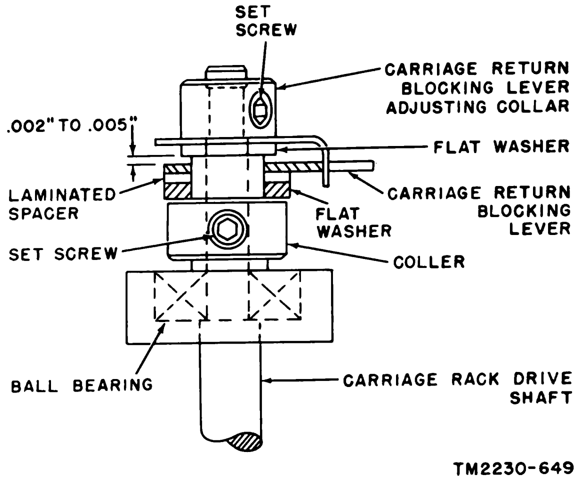


Figure 197. Carriage return blocking lever clearance adjustment.

221. Carriage Return Blocking Lever Adjusting Collar Adjustment

(fig. 198)

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 out from the left margin.

b. Method of Checking. With the carriage one space from the left margin set up the carriage return functions. Turn the motor by hand until the carriage return sensing lever drops to the 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

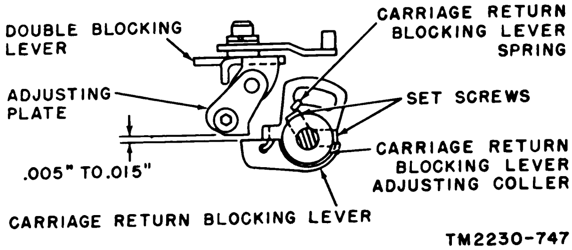


Figure 198. Carriage return blocking lever adjustment.

the adjusting plate and the carriage return blocking lever.

c. Adjustment. Loosen the two set screws on the carriage return blocking lever adjusting collar. Rotate the carriage return blocking lever until the requirement is met; tighten the two setscrews. Recheck carriage return blocking lever clearance adjustment (par. 220).

222. Carriage Return Adjustment Plate Adjustment

(fig. 199)

a. Requirement. There should be a .025- to .035-inch clearance between the carriage return blocking lever and the adjustment plate when the type bar carriage is at the left margin. In this position, the carriage return sliding clutch drum and the carriage return sliding clutch disk must not touch each other when the carriage return is selected.

b. Method of Checking. With the carriage all the way to the left margin turn the motor off. Check the gap between the carriage return blocking lever and the adjustment plate with a feeler gage.

c. Adjustment. Loosen the adjusting screw. Move the adjustment plate to meet the requirement, and tighten the adjusting screw. Set up the carriage return function and release the transfer lever. Turn the motor by hand and check to see that the carriage return clutch does not engage.

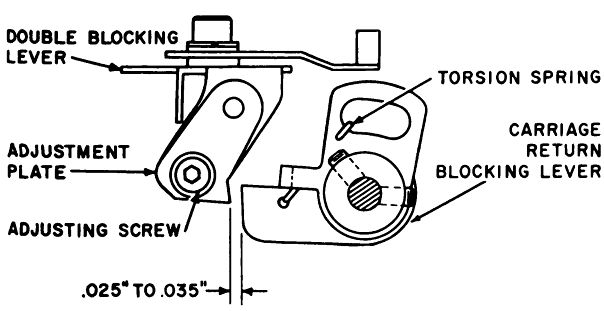


Figure 199. Carriage return adjustment plate adjustment.

223. Manual Carriage Return Trip Pawl Adjustment

(fig. 200)

a. Requirement. The trip pawl should just clear the double blocking lever when the carriage return clutch is fully engaged.

b. Adjustment. Back off the nuts on the carriage return button link. Loosen the plain hexagonal nut on the adjusting screw and push the

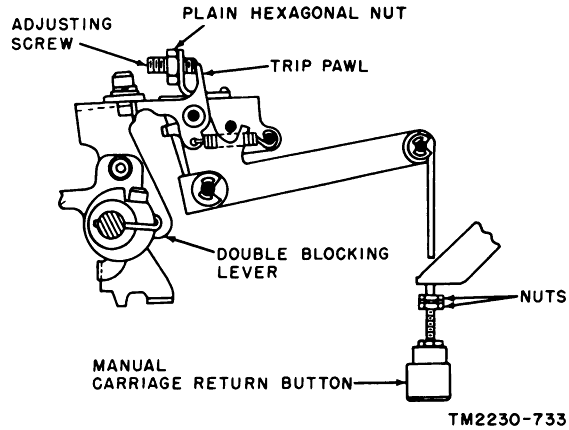


Figure 200. Manual carriage return trip pawl adjustment.

manual carriage return button. When the double blocking lever is in the operated position for carriage return, turn the adjusting screw in or out until the trip pawl just clears the double blocking lever; tighten the plain hexagonal nut on the adjusting screw.

224. Manual Carriage Return Lever Adjustment

(fig. 201)

a. Requirement. There should be a .002- to .025-inch clearance between the manual carriage return lever and pin when the manual carriage return button has been stopped by the nuts pressing against the carriage return button bracket.

b. Adjustment. Loosen the two nuts on the carriage return button link. Push the manual carriage return button until the double blocking lever is in the operated position for carriage return. Turn the nuts until they are against the carriage

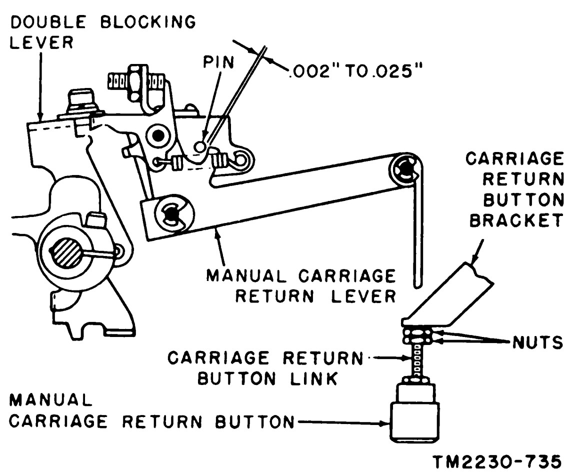


Figure 201. Manual carriage return lever adjustment.

return button bracket. Insure that proper clearance between the manual carriage return lever and the pin is met. Tighten the two nuts against each other; recheck the clearance.

c. *Manual Carriage Return Bracket Adjustment.*

(1) *Requirement.* There should be a .005- to .015-inch clearance between the trip pawl and the double blocking lever when the trip pawl is against the adjusting screw. The double blocking lever should be away from the carriage return clutch actuating lever.

(2) *Adjustment.* Operate the manual carriage return button. Unlatch the carriage return clutch actuating lever and position the bracket to meet the requirement ((1) above). Tighten the two bracket mounting screws.

225. Carriage Feed Pawl Adjustment
(fig. 202)

a. *Requirement.* There should be a .005- to .025-inch gap between the ratchet wheel and carriage feed pawl when the carriage feed pawl is pulled to maximum disengagement by the carriage feed link.

b. *Method of Checking.* Select any one of the printed characters, and release the transfer lever. Turn the motor by hand until the carriage feed pawl has reached maximum disengagement. Check the clearance with a feeler gage.

c. *Adjustment.* Remove the connecting link from the carriage feed pawl. Turn the connecting link in or out to meet the requirement. Replace the connecting link on the carriage feed pawl.

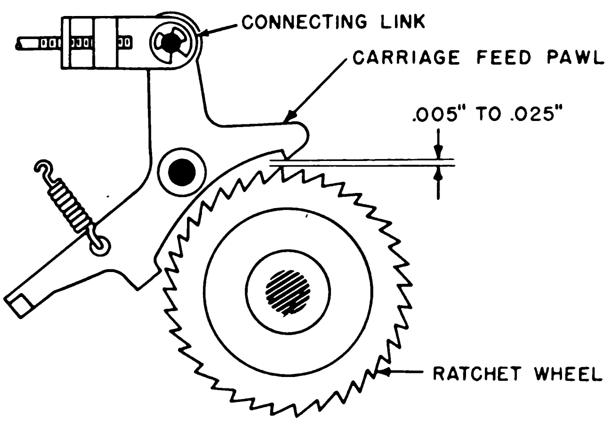


Figure 202. Carriage feed pawl adjustment.

226. Manual Space Push Button Adjustment
(fig. 203)

a. *Requirement.* There should be a .015- to .035-inch clearance between the carriage feed pawl and the ratchet wheel when the manual space push button is depressed all the way.

b. *Method of Checking.* Depress the manual space push button with the motor off. Check the clearance between the carriage feed pawl and the ratchet wheel with a feeler gage.

c. *Adjustment.* Loosen the nut on the link. Turn the manual space push button clockwise or counterclockwise to obtain the required clearance. Tighten the nut on the link.

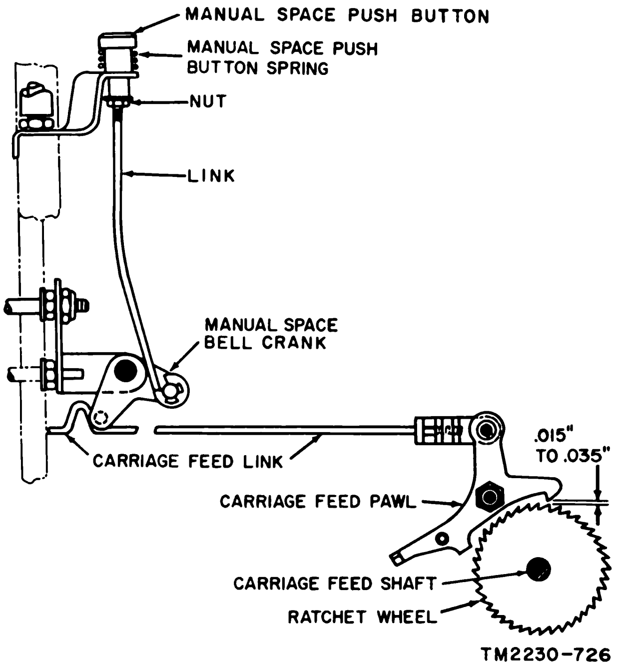


Figure 203. Manual space push button adjustment.

227. Function Cam Adjustment
(fig. 204)

a. *Requirement.* There should be a .008- to .020-inch clearance between the function selecting arm and the punch bar guide block when the function selecting arm is in its unoperated position.

b. *Adjustment.* Loosen the function cam setscrews. Move the function cam in or out on the function shaft until the requirement is met; tighten the setscrews.

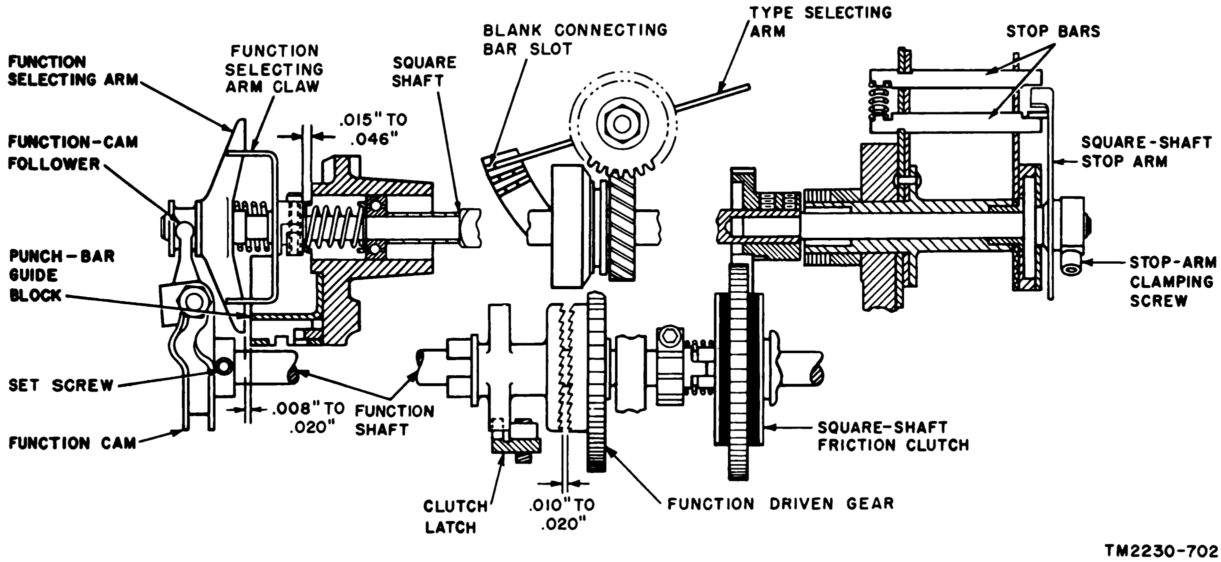


Figure 204. Function cam adjustment.

228. Type and Function Selecting Arms, Adjustments

(fig. 204)

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 .015- to .046-inch clearance between the frame and the function selecting arm claw.

b. Adjustments.

(1) *Type selecting arm.* Select the blank combination; move all five code bars counterclockwise. Loosen the stop arm clamping screw. 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 bars clockwise, others counterclockwise), and turn the square shaft until its stop arm contacts the H stop bar. Turn the function selecting arm so that it is opposite the motor stop function punch bar. Position the function selecting arm claw to have .015- to .046-inch clearance, and tighten the clamping screw.

229. Platen Trough Spring Adjustment

(fig. 205)

a. Requirement. Three to six ounces of tension is required to start the paper trough guide moving.

b. Adjustment. Remove the hinge pin. Wind or unwind the platen trough spring to meet the requirement; reinstall the pin.

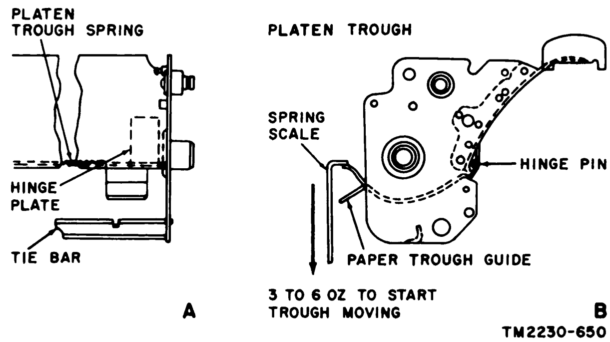


Figure 205. Platen trough spring adjustment.

230. Paper Guide Alinement and Adjustment

(fig. 206)

a. Requirement. The sprocket feed pins should be spaced equally in slots of the paper guide. Both paper guides should be in contact with the platen.

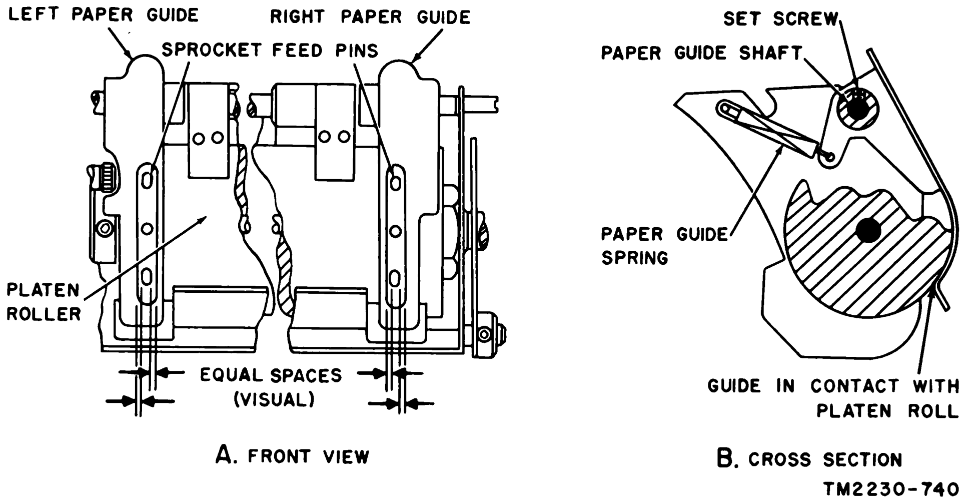


Figure 206. Paper guide alinement and adjustment.

b. Adjustment. Loosen the setscrews on the right-hand and left-hand paper guides. Slide the right-hand paper guide on the paper guide shaft until the sprocket feed pins are spaced equally in the paper guide slot. Tighten the right-hand setscrew. Slide the left-hand paper guide to line up sprocket feet pins in the slot. With the guide against the platen, tighten the left-hand setscrew.

231. Sprocket Feed Pins Operational Adjustment

(fig. 207)

a. Requirement.

(1) *Sprocket feed.* The sprocket feed pins should fully engage the holes in the sprocket feed paper.

(2) *Paper roll.* The sprocket feed pins should be fully retracted so that they do not engage or damage the paper roll.

b. Adjustment. Hold the sprocket cam plate by inserting a screw driver 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.

232. Pressure Roller Lever Position Adjustment

(fig. 208)

a. Requirement. The pressure roller lever should be in the sprocket feed notch (forward notch) when sprocket hole paper is being used. The roller lever should be in the friction feed notch (rear notch) when plain paper is being used.

b. Adjustment. To release the pressure roller lever, push on the platen lever latch. Position the pressure roller lever to satisfy the requirement and release the platen lever latch.

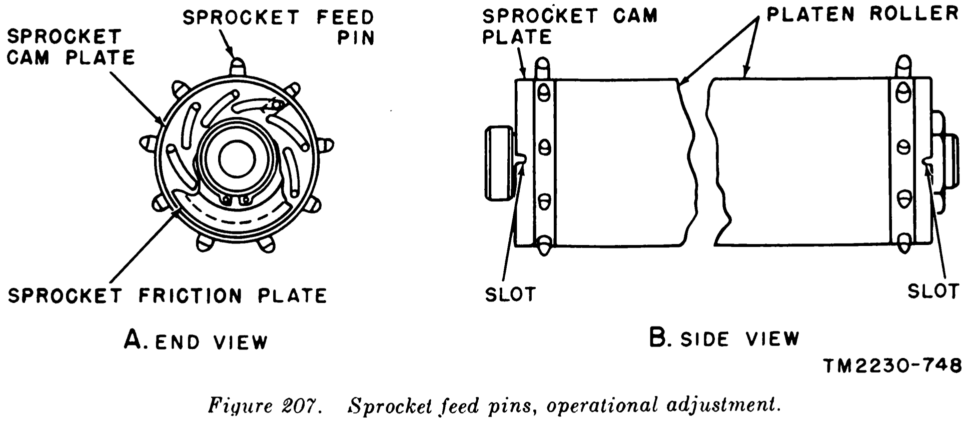


Figure 207. Sprocket feed pins, operational adjustment.

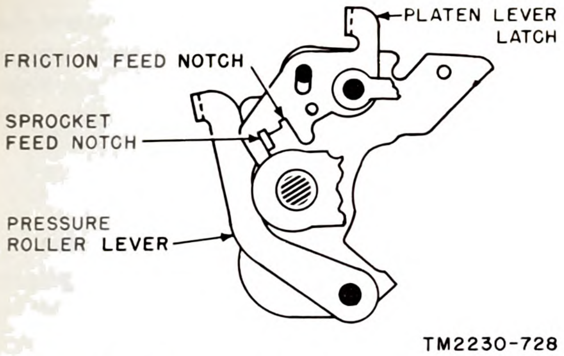


Figure 208. Pressure roller lever position adjustment.

233. Platen Pressure Roller Adjustment

(fig. 209)

a. Requirement. When the line feed operation takes place, there should be enough pressure exerted against the platen by the platen pressure roller to pull the paper one or two line spaces.

b. Adjustment. Place the pressure roller lever in the locked position and loosen the mounting setscrew. To move the platen pressure roller against the platen, use a $\frac{1}{4}$-inch open-end wrench (inserted from the rear of the machine) and rotate the platen pressure roller operating shaft. Tighten the setscrews.

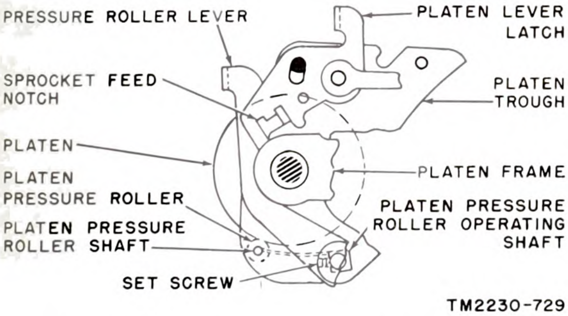


Figure 209. Platen pressure roller adjustment.

234. Character Alinement Adjustment

(fig. 210)

a. Requirement. All the characters on a line should appear with equal density. There should be no variation from one end of the line to the other.

b. Adjustment. Print a full line of characters. Loosen the eccentric pivot setscrews on the selector and function side frames. If the line varies near the right-hand margin, turn the right-hand eccentric pivot. If the line varies on the left-hand margin, turn the left-hand eccentric pivot. If necessary, use both eccentric pivots until the requirement is met. The direction of eccentricity on both eccentric pivots should be approximately the same. Hold the eccentric pivots in against the castings and tighten the setscrews. Check related adjustment (pars. 229, 230, 231, 233, 235, and 236).

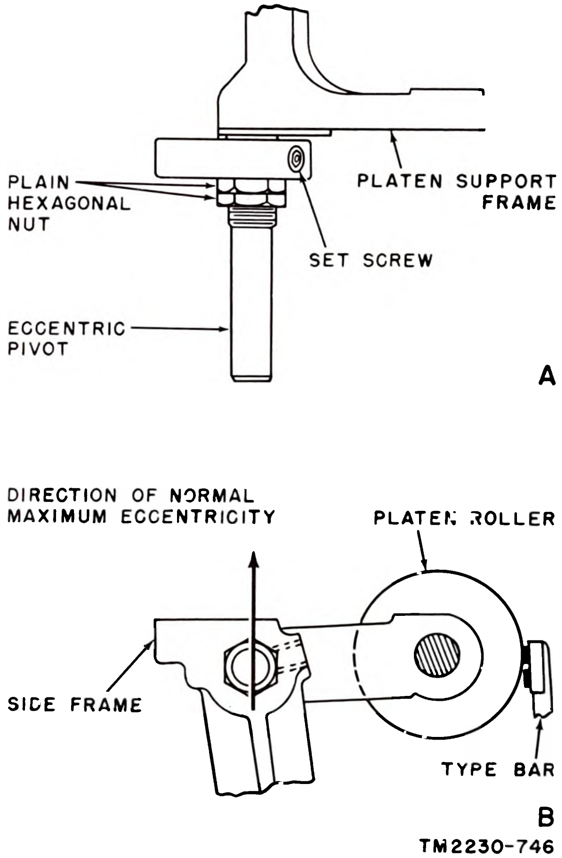


Figure 210. Character alinement adjustment.

235. Platen Assembly End Play and Positioning Adjustment

(fig. 211)

a. Requirement. When the carriage is in the left-hand margin, there should be a $\frac{5}{16}$-inch clearance between the left-hand edge of the paper and the left-hand edge of the first character, and .002- to .005-inch clearance between the eccentric pivot and the bearing in the platen casting.

b. Adjustment. With the carriage in the left-hand margin, loosen the four hexagonal nuts and two setscrews. Hold the platen against the right-hand eccentric pivot and move the screw until the 9/16-inch requirement is met. Tighten the two hexagonal nuts and the set screw on this side and repeat the procedure for the left-hand side. Upon completion of these two adjustments, check for .002- to .005-inch clearance between the eccentric pivot and the bearing in the platen casting. Check related adjustments (pars. 229, 230, 231, 233, 234, and 236).

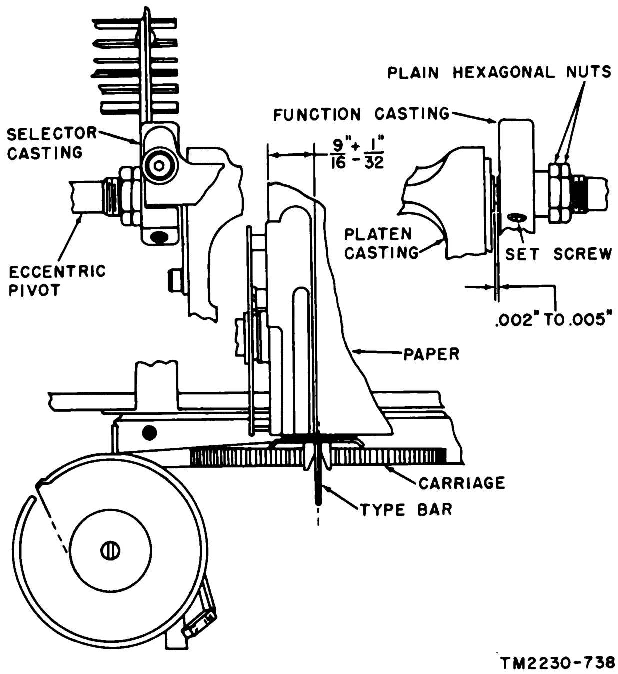


Figure 211. Platen assembly end play and positioning adjustment.

236. Platen Shift Preliminary Adjustment
(fig. 212)

a. Requirement. The platen latch should engage the lug on the aperture gate when the platen is moved to the figures position.

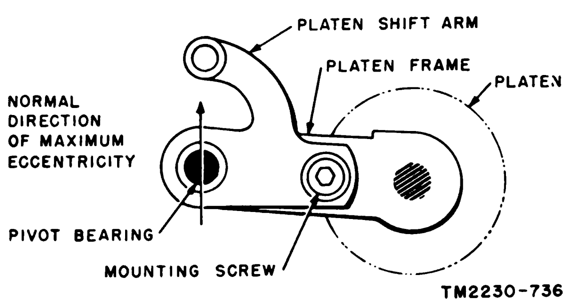


Figure 212. Platen shift preliminary adjustment.

b. Adjustment. Loosen the mounting screw that holds the shift arm. Position the shift arm to meet the requirement and tighten the mounting screw. Check related adjustments (pars. 229, 230, 231, 233, 234, and 235).

237. Figures Shift Position Adjustment
(fig: 213)

a. Requirement. Characters should be printed evenly without being cut off at the top or the bottom when the platen is in the figures position.

b. Method of Checking. With the platen in the figures position, send repeated 7 and 2 signals. Inspect the typed result for cutoff at the top or the bottom of the characters.

c. Adjustment. Loosen the platen latching arm mounting screw. Position the platen latching arm up or down so that cutoffs of characters are eliminated. Tighten the mounting screw. If all adjustments are not being made in sequence, check the letters shift position adjustment (par. 238) and the platen shift final adjustment (par. 239).

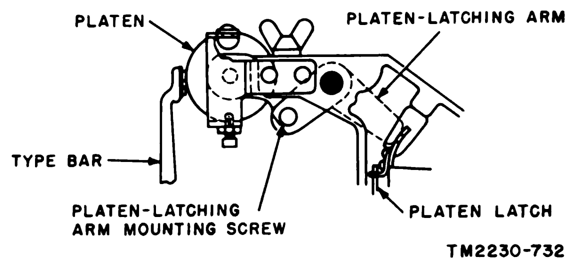


Figure 213. Figures shift position adjustment.

238. Letters Shift Position Adjustment
(fig. 214)

a. Requirement. Characters printed with the platen in the letters shift position should be perfectly alined with characters printed with the platen 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 nut that holds the platen stop screw of the platen bracket. If the letters print below the figures, turn the platen stop screw counterclockwise. If the letters print above the figures, turn the platen stop screw clockwise. It may be necessary to alter the figures shift position adjustment (par. 237) to aline the characters. Recheck the requirement; readjust, if necessary, until the requirement is met. Tighten the nut.

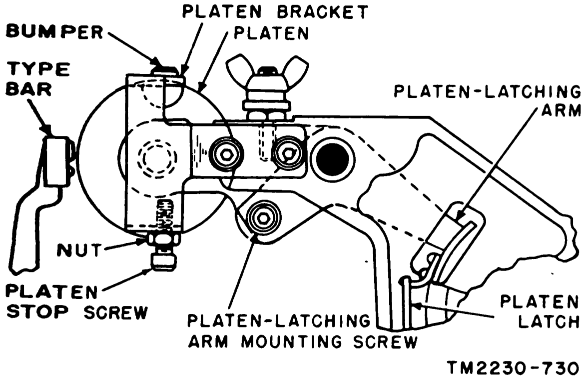


Figure 214. Letters shift position adjustment.

239. Platen Shift Final Adjustment

(fig. 215)

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 on the highest part of the figures shift cam.

b. Method of Checking. Select the figures combination group. Turn the motor by hand until the roller of the figures shift cam follower is on the highest part of the figures shift cam. Check the requirement with feeler gages.

c. Adjustment. Loosen the mounting screw that holds the platen latching arm. Reposition the arm to meet the requirement, and tighten the mounting screw. It may be necessary to readjust the figures shift position adjustment (par. 237) to get the required clearance.

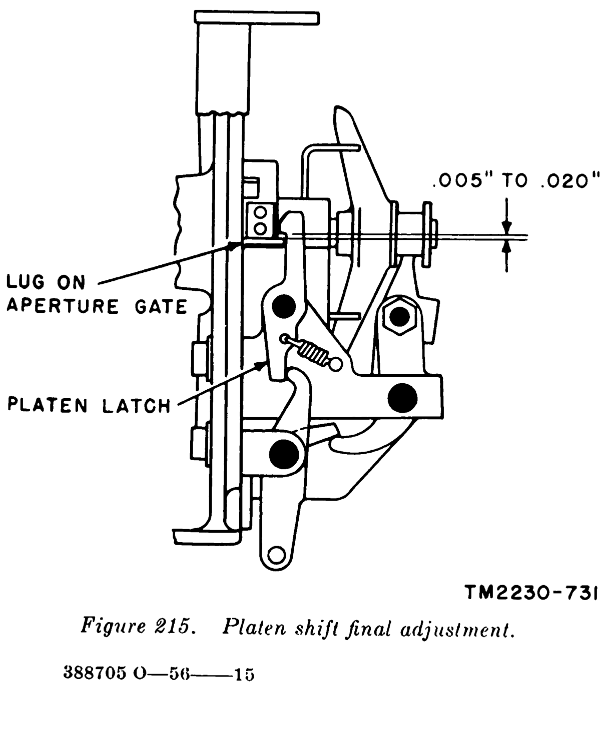


Figure 215. Platen shift final adjustment.

240. Platen Blocking Arm Adjustment

(fig. 216)

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 letters position.

b. Adjustment. With the platen in letters position, loosen the platen blocking arm mounting screw locknut. Position the platen blocking arm to obtain the requirement. Tighten the mounting screw locknut.

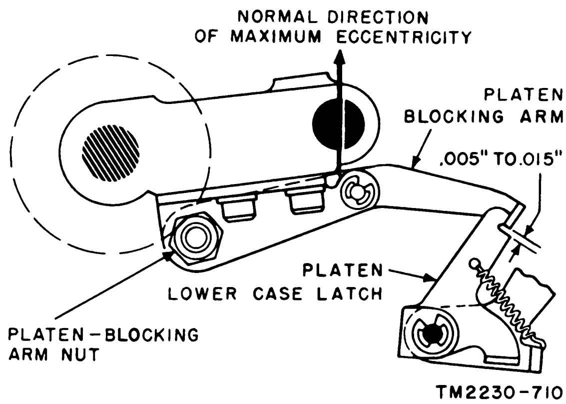


Figure 216. Platen blocking arm adjustment.

241. Line Feed Connecting Link Adjustment

(fig. 217)

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 and allow the platen to be rotated in either direction.

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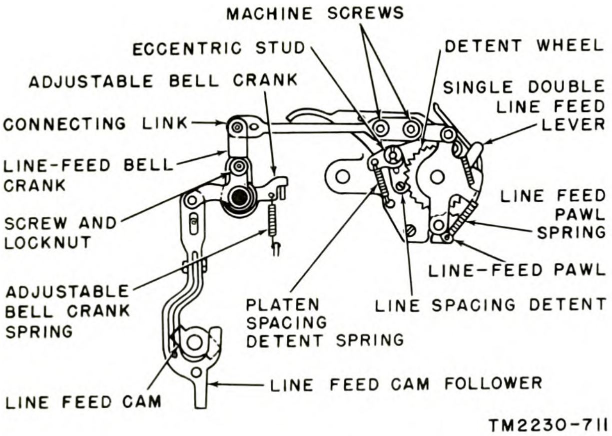

Figure 217. Line feed, line feed bell crank, and line feed detent adjustments.

b. Adjustment. Loosen the machine screws that hold the connecting link. Position the single-double line feed lever for double line feed operation. Select the line feed combination and rotate the motor by hand until the line feed cam follower is on the high part of the line feed cam. Rotate the line feed lever on which the line feed pawl is mounted until the platen has advanced two line spaces. Tighten the machine screws to hold the connecting link in this position. Continue to turn the machine until the line feed operation is completed and the parts are restored to their normal position. Be sure that the requirement described in *a* (2) above is met. Check visually to see whether the line spacing detent is resting equally between two teeth on the detent wheel. If it is not, make the line feed bell crank adjustment (par. 242).

242. Line Feed Bell Crank Adjustment

(fig. 217)

a. Requirement. With the single-double line feed lever in the double line feed position, the platen should be rotated two full line spaces for each line feed operation.

b. Method of Checking. Select the line feed combination. Turn the motor by hand until the line feed operation is completed. Check visually the number of line spaces the platen rotated and see if the line feed detent is resting equally between two teeth on the detent wheel.

c. Adjustment. Loosen the line feed adjustable bell crank lock nut. Turn the adjustable bell crank slightly clockwise and tighten the lock nut. Check the requirement; readjust if necessary until the requirement is met. It may be necessary to readjust the line feed adjustment (par. 241).

243. Line Feed Detent Adjustment

(fig. 217)

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 space detent is resting equally between two teeth of the detent wheel.

b. Adjustment. Loosen the lock nut that holds the eccentric stud of the line space detent. Turn the stud until the requirement is met; tighten the locknut.

244. Manual Unshift Link Adjustment

(fig. 218)

a. Requirement. There should be .020- to .040-inch clearance between the operating end of the manual unshift lever link and the unshift lever when the manual letters shift mechanism is in the unoperated position.

b. Adjustment. Detach the connector link from the manual unshift bell crank and loosen its locknut. Turn the connector link until the requirement is met; tighten the locknut. Reattach the connector link to the manual unshift bell crank.

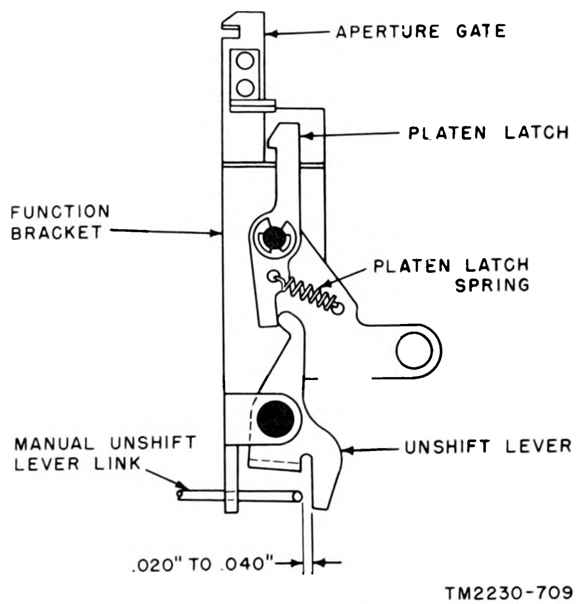

Figure 218. Manual unshift lever link adjustment.

245. Carriage Feed Shaft Ratchet Wheel Adjustment

(fig. 219)

a. Requirement. There should be a .010- to .020-inch clearance between the ratchet wheel and the flat on the carriage feed shaft.

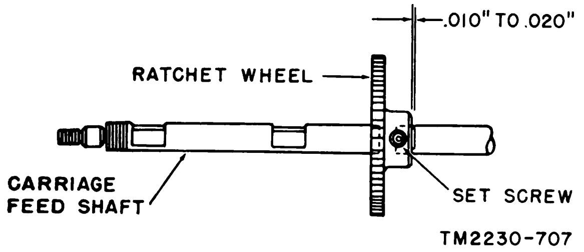

Figure 219. Carriage feed shaft ratchet wheel adjustment.

b. Adjustment. Loosen the setscrews on the ratchet wheel and slide the ratchet wheel to meet the requirement; tighten the setscrews. Check related adjustments (pars. 213, 214, and 226).

246. Carriage Feed Shaft Drive Shaft Collar Adjustment

(fig. 220)

a. Requirement. There should be 1 13/16-inches, plus or minus 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. Slide the drive shaft collar to meet the requirement and tighten the setscrews. Check related adjustments (pars. 245 and 247).

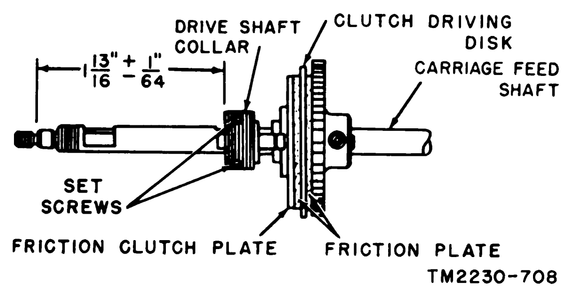

Figure 220. Carriage feed shaft drive shaft collar adjustment.

247. Carriage Feed Driven Gear Adjustment

(fig. 221)

a. Requirement. There should be 1 13/16-inches, plus or minus 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. With 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 adjustment (pars. 245 and 246).

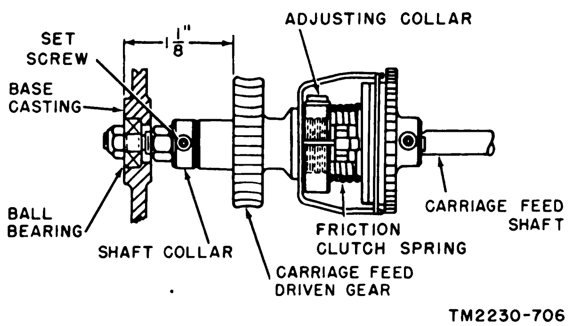

Figure 221. Carriage feed driven gear adjustment.

248. Carriage Feed Friction Clutch Adjustment

(fig. 222)

a. Requirement. Forty to forty-eight ounces of tension is required to hold the carriage from moving when the carriage feed mechanism operates.

b. Method of Checking. With the motor on, 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 space bar and repeat key. When the carriage is arrested by the spring scale, check the reading against the requirement.

c. Adjustment. With the motor off, loosen the clamping screw in the adjusting collar. Turn the adjusting collar to meet the requirement and

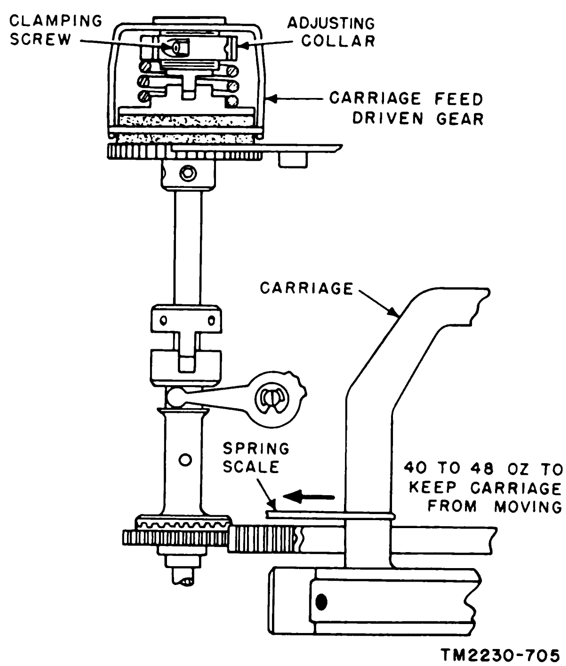

Figure 222. Carriage feed friction clutch adjustment.

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.

249. Carriage Return Safety Clutch Adjustment

(fig. 223)

a. Requirement. Between 48 and 56 ounces of tension is required to prevent the carriage from moving when the carriage return mechanism is operating.

b. Method of Checking. With 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 carriage return key. The carriage should move toward the left until the pull of the spring scale arrests it. Move the spring scale slowly to the left and read it when the carriage just starts to move again. This reading should equal the requirement.

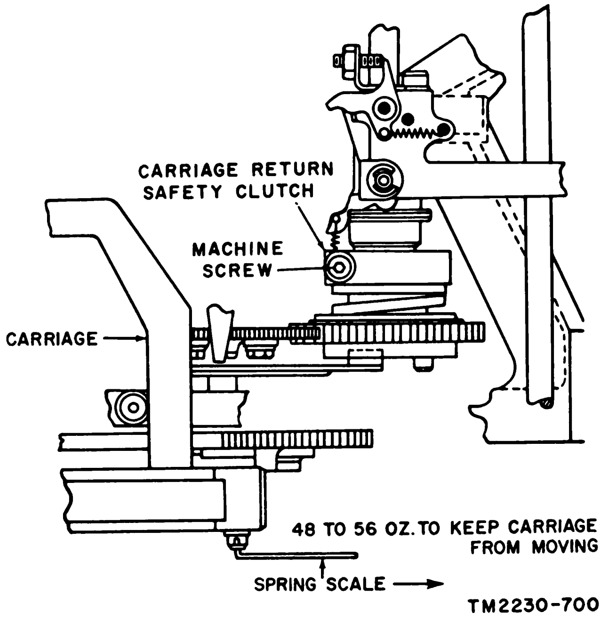

Figure 223. Carriage return safety friction clutch adjustment.

c. Adjustment. Turn the motor on and move the carriage away from the left margin until a socket head wrench can be inserted into the machine screw. Turn off the motor and insert the wrench into the maching screw and loosen it. Turn the motor by hand until the carriage return clutch is adjusted to meet the requirement. Turn the motor by hand clockwise to increase the tension; turn it counterclockwise to decrease the tension. Tighten the machine screw, remove the wrench and recheck.

250. Printing Bail and Ribbon Lifter Adjustment

(fig. 224)

a. Requirements.

(1) The travel of the print bail blade should be equal to each side of the vertical side of the vertical center line through its shaft.

(2) The function shaft should be rotated clockwise by hand just far enough to move the print cam follower from the low part on the print cam. There should be about .030-inch clearance between the type selecting arm and the guide plate when the function shaft clutch is engaged. The clearance can be increased

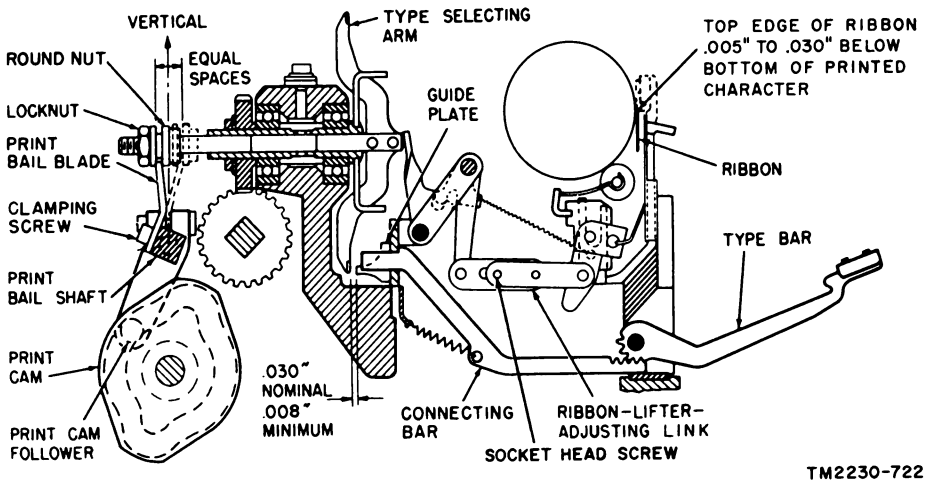

Figure 224. Printing bail and ribbon lifter adjustmenis.

or decreased to get lighter or heavier printing. The minimum allowable clearance is .008 inch.

(3) The top of the ribbon should be flush to within .005 to .030 inch below the bottom edge of the printed character on the paper.

b. Adjustments.

(1) Loosen the clamping screw on the print cam follower. Turn the print bail shaft so that the requirement is met, and tighten the clamping screw. Check the requirement by observing that the clearance between the edge of the print bail blade and the bottom of the round nut groove is the same in both the extreme forward and backward positions of the print bail blade.

(2) Loosen the locknut on the end of the shaft of the type selecting arm. Turn the round nut until the requirement is met, and tighten the locknut against the round nut.

(3) Loosen the socket-head screws and move the link to meet the requirement; tighten the socket-head screws.

Note.—This adjustment should always be made when changing from 60-wpm operation to 100-wpm operation, or vice versa.

251. Printing Bail Blade Adjustment

(fig. 225)

a. Requirement. 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 print bail blade.

b. Adjustment. Loosen the screws that hold the print bail blade and move the print bail blade up or down until the requirement is met; tighten the screws.

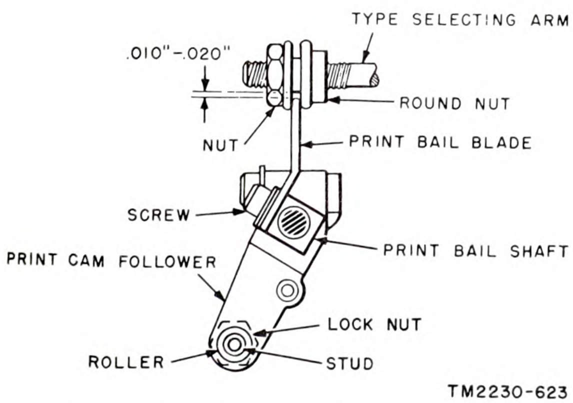

Figure 225. Printing bail blade adjustment.

252. Ribbon Reversing Detent Plate Adjustment

(fig. 226)

a. Requirement. There should be equal engagement on each side of the ribbon reversing detent plate in both ribbon driving positions.

b. Method of Checking. With the detent spring removed, position the ribbon reversing beam so that the high points of the detent and ribbon reversing detent plate meet. Clearances should be equal, or the engagement between the detent and ribbon reversing detent plate should be equal in both positions of the beam.

c. Adjustment. Loosen the two mounting screws that hold the ribbon reversing detent plate and, while holding the ribbon reversing detent plate in position, shift the beam until the clearances are equal; tighten the mounting screws. Check both latched beam positions for equal engagement.

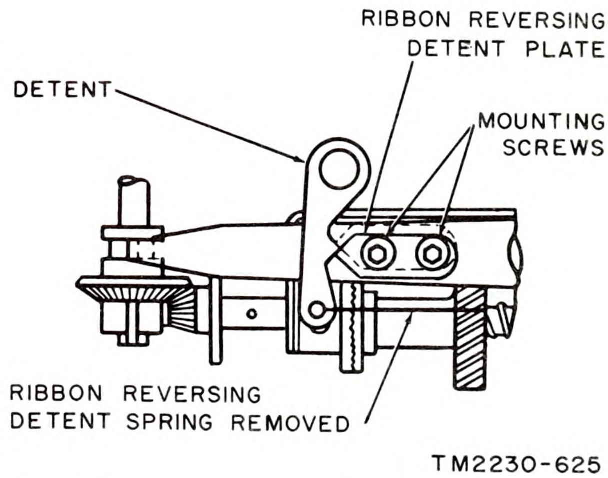

Figure 226. Ribbon reversing detent plate adjustment.

253. Ribbon Spool Drive Shaft Adjustment

(fig. 227)

a. Requirement. There should be equal engagement of the bevel gears at each end of the ribbon driving shaft.

b. Adjustment. Loosen the setscrews in the collars and in the clutch; shift the shaft so that the requirement is met and tighten the setscrews in the clutch. Place a .002- to .005-inch feeler gage between the clutch and mounting, hold the shaft to the left, hold the collar to the right to compress the spring, and tighten the setscrews in the collars.

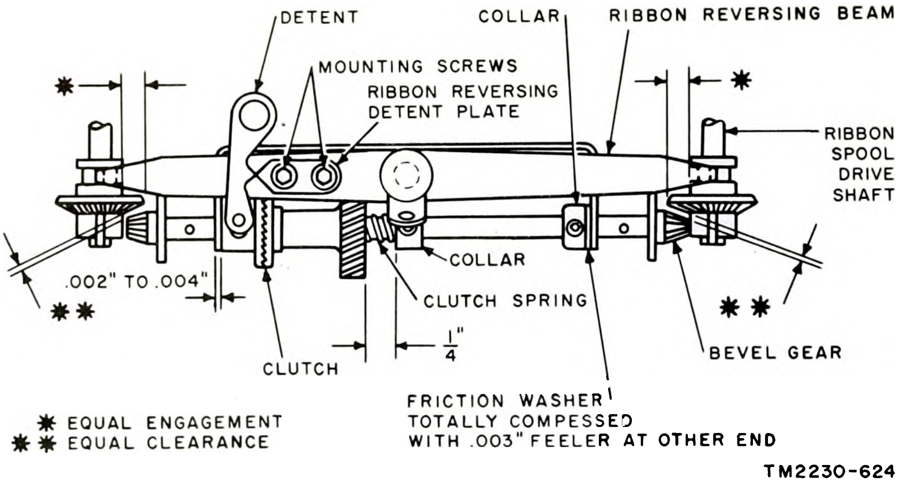

Figure 227. Ribbon spool drive shaft and clutch spring adjustments.

254. Ribbon Driving Clutch Spring Adjustment

(fig. 227)

a. Requirement. The collar that holds the ribbon driving clutch spring should be ¼ inch from the face of the gear teeth on the clutch.

b. Adjustment. Loosen the setscrews that hold the collar and shift the collar until the requirement is met; tighten the setscrews. Check related adjustment (pars. 252 and 253).

255. Left-hand Margin Trip Plate Adjustment

(fig. 228)

a. Requirement. There should be a .020- to .030-inch clearance between the stop bar shift and the delaying latch when the carriage is against the left margin stop screw.

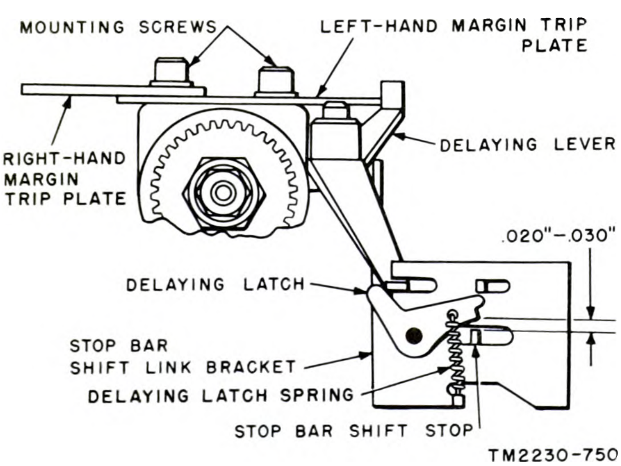

Figure 228. Left-hand margin trip plate adjustment.

b. Adjustment. Loosen the left- and right-hand margin trip plate mounting screws. Move the carriage against the left-hand margin stop screw. Move the left-hand margin trip either right or left; this causes the angular rotation of the delaying lever to be increased or decreased until the requirement is met; tighten the mounting screws.

256. Automatic Carriage Return Right-hand Margin Trip Plate Adjustment

(fig. 229)

a. Requirement. The stop bar shift link should extend beyond the link support 7/64 to 9/64 inch when the carriage is in the 73d space position.

b. Adjustment. Loosen the mounting screw and slide the right-hand margin trip plate to meet the requirement.

257. Automatic Carriage Return, Stop Bar Shift Stop Adjustment

(fig. 230)

a. Requirement. There should be a .005- to .010-inch clearance between the stop bar shift stop and the delaying latch when the carriage is in the 73d space position.

b. Method of Checking. Space the carriage to the 73d position and check the gap with a feeler gage.

c. Adjustment. Loosen the setscrew and slide the stop bar shift stop to meet the requirement.

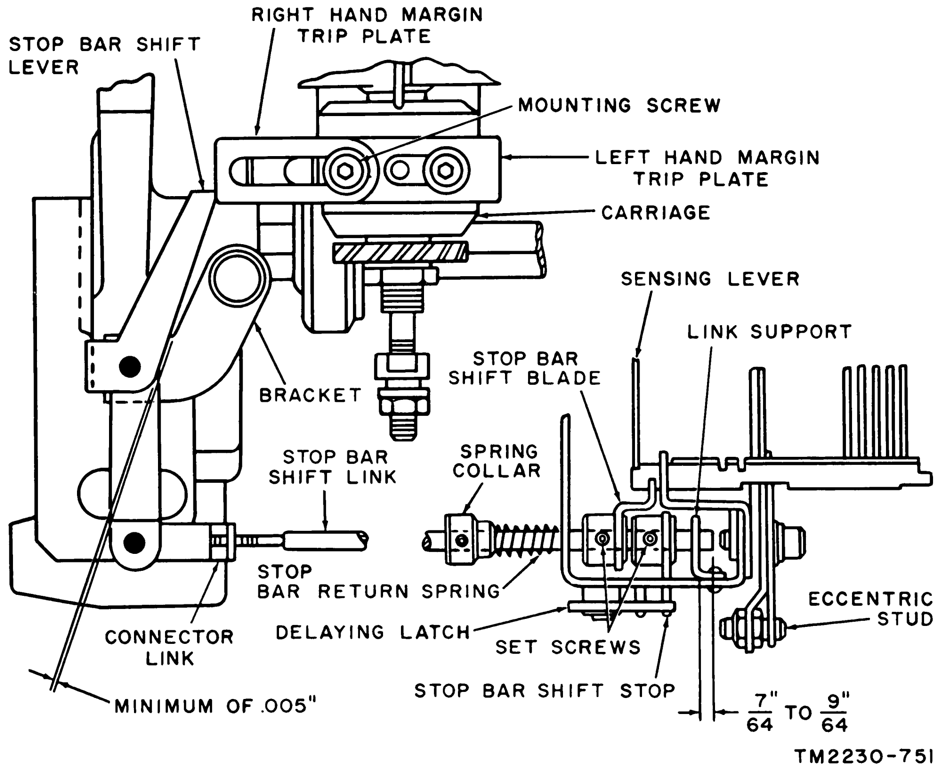

Figure 229. Automatic carriage return, shift link adjustment.

258. Automatic Carriage Return Stop Bar Shift Blade Adjustment

(fig. 231)

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 space positions and the stop bar shift stop is latched by the delaying latch.

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 socket setscrew and slide the stop bar shift blade to meet the requirement.

d. Final Check. When the carriage is returned to the left margin, there should be a minimum of .005-inch clearance between the bracket and the

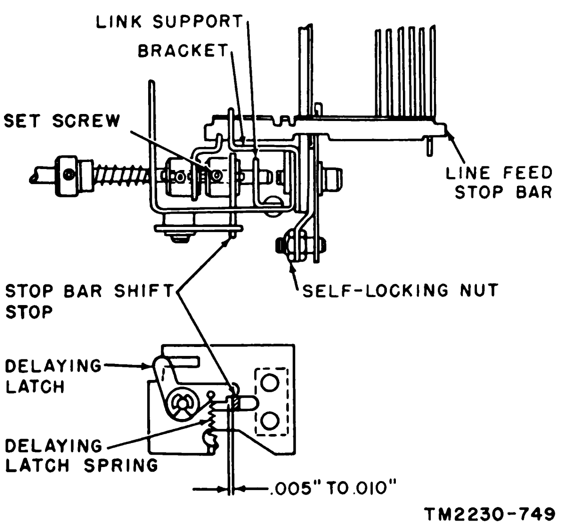

Figure 230. Automatic carriage return, stop bar shift stop adjustment.

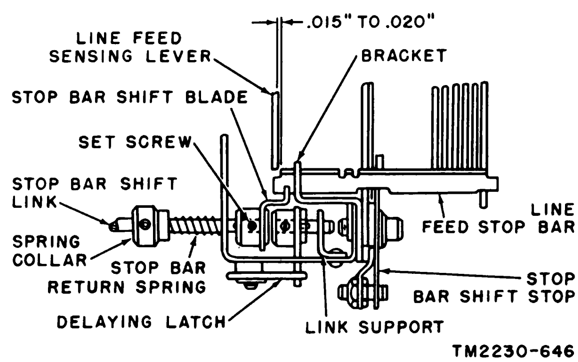

Figure 231. Automatic carriage return, stop bar shift blade adjustment.

stop bar shift lever (fig. 228). If the stop bar shift lever touches the bracket, remove the E-ring and connector link and screw the connector link onto the stop bar shift link until the requirement is met. Readjust for the .005- to .010-inch clearance shown in figure 230 by repositioning the right-hand margin trip plate.

259. Automatic Carriage Return Stop Bar Return Spring Adjustment

(fig. 232)

a. Requirement. Between 13 and 16 ounces of tension is required 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. Check related adjustment (pars. 255–258).

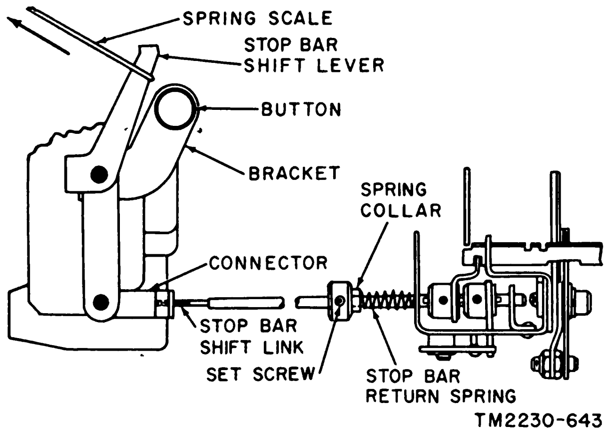

Figure 232. Automatic carriage return stop bar return spring adjustment.

260. Margin Signal Bell Adjustment

(fig. 233)

a. Requirement. The margin signal bell should ring on the 66th character from the left.

b. Method of Checking. Space the carriage out from the left margin. The margin bell should ring when the carriage reaches the 66th character position.

c. Adjustment. Loosen the adjusting screws and move the margin bell pawl trip arm to meet the requirement; tighten the adjusting screws. Recheck and readjust, if necessary.

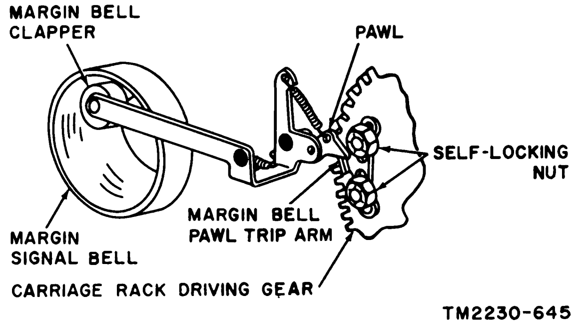

Figure 233. Margin signal bell adjustment.

261. Motor Stop Switch Assembly Bracket Adjustment

(fig. 234)

a. Requirement. There should be a .040- to .060-inch clearance between the motor stop function 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 bracket to obtain the requirement; tighten the two mounting screws.

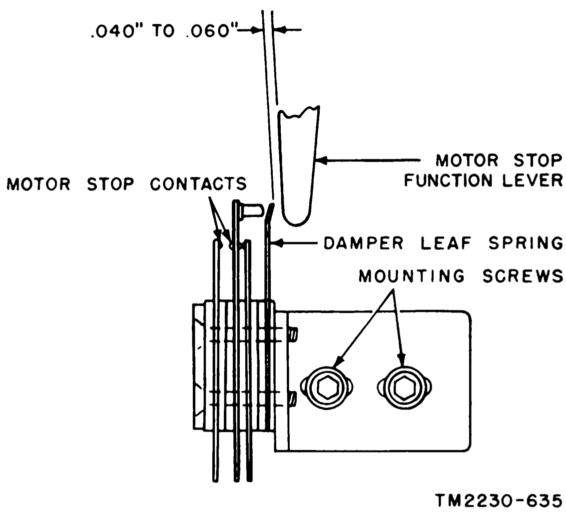

Figure 234. Motor stop switch assembly bracket adjustment.

262. Disabling Motor Stop Adjustment

(fig. 235)

a. Requirement. With the platen in the shift position, operation of the H key should not cause the motor to stop.

b. Adjustment. Loosen the two motor stop mounting bracket screws. Position the bracket away from the function lever until the function lever does not move the contacts when the platen is in the shift position and the H-lever selected. Tighten the mounting screws.

263. Key Lever Locking Bar Adjustment

(fig. 235)

a. Requirement. There should be a .005- to .015-inch clearance between the key lever locking bar and the key levers.

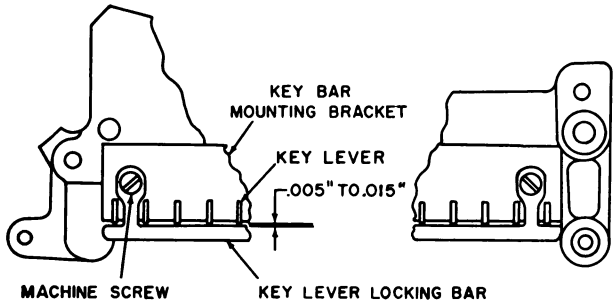

Figure 235. Key lever locking bar adjustment.

b. Adjustment. Loosen the three machine 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 machine screws; recheck the clearance.

264. Sensing Levers Clearance and Alinement Adjustment

(fig. 236)

a. Requirement. The sensing levers and code bars should be in alinement, and there should be a .001- to .003-inch clearance between the flat washer and sensing lever.

b. Adjustment. Peel the washer until the sensing lever and code bar are in alinement. Move the selector lever pivot stud in or out to obtain the .001- to .003-inch clearance; tighten the setscrew.

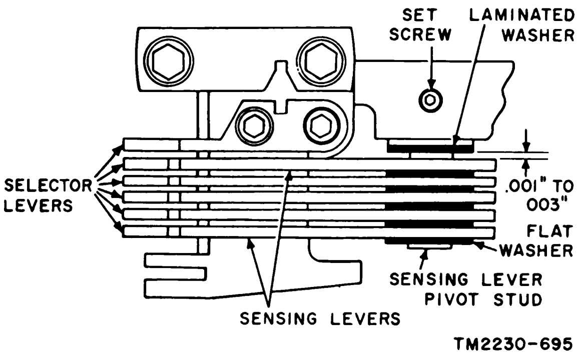

Figure 236. Sensing levers clearance alinement adjustment.

265. Selector Levers and Sensing Levers Adjustment

(fig. 237)

a. Requirement. With the selector lever on the low part of the cam, there should be a .003-inch minimum clearance between the selector levers and the sensing levers.

b. Adjustment. Adjust the selector lever comb to obtain minimum clearance. This adjustment should be made and checked at the same time as the minimum clearance when making the selector lever latch adjustment (par. 266).

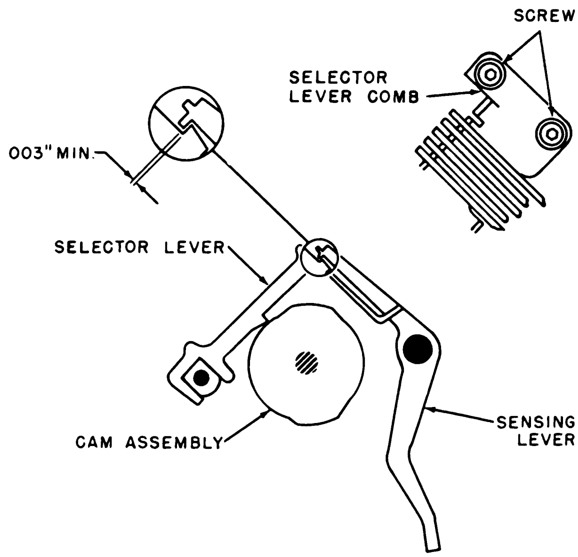

Figure 237. Selector levers and sensing levers adjustment.

266. Stop Selector Lever Latch and Transmitter Contact Adjustment

(fig. 238)

a. Requirement.

(1) The stop selector lever latch should be adjusted to give the correct stop pulse length. There should be .005-inch minimum clearance between the stop selector lever and stop selector lever latch when the stop selector lever is on the 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 a distortion test set, TS-383/GG, to measure the signal transmitted by the teleprinter.

c. Adjustment.

(1) Loosen the screws. Turn the motor on and push the repeat key and blank key. Move the stop selector lever latch to obtain the required stop signal length on a TS-383/GG. Move to the left to decrease and to the right to increase pulse length; tighten the screws and recheck the signal length.

(2) Connect a milliammeter across the sequential contact when the send plug is disconnected.

(3) Remove the transmitter contact cover and back off the stationary mark contact.

(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, press the letters key, and turn the motor by hand. Watch the milliammeter again.

(6) Repeat this procedure until all breaks between the marking impulses made by the five intelligence selector levers are eliminated.

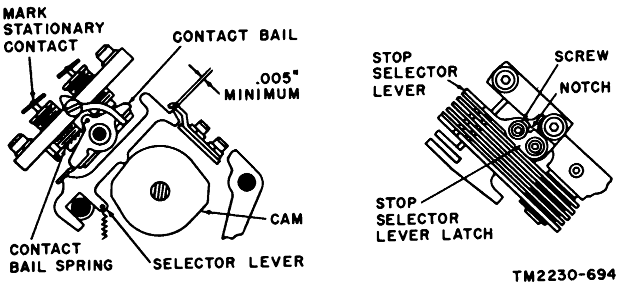

Figure 238. Stop selector lever latch and transmitter contact adjustment.

267. Sensing Lever Locking Bail Adjustment
(fig. 239)

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. With the sensing lever locking bail engaged with the sensing levers, turn the eccentric bearing clockwise or counterclockwise until the requirement is met; tighten the nut.

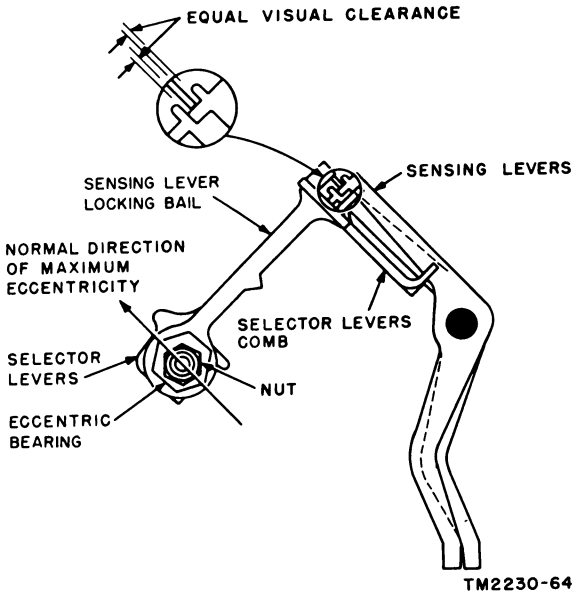

Figure 239. Sensing lever locking bail adjustment.

268. Universal Bar Adjustment
(fig. 240)

a. Requirement. There should be a .005- to .015-inch clearance between the cam stop lever and the locking lever latch when any key lever is in the depressed position.

b. Adjustment. Loosen the plain nut and turn the universal bar adjusting screw in or out to meet the requirement; tighten the plain nut.

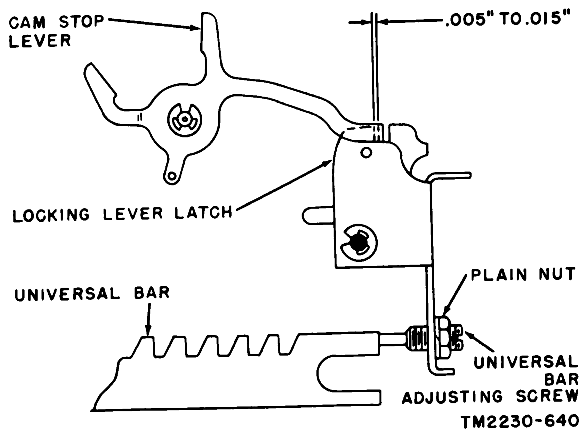

Figure 240. Universal bar adjustment.

269. Transmitter Friction Clutch Adjustment

(fig. 241)

a. Requirement. Twenty-five to thirty ounces of tension is required to keep the clutch fork from turning when the motor is running.

b. Method of Checking. With the motor on, hook a spring scale on the clutch fork. Depress the space bar and read the scale.

c. Adjustment. With the motor off, loosen the clamping screw. Turn the friction adjusting collar in or out to meet the requirement; tighten the clamping screw. Turn the motor on and recheck the tension.

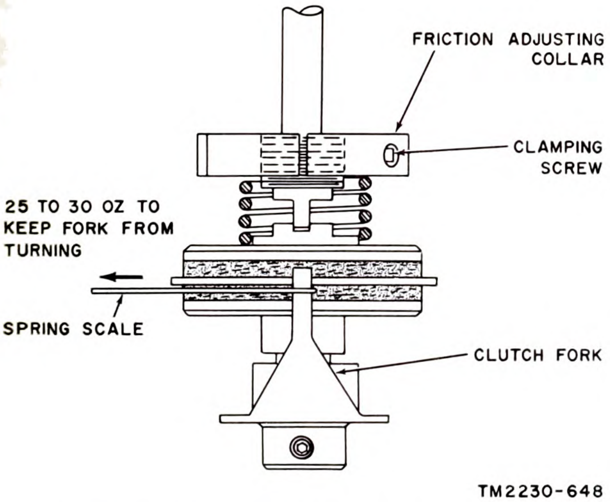

Figure 241. Transmitter friction clutch adjustment.

270. Dust Cover Copy Light Screws Adjustment

(fig. 242)

a. Requirement. There should be a 13/16-inch clearance, plus or minus 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 hexagonal nuts and turn the copy light screws to meet the requirement; tighten the hexagonal nuts.

271. Dust Cover Window Door Adjustment

(fig. 243)

a. Requirement. The dust cover window should close smoothly and be tight when closed.

b. Adjustments.

(1) Loosen the binding head screws and move the dust cover window latch until it is parallel (visually) with the edge of the dust cover and strikes the dust cover window catch approximately in the middle of the sloping surface; tighten the binding head screws.

(2) With the dust cover window closed, loosen the socket-head screws and slide the dust cover window latch until its edge just touches the dust cover window catch; tighten the socket-head screws. Check by opening and closing the dust cover window a few times and pulling up on the corners of the dust cover window. If it does not operate smoothly or if the corners have excessive play, readjust.

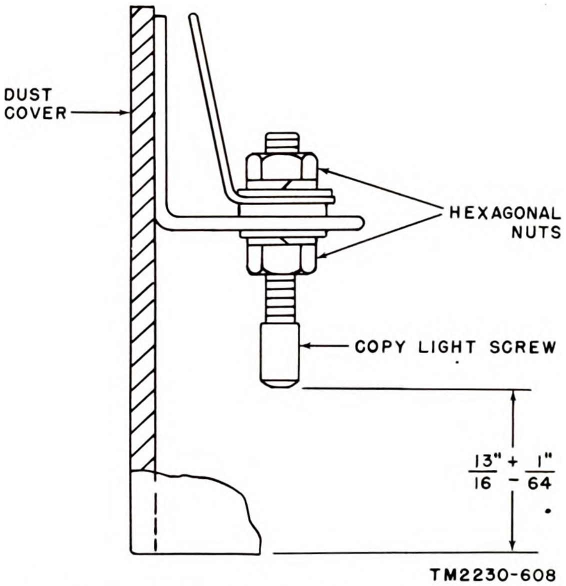

Figure 242. Dust cover copy light screws adjustment.

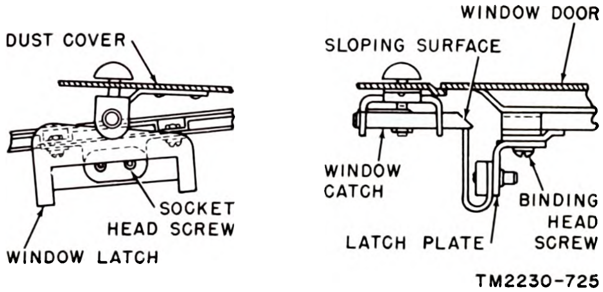

Figure 243. Dust cover window door adjustment.

272. Dust Cover Knob Adjustment

(fig. 244)

a. Requirement. There is to be a .002- to .012-inch clearance between the locking knob and the casting.

b. Adjustment. Loosen the adjusting screw and insert a feeler gage between the casting and the locking knob. Push the dust cover arm and locking knob towards each other until all clearance is

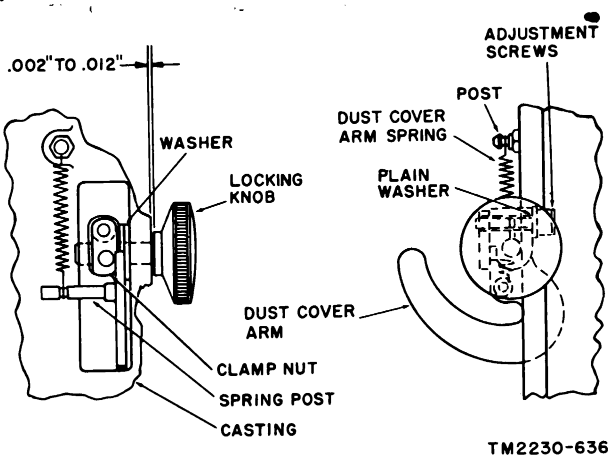

Figure 244. Dust cover knob adjustment.

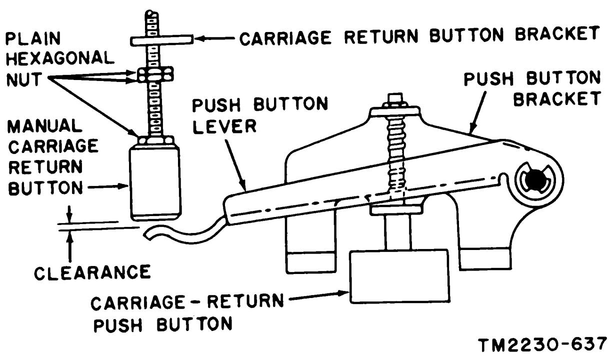

Figure 245. Manual carriage return pushbutton adjustment.

removed. Tighten the adjusting screw and remove the feeler gage. Check to be sure the dust cover arm does not hit the casting when the locking knob is turned.

273. Manual Carriage Return Pushbutton Adjustment

(fig. 245)

a. Requirement. There should be enough clearance, but not to exceed one-sixteenth inch, between the manual carriage return button and the pushbutton lever to place the cover in its proper position over the machine without interference.

b. Adjustment. Loosen the locknut and turn the manual carriage return button in or out until the requirement is met; tighten the locknut.

274. Manual Letters Pushbutton Adjustment

(fig. 246)

a. Requirement. When the cover is put in position over the machine, the manual letters pushbutton should clear the unshift pushbutton.

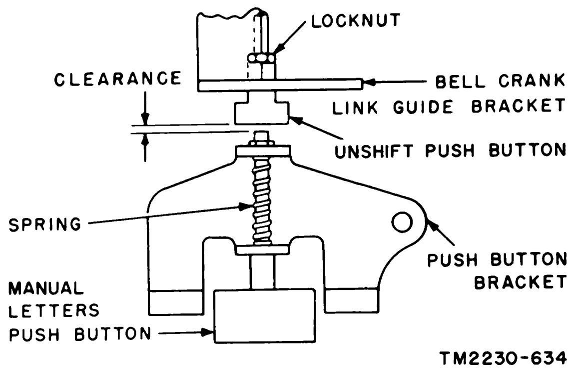

Figure 246. Manual letters pushbutton adjustment.

When the manual letters pushbutton is pressed, it should operate the platen latch.

b. Adjustment. Loosen the locknut and screw the unshift pushbutton 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 (par. 244).

Section VIII. SPRING DATA

275. General

a. This section contains data on the coil springs used in these teleprinters. This information is useful when inspecting or overhauling to determine which springs must be replaced. It is also useful as a checklist when reassembling, adjusting, or troubleshooting, and as a means of identifying springs.

b. The charts in paragraphs 276 through 279 give the dimensional and strength characteristics required of each spring used in the teleprinters. Each type of spring is illustrated in figures 247 through 252. The free length is measured between the inside surfaces of the end hooks. A spring that fails to pass its strength check should be replaced.

Note.—In some cases, spring tensions are indicated in grams for more accurate adjustments than are possible with ounce scales. If it is necessary to convert from ounces to grams, or from grams to ounces, remember that 1 ounce equals 28.35 grams.

276. Crossed-end Spring Data
(fig. 247)

Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension, extended length	C Wire thickness (in.)	D Number of coils	E Outside diameter (in.)
50196	Trip pawl	9/16	5/8	1 oz ±1/4 oz	0.010±0.0003	30	0.125
50904	Transfer lever latch	11/16	13/16	2½ oz±3/4 oz	.012± .0003	31	.156
50906	Carriage return bell crank	11/16	13/16	4½ lbs±6 oz	.034± .0005	8½	.250
50911	Carriage feed clutch lever	25/32	15/16	40 oz±4 oz	.025± .0005	15	.200
50912	Paper roller latch	½	21/32	17½ oz±½ oz	.018± .0005	12¾	.156
50915	Function cam follower support lever	21/32	23/32	4 lbs 2 oz±6 oz	.038± .0008	7¼	.250
50916	Delaying latch	3/8	½	7 oz±1 oz	.013± .0003	12¼	.125
50919	Function blocking bar	½	5/8	2½ oz±1/4 oz	.011± .0003	26	.125
50941	Key lever, locking bail	½	5/8	20 oz±2 oz	.020± .0003	8¾	.187
50946	Double blocking lever	19/32	11/16	28 oz±3 oz	.024± .0003	11¾	3/16
51136	Universal code bar return	11/16	1	15 to 20 grams	.009± .0003	45 max.	.150
51544	Locking lever latch	7/8	1 1/8	1½ oz±1/4 oz	.010± .0003	57	.125
51754	Line feed and figures shift sensing lever	11/16	7/8	34 oz±4 oz	.019± .0008	26	1/8
51851	Platen spacing detent	21/32	25/32	54 oz±6 oz	.026± .0005	16	.160
53149	Platen lever latch	25/32	7/8	19–21 oz	.020± .0003	27	.156
53974	Space bar	15/32	5/8	86 oz±8 oz	.028± .0005	4¾	.218
55009	Y lever detent	1/4	.342	90–130 grams	.009± .0003	12¾	.083
55014	Dust cover arm	1 1/16	1 5/8	5 lbs 10 oz±10 oz	.028± .0005	27½	.187
56258	Blocking lever	9/16	3/4	6–8 oz	.014± .0003	17¾	.140

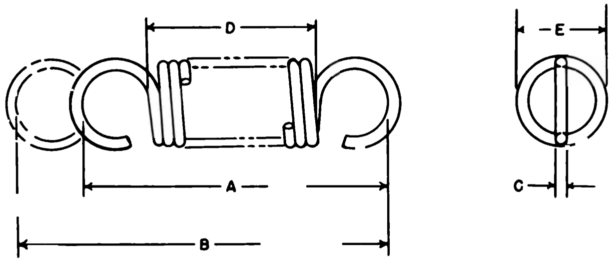

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Figure 247. Crossed-end spring.

277. Parallel-end Spring Data
(fig. 248)

Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension, extended length	C Wire thickness (in.)	D Number of coils	E Outside diameter (in.)
50231	Margin bell clapper	11/16	3/4	8 oz ± 1 oz	0.016 ± 0.0003	28	0.125
50232	Margin bell trip pawl	5/8	11/16	1 oz ± 1/4 oz	.010 ± .0003	36	.125
50334	Governor adjusting	15/16	1	32 oz ± 3 oz	.026 ± .0005	26	.156
50403	Reversing detent	1	1 1/4	5 oz ± 3/4 oz	.013 ± .0003	58	.125
50447	Ribbon sensing lever	13/32	15/32	2 oz ± 1/2 oz	.010 ± .0003	11	.156
50595	Connecting bar	9/16	7/8	3 1/2 oz ± 1/4 oz	.011 ± .0003	31	.138
50903	Transfer lever	1 3/32	1 1/4	5 lbs. 13 oz ± 3 oz	.042 ± .0005	14	.281
50920	Signal bell clapper	23/32	27/32	1 1/2 oz ± 1/4 oz	.010 ± .0003	45	.125
50921	Print cam follower	7/8	1 1/16	6 1/2 lbs ± 8 oz	.039 ± .0005	11 3/4	.250
50944	Blocking lever	15/32	9/16	2 1/2 oz ± 1/2 oz	.010 ± .0003	20	.125
51574	Sensing lever locking bail	5/8	27/32	2 1/2 oz ± 1/4 oz	.012 ± .0003	28	.156
55143	Stripper	19/32	11/16	42 grams ± 4 grams	.009 ± .0003	----------	.120

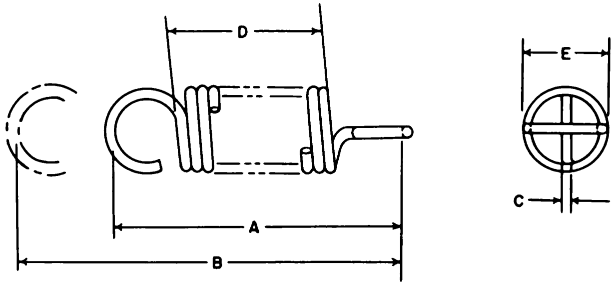

Figure 248. Parallel-end spring.

278. Extension Spring Data
(fig. 249)

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.)
50848	Clutch	$\frac{3}{4} \pm \frac{1}{16}$	$\frac{7}{16}$	1 lb 12 oz $\pm$ 3 oz	0. 041 $\pm$ 0. 0005	$5\frac{1}{2}$	0. 578 ID
50917	Function selecting arm	$\frac{9}{16} \pm \frac{3}{64}$	$\frac{13}{32}$	6 oz $\pm \frac{1}{2}$ oz	. 024 $\pm$. 0003	$5 \pm \frac{1}{4}$	. 390 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	$9 \pm \frac{1}{2}$	$\frac{15}{64}$ OD
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	$\frac{1}{2} \pm \frac{3}{64}$	$\frac{9}{32}$	10 lbs. 8 oz $\pm$ 12 oz	. 067 $\pm$. 0005	$3\frac{1}{2}$	
54933	Clutch pressure	$\frac{1}{2} \pm \frac{3}{4}$	$\frac{9}{32}$	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 push button	$\frac{5}{8}$			. 025	$9\frac{1}{2}$	. 343 ID

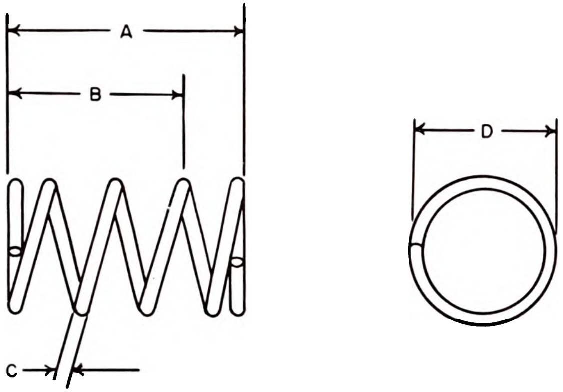

Figure 249. Extension spring.

279. Special Spring Data

Fig. number	Reference number	Name	A Free length (in.)	B Extended length (in.)	Required tension, extended length	C Wire thickness (in.)	Number of coils	D Diameter (in.)
250	50902	Selector lever	1	1¼	8 oz ± ½ oz	0. 012 ± 0. 0003	53 max	. 085 OD
251	54967	Platen trough	1³⁄₁₆			. 027	43½	. 179 OD
252	56269	Carriage return blocking lever				. 018 ± . 0003	2	. 500 ID

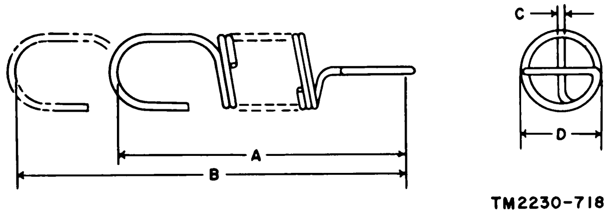

Figure 250. *Selector lever spring.*

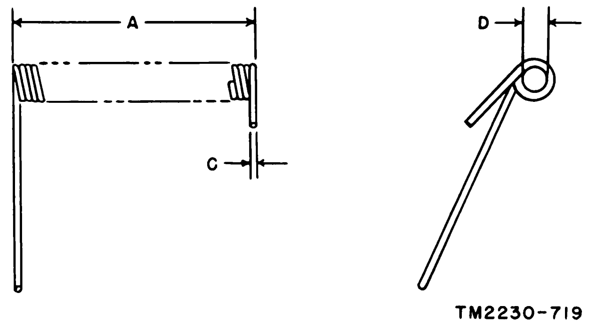

Figure 251. *Platen trough spring.*

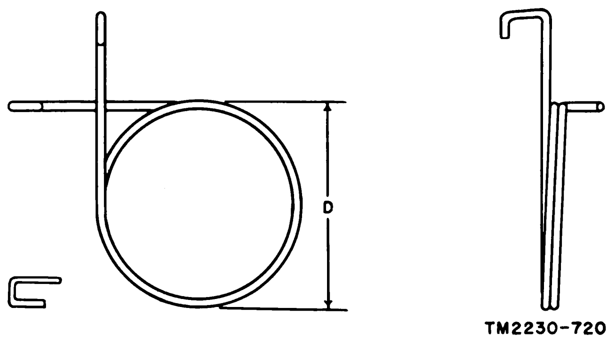

Figure 252. Carriage return blocking lever spring.

Section IX. FINAL TESTING

280. General

The teleprinter should meet certain performance requirements before it is returned to operational service. This section describes the procedures for final testing the operational limits of the teleprinter.

281. Test Equipment Required for Final Testing

The test equipment required for final testing is the same as that listed for troubleshooting in paragraph 82. Refer to the appropriate technical manuals for instructions on the use of the test equipment.

282. Test Setup

The local test arrangement described in paragraph 19*a* through *c* provides the best conditions for final testing the teleprinters. This setup can be modified as necessary to use the test equipment to the best advantage.

283. Performance Test

Check the performance of the teleprinter as described in paragraph 33 to check the over-all operation of the teleprinter as well as the operation of each component and subassembly within the unit. If any failures occur, refer to paragraph 101 to determine the cause of the trouble and the steps necessary to correct the trouble. Further check the operation of the teleprinter as described in paragraphs 284 and 285.

284. Sending Tests

Signals transmitted by the keyboard transmitter can be analyzed by the Distortion Test Set TS-383B/GG to detect any deviation from normal signals, thereby enabling maintenance personnel to determine what adjustments and corrections, if any, must be made in the keyboard transmitter 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 receive cord from the distortion test set to terminals 1 and 4 of the terminal and switch box.

b. Turn the LINE SELECTOR switch to the 60 position.

c. Turn the DC POWER switch to the ON position.

d. Test the signals sent from the keyboard transmitter as described in the distortion test set manual. The signal bias of the keyboard transmitter must not exceed 5 percent.

285. Receiving Tests

a. Preparation.

(1) Plug the send cord of the distortion test set to terminals 1 and 4 of the terminal and switch box. This connects the distortion test set in series with the teleprinter.

(2) Adjust the motor speed of the teleprinter as described in paragraph 20.

(3) Send the test message from the distortion test set with no distortion.

b. Range Test.

(1) Binding posts for checking the BIAS potentiometer setting are provided at the terminal and switch terminal box. To adjust the BIAS potentiometer setting, disconnect the strap that connects the binding posts and connect a dc milliammeter 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 dc milliammeter and reconnect the strap between the binding posts.

(2) Arrange the distortion test set to transmit undistorted signals.

(3) While still receiving the test message, determine the upper and the lower limits of the range.

(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 range finder dial assembly at the midpoint between the two limits of the range.

c. Bias Tolerance Test. The teleprinter 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

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percent. The bias tolerance of the properly adjusted teleprinter operating at 600 opm should be a minimum of 35 percent. The formula given in (5) below is used to compute bias tolerance. When signal distortion test sets are arranged to transmit signals with a bias distortion, the distortion test 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 distortion test set advances the beginning of each marking impulse. When adjusted to transmit signals with a *spacing bias*, the distortion set retards the beginning of each marking impulse. The bias tolerance of the receiving units may be tested as follows:

(1) Connect the teleprinter as described in *a* above.
(2) Set the BIAS potentiometer as described in *b* (2) above.
(3) Adjust the distortion test set to transmit test signals with a marking bias of 35 percent. Use these signals to determine the upper range limit with the range finder.
(4) Adjust the distortion 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 the teleprinter using the following formula:

$$\text{Bias tolerance} = 35 + \frac{\begin{pmatrix}\text{upper limit}\\\text{marking bias}\end{pmatrix} - \begin{pmatrix}\text{lower limit}\\\text{spacing bias}\end{pmatrix}}{2}$$

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 the distortion test sets are adjusted to transmit signals with end distortion, the distortion test 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 distortion test 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 distortion test set retards the end of each marking code impulse. The end distortion tolerance of the teleprinter may be tested in the following manner:

(1) Connect the teleprinter as described in *a* above. Adjust the distortion 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 distortion test set to transmit test signals with 35 percent spacing end distortion. Use the test signals to determine the upper range limits with the range finder assembly.
(4) Adjust the distortion 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:

$$\text{End distortion tolerance} = 35 + \frac{\begin{pmatrix}\text{upper limit}\\\text{spacing end}\\\text{distortion}\end{pmatrix} - \begin{pmatrix}\text{lower limit}\\\text{marking end}\\\text{distortion}\end{pmatrix}}{2}$$

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 teleprinter. It is used as a measure of the mechanical efficiency of the receiving unit. The internal bias of the receiving unit 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 teleprinter should be rechecked for maladjustment or other mechanical fault.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

286. Disassembly

Prepare these teletypewriter sets for storage as follows:

a. Disconnect the signal and power cords of the teleprinter.

b. Remove the paper roll or fanfold forms from the teleprinter.

c. 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 platen lock.

d. Remove the teleprinter from the table.

287. Repacking for Shipment and Limited Storage

a. If the original packing materials are on hand, use them and reverse the unpacking procedures given in paragraph 14. General repacking information is usually available at depots.

b. The prime requirement is to pack the equipment so as to prevent damage during transit or limited storage. Package the equipment securely and use sufficient wadding to minimize the effects of severe jolting. Make sure that the equipment is protected from rain or snow.

Section II. DEMOLITION OF THE MATERIEL TO PREVENT ENEMY USE

288. General

Demolition of the equipment will be accomplished only upon the order of the commander. The demolition procedures outlined in paragraph 289 will be used to prevent the enemy from using or salvaging the equipment.

289. Destruction of Components

a. Smash. Smash the teleprinter mechanism and all other parts; use sledges, crowbars, axes, handaxes, pickaxes, hammers, or heavy tools.

b. Cut. Cut all cords and wiring; use axes, handaxes, or machetes.

c. Burn. Burn technical manuals, circuit labels, other diagrams, resistors, coils, capacitors, cords, and wiring; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Explode. If explosives are necessary, use firearms, grenades, or TNT.

e. Dispose. Bury, scatter, and destroy parts in slit trenches, foxholes, or throw them in streams.

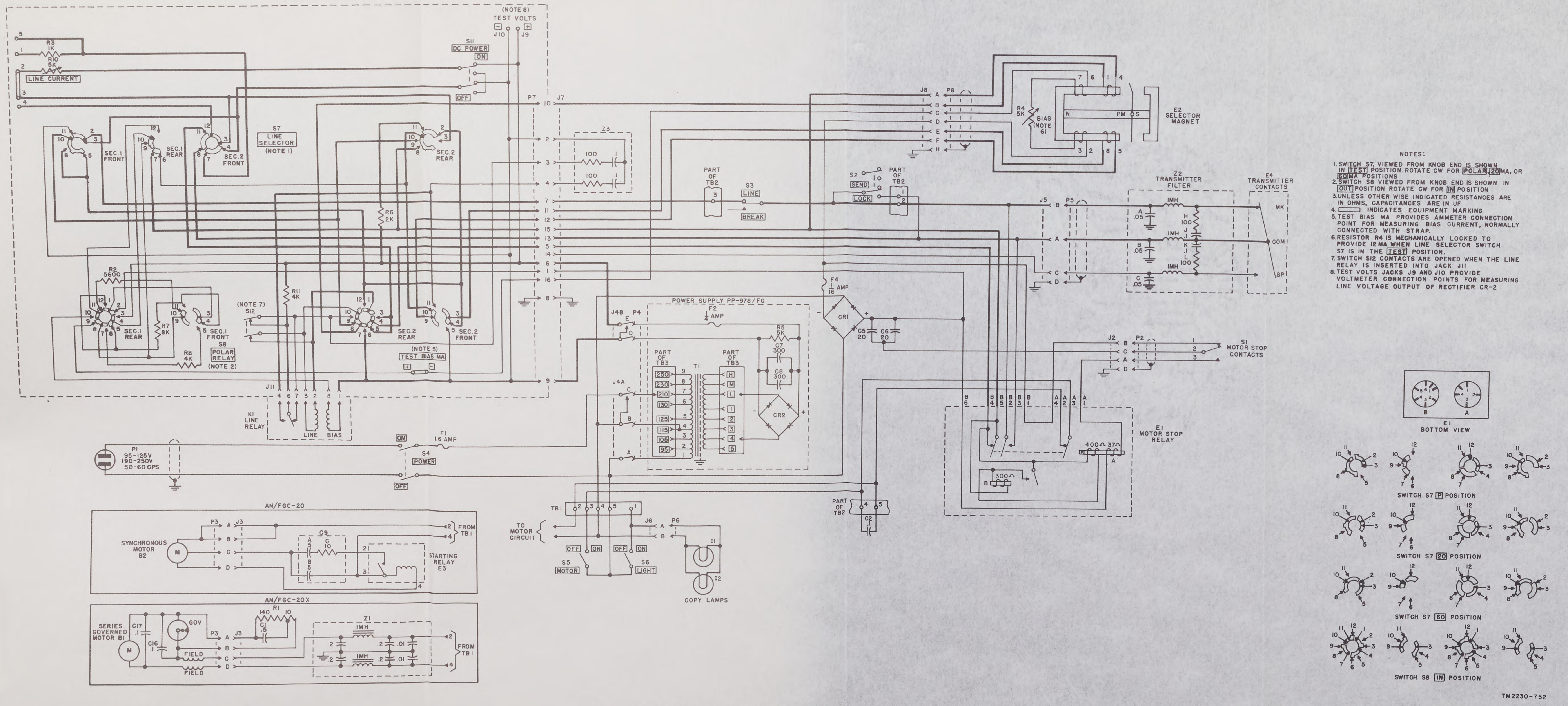
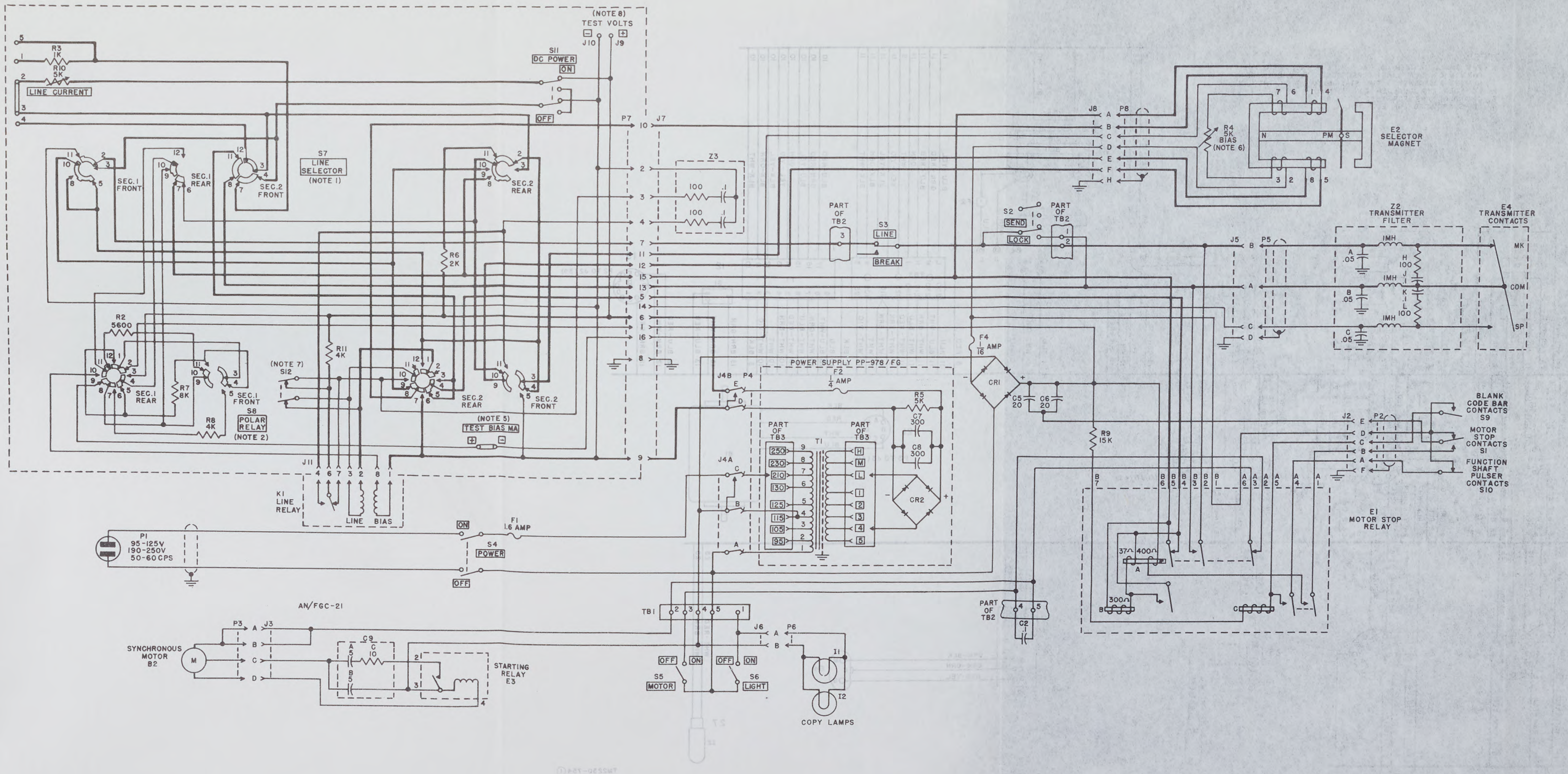


Figure 253. Teletypewriter sets AN/FGC-20 and AN/FGC-20X, schematic diagram.



NOTES:

1. SWITCH S7, VIEWED FROM KNOB END IS SHOWN IN TEST POSITION. ROTATE CW FOR POLAR, 20 MA, OR 60 MA POSITIONS
2. SWITCH S8 VIEWED FROM KNOB END IS SHOWN IN OUT POSITION ROTATE CW FOR IN POSITION
3. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF
4. ☐ INDICATES EQUIPMENT MARKING
5. TEST BIAS MA PROVIDES AMMETER CONNECTION POINT FOR MEASURING BIAS CURRENT, NORMALLY CONNECTED WITH STRAP.
6. RESISTOR R4 IS MECHANICALLY LOCKED TO PROVIDE 12 MA WHEN LINE SELECTOR SWITCH S7 IS IN THE TEST POSITION.
7. SWITCH S12 CONTACTS ARE OPENED WHEN THE LINE RELAY IS INSERTED INTO JACK J11
8. TEST VOLTS JACKS J9 AND J10 PROVIDE VOLTMETER CONNECTION POINTS FOR MEASURING LINE VOLTAGE OUTPUT OF RECTIFIER CR-2

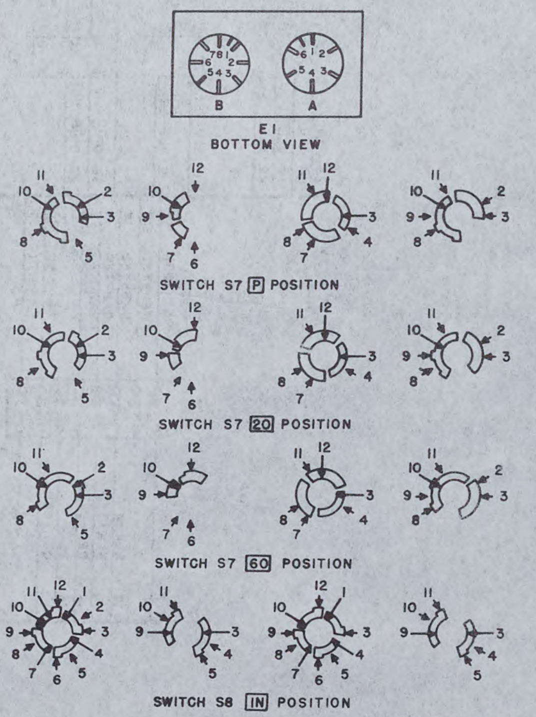


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Figure 254. Teletypewriter set AN/FGC-21, schematic diagram.

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 LINE RUNS.
2. (⊂⊃)— DENOTES SHIELDED CONNECTION.
3. J9 AND J10 ARE FOR TEST VOLTS CR2.
4. J11 IS PROVIDED FOR LINE RELAY EQUIPMENT.

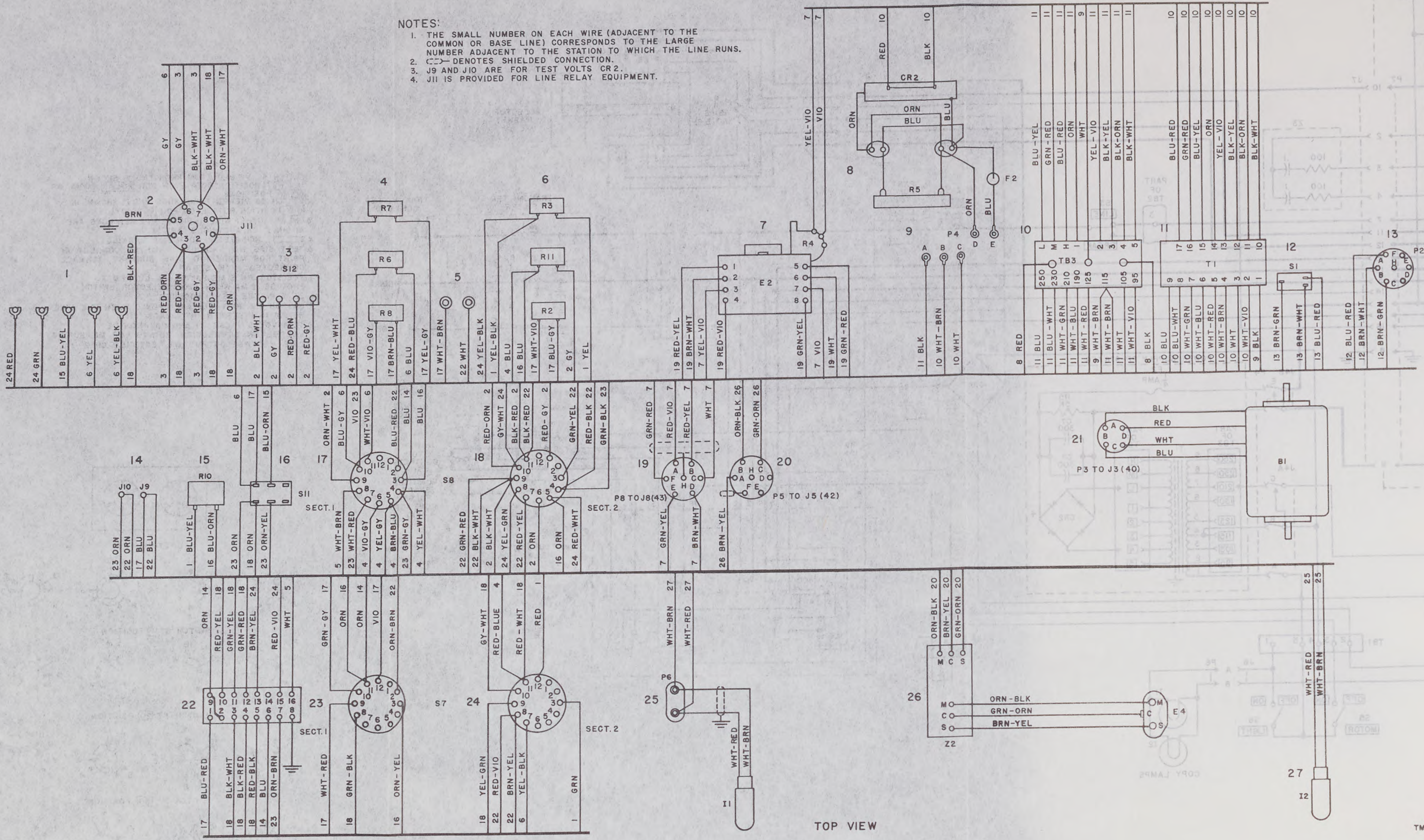

Figure 255. Teletypewriter set AN/FGC-20, airline diagram.

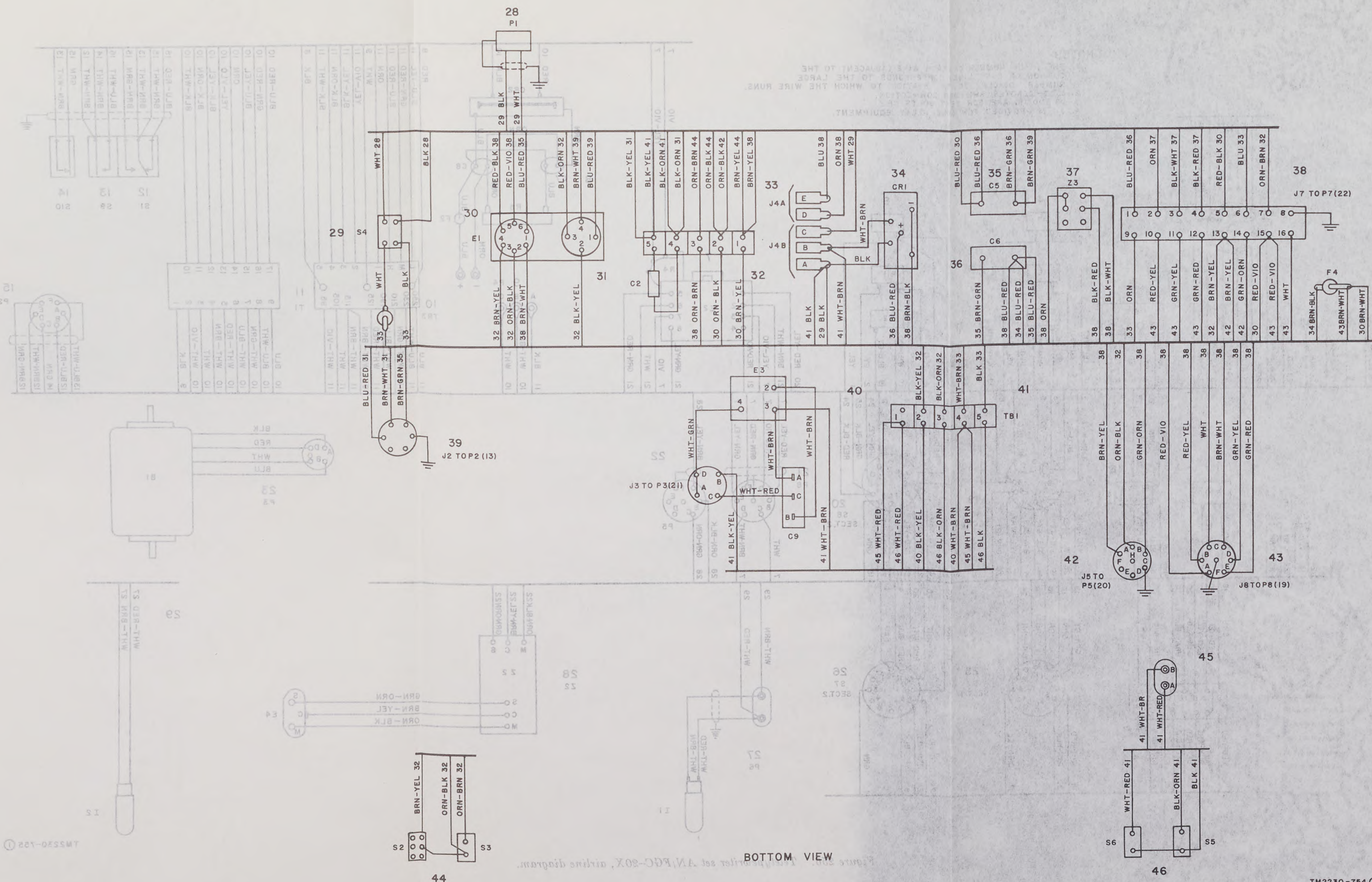

Figure 255.—Continued.

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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. J9 AND J10 ARE FOR TEST VOLTS CR2.
4. J11 IS PROVIDED FOR LINE RELAY EQUIPMENT.

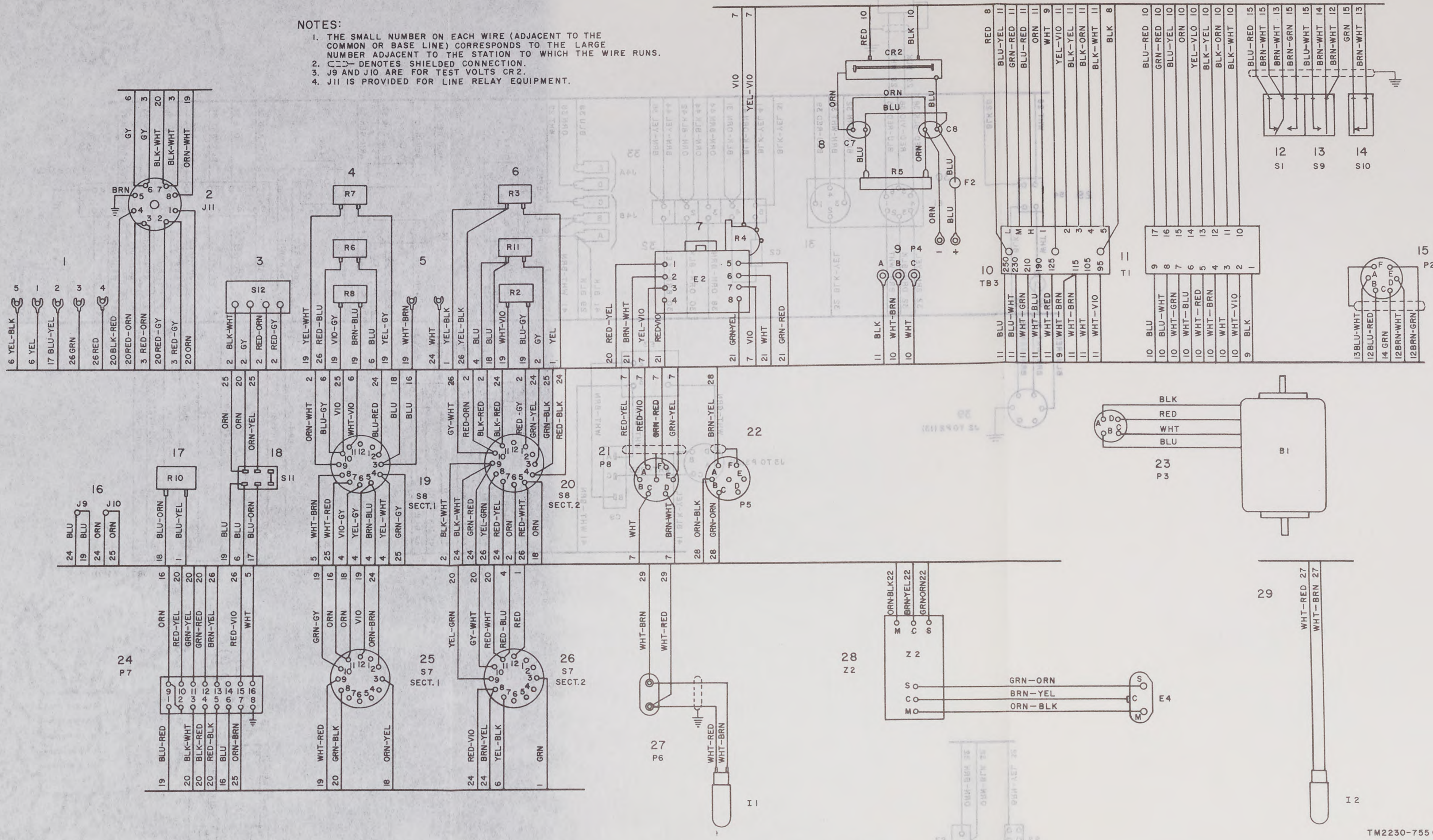

Figure 256. Teletypewriter set AN/FGC-20X, airline diagram.

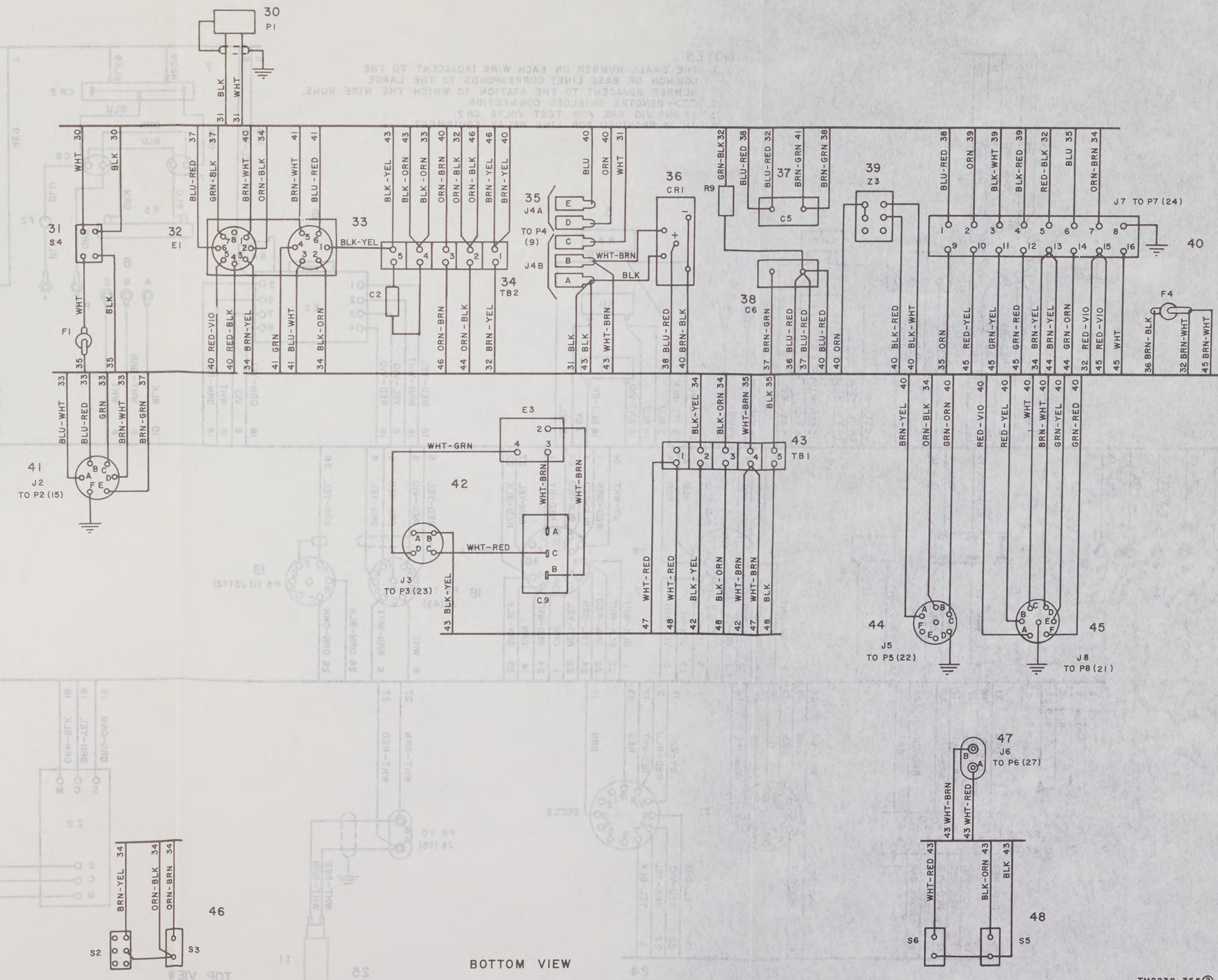

Figure 256.—Continued.

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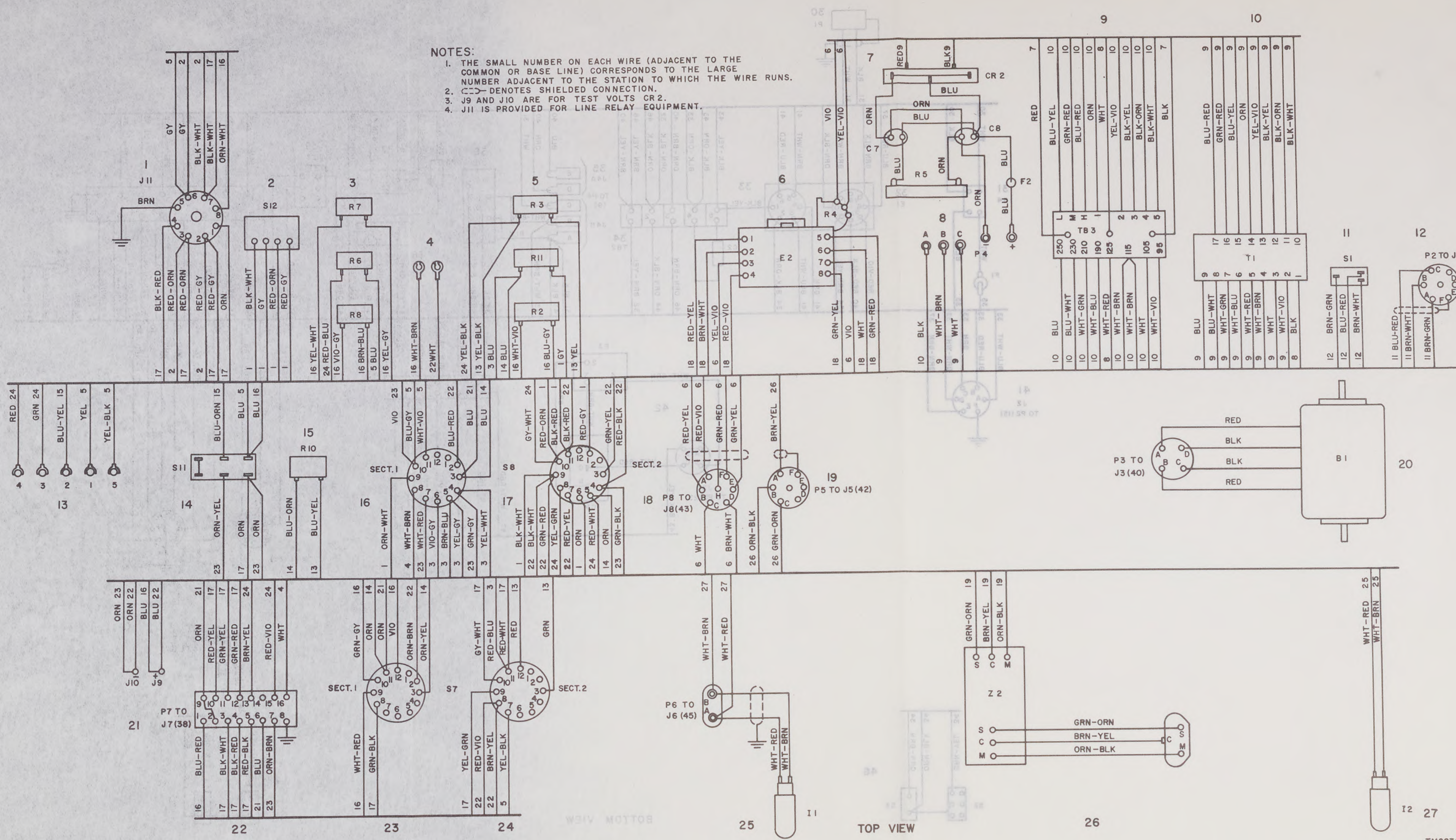

Figure 257. Teletypewriter set AN/FGC–21, airline diagram.

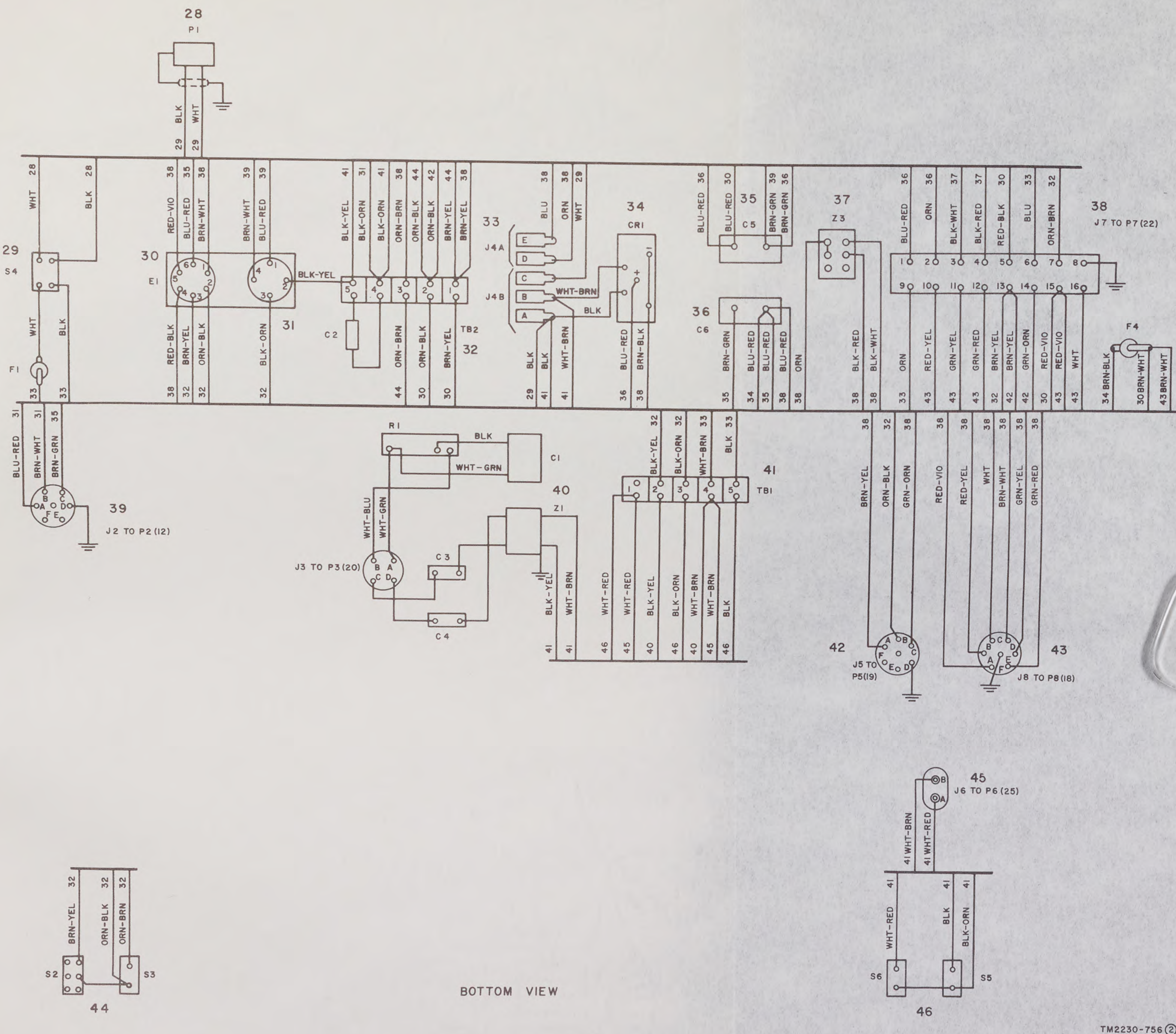

Figure 257.—Continued.

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[AG 413.48 (29 May 56)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
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11–127R, Sig Rep Co (2)
11–128R, Sig Depot Co (2)
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11–587R, Sig Base Maint Co (2)
11–592R, Hq & Hq Co, Sig Base Depot (2)
11–597R, Sig Base Depot Co (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see SR 320–50–1.

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