TM 11-5815-200-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

Direct Support, General Support, And Depot Maintenance Manual
TELETYPEWRITER SETS AN/FGC-20 (NSN 5815-00-503-2652); AN/FGC-20X (NSN 5815-00-392-7743); AN/FGC-21 (NSN 5815-00-503-2653); AN/FGC-66 (NSN 5815-00-817-9277); AN/FGC-159 (NSN 5815-00-041-3382); AN/FGC-159X (NSN 5815-00-561-7964); AN/FGC-160 (NSN 5815-00-025-9036); AN/FGC-177 (NSN 5815-01-017-3780); AN/UGC-4 (NSN 5815-00-557-5970); AN/UGC-29 (NSN 5815-00-082-4199); AN/UGC-29X (NSN 5815-00-082-4200); AND TELEPRINTER TT-259/FG (NSN 5815-00-688-8761).

This copy is a reprint which includes current pages from Changes 1 through 4.

HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1966

WARNING

This equipment contains selenium rectifiers which immediately release poisonous fumes when they burn out. The fumes are very toxic and have a strong, unpleasant odor resembling the smell of rotten eggs. Whenever this odor is detected, IMMEDIATELY disconnect power and thoroughly ventilate the area. Do not handle the burned-out rectifier until it cools. PERMANENT INJURY OR DEATH MAY RESULT FROM PROLONGED BREATHING OF THE FUMES.

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. Serious injury or death may result from contact with these circuits. Turn off the power and discharge all high-voltage capacitors before making any connections or replacing any parts inside the equipment.

DON'T TAKE CHANCES!

TECHNICAL MANUAL
No. 11-5815-200-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 14 *February* 1966

Direct Support, General Support, and Depot Maintenance Manual TELETYPEWRITER SETS AN/FGC-20 (NSN 5815-00-503-2652); AN/FGC-20X (NSN 5815-00-392-7743); AN/FGC-20 (NSN 5815-00-503-2653); AN/FGC-66 (NSN 5815-00-817-9277); AN/FGC-159 (NSN 5815-00-041-3382); AN/FGC-159X (NSN 5815-00-561-7964); AN/FGC-160 (NSN 5815-00-025-9036); AN/FGC-177 (NSN 5815-01-017-3780): AN/UGC-4 (NSN 5815-00-557-5970): AN/UGC-29 (NSN 5815-00-082-4199); AN/UGC-29X (NSN 5815-00-082-4200); AND TELEPRINTER TT-259/FG (NSN 5815-00-688-8761)

NOTE

All references to Teletypewriter Set AN/FGC-64, AN/FGC-67, and AN/FGC-67X in this manual are deleted. The AN/FGC-64 has been classified as obsolete. The AN/FGC-67 and AN/FGC-67X were never type classified and are no longer in the US Army inventory.

*This manual, together with TM 11-5815-200-12, 14 February 1966, supersedes TM 11-5815-200-35, 30 June 1959; including Cl, 11 May 1960; C 2; 30 March 1961; C 3, 18 September 1961; C 4, 5 June 1963, and C5, 15 January 1964.

CHAPTER 1
FUNCTIONING OF EQUIPMENT

Section I. GENERAL

1-1. Scope

a. This manual covers direct support, general support, and depot maintenance information for Teletypewriter Sets AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, AN/UGC-4, AN/UGC-29, AN/UGC-29X, and Teleprinter TT-259/FG. It includes instructions appropriate to support troubleshooting, testing, aligning and repairing procedures for all component parts of the equipment. In addition, it provides a Depot Inspection Standard for the use of depot maintenance personnel to verify the condition of equipment, before its return to the supply system.

b. The complete technical manual for this equipment includes TM 11-5815-200-12 (Organizational Maintenance Manual Teletypewriter Sets AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, AN/UGC-4, AN/UGC-29, AN/UGC-29X, and Teleprinter TT-259/FG). For repair parts and special tools lists see TM 11-5815-200-20P and TM 11-5815-200-34P-Series.

c. Official nomenclature followed by (*) is used to indicate all models of the equipment item covered in this manual. Thus, Teletypewriter TT-664(*)/FG represents Teletypewriter TT-664/FG, TT-664A/FG, TT-664B/FG, and TT-664C/FG.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO'S) pertaining to the equipment.

1-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those described **by** TM 38-750, The Army Maintenance Management System (Army). Air Force personnel will use AFM 66-1 for maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58 /NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

1-3.1 Administrative Storage

Administrative storage of equipment issued to and used by Army activities shall be in accordance with TM 740-90-1.

1-3.2. Destruction of Army Electronics Materiel

Destruction of electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-3.3. Reporting Errors and Recommending Improvements

a. You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

b. For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, section VI, TO 00-5-1. Forward direct to prime LAC/MST.

1-3.4 Reporting Equipment Improvement Recommendations (EIR)

a. Army. If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US

Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. We'll send you a reply.

b. Air Force. Air Force personnel are encouraged to submit EIR's in accordance with AFM 900-4.

Item	Order No. 27133-Phila-56				Order No. 44748-Phila-56		Order Nos. 23425-Phila-57, 13930-Phila-58 and 21897-Phila-60		Order No. 41185-PC-59
	AN/FGC-20X [d]		AN/FGC-20 [c]	AN/FGC-21 [b]	AN/FGC-20X [d]	AN/FGC-20 [c]	AN/FGC-20X [d] AN/UGC-4 [a, e]		TT-259/FG
	TT-98/FG	TT-98A/FG	TT-100/FG	TT-99/FG [b]	TT-98B/FG	TT-100B/FG	TT-98B/FG [a] and TT-98C/FG [f]	TT-100B/FG [g]	
Type of printed symbols.	Standard.	Standard.	Standard.	Weather.	Standard.	Standard.	Standard	Standard.	Standard.
Motor.	Series-governed.	Series-governed.	Synchronous.	Synchronous.	Series-governed.	Synchronous.	Series-governed.	Synchronous.	Synchronous.
Terminal and switch box.	Contains circuitry and components for use with a polar relay.	Does not contain circuitry and components for use with a polar relay.	Same as for TT-98A/FG.	Same as for TT-98A/-FG.	Same as for TT-98A/-FG.	Same as for TT-98A/-FG.	Same as for TT-98A/-FG.	Same as for TT-98A/-FG.	Same as for TT-98A/-FG.
Carriage lock.	A locking arm engages a locking sutd.	Same as for TT-98/FG.	Same as for TT-98/FG.	Same as for TT-98/FG.	A blocking plate engages gear.	Same as for TT-98B/-FG.	Same as for TT-98B/-FG.	Same as for TT-98B/-FG.	Same as for TT-98B/-FG.
Repeat blocking lever.	Nonadjustable.	Nonadjustable.	Nonadjustable.	Nonadjustable.	Nonadjustable.	Nonadjustable.	Adjustable.	Adjustable.	None.
Friction clutch adjusting collars.	Threaded (ID), splitring.	Same as for TT-98/FG.	Same as for TT-98/FG.	Same as for TT-98/FG.	Threaded (ID), splitblock.	Same as for TT-98B/-FG.	Same as for TT-98B/-FG.	Same as for TT-98B/-FG.	Same as for TT-98B/-FG.

[a] Teletypewriter Sets AN/FGC-66 and AN/UGC-4 are identical except that the AN/FGC-66 includes Teletypewriter TT-300/FG instead of the TT-98B/FG. The TT-98B/FG and TT-300/FG are identical except that the TT-300/FG includes a more easily removed type basket (para 1-8).

[b] Teletypewriter Sets AN/FGC-64 and AN/FGC-21 are identical except that the AN-FGC-64 includes Teletypewriter TT-293/FG instead of the TT-99/FG. The TT-99/FG and the TT-293/FG are identical except that the TT-293/FG includes a series-governed motor and its keyboard transmitter transmits 8.00 unit code signals only (start impulse, five code impulses, and two stop impulses; all impulses of equal length). AN/FGC-67 is the same as AN/FGC 64 except standard communication symbols replace the weather symbols. AN/FGC-67X differs from AN/FGC-67 in motor type. Its major component TT-488/UGC uses a series-governed motor. AN/FGC-160 is the same as AN/FGC-67 except low level conversion kit MK-1631/FGC is installed; major component is TT-665/FG.

[c] Teletypewriter Set AN/FGC-159 is the same as AN/FGC-20, except that it contains circuits for low level operation; major

components are: TT-664/FG (TT-100/FG), TT-664A/FG (TT-100B/FG) TT-664B/FG (TT-100C/FG), and TT-664C/FG (TT-100D-FG).

[d] Teletypewriter Set AN/FGC-159X is the same as AN/FGC-159, except that it includes a series-governed motor. Major components of the AN/FGC-159X are: TT-688/FG (TT-98/FG), TT-688A/FG (TT-98A/FG), TT-688B/FG (TT-98B/FG), TT-688C/FG (TT-98C/FG), and TT-688D/FG (TT-98D/FG).

[e] The AN/FGC-177/FG is identical to the AN/UGC-4 except that it contains circuits for low-level operation.

[f] TT-98D/FG is identical to TT-98C/FG except that TT-98D/FG includes improved platen assembly (fig. 2-14 and 2-15).

[g] TT-100C/FG and TT-100D/FG are identical to TT-98C/FG and TT-98D/FG except for motor differences.

Section II. MECHANICAL FUNCTIONS

1-4. General

This section covers the complete mechanical functioning for Teletypewriter Sets AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-66, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, AN/UGC-4, AN/UGC-29, AN/UGC-29X, and Teleprinter TT-259/FG; the information is applicable to all of the teletypewriter sets, unless otherwise indicated.

1-5. Signaling Code
(fig. 1-1)

The signaling code used in teletypewriter communication systems consists of a sequence of marking and spacing impulses. Each code group is composed of five selecting impulses which may be either marking or spacing, depending on the code of the character or function to be transmitted. The five selecting impulses are preceded by a start impulse (spacing) and followed by a stop impulse (marking) to maintain a synchronism between the transmitting and receiving mechanisms. When the five selecting impulses are arranged in all possible combination, they provide 32 different code groups.

1-6. Baud Rate
(fig. 4-13)

a. The term "baud rate" indicates the maximum number of impulses that occur within 1 second when all impulses in a code group are of equal length (7.00- or 8.00-unit code). When *all* impulses in a code group are not the same length (7.42-unit code), the baud rate is based on the shortest impulse of the code group.

b. The baud rate is obtained by dividing 1,000 milliseconds (1 second) by the length (in milliseconds) of shortest impulse of the code group. Thus, if the shortest impulse of a code group is 20 milliseconds, the baud rate is equal to 1,000 divided by 20 and is referred to as a 50-baud rate.

c. The code impulse chart (fig. 4-13) shows the interrelationship between the codes, impulse lengths, and baud rates.

d. Figure 1-2 shows the interrelationship with a 45.5 baud rate interval applied to the code group for the letter Y in 7.42 unit code ap-

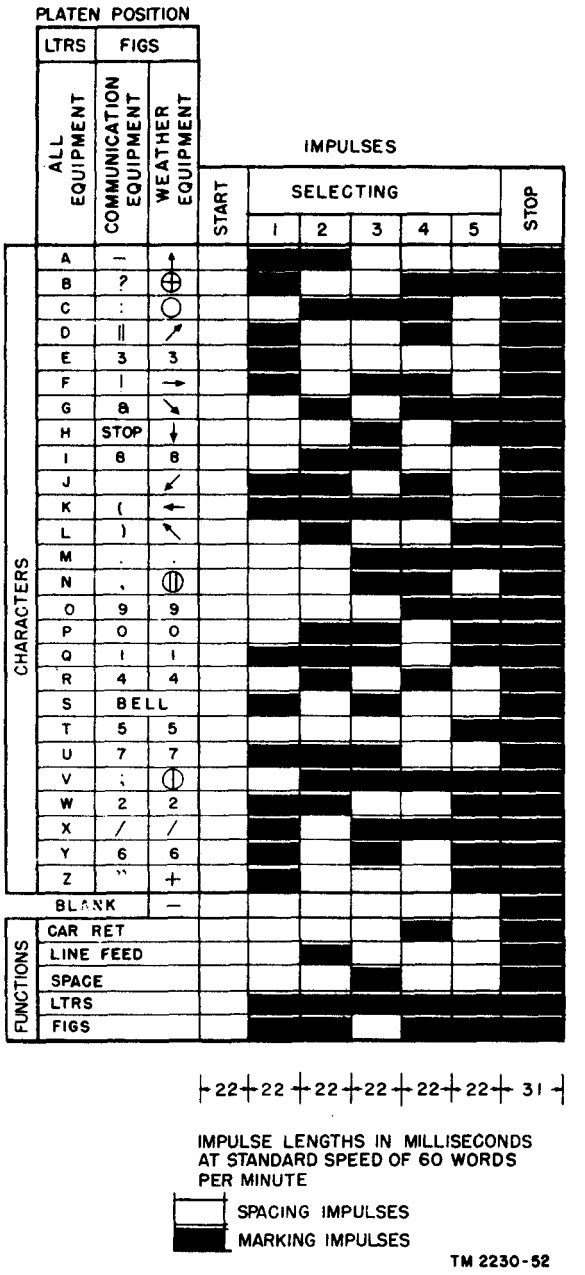


Figure 1-1. Standard start-stop five-unit code chart.

1-7. Teletypewriter Set Block Diagram (fig. 1-3 or 1-3.1 (TT-664(*)/FG, TT-665/FG and TT-688(*)/FG))

a. Sending (not applicable to TT. 259/FG). When a keylever is depressed, a train of parts within the transmitter mechanism is positioned so that the mechanical arrangement of these parts will represent the five unit code group for the character or function assigned to that particular keylever. Depressing the keylever also causes an intermediate shaft assembly to operate the transmitter contacts which send electrical code impulses to the selector mechanism and to the signal line. (In the TT-664(*)/FG, TT-665/FG and TT-688(*)/FG, the transmitter contacts generate a low level electrical signal code which is sent to the low level conversion circuitry and then to the send line.)

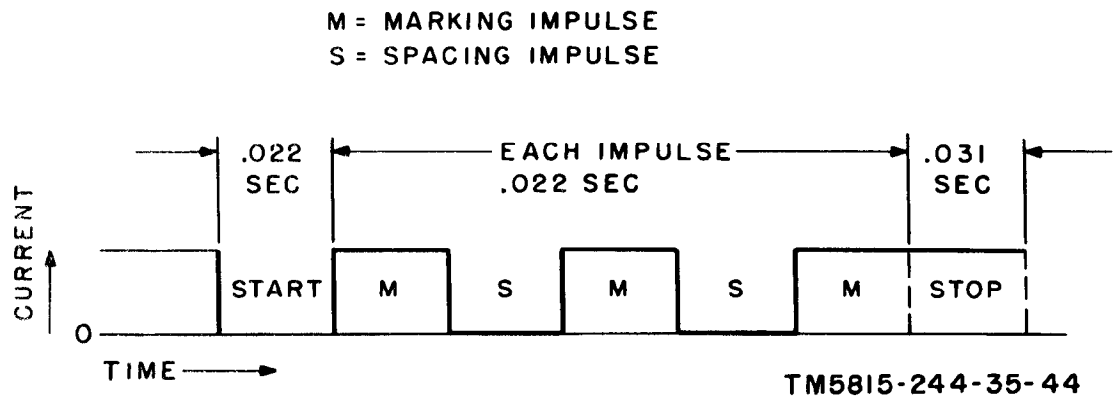


Figure 1-2. Neutral signals for letter Y at 60 wpm (7.42 unit code).

b. Receiving. Electrical code impulses from the signal line are received by the selector mechanism. (In the TT-664(*)/FG, TT-665/FG and TT-688(*)/FG, the electrical code impulses from the signal line are applied first to the low level conversion circuitry and then to the selector mechanism). The selector mechanism converts the electrical code impulses into a mechanical arrangement that corresponds to the received code group. This mechanical setting is then transferred to the code ring mechanism which determines the character to be printed or the function (para 1-28) to be performed. The main shaft and the intermediate shaft assemblies are driven by the ac motor. The shafts, in turn, provide the mechanical power to perform the printing or functional operation selected by the code ring mechanism.

c. Ac Power. Any 50 to 60 cycle power source from 95 to 250 volts may be furnished to the power supply. The power supply output is adjustable to provide 115 volts for the ac motor and copy lamp circuits.

NOTE

TT-259/FG does not include the key lever, transmitter-mechanism, transmitter contacts, and power supply.

1-8. Changing Type Basket of Teletypewriter TT-300/FG

a. Remove the inking ribbon from the ribbon guide.

b. Remove the two screws (1) (fig. 2-36) and lockwashers (2) and remove the ribbon feed mechanism from the carriage frame.

c. Loosen the screws (3) and lift the type basket upwad and outward from the carriage frame.

d. Install the alternate type basket by reversing the procedure described in *a* through c above.

1-9. Motors

The sending and receiving mechanisms are powered by an electrical motor located on the right side of the teletypewriter. The TT-98/FG, TT-98A/FG, TT-98B/FG, TT-98C/FG,

TT-293/FG, TT-300/FG, TT-483/FG, and TT-688(*)/FG are powered by series-governed motors and TT-99/FG, TT-100/FG, TT-100B/FG, TT-259/FG, TT-482/FG, TT-664(*)/FG, and TT-665/FG are powered by synchronous motors.

a. *Series-Governed Motor.* The series governed motor required 105- to 125-volt, 50 to 60 cycle ac for operation. The motor develops a speed which is regulated for 3,600 revolutions per minute (rpm) by a mechanical governor assembly, (para 1-10) mounted on the motor aramture shaft. The motor armature rotates clockwise when viewed from the target wheel end.

b. Synchronous Motor. The synchronous motor requires single phase, 105- to 125-volt, regulated 60 cycle ac for operation. This is a constant speed motor which develops 3,600 rpm. A squirrel cage type armature and a stator, consisting of a start winding and a main run winding, develop the torque required to start the motor and to keep it operating at the proper speed. The armature rotates clockwise when viewed from the end opposite the worm gear.

1-10. Motor Governor Assembly, Series Governed Motor (figs. 1-4 and 1-5)

The motor governor assembly permits the motor speed to be maintained at 3,600 rpm. The assembly is mounted on the motor armature shaft and rotates with it. The speed of the motor is adjusted by pulling or pushing the governor worm shaft while the motor is running. The constant speed is maintained by the vibrating action of the governor contacts (para 1-46c) that are controlled by the tension of the coil spring. As the contacts open, additional resistance is placed in series with the motor circuit. When the contacts close, full current flow is resumed.

a. When the governor worm shaft is pulled outward, the left -hand worm engages the motor speed adjustment gear and causes that gear to rotate. As the motor speed adjustment gear turns on the threads of the governor adjustment screw, the governor adjustment lever moves to the right and decreases the tension on the coil spring. When the tension of the coil spring is reduced, less centrifugal force is required to shift the movable electrical contact away from the stationary electrical contact.

b. When the governor worm shaft, is pushed inward, the right -hand worm engages and the reverse action takes place to increase the tension of the coil spring. An increase of tension on the coil spring causes the contacts to remain closed until a high centrifugal force is attained.

1-11. Main Shaft and Power Distribution (fig. 1-6)

Motion is distributed to the various mechanisms of the teletypwriter through the gears on the main shaft. The main shaft speed is determined by the drive gear set that is used to adapt the 3,600 rpm motor speed to the required speed of operation. This drive gear set consists of a movable worm at the end of the motor armature shaft and its mating fiber worm gear at the end of the main shaft. The teletypewriter is initially equipped with a drive gear set that provides 60-word-per-minute operation. However, the teletypewriter can be modified for operation at other speeds by the substitution of the appropriate drive gear set. The main shaft rotates constantly when the teletypewriter is in operation and transfers mechanical power through the various gears and clutches to the entire assembly. The speeds of rotation for the various parts shown in figure 1-6 are for 60-wpm operation. When other drive gear sets are used, the speeds of the shafts are propor-

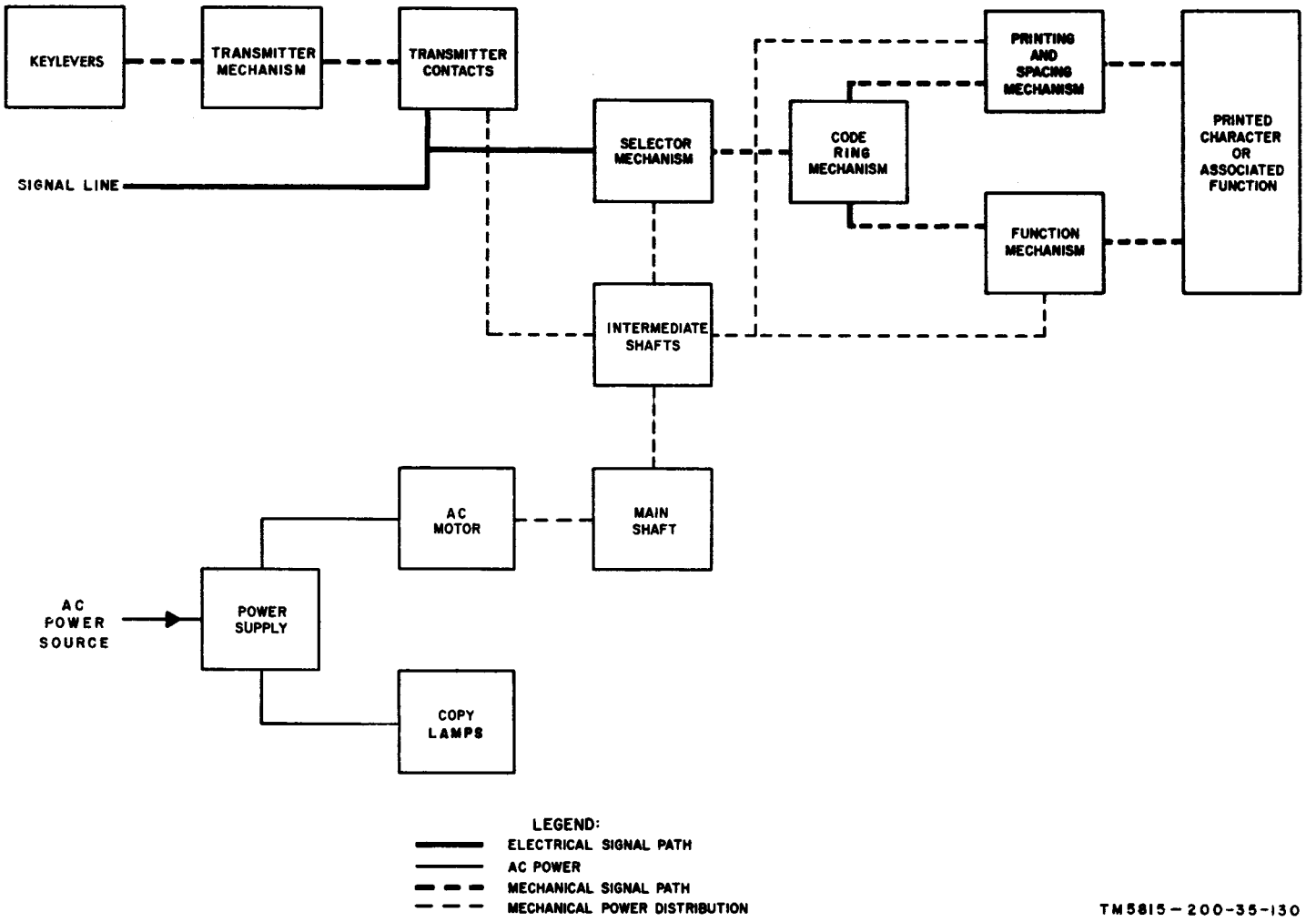


Figure 1-3. Teletypewriter set, block diagram. (Not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG.)

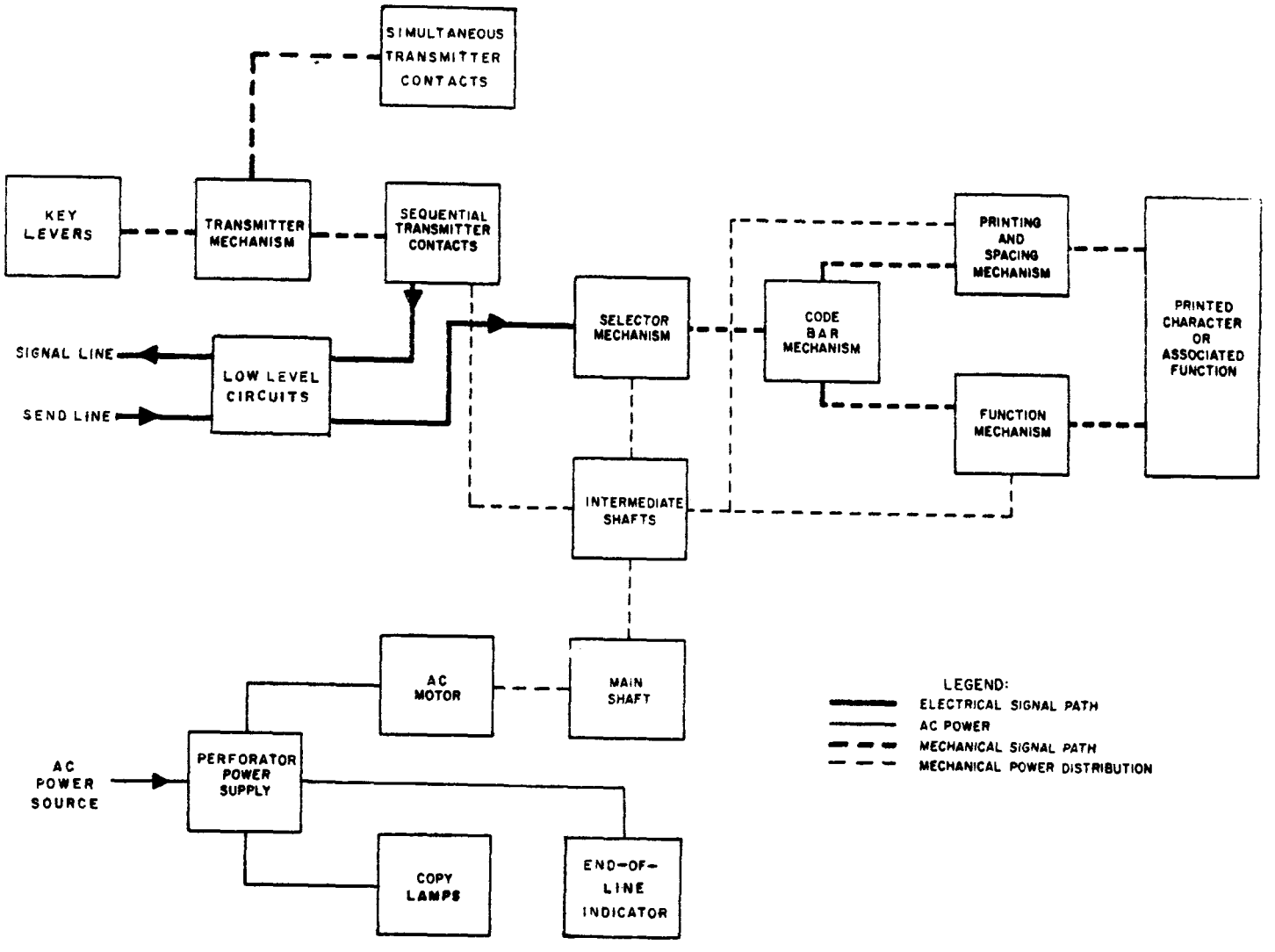


Figure 1-3.1. Teletypewriter set, block diagram (TT-664(*)/FG, TT-655/FG, and TT-688(*)/FG).

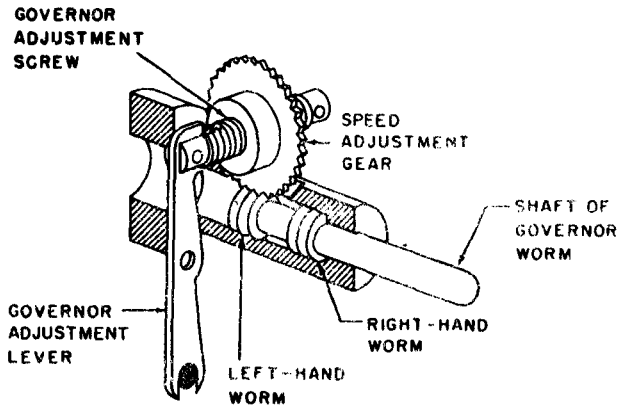


Figure 1-4. Cutaway view of governor worm shaft mechanism.

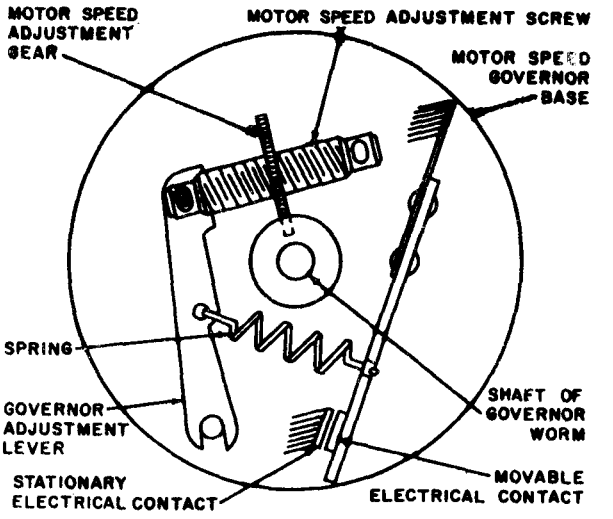


Figure 1-5. Motor governor assembly.

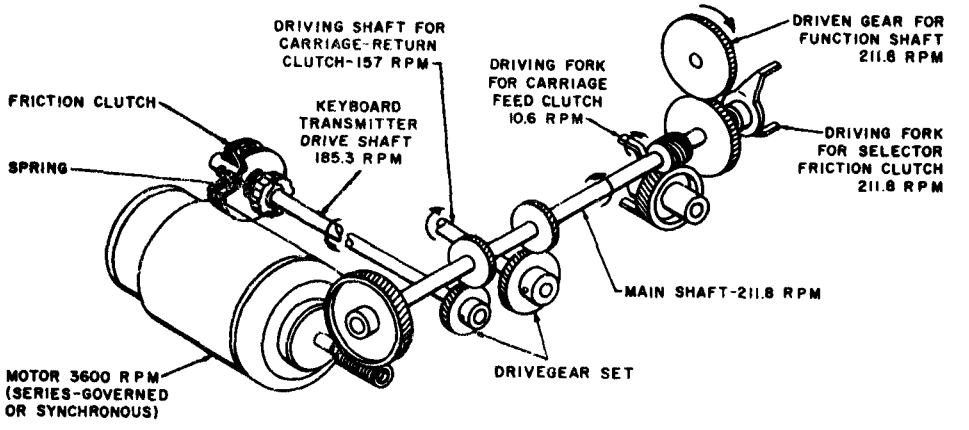


Figure 1-6. Mechanical power distribution with 60 wpm drive gear set.

tionately higher although the motor speed remains constant.

1-12. Friction Clutches

(fig. 1-7)

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

a. Transmitter Camshaft Friction Clutch (not applicable to TT-259/FG) (A, fig, 1-7). The clutch fork of the transmitter camshaft engages notches on the clutch driver plate. Two felt friction plates on the transmitter drive shaft are held against the clutch driver plate by spring pressure. This spring pressure can be increased or decreased by moving the friction adjusting collar, thus increasing or decreasing the torque transmitted through the clutch. The clutch driver plate has projections on each side which engage holes in the felt friction plates. This causes the clutch driver plate and the felt friction plates to rotate in unison. Friction between the clutch disks and the friction plates is sufficient to rotate the transmitter camshaft under its normal workload. When the travel of the transmitter camshaft is blocked (when the cam stop level is engaged (para 1-13), the friction drive is overcome and slippage occurs between the felt friction plates and the clutch disks. This allows the transmitter camshaft, the clutch driver plate, and the felt plates to stop, but maintains a constant torque at the clutch disks which immediately resume rotation when the blocking member is removed

b. Selector Camshaft and Carriage-Feed Shaft Friction Clutches (B, fig. 1-7). The design of the selector camshaft and the carriage feed shaft friction lcutches is identical with the transmitter camshaft friction clutch but the operation is reversed. The clutch fork becomes the driving member and the clutch driver plate and the felt friction plates rotate constantly with the clutch work. When the motion of the driven shaft (selector camshaft illustrated) is blocked, slippage occurs between the felt friction plates and the clutch disks. When the blocking member is removed, the driven shaft will turn immediately.

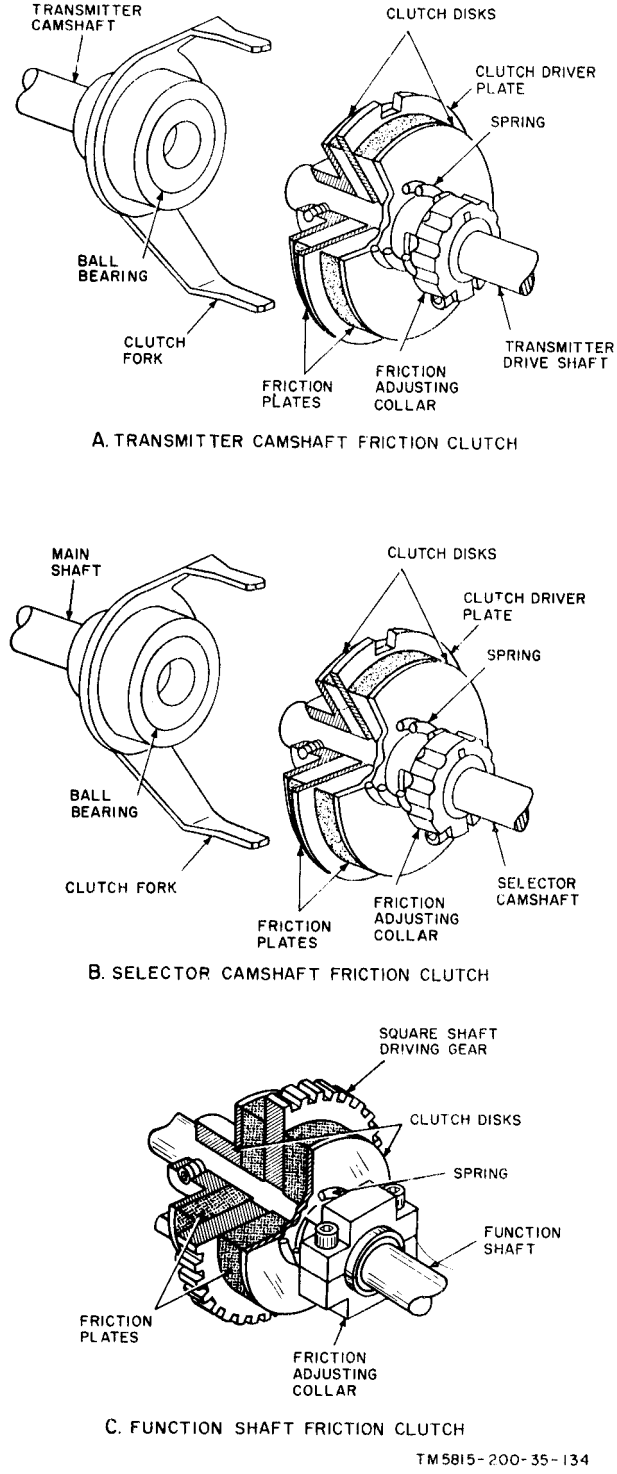


Figure 1-7. Friction clutches.

c. Function Shaft Friction Clutch (C. fig. 1-7). The design of the function shaft friction clutch, which powers the square shaft, is different from those previously described but the principle of operation is similar. When the function shaft turns, a friction torque is applied to the square shaft driving gear which (in operation) is meshed with the square shaft driven gear. Wherever the square shaft stop arm is free to turn, the square shaft driving gear and the friction plates rotate with the function shaft. When the square shaft stop arm is blocked in its rotation, the square shaft gear remains stationary and slippage occurs at the clutch as the function shaft continues to rotate.

1-13. Keyboard-Transmitter, General

Note. Information in paragraphs 1-13 through 1-18 is not applicable to TT-259 FG.

The keyboard-transmitter (fig. 1-8) may conveniently be subdivided into a code selecting mechanism (fig. 1-9), a code transmitting mechanism (fig. 1-10), and a transmitter camshaft control mechanism (fig. 1-11) for analysis. The code selecting mechanism converts the downward movement of a keylever into mechanical settings which determine the code to be transmitted. The code transmitting mechanism converts these mechanical settinge into an electrical code group. The transmitter camshaft control mechanism provides the control of the transmitter camshaft friction clutch.

a. *Code Selecting Mechanism.* This mechanism consists of 32 keylevers, 5 code bars, and 5 sensing levers.

b. Code Transmitting Mechanism. This mechanism consists of a pair of transmitting contacts, a set of six selector levers, a transmitter camshaft, and its associated clutch fork.

c. Transmitter Camshaft Control Mechanism. This mechanism consists of the keylevers, a universal bar, a locking lever latch, a cam stop lever, and a repeat blocking lever.

1-14. Code Selecting Mechanism

As a keylever. (or the space bar) is depressed, it strikes five code bare that extend across the width of the keyboard. Each of the code bars (fig. 1-9) is slanted in one of two ways at the point where it is engaged by each of the keylevers; thus, the depression of a keylever results in each of the code bare moving either to the right or to the left on their bearings. If the keylever for the letter Y is depressed, the first, third, and fifth code bars are slanted to move to the right (A, fig. 1-10) and the second and fourth code bare are slanted to move to the left (B, fig. 1-10). This mechanical setting of code bare corresponds to the code for the letter Y (fig. l-l) which is to be sent to the signal line. As the code bare are positioned, each code bar moves its associated sensing lever, which is engaged in a notch at the right side of the code bar. A code bar moved to the right (marking) pivots its sensing lever counterclockwise into engagement with its associated selector lever. A code bar moved to the left (spacing) pivots its sensing lever clockwise and out of engagement with its associated selector lever.

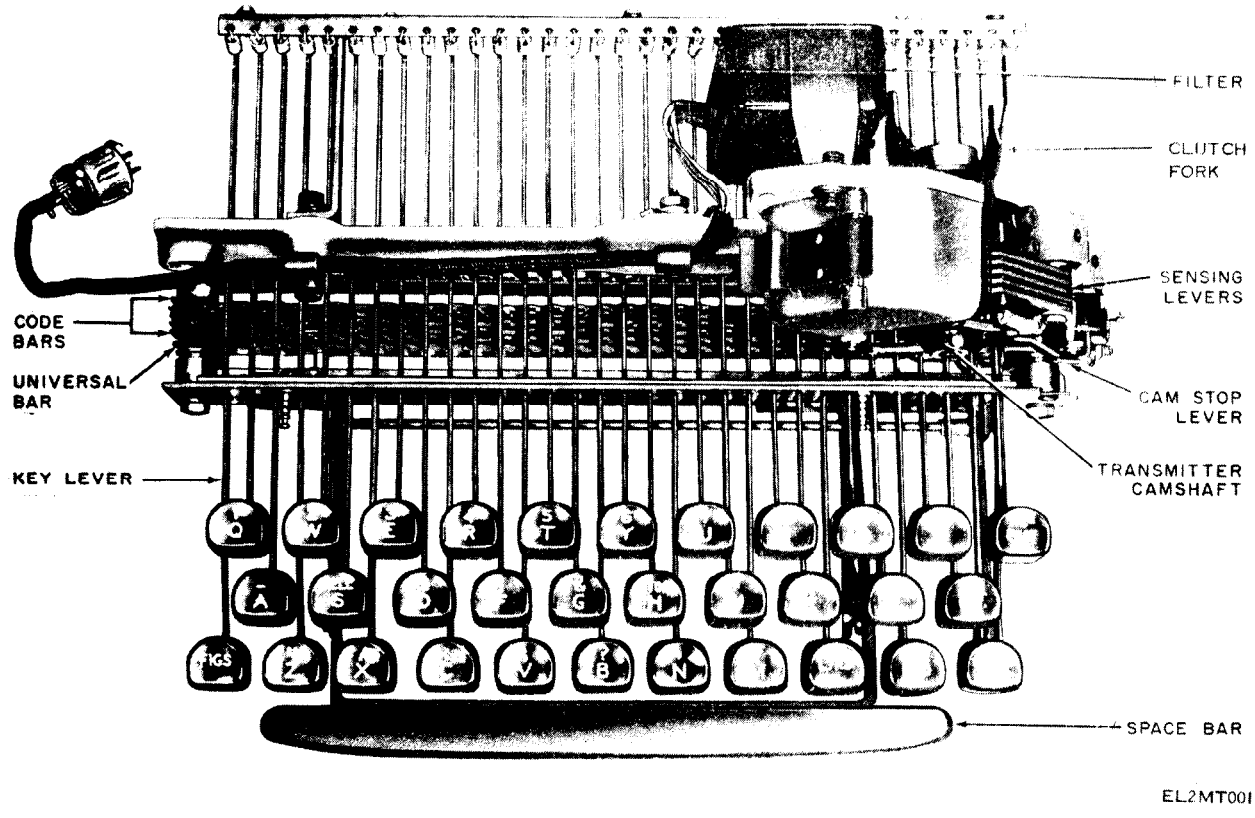


Figure 1-8. Keyboard-transmitter parts.

1-15. Code Transmitting Mechanism

TT-665/FG, and TT-688(*)/FG))

NOTE

Subparagraphs *a.1* and *b.1* below instead of *a* and *b* below are applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG.

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

a.1. The transmitting contact assembly (fig. 1-10.1) consists of a reed switch, permanent magnet, and field interrupter on a transmitter base, which mounts directly over the contact bail. The movement of the contact bail activates the field interupter which passes and inhibits the magnetic field of the permanent magnet. The uninhabited magnetic field closes the contacts of the reed switch for a marking impulse and the inhibited magnetic field allows the contacts to open for a spacing impulse.

b. Each of the six selector levers beneath the contact, bail is operated by its own cam. The cams are distributed in a 180° arc around the transmitter camshaft and, as the camshaft turns (para 1-6), each selector lever is operated in a sequence. If a cam strikes the projection on a selector lever that, is latched by a sensing lever, the lower end of the selector lever is forced upward and the contact bail is moved clockwise to close the transmitting contacts. If the selector lever is not latched, the cam raises the opposite end of the selector lever; the selector lever spring holds the selector lever firmly on

the bearing shoe as the selector lever pivots. The pull of the contact bail spring then exerts pressure to open the contacts.

b.1. Each of the six selector levers beneath the contact bail is operated by its own cam. The cams we distributed in a 180° arc around the transmitter camshaft and, as the camshaft turns (para 1-6), each selector lever is operated in a sequence. If a cam strikes the projection on a selector lever that is latched by a sensing lever, the lower end of the selector lever is forced upward and the contact bail is moved clockwise to close the transmitting contacts. If the selector lever is not latched, the cam raises the opposite end of the selector lever the selector lever spring holds the selector lever firmly on the bearing shoe as the selector lever pivots. The pull of the lifter spring then exerts pressure to open the transmitter contacts. The field interrupter tension spring reduces the field interrupter bounce.

c. The five selector levers involved in the transmission of the five selecting impulses (fig. 1-1) are controlled, in each cycle of operation, by their associated sensing levers. The sixth selector lever is permanently latched to provide a stop (marking) impulse in the normal stopped position of the transmitter camshaft. The absence of a cam in the area which would normally be effective at the start of the transmitter camshafts motion provides the start (spacing) impulse. Therefore, seven impulses are sent during each 1/2 revolution of the transmitter camshaft: a start impulse, five selecting impulses, and a stop impulse.

1-16. Transmitter Camshaft Control Mechanism

a. The transmitter camshaft is normally held in the stopped position by the camstop lever (B, fig. 1-10). When any keylever (or the space bar) is depressed, the universal bar is

moved to the right. As the universal bar moves, the upper end of the locking lever latch moves to the left and allows the right arm of the cam stop lever to move downward between the locking lever latch and the repeat blocking lever under pressure of the spring. The clockwise movement of the cam stop lev causes the blocking extension (vertical arm) of the cam stop lever to move toward the right, out of engagement with the stop tooth of the transmitter camshaft. This permits the friction clutch to turn the transmitter camshaft.

b. The transmitter camshaft is normally stopped at the end of 1/2 of a complete revolution by the cam stop lever. As the camshaft turns, the left extension of the cam stop lever is caromed downward and it restores the vertical arm of the cam stop lever to the blocking position. The cam stop lever is then held in this position by the repeat blocking lever. When the keylever is released, the universal bar is moved to the left by its spring. The locking lever is moved to the right by its spring and it moves the repeat blocking lever with it. This causes the right extension of the camstop lever to come to rest on the top of the locking lever latch. A more rapid release of the keylever causes the cam stop lever to come to rest on top of the locking lever latch directly, without contacting the repeat blocking lever.

c. The transmitter camshaft rotates constantly when the repeat keylever is depressed at the same time as another keylever. As the repeat keylever (fig. 1-12) moves downward, it strikes the lower extension of the repeat lever and pivots it counterclockwise. 'I'he repeat lever upper extension strikes the repeat blocking lever and pivots it clockwise, out of the path of the right extension of the cam stop lever (fig. 1–11). At the same time, the depression of the associated keylever causes the universal bar to move to the right and pivot the locking lever latch counterclockwise. In each cycle of operation, the restoring cam on the transmitter camshaft strikes the cam stop lever and moves it counterclockwise. As the restoring cam moves past the lever and there is nothing to block the clockwise (downward) movement of the right extension of the cam stop lever, the vertical

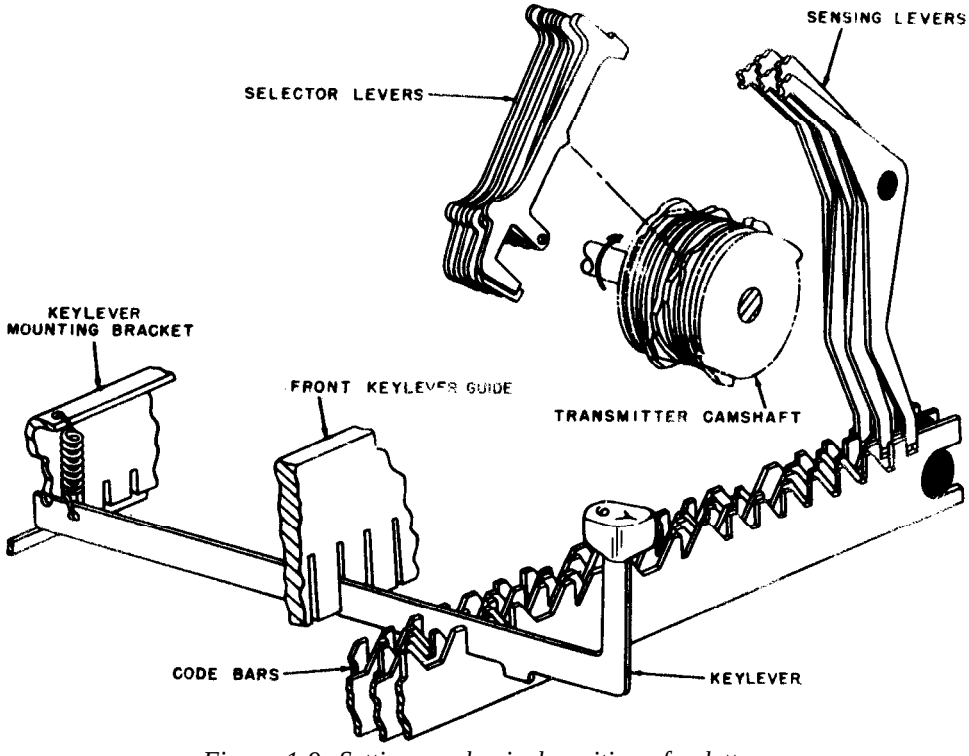


Figure 1-9. Setting mechanical positions for letter

(blocking) extension moves out of the path of the stop tooth of the transmitter camshaft. The transmitter camshaft rotates without interruption and the code group selected by the depression of the keylever is repeated to the signal line until the repeat keylever is released.

1-17. Sensing Lever Locking Bail

As the transmitter camshaft begins each cycle of operation, the sensing lever locking bail (fig. 1-11) moves slightly clockwise (under spring pressure) off the high portion of its associated cam on the camshaft and locks the sensing levers (fig. 1-9) in place during the transmission of the selected code group. During the time the sensing levers are locked in place, no other keylever can be fully depressed and the transmission of the previously selected code group cannot be affected either by the typing speed of the operator or the accidental depression of another keylever. At the completion of the cycle, the opposite high portion of the cam raises the sensing lever locking bail out of engagement with the sensing levers to permit the selection of another keylever and the transmission of another code group.

1-18. Keyboard-Transmitter Sequence Chart

NOTE

The operation of keyboard-transmitter subassemblies have been isolated in paragraphs 1-13 through 1-17 for simplicity of presentation. In actual operation, the operations are interrelated and the sequence of operation is presented in the chart below:

Keyboard Transmitter Sequence Chart

Keylever or space bar pressed.

Keylever or space bar strikes slanted groove of universal bar camming the universal bar to the right (fig. 1-11).

Keylever or space bar strikes slanted grooves of the five code bars camming them individually to the right or left according to code (fig. 1-9).

Universal bar strikes adjusting screw pivoting locking lever latch counterclockwise (fig. 1-11).

Code bars turn the five sensing levers individually counterclockwise or clockwise (fig. 1-10).

Repeat blocking lever on locking lever latch strikes the cam stop lever and is pivoted clockwise, causing a slot between the repeat blocking lever and locking lever latch. Cam stop lever dropped between locking lever latch and repeat blocking lever to permit rotation of the transmitter camshaft.

Transmitter camshaft released by the cam stop lever starts revolving as friction clutch operates.

Sensing lever locking bail pivoted counterclockwise by the sensing lever locking bail spring as the locking bail moves off the high point of the locking bail cam locking the five sensing levers. (Keylever may be released at any time hereafter.) (Fig. 1-11.)

6 No. 6 selector lever (permanently latched) drops off cam to permit the selector lever to pivot counterclockwise, moving away from the transmitter contact.

7 Contact bail spring (or pushrod lifter spring of TT-664(*)/FG, TT-665(FG, and TT-688(*)/FG) turns transmitter contact bail counterclockwise opening contacts.

8 Start (no current) impulse sent.

9 First 5-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 bail clockwise; if not latched by sensing lever, contact bail spring (or pushrod lifter spring of TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG) turns transmitter contact bail counterclockwise (fig. 1-1 0).

11 Mark impulse or space impulse sent, depending on whether transmitter contact bail 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 lever raises No. 6 selector lever (permanently latched).

16 Lower end of No. 6 selector lever turns transmitter contact bail clockwise, closing contacts.

17 Stop (current) impulse sent.

18 Tooth on transmitter camshaft strikes cam stop lever and transmitter camshaft stops revolving (having completed a one-half revolution).

19 Keylever releases before above sequence can be repeated for any other or the same keylever to allow locking lever latch to return under cam stop lever.

1-19. Selector Magnet (Except TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG)

a. Description. The selector magnet (A, fig. 1-13) consists of a permanent bar magnet, an armature, and two windings wound around each arm of a U-shaped silicon-steel core (B, fig. 1-13). The armature is pivoted at its center and is mounted over the open end of the U-shaped core. It is magnetically balanced with respect to either arm of the core. The line windings are in series with the signal line and the code impulses pass through these windings. The bias windings are supplied with local battery. The circuitry is described in detail in paragraph *60b.*

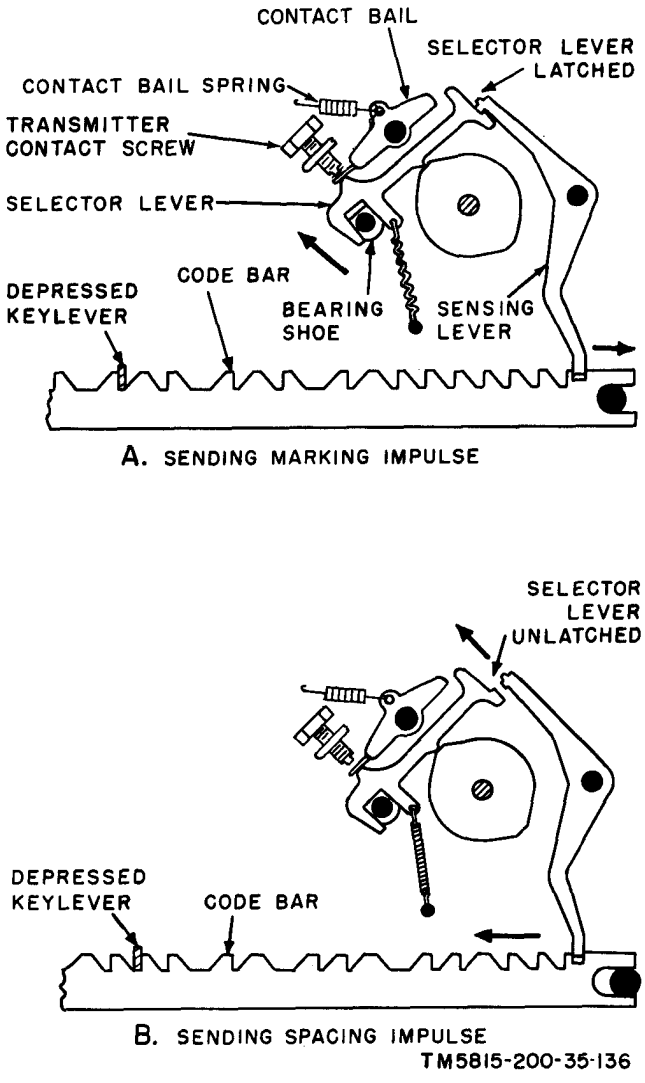


Figure 1-10. Operation of code transmitting mechanism (not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

b. Operation. When a marking impulse is received, current flows in the line windings and the armature is attracted to the right core (A, fig. 1-13). When a spacing impulse is received, there is no current flow in the line windings and the armature is moved to the left core (A, fig. 1-13) under control of the bias windings. The resultant motions of the armature from the reception of seven impulses in sequence (a complete code group) are used to control the rotation of the selector camshaft and to position five selector Y-levers (para 1-21).

NOTE

The blade on the armature is sufficiently wide to engage the top plate and the five selector levers.

1.19.1. Selector Magnet (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG)

a. Description. The selector magnet (A, fig. 1-13) consists of a permanent bar magnet, an armature, and one winding wound around each arm of a U-shaped silicon-steel core (C, fig. 1-13). The armature is pivoted at its center and is mounted over the open end of the U-shaped core. It is magnetically balanced with respect to either arm of the core. The line windings are connected in series with the output circuit of the selector magnet driver board, which in turn is controlled by the code impulses. The circuitry is described in detail in section V.

b. Operation. When a marking impulse is received, current flows in the line windings and the armature is attracted to the right core (A, fig. 1-13). When a spacing impulse is received, the current flows in the opposite direction and the armature is moved to the left core (A, fig. 1-13). The resultant motions of the armature from the reception of seven impulses in sequence (a complete code group) are used to

Figure 1-10.1. Deleted.

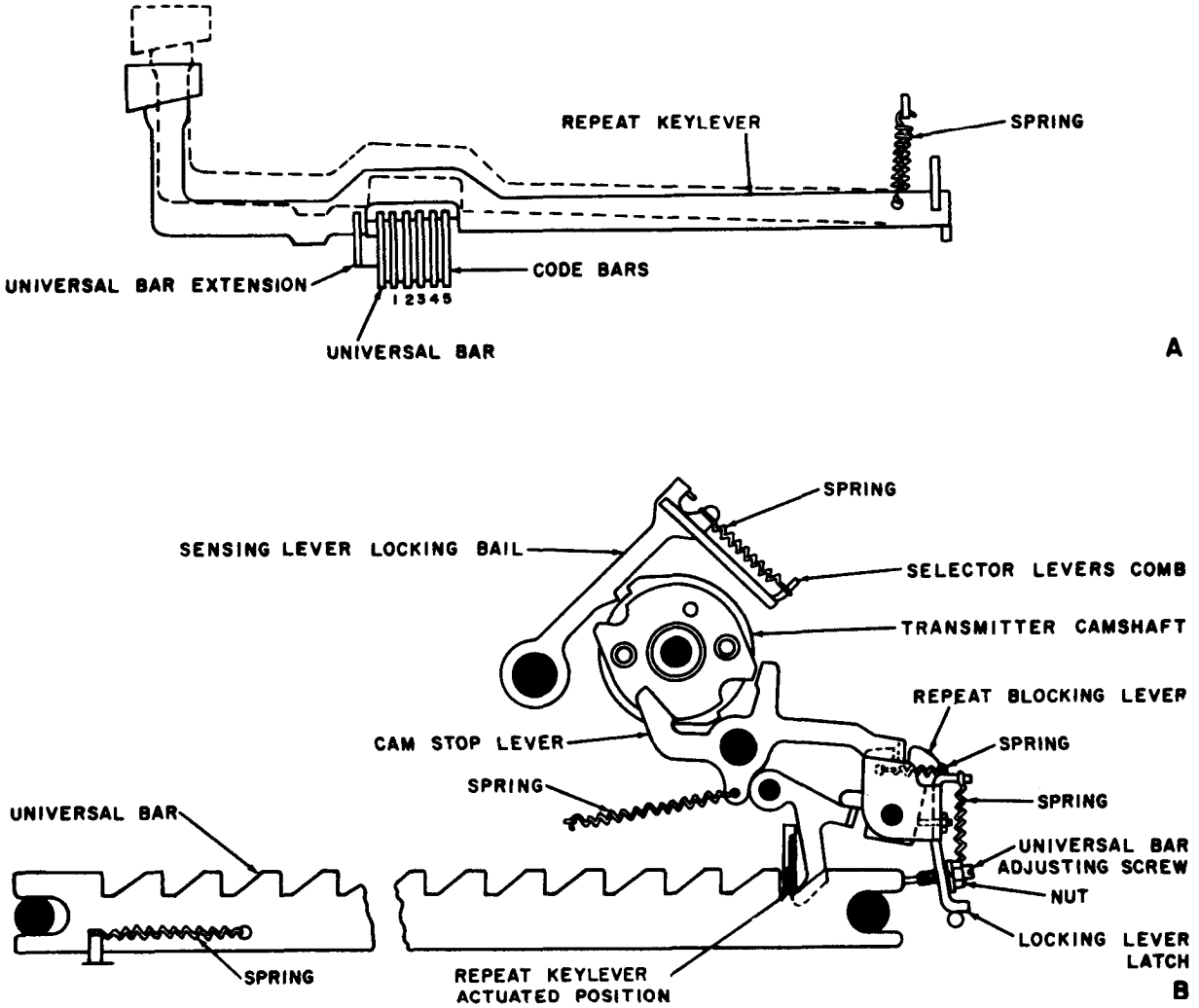
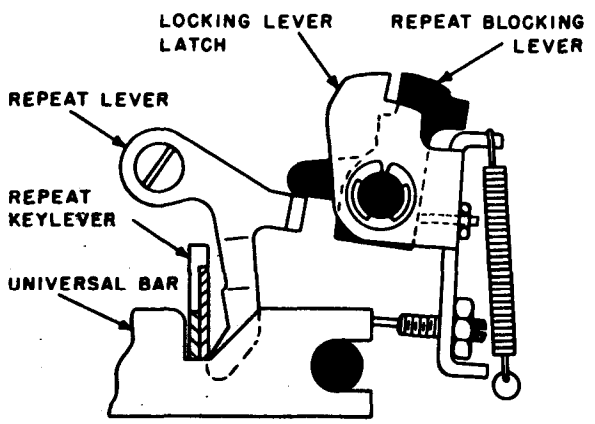


Figure 1-11. Transmitter camshaft control mechanism.



,Figure 1-12. Repeat keylever mechanism.

control the rotation of the selector camshaft and to position five selector Y-levers (para 1-21).

1-20. Selector Camshaft Control Mechanism

The eeven electrical impulses for each complete code group are received in sequence by the selector magnet. To convert the electrical impulses into mechanical Bettings, it is necessary to have the mechanical actions in the selector mechanism coincide in sequence to the signals being received. This is achieved by placing the selector camshaft friction clutch under the control of the start and stop impulses and restricting the camshaft to 1/2 turn for

each code group received. The camshaft comes to rest at the end of each code group and ie started anew with the receipt of the next start impulse. This prevents any small difference between the length of the transmitted signals and the selector camshaft speed (timing) from becoming cumulative.

a. Normal Rest Position. During periods when no transmission is received, the selector camshaft is held stationary by the engagement of the armature and the stop lever (A, fig. 1-14). The position of the armature reflects a marking (stop) impulse in the selector magnet. The stop plate, which is connected to the selector camshaft (para 1-22), is prevented from turning by the projection on the midpoint of the stop lever.

b. Starting. Upon the receipt of a start impulse, which is always a spacing (no current) impulse, the armature moves downward and out of the path of the stop lever. The stop plate, driven by the selector camshaft friction clutch (para 1-12), begins to turn and move past the projection on the stop lever (B, fig. 1-14). Each of the cams spaced in a 180° arc around the selector camshaft (fig. 1-16) operates its associated mechanism in sequence.

c. *Stopping.* As the opposite lobe of the stop plate nears the stop lever, the stop impulse is received and the armature is raised into engagement with the stop lever. When the stop plate strikes the projection of the stop lever (A, fig. 1-14), the selector camshaft is blocked from further rotation. The motion of the camshaft is restricted to 1/2 revolution for each code group received.

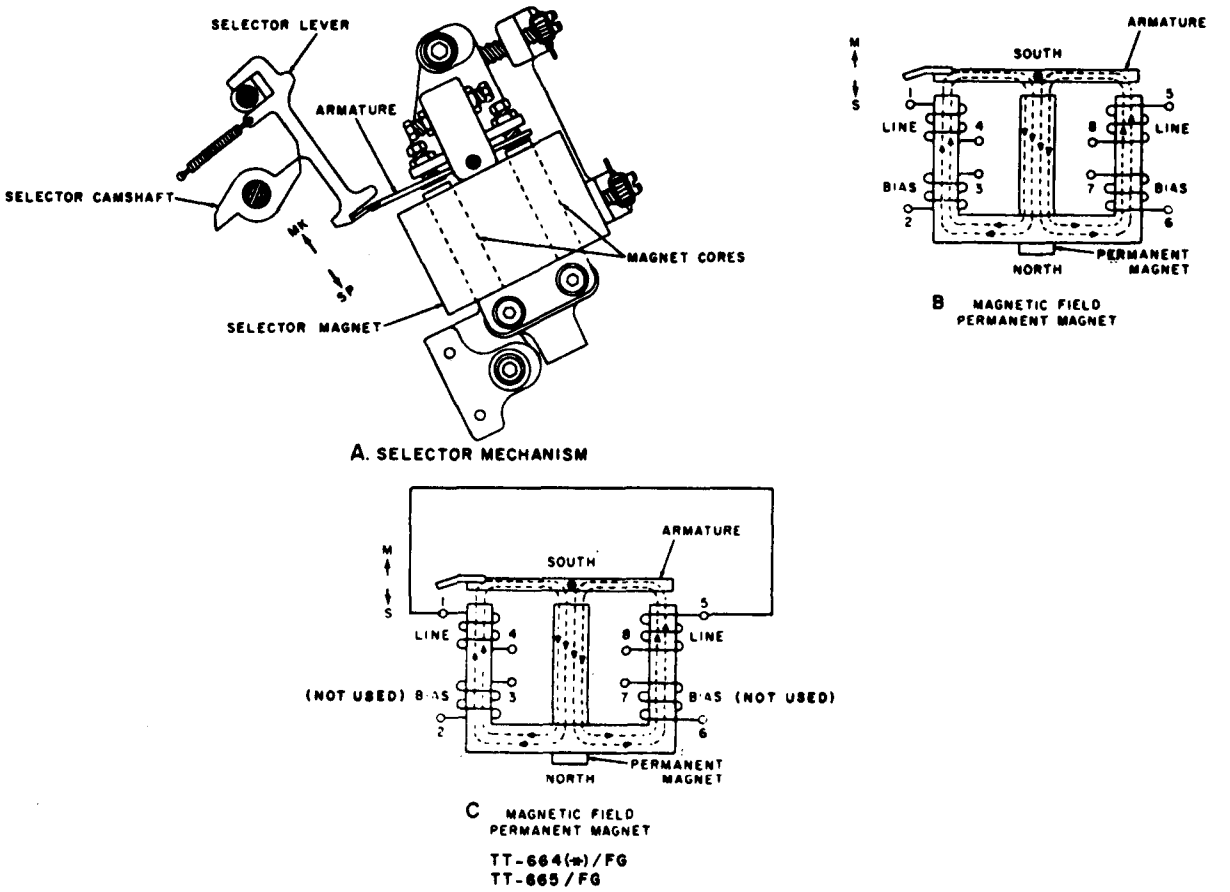


Figure 1-13. Selector mechanism operation.

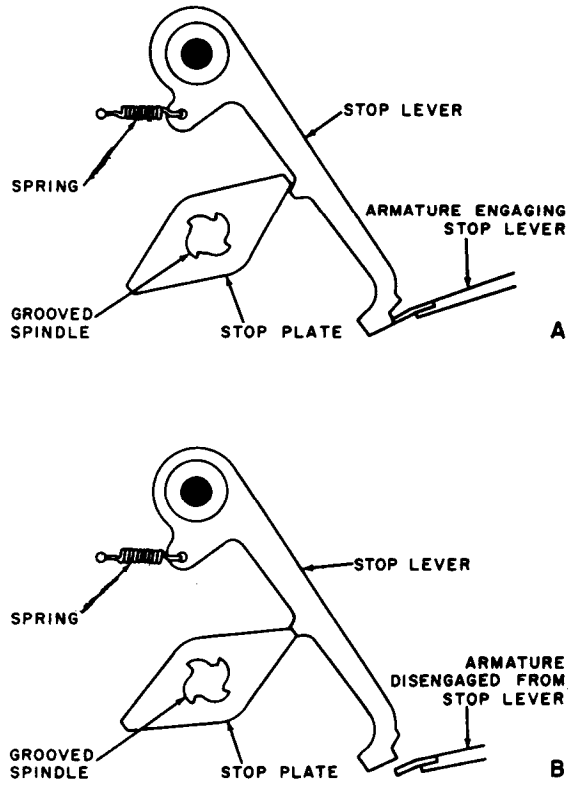


Figure 1-14. Selector camshaft control mechanism.

1–21. Recording Code Impulses (fig. 1-15)

a. Each code impulse received through the selector magnet line windings (para 1-19) is reflectedby a position of the armature for the duration of the impulse (.022 second at 60 wpm). The armature moves into the path of the selector levers for a marking impulse and out of the path of the selector levers for a spacing impulse.

b. The selector camshaft, driven by the selector camshaft friction clutch, brings the first selector cam into engagement with its associated selector lever during the time the first selector impulse is being received. Thereafter, each of the remaining four selector cams engages its associated selector lever in a timed sequence because of the location of the cams around 1/2 the circumference of the camshaft. The speed of the camshafts turning brings each of the cams into contact with its associated selector lever during the time the armature is positioned as a result of the corresponding impulse. All five selector levers are operated during the 1/2 revolution of the camshaft.

c. During the time a marking impulse is received (A, fig. 1-15), the selector magnet armature is moved in the path of the selector levers. 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 or the second cam lobe for the second impulse, etc.), will rotate to the position shown and raise the selector lever. As the armature prevents the movement of the lower end, the selector lever is-forced to move at its upper end by sliding on the pivot bearing. In doing so, the selector lever pushes against the Y-lever, turning it clockwise (unless it is already in that position). Further rotation of the selector camshaft permits the selector lever to drop back, but the Y-lever is held in the clockwise position by the Y-lever detent. A marking impulse thus is recorded in the form of the clockwise position of a Y-lever.

d. During the time a spacing impulse is received (B, fig. 1-15), the selector magnet

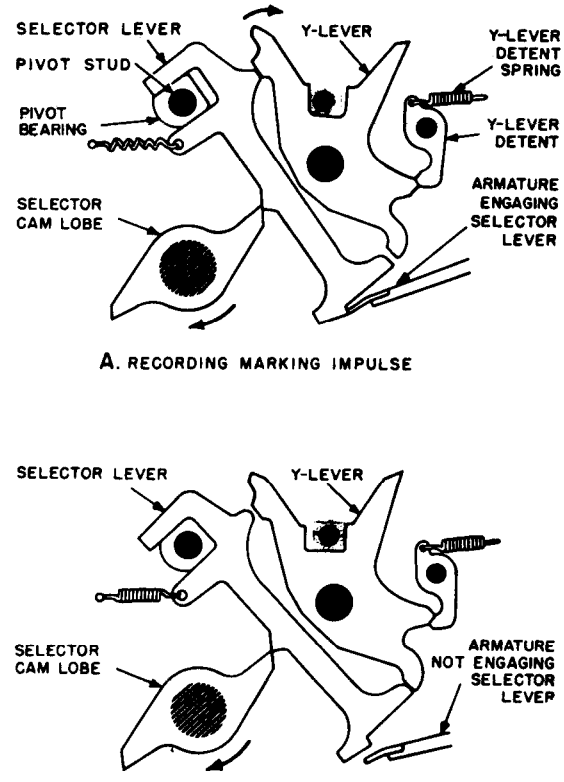


Figure 1-15. Recording code impulses

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; therefore it is free to move. In moving, the selector lever pushes against the lower portion of the Y-lever, turning it counterclockwise (unless it is already in that position). A spacing impulse thus is recorded in the form of the counterclockwise position of a Y-lever. The Y-lever detent holds the Y-lever in the space position.

e: Each code impulse is recorded in the form of a clockwise. (marking) or counterclockwise (spacing) setting of a corresponding Y-lever.

1–22. Rangefinder Mechanism

(fig. 1-16)

a. The amount of time that elapses between the release of the stop plate (during the start impulse (para 1-20) and the time when the first selector cam becomes operative (during the first selecting impulse.) is determined by the position of the stop plate with respect to the selector campshaft. This

position is made adjustable by the rangefinder mechanism. The stop plate is mounted upon a grooved spindle which is slotted (at the mating end) to engage a key in the selector camshaft. The position of the grooved spindle, in turn, is deter-mined by an orientation lever which is operated w-hen the rangefinder dial assembly is turned either clockwise or counterclockwise.

(1) *Clockwise Rotation.* Turning the rangefinder dial clockwise, moves the grooved spindle inward and increases the angle between the stop plate and tile first selector cam. This causes the No. 1 selector cam to position its train of parts during the latter part of the time that the No. 1 impulse is present at the magnet.

(2) *Counterclockwise rotation.* Turning the rangefinder dial counterclockwise allows the grooved spindle to move outward and decreases the angular relationship. This causes the No. 1 selector cam to position its train of parts during the earlier part of the time the No. 1 impulse is present at the selector magnet.

b. Although the time length of each code impulse is 22 milliseconds, only about, one-fifth of that time is required for a selector cam to position a selector Y-lever. Under ideal conditions, maximum reliability is obtained when the selector Y-lever positioning time occurs during the middle portion of the 22 milliseconds. The rangefinder setting determines which portion of each impulse is used for the positioning of its respective selector Y-lever. The setting for the rangefinder (para 2–14, TM 11–5815–200–12) precedes the reception of message traffic. The rangefinder dial is held in posit ion thereafter by tile detenting action of the positioning ball.

1-23. Selector Mechanism Sequence Chart

The mechanism discussed in paragraphs 1-19 through 1-22 comprises the selector mechanism. The chart below summarizes tile operations that occur when a code group is received.

1 Start impulse received.
2 Selector magnet armature moves to space position.
3 Armature releases selector camshaft locking lever.
4 Locking lever releases stop plate.

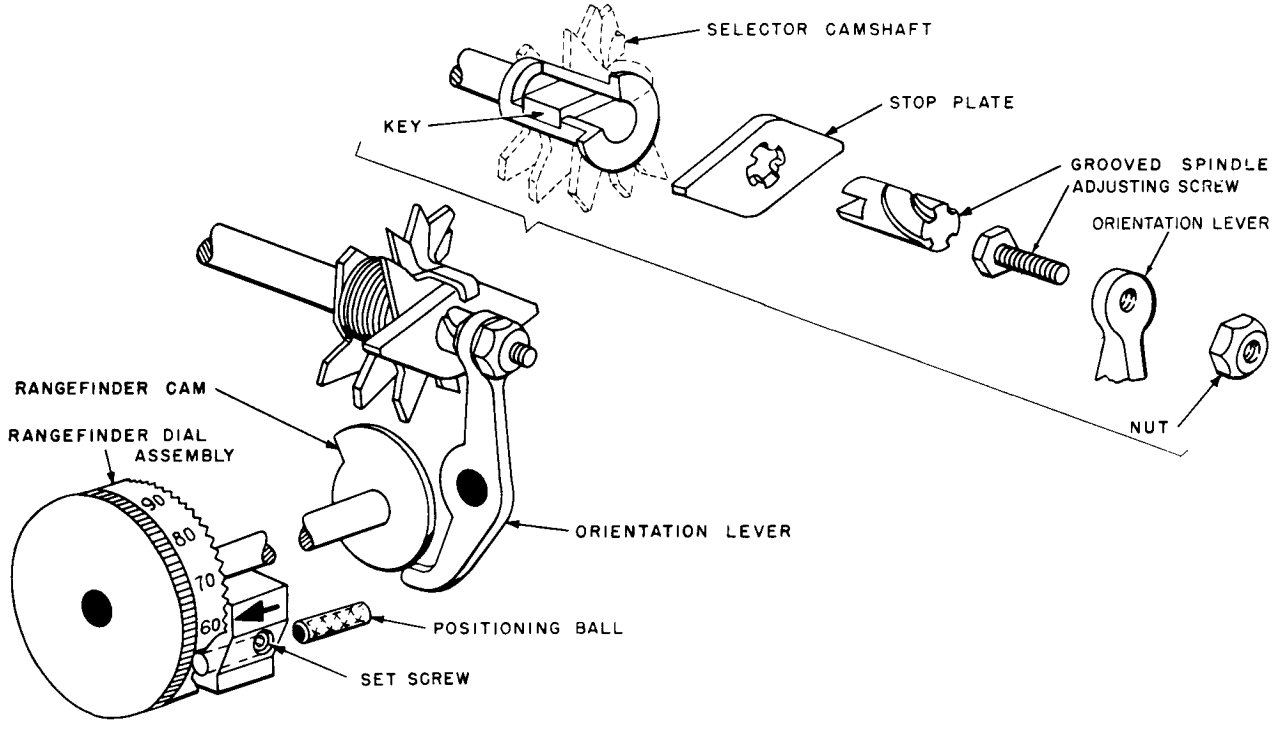


Figure 1–16. Range finder mechanism.

5 Selector camshaft starts rotating, driven by the friction clutch.
6 First code impulse moves armature to mark or space position, depending on whether the code impulse is a marking or spacing impulse.
7 First selector camshaft cam lifts first selector lever.
8 First selector lever pivots on the end of armature if armature is in marking position or on selector lever pivot stud if armature is in spacing position.
9 First selector lever pushes first Y-lever clockwise if selector lever is pivoting on the armature end (marking), or counterclockwise if selector lever is pivoting on the pivot stud (spacing). The Y-lever detents engage Y-levers to hold them in place.
10 Second, third, fourth, and fifth code impulses, in turn, are recorded in the corresponding parts of the selector mechanism, as described for the first code impulse. Each Y-lever is positioned clockwise or counterclockwise as determined by its associated code impulse.
11 Transfer lever latch tripping cam turns transfer lever latch (para 1–24).
12 Stop impulse is received.
13 Armature moves to marking position.
14 Stop plate engages selector camshaft locking lever.
15 Armature latches locking lever.
16 Locking lever holds stop plate.
17 Selector camshaft stops at end of ½ revolution.

1-24. Transfer Operation

After the five Y-levers have been positioned as described in paragraph 36, the Y-lever settings must be transferred to the code rings (A, fig. 1–17) and the function shaft (fig. 1–18) must be allowed to rotate to complete the printing or functional operation desired.

a. The transfer operation occurs immediately after the fifth code impulse is stored in the Y-levers. A sixth cam of the selector camshaft, the transfer lever latch tripping cam (A, fig. 1-17), moves against the transfer lever trip latch and pivots the latch counterclockwise against the tension of its spring. The lower arm of the transfer lever trip latch moves downward out of engagement with the transfer lever and permits the transfer lever spring to snap the transfer lever clockwise. Five T-levers are mounted on a study which is, in turn, mounted on the right side of the transfer lever. The clockwise motion of the transfer lever brings each of the T-levers into engagement with its associated Y-lever. Each Y-lever positioned in a clockwise direction will cause its associated T-lever to pivot counterclockwise. The T-lever will cause the associated code ring to move clockwise. A Y-lever pivoted counterclockwise (B, fig. 1-17) will cause its associated code ring to move counterclockwise and a Y-lever pivoted clockwise (A, fig. 1-17) will cause its associated code ring to move clockwise.

b. As the transfer lever turns, it turns the transfer lever shaft (fig. 1-18) and the function shaft clutch latch fastened to it. When the latch moves downward out of the path of the stop arm on the sliding clutch drum (which is keyed to the function shaft), the clutch pressure spring moves the sliding clutch drum into engagement with the constantly rotating function shaft driven gear. This action mechanically couples the function shaft to the function shaft driven gear which normally rotates freely about the function shaft when the clutch is disengaged. The function shaft begins its ½ revolution.

c. After the function shaft has turned a few degrees, the five code rings are locked in position by a code ring locking bail (fig. 1-19). This locking action occurs when the cam follower of tile code ring cam follower locking lever rides down off the high portion of the locking bail cam on the function shaft. The code ring cam follower locking lever moves counterclockwise and allows tile code ring locking lever and the code ring locking bail fastened to it to move clockwise under tile pressure of the locking bail spring. As the locking bail engages the code rings, it engages either on one side or the other of a. projection on each code ring depending on whether the code ring is positioned clockwise or counterclockwise. Toward the end of the ½ revolution of the function shaft, the cam follower is raised upward and the procedure is reversed to move the code ring locking bail counterclockwise and out of engagement with tile code rings so that they may be free to accept tile next Y-lever settings.

d. After the function shaft has turned approximately 90°, the transfer lever restoring cam (fig. 1–18) lifts the transfer lever to restore it to its latched position. This action simultaneously raises the function shaft clutch latch into position in the path of a stop arm on the sliding clutch drum. As the function shaft completes ½ revolution, the stop arm strikes the ball bearing on the function clutch latch to the left of its center and as the stop arm continues forward the sliding

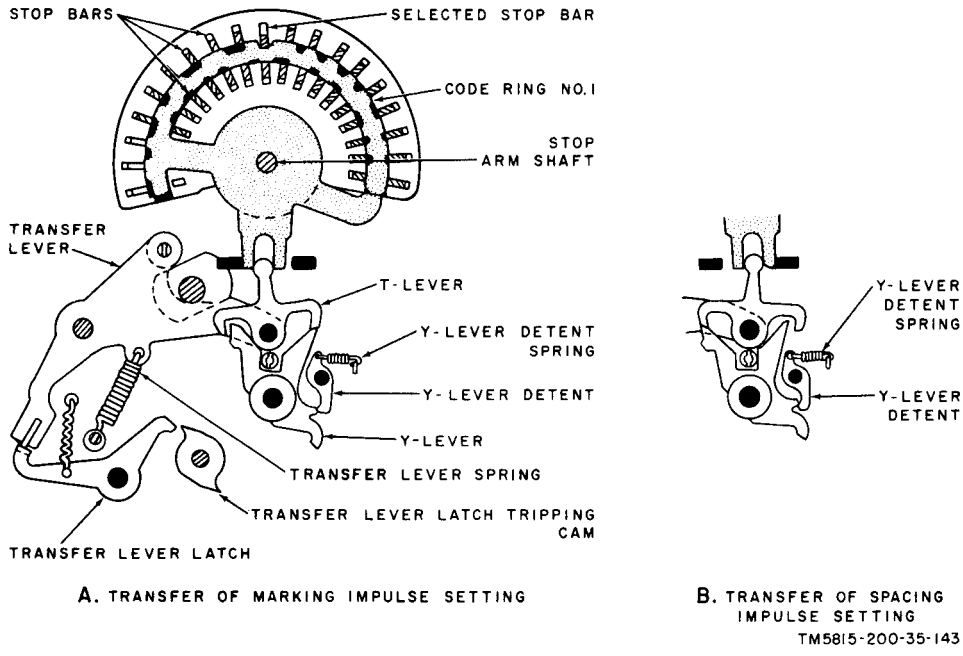


Figure 1-17. Transfer of Y-lever settings.

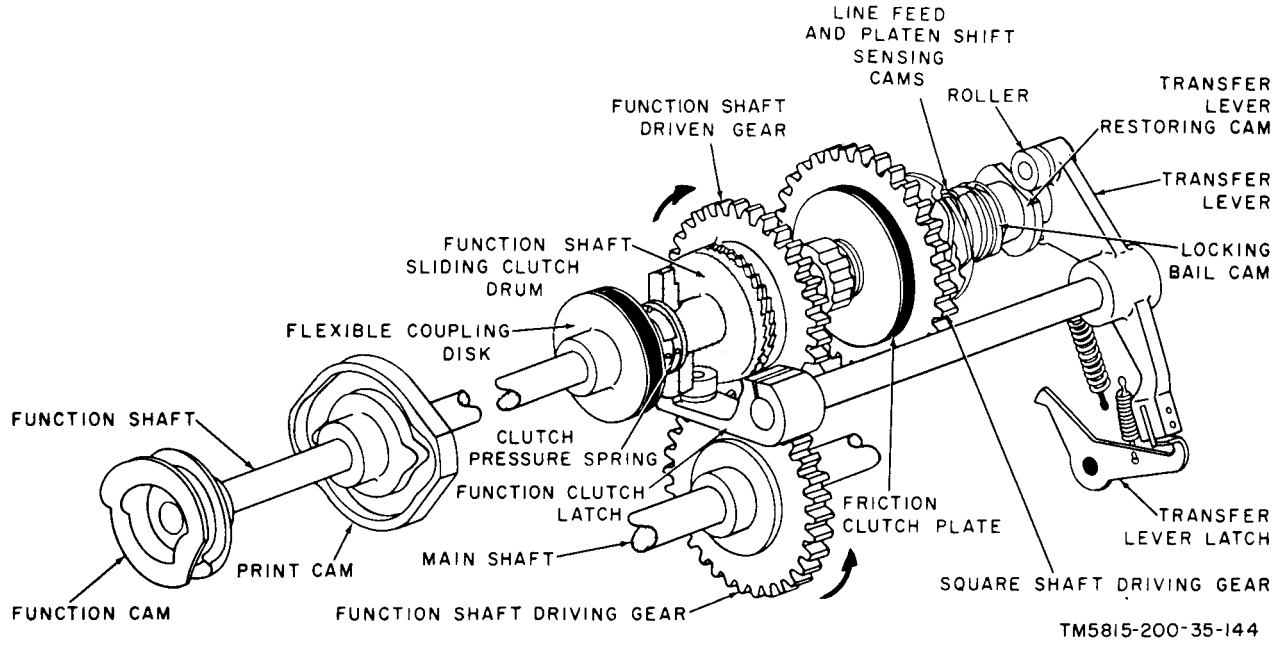


Figure 1–18. Function shaft and associated assemblies.

clutch drum is cammed out of engagement with the function shaft driven gear. The gear continues to rotate as the function shaft comes to rest. The flexible coupling provided on the function shaft absorbs the shocks involved in the engaging and disengaging of the function clutch.

1–25. Stop Bar Selection

a. Each of the five code rings (fig. 1–19) housed in the code-ring cage has a unique arrangement of notches cut in the inner and outer edges of its curved portion. Sixteen stop bars are placed across the outer edges of the 5 code rings and 16

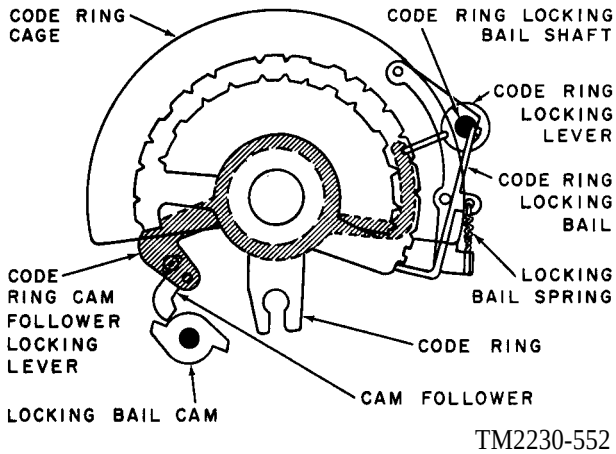


Figure 1-19. Code-ring locking mechanism.

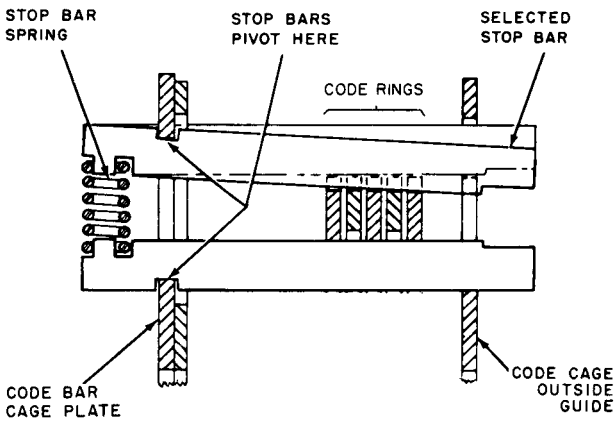


Figure 1–21. Cross-sectional view of stop bars in code-ring cage.

are placed across the inner edge. Each of the 32 stop bars (fig. 1–20) represents a printed character or a functional operation which can be produced by the teletypewriter. Compression-type springs are located at the rear of the code-bar cage between each inner and outer stop bar pair. Each stop bar spring applies pressure to move the opposite ends of its associated stop bar pair towards each other (fig. 1–21).

b. When a new Y-lever setting is transferred to the code rings, each of the code rings is positioned with one of its notches lined up with a similar notch of each of the other code rings. The stop bar located at that particular segment is moved into the notch formed by all five code rings under pressure of the stop bar spring. The selected stop bar moves into the path traveled by tile stop arm.

c. Three duplicate stop bars are located in the lower left of the code-bar cage for line feed, carriage return, and figures. These three stop bars project from the rear of the code-bar cage and do not in any way control the stop arm.

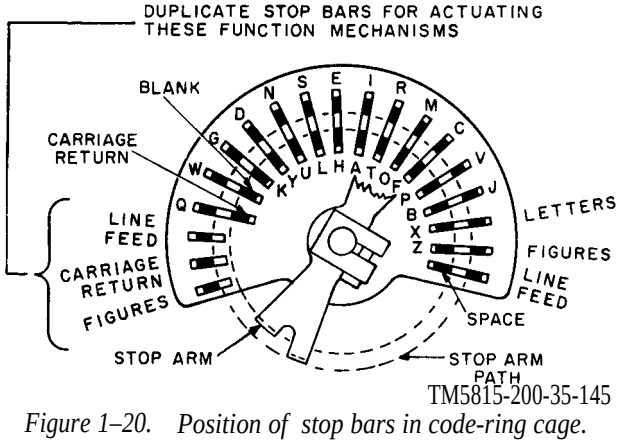


Figure 1–20. Position of stop bars in code-ring cage.

d. For every new selection, the previously selected stop bar is moved out of the stop arm path when it is contacted by the sloping side of the high portion of one or more of the code rings.

e. The following sequence chart summarizes the operations that occur between the time the transfer operation begins and the selection of a stop bar.

Stop Bar Selection Sequence Chart

1 Transfer lever latch tripping cam turns transfer lever trip latch.
2 Transfer lever trip latch releases transfer lever.
3 Transfer lever moves five T-levers against Y-lever.
4 Y-levers position T-levers.
5 T-levers position code rings.
  a. Selected stop bar moves into notch formed by 5 code rings.
  b. Previously selected stop bar rides to high portion of one or more of the code rings.

1-26. Square Shaft Operation

a. As the previously selected stop bar moves out of the path traveled by the stop arm and the function shaft begins to turn (para 1–24), the square shaft begins its motion. The square shaft is driven by the function shaft friction clutch (C, fig. 1-7). Tile degree of turn to be accomplished is determined by the point at which the square shaft stop arm encounters the newly selected stop bar in its path. Since there are 32 stop bars, it is possible to stop the square shaft in

any one of 32 positions, dependent upon the stop bar selected.

b. The square shaft driving gear of the function shaft friction clutch engages the square shaft driven gear (fig. 1-22) to provide this motion. The gear ratio between the two shafts guarantees that the turning of the square shaft is fully accomplished prior to the time the function shaft delivers the motion to other assemblies for printing and functional operation. This applies in all cases except when there is a repetition of the previous selection. The stop arm, in this case, remains in the same position since the same stop bar remains in its path.

c. The position of the square shaft determines the character to be printed or the functional operation to be performed. Printing operations are controlled by the type selecting arm. Functional operations are cent rolled by the function selecting arm on the square shaft and the duplicate stop bars in the code-ring cage.

d. Since the square shaft must be positioned accurately to select the proper characters and functions, very little bouncing can be tolerated when the stop arm strikes a stop bar. An antibounce clutch (fig. 1–23) is provided on the stop arm shaft to minimize any bouncing motion. The inner portion of the antibounce clutch is an integral part of the stop arm shaft. The stop arm is fixed to the front end of the stop arm shaft, and the other end of the stop arm shaft is rigidly coupled to the square shaft. The four rollers of the antibounce clutch are spring-loaded to permit only clockwise rotation of tile stop arm. The rollers roll along the inside surface of tile cylindrical housing. Any attempt to make the stop arm rotate counterclockwise immediately causes the rollers to jam between the housing and the moving part of the antibounce clutch. Thus, any tendency to reverse direction through rebound is minimized.

1-27. Printing

(fig. 1-24)

a. Selection. The type selecting arm, operating under the control of the square shaft (para 1-26), rotates at the rear of a semicircular frame On the type bar carriage which houses the 26 type bars (27 in weather symbol teletypewriters). Each of the 26 type bars reflects an individual character of the alphabet. (The remaining six positions in which the square shaft can be stopped are used for functional operations and tile type selecting arm then comes to rest at a point which is not aligned with a type bar position.) Whenever the square shaft comes to rest as the result of the stop arm striking a stop bar associated with a letter of the alphabet in its path (fig. 1-20), the type selecting arm comes to rest behind tile associated stop bar. For example, if the stop arm strikes tile N stop bar, the type selecting arm is aligned with the N type bar.

Note. the twenty seventh type bar of weather symbol teletypewriters prints a dash symbol in the figures position of the platen when the blank code group is received.

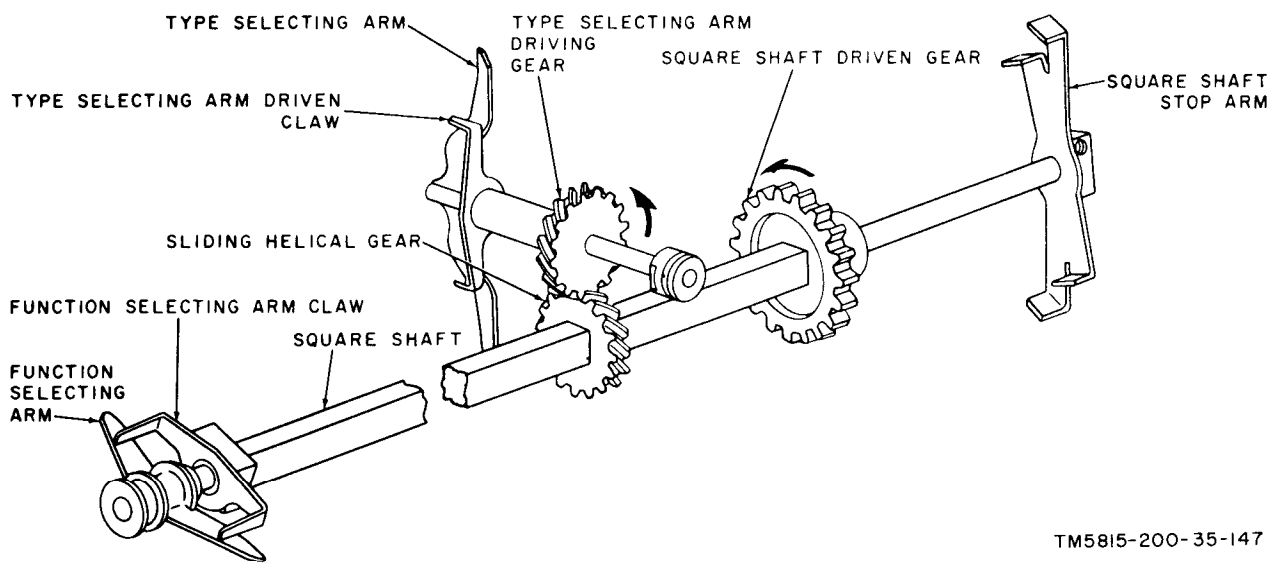


Figure 1-22. Square Shaft and type selecting arm assembly.

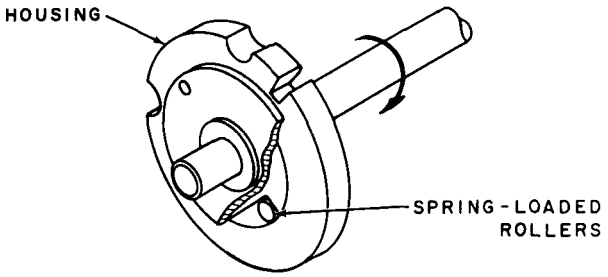


Figure 1-23. Antibounce clutch for stop arm.

b. Mechanical Operation.

(1) After the type selection arm is positioned, the high part of the print cam strikes the print cam follower roller and movesthe print cam follower and the print bail Made counterclockwise. The print bail blade is engaged in a slotted portion of the round nut at the rear of the type selecting arm shaft. As the print bail blade moves counterclockwise, the type selecting arm is moved forward to strike the connecting bar associated with the type bar. The forward motion of the connecting bar moves the type bar upward towards the platen. The type selecting arm provides only the forward motion necessary to create the momentum to carry the type bar to the platen with sufficient force to print clearly.

(2) The type selecting arm moves rearward as the print cam follower moves to the lower portion of its cam under pressure of the print cam follower spring. The overall movement. of the print bail occurs so quickly that the type selecting arm is returned to its rearmost position before the type bar reaches tile platen. The connecting bar and the type bar return to their normal positions rapidly because of the rebound of the type bar and the tension of the connecting bar spring.

1-28. Functions

The page printing mechanism performs two types of operations. The first operation, the printing of letters and characters is described in paragraph 1–27, The second type of operation, called functions (paras 1–30 through 142), consists of rotating the platen for line feed, shifting and upshifting 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

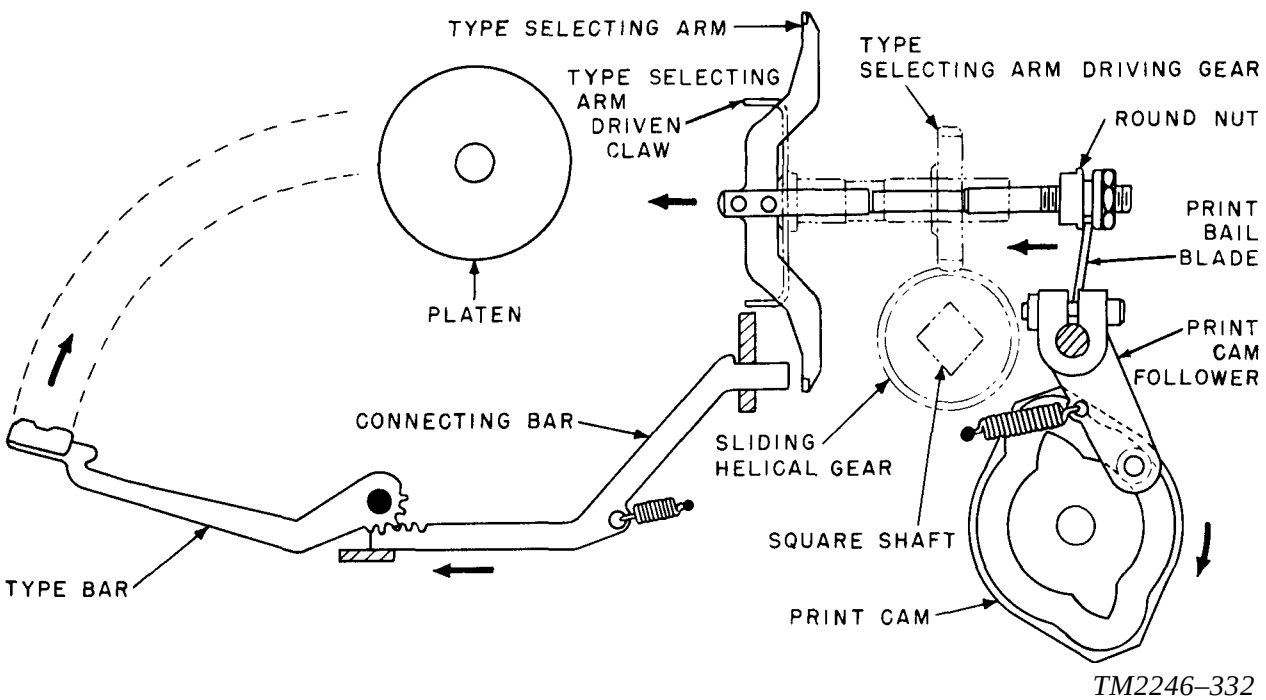


Figure 1–24. Cross section of printing mechanism.

by the function cam and function selection arm (fig. 1-2). the figures (shift), line feed, and carriage return are controlled by the duplicate stop bars in the code ring cage (fig. 1-20).

1-29. Function Selecting Arm and Punch Bar Guide Block Relationship
(fig. 1-25)

a. The function selecting arm is freely mounted on the end of the square shaft and rotates with the function selecting arm claw to 1 of 32 positions as (determined by th squre shaf (para 1–26). It moves inward and outward along the shaft to operate punch bars located in the punch bar guide block. The function selecting arm is operated by the function cam follower.

b. The function cam follower is pivoted on a stud fastened to the upper arm of the support lever. As the function cam rotates, the lower end of the function ca follower is moved outward and the upper end (engaged in the slotted portion of the function selecting arm) moves inward. If the function selecting arm is not blocked in its inward motion, the support lever is held firmly in place by the support lever spring. If the inward motion is blocked, the upper end of the function cam follower acts as a pivot and the stud which normally serves as the pivot for the function cam follower is moved outward. The movement of the stud causes tile support lever to turn clockwise against tile tension of the support lever spring. As the lower end of the cam follower moves inward at the end of the cycle, the support lever is moved counterclockwise by its spring. The movement of the support lever (when the function selecting arm is blocked) provides the spacing (para 1-30) necessary to prevent the overprinting of characters and the spacing between words.

c. The inward motion of the function selecting arm is regulated by the construction of tile punch bar guide block (B. fig. 1-26), its associated aperture gate. (A, fig. 1-26), and the punch bars (C, fig. 1-26). The forward surface of the punch bar guide block is cut away in the three areas which are associated with the position of the function selecting arm for functional operations. Punch bars (three) are located in two of these areas for all teletypewriters. The weather symbol teletypewriters make use of all three areas for punch bar positions (four).

d. The aperture gate is located in the annular groove formed by the punch bar guide block and the side plate (fig. 1-25). The position of the aperture gate is controlled by the position of platen The aperture gate is cut to permit the motor stop and signal bell punch bars to be fully operated in *figures-shift* position (B, fig. 1-28) but to be blocked in the *letters-shift* positon (A, fig. 1-28) of the platen. The cut of the aperture gate in the area of the letters punch bar is such that the letters punch bar may be fully operated in either letters-*shift* or *figures-shift* position of the aperture gate. In weather symbol teletypewriters, a blank punch bar is used which may be fully operated in *letters-shift* position because of the *cut* of the aperture gate and is blocked by the aperture gate in *figures-shift* position to provide the spacing required in conjunction with the printing of the upper case blank symbol (-). Figure 1-27 shows the relative positions of the function selecting arm with respect to the punch bar guide block. The solid black segments of A, figure 1-27 indicate the position of the high portions of the aperture gate in *letters-shift* position. The solid black segments of B, figure 1-27 indicate the same high portions moved as a result of the aperture gate being moved to figures-shift position.

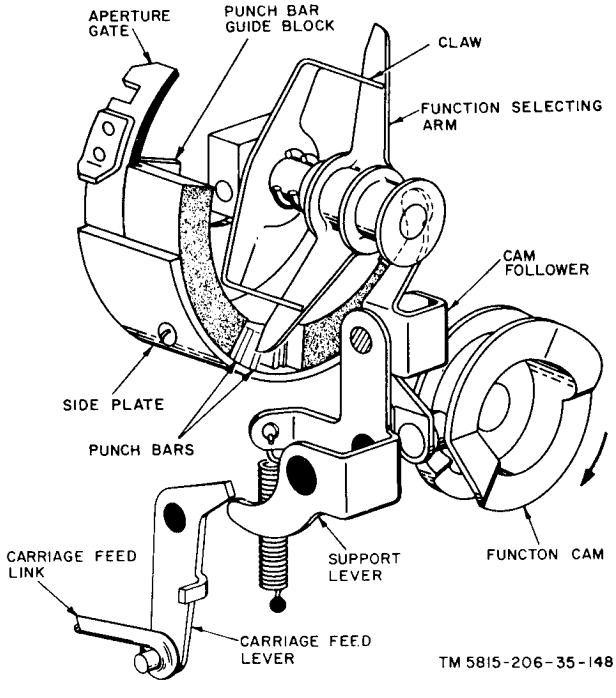


Figure 1-25. Function selecting arm mechanism.

e. The only exception to the information given in *d* above occurs in weather symbol teletypewriters when the function selecting arm fully operates the motor stop punch bar (which is never blocked in figures position) but at the same time provides some motion to the support lever. This occurs because of a slightly elongated motor stop punch bar (.062-inch longer) used in weather station equipment to provide the spacing required in conjunction with the printing of the upper case H symbol(↓).

1-30. Carriage-Feed Operation (fig. 1-29)

a. The carriage is moved automatically one letter space to the right each time a character is printed or the space bar is depressed to prevent characters from being printed one on top of another (strike-overs). The carriage rolls along the guide rail and slides on the square shaft. It is driven by the carriage-rack driving gear and carriage-feed 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 carriage-feed shaft 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 tile carriage is moved to the right. The carriage-feed link which pivots the carriage-feed pawl is operated by the function cam (fig. 1-25) through the support lever which operates the carriage-feed lever. The support lever is turned through the mot ion of 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 carriage-feed mechanism is operated because the carriage-feed pawl is repositioned immediately after the one tooth of the ratchet wheel is spaced.

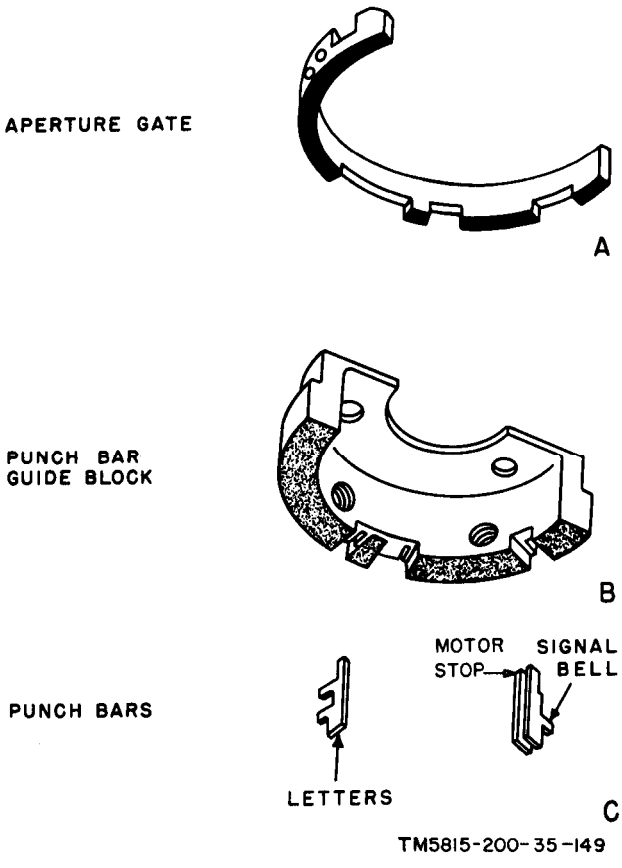


Figure 1–26. Punch bar guide block and associated parts.

b. The following chart shows the sequence of operation for carriage feeding:

Carriage-Feed Sequence Chart

1	Printed character or space selected.
2	Function cam turns function cam follower.
3	Function cam follower pivots about its upper end (function selecting arm blocked).
4	Support lever turned clockwise.
5	Carriage-feed lever turned counterclockwise.
6	Carriage-feed link pulled to the right.
7	Carriage-feed pawl raised off ratchet.
8	Ratchet wheel starts turning (friction clutch drive).
9	Carriage moves to right.
10	Function cam returns function cam follower.
11	Support lever turned counterclockwise by its spring.
12	Carriage-feed lever turned clockwise.
13	Carriage-feed link moves to left.
14	Carriage-feed pawl moves downward and engages the next ratchet wheel tooth.
15	Ratchet wheel held and carriage stopped (carriage has moved one letter space to right).

c. A manual carriage-feed mechanism (fig. l–30) 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 bell crank. When the manual space push button is depressed, the bell crank is rotated against the loop in the carriage-feed link, pulling the carriage-feed pawl out of engagement with the ratchet, wheel on the carriage-feed shaft. This allows the main shaft to drive

the carriage-feed driving gear and carriage-rack driving gear to move the carriage to the right until the manual space push button is released.

1-31. 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. 1–33). This is accomplished by uncoupling the carriage-feed sliding clutch drum (B, fig. 1-33) from the small carriage-feed driving gear and engaging the carriage-return sliding clutch drum. Power from the main shaft thus is transmitted to the large carriage-rack driving gear through the carriage-return clutch and the carriage-return driving and driven gears. The carriage-feed sliding clutch drum is uncoupled to permit the small carriage-feed driving gear to idle while the large carriage-rack driving gear rotates in reverse. Both clutches are operated simultaneously: the carriage-feed clutch is disengaged, and the carriage-return clutch is engaged. The carriage-return bell crank is returned to pull the horizontal carriage-return link attached to the double blocking lever. The carriage-return clutch lever, which moves with the double blocking lever, engages the carriage-return sliding clutch drum directly and at the same time turns the carriage-feed clutch lever to disengage the carriage-feed sliding clutch drum.

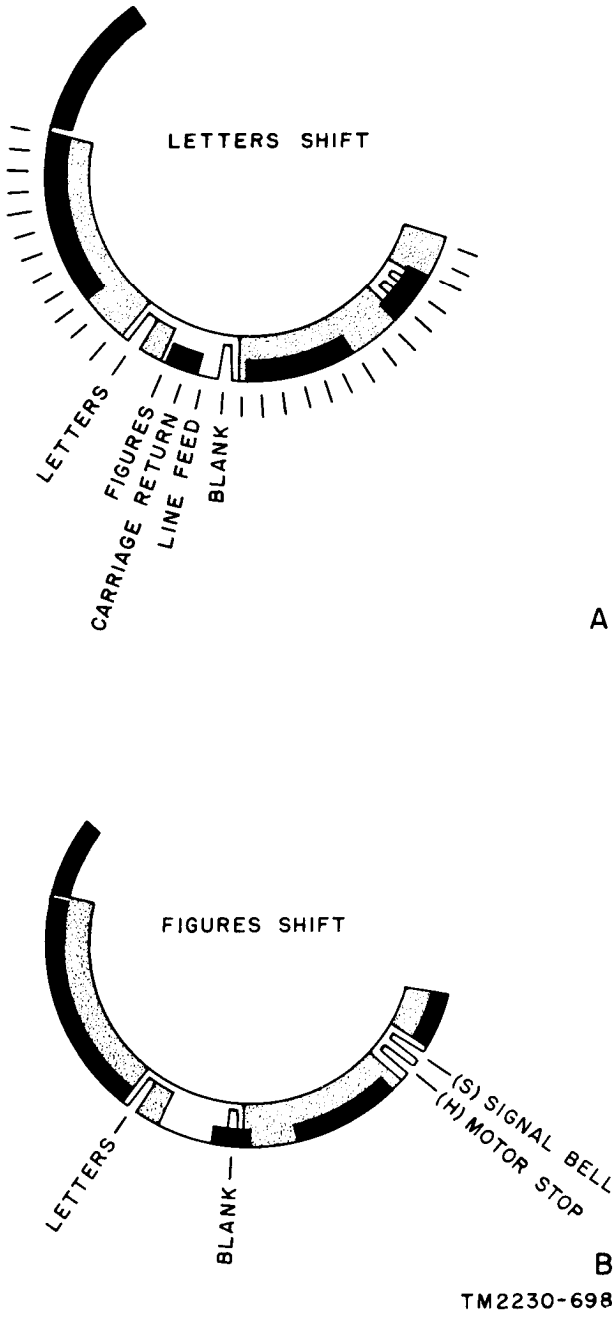


Figure 1-27. Aperturc gate positions for letters and figures-shift positions of platen.

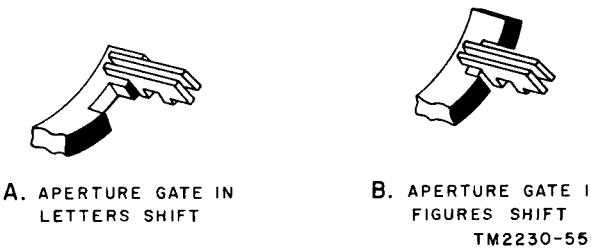


Figure 1–28. Motor-stop and signal-bell punch bars in *blocked and unblocked positions.*

b. The decelerating cam is used to slow down the movement of the carriage as it approaches the extreme left end of its travel to reduce shock and prevent damage. The decelerating cam is mounted on the carriage-return driving gear and is engaged by the decelerating arm attached to the carriage-return driven gear. The decelerating arm engages the cam only when the gears have turned the carriage to within approximately 7/8 inch of the left end. No teeth are provided on that portion of the carriage-return driven gear that would be in mesh when the decelerating arm and decelerating cam are engaged so that the driving action is transferred from between the gear teeth to between the decelerating cam and decelerating arm. The decelerating cam and decelerating arm continue the driving action between the gears, but as the decelerating arm moves farther into the

cam opening, the turning ratio between the two becomes smaller and smaller. That is, the carriage-return driven gear turns through a smaller and smaller angle for the same angular movement. of the carriage-return driving gear and thus decelerates the carriage motion.

c. Bothe the carriage return and carriage feed are held in the position shown in figure 1-33 throughout the carriage-return movement by the holding action of the carriage-return cluth latch actuating against the carriage-return clutch latch lever. When the carriage reaches the end of its travel, the carriage-return clutch latch lever is disengaged by the carriage-return latch tripping arm mounted on the carriage-return driven gear. If for any reason, the carriage-return clutch does not disengage, further action of the carriage-return drivn gear causes the carriage-return latch tripping arm to contact the throwout lever. The throwout lever pivots the carriage-return clutch lever, disengaging the carriage-return clutch. This permits the carriage-feed clutch spring attached to the carriage-feed clutch lever to return tile levers and clutches to the carriage-feed position (the carriage-return sliding clutch drum disengaged, the carriage-feed sliding clutch drum reengaged).

d. The pulling of the horizontal carriage-return link by turning the carriage-return bell crank is accomplished when the carriage-return stop bars are operated. The duplicate stop bar shown in figure 1–20 is the one for the carriage-return function. The stop bar (like the other two duplicate stop bars) has an extension on the rear side of the code ring cage, which normally engages the sensing lever.

e. The sensing lever therefore is released only when the carriage-return stop bar is operated. The carriage-return sensing lever restoring cam (fig. 1-31) or roller (fig. 1-32), which is mounted on the function shaft, turns ½ revolution every time any stop bar is operated as the result of the transfer operation. Thus, whenever the carriage-return stop bar is operated, the sensing lever drops to the low point of the carriage-return sensing lever restoring cam and pulls the-vertical carriage-return link that turns the carriage-return bell crank. Before the carriage-return sensing lever restoring cam completes its ½ revolution, the carriage-return sensing lever is restored to its initial position ready to be held there by the carriage-return stop bar when it moves back as a result of another code group.

f. The hole by which the horizontal carriage-return link is attached to the double blocking lever (fig. 1-33) is elongated. The elongation is provided to allow the horizontal carriage-return link to move back to its unoperated position when the carriage-return sensing lever is restored even though the carriage-return clutch actuating lever is still latched. This is necessary because it takes approximately three times as long for the carriage to return as it does for the function to make a ½ revolution.

g. The carriage-return clutch cannot be engaged when the carriage is in its extreme left-hand position because the adjusting plate of the double blocking lever w-ill engage the end of a carriage-return blocking lever. The double blocking lever cannot move; therefore the carriage clutch cannot be engaged. As soon as the carriage is moved on space, the carriage-return blocking lever moves downward enough to clear the end of the double blocking lever so that it can move (if a carriage-return code group is received) sufficiently to operate the carriage-return clutch.

h. A manual carriage-return mechanism allows the operator to return the carriage to the left-hand margin without receiving carriage return signals. Pushing the manual CAR. RET. push button on the right front of the dust cover causes the push button lever to pivot and the manual carriage-return lever trip pawl (fig. 1–34) to move the double blocking lever counterclockwise so that the carriage-return mechanism operates as described above. To prevent damage to the operating mechanism by pushing the double blocking lever too far, the trip pawl is automatically disengaged by tile adjusting screw as soon as it has caused the mechanism to latch. When the manual CAR. RET. push button is released, the entire manual carriage-return mechanism is pulled back by the trip pawl spring to its unoperated position against a stop pin.

i. A considerable amount of force is applied when the carriage-return mechanism drives the carriage to the left margin. To prevent serious damage resulting from the sudden stop caused by an obstruction of the carriage-return mechanism, the carriage-return driving gear is powered by a

friction clutch. This friction clutch allows the carriage-return driving gear to slip if the travel is blocked. The carriage-return driving gear itself is free to turn, but it is coupled to the carriage-return sliding clutch drum (fig. 1–35) by means of friction plates on both sides. Pressure for creating the necessary friction is obtained by compressing the spring by means of the adjusting collar.

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

Carriage Return Sequence Chart

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	Double blocking 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 returns carriage-return driven gear and large carriage rack driving gear to move carriage to left. Small carriage-feed driving gear idles. Function shaft stops (after completing ½ turns).
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 driving gear teeth.
16	Carriage decelerates.
17	Carriage-return latch tripping arm strikes carriage-return clutch latch lever.
18	Double blocking lever released. Carriage-ret urn 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.

1-32. Function Sensing Cam and Drawbar Mechanism (TT-98C/FG)

(fig. 1-36)

On the TT-98C/FG, the figures-shift, line-feed and line- feed-on-carriage-return sensing levers and the connecting links are operated by the function sensing cam assembly (which is mounted on the function shaft) and the drawbar assembly. The drawbar roller is held in contact with the function sensing cam by the drawbar spring. The drawbar moves up and down once, under the influence of the function sensing cam and the drawbar spring, for each half revolution of the function shaft.

a. *Figures-Shift Mechanism, Partial View* (fig. 1-38).

(1) When the figures code group is received, the duplicate figures stop bar moves out of the path of the figures-shift sensing lever; and the spring-actuated figures-shift sensing lever turns counterclockwise as the restoring roller moves out of engagement with it. This allows the spring-operated figures-shift pawl to pivot clockwise into the path of the drawbar assembly. As the drawbar assembly moves downward, it pulls the figures-shift pawl with it. The figures-shift pawl rocks the platen-shift bellcrank counterclockwise, which in turn pulls the platen-shift link towards the rear of the machine. The platen-shift link rocks the platen-shift arm about its pivot point, thereby raising the platen support frame and platen. The upward movement of the platen is limited by the bumper on the platen bracket. As the platen rises, the attached platen latching arm moves downward, and repositions the aperture gate. The platen latch engages the lug of the aperture gate to hold the platen in the figures position.

(2) The figures-shift sensing lever is restored to the starting position by one of the four restoring rollers, and the figures-shift. sensing lever restores the platen-shift bellcrank. When a different code group is received, the duplicate figures stop bar is restored and will hold the figures-shift

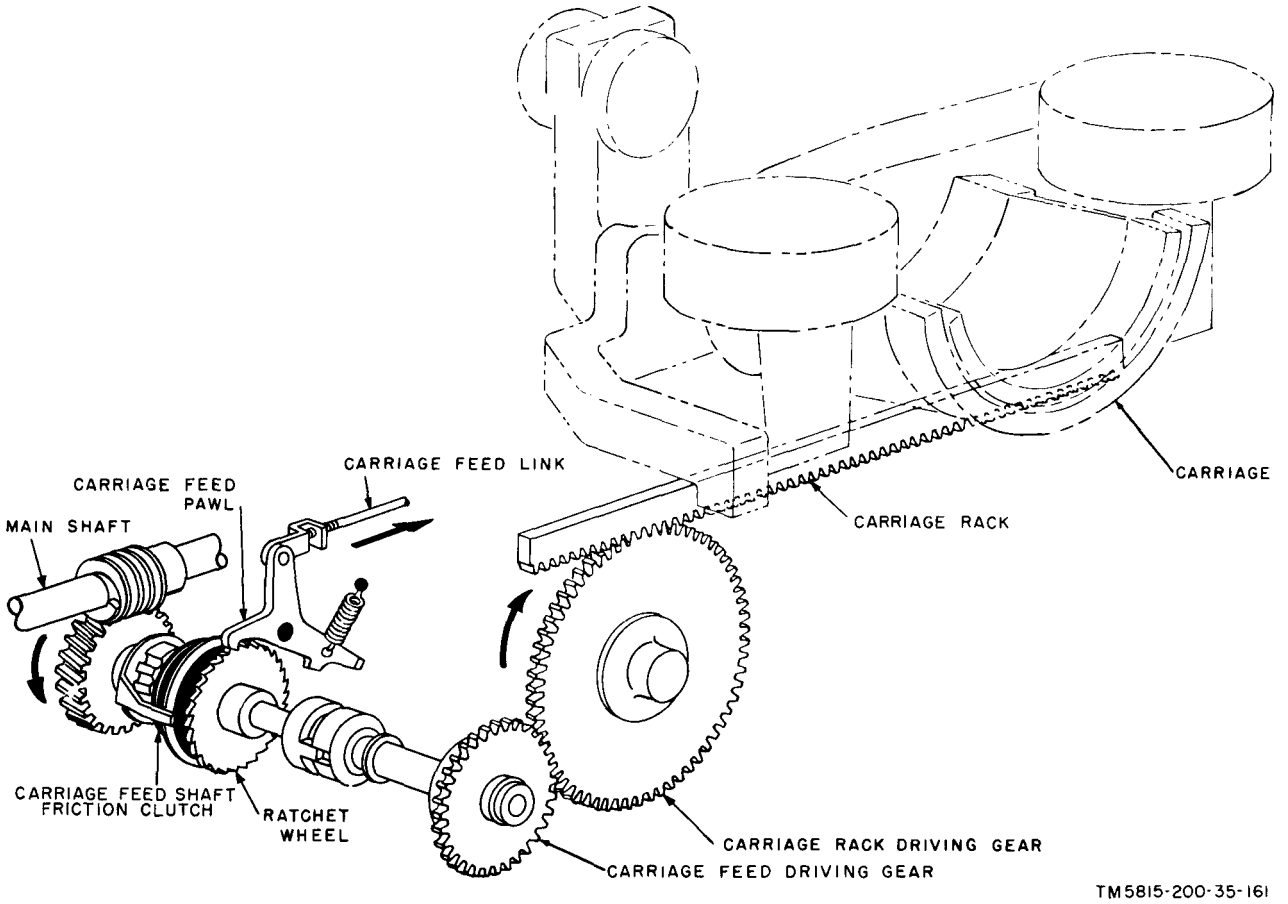


Figure 1–29. Carriage-feed mechanism.

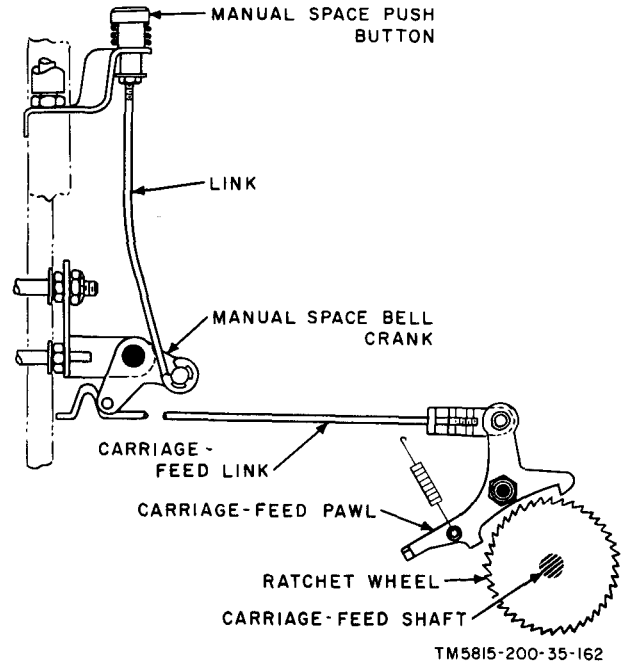


Figure 1-30. Manual carriage-feed mechanism.

sensing lever, figures-shift pawl, and platen-shift bellcrank in the restored position. The operations are summarized in the following chart:

Figures-Shift Sequence Chart

1 Figures code group received.
2 Transfer lever released.
3 Code rings alined for figures-shift. Function shaft starts turning.
4 Figures-shift sensing lever lifted off figures stop bar by restoring roller.
5 Figures stop bar operated.
6 Figure-shift sensing lever drops.
7 Figures-shift pawl moves into path of drawbar.
8 Drawbar moves downward and pulls figures-shift pawl with it.
9 Platen-shift bellcrank rocks counterclockwise.
10 Platen-shift link pulled toward the rear of the teletypewriter. Platen-shift arm rocked counterclockwise.
11 Platen support frame and platen raised.
12 Platen latching arm rocked downward.
13 Aperture gate repositioned and latched.

Figures-Shift Sequence Chart—Continued

14 Restoring roller raises figures-shift sensing lever and restores figures-shift pawl.
15 Duplicate figures stop bar restored by a different code selection.
16 Function shaft stops turning.
17 Platen remains latched in figures position until letters code group is received.

b. Line-Feed and Line-Feed-on-Carriage-Return Mechanisms (fig. 1-42). The platen is turned to feed the paper one or two spaces by the operation of the line-feed mechanism. The degree of turn depends on the position of the single-double line-feed lever. The line-feed mechanism functions each time a carriage-return code group or a line-feed code group is received.

(1) When a line-feed code group is received, the line-feed and duplicate line-feed stop bars are actuated. The duplicate line-feed stop bar moves toward the rear of the teletypewriter, out of the path of the line-feed sensing lever. As the restoring roller moves out of engagement with it, the spring-operated line-feed sensing lever turns counterclockwise. This allows the spring-operated line-feed bellcrank pawl to turn clockwise into the path of the drawbar assembly. As the drawbar assembly moves downward, it pulls the line-feed bellcrank pawl with it. The line-feed bellcrank pawl rotates the line-feed bellcrank, which in turn pulls the connect ing link toward the rear of the teletypewriter. The connecting link rotates tile line-feed lever counterclockwise. The line-feed pawl is mounted on the line-feed lever and spring-operated in the direction of the detent wheel. In the rest position, the line-feed pawl is held away from the detent wheel by the single-double line-feed lever. When the line-feed lever is rotated counterclockwise, the line-feed pawl moves toward and engages the detent wheel. Further counterclockwise movement of the line-feed lever causes the line-feed pawl to turn the detent wheel and the platen in unison. The platen is held in its new position by the action of the spring-loaded line spacing detent, which is held against, the detent wheel. The single-double line-feed lever (fig. 1-40) is positioned by the operator, and held in position by the platen spacing detent. The single-double line-feed lever determines the amount of line-feed lever movement which is wasted before the line-feed pawl engages the detent wheel and begins to turn the

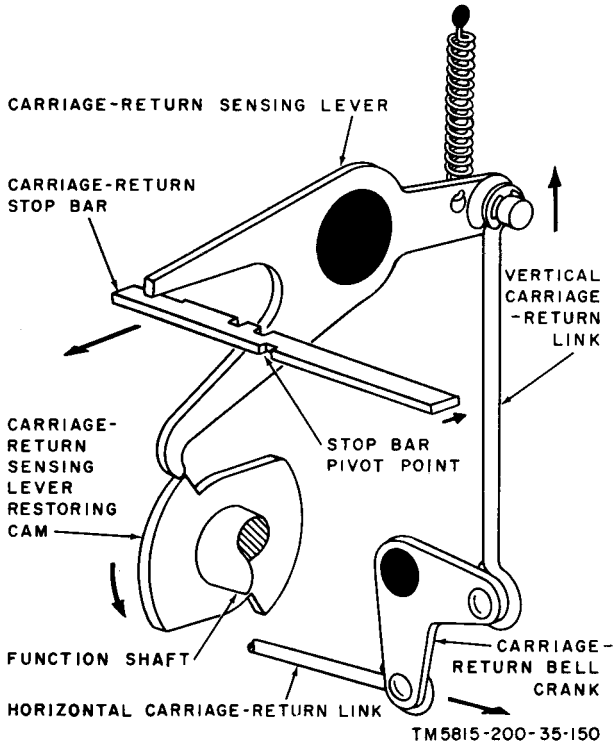


Figure 1–31. Carriage-return sensing mechanism (not *applicable to TT–98C/FG).*

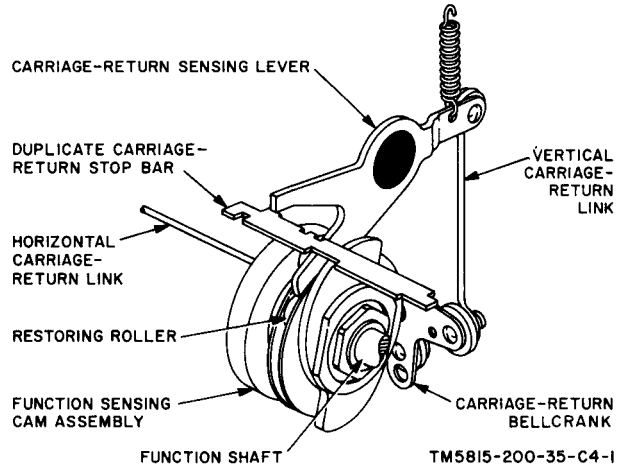


Figure 1-32. Carriage-return sensing mechanism (TT-98C/FG).

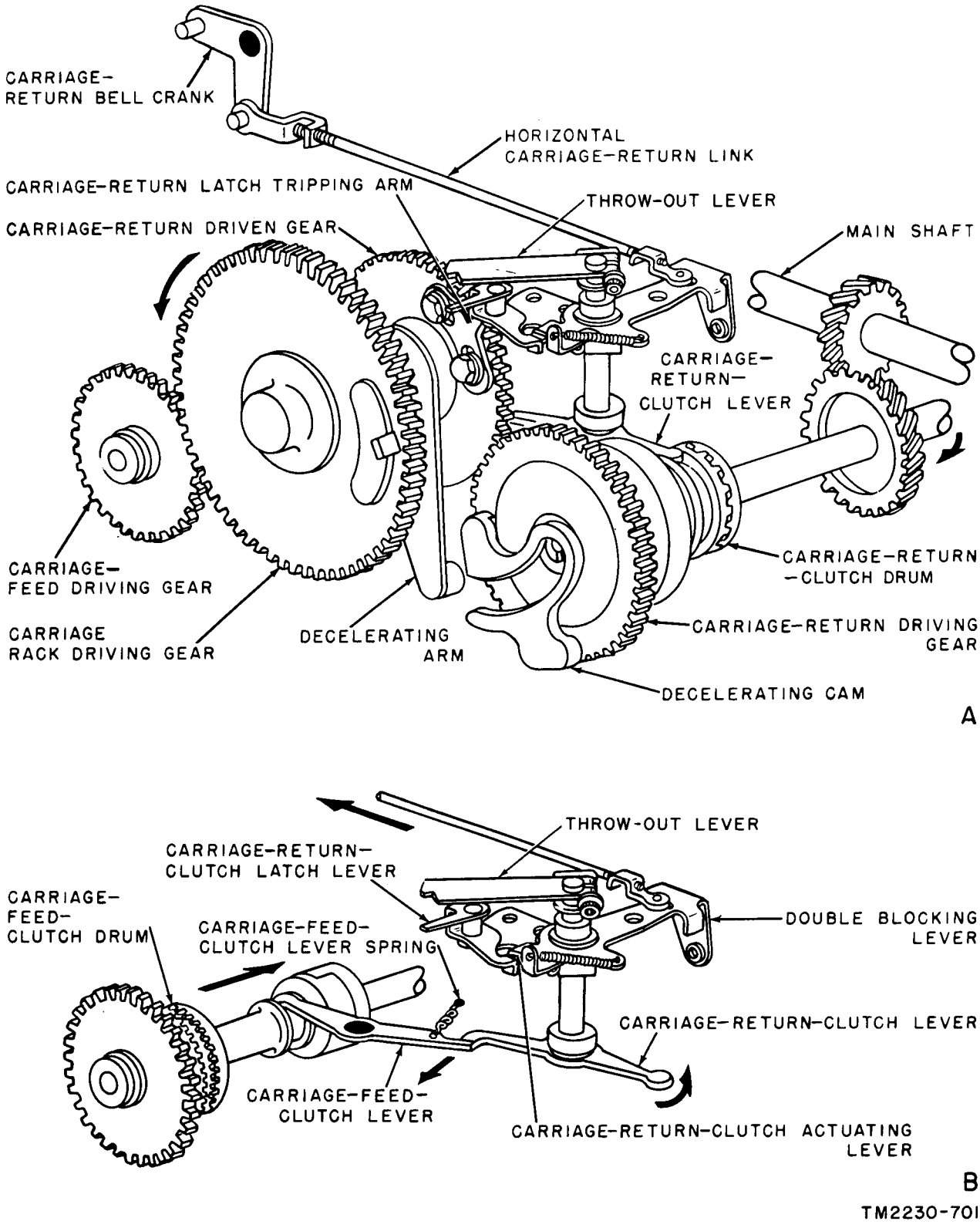


Figure 1-33. Carriage-return driving mechanism.

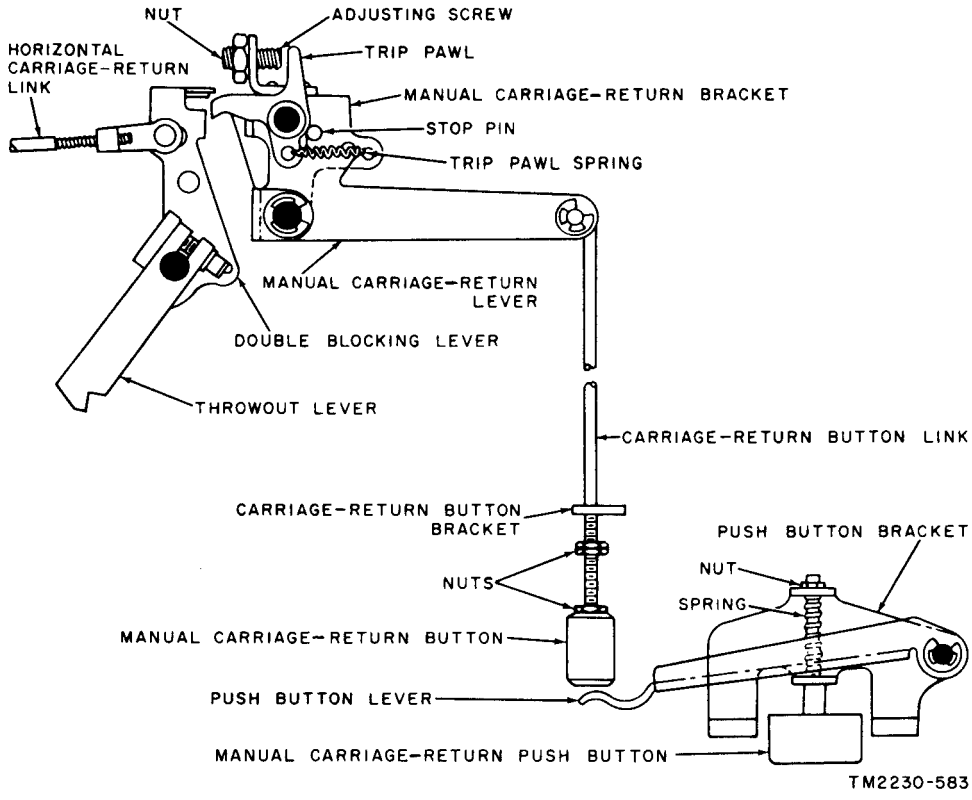


Figure 1–34. Manual carriage-rcturn mechanism.

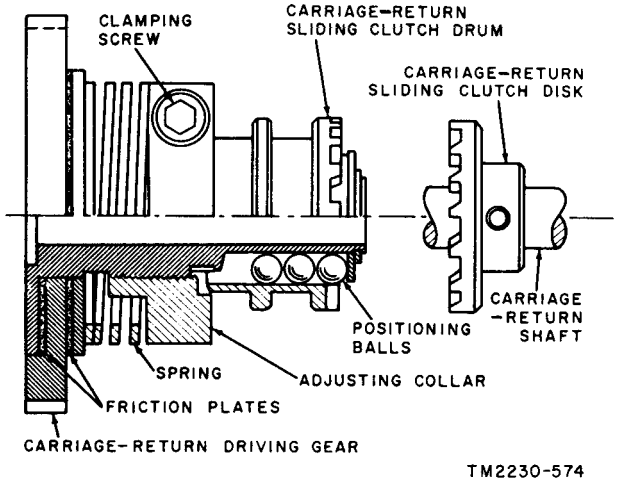


Figure 1–35. Carriage-return safety-clutch.

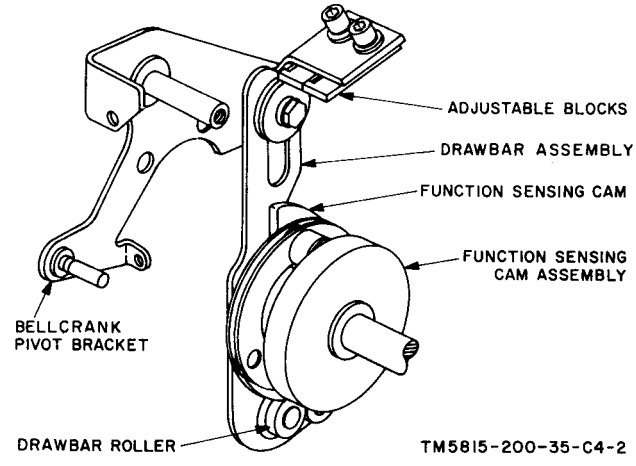


Figure 1-36. Functian sensing cam and drawbar mechanism (TT-98C/FG).

platen. The line-feed mechanism is restored to the starting position as the line-feed restoring roller raises the line-feed sensing lever.

(2) When a carriage-return code group is received, the duplicate carriage-return stop bar moves out of the path of the line-feed-on-carriage-return sensing lever. As the restoring roller moves out of engagement with the spring-operated line-feed-on-carriage-return sensing lever, it turns counterclockwise. This allows the spring-loaded line-feed-on-carriage-return pawl to turn clockwise into tile path of the

drawbar assembly. The line-feed-on-carriage-return pawl is mounted on the bellcrank assembly; therefore, the remainder of the operation of the mechanism for line-feed-on-carriage-return is identical with the operation of the mechanism described in (1) above.

(3) The operations are summarized in the following chart:

Line-Feed and Line-Feed-on-Carriage-Rct urn Sequence Chart

1 Line-feed core group or line-feed-on-carriage-return operation selected.
2 Transfer lever released.
3 Code rings aligned. Function shaft starts turning.
4 Stop bar operated.
5 Sensing lever drops.
6 Line-feed bellcrank pawl moves into path of drawbar assembly.
7 Drawbar assembly moves downward and pulls the line-feed bellcrank pawl with it.
8 Bellcrank assembly rotated counterclockwise.
9 Connecting link pulled toward the rear of machine.
10 Line-feed lever rotated counterclockwise.
11 Line-feed pawl slides off single-double line-feed lever and engages detent wheel.
12 Detent wheel and platen turn one or two line spaces, depending on the setting of the single-double line-feed lever.
13 Restoring roller raises the line-feed sensing lever and line-feed bellcrank pawl.
14 Stop bar restored by a different code selection.
15 Line-feed mechanism restored.
16 Function shaft stops turning.

1-33. Figures-Shift Mechanism (not applicable to TT-98C/FG)

a. The platen is shifted in position to print figures and other upper-case characters by the operation of the figures-shift mechanism. When the figures code group is received, the figures stop bar moves out of the path of the figures shift sensing lever (fig. 1–37). The figures-shift sensing lever drops to the low point of the figures sensing lever restoring cam. In doing so, it pushes the platen shift cam follower to the right so that its roller moves under the platen shift operating cam. As the function shaft revolves, the lobe on the platen shift operating cam pulls the platen shift cam follower down to pivot the platen shift bell crank. The platen shift bell crank moves the platen shift link toward the rear of the machine, pulling the platen shift arm. The platen shift arm raises the platen support frame and platen. The upward movement of the platen is limited by the bumper on the platen bracket. As the platen rises, it moves the platen latching arm (fig. 1–39) down at the end where it engages the aperture gate. After the low point of the platen shift operating cam passes the roller, the platen shift cam follower and platen shift bell crank are restored to the starting position by the platen shift bell crank spring. At the same time, the lobe of the figures-shift sensing lever restoring cam raises the figure shift sensing lever. The figures stop bar will block the figures-shift sensing lever if another code group is received, selecting a different stop bar. The platen is retained in the shifted position by the platen latch which engages a lug on the semicircular aperture gate.

b. The operations described in this paragraph are summarized in the following chart:

Figure-Shift Sequence Chart

1 Figures code group received.
2 Transfer lever released.
3 Code rings aligned for figures stop bar. Function shaft starts turning.
4 Figure stop bar operated.
5 Figures-shift sensing lever drops to low part of figures sensing lever restoring cam.
6 Figures-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 tilted upward.
12 Platen latching arm and aperture gate moved down and latched.
13 Figures-shift 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.

1-34. Line Feed Mechanism (not applicable to TT-98C/FG)

a. The platen is turned to feed the paper one or two spaces by the operation of the line feed mechanism. The degree of turn is dependent 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. 1-40). The detent wheel is held by the line spacing detent (fig. 1-41) to keep the platen from turning while printing. When line feeding, the detent wheel is turned one spare or two spaces by the line feed pawl. The line feed lever on which the line feed pawl is mounted pivots about the platen shaft. Moving the upper end of the line feed lever to 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 one or two line spaces, the line spacing detent engages the next tooth or the second tooth of the detent wheel to hold the platen in the advanced position. The line feed lever is actuated by" turning the bell crank to pull the connecting link. The bell crank is operated whenever the line feed stop bar is selected by the code rings (para 1-25).

c. The line feed operating cam and the line feed cam follower become engaged only when the line feed code group is received. When this occurs, the line feed sensing lever is released by the operation of the line feed stop bar and drops to the low point of the line feed sensing lever restoring cam right after the function shaft starts turning. (The line feed sensing lever is pulled downward by the line feed sensing lever spring.) In its downward movement, the line feed sensing lever pushes against the two sloping projections on the upper part of the line feed cam follower to make the line feed cam follower shift to the left of the function shaft. This movement causes the roller on the lower end of the line feed cam follower to move under the line feed operating cam. As the function shaft makes its ½ revolution, the line feed operating cam pulls the line feed cam follower downward to turn the adjustable bell crank. The mating surfaces of the line feed operating cam and the roller on the line feed cam follower are beveled approximately 15° so that, as the line feed operating cam turns, it holds the line feed cam follower engaged even though it has moved clear of the line feed sensing lever. After the lobe of the line feed operating cam has passed, the adjustable bell crank operates the platen line feed mechanism as explained above. The line feed sensing lever is raised by the line feed sensing lever restoring cam. As the function shaft completes its ½ revolution, the low part of the line feed operating cam is opposite the roller and the line feed cam follower is pulled to the right by the spring. The line feed stop bar will block the line feed sensing lever if another code group is received, selecting another stop bar.

d. The operations described in this paragraph are summarized in the following chart:

Line Feed Sequence Chart

1 Line feed code group received.
2 Transfer lever released.
3 Code rings alined to accept the line feed stop bar. Function shaft starts turning.
4 Line feed stop bars operated.
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 lobe.
9 Line feed cam follower pulled down by line feed operating cam lobe.
10 Bell crank turned.
11 Connecting link pulled.
12 Connecting lever turned.
13 Line feed pawl engages detent wheel.
14 Detent wheel and platen 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 link 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). Funct ion shaft stops turning.
22 Line feed sensing lever blocked by line feed stop bar on next signal (unless line feed group is repeated).

1-35. Letters-Shift Mechanism

a. The platen is returned to the letters position from the figures position by the operation

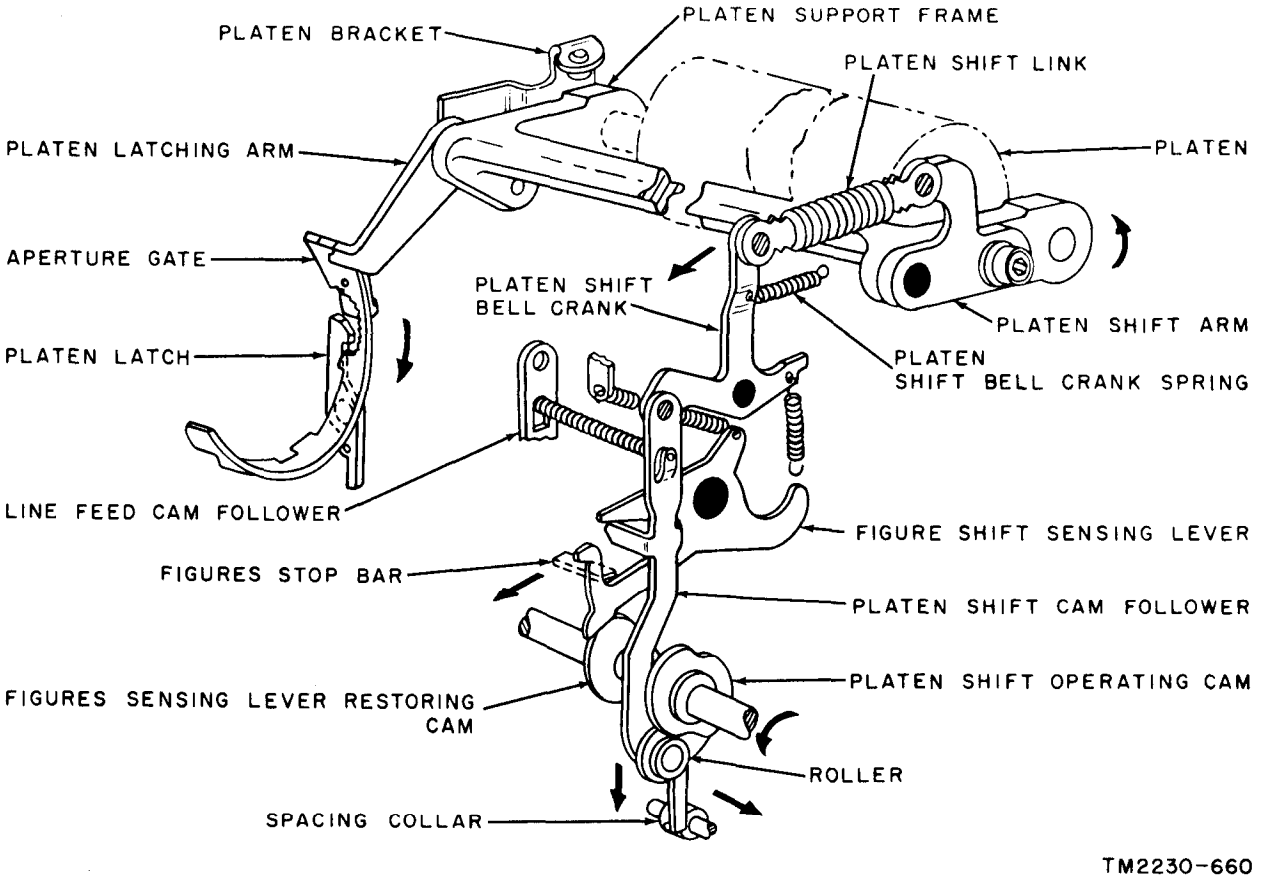


Figure 1–37. Figures-shift mechanism (not applicable to TT–98C/FG).

of the letters-shift mechanism. When the letters code group is received, the function selecting arm (fig. 1-25) is positioned over the letters punch bar (fig. 1-26). As tile function shaft rotates the function cam pivots the function cam follower (fig. 1-25), which causes the function selecting arm to move inward on its shaft and push in the letters punch bar. The letters punch bar turns the letters-shift lever, which forces the platen latch out of engagement with the lug on the aperture gate. The aperture gate is released and the platen drops down (from its own weight) to the letters position. The function selecting arm is moved out of engagement with the letters punch bar. The letters punch bar, the letters-shift lever, and the platen latch return to their original position, through spring action.

b. The platen blocking mechanism (fig. 1-43) is operated by the movement of the platen. When the platen moves into the letters position, the platen blocking arm bracket., mounted on the lower left side of the platen support frame (when viewed from the front), moves the platen blocking arm, which is mounted to it, 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 figures shift sensing lever moves the platen lower case latch away from the platen blocking arm. The platen now is free to move to the figures position.

c. The operations described in this paragraph are summarized in the f ollowing chart:

Letters-Sh Sequence Chart

1 Platen is in figures position.
2 Letters code group received.
3 Function selecting arm positioned over letters punch bar.
4. Function cam pivots function cam followed about support lever.
5 Function selecting arm plunged axially.
6 Letters punch bar pushed in.

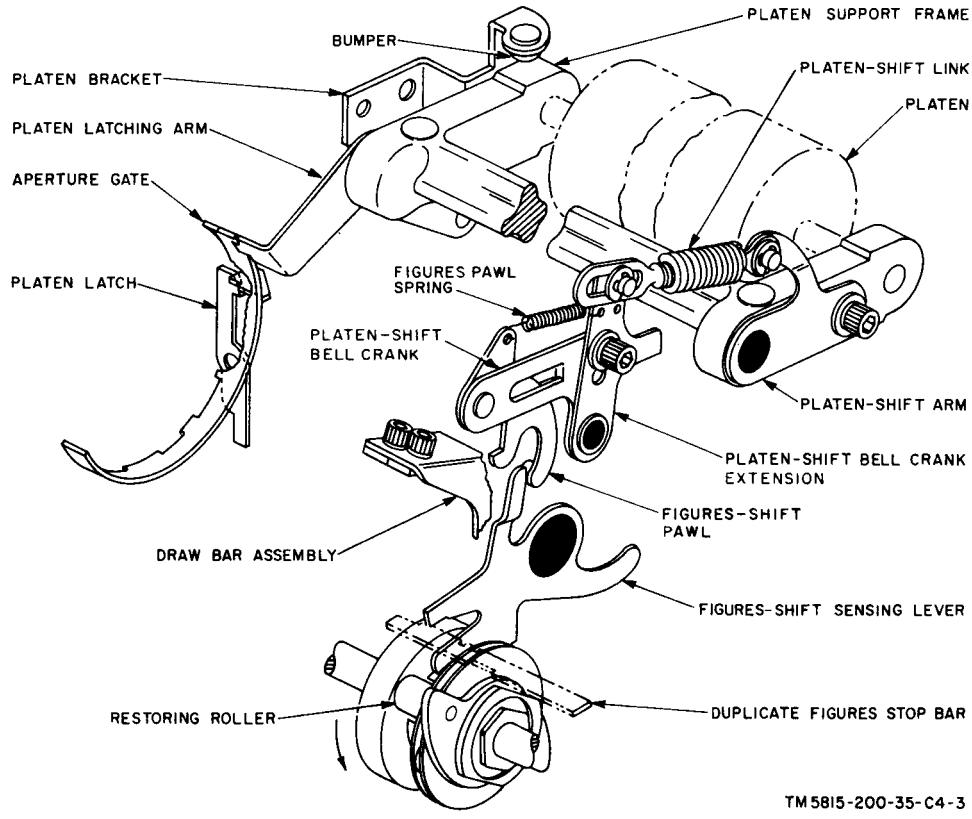


***Figure 1–38. Figures-shift mechanism, partial** view (TT-98C/FG).*

Letters-Shift Sequence Chart—Continued

7 Letters-shift lever turned.
8 Platen latch turned.
9 Aperture gate released.
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, letters-shift lever, and platen latch return to original position (spring return).

d. A manual operating mechanism is supplied to allow the operator to move the platen from the figures position without receiving the letters signal code group. When the manual letters push button (A, fig. 1-44) on the left front of the dust cover is depressed, it causes the manual letters-shift bell crank to rotate and move the manual letters-shift lever link to the right (when viewed from front). The manual letters-shift lever link (B, fig. 1-44) strikes the letters-shift lever extension and causes it to rotate and move the platen latch out of engagement with the lug on the aperture gate. The platen then drops into letters position by its own

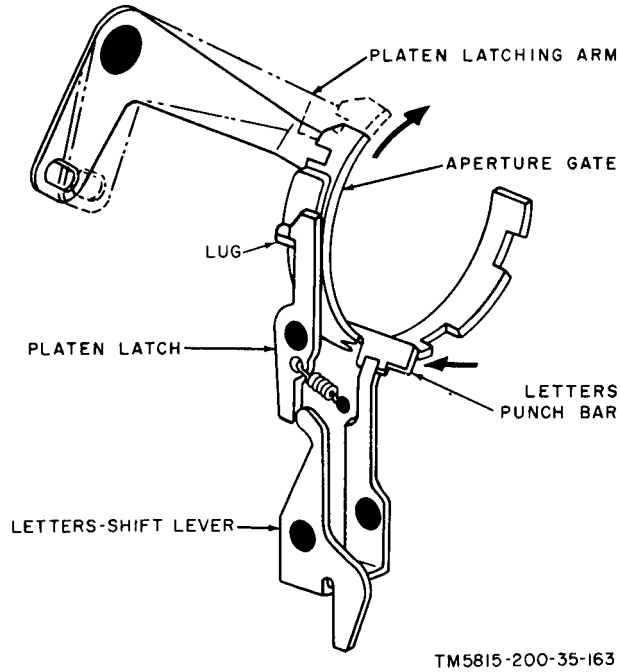


Figure 1–39. Aperture gate latched.

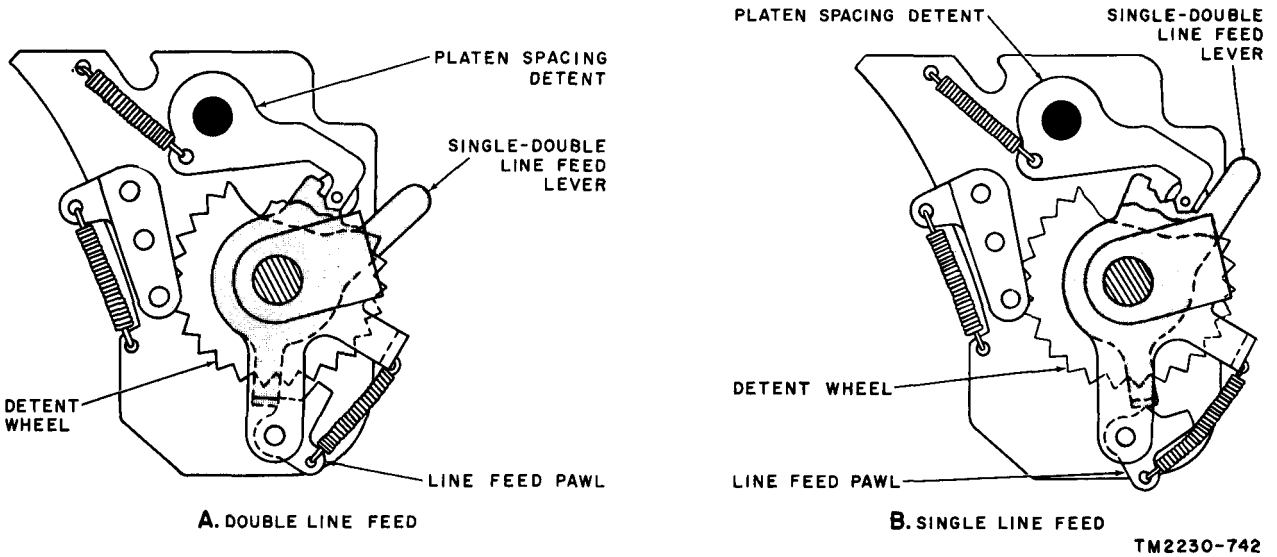


Figure 1–40. Single-double line feed controls.

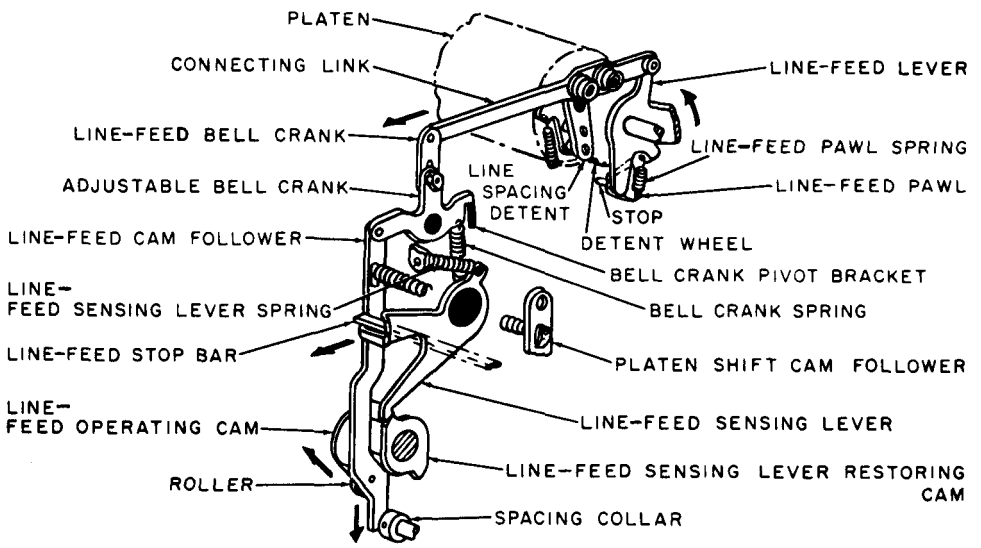


Figure 1-41. Line-feed operating mechanism (not applicable to TT-98C/FG).

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 letters-shift bell crank spring.

1-36. Signal Bell Mechanism

a. The signal bell sounds to alert the operator when the 5 code group is received while the platen is in figures position. The function selecting arm (fig. 1-25) is positioned over the signal bell punch bar. The function cam then pivots the function cam follower and causes the function selecting arm to move inward along its shaft, and push in the signal bell punch bar (fig. 1-45). The aperture gate does not block the movement of the signal bell punch bar (B, fig. 1-27). The signal bell punch bar moves the signal bell clapper to the clapper stop post. Momentum then causes the signal bell clapper to strike the signal bell. The function cam then pivots the function cam follower in the opposite direction and pulls back the function selecting

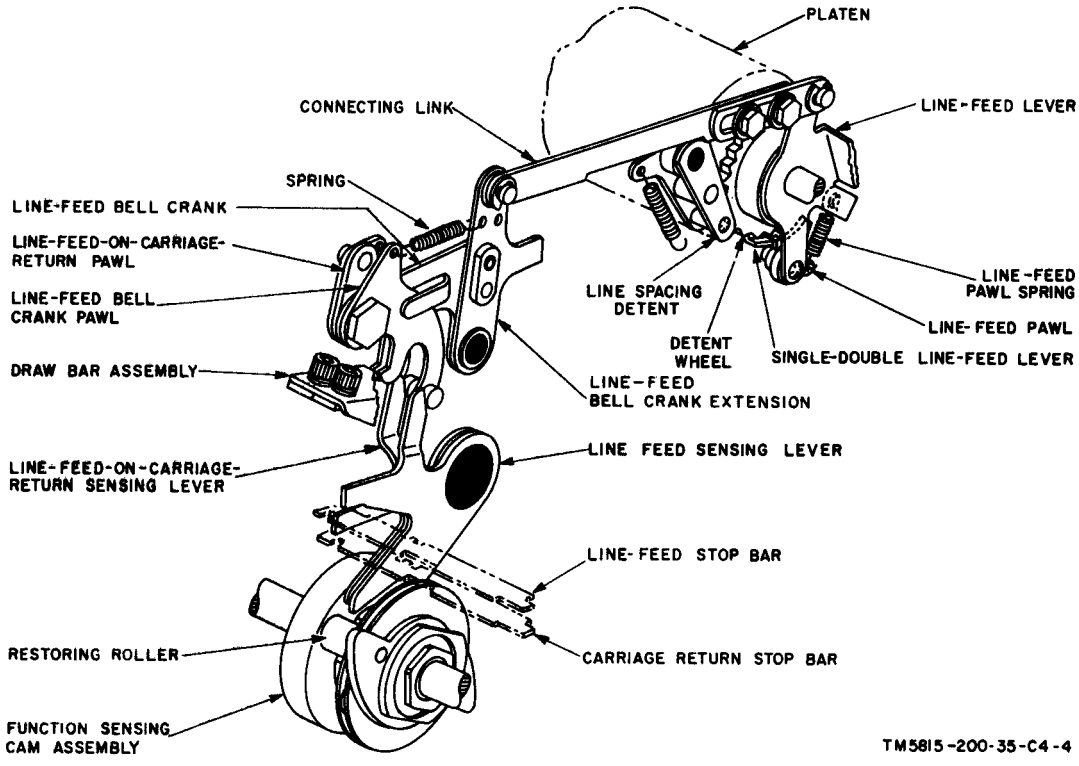


Figure 1-42. Line-feed mechanism and line-feed-on-carriage-return, partial view (TT-98C/FG).

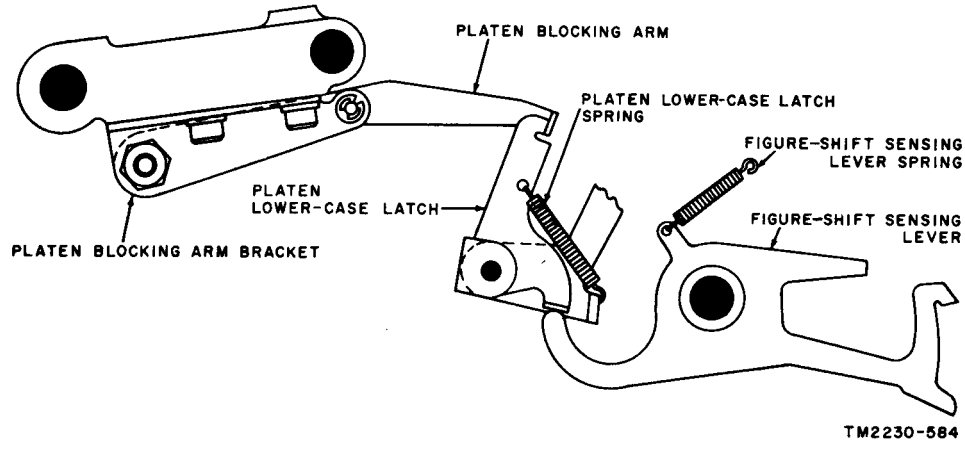


Figure 1-43. Platen blocking mechanism.

arm. The signal bell punch bar and signal bell clapper are returned to their original position by the signal bell clapper spring.

b. The sequence of operation of the signal bell is shown in the following chart:

Signal Bell Sequence Chart

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).

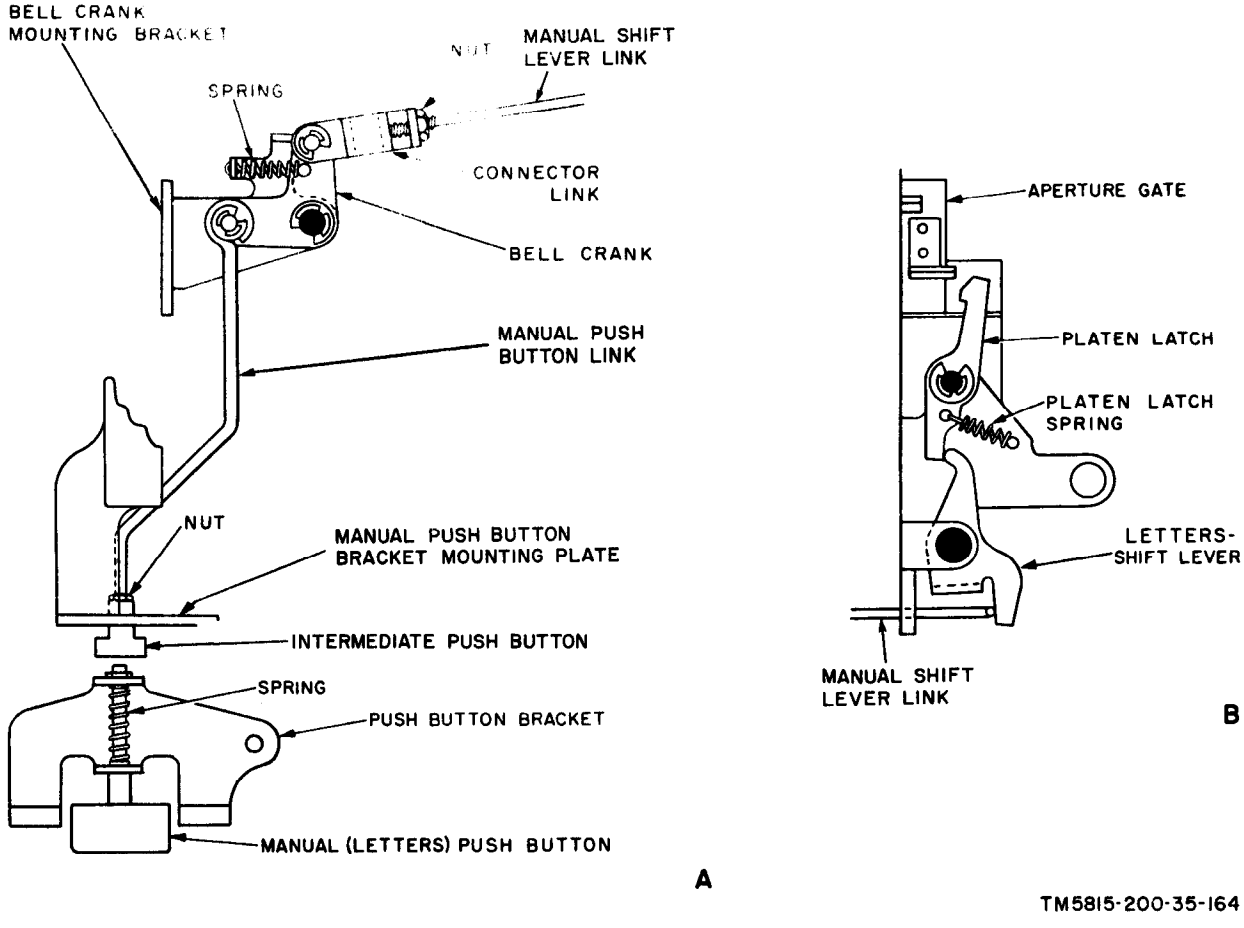


Figure 1-44. Manual letters-shift mechanism.

1-37. Motor Stop Operation (Not Applicable to TT-664(*)/FG, TT-66/FG, and TT-688(*)/FG)

The motor stop operation permits the motors of all of the connected equipments to be stopped during periods when the signal line is idle. The motor is started automatically by either the local station of a connected station when the current flow in the signal line circuit is interrupted and then restored. The motor is stopped in standard communications equipment when the H code group is received while the

platen is in figures position. The motor is stopped in weather symbol teletypewriters when the H code group is received immediately after the blank code group while the platen is in figures position.

a. Standard Communications Equipment. The *reception* of a figures code group causes the platen to shift to figures position and moves the aperture gate out of the blocking position (fig. 1-27) in front of the motor stop punch bar. When the H code group is received, the function selecting arm moves into alignment with the motor stop punch bar and is then plunged axially by the function cam follower (fig. 1-25). The TT-259/FG does not include a switch for interrupting and restoring the signal line circuit. Therefore, when the motor of the TT-259/FG is stopped as a result of the motor stop operation, it can be started only by the interruption and restoration of the signal line circuit at the transmitting end of the circuit. As the motor stop punch bar (fig. 1-45) is driven forward, it pivote the motor stop function lever and operates the float of the motor stop contact switch (S1) to open the motor circuit. The function cam then pivots the cam follower in the opposite direction and the function selecting arm moves away from the motor stop punch bar. The motor stop punch bar and the motor stop function lever return to their original unoperated position through the action of the motor stop function lever spring. The motor will start again when LINE BREAK switch S3 is operated and released.

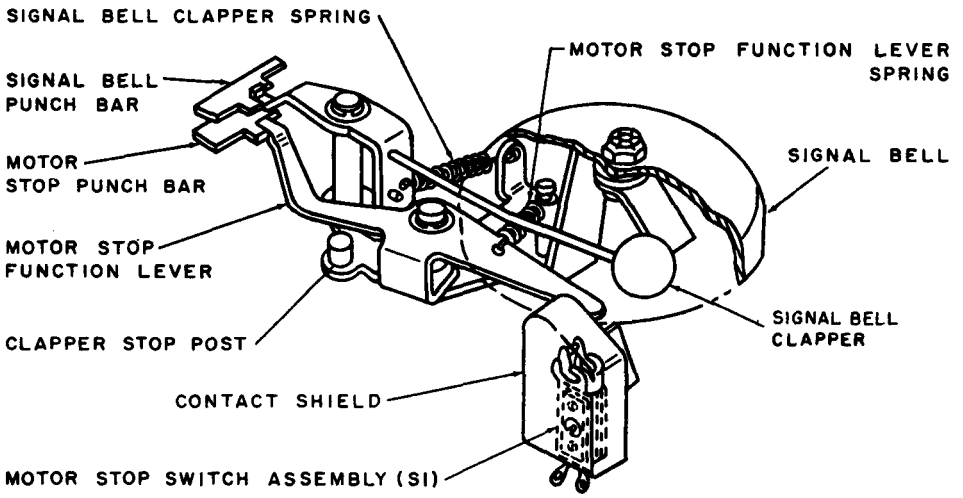


Figure 1-45. Signal bell and motor stop actuating mechanisms. (Motor stop functions not applicable to TT-664(*)/FG, TT-665/FG, and TT-688 (*)/FG .)

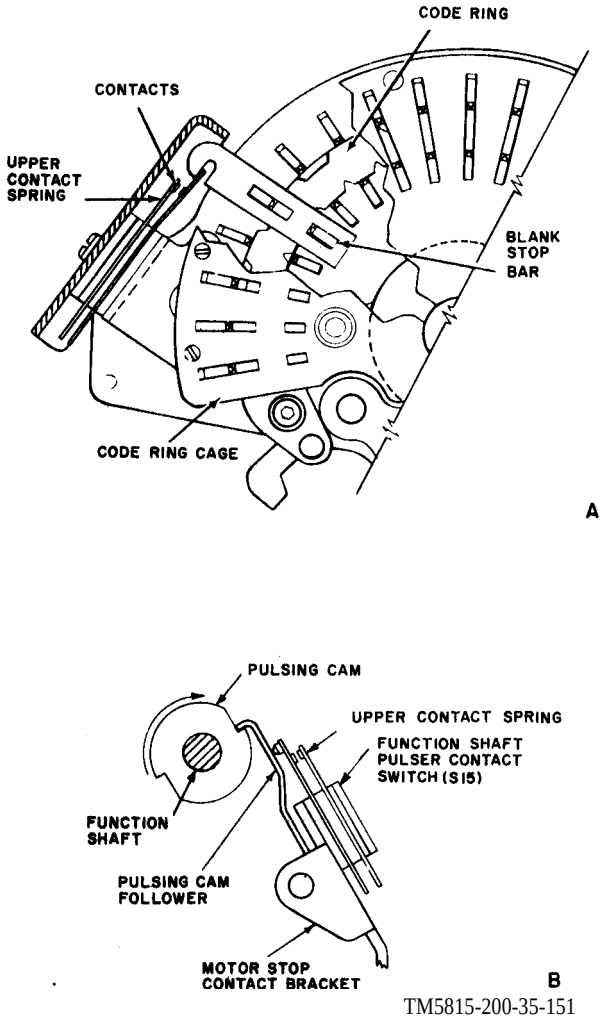


Figure 1-46. Motor stop contacts. Weather symbol teletypewriter.

b. Weather Symbol Tektypewriters. The operation is similar to that described in a above except that the figures position of H is used for the printing of a weather symbol (1). This necessitates an additional control feature before the motor stop operation is effected in weather symbol teletypewriters or similar weather equipment. This additional control requirement is met by the use of an additional relay in the motor stop relay assembly (E1) which is used to complete the electrical path to the motor stop contact switch when the blank code group (-) is received immediately before the H code group. The reception of the blank code group causes the selection of the blank stop bar (A, fig. 1-46) in the code ring cage. As the blank stop bar moves, it raises the stop bar link connected to it. The upward motion of the link allows the closure of the blank code bar contacts (S9) to energize the additional (C) relay. As the H code group is received immediately afterward, the stop bar link is moved downward as the blank stop bar is caromed down by the code rings (as the H stop bar is selected) and the contacts open. The energized relay is then held operated through the closure of the function shaft pulser contacts (B, fig. 1-46) which are closed in every cycle of operation by the pulsing cam located next to the printing cam on the function shaft. Since printing (and therefore spacing between symbols) is required for the H code group and the blank code group in figurea

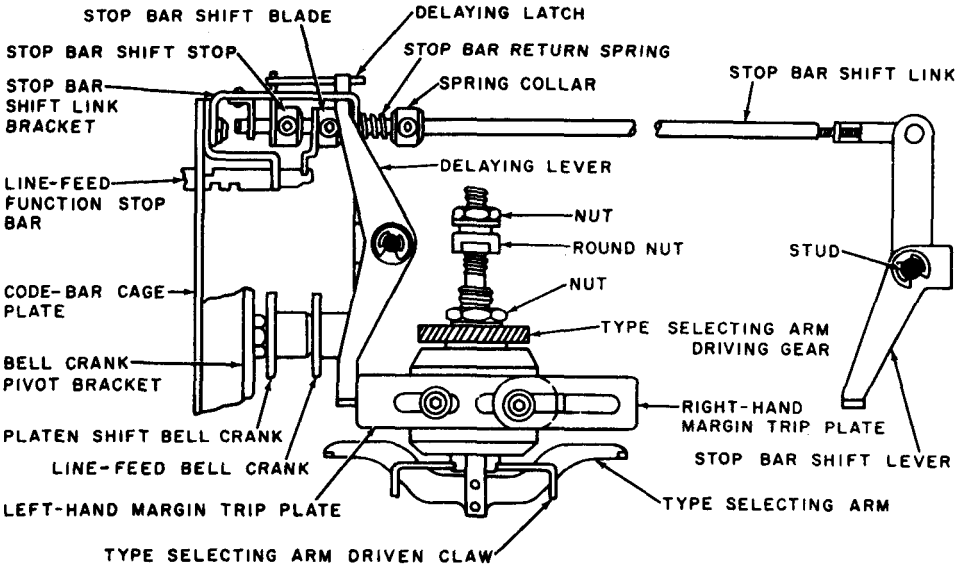


Figure 1-47. Automatic carriage-return and line-feedmechani.wm

position, the function guide block assembly is modified slightly. A blank punch bar is inserted in the blank slot of the function guide block to block axial movement of the function selecting arm in figures position to permit spacing with blank. A slightly longer (.062 inch) motor stop punch bar restricts the motion of the function selecting arm sufficiently to provide spacing in figures H position.

1-38. Automatic Carriage Return and Line Feed Operation

(fig. 1-47)

Automatic carriage return and line feed is initiated when the carriage reaches the right hand margin. At the 73d character (77th in weather symbol teletypewriters the right hand margin trip plate, mounted on the type selecting arm bearing cap of the carriage frame, rotates the stop bar shift lever. This 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 actuated by the right-hand margin trip plate then is held in this operated position by the delaying latch which engages the stop bar shift stop. Since 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-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 un-operated posit ion and moves the functional stop bars back under their associated sensing levera.

1-39. Ribbon Lifter Mechanism

(fig. 1-48)

The normal rest position of the ribbon is below the printing line. The ribbon must be raised and lowered during the printing of each character. The ribbon guide can slide up and down on its mounting and is lifted when the ribbon vibrator bell crank is turned. The ribbon vibrator bell crank is actuated when the type selecting arm pushes the first lever of the ribbon vibrator lever and bracket. Since the ribbon must be raised higher for printing figures than for printing letters, the point about which the lever of the ribbon vibrator bell crank turns is not fixed but is mounted, on a pivot bearing. The pivot bearing can be raised and lowered in accordance with the platen position by means of the bar of the platen trough. Thus, the ribbon is in a raised position

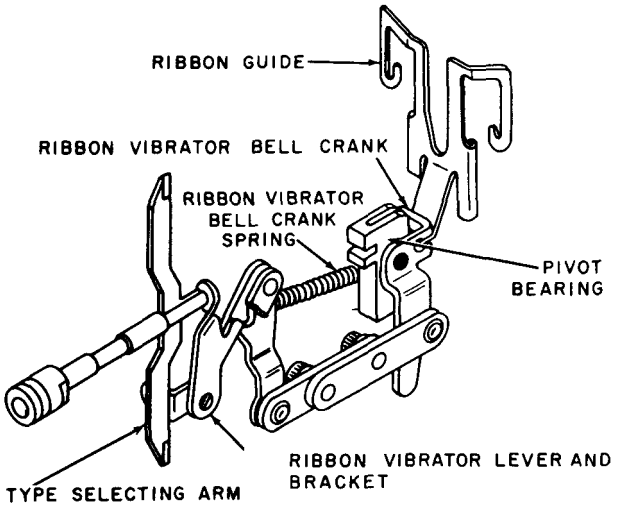


Figure 1–48. Ribbon lifter mechanism.

for figures and in a lowered position for letters but moves in the same manner in both positions.

1-40. Ribbon Feeding Operation

a. The ribbon is pulled a short distance through the ribbon guide each time a character is printed to provide uniformly printed impressions. The ribbon fed mechanism is mounted on the carriage, and is shown in figure 1-49. Both ribbon spools are mounted on ribbon spool drive shafts. The ribbon spool driving gear on the lower end of one or the other of these ribbon spool drive shafts always is engaged with a bevel gear on the drive shaft. The helical gear on the drive shaft mates with the ribbon feed rack which is part of the guide rail of the carriage. Movement of the carriage to the right causes the helical gear, drive shafts, and one ribbon spool to turn and wind up part of the ribbon. The other ribbon spool idles and an equivalent amount of ribbon unwinds from it. This ribbon is kept taut by the spool friction spring of the paying-out ribbon spool. When the carriage is returned to the left, the helical gear turns in the opposite direction ‘but the jaw clutch teeth slip so that the drive to the ribbon spools is effectively disengaged, thus preventing the ribbon from unwinding.

b. On the TT-98C/FG, the ribbon feed mechanism is identical with that described in a above with the following except ions (fig. 1–50) : The ribbon reverse detent and the ribbon reverse detent

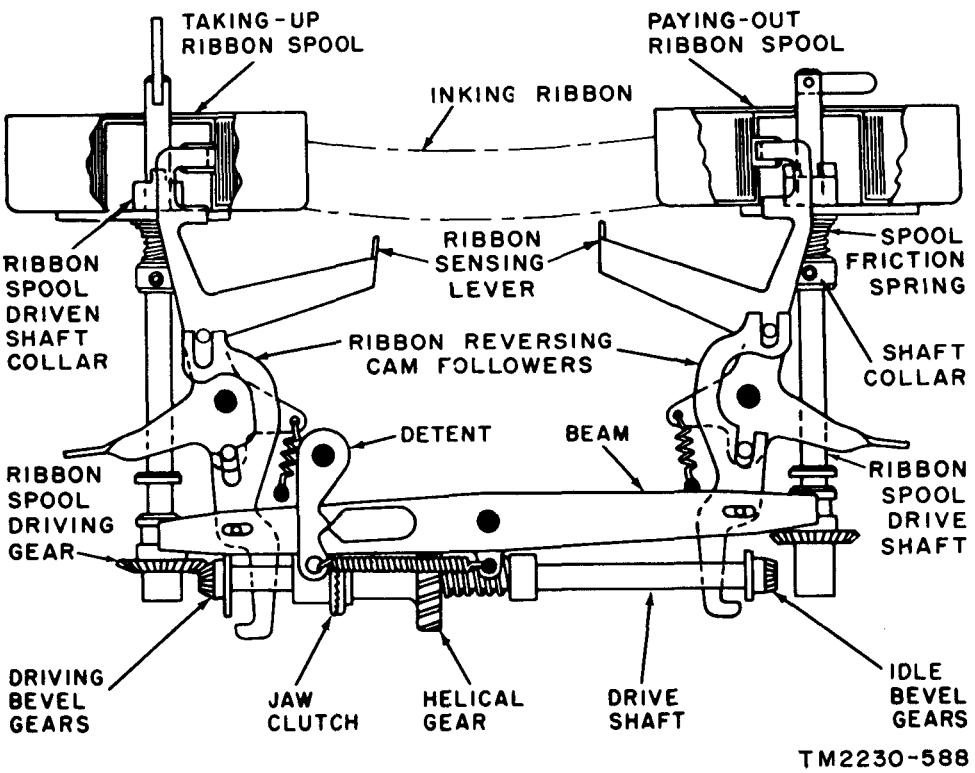


Figure 1–49. Ribbon feed mechanism (not applicable to TT–98C/FG).

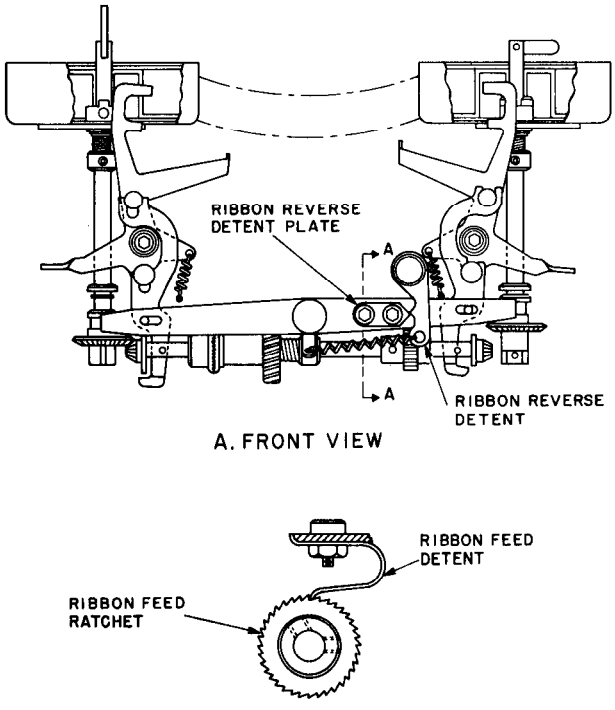


Figure 1-50. Ribbon feed mechanism (TT-98C/FG).

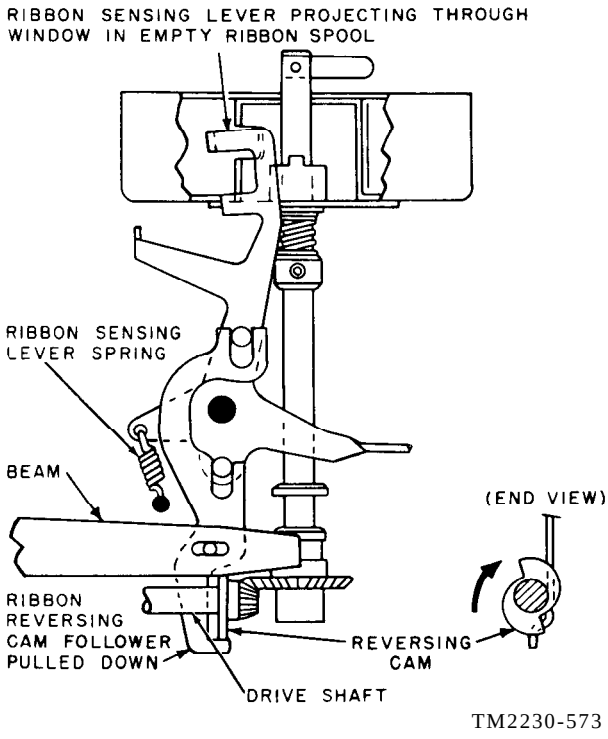


Figure 1-51. Ribbon reversing mechanism.

plate are on the right side of the beam, but the operation is unaffected. A ribbon feed ratchet wheel is mounted on the drive shaft. An associated ribbon feed detent is mounted on the ribbon drive subassembly. The ratchet wheel and detent insure that the jaw clutch teeth slip during the carriage return operation as described in a above.

1-41. Ribbon Reversing Operation

a. After the ribbon is wound entirely on one ribbon spool, the direct ion of ribbon feed must be reversed so as to rewind the ribbon on the empty ribbon spool. This reversing operation is done automatically by the ribbon feed mechanism (fig. 149) when the last turn of ribbon is unwound from the paying-out printing ribbon spool.

b. The core of each ribbon spool has a cutout, or window, through which the end of the ribbon sensing lever projects when the ribbon or the spool is completely unwound. As long as one layer of ribbon is wrapped around the core of the printing ribbon spool, the ribbon sensing lever (fig. 1–51) is retained in position; when the last turn or layer is unwound, the end of the ribbon sensing lever moves through the window. The lower end of the ribbon reversing cam follower, mounted on the ribbon sensing lever, is brought into position under the reversing cam on the drive shaft. The lobe of the reversing cam pulls down the ribbon reversing cam follower (which can slide on its mounting pins) within the next ½ revolution of the drive shaft. The downward movement of the ribbon reversing cam follower forces the beam to pivot, disengaging the bevel gears on one end of the drive shaft and engaging. those on the other end. The empty ribbon spool thus becomes the taking-up ribbon spool and, as soon as one layer of ribbon is wound onto it, the ribbon sensing lever is pushed in and the ribbon reversing cam follower moves away from the reversing cam. The detent (fig. 1-49) keeps the beam latched in the new position. When the last layer of ribbon is removed from the supply ribbon spool, the whole process is repeated.

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

Ribbon Reversing Sequence Chart

1 Starting with left bevel gears meshed and right bevel gears unmeshed, whenever carriage moves to right; left printing ribbon spool is driven, taking up inking ribbon; right printing ribbon spool idles, paying out inking ribbon.
2 Eventually, almost entire ribbon is unwound from right printing ribbon spool.
3 Window in printing ribbon spool becomes uncovered.
4 End of ribbon sensing lever projects through window (spring action).
5 Ribbon cam follower moved under reversing cam (which turns when carriage moves to right).
6 Within 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 printing ribbon spool now is driven taking up ribbon, and left printing ribbon spool idles, paying out inking ribbon.
11 Above sequence repeats in opposite direction.

1-42. Margin Signal Bell Operation (not applicable to TT-259/FG)

a. The margin signal bell rings automatically to warn the sending operator that the end of a line is about to be reached. It is operated by the pawl tripping arm attached to the carriage rack driving gear (fig. 1-52), when the carriage approaches the end of its travel.

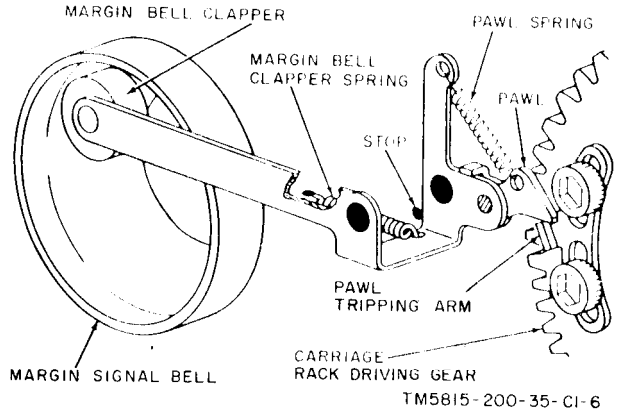


Figure 1-52. Margin-bell mechanism (not applicable to TT-259/FG).

b. As the carriage rack driving gear turns to feed the carriage, the pawl tripping arm lifts the pawl to cause it to pivot downward. When the carriage rack driving gear turns farther, the pawl slips past the pawl tripping arm and the margin bell clapper snaps back swiftly. The momentum of the margin bell clapper carries it past its stop to strike the upper side of the margin signal bell, ringing the bell. The pawl is pivoted and is held to the margin bell clapper by a pawl spring to permit the pawl tripping arm to move past the pawl when the carriage rack driving gear comes around for carriage return.

Section III. ELECTRICAL FUNCTIONS (NOT APPLICABLE TO TT-664(*)/FG, TT-665/FG, AND TT-688(*)/FG)

1-43. General

The circuits of the teletypewriter are divided into four groups for analysis: power, motor and copy lamps, signal, and local dc. Figures 1-53 through 1-68 are simplified schematic diagrams; figures 4-1 through 4-13 are overall schematic and wiring diagrams.

1-44. Power Circuits (not applicable to TT-259/FG)

(fig. 1-63 and 1-55)

a. Ac Input Circuit. When input plug P1 is connected to an ac source of power, ac is applied to Power Supply PP-978/FG, to terminals 4 and 5 of terminal board TB1, and rectifier CR1. The ac input circuit is controlled by POWER switch S4 and is protected by fuse F1. Terminals 4 and 5 of terminal board TB1 and rectifier CR1 are connected permanently, in parallel, across the 115-volt portion of the primary winding of transformer T1. When Power Supply PP-978/FG is not used (plug P4 withdrawn from jack J4), input ac is applied directly to terminals 4 and 5 of terminal board TB1 and to rectifier CR1, through a shorting contact between terminals C and B of j ack J4.

Note. Power Supply PP-978/FG must be used for all ac input voltages except those between 105 and 125 volts.

b. Power Supply PP-978/FG.

(1) When ac is applied to the primary winding of transformer T1 through terminals A and C of plug P4, and adjusted ac is applied to terminals 4 and 5 of ter-

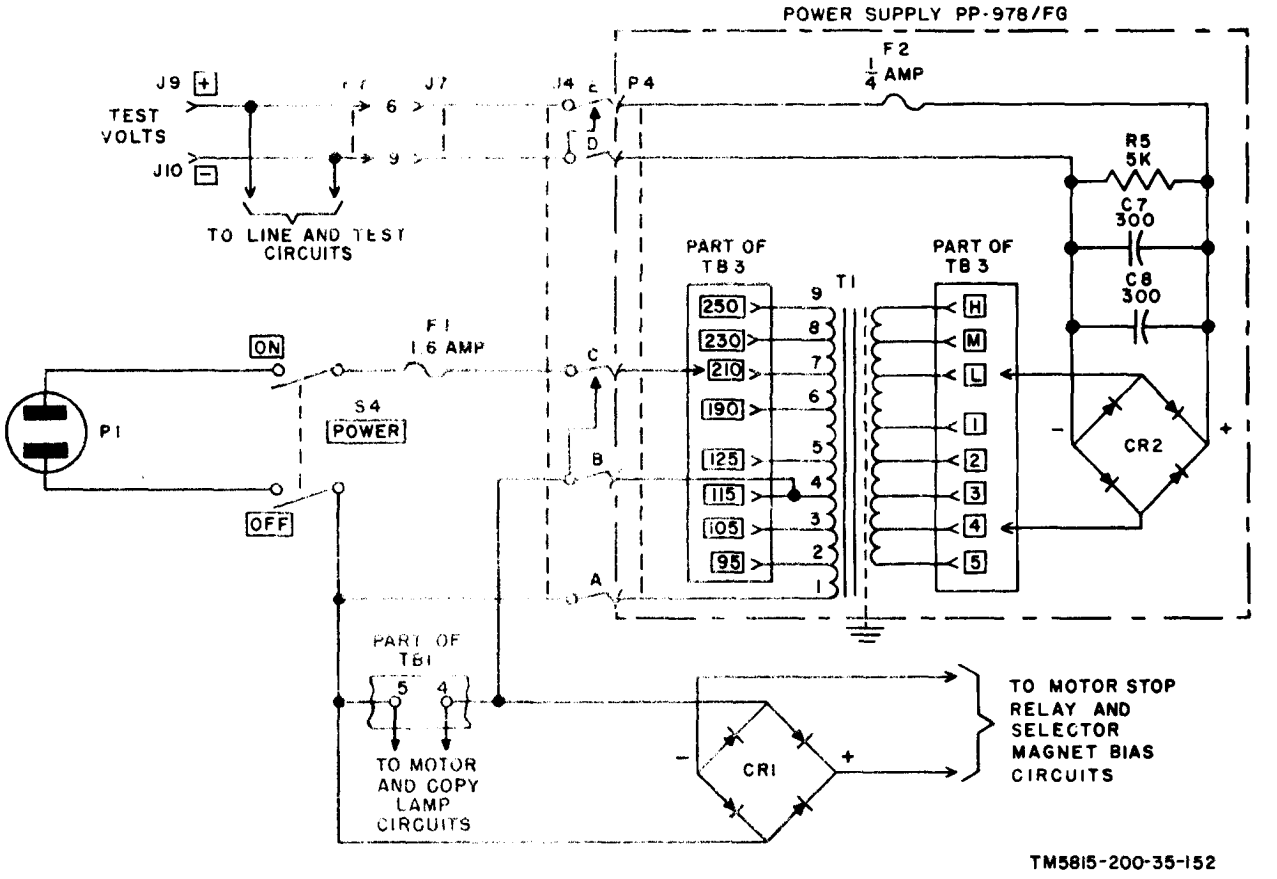


Figure 1-53. Ac input and power supply circuits, simplified schematic diagram (not applicable to TT-259/FG).

minal board TBI and to recifier CR1 through terminals A and B of plug P4. The movable input transformer lead from terminal C of plug P4 is connected to the marked tap on transformer T1 that corresponds to the ac voltage at plug P1.

(2) Induced ac on the secondary winding of transformer T1 is rectified by rectifier CR2 and filtered by capacitors C7 and C8; the voltage applied to rectifier CR2 is adjustable. Resistor R5 maintains a constant load in the output circuit, which is fused by fuse F2. The deoutput. When power supply is used for line current and for test circuits. Jacks J2 and J10 are used for measuring the de output. When Power Supply PP-978(FG is not used *(a* above), contacts D and E of jack J4 are shorted, In this case, dc for the line and test circuit must be supplied from an alternate source.

1-45. Ac Input Circuit (TT-259/FG)

(fig. 1-54)

When input plug P1 is connected to an ac source of power, ac is supplied through power switch S4 to rectifier CR1 and through terminals 4 and 5 of terminal board TB1 to the motor and copy lamps circuits. The ac input circuit is protected by fuses F1 and F2.

1-46. Motor and Copy Lamps Circuits (not applicable to TT-259/FG)

a. Copy Lamps Circuit (A, fig. 1-58). The ac input at terminals 4 and 5 of terminal board TB1 (para 58) is applied to copy lamps I1 and I2, Through LIGHT switch S6, plug P6, and jack J6.

b. Synchronous Motor Circuit (A fig. 1-58). The ac input at terminals 4 and 5 of terminal board TB1 (para 1-44) is applied to the motor, The circuit can be traced from terminal 4 of terminal board TB1, through relay E3, motor the contacts of relay El, and MOTOR switch S5, to terminal

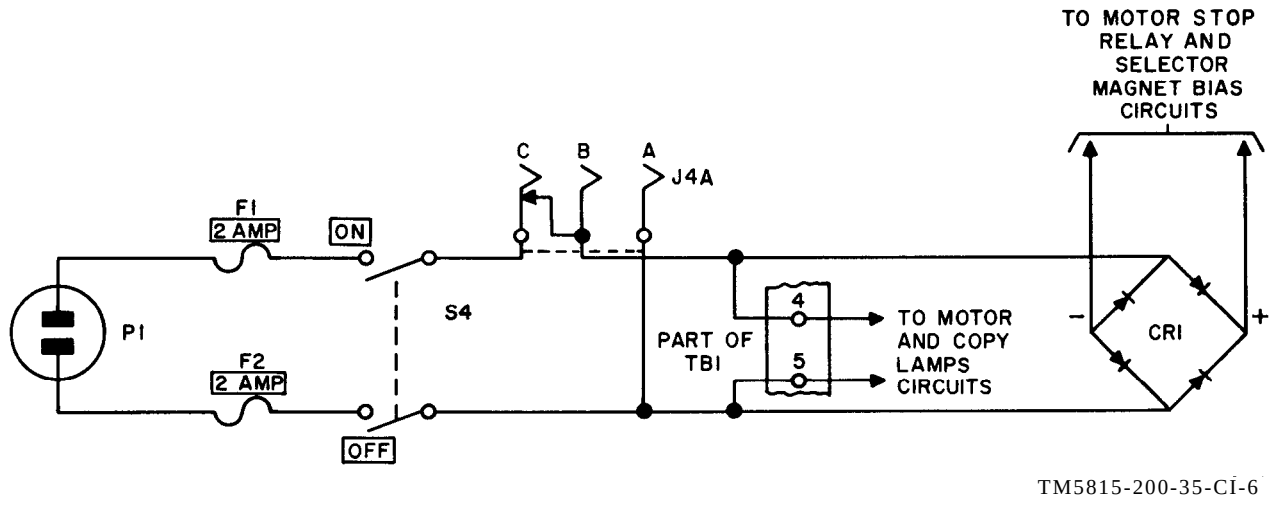


Figure 1-54. Ac input circuit, schematic diagram (TT-259/FG).

5 of terminal board TB1. When MOTOR switch S5 is closed, a large amount of current is required initially for the operation of the motor. When this large current flows through the winding of relay E3, the relay is energized and relay contacts 2 and 3 close. This places a 10-ohm resistor and a 5-µf capacitor in parallel with the 5-µf capacitor that is in series with the start winding of the motor; the effective capacitance in series with the start winding is increseed and it provides the initial torque required to start the armature rotasting. As the armature gains speed, the current that flows though the motor and the winding of relay E3 decreases. When a predetermined value is reached, relay E3 deenergizes and its contacts open. The start winding circuit remains completed through the 5-µf capacitor. The motor armature continues to accelerate until it reaches 3.600 rpm.

c. Series-Governed Motor Circuit (B, fig. 1–58). The ac input at terminals 4 and 5 of terminal board TB1 (para 144) is applied to motor B1. The circuit can be traced from terminal 4 of terminal board TBl, through motor B1 (field windings, armature, and governor), the cent acts of relay El, and MOTOR switch S5, to terminal 5 of terminal board TB1. When MOTOR switch S5 is closed initially, current flows through both of the field windings and the armature of the motor at the maximum permissible rate. At this point, the governor contacts are closed and 150-ohm resistor R1 in parallel with the governor contacts is shorted out. When the motor reaches a predetermined speed, centrifugal force overcomes the spring pressure that holds the movable electrical contact against the stationary electrical contact of the governor (fig. 1–5). When the contacts open, 150-ohm resistor R1 is introduced in series with the field windings and the armature. The resulting reduction in current flow causes the motor to slow down sufficiently to enable the movable-contact spring to close the governor contacts and short out resistor R1. As the current again increases, the motor speed also increases and the governor contacts again open and the cycle is repeated as long as the motor is running. Capacitors Cl and C16 suppress arcing at the governor contacts. Capacitor C17 suppresses arcing at the armature brushes. Filter Z1 suppresses radio frequencies.

1-47. Motor and Copy Lamps Circuits (TT-259/FG)

(fig. 1-59)

a. copy Lamps Circuit. The ac input at terminals 4 and 5 of terminal board TB1 (para 145) is applied to copy lamps 11 and 12 through jack J6 and plug P6.

b. Motor Circuit (fig. 1–59). The ac input from terminals 4 and 5 of terminal board TB1 is applied through relays El and E3 to synchronous motor B1. The circuit is traced from terminal 4 of terminal board TB1, through starting relay E3, synchronous motor Bl, the contacts of motor stop relay El, terminals 3 and 5 of terminal board TB1. When power switch S4 (fig. 1-54) is closed, a surge of current flows through the winding of starting

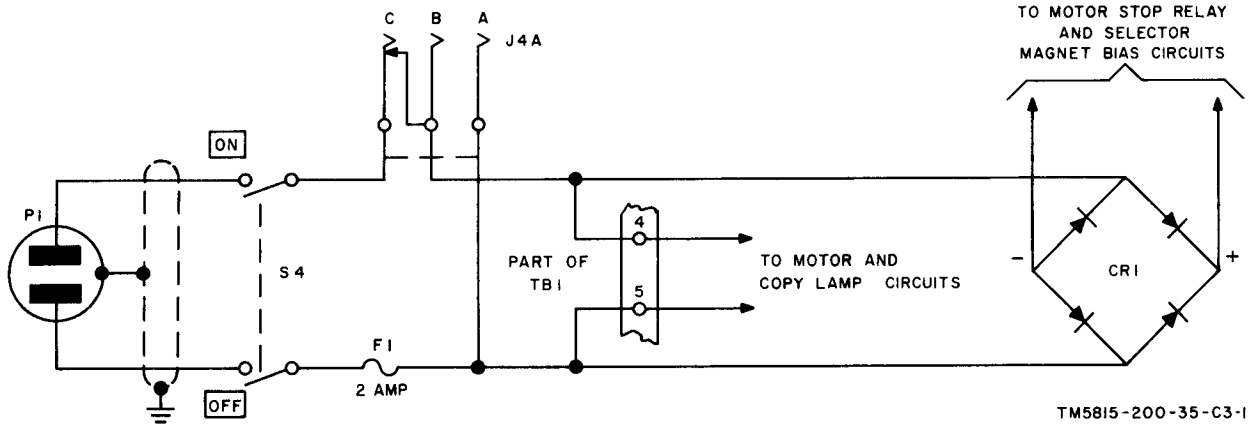


Figure 1–55. Ao input circuit (TT–98B/FG, TT-100B/FG, TT–293/FG, TT-300/FG, TT-482/UGC and TT-483/UGC).

relay E3, energizing it, and contacts 2 and 3 close. Subsequent operation of thestarting relay is described in paragraph 1-46b.

1-48. Signal Circuits

The signal circuits consist of the send, receive, and test circuits. Each of these circuits are used to carry code impulses.

a. *Send Circuit* (fig. 1–60) (not applicable to TT-259/FG).

(1) The send circuit is used to transmit neutral mark and space impulses to external signal lines connected at terminals 1 or 5, and 2 of the terminal and switch box in all positions of LINE SELECTOR SWITCH S7 except TEST (c below). Current flow is controlled by transmitter contacts E4 which are mechanically operated (para 1–15). The transmitter filter (Z2) suppresses radio interference.

(2) Provisions are made for the automatic shorting of the transmitter contacts during motor stop (para 1–49) and for manual shorting of the transmitter contacts by positioning S2 to its LOCK position during periods when message traffic is being received on the associated receiver. LINE-BREAK switch S3 which is normally in the LINE position may be operated to BREAK to open the line to signal the distant station or to break in on lower priority traffic.

(3) Dc current is supplied from rectifier CR2 with S11 positioned to ON or by the distant station with S11 positioned to OFF. Current flow is controlled by the variable resistor R10 when the local station supplies line current. When the distant station supplies line current, R3 may be used to limit the level of the signal line current.

Note. One of the two sections in SEND LOCK switch S2 in the TT–293/FG is connected to the two terminals of terminal board TB3 (fig. 1–65). When S2 is at SEATD, a control circuit is completed to an associated radio transmitter.

b. Recieve Circuits. Code impulses received from the signal line at terminals 3 and 4 of the terminal and switch box are used to control selector magnet 132 which, in turn, governs the position of mechanical parts within the selector mechanisms. Either 20- or 60-ma signals may be received to operate the selector magnet. LINE SELECTOR switch S7 adapts the circuit to the level of the line current; the windings may be arranged in series or in parallel through positioning switch S7. The receive circuit consists of the two selector magnet windings, switch S7, and a pair of contacts of motor stop relay E1 (para 1-49).

(1) When switch S7 is positioned to TEST (para 1-49), P (polar), or 60 MA (B, fig. 1–61), the line windings of the selector magnets are arranged in parallel. Half of tile signal line current passes through each of the windings to activate the selector magnet armature (para 1-19).

(Q) When switch S7 is positioned to 20 MA (A, fig. 1–61), the selector magnets

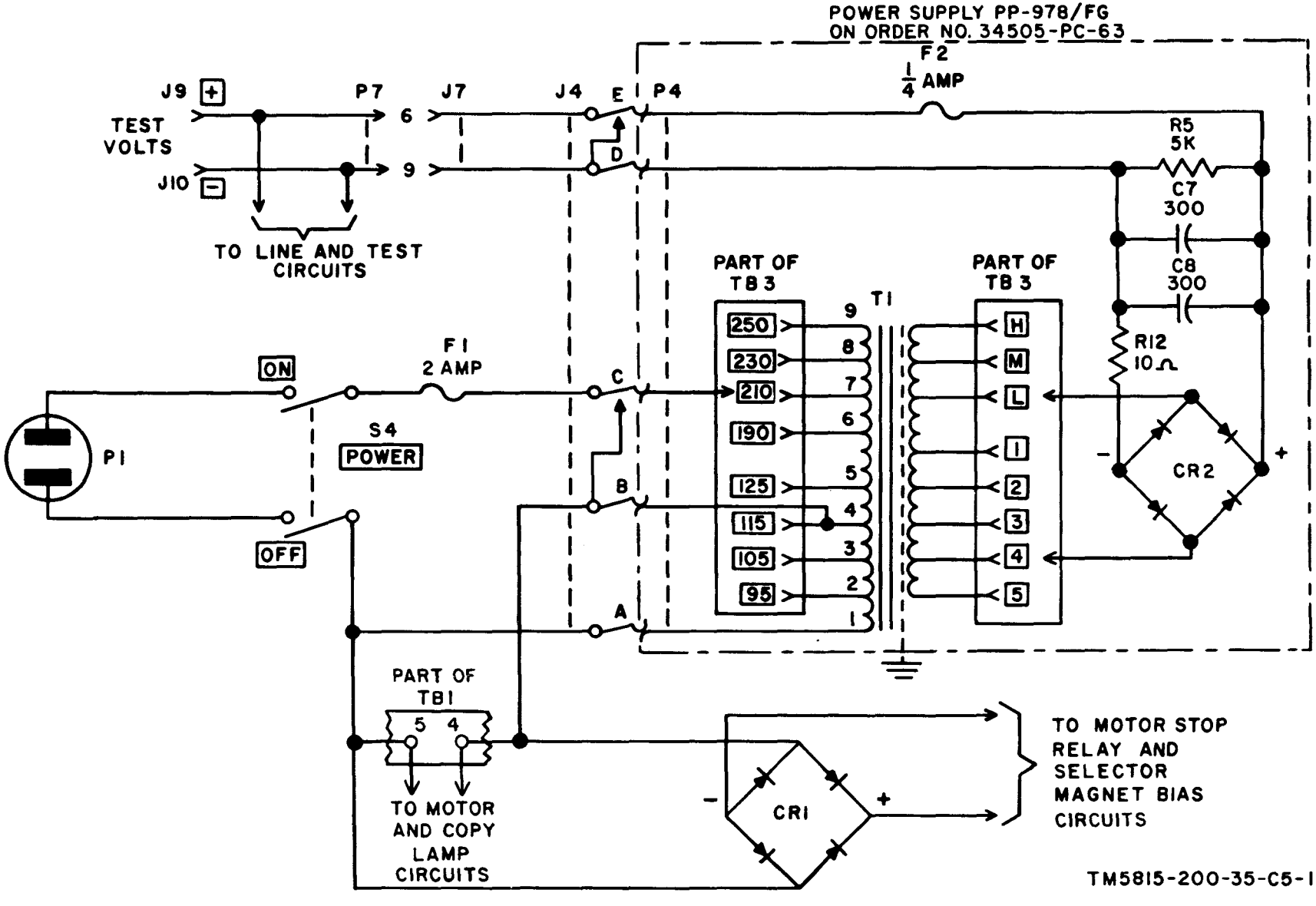


Figure 1-56. Ac input and power supply circuit, simplified schematic diagram (Order No. 34505-PC-63).

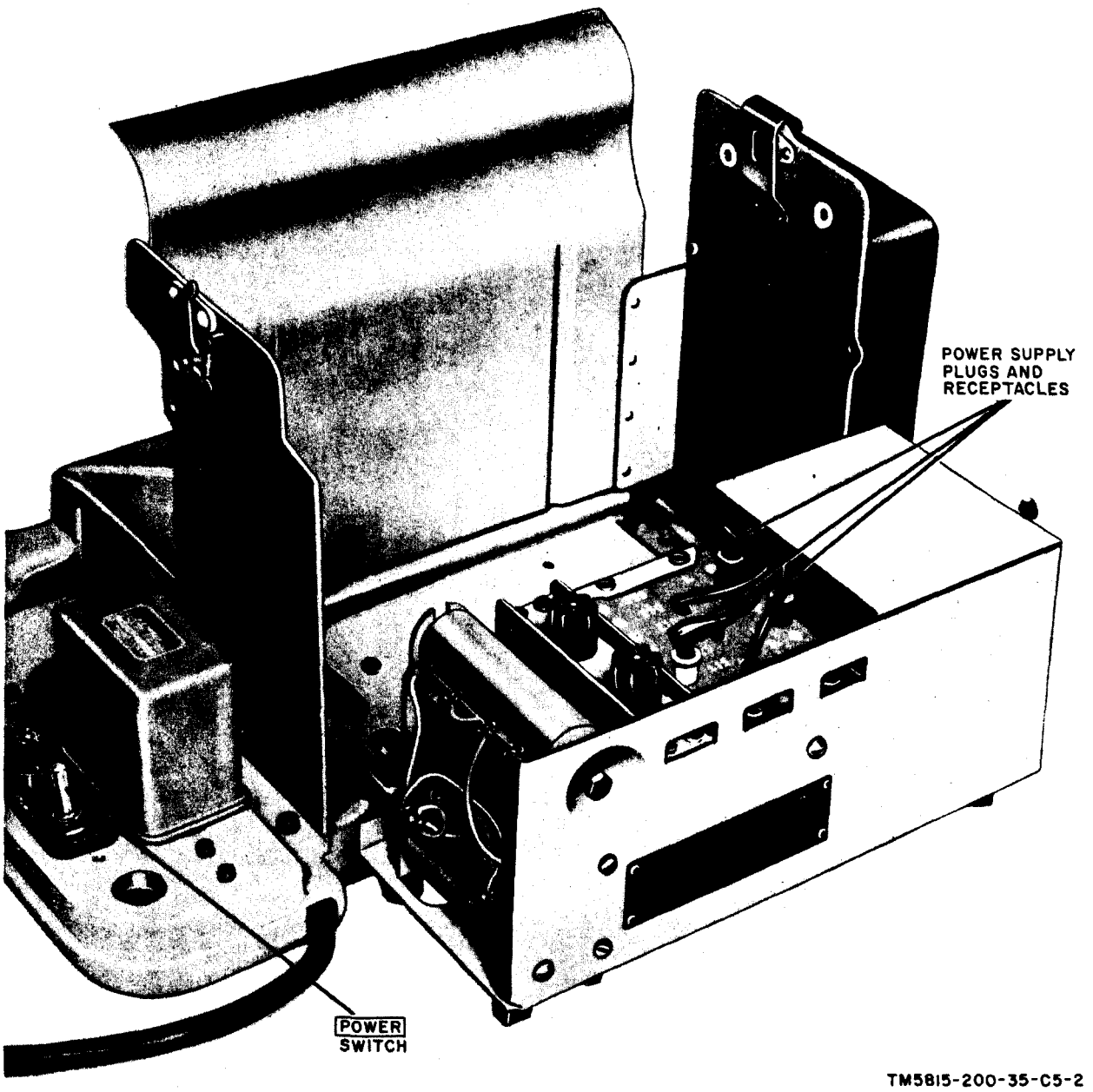


Figure 1–57. Power supply PP–978/FG on Order No. 34505–PC–63.

are arranged in series and the full value of the line current passes through each winding.

(3) When motor stop relay E1 is energized, the receive circuit is completed through the 400-ohm winding of relay A and the 300-ohm winding of relay B.

Note. The receive circuits of all models are as described in *b* above except that the terminal contact numbers and switch sections of LINE SELECTOR switch S7 differ (fig. 1-62).

1-49. Local DC Circuits

a. Test Circuit (fig. 1-63) (not applicable to TT-259/FG). The test circuit provides a means of placing the transmitter and the receiver into

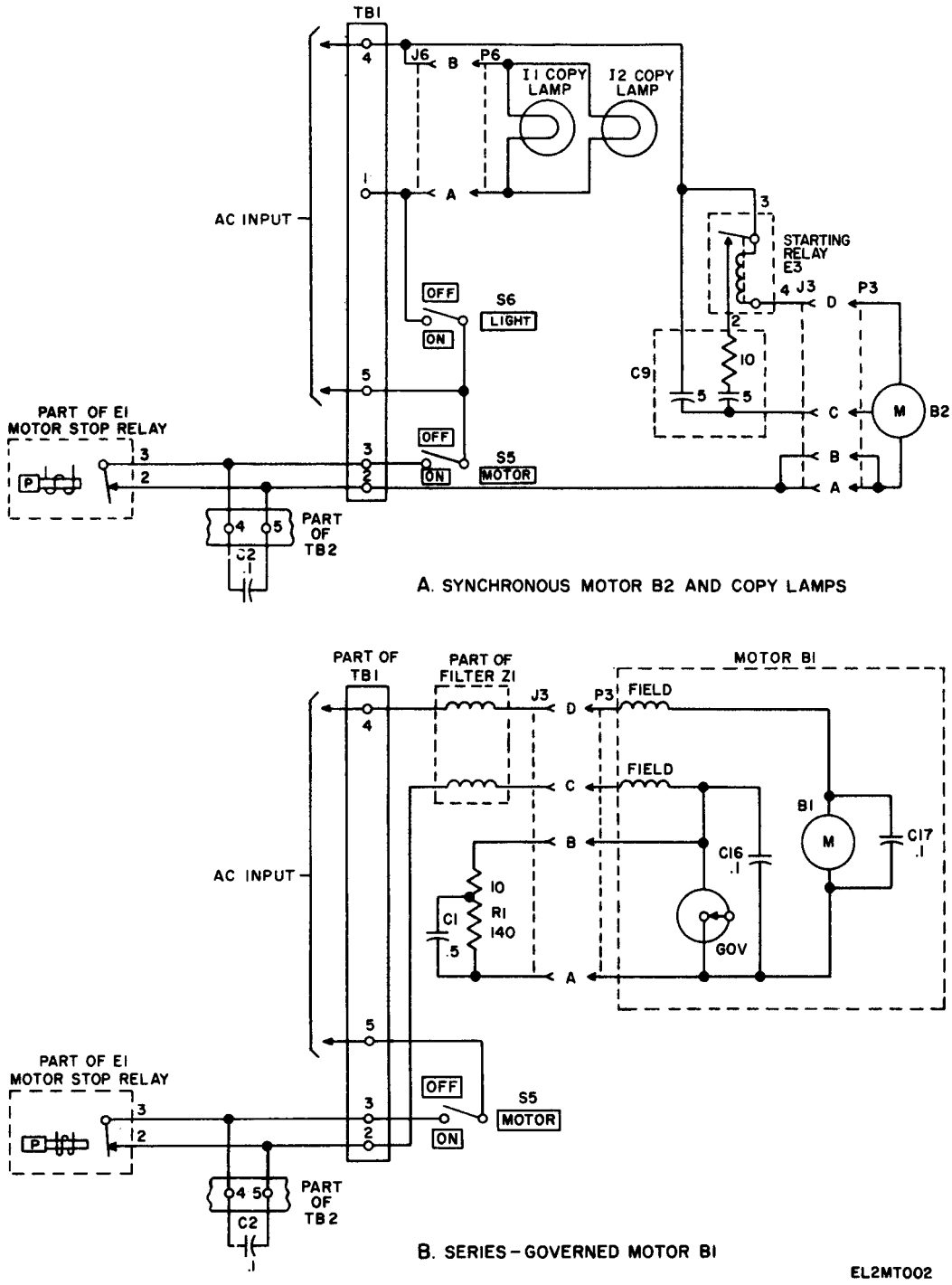


Figure 1-58. Motor and copy lamps circuits, simplified schematic diagram (not applicable to TT-259/FG).

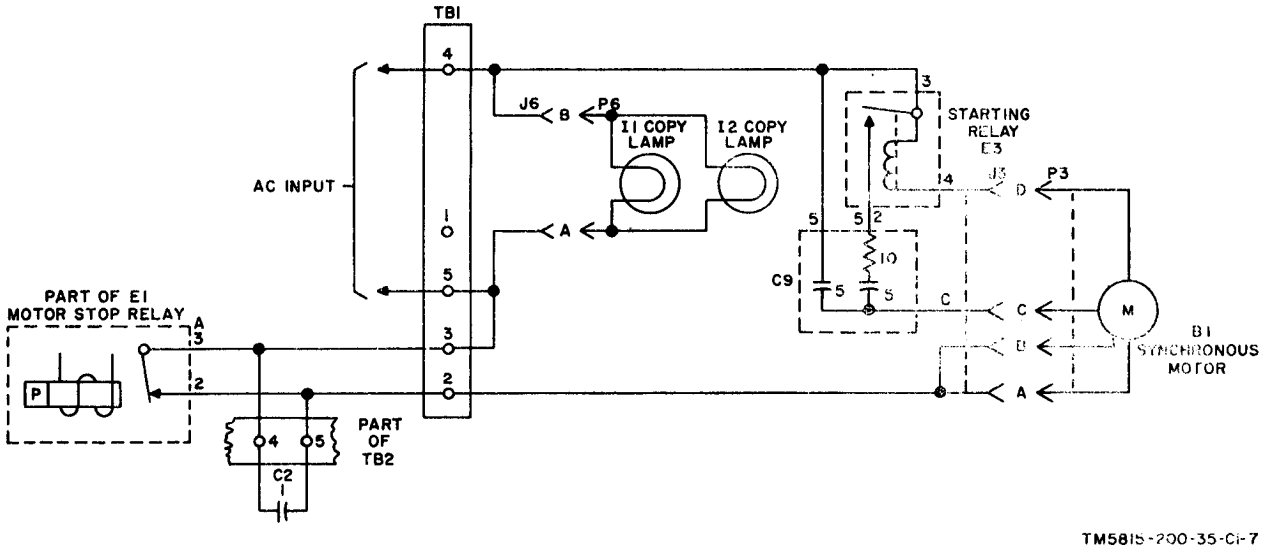


Figure 1–59. Motor and copy lamps circuits, schematic diagram (TT–259/FG).

a local 60-ma neutral circuit for testing purposes without affecting the external signal circuits connected to the terminal and switch box. LINE SELECTOR switch S7 must be in the TEST position.

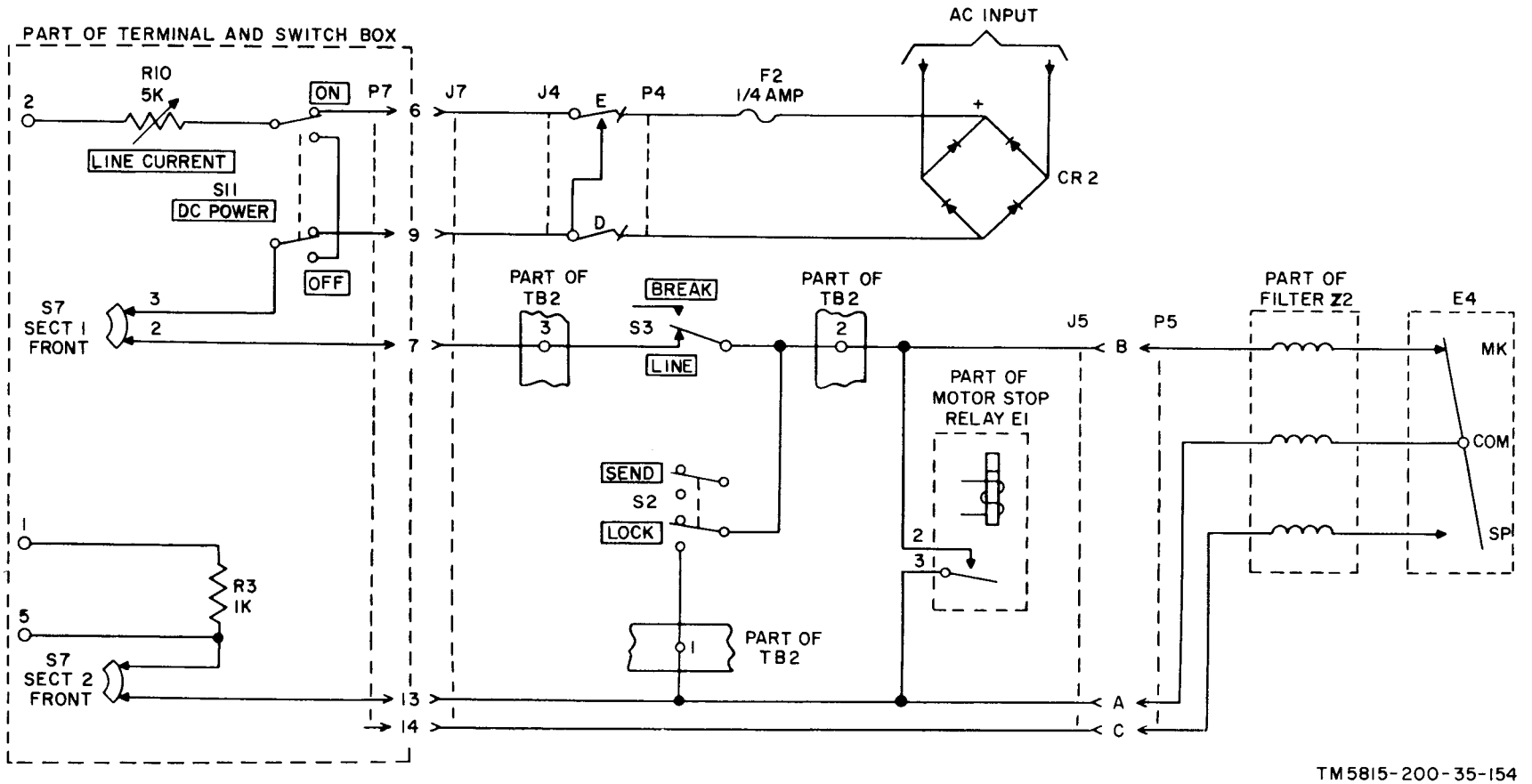
(1) Rectifier CR2 provides the dc for the circuit. The circuit may be traced from the positive side of CR2, through fuse F2 and resistor R6, to selector magnet windings E2 which are in parallel. The parallel circuit legs join at a point between 15 of J7 and A of J8 and then the circuit is continued through the contacts of motor stop relay E1 and the common (COM) of transmitter contacts E4 to the MK contact, through LINE-BREAK switch S3, and returns to the negative side of CR2.

(2) The external signal circuits connected to terminals 3 and 4 of the terminal and switch box remain closed. If DC POWER switch S11 is in the OFF position, send terminals 1 or 5, and 2 are held closed through the strap at S11. If DC POWDER switch S11 is in the ON position, rectifier CR2 remains connected to the external line attached to the send terminals 1 or 5, and 2. Positive battery is supplied to terminal 2 through the LINE CURRENT potentiometer. Terminals 1 and 5 of the terminal and switch box remain connected to the negative side of CR2.

b. Test Circuit for TT-259/FG (fig. 1-64). The test circuit provides a means of connecting the teletypewriter to a local source of 60-ma neutral test signals. When LINE SELECTOR switch S7 is moved to the TEST position, the teletypewriter receive circuit components are switched from the distant-station signal circuit (signal line terminals 3 and 4) to the local test circuit (signal line terminals 2 and 5).

(1) The positive polarity lead of the local test circuit must be connected to signal line terminal 2 and power for the local test circuit must be supplied externally. The test circuit may be traced through variable resistor R8, DC POWER switch S11, resistor R6, section 2 of LINE SELECTOR switch S7, the parallel-connected line windings of selector magnet E2, contacts B4 and B5 of motor stop relay E1, section 1 of S7, and DC POWER switch S11 to signal line terminal 5. The E contacts of J4B must be kept apart (by the insertion of several layers of rubber tape) to prevent the shorting out of the selertor magnet line windings.

(2) When LINE SELECTOR switch S7 is in the TEST position, the signal circuit



TM5815-200-35-154

Figure 1–60. Send circuit, simplified schematic (not applicable to TT–259/FG).

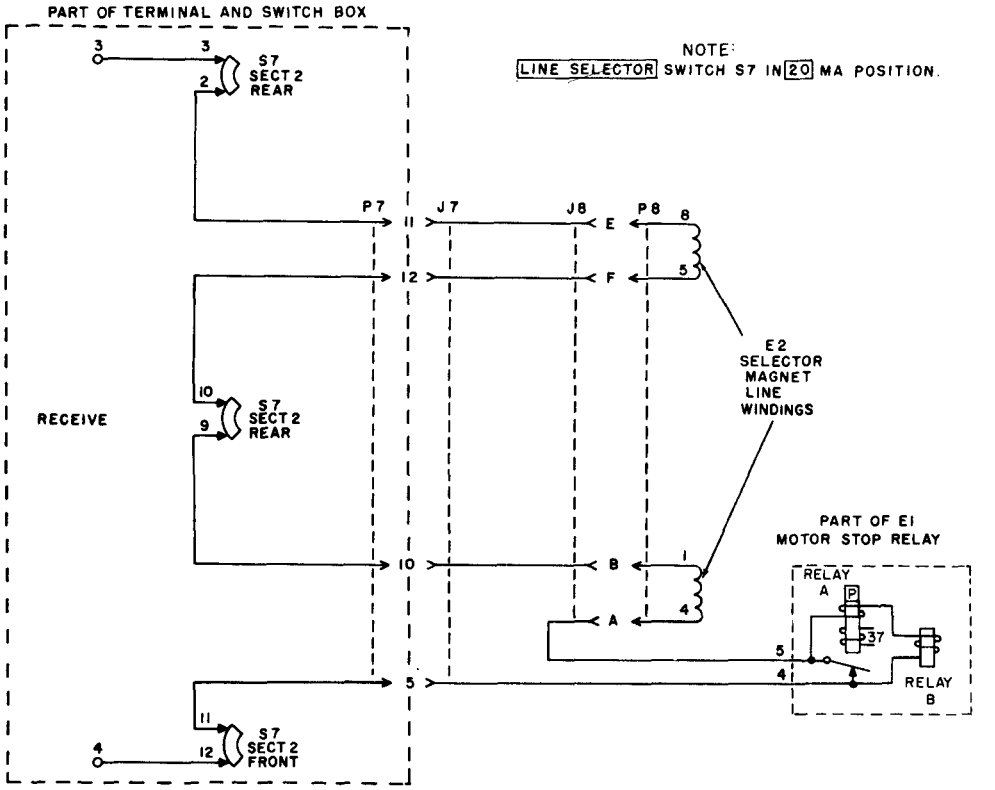
from the distant station is shorted at contacts 4 and 11, section 1 rear of S7.

c. Selector Magnet Bias Circuit (figs. 1-66 and 1-67). The selector magnet bias circuit is used during neutral operation to control the movement of the selector magnet armature to the space position. The current in the circuit is determined by the position of LINE SELECTOR switch S7. In TEST and 60 MA positions, current flow through the bias windings is 12 MA. In 20 MA position, the current flow is 8 MA. In P (polar) position, the circuit is open at switch S7. The circuit is protected by fuse F4.

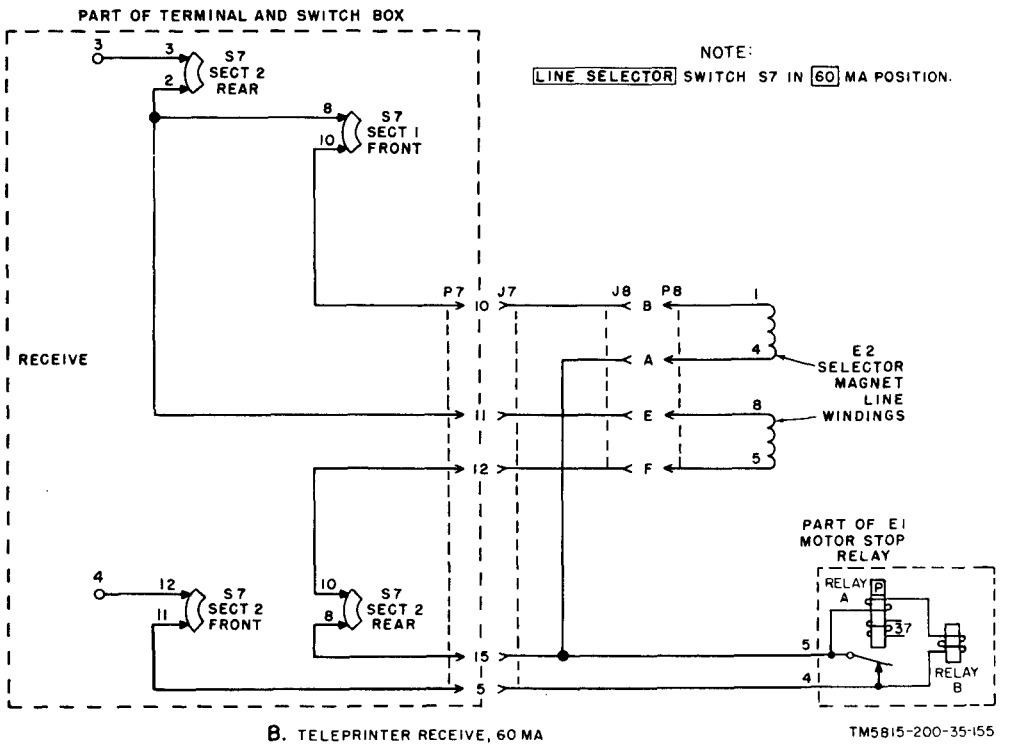
d. Motor-Stop Circuits.

(1) *Communication symbol equipment* (A, fig. 1-68). The motor stop circuit provides a means of controlling the motor from either the local station or from the distant station through signals received by the signal circuit. The motor stop operation is an electro-mechanical function which is initiated when the code combination for the letter H is received when the platen is in figures position. In the normal unoperated position (as illustrated), capacitors C5 and C16 are charged from rectifier CR1. When the motor stop actuating lever (para 1-37) moves contact 2 against the contact 3 of S1, a circuit is completed from C5 and C6 through the 37-ohm winding of relay A, and relay A operates as C5 and C6 discharge. Relay A is composed of a 37-ohm winding, a 400-ohm winding, and a permanent magnet core. The permanent magnet is not sufficiently strong to operate the contacts of relay A without the aid of the current flow through the 37-ohm winding. However, once the contacts are in the operated position, the permanent magnet is capable of holding them operated indefinitely. One pair of contacts (2A and 3A) operates the motor circuit (A, fig. 1-58); another pair (2B and 3B) places a short across the send circuit (fig. 1-60) (2B and 3B are not used in the TT-259/FG); a third pair of contacts (4B and 5B), in series with the receiver circuit (fig. 1-61), opens. As this pair of contacts open, the receive circuit is completed through the B relay and the 400-ohm winding of relay A. As the current passes through the winding of relay B, and its contacts close, a short is placed across relay A release winding, and the circuit remains completed through relay B contacts. To start the motor again, LINE-BREAK switch S3 is moved to the BREAK position. (Restarting the TT-259/FG motor is accomplished by the transmitting station operator who must open and then close the signal circuit, usually by pressing and releasing a switch.) The receive circuit is opened and relay B is de-energized. When LINE-BREAK switch S3 is released, it automatically returns to LINE position, and current flows through relay B and the release winding of relay A. The release winding opposes the field of the permanent magnet, and the contacts of relay A are released to their normal positions. When this occurs, the motor is started, the short is removed across the send circuit, and the release winding of relay A and the winding of relay B are shunted from the receive circuit.

(2) *Weather Symbol Equipment* (B, fig. 1-68). An additional control relay (C) is furnished with the motor stop of weather symbol equipment (para 1-37 *b).* The reception of a blank code group causes the closure of blank code bar contacts S9. This completes a circuit from the negative side of CR1 through relay C to the positive side of CR1. Relay C, which is slow to release, becomes energized. If the H code group immediately follows the reception of the blank code group, the function shaft pulser contacts (S10) close and the motor stop contacts close. The closure of S10 keeps relay C energized and maintains a closed path momentarily from motor stop contacts S1 through the operate winding of relay A. The rest of the motor stop operation is identical with that in (1) above.



A. TELEPRINTER RECEIVE, 20 MA



B. TELEPRINTER RECEIVE, 60 MA

Figure 1–61. Receive circuits, simplified schematic (not applicable to TT–259/FG).

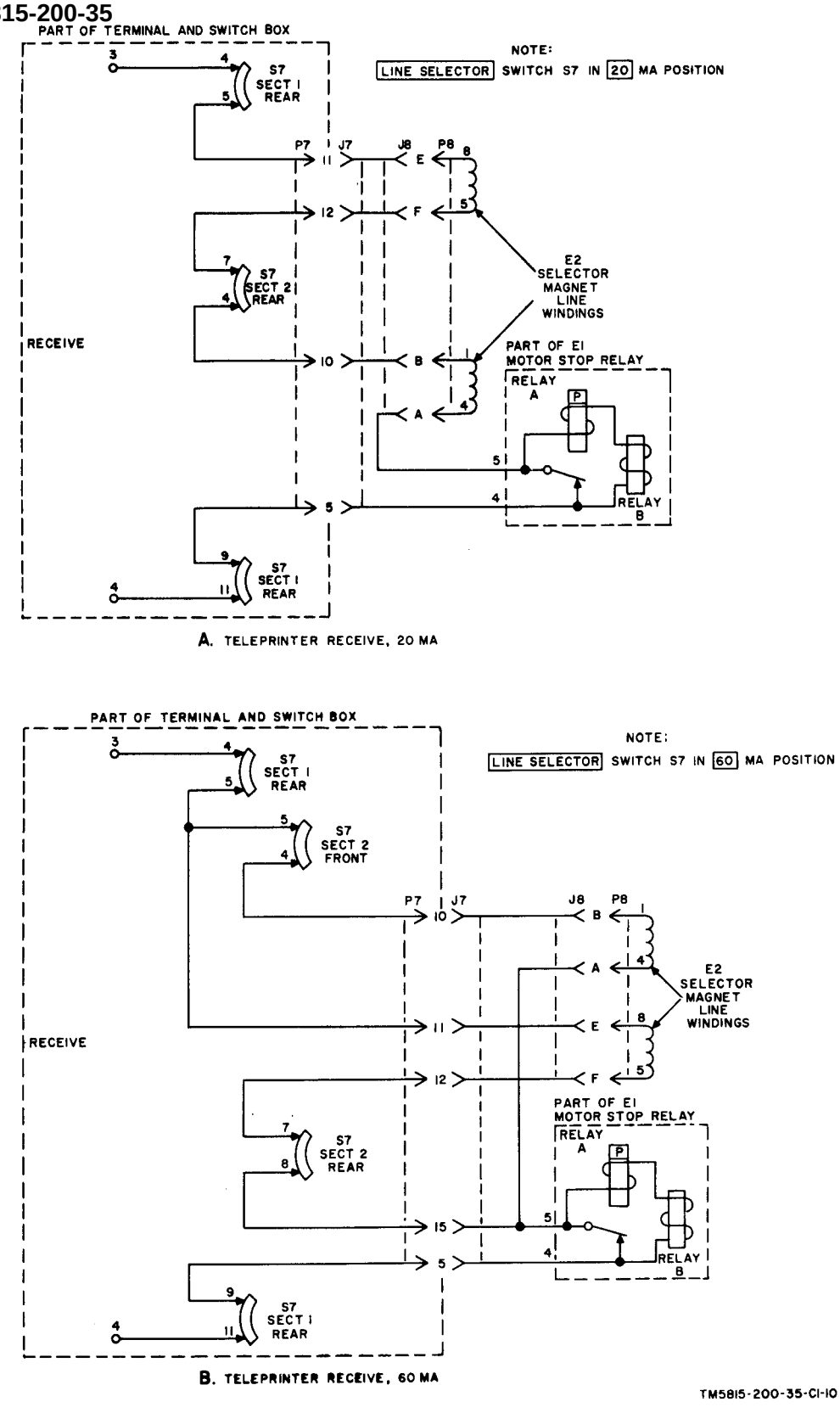


Figure 1–62. Receive circuits, schematic diagram for TT–259/FG.

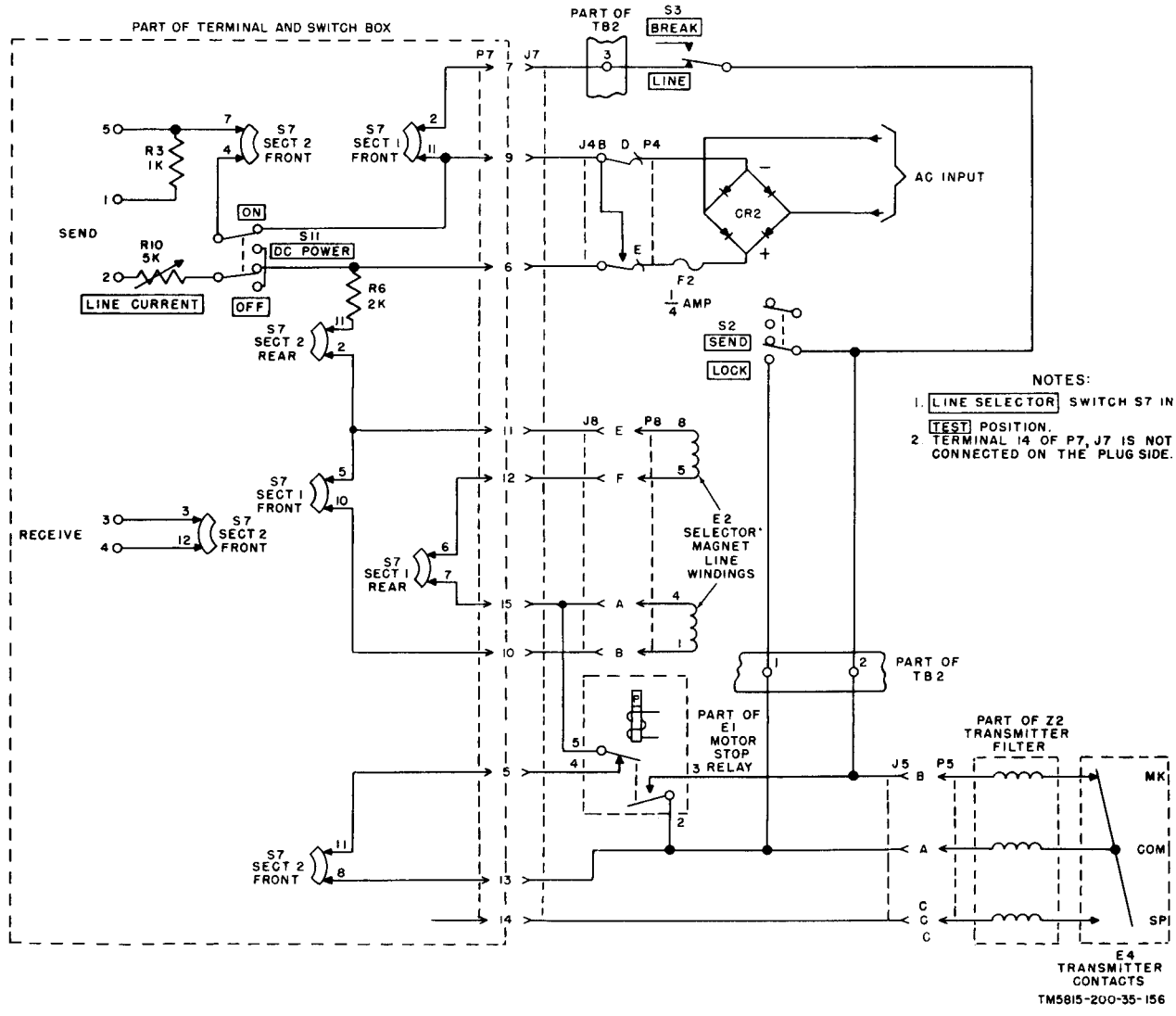


Figure 1–63. Test circuit, schematic diagrams (TT–98/FG, TT–98A/FG, TT–99/FG, and TT–100/FG only).

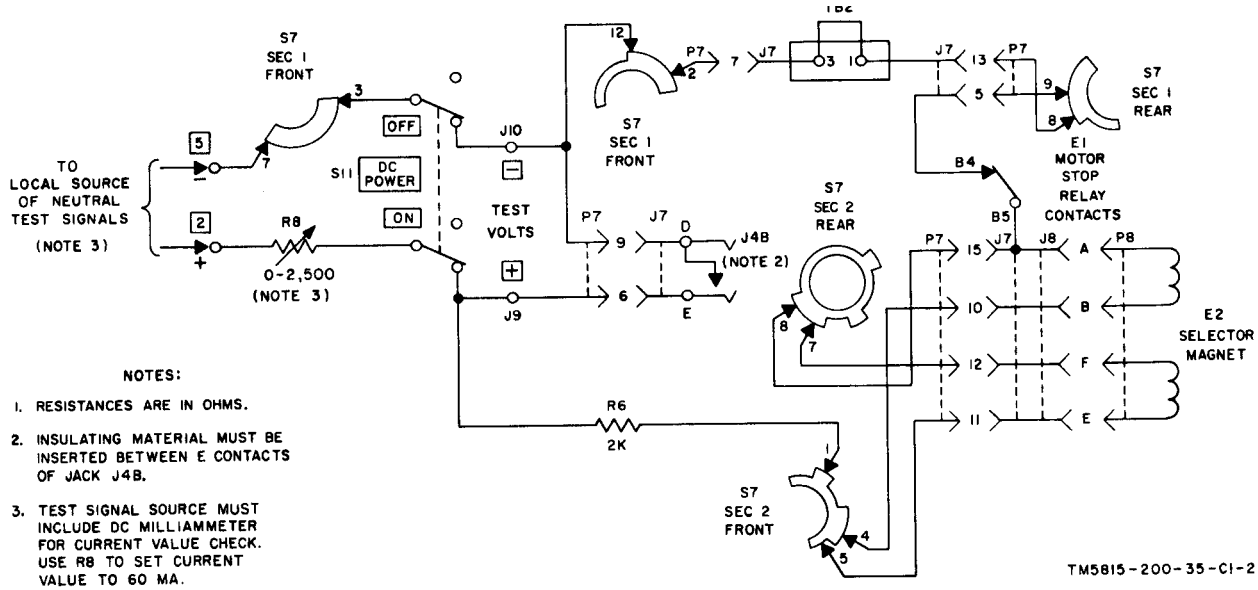


Figure 1–64. Test circuit, schematic diagram for TT–259/FG.

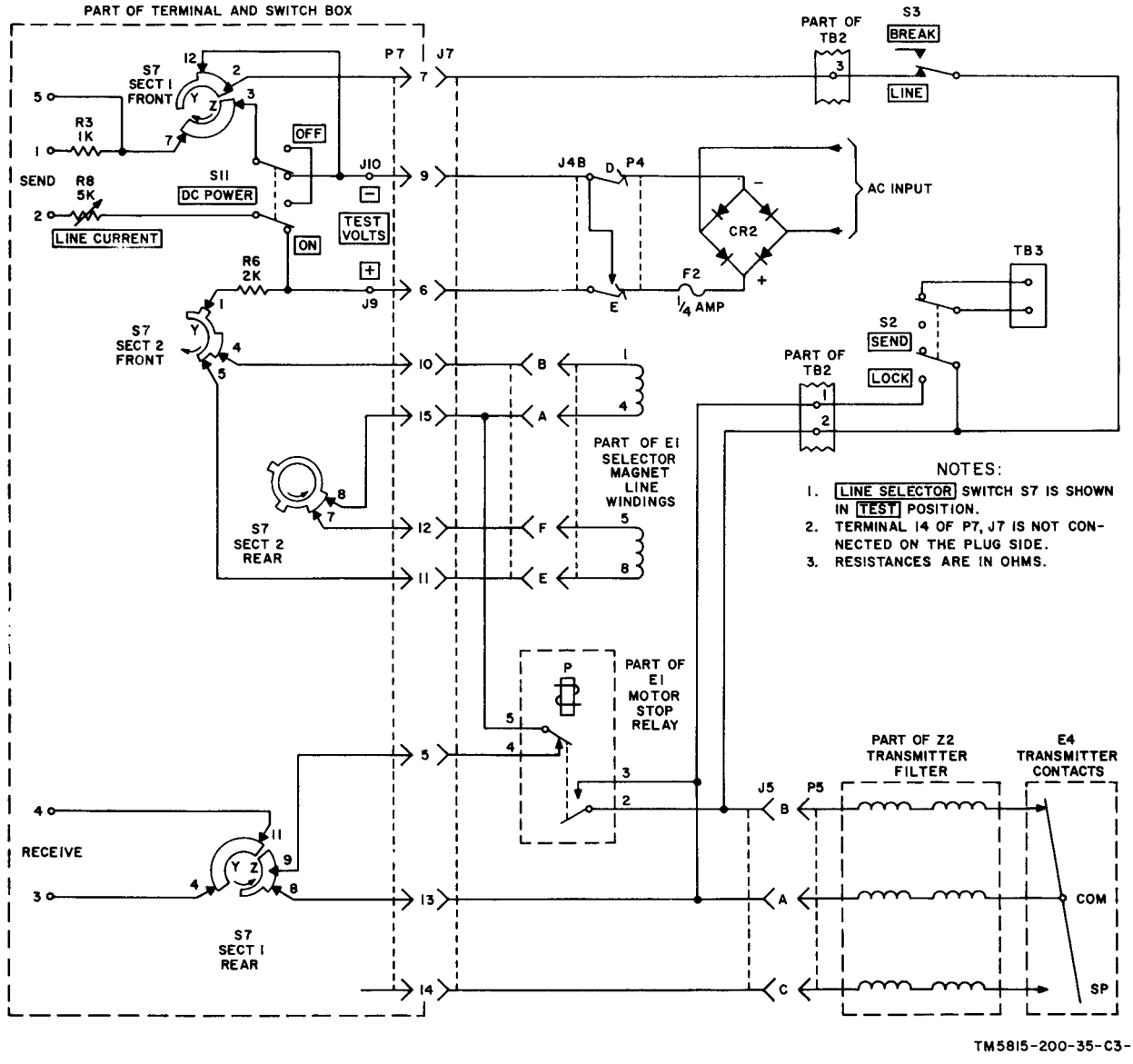


Figure 1–65. Test circuit, schematic diagram (all models except TT–98/FG, TT–98A/FG, TT–99/FG, TT–100/FG, and TT–259/FG).

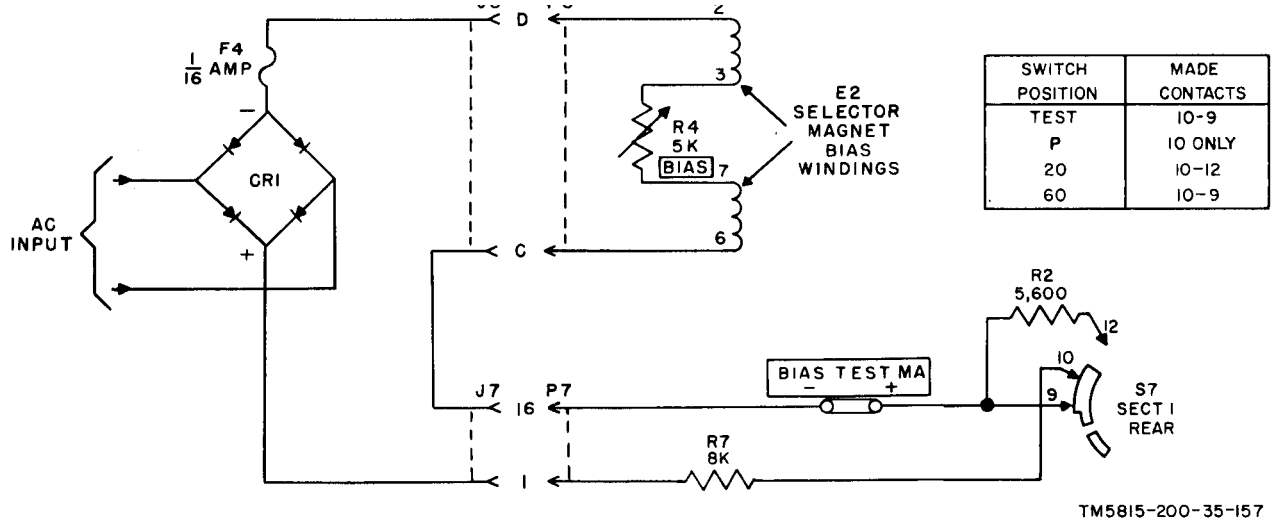


Figure 1-66. Bias circuit, schematic diagram (TT-98/FG, TT-98A/FG, TT-99/FG, and TT-100/FG only).

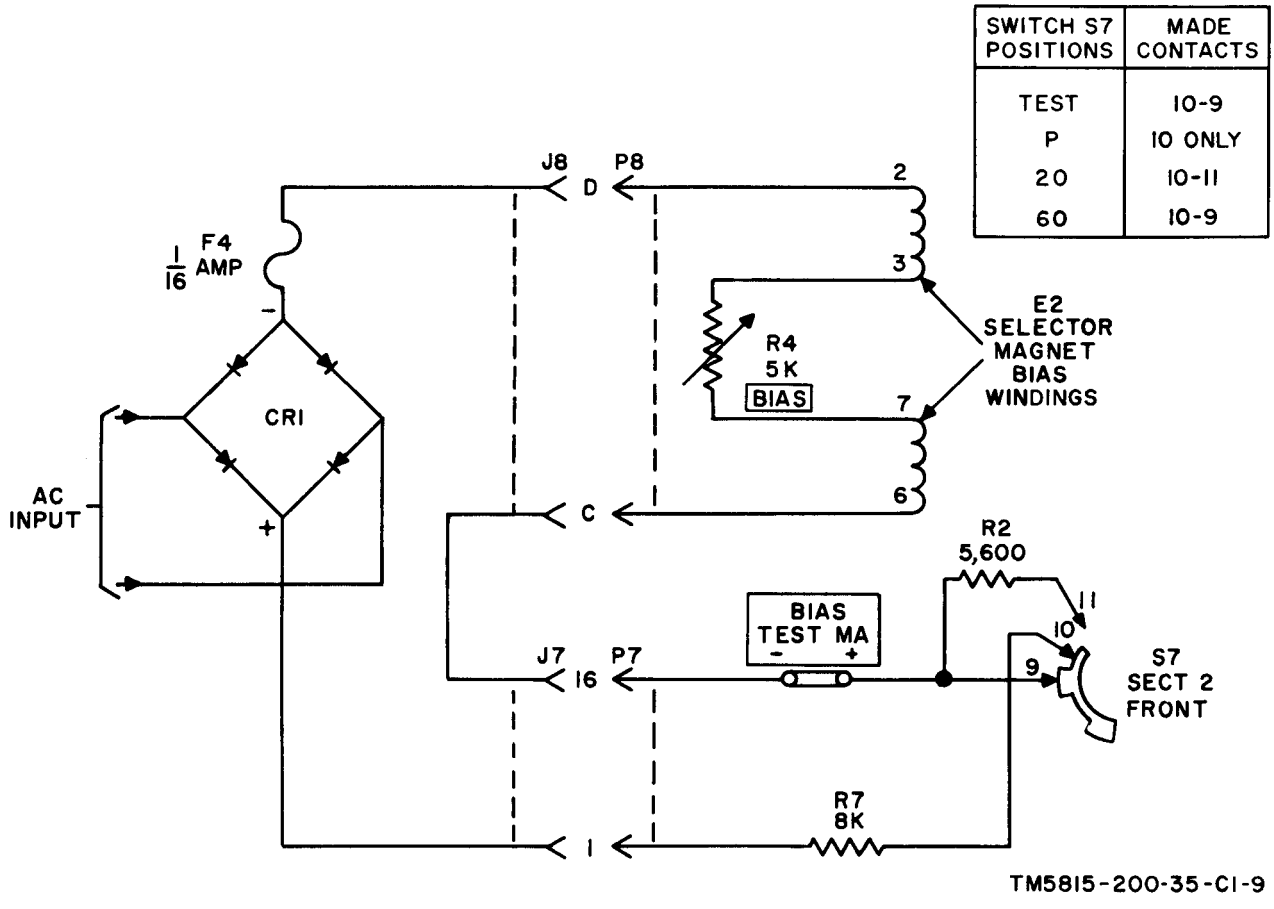
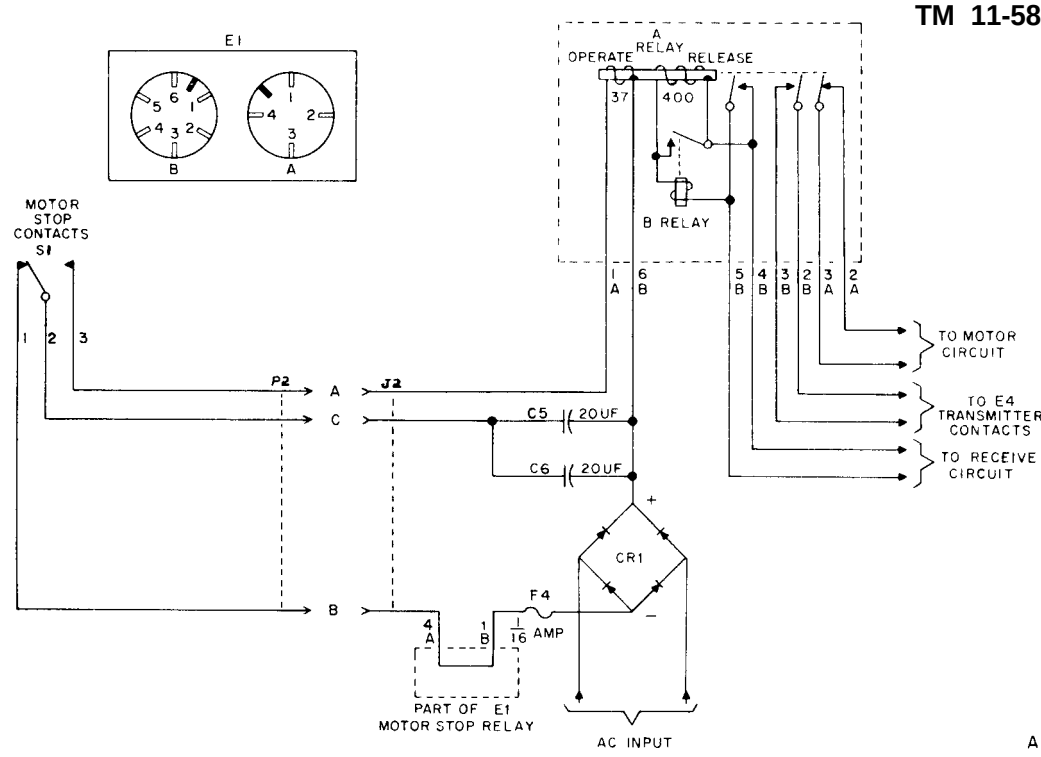


Figure 1-67. Bias circuit, schematic diagram (all models except TT-98/FG, TT-98A/FG, TT-99/FG, and TT-100/FG).



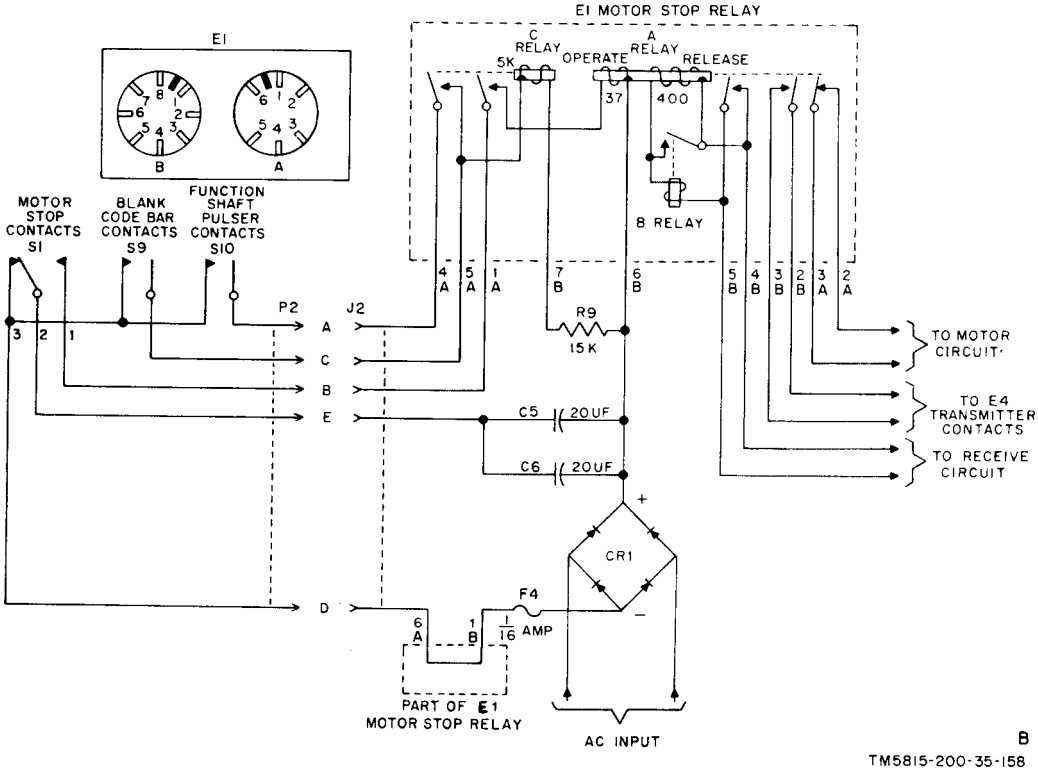


Figure 1–68. Motor stop circuits, simplified schematics.

Section IV. CONVERSION OF TELETYPEWRITER SET AN/FGC-20X TO PROVIDE SYNCHRONOUS MOTOR OPERATION

1-50. Parts Required

Modification kit (FSN 6105-831-6250) is required to convert the AN/FGC-20X to synchronous motor operation. Do not requisition the kit until authorization has been received. The kit consists of the following items:

Item No.	Quantity	and description
1–1	1	motor assembly, synchronous: 115 v, 60 cycles, 1/20 hp, 3.600 rpm; Kleinschmidt part No. 59202A or equal.
1–2	5	shims: 7/16 in. w x 1–3/4 in. o/a lg: 0.002 thk; Kleinschmidt part No. 51509 or equal; FSN 5815–527–0231.
1–3	5	shims: 7/16 in. w x 1–3/4 in. o/a lg, 0.005 thk ; Kleinschmidt part No. 51510 or equal; FSN 5815–527–0230.
1–4	4	lockwashers: split helical ring; No. 6 in. nom bolt size; Kleinschmidt part No. 10429 or equal; FSN 5310–209–5118.
1–5	3	screws, machine: No. 6–40 x 3/8 in. lg; flat-fillister head, socket drive. Kleinschmidt part No. 10004 or equal; FSN 5305–521–8644.
1–6	1	screw, machine: No. 6–40 x 1/2 in. lg; flat-fillister head, socket drive; Kleinschmidt part No. 10005 or equal; FSN 5305–521–8648.
1–7	4	lock washers: ext and int teeth, No. 10 in. nom bolt size; Kleinschmidt part No. 10406 or equal; FSN 5310–261–6197.
1–8	1	filter box assembly, synchronous motor: Kleinschmidt part No. 53285A or equal.
1–9	4	lock washers: int teeth, No. 8 in. nom bolt size; Kleinschmidt part No. 10404 or equal; FSN 5310–261–6198.
1–10	4	lock washers: int teeth, No. 6 in. nom bolt size; Klenischmidt part No. 10403 or equal; FSN 5310–209–3990.
1–11	4	screws, machine: No. 6–32 x 3/8 in. lg; binding head, slot drive. Kleinschmidt part No. 10308 or equal; FSN 5305–206–2267.

1-51. Procedure

a. Disconnect the power and signal line connections from the teletypewriter.

b. Remove the dust cover from the teletypewriter.

c. Lift the right side of the teletypewriter and disconnect the motor plug connector from the receptacle connector in the teletypewriter base.

d. Remove the four machine screws and the lockwashers that hold the gear cover to the teletypewriter frame (fig. 1-69).

e. Remove the worm gear bracket, the gear cover, and the gasket from the teletypewriter frame (fig. 1-69).

f. Remove the four machine screws and the lockwashers that hold the series-governed motor assembly to the teletypewriter frame (fig. 1-69). Remove the assembled motor by moving it sideways away from the teletypewriter frame.

g. Remove the machine screw and the lockwasher that hold the worm gear on the motor shaft. Remove the worm gear (fig. 1-69).

h. Install the worm gear on the shaft of synchronous motor assembly 59202A (item 1-1) (fig. 1-70). Secure the worm gear with the lockwasher and the machine screw that held it on the series-governed motor shaft.

i. Install synchronous motor assembly 59202A (item 1-1) on the teletypewriter frame and secure it with the four lockwashers and the machine screws (fig. 1-70) removed in *f* above. Do not tighten the machine screws too tightly because they must be adjusted later.

j. Visually center the worm gear with the main shaft driving gear.

k. Position the motor to obtain minimum backlash, without binding, between the worm gear and the main shaft driving gear (fig. 1-71).

1. If necessary, install shims 51509 and/or 51510 (items 1-2 and 1-3) between the motor and the teletypewriter frame to meet this requirement (fig. 1–71).

m. Tighten the four machine screws when the correct alignment is obtained.

n. Reinstall the gasket, the gear cover, and the worm gear bracket on the teletypewriter frame and secure them with the four lockwashers (item 1-4), the three machine screws (item 1-5), and the one machine screw (item 1-6), The longer machine screw (item 1-6) also se-

cures the motor stop switch cable clamp (fig. 1-70).

o. Place the teletypewriter on its motor side to provide access to the baseplate of the unit.

p. Remove the nine machine screws that hold the baseplate to the teletypewriter base. Remove the baseplate.

q. Remove the four machine screws and the lockwashers that hold the cover on the series-governed motor filter box assembly (fig. 1-72). Remove the cover.

r. Disconnnect all the leads of the two cables that enter the series-governed motor filter box assembly and terminate at terminal board TBI (fig. 1-72).

Caution: **Record the color code of each lead and its respective terminal before disconnection to facilitate reinstallation.**

s. Remove the four studs and the lockwashers that hold the series-governed motor filter box assembly to the teletypewriter base (fig. 1-72).

t. Remove the series-governed motor filter box assembly and the four grounding lockwashers from the teletypewriter base.

u. Install the four grounding lockwashers (item 1-7) and synchronous motor filter box assembly 53285A (item 1-8) on the teletypewriter base (fig. 1-73). Secure them with the four lockwashers (item 1-9) and the four studs that held the series-governed motor filter box assembly.

Note. Stiff wires or thin rods may be used in each of the mounting holes as temporary guides when installing the lockwashers, the motor filter box assembly, and the studs.

v. Reconnect the leads of the two cables to their respective terminals on terminal board TB1 of the synchronous motor filter box assembly (fig. 1–73). Follow the color code and terminal numbers recorded during removal.

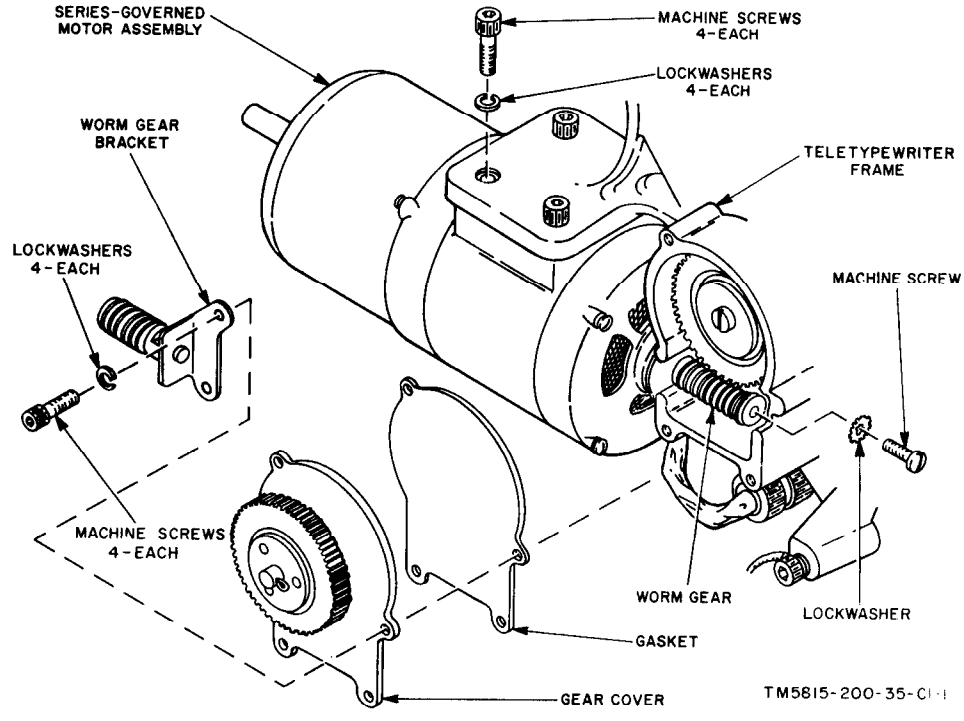


Figure 1–69. Series governed motor assembly removal.

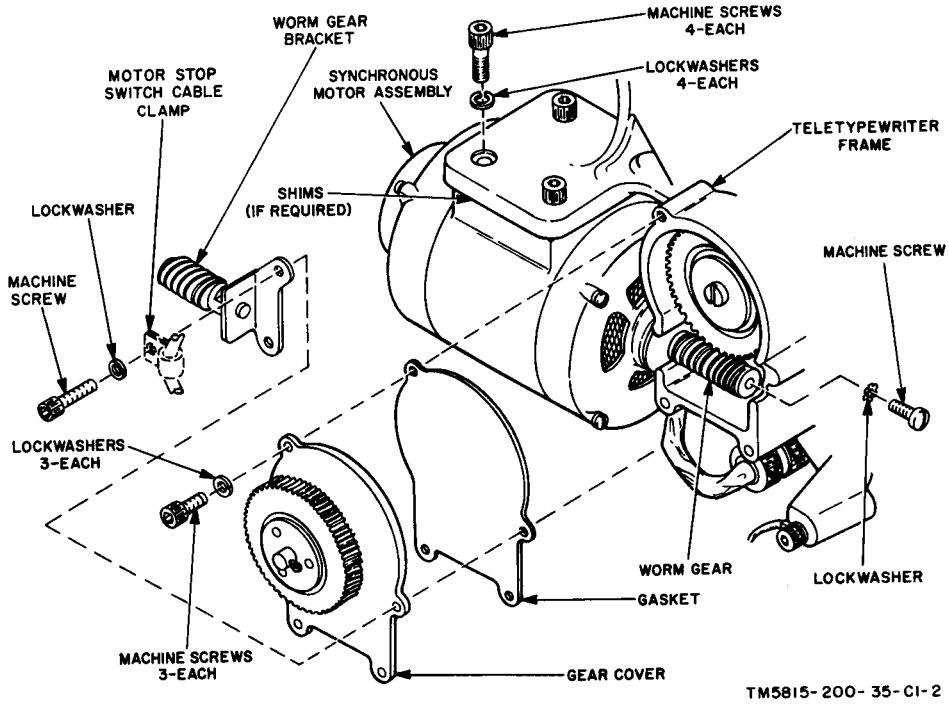


Figure 1–70. Installation of synchronous motor assembly.

w. Reinstall the cover on the synchronous motor filter box assembly and secure it with the four lockwashers (item 1-10) and the four machine screws (item 1-11) (fig. 1-73).

x. Reinstall the baseplate on the teletypewriter base and secure it with the original hardware.

y. Reconnect the motor plug connector to the receptacle connector on the synchronous motor filter box assembly.

z. Return the teletypewriter to its normal upright position.

aa. Reinstall the dust cover on the teletypewriter.

ab. Reconnect the power and signal line connections to the teletypewriter.

ac. Perform the operating checks and adjustments.

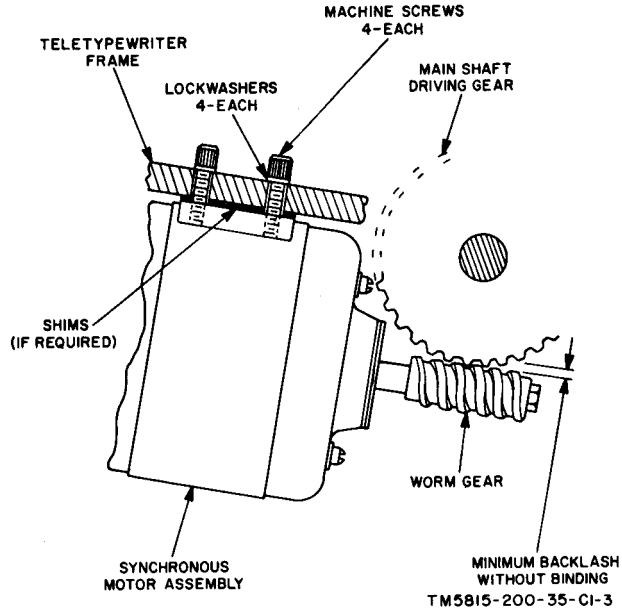


Figure 1–71. Synchronous motor assembly alinement.

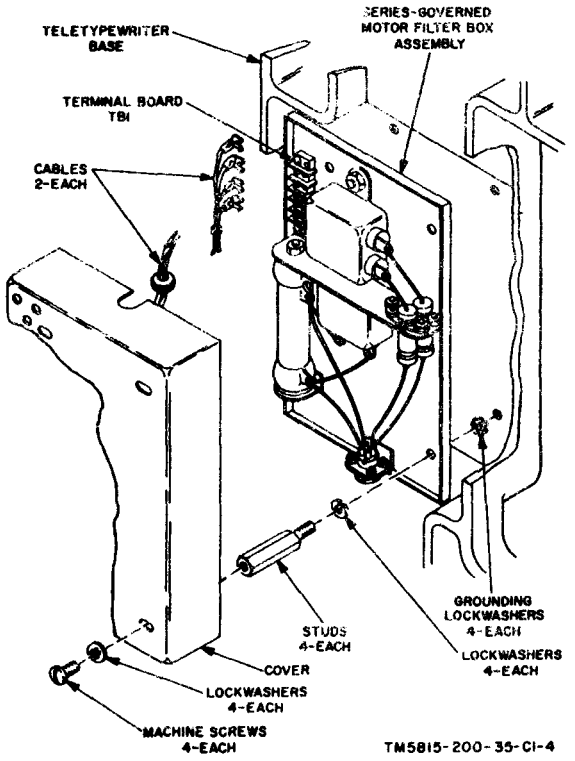


Figure 1–72. Series-governored motor filter bar assembly removal.

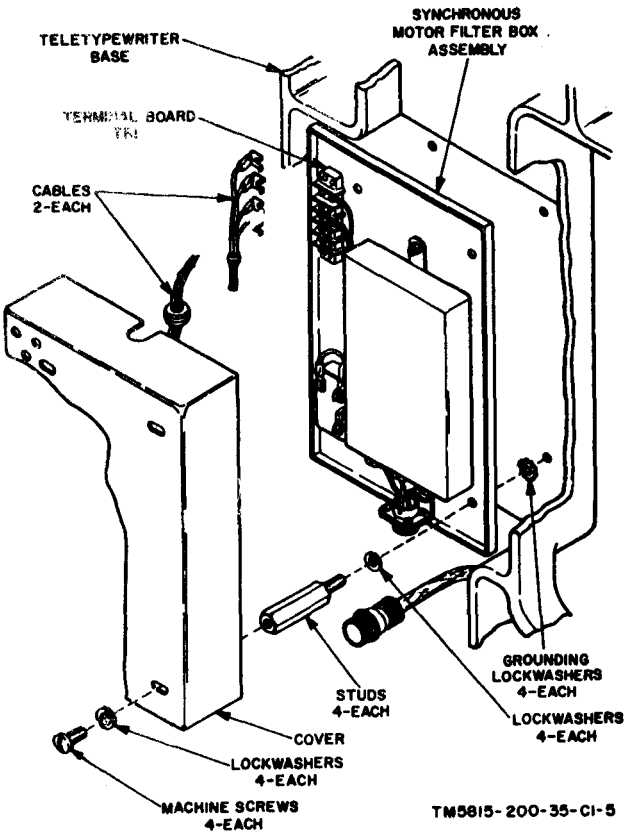


Figure 1–73. Synchronous motor filter box assembly installation.

Section V. ELECTRICAL FUNCTIONS (APPLICABLE TO TT-664(*)/FG, TT-665/FG, AND TT-688(*)/FG)

1-52. General

The circuits of the teletypewriter are divided into three groups for analysis: power; motor and copy lamps; and signal. Figures 1-74 through 1-80 are simplified schematic diagrams; figures 4-2.1 and 4-2.2 are overall schematic and wiring diagrams.

1-53. Power Circuits

(figs. 1-74 and 1-75)

a. Ac Input Circuit. When input P1 is connected to an ac source of power, ac is applied to Power Supply PP-978/FG and terminals 4 and 5 of terminal board TB1. The ac input circuit is controlled by POWER switch S4 and is protected by fuse F1. Terminals 4 and 5 of terminal board TB1 are connected permanently, in parallel, across the 115-volt portion of the primary winding of transformer T1.

b. Power Supply PP-978/FG.

(1) When ac is applied to the primary winding of transformer T1 through terminals A and C of plug P4, and adjusted ac is applied to terminals 4 and 5 of terminal board TB1 through terminals A and B of plug P4, the movable input transformer lead from terminal C of plug P4 is connected to the *marked* tap on transformer T1 that corresponds to the ac voltage at plug P1.

(2) Induced ac on the secondary winding of transformer T1 is rectified by rectifier CR2 and filtered by capacitors C7 and C8; the voltage applied to rectifier CR2 is adjustable, but in Teletypewriter Sets AN/FGC-159 and AN/FGC-160, the movable secondary output leads are always connected to the taps marked L and 1 on transformer T1. Resistor R5 maintains a constant load in the output circuit, which is protected by fuse F2. The dc output (90 $^{+15}_{-10}$ vdc) of the power supply provides power to the low level conversion circuits in the terminal box A1. In the terminal box, the 90-volt power supply output is connected across voltage dropping resistor R1 and Zener diode VR1. Diode VR1 regulates the voltage at 30 volts.

1-54. Motor and Copy Lamp Circuits

(fig. 1-76)

a. Copy Lamps Circuit. The ac input at terminals 4 and 5 of terminal board TB1 is applied to copy lamps I1 and I2, through LIGHT switch S6, plug P6, and jack J6.

b. Motor Circuit. The ac input at terminals 4 and 5 of terminal board TBl is applied to the motor. The circuit can be traced from terminal 4 of terminal board TB1, through relay E3, motor, and MOTOR switch S5, to terminal 5 of terminal board TB1. When MOTOR switch S5 is closed, a large amount of current is required initially for the operation of the motor. When this large current flows through the winding of relay E3, the relay is energized and relay contacts 2 and 3 close. This places a 10-ohm resistor and a 5- µf capacitor in parallel with the 5- µf capacitor that is in series with the start winding of the motor; the effective capacitance in series with the start winding is increased and it provides the initial torque required to start the armature rotating. As the armature gains speed, the current that flows through the motor and the winding of the relay E3 decreases. When a predetermined value is reached, relay E3 deenergizes and its contacts open. The start winding circuit remains completed through the 5- µf capacitor. The motor armature continues to accelerate until it reaches 3,600 rpm.

1-55. Signal Circuits

(figs. 1-77 through 1-80)

The signal circuits consist of the send and receive circuits. Each of these circuits is used to carry code impulses.

a. Send Circuit (fig. 1-77). The send circuit is used to transmit polar mark and space impulses to external signal lines which are connected to teminals 4 and 5 of terminal board A1TB1. The send circuits low level coded impulses are generated by the transmitter contacts which are mechanically operated (para *1-15a.1),* The low level impulses pass through noise suppressor Z1 and LINE BREAK switch S2 to transmitter module AlA1A1. The SEND LOCK switch can

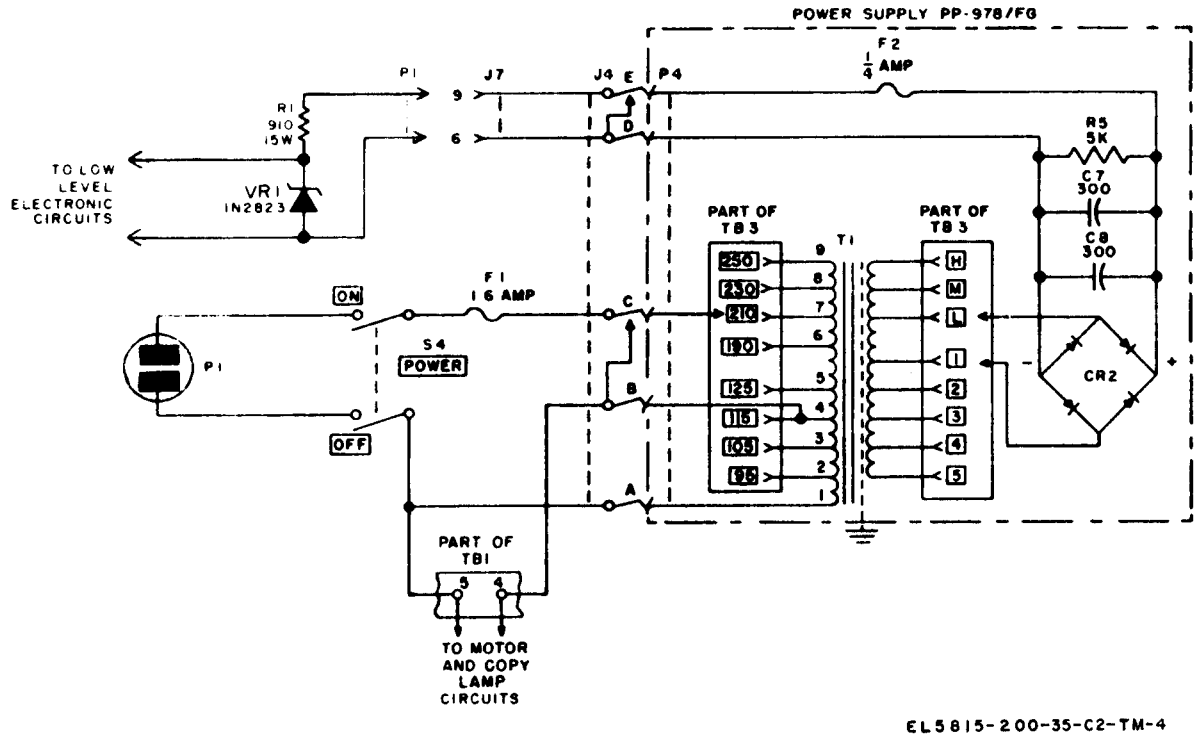


Figure 1-74. Ac input and power supply circuits, simplified schematic diagram (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

short the transmitter contacts to inhibit transmission to the line. The LINE BREAK switch is used for testing purposes to simulate a space condition by opening the line. Noise suppressor Z1 is a resistor capacitor network which eliminates the effects of contact bounce during the opening and closing of the transmitter contacts. The transmitter module (fig. 178) generatea a ±6-volt polar output for transmission to the line, and operates as follows:

(1) The purpose of the driver U1 is to provide sufficient signal drive to operate output transistors Q1 and Q2. Resistore R5 and R8 and 6.2-volt Zener diodes CR4 and CR5 act as a voltage divider across the 30-volt power source. This fixes the voltage at pin B (reference line) at +15 volts with reference to the negative return line of the 30-volt power supply. The reference line, which is fixed at 15 volts, is the point from which all signal levels are referenced.

(2) The input voltage needed to operate U1 is provided by the voltage dividing network consisting of resistors RI, R2, R3, and diodes CR1, CR2, and CR3. During a SPACE operation, the contacts of the contact assembly are opened and the action of the voltage divider network causes pin 2 of U1 to be .4 volt above pin 3. This condition causes the output of U1 (pin 6) to drop to approximately -12 volts with reference to pin B (TP4). This -12-volt pulse from Ul, turns transistor Q1 on. Transistor Q2 acte as a switch and effectively connects the 6.2-volt Zener diode CR5 across output resistor R9, thereby establishing a 6.2-volt potential across R9. In this condition, the current flow through R9 is from TP3 to TP4, thus putting the signal line 6.2 volts below the signal line.

(3) During a MARK operation, the contacts opf the contact assembly are closed, shorting out CR1 and CR2 of the voltage divider. This condition changes the input potential to U1 such that pin 3 is now 0.4 volt above pin 2, causing the output of U1 (pin 6) to increase approximately +12 volts with reference to pin B (TP4). This +12 volt pulse from U1 turns transistor Q1 on, which connects the 6.2-volt Zener diode CR4 across R9 to establish a 6.2-

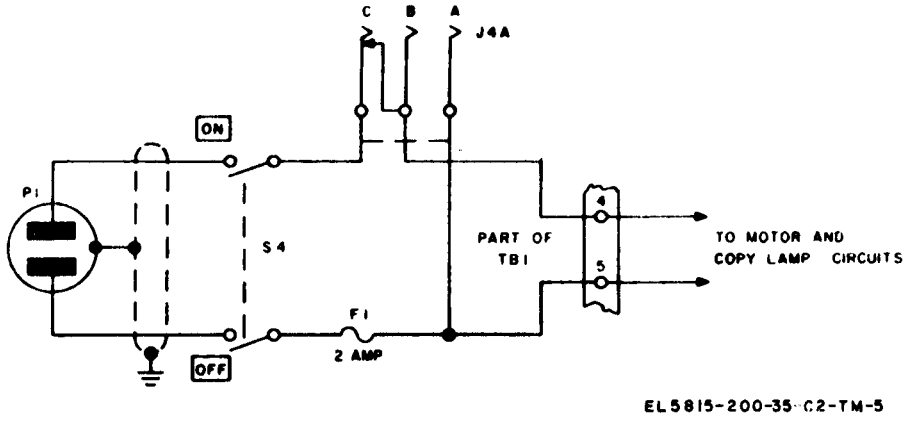


Figure 1-75. Ac input circuits, simplified schematic diagram (TT-664A/FG).

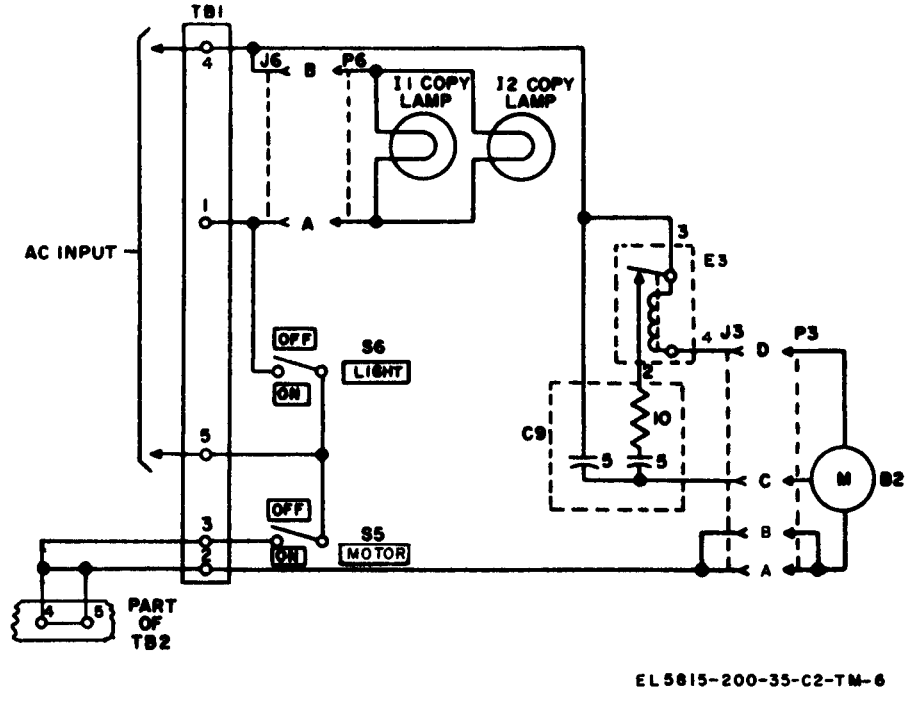


Figure 1-76. Motor and copy lamps circuit, simplified schematic diagram (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

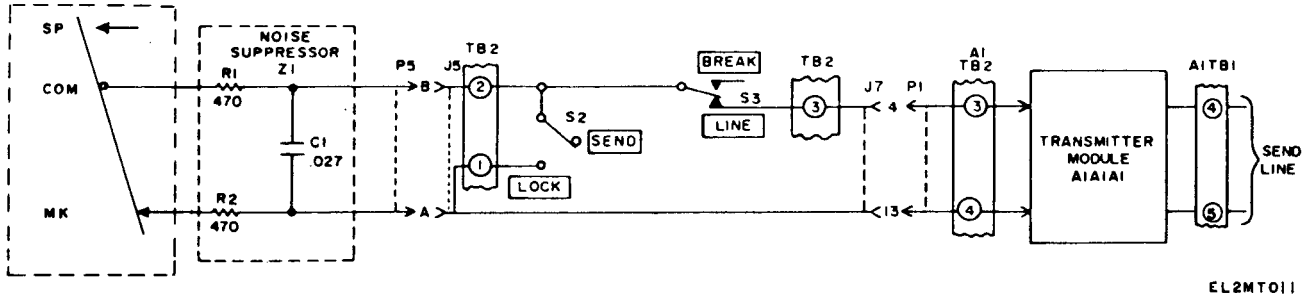


Figure 1-77. Send circuit block diagram (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

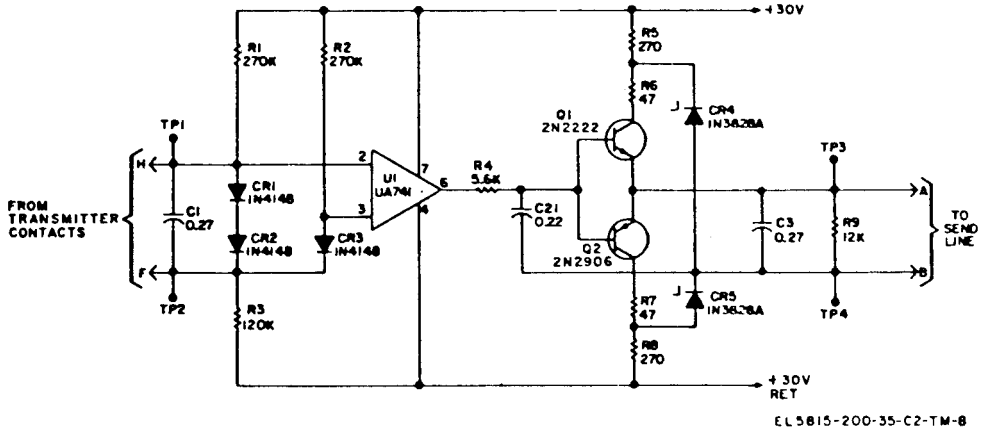


Figure 1-78. Transmitter module, simplified schematic diagram (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

volt potential across R9. In this condition the current flow through R9 is from TP4 to TP3, thus putting the signal line 6.2 volts above the reference line. The resultant output at R9 caused by the transmitter contacts closing and opening is a ±6 volts for a MARK and SPACE respectively.

(4) The output impedance of the transmitter is fixed at approximately 80 ohms. The output of the transmitter assembly may be connected to a patch panel where it can be patched into a receiver or special equipment for processing.

b. Receive Circuit (fig. 1-79). The receive circuit is used to accept polar mark and space impulses from external signal lines connected to terminals 9 and 10 of terminals board A1TB1. The coded impulses are applied to receiver assembly A1A1A2, which amplifies the impulses. The amplified impulses are sent to the selector magnet module A1A1A3 which controls selector magnet E2, which is turn governs the position in mechanical parts within the selector mechanisms.

(1) *Receiver module A1A1A2 (fig. 1-80).* The receiver module accepts the ±6 volt MARK/SPACE signals from the receive line. The input impedance of the receiver is approximately 56 K-ohms, which limits the signal line currents to approximately 100 microampere for low level operation.

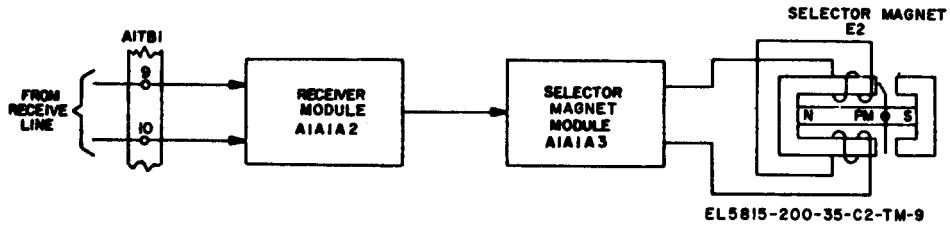


Figure 1-79. Receive circuit, simplified schematic diagram (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

(a) Resistors R4 and R6 act as a voltage divider between the 30-volt power source which fixes pin 3 of driver U1 at +15 volts (reference point) with respect to the negative power supply return line. With no signal input, potentiometer R8 is adjusted to also fix the output of Ul (pin 6) at +15 volts above the return line. This is done to establish the same receiver signal reference point as in the transmitter output line. Resistor R7 issued as a feedback to fix pin 2 of U1 at a +15 volts with no signal input.

(b) Amplifier U1 provides the necessary signal drive to the selector magnet module. In a SPACE condition, the signal line connected to pin 2 of U1 is +6 volts with respect to the reference line connected to pin 3. This causes the output at pin 6 (TP3) to increase to approximately +17 volts with respect to the reference line. A MARK input forces pin 2 to +6 volts with respect to pin 3, which causes the output at pin 6 to drop to approximately -17 volts with respect to the reference line.

(c) The ±17 volt SPACE/MARK output of the receiver is used to drive the selector magnet module.

(2) *Selector magnet driver module A1A1A3 (fig. 1-81).*

(a) Resistors R2, R3, R4, end R5 form a voltage divider network across the 30-volt power source. The common connection between R4 and R5 fixes TP3, the reference line, at a +15 volts with respect to the negative return line of the 30-volt power supply.

(b) A +17 volt SPACE pulse at TP1 switches transistor Q1 on, allowing current to flow through R2, Ql, the selector magnet E3, R5, and R3. The direction of current flow causes TP2 to be positive with respect to TP3 (reference line). A -17 volt MARK input pulse at TP1 switches transistor Q2 on, allowing current flow through R2, R4, E3, Q2, and R3. The direction of current flow causes TP2 to be negative with respective TP3 (reference line). In both cases the current through the selector is typically 6 to 7 milliamperes, (shall not exceed 10 milliamperes). The selector magnet windings are arranged in series and the full valve of the selector driver magnet current passes through each winding.

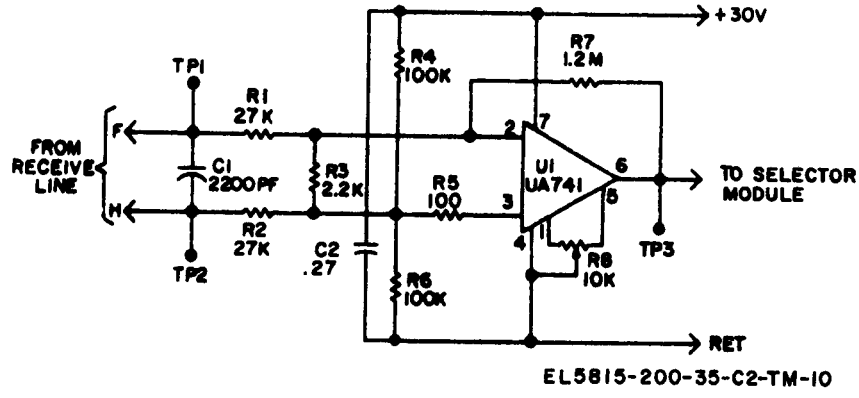


Figure 1-80. Receiver module, simplified schematic diagram (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

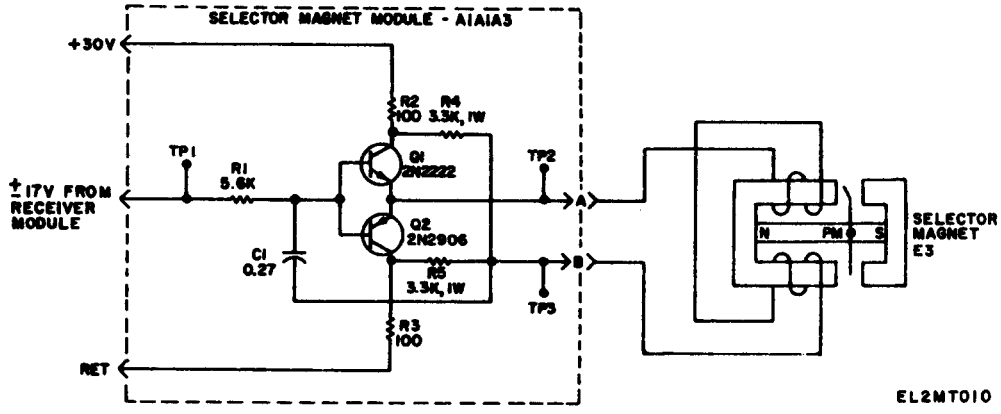


Figure 1-81. Selector magnet driver, simplified schematic diagram (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

CHAPTER 2
MAINTENANCE

Section I. TOOLS, MATERIALS, AND TEST EQUIPMENT

2-1. Tools

Tool Equipment TE-50B and the following tools are required for maintenance of the teletypewriter set:

Item	*Stock No.*
Reamer, hand 6/0.	FSN 5110-253-3154
Reamer, hand 5/0	FSN 5110-253-3156
Reamer, hand 4/0	FSN 5110-253-3158
Reamer, hand 3/0	41-6656.650.007
Punch, pin .03 in dia point. . . .	41-P-3550 (Ordance Corps)
Punch, pin 1/16 in. dia point . .	FSN 5120-240-6082
Pliera, retainer ring	FSN 5120-288-9717
Puller, wheel	FSN 5120-537-8684

2-2. Materials

Required maintenance materials are listed in the following table.

Item	*Stock No.*
Brush, sash, 1 x 5/8 in.	FSN 8020-239-0956
Brush, toothbrush style.	53-B-121610 (QMC)
Cheesecloth, bleached, 36 in. wide.	FSN 8305-170-5062
Trichlorotrifluoroethane	NSN 6850-00-105-3084
Cloth, crocus, 9 x 11 in. sheets.	FSN 5350-192-5052
Compound, Antiseize	CE-52-2724.5000.080
Grease (GH) (1 pound can). . . .	FSN 9150-273-4003
Oil lubricating, general purpose (OGP).	FSN 9150-263-3490
Oil, lubricating (OAI) (1 quart can).	FSN 9150-223-4129
Paper, cleaning, Bell Seal Bond, 1/4 x 21/2 in.	FSN 7530-448-2352
Sandpaper, flint, #4/9 x 10 in.	FSN 5350-271-7938
Tape TL-192	FSN 5970-296-1175
Tape TL-83	FSN 5970-184-2003

2-3. Test Equipment

Required test equipment is listed in the following chart.

Item	*Technical manual*
Distortion Test Set TS-383/GG.	TM 11-2217
Test Set TS-2/TG	TM 11-2208
Multimeter TS-352B/U	TM 11-6625-366-15

Section II. PREVENTIVE MAINTENANCE

2-4. General Cleaning Instructions

a. Use No. 0000 sandpaper to remove corrosion.

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

(1) Use a cloth moistened with trichlorotnfluoroethane to clean metallic parts (except electrical contacts). Wipe trichlorofluoroethane and dirt from the part with a clean, dry cloth.

(2) Flush electrical contacts with trichlorotrifluoroethane; dip an orangestick in trichlorotrifluoroethane and allow the liquid to drip from the stick through the contacts. Remove the trichlorotrifluoroethane carefully with a clean, dry cloth.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

c. Use vacuum cleaning equipment (if available) to remove loose dust, paper lint, and dirt from teletypewriters.

d. Clean all parko-lubrized and parkenzed parts with an oil-soaked, lint-free cloth. Treat the parts after cleaning with oil (OGP). This lightweight preservative oil is to be used because it has no harmful effects on finishes, rubber, plastics, or paint.

e. Clean oil-impregnated bronze (oilite) bearings with a stiff brush or wipe an oil-soaked cloth. Oil-impregnated bronze (oilite) bearings and other parts must *not* be immersed in trichlorotrifluoroethane or the impregnated oils will be dissolved.

f. Clean all ball bearings used on the teletypewriter with a clean, dry cloth. All ball bearings used on the teletypewriter are sealed.

g. Clean the metal parts of the platen with a cloth dampened with trichlorotrifluoroethane. Clean the rubber platen and the plastic paper roller with soap and water; wipe off with a clean, dry cloth.

h. Clean the motor as follows:

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

(2) To clean the internal parts of the motor, disassemble the motor. Remove all dust and dirt from the motor with a clean, dry sash brush.

CAUTION

Be careful not to darnage the windings.

(3) Clean all oil, greasy, or gummy deposits from the armature and field with a clean piece of cheesecloth or other lint-free cloth dampened lightly with trichlorotrifluoroethane. Do not use an excessive amount of trichlorotrifluoroethane.

(4) Clean all parts made entirely of metal by immersing them in a container of trichlorotrifluoroethane.

NOTE

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

i. Clean the coils of the selector magnet with a cloth dampened in trichlorotrifluoroethane. Remove rust from the pole pieces with No. 000 sandpaper, then recoat with a thin flim of lacquer.

j. Do not clean felt washers. When overhauling the equipment, replace all felt washers with new ones regardless of condition.

2-5. General Preventive Maintenance Procedures

Remove the teletypewriter set from service before performing preventive maintenance; disconnect the power input cord and the signal line.

a. Dust Cover.

(1) Inspect the dust cover. Look for dents, cracks, marred painted surfaces, loose or missing screws, and faulty hinges. See that the copyholder is in good condition.

(2) Check all screws for tightness.

(3) Clean the outer surfaces of the dust cover with a piece of cheese cloth slightly dampened with water. To remove oil, grease, or gummy stains from the surface of the cover, moisten the cloth with trichlorotrifluoroethane.

(4) Remove rust spots; repaint exposed metal surfaces.

b. Table.

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

(2) Clean the painted surfaces with a piece of cheesecloth moistened with trichlorotrifluoroethane.

c. *Teletypewriter 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 clean brush to remove all loose dirt and paper lint from hard-to-reach places. If deposits are difficult to remove with a dry cloth, moisten the cloth with trichlorotrifluoroethane.

(2) Perform the preventive maintenance for cords, wiring, terminal boards, and switches as instructed in *f, g,* and *h* below.

d. Motor.

(1) Check the motor for evidence of overheating. This may be indicated by discoloration or by an odor of burned insulating material. The motor should turn freely, smoothly, and quietly when turned by hand or when under power.

(2) Clean the motor as instructed in paragraph *2-4h.* Check to see that the wires leading to the motor are intact and clean.

(3) Apply necessary lubrication to the motor governor lubrication points listed in paragraphs 2-8 through 2-12.

e. Power Supply.

(1) Inspect for loose connections, damaged or broken parts, and defective or burned-out wiring. Look for evidences of overheating, and note whether the transformer or rectifying stack appear to be discolored. Be sure that there is a spare fuse in the spare fuse holder.

(2) Tighten all loose screws, bolts, nuts, cable clamps, etc. Solder any loose or broken con-

nections. Check the condition of the flexible transformer taps.

(3) Use a brush, cheesecloth, or a vacuum cleaner, if available, to remove dust and dirt. Remove oily and gummy deposits with a cloth dampened with trichlorotrifluoroethane. Remove all rust spots. Repaint all exposed metal surfaces.

f. Cords and Wiring.

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

(2) Tighten loose fasteners, clamps, and wiring connections. Repair loose or broken connections. Remove corrosion, rust, dirt, or dust from ground connections. Be sure that the outer insulation cover on the power cord is wiped clean. Never use oil or trichlorotrifluoroethane on rubber insulation. Renew the weatherproof coating on any fabric-covered wires that require it.

(3) Adjustment of wiring normally is confined to arranging it so that it does not interfere with the operation of mechanical parts. Resolder loose connections and replace worn or damaged wiring.

g. Terminal Boards.

(1) Inspect the terminal boards for cracks, breaks; and loose connections or mounting screws. Examine the connections for mechanical defects (broken or stripped screws and threads), dirt, grease, and corrosion. Tighten loose screws, lugs and mounting bolts. Be extremely careful not to strip the threads by exerting too much force. Use tools of the correct size. Solder loose or broken connections.

(2) Wipe off moisture with a clean cloth and brush off dirt and dust with a clean, dry brush. When necessary, terminal boards may be cleaned with a cloth moistened with trichlorotrifluoroethane. However, be sure that the solvent does not come into contact with the insulation of the wires leading into the terminal board. Remove and clean corroded connections. Use trichlorotrifluoroethane to clean electrical contact surfaces on all connecting devices.

h. Switches.

(1) Check the mechanical action of each switch. Look for dirt or corrosion. Operate each switch to see that it moves freely. Check spring tension for insufficient. contact pressure. Tighten loose screws; lugs; or mounting bolts. Clean connections that are dirty or corroded. Tighten or solder all loose connections.

(2) Wipe off moisture. Carefully clean the exterior surfaces of the switches with a clean, dry brush. Use a burnishing tool to polish contact surfaces after cleaning with abrasives, such as No. 0000 sandpaper, crocus cloth, or a contact file. If contacts are pitted, or burned, use a contact file to restore the surfaces and then polish them with a burnishing tool. Take care not to remove too much metal. Clean the contacts with trichlorotrifluoroethane.

2-6. Preventive Maintenance Procedures For Keyboard Transmitters (Not Applicable to TT-259/FG)

NOTE

Conditions *a* (7) and *c* (3) are not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG because transmitter contacts are hermetically sealed in a glass envelope.

a. Remove the keyboard transmitter from the teletypewriter and inspect for the following conditions:

(1) Cracks or other damage to the keyboard guard and mechanical linkages.

(2) Loose, missing, or broken screws, nuts, bolts, fastenings, and electrical connections.

(3) Broken wires and frayed or oil-soaked insulation.

(4) Darnaged or broken levers, pawls, latches, code bars, springs, and bearings; see that all parts move freely.

(5) Missing, broken, or illegible keytops.

(6) Missing, broken, or distorted springs.

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

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

c. Clean the keyboard transmitter as follows:

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

(2) Blow out or brush away dust and debris that may have accumulated in the keyboard transmitter and around the key levers.

(3) Burnish or file contacts if they are dirty, built up, or pitted. Clean contacts with trichlorotrifluoroethane.

(4) Lubricate the keyboard transmitter as described in paragraphs 2-8 through 2-12.

2-7. Preventive Maintenance Procedures for Main Frame Mechanism

Main frame mechanisms include the selector, platen, carriage, function, and ribbon groups.

a. Check for excessive wear, lack of lubrication, accumulations of dirt or grime, and loose parts.

b. Clean all assemblies; remove lubricants that may have dripped from lubrication points. Note whether too much lubricant was applied during the preceding routine servicing.

c. 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 2-185.

d. Check the type bar pallets for dirt deposits on 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 trichlorotrifluoroethane. Check the small center areas of letters, such as o, q, d, g, and b, to be sure that no dirt remains.

e. Lubricate the assemblies as described in paragraphs 2-8 through 2-12.

Section III. LUBRICATION

2-8. Recommended Lubricants

The following lubricants are recommended for use with the teletypewriter sets.

a. Oil, lubricating (OAI), (1 quart can), FSN 9150-223-4129.

b. Grease (GH), (1 pound can), FSN 9150-223-4003.

2-9. Lubrication Schedule

a. The following chart lists the recommended interval for checking the lubrication of the teletypewriter sets. Lubticate only those items that require lubrication. Do not overlubricate.

Operating speed (wpm)	*Operating time (hours per day)*	*Lubrication interval (days)*
60	8 or less	30
	8 to 12	20
	12 to 16	15
	16 to 24	10
66	8 or less	27
	8 to 12	18
	12 to 16	13
	16 to 24	9
75	8 or less	24
	8 to 12	16
	12 to 16	12
	16 to 24	8
100	8 or less	18
	8 to 12	12
	12 to 16	9
	16 to 24	6

b. The above intervals between lubrication checks apply to teletypewriters in which felt washers are used only as part of friction clutch assemblies. Teletypewriters that include lubricating felts at additional lubrication points require less frequent lubrication at *those particular lubrication points*. Lubricate the felts only when necessary; *avoid oversaturation.*

2-10. Preparation for Lubrication

The teletypewriter should be partially disassembled *(a* below) and old lubricants should be removed, whenever possible, before new lubricants are applied.

a. Disassembly.

(1) Remove the power input cord from the ac outlet. Disconnect the ground connection.

(2) Remove the dust cover; disconnect the signal lines.

(3) Remove the selector magnet plug from the base.

(4) Perform, as applicable, the following steps:

(a) Remove the keyboard transmitter plug from the base (not applicable to TT-259/FG).

(b) Remove the motor stop plug from the base (not applicable to TT-259/FG, TT-664(*)/FG, TT-665/FG, and TT-668(*)/FG.

(5) Remove the receiving unit from the base (para 2-17 *a*).

(6) Remove the keyboard transmitter (pars 2-18a).

(7) Remove the keyboard transmitter contact cover (not applicable to TT-259/FG).

(8) Remove the governor cover (series-governed motors only).

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

2-11. Method of Applying Lubricants

Use the grease gun and oiler supplied with Tool Equipment TE-50-B to apply lubricants to the teletypewriter set.

a. Grease. Hold the grease gun so that the nozzle forms an angle of about 45° with the part to be lubricated. Operate the handle of the grease gun until enough grease is ejected; at the same time; rotate the gear or move the nozzle along the rack to form a continuous ribbon of grease along the periphery of the part.

b. Oil. Use a piece of wire approximately .030-inch diameter to apply oil to those parts that require only 1 or 2 drops. Drip the wire about 1/2 inch into the oil and then touch the wire to the lubrication point. This procedure prevents over-lubrication. To lubricate all other parts of the equipment, use the oiler supplied with Tool Equipment TE-50-B.

2-12. Detailed Lubrication Instructions

(figs. 2-1-2-10)

Lubrication points and the quantity of lubricant to be applied are listed in the following charts *(b-f* below). The charts are arranged according to the type of part to be lubricated so that the teletypewriter set can be lubricated systematically. Item numbers listed in the charts correspond with item numbers on the referenced figure.

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

b. Gears, Racks and Cam Surfaces. Wipe 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
2-1	16	Carriage return driven gears	Apply sparingly all around gear teeth.
2-3	11	Main shaft driving gears (inside cover)	Work grease around gears, and cover gear teeth liberally.

Fig. No		Name of part	Method and quantity
2-3	2	Carriage rack driving gears	Apply sparingly all around gear teeth.
2-3	6	Function shaft driven gear	
2-3	8	Square shaft driving gear	
2-3	21	Function shaft driving gear	
2-3	23	Carriage feed worm gear	
2-3	26	Carnage return shaft drive gears	
2-3	27	Transmitter shaft drive gears (not applicable to TT-259/FG).	
2-4	1	Carriage-rack retainer	Apply sparingly all along the upper surfaces of the carriage rack.
2-4	4	Adjustable blocks	Apply sparingly to working surfaces.
2-4	7	Restoring rollers	Apply sparingly to the working surfaces of the rollers.
2-6	9	Ribbon drive gears	Apply sparingly all around gear teeth.
2-6	12	Guide rail	Apply sparingly to rack teeth.
2-7	4	Carriage feed and return driving rack	

c. Friction Clutches. Apply oil as shown in the chart below. Do not release spring tension on friction clutches for periodic lubrication.

Fig. No.	Item No.	Name of part	Method and quantity
2-1	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.
2-1	14	Keyboard transmitter friction clutch (not applicable to TT-259/FG).	
2-3	18	Selector friction clutch	
2-3	19	Square shaft driving friction clutch	

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

Fig. No.	Item No.	Name of part	Method and quantity
2-3	4	Function shaft sliding clutch drum	At least 5 drops in hole on either side. Saturate felt washer, if present.
2-3	14	Code ring cage	At least 5 drops in hole on top of central bearing sleeve (underneath stop bars).
2-3	22	Carriage feed driven gear	At least 5 drops in hole in hub,
2-7	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
2-1	10	Square shaft bearings	Several drops at either end of both bearings.
2-1	11	Platen frame pivot bearings	Several drops between pivot and bearings.
2-1	17	Carriage rack drive shaft bearing	Several drops at both ends of bearings.
2-2	5	Function selecting arm bearing	
2-2	6	Printing ball blade shaft bearings	Several drops at either end of both bearings.
2-3	20	Transfer lever shaft bearings	
2-9	6	Stop latch post	Several drops at either end.
2-6	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
2-1	1	Stop bar shift blade	Apply sparingly to latching surface.
2-1	4	Square shaft	Thin film all sides, entire length.
2-1	5	Carriage feed pawl and ratchet wheel	Apply sparingly to teeth; 2 drops at each pawl pivot. [b]
2-1	7	Carriage return operating mechanism	2 drops at each pivot point. [b]
2-1	8	Manual carriage return mechanism	Apply sparingly to all pivots and rubbing surfaces.
2-1	12	Carriage return sliding clutch drum	Apply sparingly to teeth and annular grooves, 2 or 3 drops in each group of spline balls inside clutch.
2-1	13	Carriage return safety clutch felt plates	Several drops around periphery of each washer.
2-1	15	Decelerating cam	Thin film on working surface.
2-1	18	Carriage return clutch latch lever	2 drops on pivot; thin film on working surfaces [b]
2-1	19	Carriage feed clutch lever	2 drops at pivot; thin film at each end [b]
2-1	21	Margin bell clapper and pawl	1 or 2 drops at each pivot point and at tip of pawl.
2-1	22	Carriage feed clutch	Apply sparingly to clutch teeth.
2-1	23	Carriage feed sliding clutch drum	Apply sparingly to rubbing surfaces.
2-1	24	Platen lower case latch	1 drop at pivot, apply sparingly to latching surface. [b]
2-1	25	Code ring locking bail shaft	1 drop at blade and cam follower locking lever.
2-1	26	Function bell crank pivots	Several drops between levers and washers. [b]
2-1	3	Felt washer (on function shaft sliding clutch drum).	Oil to saturation only.
2-1	6	Felt washer (on horizontal carriage return link)	Oil to saturation only.
2-1	9	Felt washers (on square shaft and print bail blade shaft).	Oil to saturation only.
2-1	20	Felt washer (next to carriage feed driving gear)	Oil to saturation only.
2-1	27	Function sensing levers	Thin film on rubbing surfaces.
2-2	1,2	Paper guide link	1 drop at each end.
2-2	3	Function selecting arm	Apply sparingly to all working surfaces.
2-2	4	Stop bar shift lever	1 drop at pivot.
2-2	8	Stop bar shift link	Thin film.
2-2	9	Paper roller latch	1 drop at pivot.
2-2	10	Motor stop actuating lever and signal bell clapper pivots.	2 drops at each pivot point. [d]
2-2	12	Function cam follower	Apply sparingly to cam groove and bearing of roller.
2-2	14	Unshift and carriage feed levers	2 drops at each pivot. [b]
2-2	15	Support lever	
2-2	16	Function punch bars	Several drops between bars and guide block.
2-2	17	Platen latch	2 drops at pivot; thin film on working surface, each end. [b]
2-2	18	Aperture gate	2 drops in notch; several drops between gage and guide block.
2-2	5	Felt washer (on function selecting arm bearing) [b]	Oil to saturation only.
2-2	7	Felt washer (on stop bar shift lever bearing) [b]	Oil to saturation only.
2-3	1	Printing bail blade	Thin film both sides, along entire edge.
2-3	3	Clutch spring	Apply sparingly to clutch spring.
2-3	5	Function driven gear	Several drops at bearing and clutch teeth.
2-3	9	Delaying lever	1 drop at pivot.
2-3	10	Line feed and figures connecting links [c]	2 drops at each end of both links.
2-3	11	Line feed and figures and bell crank pivots [c]	Several drops each. [b]
2-3	12	Line feed and figures cam follower pivots [c]	2 drops each.
2-3	13	Delaying latch	1 drop at pivot; apply sparingly to latching surface. [b]

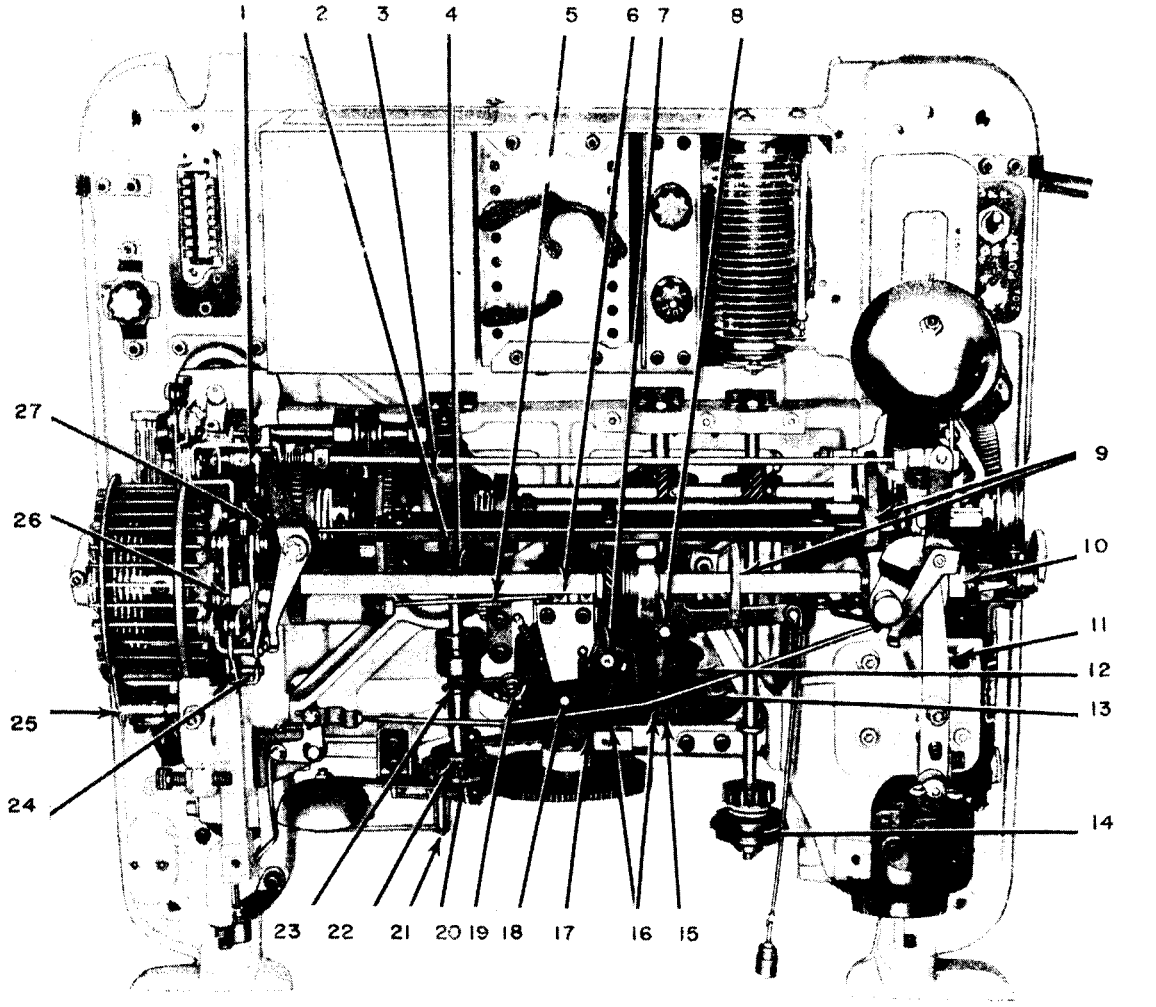
See footnotes at end of table.

Fig. No.	Item No.	Name of part	Method and quantity
2-3	15	Code rings	Thin film all along inner and outer working surfaces of each code bar.
2-3	16	Line feed and figures cam followers [c]	Apply sparingly to rollers, pivots, and all rubbing surfaces.
2-3	17	Line feed, figures and sensing lever restoring cams.[c]	Thin film on all exposed surfaces.
2-3	24	Clutch latch	Apply sparingly to roller and latching surfaces.
2-3	25	Carriage return blocking mechanism	1 or 2 drops at pivot; apply sparingly to latch surfaces.
2-3	28	Print cam follower	Apply sparingly to cam groove and bearing of roller and to spring hook.
2-3	7	Felt washer (on function driven gear) [b]	Oil to saturation only.
2-3	22	Felt washer (next to carriage-feed driven gear)[b]	Oil to saturation only.
2-3	29	Felt washers (on function shaft on each side of bearing block).	Oil to saturation only.
2-4	2	Pawl spring	Apply one drop at each end of each spring.
2-4	3	Pawl springs	
2-4	5	Sensing levers	Apply one drop to each of three spaces between the sensing levers.
2-4	6	Drawbar slot	Apply two drops to the working surfaces on each side of the drawbar slot.
2-4	8	Restoring rollers	Apply one drop at each end of each restoring roller.
2-4	9	Restoring rollers	
2-4	10	Drawbar spring	Apply one drop at each end of the spring.
2-4	11	Drawbar roller	Apply sparingly to the working surfaces.
2-5	1	Stop bars in code ring cage	2 drops at each end of all 35 stop bars.
2-5	2	Platen eccentric pivot	1 or 2 drops at pivot points.
2-5	3	Code ring locking shaft	1 drop at each pivot.
2-5	4	Detent wheel	Several drops at lever point; thin film on detent wheel teeth.
2-5	5	Single-double line feed lever	1 drop at pivot and detent surface.
2-5	6	T-lever	2 drops on bearing surface.
2-5	7	Code ring locking bail latching surface	Thin film on latching surface. [b]
2-5	8	T-levers and separating washers	Apply sparingly to all rubbing and bearing surfaces.
2-5	9	Y-levers and detents	
2-5	10	Selector lever guide comb	Apply sparingly to all rubbing surfaces.
2-5	11	Selector magnet armature knife edge	Apply sparingly. [b]
2-5	12	Selector levers, pivot bearings, and separating washers.	Apply sparingly to all rubbing and bearing surfaces.
2-5	13	Orientation lever pivot and range-finding cam	1 or 2 drops. Thin film on cam surface.
2-5	14	Grooved pin in end of selector camshaft	Several drops between pin and camshaft. [b]
2-5	15	Selector cams and stop plate	Thin film on working surfaces.
2-5	16	Transfer lever latch	2 drops on pivot; thin film on latching surface.
2-5	18	Transfer lever restoring cam	1 drop on cam surface.
2-5	19	Transfer lever roller	Apply sparingly to working surfaces. [b]
2-5	20	Antibounce clutch	Several drops in clutch.
2-5	17	Felt washer (on transfer lever shaft) [b]	Oil to saturation only.
2-5	21	Felt washer (on stop arm shaft) [b]	Oil to saturation only.
2-6	2	Line feed pawl	2 drops at pivot.
2-6	3	Sprocket feet pins	1 drop on each pin.
2-6	5	Beam detent	1 drop at pivot; apply sparingly to latching surfaces.
2-6	6	Ribbon feed clutch	Apply sparingly to clutch teeth.
2-6	7	Ribbon drive shaft	Apply sparingly to bearings, cam surfaces, and gear teeth at both ends.
2-6	8	Ribbon sensing levers	1 or 2 drops at each bearing and pin.
2-6	9	Ribbon spool driving gears	Apply sparingly to annular groove, teeth, and driving jaws.

See footnote at end of table.

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

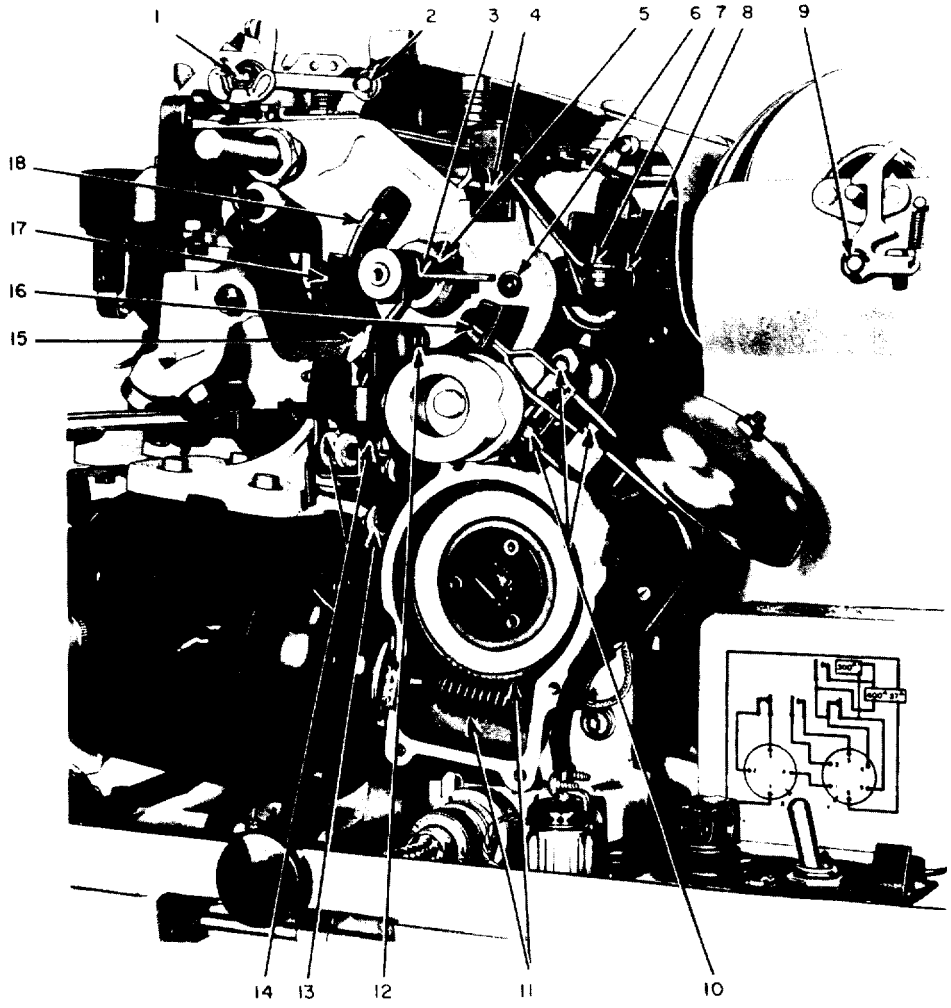
[a] ot applicable to Teleprinter TT-259/FG
[b] Saturate felt washer if present.
[c] Not applicable to TT-98C/FG.
[d] Not applicable to TT-664(*)/FG, TT-665/FG and TT-688(*)/FG



1 Stop bar shift blade
2 Carriage-feed friction clutch
3 Felt washer (on function shaft) [a]
4 Square shaft
5 Carriage-feed pawl and ratchet [a]
6 Felt washer (on horizontal carriage-return link) [a]
7 Carriage-return operating mechanism [a]
8 Manual carriage-return mechanism
9 Felt washers (on square shaft and print bail blade shaft) [a]
10 Square shaft bearings
11 Platen frame pivot bearings
12 Carriage-return sliding clutch drum
13 Carriage-return safety clutch plates
14 Keyboard transmitter friction clutch (not applicable to TT-259/FG)
15 Decelerating cam
16 Carriage-return driving and driven gears
17 Carriage rack drive shaft bearing
18 Carriage-return clutch latch lever [a]
19 Carriage-feed clutch lever [a]
20 Felt washer (next to carriage-feed driving gear) [a]
21 Margin bell clapper and pawl (not applicable to TT-259/FG)
22 Carriage-feed clutch
23 Carriage-feed sliding clutch drum
24 Platen lower case latch
25 Code ring locking bail shaft
26 Function bell crank pivots [a]
27 Function sensing levers

[a] Felt washers provided at this lubrication point on some teletypewriters.

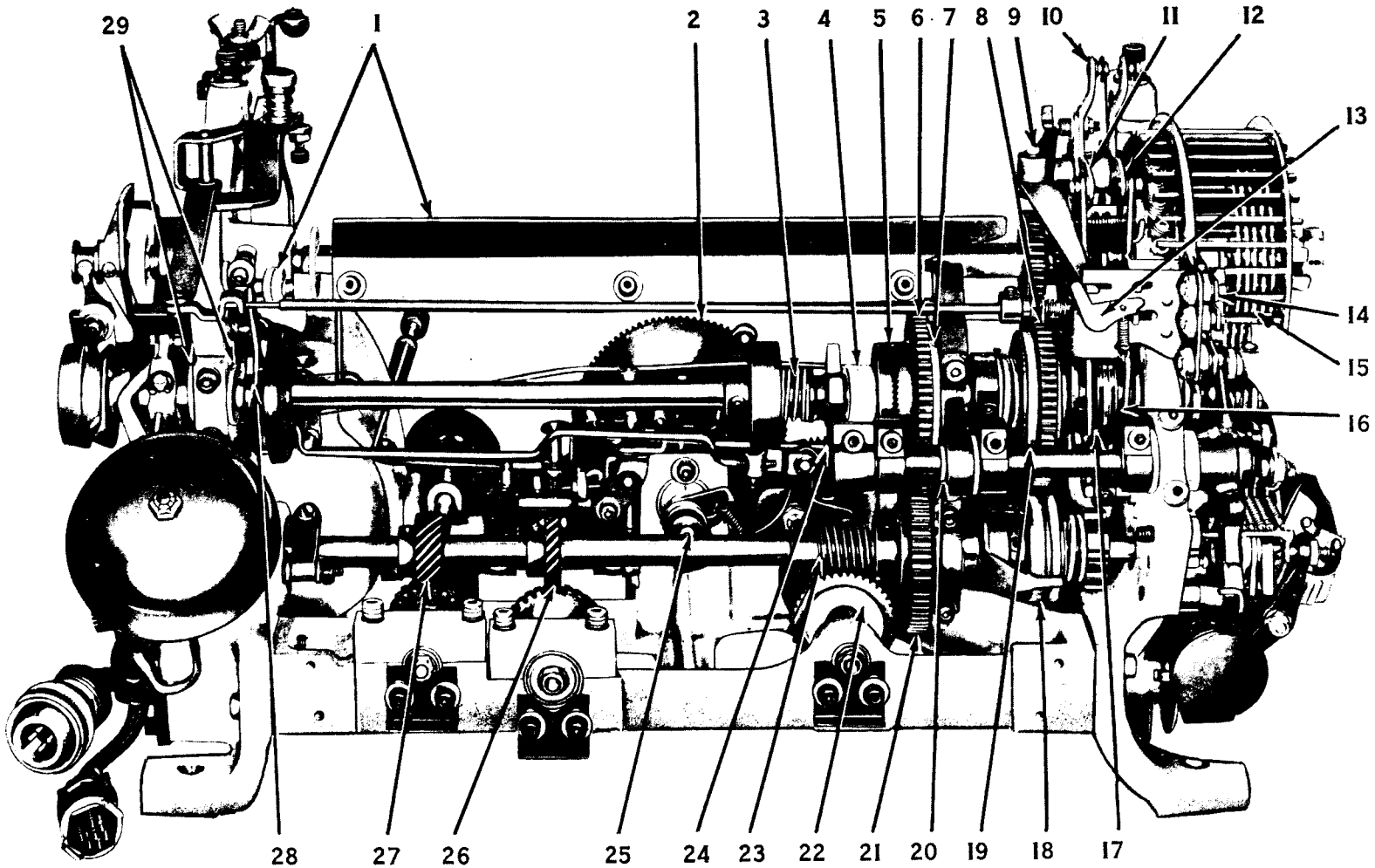
Figure 2-1. Teletypewriter, carriage and platen removed to show lubrication points.



1 Paper guide link (front)
2 Paper guide link (rear)
3 Function selecting arm
4 Stop bar shift lever
5 Felt washer (on function selecting arm bearing)[a]
6 Printing bail blade shaft bearings
7 Felt washer (stop bar shift lever pivot)[a]
8 Stop bar shift link
9 Paper roller latch
10 Motor stop actuating lever and signal bell clapper pivots
11 Main shaft driving worm (inside cover)
12 Function cam follower[a]
13 Felt washer (on carriage-feed link)[a]
14 Unshift and carriage-feed levers[a]
15 Support levers[a]
16 Function punch bars
17 Platen Latch[a]
18 Aperture gate

Figure 2-2. Teletypewriter, motor side, showing lubrication points.

[a] Felt washers provided at this lubrication point on some teletypewriters.

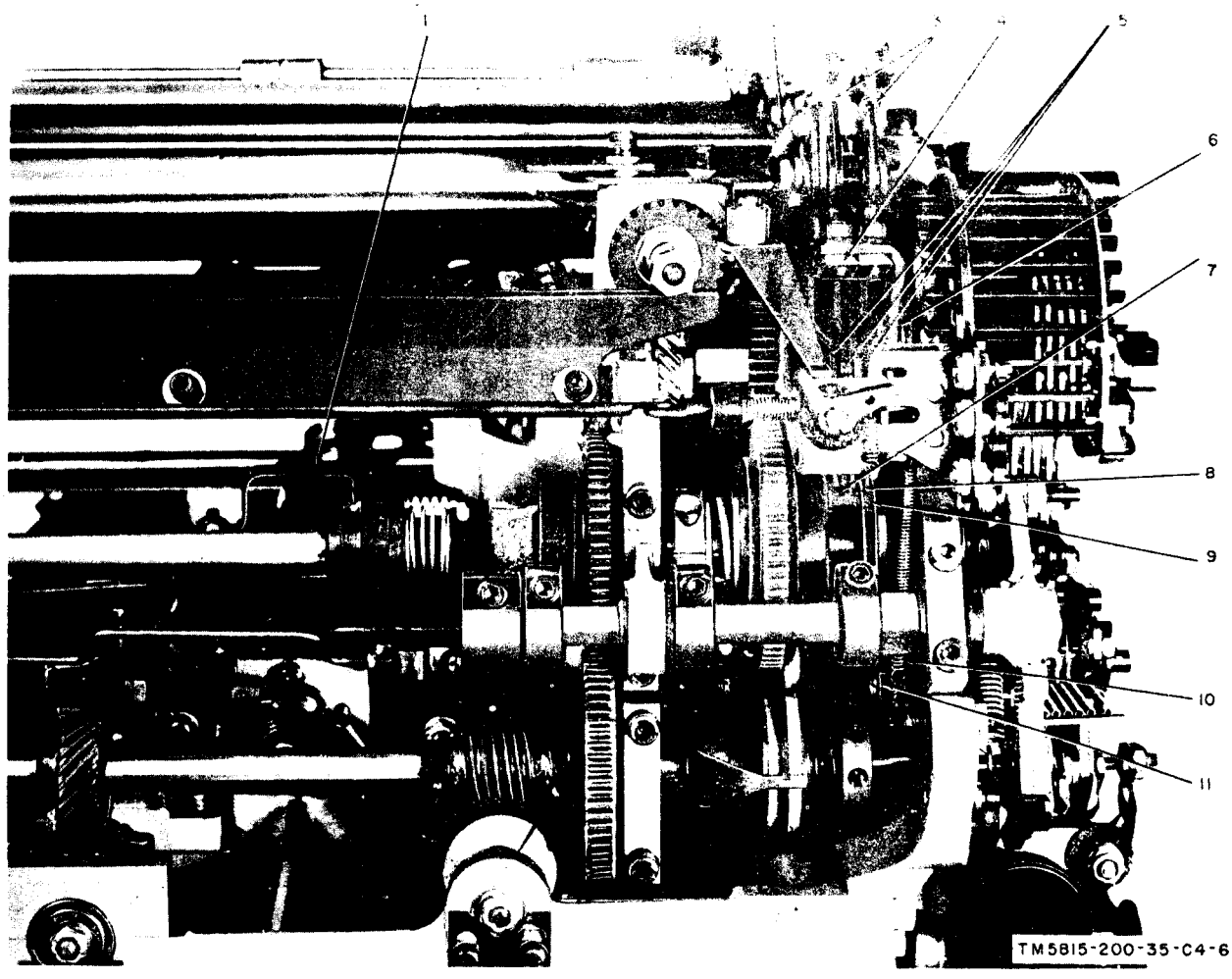


TM5815—200—35—C2—9

1 Print bail blade
2 Carriage rack driving gear
3 Clutch spring
4 Felt washer (on function shaft sliding clutch drum)[a]
5 Function shaft driven gear clutch teeth
6 Function shaft driven gear teeth
7 Felt washer (on function shaft driven gear)[a]
8 Square shaft driving gear
9 Delaying lever
10 Line-feed and figures shift connecting links not applicable to TT–98C/FG
11 Line-feed and figures bell crank pivots[a] not applicable to TT–98C/FG
12 Line-feed and figures cam follower pivots not applicable to TT–98C/FG
13 Delaying latch[a]
14 Code ring cage
15 Code rings
16 Line-feed and figures cam followers not applicable to TT–98C/FG
17 Line-feed, figures, and carriage-return sensing lever restoring cams not applicable to TT–98C/FG
18 Selector friction clutch
19 Square shaft driving friction clutch
20 Transfer lever shaft bearings
21 Function shaft driving gear
22 Felt washer (next to carriage-feed driven gear)[a]
23 Carriage-feed worm gear
24 Clutch latch
25 Carriage-return blocking mechanism
26 Carriage-return shaft drive gears
27 Transmitter shaft drive gears (not applicable to TT–259/FG)
28 Print cam follower
29 Felt washers (function shaft, on each side of bearing blocks)[a]

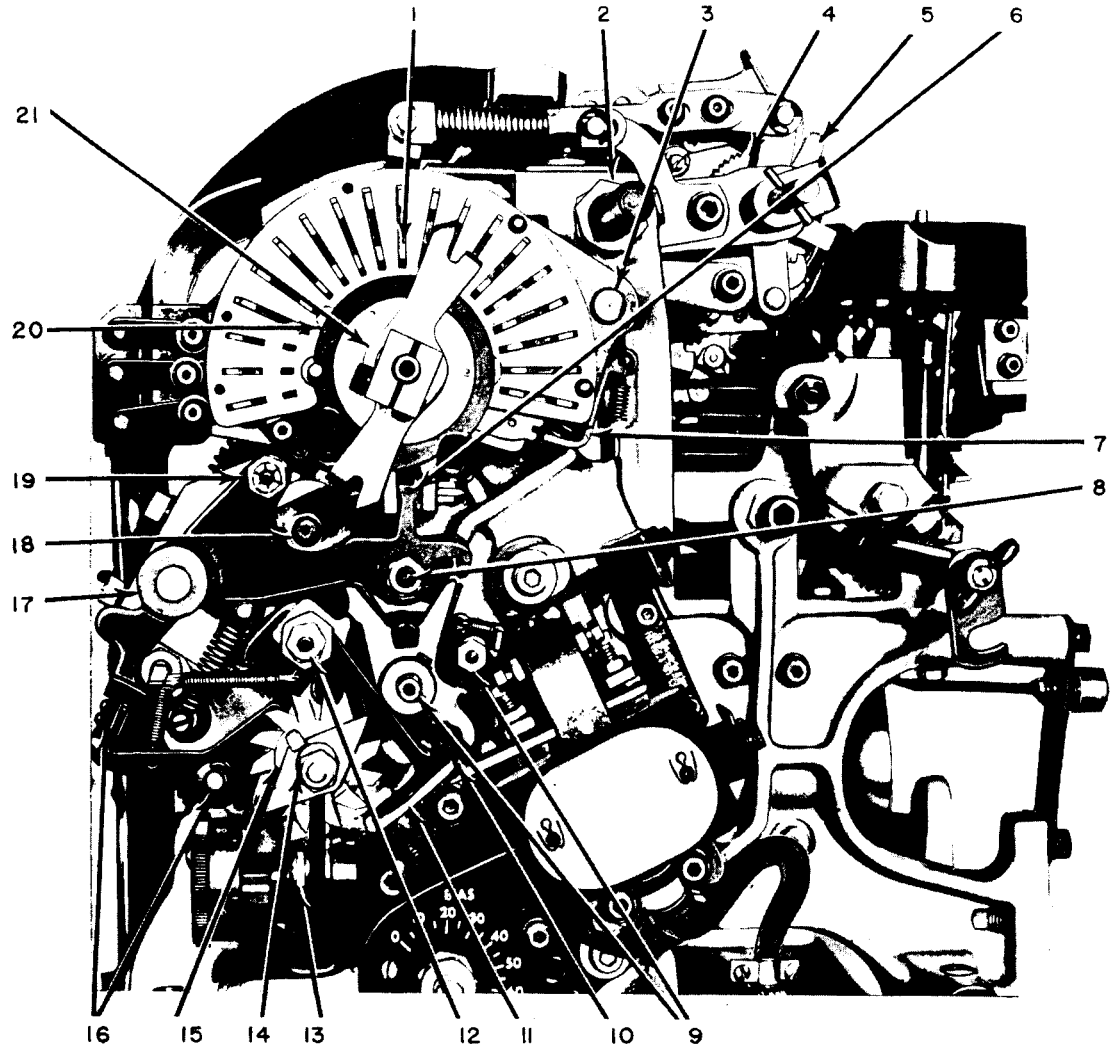
Figure 2–3. Teletypewriter, rear view, showing lubrication points.

[a] Felt washers provided at this lubrication point on some teletypewriters.



1	Carriage-rack retainer	7	Restoring rollers
2	Pawl spring	8	Restoring rollers
3	Pawl springs	9	Restoring rollers
4	Adjustable blocks	10	Drawbar spring
5	Sensing levers	11	Drawbar roller
6	Drawbar slot		

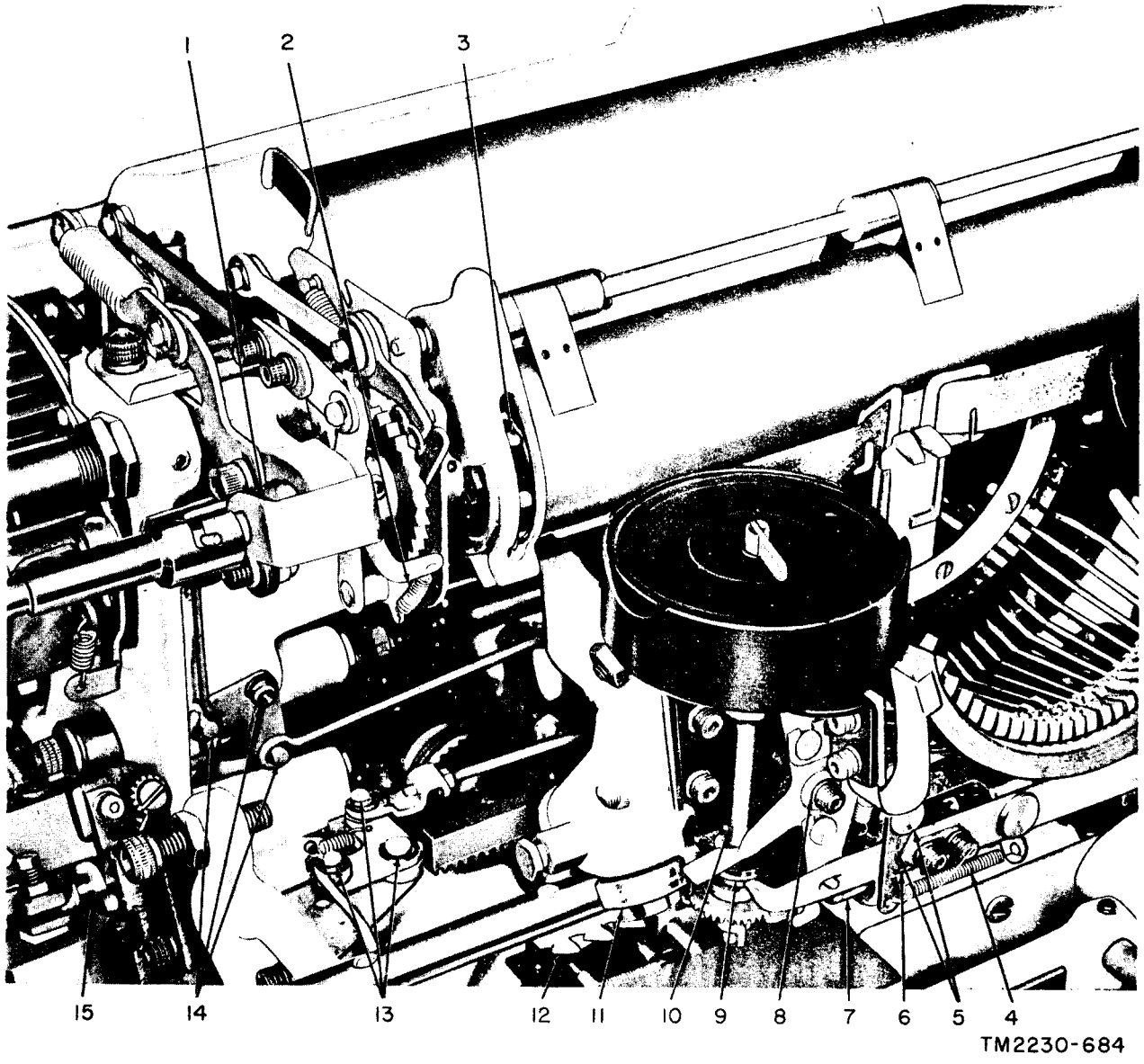
Figure 2–4. Line-feed mechanism lubrication points (TT-98C/FG).



1 Stop bars in code rings
2 Platen eccentric pivot
3 Code ring locking shaft
4 Detent wheel
5 Single-double line feed lever [a]
6 T-levers
7 Code ring locking bail (latching surface)
8 T-levers and separating washers [a]
9 Y-lever and Y-lever detent separating washers [a]
10 Selector lever guide comb
11 Selector magnet armature (blade edge)
12 Selector levers, pivot bearings, and separating washers [a]
13 Orientation lever pivot and range finder cam [a]
14 Grooved pin (in end of selector camshaft)
15 Selector cams and stop plate
16 Transfer lever latch [a]
17 Felt washer (on pivot post) [a]
18 Transfer lever restoring cam
19 Transfer lever roller
20 Antibounce clutch
21 Felt washer (on stop arm shaft) [a]

Figure 2–5. Teletypewriter, selector side, showing lubrication points.

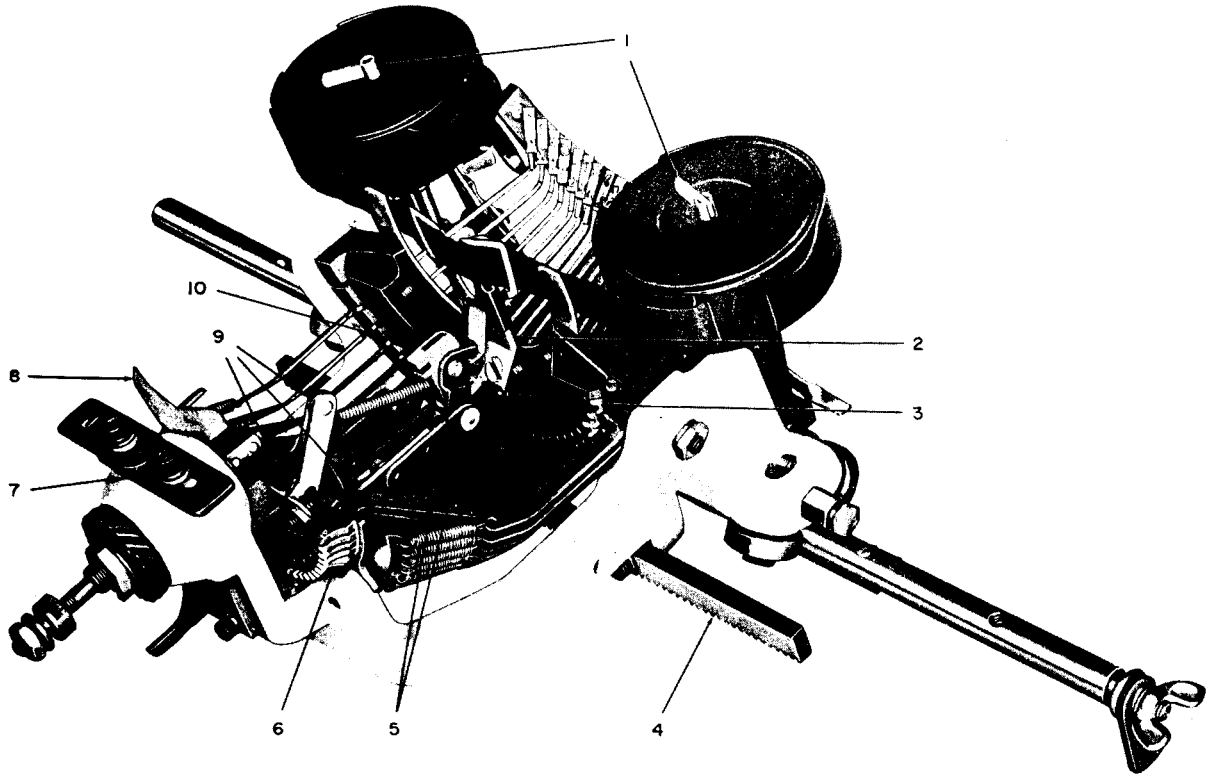
[a] Felt washers provided at this lubrication point on some teletypewriters.



1 Platen shaft bearing
2 Line feed pawl[a]
3 Sprocket feed pin
4 Ribbon drive gear
5 Beam detent
6 Ribbon feed clutch
7 Ribbon drive shaft
8 Ribbon sensing lever
9 Ribbon 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 2–6. Teletypewriter, left front view, showing lubrication points.

[a] Felt washers provided at this lubrication point on some teletypewriters.



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 [a]
10 Ribbon lifter pivot bearing

Figure 2–7. Teletypewriter, rear view, showing lubrication points.

[a] Felt washer provided at this lubrication point on some teletypewriters.

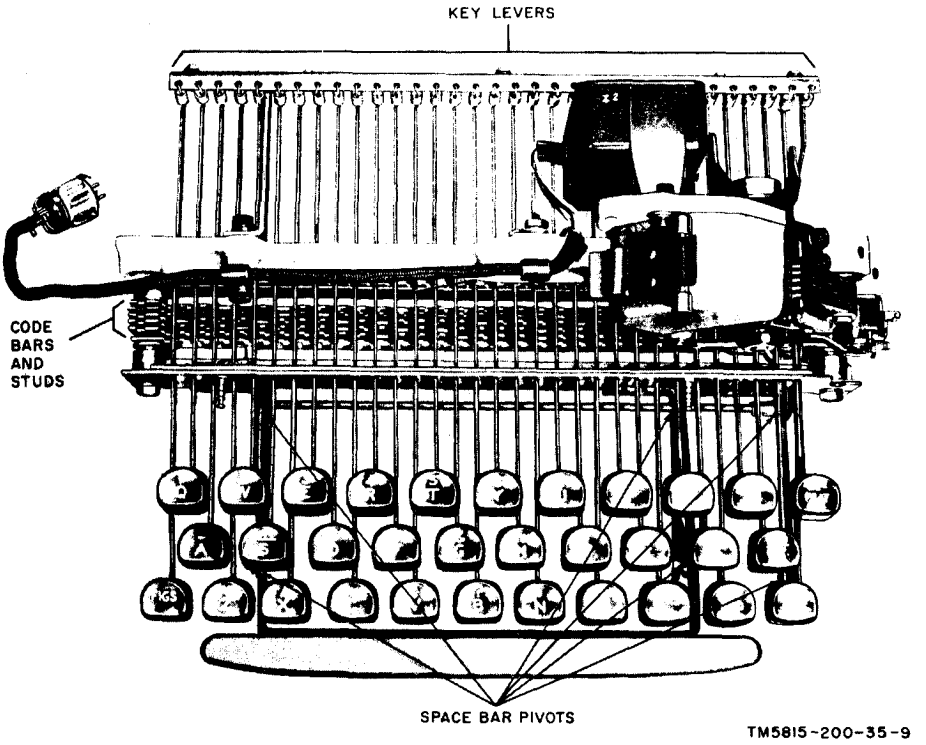
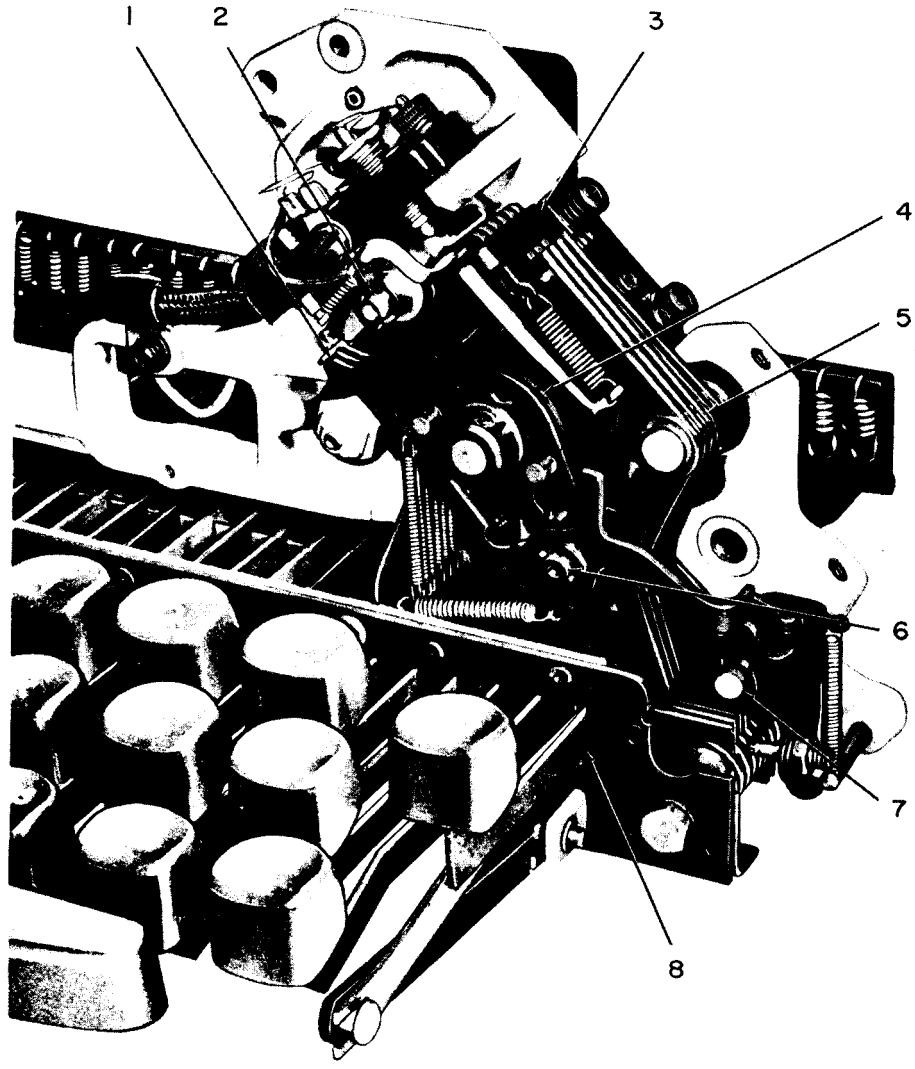


Figure 2–8. Keyboard transmitter, top view, showing lubrication points (not applicable to TT–259/FG).



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

Figure 2–9. Keyboard transmitter, right front view, showing lubrication points (not applicable to TT–259/FG).

[a] Felt washer provided at this lubrication point on some teletypewriters.

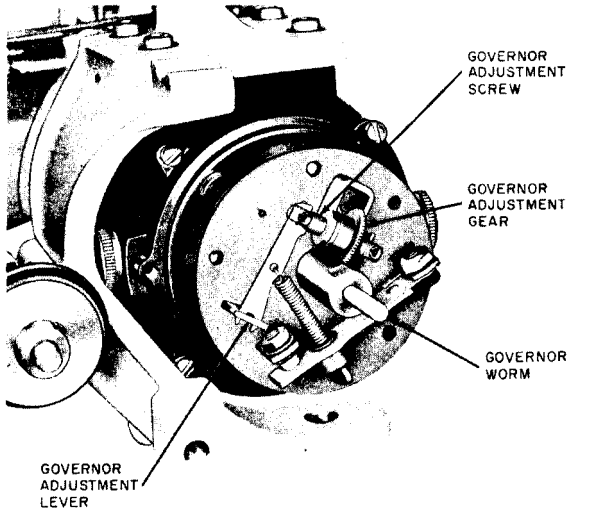


Figure 2–10. Governor of series-governed motor, showing lubrication points (not applicable to TT–259/FG).

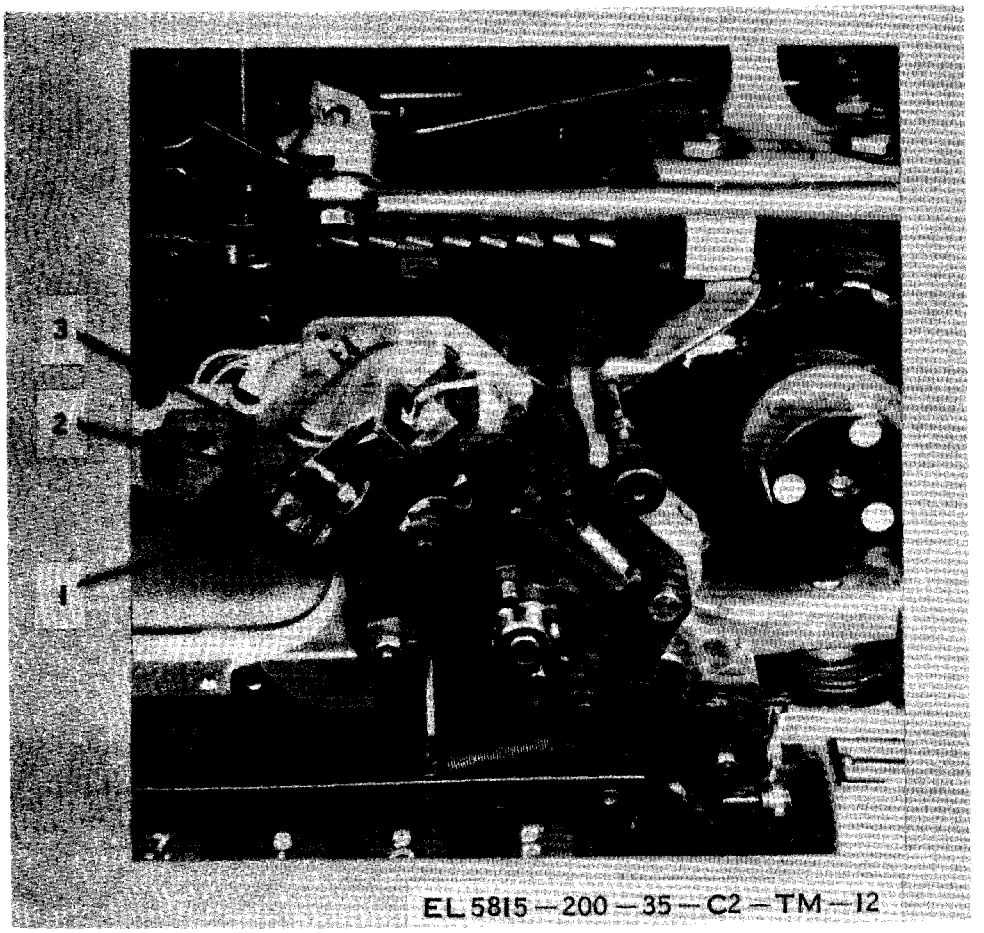


Figure 2-10.1. Keyboard transmitter, transmitter contact assembly, lubrication points (applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

Section IV. TROUBLESHOOTING

2-13. General

The troubleshooting information presented in this section consists of a series of operational, mechanical, and electrical checks designed to lead maintenance personnel to the specific part, maladjustment, or electrical component that is causing trouble in the equipment. The procedures for sectionalizing, localizing, isolating, and correcting the meet common troubles are included in this section.

2-14. Sectionalizing and Localizing Troubles

When trouble occurs in the teletypewriter set and the cause is not immediately apparent, proceed as follows:

a. Obtain as much information as possible from the teletypewriter operator regarding the equipment performance at the time the trouble occurred.

b. Make a visual inspection of the unit to determine if the trouble is caused by loose line or power connection, improperly set switches, erratic motor speed, or improper rangefinder adjustment.

c. Arrange the set to operate on local test to sectionalize and localize the trouble. On TT-664(*)/FG and TT-665/FG, the local test made is configured by disconnecting the external transmitting and receiving from terminal board (A1TB1) and connecting jumpers from terminals 4 and 5 to 9 and 10, respectively.

d. After the trouble has been localized: refer to the troubleshooting chart (para 2-15) to isolate the trouble to a specific part or electrical component.

2-14.1. Module Board Testing (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG)

The easiest method of determining whether a module is the cause of a malfunction is to substitute a known good module for a suspected module. If substitution is not possible, the following checks can be made to determine the operability of the modules:

a. Transmitter Module. With the transmitter contacts operating properly, the transmitter module should supply a ±6 = volt pulse output (+ 6 volts for a mark and -6 volts for a space). The mark and space pulses should have pulse widths of equal time duration. These checks can be made by placing an oscilloscope across terminals TP3 and TP4 on the transmitter module.

b. Receiver Module. The receiver module receives ±6-volt mark and space signal and TD control pulses (±6-volt pulses or +6-volt pulses may be used in the TD clutch magnet circuit) from the receive line and amplifies them to ±17 ±l-volt pulses. The input can be measured across terminals TP1 and TP2 on the module and the output can be measured across TP3 and TP2 on the module. If the output voltage is incorrect, remove the signal input and check for +15 volts between TP3 (+) on the receiver module and TP2 (-) on the mother board. If necessary, adjust potentiometer R8 for the +15 volts. Apply input signal and recheck output.

c. Selector Magnet Module. The selector magnet module receives the ±2.4-volt mark and space pulses from the receiver module and provides an output of approximately ±l.5 ±.5 volts to drive the selector magnet. The input and output voltages can be measured across module terminals TP1 and TP3 and TP2 and TP3, respectively.

d. Dc Power Supply Ripple Voltage. Connect an oscilloscope across the electrolytic capacitor in question (signal lead to capacitor positiv terminal, ground lead to capacitor negativ terminal), Set the oscillosocpe time base to observe a 120Hz signal. The observed A ripple voltage should be one-half volt peak-to peak or less. Replace filter capacitors when th ripple voltage exceeds the above limit.

WARNING

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

2-15. Troubleshooting Chart

The following chart is provided as an aid in isolating troubles to a specific part in the teletypewriter set.

NOTE

Include TT-688(*)/FG in conjunction with TT-664(*)/FG and TT-665/FG on troubleshooting chart.

a. Keyboard Transmitter Trouble Chart (Not Applicable to TT-259/FG).

Condition	*Probable trouble*	*Correction*
No transmission from keyboard transmitter.	Send plug disconnected (not applicable to TT-664(*)/FG)	Connect plug.
	Signal output leads not properly connected at TB1, terminals 4 and 5 of terminal box.	Connect leads.
	Keyboard transmitter contacts out of adjustment (not applicable to TT-664(*)/FG and TT-665/FG).	Adjust contacts (para 2-96).
	Transmitter contact assembly out of adjustment (TT-664(*)/FG and TT-665/FG).	Adjust transmitter contact assembly (para 2-96.1).
	Keyboard transmitter plug disconnected.	Connect keyboard transmitter plug.
	Keyboard transmitter friction clutch out of adjustment.	Adjust friction clutch (para 2-95).
	Cam stop lever binding	Clean cam stop lever.
	Deleted.....	Deleted
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 (para 2-91).
	Repeat blocking lever spring broken or missing.	Replace repeat blocking lever spring.
Transmitter mechanism transmits garbled copy.	Friction clutch dry or out of adjustment.	Lubricate (para 2-12) and adjust (para 2-95). Replace felt disks if necessary.
	Transmitter contacts dirty or out of adjustment (not applicable to TT-664(*)/FG and TT-665/FG).	Clean and adjust transmitter contacts (para 2-96).
	Transmitter contact assembly out of adjustment (TT-664(*)/FG and TT-665/FG).	Adjust transmitter contact assembly (para 2.96.1).
	Contact bail spring weak (not applicable to TT-664(*)/FG and TT-665/FG).	Replace contact bail spring.
	Binding in selector levers or sensing levers.	Clean and adjust sensing levers and selector levers (para 2-93).
	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.
	POWER fuse blown	Replace 2 amp fuse (fig. 2-8, TM 11-5815-200-12).

b. Page Printing Mechanism Trouble Chart.

Condition	*Probable trouble*	*Correction*
Motor fails to start	Failure of power source	Correct defect or use another power source.
	Motor stop contacts dirty or do not close (not applicable to TT-664(*)/FG and TT-665/FG).	Clean and burnish motor stop contacts (para 2-4 *b* (2)).
	Dirty commutator on motor	Clean commutator (para 2-4 *h* (4)).
	Defective motor brushes	Replace brushes (para 2-38).
	Open in field or armature winding ...	Replace motor (para 2-19).
	Dry friction clutches or mechanical binding.	Locate and correct trouble in mechanism.

Condition	*Probable trouble*	*Correction*
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 broke (not applicable to TT-664(*)/FG and TT-665/FG).	Install new motor stop contacts.

Condition	Probable trouble	Correction
Receiving unit runs open (line current is steady marking) (not applicable to TT-664(*)/FG and TT-665/FG).	Dirty commutator on motor	Clean commutator (para 2-4 *b* (4)).
	Line circuit fuse blown	Replace fuse.
	External line circuit open or shorted	Check line from teletypewriter terminals for continuity or short.
	No line current or low line current	Correct or replace source of voltage. Adjust LINE CURRENT rheostat (para 2-21*e*).
	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 (para 2-139, 2-140 and 2-141).
	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 runs open (applicable to TT-664(*)/FG and TT-665/FG.	DC power supply fuse blown	Replace fuse.
	External signal line opened or shorted.	Check signal line for continuity or short.
	Space instead of mark impulses received.	Reverse input signal line leads.
	Receiver electronic circuitry malfunctioned.	Check for correct output voltages from receiver module and selector magnet module (para 2-14.1); replace boards if necessary.
	Transmitting signa source malfunctioned.	Check for proper transmitting voltages and, if necessary, repair fault at source.
	Selector magnet armature not holding stop lever.	Readjust selector mechanism (para 2-139, 2-140, and 2-141).
	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.	Rangefinder dial assembly improperly set.	Adjust rangefinder dial assembly.
	Sending contacts dirty or pitted (not applicable to TT-664(*)/FG and TT-665/FG).	Clean, burnish, or replace sending contacts.
	Transmitter contact assembly out of adjustment (applicable to TT-664(*)/FG and TT-665/FG).	Adjust transmitter contact assembly (para 2-96.1).
	Selector camshaft or transmitter camshaft friction clutch slipping.	Adjust friction clutch (paras 2-95 and 2-127).
	Dirty, binding, or sticking selector mechanism.	Clean or adjust selector parts (paras 2-124-2-141).
	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 (para 2-182).
	Selector magnet mounting loose	Readjust and tighten mounting screws (para 2-133).
	Type arm or function selecting arm loose.	Readjust and tighten selecting arms (para 2-181).
Receiving unit prints same character or performs same function regardless of signals being sent.	Transfer lever latch spring or transfer lever spring broken.	Replace broken spring.
	Antibounce clutch jammed	Replace antibounce clutch.

Condition	Probable trouble	Correction
	Function selecting arm sticking in punch bar guide block.	Clean and readjust if necessary (para 2-181).
	Stop bar sticking	Clean stop bar guide plate and code rings.
Certain characters (or functions) will not print (or operate).	Stop bar spring broken or missing	Replace spring.
Receiving unit operates, but range (rangefinder measurement) is narrow (not applicable to TT-664(*)/FG and TT-665/FG).	Line current too high or too low	Readjust line current (para 20).
	Bias resistor improperly set	Check and adjust the bias resistance.
	Motor speed incorrect	Check motor speed.
	Selector mechanism improperly adjusted.	Make complete adjustment of selector mechanism (para 2-127 - 2-141).
Receiving unit operates, but range (rangefinder measurement) is narrow (applicable to TT-664 (*)/FG and TT-665/FG.	Selector magnet drive circuit current too low.	Check for correct output voltage from selector magnet module (para 2-14.1a) and replace if necessary.
	Motor speed incorrect	Check transmitter motor speed.
	Selector mechanism improperly adjusted.	Make complete adjustment of selector mechanism (para 2-127 through 2-141).
	Keyboard transmitter friction clutch improperly adjusted.	Make the adjustment (para 2-95).
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 (not applicable to TT-98C /FG).	Replace spring.
	Platen shift arm mounting loose	Readjust arm and tighten mounting screws (para 2-198).
	Figures shift sensing lever or cam follower bent or broken (not applicable to TT-98C /FG).	Replace defective parts.
Platen will not unshift	Function aperture gate stuck	Clenn 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 (not applicable to TT-98C/FG).	Clean and adjust collar (para 2-144).
	Line feed and figures shift cam follower spring broken (not applicable to TT-98C/FG).	Replace broken line feed and figures shift cam follower spring.
Carriage will not feed	Carriage feed link improperly adjusted.	Readjust link (para 2-204).
	Carriage feed clutch slipping	Readjust clutch; replace felts if necessary (para 2-174).
	Driving collar loose	Tighten setscrews.
	Carriage feed clutch lever spring broken.	Replace spring.
	Ribbon-driving mechanism jammed	Readjust ribbon-driving mechanism (para 2-217).
Carriage does not feed properly	Carriage return link improperly adjusted.	Adjust link (para 188).
	Carriage feed pawl spring broken	Replace spring.
Carriage return function inoperative	Carriage return link improperly adjusted.	Adjust link (para 2-162).
	Carriage return sensing lever spring broken.	Replace spring.
	Carriage return clutch mechanism out of adjustment.	Adjust carriage return mechanism (para 2-160-2-175).

Condition	Probable trouble	Correction
Carriage does not make complete return	Latch-tripping arm improperly adjusted.	Readjust latch-tripping arm (para 2-165).
	Mechanism binding	Clean and adjust carriage mechanism (para 2-166, 2-167 and 2-168).
Line feed function does not operate	Line feed sensing lever spring broken (not applicable to TT-259/FG).	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 (not applicable to TT-259/FG).	Clean collar and stud and reset collar if necessary.
	Line feed and figures shift cam follower spring broken (not applicable to TT-259/FG).	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 (not applicable to TT-664 (*) /FG and TT-665/FG)	Motor stop contact bracket improperly adjusted.	Readjust position of bracket (para 2-227).
	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 (para 2-185).
	Stop screw for platen arm not properly adjusted.	Adjust platen arm stop screw (para 2-196).
Printing too light or too heavy	Grooved nut on type selecting arm improperly adjusted.	Adjust grooved nut (para 2-185).
Lines are not printed straight	Platen arm stop screw loose	Tighten stop screw.
	Platen casting eccentric mounting screws not prpoerly adjsuted.	Adjust platen casting eccentric mounting screws (para 2-193).
Margins printing unevenly	Carriage return blocking mechanism improperly adjusted.	Adjust carriage return blocking mechanism (para 2-170).
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 (para 2-219).
	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 (not applicable to TT-259 /FG)	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 (para 2-191).
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 V. REMOVAL AND REPLACEMENT

2-16. General Removal and Replacement Instructions

a. Removal. When removing the various parts and assemblies, use the correct tool for specific operation. Do not remove assemblies beyond the point necessary to inspect, lubricate, or repair the mechanism.

NOTE

Felt washers (para 2-244) are included as lubrication reservoirs on some teletypewriters. The superscript "a" is used to identify these felt washers in the legends of the illustrations in this section and in section VI of this chapter.

b. Replacement. When replacing components of the teletypewriter, be sure that mating gears, clutch assemblies, and mechanical linkages are engaged before tightening the holding screws or bolts. Do not tighten screws, nuts, or bolts excessively. Steel screws should be coated with Compound, Antiseize (CE 52-2724.5000.080) before they are inserted into magnesium or aluminum castings. If springs are removed, tag them to identify their location.

2-17. Removal and Replacement of Receiving Unit

(fig. 2-11)

a. Removal.

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

NOTE

The TT-259/FG is not equipped with a keyboard-transmitter plug.

(2) Remove the motor stop plug from the receptacle connector at the right rear of the teletypewriter base (not applicable to TT-664(*)/FG and TT-665/FG).

(3) Lift the right hand side of the teletypewriter and disconnect the cannon-type plug connector (15, fig. 2-13) from the receptacle connector in the teletypewriter base.

(4) Remove the four socket-head screws, lockwashers, and flat washers that hold the feet of the frame to the vibration mounts on the teletypewriter base. Lift the ends of the four grounding leads free from the mounting screws.

(5) Remove the receiving unit from the base by lifting it upward and forward.

b. Replacement. Replace the receiving unit on the base by reversing the procedures in a above.

2–18. Removal and Replacement of Keyboard Transmitter (Not Applicable to TT-259/FG)

(fig. 2-11)

a. Removal.

(1) Remove the receiving unit from the teletypewriter base (para *2-17a).*

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

b. Replacement.

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

(2) Replace the receiving unit on the teletypewriter base (para *2-17a).*

2–19. Removal and Replacement of Motor

(figs. 2-12 and 2-13)

a. Removal.

(1) Lift the right hand side of the teletypewriter and disconnect the cannon-type plug connector from the receptacle connector in the teletypewriter base.

(2) Remove the four machine screws (1; fig. 2-12) and lockwashers (2). Remove the worm gear bracket (9), gear cover (6), and gasket (3).

(3) If the motor is a synchronous motor, remove the machine screws (1, fig. 2-13) and lockwashers (2). Remove the assembled motor by moving it sideways, away from the receiving unit frame. Re-

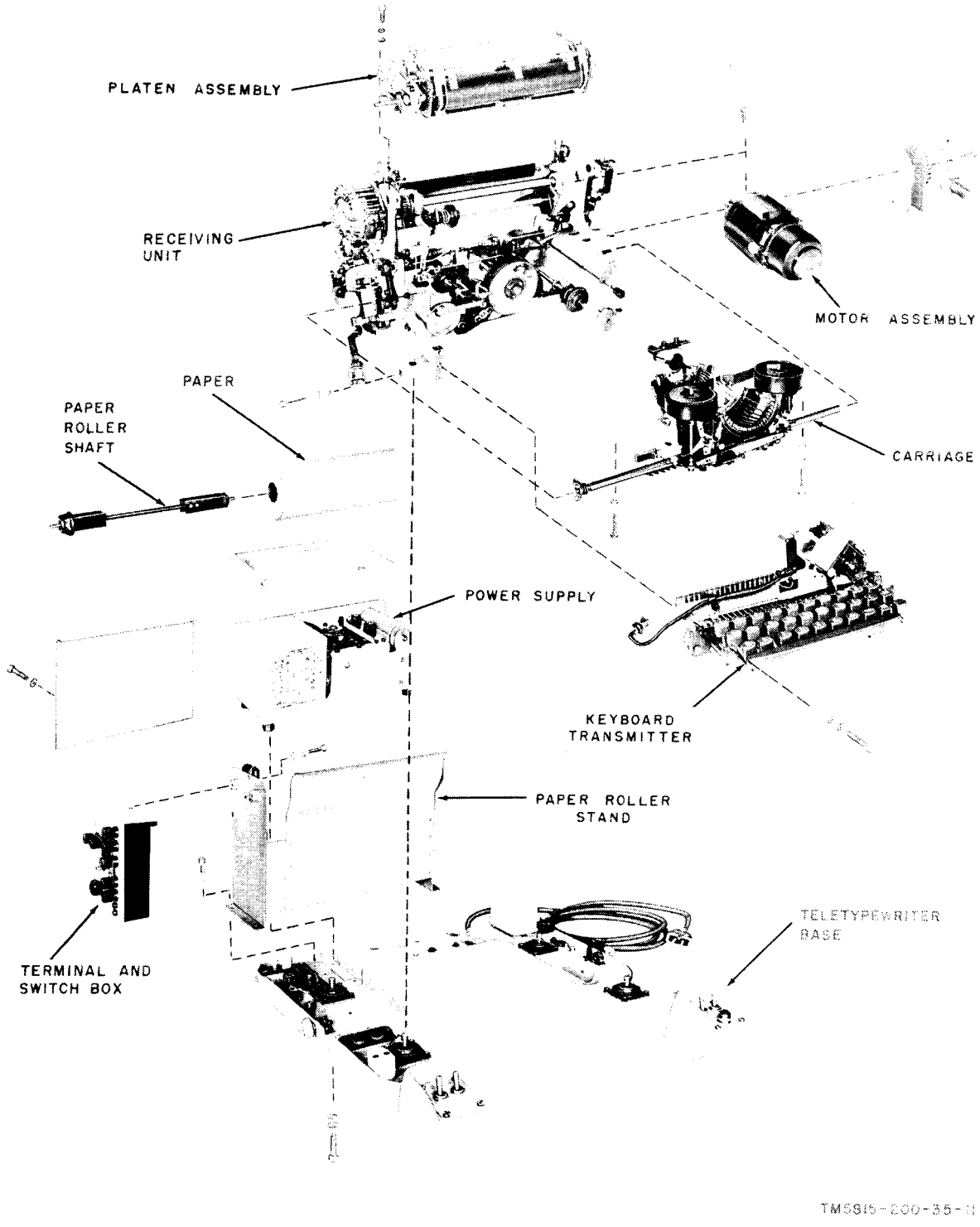


Figure 2 11. Teletypewriter, functional groups.

move the shims, when present, from the motor housing.

(4) If the motor is series-governed (fig. 92), remove the machine screws (1) and lockwashers (2). Remove the assembled motor by moving it sideways from the frame. Remove the shims (5), when present, from the flats on the motor housing.

(5) On teletypewriters equipped with hexagonal headed, externally threaded sleeves and lockwashers, remove the three sleeves (3) and lockwashers (4) from the frame assembly.

b. Replacement.

(1) Replace a synchronous motor by reversing the procedure described in *a(3)* above. Be sure the holes in the shims are aligned with the holes in the spacer plates.

(2) Replace a series-governed motor by reversing the procedure described in *a(4)* and (5) above.

Note. There should be a minimum of backlash between the main shaft driven gear and the worm gear. Use shims as required (para 2-97).

(3) Place the gasket (3, fig. 2-12), gear cover (6), and worm gear bracket (9) on the teletypewriter. Secure them with the four machine screws (1) and lockwashers (2).

(4) Lift the right hand side of the teletypewriter and connect the cannon-type plug connector to the receptacle connector in the teletypewriter base.

2-20. Removal and Replacement of Platen Assembly

(figs. 2-14 and 2-15)

a. Removal.

(1) Disconnect the platen shift bell crank spring (47, fig. 2-14) from the bracket link (12).

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

(3) Remove the two retainer rings (5 and 10) that, hold the connecting links (6 and 11) to the studs on the platen assembly. Disconnect the connecting links from the platen assembly. Remove the bracket link (12).

(4) Remove the retainer ring (32, fig. 2-15) from the platen shift arm (19). Disconnect the platen shift link from the platen shift arm.

(5) Remove the retainer ring (31) from the line feed lever (29). Disconnect the connecting link from the line feed lever.

(6) Remove the two setscrews (1) that hold the eccentric pivots (4) to the two ends of the teletypewriter frame. Remove the assembled eccentric pivots. The two hexagonal nuts (2) and the spacing collar (3) need not be removed from each of the eccentric pivots.

(7) Lift the platen assembly from the teletypewriter frame.

b. Replacement.

(1) Position the platen assembly on the teletypewriter frame. Be certain that the projection of the platen latching arm (7) is placed in the cutout of the aperture gate (30, fig. 2-46).

(2) Place the eccentric pivots (4, fig. 2-15) (including the spacing collar (3) and the two hexagonal nuts (2)) in the holes in the frame casting so that the stud on the end of the pivot engages the bearing in the platen support frame (30). Secure each of the eccentric pivots with the two setscrews (1).

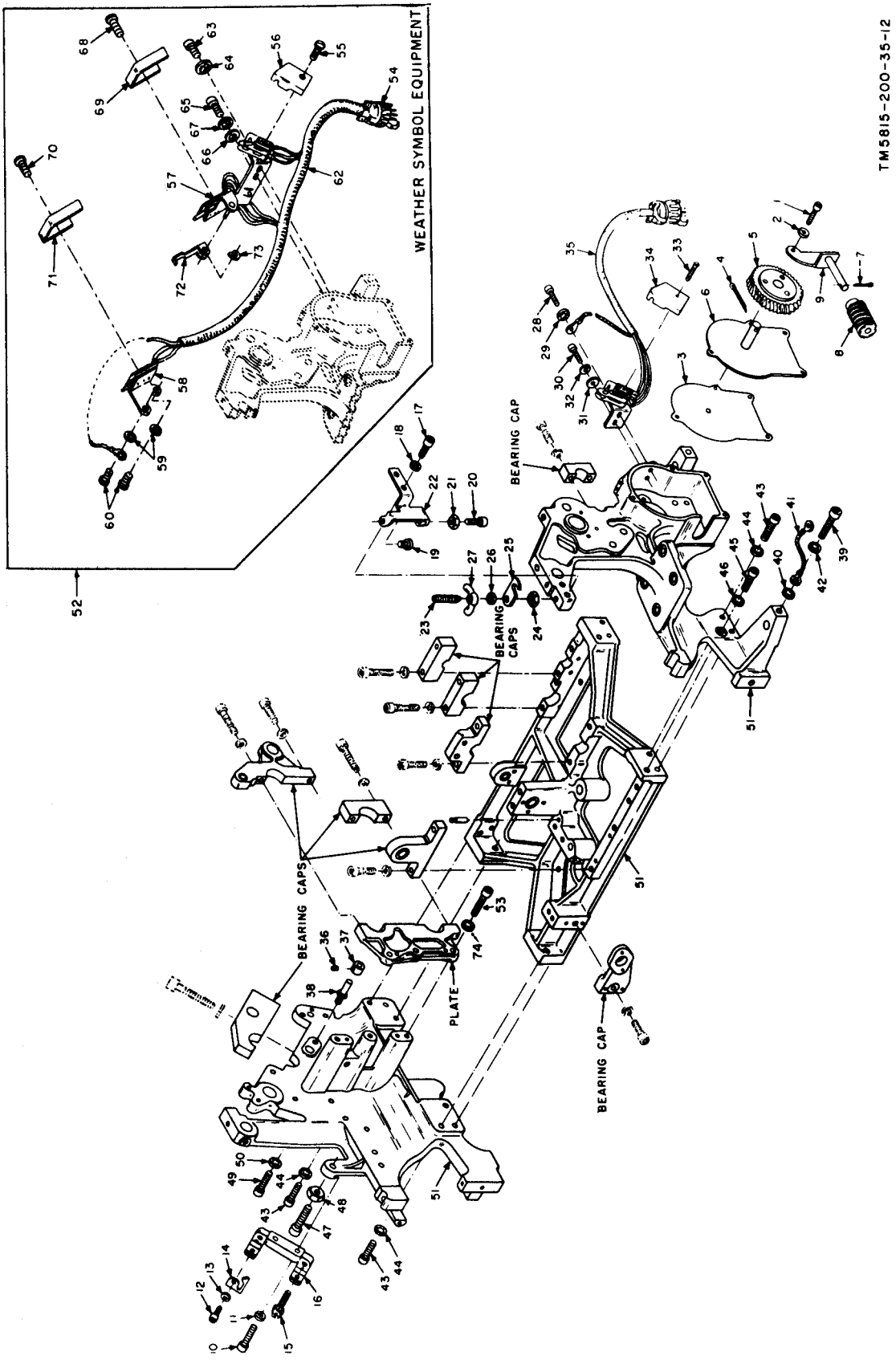
(3) Place the connecting link on the line feed lever (29) and the platen shift link on the platen shift arm (19). Secure them with the two retainer rings (31 and 32).

(4) Replace the bracket link (12, fig. 2-14) on the teletypewriter frame. Aline the holes in the bracket link with the tapped holes in the teletypewriter frame. Secure the bracket link to the frame with the two machine screws (1), flat washers (2), and lockwashers (3).

(5) Place the connecting links (6 and 11) on the studs on the platen assembly. Secure them with the two retainer rings (5 and 10).

(6) Connect the platen shift, bell crank spring (47) to the bracket link (12).

(7) Adjust the platen assembly (para 2-11).

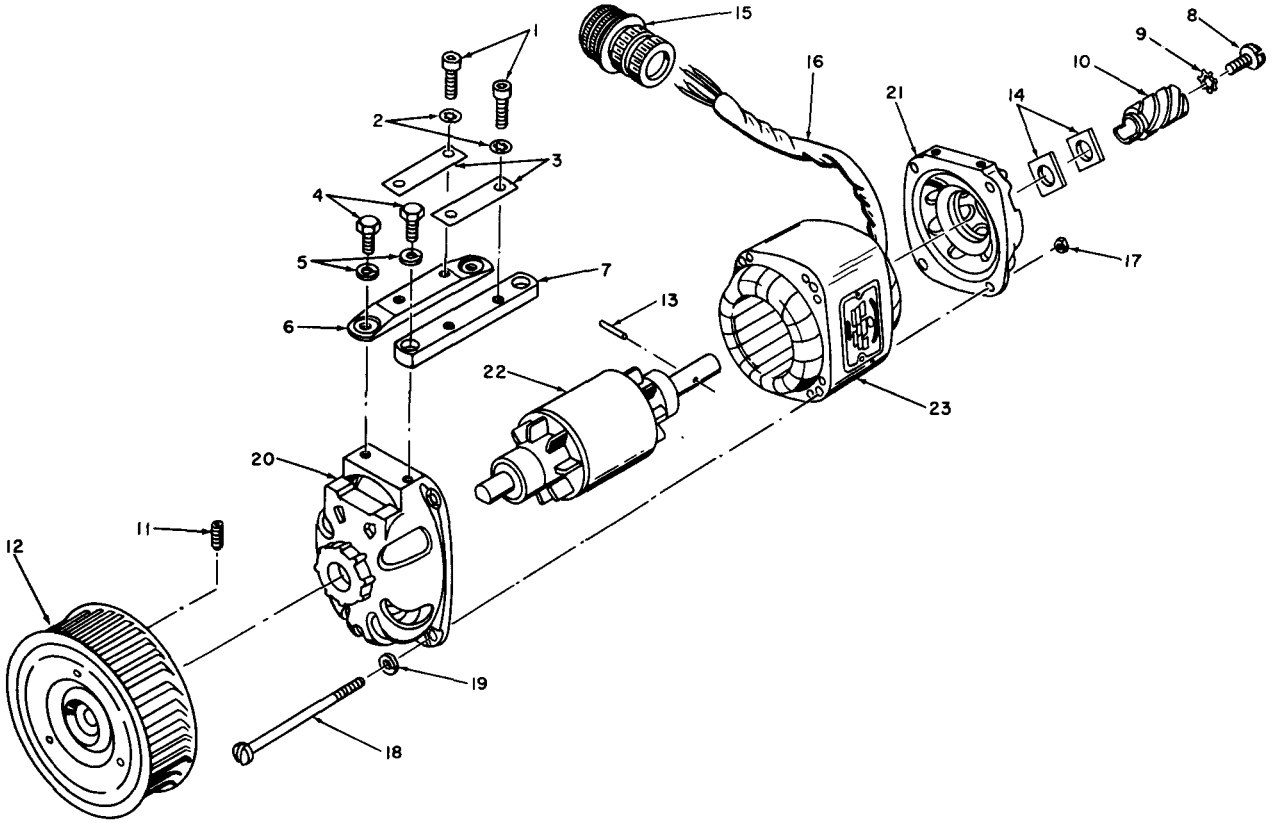

WEATHER SYMBOL EQUIPMENT
BEARING CAP
BEARING CAPS
BEARING CAPS
PLATE
BEARING CAP
TM5815-200-35-12

1 Machine screw, 10004
2 Lockwasher, 10429
3 Gasket, 50725
4 Cotter pin, 10805
5 Main shaft driven gear, 50597A (61745A on TT-293/FG, TT-482/UGC and TT-483/UGC).
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, 11209
21 Hexagonal nut, 10516
22 Platen bracket, 51464
23 Setscrew, 10212
24 Hexagonal nut, 10509
25 Platen lock, 50598
26 Lockwasher, 10431
27 Wingnut, 10508
28 Machine screw, 10003 [a]
29 Lockwasher, 10406 [a]
30 Machine screw, 10003 [a]
31 Flat washer, 10459 [a]
32 Lockwasher, 10429 [a]
33 Machine screw, 10386 [a]
34 Contact shield, 53116 [a]
35 Motor stop switch and cable assembly, 53330A [a] (includes switch (S1), 53428A; cable, 54083A; and connector plug (P2), 20419)
36 Setscrew, 10201
37 Spacing collar, 51717
38 Cam follower stop stud, 51719
39 Machine screw, 10042
40 Lockwasher, 10405
41 Electrical lead, 53651
42 Lockwasher, 10405
43 Machine screw, 10018-01
44 Lockwasher, 10405
45 Machine screw, 10024
46 Lockwasher, 10405
47 Machine screw, 10021
48 Hexagonal nut, 10502
49 Machine screw, 10017-01
50 Lockwasher, 10405
51 Frame assembly 55700A (includes bearing caps, three main castings, plate dowels, and spring posts)
52 Motor stop switch and cable assembly 53335A [b] (includes items 54-58 and 62-73)
53 Machine screw, 10018
54 Connector plug (P2), 20419 [b]
55 Screw, 10386 [b]
56 Contact shield, 53116 [b]
57 Motor stop contacts (S1) and function shaft pulsing contacts (S10) assembly, 53770A [b] (includes item 61)
58 Blank code bar contact assembly (89), 53776A [b]
59 Lockwasher, 10418 [b]
60 Screw, 10362 [b]
61 Bracket (part of item 57)
62 Motor stop cable, 53365A [b]
63 Machine screw, 10003 [b]
64 Lockwasher, 10403 [b]
65 Machine screw, 10003 [b]
66 Flat washer, 10459 [b]
67 Lockwasher, 10429 [b]
68 Screw, 10386 [b]
69 Contact shield, 53769 [b]
70 Screw, 10386 [b]
71 Contact shield, 53769 [b]
72 Pulsing contact cam follower, 53771 [b]
73 Retainer ring, 10969 [b]
74 Lockwasher, 10405

Figure 2-12. Teletypewriter frame assembly, exploded view.

[a] Not applicable to weather symbol teletypewriters and communications teletypewriters TT-664(*)/FG, and TT-665/FG.

[b] Applicable only to weather symbol teletypewriters.



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 Hexagonal nut, part of 52470A (includes items 18, 19, 20, 21, 22, and 23)
18 Through bolt
19 Lockwasher
20 Rear end casting, 53502A (includes items 3–7, 14, and 17–23)
21 Front end casting
22 Motor armature, 53361A (includes item 13)
23 Motor stator, 53362A

Figure 2–13. Synchronous motor, exploded view.

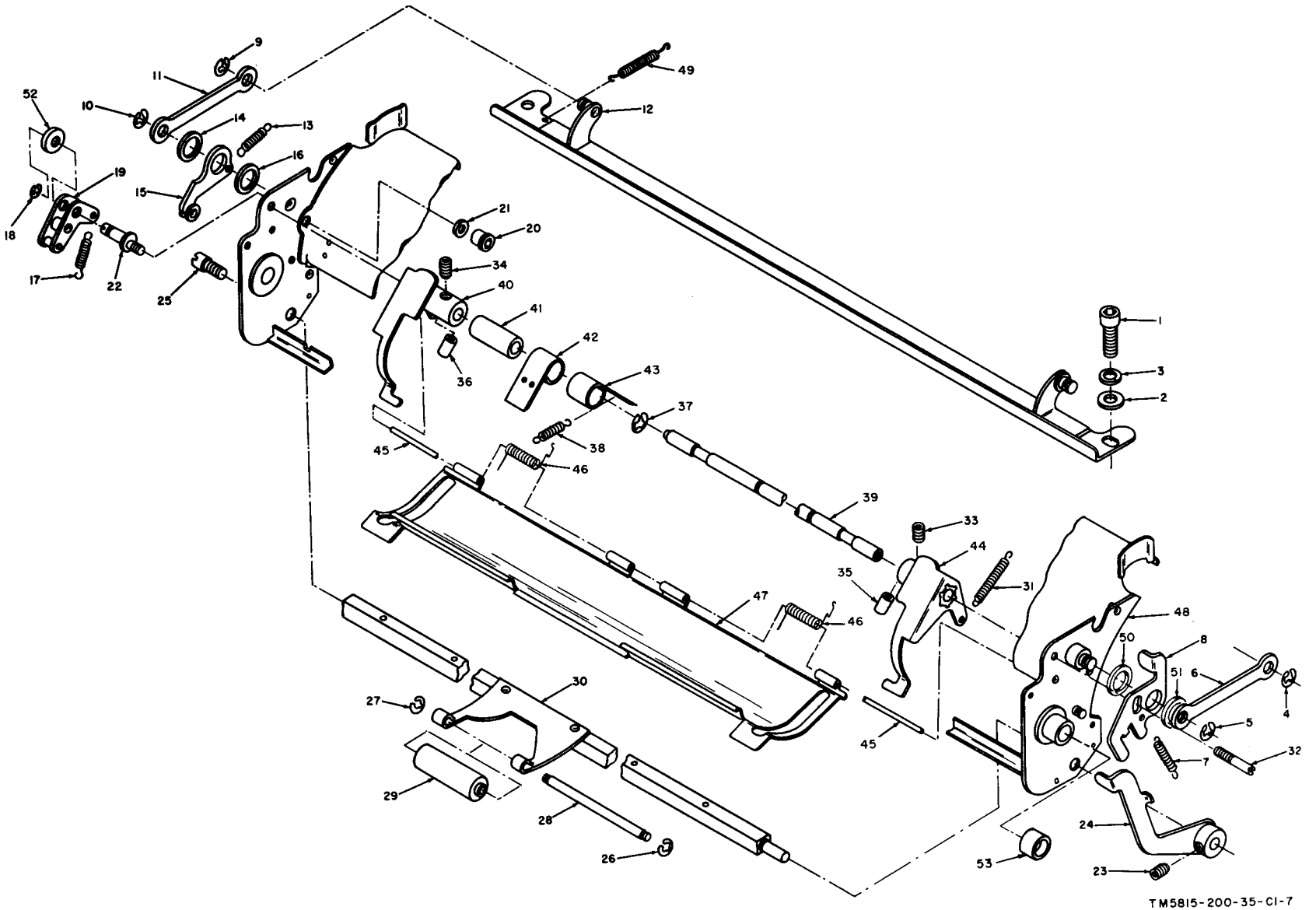


Figure 2-14. Platen trough assembly, exploded view.

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 (57971A on TT-98C/FG)
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, 10203
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 Roll pin, 11058 (TT-98C/FG)
36 Roll pin, 11058 (TT-98C/FG)
37 Retainer ring, 10949
38 Stripper spring, 55143
39 Paper guide shaft, 55152 (61074A on TT-98C/FG)
40 Paper guide, 55144A (61069A on TT-98C/FG)
41 Sleeve, 55041
42 Paper stripper, 55151
43 Paper stripper, 55151
44 Paper guide, 55141A (61074A on TT-98C/FG)
45 Hinge pin, 55146
46 Platen trough spring, 54967
47 Paper trough guide, 54962
48 Platen trough, 59432A (includes items 45, 46 and 47) (63831 on TT-98D/FG)
49 Platen shift bell crank spring, 51645
50 Flat washer, 51768
51 Flat washer, 51768
52 Felt washer, 61472
53 Felt washer, 61470 (included as lubrication reservoir on some teletypewriters)

Figure 2-14. Platen trough assembly, exploded view.

2-21. Removal and Replacement of Carriage

(fig. 2-16)

Note. Refer to paragraph 2-12 for instructions on the removal and replacement of the type basket of the TT-300/FG.

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. On TT-98C/FG, remove the carriage-rack ret airier (2, fig. 2-58).

(2) Remove the machine screw (1) and lockwasher (2) that hold the carriage guide rail (18) to the teletypewriter frame on the left side and the similar screw and two lockwashers that hold the guide rail and the carriage return but ton 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- and left-hand margin trip plates, bearing cap, and type selecting arm.

(4) Remove the two machine screws (9) and lockwmhers (10) that hold tile 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 teletypewriter frame by lifting it forward and upward.

b. Replacement.

(1) Position the carriage on the teletypewriter 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 teletypewriter 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).

(4) Press the blank key and turn the teletypewriter motor by hand until the square stops turning. Install the type selecting a rrn 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). On TT-98C/FG, reinstall the carriage-rack retainer (2,fig. 2-58).

2-22. Removal and Replacement of Function Shaft (not applicable to TT-98C/FG)

(fig. 2-18)

a. Removal.

(1) Remove the receiving unit from the base (para *2-17a).*

(2) Remove the signal bell and motor stop function lever from the function side of the teletypewriter frame (para *2-55a).*

(3) Remove the transfer lever shaft (para 2-53 *a*).

(4) Remove the figures shift and line feed cam follower spring (para *2-58a).*

(5) Remove the line feed cam follower (para *2-58a).*

(6) Remove the cam follower stop stud (para 2-58 *a*).

(7) Remove the platen shift cam follower (para *2-58a).*

(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 teletypewriter 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 engagement 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 teletypewriter frame.

b. Replacement.

(1) Position the assembled function shaft (46) on the teletypewriter frame, with the bearings resting in the bearing supports on the frame.

(2) Install the bearing cap on the selector side of the teletypewriter 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), lockwashers (6), machine screw (3), and lockwasher (4).

(4) Install the bearing cap on the function side of the teletypewriter 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 (para *2-58b).*

(7) Install the cam follower stop stud (para *2-58b).*

(8) Install the line feed cam follower (para *2-58b).*

(9) Install the figures shift and line feed cam follower spring (para *2-58b).*

(10) Install the transfer lever shaft (para *2-53b).*

(11) Install the signal bell and motor stop function lever from the function side of the teletypewriter frame (para *2-55b).*

(12) Adjust the function shaft (paras 2-144-2-150 and 2-182).

(13) Install the receiving unit on the base (para 2-13).

2-23. Removal and Reinstallation of Function Shaft Assembly (TT-98C/FG)

(fig. 2-18)

a. Removal.

(1) Remove the function shaft (para *2-22a* (l)-(3)).

(2) Disconnect the dra wbar spring (58, fig. 2-48) from the function stop bar support guide (15, fig. 2-20).

(3) Remove the machine screw (60, fig. 2-48), lockwasher (61), and flat washer (62) that hold the adjustable block (63) located closest to the code-ring cage. Remove the adjustable block.

(4) Perform the procedure in paragraphs 2-*22a(8)* through (11).

(5) Disengage the drawbar cam on the line-feed and platen-shift sensing cam (20, fig. 2-48) from the drawbar. Remove the three bearing supports in the page printer frame.

b. Reinstallation.

(1) Move the carriage assembly to the right-hand side of the page printer.

(2) Reverse the steps and procedures outlined in *a* (2) through (5) above.

(3) Perform the adjustments described in paragraphs 2-114, 2-145, 2-146, 2-147, 2-l82, and 2-203.

(4) Reinstall the transfer lever shaft (para *2-53b).*

(5) Reinstall the signal bell (para *2-55b).*

(6) Adjust the signal bell (paras 2-225 and 2-226).

(7) Reinstall the paper roller stand and terminal box (para *2-28b).*

2-24. Removal and Replacement of Main Shaft

a. Removal.

(1) Remove the receiving unit from the base (para *2-17a).*

(2) Remove the gear cover, worm gear bracket, and gasket from the teletypewriter frame (para 2–19).

(3) Remove the machine screw (1, fig. 2-19) and lockwasher (2). Loosen the four

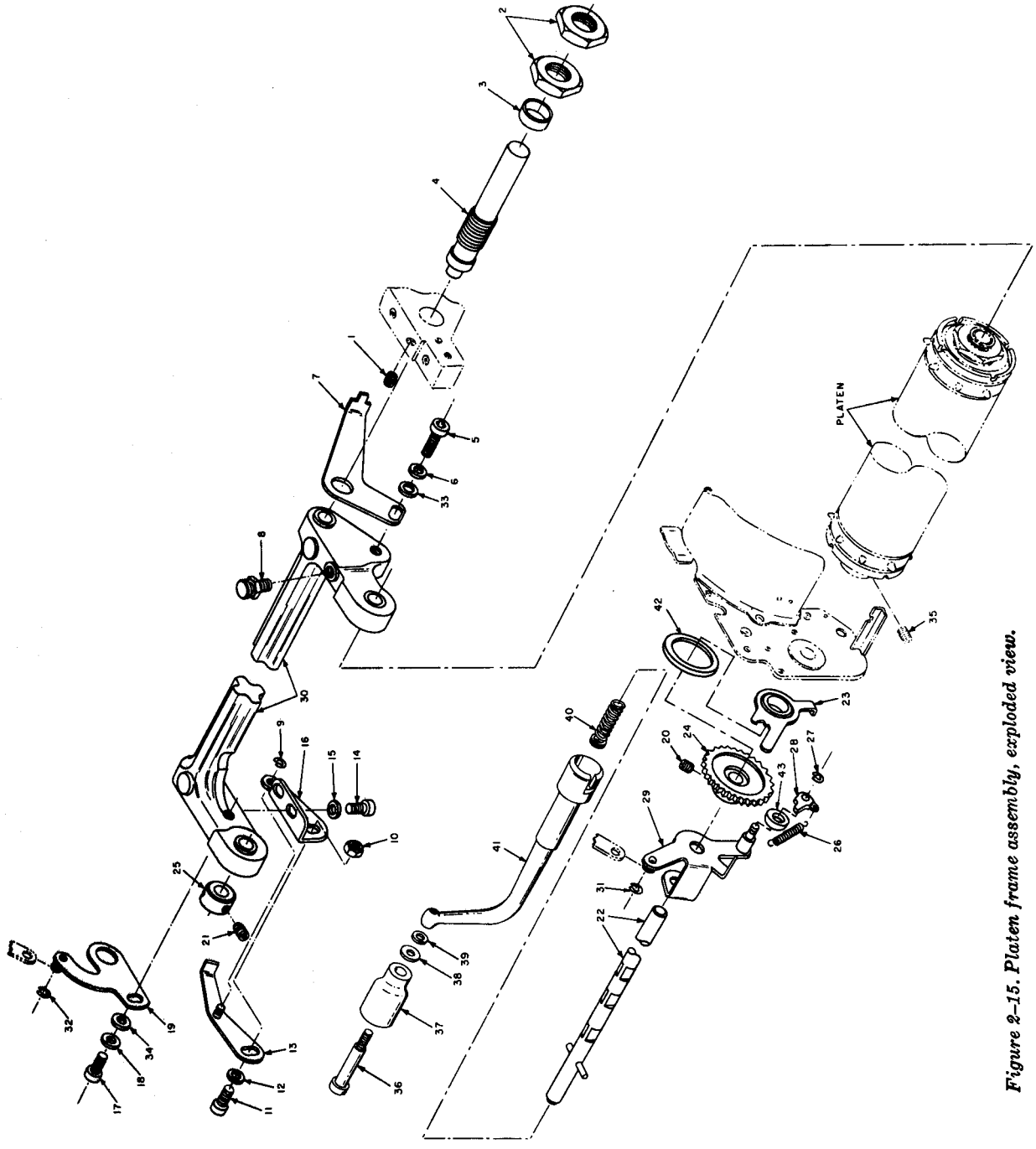
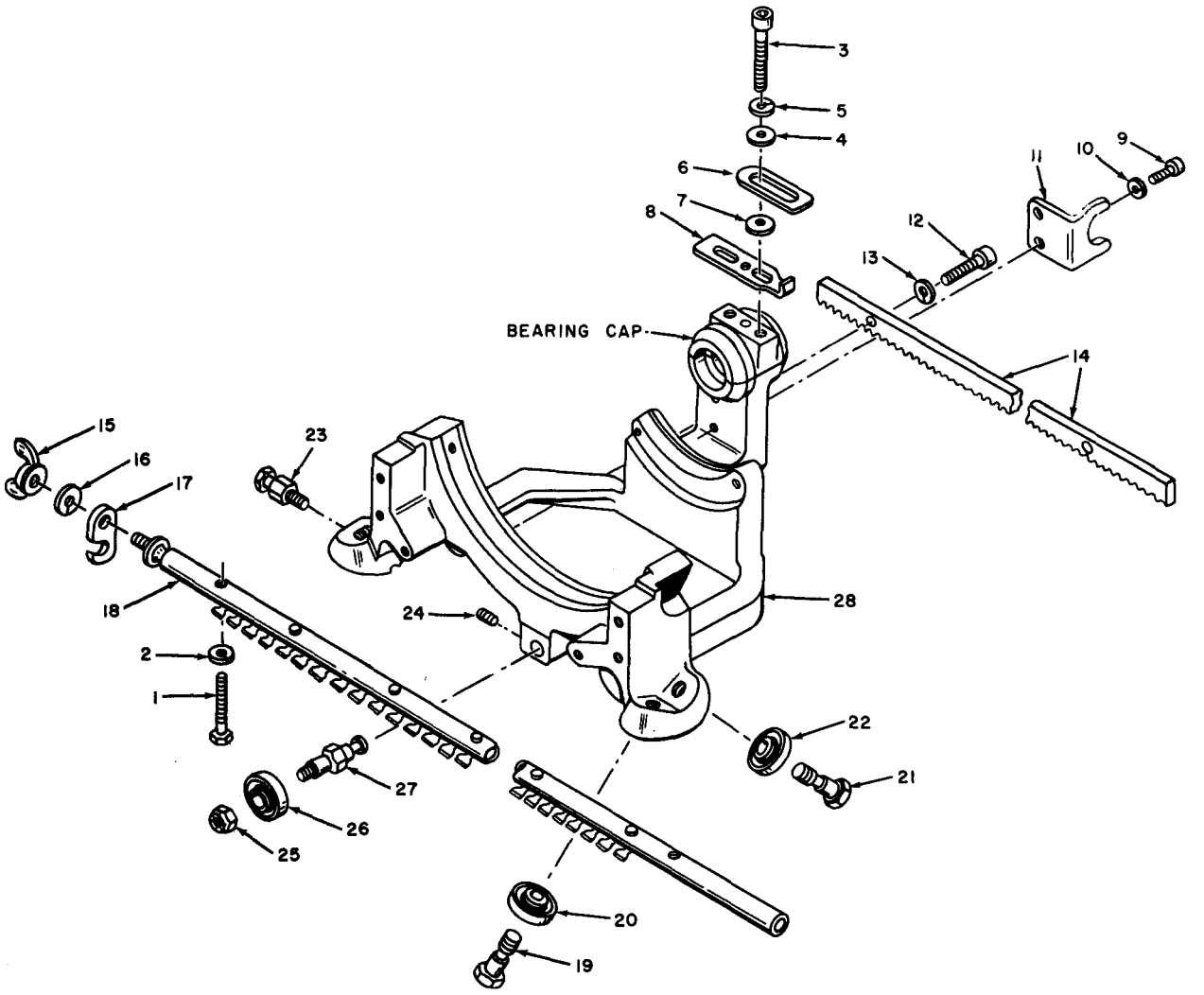


Figure 2–15. Platen frame assembly, exploded view.

1 Setscrew, 10211
2 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-lock hexagonal nut, 10501
11 Machine screw, 10008
12 Flatwasher, 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 (57981A on TT-98C/FG)
20 Setscrew, 10209
21 Setscrew, 10209
22 Platen shaft, 54955A
23 Single-double line feed lever, 51762A
24 Detent wheel, 52807 (63828 on TT-98D/FG)
25 Shaft collar, 50209
26 Line feed pawl spring, 50333
27 Retainer ring, 10969
28 Line feed pawl, 50165
29 Line feed lever, 53137A (63829A on TT-98D/FG)
30 Platen support frame, 53305A
31 Retainer ring, 10949
32 Retainer ring, 10949
33 Flat washer, 10458
34 Flat washer, 10458 (10401 on TT-98C/FG)
35 Setscrew, 10209
36 Screw, 54959
37 Platen crank knob, 54961
38 Plain washer, 10454
39 Lockwasher, 10409
40 Spring, 54957
41 Platen crank, 54960A (includes items 36–40)
42 Felt washer, 61471 [a]
43 Felt washer, 61473 [a]

Figure 2–15. Platen frame assembly, exploded view.

[a] Included as lubrication reservoir on some teletypewriters.



1 Machine screw, 10319
2 Lockwasher, 10430
3 Machine screw, 10013
4 Flat washer, 10467
5 Lockwasher, 10430
6 Right-hand margin trip plate, 52257
7 Flat washer, 10467
8 Left-hand margin trip plate, 52253
9 Machine screw, 10004
10 Lockwasher, 10429
11 Carriage rear support bracket, 50571
12 Machine screw, 10011
13 Lockwasher, 10430
14 Carriage feed and return driving rack, 50592 (62207 on TT–98C/FG)
15 Wingnut, 10508
16 Lockwasher, 10431
17 Platen lockup arm, 50598
18 Carriage guide rail, 50394A (includes items 15, 16, and 17)
19 Capscrew, 50591
20 Ball bearing, 10752
21 Capscrew, 50591
22 Ball bearing, 10752
23 Carriage locking stud, 50594
24 Setscrew, 10204
25 Self-locking hexagonal nut, 10501
26 Ball bearing, 10752
27 Roller mounting stud, 50593
28 Carriage frame, 50545A (62619A on TT–300/FG)

Figure 2–16. Carriage frame assembly, exploded view.

motor mounting screws and remove the main shaft driven gear (3),

(4) Remove the drive keys (4) from the main shaft driven gear (3),

(5) Remove the two machine screws (5), lockwashers (6), and flat washers (7) ancl remove the ball bearing (8).

(6) Remove the two machine screws (9) and lockwashers (10) and remove the bearing cap from the teletypewriter frame.

(7) Remove the rangefinder orientation lever (10. fig. 2-40) from the rangefinder mechanism (para 2-51 *a* (3)).

(8) Remove machine screws (1, fig. 2-50) and lockwashers (2). Pull the selector camshaft (18) out of the frame far enough to allow the selector clutch fork (12, fig. 2-19) to clear the driving disk (8, fig. 2-50) on the selector camshaft.

(9) With the function shaft in the stop position, remove the main shaft (22, fig. 2-19).

b. Replacement.

(l) Insert the left end of the main shaft (22, fig. 2-19) in the hole in the function side of the teletypewriter frame.

(2) Position the ball bearing (13) in the bearing seat in the selector side of the frame. Position the bearing cap on the bearing and on the frame. Secure the cap with the two 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 teletypewriter 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 operating speed desired.

(6) Install the rangefinder orientation lever (10, fig. 2-40) on the rangefinder mechanism (para. 2-51 *b).*

(7) Move the selector camshaft (18, fig. 2-50) so that the driving disk (8) of the friction clutch engages the selector clutch fork (12, fig. 2-19) on the main shaft (22).

(8) Install the two machine screws (1, fig. 2-50) and lockwashers (2) that hold the selector camshaft (18) to the selector side of the teletypewriter frame.

(9) Install the gasket, gear cover, and worm gear bracket on the teletypewriter frame (para 2-19 *b*).

(10) Install the receiving unit on the base (para 2-17 *b).*

2-25. Removal and Replacement of Code Ring Cage

a. Removal.

(1) On the TT–99/FG only, remove the two binding head screws (60, fig. 2-20) the electrical lead, lockwasher (59) and the stop bar contact assembly (58).

(2) Remove the two machine screws (1) and lockwashers (2) that hold the code ring cage to the selector side of the teletypewriter frame.

(3) Remove the four setscrews (10, fig. 2-49) and the assembled stop arm shaft and square shaft stop arm (4, fig. 2–20).

(4) 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 bracket. Remove the sensing levers (para 2–65 *a).*

(5) Remove the code ring cage by pulling it away from the teletypewriter frame.

b. Replacement.

(1) Replace the code ring cage by reversing the procedures outlined in *a* above.

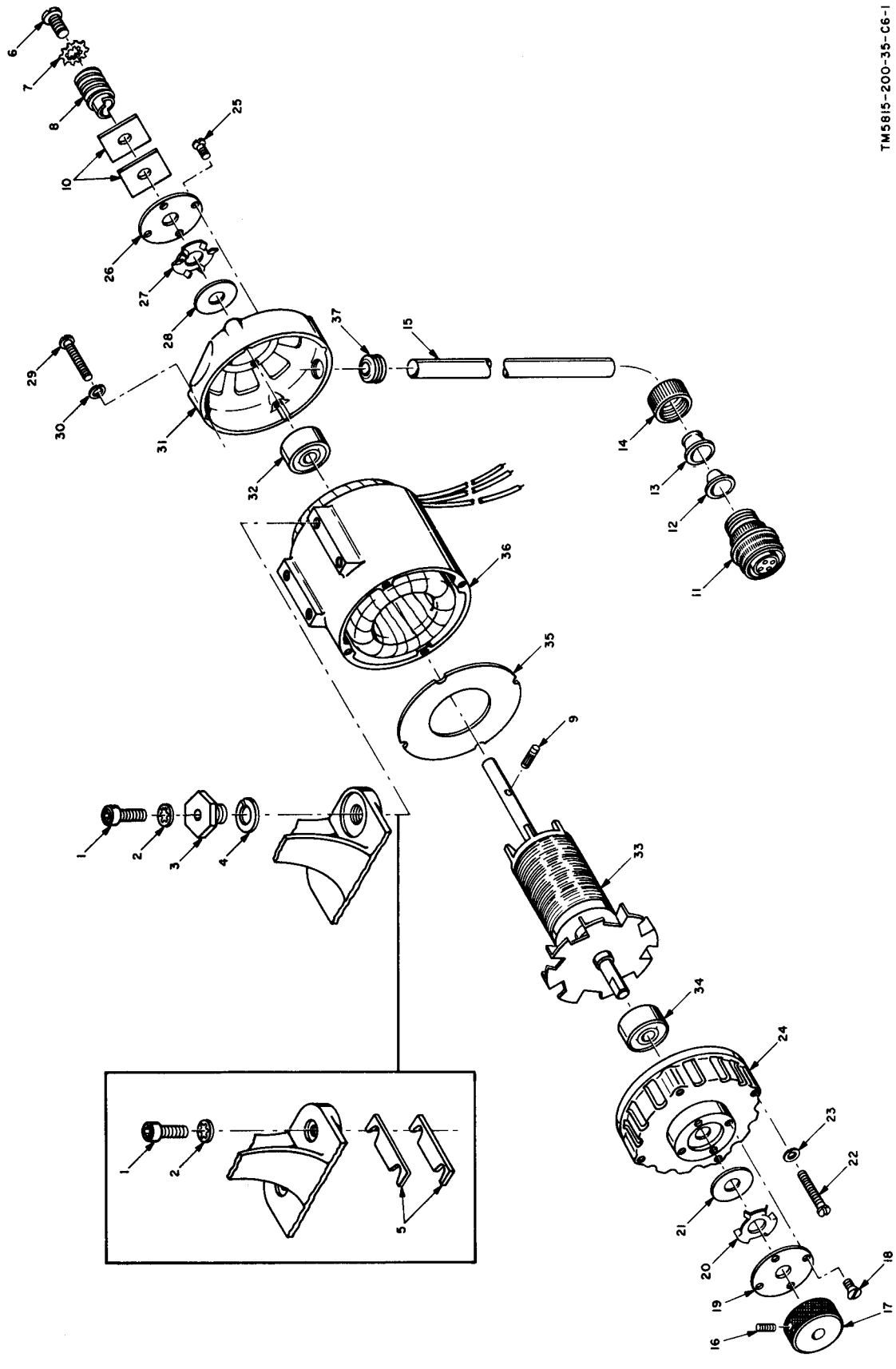
(2) Adjust the code ring cage and the square shaft stop arm as instructed in paragraphs 2-112 and 2-181.

2-26. Removal and Replacement of Carriage-Return Operating Mechanism

(fig. 2-21)

a. Removal.

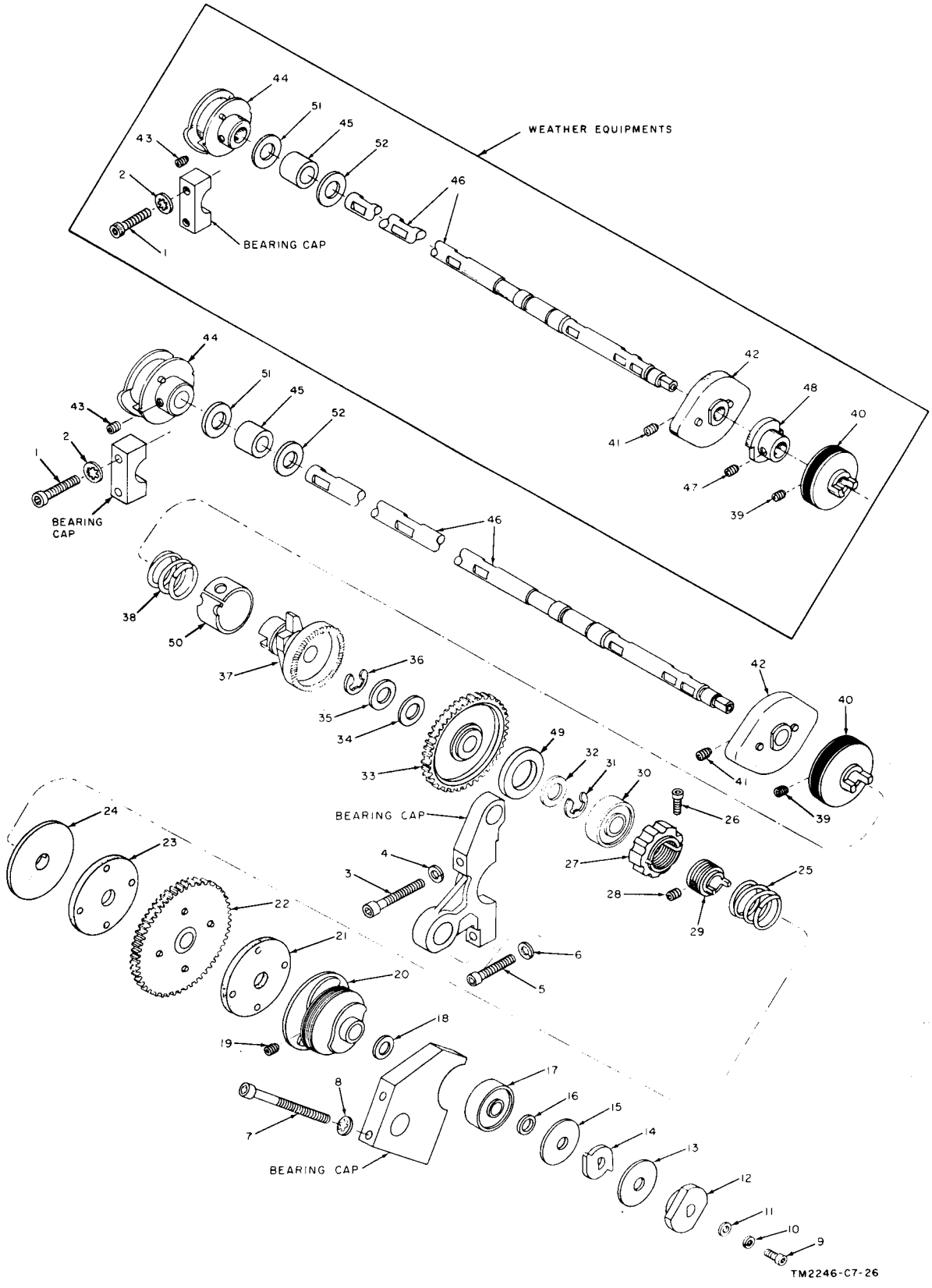
(1) Remove the manual unshift lever link (para 2-67 *a).*


TM5815-200-35-C6-1

1 Machine screw, 10018–01
2 Lockwasher, 10405
3 Sleeve, 57493
4 Lockwasher, 10422
5 Shim, 51509, as required, and/or 51510, as required.
6 Machine screw, 50207
7 Lockwasher, 10403
8 Worm, 50350
9 Pin, 50359
10 Grease seal, 50949
11 Plug connector P3, 20421
12 Ferrule, 20847
13 Ferrule, 20846
14 Nut, 10533
15 Tubing, 20814–03.60
16 Setscrew, 10211
17 Motor shaft knob, 54217
18 Machine screw, 10196
19 Bearing retainer, 56886
20 Spring tension washer, 56887
21 Shim, 56888 (as required)
22 Machine screw, 10172
23 Lockwasher, 10442
24 End bell, 68030
25 Machine screw, 10196
26 Bearing retainer, 56886
27 Spring tension washer, 56887
28 Shim, 56888 (as required)
29 Machine screw, 10172
30 Lockwasher, 10442
31 End bell (drive end), 68100
32 Ball bearing, 10760
33 Rotor core and shaft, 68101 (includes items 32 and 34)
34 Ball bearing, 10760
35 Baffle, 68103
36 Stator, 68102
37 Grommet, 20726

Figure 2–17. Synchronous motor 68114A, exploded view.

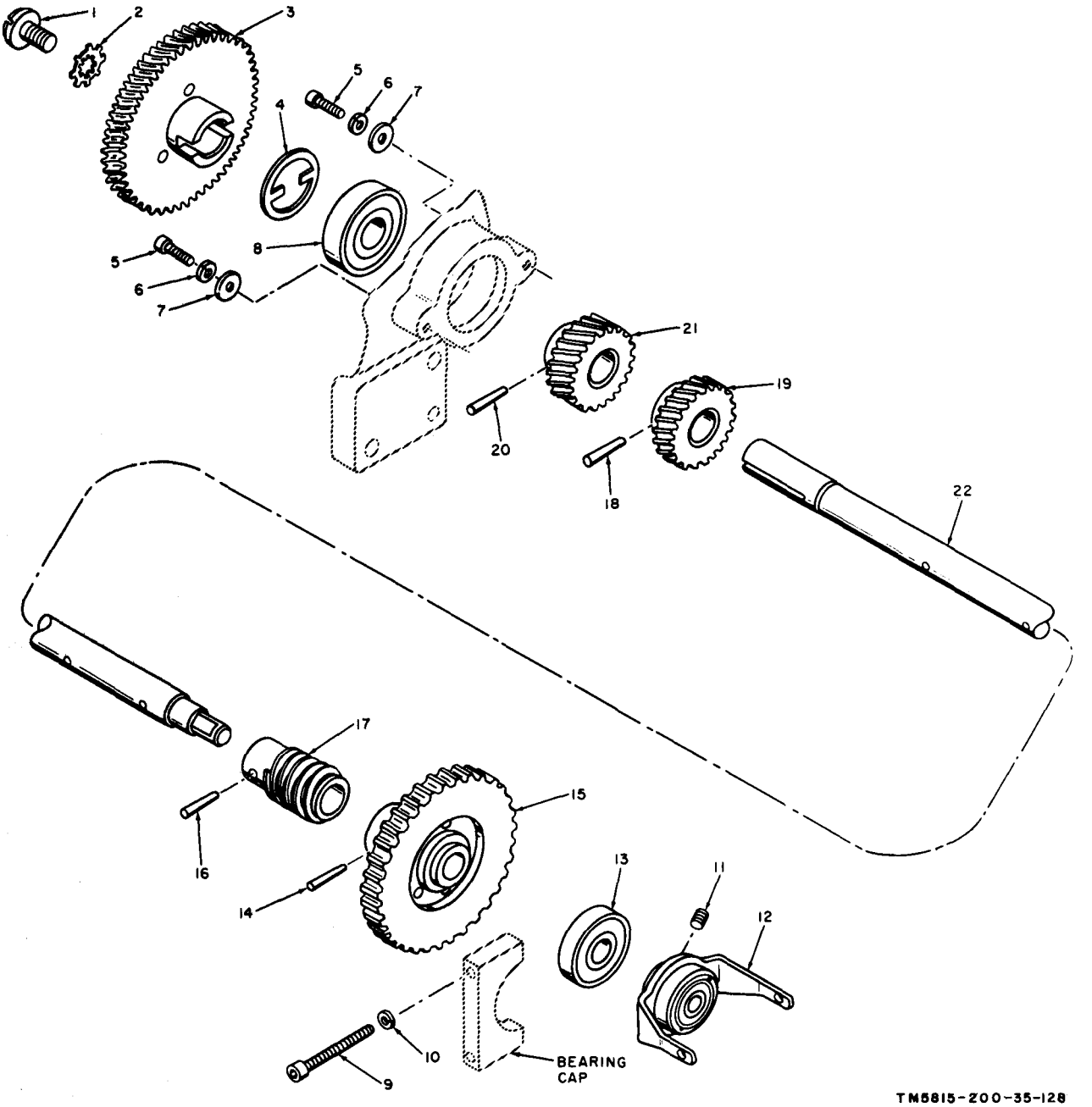
Note. Items 9, 10, and 18 through 36 are available as Howard spare part motor No. 68114A.


WEATHER EQUIPMENTS
BEARING CAP
BEARING CAP
BEARING CAP
BEARING CAP
TM2246-C7-26

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, 62115A [a]
21 Friction plate, 56764
22 Square shaft driving gear, 56274A
23 Friction plate, 56764
24 Friction clutch plate, 54929
25 Clutch pressure spring, 54933
26 Clamping screw, 10043
27 Friction adjusting collar, 56832 [a]
28 Setscrew, 10209
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 (0.004-in.) or 51848 (0.006-in.)
35 Flat washer, 50515
36 Retainer ring, 10959
37 Function shaft sliding clutch drum, 50516, 57893A [a]
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
47 Setscrew, 10209
48 Pulsing cam, 53772
49 Felt washer, 61491
50 Felt washer, 61496
51 Felt washer, 61490
52 Felt washer, 61490

Figure 2–18. Function shaft, exploded view.

[a] TT–98C/FG



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 clutch fork, 50484A
13 Ball bearing, 10757
14 Taper pin, 10852 (10860 [a])
15 Function shaft driving gear, 50354A
16 Taper pin, 10850 (10862 [a])
17 Carriage feed worm gear, 50268
18 Taper pin, 10852 (10860 [a])
19 Carriage-return shaft drive gear, 55167
20 Taper pin, 10852 (10860 [a])
21 Transmitter shaft drive gear, 55166 (61316 on TT-482/UGC and TT-483/UGC)
22 Main shaft, 54563

Figure 2-19. Main shaft, exploded view.

[a] On order No. 27133—Phila—56 only.

(2) Remove the horizontal carriage-return link (para 2-64 *a* (4)).

(3) Remove the two machine screws (1) and lockwashers (2) and remove the assembled carriage-retum operating mechanism.

b. Replacement.

(1) Position the assembled carriage-return operating mechanism on the teletypewriter 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 teletypewriter with the two machine screws (1) and lockwashers (2).

(2) Install the horizontal carriage-return link (para 2-65 *b* (9)).

(3) Install the manual unshift lever link (para 2-67 *b*).

(4) Adjust the carriage-return operating mechanism (para 2-165, and 2-169-2-172).

2-27. Removal and Replacement of Carriage-Feed Shaft

(fig. 2-22)

a. Removal.

(1) Remove the keyboard transmitter from the teletypewriter (para 2-18 *a*).

(2) Remove the carriage-feed mechanism from the teletypewriter (para 2-70 *a*).

(3) Remove the machine screw (1) and lockwasher (2) and remove the assembled bearing block and ball bearing (6).

(4) Remove the two machine screws (3), flat washers (4), and lockwashers (5). Remove the ball bearing (6).

(5) Remove the two machine screws (7), flat washers (8), and lockwashers (9) and remove the bearing retainer (10).

(6) Remove the self-locking hexagonal nut (11); pull the carriage-feed shaft (34) far enough forward to clear the ball bearing (12) and remove the shaft and, if present felt washer (37) from the teletypewriter.

(7) Remove the ball bearing (12) from the bearing seat in the teletypewriter frame.

b. Replacement.

(1) Position the ball bearing (12) in the bearing seat in the teletypewriter frame.

(2) Insert the assembled carriage-feed shaft (34) through the ball bearing (12) in the bearing seat on the teletypewriter frame and secure it with the self-locking hexagonal nut (11).

(3) Position the bearing retainer (10) on the teletypewriter 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) If available, mount a felt washer (37) on the carriage-feed shaft assembly. 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 teletypewriter frame and secure it with the machine screw (1) and lockwasher (2).

(6) Install the carriage-feed mechanism on the teletypewriter (para 2-70 *b*).

(7) Install the platen on the teletypewriter (para 2-20 *b*).

(8) Install the keyboard transmitter on the teletypewriter (para 2-18 *b*).

(9) Adjust the carriage-feed shaft (para 2-152-2-157, 2-164, and 2-174).

2-28. Removal and Replacement of Terminal and Switch Box, Paper Roller Stand, and Power Supply

a. Removal.

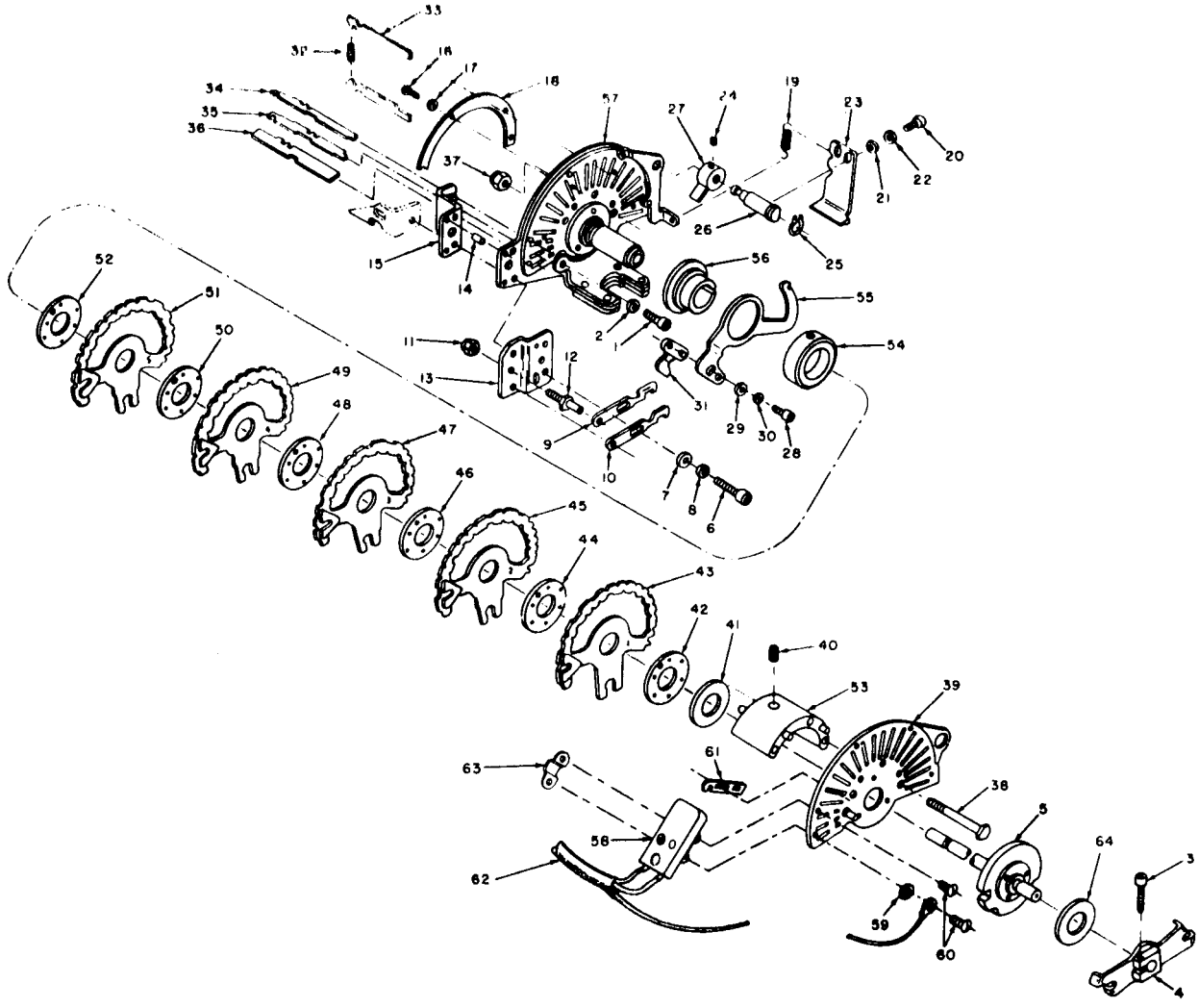
(1) (Not Applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG) Remove the two machine screws (13, fig. 2-23), flat washers (14) and lockwashers (15). Lift the terminal and switch box (16) clear of the multiple jack on the teletypewriter base.

(1.1) (Applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG) Remove the two machine screws (13, fig. 2-23.1), flat washers (14), and lockwashers (15). Lift the terminal box (16) clear of the multiple jack on the teletypewriter base.

(2) Remove the machine screw (5), flat washer (7), and lockwasher (8). Remove the rear paper deflector (6).

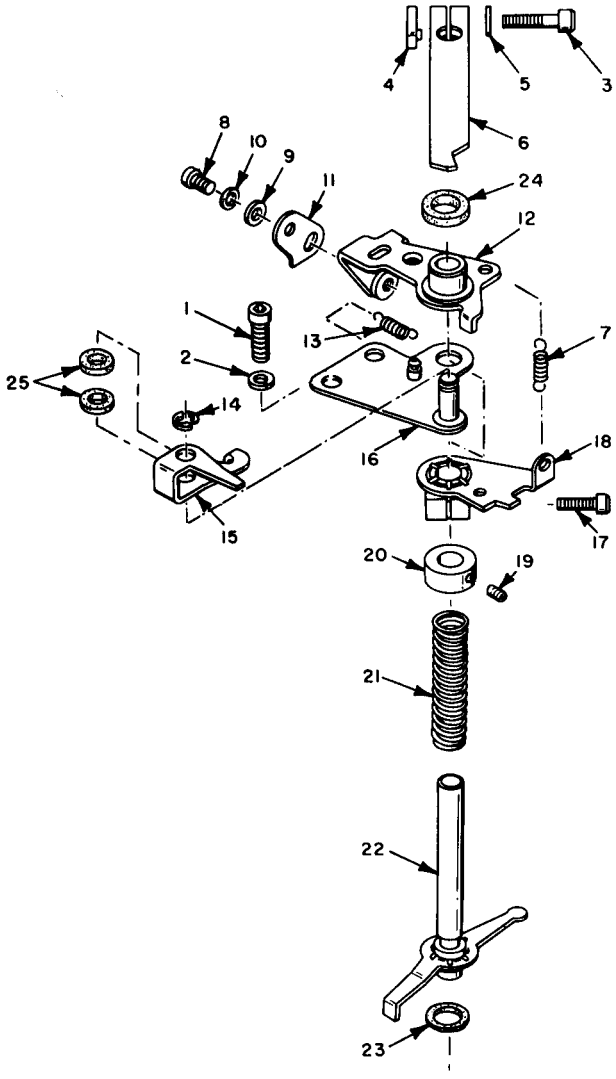
(3) Remove the locknut (3, fig. 2-44) and the signal bell (4) from the teletypewriter.

(Next printed page is 2-46.2)


TM5815-200-35-C2-40

1 Machine screw, 10024
2 Lockwasher, 10431
3 Machine screw, 10009
4 Square shaft stop arm, 53802A (includes item 3)
5 Stop arm shaft, 50377A
6 Machine screw, 10005
7 Flat washer, 10458
8 Lockwasher, 10429
9 Line feed carriage-return fulcrum, 56178
10 Figures fulcrum, 56176
11 Self-locking hexagonal nut, 10500
12 Eccentric stud, 55738
13 Bracket, 55737
14 Dowel
15 Function stop bar support guide
16 Machine screw, 10317
17 Lockwasher, 10433
18 Retainer plate, 56177
19 Locking bail spring, 50941
20 Machine screw, 10004
21 Flat washer, 10459
22 Lockwasher, 10429
23 Code ring locking bail, 53884
24 Setscrew, 10201
25 Retainer ring, 10451
26 Code ring locking bail shaft, 53871
27 Code ring locking lever, 53875A
28 Machine screw, 10001
29 Flat washer, 10459
30 Lockwasher, 10429
31 Cam follower, 53882
32 Stop bar spring, 52940
33 Stop bar, 50502
34 Line feed stop bar, 53530A (includes item 35) (52959 on TT-98C/FG)
35 Carriage-return stop bar (62142 on TT-98C/FG)
36 Figures stop bar, 56179
37 Self-locking hexagon nut, 10500
38 Cage tie bolt, 53972
39 Code cage outside guide, 53809A (57926A on TT-98C/FG) (includes item 57)
40 Setscrew, 10223
41 Flat washer, 53453
42 Ball retainer, 53647A
43 Code ring, 53641A
44 Ball retainer, 53647A
45 Code ring, 53642A
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 cage spacer, 53455
54 Code ring collar, 53868
55 Code ring cam follower locking lever, 53869
56 Sleeve bearing, 53867
57 Code bar cage plate (part of item 39)
58 Stop bar contact assembly, 60036A (TT-99/FG only)
59 Lockwasher, 10418
60 Binding head screw, 10362
61 Blank contact link, 53778 (TT-99/FG only)
62 Motor stop cable, 53365A (TT-99/FG only)
63 Stop bracket, 59332 (all models except TT-99/FG)
64 Felt washer, 61485 (Included as lubrication reservoir on some teletypewriters)

Figure 2-20. Code ring cage, exploded view.



1 Machine screw, 10008
2 Lockwasher, 10430
3 Machine screw, 10011
4 Clamp nut, 52073
5 Flat washer, 10467
6 Throwout lever, 56283
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 Setscrew, 10209
20 Shaft collar, 50209
21 Spring, 52259
22 Carriage-return clutch lever, 56243A
23 Felt washer, 61485 [a]
24 Felt washer, 61667 [a]
25 Felt washer, 61474 [a]

Figure 2-21. Carriage-return operating mechanism, exploded view.

[a] Included as lubrication reservoir on some teletypewriters.

(4) Remove the four machine screws (17, fig. 2-23) and lockwashers (18) and the paper roller stand (19).

(5) To remove the power supply (20), turn the teletypewriter up on its side. Remove the four machine screws (21) and lockwashers (22) through the holes in the base plate.

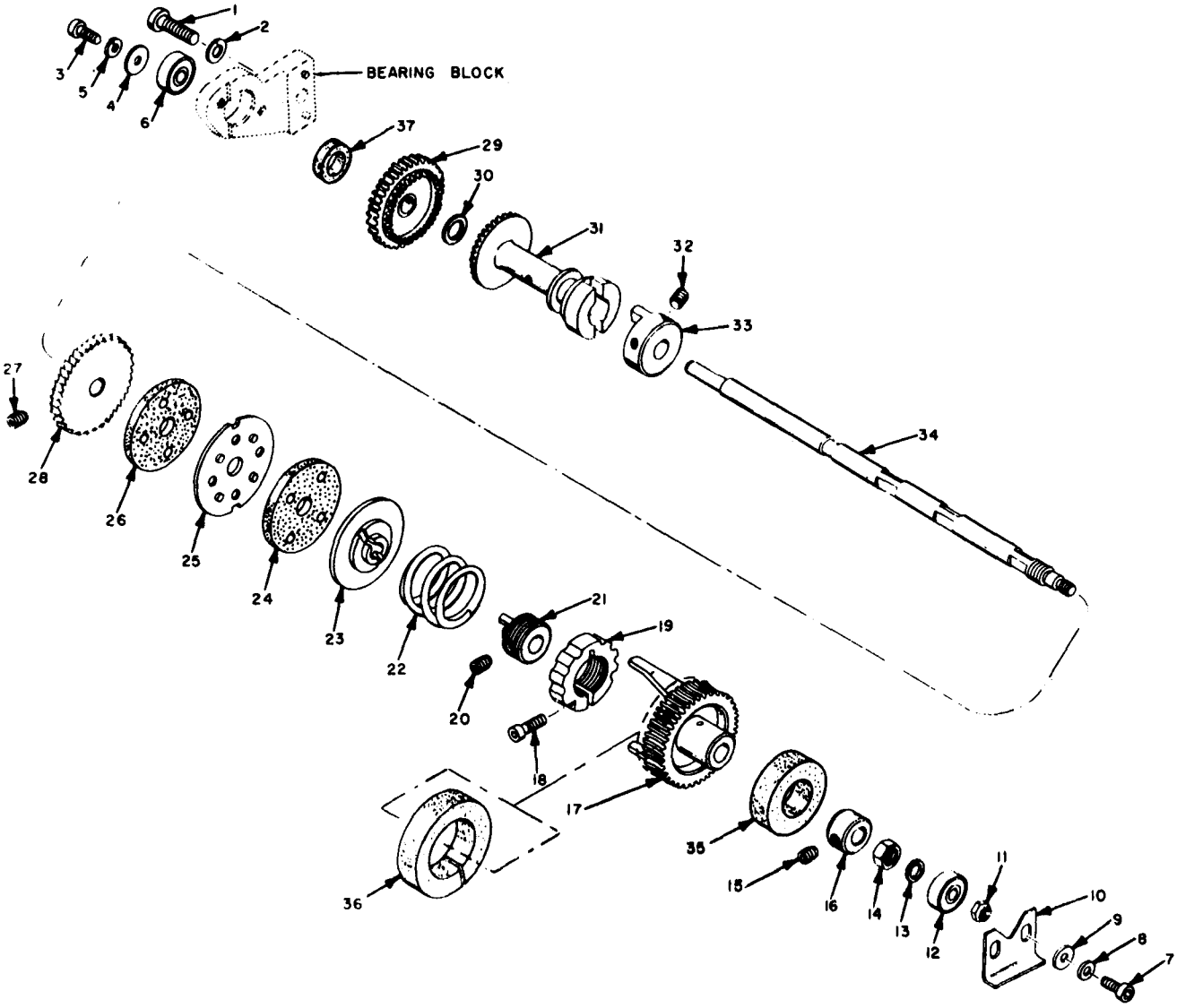
Caution: **The power supply is heavy. Be certain to hold it firmly as the last machine screw is being removed, otherwise the power supply will drop out of the teletypewriter and be damaged or cause injury to maintenance personnel.**

b. Replacement.

(1) Replace the power supply, if applicable, paper roller stand, and terminal and switch box by reversing the procedures outlined in a above.

(2) Replace the signal bell by reversing the procedures outlined in *a* (3) above.

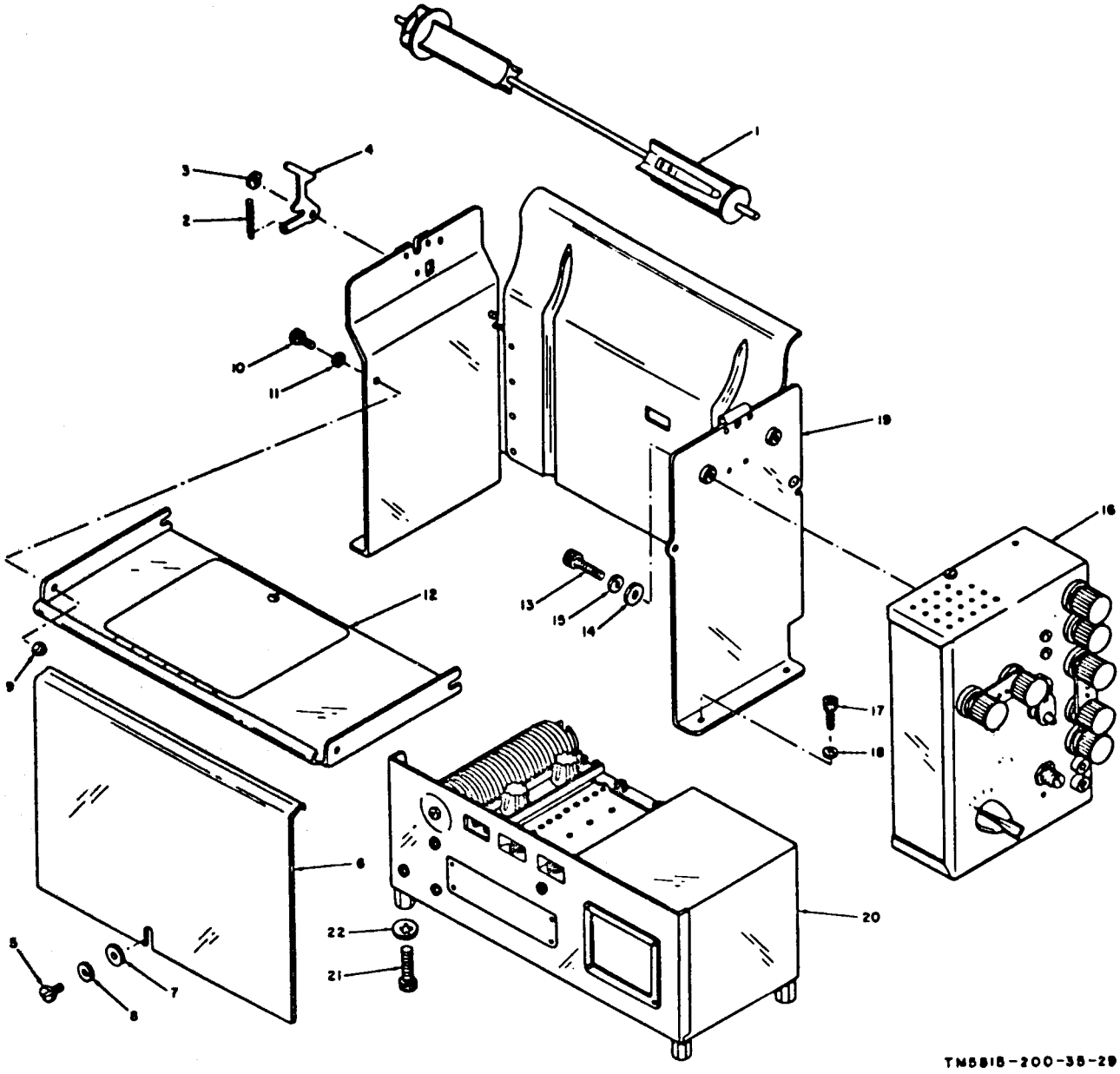
(3) Adjust the signal bell (para 2-226).



1 Machine screw, 10017
2 Lockwasher, 10405
3 Machine screw, 10003
4 Flat washer, 10450
5 Lockwasher, 10429
6 Ball bearing, 10755
7 Machine screw, 10003
8 Flat washer, 10459
9 Lockwasher, 10429
10 Bearing retainer, 55020
11 Self-locking hexagonal nut, 10500
12 Ball bearing, 10755
13 Flat washer, 51408
14 Adjusting nut, 51079
15 Setscrew, 10209
16 Shaft collar, 50209
17 Carriage-feed driven gear, 54930A
18 Machine screw, 10003 (10208 on TT-98C/FG)
19 Friction clutch adjusting collar, 56832 (54928 on TT-98C/FG)
20 Setscrew, 10208
21 Driving collar, 54928
22 Friction clutch spring, 54934
23 Friction clutch plate, 54931
24 Friction plate, 56765
25 Clutch driving disk, 51117
26 Friction plate, 56765
27 Setscrew, 10209
28 Ratchet wheel, 50201
29 Carriage-feed driving gear, 50884A
30 Flat washer, 50887
31 Carriage-feed sliding clutch drum, 50331
32 Setscrew, 10209
33 Shaft collar, 50336
34 Carriage-feed shaft, 50525
35 Felt washer, 61494 *
36 Felt washer, 61495 *
37 Felt washer, 61678 *

Figure 2-22. Carriage-feed shaft, exploded view.

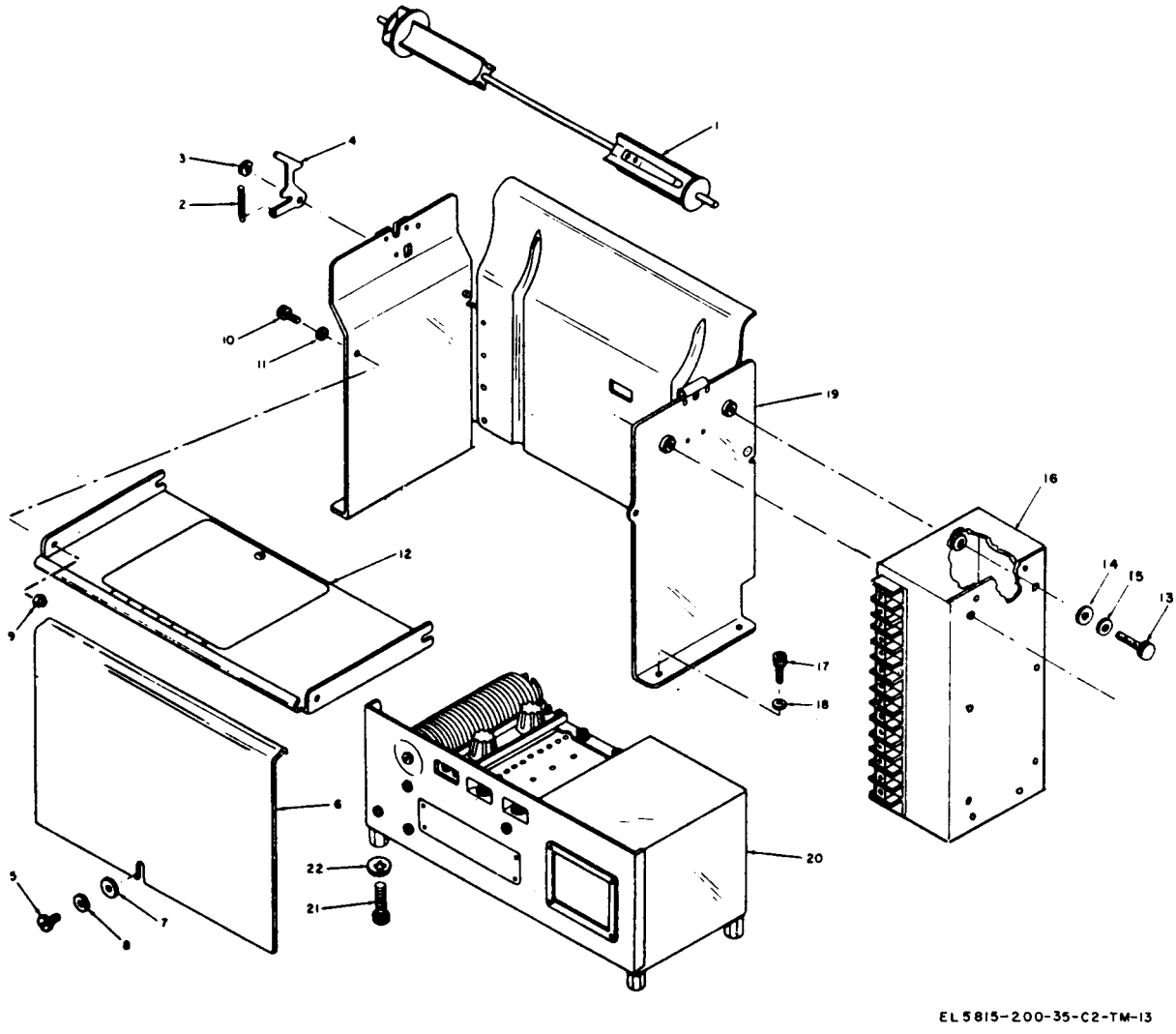
* Included as lubrication reservoir on some teletypewriters.



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, 10010
14 Flat washer, 10467
15 Lockwasher, 10430
16 Terminal and switch box, 57053A
17 Machine screw, 10008
18 Lockwasher, 10430
19 Paper roller stand, 56695A
20 Power supply, 52025A (not applicable to TT-259/FG)
21 Machine screw, 10042 (not applicable to TT-259/FG)
22 Lockwasher, 10405 (not applicable to TT-259/FG)

Figure 2-23. Paper roller stand, terminal and switch box, and power supply, exploded view.

(Not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).



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, MS 51957-46
14 Flat washer, MS 15795-807
15 Lockwasher, MS 35338-137
16 Terminal box, SM-D-759827
17 Machine screw, 10008
18 Lockwasher, 10430
19 Paper roller stand, 56695A
20 Power supply, 52025A (not applicable to TT-259/FG)
21 Machine screw, 10042 (not applicable to TT-259/FG)
22 Lockwasher, 10405 (not applicable to TT-259/FG)

Figure 2-23.1. Paper roller stand, terminal box, and power supply, exploded view (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

Section VI. DISASSEMBLY AND REASSEMBLY

2-29. General Disassembly and Reassembly Instructions

a. Disassembly. When disassembling the various parts and assemblies, use the correct tool for specific operation. Do not disassemble the teletypewriter or its subassemblies beyond the point necessary to inspect, lubricate, or repair the mechanism.

NOTE

See note, paragraph 2-16 *a*.

b. Reassemble. When reassembling components of the teletypewriter, be sure that mating gears, clutch assemblies, and mechanical linkages are engaged before tightening the holding screws or bolts. Do not tighten screws, nuts, or bolts excessively. Steel screws should be coated with Compound, Antiseize (CE 52-2724.5000.080) before they are inserted into magnesium or aluminum castings. If springs are removed, tag them to identify their location.

2-30. Disassembly and Reassembly of Transmitter Contact Mechanism

(fig. 2-24)

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 hold 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 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 (para 2-96).

(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), 1/2 to 1 1/2 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 2-96, 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 (l).

2-30.1. Deleted.

2-31. Disassembly and Reassembly of Keyboard Transmitter Sensing and Selector Levers (Not Applicable to TT-259/FG)

(fig. 2-25)

a. Disassembly.

(1) Remove the keyboard transmitter from the teletypewriter (para 2-18 *a*).

(2) Remove the setscrew (l). Slowly withdraw the sensing lever pivot stud (2) and catch the flat washers (3, 4, 6, 8, 10, 12, and 56), felt washer (51, if present) and sensing levers, (5, 7, 9, 11, and 13) as they are released from the pivot stud.

(3) Remove the six selector lever springs (14) from the selector levers and the selector lever spring bracket (43 or 55). Remove the sensing lever locking bail spring (15).

(4) Remove the hexagonal nut (16), eccentric bearing (17), and sensing lever locking bail (18) from the selector lever pivot post (40 or 53).

(5) Remove the spacing collar (19), the six selector levers (20, 23, 26, 29, 32, and 35), the six bearing shoes (21, 24, 27, 30, 33, and 36), the six flat washers (22, 25, 28, 31, 34, and 37), and, if present, remove the spacer (38) and felt washer (54) from the selector lever pivot post.

(6) If present remove the hexagonal nut (52) and the selector lever pivot post (53). Otherwise, loosen setscrew (39) and remove the selector lever pivot post (40).

(7) Remove the two machine screws (41) and lockwaahers (42) and the selector lever spring bracket (43 or 55).

NOTE

Two machine screws, 10003 (41) are used to hold the selector lever spring bracket on the TT-98/FG, TT-98A/FG, TT-99/FG, and TT-100/FG. All other models (except the TT-259/FG) require one machine screw (10003 (41) and one machine screw 10034 (35, fig. 2-27).

(8) Remove the two machine screws (44) and lockwashers (45), adjusting plate (46), and selector lever comb (50).

(9) Remove the two machine screws (47), lockwashers (48), and the stop selector lever latch (49).

b. Reassembly.

(1) Reassemble the keyboard transmitter sensing and selector levers by reversing the procedures outlined in *a* (9) through (2) above.

(2) Replace the keyboard transmitter (para 2-18 *b*).

(3) Adjust the selector and sensing levers (para 2-92–2-94).

2-33. Disassembly and Reassembly of Transmitter Camshaft and Transmitter Filter (All Models Except TT-98/FG, TT-98A/FG, TT-99/FG, TT-100/FG, TT-259/FG, and TT-664/FG)

(fig. 2-26)

a. Disassembly.

(1) Remove the keyboard transmitter from the teletypewriter (para 2-18 *a*).

(2) Remove the sensing and selector levers (para 2-31).

(3) Remove the two setscrews (1) that hold the transmitter clutch fork (2) to the transmitter camshaft (3). Remove the transmitter camshaft from the keyboard from (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 hexagonal nut (12) and the lockwasher (13) that secure the cam stop lever post (14) to the keyboard frame (32). Remove the post.

(7) Remove the 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) to release the cable clamp (20).

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

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

NOTE

Step (10.1) in lieu of step (10) is applicable to TT-664(*)/FG. When performing step (10.1), refer to figure 2-26.1 for location of parts.

(10.1) Remove the machine screw (26) and lockwasher (27) that secure the noise suppressor (31) to the key bar mounting bracket. Remove the machine screw (28) and lockwasher (29) that secure the noise suppressor to the keyboard frame (32). Remove the noise suppressor and bracket (31), and cable assembly (30) as one item.

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

b. Reassembly.

(1) Reassemble the transmitter camshaft

NOTE

On low-level units only, gold plated contact (9.1) must be used. Gold plated contact (13.1) must also be used only on low-level units.

1	Machine screw, 10001
2	Internal tooth lockwasher, 10403
3	Contact cover, 51579A
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 (high-level)
9.1	Transmitter contact, SM-B-930672 (low-level)
10	Machine screw, 10301
11	Internal tooth lockwasher, 10403
12	Transmitter contact terminal, 51597
13	Transmitter contact, 51588A (high-level)
13.1	Transmitter contact, SM-B-930674 (low-level)
14	Electrical wire, 51610
15	Contact mounting, 51595A

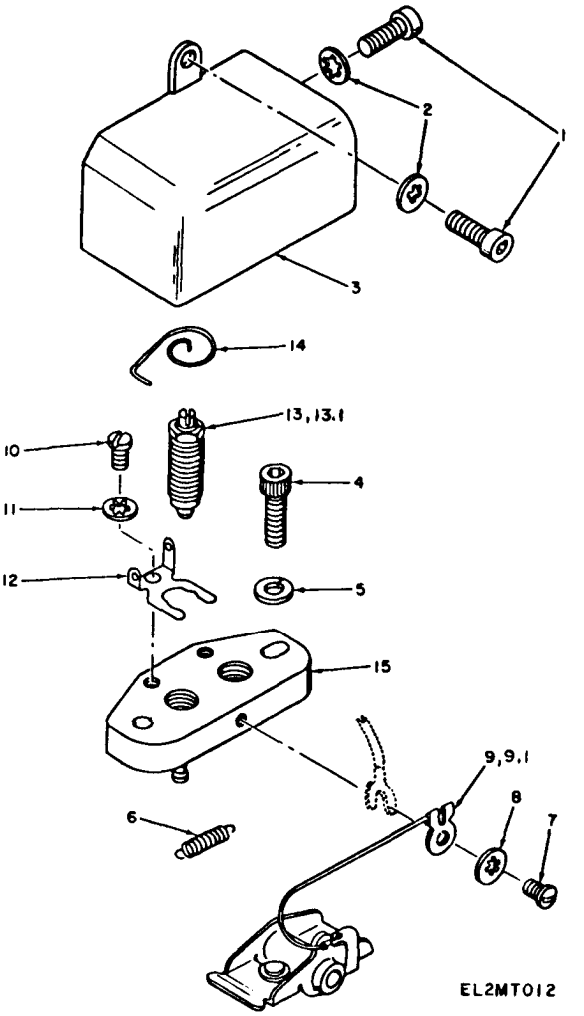


Figure 2-24. Transmitter contacts, exploded view.

and transmitter filter by reversing the steps and procedures outlined in *a* (3) through (11) above.

(2) Replace the sensing and selector levers (para 2-31 *b*).

(3) Replace the keyboard transmitter (para 2-18 *b*).

2-33. Disassembly and Reassembly of Transmitter Camshaft and Transmitter Filter (All Models Except TT-98/FG, TT-98A/FG, TT-99/FG, TT-100/FG, TT-259/FG, and TT-664/FG)

(fig. 2-27)

a Disassembly.

(1) Remove the keyboard transmitter from the teletypewriter (para 2-18 *a*).

(2) Remove the sensing and selector levers (para 2-31 *a*).

(3) Loosen the two setscrews (1) that hold the transmitter clutch fork (2) to the transmitter camshaft (3). Remove the clutch fork and flat washer (4) from the transmitter camshaft. Remove the transmitter camshaft from the keyboard frame (37).

(4) Remove the two machine screws (5), lockwashers (7), flat washers (6), ball bearing (8), collar (9), and ball bearing (10) from the keyboard frame.

(5) Remove cam stop lever spring (11).

(6) Remove the retainer ring (12), and cam stop lever (13) from the camp stop lever post (16). If present, remove the three felt washere (38).

(7) Remove the hexagonal nut (14), and flat washer (15). Remove the cam stop lever post (16) from the keyboard frame.

(8) Remove the machine screw (17), and lockwashers (18, 20, and 21).

(9) Remove the machine screw (22), and lockwasher (23).

(10) Remove the cable clamps (19 and 24) from the cable assembly (34).

(11) Remove the two machine screws (25), lockwashers (26), and transmitter filter 22 (27).

NOTE

Step (11.1) in lieu of step (11) is applicable to TT-664A/FG, TT-664B./FG, TT-664C/FG and TT-665/FG.

(11.1) Remove the two machine screws (25, fig. 2-27.1), lockwashers (26), and noise suppressor (27).

(12) Remove the two hexagonal nuts (28 and 29), filter bracket (30), lockwashers (31), machine screw (32), and lockwasher (33).

(13) If a new filter is to be installed, unsolder the leads of the cable assembly from the lugs on the filter.

(14) Remove the machine screw (35), lockwasher (36), and the selector lever spring bracket (43, fig. 2-25).

b. Reassembly.

(1) Reassemble the transmitter camshaft and transmitter filter by reversing the steps and procedures described in *a(3)* through (14) above.

(2) Replace the sensing and selector levers (para 2-31 *b*).

(3) Replace the keyboard transmitter (para 2-18 *b*).

2-34. Disassembly and Reassembly of Keylevers and Code Bars (Not Applicable to TT-259/FG)

a. Disassembly.

(1) Remove the keyboard transmitter from the teletypewriter (para 2-18 *a*).

(2) Remove the two machine screws (1, fig. 2-28) 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 (6), and space bar arm assembly (8).

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

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

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

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

(8) Remove the three machine screws (20) and lockwashers (21). Remove the cap nut (21, fig. 2-26), lockwasher (22), cable clamp (23), lockwasher (24), and machine screw (25).

Remove the keylever mounting bracket (22, fig. 2-28).

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

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

(11) Remove the middle keylever guide (30), the code bars (31-35), and the universal bar (36).

b. Reassembly.

(1) Position the universal bar (36) and the five code bars on the code bar guide studs (29). 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 keylever guide (30).

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

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

(4) Install the keylever mounting bracket (22) on the keyboard casting with the three machine screws (20), lockwaahers (21), the machine screw (25, fig. 89), lockwasher (24), cable clamp (23), lockwasher (22), and cap nut (21).

(5) Install the repeat keylever (19, fig.

(6) Install the long keylevers (17 from left to right in the order shown in figure 2-28.

Figure 2-24.1. Deleted.

Similarly install the medium keylevers (16) and short keylevers (15) from left to right.

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

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

(9) Position the space bar arm assembly (8) on the front keylever 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 keylever guide. Secure it with the 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 teletypewriter (para 2–18 *a*).

(12) Adjust the keylevers, code bars, and universal bar (paras 2-86-2-91).

2-35. Disassembly and Reassembly of Transmitter Camshaft Locking Mechanism (not applicable to TT-259/FG)

(fig. 2-29)

a. Disassembly.

(1) Remove the keyboard transmitter from the teletypewriter (para 2-18 *a*).

(2) Remove the sensing levers (para 2-31 *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 tile 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. Catch the three felt washers (17, if present), as they fall free of the locking lever latch stud. Remove the lockwasher (7), the 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 (13), and repeat lever (12) from the keyboard frame.

(9) On TT-98B/FG and TT-100B/FG, Order No. 23425-Phila-57, also on TT-987B/FG, Order No. 13930-Phila-58, remove the hexagonal nut (15), the flat washer (14), and the repeat blocking lever latch adjusting screw (16).

b. Reassembly.

(1) If applicable, replace the hexagonal nut (15), the flat washer (14), and the repeat blocking lever latch adjusting screw (16).

(2) Reassemble the transmitter camshaft locking mechanisrn by reversing tile procedure in *a(8)* through (3) above.

(3) Replace tile sensing levers (para 2-30 *a*).

(4) Replace the keyboard transmitter (para 2-18 *b*).

(5) Adjust the locking mechanism (para 2-91).

2-36. Disassembly and Reassembly of Synchronous Motor 56854A

(fig. 2-13)

a. Disassembly.

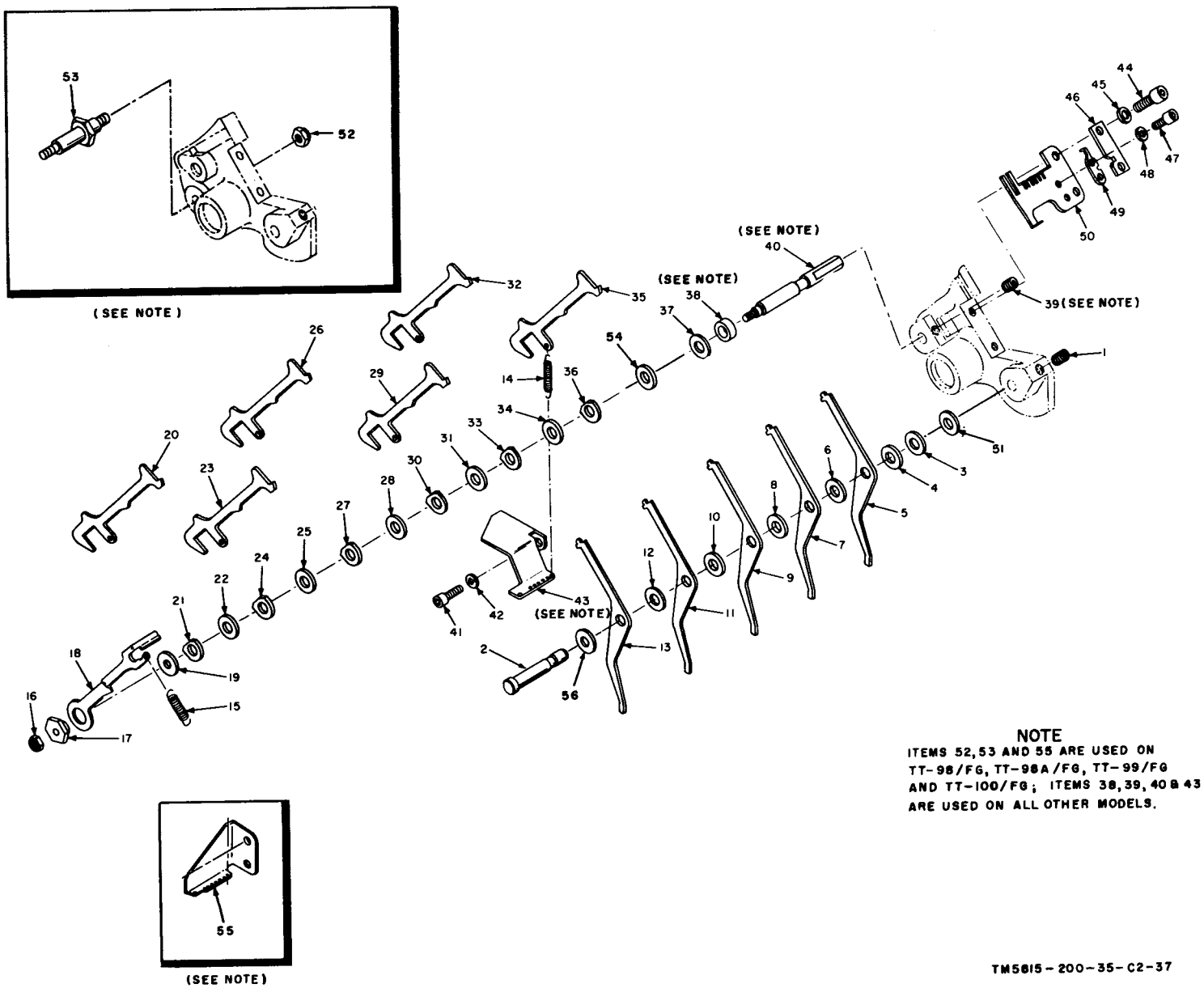
(1) Remove the motor from the teletypewriter (para 2-19 *a*).

(2) Remove tile four machine screws (4) and lockwasllers (5). Remove the right and left 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 Shrift.

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



NOTE

ITEMS 52,53 AND 55 ARE USED ON TT-98/FG, TT-98A/FG, TT-99/FG AND TT-100/FG; ITEMS 38,39,40 & 43 ARE USED ON ALL OTHER MODELS.

TM5815-200-35-C2-37

1 Setscrew, 10210
2 Sensing lever pivot stud, 51562
3 Flat washer (laminated), 53526
4 Flat washer, 50147
5 Sensing lever (part of sensing lever set, 51573A, which includes items 7, 9, 11, and 13 also)
6 Flat washer, 50147
7 Sensing lever (see item 5)
8 Flat washer, 50147
9 Sensing lever (see item 5)
10 Flat washer, 50147
11 Sensing lever (see item 5)
12 Flat washer, 50147
13 Sensing lever (see item 5)
14 Selector lever spring, 50902
15 Sensing lever locking bail spring, 51574
16 Hexagonal nut (self-locking), 10500
17 Eccentric bearing, 51557
18 Sensing lever locking bail, 51567
19 Spacing Collar, 51555
20 Selector lever (part of selector level set, 51598A, which includes items 23, 26, 29, 32, and 35 also)
21 Bearing shoe (part of bearing shoe set 50019A, which includes items 24, 27, 30, 33, and 36 also)
22 Flat washer, 50147
23 Selector lever (see item 20)
24 Bearing shoe (see item 21)
25 Flat washer, 50147
26 Selector lever (see item 20)
27 Bearing shoe (see item 21)
28 Flat washer, 50147
29 Selector lever (see item 20)
30 Bearing shoe (see item 21)
31 Flat washer, 50147
32 Selector lever (see item 20)
33 Bearing shoe (see item 21)
34 Flat washer, 50147
35 Selector lever (see item 20)
36 Bearing shoe (see item 21)
37 Flat washer, 50147
38 Spacer 56252 [b]
39 Setscrew, 10210 [b]
40 Selector lever pivot post, 54673 [b]
41 Machine screw 10003
42 Lockwasher, 10429
43 Selector lever spring bracket, 54672 [b]
44 Screw, 10008
45 Lockwasher, 10430
46 Adjusting plate, 55869
47 Machine screw, 10002
48 Lockwasher, 10429
49 Stop selector lever latch, 55870
50 Selector lever comb, 51558
51 Felt washer, 51466 [a]
52 Hexagonal nut (self-locking), 10501 [c]
53 Selector lever pivot post, 51561 [c]
54 Felt washer, 51467 [c]
55 Selector lever spring bracket, 51559 [c]
56 Flat washer, 50147

Figure 2-25.—Keyboard transmitter sensing and selector levers, exploded view (not applicable to TT-259/FG).

[a] Used as lubricant reservoir on some teletypewriters.
[b] Used on all models except TT-98/FG, TT-98A/FG, TT-99/FG, and TT-100/FG.
[c] Used only on TT-98/FG, TT-98A/FG, TT-99/FG, and TT-100/FG.

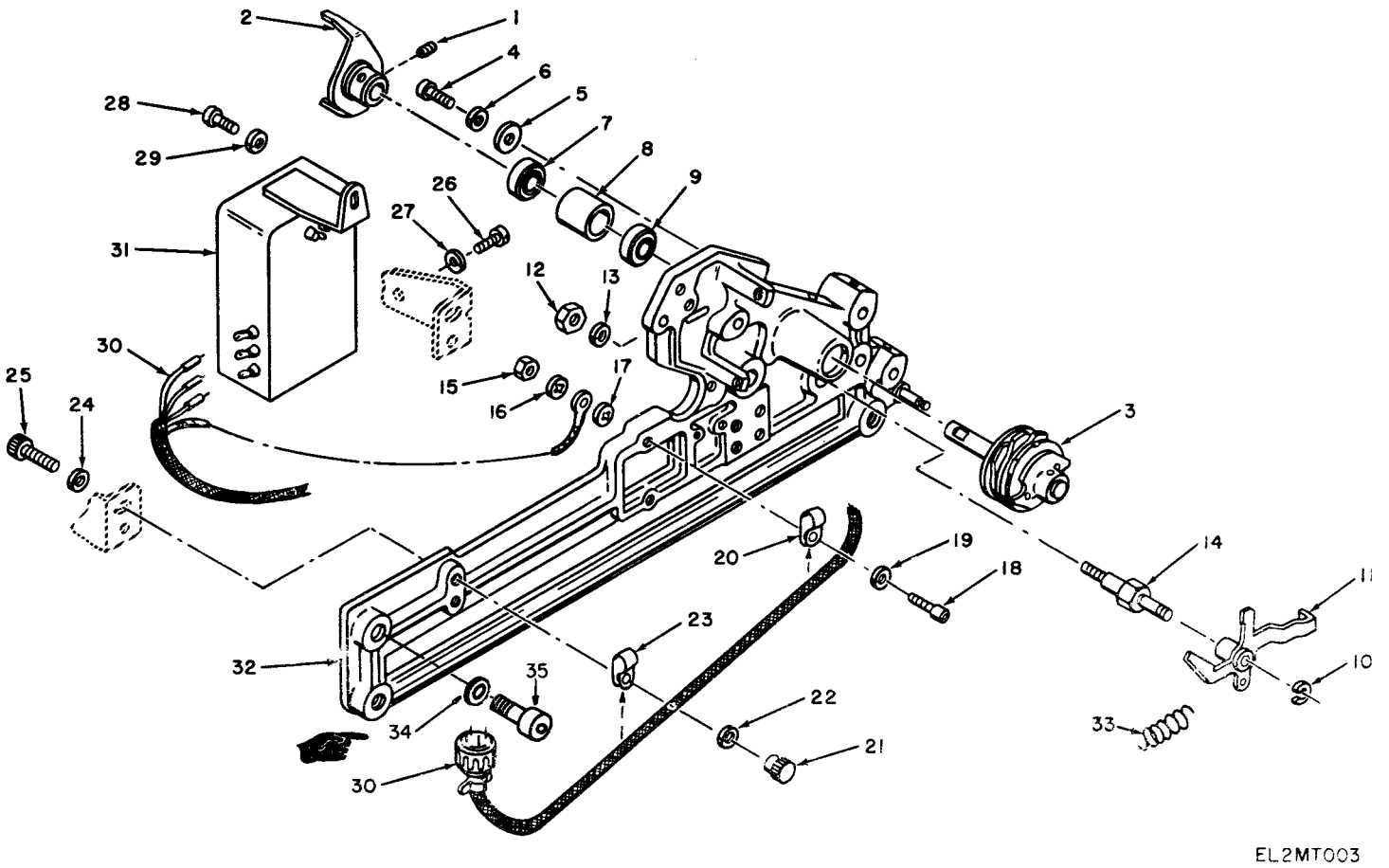


Figure 2-26. Transmitter camshaft and filter, exploded view (TT-98/FG, TT-98A/FG, TT-99/FG and TT-100/FG) (not applicable to TT-259/FG, TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

Legend for Fig. 2-26:

1 Setscrew, 10209
2 Transmitter clutch fork, 50484A
3 Transmitter camshaft, 51545A (63172 on TT-293/FG, TT-482/UGC, and TT-483/UGC)
4 Machine screw, 10003
5 Flat washer, 10450
6 Lockwasher, 10429
7 Ball bearing, 10753
8 Collar, 51599
9 Ball bearing, 10753
10 Retainer ring, 10949
11 Cam stop lever, 51549A
12 Hexagonal nut, 10501
13 Lockwasher, 10430
14 Cam stop lever post, 51663
15 Hexagonal nut, 10512
16 Lockwasher, 10408
17 Lockwasher, 10403
18 Machine screw, 10041
19 Lockwasher, 10429
20 Cable clamp, 20519
21 Cap nut, 10547
22 Lockwasker, 10431
23 Cable clamp, 20518
24 Lockwasher, 10405
25 Machine screw, 10015
26 Machine screw, 10003
27 Lockwasher, 10429
28 Machine screw, 10003
29 Lockwasher, 10403
30 Cable assembly, 53288A and 20419
31 Transmitter filter, Z2 52305A
32 Kayboard frame, 51441A
33 Camp stop lever spring, 51575
34 Lockwasher , 10400
35 Machine screw, 10027

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

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

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

b. Reassembly.

(1) Reassemble the synchronous motor by reversing the procedures outlined in *a(8)* through (2) above.

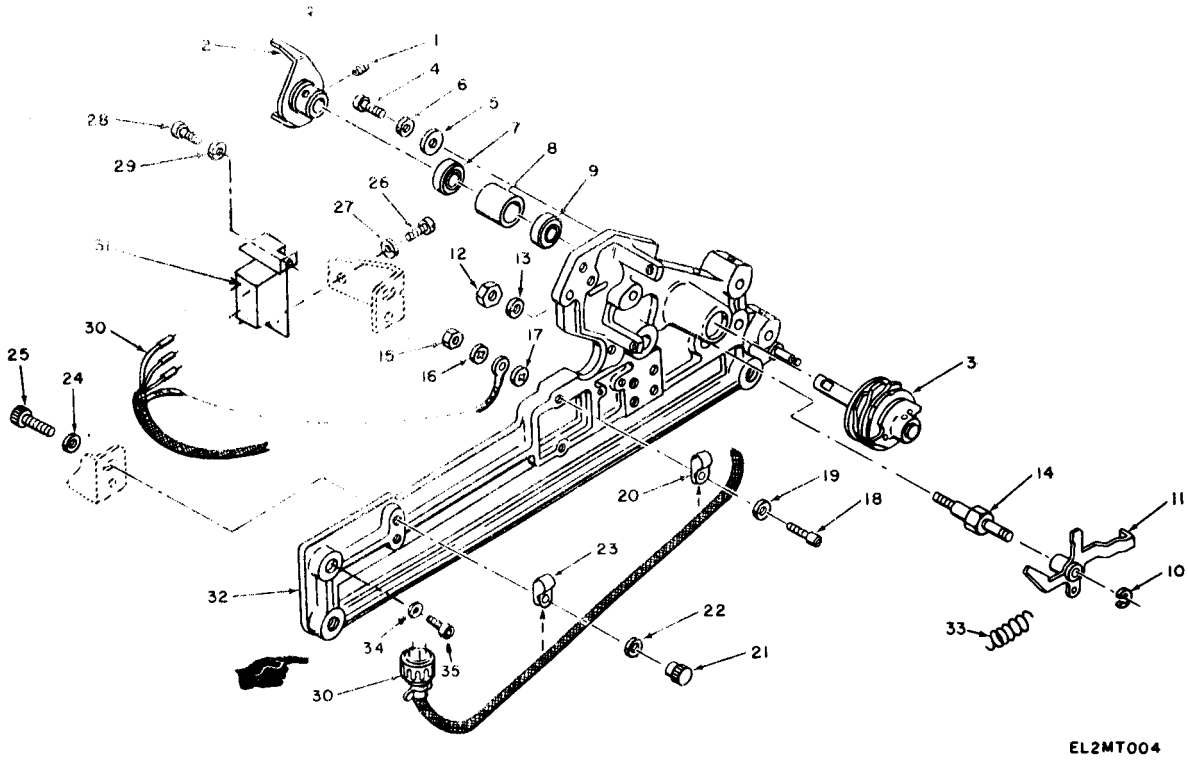
(2) Replace the motor in the teletypewriter (para 2-19 *b*).

2-37. Disassembly and Reassembly of Synchronous Motor 68814A

(fig. 2-17)

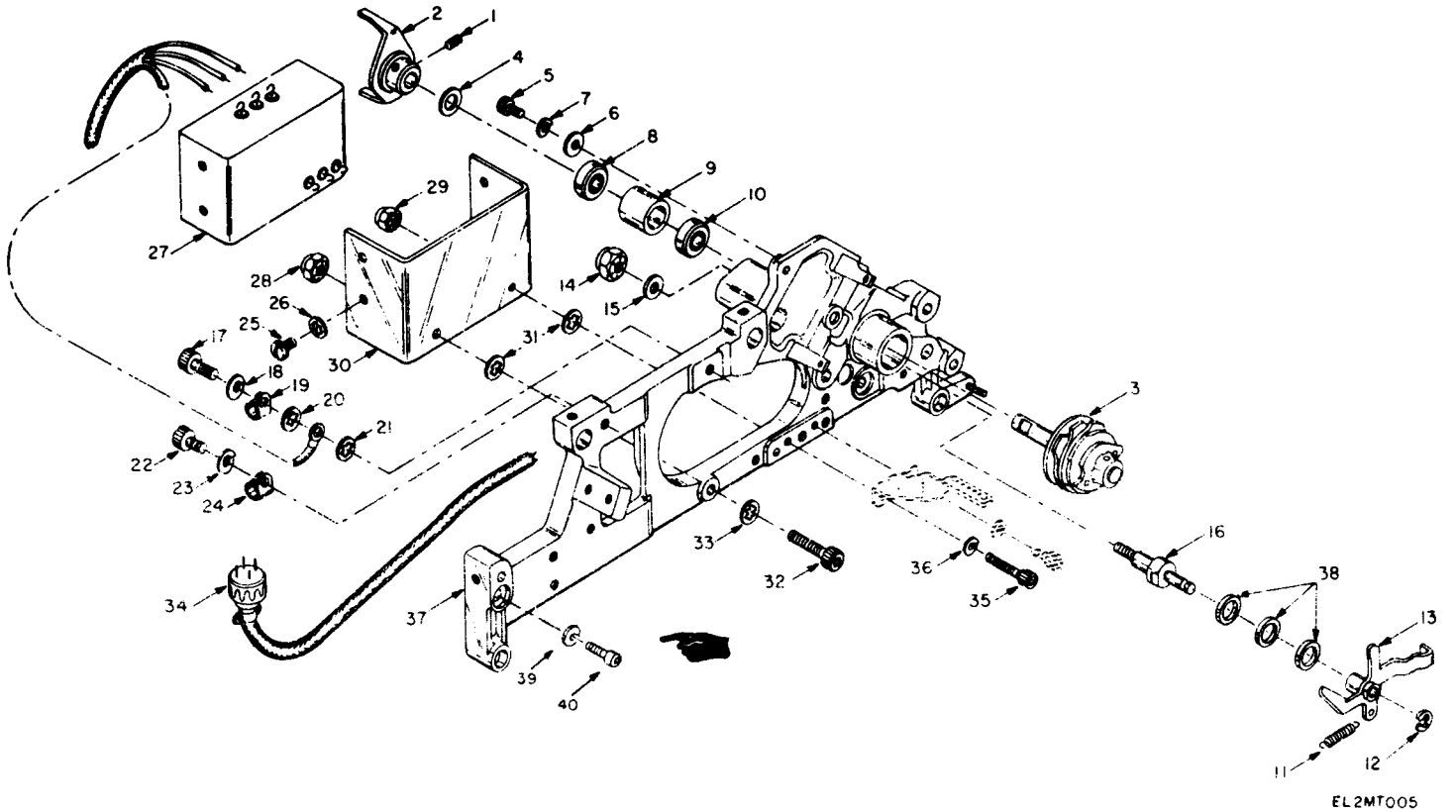
a. Disassembly.

(1) Remove the motor as described in paragraph 2-19 *a*.



1 Setscrew, 10209
2 Transmitter clutch fork, 50484A
3 Transmitter camshaft, 51545A (63172 on TT-293/FG, TT-482/UGC, and TT-UGC)
4 Machine screw, 10003
5 Flat washer, 10450
6 Lockwasher, 10429
7 Ball bearing, 10753
8 Collar, 51599
9 Ball bearing, 10753
10 Retainer ring, 10949
11 Cam stop lever, 51549A
12 Hexagonal nut, 10501
13 Lockwasher, 10430
14 Cam stop lever post, 51563
15 Hexagonal nut, 10512
16 Lockwasher, 10403
17 Lockwasher, 10403
18 Machine screw, 10041
19 Lockwasher, 10429
20 Cable clamp, 20519
21 Cap nut, 10547
22 Lockwasher, 10431
23 Cable clamp, 20518
24 Lockwasher, 10405
25 Machine screw, 10015
26 Machine screw, 10003
27 Lockwasher, 10429
28 Machine screw, 10003
29 Lockwasher, 10403
30 Cable assembly, 53288A and 20419
31 Noise suppressor with bracket, SM-D-759881
32 Keyboard frame, 51441A
33 Cam stop lever spring, 51575
34 Lockwasher, 10400
35 Machine screw, 10027

Figure 2-26.1. Transmitter camshaft and filter, exploded view (applicable to TT-664/FG).



1 Setscrew, 10209
2 Transmitter clutch fork, 50484A
3 Transmitter camshaft, 51545A
4 Flat washer, 51552
5 Machine screw, 10003
6 Flat washer, 10458
7 Lockwasher, 10429
8 Ball bearing 10753
9 Collar, 51599
10 Ball bearing, 10753
11 Cam stop lever spring, 51575
12 Retainer ring, 10949
13 Cam stop lever, 51549
14 Hexagonal nut (self-locking), 10525
15 Flat washer, 10464
16 Cam stop lever post, 56669
17 Machine screw, 11503
18 Lockwasher, 10430
19 Cable clamp, 20519
20 Lockwasher, 10404
21 Lockwasher, 10404
22 Machine screw, 10008
23 Lockwasher, 10430
24 Cable clamp, 20519
25 Machine screw, 10301
26 Lockwasher, 10403
27 Transmitter filter Z2, 54577
28 Hexagonal nut self-locking, 10501
29 Hexagonal nut self-locking, 10500
30 Filter bracket, 56668
31 Lockwasher, 10404
32 Machine screw, 10011
33 Lockwasher, 10404
34 Cable assembly, 57027A
35 Machine screw, 10034
36 Lockwasher, 10429
37 Keyboard frame, 56670A
38 Felt washer, 61469 (included as lubrication reservoir on some teletypewriters).
39 Lockwasher, 10400
40 Machine screw, 10027

Figure 2-27. Transmitter camshaft and filter, exploded view (all models except TT-98/FG, TT-98A/FG, TT-99/FG, TT-100/FG, TT-259/FG, TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

(2) Remove the machine screw (6) and lockwasher (7) that hold the worm (8) to the motor shaft; remove the worm.

(3) Remove the pin (9) from the motor shaft and remove the four grease seals (10).

(4) Remove the nut (14), the ferrules (12 and 13), and the plug connector (11) from the motor leads. Slide the tubing (15) off the motor leads.

(5) Remove the setscrew (16) that holds the motor shaft knob (17) to the motor shaft. Remove the knob.

(6) Remove the four machine screws (18) that hold the bearing retainer (19) to the end bell (24); remove the bearing retainer, spring tension washer (20), and shim (21), when present.

(7) Remove the four machine screws (22) and the lockwashers (23) that hold the end bell (24) to the motor stator (36); remove the end bell.

(8) Remove the four machine screws (25) that hold the bearing retainer (26) to the end bell (31); remove the bearing

retainer spring tension washer (27) and shim (28), when present.

(9) Remove the four machine screws (29)) and lockwashers (30) that hold the end bell (31) to the motor stator (36).

(10) Remove the end bell from the motor and four wire lends. Remove the rubber grommet (37) from the end bell only when necessary.

(11) Remove the rotor core and shaft (33) from the motor stator (36). Remove the baffle (35) from the shaft. Remove the two ball bearings (32 and 34) from the shaft only when necessary.

b. Reassembly.

(1) Reassemble the motor by reversing the procedures in *a* (2) through *a* (11) above.

(2) Replace the motor as described in 2-19 *b*.

2-38. Disassembly and Reassembly of Series-Governed Motor

(fig. 2-30)

a. Disassembly.

(1) Remove the motor as described in paragraph 2-19 *a*.

(2) Remove the machine screw (6) and lockwasher (7) that hold the worm (8) to the armature shaft; remove the worm.

(3) Remove the pin (9) from the motor armature shaft and remove the grease seals (10) (four on Howard motors and two on Bodine motors).

(4) Remove the plug connector P3 (11) from the four motor leads.

(5) Unscrew the capnut (12) from the motor housing and slide the nut off the cable; slide the shielding (13) with eyelet (14), from the motor leads. Remove the nipple (15) and lockwasher (16) from the motor housing. (Unsolder the eyelet from the shielding only when necessary.)

(6) Remove the setscrew (17) that holds the motor governor target (18) to the shaft of the motor speed governor base (43); remove the motor governor target.

(7) Remove the two machine screws (19) and lock washers (20) that hold the motor governor cover (21) to the motor (47); remove the motor governor cover.

(8) Remove the two setscrews (22) that hold the motor speed governor base (43) to the motor armature shaft; remove the assembled motor governor.

(9) Remove the governor worm spring (23) and the governor worm (24) from the motor governor.

(10) Remove the electrical contact brush (25) from the motor governor.

(11) Remove the two electrical contact brushes (26).

(12) Remove the motor brush shields (44), motor brush caps (45), and motor brushes (46).

(13) Remove the four machine screws (48) that hold the endplate (49) to the end bell (57); remove the endplate.

(14) On the Bodine 1/23-hp motor, remove the oil and dust seal (50) and felt mounting plate (51) from the armature shaft.

(15) On the Howard 1/20- and 1/23-hp motors, remove spring washer (52) from the armature shaft.

(16) Remove shim washer (53). On the Howard 1/23-hp motor, remove washer (54) from armature shaft.

(17) Remove the four machine screws (55) and lockwashers (56) that hold the endbell (57) to the motor (47). Remove the endbell.

(18) Remove the armature (62 or 63) from the motor (47). On the Howard 1/20-hp motor, also remove the baffle plate (64). On the Howard 1/23-hp motor, remove spring washer (59) from the armature shaft.

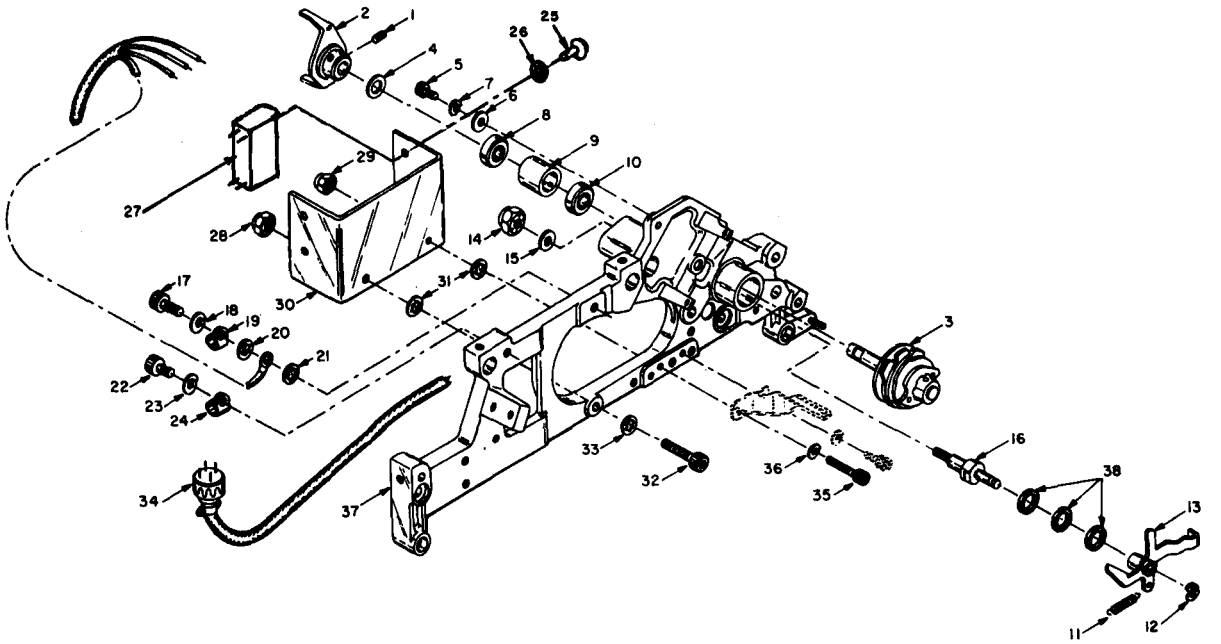
(19) Remove shim washer (60) and ball bearings (58 and 61) from the armature shaft.

(20) On the Bodine 1/23-hp motor, remove the setscrew (65) from the fan (66); remove the fan from the armature shaft.

b. Removal and Replacement of Motor Capacitors.

(1) Disassemble the seriee-governed motor as described in *a* (1) and (6) through (11) above.

(2) Remove the four machine screws (67) that hold the endplate (68) to the endbell (75); remove the endplate.



1 Setscrew, 10209
2 Transmitter clutch fork, 50484A
3 Transmitter camshaft, 51545A
4 Flat washer, 51552
5 Machine screw, 10003
6 Flat washer, 10458
7 Lockwasher, 10429
8 Ball bearing, 10753
9 Collar, 51599
10 Ball bearing, 10753
11 Cam stop lever spring, 51575
12 Retainer ring, 10949
13 Cam stop lever, 51549
14 Hexagonal nut (self-locking), 10525
15 Flat washer, 10464
16 Cam stop lever post, 56669
17 Machine screw, 11503
18 Lockwasher, 10430
19 Cable clamp, 20519
20 Lockwasher, 10404
21 Lockwasher, 10404
22 Machine screw, 10008
28 Lockwasher, 10430
24 Cable clamp, 20519
25 Machine screw, 10301
26 Lockwasher, 10403
27 Noise suppressor, SM-D-759881
28 Hexagonal nut self-locking, 10501
29 Hexagonal nut self-locking, 10500
30 Filter bracket, 56668
31 Lockwasher, 10404
32 Machine screw, 10011
33 Lockwasher, 10404
34 Cable assembly, 57027A
35 Machine screw, 10034
36 Lockwasher, 10429
37 Keyboard frame, 56670A
38 Felt washer, 61469 (included as lubrication reservoir on some teletypewriters).

Figure 2-27.1. Transmitter camshaft and filter, exploded view (applicable to TT-664(*)/FG, **TT-665/FG, and TT-688(*)/FG.**

(3) On the Bodine 1/23-hp motor, remove the oil and dust seal (69) and felt mounting plate (70).

(4) On the Bodine and Howard 1/23-hp motors, remove the four machine screws (71) and lockwashers (72) that hold the endbell (75) to the motor. On the Howard 1/20-hp motor, remove the two machine screws (73) and lockwashers (74) that hold the endbell (75) to the motor. Remove the endbell carefully from the motor housing and field (80).

(5) On the Bodine 1/23-hp motor, unsolder and disconnect leads of the two capacitors (81) from the brush holder bushings in the endbell. Remove the two machine screws (76) and lockwashers (78) that hold the capacitor leads, motor field leads, and motor brush holder leads to their respective governor brush holders. Remove the capacitors from the endbell.

(6) On the Howard 1/20- and 1/23-hp motors, remove the two spring clips (79) from their seats on the brush holder bushings in the endbell. Remove the two hexagonal nuts (77) and lockwashers (78) that hold the capacitor leads, motor field leads, and motor brush holder leads to their respective governor brush holder. Remove the capacitors (81) from the endbell.

(7) Reassemble the capacitors in the motor by reversing the procedures in (2) through (6) above.

(8) Reassemble the series-governed motor as described in *c* (4), (5), (6), (7), (9), and (10) below.

c. Reassembly.

(1) Check the motor brushes (46). Clean them if they are dirty or glazed; replace them if they are worn, chipped, or saturated with oil.

(2) Reassemble the motor by reversing the procedures in *a(12)* through (20) above.

(3) Perform adjustment described in paragraph 2-104.

(4) Reassemble the motor governor by reversing the procedures in paragraph *a(8)* through (11) above.

(5) Perform adjustment in paragraph 2-101.

(6) Reassemble the motor by reversing the procedures in *a* (6) and (7) above.

(7) Perform adjustment in paragraph 2-102.

(8) Reassemble the motor by reversing the procedures in a (2) through (5) above.

(9) Replace the motor as described in paragraph 2-19 *b*.

(10) Adjust the motor speed.

2-39. Disassembly and Reassembly of Motor Governor

(fig. 2-30)

a. Disassembly.

(1) Remove the motor governor from the motor as described in paragraph 2-38 *a* (6) through (10).

(2) Remove the adjustment lever spring (27) from the governor adjustment lever (38) and from the grooved pin (28); remove the grooved pin.

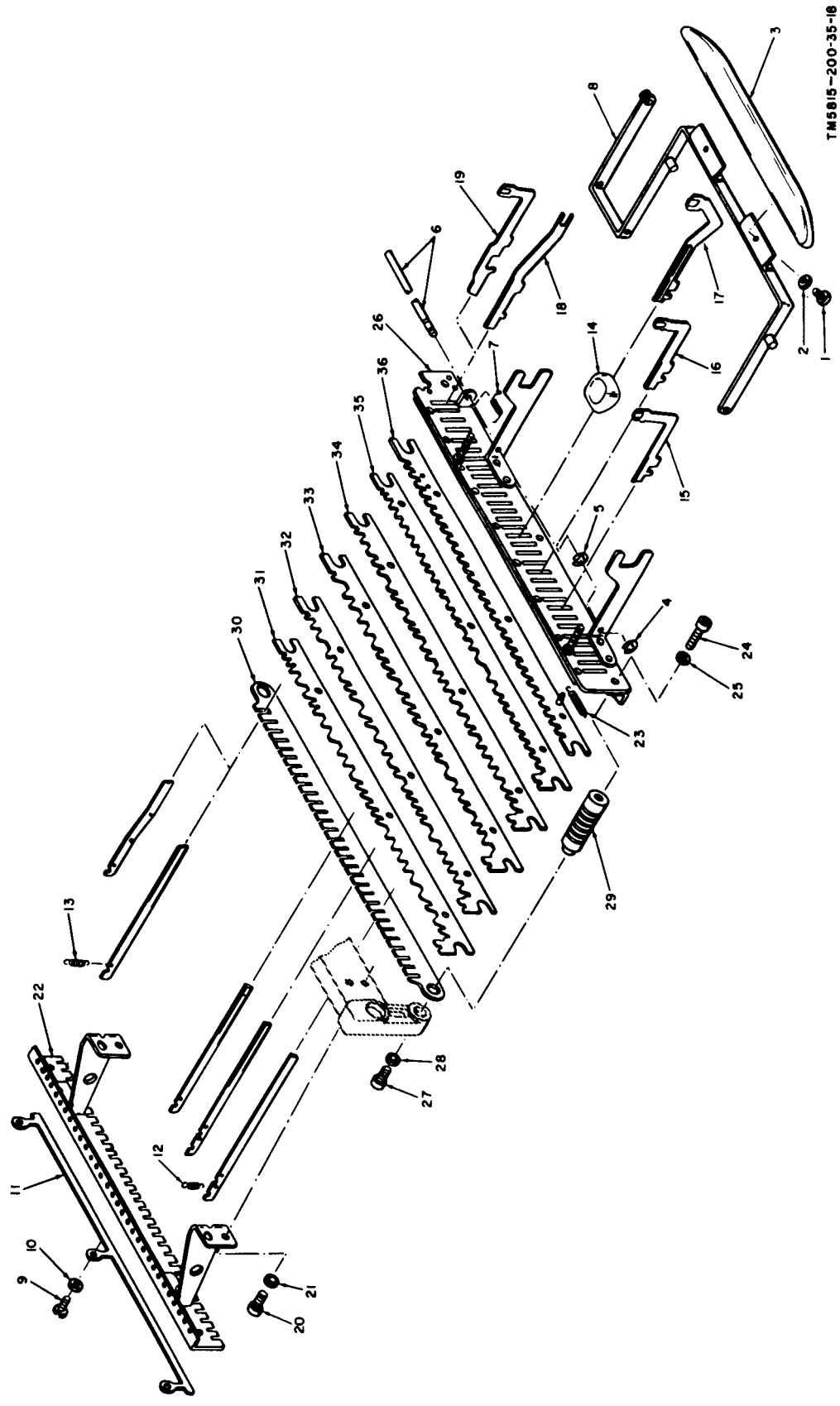
(3) Remove the self-locking hexagonal nut (29), machine screw (30), and lockwasher (31) that hold the electrical contact arm (32) to the motor speed governor base (43); remove the electrical contact arm and remove the sleeve (33) from the contact arm.

(4) Remove the plain hexagonal nut (34) and lockwasher (35) that hold the electrical contact (36) to the motor speed governor base (43); remove the electrical contact.

(5) Remove the cotter pin (37) that holds the governor adjustment lever (38) to the governor adjustment screw (40); remove the governor adjustment lever.

(6) Remove the cotter pin (39) from the opposite end of the governor adjustment screw (40); turn out the governor adjustment screw from the mounting on the motor speed governor base (43); catch the flat washer (41) and the motor governor adjust ment gear (42) as they fall from the motor speed governor base.

b. Reassembly. If necessary, clean or burnish the governor electrical 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.


TM5815-200-35-18
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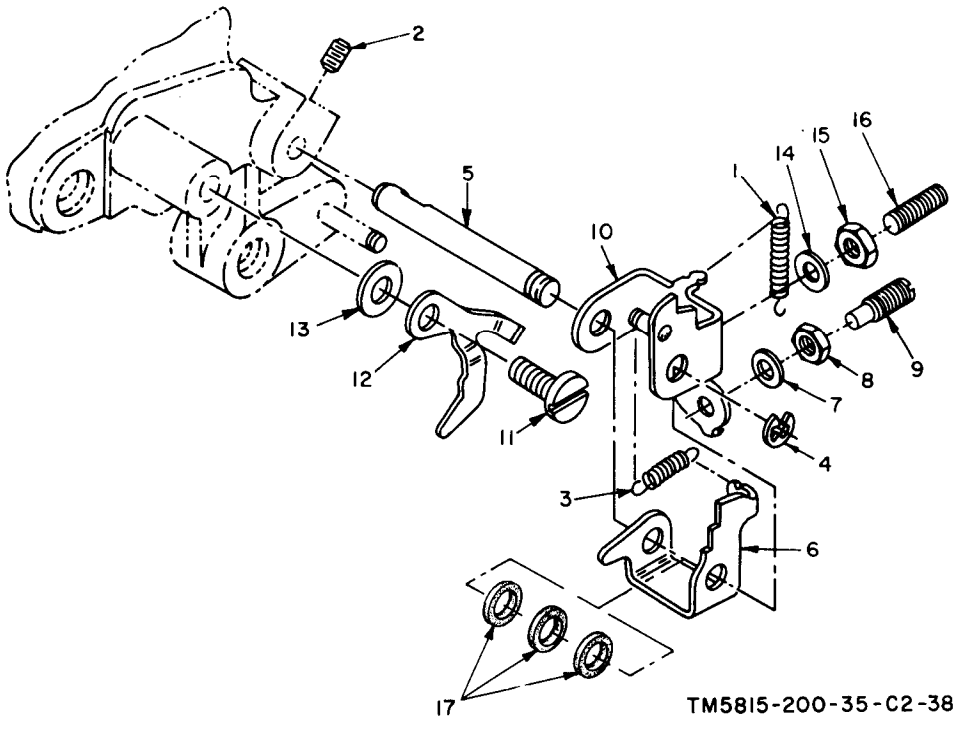
1 Machine screw, 10001
2 Lockwasher, 10429
3 Space bar, 53944A
4 Retainer ring, 10969
5 Retainer ring, 10969
6 Space bar arm shaft, 55862
7 Spring, 56688
8 Space bar arm assembly, 55875A
9 Machine screw, 10304
10 Lockwasher, 10429
11 Keylever locking bar, 53210
12 Keylever spring, 50941
13 Space bar spring, 53974
14 Keytop, 54001 or 50777
15 Short keylever, 55917
16 Medium keylever, 55918
17 Long keylever, 53969
18 Space bar lever, 55916
19 Repeat keylever, 55915
20 Machine screw 10015
21 Lockwasher, 10405
22 Keylever mounting bracket, 54963A
23 Universal code bar return spring, 51136
24 Machine screw, 10024
25 Lockwasher, 10431
26 Front keylever guide, 55860A
27 Machine screw, 10017
28 Lockwasher, 10431
29 Code bar guide stud, 55866
30 Middle keylever guide, 52915
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 2–28. Keylevers and code bars, exploded view (not applicable to TT–259/FG).



1 Locking lever latch spring, 51544
2 Set screw, 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 Hexagonal nut, 10507
9 Universal bar adjusting screw, 50658
10 Locking lever latch, 59475A
11 Repeat lever pivot stud, 51568
12 Repeat lever, 52914
13 Flat washer, 50414
14 Flat washer, 10409
15 Hexagonal nut, 10507
16 Repeat blocking lever adjusting screw, 10233
17 Felt washer, 61468 (include as lubrication reservoirs on some teletypewriters)

Figure 2–29. Keyboard transmitter camshaft locking mechanism, exploded view (not applicable to TT–259/FG).

(1) Reassemble the motor governor by reversing the procedures in *a(3)* through (6) above.
(2) Perform adjustment in paragraph 2-100.
(3) Reassemble the motor governor by reversing the procedure in *a(2)* above.
(4) Install the motor governor on the motor by reversing the procedures in paragraph 2-38 *a(8),* (9), and (10).
(5) Perform adjustment in paragraph 2-101.
(6) Reassemble the motor governor by reversing the procedures in paragraph 2-38 *a* (6).
(7) Perform the adjustment in paragraph 2-102.
(8) Adjust the motor speed.

2-40. Disassembly and Reassembly of Platen Assembly

(fig. 2-15)

a. Disassembly.

(1) Remove the platen assembly from the teletypewriter (para 2-20 *a*).
(2) Remove the machine screw (5), lockwasher (6), and flat washer (33). Remove tile platen latching arm (7).
(3) Remove the platen locking stud (8) from the platen support frame (30).
(4) Remove the retainer ring (9) from the 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), lockwasher (18), and flat washer (34). Removethe platen shift arm (19).

(8) Remove the two set screws (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 (35) that secure the platen to the platen shaft (22). Remove the platen shaft. Remove the single-double line feed lever (23), detent wheel (24), shaft collar (25), platen, the platen trough, and the assembled line feed lever (29) and line feed pawl (28). Catch the felt washer (42, if present) as it fails from the line feed lever.

(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) and felt washer (43, if present) from the line feed lever.

b. Reassembly.

(1) Reassemble the platen assembly by reversing the procedures outlined in *a(12)* through (2) above.

(2) Replace the platen assembly on the teletypewriter (para 2-20 *b*).

(3) Adjust the platen assembly (paras 2-192 through 2-204 and 2-232).

2-41. Disassembly and Reassembly of Platen Trough

(fig. 2-14)

a. Disassembly.

(1) Remove the platen assembly from the teletypewriter (para 2-20 *a)*. If a felt washer (50) is present, remove it from the hub of the platen shaft bearing on the platen trough (46).

(2) Remove the platen lever latch spring (7) from the spring post on the platen trough and from the platen lever latch (8). Remove the platen lever latch.

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

(4) Remove the flat washer (14), platen spacing detent (15), and flat washer (16) from the platen trough (46).

(5) Remove the platen detent spring (17) from the line spacing detent (19) and the spring post on the platen trough (46).

(6) Remove the retainer ring (18) that holds the line spacing detent (19) to the platen detent eccentric stud (22). Remove the line-spacing detent,

(7) Remove the plain round nut (20) and lockwasher (21) and remove the platen detent eccentric stud (22). If a felt washer (51) is present, remove it from the platen detent eccentric stud.

(8) 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.

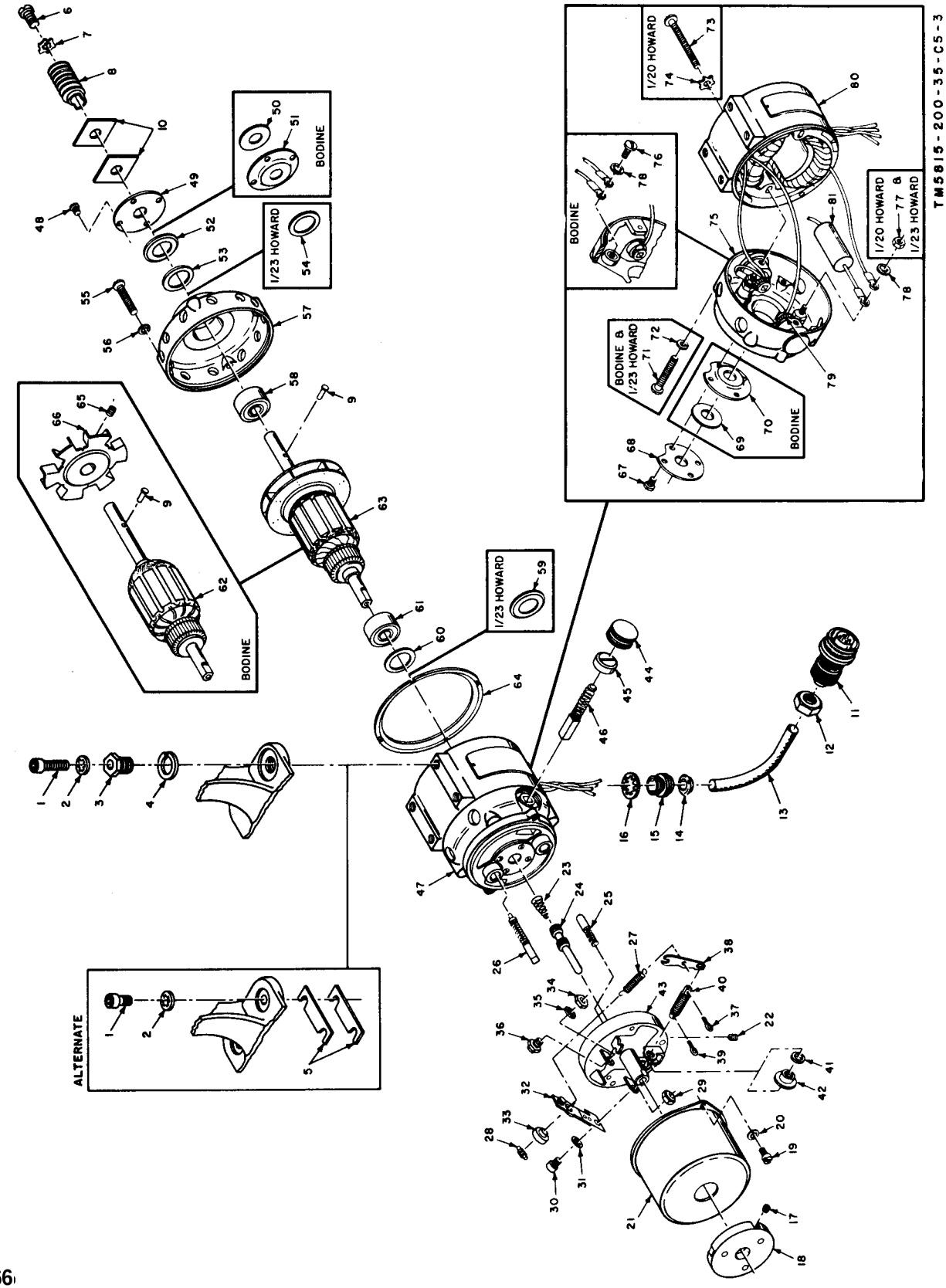
(9) Remove the pressure roller operating shaft screw (25). Slide the platen pressure roller operating shaft (30) to the left to remove it from the platen trough (46).

(10) 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).

(11) Unhook the paper guide spring (31) from the paper guide (42) and from the platen trough (46).

(12) Remove the pivot screw (32) that holds the paper guide shaft (37) to the platen trough (48).

(13) Remove the two setscrews (33 and 34) that hold the paper guides (40 and 44) to the paper guide shaft (39). On TT-98C/FG, remove the roll pins (35 and 36)


TM5815-200-35-C5-3
BODINE
1/23 HOWARD
1/20 HOWARD
BODINE & 1/23 HOWARD
1/20 HOWARD & 1/23 HOWARD
ALTERNATE

1 Machine screw, 10024–01, or 10017–01 (used with item 5)
2 Lockwasher, 10405
3 Bushing, 57493
4 Lockwasher, 10422
5 Shim, 51509, as required, and/or 51510, as required
6 Machine screw, 50207
7 Lockwasher, 10406
8 Worm, 50350
9 Pin, 50359
10 Grease seal, 50949 (2 on Bodine motor; 4 on Howard motors)
11 Plug connector P3, 53512A
12 Capnut, 51171
13 Shielding, 20729–03–10
14 Eyelet
15 Nipple, 51172
16 Lockwasher, 10478
17 Setscrew, 10204
18 Motor governor target, 50303A
19 Machine screw, 10321
20 Lockwasher, 10412
21 Motor governor cover, 50311
22 Setscrew, 10203
23 Governor worm spring, 51855
24 Governor worm, 56555A
25 Electrical contact brush, 51154
26 Electrical contact brush, 51543 [a] [b], 63649 [c]
27 Adjustment lever spring, 50334
28 Grooved pin, 50302
29 Self-locking hexagonal nut, 10840
30 Machine screw, 10055
31 Lockwasher, 10403
32 Electrical contact arm, 50281A
33 Sleeve, 50293
34 Plain hexagonal nut, 10507
35 Lockwasher, 10404
36 Electrical contact, 50338
37 Cotter pin, 10800
38 Governor adjustment lever, 50301
39 Cotter pin, 10800
40 Governor adjustment screw, 50299
41 Flat washer, 50148
42 Motor governor adjustment gear, 50278A
43 Motor speed governor base, 51249A
44 Motor brush shield, 51155 [a], 60495 [b] [c]
45 Motor brush cap, 20747[a], 60496[b], c
46 Motor brush, 56834 [a], 60503 [b] [c]
47 Motor, 65309A (includes items 14, 15, 16, 44, 45, 46, and 48 through 81)
48 Machine screw, 10367 [a], 60494 [b] [c]
49 Endplate, 20738 [a], 60500 [b] [c]
50 Oil and dust seal, 20739 [a]
51 Felt mounting plate, 20749 [a]
52 Spring washer, 60501 [b] [c]
53 Shim washer, 60506 [b] [c] (Bodine part No. not available)
54 Washer, 60493 [b]
55 Machine screw, 10332 [a], 10172 [b] [c]
56 Lockwasher, 10412 [a], 10444 [b] [c]
57 Endbell, 20751 [a], 60505 [b], 64752 [c]
58 Ball bearing, 10760
59 Spring washer, 60501 [b]
60 Shim water, 60493 [b] or 60506 [b], 60493 [c] (Bodine part No. not available)
61 Ball bearing, 10765 [a] [c], 10760 [b]
62 Armature, 51187A [a]
63 Armature, 60492A [b], 64751A [c]
64 Baffle plate, 64755 [c]
65 Setscrew, 10203 [a]
66 Fan, 51800 [a] (includes item 65)
67 Machine screw, 10367 [a], 60494 [b] [c]
68 Endplate, 51060 [a], 60491 [b] [c]
69 Oil and dust seal, 20739 [a]
70 Felt mounting plate, 20740 [a]
71 Machine screw, 10333 [a], 10172 [b]
72 Lockwasher, 10412 [a], 10444 [b]
73 Machine screw, 10384 [c]
74 Lockwasher, 10437 [c]
75 Endbell, 51804 [a], 60490 [b], 64797A [c]
76 Machine screw, 10374 [a]
77 Hexagonal nut, 10517 [b] [c]
78 Lockwasher, 10408
79 Spring clip, 11033 [b] [c]
80 Motor housing and field, 51188A [a], 60499A [b], 64753A [c]
81 Capacitor, 20212

Figure 2–30. Series-governed motor, exploded view.

[a] Used on 1/23 hp Bodine motor only.
[b] Used on 1/23 hp Howard motor only.
[c] Used on 1/20 hp Howard motor only.

from the hubs of the paper guides (40 and 44).

(14) Unhook the three stripper springs (36) from the six paper guides (40), three sleeves (41), and six paper strippers (42 and 43).

(15) Remove the four retainer rings (37) and remove the paper guide shaft (39). Catch the paper guide (40), three sleeves (41), six paper strippers (42 and 43), and paper guide (44), as they fall from the shaft.

(16) Remove the hinge pin (45). Remove the platen trough springs (46) and the paper trough guide (47). Remove the felt washer (52), if present, from the platen shaft bearing hub on the platen trough (48).

b. Reassembly.

(1) Reassemble the platen trough by reversing the steps and procedures outlined in *a* (2) through (16) above.

(2) Replace the platen assembly on the teletypewriter (para 2-20 *a*).

(3) Adjust the platen trough (paras 2-186 through 2–191, 2–195 through 2–200, and 2-204).

2-42. Disassembly and Reassembly of Platen

(fig. 2-31)

a. Disassembly.

(1) Remove the platen assembly (para 2-20 *a*).

(2) Disassemble the platen assembly (para 2-40 *a*).

(3) Remove the hexagonal nut (2) from the shaft (3).

(4) Remove the pinwheel bodies (12 and 20) from the platen roller (4),

(5) Remove the retainer ring (5), flat washer (6), sprocket friction plate (7), sprocket cam plate (8), inside guide (9), sprocket feed pins (10), and locking pin (11) from the pinwheel body (12).

(6) 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 tile pins in the side of the sprocket feed pins.

(2) Position the inside guide (17) on the pinwheel body (20). The head of the locking pin should be flush with, or not more than .005 inch below, the outer edge of tile pinwheel body (20).

(3) Position the sprocket cam plate (16) on the side pins of the sprocket feed pins (18).

(4) Place the sprocket friction plate (15) and the flat washer (14) on the sprocket cam plate (16). Hold the assembled parts in place in tile 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).

2-43. Disassembly and Reassembly of Type Selecting Arm

(fig. 2-32)

a. Disassembly.

(1) Remove the type selecting arm (para 2-21 *a* (3)).

(2) Remove the 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). If a felt washer (13) is present, catch it as it falls from the type selector arm driven claw.

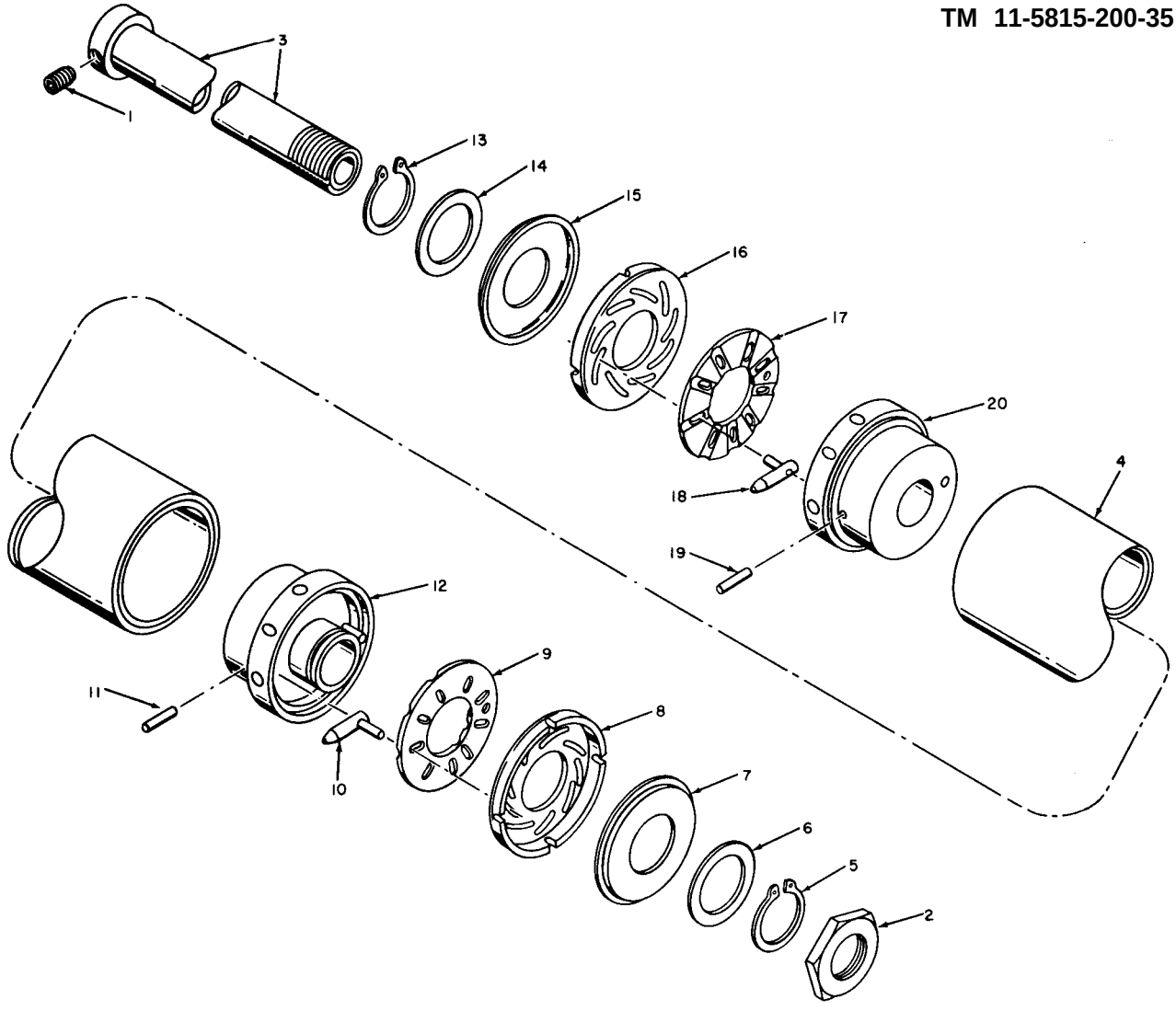
(3) Remove the hexagonal nut (4) and the internal-tooth lockwasher (5) from the type selector arm driven claw (12).

(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 ball bear-



1 Setscrew, 10209
2 Hexagonal nut, 52806
3 Shaft, 52755A
4 Platen roller, 55079A
5 Retainer ring, 11046
6 Shim, 55169 (0.005-in.)
7 Sprocket friction plate, 55160
8 Sprocket cam plate, 55158
9 Inside guide
10 Sprocket feed pin, 55170A
11 Locking pin, 55161
12 Platen sprocket assembly, 55155A (includes items 5–10)
13 Retainer ring, 11046
14 Shim, 55169 (0.005-in.)
15 Sprocket friction plate, 55160
16 Sprocket cam plate, 55158
17 Inside quide
18 Sprocket feed pin, 55170A
19 Locking pin, 55161
20 Platen sprocket assembly, 55155A (includes items 13–18)

Figure 2–31. Platen assembly, 54965A, exploded view.

ing (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 hexagonal nut (4) tight against the internal-tooth lockwasher.

(4) Insert the type seleting arm (3) in the type selector arm driven claw. Install the round nut (2) and the hexagonal nut (1) on the type selecting arm.

(5) Press the blank key and turn the teletypewriter 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 tile right side of the guide plate).

(6) Replace tile bearing cap, left hand margin trip plate (8, fig. 80), flat washers (7), right hand margin trip plate (6), lockwashers (5), flat washers (4) and machine screws (3) that hold the type selecting arm assembly to the carriage frame.

(7) Adjust the type selecting arm (para 2-181).

(6) Slide the assembled pinwheel body (20) onto the shaft (3). Posit ion the hole in the pinwheel body over the slot in the shaft. Replace the locking pin (19) in the hole in the pinwheel body and in the slot in the shaft.

(7) Slide the platen roller (4) on the shaft (3) and 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 shaft with the slot up and slide the pinwheel body into the platen roller. Bottom the locking pin (11) in the slot.

(9) Replace the hexagonal nut (2).

(10) Adjust the platen (paras 2-192 through 2-204, and 2-232).

(11) Reassemble the platen assembly (para 2-40 *b*).

(12) Replace the platen assembly (para 2-20) .

2-44. Disassembly and Reassembly of Ribbon Guide and Vibrator

(fig. 2-33)

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 the 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) Reassemble the ribbon guide and vibrator by reversing the procedures outlined in a above.

(2) Adjust, the ribbon guide and vibrator (para 2-185).

2-45. Disassembly and Reassembly of Ribbon Feed Mechanism

a. Disassembly.

(1) Remove the ribbon from the ribbon guide.

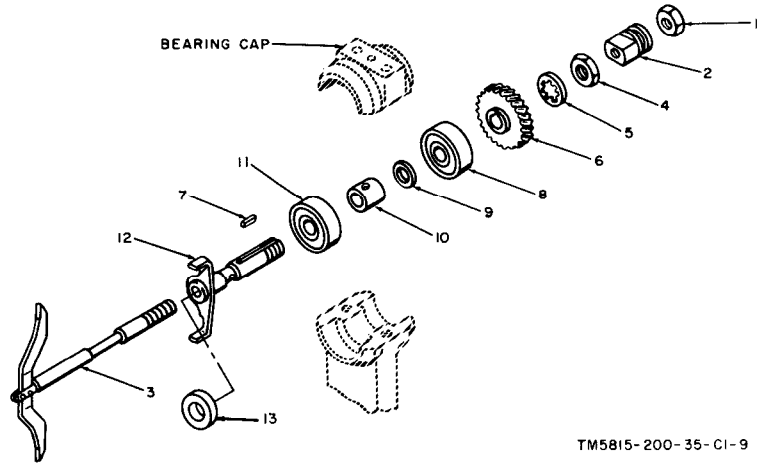
(2) Lift the ribbon spool lock (30, fig. 2-34) and press in the ribbon sensing levers (20) to remove the ribbon spools (1) from the ribbon spool drive shafts (24). Remove the ribbon spools and the ribbon from the machine.

(3) Remove the six machine screws (2) and lockwashers (3) (two machine screws and lockwashers (1 and 2, fig. 2-36) on the TT-300/FG). 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). On the TT-98C/FG, catch the detent spring (31, fig. 2–34) as it falls from the machine screw (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).



1 Hexagonal nut, 10509
2 Round nut, 50564
3 Type selecting arm, 50560A
4 Hexagonal nut, 50559
5 Internal-tooth lockwasher, 10401
6 Type selector arm driving gear, 50556
7 Machine key, 50558
8 Ball bearing, 10757
9 Flat washer, 50552
10 Spacing collar, 50557
11 Ball bearing, 10757
12 Type selector arm driven claw, 50553A
13 Felt washer 61476 (included as lubrication reservoir on some teletypewriters)

Figure 2–32. Type selecting arm, exploded view.

(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) Reassemble the ribbon feed mechanism by reversing the procedures outlined in *a(12)* through (2) above.

(2) Replace the ribbon (para 17, TM 11-5815-200-10/TO 31W4-2FGC-20-11).

(3) Adjust the ribbon feed mechanism (paras 2-217 through 2-219).

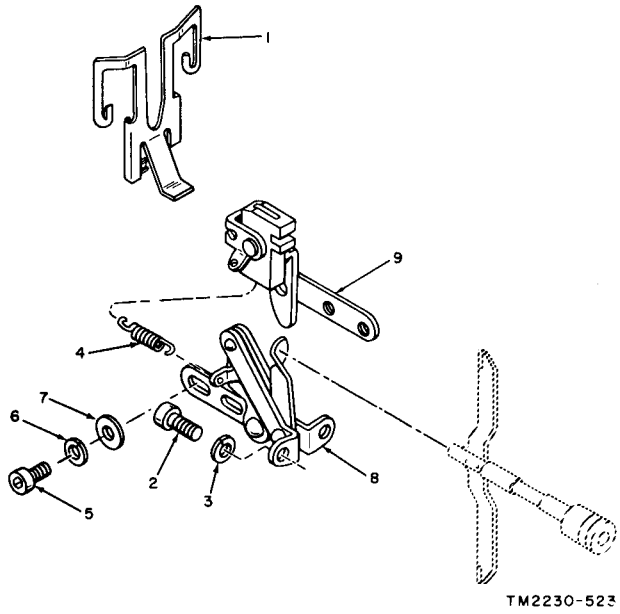
2-46. Disassembly and Reassembly of Type Bar Group (all models except TT-300/FG)

(fig. 2-35)

a. Disassembly.

(1) Remove the ribbon feed mechanism (paras 2-45 *a(1)* through (3)).

(2) Remove the 26 springs (1) from the guide plate (18) and from the connecting bars (4).



1 Ribbon guide, 55036 (62690 on TT-300/FG)
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 2–33. Ribbon guide and vibrator assembly, exploded view.

(3) Push the hinge pin (2) out of the type bar segment (14).

(4) Remove the 26 type bars (3) and the 26 connecting bars (4) from the type bar segment (14) and from the mounting plate (17).

(5) Remove the two 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.

(6) Remove the type bar segment machine key (8) from the carriage frame.

(7) Remove the two machine screws (9). Remove the ribbon guide mounting bracket (10).

(8) Remove the four machine screws (11). Remove the stop plate (12).

(9) Remove the two machine screws (15) and lockwashers (16). Remove the guide plate (18) and the mounting plate (17).

b. Reassembly.

(1) Reassemble the type bar group by reversing the steps and procedures outlined in *a* (2) through (9) above.

Note. Numbers 1 to 26 are stamped in both the connecting bars and the type bars of communication symbol machines, and numbers 1 to 27 are stamped on weather symbol machines. Install the bars in matched pairs with the No. 1 set on the left hand side of the carriage.

(2) Replace the ribbon feed mechanism by reversing the procedures outlined in paragraph *2-45a(1)* through (3).

2-47. Disassembly and Reassembly of Carriage (all models except TT-300/FG)

(fig. 2-16)

a. Disassembly.

(1) Remove the carriage from the teletypewriter (para 2-21 *a*).

(2) Remove the two machine screws (12) and lockwashers (13) and remove the carriage feed and return driving rack (14).

(3) Remove the wingnut (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 capscrews (19) and ball bearings (20).

(5) Remove the capscrews (21) and ball bearings (22).

(6) Remove the carriage locking stud (23) from the carriage frame (28).

(7) Remove the setscrew (24). Remove the assembled roller mounting stud (27) and ball bearing (26).

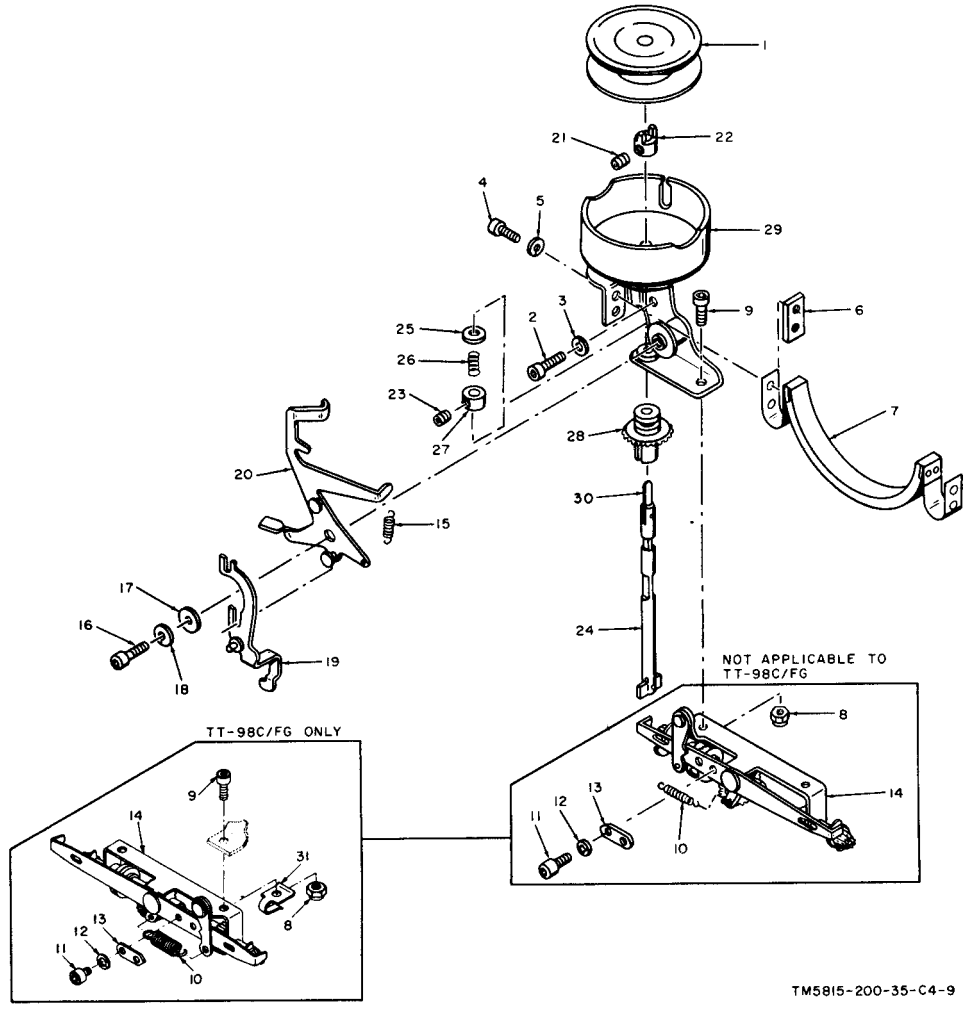
(8) Remove the self-locking hexagonal nut (25) and the ball bearing (26) from the roller mounting stud (27).

b. Reassembly.

(1) Reassemble the carriage by reversing the steps and procedures outlined in *a* (2) through (8) above.

(2) Replace tile carriage on the teletypewriter (para 2-21 *b*).

(3) Adjust the carriage (paras 2-166 through 2-168, and 2-210).



1 Ribbon spool, 10900
2 Machine screw, 10004 (62617 on TT–300/FG)
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 screws, 10002
12 Lockwasher, 10429
13 Ribbon reversing detent plate, 50393
14 Ribbon drive subassembly, 50400A (includes items 11, 12, and 13) (61287A on TT–98C/FG)
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, 53961
27 Shaft collar, 50391
28 Ribbon spool driving gear, 50448
29 Ribbon drive mounting, 50451A (left hand), 50453A (right hand)
30 Ribbon spool lock
31 Detent spring, 61288 (TT–98/FG)

Figure 2–34. Ribbon feed mechanism, exploded view.

2-48. Disassembly and Reassembly of Type Basket (TT-300/FG Only)

a. Disassembly.

(1) Remove the type basket.

(2) Push the hinge pin (5) out of the type bar segment (9).

(3) Remove the 26 type bars (6) from the type bar segment (9).

(4) Remove the two screws (3), lockwashers (4), and type bar segment (9) from the carriage frame.

(5) Remove the two machine screws (8) and the type bar segment machine key (7) from the carriage frame.

(6) Remove the two machine screws (10) and type bar guide (11).

(7) Remove the four machine screws (12) and ribbon stop plate (13).

(8) Remove the two machine screws (15) and lockwashers (16) and the type bar stop ring (17).

b. Reassembly.

(1) Reassemble the type basket by reversing the procedure described in *a(2)* through (8) above.

(2) Install the type baseket.

2–49. Disassembly and Reassembly of Connecting Bar Assembly (TT-300/FG Only)

(fig. 2-37)

a. Disassembly.

(1) Remove the type basket.

(2) Disconnect the 26 springs (1) from the mounting plate (11) and from the connecting bars (2).

(3) Remove the 26 connecting bars from the connecting bar guide (7) and the guide plate (12).

(4) Remove the two machine screws (3), and plain washers (4), lockwashers (5), connecting bar guide frame (6), connecting bar guide (7), and lockwashers (8).

(5) Remove the two machine screws (9), lockwashers (10), mounting plate (11), and guide plate (12).

b. Reassembly. Reassemble the connecting bar assembly by reversing the procedure described in a (2) through (5) above.

2-50. Disassembly and Reassembly of Selector Magnet

NOTE

Either one of two selector magnet assemblies are used on these teletypewriters. One magnet is provided with terminals (fig. 2-38), the other magnet without terminals (fig. 2-39).

a. Disassembly-Terminal Magnet (fig. 2-38).

(1) Remove the two machine screws (1), flat washers (2), and lockwashers (3). Remove the selector magnet assembly from the frame of the teletypewriter.

(2) Remove the two cotter pins (4). Remove the cover (5) and the two cover-springs (6).

NOTE

Subparagraphs (3), (4), and (5) below are not applicable to TT-664(*)/FG and TT-665/FG.

(3) Remove the two machine screws (7) and lockwashers (8). Remove the assembled resistor (14) and bracket (11).

(4) Remove the locking nut (9) and the hexagonal nut (10) from the threaded bushing of the resistor (14). Remove the resistor mounting bracket (11) from the resistor.

(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 resistor (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 resistor.

(6) Remove the hexagonal nut (15) and lockwasher (43) from 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 or 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 magnet (27) in the selector magnet bracket (42); mark the magnet and bracket before removing the magnet from the 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 hexagonal nuts (36) from the armature stop bracket (37).

(14) Remove the two armature leaf spring stop screws (38) and hexagonal nuts (39) from the selector magnet bracket (42).

(15) Remove the setscrews (40 and 41) from the selector magnet bracket (42).

b. Disassembly -Nonterminal Magnet (fig. 2-39)

(1) Remove the two machine screws (1), flat washers (2), and lockwashers (3). Remove the selector magnet assembly from the teletypewriter.

NOTE

Subparagraphs (2) and (3) below are not applicable to TT-664(*)/FG and TT-665/FG.

(2) Remove the two machine screws (4) and lockwashers (5). Remove the assembled resistor (11) and resistor 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 resistor (11). Tag the leads. Remove the tubing from the electrical cable assembly. Remove the pieces of 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 (19) 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 bar magnet (23), the selector magnet bracket (38), and remove the magnet.

(7) Remove the setscrew (24) from the selector magnet bracket (38).

(8) Remove the retainer rings (25) and 26). Slide the armature mounting shaft (24) from the armature (28) and from the selector 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 (33).

(10) Remove the two machine screws (31) and hexagonal nuts (32) from the armature stop bracket (33).

(11) Remove the two armature leaf spring stop screws (34) and hexagonal nuts (35) from the magnet bracket (38).

c. *Reassembly-Terminal Magnet* (fig. 2-38).

(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 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 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 magnet (27) on the selector magnet bracket (42). Leave a gap of .015 inch between the south pole of the magnet and the armature stop bracket (37) (para 168). Fasten the bar magnet in place with a setscrew (26). The north pole of the bar magnet is designated by a red dot.

(8) Position the bracket (25) on the selector magnet bracket (32) and on the end of the 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 study (18) (para 2-135).

(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 resistor wires to the proper terminals on the selector magnet.

(11) Position the electrical clamp (16) on the studs of the selector magnet cable stud (18) and secure it with the lockwasher (43) and hexagonal nut (15).

NOTE

Subparagraphs (12), (13), and (14) below are not applicable to TT-664(*)/FG and TT-665/FG.

(12) Slide the two pieces of tubing (13) over the ends of the wires in the tubing (12). Solder the two wires to the two terminal lugs on the resistor (14). Slide the two pieces of insulating tubing over the soldered connections.

(13) Install the resistor (14) on the resistor mounting bracket (11). Fasten it in place with a hexagonal nut (10). Install and tighten the locking-nut (9) fingertight.

(14) Fasten the assembled resistor (14) and resistor 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 (para 2-136).

(17) Adjust the selector magnet attractive force and leaf spring alinement (para 2-138).

(18) Install the selector magnet bracket (42) on the frame of the teletypewriter 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 (para 2-139) .

(20) Adjust the alinement of the selector and Y-levers with the selector magnet (para 2-140) .

(21) Adjust the clearance between the selector levers and the armature blade of the selector magnet (para 2–141).

d. Reassembly-Nonterminal Magnet (fig. 2-39) .

(1) Install the setscrews (37 and 36) in the selector magnet bracket (38), with the leading ends of the screws flush with surface of the mounting bracket.

(2) Screw the 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 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 a gap of .015 inch between the south pole of the bar magnet and the end of the armature stop bracket (para 2-134). Fasten the bar magnet with a setscrew (26). The north pole of the bar 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).

NOTE

Subparagraphs (10) through (13) below are not applicable to TT-664(*)/FG and TT-665/FG.

(10) Solder the resistor 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 resistor (11). Slide the pieces of tubing over the solder joints.

(12) Position the resistor (11) on the resistor mounting bracket (8) and secure it with a hexagonal nut (7). Tighten the locking nut (6) fingertight.

(13) Attach the assembled resistor (11) and resistor 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 2-136.

(15) Adjust the selector magnet attractive force and leaf spring alinement (para 2-138).

(16) Install the selector magnet bracket (38) on the teletypewriter 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 (para 2-139) .

(18) Adjust the alinement of the selector and Y-levers with the selector magnet para 2-140) .

(19) Adjust the clearance between the selector levers and the armature blade of the selector magnet (para 174).

2–51. Disassembly and Reassembly of Rangefinder

(fig. 2-40)

a. Disassembly.

(1) Remove the two 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). If a felt washer (19) is present, remove it from the orientation lever study.

(4) Remove the self-locking hexagonal nut (6) and machine screw (7) from the orientation lever (10).

(5) Remove the orientation lever stud (11).

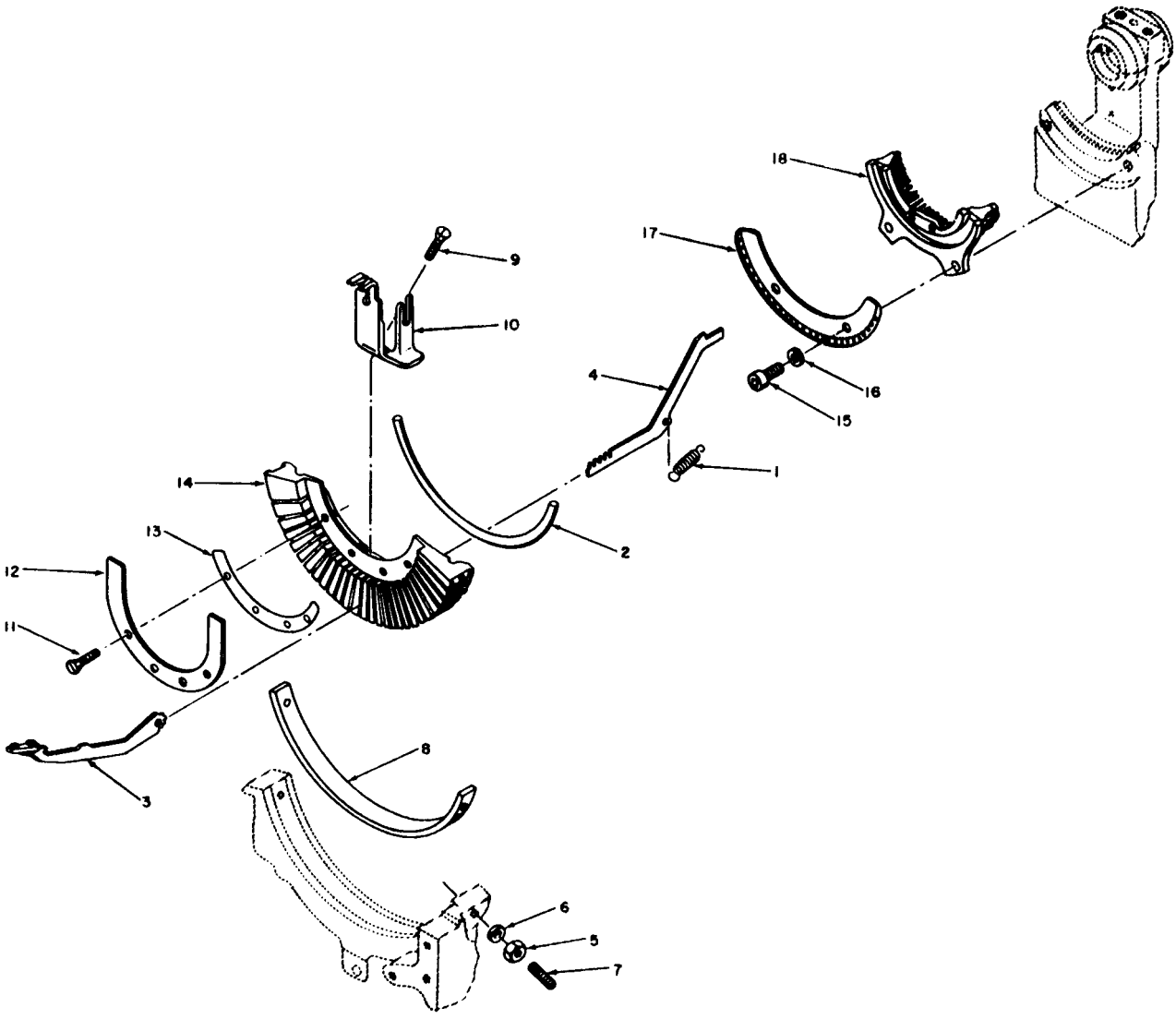
(6) Remove the two setscrews (12) that hold the rangefinder cam (13) to the shaft of the rangefinder dial assembly (15), Pull the dial assembly from the rangefinder cam (13) and the spacer (14).

(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 rangefinder dial assembly (15) in the hole in



TM2230-533

1 Spring, 50595
2 Hinge pin. 50572
3 Type bar
4 Connecting bar
5 Hexagonal nut, 10509
6 Lockwahser, 10431
7 Setscrew, 10214
8 Type bar segment machine key. 50550
9 Machine screw, 10306
10 Ribbon guide mounting bracket, 55147
11 Machine screw, 51132
12 Ribbon stop plate. 55791
13 Type bar bumper plate shim, 51244 to 51247
14 Type bar segment, 50549
15 Machine screw, 10025
16 Lockwasher, 10430
17 Mounting plate, 50548
18 Guide plate, 50547

Figure 2-35. Type bar group, exploded view.

the selector levcr comb bracket (18). Position the spacer (14) and the range-finder cam (13) 011 the shaft and complete the dial assembly installation. Hold the range finder cam on the shaft loosely with the two setscrews (12).

(3) Install the orientation lever stud (11) on the selector lever comb bracket (18). If available, install a felt washer (19) on the hexagonal portion of the orientation lever stud.

(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) 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 screw driver while maneuvering the lever stop into position.

(7) Attach the selector lever comb bracket to the frame of the teletypewriter with the two lockwashers (2) and machine screws (1).

(8) Adjust the rangefinder (paras 2–128 through 2-131).

2-52. Disassembly and Reassembly of Selector Levers and Y-Levers

(fig.2-41)

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 hexagonal nut (3) from the anchor post (2); remove the anchor post from the teletypewriter 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 hexagonal 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). If present, remove the felt washer (55). On the TT-98C/FG, remove the machine screw (58), flat washer (59) and clamp nut (60). Remove the machine screws (61), lockwashers (62), and flat washers (63) that hold the Y-lever-eccentric tie (64) to the Y-lever stud bracket (65). Remove the Y-lever stud bracket (65), Y-lever-eccentric tie (64), and spacer (66). Remove the flat washers (21, 23, 25, 27, and 29) and Y-levers (22, 24,26, 28, and 30) alternately, felt. washer (56), if present 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), felt washer (57), if present 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 teletypewriter frame.

(10) Remove the setscrew (49) that holds the selector lever pivot stud (50) to the teletypewriter frame. Remove the selector lever pivot stud.

(11) Remove the setscrew (51) that holds the Y-lever pivot stud (52) to the teletypewriter frame. Remove the Y-lever pivot stud.

(12) Remove the transfer lever assembly.

(13) Remove the setscrew (53) that holds the Y-lever eccentric stop (54) to the teletypewriter frame. Remove the Y-lever eccentric stop.

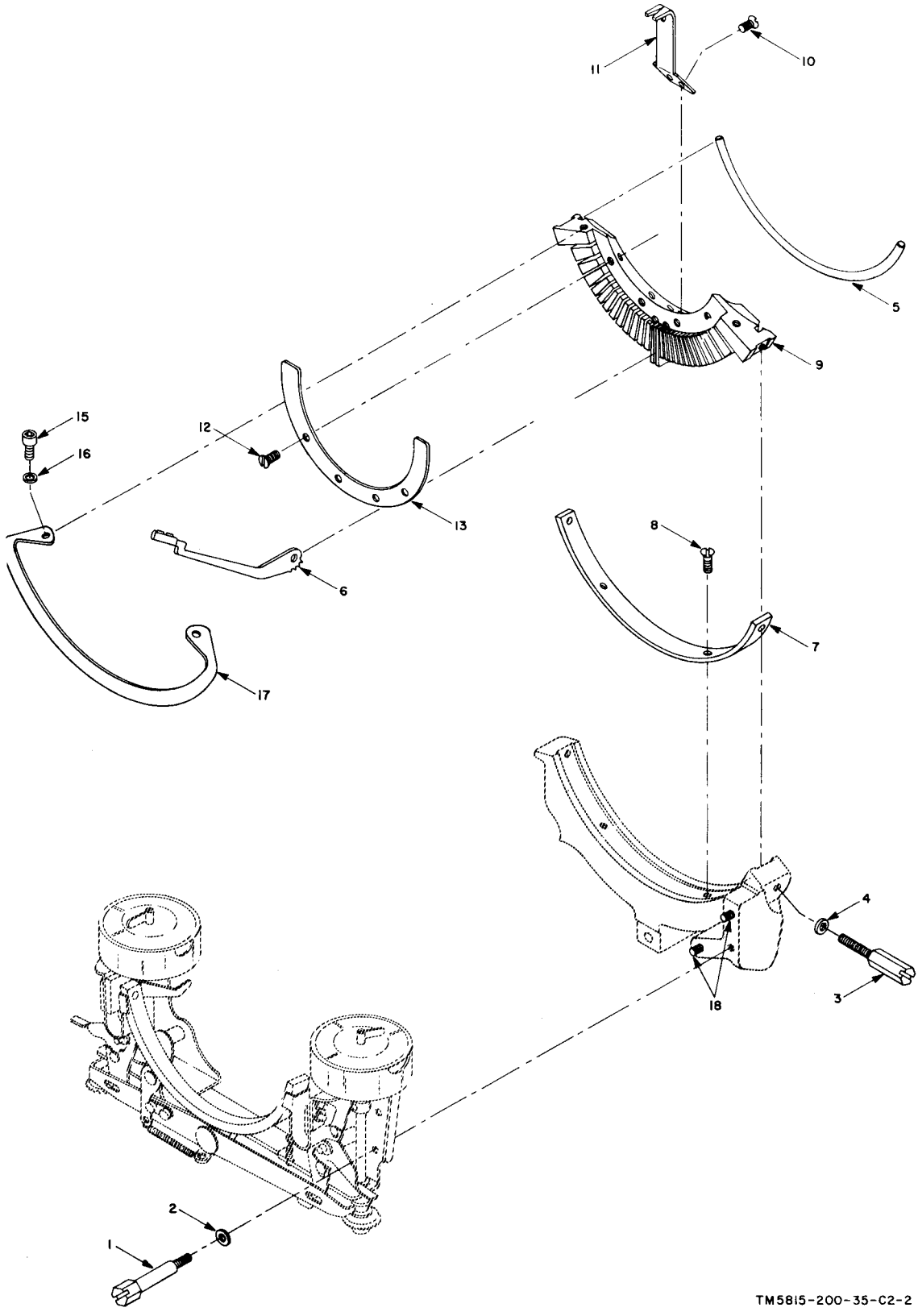
b. Reassembly.

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 teletypewriter frame. Fasten it with a setscrew (53).

(2) Replace the transfer lever assembly.

(3) Install the Y-lever pivot stud (52) in the teletypewriter frame. Fasten it with a setscrew (51).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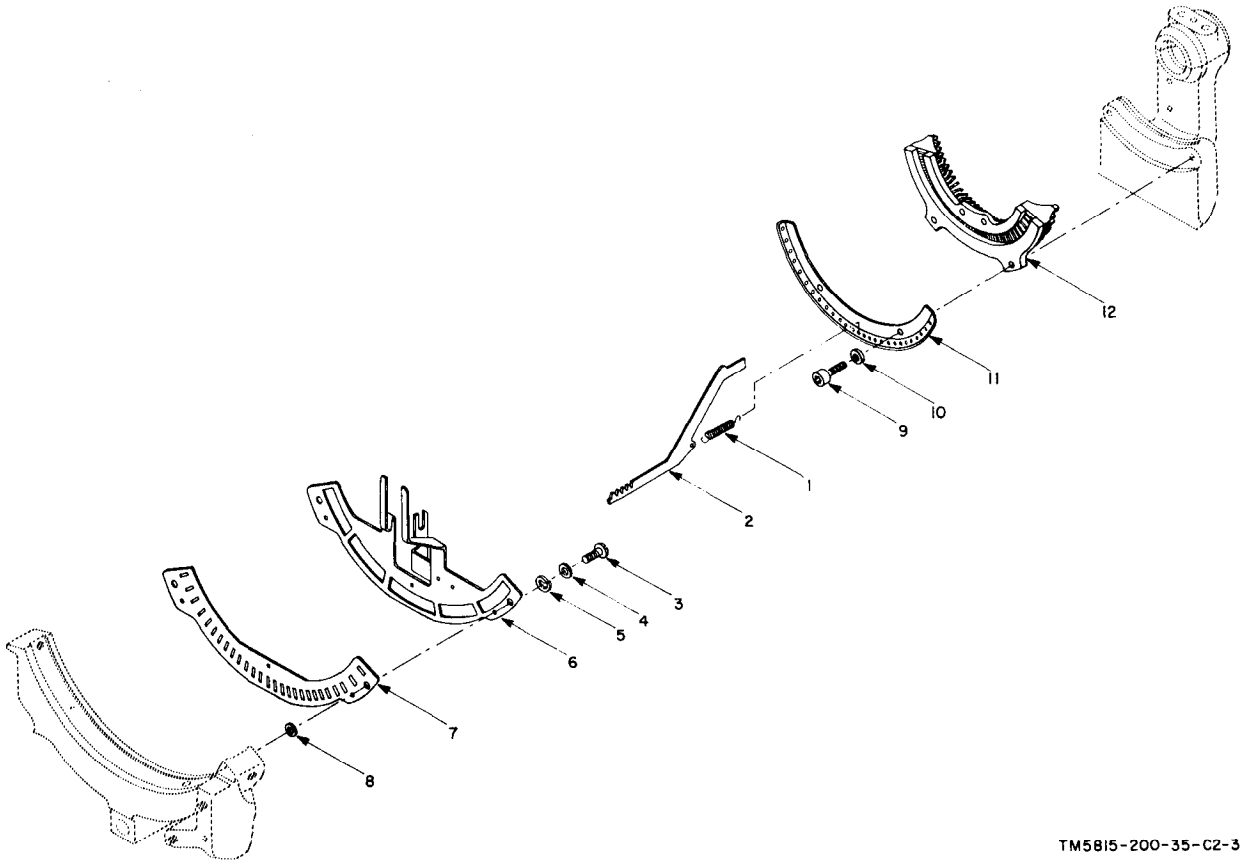
TM5815-200-35-C2-2

1 Screw, 62617
2 Lockwasher, 10429
3 Screw, 62616
4 Lockwasher, 10431
5 Hinge pin, 50572
6 Type bar, 50054A through 50068A and 50071A through 50079A
7 Type bar segment machine key, 50550
8 Machine screw, 10186
9 Type bar segment, 62602A
10 Machine screw, 10306
11 Type bar guide, 62603A
12 Machine screw, 51132
13 Ribbon stop plate,55791
15 Machine screw, 10429
16 Lockwasher, 10004
17 Type bar stop ring, 62604
18 Setscrew, 10226

Figure 2-36. Type basket, exploded view (TT–300/FG only).



1 Spring, 50595
2 Connecting bar, 50022 through 50047
3 Machine screw, 10004
4 Plain washer, 10459
5 Lockwasher, 10429
6 Connecting bar guide frame, 62606
7 Connecting bar guide, 62607
8 Lockwasher, 10455
9 Machine screw, 10025
10 Lockwasher, 10430
11 Mounting plate, 50548
12 Guide plate, 50547A

Figure 2-37. Connecting bar assembly, exploded view (TT–300/FG only).

(4) Install the selector lever pivot stud (50) in the teletypewriter frame. Fasten it with a setscrew (49).

(5) Position the Y-lever detent spring bracket (48) on the teletypewriter frame. Secure it by installing the Y-lever detent pivot (47).

(6) Install the collar (46), the bearings (45, 43, 41, 39, and 37), and the flat washers (42, 44, 40, and 38) alternately, and the flat washer (36), felt washer (57), if available 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.

(7) Position the five selector levers (32) in their original positions on the five bearings.

(8) Assemble the collar (31), felt washer (56), if available, the Y-levers (30,28,26, 24, and 22), and flat, washers (29, 27, 25, 23, and 21) alternately on tile Y-lever pivot stud (52). Install a felt washer (55), if available and the collar (20) on the Y-lever pivot stud (52). Fasten it with the setscrew (19).

(9) 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.

(10) Install the centering sleeve (7) on the Y-lever detent pivot (47). Secure it with a lockwasher (6) hexagonal nut (5).

(11) 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).

(12) Install the select or spring anchor post (2) in the teletypewriter frame. Lock the post, with a hexagonal nut (3).

(13) Hook the six selector lever springs (1) in the. holes in tile selector spring anchor post (2) and to tile five selector levers (32), and the stop levers (35).

(14) On the TT-98C/FG, reassemble the Y-lever stabilizer mechanism by reversing the procedure described in *a* (5) above. Adjust the Y-lever stud bracket.

(15) Adjust the selector levers and Y-levers (paras 2-105, 2-120, 2-126, 2-128, 2-130 and 2–139).

2-53. Disassembly and Reassembly of Transfer Lever Assembly

(fig. 2-42)

a. Disassembly.

(1) Remove tile receiving unit from the base (para 2-17 *a).*

(2) Remove the transfer lever spring (1).

(3) Remove the self-locking hexagonal nut (2) and flat, washer (3) that hold the T-levers (4, 7, 9, 11, and 13) on the T-lever pivot stud (17).

(4) Remove the T-levers, flat washers, and shim (4 through 13).

(5) Remove the felt (14).

(6) Remove the hexagonal nut (15), lockwasher (16), and T-lever pivot stud (17).

(7) Remove the machine screw (18) and the assembled clutch latch (19). Remove the hexagonal nut (20), lockwasher (21), machine screw (22) and ball bearing (23).

Note. Equipments may be supplied with either split shaft collars (25, 30 and 31) or solid shaft collar (48). Solid collars are, secured with two setscrews (46 and 47). The transfer lever shaft has flat surfaces to accommodate the setscrews. Each split shaft collar is secured with one socket-head machine screw.

(8) Remove the machine screw (24) and shaft collar (25) (or setscrews (46 and 47) and shaft collar (48), if solid collars are used).

(9) Remove the machine screws (26 and 27) (or setscrews (46 and 47) if solid collars are used) from the collars.

(10) Pull the transfer lever assembly (28) out of the bearings in the teletypewriter frame. Catch the felt (29) and collars (30, 31, and 32) as they fall from the shaft of the transfer lever assembly. Remove the felt (33) from the shaft.

(11) Remove the spring stud (34) from the transfer lever assembly (28).

(12) Remove the self-locking hexagonal nut (35) and the transfer lever roller stud (36) from the transfer lever assembly (28).

(13) Disconnect both ends of the spring (37) and remove it.

(14) Remove tile retainer ring (38), transfer lever latch (39), and three felts (40).

(15) Remove tile transfer lever latch stud (41).

(16) Remove tile machine screw (42), flat washer (43), and lockwasher (44). Remove the spring post eccentric (45).

b. Reassembly.

(1) Reassemble the transfer lever assembly by reversing the procedures in *a* above.

(2) Adust the transfer lever assembly as described in paragraphs 2-117, 2-119, 2–123, through 2–125, and 2–132.

2-54. Disassembly and Reassembly of Print Bail Blade Shaft

(fig. 2-43)

a. Disassembly.

(1) Remove the receiving unit from the base (para 2-17 *a*).

(2) Remove the transfer lever shaft (para 2-53 *a*)

(3) Remove the two setscrews that hold the print cam to the function shaft. Slide the print cam to the selector side of the teletypewriter. *Be careful not to lose the bushing ont he cam follower stud.*

(4) Unhook the print cam follower spring (1) from the print, cam follower (8) and

from the spring post on the teletypewriter frame.

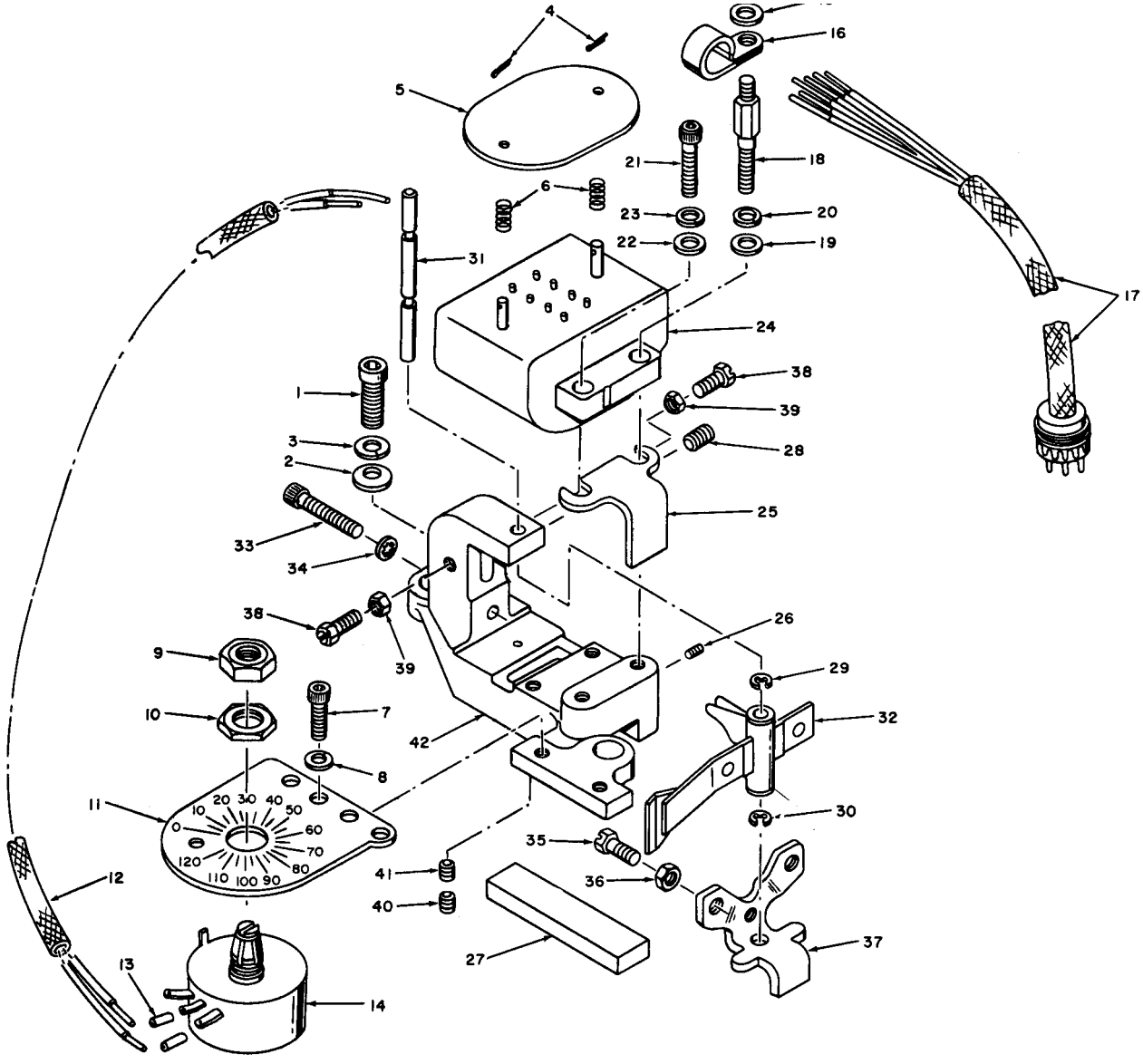
(5) Remove two screws and lockwashers that hold the middle bearing cap to the frame assembly. Remove the middle bearing cap by sliding it toward the selector side of the teletypewriter.

(6) Remove the print bail blade shaft (13), print bail blade (12), and print cam follower (8) by moving it toward the selector side of the teletypewriter, free of the bearing. If present, renlove the felt washers (14) and (16).

(7) Remove the bushing (2), locknut (4), and stud (3) from the print cam follower.

(8) remove the nut (5), machine screw (6), and washer (7) that hold the print cam follower (8) to the print bail blade shaft (1:3) and remove the follower. If present, remove the two felt washers (15).

(9)Remove the three machine screws (9), lockwashers (10), and washers (11) that



TM5815-200-35-19

hold the print bail blade (12) to the print bail blade shaft (13) and remove the blade.

b. Reassembly.

(1) Position the print bail blade (12) on the print bail blade shaft (13). Fasten it with the three screws (9), lockwashers (10), and washers (11). If available, install two felt washers (15) on the print bail blade shaft.

(2) Position the print cam follower (8) on the print bail blade shaft (13). Fasten it with a machine screw (6), plain washer (7), and nut (5). If available, install two felt washers (14) and (16) on the print bail blade shaft.

(3) Position the stud (3) on the cam follower (8) and secure it with a locknut (4). Install the bushing (2) on the stud.

(4) Insert the end of the print bail blade shaft with the bushing (2) in the function side of the teletypewriter.

(5) Position the bearing cap on the opposite end of the print bail blade shaft. Secure the bearing cap to the frame with two screws and lockwashers.

(6) Attach the print cam follower spring (1) to the print cam follower (8) and the spring post on the teletypewriter.

(7) Slide the print cam to engage the print cam follower (8). Secure the cam to the function shaft with two setscrews.

(8) Replace the transfer lever shaft (para 2-53 *b*).

(9) Adjust the print bail blade shaft (para 2-184 and 2-185).

(10) Replace the receiving unit on the base (para 2-17b).

2–55. Disassembly and Reassembly of Signal Bell

(fig. 2-44)

a. Disassembly.

(1) Remove two machine screws (1) and lockwashers (2) and remove the signal bell assembly by sliding it downward until the bell clapper (10) and the motor stop function lever (13) are clear of their punch bars.

(2) Remove the locknut (3) and signal bell (4).

(3) Remove the locknut (5) and machine screw (6) and remove the clapper stop (7).

(4) Remove the spring (8) from the clapper (10) and signal bell bracket (14).

(5) Remove the retainer ring (9) and the signal bell clapper (10).

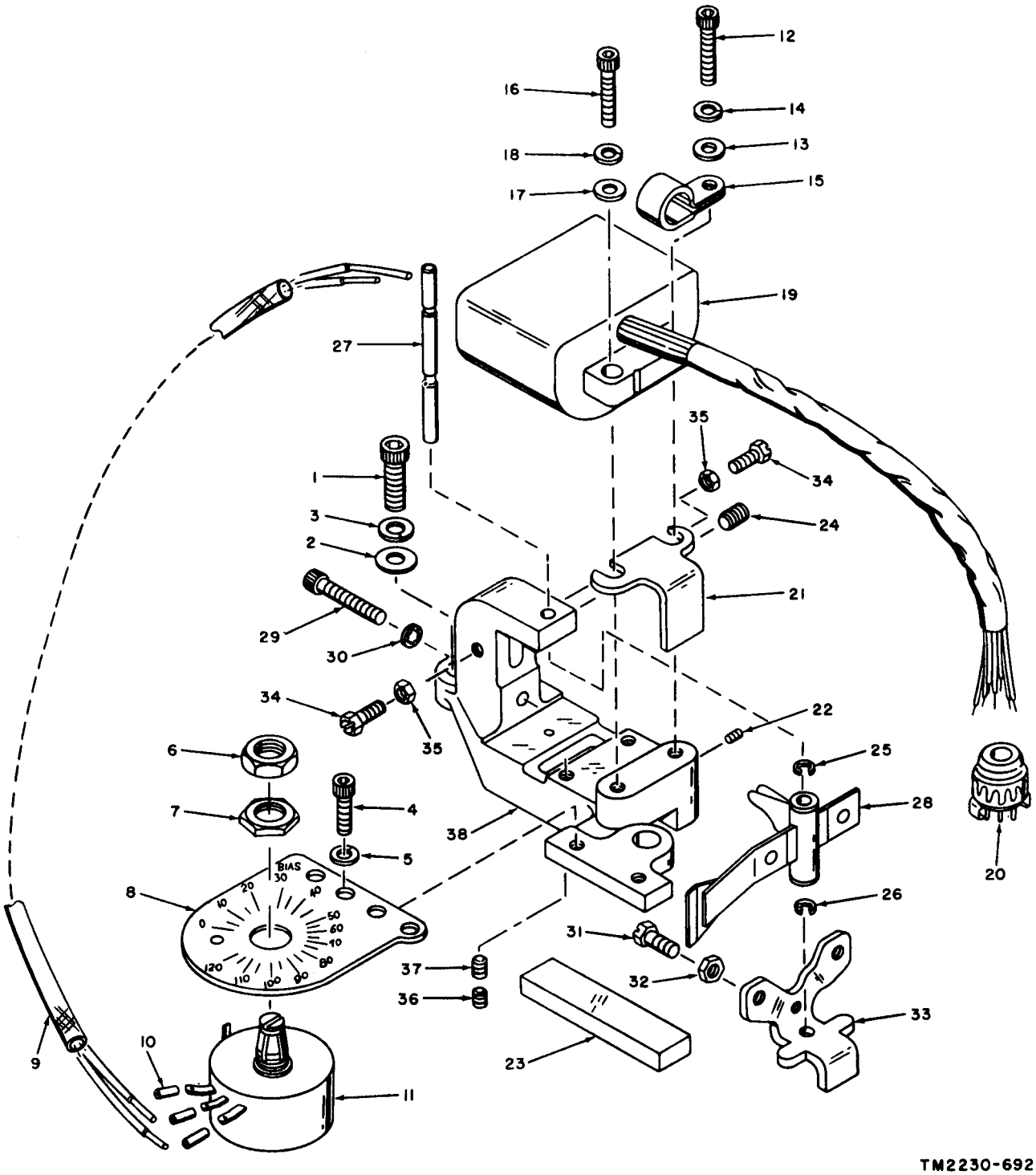
(6) Unhook the spring (11) from the motor stop function lever (13) and from the

1 Machine screw, 10018-01
2 Flat washer, 10464
3 Lockwasher, 10420
4 Cotter pin, 10806
5 Cover, 56089
6 Cover-spring, 56091
7 Machine screw, 10032[a]
8 Lockwasher, 10430[a]
9 Locking nut[a]
10 Hexagonal nut, 10529[a]
11 Resistor mounting bracket, 53333[a]
12 Tubing[a]
13 Insulating tubing[a]
14 Resistor, 20025 [a] (includes Item 9)
15 Hexagonal nut, 10501
16 Electrical clamp, 20513
17 Selector magnet cable, 53545A
18 Selector magnet cable stud, 56127
19 Flat washer, 51408
20 Lockwasher, 10430
21 Machine screw, 10011
22 Flat washer, 51408
23 Lockwasher, 10430
24 Selector magnet, 56126A
25 Bracket, 52292
26 Setscrew, 10220
27 Magnet, 61973
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 Hexagonal nut, 10507
37 Armature stop bracket, 52529
38 Armature leaf spring stop screw, 53183
39 Hexagonal nut, 10507
40 Setscrew, 10235
41 Setscrew, 10221
42 Selector magnet bracket, 52528
43 Lockwasher, 10430

Figure 2-38. Terminal selector magnet, exploded view.

NOTE Some selector mechanisms include two locking tabs, 59896 and two machine screws, 10058, instead of hexagonal nuts to lock the armature leaf spring stop screws (38) in position and a lockwasher, 10419 on the shaft of the resistor (item 14).

[a] Not applicable to TT-664(*)/FG and TT-665/FG.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1 Machine screw, 10018
2 Flat washer, 10464
3 Lockwasher, 10420
4 Machine screw, 10032[a]
5 Lockwasher, 10430 [a]
6 Locking nut[a]
7 Hexagonal nut, 10529[a]
8 Resistor mounting bracket, 53333[a]
9 Tubing[a]
10 Tubing[a]
11 Resistor, 20025 (includes item 6) [a]
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
19 Selector magnet, 53550A
20 Electrical connector, 20419
21 Magnet bracket, 52292
22 Setscrew, 10220
23 Bar magnet, 61973
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 Hexagonal nut, 10507
33 Armature stop bracket, 52529
34 Armature leaf spring stop screw, 53183
35 Hexagonal nut, 10507
36 Setscrew, 10221
37 Setscrew, 10235
38 Selector magnet bracket, 52528

[a]Not applicable to TT-664(*)/FG and TT-665/FG.

Figure 2-39. Nonterminal selector magnet, exploded view.

spring post on the signal bell bracket (14).

(7) Remove the retainer ring (12) and the motor stop function lever (13).

b. Reassembly.

(1) Reassemble the signal bell by reversing the procedures outlined in *a* above.

(2) Adjust the signal bell (para 2-226).

2–56. Disassembly and Reassembly of Manual Space Mechanism

a. Disassembly.

(1) Remove 'the retainer ring (1, fig. 2-54) that holds the stop bar shift lever (3) to the connector link (5). Remove the retainer ring (2) that holds the stop bar shift lever (3) on the stud (4). Remove the stop bar shift lever.

(2) Remove the retainer ring (1, fig. 2-45) that holds the link (7) to the manual space bell crank (9).

(3) Remove the stud (4, fig. 2-54). Remove the assembled push button and link (items 2, 3, 4, 5, 6, and 7, fig. 2-45).

(4) Remove the manual space pushbutton (2) from the link (7). Remove the manual space pushbutton spring (3), bracket (4), and washer (5).

(5) Remove the nut (6) from the link (7).

(6) Remove the retainer ring (8) and the manual space bell crank (9).

(7) Remove the self-locking hexagonal nut (10) and bracket (11).

b. Reassembly.

(1) Reassemble the manual space mechanism by reversing the procedure outlined in *a* above.

(2) Adjust the manual space mechanism (para 2-158).

2–57. Disassembly and Reassembly of Function Mechanism

a. Disassembly.

(1) Remove the self-locking hexagonal nut (10, fig. 2-45). Remove the manual space bracket (11).

(2) Remove the mounting bracket stud (1, fig. 2-46), lockwasher (2), mounting bracket stud (3), and lockwasher (4) that hold the function bracket (24) to the function side of the teletypewriter frame.

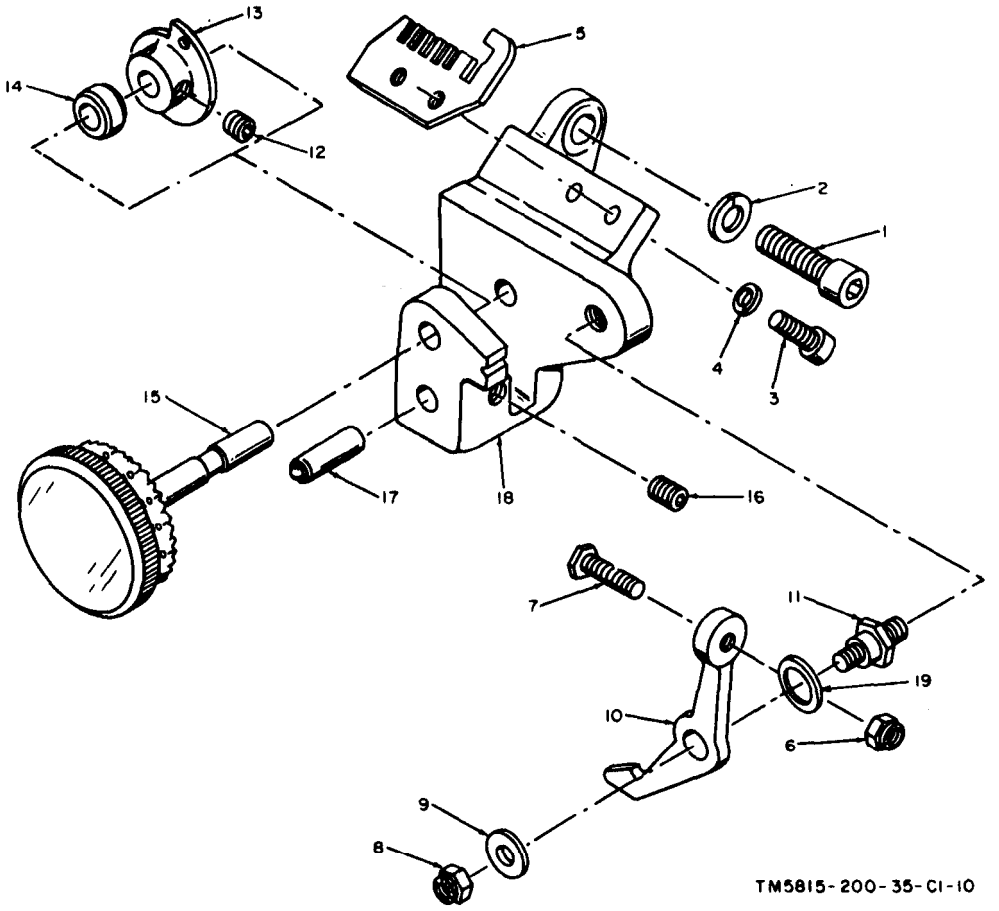
(3) Remove the retainer ring (5) and the assembled function bracket mechanism.

(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 the platen latch (8), and the felt washer (36), if present.

(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). Catch the" two felt washers (37), if present.



1 Machine screw, 10018
2 Lockwasher, 10431
3 Machine screw, 10004
4 Lockwasher, 10429
5 Selector lever guide comb, 50511
6 Self-locking hexagonal nut, 10500
7 Machine screw, 10090
8 Self-locking hexagonal nut, 10500
9 Flat washer, 50414
10 Orientation lever, 53112
11 Orientation lever stud, 53111
12 Setscrew, 10203
13 Rangefinder cam. 50317
14 Spacer, 51424
15 Rangefinder dial assembly, 52920A
16 Setscrew, 10203
17 Positioning ball, 53306A
18 Selector lever comb bracket, 53109
19 Felt washer, 61480 (included as lubrication reservoir on some teletypewriters)

Figure 2-40. Range finder, exploded view.

(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), Catch the two felt washers (38), if present.

(10) Remove the self-locking hexagonal nut (15) and the function cam follower pivot stud (16).

(11) Remove the felt washers (39), if present, nnd loosen the two setscrews (18). Remove the pivot (19) slowly and catch the shaft collar (20), carriage-feed lever (21), spacer (22), the three felt washers (40), if present, and the unshift lever (23) as they fall from the pivot.

(12) Remove the two machine screws (25) and lockwwshers (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), motor stop punch bar (32), blank punch bar (34), and letters punch bar (35) from the punch bar guide block (33).

b. Reassembly.

(1) Reassemble the function mechanism by reversing the steps and procedures outlined in *a(2)* through (13) above.

(2) Replace the manual space bracket by reversing the removal procedures outlined in *a* (1) above.

2-58. Disassembly and Reassembly of Line Feed and Platen Shift (Not Applicable to TT-98C/FG)

a. Disassembly.

(1) Remove the retainer ring (1, fig. 2-47) and the delaying lever (2) and felt washer (38) if present.

(2) Remove the delaying latch spring (3) from the delaying latch (5) and from the stop bar shift link bracket (9).

(3) Remove tile retainer ring (4) and the delaying latch (5) from the pivot stud on the stop bar shift link bracket (9). Remove the felt washer (39) if present.

(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 figures-shift cam follower spring (11) from the platen shift 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 (17).

(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), and the felt washer (40) if present.

(12) Remove the platen shift bell crank spring (25) frolll tile platen shift bell crank and from the platen bracket link.

(13) Remove the set screw (36, fig. 2-19) that holds the spacing collar (37) to the cam follower stop stud (38). Remove the spacing collar and the cam follower stop stud.

(14) Remove the retainer ring (26, fig. 2-47) 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 (para 2-22 *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) and remove the felt washer (41) if present.

(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).

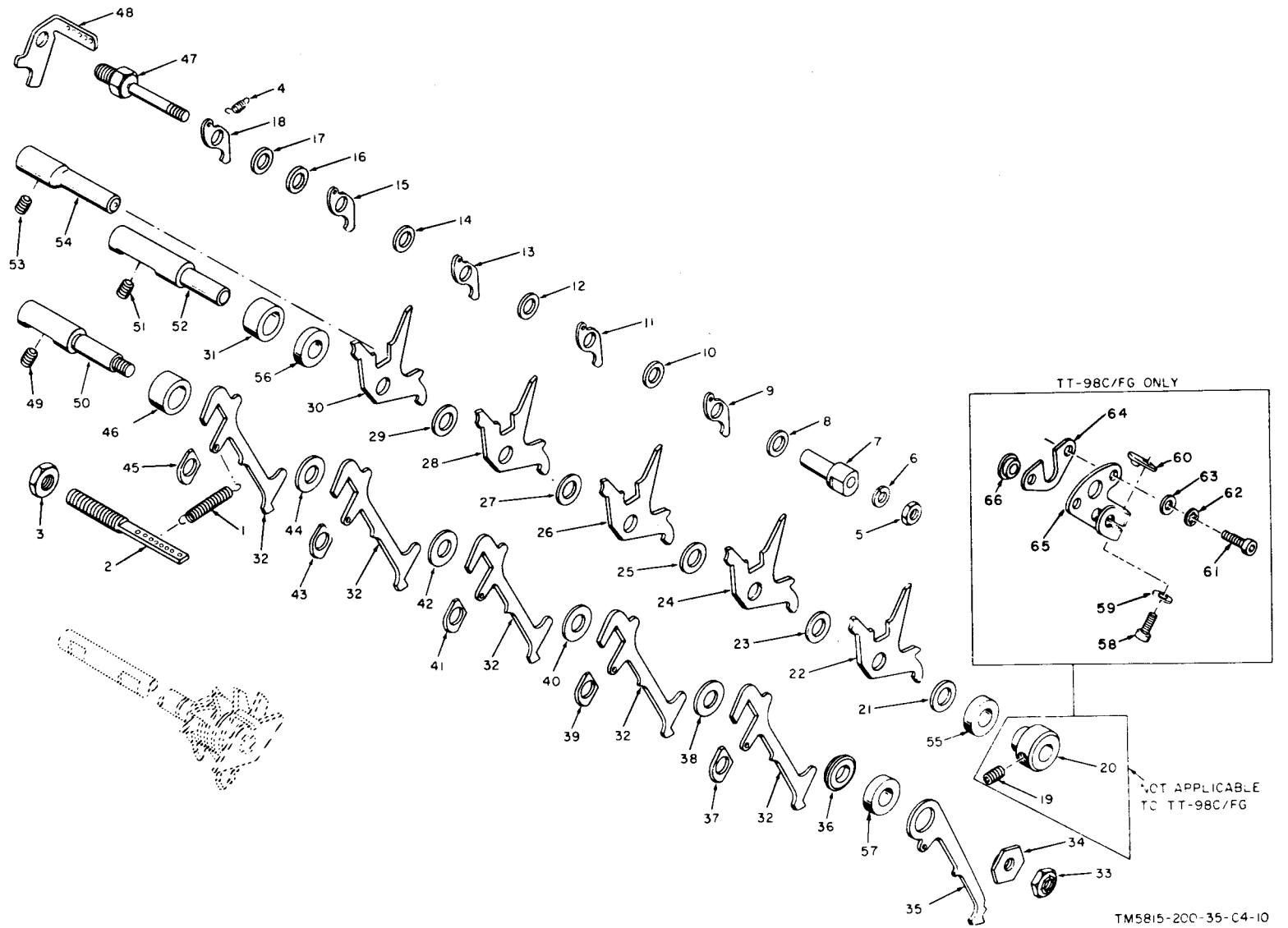
(19) Remove the retainer ring (33) from the pivot post on the bell crank pivot bracket (37). Remove the platen lower case latch (34) and the felt washers (42) and (43) if present.

(20) Remove the two machine screws (35) and lockwashers (36). Remove the bell crank pivot bracket (37).

b. Reassembly.

(1) Reassemble the line feed and platen shift mechanism by reversing the procedures outlined in *a* above.

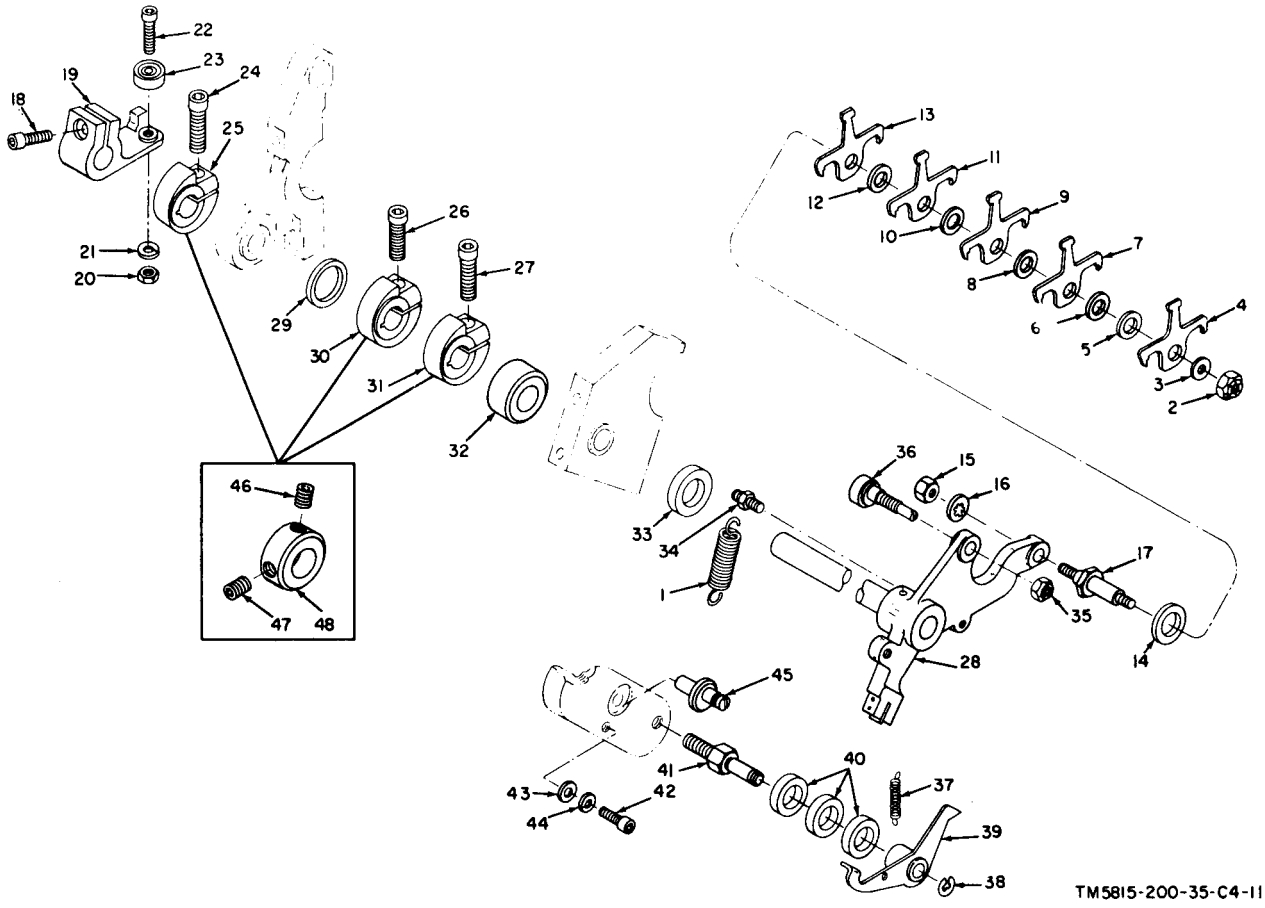
(2) Adjust tile line feed and platen shift mechanism (paras 2-202, 2-204, and 2–211 through 2-214).


TT-98C/FG ONLY
NOT APPLICABLE TO TT-98C/FG
TM5815-200-35-C4-10

1 Selector lever spring, 50902
2 Anchor post, 50325
3 Hexagonal nut, 10509
4 Y-lever detent spring, 55009
5 Hexagonal nut, 10504
6 Lockwasher, 10434
7 Centering sleeve, 55007
8 Thrust washer, 55001
9 Y-lever detent (part of Y-lever detent set 5004A, which also includes items 11, 13, 15, and 18.
10 Thrust washer, 55001
11 Y-lever detent
12 Thrust washer, 55001
13 Y-lever detent
14 Thrust washer, 55001
15 Y-lever detent
16 Thrust washer, 55001
17 Flat washer, 55076
18 Y-lever detent
19 Setscrew, 10209
20 Spacing collar, 55006
21 Flat washer, 50148
22 Y-lever, 53540A (set of 5; consists of items 22, 24, 26, 28, and 30)
23 Flat washer, 50148
24 Y-lever
25 Flat washer, 50148
26 Y-lever
27 Flat washer, 50148
28 Y-lever
29 Flat washer, 50148
30 Y-lever
31 Collar, 51416
32 Selector lever, 51068A (set of 5)
33 Self-locking hexagonal nut, 10500
34 Eccentric bearing, 50146
35 Stop lever, 50014
36 Flat washer, 50053
37 Bearing, 50019A (set of 6; consists of items 37, 39, 41, 43 and 45 and one spacer)
38 Flat washer, 50147
39 Bearing
40 Flat washer, 50147
41 Bearing
42 Flat washer, 50147
43 Bearing
44 Flat washer, 50147
45 Bearing
46 Collar, 51416
47 Y-lever detent pivot, 55008
48 Y-lever detent spring bracket, 55002
49 Setscrews, 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
55 Felt washer, 61478 [a]
56 Felt washer, 61469 [a]
57 Felt washer, 61479 [a]
58 Machine screw, 10006
59 Flat washer, 10459
60 Clamp nut, 50174
61 Machine screw, 10002
62 Lockwasher, 10403
63 Flat washer, 50319
64 Y-lever eccentric tie, 60678
65 Y-lever stud bracket, 60677
66 Spacer, 60679

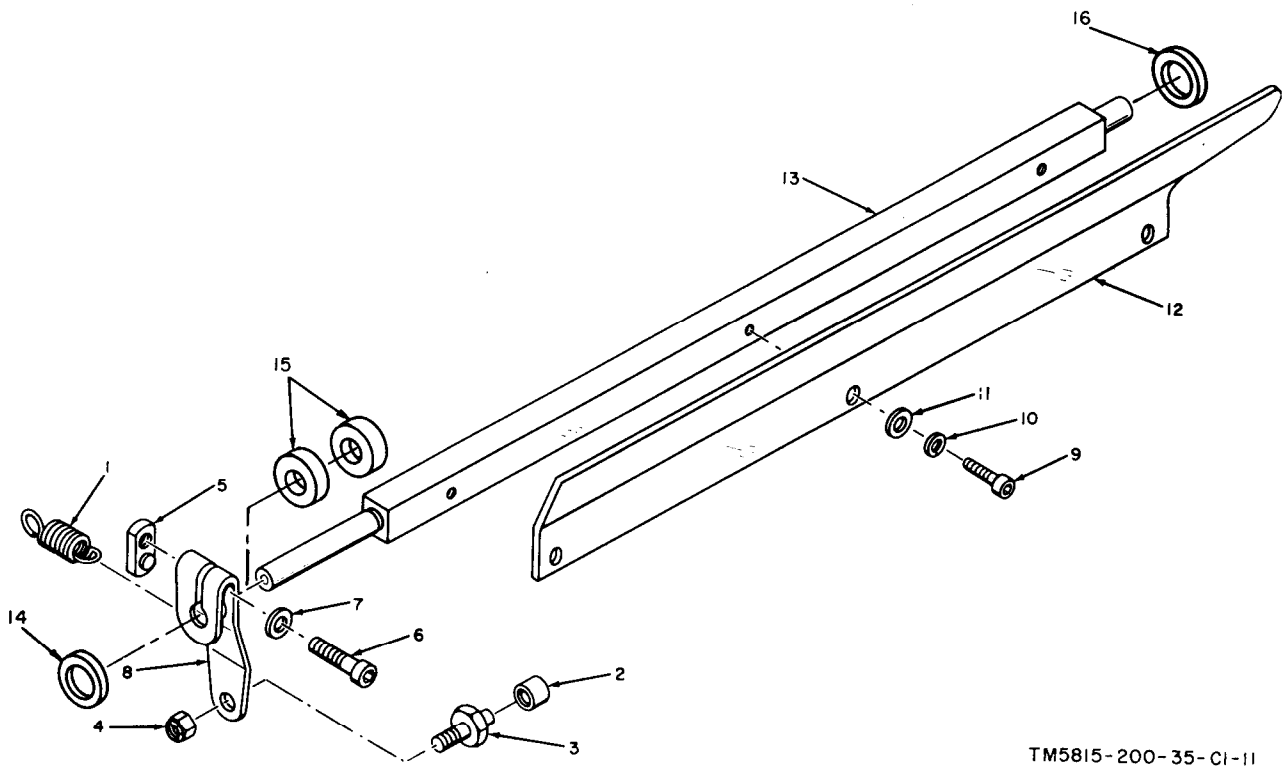
Figure 2–41. Selector levers and Y-levers, exploded view.

[a] Included as lubrication reservoirs on some teletypewriters.



1 Transfer lever spring, 50903
2 Self-locking hexagonal nut, 10500
3 Flat washer, 50414
4 T-lever, 56766A (includes items 7, 9, 11, and 13)
5 Shim, 57072 or 57073
6 Flat washer, 50148 (includes items 8, 10, and 12)
7 T-lever
8 Flat washer
9 T-lever
10 Flat washer
11 T-lever
12 Flat washer
13 T-lever
14 Felt, 61480
15 Hexagonal nut, 50651
16 Lockwasher, 10404
17 T-lever pivot stud, 50650
18 Machine screw, 10008
19 Clutch latch, 50535
20 Hexagonal nut, 10504
21 Lockwasher, 10434
22 Machine screw, 10000
23 Ball bearing, 10754
24 Machine screw, 10010
25 Shaft collar, 53973
26 Machine screw, 10010
27 Machine screw, 10010
28 Transfer lever assembly, 52394 (without flats) or 52434A (with flats)
29 Felt, 61488
30 Shaft collar, 53973
31 Shaft collar, 53973
32 Collar, 57922
33 Felt, 61489
34 Spring stud, 50649
35 Hexagonal nut, 10501
36 Transfer lever roller stud, 56185A
37 Spring, 50904
38 Retainer ring, 10949
39 Transfer lever latch, 50020A
40 Felt, 61467
41 Transfer lever latch stud, 52319
42 Machine screw, 10003
43 Flat washer, 50829
44 Lockwasher, 10429
45 Spring post eccentric, 56076
46 Setscrew, 10209
47 Setscrew, 10209
48 Shaft collar, 50327

Figure 2-42. Transfer lever shaft, exploded view.



1 Print cam follower spring, 50921
2 Bushing, 50843
3 Stud, 50886
4 Locknut, 10501
5 Nut, 50174
6 Machine screw, 10046
7 Plain 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
14 Felt washer, 61480 [a]
15 Felt washer, 61481 [a]
16 Felt washer, 61482 [a]

Figure 2-43. Print bail blade shaft, exploded view.

[a]Included as lubrication reservoir on some teletypewriters.

2-59. Disassembly and Reassembly of Line-Feed and Platen Shift Mechanisms (TT-98C/FG)

(fig. 2-48)

a. Disassembly.

(1) Remove the retainer ring (1), delaying lever (2), and felt (3).

(2) Remove the delaying latch spring (4).

(3) Remove the retainer ring (5), delaying latch (6), and felt (7).

(4) Remove the machine screw (8), lockwasher (9), and flat washers (10 and 12).

(5) Remove the stop bar shift link (para 2-68 *a(1)-(7)).* Remove the stop bar shift link bracket (11).

(6) Remove the retainer ring (13) and platen-shift link (14).

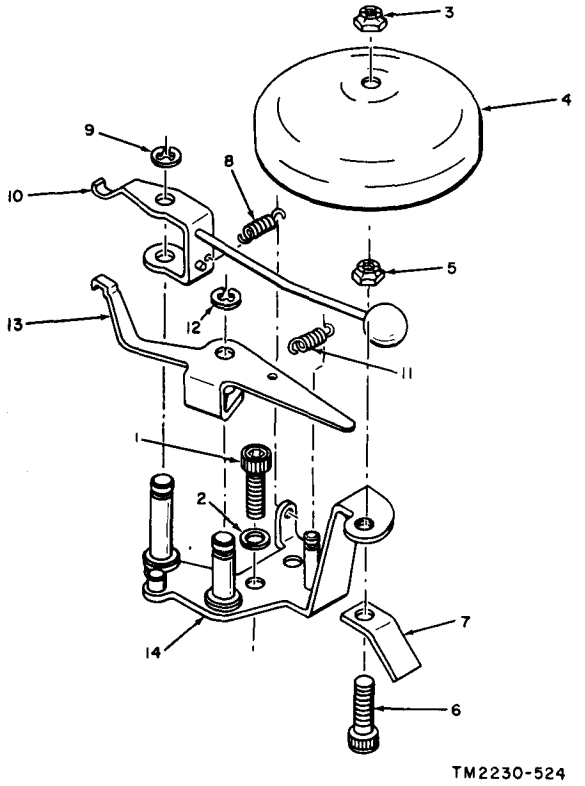
(7) Remove the retainer ring (15). Remove the machine screw (17), lockwasher (18), and flat washer (19). Remove the connect ing link (16) and adjusting link (20).

(8) Remove the pawl spring (21), bellcrank spring (22), and bellcrank pawl spring (23).

(9) Remove the bellcrank post. (24), lock washer (25), flat washer (26), linefeed bellcrank (27) assembly, linefeed bellcrank extension (28), and nut plate (29).

(10) Remove the hexagonal nut (30), lockwasher (31), flat washers (32 and 33), plate assembly (34), bushing (35), linefeed bell crank pawl (36), and shoulder screw (37).

(11) Remove the hexagonal nut (38), flat



1 Machine screw, 10008
2 Lockwasher, 10430
3 Locknut, 10501
4 Signal bell, 51080
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 2-44. Signal bell, exploded view.

washer (39), and line-feed-on-carriage-return pawl (40).

(12) Remove the bellcranks pring (41) and pawl spring (42).

(13) Remove the flat washer (43).

(14) Remove the retainer ring (44) and figures-shift pawl (45).

(15) Remove the platen-shift bellcrank (46).

(16) Remove the machine screw (47), lockwasher (48), flat washer (49), nut plate (50), and platen-shift bellcrank extension (51).

(17) Remove the function shaft (para 2-23 *a*).

(18) Remove the machine screw (52) from the bellcrank pivot bracket (69). Catch the lockwasher (53), flat washers (54, 56, 57, 64, and 65), and spacers (55 and 66) as they fall from the mechanism. Remove the drawbar (59) assembly.

(19) Remove the two machine screws (60), lockwashers (61), flat washer-s (62) and adjustable blocks (63) from the drawbar.

(20) Remove the two machine screws (67) and lockwashers (68). Remove the bellcrank pivot bracket (69).

(21) Remove the platen lower-case latch spring (70). Remove the retainer ring (71) from the pivot post of the bellcrank pivot bracket (69). Remove the platen lower-case latch (72).

b. Reassembly.

(1) Reassemble the line-feed and platen-shift mechanism by reversing the procedures in *a* above.

(2) Adjust the line-feed and platen-shift mechanism as described in paragraphs 2-108, 2-109, 2-205, and 2-211 through 2-214.

2-60. Disassembly and Reassembly of Square Shaft

(fig. 2-49)

a. Disassembly.

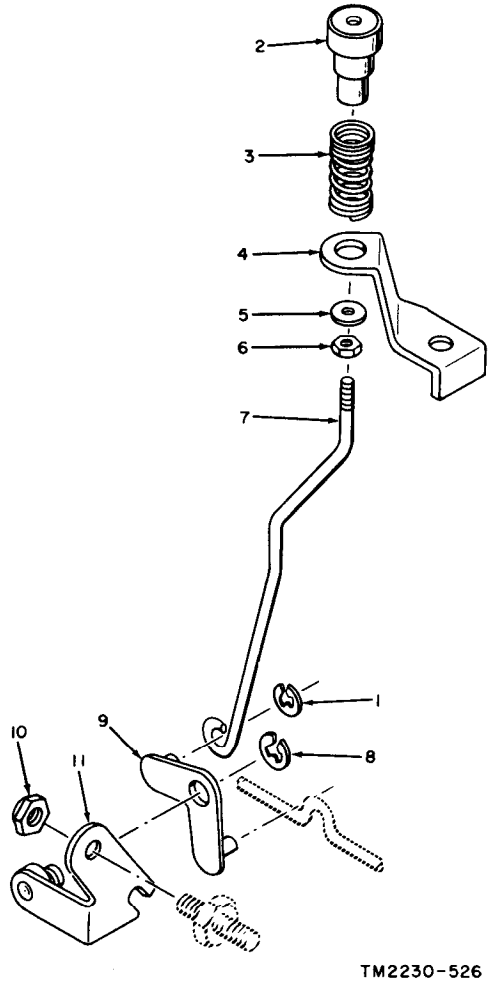
(1) Loosen the four setscrews (10) that hold the square shaft driven gear (11) to the square shaft and to the stop arm shaft.

(2) Remove the assembled cam follower support lever and function cam follower as instructed in paragraph 2-57 *a* (7).

(3) Remove the function selecting arm (1), function selecting arm spring (2), and, the felt washer (14), if present, 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) toward the function side of the teletypewriter to dis-



1 Retainer ring, 10960
2 Manual space pushbutton, 55508
3 Manual space pushbutton 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 2-45. Manual space mechanism, exploded view.

lodge the ball bearing (8) from its seat in the teletypewriter frame. Remove the ball bearing (8) and spacing collar (9) from the shaft.

(6) Pull the square shaft (13) through the opening in the teletypewriter frame. Catch the square shaft driven gear (11) and sliding helical gear (12) as they fall from the shaft. Catch the felt washer (15), if present.

b. Reassembly.

(1) Insert the square shaft (13) into the opening in the function side of the teletypewriter frame. If available, install a felt washer (15) on the square shaft. Install the sliding helical gear (12), with the flatted portion of the gear toward the rear of the teletypewriter and tile square shaft driven gear (11) on the square shaft.

(2) Install the end of the square shaft (13) on the stop arm 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 ($), spring ret airier (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). If available, install a felt washer (14) on the square shaft.

(5) Install the function selecting arm spring (2) and function selecting arm (1) on the square shaft (13) .

((i) Replace the assembled function cam follower support lever and function cam follower by reversing the procedures outlined in paragraph 2-57 *b* (7).

(7) Adjust the square shaft (paras 2-142, 2-180, and 2-181) .

2-61. Disassembly and Reassembly of Function Shaft

(fig. 2-17) (fig. 2-18 on TT-98C/FG

a. Disassembly.

(1) Remove the function shaft from the teletypewriter (para 2–22 *a*).

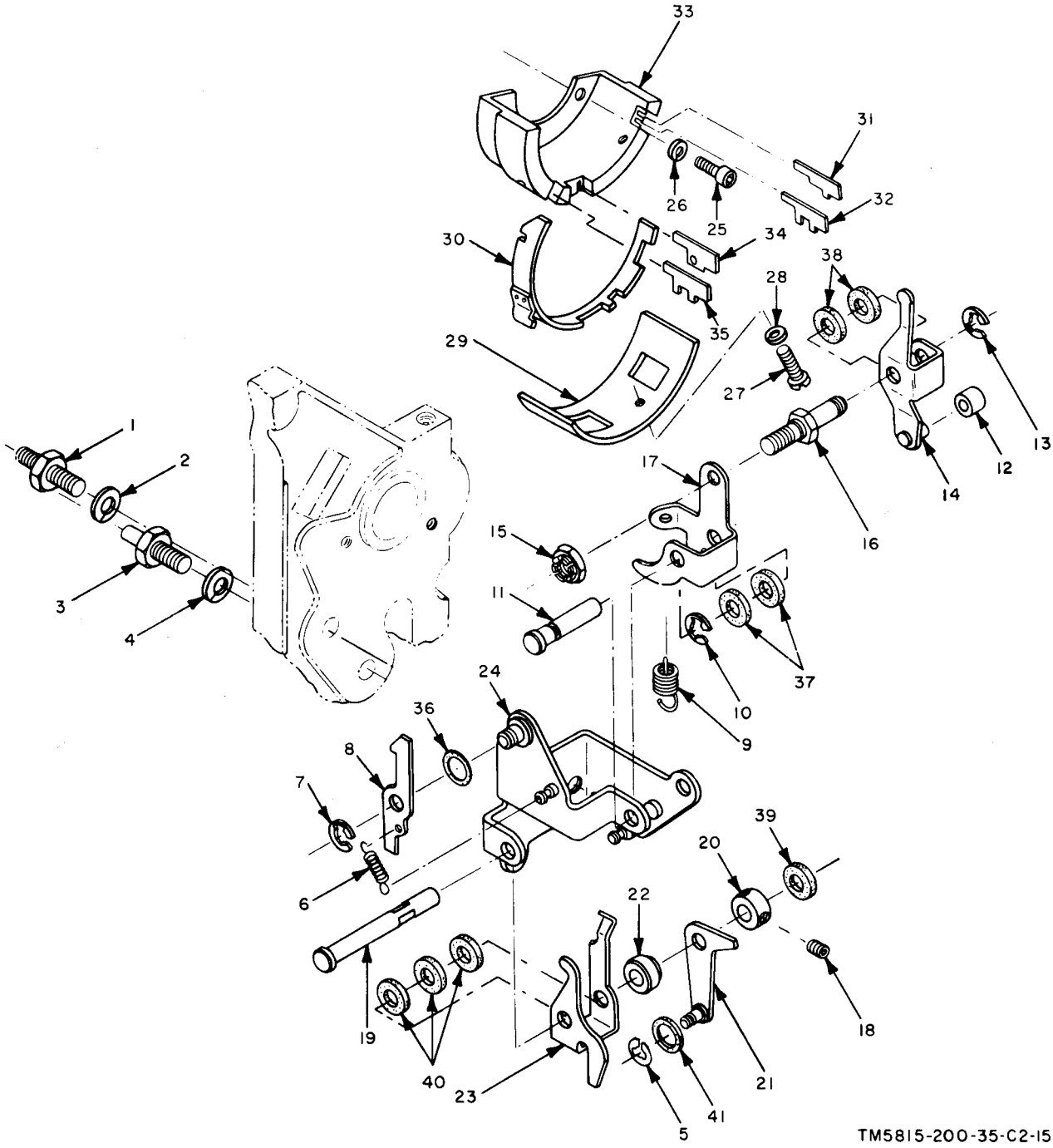
(2) Remove the machine screw (9), lockwasher (10), and flat washer (11). Remove the transfer lever restoring cam (12) (and spacer (53) on TT-98C/FG), flat washer (13), locking bail cam (14), flat washer (15), flat washer (16), ball bearing (17), and flat washer (18) from the function shaft.

(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 machine screws (26) and 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), felt washer (49), if present, 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), felt washer (50), if present and clutch spring (38).

(9) Remove the two setscrews (39) and the flexible coupling disk (40).

(10) On TT-99/FG only, remove the setscrew (47) and the pulsing cam (48).

(11) Remove the two setscrews (41) and the print cam (42).

(12) Remove the two setscrews (43), the function cam (44), and, if present, the felt washer (51).

(13) Remove the sleeve bearing (45) and if present, the felt washer (52) from the function shaft.

b. Reassembly.

(1) Install felt washer (51) and (53, if available) and the sleeve bearing (45) on the function shaft.

(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) On TT-99/FG only, position the pulsing cam (48) on the function shaft (46). Secure it with the setscrew (47).

(5) Position the flexible coupling disk (40) on the function shaft (46), Secure it with the two setscrews (39).

(6) Position the clutch spring (38), felt washer (50, if available), 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).

(7) Install the two flat washers (35 and 34), function driven gear (33), felt washer (49, if available), and flat washer (32) on the function shaft (46). Install the retainer ring (31).

(8) Position the ball bearing (30) on the function shaft (46).

(9) Position the driving collar (29) on the function shaft (46). Secure it with the setscrews (28).

(10) Place the friction clutch adjusting collar (27) on the driving collar (29). Adjust it as instructed in paragraph 2-145, and secure it with machine screws (26).

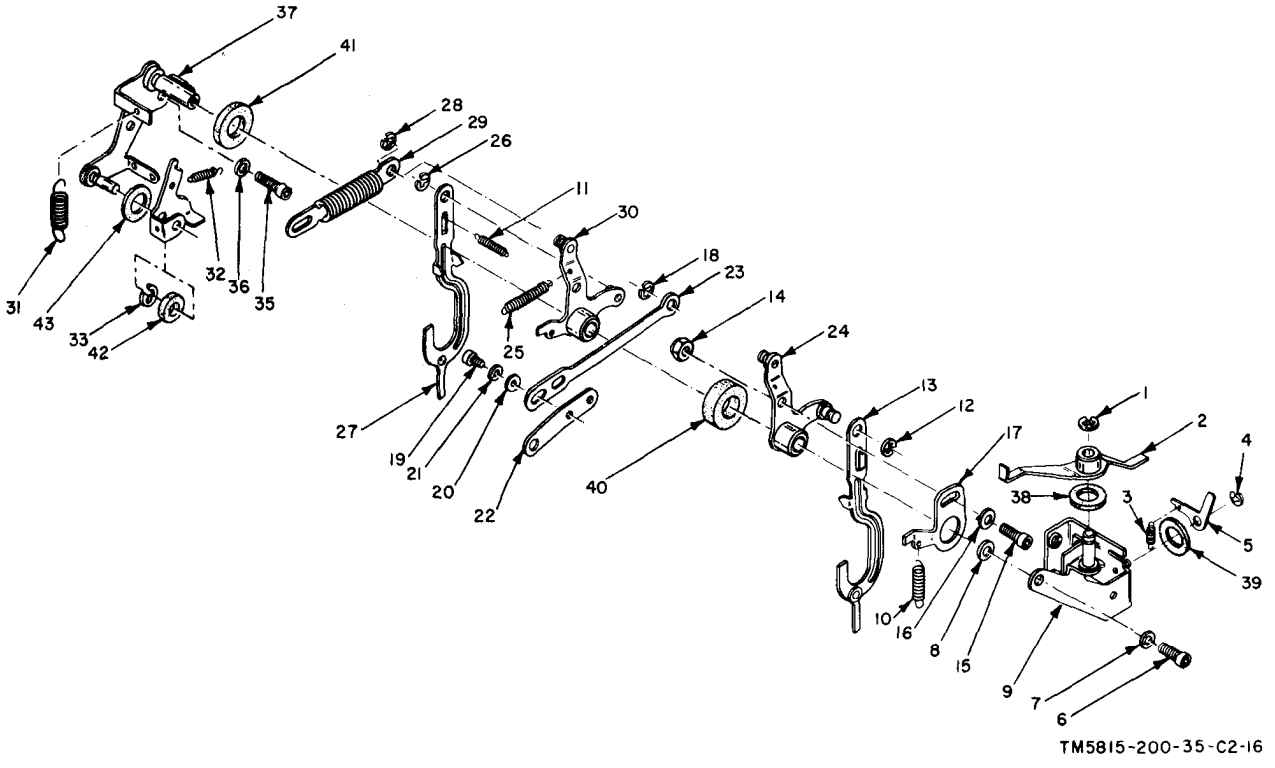
(11) Position the clutch pressure, spring (25) and the friction clutch plate (24) on the function shaft (46) so that the friction clutch plate engages the driving collar (29). Position the friction plate (23),

---

1 Mounting bracket stud, 55501
2 Lockwasher, 10431
3 Mounting bracket stud, 55502
4 Lockwasher, 14031
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, 10203
19 Pivot, 50829
20 Shaft collar, 50391
21 Carriage-feed lever, 53129
22 Spacer, 51424
23 Unshift lever, 52454
24 Function lever bracket, 52543A
25 Machine screw, 10004
26 Lockwasher, 10429
27 Machine screw, 10304
28 Lockwasher, 10429
29 Sideplate, 50735 (52770A on TT-99/FG)
30 Aperture gate, 50743A
31 Signal bell punch bar, 50881
32 Motor stop punch bar, 50755 (53606 on TT-99/FG)
33 Punch bar guide block, 51428
34 Blank punch bar, 53648
35 Letters punch bar, 50755
36 Felt washer, 61492 [a]
37 Felt washer, 61475 [a]
38 Felt washer, 61475 [a]
39 Felt washer, 61475 [a]
40 Felt washer, 61475 [a]
41 Felt washer, 61486 [a]

Figure 2-46. Function mechanism, exploded view.

[a] Included as lubrication reservoir on some teletypewriters.



1 Retainer ring, 10949
2 Delaying lever, 52960A
3 Delaying latch spring, 50916
4 Retainer ring, 10960
5 Delaying latch, 52963
6 Machine screw, 10003
7 Lockwasher, 10429
8 Flat washer, 10450
9 Stop bar shift link bracket, 55730A
10 Adjustable bell crank spring, 51755
11 Line-feed and figures-shift cam follower spring, 50901
12 Retainer ring, 10949
13 Line-feed cam follower, 51714A
14 Self-locking hexagonal nut, 10500
15 Machine screw, 10003
16 Flat washer, 10450
17 Adjustable bell crank, 53462
18 Retainer ring, 10949
19 Machine screw, 10001
20 Flat washer, 10450
21 Lockwasher, 10429
22 Connecting link, 51771
23 Connecting link, 50474
24 Line-feed bell crank, 53136A
25 Platen shift bell crank spring, 51645
26 Retainer ring, 10949
27 Platen shift cam follower, 51712A
28 Retainer ring, 10949
29 Platen shift link, 56676A
30 Platen shift bell crank, 53135A
31 Carriage-return bell crank spring, 50906
32 Platen lower case latch spring, 50920
33 Retainer ring, 10960
34 Platen lower case latch, 52748
35 Machine screw, 10025
36 Lockwasher, 10430
37 Bell crank pivot bracket, 52303A
38 Felt washer, 61483 [a]
39 Felt washer, 61483 [a]
40 Felt washer, 61669 [a]
41 Felt washer, 61668 [a]
42 Felt washer, 61474 [a]
43 Felt washer, 61483 [a]

Figure 2-47. Line-feed and platen shift mechanism, exploded view (not applicable to TT-98C/FG).

[a] Included as lubrication reservoir on some teletypewriters.

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).

(12) Position the flat washer (18), ball bearing (17), flat washer (16), flat washer (15), locking bail cam (14), flat washer (13) (and spacer (53) on TT-98C/FG), and transfer lever restoring cam (12) on the function shaft (46). Secure them with a machine screw (9), lockwasher (10), and flat washer (11).

(13) Replace the function shaft in the teletypewriter (para 2-22 *b*).

2-62. Disassembly and Reassembly of Selector Camshaft

(fig. 2-50).

(1) Remove the orientation lever from the rangefinder (para 2–51 *a* (3)).

(2) Remove the two machine screws (1) and lockwashers (2) that, hold the selector camshaft ball bearing (15) to the selector side of the teletypewriter.

(3) Remove the two setscrews (3) that hold the friction clutch disk (6) to the selector camshaft (18).

(4) Remove the machine screws (4). Remove the friction clutch adjusting collar (13) from the driving collar (12). Remove the two setscrews (5) from the driving collar.

(5) Remove the selector camshaft assembly (18) and ball bearing (15) from the teletypewriter. Catch the friction clutch disk (6), friction plate (7), driving disk (8), friction plate (9), friction clutch plate (10), friction clutch spring (11), and the driving collar (12) as they fall from the selector camshaft.

(6) Remove tile retainer ring (14) and the ball bearing (15).

(7) Bend the tab on the end of selector camshaft (18) to release stop plate (17). Pull the grooved spindle (16) and the stop plate (17) out of the assembly. Turn the grooved spindle counterclockwise to separate it from the stop plate.

b. Reassembly.

(1) Position the selector camshaft ball bearing (15) on the selector camshaft (18) and install retainer ring (14).

(2) Insert the selector camshaft (18) in tile opening in the teletypewriter. Install the driving 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 teletypewriter with the two machine screws (1) and lockwashers (2).

(4) Position the driving collar (12) on tile selector camshaft (18) so that the holes in the collar line up with the flats on the retainer camshaft. Secure the collar with the two setscrews (5).

(5) Position the friction clutch disk (6) on the selector camshaft (18) 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) Place the friction clutch adjusting collar (13) on the driving collar (12). Adjust it as instructed in paragraph 2-127 and tighten the machine screws (4) to lock the adjustment.

(7) Replace tile grooved spindle (16) in the selector camshaft.

(8) 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.

(9) Replace the orientation lever on the rangefinder (para 2–51 *b).*

2-63. Disassembly and Reassembly of Main Shaft

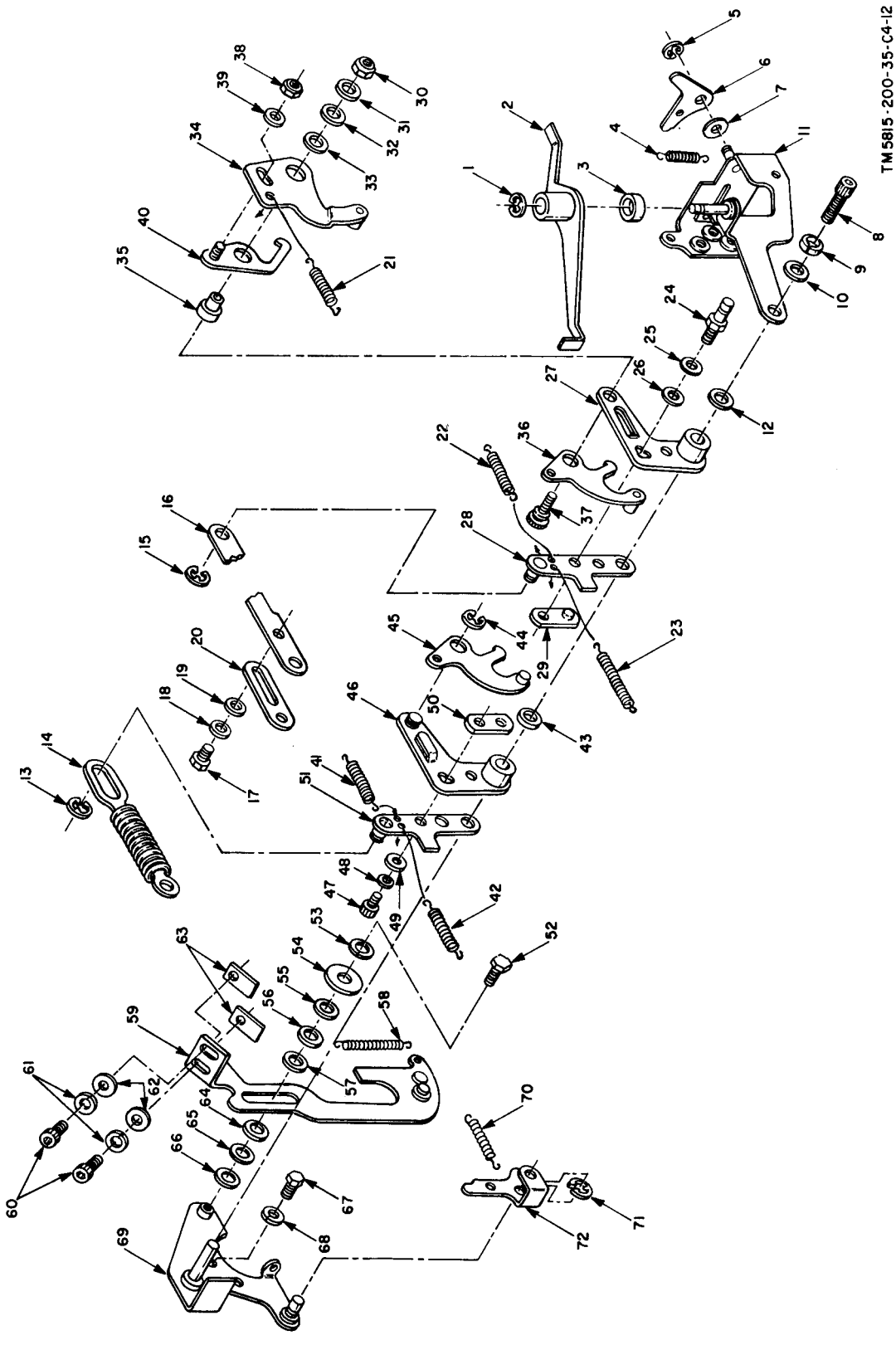
(fig. 2-19)

a. Disassembly.

(1) Remove the main shaft (para 2-24 *a*).

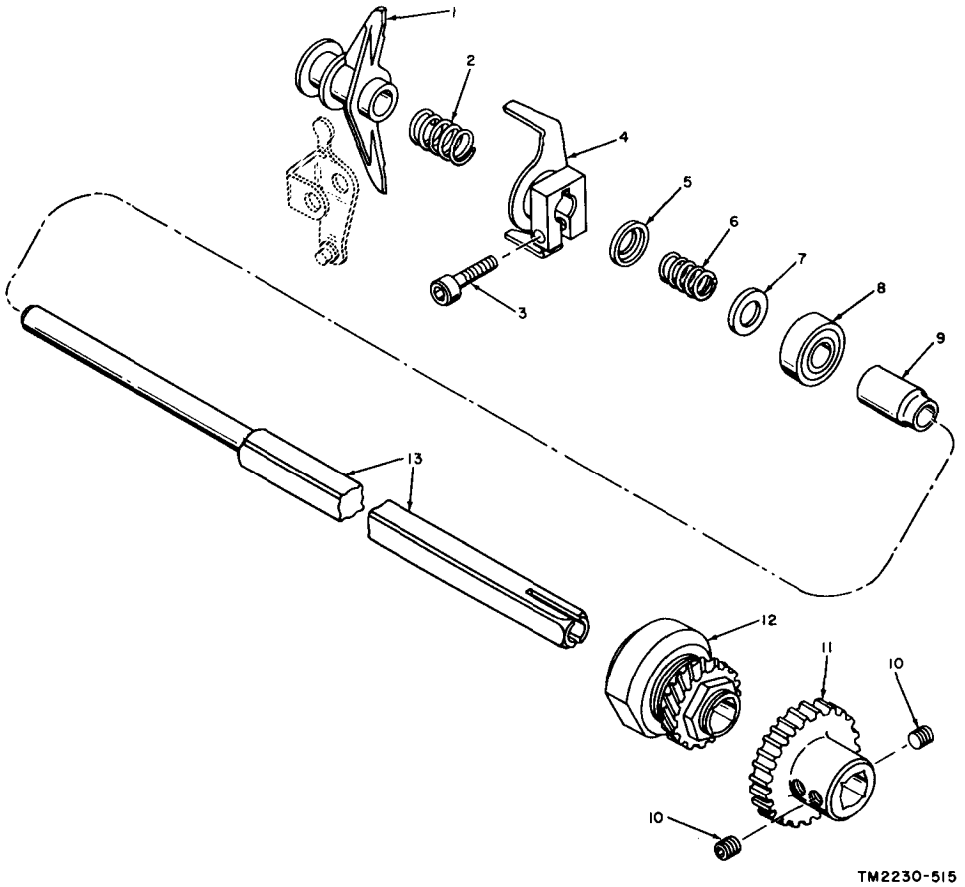
(2) Remove the two setscrews (11) and the clutch fork (12).

(3) Remove the ball bearing (13) from the main shaft.


TM5815-200-35-C4-12

1 Retainer ring, 10949
2 Delaying lever, 52960A
3 Felt, 61483
4 Delaying latch spring, 50916
5 Retainer ring, 10960
6 Delaying latch, 52963
7 Felt, 61483
8 Machine screw, 10003
9 Lockwasher, 10429
10 Flat washer, 10450
11 Stop bar shift link bracket, 57997A
12 Flat washer, 10450
13 Retainer ring, 10949
14 Platen-shift link, 62611A
15 Retainer ring, 10949
16 Connecting link, 57979
17 Machine screw, 10303
18 Lockwasher, 10429
19 Flat washer, 10458
20 Adjusting link, 62590
21 Pawl spring, 62154
22 Bellcrank spring, 57875
23 Bellcrank pawl spring, 62169
24 Bellcrank post, 62130
25 Lockwasher, 10429
26 Flat washer, 10450
27 Line-feed bellcrank, 62114A
28 Line-feed bellcrank, extension, 57920A
29 Nut plate, 52073
30 Hexagonal nut, 10507
31 Lockwasher, 10426
32 Flat washer, 10467
33 Flat washer, 63577
34 Plate assembly, 62138A
35 Bushing, 62146
36 Line-feed bellcrank pawl, 57945A
37 Shoulder screw, 62145
38 Hexagonal nut, 10551
39 Flat washer, 50320
40 Line-feed-on-carriage-return pawl, 62113A
41 Bellcrank spring, 57825
42 Pawl spring, 59310
43 Flat washer, 10450
44 Retainer ring, 10959
45 Figures-shift pawl, 57947A
46 Platen-shift bellcrank, 57914A
47 Machine screw, 10032
48 Lockwasher, 10430
49 Flat washer, 10454
50 Nut plate, 52073
51 Platen-shift bellcrank extension, 57920
52 Machine screw, 10398
53 Lockwasher, 10429
54 Flat washer, 57872
55 Spacer, 57924
56 Flat washer, 57873
57 Flat washer, 57873
58 Drawbar spring, 57871
59 Drawbar, 57939A
60 Machine screw, 10003
61 Lockwasher, 10421
62 Flat washer, 10459
63 Adjustable block, 62151
64 Flat washer, 57873
65 Flat washer, 57873
66 Spacer, 57924
67 Machine screw, 10076
68 Lockwasher, 10430
69 Bellcrank pivot bracket, 57910A
70 Platen lower-case latch spring, 50920
71 Retainer ring, 10960
72 Platen lower-case latch, 52748

Figure 2-48. Line-feed and platen shift mechanisms (TT-98C/FG).



1 Function selecting arm, 50936
2 Function selecting arm spring, 50917
3 Machine screw, 10009
4 Function selecting arm claw, 50841A (includes item 3)
5 Spring retainer, 56277
6 Square shaft bearing spring, 56279
7 Spring retainer, 56277
8 Ball bearing, 10753
9 Spacing collar, 56278
10 Setscrew, 10209
11 Square shaft driven gear, 50383 (62136 on TT-98C/FG)
12 Sliding helical gear, 50565A
13 Square shaft, 50456

Figure 2-49. Square shaft, exploded view.

(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 (19).

(7) Remove the taper pin (20) and remove the transmitter shaft drive gear (21).

b. Reassembly.

Caution: **Use taper pins 10860 and 10862 (fig. 2-19) when installing new taper pins in the *original* main shaft in teletypewriters bearing Order No. 27133-Phila-56. When installing a new main shaft, function shaft driving gear, carriage-feed worm gear, or transmitter shaft drive gear, use a tapered reamer to ream the holes in the new part to obtain a snug fit of both parts with the taper pin.**

(1) Reassemble the main shaft by reversing the steps and procedures outlined in *a* (2) through (7) above.

(2) Replace the main shaft para 2-24 *b*.

2-64. Disassembly and Reassembly of Code Ring Cage

(fig. 2-20)

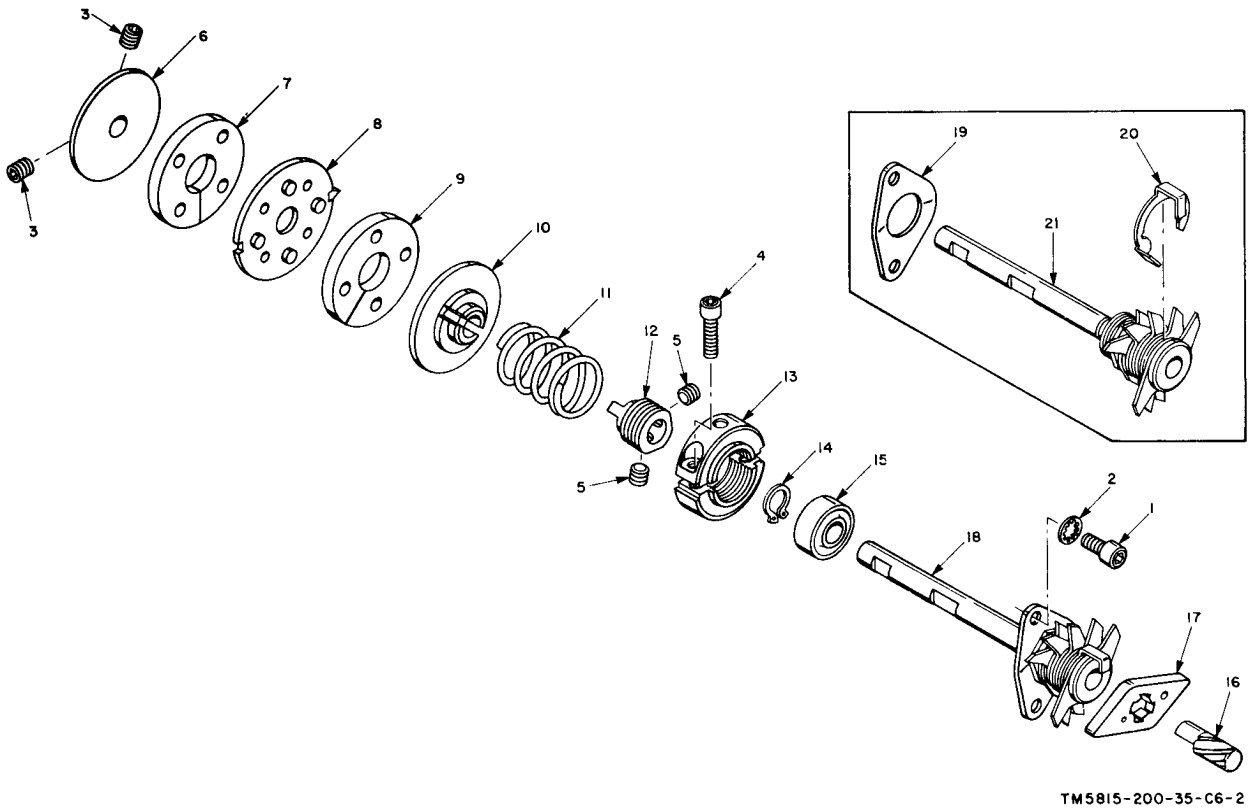
a. Disassembly.

(1) Remove the code ring cage (para 2-25 *a*).

(2) Remove the machine screw (3), square shaft stop arm (4), and if present, felt washer (64).
(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 (57). 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 (57).
(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 bail 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 carrier return stop bar (35), and the figures stop bar (36). On the TT-99/FG only, the blank contact link (61) will fall out when the blank stop bar is removed.
(12) Remove the setscrew (40), three self-locking hexagonal nuts (37), and cage tie bolts (38). Remove the code cage outside guide (39).
(13) Remove the flat washer (41) from the stud on the code bar cage plate (57). 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 (54), code ring cam follower locking lever (55), and the sleeve bearing (56) from the code bar cage plate (57).
(15) If present, remove the two machine screws (60), lockwashers (59), and either the stop bar contact assembly (58) or the stop bracket (63).

b. Reassembly.

(1) Install the sleeve bearing (56), code ring cam follower locking lever (55), and code ring collar (64) on the stud on the code bar cage plate (57).
(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 (57). Alternate a ball retainer and a code ring. 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 stud of the code bar cage plate (57). Secure it with three cage tie bolts (38), self-locking hexagonal nuts (37), and the setscrew (40).
(4) Install the 32 stop bars (33) and 16 stop bar springs (32). On the TT-99/FG only, place the blank contact link (61) on the blank and W stop bar, between the No. 1 code ring and the code cage outside guide (39). 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 the three remaining stop bar 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



1 Machine screw, 10003
2 Lockwasher, 10403
3 Setscrew, 10209
4 Machine screw, 10005
5 Setscrew, 10208
6 Friction clutch disk, 50200
7 Friction plate, 56765
8 Driving disk, 51117
9 Friction plate, 56765
10 Friction clutch plate, 54931
11 Friction clutch spring, 54932
12 Driving collar, 54928
13 Friction clutch adjusting collar, 56832A
14 Retainer ring, 10462
15 Selector camshaft ball bearing, 10753
16 Grooved spindle, 50133
17 Stop plate, 50134
18 Selector camshaft, 50125A
19 Retainer, 50115
20 Retainer ring, 67007
21 Camshaft assembly, 67008A

Figure 2-50. Selector camshaft, exploded view.

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 (57).

(10) Position the retainer plate (18) on the code bar cage plate (57). Secure it with the three machine screws (16) and lockwashers (17).

(11) Position tile two dowels (14) in the function stop bar support guide (15) and in the code bar cage plate (57).

(12) Position the three eccentric studs (12) on the bracket (13). Secure them with the three self-locking hexagonal nuts (11).

(13) If available, install a felt washer (64) on the stop arm shaft (5). Position the square shaft stop arm (4) on the stop

arm shaft (5) and secure it with a machine screw (3).

(14) Replace the code ring cage (para 2-25 *b*).

2-65. Disassembly and Reassembly of Function Sensing Lever Group (not applicable to TT-98C/FG)

a. Disassembly.

(1) Remove the square shaft, (para 2-60 *a).*

(2) Remove the line feed and the platen shift mechanism (para 2–58 *a).*

(3) Remove the retainer ring (1, fig. 2-51) from the pivot stud on the connector link (2). Disconnect the. connector link from the double blocking lever (12, fig. 2-21) and remove the connector 1 ink, and if present, the felt washer (21, fig. 2-51).

(4) Remove the retainer ring (3, fig. 2-51) from the pivot stud on the carriage-return bell crank (9). Remove the felt washer (22), if present, and 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) and, if present, felt washers (23 and 25) from the pivot studs.

(6) Remove the ret airier ring (8) from the carriage-return bell crank pivot (10). Remove the carriage-return bell crank (9) and, if present, the felt washer (24) 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 tile flat washer (14), carriage-return sensing lever (15), and flat washer (16).

(12) Remove the figures-shift sensing lever spring (17) from the figures-shift sensing lever (18) and from tile bell crank pivot bracket.

(13) Remove the figures-shift sensing lever (18), felt washers (26), if present spacing collar (19), and tolerance take-up flat washer (20) from the stop arm shaft.

b. Reassembly.

(1) Place the tolerance take-up flat, washer (20), spacing collar (19), two felt washers (26), if available and figures-shift sensing lever (18) on the stop arm shaft.

(2) Hook tile figures-shift sensing lever spring (17) to the figures-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 felt washer (24), if available, and the carriage-return bell crank (9) on the carriage-return bell crank pivot (10). Secure it with a retainer ring (8).

(8) Place the felt washers (23) and (25), if available and the vertical carriage-return link (7) on the pivot studs of 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 felt washer (22), if available and the horizontal carriage-return link (4) on the remaining stud on the carriage-return bell crank (9) and secure it with a retainer ring (3).

(10) Install the connector link (2) and felt washer (21), if available, on the horizontal carriage-return link (4). Adjust the length of the horizontal carriage-return link (para 2-162).

(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) Replace the line feed and the platen shift-mechanism (para 2–58 *b).*

(13) Replace the square shaft (para 2-60 *b).*

2-66. Disassembly and Reassembly of Function Sensing Lever Group (TT-98C/FG)

(figs. 2-21 and 2-52)

a. Disassembly.

(1) Remove the square shaft (para 2-60 *a).*

(2) Remove the line-feed and platen-shift mechanism (para 2–59 *a).*

(3) Remove the retainer ring (1, fig. 2-52) from the stud on the connector link (2). Disconnect the connector link from the double blocking lever (12, fig. 2-21). Disengage the end of the felt (3, fig. 2-52) from the end of the horizontal carriage-return link (5). Remove the connector link and felt.

(4) Remove the retainer ring (4) and horizontal carriage-return link (5).

(5) Remove the retainer rings (6 and 7). Remove the vertical carriage-return link (8).

(6) Remove the felt (9) from the carriage-return sensing lever (24). Remove the felts (10 and 11) from the carriage-return bellcrank (13).

(7) Remove the retainer ring (12) and carriage-return bellcrank (13) from the carriage-return bellcrank pivot (15).

(8) Remove the felt (14) and carriage-return bellcrank pivot (15).

(9) Remove the flat washer (16), line-feed-on-carriage-return sensing lever (17), and flat washer (18), line-feed sensing lever (19), flat washer (20), figures-shift sensing lever (21), and flat washer (22).

(10) Remove the carriage-return sensing lever spring (23) from carriage-return sensing lever (24).

(11) Remove the carriage-return sensing lever (24) and sleeve (25).

(12) Remove the two felts (26) from the spacing collar (27). Remove the spacing collar.

(13) Remove the tolerance takeup flat washer (28) from the stop arm shaft.

b. Reassembly. Reassemble the function sensing lever group by reversing the steps and procedures in a above.

2-67. Disassembly and Reassembly of Manual Unshift Mechanism

(fig. 2-53)

a. *Disassembly.*

(1) Remove the manual unshift push button (2) and hexagonal nut (3) from the manual unshift push-button link (4).

(3) Remove the two machine screws (5) and lockwashers (6) and remove the manual unshift push-button bracket mounting plate (7).

(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 hexagonal nut (11) from the manual unshift lever link (12). Pull the manual unshift lever link through the opening in the function side of the teletypewriter.

(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) Reassemble the manual unshift mechanism by reversing the procedures outlined in a above.

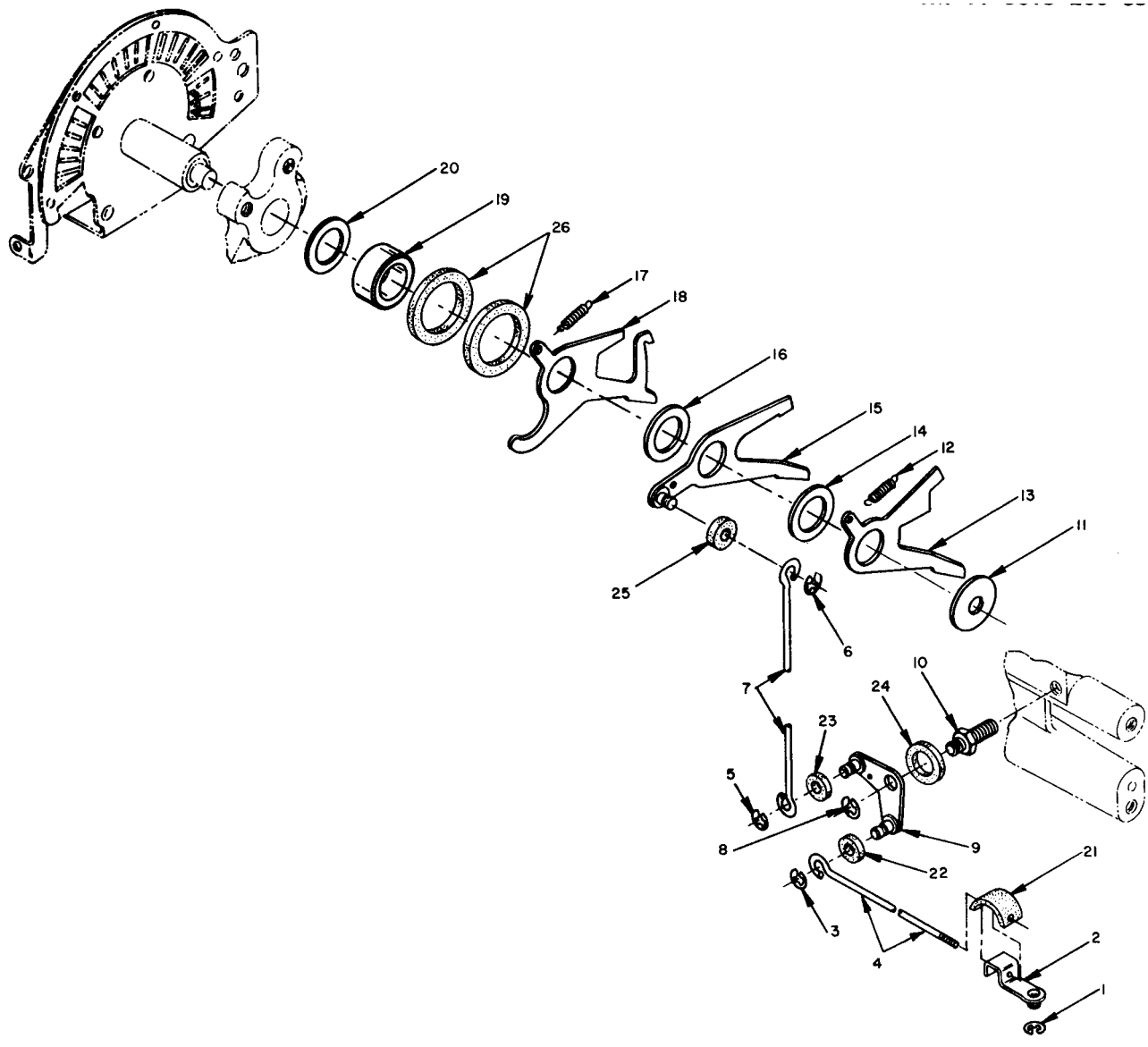
(2) Adjust the manual unshift mechanism (para 2-238).

2-68. Disassembly and Reassembly of Automatic Carriage-Return Mechanism

(fig. 2-54)

a. *Disassembly.*

(1) Remove the retainer ring (1) that holds the automatic carriage-return link connect link (5) to the stop bar shift lever (3).



TM5815-200-35-C2-17

1	**Retainer ring, 10960**	14	Flat washer, 50384
2	**Connector link, 53161A**	15	Carriage-return sensing lever, 52659A
3	**Retainer ring, 10960**	16	Flat washer, 50384
4	**Horizontal carriage-return link, 50864**	17	Figures-shift sensing lever spring, 51754
5	**Retainer ring, 10960**	18	Figures-shift sensing lever, 52749
6	**Retainer ring, 10960**	19	Spacing collar, 50505
7	**Vertical carriage-return link, 50483**	20	Tolerance takeup flat washer, 51100
8	**Retainer ring, 10949**	21	Felt washer, 61677 [a]
9	**Carriage-return bell crank, 52121A**	22	Felt washer, 61483 [a]
10	**Carriage-return bell crank pivot, 52552**	23	Felt washer, 61483 [a]
11	**Flat washer, 50374**	24	Felt washer, 61673 [a]
12	**Line-feed sensing lever spring, 51754**	25	Felt washer, 61677 [a]
13	**Line-feed sensing lever, 53106**	26	Felt washer, 61497 [a]

Figure 2–51. Function sensing lever group, exploded view (not applicable to TT–98C/FG).

[a] **Included as lubrication reservoir on some teletypewriters.**

(2) Remove the retainer ring (2) and the stop bar shift lever (3) from the stud (4).
(3) Remove the connector link (5) from the stop bar shift link (9)
(4) Remove the setscrew 6) from the spring collar (13).
(5) Remove the setscrew (8) from the stop bar shift blade (11).
(6) Remove the setscrew (7) from the stop bar shift stop (10).
(7) Remove the stop bar shift link (9) by moving it toward the function side of the teletypewriter. Catch the stop bar shift stop (10) and stop bar shift blade (11) as they fall from the link. Remove the stop bar return spring (12) and spring collar (13) from the link.

b. Reassembly.

(1) Reassemble the automatic carriage-return mechanism by reversing the procedures outlined in a above.
(2) Adjust the automatic carriage-return mechanism (paras 2–211, 2–212, and 2-213).

2-69. Disassembly and Reassembly of Manual Carriage Return Button Mechanism

(fig. 2-55)

a. Disassembly.

(1) Remove the machine screw (1) and two lockwashers (2) that hold the carriage-return button bracket (8) to the teletypewriter.
(2) Remove the two machine screws (3) and lockwashers (4) and the manual carriage-return bracket (15).
(3) Remove the retainer ring (5) and 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 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 hexagonal nut, (14) from the manual carriage-return bracket (15).

b. Reassembly.

(1) Reassemble the manual carriage-return button mechanism by reversing the procedures outlined in a above.
(2) Adjust the manual carriage-return button mechanism (paras 2-208 and 2-209).

2-70. Disassembly and Reassembly of Carriage-Feed Mechanism

a. Disassembly.

(1) Remove the retainer ring (5, fig. 2-46) that holds the carriage-feed link (3, fig. 2-56) to the carriage-feed lever (21, fig. 2-46). Remove the carriage-feed link from the carriage-feed lever.
(2) Remove the retainer ring (1, fig. 2-56). Remove the assembled carriage-feed link (3) and connector link (2). Remove the

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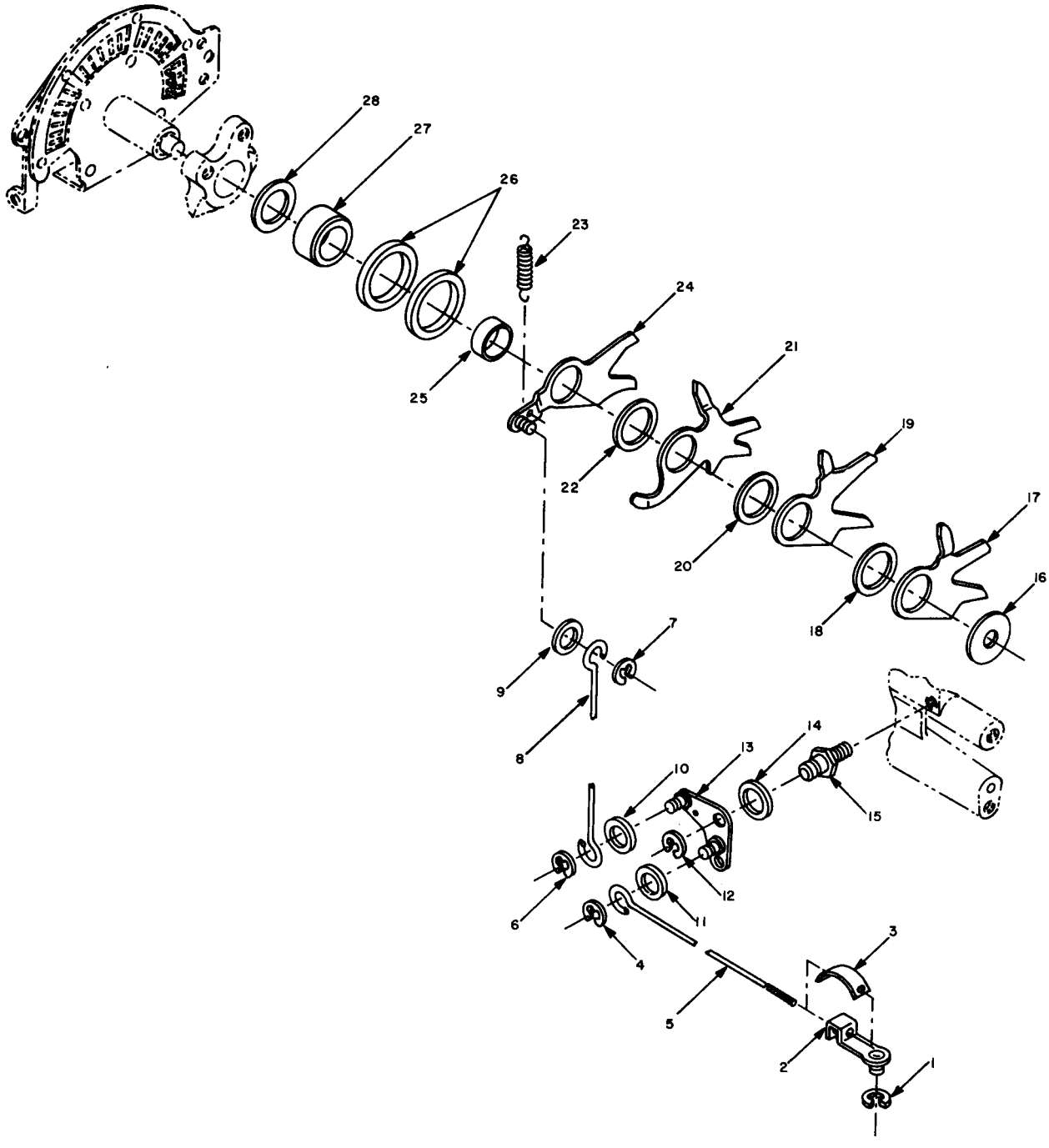
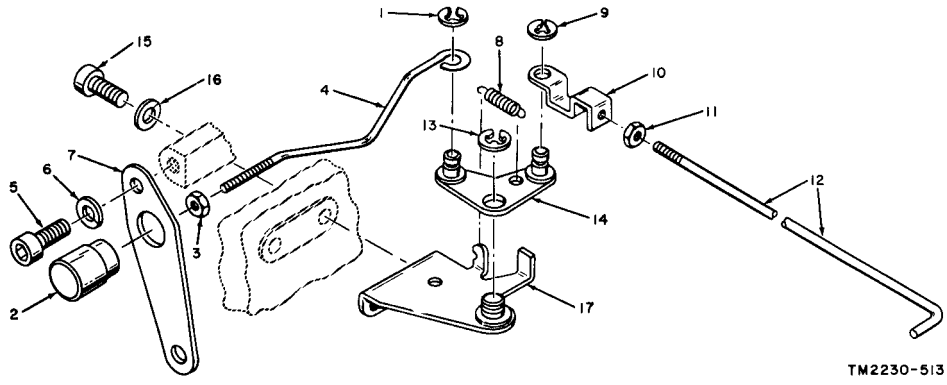
1 Retainer ring, 10960
2 Connector link, 53161A
3 Felt, 61677
4 Retainer ring, 10960
5 Horizontal carriage-return link, 50864
6 Retainer ring, 10960
7 Retainer ring, 10960
8 Vertical carriage-return link, 50483
9 Felt, 61677
10 Felt, 61483
11 Felt, 61483
12 Retainer ring, 10949
13 Carriage-return bellcrank, 59441A
14 Felt, 61673
15 Carriage-return bellcrank pivot, 52552
16 Flat washer, 50374
17 Line-feed-on-carriage-return sensing lever, 62140
18 Flat washer, 62134
19 Line-feed sensing lever, 62139
20 Flat washer, 62134
21 Figures-shift sensing lever, 62141
22 Flat washer, 62135
23 Carriage-return sensing lever spring, 59442
24 Carriage-return sensing lever, 62128A
25 Sleeve, 62594
26 Felts, 61497
27 Spacing collar, 57923
28 Laminated washer, 51100

Figure 2–52. Function sensing lever group, exploded view ( ).

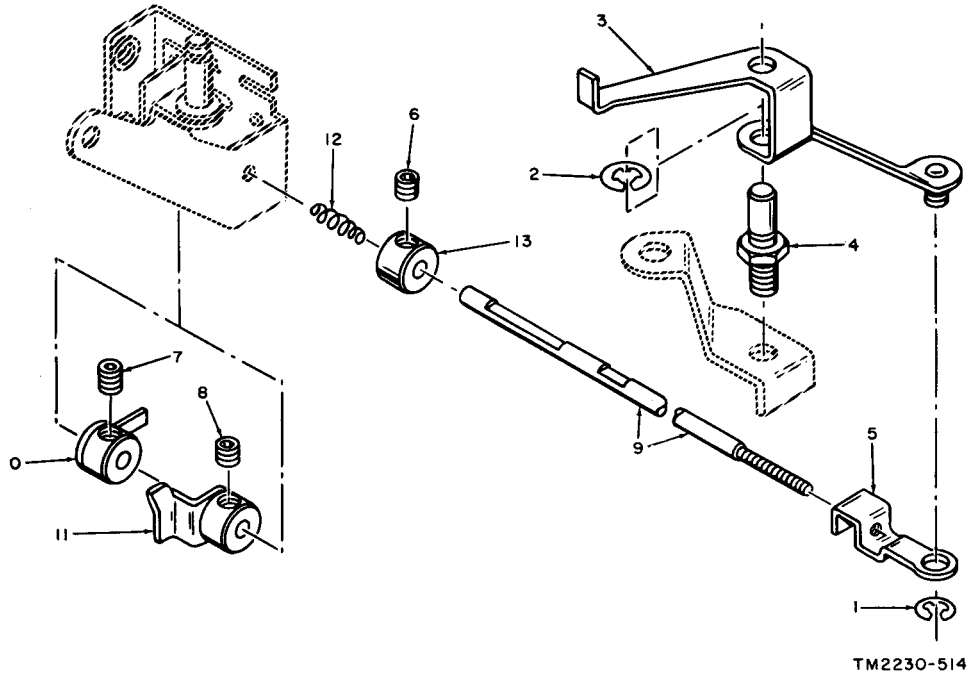


TM5815-200-35-C4-13



1 Retainer ring, 10960
2 Manual unshift push button, 55513
3 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, 56211
8 Manual unshift bell crank spring, 50916
9 Retainer ring, 10960
10 Connector link, 51783
11 Hexagonal nut, 10520
12 Manual unshift lever link, 53616
13 Retainer ring, 10949
14 Manual unshift bell crank, 52121A
15 Machine screw, 10025
16 Lockwasher, 10430
17 Bell crank mounting bracket, 53415A

Figure 2-53. Manual unshift mechanism, exploded view.



1 Retainer ring, 10960
2 Retainer ring, 10949
3 Stop bar shift lever, 52945A
4 Stud, 52948
5 Connector link, 51783
6 Setscrew, 10203
7 Setscrew, 10203
8 Setscrew, 10203
9 Stop bar shift link, 56622A
10 Stop bar shift stop, 55740A
11 Stop bar shift blade, 55735A
12 Stop bar return spring, 59620
13 Spring collar, 55736

Figure 2-54. Automatic carriage-return mechanism, exploded view.

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 teletypewriter.

(4) Remove the two machine screws (5) and lockwashers (6). Remove the assembled space pawl mounting bracket (11) and carriage-feed paw] (9).

(5) Remove the self-locking hexagonal nut (7) and flat washer (8). Remove the carriage-feed pawl (9), spacer (19), space pawl flat washer (10), and, if present, the felt washer (17).

(6) Disconnect the carriage-feed clutch lever spring (12) from the carriage-feed clutch lever, (14) and the spring post on the teletypewriter.

(7) Remove the retainer ring (13). Remove the carriage-feed clutch lever (14) and, if present, the felt washer (18).

(8) Remove the setscrew (15) and the carriage-feed clutch lever pivot stud (16).

b. Reassembly.

(1) Reassemble the carriage-feed mechanism by reversing the procedures outlined in a above.

(2) Adjust the carriage-feed mechanism (paras 2-157 and 2-158).

2-71. Disassembly and Reassembly of Carriage-Return Operating Mechanism

(fig. 2-21)

a. Disassembly.

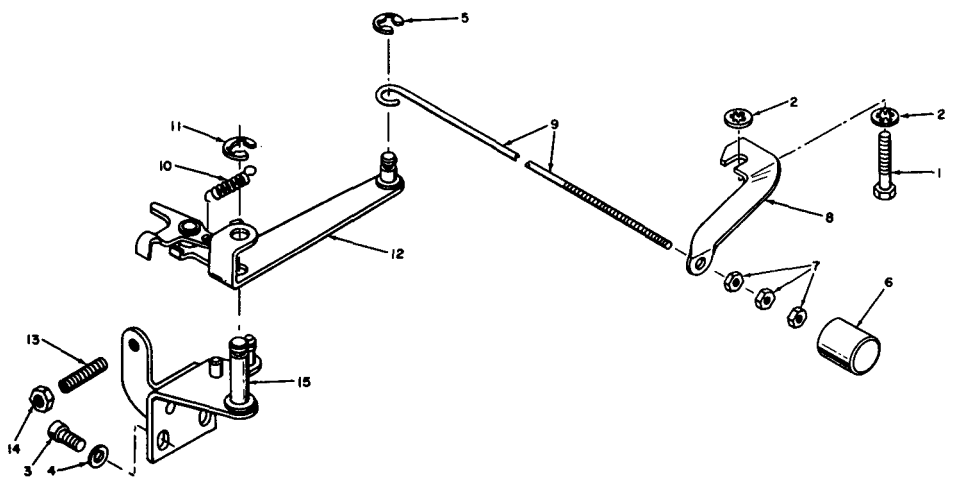
(1) Remove the carriage-return mechanism (para 2-26 *a)* and, if present, the felt washer (23).

(2) Remove the machine screw (3), flat washer (5), and clamp nut (4). Remove the throwout lever (6) and, if present, the flat washer (24).

(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).

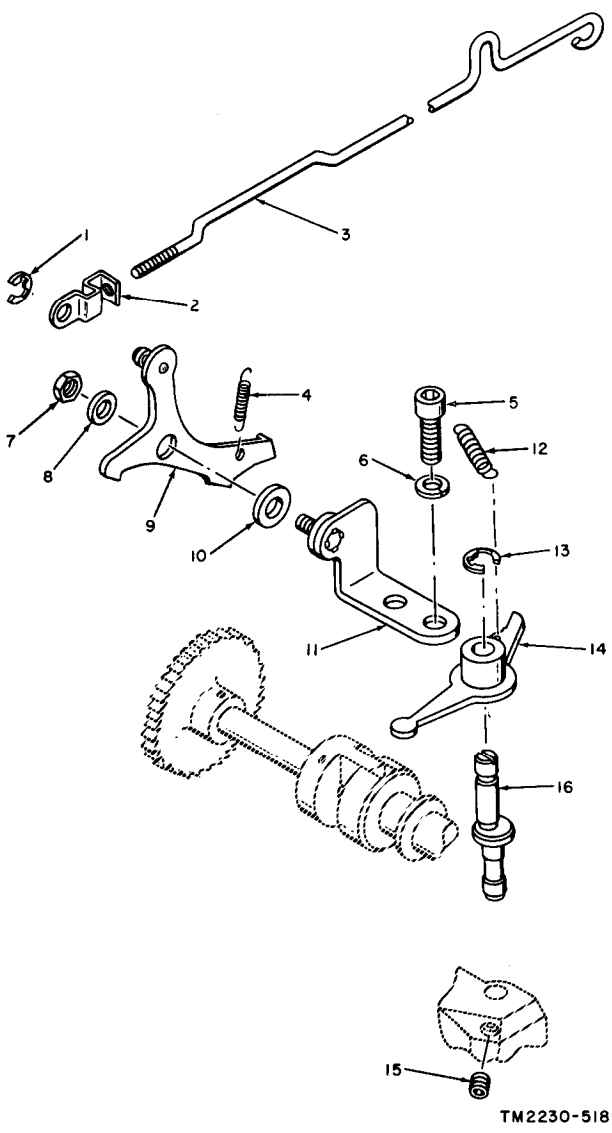
(4) Remove the assembled double blocking lever (12) and adjusting plate (11) from the shaft of the carriage-return clutch lever (22).

(5) Remove the machine screw (8), flat washer (9), and lockwasher (10). Remove the adjusting plate (11).



1 Machine screw, 10320
2 Lockwasher, 10437
3 Machine screw, 10008
4 Lockwasher, 10430
5 Retainer ring, 10960
6 Manual carriage-return button, 55513
7 Hexagonal nut, 10520
8 Carriage-return button bracket, 55514
9 Carriage-return button link, 55517
10 Trip pawl spring, 50196
11 Retainer ring, 10949
12 Manual carriage-return lever, 52791A
13 Adjusting screw, 10206
14 Hexagonal nut, 10505
15 Manual carriage-return bracket, 52790A

Figure 2-55. Manual *carriage-return button mechanism, exploded view.*



1 Retainer ring, 10960
2 Connector link, 61442
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 Setscrew, 10204
16 Carriage-feed clutch lever pivot stud, 52318
17 Felt washer, 61675 [a]
18 Felt washer, 61480 [a]
19 Spacer, laminated (.032-in.), 50831

Figure 2–56. Carriage-feed mechanism, exploded view.

[a] Included as lubrication reservoir on some teletypewriters.

(6) Remove the double blocking lever spring (13) that connets the carriage-return clutch latch lever (15) and the clutch latch mounting plate (16).

(7) Remove the retainer ring (14) nd the carriage-return clutch latch lever (15) and, if present, the, two flat washers (25).

(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) Reassemble the carriage-return operating mechanism by reversing the procedures outlined in *a* (10) through (2) above.

(2) Replace the carriage-return mechanism (para 2-26 *b*).

2-72. Disassembly and Reassembly of Carriage-Rack Drive Shaft (Not Applicable to TT-98C/FG)

(figs. 2-57 and 2-58)

a. Disassembly.

(1) Remove the carriage (para 2-21 *a*).

(2) Remove the two machine screws (1) and lockwashers (2) that hold the bearing cap (30) to the front of the teletypewriter.

(3) Remove the two setscrews (3 and 4). Remove the carriage-return blocking lever adjusting collar (5), flat washer (6), carriage-return blocking lever spring (7), fiat 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 teletypewriter.

(6) Pull the assembled carriage-rack drive shaft and gear forward until it clears the ball bearing (18) in the teletypewriter

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 tile carriage-rack drive shaft and gear (29) from the bearing cap (30).

b. Reassembly.

(1) Reassemble the carriage-rack drive shaft by reversing the steps and procedures outlined in *a* (2) through (10) above.

(2) Replace the carriage (para 2-21 *b).*

(3) Adjust the carriage-rack drive shaft (paras 2-169) through 2-172. and 2-206).

2-73. Disassembly and Reassembly of Carriage-Rack Drive Shaft (TT-98C/FG)

(fig. 2-58)

a. Disassembly.

(1) Remove the carriage (para 2-21 *a).*

(2) Remove the two self-locking hexagonal nuts (1) that hold the retainer (2) to the retainer posts (5). Remove the retainer.

(3) Remove the two flat washers (3) and shims (4).

(4) Remove the two retainer posts (5) and lockwashers (6).

(5) Remove the two setscrews (7 and 8) and carriage-return blocking lever adjusting collar (9).

(6) Remove the flat washer (10), carriage-return blocking lever spring (11), flat washer (12), carriage-return blocking lever (13) and two flat washers (14 and 15).

(7) Remove the two setscrews (16 and 17) and collar (18).

(8) Remove the machine screws (19), lockwasher (20), and flat washer (21). Leave the ball bearing (22) in the bearing block.

(9) Pull the assembled carriage-rack drive shaft and gear (33) forward until it clears the ball bearing (22).

(10) Remove the ball bearing (22) f'rom the bearing cap.

(11) Remove the two machine screws (23), flat washers (24), and lock washers (25). Remove the carriage-return latch tripping arm (26) from the carriage-return driven gear (28).

(12) Remove the taper pin (27) and carriage-return driven gear (28).

(13) Remove the two machine screws (29), flat washers (30), lockwashers (31), and margin bell pawl trip arm (32) from the carriage-rack drive shaft and gear (33).

(14) Remove the carriage-rack drive shaft and gear (33) from the bearing cap (34). Remove the bearing cap.

b. Reassembly.

(1) Reassemble the carriage-rack drive shaft by reversing *a* (2) through (14) above.

(2) Reinstall the carriage (para 2-21 b).

(3) Adjust the carriage-rack drive shaft (paras 2-169-2-172, and 2-206).

2-74. Disassembly and Reassembly of Margin Signal Bell (Not Applicable to TT-259/FG)

(fig. 2-59)

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 ret airier ring (4) and remove the margin bell clapper (6).

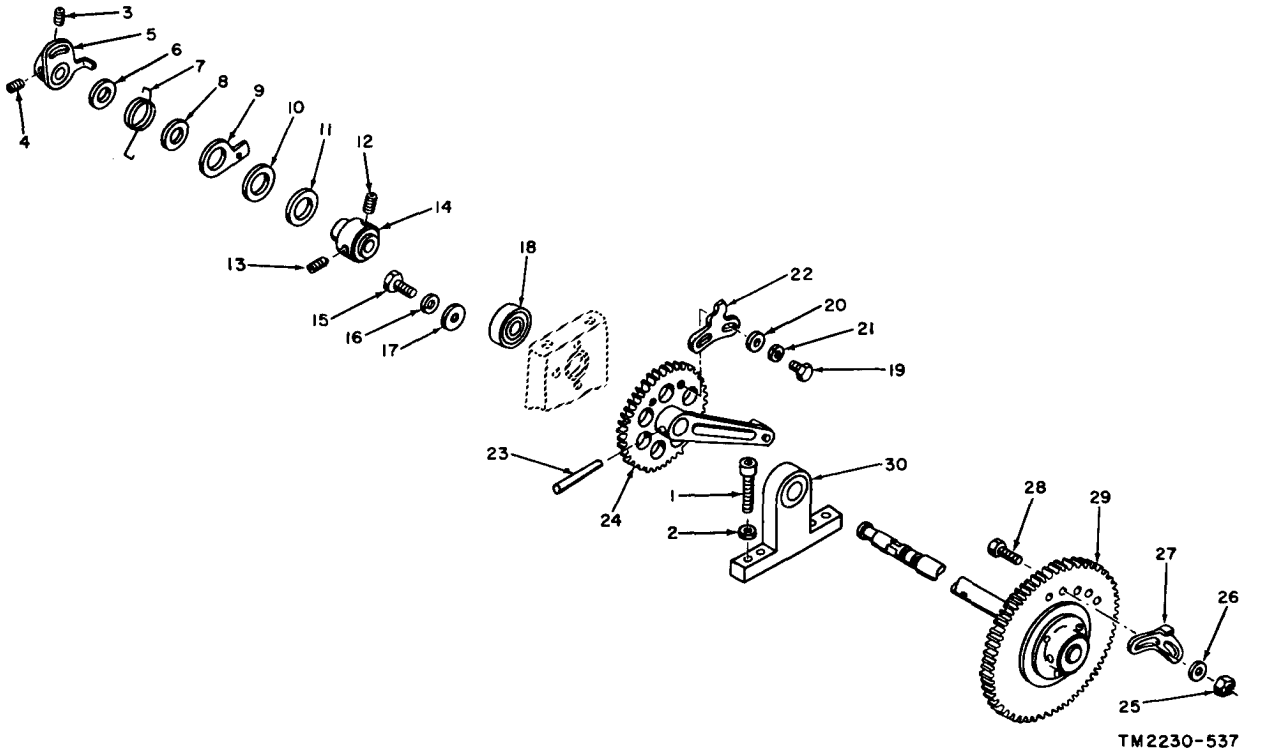
(4) Remove the spring (5) from the margin bell clapper (6).

(5) Remove the locknut (7), machine screw (8), and lockwasher (9) and remove the margin signal bell (10).

b. Reassembly.

(1) Reassemble the margin signal bell by reversing the procedures outlined in *a* above.

(2) Adjust the margin signal bell (para 2-206) .



1 Machine screw, 10011
2 Lockwasher, 10430
3 Setscrew, 10209
4 Setscrew, 10223
5 Carriage-return locking lever adjusting collar, 55090A
6 Flat washer, 56254
7 Carriage-return blocking lever spring, 56269
8 Flat washer, 53783
9 Carriage-return blocking lever, 56238
10 Flat washer 57717
11 Flat washer, 10468
12 Setscrew, 10209
13 Setscrew, 10223
14 Collar, 51668
15 Machine screw, 10003
16 Lockwasher, 10429
17 Flat washer, 10458
18 Ball bearing, 10759
19 Machine screw, 10303
20 Flat washer, 10458
21 Lockwasher, 10429
22 Carriage-return latch tripping arm, 55524
23 Taper pin, 10851
24 Carriage-return driven gear, 50138A
25 Self-locking hexagonal nut, 10500
26 Flat washer, 10450
27 Margin bell pawl trip arm, 50124
28 Machine screw, 10080
29 Carriage-rack drive shaft and gear, 61742A
30 Bearing cap

Figure 2-57. Carriage-rack drive shaft, exploded view (not applicable to TT-98C/FG).

2-75. Disassembly and Reassembly of Carriage-Feed Shaft

(fig. 2-22)

a. Disassembly.

(1) Remove the carriage-feed shaft (para 2-27 *a).*

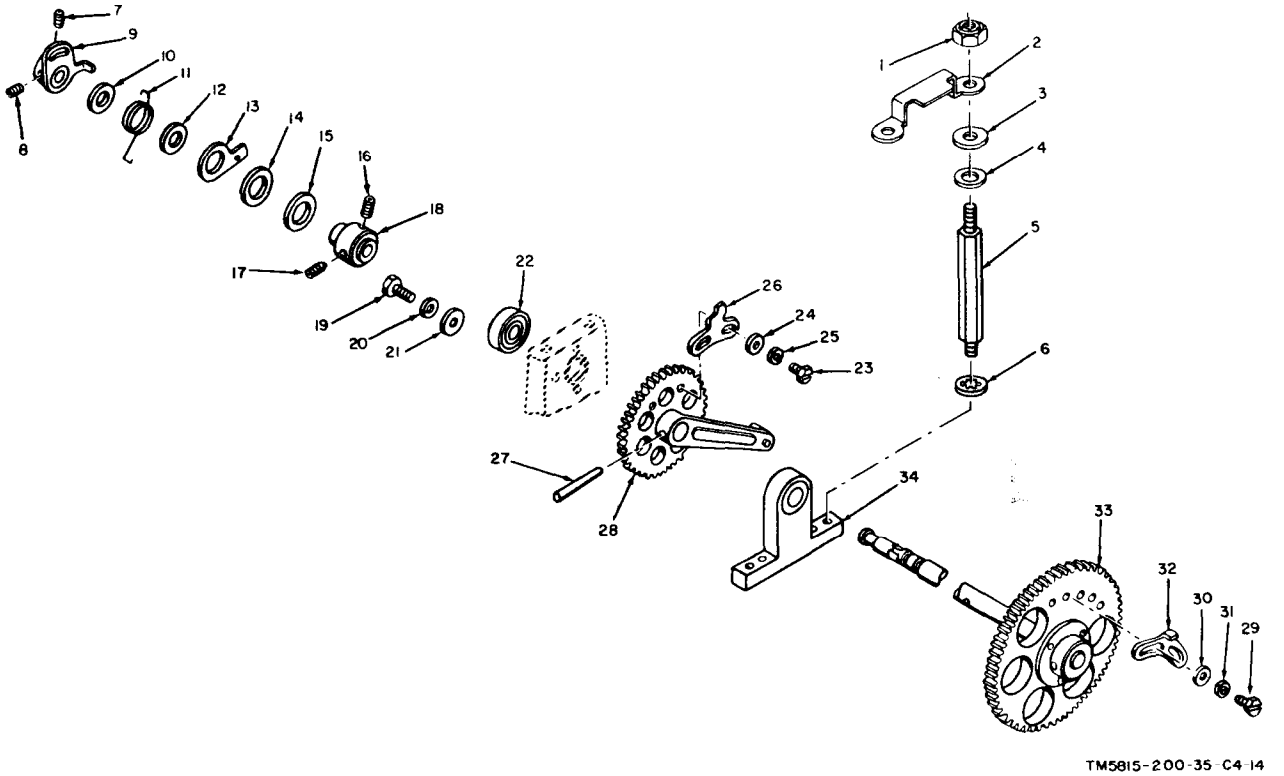
(2) Remove the flat washer (13), if present, and adjusting nut (14) from the carriage-feed shaft (34). Loosen the two setscrews (15) and remove the shaft collar (16) from the carriage-feed shaft (34). If present, remove the felt washer (35).

(3) Slide the carriage-feed driven gear (17) from the clutch driving disk (25) and from the carriage-feed shaft (34). If present, remove felt washer (36) from the carriage-feed driven gear.

(4) Remove the machine screws (18) and the friction clutch adjusting collar (19).

(5) Remove the two setscrews (20) and the driving collar (21).

(6) Remove the friction clutch spring (22),



1 Self-locking hexagonal nut, 10501
2 Carriage-rack retainer, 62268
3 Flat washer, 10454
4 Shim, 59561 and/or 59562, as required
5 Retainer post, 62267
6 Lockwasher, 10404
7 Setscrew, 10209
8 Setscrew, 10223
9 Carriage-return locking lever adjusting collar, 55090A
10 Flat washer, 56254
11 Carriage-return blocking lever spring, 56269
12 Flat washer, 53783
13 Carriage-return blocking lever, 56238
14 Flat washer, 57717
15 Flat washer, 10468
16 Setscrew, 10209
17 Setscrew, 10223
18 Collar, 51668
19 Machine screw, 10003
20 Lockwasher, 10429
21 Flat washer, 10450
22 Ball bearing, 10759
23 Machine screw, 10303
24 Flat washer, 10450
25 Lockwasher, 10429
26 Carriage-return latch tripping arm, 55524
27 Taper pin, 10851
28 Carriage-return driven gear, 51747A
29 Machine screw, 10303
30 Flat washer, 10450
31 Lockwasher, 10429
32 Margin bell pawl trip arm, 50124
33 Carriage-rack drive shaft and gear, 57936A
34 Bearing cap, 55773

Figure 2-58. Carriage-rack drive shaf t, exploded view (TT-98C/FG and subsequent models).

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 the ratchet wheel (28).

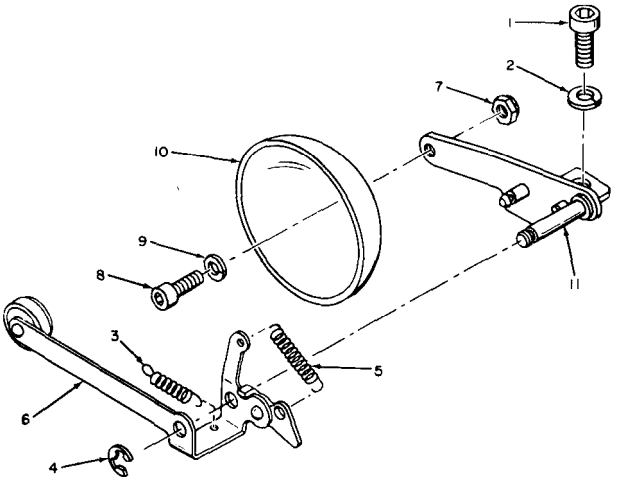
(8) Remove the carriage-feed driving gear (29), the flatwasher (30) and the carriage-feed sliding clutch drum (31), from the carriage-feed shaft (34).

(9) Remove the two setscrews (32) and the shaft collar (33).

b. Reassembly.

(1) Reassemble the carriage-feed shaft by reversing the steps and procedures outlined in *a* (2) through (9) above.

(2) Replace the carriage-feed shaft (para 2–27 *b).* Perform the adjustment procedures described in paragraphs 2–151 through 2–153.



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, 51403
5	Spring, 50232	11	Margin bell bracket, 53164A
6	Margin bell clapper. 50244A		

Figure 2-59. Margin signal bell, exploded view (not applicable to TT-259/FG.

2-76. Disassembly and Reassembly of Carriage-Return Shaft

a. Disassembly.

(1) Remove the carriage-feed clutch lever (para 2-70 *a(7)).*

(2) Mark the two teeth on the carriage-return driving gear of the carriage-return safety clutch (16, fig. 2–60) that engage the last tooth on the carriage-return driven gear.

(3) Remove the two machine screws (1), flat washers (2), lockwashers (3), and bearing retainer (4).

(4) Remove the two machine screws (5) and lockwashers (6) that hold the bearing cap to the teletypewriter. Remove the bearing cap.

(5) Remove the two machine screws (7) and lockwashers (8) that hold tile bearing cap to the teletypewriter. Remove the bearing cap.

(6) Remove the self-locking hexagonal nut (9), flat washer (10), and ball bearing (11) from the carriage-return shaft (24).

(7) Lift the front of the carriage-return shaft (24) sligltly and slide the oilite bearing (21) toward tile rear of the shaft, far enough to clear the bearing seat in the teletypewriter.

(8) Loosen the machine screw (17, fig. 2-21) that holds the carriage-return clutch actuating lever (18) to the carriage-return clutch lever (22). Tilt the carriage-return shaft (24, fig. 2–60) far enough forward to clear the carriage-return clutch lever, and pivot the lever so that it is parallel wit h the carriage-return shaft. Pull the carriage-return shaft upward and forward to remove it from the teletypewriter.

(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 deceleratig 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) Reassemble the carriage-return shaft by reversing the steps and procedures outlined in *a* (2) through (14) above.

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).

(2) Replace the carriage-feed clutch lever (para 2-70 *b).*

(3) Adjust the carriage-return shaft (paras 2-162 and 2-208).

2-77. Disassembly and Reassembly of Carriage-Return Safety Clutch

(fig. 2-61)

a. Disassembly.

(1) Disassemble the carriage-return shaft (para 2-76 *a*).

(2) Remove the retainer ring (1) and the flat washer (2) from the end of tile sleeve (13).

(3) Remove the carriage-return sliding clutch drum (3) from the sleeve (13). Catch the nine positioning balls (4) as they drop out of the carriage-return sliding clutch drum.

(4) Remove the machine screw (5) from the adjusting collar (6). Remove the adjusting collar from the threaded portion of the sleeve.

(5) Remove the spring (7) and the ball retainer ring (8) from the sleeve.

(6) Remove the clutch disk (9), friction plate (10), carriage-return driving gear (11), and friction plate (12) from the sleeve.

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.

b. Reassembly.

(1) Assemble tile friction plate (12), carriage-return driving gear (11), friction plate (10), and clutch disk (9), on tile sleeve (13).

(2) Position the ball retainer ring (8) and the spring (7) on the sleeve (13).

(3) Start the adjusting collar (6) on the threaded portion of the sleeve (13). Turn it into the spring (7) but do not tighten it.

(4) Start the machine screw (5) in the adjusting collar (6). Do not tighten it.

(5) Position the carriage-return sliding clutch drum (3) on the sleeve (13). Drop the nine positioning balls (4) into the three grooves.

(6) Place the flat washer (2) on the end of the sleeve (3) and install the retainer ring (1).

(7) Reassemble the carriage-return shaft (para 2-76 *b*)

(8) Adjust the carriage-return safety clutch (paras 2-162 and 2-175).

2-78. Disassembly and Reassembly of Keyboard Transmitter Drive Shaft (Not Applicable to TT-259/FG)

(fig. 2-62)

a. Disassembly.

(1) Remove the keyboard transmitter (para 2-18 *a*).

(2) Remove the two machine screws (1) and lockwashers (2) that hold the bearing cap to the teletypewriter and remove the bearing cap.

(3) Remove the two self-locking hexagonal nuts (3) that hold the blocking plate (27) in place. Remove the blocking plate.

(4) Remove the two nuts (28) and lockwashers (4) that hold the mounting bracket (26) to the teletypewriter. Remove the set screws (29) from the teletypewriter.

(5) 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).

(6) Remove the machine screws (12) and the friction adjusting collar (13).

(7) Remove the two setscrews (14). Remove the drive shaft collar (15).

(8) Remove the two machine screws (16), flat washers (17), and lockwashers (18). Remove the bearing retainer (19).

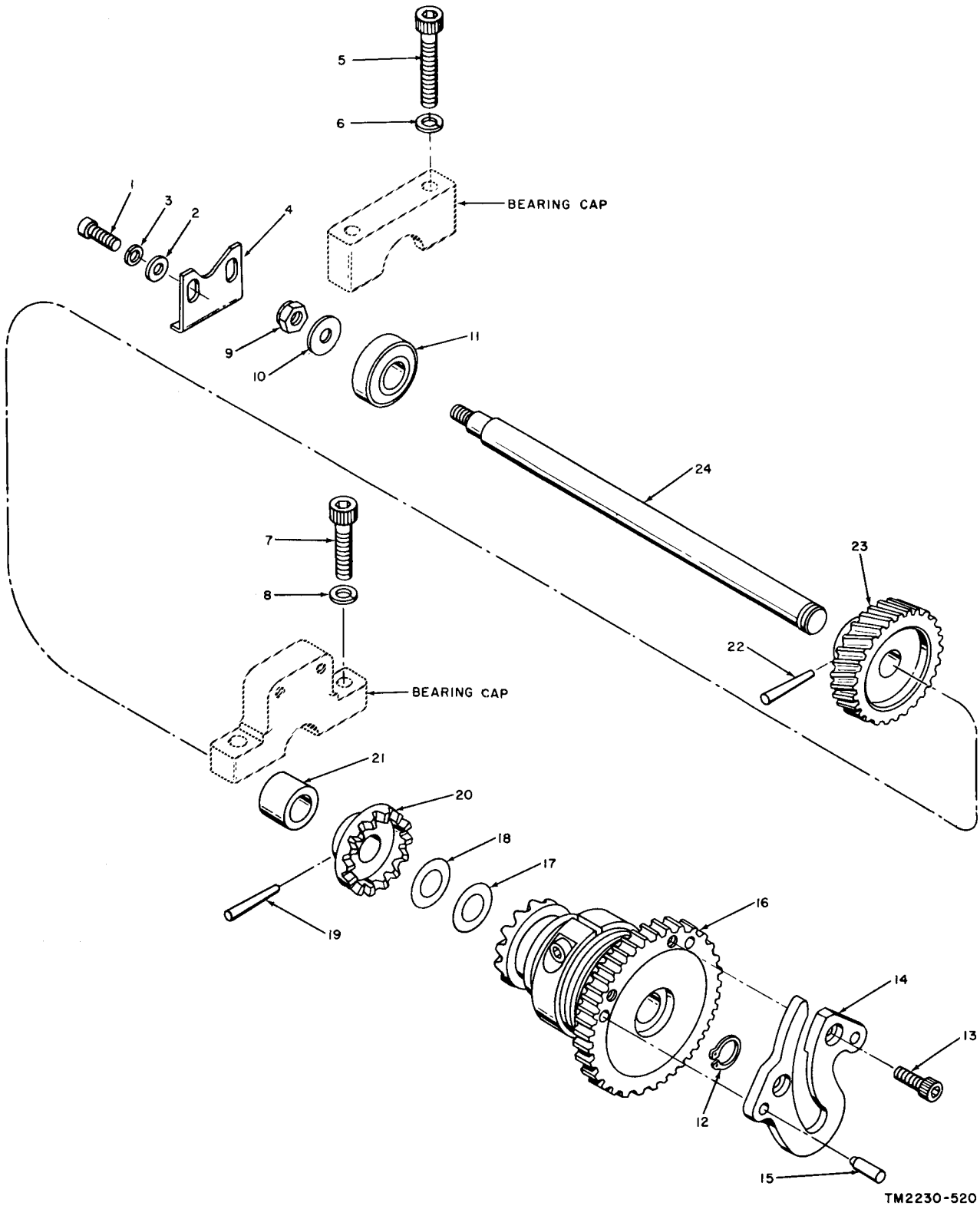
(9) Remove the self-locking hexagonal nut (20) and spacer (21). Remove the ball bearing (22).

(10) Tilt the transmitter drive shaft (25) forward enough to clear the gear on the main shaft and remove the assembled transmitter drive shaft and transmitter shaft driven gear (24).

(11) Remove the taper pin (23) and remove the transmitter shaft driven gear (24) and the mounting bracket (26).

b. Reassembly.

(1) Reassemble the keyboard transmitter drive shaft, by reversing the steps and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23
24
BEARING CAP
BEARING CAP
TM2230-520

procedures outlined in *a* (2) through (11) above.

(2) Replace the keyboard transmitter drive shaft (para 2-18 *b*).

(3) Adjust the keyboard transmitter drive shaft (para 2-95).

2-79. Disassembly and Reassembly of Keyboard Guard, Vibration Mounts, and Base Plate (Not Applicable to TT-259/FG)

(fig. 2-63)

a. Disassembly.

(1) Remove the receiving unit from the teletypewriter base (para 2-17 *a).*

(2) Remove the four machine screws (3), lockwashers (2), flat washers (1), and the two cover plates (4) from the bottom of the teletypewriter base (29).

(3) Remove the two hexagonal nuts that hold the toggle switches to the switch plate (7). Remove the four machine screws (5), lockwashers (6), and the switch plate.

(4) Remove the two hexagonal nuts that hold the two toggle switches to the switch plate (10). Remove the four machine screws (8), lockwashers (9), and the switch plate.

(5) Remove the two machine screws (11), lockwashers (12), two machine screws (13), lockwashers (14), the spacer plates (15), and the keyboard guard (16).

(6) Remove the nine machine screws (17) and the teletypewriter base plate (18).

(7) Remove the four machine screws (19), lockwashers (20), and the four vibration mounts (28).

(8) Remove the hexagonal nuts (21) from the vibration mount studs (22) and remove the studs.

(9) Remove the lockwasher (23), vibration mount limit stop (24), flat washer (25), vibration mount (28), flat washer (27), and vibration mount limit stop (26).

(10) Repeat the procedure given in paragraphs (8) and (9) above to disassemble the three remaining vibration mounts.

b. Reassembly.

(1) Reassemble the keyboard guard, vibration mounts, and base plate by reversing the steps and procedures outlined in *a(2)* through (10) above.

(2) Replace the receiving unit on the teletypewriter base (para 2-17 b).

2-80. Disassembly and Reassembly of Base (TT-259/FG)

(fig. 2-64)

a. Disassembly.

(1) Remove the receiving unit from the base (para 2-17 *a*).

(2) Remove the two hexagonal nuts (1) and lockwashers (2) that hold the toggle switch (27) to the switch plate (3). Remove the two machine screws (4), lockwashers (5) and switch plate.

(3) Remove the machine screw (6), lockwasher (7), and clamp (8) from the front plate (9).

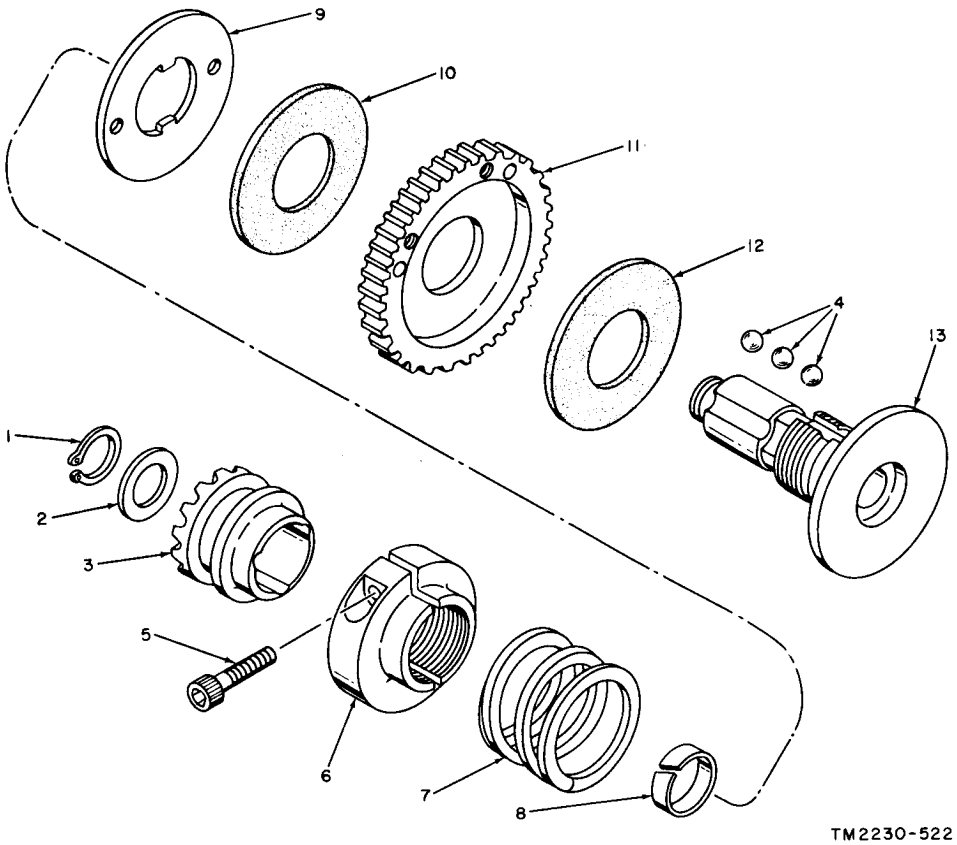
(4) Remove the two machine screws (10) and lockwashers (11) that hold the front plate to the, base casting (28). Remove the front plate.

(5) Remove the nine machine screws (12) and the base plate (13) from the base.

---

1 Machine screw, 10003
2 Flat washer, 10459
3 Lockwasher, 10429
4 Bea ring retainer, 55020
5 Machine screw, 10012
6 Lockwasher, 10430
7 Machine screw, 10011
8 Lockwasher, 10430
9 Self-locking hexagonal nut, 10.700"
10 Flat washer, 50414
11 Ball bearing, 10759
12 Retaining ring, 10451
13 Machine screw, 10001
14 Decelerating cam, 50364
15 Dowel pin, 10917
16 Carriage-return safety clutch, 51642A (57929A on TT-98C/FG)
17 Spacer, 52117
18 Spacer, 52118
19 Taper pin, 10852
20 Carriage-return sliding clutch disk 50211 (57933 on TT-98C/FG)
21 Oilite bearing, 59398A
22 Taper pin, 10852
23 Carriage-return shaft driven gear, 55164
24 Carriage-return shaft, 55171 (59394 on TT-98C/FG)

Figure 2-60. Carriage-return shaft, exploded view.



1 Detainer ring, 10453
2 Flat washer, 50306
3 Carriage-return sliding clutch drum
4 Positioning ball, 10908
5 Machine screw, 10010
6 Adjusting collar, 51697
7 Spring, 55042
8 Ball retainer ring, 51651
9 Clutch disk, 51678
10 Friction plate, 50260
11 Carriage-return driving gear, 50257
12 Friction plate, 50260
13 Sleeve, 51643A, includes item 3

Figure 2–61. Carriage-return safety clutch, exploded view.

(6) Remove and disassemble a vibration mount assembly as follows:

(a) Remove the machine screws (14), lockwashers (15), and lift, the vibration mount assembly from the base.

(b) Remove the hexagonal nuts (17) from the vibration mount stud (18) and remove the stud.

(c) Remove the vibration mount limit. stop (19), spacer (20), flat washer (21), and vibration mount limit stop (22) from vibration mount (16).

b. Reassembly.

(1) Reassemble the base by reversing the steps and procedures outlined in *a(2)* through (6) above.

(2) Replace the receiving unit on the base (para 2-17 *b*).

2-81. Disassembly and Reassembly of Dust Cover Arms and Guides

(fig. 2-65)

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 teletypewriter base.

(2) Remove the machine screws (11), nut plate (13), and flat washers (12); remove the dust cover knobs (14).

(3) Catch the flat washers (16) and dust cover arms (15) as they fall from the dust cover knobs (14).

(4) Remove the four machine screws (38), flat washers (40), and lockwashers (39) that hold the two dust cover guides (41) to the teletypewriter base. Remove the dust cover guides.

(5) Remove the spring posts (17) from the teletypewriter base.

b. Reassembly. Reassemble the dust cover arms and guides on the teletypewriter base by reversing the procedures outlined in *a* above.

2-82. Disassembly and Reassembly of Teletypewriter Base Components (Not Applicable to TT-259/FG)

NOTE

Subparagraph *a(3),* (7), (10), and (11) below are not applicable to TT-664(*)/FG and TT-665/FG.

a. Disassembly.

(1) Remove the receiving unit from the teletypewriter base (para 2-17 *a*).

(2) Remove the nine machine screws 17, fig. 2-63) and the teletypewriter base plate (18).

(3) Remove the four self-locking hexagonal nuts (36, fig. 2-65). Disconnect (and tag) 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 (not shown) to the switch plate (46) and remove the switch plate.

(5) Remove the two machine screws (1) that hold the receptacle connector (2) to the teletypewrriter base. Unsolder the leads and remove the receptacle connector.

(6) Remove the two machine screws (7) and lockwashers (8), unsolder (and tag) the electrical leads from the selector magnet jack (23, fig. 2-66) and the keyboard transmitter jacks (24), and remove the switch plate (9, fig. 2-65).

(7) Remove the two machine screws (18) and lockwashers (19), unsolder the leads from the fuse holder (20, fig. 2-66), and remove the mounting bracket (20, fig. 2–65).

(8) Remove the two machine screws (21) and lockwashers (22). Disconnect (and tag) the electrical leads and remove the assembled receptacle connector (25) and mounting plate (26).

(9) Remove the two self-locking hexagonal nuts (23) and machine screws (24) and separate the receptacle connector from the mounting plate (26).

(10) Remove the self-locking hexagonal nut (27), machine screw (28), lockwashers (29), terminal lug (30), lockwasher (31), and lockwasher (32) that hold the one side of the mounting plate (35) to the teletypewriter base.

(11) Remove the machine screw (33) and lockwasher (34) that hold the other side of the mounting plate to the teletypewriter base; unsolder (and tag) the leads to the motor stop switch jack (not shown) and remove the mounting plate (35).

(12) Remove the four machine screws (3), the four grounding leads (5), and the eight lockwashers (4 and 6).

b. Reassembly.

(1) Reassemble the teletypewriter base components by reversing the steps and procedures outlined in *a* (2) through (12) above.

(2) Replace the receiving unit on the teletypewriter base (para 2-17 *b).*

2–83. Removal and Replacement of Base Electrical Components TT–259/FG)

a. Disassembly.

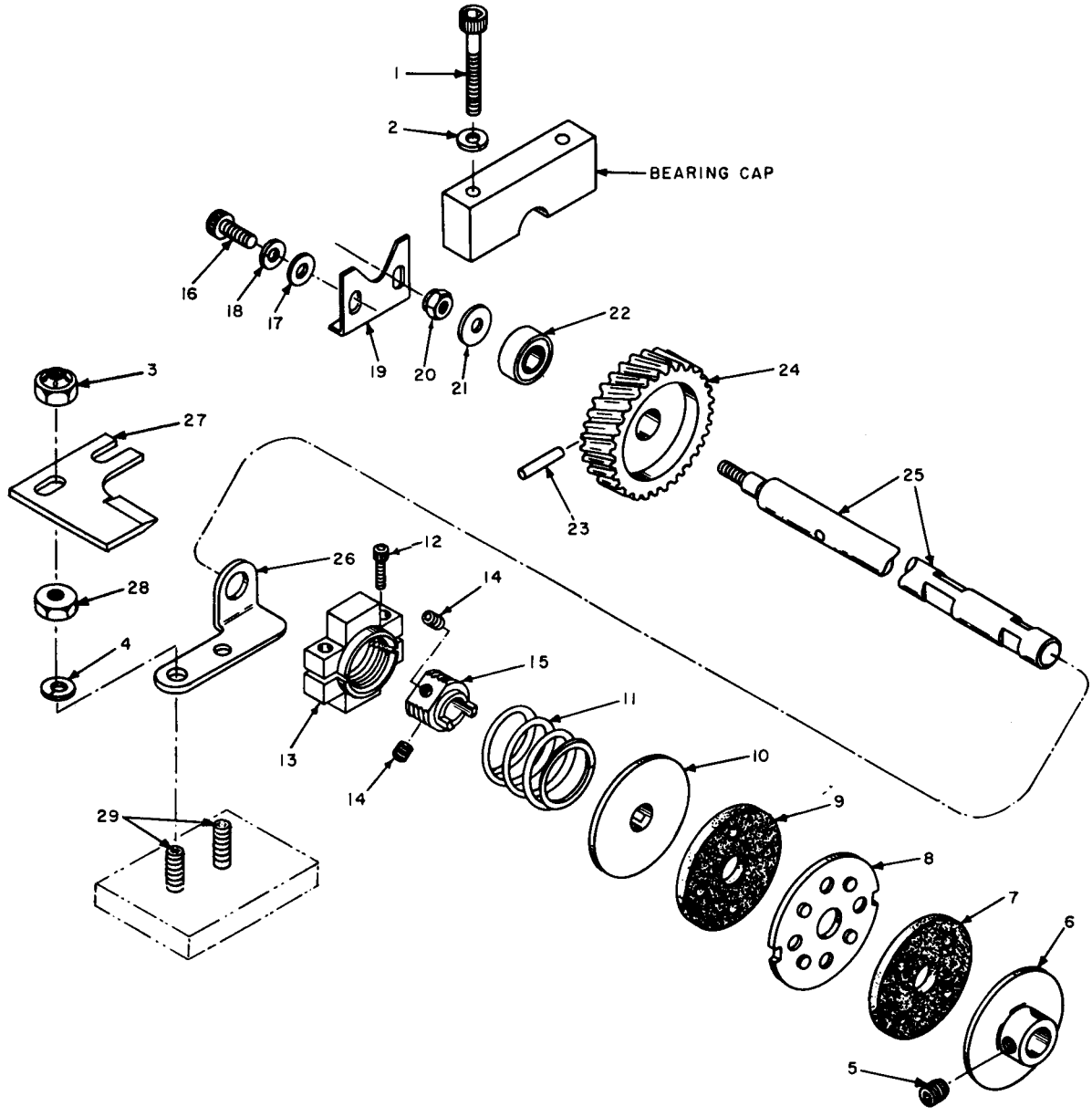
(1) Remove the receiving unit from the base (para 2-17 *a).*

(2) Remove the nine machine screws (12, fig. 2-64) and the base plate (13).

(3) Remove the four self-locking hexagonal nuts (36, fig. 2-65). Disconnect, and tag, the electrical leads and remove the motor stop relay (37).

(4) Remove the two hexagonal nuts (24, fig 2-64). Disconnect, and tag, the electrical leads from the fuseholders. Remove the two fuseholders (23), lockwashers (25), and rubber washers (26).

(5) Remove the two machine screws (1, fig, 2-65) that hold the receptacle connector (2) to the base. Unsolder the leads and remove the



1 Machine screw, 10012
2 Lockwasher, 10430
3 Self-locking hexagonal nut, 10501
4 Lockwasher, 10430
5 Setscrew, 10209
6 Friction clutch disk, 50200
7 Friction plate, 56764
8 Clutch driver plate, 51117
9 Friction plate, 56764
10 Friction clutch plate, 54931
11 Friction clutch spring, 54932
12 Machine screw, 10043
13 Friction adjusting collar, 56832A (includes item 12)
14 Setscrew, 10208
15 Drive shaft collar, 54928
16 Machine screw, 10003
17 Flat washer, 10459
18 Lockwasher, 10429
19 Bearing retainer, 55020
20 Self-locking hexagonal nut, 10500
21 Spacer, 50414
22 Ball bearing, 10755
23 Taper pin, 10854
24 Transmitter shaft drive gear (61317 on TT-482/UGC and TT-483/UGC), 55163
25 Transmitter drive shaft, 55172
26 Mounting bracket, 55787
27 Blocking plate, 56707
28 Hexagonal nut, 10505
29 Setscrew, 10237

Figure 2-62. Keyboard transmitter drive shaft, exploded view (not applicable to TT-259/FG

receptacle connector.

(6) Remove the two machine screws (7, fig. 2-65) and lockwashers (8); unsolder, and tag, the electrical leads from the jacks (3 and 2, fig. 2-67) and remove the plate (9, fig. 2-65).

(7) Remove the two machine screws (18, fig. 2-65).

(7) Remove the two machine screws (18, fig. 2-65) and lockwashers (19); unsolder the leads from the fuseholder (9, fig. 2-67) and remove the mounting bracket (20, fig. 2-65).

(8) Remove the two machine screws (21) and lockwashers (22, fig. 2-65). Disconnect, and tag, the electrical leads and remove the assembled receptacle connector (25) and mounting plate (26).

(9) Remove the two self-locking hexagonal nuts (23, fig. 2-65) and machine screws (24) and separate the receptacle connector from the mounting plate (26).

(10) Perform the disassembly procedures described in paragraph *2-82a(10)* through (12), making reference to figure 2-65.

b. Reassembly.

(1) Reassemble the base components by reversing the steps and procedures outlined in *a(2)* through (10) above.

(2) Replace the receiving unit on the base para 2-17 *b*).

2-84. Disassembly and Reassembly of Teletypewriter Base, Terminal and Switch Box, Motor Interference Suppression Filters and Dust Cover Assembly (Not Applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

The electrical components mounted in the teletypewriter base, terminal and switch box, and in the motor interference suppression filter assemblies are illustrated in figures 2-66, 2-68, 2-69, 2-70 and 2-71. The disassembly and reassembly procedures are simple and therefore have not been detailed in this technical manual. The components should not be removed unless they are damaged or inoperative. Reference numbers are shown on the legends which accompany the illustrations. Components of the dust cover assembly are illustrated in figure 2-71.1 and the above disassembly and reassembly procedures are applicable.

2-84.1 Disassembly and Reassembly of Teletypewriter Base, Terminal Box, Motor Interference Suppression Filters and Dust Cover (Applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

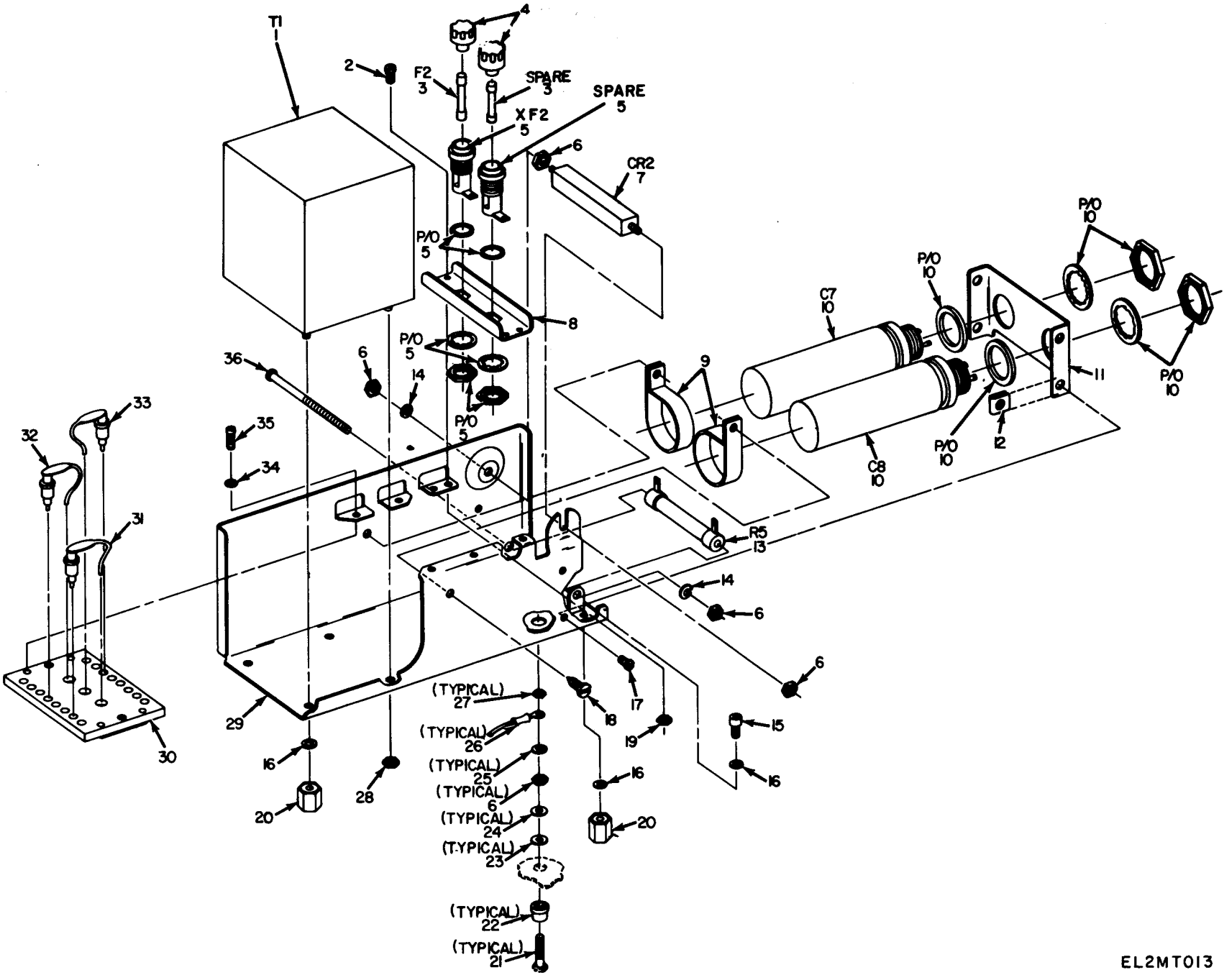
a. The electrical components mounted in the teletypewriter base, terminal box, and in the motor interference suppression filter assemblies are illustrated in figures 2-66, 2-70.1 and 2-71.

b. The disassembly and reassembly procedures are simple and therefore have not been detailed in this technical manual. The components should not be removed unless they are damaged or inoperative. Reference numbers are shown on the legends which accompany the illustrations. Components of the dust cover assembly are illustrated in figure 2-71.1 and the above disassembly and reassembly procedures are applicable.

2.84.2. Disassembly and Reassembly of Power Supply, PP-978/FG

a. The components mounted in the power supply are illustrated in figure 2-62.1.

b. The disassembly and reassembly procedures are simple and therefore have not been detailed in this technical manual. The components should not be removed unless they are damaged or inoperative. Reference numbers are shown on the legends which accompany the illustration.

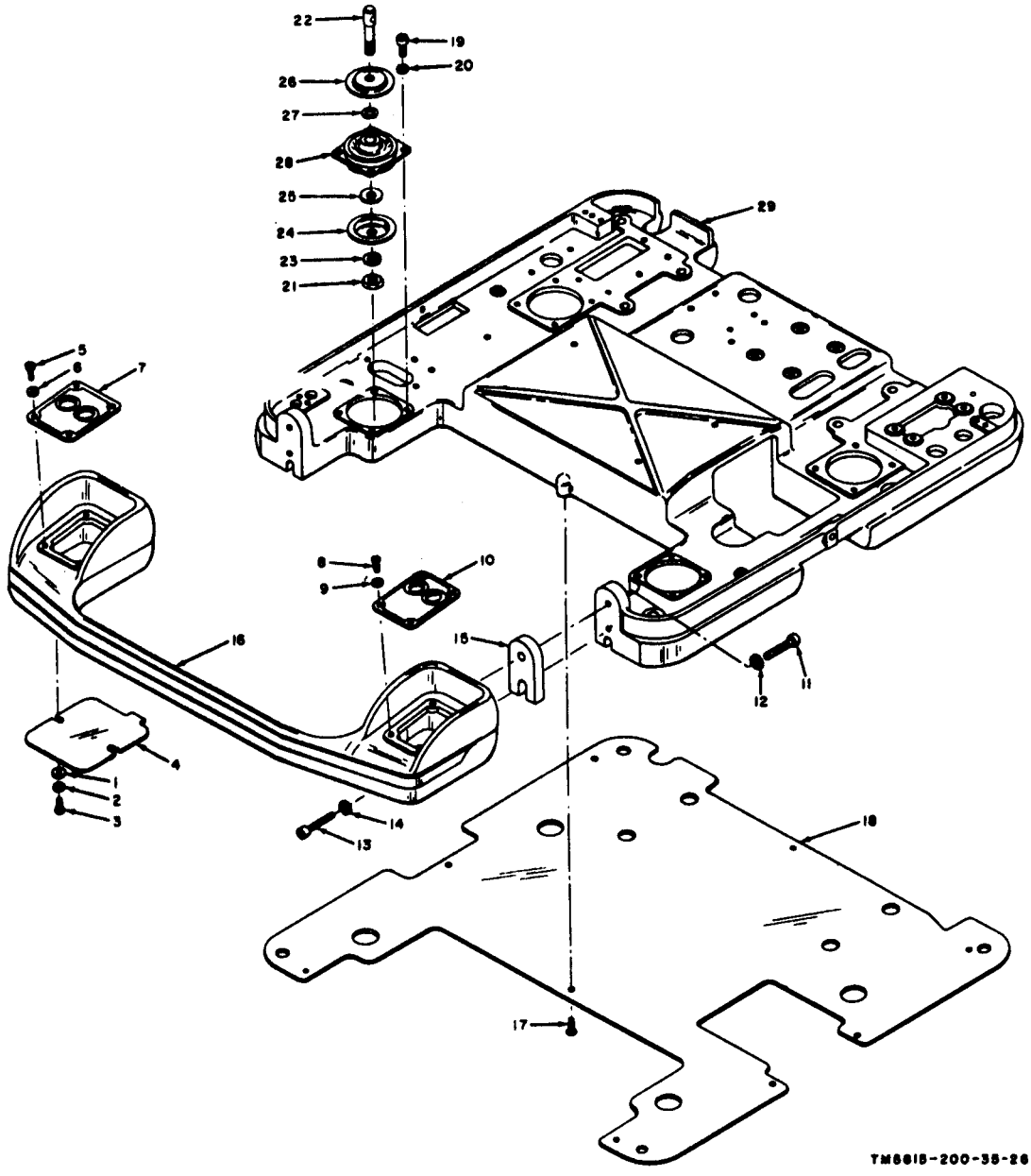


EL2MT013

Figure 2-62.1. Power Supply PP-978/FG parts location exploded view.

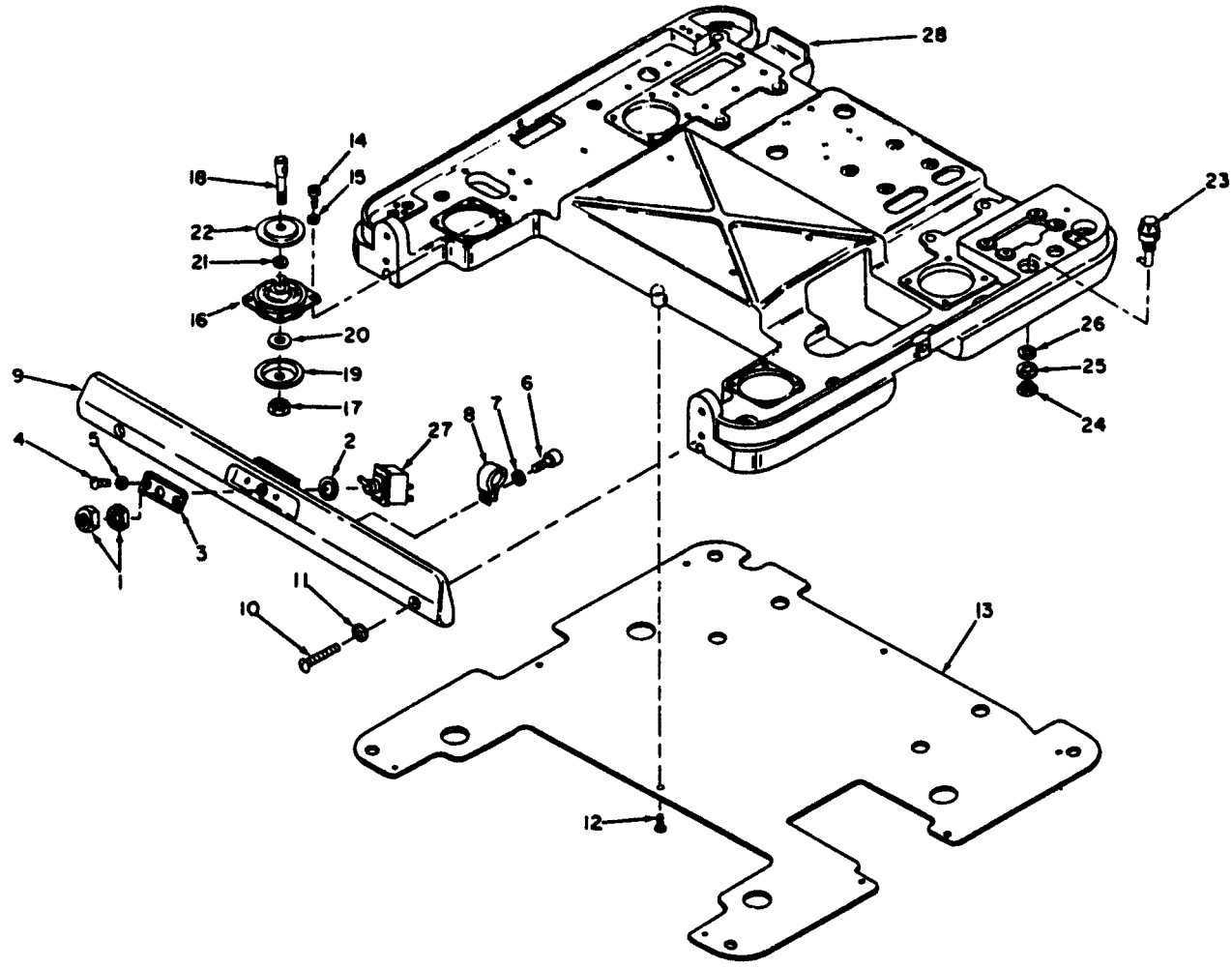
Power transformer, SMC148765
Machine screw, 10003
3 Fuse, FO2GR250A
4 Fuse cap, 34004-SA2
5 Fuseholder, 342004
6 Hexagonal plain nut, 10516
7 Semiconductor (CR2), 23290
8 Channel, 53393
9 Clamp, 20792
10 Electrolytic capacitor (C7,C8), CE41C301J
11 Bracket, 53389
12 Sheet sprin nut, C8091-623-1
13 Fixed resistor (R5), RW33V512
14 Lockwasher, MS35339-61
15 Cap screw, MS16998-26
16 Lockwasher, MS35333-73
17 Machine screw, 10111
18 Threaded tapping screw, 10337
19 Self-locking hexagonal nut, 79 NTM60
20 Hexagonal plain nut, 52941
21 Electrical contact, 52772
22 Insulator, 52771
23 Insulator, 52773
24 Flat washer, MD1974
25 Lockwasher, MS35333-72
26 Terminal lug, 20807
27 Hexagonal plain nut, 10507
28 Self-locking hexagonal nut, F22NTM-02
29 Frame, 52774
30 Terminal board, 53276A
31 Electrical plug connector, SM-B-148798-1
32 Plug connector, SM-B-148798-2
33 Lead plug connector, SM-B-148798-3
34 Lockwasher, MS-35340-41
35 Socket cap screw, MS16998-11
36 Machine screw, 10361

Figure 2-62.1-Continued



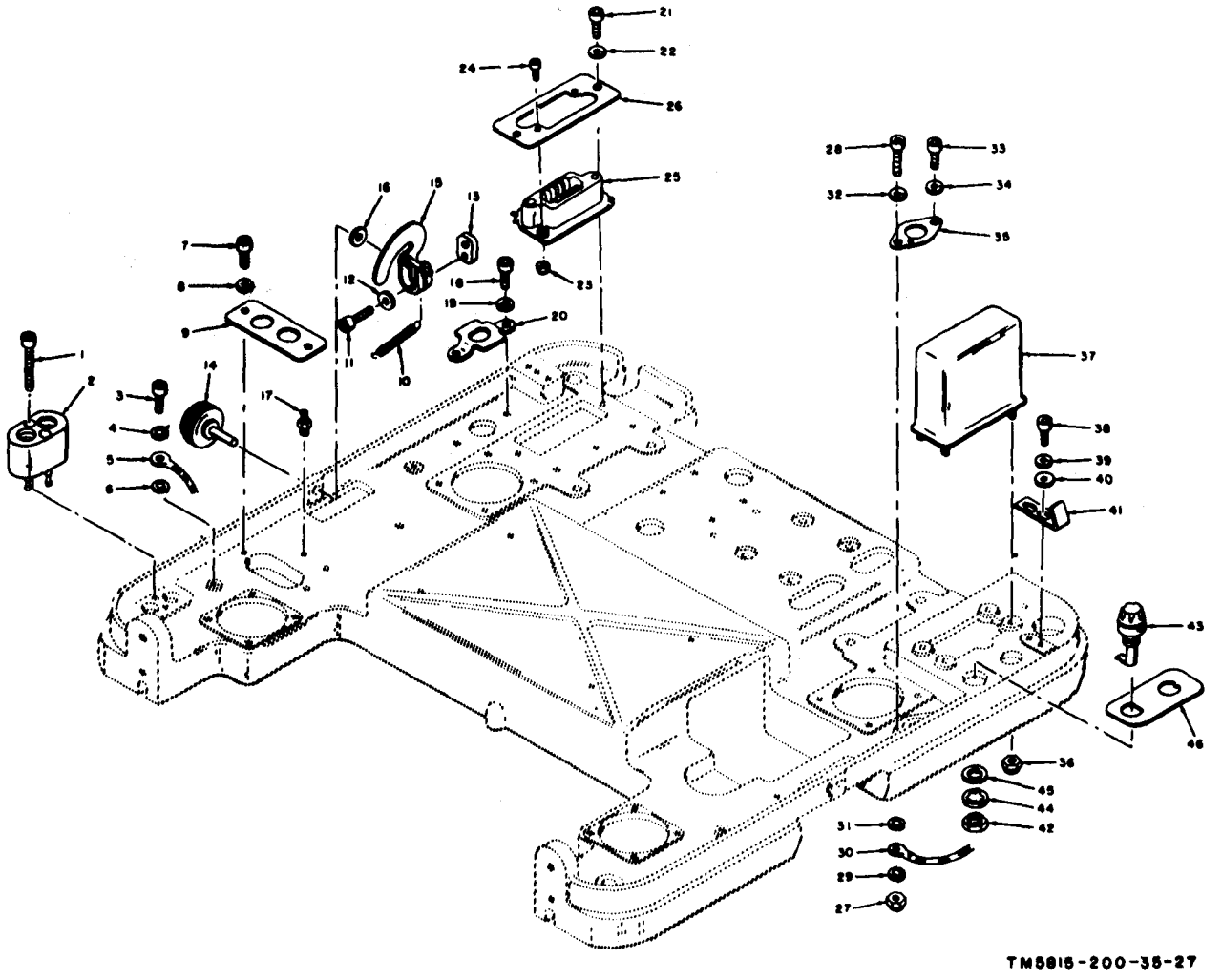
1 Flat washer, 10450
2 Lockwasher, 10429
3 Machine screw, 10393
4 Cover plate, 53171
5 Machine screw, 10393
6 Lockwasher, 10429
7 Switch plate, 52998
8 Machine screw, 10393
9 Lockwasher, 10429
10 Switch plate, 52999
11 Machine screw, 11502
12 Lockwasher, 10404
13 Machine screw, 11502
14 Lockwasher, 10404
15 Spacer plate, 54952
16 Keyboard guard, 52997
17 Machine screw, 10179
18 Teletypewriter base plate, 53421
19 Machine screw, 10008
20 Lockwasher, 10430
21 Hexagonal nut, 10534
22 Vibration mount stud, 53557
23 Lockwasher, 10427
24 Vibration mount limit stop, 54127
25 Flat washer, 50862
26 Vibration mount limit stop, 54127
27 Flat washer, 50494
28 Vibration mount, 10911
29 Teletypewriter base, 55872A

Figure 2-63. Teletypewriter base and keyboard guard, exploded view (not applicable to TT-259/FG).



1 Hexagonal nut (part of item 27)
2 Lockwasher (part of item 27)
3 Switch plate, 61048
4 Machine screw, 10393
5 Lockwasher, 10403
6 Machine screw, 10025
7 Lockwasher, 10430
8 Clamp, 20519
9 Front plate, 61046A
10 Machine screw, 10144
11 Lockwasher, 10404
12 Machine screw, 10179
13 Base plate, 53421
14 Machine screw, 10008
15 Lockwasher, 10430
16 Vibration mount, 10911
17 Hexagonal nut, 10534
18 Vibration mount stud, 53557
19 Vibration mount limit stop, 54127
20 Spacer, 50862
21 Flat washer, 50404
22 Vibration mount limit stop, 54127
23 Fuseholder, 20458 (includes items 24, 25, and 26)
24 Hexagonal nut
25 Lockwasher
26 Rubber washer
27 Toggle switch (S4) 20143A (includes items 1 and 2)
28 Base casting, 56685A

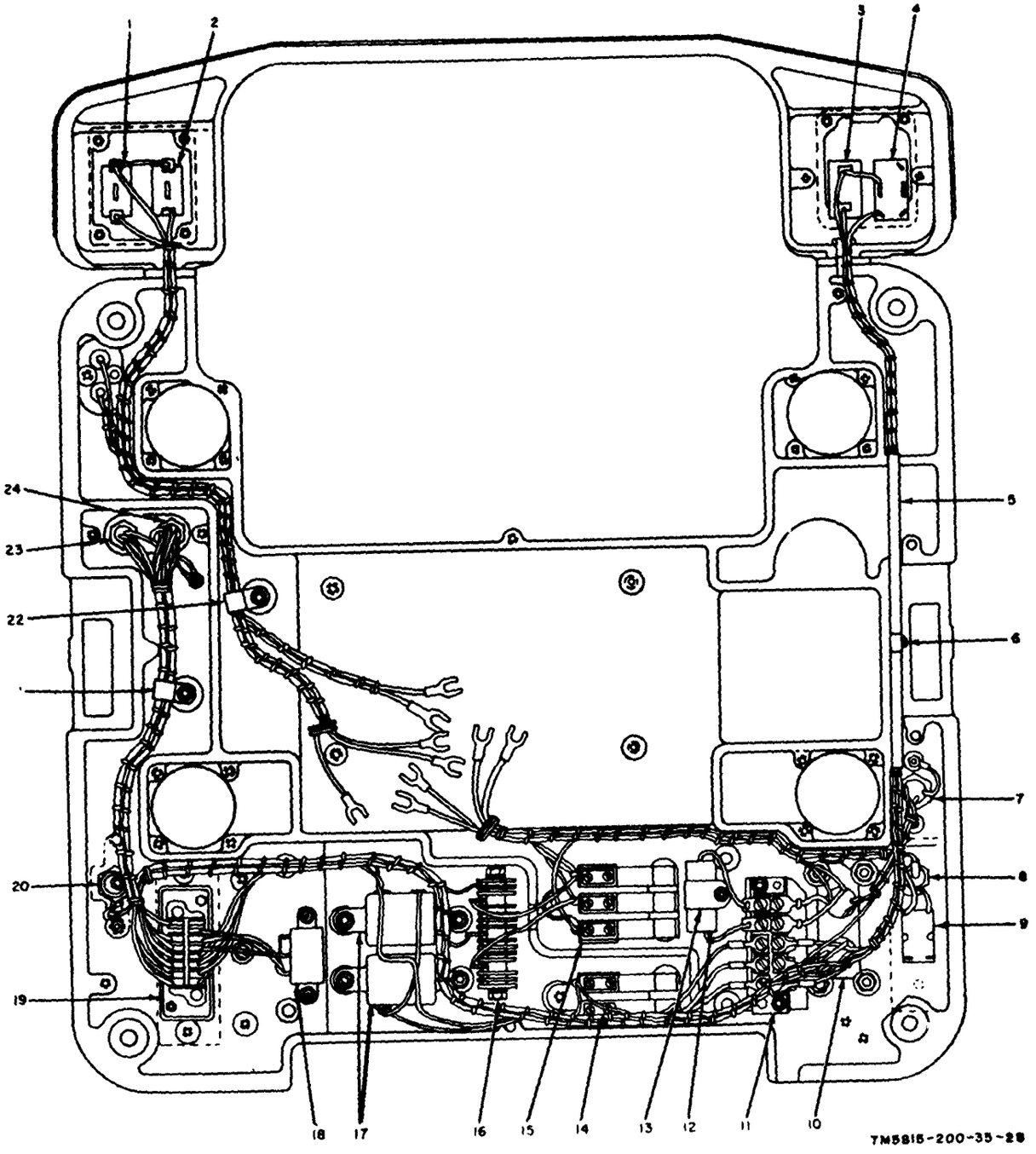
Figure 2-64. TT-259/FG base, exploded view.



1 Machine screw, 10013
2 Receptacle connector, 53320A
3 Machine screw, 10008
4 Lockwasher, 10404
5 Grounding lead, 53651A
6 Lockwasher, 10404
7 Machine screw, 10008
8 Lockwasher, 10430
9 Switch plate, 53167
10 Dust cover arm spring, 55014
11 Machine screw, 10010
12 Flat washer, 10467
13 Nut plate, 52073
14 Locking knob, 55013
15 Dust cover arm, 55010A (LH) and 55015A (RH)
16 Flat washer, 50315
17 Spring post, 56288
18 Machine screw, 10008
19 Lockwasher, 10430
20 Mounting bracket, 53806
21 Machine screw, 10008
22 Lockwasher, 10430
23 Self-locking hexagonal nut, 10551
24 Machine screw, 10050
25 Receptacle connector, 20263
26 Mounting plate, 53092
27 Self-locking hexagonal nut, 10501
28 Machine screw, 10010[a]
29 Lockwasher, 10404
30 Terminal lug
31 Lockwasher, 10404
32 Lockwasher, 10430[a]
33 Machine screw, 10008[a]
34 Lockwasher, 10430[a]
35 Mounting plate, 53172[a]
36 Self-locking hexagonal nut, 10501[a]
37 Motor stop relay E1, 23161
38 Machine screw, 10008
39 Lockwasher, 10430
40 Flat washer, 10467
41 Dust cover guide, 55021
42 Hexagonal nut (not applicable to TT-259/FG)
43 Fuse holder, (20458 (includes items 42, 44, and 45)) and cap, 20460 (not applicable to TT-259/FG)
44 Lockwasher (not applicable to TT-259/FG)
45 Rubber washer (not applicable to TT-259/FG)
46 Switch plate S4, 53563 (not applicable to TT-259/FG)

[a]Not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG.

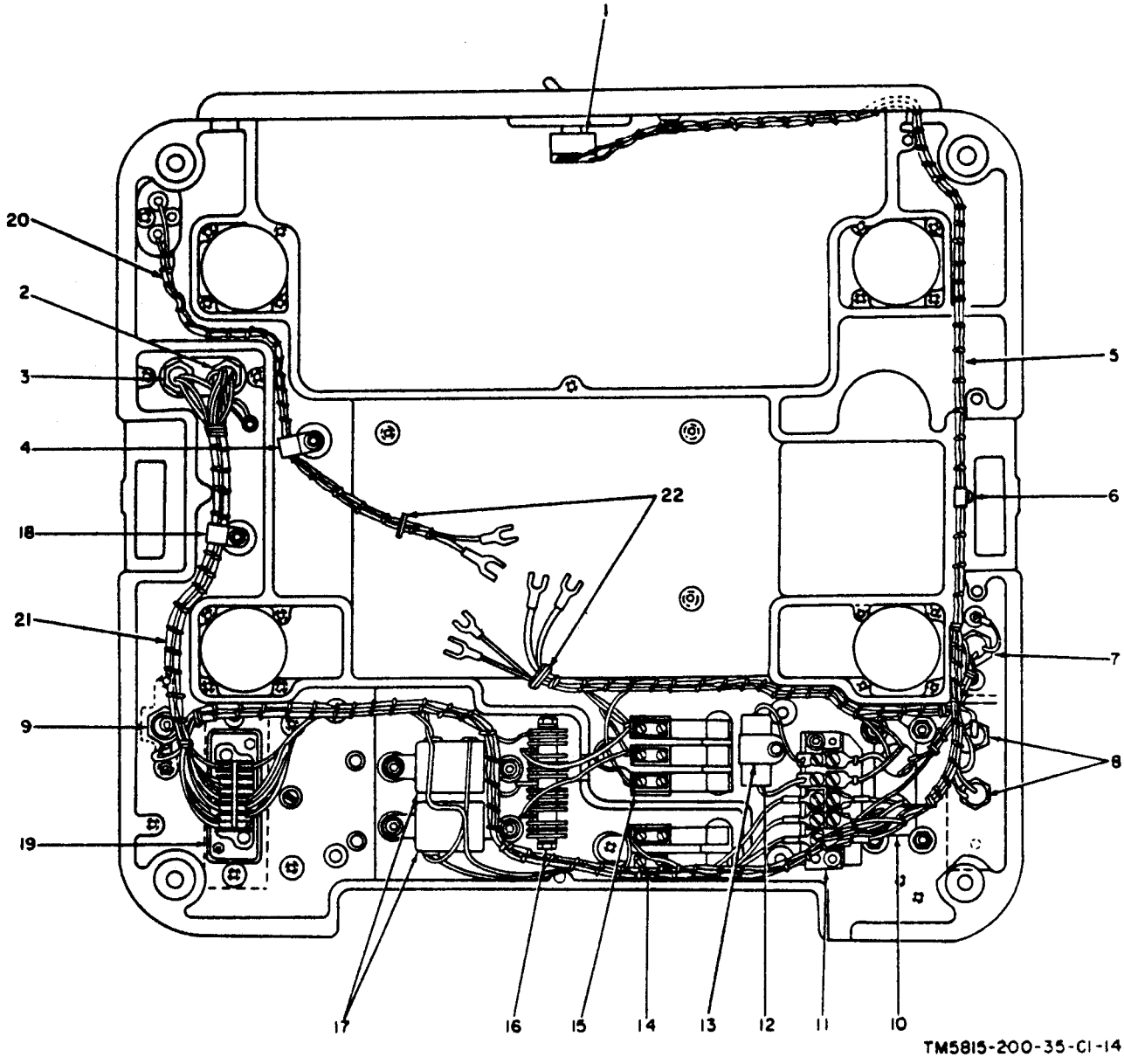
Figure 2-65. Teletypewriter base components, exploded view.



1 Toggle switch (S5), 20119
2 Toggle switch (S6), 20119
3 Toggle switch (S3), 20116
Toggle switch (S2), 20121
4 Cable shield, 53614
6 Electrical clamp, 20517 [a]
7 Motor stop jack (J2), 20262
8 Fuse (F1)
9 Toggle switch (S4), 20115 [a]
10 Motor stop relay (E1), 20301
11 Terminal strip (TB2), 20385
12 Capacitor (C2), 20212 [a]
13 Electrical clamp, 20774 [a]
14 Electrical contact (J4B), 53416A
15 Electrical contact (J4A), 53414A
16 Metallic rectifier (CR1), 54356A [a]
17 Capacitors (C5) and (C6), 20213 [a]
18 Filter (Z3) 54582 (TT-98/FG only)
19 Receptacle connector (J7), 20263
20 Fuse (F4) [a]
21 Electrical clamp, 20514
22 Electrical clamp, 20513
23 Selector magnet jack (J8)
24 Transmitter contact jack (J5)

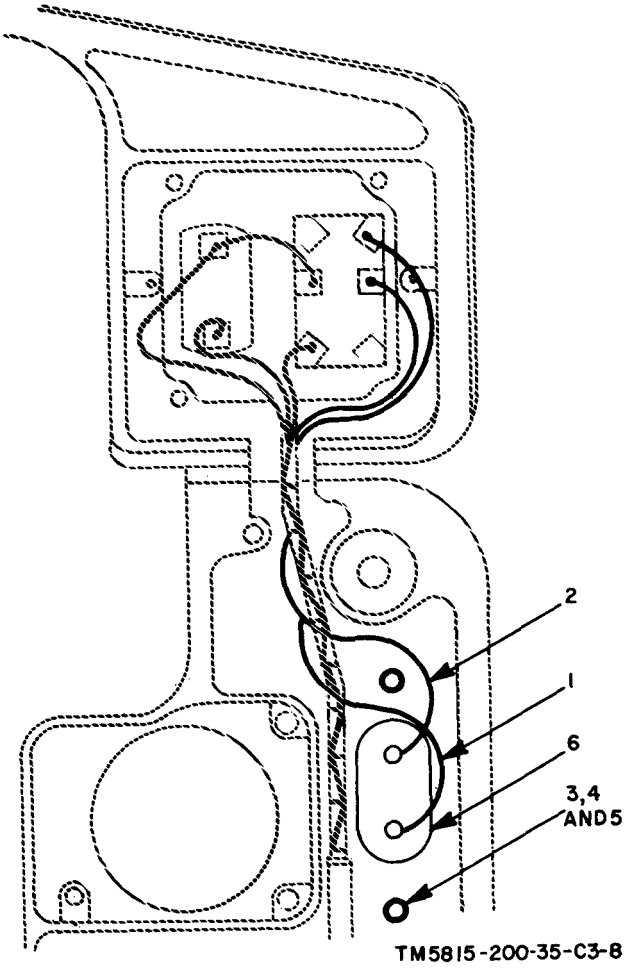
Figure 2-66. Teletypewriter base, electrical components (not applicable to TT-259/FG).

[a] Not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG.



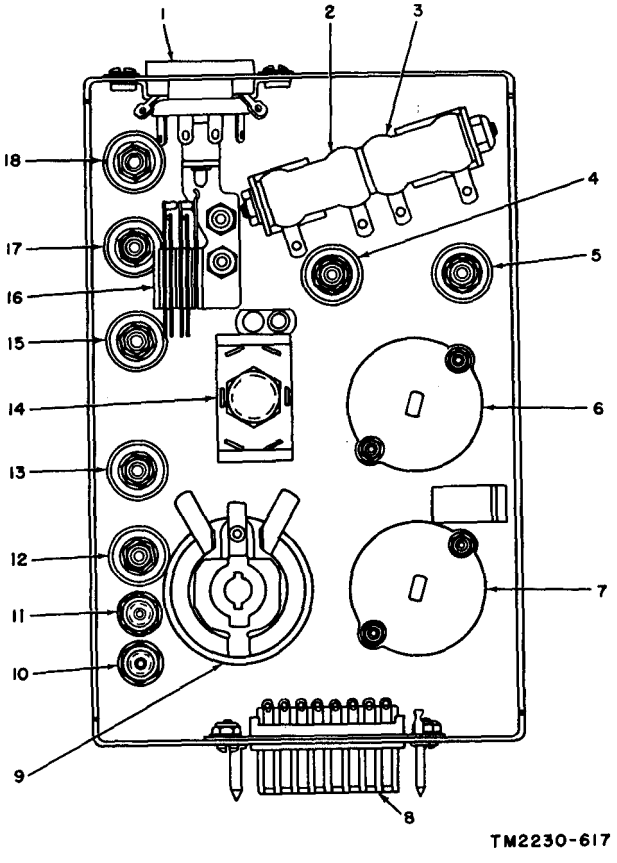
1 Toggle switch (S4), 20143A
2 Transmitter contact jack (J5)
3 Selector magnet jack (J8)
4 Electrical clamp, 20513
5 Cable assembly
6 Electrical clamp, 20519
7 Motor stop jack (J2), 20115
8 Fuseholder (XF1, XF2)
9 Fuseholder (XF4)
10 Motor stop relay (E1), 20301
11 Terminal strip (TB2), 20385
12 Capacitor (C2), 20212
13 Electrical clamp, 20774
14 Electrical contact (J4B), 53416A
15 Electrical contact (J4A), 53414A
16 Rectifier (CR1), 54356A
17 Capacitors (C5 and C6), 20213
18 Electrical clamp, 20514
19 Receptacle connector (J7), 20263
20 Cable assembly, 56677A
21 Cable assembly
22 Grommet, rubber, 20726

Figure 2-67. Electrical components of TT-259/FG base.



1 Electrical lead (black), 22000–07.43
2 Electrical lead (white), 22099–07.03
3 Machine screw, 10050
4 Lockwasher, 10432
5 Flat washer, 10457
6 Terminal board TB3, 20396

Figure 2-68. Location of terminal board TBS on base of TT-293/FG.



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 (R10), 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

Figure 2-69. Terminal and switch box components, Teletypewriter TT-98/FG

1 Resistors (R6) and (R7), 20042 and 20039
2 Resistors (R2) and (R3), 20040 and 20041
3 Positive terminal
4 Negative terminal
5 Switch (S7), 20130 (20133 on TT-259/FG)
6 Connector (P7), 20420
7 Resistor (R8), 20015
8 Negative iack (J10), 20852
9 Positive jack (J9), 20852
10 No. 4 terminal
11 No. 3 terminal
12 Switch (S11), 20121
13 No. 2 terminal
14 No. 1 terminal
15 No. 5 terminal

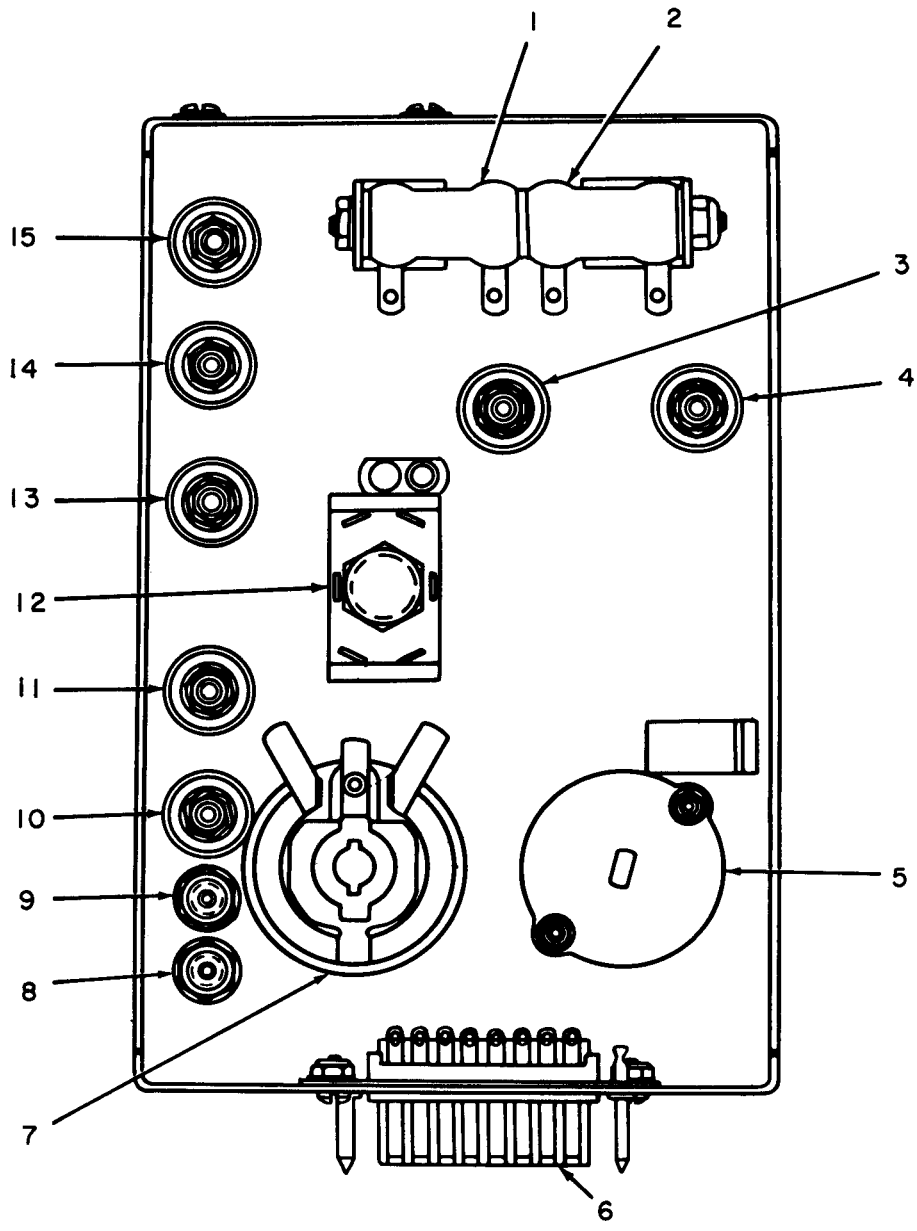


Figure 2-70. Terminal and switch box components, all models except Teletypewriter TT-98/FG, TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG.

1 Zener diode (A1VR1), JAN 1N2823B
2 Resistor (A1R1), RER70F9100M
3 Selector magnet module (A1A1A3), SM-C-759853
4 Receiver module (A1A1A2), SM-C-759849
5 Plug (A1P1), SM-C-759834
6 Transmitter module (A1A1A1), SM-C-759840
7 Terminal board (A1TB2), 37TB4
8 Terminal board (A1TB1), 40TB15
9 Mother board (A1A1), SM-D-759836

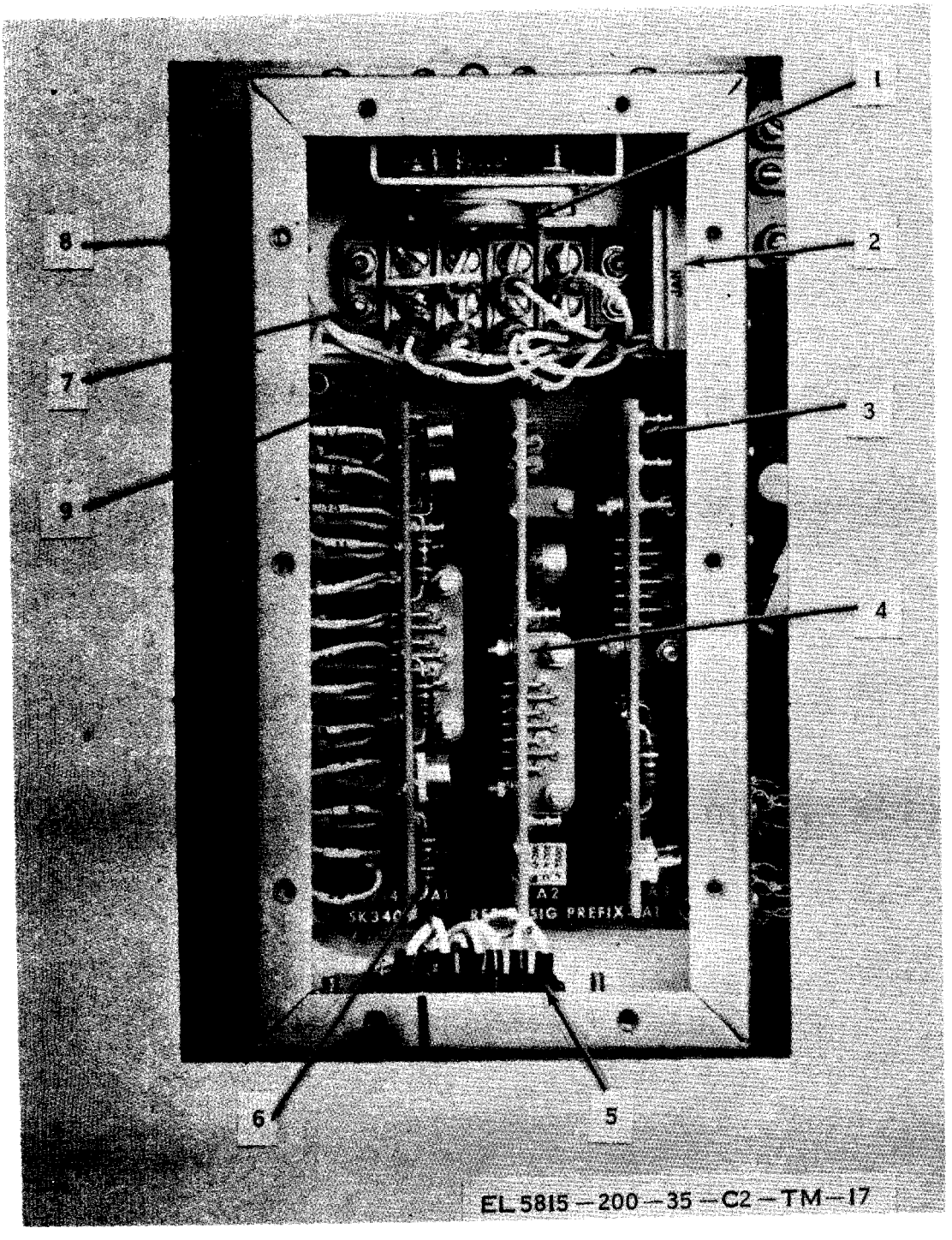


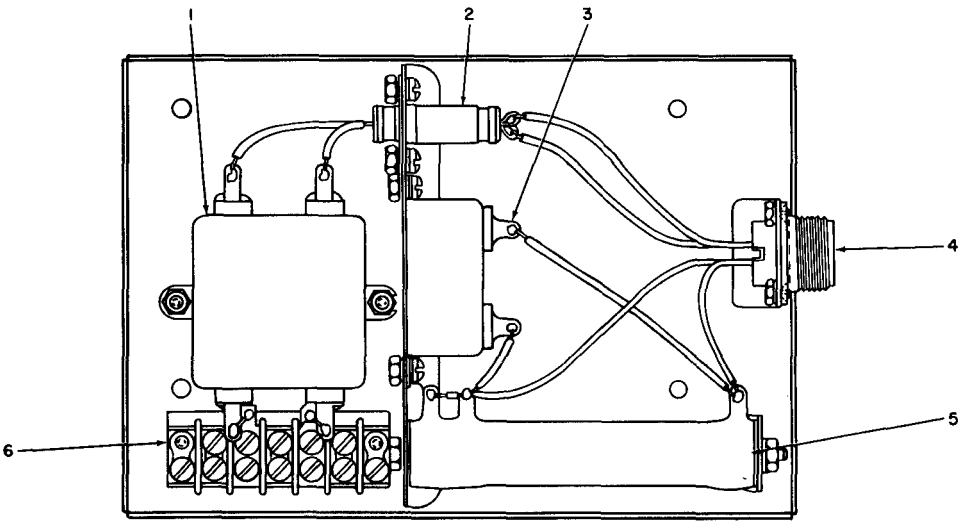
Figure 2-70.1. Terminal box components, teletypewriters (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

A-Equipment with series-governed motors

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-Equipment with synchronous motors

1 Capacitor (C9), 53343
2 Receptacle (J3), 20264
3 Starting relay (E3), 20114
4 Terminal board (TB1), 20370



A.

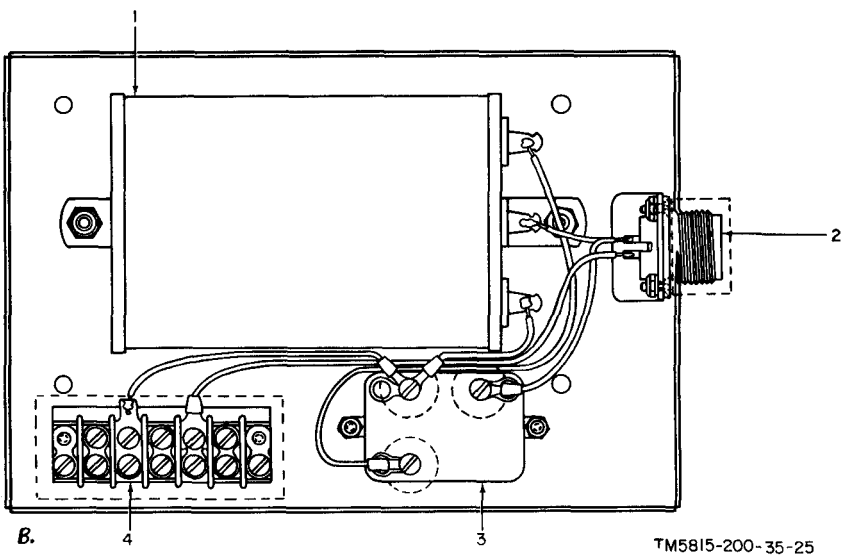
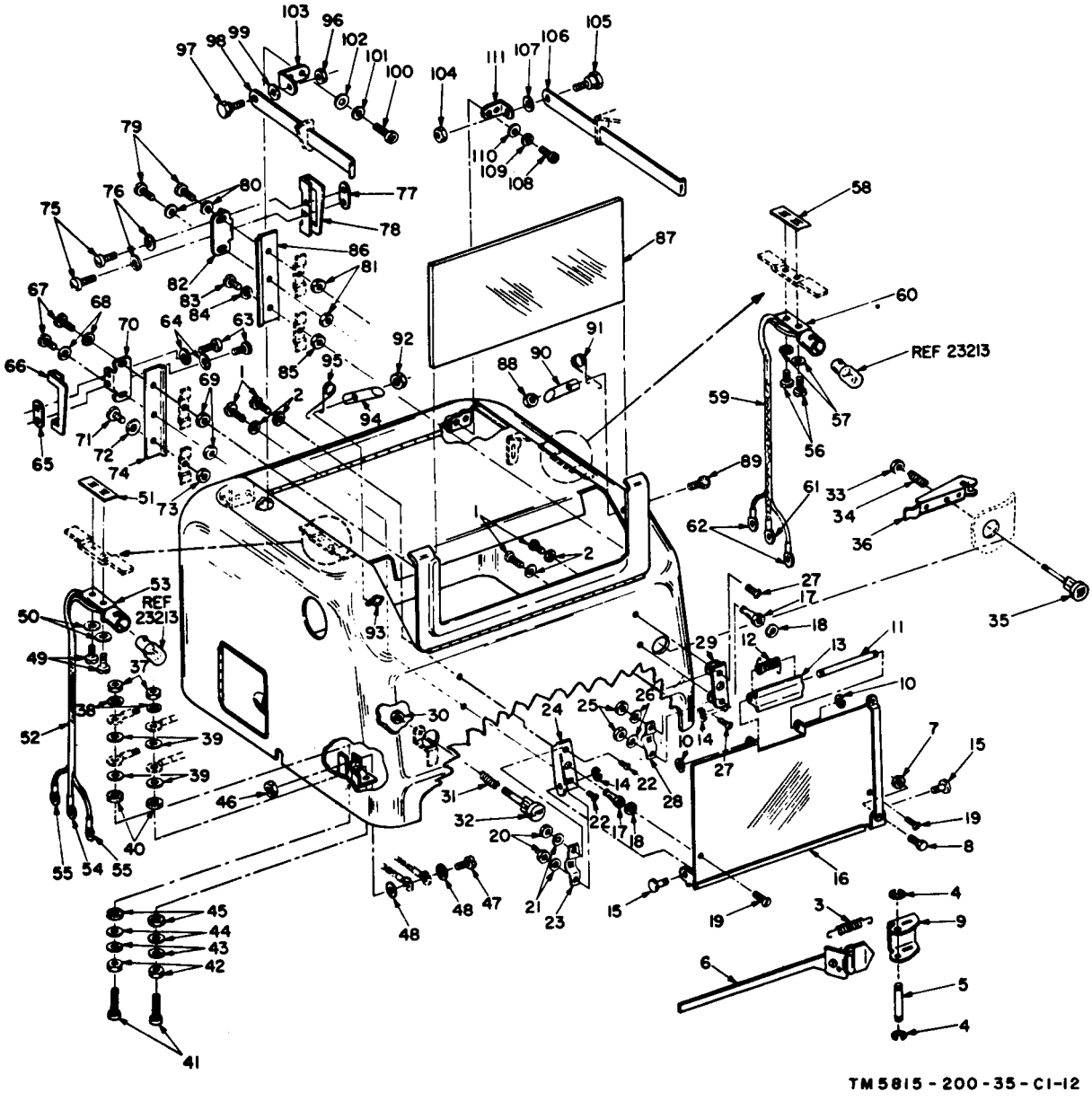


Figure 2-71. Motor interference suppression filter assemblies, electrical components.



1 Machine screw, 10376
2 Lockwasher, 10404
3 Spring, 54948
4 Lockwasher, 10960
5 Pin, 52068
6 Copy retaining arm, 53191
7 Self-locking hexagonal nut, 10500
8 Machine screw, 10001
9 Bracket, 53436
10 Retainer ring, 10969
11 Hinge pin, 52258
12 Copy holder clip spring, 52551
13 Copy holder clip, 53446
14 Retainer ring, 10949
15 Stud, 52346
16 Copy holder plate assembly, 54950A (includes items 17, 18 and 19)
17 Spring catch stud, 10984
18 Lockwasher, 10429
19. Machine screw, 10378
20 Plain hexagonal nut, 10504
21 Lockwasher, 10434

Figure 2.71.1. Page Printer Dust Cover Assembly.

22 Machine screw, 10176
23 Spring catch, 10985
24 L.H. bracket, 54942
25 Plain hexagonal nut, 10504
26 Lockwasher, 10434
27 Machine screw, 10176
28 Spring catch, 10895
29 R.H. bracket, 54941
30 Plain hexagonal nut, 10520
31 Spring, 53558
32 Push-button assembly, 54995
33 Plain hexagonal nut, 10520
34 Spring, 53558
35 Push-button assembly, 54992
36 Lever, 53379
37 Plain hexagonal nut, 10515
38 Lockwasher, 10404
39 Flat washer, 10463
40 Insulating washer, 51106
41 Contact, 55022
42 Plain hexagonal nut, 10515
43 Lockwasher, 10404
44 Flat washer, 10463
45 Insulating washer, 51481
46 Plain hexagonal nut, 10511
47 Machine screw, 10308
48 Lockwasher, 10412
49 Machine screw, 10301
50 Lockwasher, 10412
51 Spring nut, 10538
52 Cable assembly, 61373A (includes items 53, 54, and 55)
53 Lamp holder, 51115
54 Grounding lug, 20708
55 Terminal lug, 20707
56 Machine screw, 10301
57 Lockwasher, 10412
58 Spring nut, 10538
59 Cable assembly, 61374A (includes items 60, 61, and 62)
60 Lamp holder, 51115
61 Grounding lug, 20708
62 Terminal lug, 20707
63 Machine screw, 10393
64 Lockwasher, 10429
65 Nut plate, 54884
66 L.H. window latch, 54969
67 Machine screw, 10375
68 Lockwasher, 10432
69 Plain hexagonal nut, 10517
70 Latch plate, 54989
71 Machine screw, 10374
72 Lockwasher, 10432
73 Plain hexagonal nut, 10517
74 Pane retaining plate, 52992
75 Machine screw, 10393
76 Lockwasher, 10429
77 Nut plate, 54884
78 R.H. window latch, 54999
79 Machine screw, 10375
80 Lockwasher, 10432
81 Plain hexagonal nut, 10517
82 Latch plate, 54989
83 Machine screw, 10374
84 Lockwasher, 10432
85 Plain hexagonal nut, 10517
86 Pane retaining plate, 52992
87 Pane, 52896
88 Plain hexagonal nut, 10520
89 Button, 54994
90 Catch pin, 54998
91 Spring, 54996
92 Plain hexagonal nut, 10520
93 Button, 54994
94 Catch pin, 54998
95 Spring, 54996
96 Self-locking hexagonal nut, 10523
97 Cover stay hinge stud, 52987
98 Cover stay, 53182
99 Spacer, 52988
100 Machine screw, 10001
101 Lockwasher, 10421
102 Flat washer, 10458
103 Bracket, 52968
104 Self-locking hexagonal nut, 10523
105 Cover stay hinge stud, 52987
106 Cover stay, 53182
107 Spacer, 52988
108 Machine screw, 10001
109 Lockwasher, 10421
110 Flat washer, 10458
111 Bracket, 52986

Dust cover assembly, Part No. 63881, includes items (1 through 111) above
Copy holder, Part No. 54935A, includes items (3 through 23) above.
Dust cover assembly, Part No. 61375A, includes items (1, 2 and 24 through 111) above.

Figure 2-71.1 -Continued.

Section VII. TELETYPEWRITER ADJUSTMENT PROCEDURES

2-85. General

This section contains the requirement and adjustment procedures for the teletypewriter. Complete the individual checks and make the necessary adjustments, if required. Adjustments are arranged in sequence for a complete readjustment of the teletypewriter. When making individual adjustments, check all related adjustments. When removing parts to make an adjustment, refer to paragraphs 2-17 through 2-84.1 for instructions.

NOTE

Paragraphs 2-86 through 2-97 are not applicable to TT-259/FG.

2-86. Keylever Locking Bar Adjustment

(fig. 2-72)

a. Requirement. There should be a 0.005- to 0.030-inch clearance between the keylever locking bar and the keylevers.

b. Adjustment. Remove the keyboard transmitter from the teletypewriter (para 2-18 *a).* Loosen the three machine screws and move the keylever locking bar up or down to meet the requirement. Check both ends of the keylever locking bar and tighten the machine screws; recheck the clearance. Replace the keyboard transmitter in the teletypewriter (para 2-18 *b).*

2-87. Transmitter Camshaft End-Play Adjustment

(fig. 2-73)

a. Requirement. There should be a 0.001- to 0.005-inch clearance between the spacer (or clutch yoke if no spacer is installed) and the adjacent ball bearing when the cam end of the transmitter camshaft is pressed toward the keyboard casting.

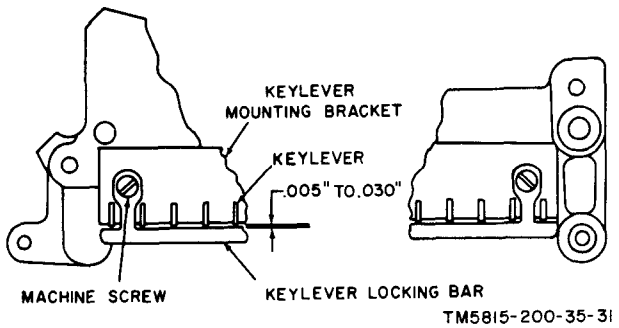


Figure 2-72. Keylever locking bar adjustment.

b. Adjustment. Loosen the setscrews in the clutch fork and insert a 0.003-inch gage between the spacer and the bearing. Press the transmitter camshaft and clutch fork toward each other; align the setscrews with the flats on the camshaft and tighten the setscrews. Remove the feeler gage and recheck the clearance.

2-88. Locking Lever Latch End Play and Repeat Blocking Lever Adjustment

(fig. 2-74)

NOTE

The repeat blocking lever adjustment applies to TT-98B/FG, TT-100B/FG, and TT-664/FG, Order No. 23425-Phila-57; and to TT-98B/FG, Order No. 13930-Phila-58 only.

a. Requirements.

(1) There should be a .002 to .005 -inch clearance between the locking lever latch and the keyboard casting (A, fig. 2-74).

(2) There should be a .045 to .050 -inch clearance between the opposing edges of the repeat blocking lever and the locking lever latch (B, fig. 2-74) when the cam stop lever is in the restored position.

b. Method of Checking. Check the requirement of *a(2)* above by turning the transmitter camshaft by hand until the cam stop lever is in the restored position and the transmitter camshaft no longer turns. Check for the required clearance.

c. *Adjustments.*

(1) Loosen the setscrew and position the locking lever latch stud to meet the requirements in *a(1)* above. Tighten the setscrew and recheck the clearance.

(2) Loosen the hexagonal nut which secures the repeat blocking lever adjusting screw. Turn the adjusting screw until the requirement in *a(2)* above is met. Tighten the hexagonal nut.

2-89. Selector Lever End-Play Adjustment (All Models Except TT–98/FG, TT–98A/FG, TT–99/FG, TT–100/FG, and TT–664/FG)

(A, fig. 2-75)

a. Requirements. There should be 0.002- to

0.005-inch clearance between the spacer and the sensing lever locking bail.

b. Adjustment. Loosen the setscrew and move the selector lever pivot post in or out to meet the requirement, tighten the setscrew, and recheck the clearance.

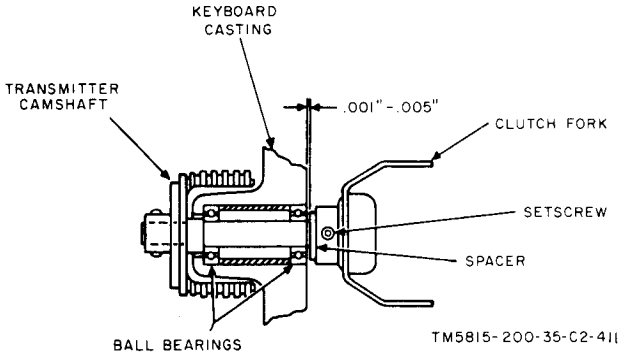


Figure 2-73. Transmitter camshaft end-play adjustment.

2–90. Selector End-Play Adjustment (Applicable to TT–98/FG, TT–98A/FG, TT–99/FG, TT–100/FG, and TT–664/FG)

(B, fig. 2-75)

a. Requirement. There should be a 0.001- to 0.007-inch clearance between the laminated washer and the No. 1 selector lever.

b. Adjustment. Remove parts as necessary to gain access to the laminated washer. Either remove laminations from the washer or install a new laminated washer, peeled to size, to meet the requirement. Reassemble the parts and recheck the clearance. Check the sensing lever locking bail adjustment (para 2-94).

2-91. Universal Bar Adjustment

(fig. 2-76)

a. Requirement. There should be a .005 to .015-inch clearance between the cam stop lever and the locking lever latch when any keylever or the space bar is in the pressed position.

b. Adjustment. Loosen the locknut and turn the universal bar adjusting screw in or out to meet the requirement; tighten the locknut.

2-92. Sensing Levers Clearance and Alinement Adjustment

(fig. 2-77)

a. Requirement. The sensing levers and the code bars should be in alinement, and there should be a .001- to .003-inch clearance between the flat washer and the sensing lever.

b. Adjustment. Loosen the setscrew. Remove the sensing levers and sensing lever pivot stud. Peel laminations from, or add laminations to, the laminated washer until the sensing levers and code bars are in alinement. Remove all burs from the laminated washer. Replace the sensing levers and sensing lever pivot stud. Move the sensing lever pivot stud in or out to obtain the .001- to .003-inch clearance. Tighten the setscrew.

2–93. Selector Levers and Sensing Levers Adjustment

(fig. 2-78)

a. Requirement. There should be a .005-inch minimum clearance between the selector levers and the sensing levers when a selector lever is on the low part of the cam assembly and its associated sensing lever is in the mark position.

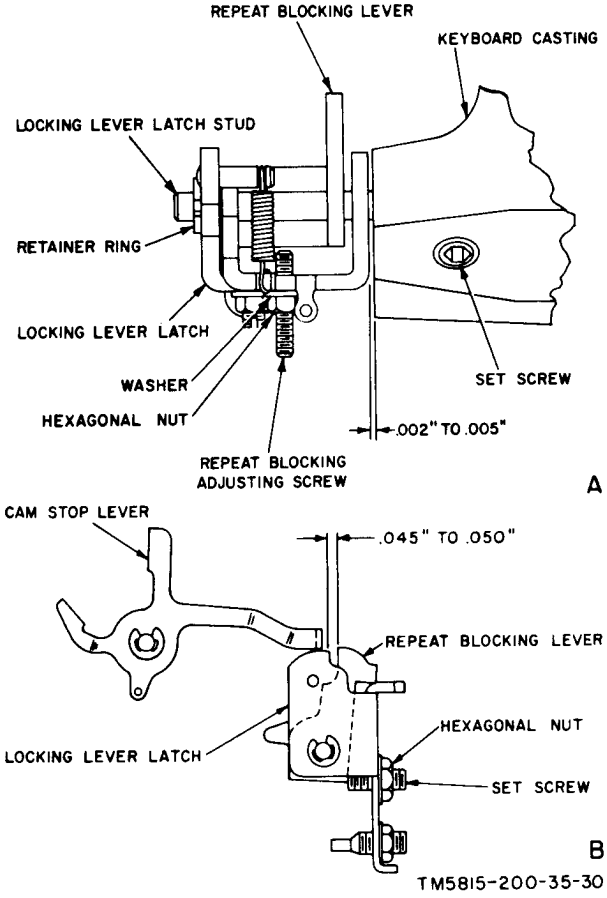


Figure 2-74. Locking lever latch end play and repeat blocking lever adjustment.

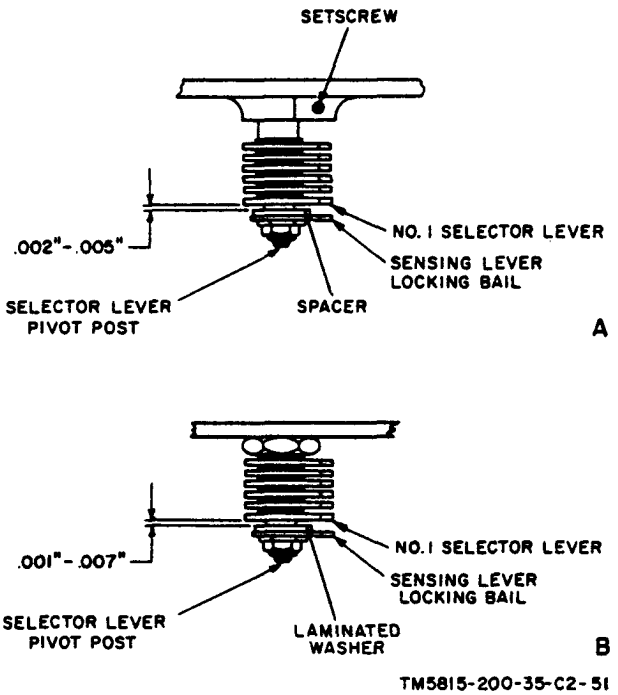


Figure 2-75. Selector lever pivot post adjustment.

b. Adjustment. Loosen the two screws which hold the selector lever comb (A, fig. 2-78) in place. Move the selector lever comb to meet the requirement (B, fig. 2-78). Tighten the two screws which hold the selector lever comb in place. This adjustment should be made and checked when making the selector lever latch adjustment (para 2-96).

2–94. Sensing Levers Locking Bail Adjustment

(fig. 2-79)

a. Requirement. There should be equal clearance between the latching surface of the sensing lever locking bail and the projections on the top of the sensing levers when the sensing levers are in the mark or space position.

b. Method of Checking. Press either the R- or Y-keylever. Turn the transmitter camshaft clockwise by hand until the sensing lever locking bail engages the sensing levers; check the clearance visually.

c. Adjustment. Loosen the nut on the selector levers pivot post. With the sensing lever locking bail engaged with the sensing levers, turn the eccentric bearing clockwise or counterclockwise to meet the requirement. Tighten the nut on the selector levers pivot post.

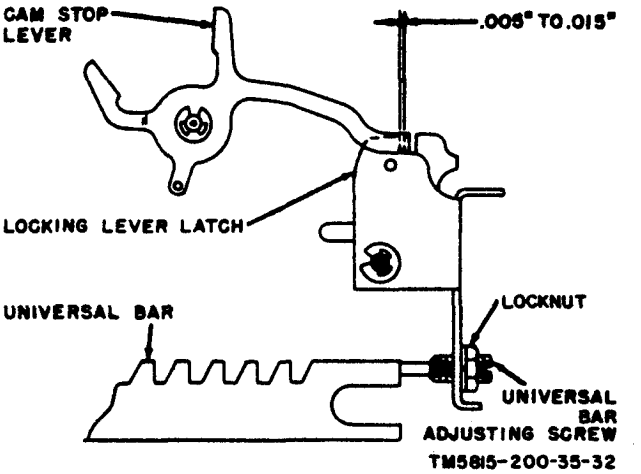


Figure 2-76. Universal bar adjustment.

2–95. Keyboard Transmitter Friction Clutch Adjustment

(fig. 2-80)

a. Requirements.

(1) There should be a .005 to .025 inch (.005 to .020 inch for TT-664(*)/FG and TT-665/FG) clearance between the friction clutch disk and the bearing of the clutch fork.

(2) It should require a pull of 25 to 30 ounces (38 to 44 ounces for TT-664(*)/FG and TT-665/FG) to prevent the friction clutch from turning when the motor is on and the camshaft is not operating any levers.

b. Method of Checking.

(1) Insert a flat feeler gage between the friction clutch disk and the bearing of the clutch fork to determine the clearance.

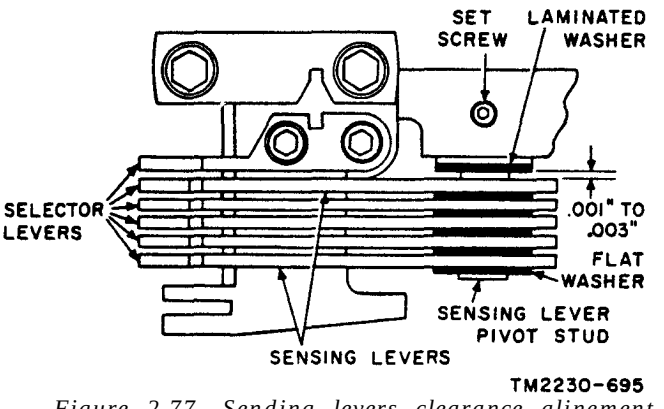


Figure 2-77. Sending levers clearance alinement adjustment.

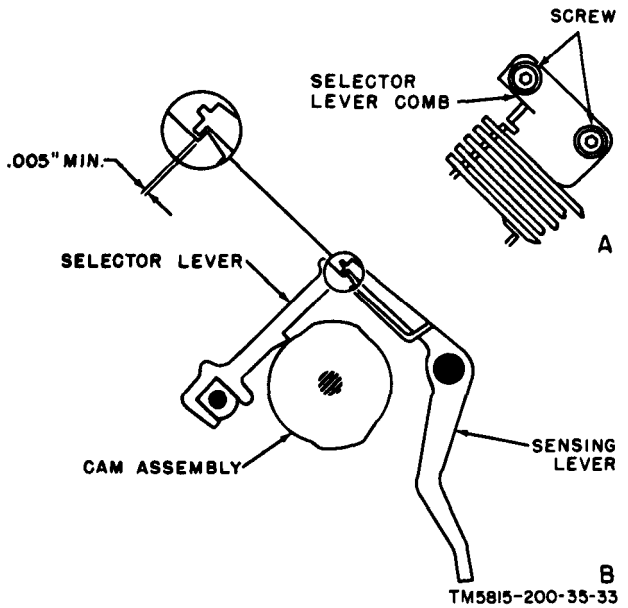


Figure 2-78. Selector levers and sensing levers adjustment.

(2) Hook a spring scale on the clutch fork. While holding the scale rigidly, press the space bar and allow the camshaft to turn slightly until it is not operating any levers. When the free spot has been established, hold the clutch fork from turning and read the scale.

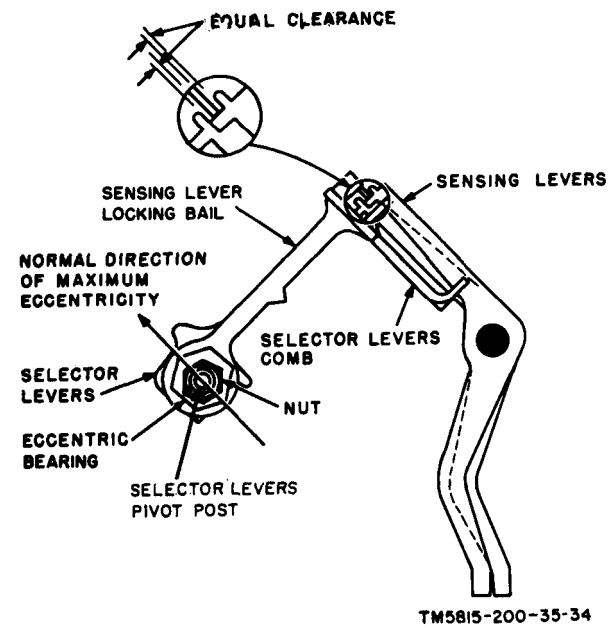


Figure 2-79. Sensing levers locking bail adjustment.

c. Adjustments.

(1) Loosen the two setscrews in the friction clutch disk and position the disk until the requirement of *a* (1) above is met.

(2) Loosen the clamping screws in the friction clutch adjusting collar and turn the collar on the driving collar to obtain the requirement of *a(2)* above.

2-96. Stop Selector Lever and Transmitter Mark Contact Adjustment (Not Applicable to TT-664(*)/, TT-665/FG, and TT-688(*)/FG)

(fig. 2-81)

a. Requirements.

(1) There should be a slight break in the signal circuit between successive marking code impulses, but the duration of the break should be as small as possible.

(2) The stop selector lever latch should be adjusted to give a minimum break in the send circuit between the marking fifth intelligence impulse and the stop impulse. There should be a .003-inch minimum clearance between the stop selector lever and the stop selector lever latch when the stop selector lever is on the low part of its cam.

b. Method of Checking.

(1) Remove the two machine screws (1, fig. 2-24), lockwashers (2), and contact cover (3). Disconnect keyboard plug P5 from the KEYBOARD receptacle on the left-hand side of the base. Arrange a multimeter to indicate resistance on its lowest ohmic scale. Connect one multimeter lead to the mark stationary

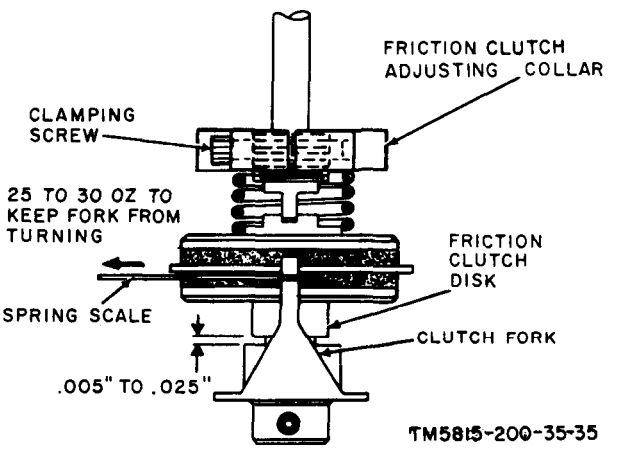


Figure 2-80. Keyboard transmitter friction clutch adjustment.

contact (fig. 2-81) and the other lead to the contact bail terminal. Press the LTRS key, slowly turn the motor by hand, and check for the requirement in *a(1)* above.

(2) With the multimeter still connected as described in (1) above, press the T-key and turn the motor slowly by hand. There should be a slight, but minimum, break between the marking fifth intelligence impulse and the stop impulse. With the stop selector lever on the low part of its cam, check the clearance between the stop selector lever and the stop selector lever latch with a feeler gage.

c. Adjustment.

(1) Connect a multimeter as described in *b(1)* above. Press the LTRS key and slowly turn the motor by hand. Adjust (by turning) the mark stationary contact (A, fig. 2-81) until the requirement of *a(1)* above is met.

(2) With the multimeter still connected as described in (1) above, loosen the machine screws that hold the stop selector lever latch (B, fig. 2-81). Press the T-key and slowly turn the motor by hand. Move the stop selector lever latch to the right or left until a slight, but minimum, break is obtained between the marking fifth intelligence impulse and the stop impulse. Move the stop selector lever latch to the right to decrease the break and to the left to increase the break. With the stop selector lever against the low part of its cam, check the clearance between the stop selector lever and the stop selector lever latch. If the clearance is less than .003 -inch, remake the adjustment described in paragraph 2-93. Reposition the stop selector lever latch to meet the requirement of *a(2)* above.

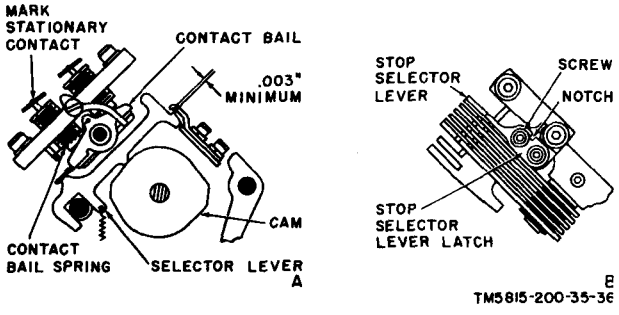


Figure 2-81. Stop selector lever latch and transmitter contact adjustment.

NOTE

If the keyboard transmitter is to be used for transmission of polar impulses, perform the transmitter space contact adjustment (para 2-97).

2-96.1 Stop Selector Lever Latch and Transmitter Contact Assembly Adjustment (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG.

(fig. 2-81.1)

a. Requirement.

(1) The stop selector lever latch should be adjusted to give the correct stop pulse length. Them should be a .003-inch minimum clearance between the stop selector lever and stop selector lever latch when the stop selector lever is on a low point of its cam.

(2) The mark and space impulses from the sequential keyboard transmitter should be of equal time duration.

b. Methods of Checking. An oscilloscope should be used to measure signals transmitted by the keyboard transmitter.

c. Adjustment.

(1) On the page printer terminal box, connect an oscilloscope to terminals 4 (-) and 5 (+) of terminal board TBI.

(2) Loosen the socket head screws that secure the selector lever latch. Turn the motor on and push the REPEAT key and blank key. With a screwdriver in the notch of the selector lever latch and latch bracket, move the selector lever latch to obtain the required stop signal length on oscilloscope. Move it to the left to decrease and to the right to increase the pulse length; tighten the screws and recheck the signal length.

(3) Press and hold the REPEAT button and "R" character button. Adjust the pushrod lifter hexnut or mark stationary contact in or out on the contact assembly until a wave shape appears with negative and positive transitions (bits) of equal time duration.

2-97. Transmitter Space Contact Adjustment (Not applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG.

(fig. 2-81)

NOTE

This adjustment is not applicable to the TT-259/FG. It applies to all other models only if they are used for trans-

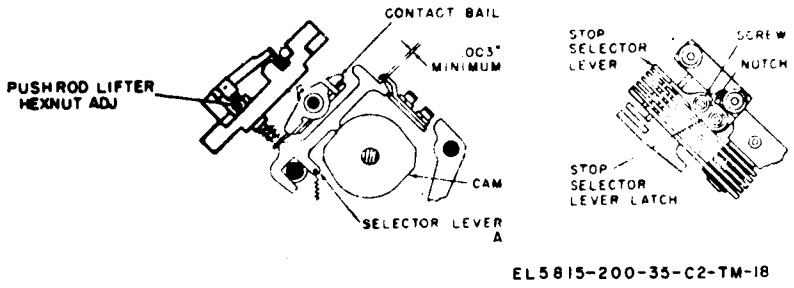


Figure 2-81.1. Stop selector level latch and transmitter contact assembly adjustment (TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG).

mitting polar impulses. Before this adjustment is performed, the keyboard transmitter must meet the adjustment requirements described in paragraph *2-96a*.

a. Requirement. There should be slight breaks in the signal circuit between alternate marking and spacing impulses, but the duration of the breaks should be as small as possible.

b. Method of Checking. Connect a multimeter as described in paragraph *2-96b(1)*. Place a shorting strap across the upper ends of the mark and space stationary contacts. Press the Y-key, slowly turn the motor by hand, and check for the requirement in a above. Press the R-key and recheck the requirement.

c. Adjustment. Turn the space stationary contact slowly toward the contact bail until no breaks occur between code impulses. Then turn The space stationary contact in the opposite direction slowly until breaks occur between impulses. Refine the adjustments as necessary to obtain the smallest possible break between impulses.

2-98. Motor Mounting Adjustment Not **Applicable to TT-98C/FG)**

(fig. 2-82)

a. Requirement.

(1) Backlash between the worm on the motor shaft and the worm gear should be as little as possible without binding.

(2) The motor shaft should be centered with the worm gear (visual check).

b. Adjustment.

(1) Remove the four screws and lock-washers that hold the motor to the casting. Install or remove 0.002-inch shims, 51509 or 0.005-inch shims, 51510 to meet requirement *a(1)* above. Replace the four

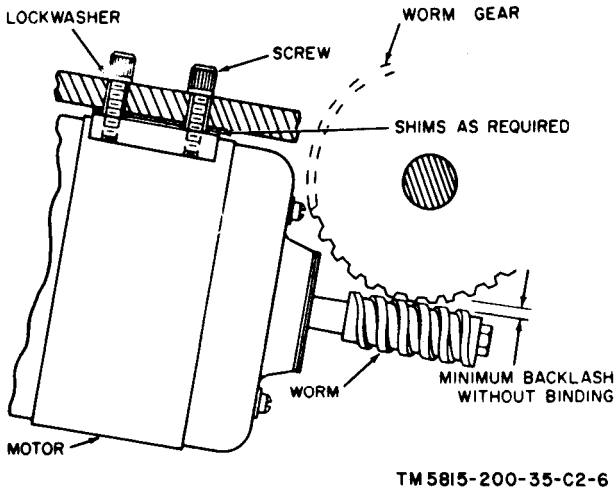


Figure 2-82. Motor mounting adjustment, requirement.

screws and lockwashers, leaving them loose enough so that the motor position can be adjusted.

(2) Adjust the position of the motor to meet the requirement in *a(2)* above, tighten the screws, and recheck the requirement.

2-99. Motor Mounting Adjustment (TT-98C/FG and Subsequent Models)

(fig. 2-83)

Note. This adjustment should be performed whenever the operating speed is changed.

a. Requirement.

(1) There should be a minimum backlash, without binding, between the mainshaft driven gear and the worm gear.

(2) The worm gear and main shaft should be visually central with the main-shaft driven gear.

b. Method of Checking. Grasp the main shaft and governor target, hold the main shaft stationary, and rock the target back and forth to determine the gear backlash. Check the gear backlash in various positions of the shaft cycle.

c. Adjustment. Loosen the motor mounting machine screws and position the threaded portion of the adjusting sleeves flush with the frame. Position the motor to centralize the worm gear on the main-shaft driven gear. Make the machine screws friction tight. Check the requirement (*a* above). Loosen the motor mounting screws and turn the three sleeves until there is a minimum backlash, without binding, between the main-shaft driven gear and the worm gear. Tighten the machine screws and recheck the requirement.

2-100. Motor Governor Contacts Alignment

(fig. 2-84)

a. Requirements.

(1) The contacts of the governor should be in alignment with each other (visual check).

(2) A force of not more than 10 ounces should be required to push or pull the governor worm shaft when the governor worm is engaged at any point of the governor adjustment gear.

(3) There should be some clearance (not more than 0.008 inch) between governor adjustment gear and governor adjustment screw bracket.

b. Adjustment.

(1) Loosen the contact arm spring mounting screw and position the contract arm spring to meet the requirement in *a(1)* above.

(2) Clean and lubricate the governor worm, governor adjustment gear, and governor adjustment screw (para *2-12f).* If the requirement in *a(2)* above is still not met, check for requirement in *a(3)* above.

(3) When adjustment of the clearance between the governor adjustment gear and the governor adjustment screw bracket is necessary, remove the solid flat washer that is originally supplied with the motor governor. Install a laminated washer,

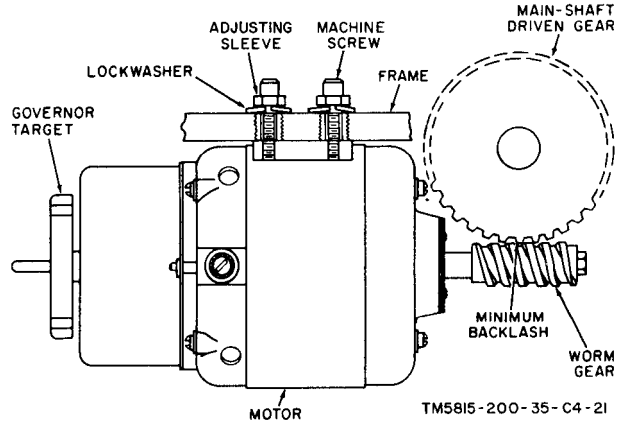


Figure 2-83. Motor gears backlash adjustment (TT-98C/FG).

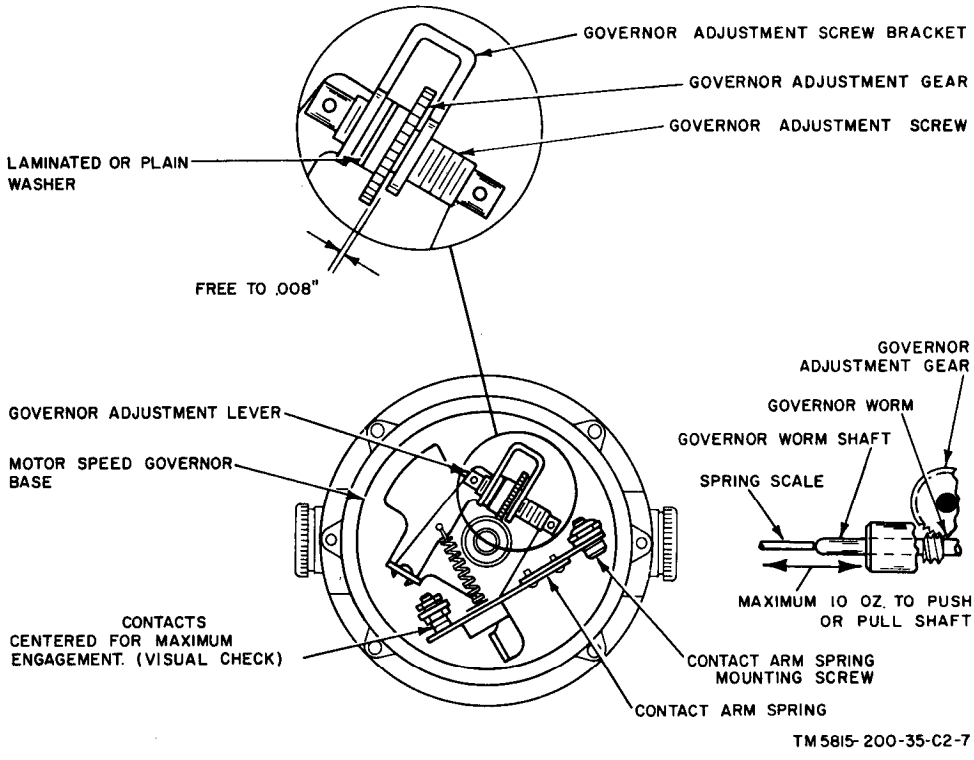


Figure 2-84. Motor governor adjustment details.

61413, peeled to the proper thickness to obtain the proper clearance.

***Caution:* Do not peel the laminated washer to a thickness less than 0.005 inch. Laminated washers less than 0.005 inch thick tend to bind the governor adjustment screw.**

2-101. Governor Assembly Position Adjustment

(fig. 2-85)

Note. This adjustment should be performed only when mounting the governor assembly on the motor.

a. Requirement. There should be a 1/32- to 3/32-inch clearance between the slip ring of the governor assembly and the adjacent brush holders.

b. Adjustment. Make sure that the governor slip rings are clean and smooth, to insure good brush contact. Remove any dirt or foreign material from between the slip rings. Position the governor assembly to meet the above requirement and tighten one setscrew lightly. Tighten the other setscrew firmly and then the first setscrew. Use this tightening procedure to insure that the governor assembly is centered on the motor shaft.

2-102. Governor Target Assembly Adjustment

(fig. 2-86)

a. Requirement. There should be some clearance, not more than 0.020 inch, between the governor target assembly and the governor cover.

b. Adjustment. Loosen the setscrew, position the governor target assembly to meet the requirement, and tighten the setscrew.

2-103. Function Shaft Driven Gear End-Play Adjustment

(fig. 2-87)

a. Requirement. There should be a 0.001- to 0.004-inch clearance between the function-shaft driven gear and the inner flat washer when the driven gear is pressed against the outer flat washer.

b. Adjustment.

(1) Remove the function shaft assembly (para *2-22a).*

(2) Remove the function cam (44, fig. 2-117), felt washer (51), if present, sleeve bearing (45), felt washer (52), if present,

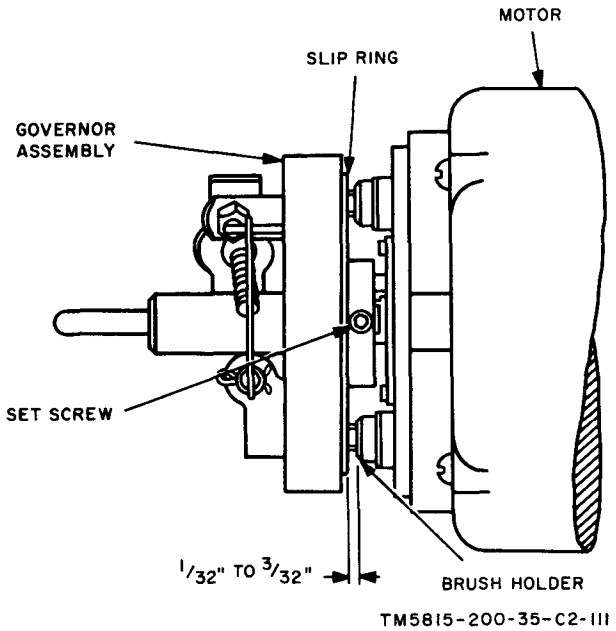


Figure 2-85. Governor assembly position adjustment.

print cam (42), pulsing cam (48, TT-99/FG only), flexible coupling disk (40), clutch spring (38), felt washer (50), if present, friction clutch drum (37), retainer ring (36), and flat washer (35).

(3) Adder remove shim 51847 (0.004-inch) or shim 51848 (0.006-inch) as required; replace the flat washer (35) and retainer ring (36) and recheck the clearance.

(4) Reassemble and install the function shaft assembly (para *2-22b).*

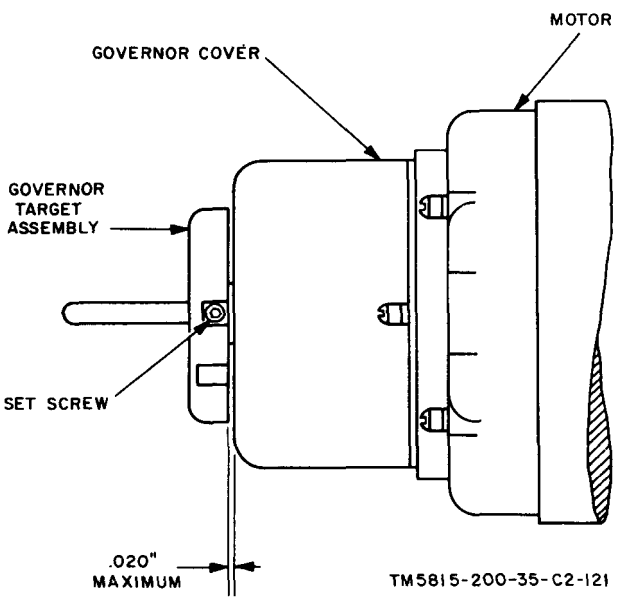


Figure 2-86. Gouernor target assembly adjustment.

2-104. Motor Governor Brush Holder Adjustment

(fig. 2-88)

Note. This adjustment should be performed when the governor brush holders have been removed or replaced.

a. Requirements.

(1) The governor brush holders should be fully seated.

(2) Two adjacent corners of the square hole in each governor brush holder should be parallel and in line within 1/64 inch as shown in figure 2-88.

b. Method of Checking.

(1) Visually check the requirement.

(2) Use a straightedge to establish a visual parallel line. Check the requirement visually.

c. Adjustment. Loosen the setscrew that retains each governor brush holder and position each brush holder to meet the requirements. Tighten the setscrew and recheck the requirements.

2-105. Y-Lever Spacing Collar Adjustment

(fig. 2-89)

a. Requirement. There should be a .002- to .005-inch clearance between the spacing collar and the flat washer on the Y-lever pivot stud.

b. Adjustment. Loosen the setscrews in the spacing collar and move it in or out to meet the requirement. Tighten the setscrews.

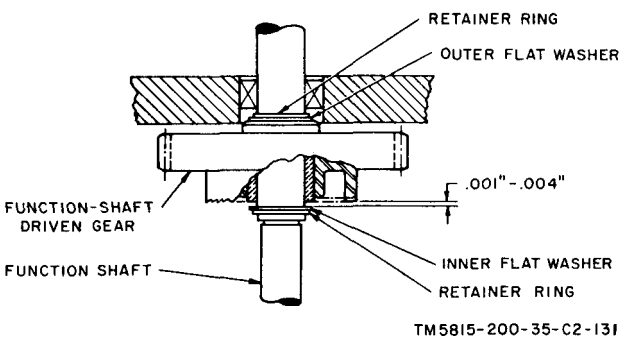


Figure 2-87. Function-shaft drive gear end-play requirement.

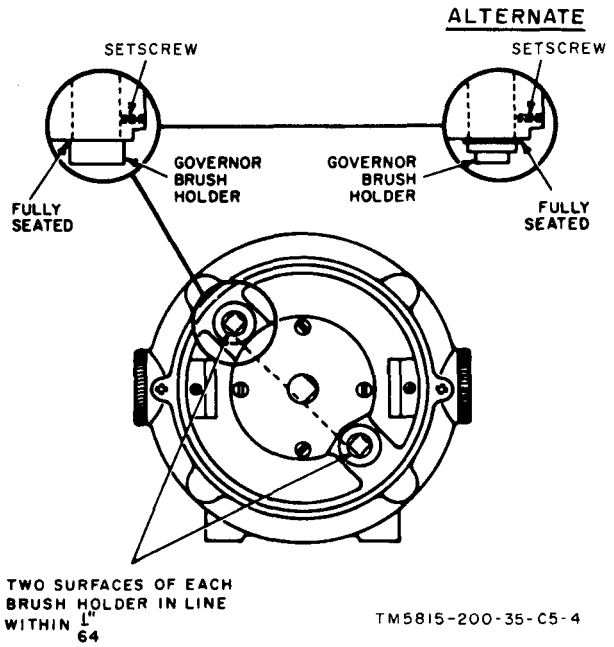


Figure 2-88. Motor governor brush holder adjustment.

2-106. Code Rings and Code Ring Cam Follower Locking Lever End Play Adjustment

(fig. 2-94)

Make this adjustment only when the code ring cage has been removed from the machine.

a. Requirements.

(1) There should be a .002 to .004-inch clearance between the code ring collar and the ball retainer.

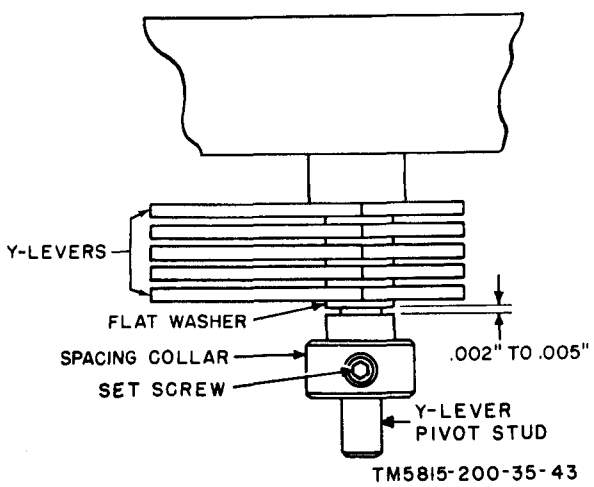


Figure 2–89. Y-Lever spacing collar adjustment.

(2) There should be a .002 to .010-inch clearance between the sleeve bearing and the code ring cam follower locking lever.

b. Method of Checking.

(1) Insert a flat feeler gage from the bottom of the code ring cage between the code ring collar and the ball retainer.

(2) Insert a flat feeler gage from the bottom of the code ring cage between the sleeve bearing and the code ring cam follower locking lever.

c. Adjustment. Two setscrews secure the code ring collar and the sleeve bearing to the shaft of the code ring cage. One setscrew can be easily reached from the bottom side of the code ring cage; the other can be reached between the top center stop bars and through the hole in the code ring cage spacer.

(1) Loosen the two setscrews and insert a .003-inch flat feeler gage between the ball retainer and the code ring collar.

(2) Hold the flat (.003 inch) feeler gage between the ball retainer and the code ring collar while shifting the sleeve bearing to meet the requirement in *a(2)* above. Tighten the setscrews and recheck the clearance.

2-107. Function Sensing Levers End Play Adjustment TT-98C/FG)

Note. Perform this adjustment whenever the code-ring cage, sensing levers, or spacers are changed, replaced, or removed.

a. Requirement. The sensing lever sleeve should project 0.025 to 0.050 inch beyond the hub of the code-ring cage.

b. Method of Checking.

(1) Loosen the four setscrews (10, fig. 2-49) in the square shaft driven gear (11) and slide the gear away from the code-ring cage.

(2) Remove the square shaft stop arm (4, fig. 2-20 (page 10 of C 2)) and the assembled stop arm shaft (5).

(3) Loosen but do not remove the two machine screws (1) that hold the code bar cage plate (57) to the frame assembly.

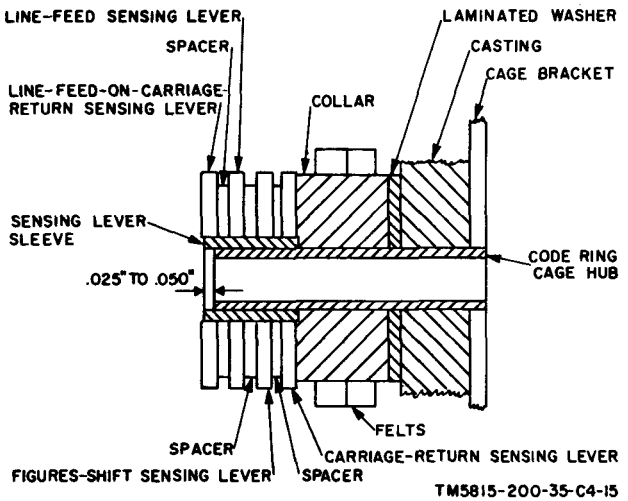


Figure 2-90. Function sensing levers end play adjustments (TT-98C/FG).

(4) Remove the flat washer (16, fig. 2-52) and line-feed-on-carriage-return sensing lever (17).

(5) Tighten the two machine screws (1, fig. 2-20) that hold the code bar cage plate (57) to the frame assembly. Place a straightedge against the end of the sensing lever sleeve (fig. 2-90) and check the requirement with feeler gages.

c. Adjustment. If the requirement is not met, proceed as follows:

(1) Remove the flat washers (18, 20, and 22, fig. 2-52) and the line-feed, the figures-shift, and the carriage-return sensing levers (19, 21, and 24), and the spacing collar (27) from the sensing lever sleeve (fig. 2-90) which is mounted on the code-ring cage hub. It may be necessary to loosen (but do not remove) the two machine screws (1, fig. 2-20) that hold the code bar cage plate (57) to the frame assembly.

(2) Remove the laminated washer (28, fig. 2-52) and replace it with a laminated washer that is peeled to the correct thickness and has all burrs removed.

(3) Reinstall the spacing collar (27), sensing levers (except the line-feed-on-carriage-return sensing lever (17)) and the flat washers (except flat washer (16)) and recheck the requirement. Be sure the carriage-return sensing lever (fig. 2-90) does not rub against the stop bar support bracket when installed against the collar.

(4) Reinstall the line-feed-on-carriage-return sensing lever (17) and flat washer (16).

(5) Tighten the two machine screws (1, fig. 2-20) that hold the code bar cage plate (57) to the frame assembly if they were loosened.

(6) Reinstall the square shaft stop arm (4) and the assembled stop arm shaft (5).

(7) Return (slide) the square shaft driven gear (11, fig. 2-49) to its original position on the square shaft.

(8) Perform the related adjustments as described in paragraphs 2-180 and 2-181.

2-108. Drawbar Shimming (TT-98C/FG)

(fig. 2-91)

Note. This is a preliminary setting; for final adjustment, see paragraph 2-109.

a. Preparation. Remove the function shaft assembly (para *2-23a).*

b. Requirement.

(1) The drawbar assembly should be visually central on the drawbar stud.

(2) The drawbar assembly should be free to move up and down, and end play must not exceed 0.010 inch.

c. Adjustment.

(1) Remove the machine screw, lockwasher, and flat washer.

(2) Install shims equally on both sides of the drawbar to meet the requirements in *b* above.

(3) Reinstall the machine screw, lockwasher, and flat washer.

(4) Reinstall the function shaft assembly (para 2-23 *b).*

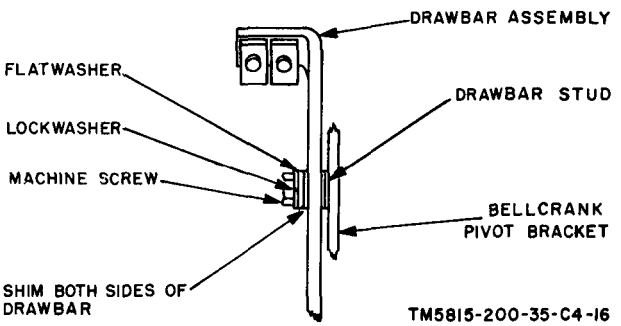


Figure 2-91. Draw bar shimming (TT-98C/FG).

2-109. Function Sensing Cam and Drawbar Adjustment (TT-98C/FG)

(fig. 2-92)

a. Requirements.

(1) When the function sensing cam assembly is against the laminated washer, the carriage-return sensing lever should ride on its function rollers without rubbing the function roller spacers, and the figures-shift sensing lever should not rub the function roller spacer.

(2) The drawbar should operate freely in the drawbar cam assembly.

b. Method of Checking.

(1) With the function shaft in the stop position, visually check the requirement.

(2) Manually operate the drawbar and check for free movement. Manually rotate the function shaft and check the requirement in various positions.

c. Adjustments.

(1) Loosen the two setscrews (fig. 2-92) in the function sensing cam assembly. Loosening the setscrews should allow the friction clutch spring to move the function sensing cam assembly towards the selector side of the teletypewriter.

(2) Determine the required thickness of the laminated washer to meet the requirement in *a* (1) above. Use feeler gages.

(3) Relocate the two setscrews on their respective flats and tighten them.

(4) Remove the function shaft assembly (para *2-23a).*

(5) Remove the machine screw (9), lockwasher (10), flat washer (11), transfer lever restoring cam (12), spacer (51), flat washer (13), locking bail cam (14), flat washers (15 and 16), ball bearing (17), and flat washer (18).

(6) Replace the flat washer (18) with a washer of the proper thickness to meet the requirement in *a* (1) above.

(7) Replace parts on the function shaft by reversing the steps and procedures in (5) above.

(8) Temporarily replace the function shaft assembly (para *2-23b).* Recheck the requirement in *a(1)* above and readjust, if necessary; otherwise, secure the function shaft in place.

(9) Check the requirement in *a* (2) above. If the requirement is not met, remove the function shaft assembly (para *2-23a).*

(10) Remove the machine screw (52, fig. 2-48) from the drawbar (59) and the bellcrank pivot bracket (69). Catch the lockwasher (53), flat washers (54, 56, 64, and 65), and spacers (55 and 66) as they fall from the machine screw (52).

(11) Install shim spacers to meet the requirement in *a* (2) above.

(12) Reinstall the spacers (55 and 56), flat washers (54, 56, 64, and 65), and lockwasher (53) on the machine screw (52). Reinstall the machine screw (52) in the drawbar (59) and the bellcrank pivot bracket (69).

(13) Reinstall the function shaft assembly (para *2-23b).*

(14) Perform the related adjustment (para 2-146).

2-110. Code-Ring Cage Adjustment (TT-98C/FG)

(fig. 2-93)

a. Requirement. There should be a 0.005-inch minimum clearance between the stop bars and their associated function sensing levers, when the sensing lever concerned is on the highest point of its respective function roller.

b. Method of Checking. Position the function shaft until the sensing levers are on the high point of their respective function rollers. Check the requirement with a 0.005-inch feeler gage.

c. Adjustment. Loosen the two machine screws that hold the code-ring cage to the frame assembly and partially rotate the code-ring cage to meet the requirement. Perform the related adjustments (paras 2-113, 2-124, and 2-181).

2-111. Sensing Levers End Play Adjustment (not applicable to TT-98C/FG)

(fig. 2-95)

This adjustment is necessary only if the code ring cage is replaced.

a. Requirement. There should be a .001- to .005-inch clearance between the flat washer and the linefeed sensing lever.

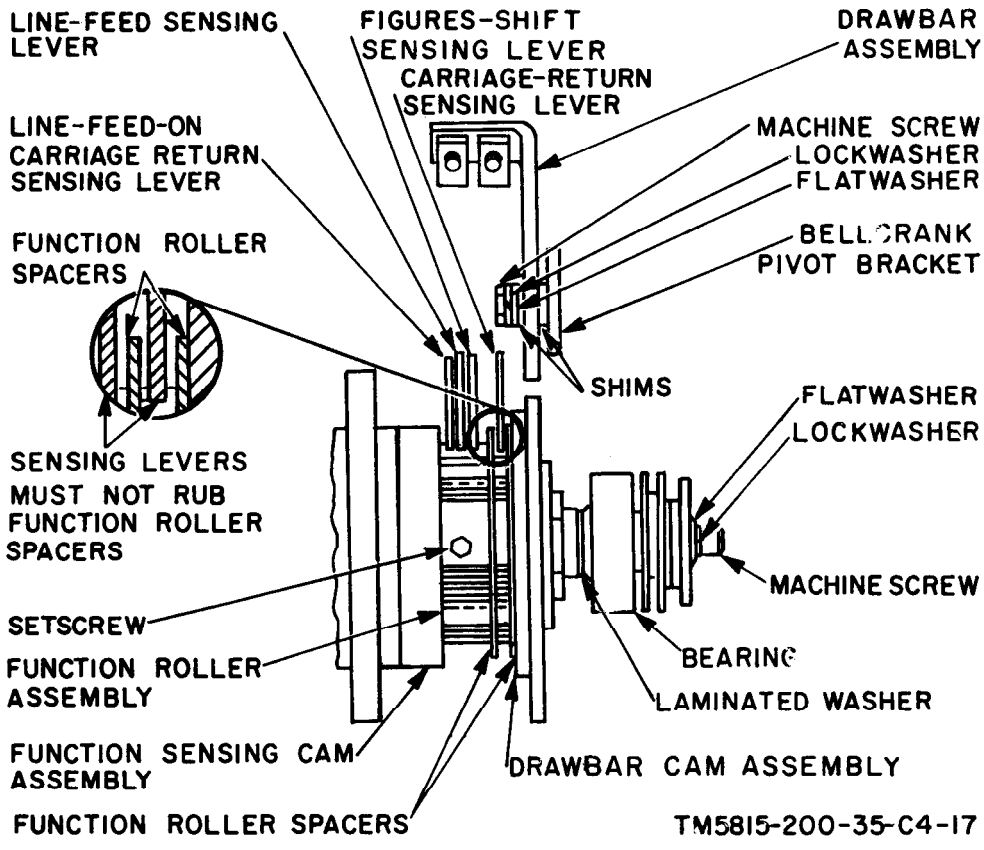


Figure 2-92. Function sensing cam and drawbar adjustment (TT-98C/FG).

b. Method of Checking. Insert a flat feeler gage from the rear of the code ring cage between the line-feed sensing lever and the flat washer.

c. Adjustments. Remove the code ring cage (para *2-25a).* Peel lamination from, or add laminations to, the tolerance take-up flat washer to meet the requirement. Replace the code ring cage (para *2-25b);* recheck the clearance. Check related adjustments (paras 2-112, 2-113, 2-120, and 2-180).

2-112. Code Ring Cage Adjustment (not applicable to TT-98C/FG)

(fig. 2-96)

a. Requirements.

(1) There should be a .010- to .020-inch clear-

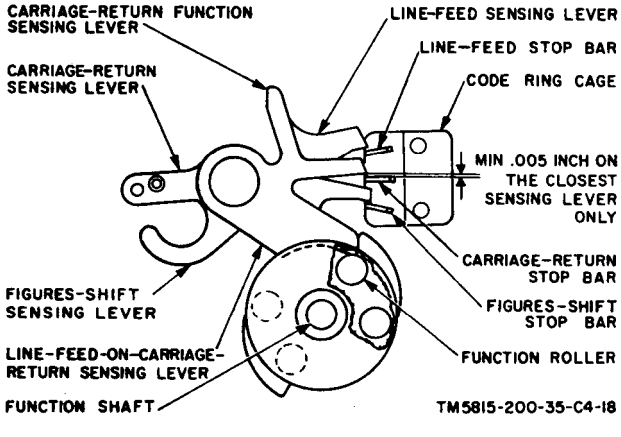


Figure 2-93. Code-ring cage adjustment (TT-98C/FG).

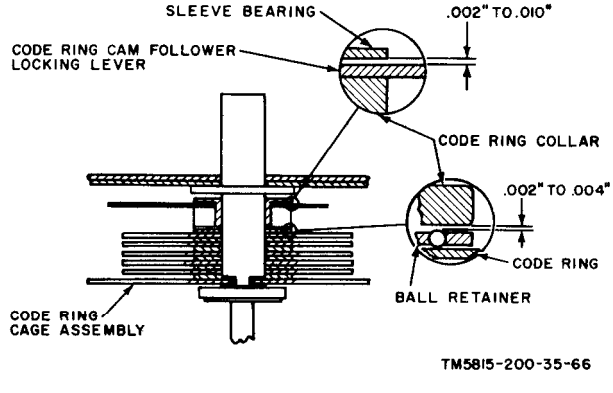


Figure 2-94. Code rings and code ring cam follower locking lever end play adjustment.

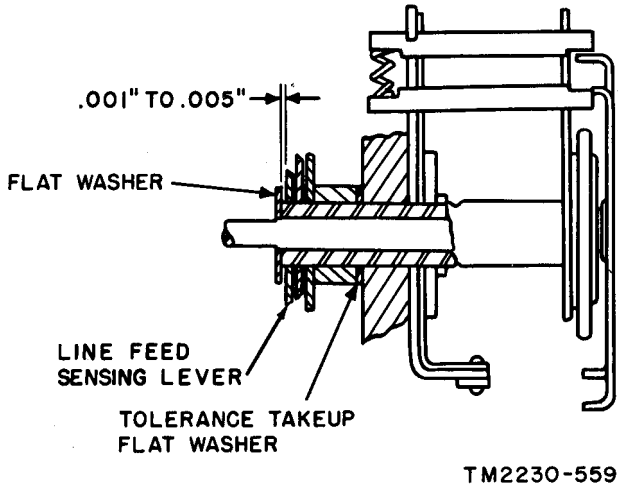


Figure 2-95. Sensing levers end play adjustment (not applicable to TT-98C/FG).

ance between the carriage-return sensing lever and its associated function stop bar when the teletypewriter is in the stopped position.

(2) There should be a .005-inch minimum clearance between the line-feed sensing lever and the figures-shift sensing lever and their associated function stop bars when the teletypewriter is in the stopped position.

b. Adjustment. Loosen the machine screws that mount the code ring cage (fig. 2-103). Turn the code ring cage either clockwise or counterclockwise until the requirement is met. Tighten the machine screws. Check related adjustments (paras 2-113, 2-119, 2-120, and 2-181).

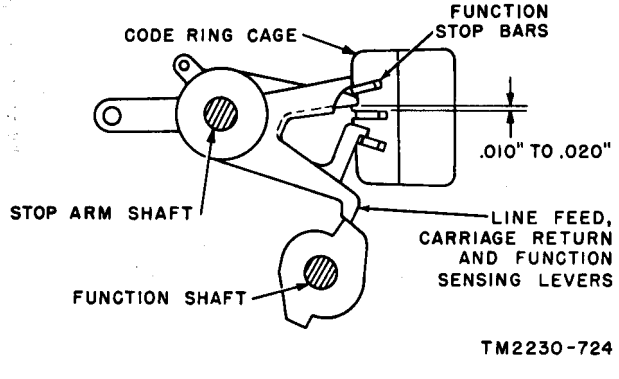


Figure 2-96. Code ring cage adjustment (not applicable to TT-98C/FG).

2-113. Code Ring Locking Bail Cam Follower Adjustment

a. Requirements.

(1) When the figures stop bar (fig. 1 20) is selected and the cam follower (fig. 2-97) is against a high part of the locking bail cam, there should be at least .010-inch clearance between the figures stop bar (not shown) and the code ring locking lever blade.

(2) When the cam follower is against a high part of the locking bail cam, the clearance between the letters stop bar and the code ring locking lever blade should be approximately equal to the clearance between the J-stop bar and the code ring locking lever blade when the cam follower is against a *low* part of the locking bail cam.

b. Adjustment. Loosen the machine screws that secure the cam follower to the code ring cam follower locking lever, position the cam follower to meet the requirements in *a(1)* and (2) above, and tighten the machine screws. Check the related adjustment described in paragraph 2-114.

Note. Under ideal conditions, adjustment is possible to meet both requirements described in *a* above. However, if adjustment to meet requirement *a* (2) above causes the clearance specified in *a* (1) to be less than 0.010 inch, reposition the cam follower to obtain the 0.010-inch minimum clearance described in *a* (1) above.

2-114. Code Ring Locking Bail Shaft Adjustment

(fig. 2-98)

a. Requirements.

(1) There should be a .010 to .020-inch clearance between the code ring locking bail and the code ring projections (A, fig. 2-98) when the function shaft is in the stopped position.

(2) There should be a .002- to .005-inch end play in the code ring locking bail shaft (B, fig. 2-98).

b. Method of Checking.

(1) With the function shaft in the stopped position, place the No. 1 code ring so that, it projects directly opposite the locking

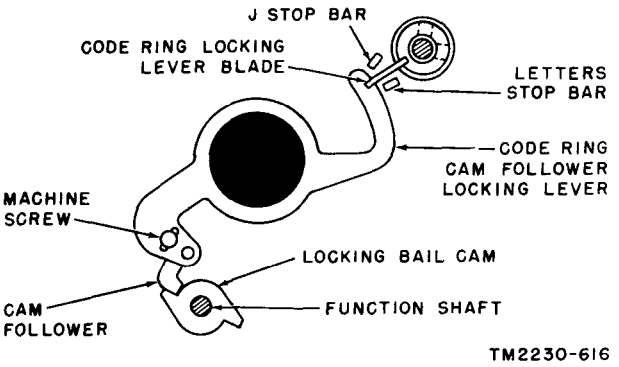


Figure 2-97. Code ring locking bail cam follower adjustment.

edge of the code ring locking bail. Check the requirement with a feeler gage.

(2) Insert a flat feeler gage between the collar of the code ring locking lever and the code bar cage plate to determine the end play.

c. Adjustment.

(1) Loosen the setscrews in the code ring locking lever collar. Rotate the code ring locking bail shaft until the requirement in *a(1)* above is met.

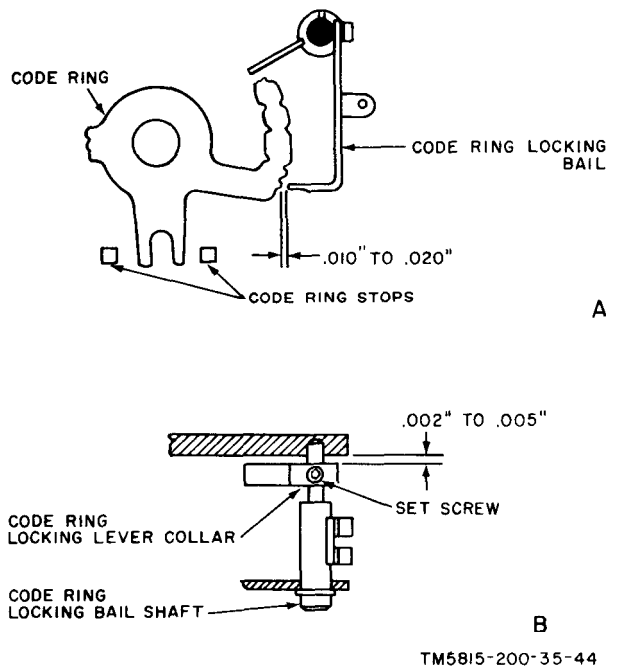


Figure 2-98. Code ring locking bail shaft and locking bail adjustments.

(2) position the collar to obtain the requirement, in *a(2)* above. Tighten the setscrews in the code ring locking lever collar.

2-115. Code Ring Locking Bail Adjustment

(fig. 2-99)

a. Requirements. 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. Turn the motor by hand until the locking bail spring 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 tile code rings. Tighten the mounting screws.

2-116. T-Lever End Play Adjustment

(fig. 2-100)

a. Requirement. The T-levers should move freely on the T-lever stud but the end play should not exceed 0.003 inch.

b. Method of Checking. Press the T-levers toward the transfer lever and measure the clearance between the first T-lever and the flat washer.

c. Adjustment. Remove the nut, flat washer, and the outer T-lever. Add or remove shims 57072 (.002 inch) or 57073 (.003 inch) to meet the requirement. Replace the T-lever, flat washer, and hexagonal nut. Tighten the hexagonal nut and recheck the requirement.

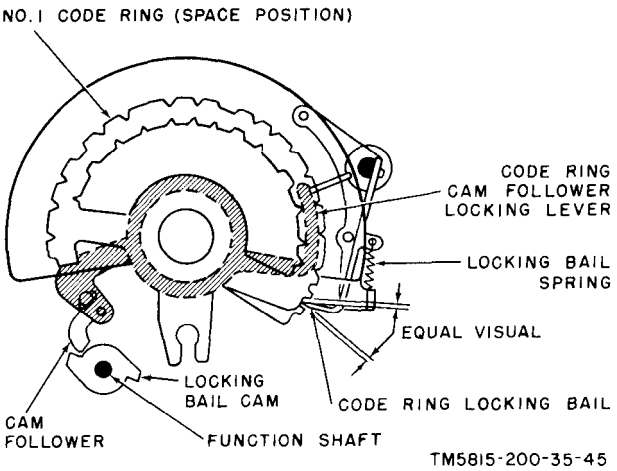


Figure 2-99. Code ring locking bail adjustment.

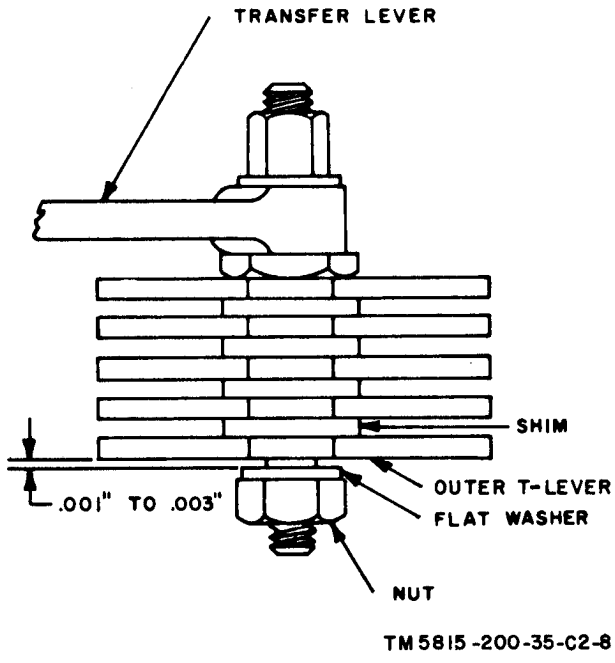


Figure 2–100. T-lever end-play adjustment.

2-117. T-Levers Alinement and Transfer Lever Shaft End Play Adjustment

(fig. 2-101)

a. Requirements.

(1) The T-lever must be in line with their associated Y-levers and the code rings. Any offset should be equally divided so that the T-levers are centered between the Y-levers and the code rings.

(2) There should be a .002 to .005-inch clearance between the rear shaft collar on the transfer lever shaft and the bearing in the teletypewriter frame when the front shaft collar is held against its bearing.

b. Adjustment.

(1) Loosen the clamping screws in the shaft collars. Move the transfer lever in or out to meet the requirement in *a(1)* above. While holding the transfer lever in position, slide the front shaft collar tight against the bearing and tighten the clamping screw.

(2) Hold the front shaft collar tight against the frame. Move the rear shaft collar to meet the requirement in *a(2)* above. Tighten the clamping screw.

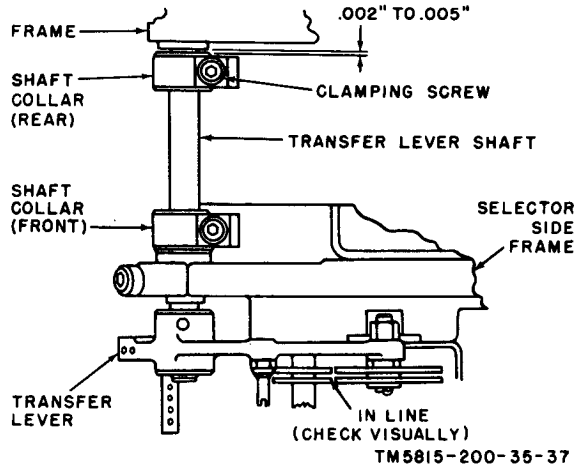


Figure 2-101. T-levers alinement and transfer lever shaf t end play adjustment.

Check related adjustments (para 2-118).

2-118. Transfer Lever Roller Stud Adjustment

(fig. 2-102)

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 teletypewriter by hand until the roller is on the high portion of the transfer lever restoring cam. Turn the stud counterclockwise until the requirement is met. Tighten the locknut. Check related adjustments (para 2-117).

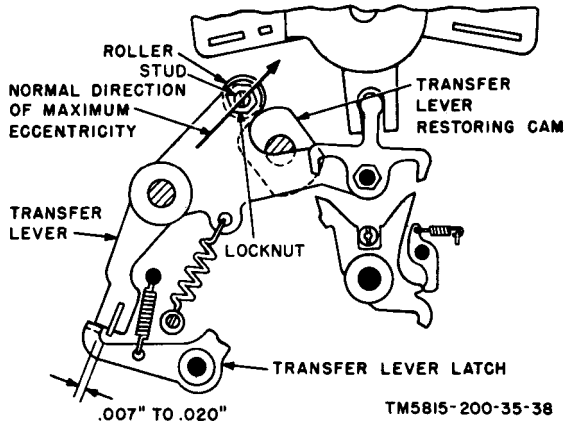


Figure 2-102. Transfer lever roller stud adjustment.

2-119. Y-Lever Eccentric Stop Preliminary Adjustment

(fig. 2-103)

a. Requirement. The Y-lever eccentric stop should be positioned midway between the Y-levers.

Note. When making the following adjustment, be extremely careful to prevent damaging the function shaft when inserting the tool into the setscrew.

b. Adjustment. Set the Y-levers in either the R- or Y-code combination. Loosen the setscrew that locks the Y-lever eccentric stop. Trip the transfer lever by pulling down the transfer lever latch. This action will cause the T-levers to engage the Y-levers. Turn the Y-lever 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 Y-lever eccentric stop. Turn tile Y-lever eccentric 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 Y-lever eccentric stop. Turn the stop to a position midway between the two noted positions and tighten the setscrew. Check related adjustments (paras 2-124, 2-126, 2-139, and 2-140).

2-120. T-Lever Pivot Stud Adjustment

(fig. 2-104)

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 down the latch. This action will cause 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-levers in a space position. Trip the transfer lever and visually check the amount of engagement between the T-levers and Y-levers.

c. Adjustment. Loosen the hexagonal nut on the rear of the T-lever pivot stud. Position the T-lever pivot stud until the requirement is met. Tighten the hexagonal nut. Check related adjustments (paras 2-119 and 2-124).

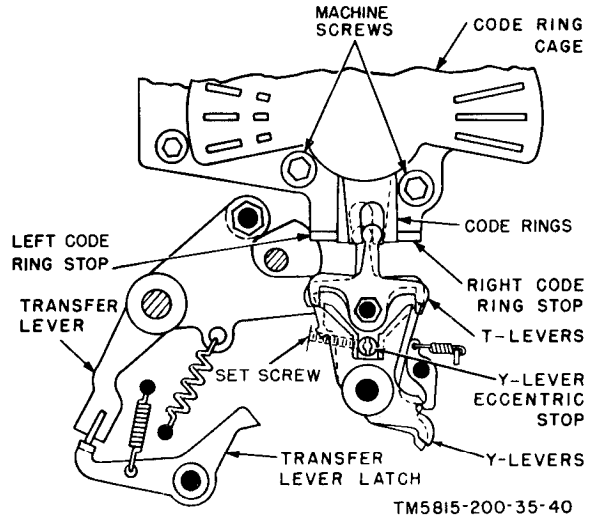


Figure 2-103. Y-lever eccentric stop preliminary adjustment.

2-121. Y-Lever Stud Bracket Adjustment (TT-98C/FG)

(fig. 2-105)

Note. The Y-lever eccentric stop preliminary adjustment (para 2-119) should be completed before this adjustment is performed.

a. Requirement.

(1) There should be 0.002- to 0.005-inch clearance between the spacer and flat washer (A, fig. 2-105).

(2) The Y-lever eccentric stop and Y-lever pivot, stud should be locked in place by the Y-lever eccentric tie. Check the requirement visually.

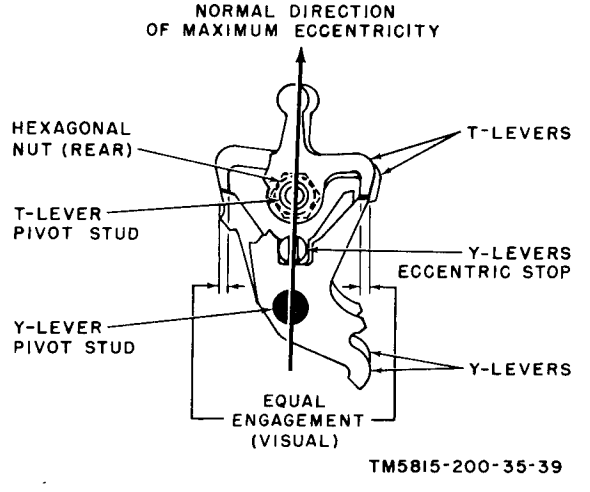


Figure 2-104. T-lever pivot stud adjustment.

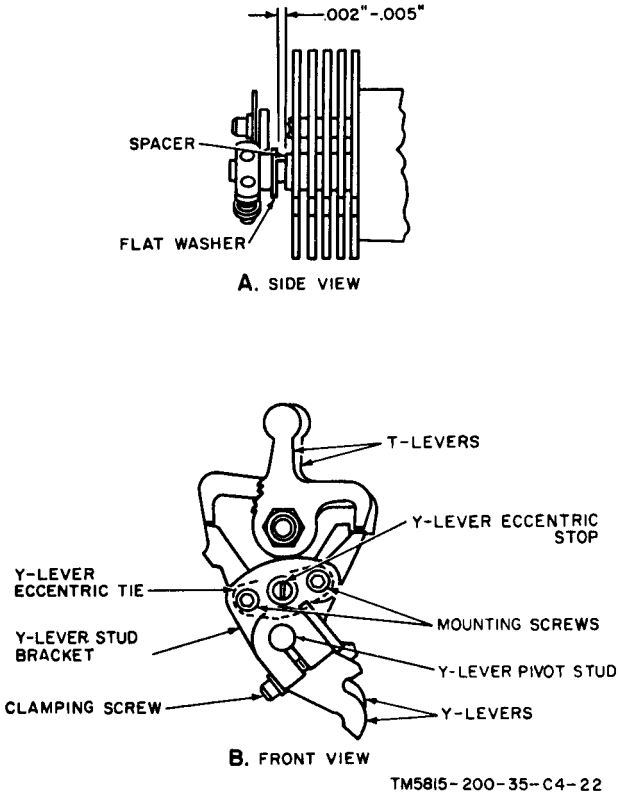


Figure 2–105. Y-lever stud bracket adjustment (TT-98C/FG).

b. Adjustment.

(1) Loosen the mounting screws of the Y-lever eccentric tie and the clamping screw of the Y-lever stud bracket. Position the bracket to meet the requirement in *a(1)* above. Tighten the clamping screw.

(2) Shift the Y-lever eccentric tie to engage the Y-lever eccentric stop. Tighten the mounting screws.

2-122. Transfer Lever Spring Adjustment

Note. This adjustment should be checked whenever the speed of the machine is changed.

a. Requirement. The tension of the transfer lever spring should be sufficient to seat the T-levers and Y-levers, and eliminate Y-lever bounce during transfer operation.

b. Adjustment. Loosen the clamping screw and turn the eccentric spring post to meet the requirements in *a* above; tighten the clamping screw.

2-123. Function Shaft Clutch Clearance Adjustment

(fig. 2-106)

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 and the function driven gear is shifted as far as possible toward the sliding clutch drum.

b. Method of Checking. Make sure the teletypewriter is in the stopped position. Hold the function driven gear as far as possible toward the function shaft sliding clutch drum and insert a flat feeler gage between the gear and the sliding clutch drum. Repeat the check when the opposite finger of the sliding clutch drum is engaged by the clutch latch.

c. Adjustment. Loosen the clamping screw in the shaft collar and in the 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 clutch latch in that position. Make the function shaft clutch latch adjustment (para 2-124).

2-124. Function Shaft Clutch Latch Adjustment

(fig. 2-107)

a. Requirement. There should be a 0.015- to 0.020-inch clearance between the clutch latch and

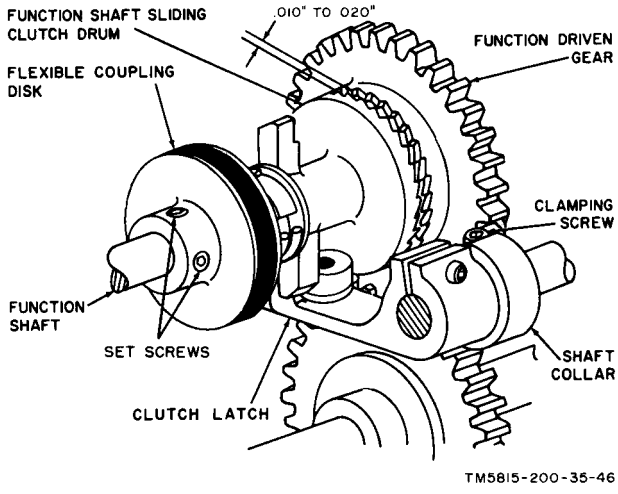


Figure 2-106. Function shaft clutch clearance adjustment.

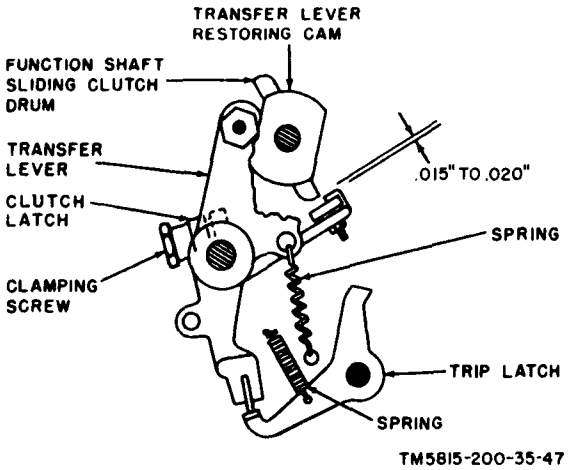


Figure 2-107. Function shaft clutch latch adjustment.

the function shaft sliding clutch drum when the clutch is engaged.

b. Method of Checking. Release the transfer lever by pulling down the trip latch. The clutch latch then will be disengaged from the sliding clutch drum. Check the requirement with a feeler gage.

c. Adjustment. Loosen the clamping screw in the clutch latch. Position the clutch latch to meet the requirement. Tighten the clamping screw.

2-125. Y-Lever Detents End-Play Adjustment

a. Requirements.

(1) The end play of the Y-lever detents should be at least 0.002 inch (A, fig. 2-108).

(2) At least one-quarter of the thickness of each Y-lever detent should be in engagements with its associated Y-lever when the latching end of the detent is pressed inward, and then pulled outward (B, fig. 2-108).

b. Method of Checking.

(1) Push the outermost Y-lever detent inward and use feeler gages to check for the requirement in *a(1)* above.

(2) Move the Y-lever detents inward and outward and visually check for the requirement in *a(2)* above.

c. Adjustment. Remove the Y-lever detent springs (4, fig. 2-41), the hexagonal nut, and the lockwasher (A, fig. 2-108). Slide the centering sleeve and detent assembly from the Y-lever detent pivot.

(1) If the detent end play was less than 0.002 inch, replace the flat washer with a new flat washer, 55076, peeled to size to meet the requirement in *a* (1) above.

(2) If the detent end play was so great that the requirement in *a(2)* above was not met, add a flat washer, 55076, peeled to size to meet the requirement in *a(2)* above.

(3) Replace the centering sleeve and detent assembly, the lockwasher, and the hexagonal nut; recheck both requirements and perform the adjustment described in paragraph 2-126.

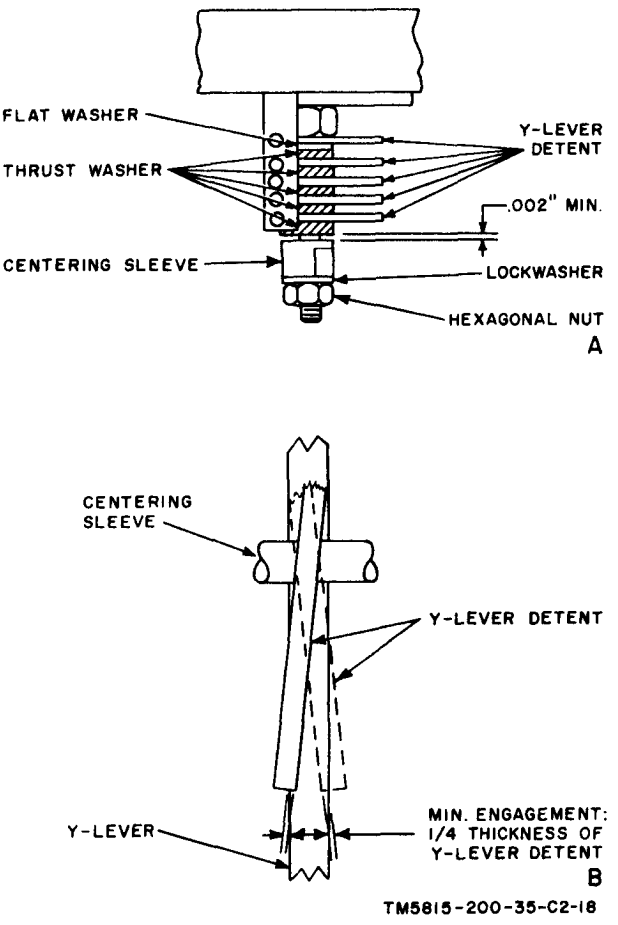


Figure 2-108. Y-lever detent end-play requirement.

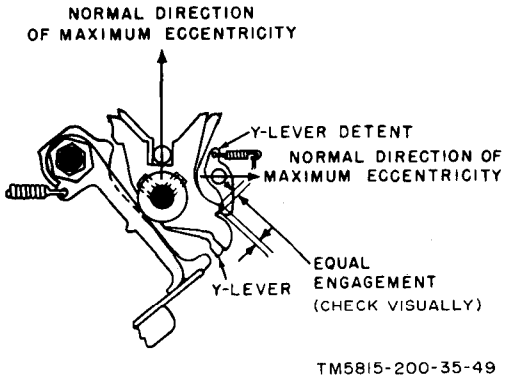


Figure 2-109. Y-levers detent and Y-levers adjustment.

2-126. Y-Lever Detents and Y-Levers Adjustment

(fig. 2-109)

a. Requirements. 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.

b. Adjustments. Loosen the hexagonal nut (fig. 2-108) and turn the centering sleeve until the requirement in *a(1)* above is met. Tighten the hexagonal nut.

2–127. Selector Camshaft Clutch Load Adjustment

(fig. 2-110)

a. Requirements.

(1) There should be a .005 to .025 -inch clearance between the friction clutch disk and the bearing of the clutch fork.

(2) It should require a pull of 48 to 54 ounces (42-44 ounces for TT-664(*)/FG and TT-665/FG) to hold the stop plate away from the step lever with the motor on.

b. Method of Checking.

(1) Insert a flat feeler gage between the friction clutch and the bearing of the selector friction clutch fork to check for the requirement in *a(1)* above.

(2) Engage the hook end of a spring scale on the stop plate retainer of the selector camshaft. Pull on the spring scale until the stop plate moves away from the stop lever. Turn the motor on and read the scale.

c. Adjustment.

(1) Loosen the two setscrews in the friction clutch disk and position the disk until the requirement of *a(1)* above is met. Tighten the two setscrews.

(2) Loosen the clamping screw of the friction clutch adjusting collar and turn the collar to meet the requirement in *a(2)* above. Tighten the clamping screw.

2-128. Rangefinder Dial Assembly Adjustment

(fig. 2-111)

a. Requirements.

(1) When the rangefinder dial is set at 60, the lower end of the orientation lever should be midway between the high and low points of the rangefinder cam (A, fig. 2-111).

(2) There should be a .010 to .020 -inch clearance between the range finder dial and the selector lever comb bracket (B, fig. 2-111).

(3) The detent should be set to hold the rangefinder dial firmly without excessive tightness.

b. Adjustment.

(1) Loosen the setscrew in the rangefinder cam. Rotate the rangefinder cam to meet the requirement in *a(1)* above. Tighten the setscrew.

(2) Loosen the setscrew in the rangefinder dial. Without rotating the rangefinder cam, hold it tight against the spacer. Move the range finder dial in or out to

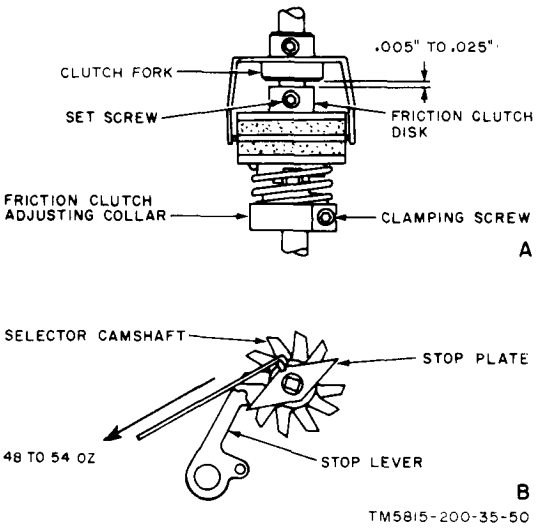


Figure 2-110. Selector camshaft clutch load adjustment.

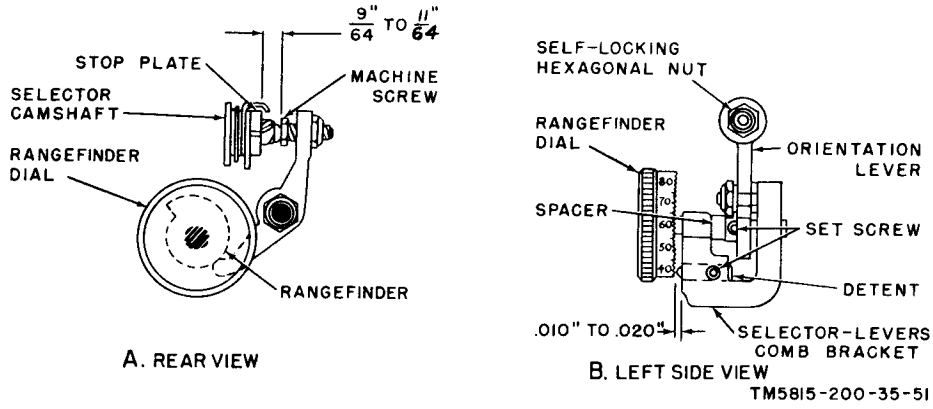


Figure 2-111. Range finder dial assembly adjustments.

meet the requirement in *a(2)* above. Tighten the setscrew.

(3) Loosen the set screw that holds the detent. Slide tbe detent against the rangefinder dial to meet the requirement in *a(3)* above. Tighten the setscrew.

(4) Check the related adjustment (para 2-129).

2-129. Orientation Lever Adjustment

(fig. 2-111)

a. Requirement. There should be a $\frac{9}{64}$- to $\frac{11}{64}$-inch clearance between the stop plate and the head of the machine screw (in the orientation lever) when the orientation lever is held against the midpoint of the range finder cam (A, fig. 2–111).

b. Adjustment. Loosen the self-locking hexagonal nut of the machine screw on the orientation lever (B, fig. 2-111). Turn the machine screw in or out to meet the requirement. Tighten the self-locking hexagonal nut. Check the related adjustment (para 2-128).

2-130. Selector Lever Clearance Adjustment

(fig. 2-112)

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 and switch box (para *2-28a)* and the transfer lever spring. Check the clearance with a flat feeler gage.

c. Adjustment. Loosen the setscrew which holds the selector lever pivot stud in the teletypewriter frame. (This setscrew extends toward the back and base of the teletypewriter.) Slide the selector lever pivot stud in or out to meet the requirement. Tighten the setscrew. Replace the terminal and switch box (para *2-28b)* and the transfer lever spring.

2-131. Selector Lever Guide Comb Adjustment

(fig. 2-113)

a. Requirement. The selector levers and the Y-levers should be alined and there should be no binding between the selector levers and the selector lever guide comb.

b. Adjustment. Loosen the two selector lever guide comb machine screws and position the selector lever guide comb to meet the requirement.

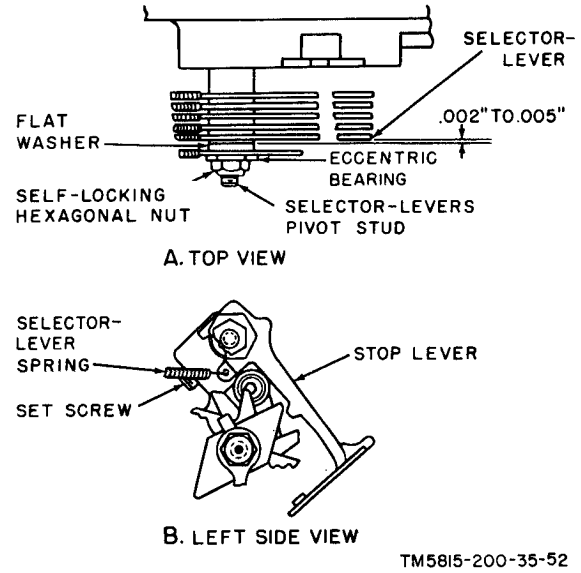


Figure 2-112. Selector lever clearance adjustment.

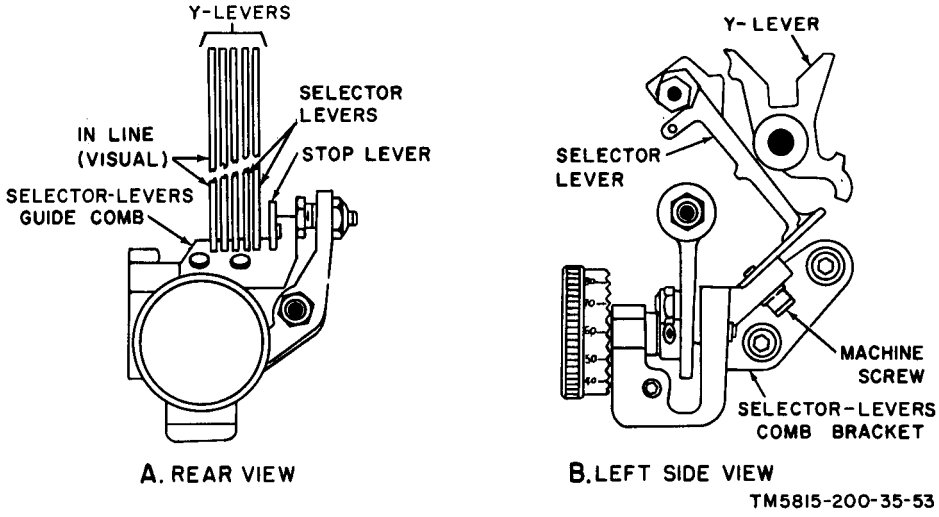


Figure 2-113. Selector lever guide comb adjustment.

Tighten the mounting screws. Recheck, and readjust if necessary. Check related adjustments (paras 2-139, 2-140, and 2-141).

2-132. Transfer Lever Spring Adjustment

(figs. 2-114 and 2-115)

a. Requirement. It should require a 4½- to 5½-pound pull to just start the transfer lever moving when it is in the transferred position.

b. Adjustment. Loosen the locknut (early models only) and the machine screw. Turn the spring post eccentric to meet the requirement. Tighten the machine screw (and locknut on early models).

2-133. Selector Magnet Bracket Alinement and Armature Preliminary Adjustment

(fig. 2-116)

a. Requirement.

(1) When the selector magnet bracket is against the bracket adjustment screws,

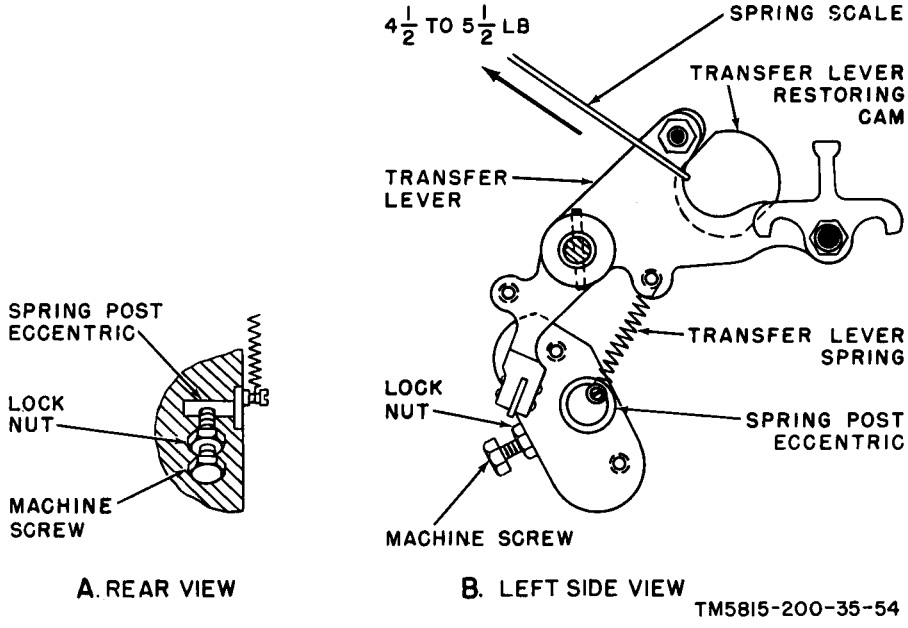


Figure 2-114. Transfer lever spring tension adjustment details (early models).

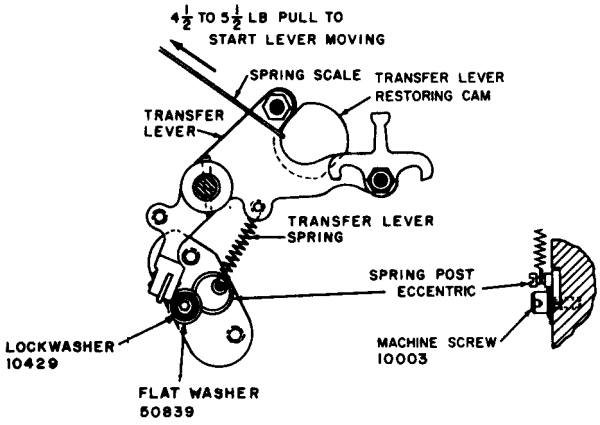


Figure 2-115. Transfer lever spring tension adjustment details (late models).

the threaded holes in the teletypewriter side casting should be centered with their associated holes in the selector magnet bracket.

(2) When the selector magnet bracket is secured in the position described in (1) above, the armature adjusting screws should be adjusted to hold the armature in a position which permits No. 1 selector lever to barely pass the armature blade without engaging the knife edge of the blade.

NOTE

This is a preliminary adjustment to establish a condition necessary for performing the adjustment described in paragraph 2-135.

b. Adjustments.

(1) Remove the two selector bracket mounting screws, hold the bracket against the bracket adjustment screws, and adjust the screws to meet the requirement in *a(1)* above. Replace and tighten the selector bracket mounting screws.

(2) Hold the armature against either armature adjusting screw and turn the adjusting screw until the position of the armature permits the No. 1 selector lever to barely pass the knife edge of the armature blade. Turn the other armature adjusting screw *slowly and carefully* toward the armature until it barely touches the armature.

CAUTION

Do not exert any pressure against the armature when adjusting the second armature adjusting screw. Failure to observe this caution will result in either a bent armature or bent armature mounting shaft.

(3) Perform the related adjustments (para 2-134 through 2-141).

2-134. Armature Stop Bracket and Bar Magnet Preliminary Clearance Adjustment (Not applicable to TT-664(*)/FG, TT-665/FG and TT-688(*)/FG

(fig. 2-117)

NOTE

Some teletypewriters include a bar magnet that is 1 3/4 inches long; others include a bar magnet that is 1 11/16 inches long. The bar magnets are interchangeable, but certain adjustment requirements vary, depending upon which bar magnet is used. Disconnect plug PS from the SELECTION MAGNET receptacle on the left side of the base. Remove the two screws that secure the selector magnet bracket to the teletypewriter side casting, remove the selector magnet bracket, and measure the length of the bar magnet to determine the appropriate tolerances in *a* below and in paragraph *2-135a.*

a. Requirement.

(1) There should be a 0.014- to 0.016-inch clearance between the armature stop bracket and the south pole of the bar magnet if the bar magnet is 1 3/4 inches long.

(2) There should be a 0.027- to 0.033-inch clearance between the armature stop bracket and the south pole of the bar magnet if the bar magnet is 1 11/16 inches long.

b. Adjustment.

(1) Loosen the two screws that secure the selector magnet to the magnet bracket, slide the selector magnet and the conductor bracket (fig. 2-118) away from the armature, and tighten the two screws.

(2) Loosen the setscrew that secures the bar magnet to the selector magnet bracket.

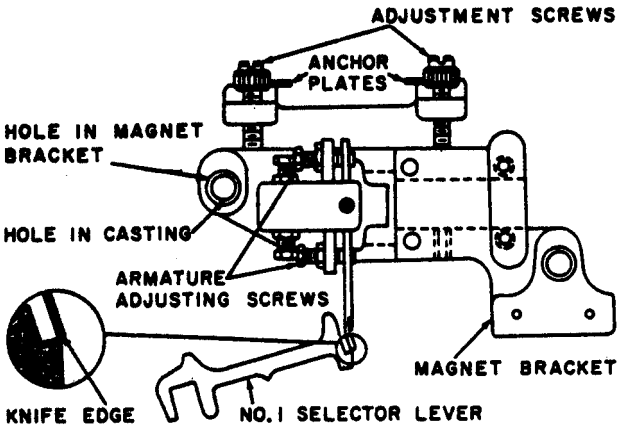


Figure 2-116. Armature and selector magnet bracket alinement.

Insert either a 0.015-inch or 0.030-inch feeler gage, as appropriate *(a(1)* or *(2)* above), between the armature stop bracket and the bar magnet, press the magnet against the gage, tighten the setscrew, and remove the feeler gage.

(3) Perform the related adjustments (para 2-135 through 2-141).

2-134.1. Armature stop Bracket and Bar Magnet Preliminary Clearance Adjustment (TT-664(*)/FGC, TT-665/FG, and TT-688(*)/FG)

(fig. 2-117)

NOTE

Some selector magnets include a bar magnet that is 1 3/4 inches long; others include a bar magnet that is 1 11/16 inches long. Disconnect plug P8 from the SELECTION MAGNET receptacle on the left side of the base. Remove the two screws that secure the selector magnet bracket to the teletypewriter side casting, remove the selector magnet bracket, and measure the length of the bar magnet. The bar magnet used with the TT-664(*)/FGC and TT-665/FGC must be the shorter version with a length of 1 11/16 inches.

NOTE

Some selector magnets have toffets that are 0.325 inches by 0.2 inches (rectangle); others have toffets that are 0.325 inches by 0.325 inches (square). The selector magnets are interchangeable, but certain adjustment requirements vary, depending upon which selector magnet is used. Measure the toffets (square or rectangle) of the selector magnet to determine the appropriate tolerances in *a* below and in paragraph *2-135.1a*.

a. Requirement.

(1) There should be a 0.008 inch clearance between the armature stop bracket and the south pole of the bar magnet if the selector magnet has rectangular toffets.

(2) There should be a 0.040 inch clearance between the armature stop bracket and the

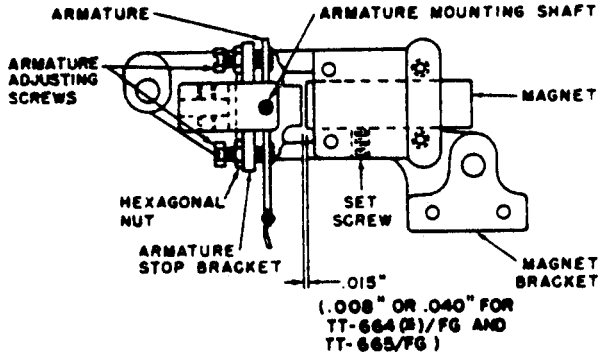


Figure 2-117. Armature stop bracket and bar magnet preliminary adjustment clearance.

south pole of the bar magnet if the selector magnet has square toffets.

b. Adjustment.

(1) Loosen the two screws that secure the selector magnet to the magnet bracket, slide the selector magnet and the conductor bracket (fig. 2-118) away from the armature, and tighten the two screws.

(2) Loosen the setscrew that secures the bar magnet to the selector magnet bracket. Insert either a 0.008-inch or 0.040 -inch feeler gage, as appropriate *(a(1)* or *(2)* above), between the armature stop bracket and the bar magnet, press the magnet against the gage, tighten the setscrew, and remove the feeler gage.

(3) Perform the related adjustments (para 2-135 through 2-141).

1-135. Selector Magnet Pole Faces and Armature Alignment (Not Applicable to TT-664(*)FG, TT-665/FG, and TT-688(*)/FG)

NOTE

Remove the selector magnet bracket and determine whether the bar magnet is 1 3/4 inches long or 1 11/16 inches long (para 2-134 note).

a. *Requirements.*

(1) There should be a 0.027- to 0.033-inch clearance between the conductor bracket and the north pole of the bar magnet, if the bar reagent is 1 11/16 inches long (B, fig. 2–118). If the bar magnet is 1 3/4 inches long, there should be no clearance between the conductor bracket and the bar magnet.

(2) When the armature is locked in position by the armature adjusting screws (para 2-133 *b* (2)), there should be a 0.004-inch clearance between each pole face of the selector magnet and its adjacent toffet (raised portion of armature; A, fig. 2-118). The center of the pole faces should be alined with the center of the armature adjusting screws.

(3) The pole faces of the selector magnet and their associated toffets on the armature should be parallel within 0.002 inch (B, fig. 2-118).

(4) The armature should not touch either armature adjusting screw when the armature is moved to the marking and spacing positions.

b. Method of Checking.

(1) If the bar magnet is 1 11/16 inches long, use feeler gages to check the requirement in *a(1)* above. Check the requirement visually, if the bar magnet is 13/4 inches long.

(2) Use feeler gages to check the requirements in *a(2)* and (3) above.

(3) After requirements *a(2)* through (3) above are met, backoff the armature adjusting

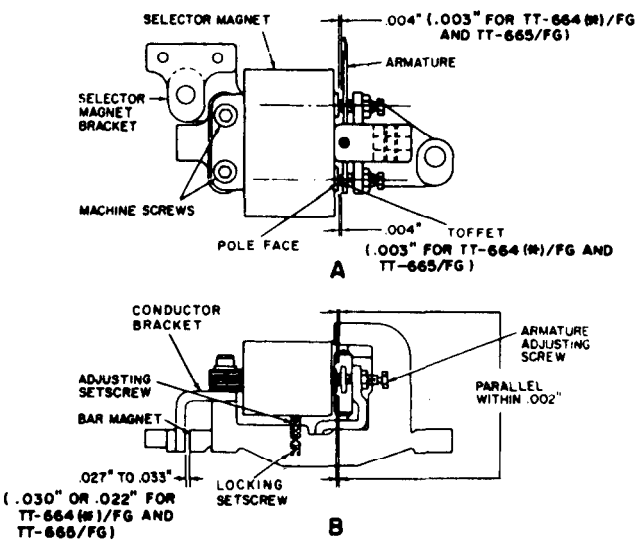


Figure 2-118. Selector magnet pole faces and armature alignment requirements.

screws and check the requirement in *a(4)* above visually.

c. Adjustments.

(1) Loosen the selector magnet mounting screws. If the bar magnet is 1 3/4 inches long, slide the conductor bracket against the bar magnet and tighten the selector magnet mounting screws friction-tight. If the bar magnet is 1 11/16 inches long, insert a 0.030-inch feeler gage between the north pole of the bar magnet and the conductor bracket, slide the conductor bracket against the feeler gage, and tighten the selector magnet mounting screws friction-tight. Perform the adjustments in (2) through (4) below.

(2) Insert a 0.004-inch feeler gage between each pole face and its associated toffet on the armature. Position the selector magnet to meet the requirement in *a(2)* above.

(3) If the pole faces and the toffets are not parallel within 0.002 inch, use the four setscrews located under the selector magnet (B, fig. 2-118) to make this adjustment. Remove the locking (outer) setscrew of each pair of setscrews, turn the adjusting (inner) setscrews in the direction necessary to meet the requirement in *a(3)* above; then tighten the locking setscrews against the adjusting setscrews.

(4) Loosen the locknuts on the armature adjusting screws (B, fig. 2-118), turn the screws away from the armature to meet the requirement in *a(4)* above, and tighten the locknuts.

(5) Perform the related adjustments (para 2-136 through 2-141).

2-135.1. Selector Magnet Pole Faces and Armature Alignment (Applicable to TT-664(*)/FG, TT-665FG, and TT-688(*)/FG

NOTE

Determine if selector magnet has rectangular or square toffets (para 2-134.1 notes).

a. Requirements.

(1) There should be 0.030-inch clearance between the conductor bracket and the north pole of the bar magnet, if the selector magnet has rectangular toffets. If the selector magnet has square toffets, there should be 0.022-inch clearance between the conductor bracket and the bar magnet.

(2) When the armature is locked in position by the armature adjusting screws (para 2-133 *b(2)*), there should be a tight 0.003-inch clearance between each pole face of the selector magnet and its adjacent toffet (raised portion of the armature; A, fig. 2-118). The center of the pole faces should be aligned with the center of the armature adjusting screws.

(3) The pole faces of the selector magnet and their associated toffets on the armature should be parallel within 0.002 inch (B, fig. 2-118).

(4) The armature should not touch either armature adjusting screw when the armature is moved to the marking and spacing positions.

b. Method of Checking.

(1) Use feeler gages to check the appropriate requirement in a (1) above.

(2) Use feeler gages to check the requirements in a (2) above.

(3) After requirements a (2) and (3) above are met, backoff the armature adjusting screws and check the requirement in a (4) above visually.

c. *Adjustments.*

(1) Loosen the selector magnet mounting screws. If the selector magnet has rectangular to ffets, insert a 0.030 -inch feeler gage between the north pole of the bar magnet and the conductor bracket; if the selector magnet has square toffets, insert a 0.022-inch feeler gage between the north pole of the bar magnet and the conductor bracket. Slide the conductor bracket against the feeler gage, and tighten the selector magnet mounting screws friction tight. Perform the adjustments in (2) through (4) below.

(2) Insert a 0.004-inch feeler gage between each pole face and its associated toffet on the armature. Position the selector magnet to meet the requirement in *a(2)* above.

(3) If the pole faces and the toffets are not parallel within 0.002 inch, use the four setscrews located under the selector magnet (B, fig. 2-118) to make this adjustment. Remove the locking (outer) setscrew of each pair of setscrews, turn the adjusting (inner) setscrews in the direction necessary to meet the

requirement in a (3) above; then tighten the locking setscrews against the adjusting setscrews,

(4) Loosen the locknuts on the armature adjusting screws (B, fig. 2-118), turn the screws away from the armature to meet. the requirement in *a(4)* above, and tighten the locknuts.

(5) Perform the related adjustments (para 2-137 through 2-141).

2-136. Bar Magnet Field Strength Adjustment

NOTE

This adjustment applies only to the selector mechanisms which include a bar magnet that is 1 3/4 inches long. Disconnect plug P8 from the SELECTOR MAGNET receptacle on the left side of the base, remove the selector magnet bracket, and check the length of the bar magnet. If the bar magnet is 1 11/16 inches long, replace the selector magnet bracket on the teletypewriter and perform the adjustments described in paragraphs 2-137 through 2-141. If the bar magnet is 1 3/4 inches long, perform the following checking and adjustment procedure before replacing the selector magnet bracket.

a. Requirement. When the armature leaf spring stop screws (fig. 2-121) are not in contact with their associated leaf springs, a 40- to 75-gram (1 1/2- to 2 l/2-ounce) force, applied as shown in figure 2-119, should be required to move the armature from the mark to the space position, and from the space to the mark position.

b. Method of Checking.

(1) Loosen the locknuts on the armature leaf spring stop screws (fig. 2-121) (or the machine screws if the selector mechanism includes locking tabs (fig. 2-120)). Back off the armature leaf spring stop screws until they no longer touch the leaf springs.

(2) Use either a suitable spring scale or a gram gage to check the requirement.

c. Adjustment.

(1) Insert a 0.004-inch feeler gage between each pole face of the selector magnet and its associated toffet on the armature, loosen the locknuts on the armature stop screws and carefully turn each screw toward the armature until it *barely* touches the armature. Tighten the locknuts and remove the feeler gages.

(2) Loosen the machine screws that secure

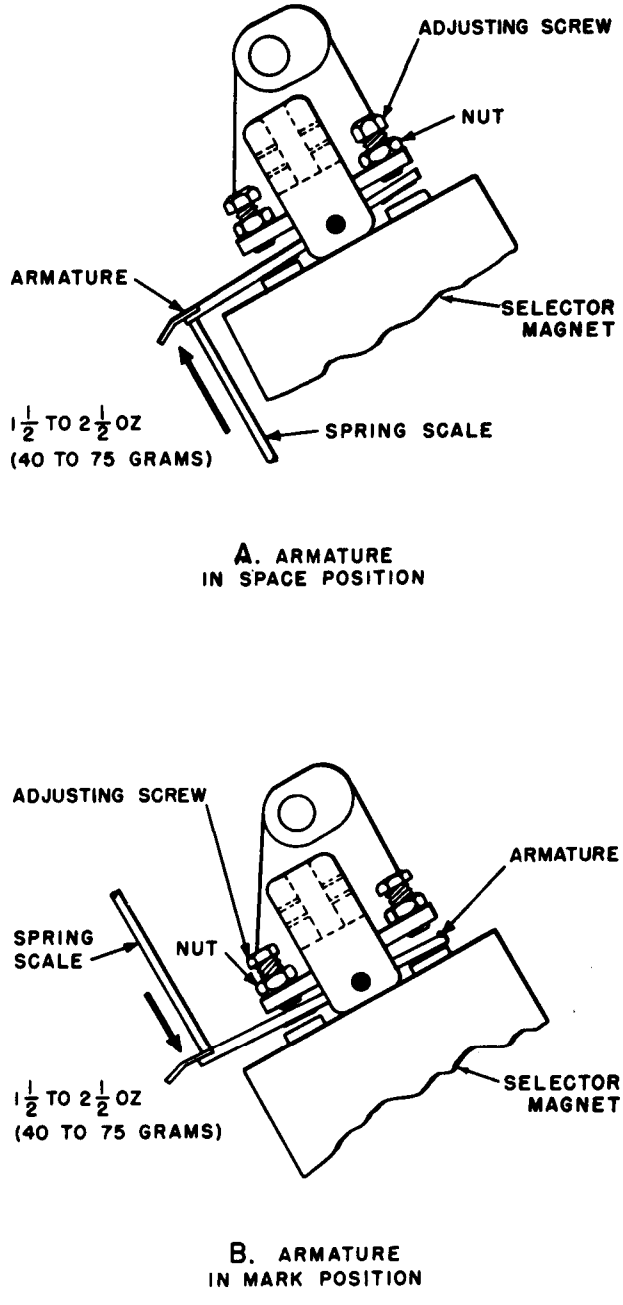


Figure 2-119. Magnet attractive force and armature clearance adjustment.

the selector magnet and the conductor bracket to the selector magnet bracket.

(3) Loosen the setscrew that secures the bar magnet (fig. 2-117), to the selector magnet bracket. Either move the bar magnet closer to the armature stop bracket to increase the force required to move the armature *(a* above), or move the bar magnet away from the armature stop bracket to *decrease* the force required to move the armature. Tighten the setscrew to secure the bar magnet in its adjusted position.

(4) Insert a 0.004-inch feeler gage between each pole face and its associated armature toffet, slide the selector magnet pole faces against the feeler gages, slide the conductor bracket against the south pole of the bar magnet, align the center of the pole faces with the center of the armature adjusting screws, and tighten the machine screws to secure the selector magnet and conductor bracket in place.

(5) Remove the feeler gages and turn armature adjusting screws away from the armature until they no longer make contact with the armature (when in either marking or spacing position). Tighter the locknuts on the armature adjusting screws.

(6) Recheck the requirement in *a(1)* above; if the requirement is met, recheck the requirements described in paragraph *2-135a(2),* (3), and (4). Perform the adjustments described in paragraphs 2-137 through 2-141.

2-137. Armature Positioning Adjustment (fig. 2-120)

a. Requirements.

(1) The toffets on the armature and the pole faces of the selector magnet must be in alignment (when viewed from direction shown in A, fig. 2-120).

(2) The step in the blade of the armature (B, fig. 2-120) should engage the full width of the stop lever but should not touch the outer selector lever when the end play of the armature is taken up in either direction (visual check).

b. Adjustment. Loosen the setscrew that secures the armature shaft (A, fig. 2-120). Position the armature to meet both requirements. Tighten the setscrew and recheck the requirements.

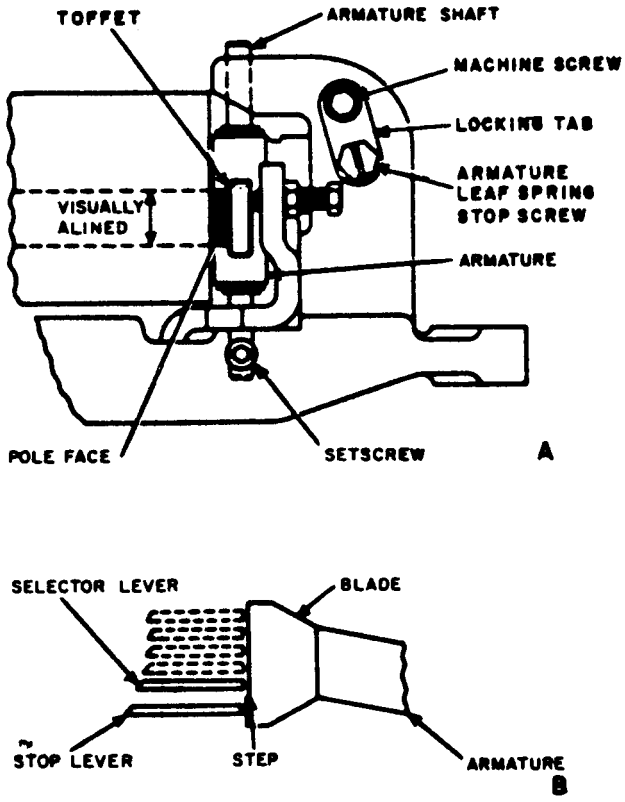


Figure 2-120. Magnet positioning adjusting requirements.

2-138. Armature Leaf Spring Adjustment (Not Applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG)

c. Requirement. When the selector mechanism is mounted on the teletypewriter and the selector magnet is deenergized, a force of 10 to 35 grams (1 1/3 to 1 1/4 ounces) applied at the point shown in figure 2-121, should be required to move the armature from the mark position to the space position and from the space position to the mark position. The forces required to move the armature in both directions should be within 10 grams of each other.

b. Method of Checking. Disconnect plut P8 from the SELECTOR MAGNET receptacle on the side of the base and turn the motor manually until none of the cams on the selector

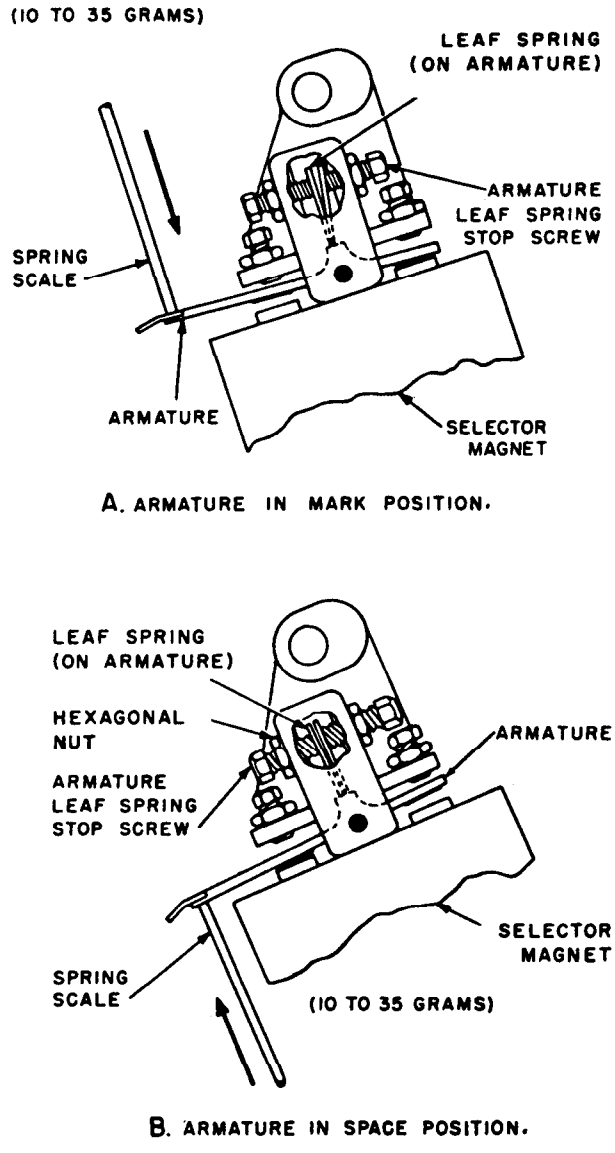


Figure 2-121. Armature leaf spring adjustment.

camshaft is in contact with its associated lever. Use either a spring scale or gram gage to check the requirement.

c. *Adjustment.* Loosen the locknuts on the armature leaf spring stop screws (fig. 2-121) (or the machine screws (A, fig. 2-120)). Adjust the position of the armature leaf spring stop screws to meet the requirement, tighten the locknuts (or machine screws), as applicable, and recheck the requirement.

2-138.1. Armature Leaf Spring Adjustment (Applicable to TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG)

a. Requirement. With the selector mechanism removed from the teletypewriter, a force of 8 to 12 grams applied at the point shown in A, figure 2-121 should be required to move the armature from the mark position to the space position, and a force of 18 to 20

grams applied to it at the point shown in figure 2-121B should be required to move the armature from the space to mark position.

b. Method of Checking. Hold the selector magnet assembly so that it is perpendicular to the work surface and use a gram gage to check the requirement.

c. *Adjustment.*

(1) Loosen the locknuts on the armature leaf spring stop nuts (fig. 2-121) or the machine screws (A, fig. 2-120), whichever is applicable.

(2) Place the armature blade in the space position and screw both leaf spring stop screws out until they no longer are in contact with the leaf springs.

(3) Adjust the rear leaf spring stop screw (figure 2-121B) in until the armature pole face just leaves (space to mark) the selector magnet toffet; and then back off screw one-half turn.

(4) Adjust the front leaf spring stop screw [figure 2-121A) in until the armature pole face just returns (mark to space) to the selector magnet toffet; and then back off screw one-half turn.

NOTE

The armature should be side stable now, i.e.: it should remain in the position (mark or space) where it has been manually positioned.

(5) Proceed to adjust the leaf spring stop screws to meet requirement *a* above; tighten the locknuts (or machine screws), as applicable, and recheck the requirement.

2-139. Selector and Stop Levers Alinement with Armature (preliminary Adjustment)

(fig. 2-122)

a. *Requirement.* With a .004-inch clearance between the pole faces and the armature toffets, the selector levers should just pass the knife-edge of the armature and the stop lever should be stopped by the knife-edge of the armature blade.

b. Adjustment. Place .004 -inch feeler gages between the pole faces and the armature toffets. Losoen the magnet bracket mounting screws sufficiently to allow friction pressure to hold the magnet bracket to the teletypewriter casting. While manually moving the selector

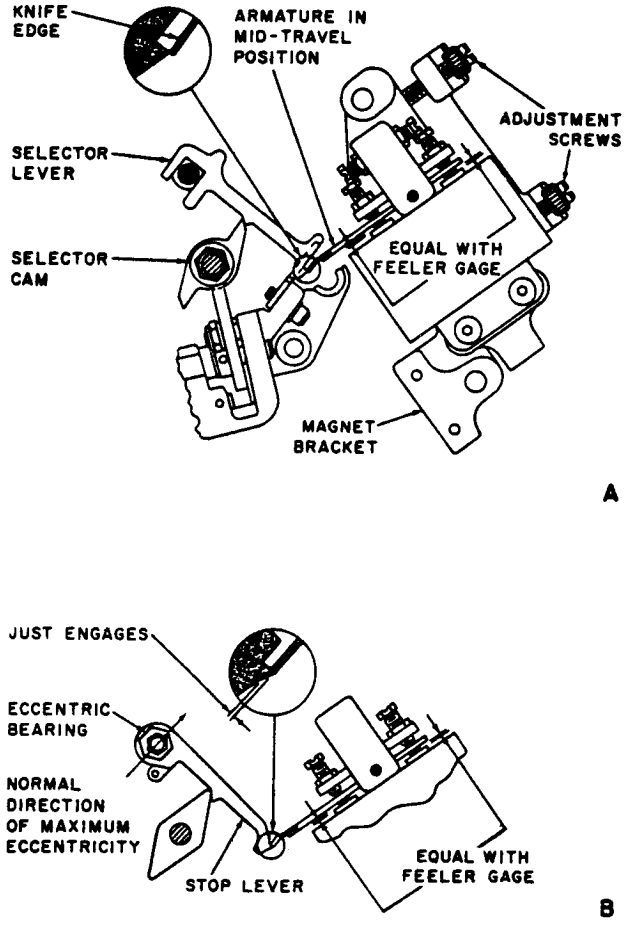


Figure 2-122. Selector and stop levers alinement with armature (preliminary adjustment).

levers past the knife-edge of the armature, position the magnet bracket (use the adjustment 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. 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 the adjustment described in paragraph 2-140.

2–140. Selector Magnet Alinement with Selector and Y-Levers

(fig. 2-123)

NOTE

This adjustment is to be made only after the adjustment in paragraph 2-139 has been made.

a. Requirement. The selector camshaft should not rotate with a .006-inch feeler gage between the Y-lever and the left side of the Y-lever eccentric stop when the letters code group is received by the selector mechanism and the motor is running. The selector camshaft should rotate when a .002-inch feeler gage is inserted at that position.

b. Adjustment. Loosen the magnet bracket mounting screws enough to allow friction pressure to hold the magnet bracket to the teletypewriter casting. Use the adjustment screws to position the magnet bracket to meet the requirement. Tighten the magnet bracket mounting screws. Check the related adjustment described in paragraph 2-139.

2–141. Selector Magnet Armature Blade and Selector Lever Clearance

(fig. 2-124)

a. Requirement. There should be a .018 to .025-inch clearance between the armature blade and the selector levers when the machine is in a standby condition.

b. Adjustment. Loosen the selector lever comb bracket adjusting screws. Move the selector lever comb bracket vertically until the requirement is met. Tighten the adjusting screws.

2–142. Line-Feed and Platen Shift Sensing Cam Alinement (Not Applicable to TT–98C/FG)

(fig. 2-125)

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 teletypewriter (para 2-22 *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 laminations from, or add laminations to, the laminated flat washer to meet the requirement. Remove all burs from the laminated flat washer and replace the parts on the function shaft. Tighten the machine screw and install the assembled function shaft (para 2-22 *b)* in the teletypewriter. Recheck the requirement and readjust if necessary. Check related adjustments (para 2-117, 2-123, 2-144, 2-146, and 2-185).

2–143. Function Shaft Driving Collar Adjustment

(fig. 2-126)

NOTE

Adjustment should be made only after reassembly of the function shaft assembly,

a. Requirement. There should be a 0.015- to 0.030-inch clearance between the driving collar and the adjacent clutch disk at the point shown in figure 2-126.

b. Adjustment. Remove the machine screws and clutch adjusting collar (26 and 27, fig. 2-17). Loosen the setscrews in the driving collar, position the collar to meet the requirement, and tighten the setscrews. Replace the clutch adjusting collar and recheck the clearance. Perform the squareshaft stop arm torque adjustment (para 2-182).

2–144. Cam Followers and Spacing Collar Adjustment

(fig. 2-127)

a. *Requirement.* There should be equal clearance between the rollers of the line-feed and the platen shift cam followers and their sensing cams (A, fig. 2-127).

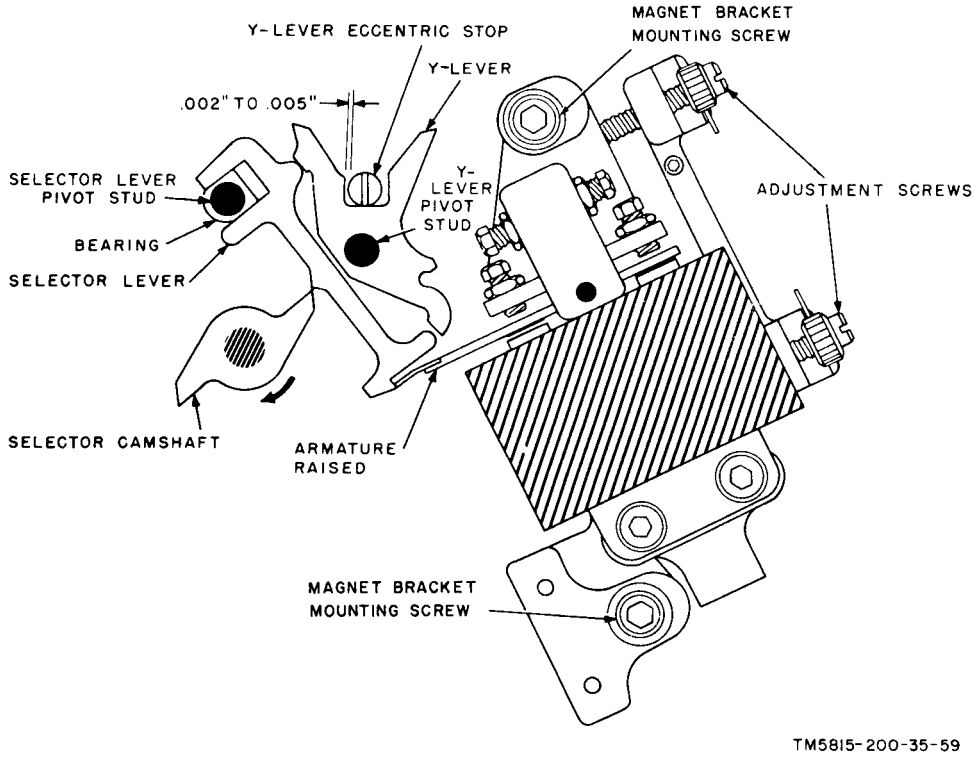


Figure 2-123. Selector magnet alinement with selectors and Y-levers.

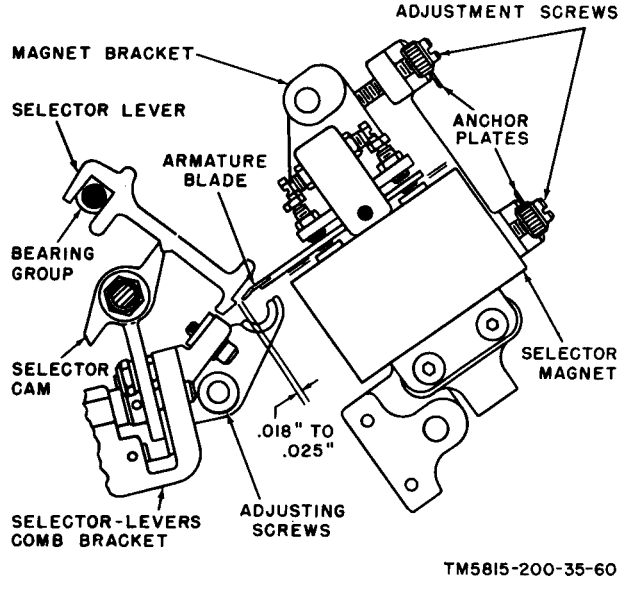


Figure 2-124. Selector magnet armature blade and selector lever clearance.

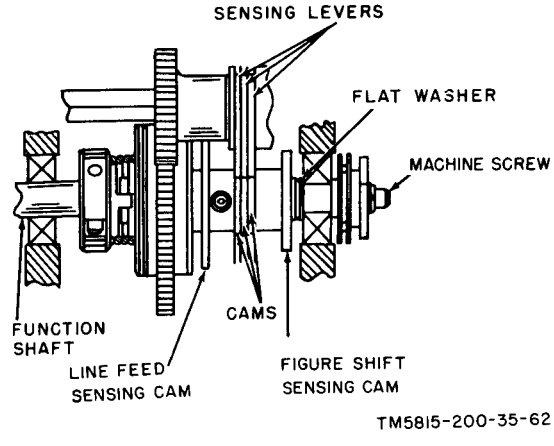


Figure 2-125. Line-feed and platen shift sensing cam alinement.

b. Method of Checking. Select a code combination other than line-feed or figures-shift. Remove the terminal and switch box and the paper roller stand (para 2-28 *a).* Check the adjustment.

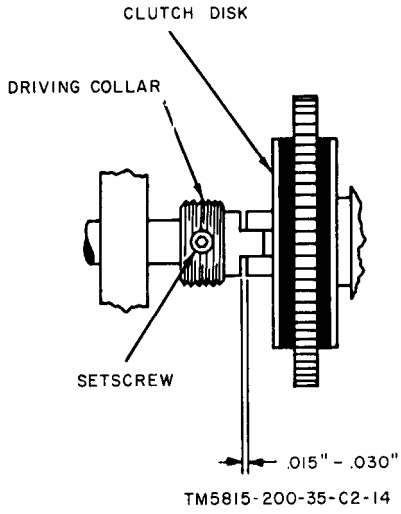


Figure 2-126. Function shaft driving collar adjustment (not applicable to TT-98C/FG).

c. Adjustment. Loosen the setscrew in the spacing collar (B, fig. 2–127). Shift the spacing collar right or left until the requirement is met. Tighten the setscrew. Replace the terminal and switch box and the paper roller stand (para 2-28 *b).* Check related adjustments (paras 2–111 and 2–142).

2-145. Function Shaft Clutch Tension Adjustment

(fig. 2-128)

a. Requirement. There should be a .080- to 100-inch clearance between the flexible coupling disk and the function shaft sliding clutch drum when the sliding clutch drum is engaged with the function driven gear.

b. Method of Checking. Trip the transfer-lever latch and turn the motor by hand until the sliding clutch drum has fully engaged the function driven gear. Insert a flat feeler gage through the clutch spring and between the flexible coupling disk and the function shaft sliding clutch drum to determine the clearance.

c. Adjustment. Loosen the two setscrews in the flexible coupling disk and shift the flexible coupling disk in the proper direction to obtain the required clearance, tighten the two setscrews. Check the related adjustment (para 2-146).

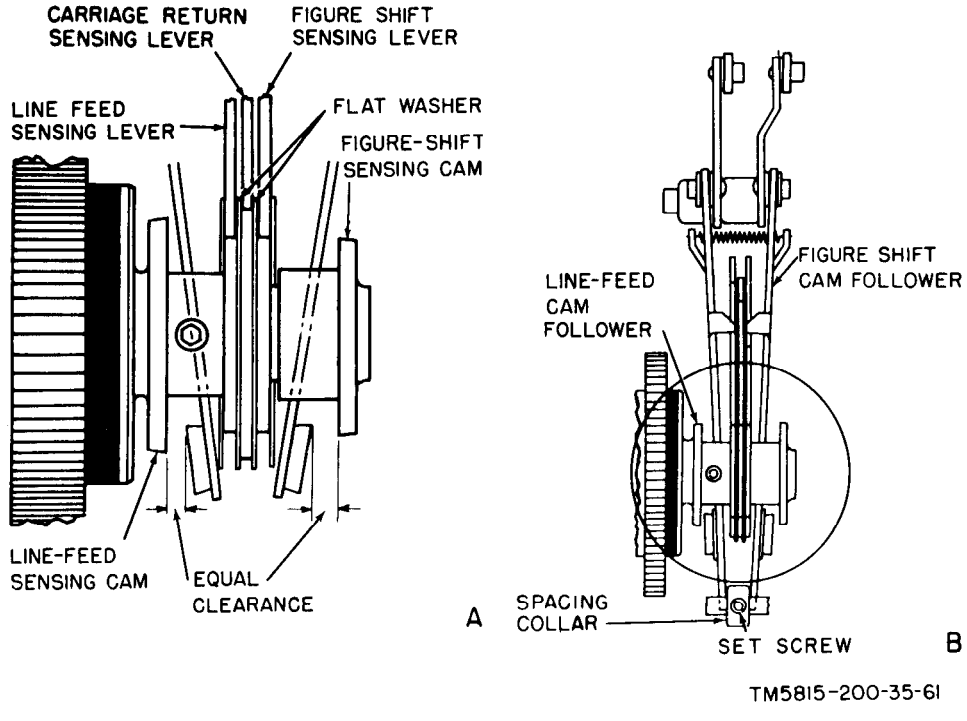


Figure 2-127. Cam followers and spacing collar adjustment (not applicable to TT-9SC/FG).

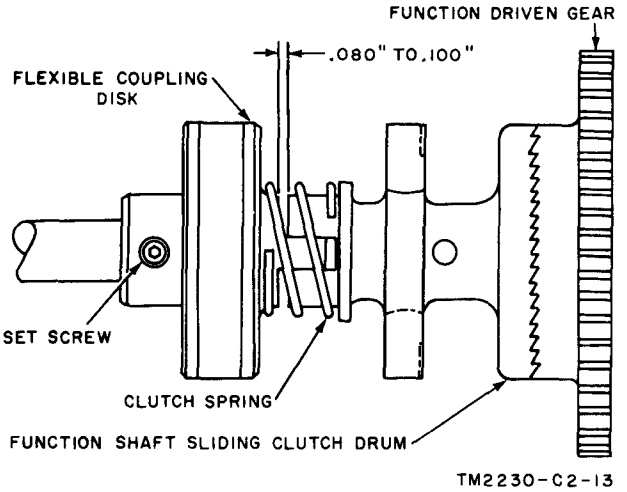


Figure 2-128. Function shaft clutch tension adjustment.

2-146. Angular Relationship of Function Shaft Parts

(fig. 2-129)

a. Requirements.

(1) With the finger of the function shaft sliding clutch drum fully engaged with the clutch latch, the code ring locking bail cam follower should be at the high point of the locking bail cam.

(2) With the finger of the function shaft sliding clutch drum fully engaged with the clutch latch, the print cam follower roller should be in the low part of the print cam.

(3) Immediately after the transfer operation has occurred and the function shaft sliding clutch drum has engaged the function driven gear, the sensing levers should fall to the low point of their restoring cams within ⅓ to ⅔ revolution of the motor.

(4) With the finger of the function shaft sliding clutch drum fully engaged with the clutch latch, the roller of the function cam follower should be just beyond the high point of the function cam (not applicable to TT-98C/FG and subsequent models).

(5) On the TT-98C/FG and subsequent models, with the finger of the function Shaft sliding clutch drum fully engaging the clutch latch, the roller of the function cam follower should be on the low point of the function cam.

b. Method of Checking.

(1) With the teletypewriter in the stopped position, turn off the motor. Manually rotate the function shaft to make sure that the finger of the function shaft sliding clutch drum has fully engaged the clutch latch. Check the requirement visually.

Note. Be sure the requirement in *a(1)* above is met before proceeding with the remaining adjustment checks.

(2) With the motor on, press any keylever. When the operation is complete, turn off the motor. Manually try to rotate the function shaft in its normal direction; there should be no movement. Trip the transfer-lever latch and rotate the motor by hand; observe the print-bail blade to make sure that there is no backward movement before the blade starts its forward travel.

(3) Turn the motor on and off to clear the machine. Manually rotate the function shaft to make sure the finger of the function shaft sliding clutch drum has fully engaged the clutch latch. Position the Y-levers for the line of feed code combination and trip tile transfer lever latch. Slowly rotate the motor by hand until the function shaft sliding clutch drum has engaged the function driven gear and note the position of a target spot on the motor. Rotate the motor ⅓ to ⅔ of a revolution more while checking to make sure that the line-feed sensing lever is pulled to the low part of its restoring cam during this operation.

(4) Turn the motor on and off to clear the machine. Manually rotate the function shaft, to make sure that the finger of the function shaft sliding clutch drum has fully engaged the clutch latch. Trip the transfer-lever latch and rotate the motor by hand; observe the function-selecting arm to make sure the there is no outward movement before the function-selecting arm starts its inward thrust.

c. Adjustments. Be sure that all setscrews are tightened against the flats of the funtion shaft

when the parts are repositioned on the function shaft. Proceed as follows:

(1) Loosen the setscrews in the flexible coupling disk. Hold the sliding clutch drum firmly against the clutch latch and rotate the function shaft to meet the requirements. Tighten the setscrews. (When this adjustment is made, be sure to make the adjustments listed in (2), (3), and (4) below.)

(2) Loosen the setscrews in the print cam. While holding the finger of the sliding clutch drum firmly engaged with the clutch latch, rotate the print cam to the point where any backward rotation of the print cam starts to move the print cam follower. Tighten the setscrews.

(3) Loosen the setscrews in the line-feed and platen shift sensing cam assembly and rotate the cam assembly to meet the requirement. Tighten the setscrews.

(4) Loosen the setscrews in the function cam and rotate the cam to meet the requirement. Make the adjustment as described in paragraph 2-145 and tighten the setscrews.

2-147. Punch Bar and Slide Plate Clearance Adjustment

(fig. 2-130)

Note. Perform this adjustment only when the punch bar guide block has been disassembled.

a. Requirement. There should be a 0.001- to 0.008-inch clearance between each punch bar and the aperture gate when a projection of the aperture gate is aligned with the punch bar.

b. Method of Checking. Align the projections of the aperture gate with the punch bars and check the requirement with feeler gages.

c. *Adjustment.* Loosen the mounting screws that secure the side plate to the punch bar guide block. Position the side plate to meet the requirement, tighten the mounting screws and recheck the clearance.

2-148. Letters Shift Lever Shaft End-Play Adjustment

(fig. 2-131)

a. Requirement. The letters shift lever shaft should have 0.001- to 0.005-inch end play when the carriage feed lever and the support lever are in alignment and the letters shift lever and the platen latch are in alignment.

b. Adjustment. Loosen the two setscrews in the collar on the letters shift lever shaft. Insert a 0.003-inch feeler gage between the carriage feed lever and the collar. Press the collar against the feeler gage, press the head of the letters shift lever shaft against the function bracket, and tighten one of the setscrews against it flat on the shaft. Remove the feeler gage and recheck the requirement. When the requirement is met, tighten the other setscrew.

2-149. Function Bracket Adjustment

(fig. 2-132)

a. Requirements.

(1) There should be a 0.001- to 0.020-inch clearance between the upper end of the

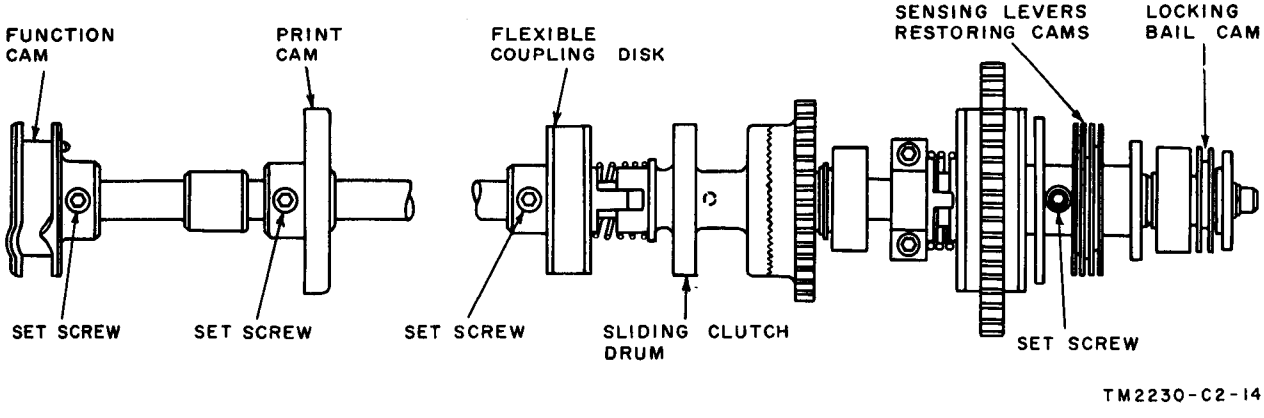


Figure 2–129. Angular relationship of function shaft parts.

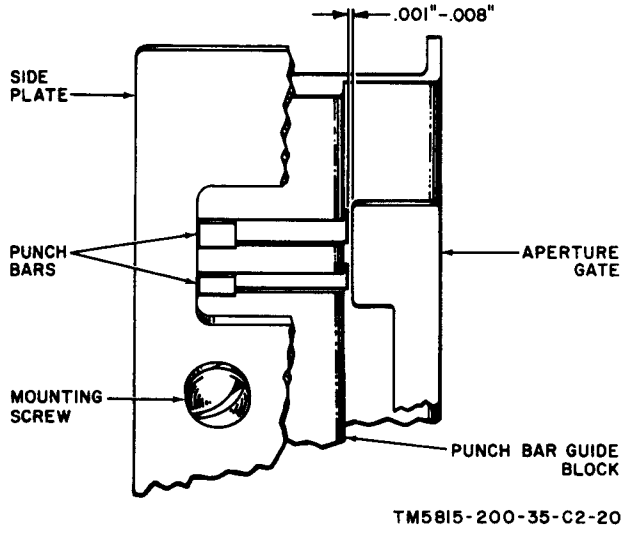


Figure 2-130. Punch bar and side plate clearance requirement.

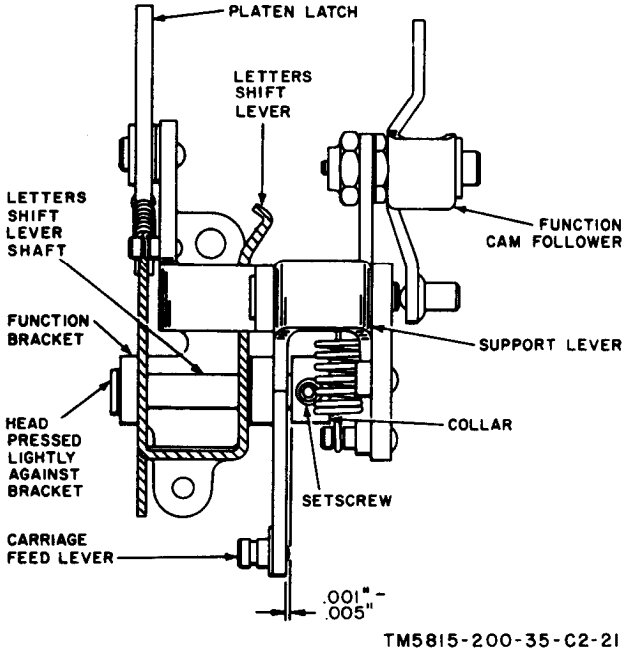


Figure 2-131. Lettcrs shift lever shaft end-play requirement.

function cam follower and the groove in the function selecting arm.

(2) There should be a 0.001- to 0.035-inch clearance between the roller on the lower end of the function cam follower and the bottom of the groove in the function cam.

b. Adjustment. Loosen the locknut on the upper bracket mounting stud. Loosen both bracket mounting studs, position the function bracket to meet both requirements, tighten both bracket mounting studs, and recheck both clearances. When both requirements are met, tighten the locknut on the upper stud. After completion of this adjustment, check for binding between the letters shift lever and the letters punch bar. If necessary, bend the letters shift lever slightly to eliminate bind.

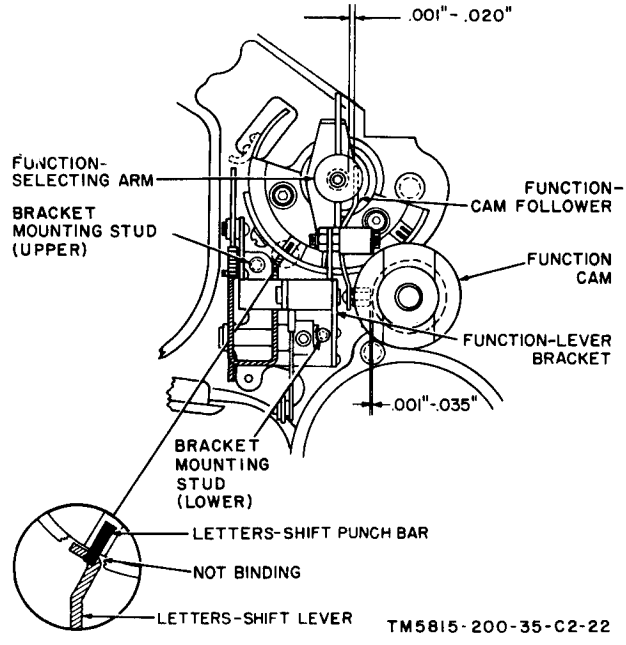


Figure 2-132. Function bracket adjustment requirement.

2-150. Function Cam Adjustment

(fig. 2-133)

a. Requirement. There should be a 0.008- to 0.020-inch clearance between the function selecting arm and the punch bar guide block when the function selecting arm is in this unoperated position. If one or more punch bars protrude from the punch bar guide block, the clearance between the function selecting arm and the punch bar that protrudes the farthest, should be at least 0.002 inch.

b. Method of Checking. Use feeler gages to check the clearances. After each check, turn the function selecting arm 180° and recheck the clearance.

c. Adjustment. Loosen the setscrews in the function cam, move the function cam either toward or away from the punch bar guide block to meet the requirement, tighten the setscrews, and recheck tile clearance. Check the related requirement (para *2-146a(4)).*

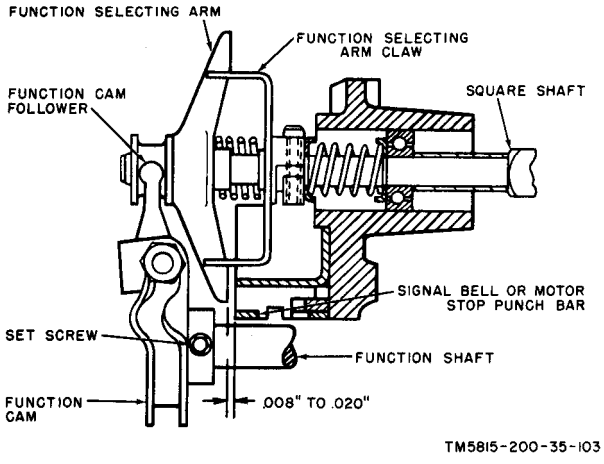


Figure 2-133. Function cam adjustment.

2-151. Carriage-Feed Driving Gear End-Play Adjustment

(fig. 2-134)

Note. If the carriage-feed shaft assembly has been disassembled in order to replace a defective part, or to accomplish any other maintenance procedure, perform the adjustments described in paragraphs 2-152 and 2-153 before making this adjustment. If the shaft assembly has not been disassembled, perform this adjustment and then the adjustment described in paragraph 2-154.

a. Requirement. There should be a .001- to .005-inch clearance between the flat washer and the shoulder on the carriage-feed shaft when the carriage-feed driving gear is held tight against the ball bearing.

b. Method of Checking. Push the carriage-feed clutch drum back and hold the carriage-feed driving gear tight against the ball bearing. Check the clearance with a feeler gage.

c. Adjustment. Loosen the self-locking hexagonal nut on the rear of the carriage-feed shaft. Rotate the adjusting nut clockwise or counterclockwise until the requirement is met. Tighten the self-locking hexagonal nut and recheck the clearance.

2-152. Carriage-Feed Ratchet Adjustment

(fig. 2-135)

Note. Perform this adjustment only during reassembly of the carriage-feed shaft assembly (para 2-75).

a. Requirement. The end of the hub portion of the carriage-feed ratchet should be flush with the end of the flat on the carriage-feed shaft (visual check).

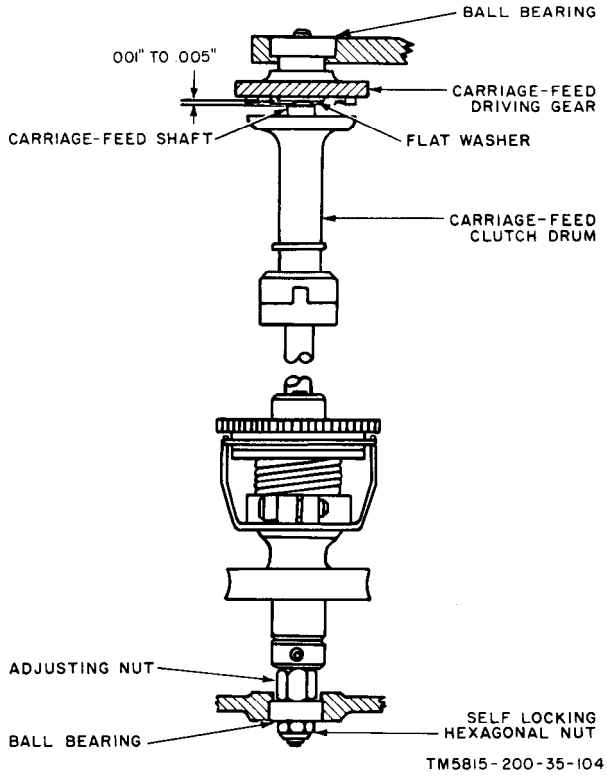


Figure 2-134. Carriage-feed, driving gear end-play adjustment.

b. Adjustment. Loosen the setscrews in the carriage-feed ratchet and move the ratchet to meet the requirement. Tighten the setscrews. Check the related adjustments (paras 2-158, 2-163, and 2-169).

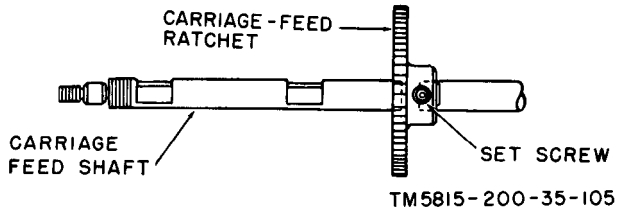


Figure 2–135. Carriage-feed ratchet adjustment.

2-153. Carriage-Feed Shaft Drive Collar Adjustment

(fig. 2-136)

Note. Perform this adjustment only during reassembly of the carriage-feed shaft assembly (para 2-75).

a. Requirement. The carriage-feed shaft drive collar should exert a 1- to 1 ½-pound pressure against the adjacent outer disk of the friction clutch assembly.

b. Adjustment. Loosen the setscrews in the drive collar. Apply a 1- to 1 ½-pound pressure against the end of the carriage-feed shaft to press the carriage-feed ratchet and the friction clutch assembly against the drive collar; tighten the setscrews in the drive collar.

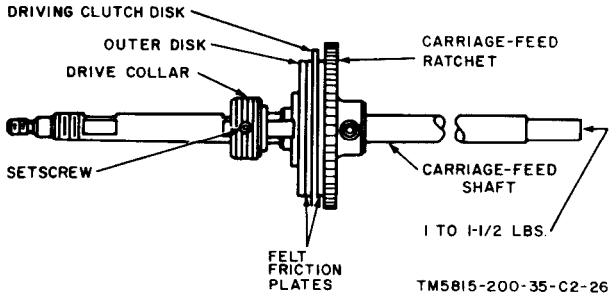


Figure 2-136. Carriage-feed shaft drive collar adjustment.

2-154. Carriage-Feed Driven Gear Adjustment

(fig. 2-137)

a. Requirement. The carriage-feed driven gear should be centered with the carriage-feed worm on the main shaft.

b. Adjustment. Loosen the setscrews in the shaft collar. Push the carriage-feed driven gear forward until it is tight against the carriage-feed worm. Measure the distance "Y," as shown. Pull the carriage-feed driven gear rearward, until tight, and measure the distance "X," as shown. Adjust the position of the carriage-feed driven gear to set the distance from the rear of the base casting to the face of the gear equal to the "X" measurement plus one-half the difference between the "X" and "Y" measurements. Slide the shaft collar against the carriage-feed driven gear and tighten the setscrews in the shaft collar.

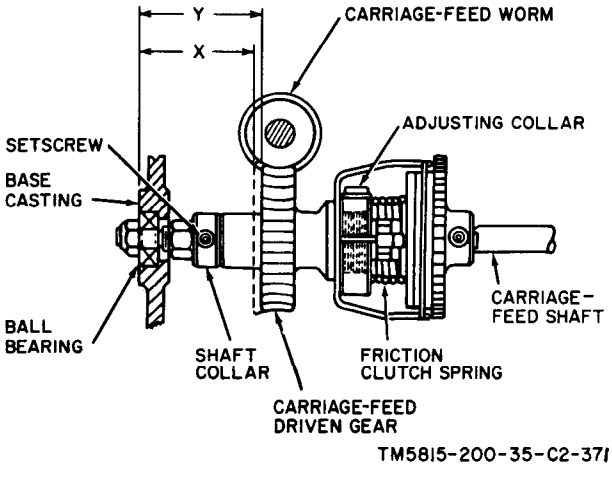


Figure 2-137. Carriage-feed drive gear adjustment.

2-155. Carriage-Feed Pawl End-Play Adjustment

(fig. 2-138)

a. Requirement. When the carriage-feed pawl is held against the washer adjacent to the hexagonal nut, there should be a 0.001- to 0.004-inch clearance between the feed pawl and the spacer on the feed pawl stud.

b. Method of Checking. Disconnect the carriage-feed pawl spring and the carriage-feed link from the carriage-feed pawl. Turn the pawl manually to check for binding. Hold the pawl toward the hexagonal nut and check the clearance with a feeler gage.

c. Adjustment. Remove the hexagonal nut, washer, and carriage-feed pawl from the stud on the bracket. Peel the spacer to meet the requirement or, if necessary, insert a new space (fig. 2-56) peeled to size. Reassemble the carriage-feed pawl, washer, and hexagonal nut and recheck the requirement. Connect the carriage-feed pawl spring and the carriage-feed link to the carriage-feed pawl.

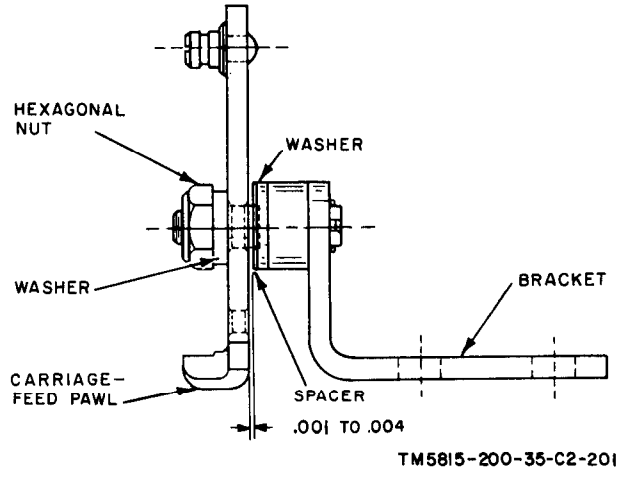


Figure 2-138. Carriage-feed pawl end-play adjustment.

2-156. Carriage-Feed Pawl Alinement

(fig. 2-139)

a. Requirement. The carriage-feed pawl should be centered against the teeth of the carriage-feed ratchet, and the pawl should engage the teeth squarely (visual checks).

b. Adjustment. Loosen the two machine screws that hold the bracket to the chassis. Position the bracket to meet the requirements. Tighten the machine screws and recheck the requirements. Check related adjustments (paras 2-157, 2-158, and 2-164).

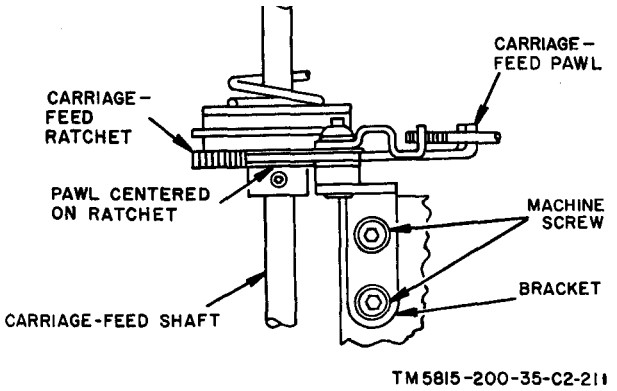


Figure 2-139. Carriage-feed pawl alinement.

2-157. Carriage-Feed Pawl Adjustment

(fig. 2-140)

Requirements.

(1) There should be maximum engagement between the carriage-feed pawl and the carriage-feed ratchet, with no end play in the carriage-feed link.

(2) There should be a minimum of .015-inch clearance between the carriage-feed pawl and the carriage-feed ratchet when the carriage-feed pawl is pulled to maximum disengagement by the carriage-feed link.

b. Method of Checking.

(1) With-the teletypewriter in the stop position, check the end play in the carriage-feed link when the carriage-feed pawl is fully engaged with the carriage-feed ratchet.

(2) Select the H-combination. Release the transfer lever. When the carriage-feed pawl has reached disengagement, measure the clearance with a feeler gage. Recheck on S-selection.

Note. On the TT-99/FG (weather symbol teletypewriters), select the H-combination while the platen is in the figures position. On all other teletypewriters, select the H-combination while the platen is in the letters position.

c. Adjustment. Remove the adjusting link from the carriage-feed pawl and turn the adjusting link to meet the requirements in *a(1)* and (2) above. Check the related adjustment (para 2-158).

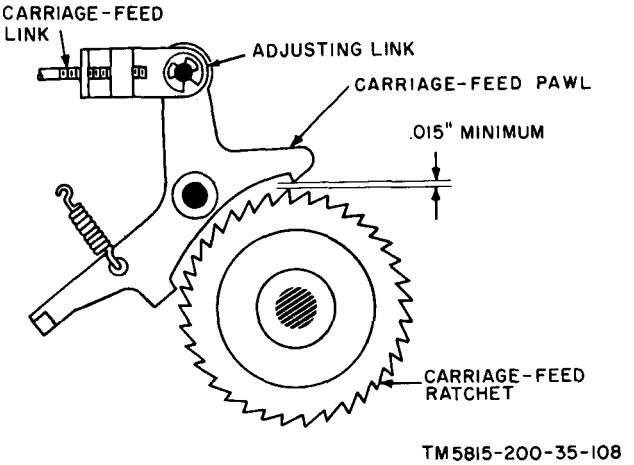


Figure 2-140. Carriage-feed pawl adjustment.

2-158. Manual Space Pushbutton Adjustment

(fig. 2-142)

a. Requirement. There should be a .025- to .040-inch clearance between the carriage-feed pawl and the carriage-feed ratchet when the manual space pushbutton is pressed all the way.

b. Method of Checking. With the motor off, press the manual space pushbutton. Check the clearance.

c. Adjustment. Loosen the nut on the link. Turn the manual space pushbutton clockwise or counterclockwise to meet the requirement Tighten the nut on the link.

2-159. Carriage-Return Safety Clutch End-Play Adjustment (TT-98C/FG)

(fig. 2-141)

Note. This adjustment should be performed only when the equipment is being reassembled after disassembly or repair.

a. Requirement. The carriage-return safety clutch assembly should be free on the shaft with end play not to exceed 0.010 inch.

b. Method of Checking. Hold the carriage-return shaft stationary. Grasp the safety clutch assembly and attempt to move it back and forth along the carriage-return shaft. Make sure the clutch can rotate freely without binding.

c. Adjustment.

(1) Remove the carriage-return shaft (para *2-76a(1)-(8)).*

(2) Remove the decelerating cam, retainer ring, and the safety clutch assembly (para *2-76a* (9)) from the carriage-return shaft.

(3) Remove or install shims to meet the requirements in *a* above.

(4) Reinstall the safety clutch, the retainer ring, and the decelerating cam on the carriage-return shaft. Make sure the retainer ring is fully seated in the slot in the carriage-return shaft.

(5) Reinstall the carriage-return shaft by reversing the procedures in paragraph *2-76a* (1) through (8).

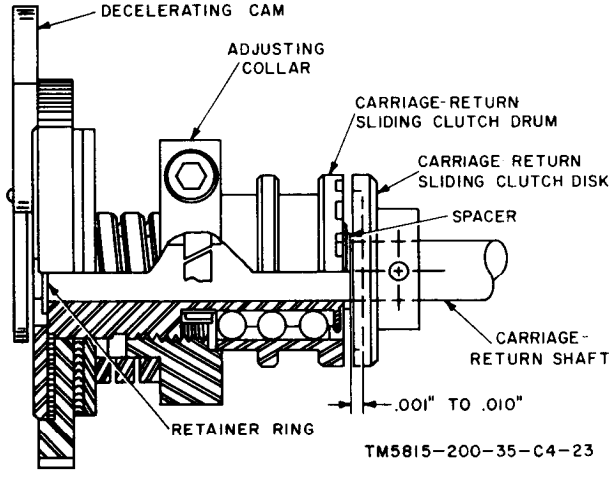


Figure 2-141. Carriage-return safety clutch end-play adjustment (TT-98C/FG).

2-160. Carriage-Return-Clutch Lever Shaft Clearance Adjustment

(fig. 2-143)

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.

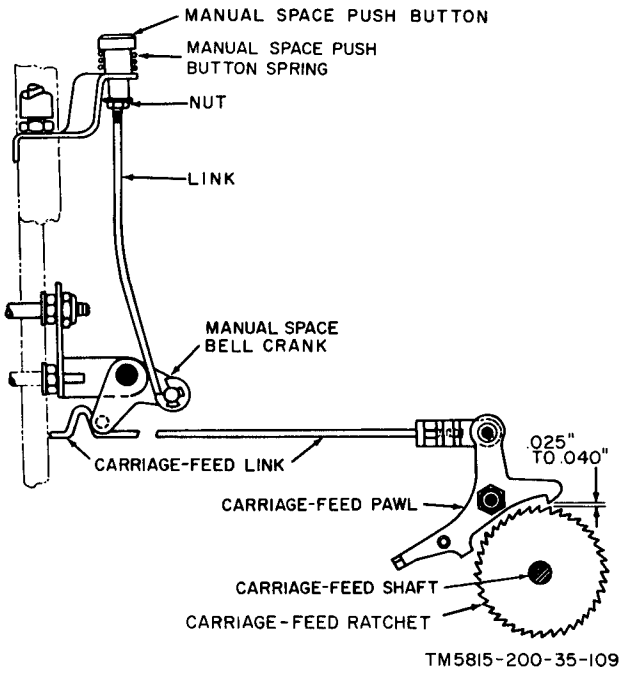


Figure 2-142. Manual space pushbutton adjustment.

(2) There should be a .002- to .005-inch clearance between the throwout lever and the double-blocking lever.

b. Adjustments.

(1) Loosen the clamping screw in the carriage-return-clutch actuating lever. Loosen the setscrews on the shaft collar. Insert a flat feeler gage between the carriage-return-clutch actuating lever and the clutch-latch mounting plate. Hold down the top of the shaft of the carriage-return-clutch lever and, while the spring grips the feeler gage between the carriage-return-clutch actuating lever and the clutch-latch mounting plate, tighten the setscrews in the shaft collar. Make the adjustment in paragraph 2-161 before tightening the clamping screw in the carriage-return-clutch actuating lever.

(2) Loosen the clamping screw on the throwout lever. Insert a flat feeler gage between the throwout lever and the double-blocking lever and tighten the clamping screw.

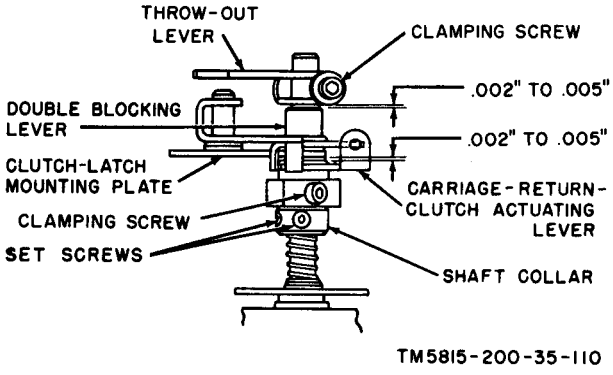


Figure 2-143. Carriage-return-clutch lever shaft clearance adjustment.

2-161. Carriage-Return-Clutch Actuating Lever Adjustment

(fig. 2-144)

a. Requirement. There should be some clearance, not to exceed .005 inch, between the carriage-return-clutch actuating lever and the carriage-return latch, when the carriage is two or more spaces out from the left-hand margin. and the carriage-return-clutch members are fully engaged.

b. Method of Checking. With the carriage two or more spaces out from the left-hand margin and the motor off, select carriage return. Release the transfer lever and turn the motor by hand until the carriage-return-clutch is fully engaged. Manually hold the carriage-return-clutch fully engaged. Manually hold the carriage-return-clutch latch counterclockwise. Check the clearance with a feeler gage.

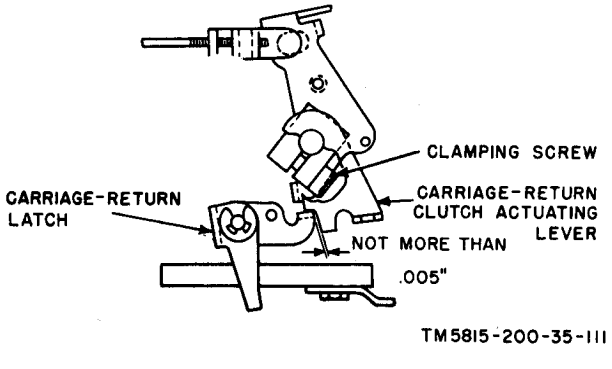


Figure 2-144. Carriage-return-clutch actuating lever adjustment.

c. Adjustment. Disconnect the carriage-feed-clutch lever spring and the horizontal carriage-return link. Manually hold the carriage-return-clutch members fully closed. Loosen the carriage-return-clutch actuating lever clamping screw and rotate the lever to meet the requirement. Hold the carriage-return-clutch activating lever down against the shaft collar and tighten the clamping screw. Reconnect the carriage-feed-clutch lever spring and make the adjustment described in paragraph 2-162. Check related adjustments (paras 2-172, 2-173, and 2-208).

2-162. Carriage-Return-Clutch Adjustment

(fig. 2-145)

a. Requirements. The carriage-return-clutch should be fully engaged before the carriage-return sensing lever strikes the lowest portion of the restoring cam, and the carriage-feed clutch should not bounce when characters other than carriage return are selected.

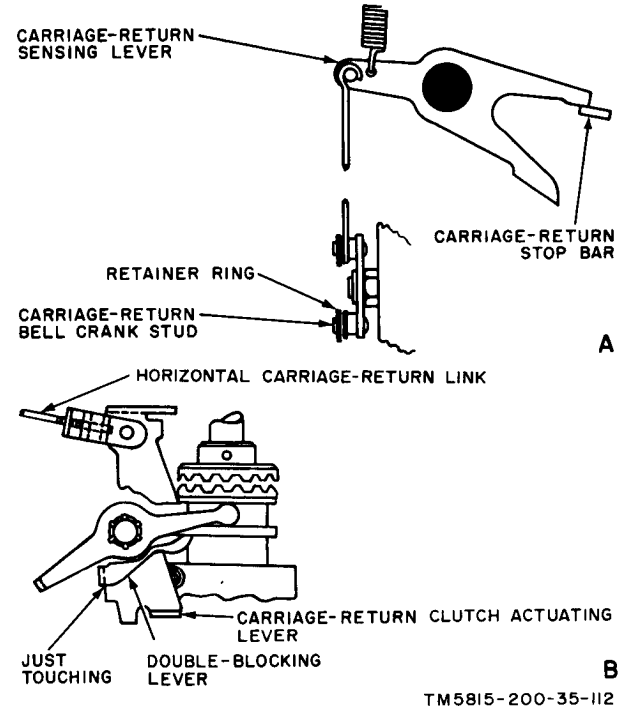


Figure 2-145. Carriage-return-clutch adjustment.

b. Method of Checking. Press the space bar and the repeat key. While the carriage is moving to the right, watch the carriage-feed clutch.

The clutch should remain fully closed while the carriage is moving. With the carriage at least one or more spaces from the left-hand margin, turn off the motor. Select any key, except carriage return, trip the transfer-lever latch, and turn the motor by hand until the carriage-return sensing lever contacts the carriage-return stop bar. Rotate the double-blocking lever to the point where it just touches the carriage-return actuating lever.

c. Adjustments. Select any character, except carriage return. Trip the transfer-lever latch and rotate the motor by hand until the carriage-return sensing lever contacts the carriage-return stop bar. Detach and adjust the horizontal carriage-return link so that when it is fitted over the stud on the carriage-return bellcrank, the double-blocking lever is just touching the carriage-return clutch actuating lever.

2-163. Carriage-Feed Clutch Drum Adjustment

(fig. 2-146)

a. Requirement. There should be a .035- to .045-inch clearance between the carriage-feed driving gear and the carriage-feed 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 off the motor. 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 gap between the carriage-feed clutch drum and the carriage-feed driving gear with a feeler gage.

c. Adjustment. Loosen the setscrew in the carriage-feed clutch lever pivot stud and turn the carriage-feed clutch lever pivot stud with a screwdriver until the requirement is met. Tighten the setscrew.

2-164. Decelerating Cam and Carriage-Feed Clutch Positioning Adjustment

(fig. 2-147)

a. Requirement. With the carriage at the left-hand margin, the top edge of the decelerating cam should be centered, $\pm\frac{1}{16}$-inch, with the adjacent

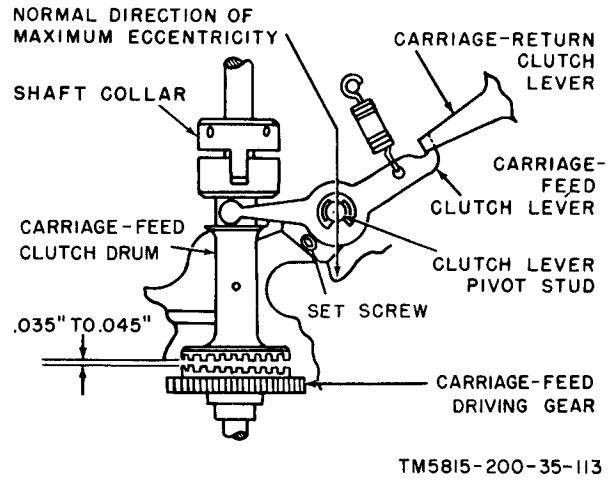


Figure 2-146. Carriage-feed clutch drum adjustment.

hole in the carriage-return driven gear (check visually).

b. Method of Checking. Turn on the motor. Return the carriage to the left-hand margin. Check the requirement visually, then turn off the motor.

c. Adjustment.

(1) Loosen the carriage-rack machine screw far enough to disengage the rack from the carriage-rack drive gear. Move the carriage to the right-hand margin.

(2) Loosen the machine screws that hold the carriage-return latch tripping arm and rotate the arm as far clockwise as possible (C, fig. 2-147).

(3) Loosen one of the two setscrews that holds the carriage-feed shaft collar to the carriage-feed shaft (fig. 2-146). Turn the shaft so that the other setscrew is straight up. Remove the double-blocking lever spring and manually disengage the carriage-feed clutch. Rotate the carriage-rack drive gear until the decelerating cam is positioned as close as possible to the requirement. Re-engage the carriage-feed clutch and replace the double-blocking lever spring. The mechanism is now positioned for easy adjustment.

(4) Loosen the other setscrew in the carriage-feed shaft collar. While holding the carriage-feed ratchet firmly against the carriage-feed pawl, rotate the collar until the decelerating cam is positioned to meet

the requirement. Tighten the setscrews and make the adjustments described in paragraphs 2-165, 2-166, and 2-167.

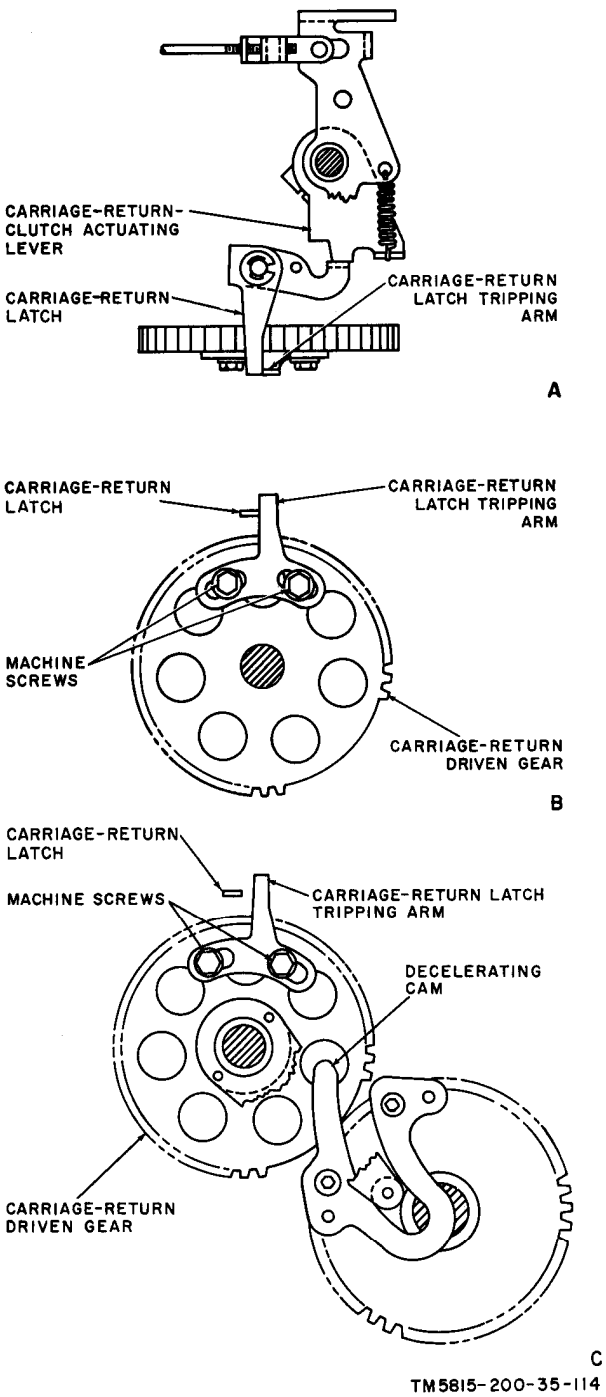


Figure 2-147. Decelerating cam and carriage- feed clutch positioning adjustment.

2-165. Carriage-Return Latch Tripping Arm Adjustment

(fig. 2-147)

a. Requirement. The carriage-return latch tripping arm should trip the carriage-return latch (A, fig. 2-147) just as the decelerating cam reaches the position shown in C, figure 2-147, and the carriage-feed clutch is alined to mesh properly.

b. Method of Checking. Space the carriage out 10 or more spaces and turn off the motor. Press the carriage-return key and turn the motor by hand until the carriage nears the left-hand margin. When the carriage-return latch tripping arm touches the carriage-return latch (B, fig. 2-147), turn the motor slowly. See that the carriage-feed clutch teeth mesh properly and the decelerating cam is positioned as shown in C, figure 2-147.

c. Adjustment. Loosen the clamping machine screw in the clutch throwout lever (fig. 2-143) before proceeding with this adjustment. With the carriage-feed clutch and the decelerating cam in the position shown in C, figure 2-147, loosen the two machine screws that hold the carriage-return latch tripping arm and position the latch tripping arm so that it is in contact with the carriage-return latch (A, fig. 2-147). Tighten the machine screws and recheck the adjustment. If the carriage-return latch is tripped too soon, position the carriage return latch tripping arm clockwise. If the carriage-return latch is tripped too late, position the carriage-return latch tripping arm counterclockwise. Check the related adjustment (para 2-173).

2-166. Carriage Positioning Adjustment

(fig. 2-148)

a. Requirement. There should be $2\frac{7}{16}$ inches ($\pm\ \frac{1}{16}$-inch) between the rear side of the code-bar cage plate and the centerline of the carriage when the carriage is at the left-hand margin. On weather symbol teletypewriters, the above dimension should be $2\frac{7}{32}$ inches ($\pm\frac{1}{16}$ inch).

b. Adjustment. Move the carriage to the left-hand margin. Loosen the locknut on the left margin stop screw and back the screw away from the carriage frame. Loosen the carriage-rack machine screws (fig. 2-149) far enough to disengage the

rack from the carriage-rack driving gear. Move the carriage rack so that the carriage is positioned to meet the requirement. Tighten the carriage-rack machine screws. Turn in the left margin stop screw until it touches the carriage frame. Tighten the locknut. Check related adjustments (paras 2-211 and 2-212).

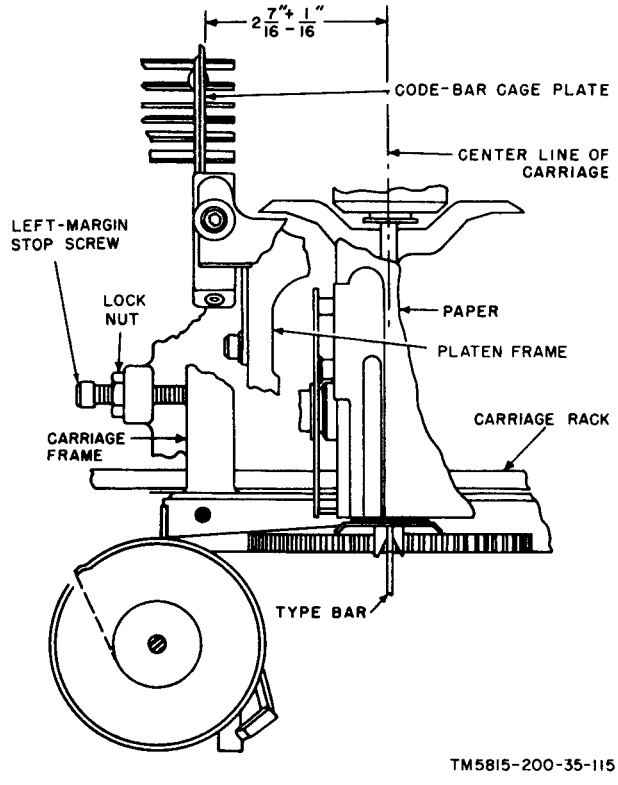


Figure 2-148. Carriage positioning adjustment.

2-167. Ball Bearing Adjustment

(fig. 2-149)

a. Requirement. The carriage should roll from one end of the guide rail to the other with no clearance bet ween 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 in the carriage frame. Turn the roller mounting stud until the requirement is met. Tighten the setscrew. Adjust the carriage rack (para 2-168).

2-168. Carriage-Rack Adjustment

(fig. 2-150)

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.

2-169. Carriage-Rack Drive Shaft Position Adjustment

(fig. 2-151)

a. Requirement. When the shoulder of the carriage-rack drive shaft lengthwise to deter-

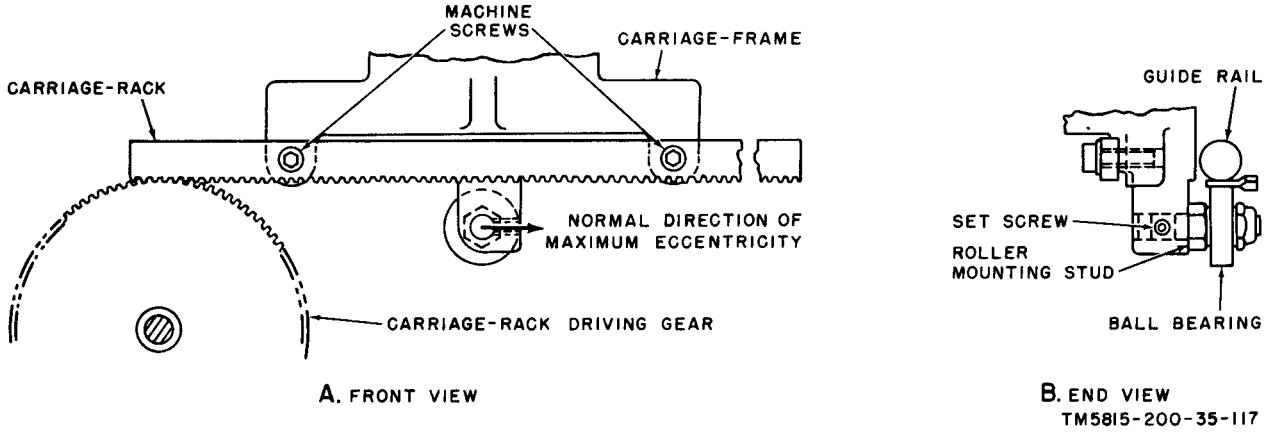


Figure 2-149. Ball bearing adjustment.

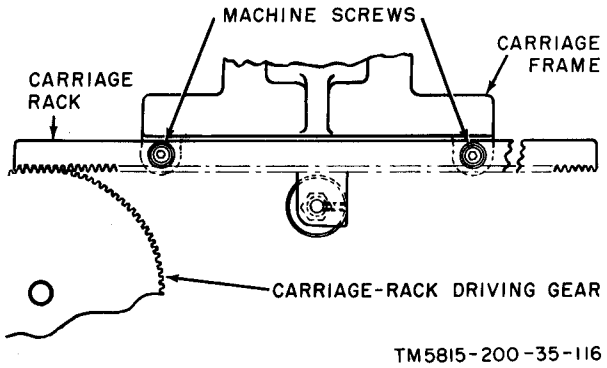


Figure 2-150. Carriage-rack adjustment.

bearing, there should be a 0.001- to 0.010-inch clearance between the collar and the opposite face of the ball bearing.

b. Method of Checking. Push and pull the carriage-rack drive shaft lengthwise to determine whether there is any play between the carriage-rack drive shaft and the ball bearing.

c. Adjustment. Loosen the setscrew in 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 in this position, insert a 0.005-inch feeler gage between the ball bearing and the collar, push the collar against the feeler gage, tighten the setscrew, and remove the gage.

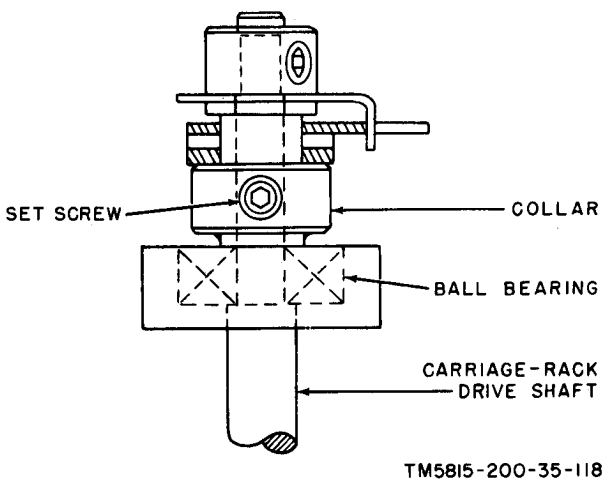


Figure 2-151. Carriage-rack drive shaft position adjustment.

2-170. Carriage-Return Blocking Lever Clearance Adjustment

(fig. 2-152)

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. Adjustment. Loosen the setscrews in the carriage-return blocking lever adjusting collar and remove the collar. Remove the carriage-return blocking lever and the laminated spacer. Peel laminations from, or add laminations to, the laminated spacer to meet the requirement. Replace the carriage-return blocking lever and the carriage-return blocking lever adjusting collar. Tighten the setscrews. Check the related adjustment (para 2-171).

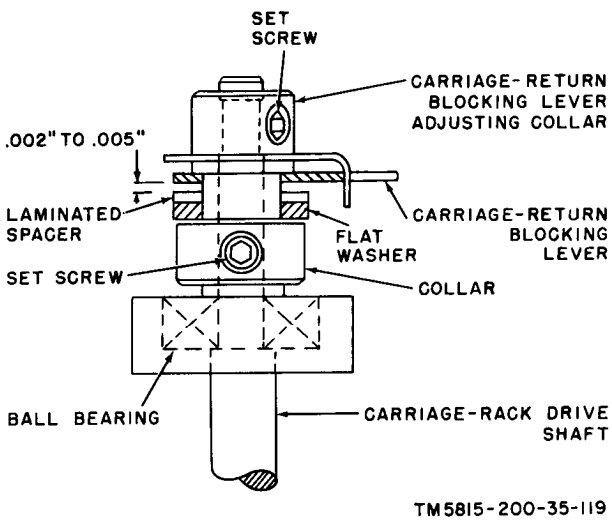


Figure 2–152. Carriage-return blocking lever clearance adjustment.

2-171. Carriage-Return Blocking Lever Adjustment

(fig. 2-153)

a. Requirement. There should be a .010- to .020-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 function. Turn the motor by hand until the carriage-return sensing lever drops to

the low part of the restoring cam. The double-blocking lever will position the adjusting plate over the carriage-return blocking lever. Measure the gap between the adjusting plate and the carriage-return blocking lever.

c. Adjustment. Loosen the two setscrews in the carriage-return blocking lever adjusting collar. Rotate the carriage-return blocking lever until the requirement is met. Tighten the two setscrews. Recheck the carriage-return blocking lever clearance adjustment (para 2-170).

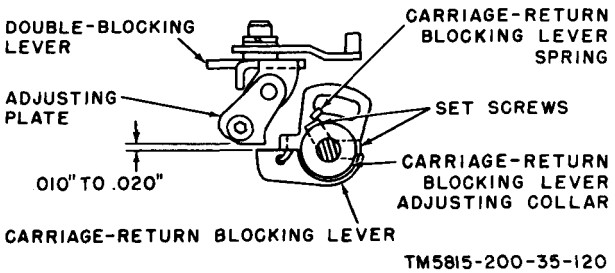


Figure 2-153. Carriage-return blocking lever adjustment.

2-172. Carriage-Return Adjusting Plate Adjustment

(fig. 2-154)

a. Requirement. There should be a .015- to .025-inch clearance between the carriage-return blocking lever and the adjusting plate when the carriage is at the left margin. The carriage-return clutch drum and the carriage-return clutch disk must not touch each other when carriage return is selected with the carriage against the left margin stop screw.

b. Adjustment. Loosen the adjusting screw. Move the adjusting plate to meet the requirement. Tighten the adjusting screw. Set up the carriage-return function and release the transfer lever. Turn the motor by hand; the carriage-return clutch should not engage.

2-173. Throwout Lever Adjustment

(fig. 2-155)

a. Requirement. There should be a .010- to .020-inch clearance between the throwout lever and the carriage-return latch tripping arm (A, fig. 2-155) when the carriage is at the left margin.

b. Method of Checking. Turn on the motor and select carriage return. Turn off the motor

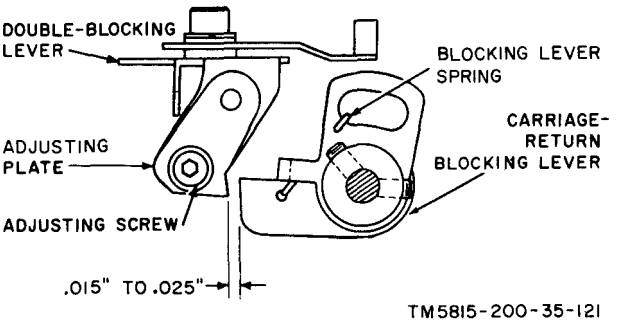


Figure 2-154. Carriage-return adjusting plate adjustment.

and trip the transfer lever latch. Pull the carriage-return blocking lever down and hold it there while turning the motor slowly by hand until the carriage-return clutch meets tooth-upon-tooth (B, fig. 2-155). If the carriage-return clutch teeth start to engage, hold the sliding member of the clutch out of engagement and continue turning the motor until the teeth are in line. Release the sliding clutch member. Check the clearance with a feeler gage.

c. Adjustment. Loosen the throwout lever clamping screw and position the throwout lever to meet the requirement. Check the requirement of paragraph 2-160 before tightening the clamping screw. Tighten the clamping screw and recheck the adjustment.

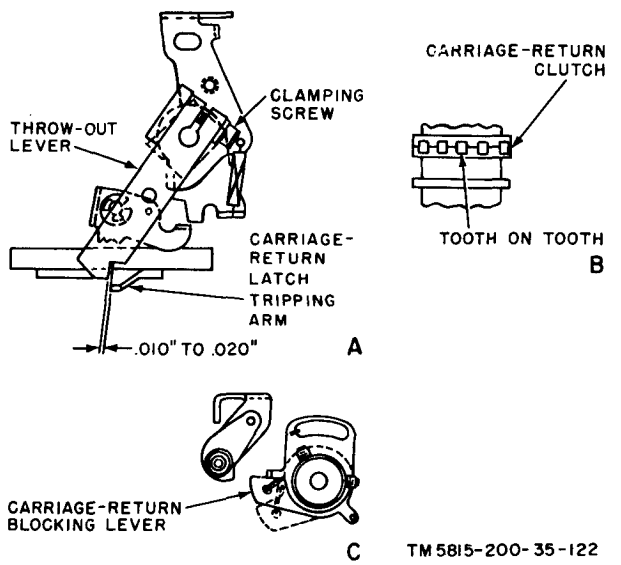


Figure 2-155. Throw out lever adjustment.

2-174. Carriage-Feed Friction Clutch Adjustment

(fig. 2-156)

a. Requirement. It should require 44 to 48 ounces of tension to prevent the carriage from moving when the carriage-feed mechanism operates.

b. Method of Checking. Turn the motor on, and move the carriage 10 spaces from the left-hand margin. Hook a spring scale on the left side of the carriage at the point shown in figure 2-156. Hold the spring scale firmly and press the manual space pushbutton. The carriage will move to the right until the pull of the spring scale stops it. Move the spring scale slowly to the right and read it when the carriage starts to move again. Continue reading the spring scale in this manner until the carriage reaches the right-hand margin. The lowest reading of the spring scale should meet the requirement.

c. Adjustment. With the motor off, loosen the clamping screw in the friction-adjusting collar. Turn the friction-adjusting collar to meet the requirement. Tighten the clamping screw. It maybe necessary to move the carriage to position the clamping screw for tightening. Recheck and readjust if necessary.

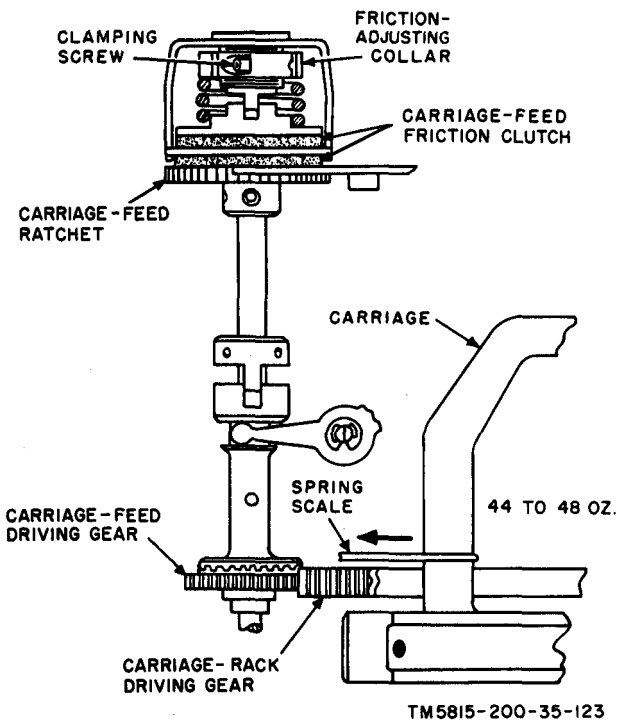


Figure 2-156. Carriage-feed friction clutch adjustment.

2-175. Carriage-Return Safety Clutch Adjustment

(fig. 2-157)

a. Requirement. It should require 48 to 56 ounces of tension 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 toward the left and read it when the carriage just starts to move again. This reading should equal the requirement.

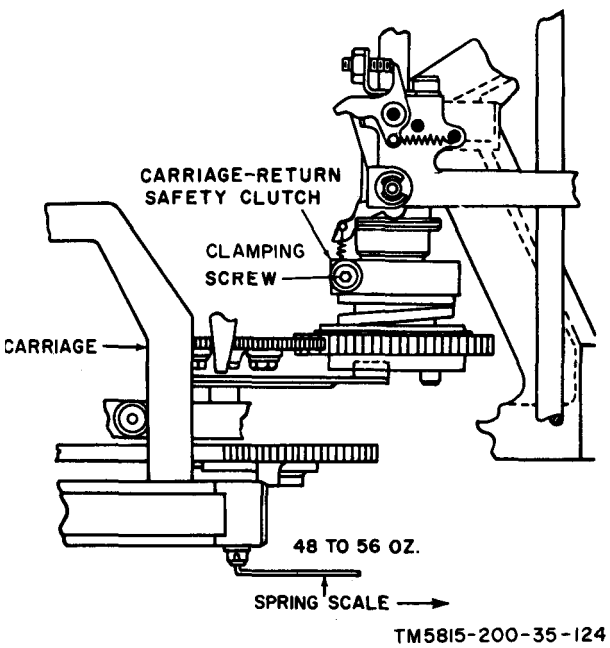


Figure 2-157. Carriage-return safety clutch adjustment.

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 clamping screw of the carriage-return safety clutch. Turn the motor off and insert the wrench into the clamping screw and loosen it. Turn the motor by hand until the carriage-return safety

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 clamping screw, remove the wrench, and recheck the adjustment.

2-176. Fulcrum Adjustment

(fig. 2-158)

a. Requirement. A .010 to .015 inch clearance is required between the selected function stop bar and its sensing lever when the lever has dropped and is level with the stop bar.

b. Adjustment. Select figures and then turn the motor by hand until the figure 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 screwdriver until the requirement is met. Hold the eccentric stud stationary and tighten the self-locking hexagonal nut. Tighten the machine screw. Recheck the clearance. Use the same procedure for the carriage return and the line feed adjustment. Check related adjustments (paras 2-106, 2-111, 2-113, and 2-118).

2-177. Stop Bar Bracket Adjustment

(fig. 2-159)

Note. This adjustment applies to all models except the TT-98/FG, TT-98A/FG, TT-99/FG, and TT-100/FG; before making this adjustment on weather symbol teletypewriters, perform the adjustment described in paragraph 2-229.

a. Requirements.

(1) When the motor is stopped, the T-stop bar is selected by the code rings, and the carriage is moved manually to the right-hand margin; removal of the carriage-return and line-feed stop bars from the code ring cage should not be possible when the following procedures are performed:

(a) Hold the outer (free) end of the line-feed stop bar (A, fig. 2-159) against the stop bar bracket, press the center of the stop bar toward the center of the code ring cage, and attempt to slide the stop bar out of the cage. The stop bar shift blade (B, fig. 2-159) should remain engaged in the slot in the inner end of the line-feed stop bar, preventing removal of the stop bar.

(b) Repeat the above procedure, using the carriage-return stop bar (A, fig. 2-159). The carriage-return stop bar also should be held captive by the stop bar shift blade.

(2) There should be no bind between the stop bar bracket and the carriage-return and line-feed stop bars when the motor is off and the T-stop bar is selected by the code rings.

b. Adjustment. Loosen the two mounting screws that hold the stop bar bracket to the code ring cage, position the bracket to meet the requirements, and tighten the screws. If the requirements cannot be met by adjustment of the bracket, re-

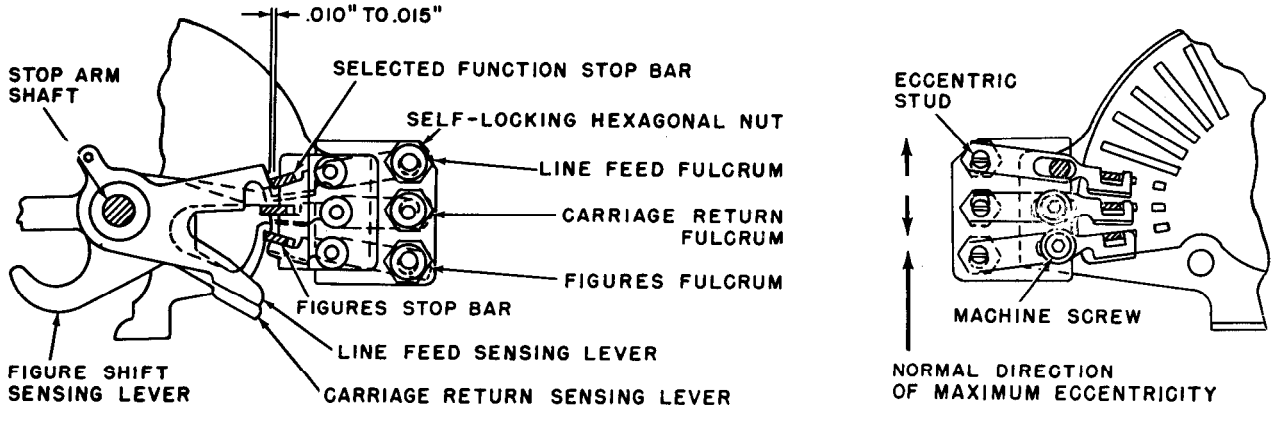


Figure 2-158. *Fulcrum adjustment.*

check the adjustment of the fulcrums (para 2-176) and the automatic carriage-return and line-feed adjustments (paras 2-170, 2-171, 2-172, 2-202, and 2-204).

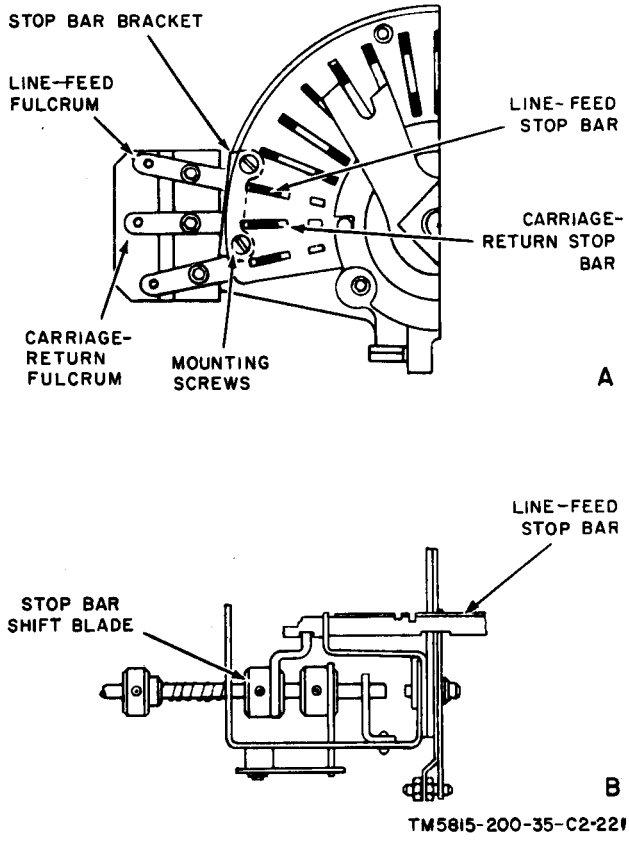


Figure 2-159. Stop bar bracket adjustment details.

2-178. Type Selecting Arm Claw Assembly End-Play Adjustment

(fig. 2-160)

Note. Perform this adjustment only when the type selecting arm claw assembly does not rotate freely or when replacing either the carriage frame, or the bearings of the type selecting arm claw assembly.

a. Requirement. When the gear is pressed toward the type selecting arm claw, there should be a 0.002- to 0.005-inch clearance between the carriage frame and the bearing that is mounted behind the type selecting arm claw. The type selecting arm claw assembly should rotate freely.

b. Adjustment. Disassemble the type selecting arm assembly (para 2-43), remove the laminated washer (fig. 2-160), and perform the appropriate steps below.

(1) If the clearance *(a* above) is below 0.002 inch, replace the laminated washer with a new washer, reassemble the assembly, recheck the clearance (should be above 0.005 inch), disassemble the assembly again, and perform (2) below.

(2) If the clearance was above 0.005 inch, peel as many of the 0.002-inch laminations from the laminated washer as necessary. File any burs from the edges of the peeled washer, reassemble the assembly, tighten the hexagonal nut securely, and recheck the clearance.

(3) Reassemble the type selecting arm assembly (para 2-43).

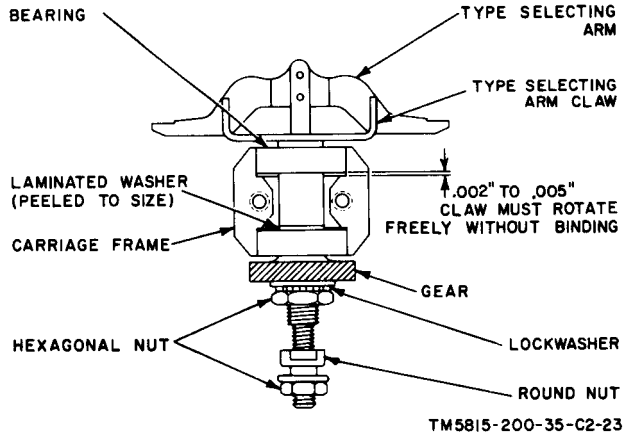


Figure 2-160. Type selecting arm claw assembly end-play requirements.

2-179. Carriage Rear Support Bracket Adjustment

(fig. 2-161)

a. Requirement. There should be as little backlash as possible between the type selecting arm drive gear and the sliding helical gear on the square shaft; however, both gears should rotate freely when the sliding helical gear is at any point on the square shaft.

b. Adjustment. Move the carriage to the left-hand margin. Loosen the mounting screws that fasten the rear of the carriage frame to the carriage rear support bracket. Move the rear of the carriage upward or downward to meet the requirement. Tighten the mounting screws and recheck the requirement. Check the related adjustment (para 2-181).

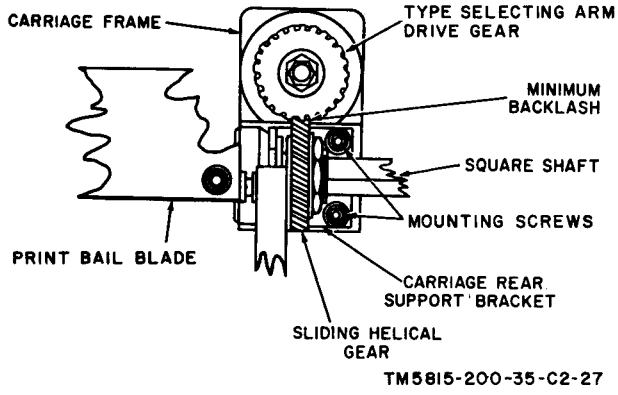


Figure 2-161. Carriage rear support bracket adjustment details.

2-180. Square Shaft Driven Gear Adjustment

(fig. 2-162)

a. Requirement. There should be .002- to .005-inch clearance between the square shaft driven gear and the flat washer.

b. Adjustment. Loosen the four setscrews in the square shaft driven gear. Loosen the function selecting arm claw clamping screw. Hold the stop arm shaft tight against the code ring cage and the square shaft toward the cage. Place a .020-inch flat feeler gage between the function selecting arm claw and the casting. Tighten the function selecting arm claw clamping screw. Replace the .020-inch flat feeler gage with a .030-inch gage. Hold the function selecting arm claw tightly against the feeler gage, and hold the stop arm shaft tightly against the code ring cage. Position the square shaft driven gear to obtain the requirement and tighten the four setscrews. Check the related adjustment (para 2-181).

2-181. Type-Selecting and Function-Selecting Arm Adjustment

(fig. 2-162)

a. Requirements.

(1) When the square-shaft stop arm is against a selected stop bar, the type-selecting arm should be alined with the connecting bar for the selected character.

(2) The function-selecting arm should be alined with the motor-stop punch bar when the square-shaft stop arm is against the H stop bar.

(3) There should be a .015- to .046-inch clearance between the hub position of the function-selecting arm claw and the teletypewriter casting.

Note. The precise dimension (within the above limitation) should be determined as follows: Legible copy should be printed, regardless of the teletypewriter operating speed; type faces (except for small punctuation marks) should not indent the paper.

b. Adjustments.

(1) Turn the motor on. Press the Q and Z keylevers alternately and check the alinement of the type-selecting arm with the Q and Z connecting bars. Loosen the stop-arm clamping screw, aline the type-selecting arm with the connecting bar for the selected character, move the square-shaft stop arm against the selected stop bar, and tighten the clamping screw, in the stop arm.

(2) Loosen the clamping screw in the function-selecting arm claw. Position the code rings for the H code group

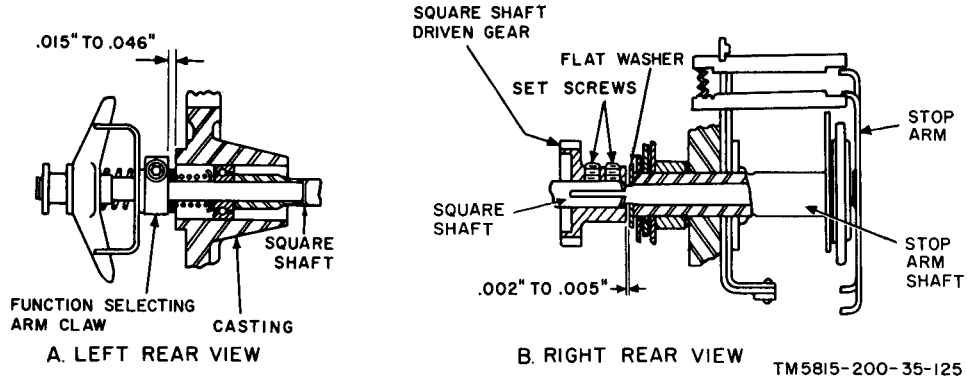


Figure 2-162. Square shaft driven gear adjustment.

(third and fifth code rings clockwise, others counterclockwise). Turn the square shaft until its stop arm is against the H stop bar. Turn the function-selecting arm until it is alined with the motor-stop punch bar. Push the stop arm end of the square shaft toward the code rings. Insert a .30-inch feeler gage between the function-selecting arm claw and the teletypewriter casting, press the claw toward the casting, and tighten the clamping screw in the claw.

2-182. Square-Shaft Stop Arm Torque Adjustment

(fig. 2-164)

a. Requirement. *When the motor is running* and the function shaft is turning, a force of 12 to 17 ounces, in the direction shown in B, figure 2-164 should be required to hold the square-shaft stop arm stationary.

b. Method of Checking. Engage the hook end of a spring scale with one end of the square-shaft stop arm and pull the scale until the tension is greater than 17 ounces. Press a keylever (other than the last keylever pressed). Slowly decrease the tension applied with the spring scale and note the tension when the stop arm starts to move.

c. Adjustment. Turn the motor off. Loosen the clamping screw of the friction adjusting collar. Turn the collar in the proper direction to increase or decrease the clutch spring pressure to meet the requirement. Tighten the clamping screw and recheck the requirement.

2-183. Print-Bail Shaft End-Play Adjustment

(fig. 2-163)

a. Requirement. There should be a 0.001- to 0.005-inch clearance between the print bail shaft and the bearing in the bearing cap when the print bail assembly is pressed toward the side casting.

b. Adjustment. Loosen the clamping screw in the print cam follower, position the follower on the shaft to meet the requirement, and tighten the clamping screw. Check the related adjustment (para 2-185).

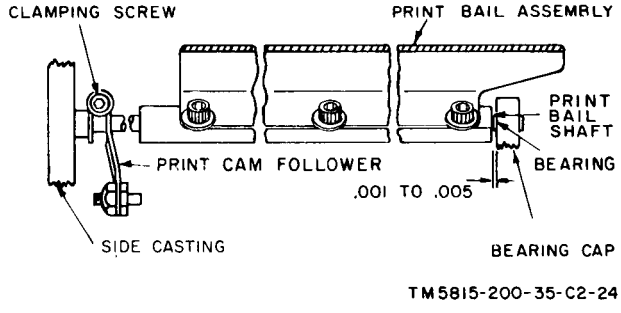


Figure 2-163. Print-bail shaft end-play requirement.

2-184. Print-Bail Blade Adjustment

(fig. 2-165)

Note. The print-bail travel requirement (para 2-*185a)* should be met before making the following adjustment.

a. Requirements. When the print-bail blade is midway between its extreme forward and

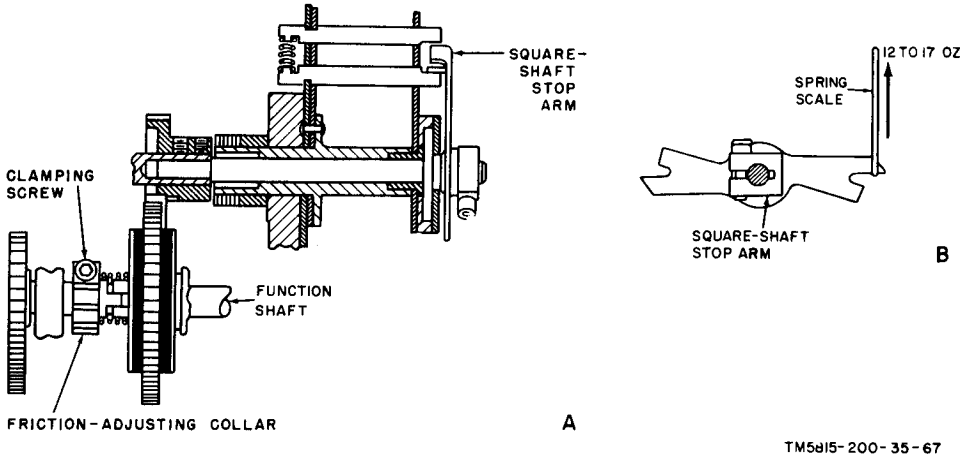


Figure 2-164. Square-shaft stop arm torque adjustment.

rearward positions, the blade should engage at least half the depth of the groove in the grooved nut (at all points along the upper edge of the blade). When the roller of the print-cam follower is at any point in the groove of the print cam, the print-bail blade should neither bind in the groove (when the grooved nut is pressed downward) nor come out of the groove (when the grooved nut is pushed upward).

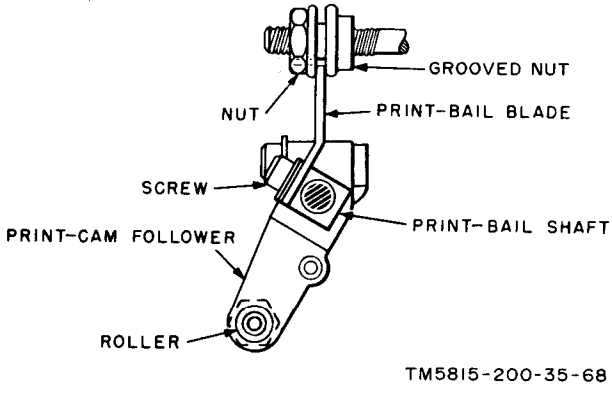


Figure 2-165. Print-bail blade adjustment

b. Adjustment. Loosen the screws that secure the print-bail blade to the print-bail shaft. Move the blade upward or downward to meet the requirement. Tighten the screws and recheck the requirement. Perform the related, adjustment (para 2-185).

2-185. Print-Bail and Ribbon Lifter Adjustments

(fig. 2-166)

a. Requirements.

(1) The travel of the print-bail blade should be equal in both directions from the vertical centerline of the print-bail shaft.

(2) Type bars should strike the platen with sufficient force to produce dark copy when a good ribbon is installed in the teletypewriter. There should be a minimum clearance of .008 inch between the type-selecting arm and the guide plate when the teletypewriter is in the stopped position.

(3) When the teletypewriter is in the stopped position, the top of the ribbon should be

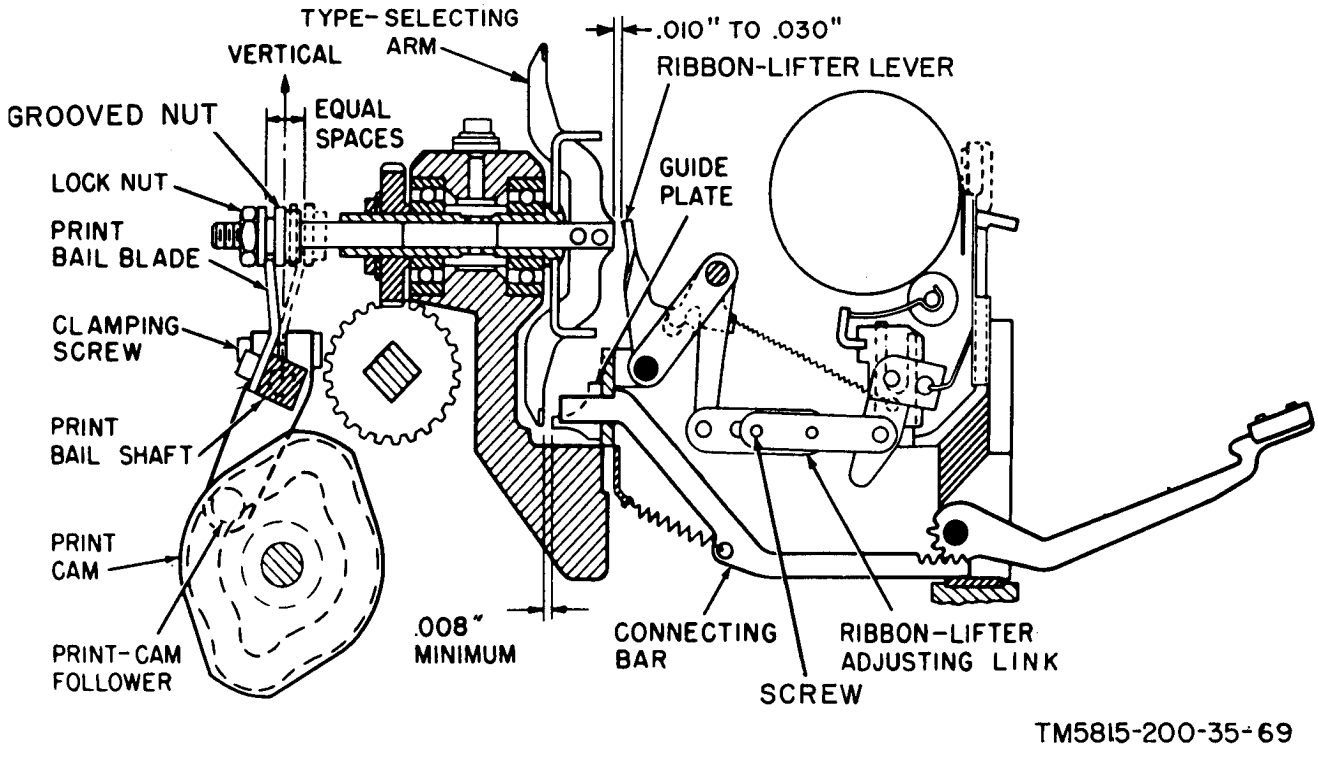


Figure 2-166. Print-bail and ribbon lifter adjustments.

either flush with the bottom edge of the printed character, or not more than 1/32 inch below the printed character.

b. Adjustments.

(1) Loosen the clamping screw on the print-cam follower and adjust the position of the follower on the print-bail shaft to meet the requirement *(a(1)* above).

(2) Loosen the locknut on the shaft of the type-selecting arm, and turn the grooved nut until dark copy is obtained. Check to be sure that the minimum clearance requirement is met.

(3) Loosen the two screws in the ribbon-lifter adjusting link; adjust the link to meet the requirement in *a(3)* above, and tighten the screws.

Note. When changing the operating speed of the teletypewriter, be sure to check requirement given in a (2) above. Failure to do so when changing to a higher operating speed may cause excessive wear to the platen and ribbon. Failure to do so when changing to a lower speed may result in the printing of characters that are too light for easy readability.

2-186. Platen-Trough Spring

(fig. 2-167)

a. Requirement. A pull of 3 to 6 ounces in the direction shown in B, figure 2-167 should be required to start the paper trough guide moving.

b. Adjustment. Withdraw the hinge pin slightly, wind or unwind the platen trough spring to meet the requirement, and restore the hinge pin to the fully inserted position.

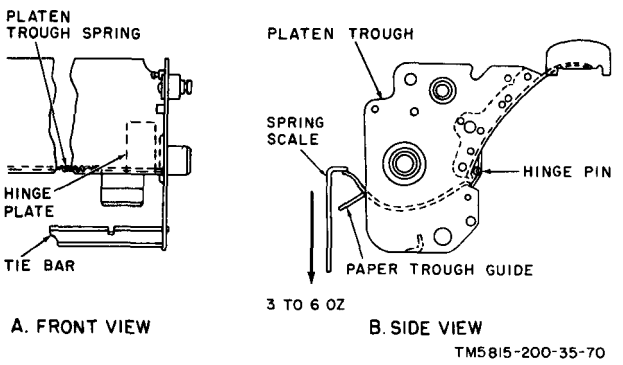


Figure 2-167. Platen-trough spring adjustment.

2-187. Platen Shaft End-Play Adjustment

(fig. 2-168)

a. Requirement. When the platen shaft end play is taken up to the left, there should be a 0.002- to 0.005-inch clearance between the shaft collar and the face of the adjacent bearing.

b. Adjustment. Loosen the setscrews in the shaft collar, position the collar to meet the requirement, tighten the setscrews, and recheck the end play.

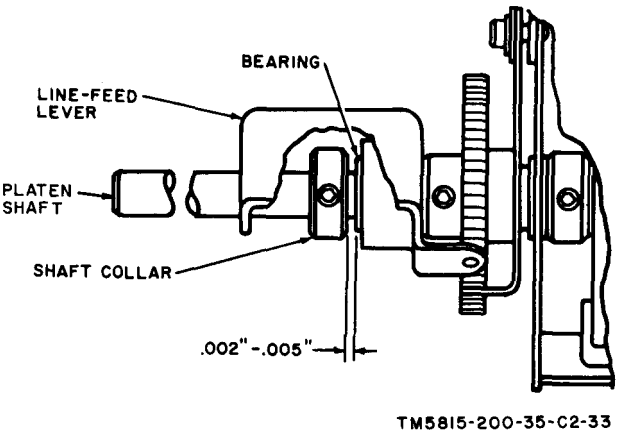


Figure 2-168. Platen shaft end-play requirement.

2-188. Platen Trough End-Play Adjustment

(fig. 2-169)

a. Requirement. When end play of the platen trough and the platen shaft is taken up to the left, there should be a 0.002.- to 0.005-inch clearance between the platen trough and the platen.

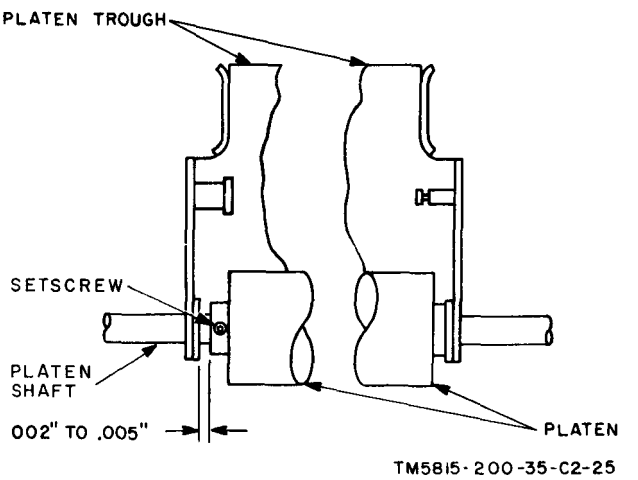


Figure 2-169. Platen trough end-play requirement.

b. Adjustment. Loosen the two setscrews that hold the platen to the shaft. Position the platen on the platen shaft to meet the requirement, tighten the set screws, and recheck the clearance.

2-189. Paper Guide Adjustment

(fig. 2-170)

a. Requirements. The sprocket-feed pins should be centered in the slots in the left and right paper guides. Both paper guides should be in firm contact with the platen roller.

b. Adjustment. Loosen the setscrews in both paper guides. Position the right paper guide on the paper guide shaft to center the pins in the slot. Tighten the setscrew in the right paper guide. Position the left paper guide to center the sprocket-feed pins in the slot, press the guide against the platen roll, and tighten the setscrew in the left paper guide.

2-190. Platen Sprocket Assembly Friction Adjustment

(fig. 2-170)

a. Requirement. A 30- to 60-ounce torque should be required to cause the sprocket feed pins to move inward or outward.

b. Method of Checking. Engage the hook end of a spring scale in one of the slots of the sprocket cam plate; turn the platen crank to move the sprocket feed pins inward and outward.

c. Adjustment. Remove the platen (para 2-*42a(1)-(4)).* Remove the retainer rings (5 and 13, fig. 2-31). Add or remove the shims (item 6 or 14) to meet the requirement. Reassemble the platen (para *2-42b)* and check the related adjustments.

2-191. Pressure-Roller Adjustment

(fig. 2-171)

a. Requirements.

(1) When the pressure-roller lever is in the friction-feed position, and the double line-feed operation occurs, the pressure exerted against the paper by the pressure roller should be sufficient to prevent any slippage between the paper and the platen roll.

(2) When the pressure-roller lever is in the sprocket-feed position, the pressure roller should not exert pressure against the platen roller.

b. Adjustment.

(1) Adjust the position of the pressure-roller lever to have the front edge of the lever tab aligned with the rear edge of the sprocket-feed notch in the platen lever latch. Loosen the setscrews in the collar of the pressure-roller lever. Use a 1/4-inch open end wrench (inserted from the rear of the teletypewriter) to turn the pressure roller operating shaft until the pressure roller touches the platen. Tighten the setscrews and perform procedure in (2) below.

(2) Move the pressure-roller lever to the sprocket-feed notch in the platen-lever

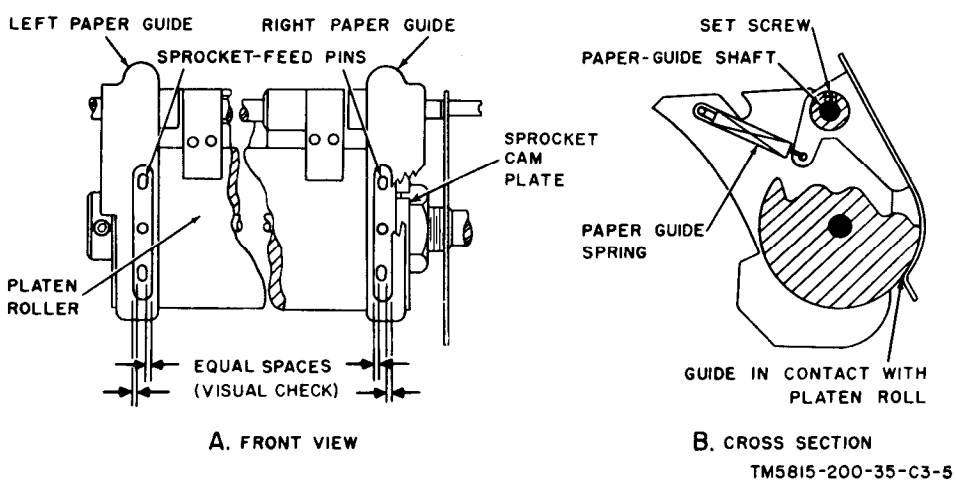


Figure 2-170. Paper guide and platen sprocket assembly friction adjustment requirements.

latch, and check for roller pressure against the platen. If roller pressure is present, readjust the position of the pressure-roller lever on the pressure-roller operating shaft *(a(2)* above).

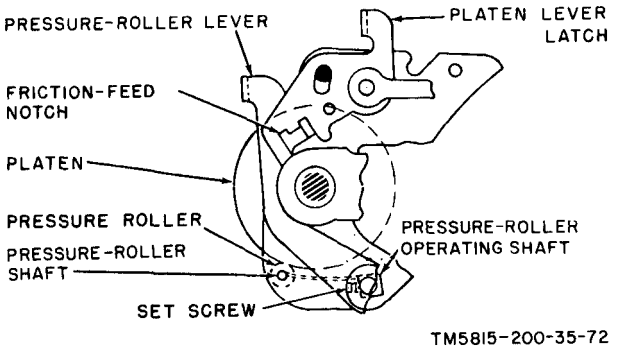


Figure 2-171. Pressure-roller adjustment.

2-192. Platen Assembly Position Adjustment

(fig. 2-172)

a. Requirements.

(1) The left hand edge of the first printed character should be $\frac{9}{16}$ inch ± $\frac{1}{16}$ ($\frac{11}{32}$ inch ± $\frac{1}{16}$ on weather symbol teletypewriters) from the left-hand edge of the paper.

(2) When the platen casting is pressed against one of the side frames, there should be a .002- to .005 -inch clearance between the opposite side frame and the platen casting.

b. Adjustments.

(1) Move the carriage to the left hand margin. Loosen the two hexagonal nuts on each of the two eccentric pivots. Loosen the setscrews that hold the eccentric pivots in place. Press the platen casting against the left-hand eccentric pivot. Position both the casting and pivot to meet the requirement in *a(1)* above. Tighten the setscrew to lock the eccentric pivot in place in the left-hand side frame.

(2) Insert a .003-inch feeler gage between the left-hand side of the platen casting and the eccentric pivot. Press the eccentric pivot in the right-hand side of the frame against the platen casting. Tighten the setscrew to lock the eccentric pivot in place in the right-hand side casting.

(3) Check related adjustments (paras 2-206 and 2-207).

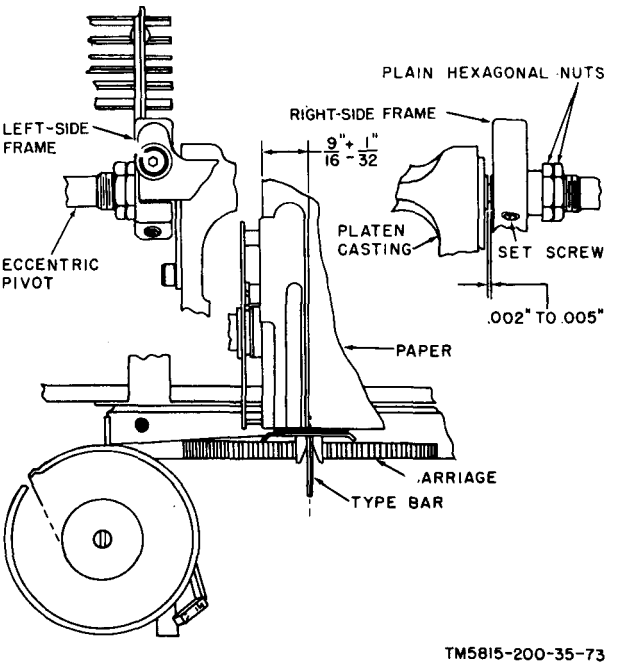


Figure 2-172. Platen assembly position adjustment.

2-193. Printed Character Alinement

(fig. 2-173)

a. Requirement. All characters should be printed equally dark across the full length of the line.

b. Adjustment.

(1) Loosen the setscrews that lock the eccentric pivots in place in the side frames. Turn each eccentric pivot to obtain maximum eccentricity as shown in B, figure 2-173. Press each eccentric pivot toward the center of the teletypewriter. Tighten the setscrews in each side frame, and recheck the requirement.

(2) If the characters on the right-hand side of the line are lighter than the characters on the left-hand side, loosen the setscrew that locks the eccentric pivot in the right-hand side frame; turn the eccentric pivot to move the platen assembly slightly forward, press the eccentric pivot toward the center of the teletypewriter, and tighten the setscrew. Recheck the requirement.

(3) If the characters on the left-hand side of the line are lighter than the characters

on the right-hand side, reverse the adjustment given in (2) above.

(4) Check related adjustments (paras 2-195, 2-196, 2-200, and 2-204).

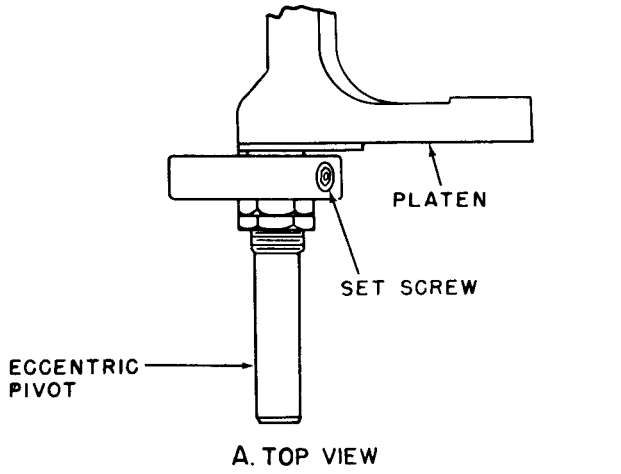


Figure 2-173. Printed character alinement.

2-194. Figures-Shift Preliminary Adjustment

(fig. 2-174)

a. Requirement. The platen latch should engage the lug on the aperture gate (fig. 2-177) when the platen is moved to the figures-shift position. The spring portion of the platen shift link (fig. 1-37) should not be stretched beyond its normal length at any time during the figures-shift operation.

b. Adjustment. Loosen the clamping screw to free the figures-shift arm, position the figures-shift arm to meet the requirement, and tighten the clamping screw.

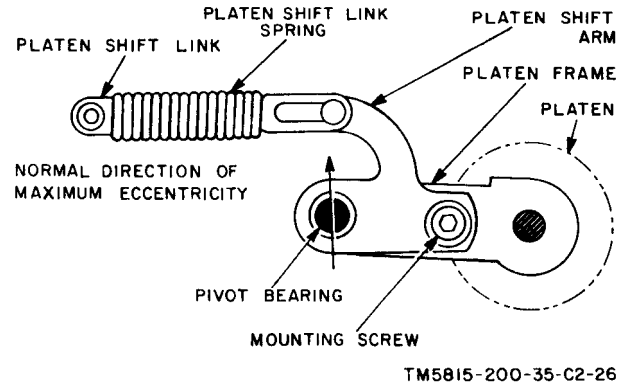


Figure 2-174. Figures-shaft preliminary adjustment.

2-195. Figures-Shift Position Adjustment

(fig. 2-175)

a. Requirement. The top and bottom of printed characters should be printed clearly when printing occurs while the platen is in the figures-shift position.

b. Method of Checking. Move the platen to the figures-shift position. Press the figure 7 and 2 key levers alternately until a line of these figures is printed. Check to be sure that the top of figure 7 and the bottom of figure 2 are equally dark.

c. Adjustment. Loosen the clamping screw to release the platen-latching arm, pivot the platen-latching arm in the proper direction to obtain the requirement, and tighten the clamping screw. Check related adjustments (paras 2-196 and 2-198).

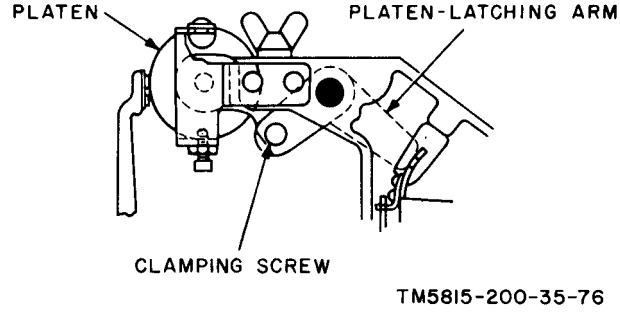


Figure 2-175. Figures-shift position adjustment.

2-196. Letters-Shift Position Adjustment

(fig. 2-176)

a. Requirement. Characters printed when the platen is in the letters-shift position should be alined with characters printed when the platen is in the figures-shift position.

b. Method of Checking. Turn on the motor and type the characters 5 and T alternately. Check for alinement of the printed characters.

c. Adjustment. Loosen the nut that locks the platen stop screw to the platen bracket. Turn the platen stop screw in the proper direction to raise or lower the printing of letters characters to meet the requirement and tighten the lock nut. Check the related adjustment (para 2-200).

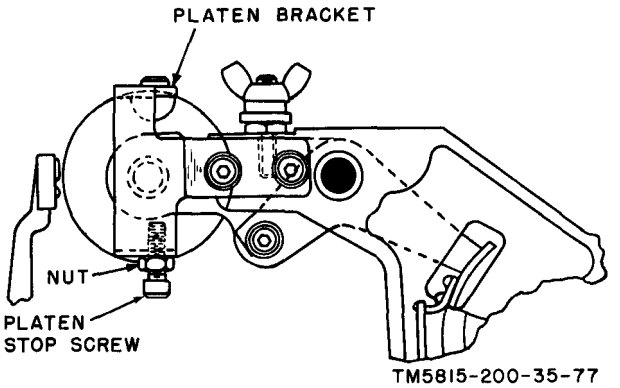


Figure 2-176. *Letters-shift position adjustment.*

2-197. Figures-Shift Final Adjustment (TT-98C/FG)

Note. This adjustment must be performed whenever the operating speed of the teletypewriter is changed.

a. Requirement.

(1) When the teletypewriter is run under power in the figures position, the platen latch should pass over the lug of the aperture gate.

(2) The clearance of the platen latch over the aperture gate should not cause misalignment of the first character printed after the platen shifts to the figures position.

b. Method of Checking. The function of the mechanism must be checked while the teletypewriter is run under power, because the throw of the mechanism depends on the speed of the teletypewriter.

c. Adjustment. Loosen the platen latching arm clamping screw (fig. 2-175), reposition the platen latching arm to meet the requirement, and tighten the screw. If necessary, revise the figures-shift position adjustment (para 2-195) to obtain the required clearance.

2-198. Figures-Shift Final Adjustment (not applicable to TT-98C/FG)

(fig. 2-177)

a. Requirement. For operation at speeds below 100 wpm, 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 high part of the figures-shift cam. For operation at 100 wpm, the clearance should be .001 to .005 inch.

b. Method of Checking. Position the code rings for the figures-shift operation (third impulse spacing, all others marking) and turn the motor manually until the roller of the figures shift-cam follower is against one of the two high parts of the figures-shift cam. Check the requirement with feeler gages. Recheck the requirement with the follower against the other high part of the cam.

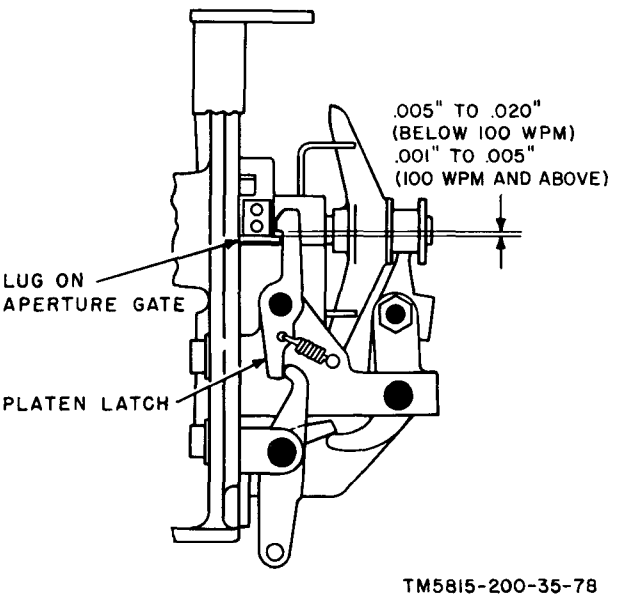


Figure 2-177. *Platen-shift final adjustment.*

c. Adjustment. Loosen the platen-latching arm clamping screw (fig. 2-175), reposition the platen-latching arm to meet the requirement, and tighten the mounting screw. If necessary, revise the figures-shift position adjustment (para 2-195) to get the required clearance.

2-199. Platen Blocking Arm Bracket Adjustment

(fig. 2-178)

a. Requirement. There should be a 0.005- to 0.020-inch clearance between the figures-shift sensing lever and the platen lower case latch when the figures-shift sensing lever drops off the high portion of its cam and is blocked by the figures-shift stop bar.

b. Method of Checking. Position the code rings for selection of any operation other than letters shift or figures shift. Trip the transfer' lever latch by hand. Rotate the motor until the figures-shift sensing lever drops off the high portion of its cam and is blocked by the figures-shift stop bar. Use feeler gages to measure the clearance between the figures-shift sensing lever and the platen lower case latch.

c. Adjustment. Loosen the mounting screws that hold the platen blocking arm bracket to the platen frame. Reposition the platen blocking arm bracket to meet the requirement, tighten the mounting screws, and recheck the clearance.

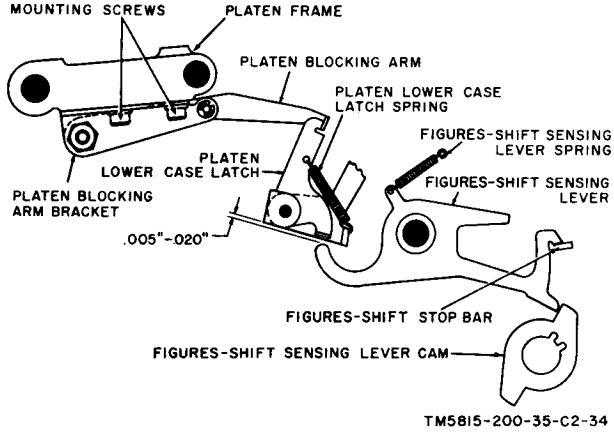


Figure 2-178. Platen blocking arm bracket adjustment requirement.

2-200. Platen-Blocking Arm Adjustment

(fig. 2-179)

a. Requirement. There should be a .010- to .020-inch clearance between the platen stop screw and the lower surface of the platen frame when the platen is moved to the letters-shift position and then pushed upward manually.

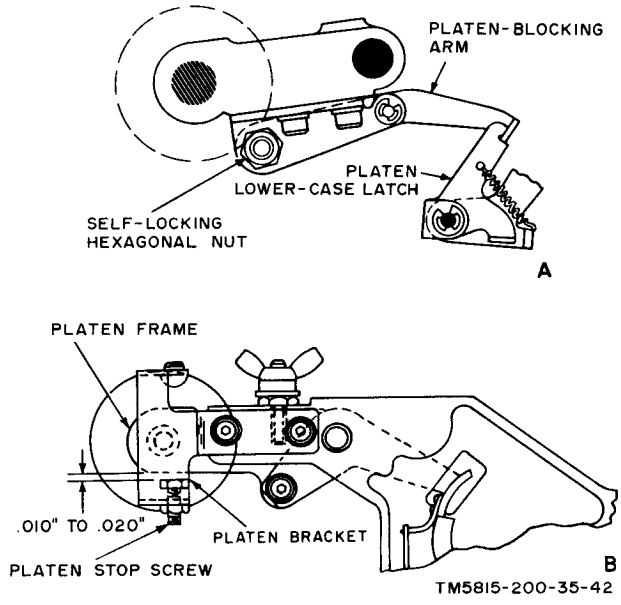


Figure 2-179. Platen-blocking arm adjustment.

b. Method of Checking. Move the platen to the letters-shift position. Check to be sure that the platen-blocking arm is latched by the platen lower-case latch. Push upward on the platen and insert a flat feeler gage "between the platen stop screw and the lower surface of the platen frame.

c. Adjustment. Loosen the clamping screw on the platen-blocking arm, position the platen-blocking arm to meet the requirement, tighten the clamping screw, and recheck the requirement.

2-201. Line-Feed Detent Adjustment

(fig. 2-180)

a. Requirement. The line-feed pawl should seat fully into one of the notches of the detent wheel when the single-double line-feed lever is in the double line-feed position, and the line-feed connecting link is moved slowly toward the rear of the teletypewriter.

b. Method *of Checking.* Move the line-feed connecting link manually toward the rear of the teletypewriter and check the requirement as the line-feed pawl moves into a notch in the detent wheel.

c. Adjustment. Loosen the nut that holds the detent eccentric stud to the platen trough. Turn the eccentric stud until the requirement is met. Tighten the nut and recheck the requirement. Check the related adjustment (para 2-204).

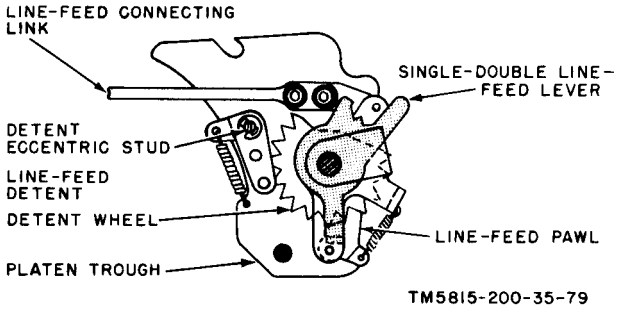


Figure 2-180. Line-feed detent adjustment.

2-202. Line-Feed Bellcrank Adjustment (not Applicable to TT-98C/FG)

(fig. 2-181)

a. Requirement. The line-feed cam follower should clear the line feed cam by a minimum of 0.010 inch when the line-feed sensing lever is pulled to the low part of its cam.

b. Method of Checking. Position the code rings for selection of the line-feed stop bar, trip the transfer lever latch manually, and turn the motor until the line-feed sensing lever is pulled to the low part of its cam. The roller on the line-feed cam follower should move under the line-feed cam. Use a feeler gage to check the clearance at *both* low points of the line-feed cam,

c. Adjustment. Loosen the screw and locknut on the line-feed bellcrank. Position the adjustable arm to meet the requirement, tighten the locknut, and recheck the clearance (check both low points of the line-feed cam). When the requirement is met, check the related adjustment (para 2-204).

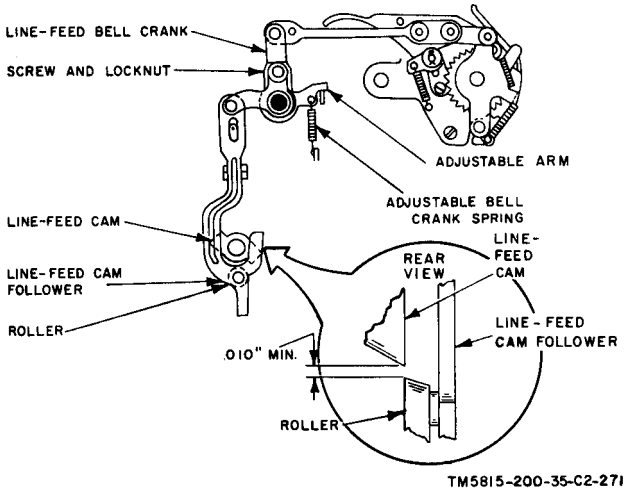


Figure 2-181. Line-feed bell adjustment requirements (not applicable to TT-98C/FG).

2-203. Adjustable Block and Pawl Adjustment (TT-98C/FG)

(figs. 1-36 and 2-182)

Note. When this adjustment is being checked or performed, the bellcrank assemblies should be against the stop.

a. Requirement.

(1) With the platen in the letters position, a 0.030- to 0.060-inch clearance should be between the bottom of the adjustable block and the latching surface of the figures-shift pawl (fig. 2-182) when the figures-shift sensing lever drops off the function roller.

(2) A 0.030- to 0.060-inch clearance should be between the bottom of the adjustable block and the latching surface of the line-feed bellcrank pawl when the line-feed sensing lever drops off the function roller.

(3) A 0.030- to 0.060-inch clearance should be between the bottom of the adjustable block and tile latching surface of the line-feed-on-carriage-return adjustable pawl when the line-feed-on-carriage-return sensing lever drops off the function roller.

(4) When any character, other than line-feed, carriage-return, or figures, is selected, and the function shaft is rotated until the sensing levers drop off the function roller, and the drawbar is pulled down until the adjustable blocks are near their respective pawls, a 0.015- to 0.025-inch clearance should be between the adjustable blocks and the line-feed-on-carriage return adjustable pawl and the figures-shift pawl.

b. Method of Checking.

(1) With the platen in the letters position, select the figures combination and rotate the function shaft manually until the figures-shift sensing lever drops off the function roller. Check the requirement *(a(1)* above) with feeler gages.

(2) Select the line feed combination and rotate the function shaft manually until the line-feed sensing lever drops off the function roller. Check the re-

quirement *(a(2)* above) with feeler gages.

(3) Select, the carriage return combination and rotate the function shaft manually until the line-feed-on-carriage-return sensing lever drops off the function roller. Check the requirement *(a(3)* above) with feeler gages.

(4) Select any character other than carriage-return, line-feed, or figures. Rotate the function shaft manually until all the sensing levers drop off the function rollers and the adjustable blocks are adjacent to their respective pawls. Check the requirement *(a(4)* above) with feeler gages.

c. Adjustment.

(1) Position the mechanism as described in *b(1)* above. Loosen the machine screw that clamps the platen-shift bellcrank assembly (fig. 1–36) and position the platen-shift bellcrank assembly to meet the requirement *(a* (1) above). Retighten the machine screw.

(2) Loosen the spring-holding screw in the line-feed bellcrank assembly (fig. 2-182). Position the mechanism as described in *b(2)* above. Position the line-feed bellcrank assembly to meet the requirement *(a* (2) above) and ret ighten the spring-holding screw.

(3) Position the "mechanism as described in *b(3)* above. Loosen the self-locking hexagonal nut that holds the line-feed bellcrank pawl. Position the line-feed bellcrank pawl to meet the requirement *(a* (3) above) and retighten the nut.

(4) Position the mechanism as described in *b(4)* above. Loosen the two machine screws that hold the adjustable blocks to tile draw-bar assembly. Position the adjustable blocks to meet the requirement *(a* (4) above) and retighten the machine screws.

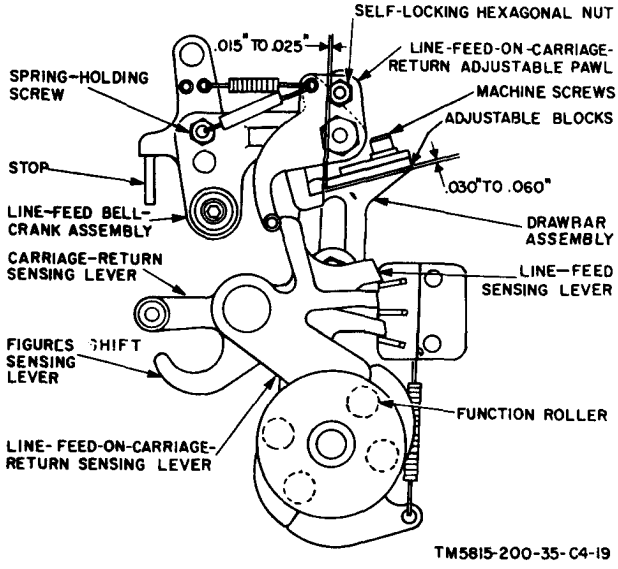


Figure *2-182. Adjustable block and* pawl *adjustment (TT-98C/FG).*

2-204. Line-Feed Connecting-Link Adjustment (not applicable to TT-98C/FG)

(fig. 2-181)

a. Requirements.

(1)- While the teletypewriter is receiving line-feed code groups, a forward pull of 40 ounces, applied to the upper arm of the line-feed lever, should not prevent the line-feed mechanism from turning the platen one line space when the single-double line-feed lever is in the single-line feed position, or two line spaces when the single-double line-feed lever is in the double line-feed position.

(2) When the line-feed operation is completed, the line-feed pawl should be clear of the detent wheel and the platen should be free to be rotated in either direction while the line-feed detent is held away from the detent wheel.

b. Adjustment. Loosen the machine screws that fasten tile connecting links together. Set the single-double line-feed lever to the double line-feed position. Position the Y-levers for the line-feed operation (second Y-lever counterclockwise; all others clockwise) and trip the transfer lever. Turn the motor by hand until the line-feed cam follower is against a high part of tile line-feed cam. Slowly move the top of the line-feed lever toward the line-feed bell-

crank. When the platen has advanced two line spaces, tighten the machine screws to clamp the connecting links together. Continue to turn the motor until the line-feed operation is completed. When the parts are restored to their normal position, check the requirement given in *a(2)* above.

2-205. Line-Feed Connecting Link Adjustment (TT-98C/FG)

(fig. 2-183)

Note. This adjustment should be checked when the teletypewriter operating speed is changed.

a. Requirement. With the single-double line-feed lever in the double line-feed position, tile detent wheel should turn two spaces, in the letters or figures mode of operation. When the teletypewriter is operating under power, overtravel of the detent wheel is permissible, if extra line-feed spacing does not occur.

b. Method of Checking. Move the single-double line-feed lever to the double line-feed position. With the teletypewriter operating under power, depress the LINE FEED key several times, in both letters and figures positions and visually check the requirement.

c. Adjustment. Loosen the machine screws that hold the line-feed connecting link and the line-feed adjusting link together. Increase or decrease the overall length of the connecting link and the adjusting link to meet the requirement, and retighten the machine screws.

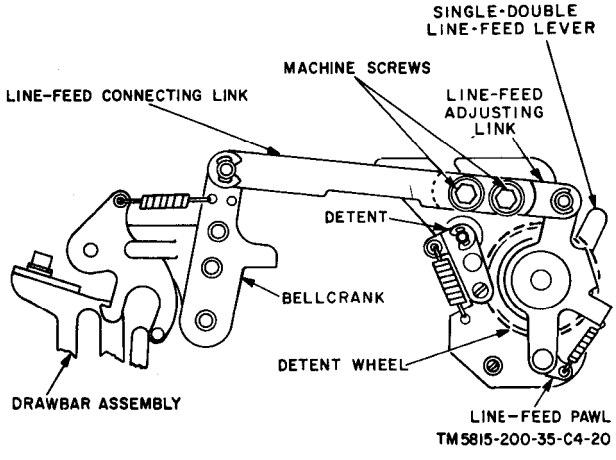


Figure 2-183. Line-feed connecting link adjustment (TT-98C/FG).

2-206. Margin-Bell and Margin-Bell Bracket Adjustment (not applicable to TT-259/FG)

(fig. 2-184)

a. Requirements.

(1) The margin-bell should ring when the carriage is 66 spaces (70 on weather symbol teletypewriters) from the left-hand margin.

(2) There should be a clearance of .020- to .025-inch between the margin-bell pawl and the pawl tripping arm when the carriage is 66 spaces (70 on weather symbol teletypewriters) from the left-hand margin.

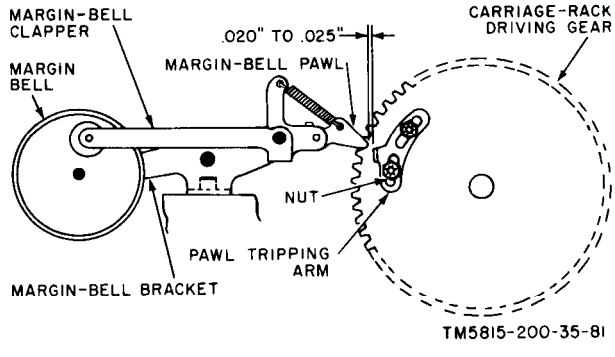
b. Method of Checking.

(1) Turn the motor on and space the carriage 65 spaces (69 on weather symbol teletypewriters) from the left-hand margin. Press any of the character keylevers once; the margin-bell should ring.

(2) With the carriage 66 spaces (70 on weather symbol teletypewriters) from the left-hand margin, move the margin-hell clapper up and down to determine the closest point between the margin-bell pawl and the pawl tripping arm. Check the clearance at the closest point.

c. Adjustment.

(1) Loosen the two nuts that hold the pawl tripping arm to the carriage-rack driving gear, position the arm to meet the requirement *(a(1)* above), and tighten the nuts.



Figures 2-184. Margin-bell and margin-bell bracket adjustment (not applicable to TT-259/FG).

(2) Loosen the machine screws that hold the margin-bell bracket to the page printer fame, Position the bracket to meet the requirements *(a* (2) above) and tighten the screws.

Caution: **Be sure that a clearance exists between the margin-bell pawl and the face of the carriage-rack driving gear.**

2-207. Manual. Carriage-Return Bracket Adjustment

(fig. 2-185)

a. Requirement. There should be a .005- to .015-inch clearance between the trip pawl and the double-blocking lever when the trip pawl and the double-blocking lever are in their unoperated positions.

b. Method of Checking. When the carriage is against its left hand stop and manual carriage-return mechanism is in the unoperated position, use a feeler gage to check the clearance between the trip pawl and the double-blocking lever.

c. *Adjustment.* Loosen the two machine screws on the manual carriage-return bracket and position the bracket to meet the requirement. Tighten the screws and recheck the clearance.

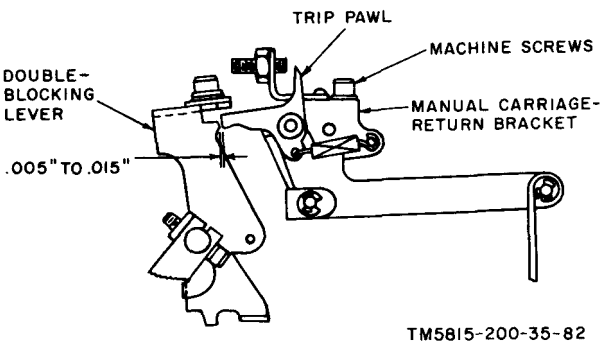


Figure 2-185. Manual carriage-return bracket adjustment.

2-208. Manual Carriage-Return Trip Pawl Adjustment

(fig. 2-186)

a. Requirement. The trip pawl should clear the double-blocking lever when the carriage-return clutch is engaged fully.

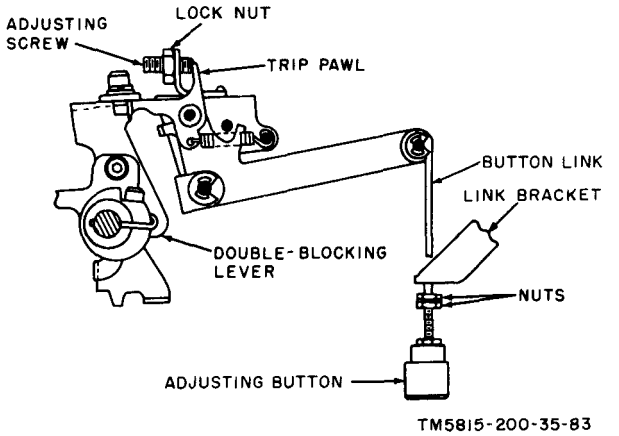


Figure 2-186. Manual carriage-return trip pawl adjustment.

b. Adjustment. Turn the nuts on the button link in a direction to cause them to move away from the link bracket. Loosen the locknut on the adjusting screw and push the adjusting 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 and tighten the locknut On the adjusting screw. Perform the related adjustment (para 2-209).

2-209. Manual Carriage-Return Lever Adjustment

(fig. 2-187)

a. Requirement. There should be a .002- to .025-inch clearance between the manual car-

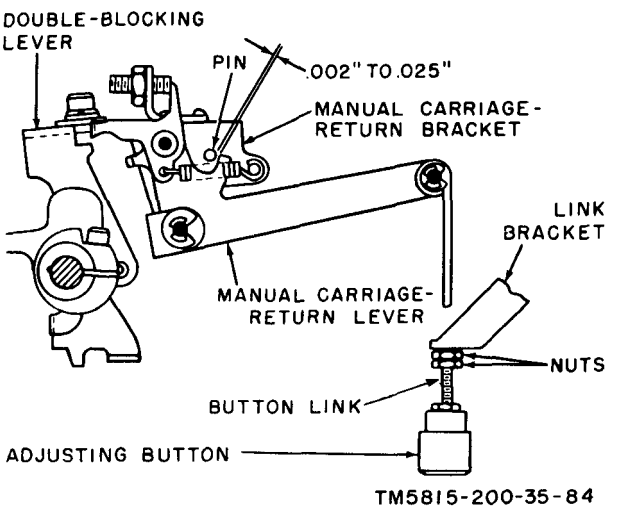


Figure 2-187. Manual carriage-return lever adqustment.

riage-return lever and the pin on the manual carriage-return bracket when the nearest nut on the button link is against the link bracket.

b. Adjustment. Loosen the two nuts on tile button link. Push the manual carriage-return button until the double-blocking lever is in the operatecd position for carriage return. Turn both nuts until one is against the link bracket. Tighten the nuts against each other and recheck the clearance.

2-210. Left-Margin Trip Plate Adjustment

(fig. 2-188)

a. Requirement. The clearance between the delaying latch and the stop bar shift stop should be equal to the clearance between the delaying latch and the latch stop when the carriage is against, the left margin stop screw.

b. Method of Checking. Turn on the motor and press the carriage-return keylever. When the carriage has returned to the left margin, check the clearances.

c. *Adjustment.* Loosen the trip-plate mounting screws, position the left margin trip plate to obtain the proper clearances, and tighten the mounting screws.

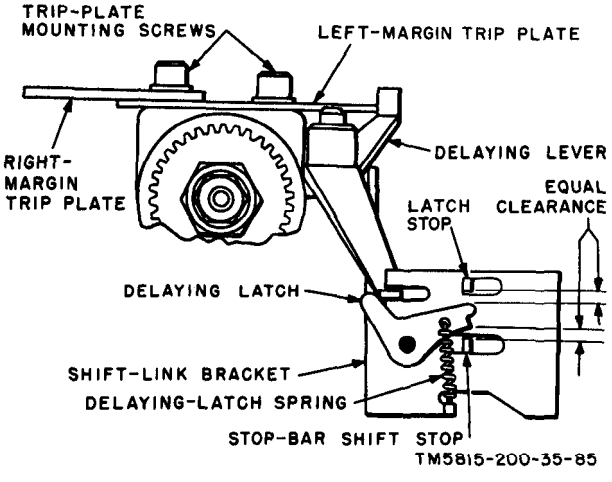


Figure 2–188. Left margin trip-plate adjustment.

2-211. Stop-Bar Shift Link Adjustment

(fig. 2-189)

a. Requirements.

(1) The end of the stop-bar shift link should be flush with the outer edge of the link support, and the stop-bar shift blade should be against the shift-link bracket when the teletypewriter is in the stopped position and the line-feed and carriage-return stop bars are held against their respective fulcrums.

(2) There should be approximately .030-inch (0.041 inch on weather symbol teletypewriters) clearance between the stop-bar shift lever and the shift-lever bracket when the stop-bar shift blade is held against the shift-link bracket.

b. Method of Checking.

(1) To check requirement in *a(1)* above, remove the retainer ring that holds the adjusting link to the stop-bar shift lever and disconnect the link from the lever. Hold the line-feed and carriage-return stop bars against their respective fulcrums and check the requirement. Reconnect the adjusting link.

(2) To check requirement in *a(2)* above, move the stop-bar shift link until the stop-bar shift blade is against the shift-link bracket and check the clearance.

c. Adjustments.

(1) Loosen the setscrew that holds the stop-bar shift blade to the stop-bar shift link. Remove the retainer ring that holds the adjusting link to the stop-bar shift lever, and disconnect the link from the lever. Hold the line-feed and carriage-return stop bars against their respective fulcrums and position the stop-bar shift link and stop-bar shift blade to meet the requirement *(a(1)* above). Tighten the setscrew and recheck the requirement.

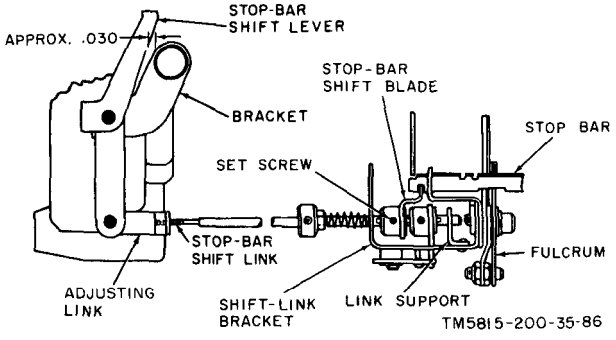


Figure 2-189. Stop-bar shift link adjustment.

(2) Hold the stop-bar shift blade against the shift-link bracket and turn the adjusting link to meet the requirement, *(a(2)* above). Reconnect the adjusting link to the stop-bar shift lever and secure it with the retainer ring.

2–212. Stop-Bar Shift Stop Adjustment

(fig. 2-190)

a. Requirements.

(1) When the carriage is 73 spaces (77 on weather symbol teletypewriters) from the left-hand margin, the carriage-return sensing lever should engage the carriage-return stop bar by one-half the thickness of the sensing lever.

(2) When the carriage is 73 spaces (77 on weather symbol teletypewriters) from the left-hand margin, the delaying latch should engage the stop-bar shift stop by one-half the thickness of the stop-bar shift stop.

b. Method of Checking. Turn on the motor, space the carriage 73 spaces (77 on weather symbol teletypewriters) from the left-hand margin, and check both requirements visually.

c. Adjustments.

(1) Space the carriage 73 spaces (77 on weather symbol teletypewriters) from the left-hand margin. Loosen the right margin trip-plate mounting screw and position the right margin trip plate to meet the requirement *(a(1)* above). Tighten the mounting screw and recheck the requirement.

(2) Space the carriage 73 spaces (77 on weather symbol teletypewriters) from the left-hand margin. Loosen the setscrew in the stop-bar shift stop and position the stop to meet the require-

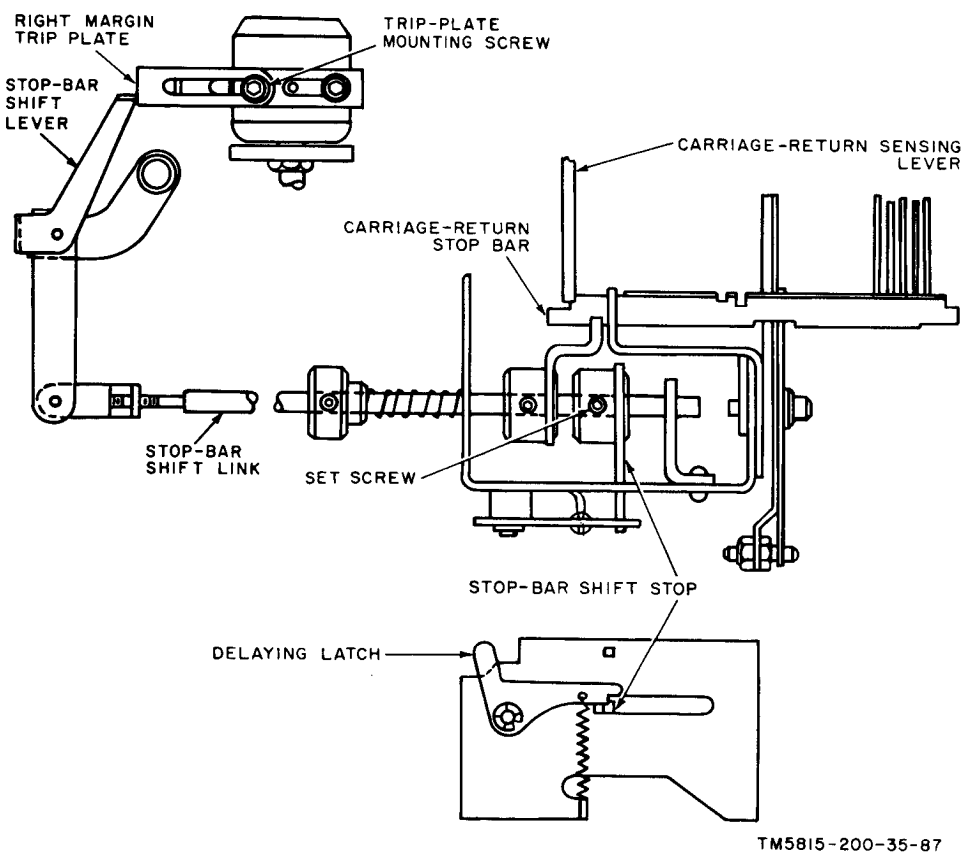


Figure 2–190. Stop-bar shift stop adjustment.

ment *(a(2)* above). Tighten the setscrew and recheck the requirement.

2-213. Stop-Bar Shift Blade Adjustment (fig. 2-191)

a. Requirement. There should be a .015- to .020-inch clearance between the line-feed sensing lever and the line-feed 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 stop-bar shift lever manually until the stop-bar shift stop is latched by the delaying latch (fig. 2–190). Check the clearance with a feeler gage.

c. *Adjustment.* Loosen the setscrew in the collar of the stop-bar shift blade, position the shift blade to meet the requirement, and tighten the setscrew.

d. Final Check. When the carriage is returned to the left margin, there should be a minimum of .005-inch clearance between the shift-lever bracket and the stop-bar shift lever (fig. 2-192). If the stop-bar shift lever touches the shift-lever bracket, disconnect the adjusting link from the stop-bar shift lever, turn the adjusting link to obtain the final check requirement, and reattach the adjusting link to the stop-bar shift link. Recheck the requirements of paragraph 2-212.

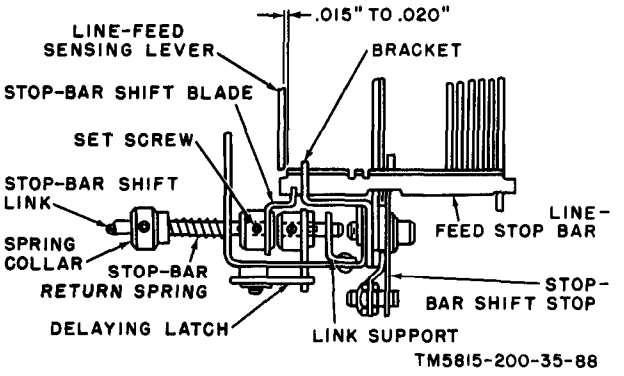


Figure 2-191. Stop-bar *shift blade adjustment.*

2-214. Stop-Bar Return Spring Adjustment (fig. 2-192)

a. Requirement. A force of 13 to 16 ounces in the direction indicated in figure 2-192 shou1d be required to start the stop-bar shift lever moving when the carriage is 73 spaces from the left-hand margin.

b. Adjustment. Loosen the setscrew in tile spring collar and move the collar along the stop-bar shift link to obtain the requirement. Tighten the setscrew and recheck the requirement.

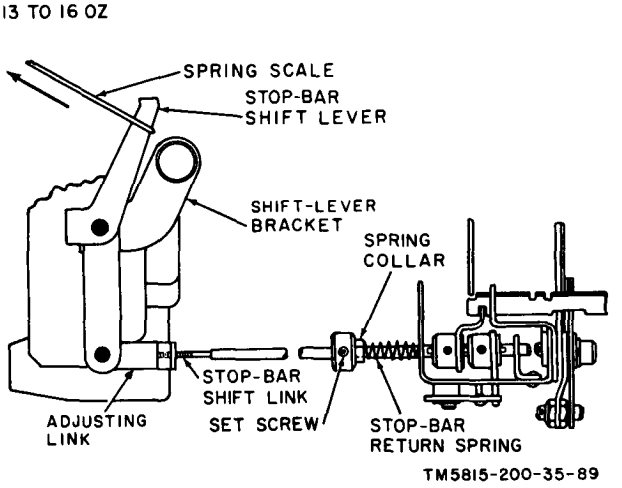


Figure 2-192. Stop-bar return spring *adjustment.*

2-215. Ribbon-Feed Mounting Bracket Adjustment (fig. 2-193)

Note. Make this adjustment only when replacing the ribbon-feed mechanism on the carriage.

a. Requirement. The ribbon spool drive shafts should be 5 inches apart, and should be parallel within 0.010 inch.

b. Adjustment. Loosen the six mounting screws (two on TT-300/FG) that hold the ribbon-feed mounting brackets to the carriage. Reposition the brackets to meet the requirement, tighten the mounting screws, and recheck the requirement. After the requirement is met, check the related adjustments (paras 2–216 and 2-217).

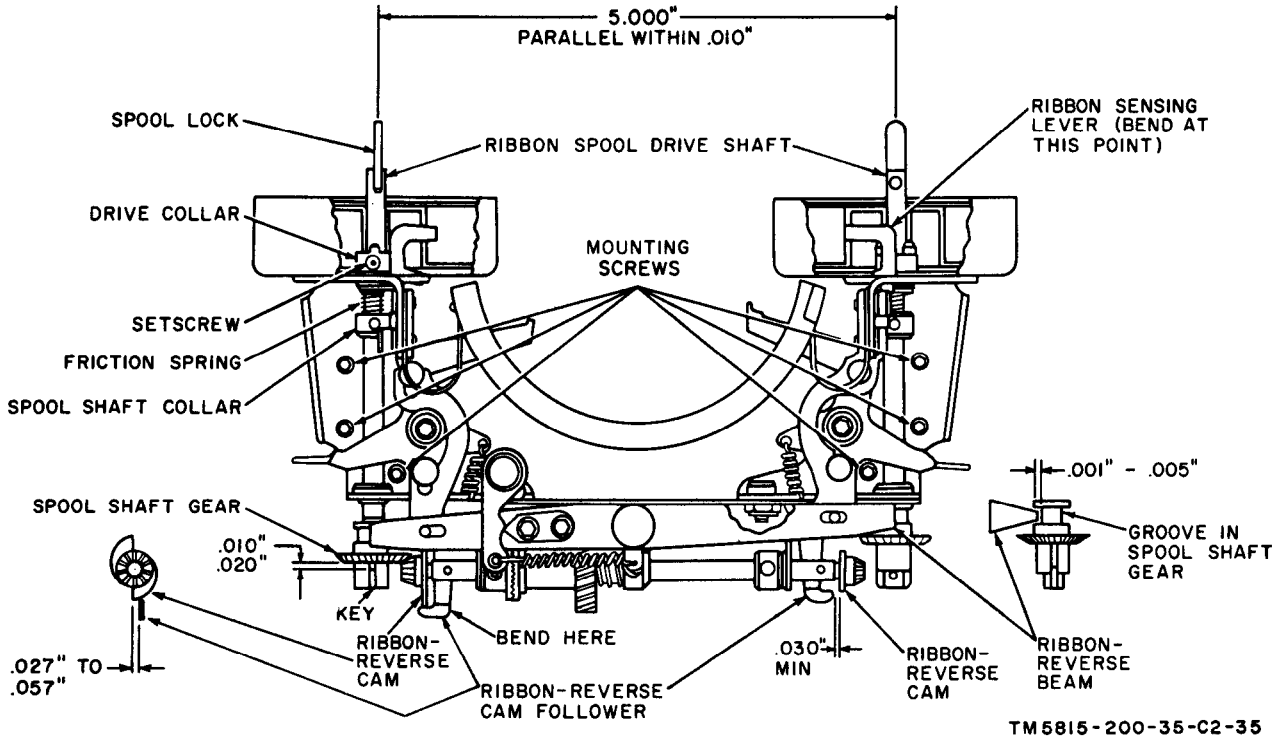


Figure 2-193. Ribbon-feed mechanism adjustment requirements.

2-216. Ribbon-Feed Shaft Adjustment

(fig. 2-194)

a. Requirement. There should be equal engagement of the bevel gear on each end of the ribbon-feed shaft and its associated bevel gear on the ribbon spool shaft.

b. Adjustment. Loosen the setscrew in the driven clutch member and in the right-hand collar. Position the shaft to meet the requirement and tighten the setscrew in the clutch member. Insert a .003 -inch feeler gage between the driven clutch member and the mounting bracket, press the ribbon-feed shaft to the left while pressing the right-hand collar to the right to compress the spring washer, and tighten the setscrew in the right-hand collar. Check related adjustments (paras 2-218 and 2-219).

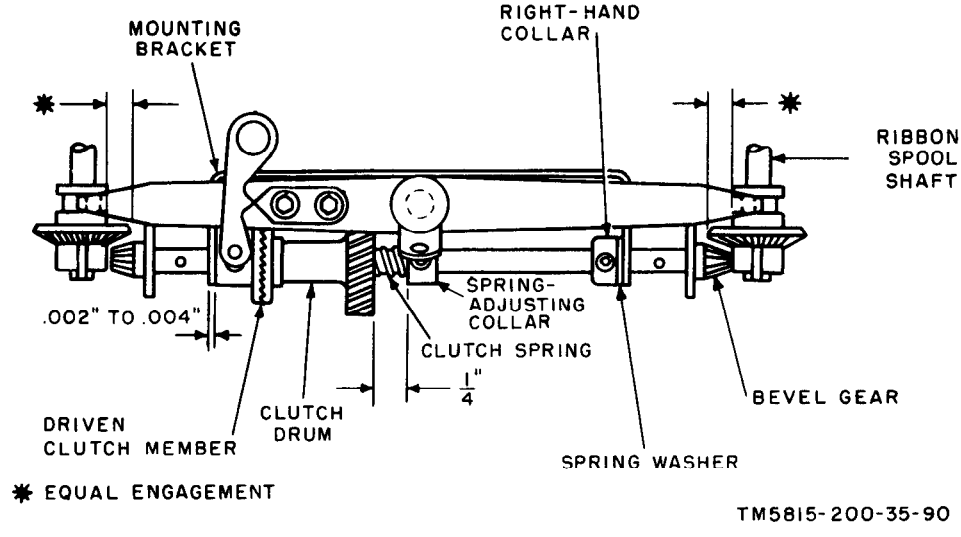


Figure 2-194. Ribbon-drive assembly adjustments.

2-217. Ribbon Spool Drive Collar Adjustments

(fig. 2-193)

a. Requirement. There should be a 0.010- to 0.020-inch clearance between the top of the key in each of the spool shafts and the top of the groove in the spool shaft gear when the spool shaft gear is engaged with its associated bevel gear on the ribbon-feed shaft.

b. Adjustment. Remove the ribbon spool and loosen the setscrews in the drive collar. Press the collar against the bottom of the spool cup and position the ribbon spool shaft to meet the requirement. Tighten the setscrews and recheck the clearance. Replace the ribbon spool and check the related adjustment (para 2-220)).

2-218. Ribbon-Reverse Detent Plate Adjustment

(fig. 2-195)

a. Requirement. The ribbon-reverse detent should engage the ribbon-reverse detent plate equally in the upper and lower positions of the ribbon-reverse beam.

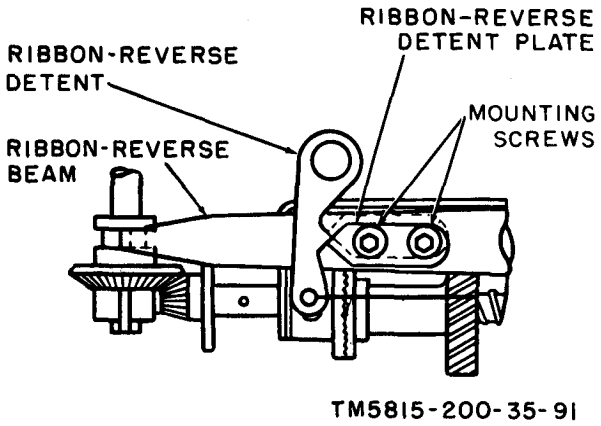


Figure 2-195. Ribbon-reverse detent plate adjustment.

b. Adjustment. Remove the detent spring. Loosen the two mounting screws that hold the detent plate to the beam, shift the position of the detent plate to meet the requirement, and tighten the mounting screws. Recheck both positions of the beam for equal detent engagement.

2-219. Ribbon-Feed Clutch Spring Adjustment

(fig. 2-194)

a. Requirement. Tile driven member of the ribbon-feed clutch should remain stationary on the ribbon-feed shaft, during the carriage-return operation.

b. Adjustment. When the teeth of the ribbon-feed clutch are engaged, loosen the setscrew in the spring-adjusting collar, position tile collar approximately ¼ inch from the adjacent clutch drum, tighten the setscrew, and recheck the equipment. If the clutch teeth do not slip during the carriage-return operation, increase the distance between the collar and the clutch drum until the requirement is met.

2-220. Ribbon Spool Friction Adjustment

(fig. 2-193)

a. Requirement. When a ribbon spool drive shaft is in the upper position, and its spool lock is in the locking (horizontal) position, a 1- to 2-ounce force, applied at right angles to the end of the spool lock, should be required to start the ribbon spool drive shaft turning.

b. Adjustment. Loosen the setscrews in the spool shaft collar and reposition the collar upward or downward to meet the requirement. Tighten the setscrews and recheck the requirement. Check both ribbon spool drive shafts for this requirement.

2-221. Ribbon Sensing Lever Adjustment

(fig. 2-193)

a. Requirement. There should be a 0.030-inch minimum clearance between the tip of each ribbon-reverse cam follower and the side of its associated ribbon reverse cam when the ribbon sensing lever is held in its innermost position by the ribbon on the ribbon spool.

b. Adjustment. Bend the top of the ribbon sensing lever at the point shown in figure 2-193 to meet the requirement. Check both ribbon sensing lever for this requirement.

2-222. Ribbon-Reverse Cam Follower Adjustment

(fig. 2-193)

a. Requirement. When a lobe of a ribbon-reverse cam on the ribbon-feed shaft pushes its asso-

ciated follower downward only enough to cause the tip of the detent plate to move just past the tip of the detent, the distance between the outer sur face of the cam follower and the step in the cam should be 0.027 to 0.057 inch.

b. Method *of Checking. Remove* the ribbon spools. Move the type-bar carriage until one of the ribbon-reverse cam followers is positioned as described in *a* above, and check the requirement. Check the opposite cam follower in the same manner.

c. Adjustment. Bend the ribbon-reverse cam follower to meet the requirement. When the requirements are met, replace the ribbon spools.

2-223. Ribbon-Reverse Beam Adjustment

(fig. 2-193)

a. Requirement. There should be a 0.001- to 0.005-inch clearance between each end of the ribbon-reverse beam and the bottom of the groove in its associated spool shaft gear.

b. Adjustment. Bend the end of the ribbon-reverse beam to meet the requirement.

2-224. Signal-Bell Bracket Adjustment

(fig. 2-196)

a. Requirement. The motor-stop actuating lever and the signal-bell clapper should move freely when their associated punch bars are pushed inward in their slots in the punch-bar guide block.

b. Method of Checking. Raise the platen to the figures-shift position. Push each punch bar to check for any tightness or binding.

c. Adjustment. Loosen the two bracket mount ing screws, position the signal-bell bracket to meet the requirement. amd tighten the screws and recheck the requirement. If the levers are deformed and it is not possible to remove the binding by adjustment, remove the deformed lever and bend it as required to remove the bind.

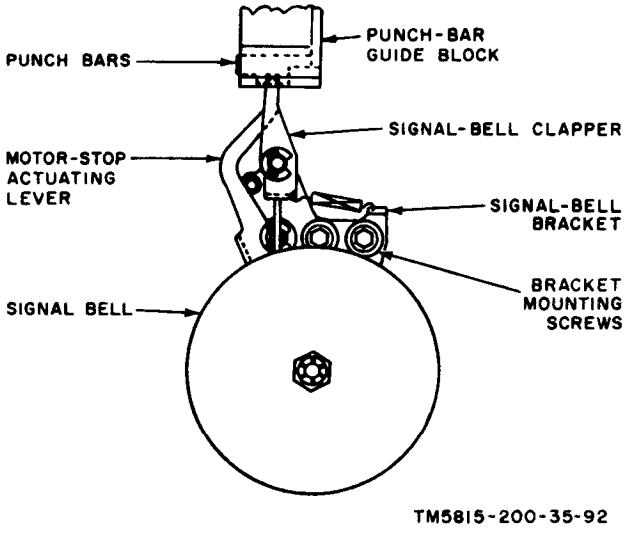


Figure 2-196. Signal-bell bracket adjustment.

2-225. Signal-Bell Clapper Preliminary Adjustment

(fig. 2-197)

Note. Perform the signal-bell bracket adjustment (para 2–224) before performing this adjustment.

a. Requirements.

(1) The clapper stop should be in the position shown in figure 2-197.

(2) When tile teletypewriter is in tile stopped condition, there should he some clearance (not more than 0.050 inch) between the signal-bell clapper and the clapper stop.

b. Method of Checking. Remove the upper locknut and the signal bell and check the requirements. If the requirements are met, perform the signal-bell final adjustment (para 2-226).

c. Adjustment.

(1) Remove the upper locknut and the signal bell. Loosen the lower locknut and posi-

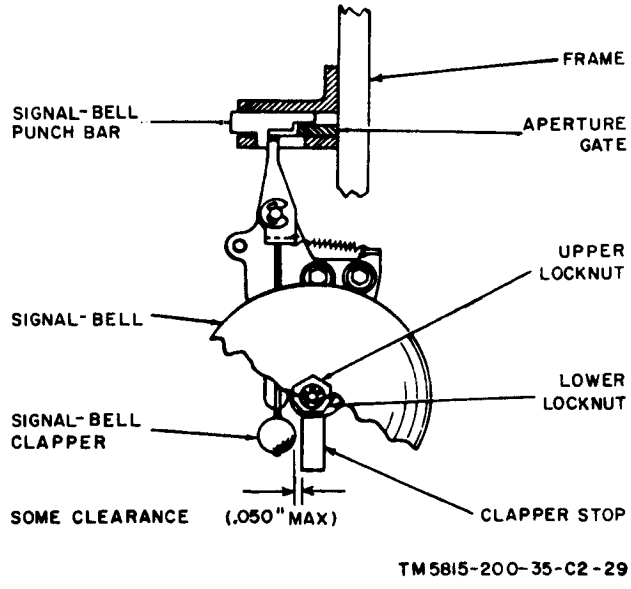


Figure 2-197. Signal-bell clapper preliminary adjustment.

tion the clapper stop to meet requirement in *a(1)* above. Tighten the lower locknut, recheck the requirement, and perform (2) below.

(2) Bend the signal-bell clapper to meet requirement in *a* (2) above and perform the signal-bell final adjustment (para 2-226).

2-226. Signal-Bell Final Adjustment

(fig. 2-198)

a. Requirements.

(1) The signal-bell should not ring when the letter S is printed by the teletypewriter.

(2) The signal-bell should ring loudly when the teletypewriter is in the figures shift position and the S code group is received.

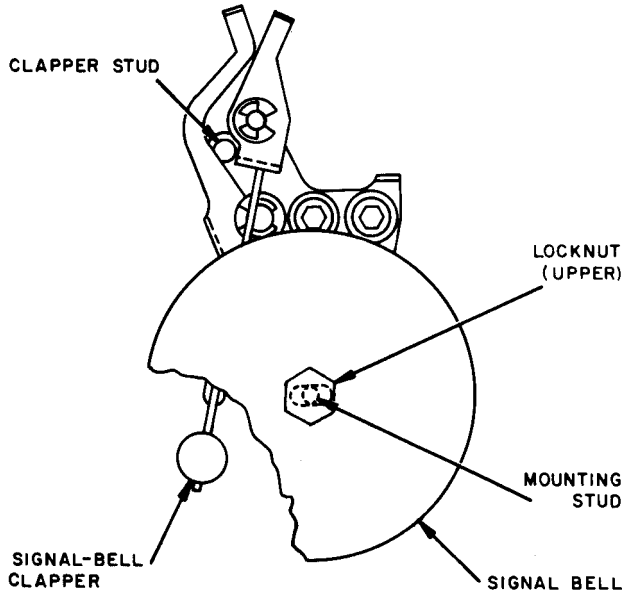


Figure 2-198. Signal-bell adjustment.

b. Adjustment. Loosen the upper locknut on the mounting stud. Position the signal bell to center the mounting stud in the elongated hole. Tighten the upper locknut and check the requirements. If the requirements are not met, reposition the signal bell in any direction as necessary. If requirement in *a(1)* above cannot be met by repositioning the signal bell, decrease the clearance between the signal-bell clapper and the clapper stop (para 2-225).

2-227. Motor Stop Switch Assembly Adjustment (Not Applicable to AN/FGC-159 and AN/FGC-160)

(fig. 2-199)

NOTE

This adjustment does not apply to teletypewriters which are adjusted to make the motor-stop function inoperative (para 2-228).

a. Requirement. There should be a .002- to 010-inch clearance between the motor-stop actuating lever and the damper leaf spring when the platen is in the letters-shift position and movement of the motor-stop actuating lever is taken up in the direction of the damper leaf spring.

b. Adjustment. Place the platen in the letters-shift position. Loosen the bracket mounting screws, position the switch bracket to obtain the required clearance, and tighten the screws. Recheck the requirement.

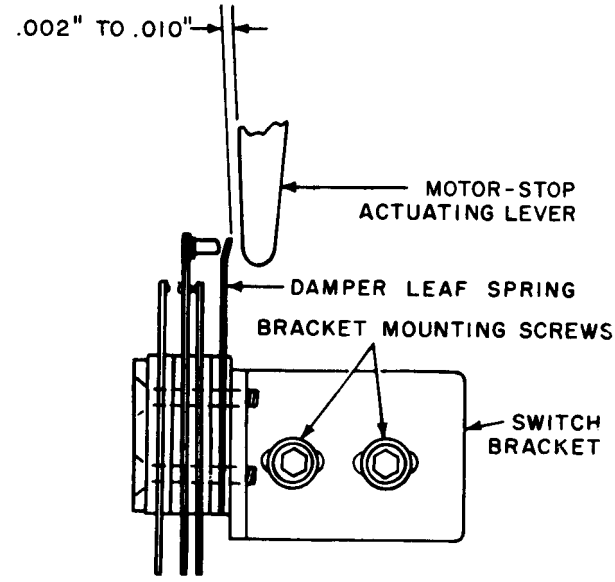


Figure 2-199. Motor-stop switch assembly adjustment

2-228. Motor Stop Disabling Procedure (Not Applicable to AN/FGC-159 and AN/FGC-160)

(fig. 2-199)

NOTE

This adjustment should be performed only when it is desired to make the motor-stop function inoperative.

a. Requirement. The motor should continue operating when an H code group is received

while the teletypewriter is in the figures-shift position.

b. Procedure. Loosen the two bracket mounting screws and position the switch for maximum clearance between the damper leaf spring and the motor stop actuating lever. Tighten the mounting screws.

2-229. Blank Contact Adjustment (Weather Symbol Teletypewriters Only)

(fig. 2-200)

a. Requirements.

(1) When any code group (except blank) is received, there should be a .006- to .015-inch gap between the blank contacts.

(2) When the blank code group is received, the blank contacts should close, and it should take 20 to 30 grams pressure to just open the contacts.

b. Adjustment.

(1) Position the code rings for any code group (except blank) and form the upper contact spring to obtain a .006- to .015-inch clearance.

(2) Position the code rings for the blank code group and form the lower contact spring to obtain the requirement. Recheck the requirement of *a(1)* above.

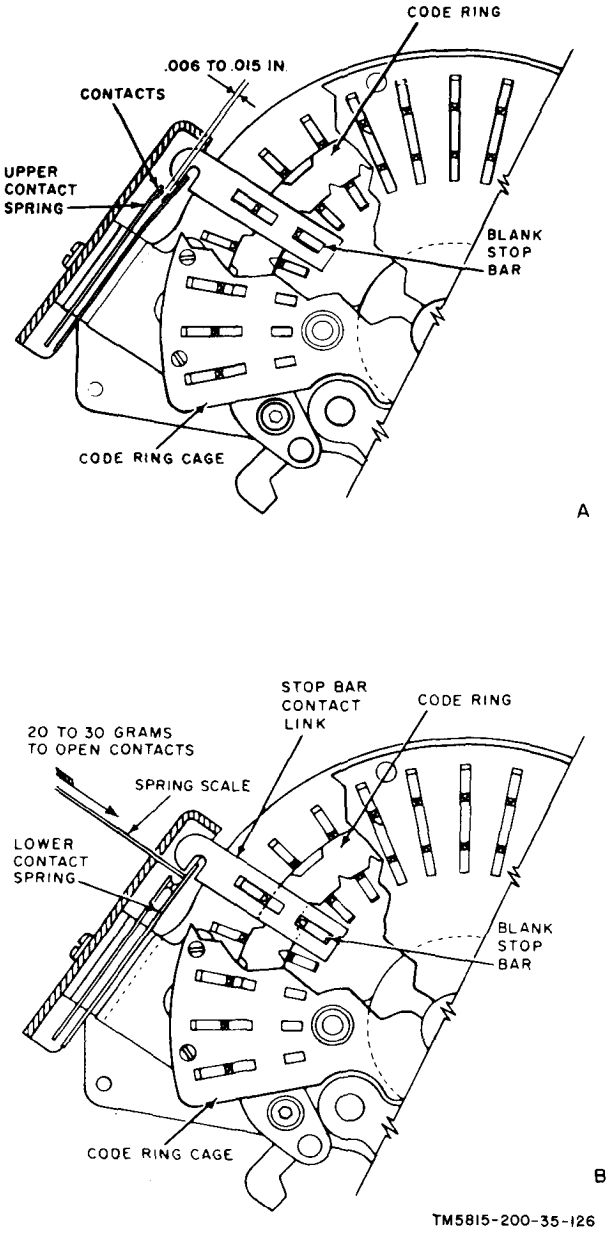


Figure 2-200. Blank contact adjustment (weather symbol teletypewriters only.

2-230. Function Shaft Pulsing Cam and Contact Adjustment (Weather Symbol Teletypewriters Only)

(fig. 2-201)

Note. Make the adjustment listed in paragraph 2-227.

a. Requirement.

(1) The motor stop contacts should make before the function shaft pulser contacts break.

(2) There should be .010- to .015 -inch clearance between the pulser contacts when the pulsing cam follower is on the low part of the pulsing cam.

b. Method of Checking. With the machine operating, shift the platen to the figures position. Depress the BLANK and the H keys, in that order. The motor should stop. Any other combination of key depressions should not stop the motor. Shift the platen to the letters position and select the BLANK–H combination. The motor should not stop.

c. Ajustments.

(1) With the machine in the stop position, loosen the setscrews that hold the pulsing cam. Position the pulsing cam so that the pulsing cam follower is on the high portion of the pulsing cam and centered on the surface of the cam.

(2) Release the transfer latch and turn the motor by hand until the pulsing cam follower is on the low part of the cam. Form the upper contact spring to meet the requirement.

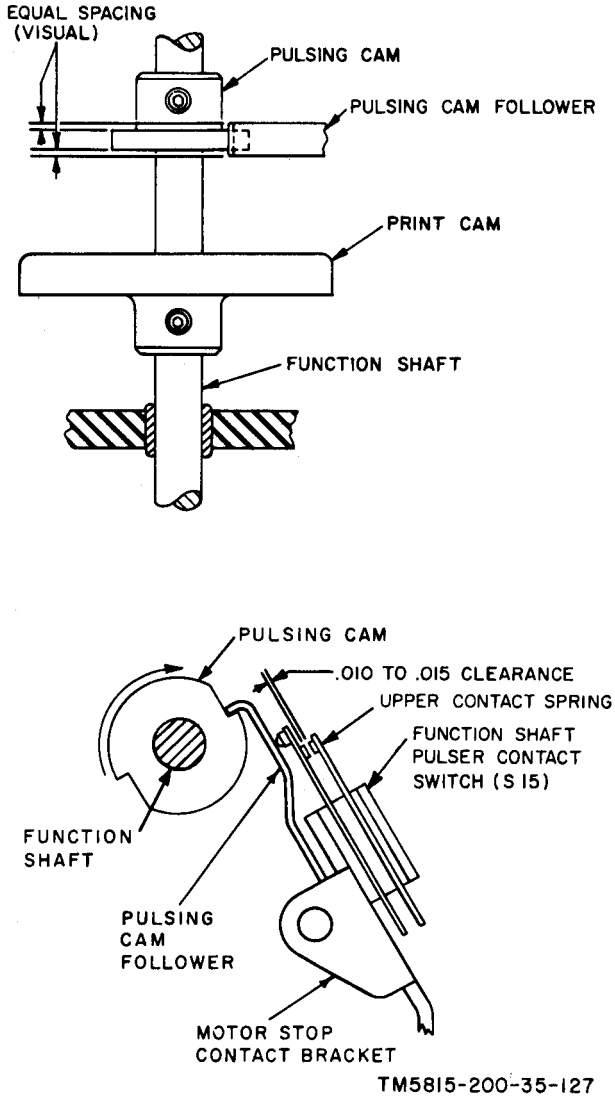


Figure 2-201. Function shaft pulsing cam and contact adjustment (weather symbol teletypewriters).

2-231. Shorting Contact Adjustment

(fig. 2-202)

Warning: **Dangerous voltages may be present between the stationary and movable contacts. Be sure to disconnect electrical power to the equipment. Serious injury or death may result from touching the contacts.**

a. Requirements. Remove the base plate.

(1) When the power supply is mounted in place on the base, there should be 1/32-inch gap (visual check) between the movable and the stationary contacts (B, fig, 2-202).

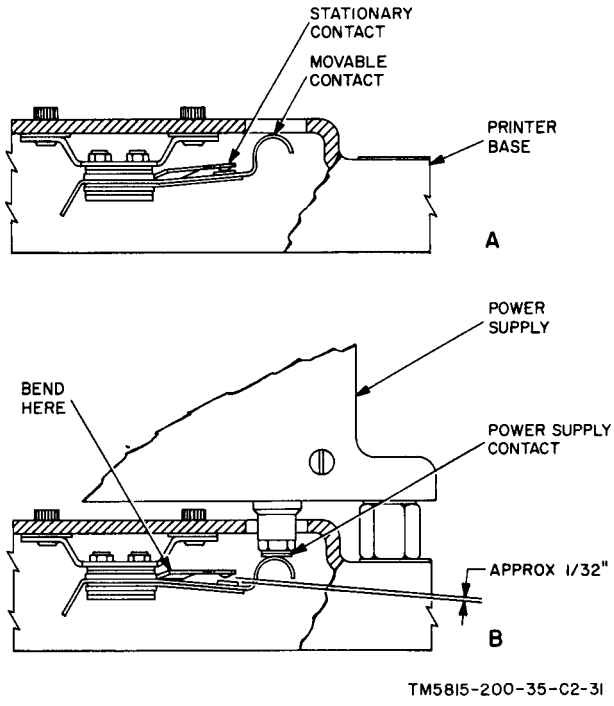


Figure 2-202. Shorting contact requirements.

(2) When the power supply is removed, the contacts should close (A, fig. 2–202) and upward pressure of the movable contact should cause the stationary contact to rise slightly.

b. Adjustment. Bend the stationary contact at the point shown in A, figure 2-202 to meet both requirements.

2-232. Letters-Shift Lever Link Adjustment

(fig. 2-203)

a. Requirement.

(1) 'There should be a .020- to .040-inch clearance between the end of the letters-shift lever link and the letters-shift lever when the manual letters-shift mechanism is in the unoperated position.

(2) When the manual LTRS button on the cover is pressed, there should be at least 0.015-inch clearance between the tip of the platen latch and the projection on the aperture gate.

(3) When the platen is in the figures-shift position, the platen latch should release the aperture gate each time the manual LTRS button is pressed.

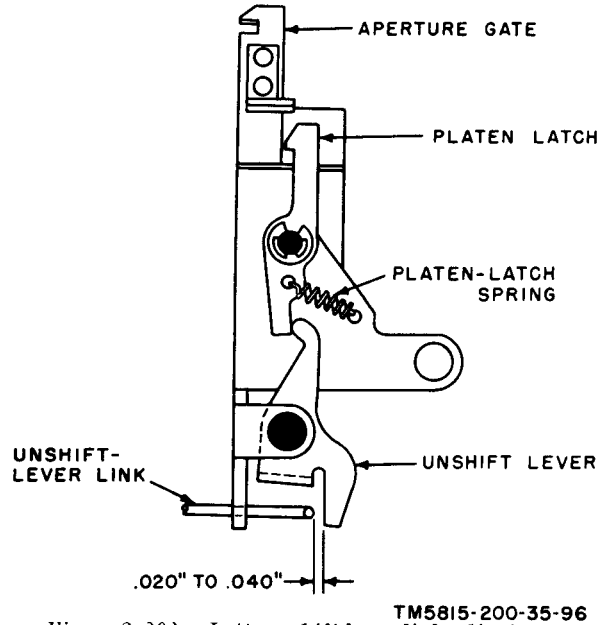


Figure 2–203. Letters-shift lever link adjustment.

(1) Detach the adjusting link from the letters-shift bellcrank. Loosen the adjusting link locknut, turn the adjusting link to obtain the required clearance, and tighten the locknut. Reconnect the adjusting link to the letters-shift bellcrank and recheck the requirement.

(2) Bend the end of the letters shift lever to meet requirements in *a(2)* and (3) above.

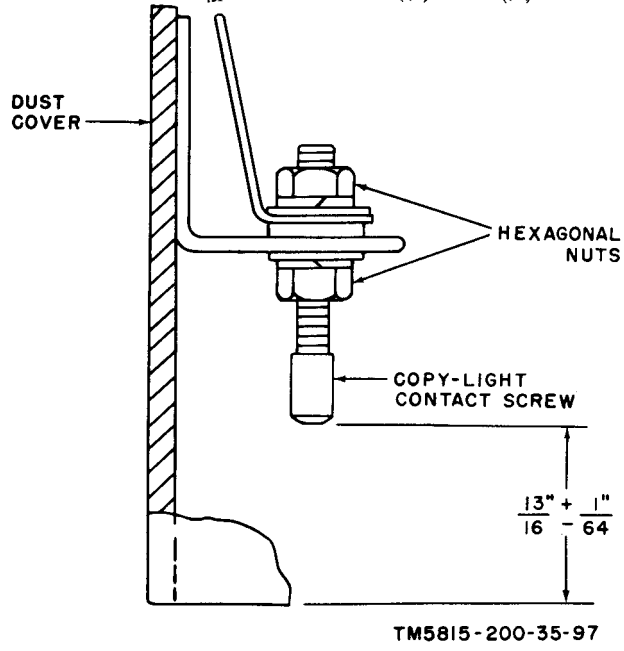


Figure 2-204. *Copy-light contact screws* adjustment.

2-233. Copy-Light Contact Screws Adjustment

(fig. 2-204)

a. *Requirement.* There should be a 13/16-inch (±1/64 inch) clearance between the contact end of the copy-light contact screws and the bottom edge of the dust cover.

b. Adjustment. Loosen the hexagonal nuts, turn them in the direction required to obtain the proper clearance, and tighten the nuts. Install the dust cover on the teletypewriter and check the operation of the copy-light. If it does not light because the contact screws are not in contact with the connector on the base, decrease the clearance requirement until proper contact is obtained.

2-234. Dust Cover Knob Adjustment

(fig. 2-205)

a. Requirement. There should be a .002- to .012 -inch clearance between the base casting and dust cover knob when the knob is pulled away from the casting.

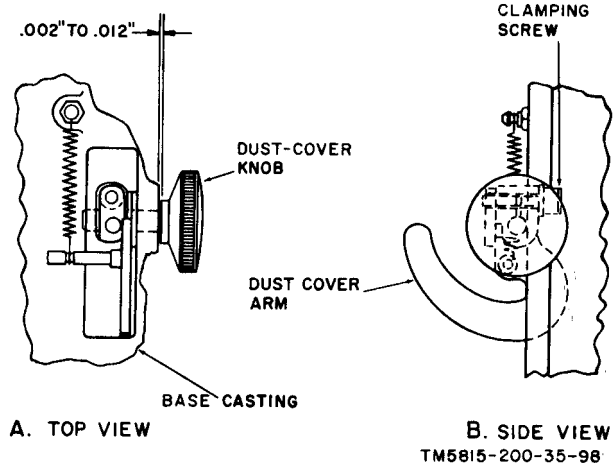


Figure 2-205. Dust cover knob adjustment.

b. Adjustment. Loosen the clamping screw on the dust cover arm, insert an .008-inch feeler gage between the base casting and the dust cover knob, push the arm and the knob toward each other and tighten the clamping screw. Remove the feeler gage and rotate the dust cover knob to be sure that the dust cover arm does not bind against the base casting.

2-235. Dust Cover Guide Adjustment

(fig. 2-206)

a. Requirement. When the dust cover is mounted on the base, the dust cover guides should touch the inside of the dust cover.

b. Adjustment. Loosen the two screws that secure each dust cover guide, slide them outward against the dust cover, and tighten the screws.

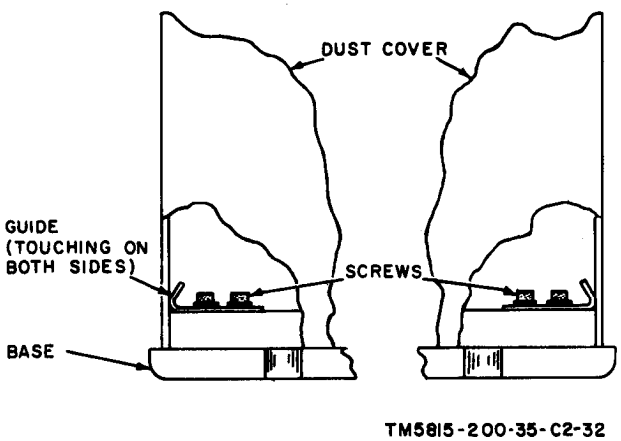


Figure 2-206. Dust cover guide adjustment.

2-236. Window Latch Adjustment

(fig. 2-207)

a. Requirements.

(1) The window in the dust cover should open easily when the release button on each side of the window is pushed outward.

(2) The window should close easily when pressed downward lightly. Both sides of the window should be latched securely when it is in the closed position.

b. Adjustments.

(1) Loosen the latch-bracket screws slightly. Set the window latch parallel with the edge of the window. Position the latch to have it strike the middle of the sloping surface of the window catch when the window is moved toward the closed position. Tighten the latch-bracket screws.

(2) If both sides of the dust cover window are not latched securely when the window is in the fully closed position, loosen the mounting screws of the loose latch, position the latch to meet the requirement, and tighten the screws.

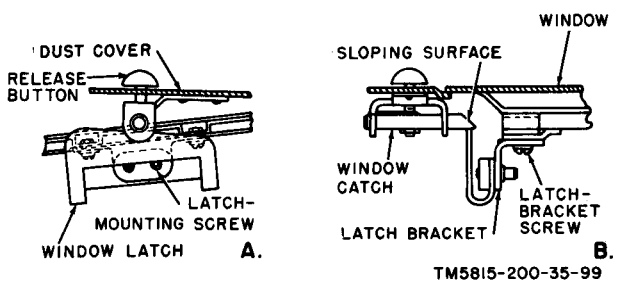


Figure 2-207. Window latch adjustment.

2-237. Manual CAR RET Button Adjustment

(fig. 2-208)

a. Requirement. There should be some clearance (not more than 1/16 inch) between the button lever and the adjusting button when the dust cover is installed on the base and the manual CAR RET button is in the unoperated position.

b. Adjustment. Loosen the locknut, turn the adjusting button in the direction required to obtain the proper clearance, and tighten the locknut.

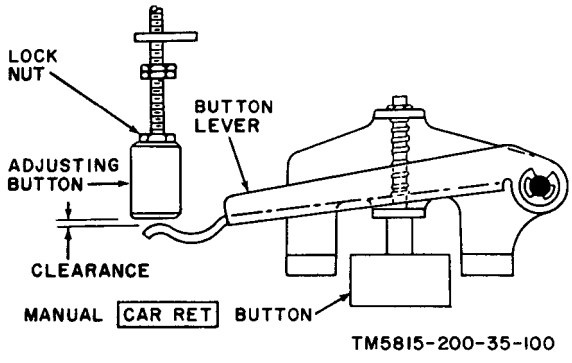


Figure 2-208. Manual CAR RET button adjustment.

2-238. Manual LTRS Button Adjustment

(fig. 2-209)

a. Requirement. There should be some clearance (not more than 1/16 inch) between the adjusting button and the shaft of the manual LTRS button when the dust cover is installed on the base and the Manual LTRS button is in the unoperated position. When the manual LTRS button is pressed while platen is in the figures position, the platen should move to the letters position.

b. Adjustment. Loosen the locknut, turn the adjusting button in the direction required to obtain the proper clearance, and tighten the locknut:

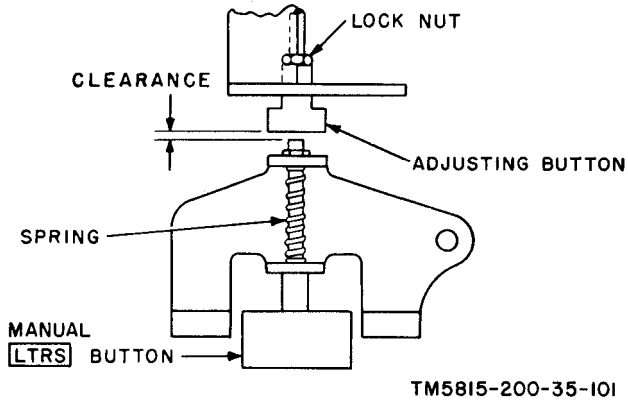


Figure 2-209. Manual LTRS button adjustment.

Section VIII. SPRING DATA

2-239. General

a. This section contains data on the coil springs used in the teletypewriters. This information is useful when inspecting or overhauling the teletypewriters 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 2-240 through 2–243 give the dimensional and strength characteristics required for each spring used in the teletypewriter. Each type of spring is illustrated (figs. 2-210 through 2-215). The free length is measured between the inside surfaces of the end hooks. If a spring fails to pass its strength check, it, should be replaced.

Note. In some cases, spring tensions are indicated in grams for more accurate adjustments than are possible with ounce scales. To convert from ounces to grams, or from grams to ounces, remember that 1 ounce equals 28.35 grams.

2-240. Cross-End Spring Data

(fig. 2-210)

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	.010 ± .0003	30	.125
50904	Transfer-lever latch	1 1/16	1 3/16	2 1/2 oz ± 3/4 oz	.012 ± .0003	31	.156
50906	Carriage-return bellcrank	1 1/16	1 3/16	4 1/2 lb ± 6 oz	.034 ± .0005	8 1/2	.250
50911	Carriage-feed-clutch lever	25/32	1 5/16	40 oz ± 4 oz	.025 ± .0005	15	.200
50912	Paper roller latch	1/2	21/32	17 1/2 oz ± 1/2 oz	.018 ± .0005	12 3/4	.156
50915	Function cam follower support lever.	21/32	23/32	4 lb 2 oz ± 6 oz	.036 ± 0.0005	7 1/4	.250
50916	Delaying latch	3/8	1/2	7 oz ± 1 oz	.013 ± .0003	12 1/4	.125
50919	Function blocking bar	1/2	5/8	2 1/2 oz ± 1/4 oz	.011 ± .0003	26	.125
50941	Key lever, locking bail	1/2	5/8	20 oz ± 2 oz	.020 ± .0003	8 3/4	.187
50946	Double-blocking lever	19/32	1 1/16	28 oz ± 3 oz	.024 ± .0003	11 3/4	3/16
51136	Universal code bar return	1 1/16	1	15 to 20 grams	.009 ± .0003	45 max	.150
51544	Locking lever latch	7/8	1 1/8	1 1/2 oz ± 1/4 oz	.010 ± .0003	57	.125
51754	Line-feed and figures-shift sensing lever	1 1/16	7/8	34 oz ± 4 oz	.019 ± .0008	26	1/8
51851	Platen spacing detent	41/64	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 ± 8oz	.028 ± .0005	4 3/4	.218
55009	Y-lever detent	1/4	.342	90–130 grams	.009 ± .0003	12 3/4	.083
55014	Dust cover arm	1 1/16	1 5/8	5 lb 10 oz ± 10 oz	.028 ± .0005	27 1/2	.187
56258	Blocking lever	9/16	3/4	6–8 oz	.014 ± .0003	17 3/4	.140

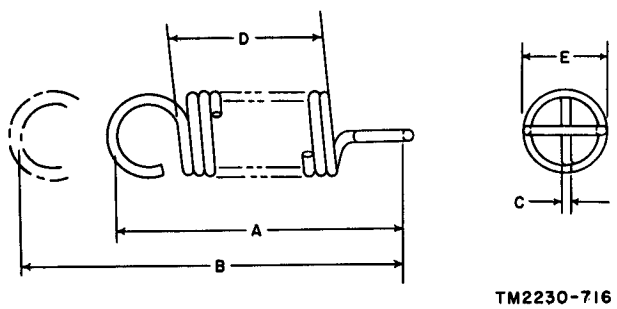


Figure 2-210. Crossed-end spring.

2-241. Parallel-End Spring Data

(fig. 2-211)

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	1 1/16	3/4	8 oz ± 1 oz	.016 ± .0003	28	.125
50232	Margin bell trip pawl	5/8	1 1/16	1 oz ± 1/4 oz	.010 ± .0003	36	.125
50334	Governor adjusting	1 5/16	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	1 3/32	1 5/32	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 lb 13 oz ± 3 oz	.042 ± .0005	14	.281
50920	Signal-bell clapper	2 3/32	2 7/32	1 1/2 oz ± 1/4 oz	.010 ± .0003	45	.125
50921	Print cam follower	7/8	1 1/16	6 1/2 lb ± 8 oz	.039 ± .0005	11 3/4	.250
50944	Blocking lever	1 5/32	9/16	2 1/2 oz ± 1/2 oz	.010 ± .0003	20	.125
51574	Sensing lever locking bail	5/8	2 7/32	2 1/2 oz ± 1/4 oz	.012 ± .0003	28	.156
55143	Stripper	1 9/32	1 1/16	42 grams ± 4 grams	.009 ± .0003		.120

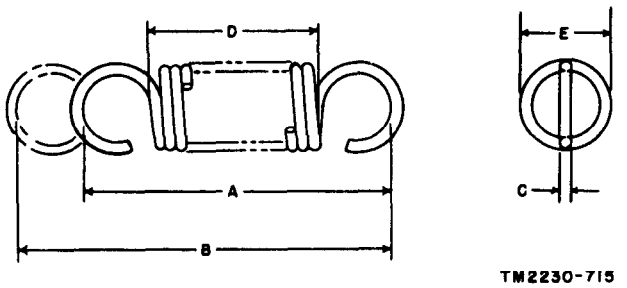


Figure 2-211. Parallel-end spring.

2-242. Extension Spring Data

(fig. 2-212)

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	5/8 ± 1/16	7/16	1 lb 12 oz ± 3 oz	.41 ± .0005	5½	.578 ID
50917	Function-selecting arm	9/16 ± 3/64	1 3/32	6 oz ± ½ oz	.024 ± .0003	5 ± ¼	.390 ID
51855	Governor adjusting pressure.	5/8 ± 1/32	.047		.14 ± .0003	6	
52940	Stop bar	3 3/64 ± 1/64	.375	8 oz ± ½ oz	.016 ± .0003	112	.183 OD
52953	Stop return bar	9/16 ± 3/64	¼	14 oz ± 2 oz	.018 ± .0003	9 ± ½	1 3/64 OD
53961	Spool friction	½ ± 1/32	¼	20 oz ± 4 oz	.021 ± .0003	7¾	.198 ID
54932	Friction clutch	½ ± 3/64	3/32	10 lb 8 oz ± 12 oz	.067 ± .0005	3½	.687 ID
54933	Clutch pressure	½ ± ¾	3/32	10 lb 8 oz ± 12 oz	.067 ± .001	3½	
54934	Friction clutch	5/8 ± 1/32	5/16	8 lb ± 12 oz	.080 ± .001	3¾	.687 ID
54957	Platen crank	¾	------	----------	.025	11	.260 OD
55518	Manual space push button.	⅝	------	----------	.025	9½	.343 ID
	Pushrod lifter	.22	.09 (solid	6 lb/inch	.022	4	.240 OD

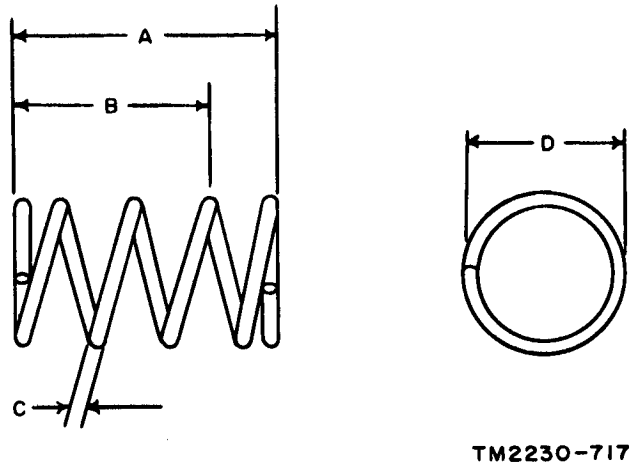


Figure 2-212. Extension spring.

2-243. Special Spring Data

Fig. No.	Reference No.	Name	A Free length (in.)	B Extended length (in.)	Required tension, extended length	C Wire thickness (in.)	Number of coils	D Diameter (in.)
231	50902	Selector lever	1	1¼	8 oz ± ½ oz	.012 ± .0003	53 max	.1085 OD
232	54967	Platen trough	1 3/16			.027	43½	.179 OD
233	56269	Carriage return-blocking lever.				.018 ± .0003	1¾	.500 ID

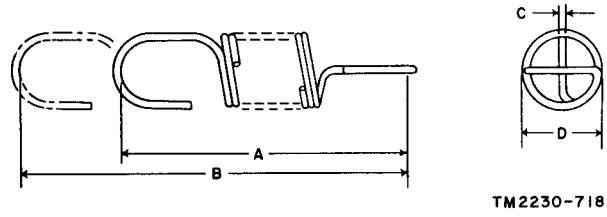
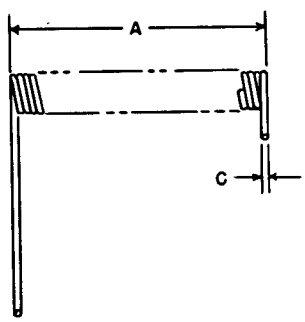


Figure 2-213. Selector lever spring.



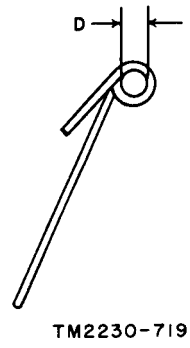
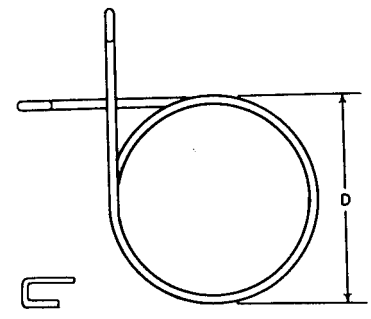


Figure 2-214. Platen trough spring.



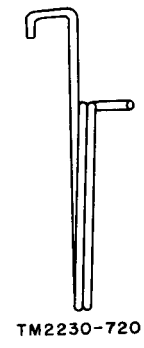


Figure 2-216. Carriage-return blocking lever spring.

2-244. Felt Lubricating Washer Data

(fig. 2-216)

a. Plain Round Felt Washers (Type A).

Reference No.	A Outside diamete (in.)	B Inside diameter (in.)	C Thickness (in.)
61466	3/4	15/32	1/16
61467	5/8	3/8	1/8
61468	5/16	7/32	1/8
61469	33/64	3/8	1/8
61470	3/4	7/16	1/16
61471	13/16	5/8	1/16
61472	9/16	3/8	1/4
61473	7/16	1/4	1/8
61474	7/16	3/16	1/8
61475	15/32	3/16	1/8
61476	1/2	3/16	1/16
61477	7/16	1/4	1/32
61478	7/16	5/16	1/8
61479	5/8	7/16	1/16
61480	5/8	3/8	1/16
61481	5/8	3/16	1/8
61482	9/16	3/8	1/16
61483	33/64	5/16	1/16
61484	1 1/8	3/8	1/8
61485	3/4	1/2	1/16
61486	15/32	9/32	1/16
61487	3/4	7/16	1/4
61488	3/4	9/16	1/16
61489	3/4	7/16	1/8
61490	5/8	5/16	1/16
61491	15/16	9/16	1/8
61492	1/2	5/16	1/32
61493	1/2	1/4	1/8
61497	15/16	3/4	1/8
61667	5/8	3/8	1/4
61668	3/4	3/8	1/8
61669	3/4	3/8	1/4
61670	3/4	7/16	1/32
61671	4/4	33/64	1/4
61672	15/32	5/16	1/32
61673	5/16	3/8	1/4
61676	33/64	5/16	1/32
61678	15/16	1/2	1/8
61681	5/16	3/16	1/32
61682	7/8	11/16	1/16
61802	9/32	9/64	1/16

b. Split Round Washers (Type B).

Reference No.	A Outside diameter (in.)	B Inside diameter (in.)	C Thickness (in.)
61494	1	1/2	1/4
61495	1 1/4	3/4	1/4
61499	5/8	7/16	1/16

c. Rectangular Washers (Type C).

Reference No.	A Length (in.)	B Width (in.)	C Thickness (in.)
61674	27/32	5/8	1/16
61677	15/16	1/2	1/16

d. T-Shaped Washer (Type D).

Reference No.	Dim. A (in.)	Dim. B (in.)	Dim. C (in.)	Dim. D (in.)	Dim. E (in.)	Dim. F (in.)
61460	11/64	13/16	1/2	9/64	1/8	1/16 ± 0.007

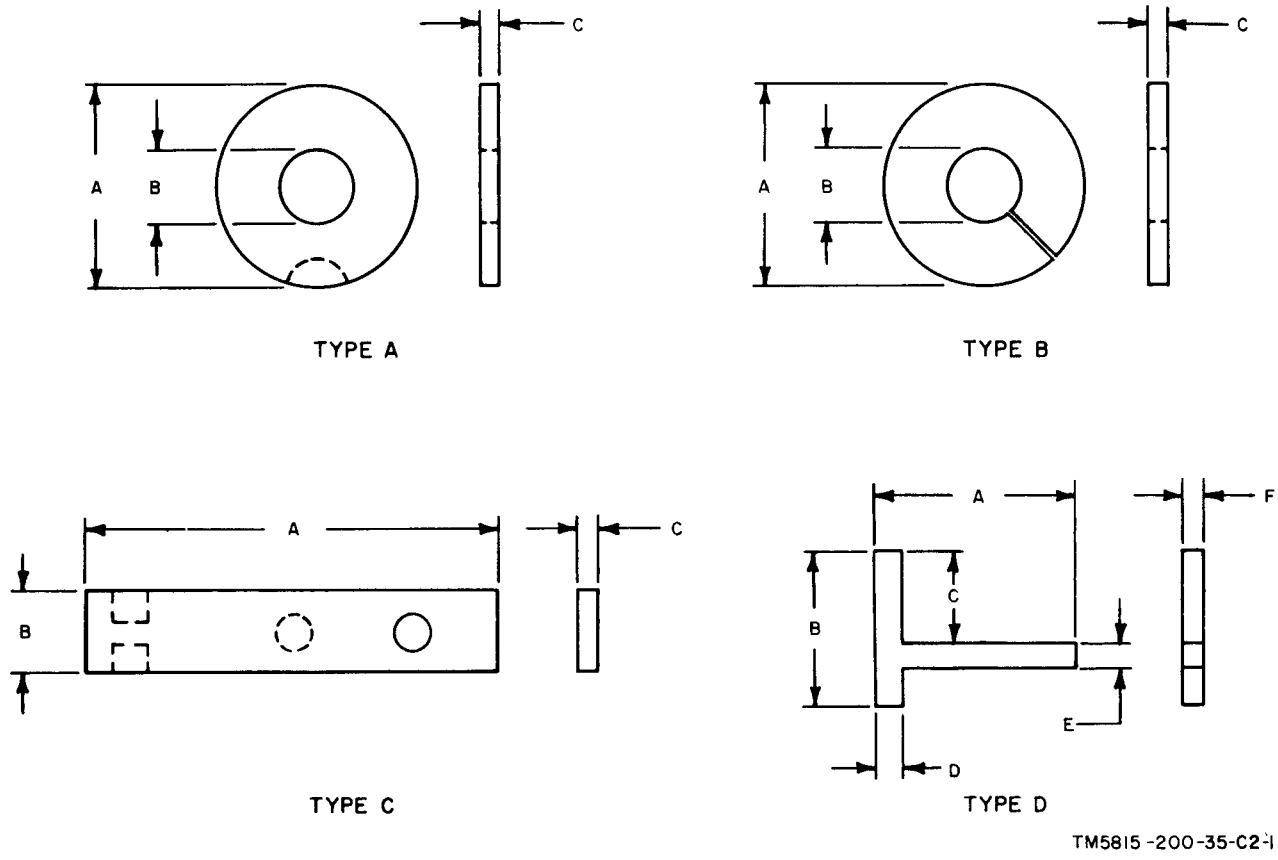


Figure 2-216. Lubricating felt washer forms.

CHAPTER 3

GENERAL SUPPORT TESTING PROCEDURES

Section I. TESTING PROCEDURES FOR ALL MODELS EXCEPT TT-664(*)/FG, TT-665/FG AND TT-688(*)/FG

3-1. General

a. Testing procedure are prepared for use by Signal field maintenance shops and signal service organizations responsible for general support maintenance of Signal equipment to determine the acceptability of repaired Signal equipment. These procedures set forth specific requirements that repaired signal equipment must meet before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment repaired at direct support level if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 3-10.

b. Each test depends on the preceding one for certain operating procedures and, where applicable, for test equipment calibrations. Comply with the instructions preceding each chart before proceeding to the chart. Perform each test in sequence. Do not vary the sequence. For each step, perform all the actions required in the control settings column; then perform each specific teat procedure and verify it against its performance standard.

3-2. Test Equipment, Materials, and Other Equipment Required

All test equipment, materials, and other equipment required to perform the testing procedures in the paragraphs below are listed in the following charts and are authorized under TA 11-17, and TA 11-100 (11-17), and TA 11-101 (11-158) or are repair part items of the subject equipment authorized for stockage at general support levels.

a. Test Equipment.

Nomenclature	Federal stock No.	Technical manual
Distortion Test Set TS-383(*)/GG[a].	6625-222-1714	TM 11-6625-364-12
Multimeter TS-352B/U	6625-242-5023	TM 11-6625-366-15
Electric Light Assembly MX-1292/PAQ.	6695-537-4470	TM 11-5540

a Indicates Distortion Test Set TS-383/GG, TS-383A/GG, or TS-383B/GGa

b. Materials. The following items are required only when testing Teleprinter TT-259/FG:

Material	Federal stock No.
Connector, plug, electrical	5935-295-5341
Clip, alligator	5940-186-8933
Wire, electrical power (5 feet required)	6145-284-0322

c. Other Equipment.

Nomenclature	Federal stock No.	Technical manual
Teletypewriter Reperforator-Transmitter TT-76(*)/GG-C[a,c].	5815-503-2760	TM 11-5815-238-12
Tuning fork, 180 vps (p/o TE-50-B).	7720-224-9717	
Rectifier RA-87-(*)	6130-230-7257	TM 11-5815-270-15
Lead, Test CX-1331/U (2 rqr).	6625-255-4699	

a Indicates Teletypewriter Reperforator-Tra nsmitter TT - 76/GGC, TT-76A/GGC, or TT-76B/GGC.
b Indicates Rectifier RA-87 or RA-87-A.
c Required only when testing Teleprinter TT-259/FG.

3-3. Modification Work Orders

Modification Work Order (MWO) 197, no priority classification, may be authorized to be performed at the discretion of local commanders. Application of the MWO has no effect on the performance standards given in tests in paragraphs 3-6 through 3-9. Any MWO'S pertaining to the equipment that may have been published since the date of this manual will be listed in DA Pam 310-4 and changes thereto. MWO'S other than those classified as URGENT should not be a basis for rejection.

3-4. Special Instructions

a. All tests are to be made at the words-per-minute operation that the equipment was set for when it was received for servicing unless other instructions accompany the equipment.

b. When testing Teleprinter TT-259/FG, if facilities are not available to connect the equipments as indicated in figure 34, it will be necessary to fabricate the test cord shown in figure 3–1. The materials required to make the test cord are listed in paragraph *3-2b.*

c. Tests presented in this chapter are performed using the Distortion Test Set TS-383(*)/GG. Instructions for tests using Teletypewriter Test Set AN/GGM-1 which will ultimately replace the TS-383(*)/GG will be prepared and issued as a change subsequent to the publication of this manual.

NOTE

If available, Teletypewriter Test Set AN/UGM-1 shall be used in lieu of Distortion Test Set TS-383(*)AW Refer to TM 11-6625-620-12 for operating instructions.

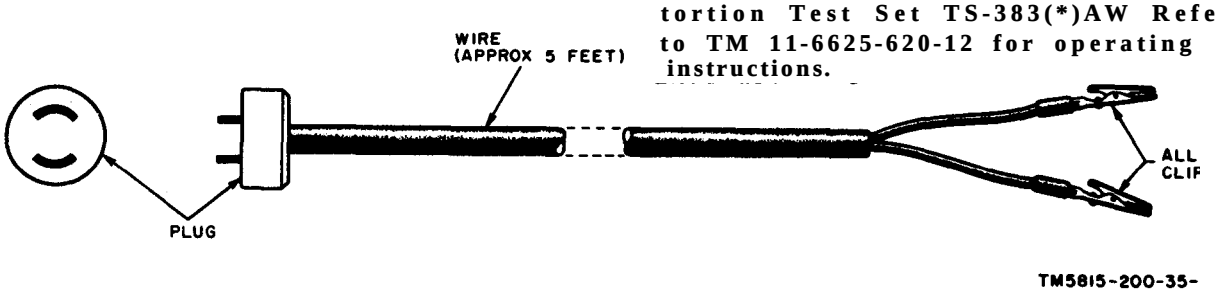


Figure 3-1. Fabrication of test cord.

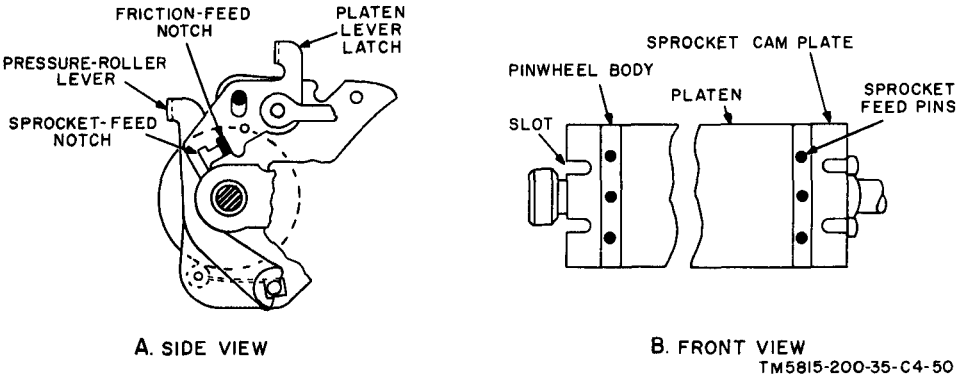


Figure 3-2. Physical tests and inspection.

Section II. TESTING PROCEDURES FOR TT-664(*)/FG, TT-665/FG AND TT-688(*)/FG

3-11. General

a. Testing procedures are prepared for use by organizations responsible for general support maintenance of equipment to determine the acceptability of repaired equipment. These procedures set forth specific requirements that repaired signal equipment must meet before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment repaired at direct support if the proper tools and teet equipment are available. A summary of the performance standads is given in paragraph

b. Comply with the instructions preceding each chart before proceeding to the chart. Perform each test in sequence. Do not vary sequence. For each step, perform all the actions required in the control settings column; then perform each specific test procedure and verify it against its performance standard.

3-12. Teat Equipment, Materials, and Other Equipment Required

All test equipment required to perform the testing procedures are listed in the following chart and/or are repair part items of the subject equipment authorized for stockage at general support levels.

Nomenclature	*National stock No.*	*Technical manual*
Multimeter TS-352B/U	6625-00-242-5023	TM 11-6625-366-15
Electric Light Assembly MX-1292/PAQ.	6695-00-537-4470	TM 11-5540

3-13. Modification Work Orders

Modification Work Order (MWO) 197, no priority classification, may be authorized to be performed at the discretion of local commanders. Application of the MWO has no effect on the performance standards given in tests in paragraphs 3-6 through 3-9. Any MWO's pertaing to the equipment that may have been published since the date of this manual will be listed in DA Pam 310-4 and changes thereto. MWO'S other than those classified as URGENT should not be a basis for rejection.

3-14. Special Instructions

a. All tests are to be made at the words-per-minute operation that the equipment was set for when it was received for servicing unless other instructions accompany the equipment.

3-15. Physical Tests and Inspection

Perform the tests in paragraph 3-4, except for steps 2 *a* through *f.*

3-16. Operational Test for TT-644(*)/FG, TT-665/FG and TT-688(*)/FG

a. Test Equipment. Multimeter TS-352B/U.

b. Test Connections and Conditions. Arrange the set to operate on local test by connecting a jumper pair from terminals 4 and-5 to 9 and 10 on terminal board A1TB1. Connect test equipment only when instructed to do so in the test procedure. Step 1 is to be performed with the dust cover installed on the teletypewriter.

c. Test Procedure.

Step No	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	N/A	MOTOR switch: OFF POWER switch: ON LIGHT switch: OFF	*a.* Plug the power cord into a 115-volt, 60 cycle, ac outlet.	*a.* None.
			b. Move the LIGHT switch to the ON and OFF positions several times.	*b.* The lamps should light each time the switch is in the ON position.
			c. Remove the power cord from the ac outlet and remove the dust cover from the teletypewriter.	*c.* None.
2	TS-352B/U: FUNCTION switch:OHMS Range switch: TX100000	MOTOR switch: ON POWER switch: ON DC POWER switch: ON SEND-LOCK: SEND; LIGHT switch: ON	*a.* Calibrate the TS-352B/U resistance scale by touching the tips of the test leads together and adjusting the OHMS ZERO ADJ knob until a 0-ohm indication is obtained on the meter.	*a.* None.
			b. Connect the TS-352B/U as shown in A, figure 3-3. Observe the indication on the meter of the TS-352B/U.	*b.* The TS-352B/U meter should indicate not less than 5 megohms.
3	N/A	POWER switch: ON MOTOR switch: ON DC POWER switch: OFF SEND-LOCK switch: LOCK	*a.* Press the spacebar several times or press several keys at random and observe the operation of the keyboard transmitter and the typing unit.	*a.* The keyboard transmitter should operate each time a key is pressed, but the typing unit should not print or perform any other function.
			b. Place the SEND-LOCK switch in the SEND position and set the line-feed lever for double spacing (toward the front of the teletypewriter). Press the LINE FEED key, then a letters key several times and observe the operation of the platen and the paper feeding.	*b.* The platen should move the paper two spaces each time the LINE FEED key is pressed.
			c. Set the line-feed lever for single spacing (toward the rear of the teletypewriter) and press the LINE FEED key, then a letters key several times and observe the operation of the platen and the paper feeding.	*c.* The platen should move the paper one space each time the LINE FEED key is pressed.
			d. Press the FIGS, CAR RET, and LINE FEED keys, then press the keys to print figures 1, 2, 3, and 4, followed by CAR RET, LINE FEED, and 1, 2, CAR RET, LINE FEED and 1, CAR RET, LINE FEED and note the printed copy.	*d.* The figure 1 should be in a straight line vertically at the left margin.
			e. Press the FIGS key, then the spacebar several times. Note the operation of the platen.	*e.* The platen should rise to the upper case and remain there.
			f. Press the FIGS key, then the S (BELL) key several times, and listen for the ring of the signal bell when the S (BELL) key is pressed.	*f.* The signal bell should ring each time the S (BELL) key is pressed after the FIGS key is pressed.
			g. Press the FIGS and LTRS keys alternately	*g.* The platen should rise to the figures position

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			several times. Note the operation of the platen.	when the FIGS key is pressed and return to the letters position when the LTRS key is pressed. The action will be distinct, with no indication of binding.
			h. While the motor is running, place the BREAK switch in the BREAK position, hold it there for several seconds, and note the operation of the teletypewriter being tested.	*h.* The teletypewriter being tested should run open, without typing, as long as the switch is held in the BREAK position.
			i. Press the FIGS key; then press the LTRS key. Note the operation of the platen.	*i.* The platen should shift to the letters position when the LTRS key is pressed.
			j. Press and hold down the spacebar or a letter key. Press and hold down the REPEAT key for several seconds. Note the operation of the teletypewriter.	*j.* The teletypewriter should repeat any character or operation, except CAR RET, when the REPEAT key and character or operation keys are held down.
			k. Press the FIGS key; then press the following keys in the order given: CAR RET, LINE FEED 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. Repeat the number sequence until the margin bell rings. Count the figures printed; then continue with the number sequence until the carriage returns to the left-hand margin.	*k.* The margin bell should ring when the 66th number is printed. There should be 72 legible characters printed before the carriage returns to the lefthand margin.
			l. Press the LINE FEED and CAR RET keys. Press and hold down a letter key and the REPEAT key until the automatic carriage-return function has been performed at least twice. Note the printed copy.	*l.* The printed copy should indicate that 72 characters are printed before the automatic carriage return and line feeding takes place. Automatic carriage return and line feeding will take place each time the carriage reaches the right-hand margin.
			m. Press the spacebar several times; then press the manual CAR RET button, a letter key, then the LINE FEED key. Repeat several times and note the printed copy.	*m.* The printed copy should indicate that the carriage returns to the left margin each time the manual CAR RET button is pressed. The letters will appear in a straight line vertically.
			n. Depress the manual space button and note the movement of the carriage.	*n.* The carriage should move from the left to the right while the manual space button is held depressed.
			o. Wind the ribbon manually, almost to the end of the spool. Press keys (at random) and observe the ribbon-reverse operation. This is to be done in both directions. **NOTE** This can be done by holding one end of the ribbon-reverse beam midway between its upper and lower positions, then turning one of the ribbon spool locks by hand.	*o.* The ribbon-reverse mechanism should operate and reverse the direction of movement of the ribbon as soon as the spool empties in either direction.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
			p. Press keys at random and observe the operation of ribbon lifter and ribbon feed.	*p.* The ribbon lifter should lift the ribbon high enough to provide inking for each printing operation and return the ribbon below the line being printed and should feed smoothly.
4	N/A	POWER switch: OFF MOTOR switch: ON DC POWER switch: ON SEND LOCK SWITCH: SEND	*a.* On the terminal box, connect the keyboard transmitter to the page printer.	*A.* None.
			b. Place the POWER switch at ON.	*b.* None.
			c. Alternately type an R and Y message on the keyboard while rotating the rangefinder dial slowly toward the upper limit of the scale. When errors begin to appear in the printed copy, stop turning the dial and record the dial indication as the upper range limit.	*c.* None.
			d. Alternately type an R and Y message on the keyboard while rotating the rangefinder dial slowly toward the lower limit of the scale. When errors begin to appear in the printed copy, stop turning the dial and record the dial indication as the lower range limit.	*d.* The range should not be less than— (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisions on the rangefinder dial for 100-wpm operation.
			e. Type at least five lines of the following test message: THE QUICK BROWN FOX JUMPED OVER A LAZY DOG'S BACK 1234567890. Check the printed copy for errors, proper spacing, print alinement, and proper line feed.	*e.* The printed copy should be error-free with the letters evenly spaced, and in straight lines, vertically and horizontally. Lines should be single spaced.

3-17. Summary of Performance Standards for TT-664(*)/FG, TT-665/FG and TT-668(*)/FG

1. INSULATION RESISTANCE TEST	
a. Between the base casting and each prong of the input plug.	*a.* Not less than 5 megohms resistance.
b. Between the base casting and signal line terminal 4.	*b.* Not less than 5 megohms resistance.
2. OPERATIONAL TEST	
a. Printing	*a.* Teletypewriter should print at least 10 lines of perfect copy.
b. Type alinement	*b.* Each line of the printed characters should be straight and evenly spaced.
c. SEND-LOCK switch	*c.* Keyboard transmitter will operate, but no function will be performed by the typing unit.
d. Orientation range limits	*d.* Orientation range limits should not be less than— (1) 72 scale divisions at 60 wpm. (2) 60 scale divisions at 100 wpm.
e. Single line-feed operation	*e.* With the line-feed lever in the rear position, the paper should advance one line when the LINE FEED key is pressed.
f. Double Doublelina-feed operation	*f.* With the line-feed lever in the forward position, the paper should advance two lines when the LINE FEED key is pressed.
g. Signal bell operation	*g.* The signal bell should ring each time the S (BELL) key is pressed after the FIGS key is pressed.
h. Carriage return operation	*h.* Carriage should return to left margin when CAR RET is pressed.
i. Copy lights	*i.* The lamps should light when the LIGHT switch is in the ON position.
j. Break operation oparation	*j.* Teletypewriter should run open without typing as long as the BREAK switch is held in the BREAK position.
k. Manual LTRS operation	*k.* Platen, in figures position, will shift to LTRS position when the manual LTRS button is pressed.
l. LTRS and FIGS shift	*l.* The platen should rise each time the FIGS key is pressed and should move down (after FIGS) when the LTRS key is pressed.
m. Margin bell	*m.* The margin bell should ring when the 66th character is printed.
n. REPEAT key operation.	*n.* Teletypewriter will repeat any character or function, except CAR RET, when the REPEAT key and the character of function keys are held down.
o. Automatic carriage return.	*o.* Carriage should return to the left margin automatically when the 72d character is received by the typing unit.
p. Manual carriage return	*p.* Carriage should return to the left-hand margin when the manual CAR RET button is pressed.
q. Manual space operation	*q.* Carriage should move from left to right while the manual space button is held depressed.
r. Ribbon reverse reverse	*r.* The ribbon should reverse direction as soon as either spool empties.
s. Ribbon lift and feed	*s.* The ribbon should be lifted high enough to provide inking for each printing operation and return below the line being printed and should feed evenly with each typing operation.

CHAPTER 4

DEPOT MAINTENANCE INSTRUCTIONS

4–1. Scope of Depot Maintenance

Complete rebuild of Teletypewriter Sets AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-64, AN/FGC-66, AN/FGC-67, AN/FGC-67X, AN/UGC-4, AN/UGC-29, AN/UGC-29X, AN/FGC-159, AN/FGC-160, and Teleprinter TT-259/FG may be accomplished by depot maintenance facilities, when authorized by Headquarters, Department of the Army. Rebuild action includes all repair, rebuild, and replacement operations necessary to make the equipment equivalent to new material and suitable for return to DA supply system stocks for re-issue to a using organization. Detailed procedures for accomplishing the repairs and adjustments are established in preceding portions of this manual, and such additional repair and rebuild operations as are deemed necessary, will be established by the facility performing the work. Paragraph 4-3 establishes the requirements that must be met by a rebuilt equipment prior to its return to DA supply system stocks.

4-2. Tools, Equipment, and Materials Required for Depot Maintenance

NOTE

All parts authorized for replacement by depot maintenance personnel are listed in TM 11-5815-200-35P/1, TM 11-5815-200-35P/2, TM 11-5815-200-35P/3, TM 11-5815-200-35P/4, and TM 11-5815-200-35P/5.

a. Tools and Maintenance Materials. The same tools and maintenance materials are required for depot maintenance as are required for general support maintenance (para 2-1) except that depot maintenance also requires the use of the normal metal-working tools and equipment such as lathes, welding equipment, and paint spraying equipment.

b. Equipment. Depot maintenance of the AN/FGC-20, AN/FGC-20X, AN/FGC-21, AN/FGC-64, AN/FGC-66, AN/FGC-67, AN/FGC-67X, AN/UGC-4, AN/UGC-29, AN/UGC-29X, AN/FGC-159, AN/FGC-160, and TT-259/FG requires the use of the equipment items listed in paragraph 3-2 and the following equipmen

Test equipment	Technical manual	Use
Ammeter, ME-65/U.	None.....	Used for measuring ac input current during operation of teletype equipment.
Electronic Multimeter TS-505/U.	TM 11-6625-239-12.	Used to measure ripple voltage.
Variac, CN-16/U.	None.....	Used to supply varying voltage to equipment under test.

4-3. Depot Inspection Standards

a. Major Subassemblies. These instructions shall also serve as a guide and standard for determining the applicability of Power Supply PP-978/FG, when repaired or processed as a separate item.

b. General Test Conditions. All tests shall be conducted under the following conditions:

(1) *Ac power source.* The operational tests shall be performed using a power source of 115-volt, 60-cycle ac for motor operation.

NOTE

Sub-paragraph (2) below is not applicable to AN/FGC-159 and AN/FGC-160.

(2) *Dc power source.* The line current for the operational test shall be 120-volt, 20 or 60 ma dc.

(3) *Run-in.* The teletypewriters shall be subjected to a run-in period of at least 6 hours,

at an operating speed of 368.1 opm or 4 hours at an operating speed of 600 opm. The operation of the teletypewriter during the course of adjustment and testing may be considered as part of the run-in time.

(4) *Standard test message.* THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK 1234567890 DTS SENDING followed by two operations of the CAR RET and one operation each of the LINE FEED and LTRS combination shall be used to meet the operational requirements.

NOTE

Subparagraph (5) below is not applicable to AN/FGC-159 and AN/FGC-160.

(5) *Line current.* The line current shall be adjusted to 20 or 60 ma by means of the R1 potentiometer in the test facility as shown in figure 5-1.

c. *Mechanical and Visual Requirements.*

(1) *Mechanical adjustment.* The teletypewriter shall be in mechanical adjustment, meeting the adjustment requirements as set forth in chapter 2 of this manual.

(2) *Lubrication.* The teletypewriter shall be lubricated with Oil, lubrication (OAI) FSN 9150-223-4129 and Grease (GH) FSN 9150-223-4003. The lubricants shall be applied in accordance with instructions contained in section III, chapter 2 of this manual.

(3) *MWO's.* Check to be sure that applicable MWO's (para 3-3) have been applied to this equipment.

d. Electrical Requirements.

(1) *Insulation resistance.* With the ac and dc power source disconnected, and the motor and the lamp switches in the ON position, the minimum resistance between ground (the metal baseplate of the teletypewriter), and each side of the ac connector and the sending and receiving line binding posts, shall be a minimum of 5 megohms, as measured with Multimeter TS-352/U.

(2) *Filter assemblies.* The capacitors and coils of the filter assemblies shall be electrically operative and shall be checked to ensure that no open or short circuits exist.

(3) *Motors.*

(a) Series-governed motors. With the teletypewriters connected to a 115-volt, 50- to 60-cycle ac power source, the motor governor shall be capable of adjusting the motor speed to provide a teletypewriter operating speed of 368.1 opm, as determined by a 180 vibrations-per-second (vps) tuning fork. The adjustments shall be made while the machine is not typing. The motor shall maintain the speed to which it has been adjusted, and shall show no signs of erratic operation. During the run-in period, the motor speed shall be checked at reasonable intervals and shall not indicate any speed variation greater than ±0.17 percent (not more than 3 target spots should pass a given point in either direction in 10 seconds) from the original adjustment.

(b) All motors. Insert a 0- to -5 ampere scale ammeter in series with one leg of the motor leads and observe the current load after the motor has attained normal operating speed. It should not exceed the current rating specified on the name plate. After one-half hour of operation, check the current load again. The ammeter should indicate approximately the same current load. An excessive rise in current indicates overheating or faulty operation.

(4) *Power supply PP-978/FG.* Remove fuse F2. Insert a 1,000-ohm load across filter capacitors C7 and C8. With an input of 115-volt, 60-cycle ac power applied, the dc output across the 1,000-ohm load should not be less than 112 volts (80 volts for TT-664(*)/FG and TT-665/FG) nor more than 128 volts (105 volts for TT-664(*)/FG and TT-665/FG) as measured with Multimeter TS-352/U. The ripple voltage, with the 1,000-ohm load attached, should not exceed 0.5 volt rms. If Power Supply PP-978/FG is checked separately, the power should be applied between pins A and C of P4 with fuse F2 installed. The dc output should be measured across a 1,000-ohm load applied to pins D and E on P4.

NOTE

Position TB3 primary setting to 115. Position secondary taps to M and 3. If above dc output requirements cannot be met, it may be necessary to reposition secondary tap settings for a higher or lower output.

(5) *Copy lamp.* The copy lamp should light when the light switch is placed in the ON position.

e. *Operational Requirements.*

(1) Switch positions (except AN/FGC-159 and AN/FGC-160). Unless

otherwise specified, the following switch positions shall be retained for the operational tests: LINE SELECTOR switch to the TEST position; POWER and MOTOR switches to the ON position; DC POWER switch to ON.

(1.1) *Switch positions and test setup (AN/FGC-159 and AN/FGC-160).* Unless otherwise specified, the following switch positions shall be retained for operational tests: POWER and MOTOR switches to the ON position. On terminal board TB1 of terminal box, connect jumpers from terminals 4 and 5 *to* 9 and 10, respectively.

(2) *SEND-LOCK switch.* Set the SEND-LOCK switch in the LOCK position and press keys at random; keyboard transmission should be prevented.

(3) *LTRS and FIGS keys.* Alternately press the LTRS and FIGS keys. The platen should operate with positive action and rise to the uppercase when the FIGS key is pressed and return to the lowercase when the LTRS key is pressed. When the FIGS key is pressed, followed by the operation of the space bar, the platen shall remain in the uppercase position.

(4) *LINE FEED key.* When pressed, it should move the paper up one or two line spaces on the platen, in accordance with the position the single-double line feed lever has been set at.

(5) *Single-double line feed lever.* In the forward position, it should cause the platen to move two spaces. In the rear position, it should cause the platen to move one space.

(6) *CAR RET key.* When pressed, the carnage (type basket) should return to the left-hand margin. When the CAR RET, LINE FEED, and a letter key is pressed in succession, the carriage should return to its left-hand margin position and the line feed should operate with sufficient speed so that the letter is printed in the first space at the left-hand margin of the new line.

(7) *SIGNAL BELL.* When the FIGS and the S (bell) keys are pressed, the signal bell should ring each time the BELL key is pressed.

(8) *LINE-BREAK switch.* When held in the BREAK position it should open the signal line circuit causing the teletypewriter to run open.

NOTE

Sub-paragraph (9) below is not applicable to AN/FGC-159 and AN/FGC-160.

(9) *Remote motor control.* Operate the remote motor control by depressing the FIGS key and then the STOP (upper case H) key in succession. The motor should stop. When the LINE-BREAK switch is momentarily set to the BREAK position, the motor should restart after the LINE-BREAK key is restored to the LINE Position.

(10) *REPEAT key.* When the REPEAT key, together with any character or function key except CAR RET are pressed and held down, the character or function should be repeated as long as the REPEAT key is held in the operated position.

(11) *Space bar.* When the space bar is pressed, it should cause the carriage to move one space to the right without printing.

(12) *Printed copy and paper feed.* Type at least 2 lines of the standard test message, followed by all the remaining uppercase characters, and observe the following:

(a) *Type alignment.* The printed characters (upper and lower case) should type evenly on all sides and should be in line horizontally. The printed characters should be centrally spaced and vertical.

(b) *Paper feed.* The paper should feed evenly and without tearing. It should also be determined that when the pressure. roller-release lever is operated, there is sufficient clearance and easing of pressure between the pressure rollers and the platen roller to permit straightening of the paper. When the platen lever latch is operated it should lock the pressure roller lever in either the applied or released position.

(13) *Ribbon feed and reverse.* Each time a character is printed, either upper or lower case, the ribbon guide should oscillate vertically to its printing position. Upon return to the original position, the ribbon should feed to a new printing surface. The ribbon should reverse its direction of travel when the last turn of the ribbon on the paying out spool has been unwrapped and the ribbon sensing lever is projected through the aperture in the core of

the spool. The reversing action of both ribbon sensing levers should be checked.

(14) *Margin signal bell.* Operate the CARRET, LINE FEED, and FIGS keys followed by 1234567890. Repeat this number group until the margin bell rings. The margin bell should ring when the 66th character is printed (70th on weather symbol teletypewriters).

(15) *Automatic carriage return and line feed.* The automatic carriage return adjustment should be such that when the 72d (76th on weather machines) character is printed, the functions are set up to return the carriage to the left-hand margin upon receiving the 73d (77th on the weather machines) character. The 73d (77th on the weather machines) character is printed after a line feed operation and about one-third the distance back from the right-hand margin. The 74th (78th on weather machines) character is printed after a line feed operation approximately 1 inch from the left-hand margin. The next character will be printed at the left-hand margin on a new line, neglecting any roll (1/2 a character displacement maximum) that may occur.

(16) *Manual CAR RET button.* When pressed, it should cause the carriage to return to the left-hand margin.

(17) *Manual LTRS button.* When pressed with the platen in the FIGS position, it should cause the platen to shift to the letters position.

(18) *Manual space push-button.* When pressed, it should cause the carriage to move continuously from left to right.

(19) *Range.* The RANGE FINDER dial should be adjusted to its optimum setting using R and Y signal code groups. Record the exact limits of the range finder dial for further test purposes. (The good copy limits of the RANGE FINDER dial of the AN/FGC-159/160 should beat least 60 points at 600 opm).

NOTE

Sub-paragraph (20) below is not applicable to AN/FGC-159 and AN/-FGC-l60.

(20) *Bias operation.* The following requirement shall be met in both 20 and 60 ma neutral half-duplex test circuits and at 368.1 or 600 operations per minute utilizing Rectifier RA-87, test facilities in accordance with figure 4-1, and Distortion Test Set TS-383(*)/GG. Set the LINE SELECTOR switch to 20 or 60 ma position as required. The DC POWER switch should be in the OFF position. The standard test message should be used to meet these requirements.

(a) Orientation range. With the teletypewriter receiving undistorted zero bias signals at 368.1 opm, the good-copy limits of the RANGE FINDER dial should be at least 72 points. Record the exact range limits for further test purposes. The good-copy limits of the RANGE FINDER dial should be at least 60 points at 600 opm.

(b) Bins tolerance, 368.1 opm. With the teletypewriter receiving 30 percent marking and spacing bias test signals, the minimum bias requirement shall be 40 percent. The minimum allowable bias of 40 percent may be determined as follows: The upper limit of the range of the selector mechanism shall be determined with 30 percent marking bias. The lower limit of the range shall be determined with 30 percent spacing bias signals. The maximum bias receivable for the teletypewriter shall be determined by the following expression:

$$\text{Max bias} = 30 + \frac{(\text{upper limit}) - (\text{lower limit})}{2}$$
$$(\text{marking bias}) \quad (\text{spacing bias})$$

(c) *End distortion operation 368.1 opm.* With the teletypewriter receiving 30 percent marking and spacing end distortion test signals, the minimum end distortion requirement shall be 35 percent. The minimum allowable end distortion of 35 percent may be determined as follows: The upper limit of the range of the selector mechanism shall be determined with 3 percent end distortion spacing. The lower limi of the range shall be determined with 30 percent end distortion marking. The maximum end distortion receivable for the teletypewriter shall be determined by the following expression:

$$\text{Max end distortion} = 30 + \frac{(\text{upper limit}) - (\text{lower limit})}{2}$$
$$(\text{end dist spacing}) \quad (\text{end dist marking})$$

(d) Bias tolerance, 600 opm. With the teletypewriter receiving 80 percent marking and spacing bias test signals, the minimum allowable bias requirement shall be 35 percent. The minimum allowable bias of 35 percent may be determined as follows: The upper limit of the

selector mechanism shall be determined with 30 percent end distortion spacing. The lower limit of the range shall be determined with 30 percent end distortion marking. The maximum end distortion receivable for the teletypewriter shall be determined by the following expression:

$$\text{Max end distortion} = 30 + \frac{\text{(upper limit) - (end dist spacing)} \quad \text{(lower limit) (end dist marking)}}{2}$$

NOTE

Subparagraph *(f)* has been deleted in its entirety.

(e) Keyboard bias. Keyboard bias shall not exceed 5 percent as tested on a TS-800/UGM-1 or equal. Measure all space-mark transitions in the average mode.

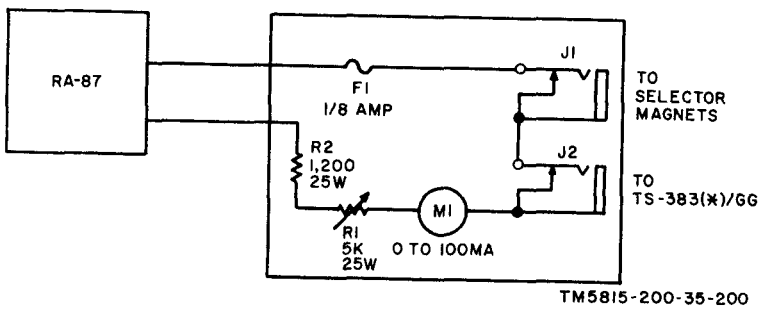


Figure 4-1. Test circuit.

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, 9), Supply Bulletins and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
SM 11-4-5180-S05	Stock List of Components of Sets, Kite, and Outfits for Tool Equipment TE-50-B.
TM 11-2208	Test Sets: TS-2/TG, TS-2A/TG, TS-2B/TG and TS-2C/TG (Teletypewriter Signal Distortion).
TM 11-5815-200-12	Organizational Maintenance Manual, Teletypewriter Sets AN/FGC-20, AN/FGX-20X, AN/FGC-21, AN/FGC-66, AN/UGC-4, AN/UGC-29, AN/UGC-29X, AN/FGC-159, AN/FGC-159X, AN/FGC-160, AN/FGC-177, and Teleprinter TT-259/FG, Including Repair Parts and Special Tools List.
TM 11-6625-239-12	Operator's and Organizational Maintenance Manual: Electronic Multimeter TS-505A/U, TS-505B/U, TS-505C/U, and TS-505D/U,
TM 11-6625-364-12	Organizational Maintenance Manual, Distortion Test Sets TS-383/GG, TS-383A/GG, and TS-383B/GG.
TM 11-6625-366-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

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EUSA (5)
Corps (2)
USAC (3)
11th Air Aslt Div (3)
507th USASA Gp (5)
508th USASA Gp (5)
318th USASA Co (5)
319th USASA Co (5)
320th USASA Co (5)
Instl (2) except
Ft Monmouth (70)
Ft Hancock (4)
Ft Gordon (10)
Ft Huachuca (10)
WSMR (5)
Ft Carson (25)
Ft Knox (12)
Ft Devens (5)
Svc Colleges (2)
Br Svc Sch (2) except
USASESCS (60)
USASCS (5)
USAQMS (5)
USATC Armor (2)
USAECFB (2)
USATC Inf (2)
USASTC (2)
Army Dep (2) except
LBAD (14)
SAAD (30)
TOAD (14)
FTWOAD (10)
LEAD (5)
SHAD (3)
NAAD (5)
SVAD (5)
CHAD (3)
ATAD (4)
Gen Dep (2)
Sig Sec, Gen Dep (5)
Sig Dep (12)
Army Tml (1) except
OART (5)
BAMC (5)
WRAMC (1)
Army Pic Cen (2)
USATTC (5)
USAEPG (5)
Sig FLDMS (2)
AMS (1)
USAERDAA (2)
USAERDAW (13)
USACRREL (2)
USABIOLABS (5)
JUSMMAT (5)
Units organized under following TOE's (2 each):

11-57	11-157
11-97	11-158
11-98	11-500 (AA-AC)
11-117	11-587
11-127	11-592
11-155	11-597

NG: State AG (3).
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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3–5. Physical Tests and Inspection

a. Test Equipment and Materials. Electric Light Assembly MX–1292/PAQ.
b. Test Connections and Conditions. Remove the dust cover of the teletypewriter.
c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standards
1	N/A	Controls may be set in any position.	*a.* Inspect the teletypewriter for dirt, rust, corrosion, and excessive lubricants.	*a.* The entire unit should be clean and free of rust and excessive amounts of lubricants.
			b. Inspect the teletypewriter for loose, missing, or damaged parts.	*b.* There should be no loose, missing, or damaged parts.
			c. Inspect the power cord and plug. Check the plug for dirt, corrosion, and bent or broken contacts. Check the cord for dirt, cuts, breaks, or frayed insulation. Inspect the ground lead at the plug end of the power cable.	*c.* The cord and plug should be in good condition and show no evidence of cuts, breaks, or frayed insulation. The plug contacts should be straight and clean. The ground lead should be in good condition.
			d. Inspect the condition of the shock mounts and ground leads.	*d.* Shock mounts should show no evidence of damage and should be properly tightened in place. Ground leads should be in good condition and securely tightened in place.
			e. Inspect all panel and equipment markings.	*e.* All markings should be clear and distinct.
			f. Inspect all wiring, connectors, and plugs for signs of damage, breaks, and worn or frayed insulation.	*f.* All connectors and plugs should be free of damage and the wiring should be free of breaks, worn, or frayed insulation.
2	N/A	Controls may be set in any position.	*a.* Place the LINE SELECTOR switch in each of its four positions.	*a.* Positive detent action should be noted; the knob should be tight on the shaft and properly indexed.
			b. Remove the bias fuse (F4) and inspect the fuse and fuseholder.	*b.* The fuseholder should be free of burns, breaks, corrosion, or cracks. The fuse should be 1/16 ampere, 250 volts.
			c. Inspect the BIAS TEST MA and signal line terminals.	*c.* All terminals should be free of chips, cracks, or corrosion and capable of making solid connections. The BIAS TEST MA and signal line terminals 2 and 3 should be connected by a shorting bar.
			d. Unlock the DC POWER switch by turning the lockscrew counterclockwise. Move the switch to each position to check the mechanical operation.	*d.* The switch should move to each position with positive action and should be mounted securely in place.
			e. Loosen the locknut on the BIAS control and rotate the control to its minimum and maximum positions. Reset the control in the middle of its range.	*e.* The BIAS control should operate smoothly and without binding through its entire range.
			f. Remove the cover nut from the LINE CURRENT control and rotate it to its minimum and maximum positions. Reset the control in the middle of its range.	*f.* The LINE CURRENT control should operate smoothly and without binding through its entire range.
			g. Open the door on Power Supply PP–978/FG and inspect the panel. Remove the power supply output fuse (F2) and the spare fuse. Check the fuses for proper value. Inspect the fuses and fuseholders for corrosion, cracks, and burns.	*g.* Fuses and fuseholders should not show evidence of cracks, burns, and corrosion. The fuses should be rated at ¼ ampere, 250 volts.
			h. Inspect the terminals, terminal board, and the three-plug-in leads on the PP–978/FG terminal board for breaks, dirt, cracks, cuts, or damage to insulation, and corrosion on terminals and terminal board.	*h.* Terminals, terminal board, and plug-in leads should not show evidence of damage and should be free of dirt or corrosion.
			i. Remove and inspect the power input fuse (F1) for proper value. Check the fuse and fuseholder for cracks, corrosion, and burns.	*i.* Fuse and fuseholder should not show evidence of cracks, corrosion, or burns. The fuse should be rated at 2 amperes, 250 volts.
			j. Operate the POWER switch to the ON and OFF positions and note the mechanical operation. Check for proper mounting.	*j.* The POWER switch should snap to each position. The mounting nut should be tight.
			k. Operate each of the switches on each side of the keyboard. Note the mechanical operation of each switch and check for proper mounting.	*k.* Each switch should snap to each indicated position properly. The BREAK switch should return to the LINE position when released. Each switch should be securely mounted in place.
3	N/A	Controls may be set in any position.	*a.* Inspect the dust cover, dust cover hinges, latches, glass copy window, and copyholder.	*a.* The dust cover and dust cover hinges, latches, copy window, and copyholder should not show evidence of damage.
			b. Inspect the dust cover and Table FN–59/FG finish for dents, cracks, tears, and worn spots that show bare metal. *Note.* Touchup painting is recommended instead of complete refinishing whenever practicable.	*b.* No dents, cracks, tears or bare metal should be evident. *Note.* Small dents are permissible only when the finish is complete and the dents do not interfere with the operation of the equipment or affect the moisture-resistant capabilities of the equipment.
4	N/A	Controls may be in any position.	*Note.* If a roll of paper is in the teletypewriter, omit steps *a* and *b* below. *a.* Press down on the paper roller latch and pull the paper roller shaft upward, then insert it in a roll of paper. Replace the paper roller shaft and paper so that the paper unrolls from the bottom of the roll.	*a.* None.
			b. Feed paper into the rear of the platen assembly up to the platen pressure roller and then turn the platen crank 2 or 3 turns counterclockwise, or until several inches of paper extend above the platen.	*b.* None.
			c. Push back on the platen lever latch and position the pressure-roller lever in the sprocket-feed notch (forward) to release the pressure on the paper. Straighten the paper on the platen (A, fig. 3–2).	*c.* When the pressure roller lever is in the sprocket-feed notch, no pressure should be on the paper.
			d. Restore the pressure roller lever to the friction-feed notch on the platen lever latch (toward the rear), and turn the platen crank 2 or 3 turns counterclockwise. Note the paper feed and the detent action.	*d.* Enough pressure should be exerted on the paper to prevent any slippage. Paper should feed through straight, without binding, tearing, or creasing. The detent action should be positive and distinct.
			e. Insert the blade of a small screwdriver in the slot in the sprocket cam plate. Turn the platen crank approximately 40° clockwise when the screwdriver blade is in the slot on the left end of platen and counterclockwise when the blade is in the slot on the right end of the platen. Note the operation of the sprocket-feed pins (B, fig. 3–2).	*e.* Sprocket-feed pins should move outward approximately ⅛ inch.
			f. Reverse the procedure in *e* above and retract the sprocket-feed pins to their original position.	*f.* Sprocket-feed pins should retract to be even with or below the surface of the pinwheel body as indicated in B, figure 3–2.
5	*MX–1292/PAQ* 245 V. FOR M. V. LAMP: ON.	Controls may be set in any position.	*a.* Expose the chassis to the direct rays of the lamp and inspect components, wiring, and chassis surfaces for evidence of MFP. Inspect connector and switch contacts, and variable capacitor plates for absence of MFP. *Note.* MFP varnish glows grayish-green when exposed to the lamp.	*a.* All components, wiring not flexed in normal use, and chassis surfaces must be covered with MFP varnish. There should be no evidence of MFP on connector and switch contacts, and variable capacitor plates. *Note.* Do not apply MFP to painted or plated surfaces, and parts or components that were not originally finished with MFP varnish.
			b. Place the MX–1292/PAQ 245 V. FOR M. V. LAMP switch in the OFF position and disconnect the power cord.	*b.* None.

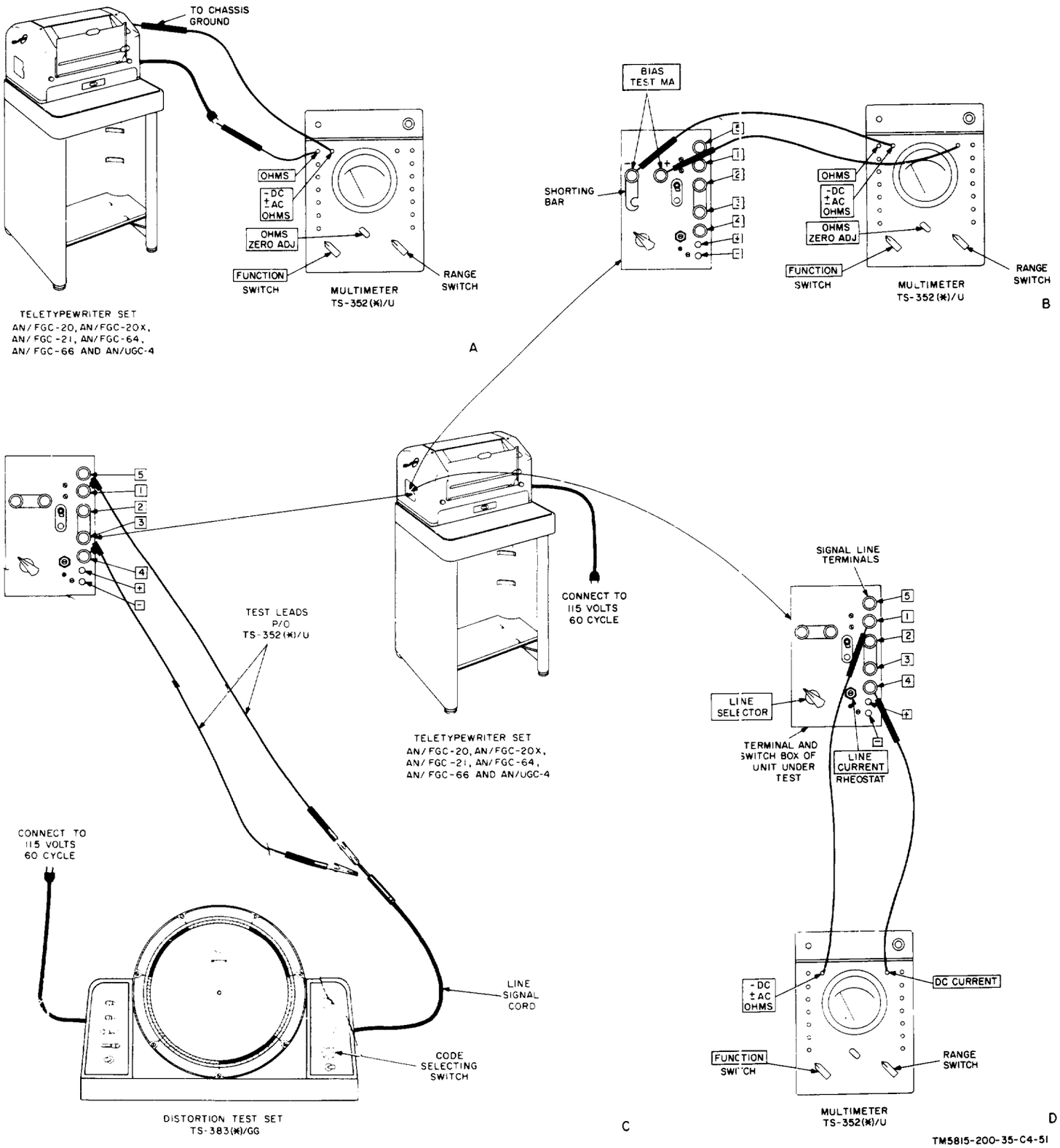

Figure 3-3. Operational tests, all models except TT-259/FG.

3–6. Operational Test For All Models Except TT–259/FG

(fig. 3–3)

a. Test and Other Equipment.
Multimeter TS–352(*)/U
Distortion Test Set TS–383(*)/GG
Tuning fork, 180 vps (p/o TE–50–B)

b. Test Connections and Conditions. Connect test and other equipment only when instructed to do so in the test procedure. Step No. 1 is to be performed with the dust cover installed on the teletypewriter.

c. Test Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	N/A	MOTOR switch: OFF POWER switch: ON LIGHT switch: OFF	*a.* Plug the power cord into a 115-volt, 60 cycle, ac outlet. *b.* Move the LIGHT switch to the ON and OFF positions several times. *c.* Remove the power cord from the ac outlet and remove the dust cover from the teletypewriter.	*a.* None. *b.* The lamps should light each time the switch is in the ON position. *c.* None.
2	*TS–352(*)/U:* FUNCTION switch: OHMS Range switch: RX10000	MOTOR switch: ON POWER switch: ON DC POWER switch: ON SEND-LOCK: SEND LIGHT switch: ON LINE SELECTOR switch: TEST	*a.* Calibrate the TS–352(*)/U resistance scale by touching the tips of the test leads together and adjusting the OHMS ZERO ADJ knob until a 0-ohm indication is obtained on the meter. *b.* Connect the TS–352(*)/U as shown in A, figure 3–3. Observe the indication on the meter of the TS–352(*)/U. *c.* Connect one TS–352(*)/U test lead to chassis ground and the other test lead to signal line terminal 4. Observe the indication on the meter of the TS–352(*)/U.	*a.* None. *b.* The TS–352(*)/U meter should indicate not less than 5 megohms. *c.* Same as *b* above.
3	*TS–352(*)/U:* FUNCTION switch: DC CURRENT Range switch: 50 MA.	POWER switch: OFF MOTOR switch: OFF LINE SELECTOR switch: TEST DC POWER switch: ON SEND-LOCK switch: LOCK	*a.* Connect the equipment as shown in B, figure 3–3, and place the POWER switch in the ON position. *b.* Loosen the locknut on the variable BIAS resistor and adjust the resistor until an indication of 12 ma is observed on the TS–352(*)/U meter. Tighten the locknut. *c.* Place the POWER switch in the OFF position. Disconnect the test leads of the TS–352(*)/U from the teletypewriter and replace the shorting bar on the BIAS TEST MA terminals.	*a.* None. *b.* None. *c.* None.
4	N/A	POWER switch: ON MOTOR switch: ON LINE SELECTOR switch: TEST DC POWER switch: OFF SEND-LOCK switch: LOCK	*a.* If line teletypewriter being tested is equipped with a governed motor, check the motor speed with a 180-cps tuning fork as follows: (1) Strike the tuning fork against the palm of the hand to start it vibrating. (2) Hold the tuning fork so that the motor governor target can be viewed through the vibrating shutters of the fork. Note the appearance of the target. *b.* Press the spacebar several times or press several keys at random and observe the operation of the keyboard transmitter and the typing unit. *c.* Place the SEND-LOCK switch in the SEND position and set the line-feed lever for double spacing (toward the front of the teletypewriter). Press the LINE FEED key, then a letters key several times and observe the operation of the platen and the paper feeding. *d.* Set the line-feed lever for single spacing (toward the rear of the teletypewriter) and press the LINE FEED key, then a letters key several times and observe the operation of the platen and the paper feeding. *e.* Press the FIGS, CAR RET, and LINE FEED keys, then press the keys to print figures 1, 2, 3, and 4, followed by CAR RET, LINE FEED, and 1, 2, 3, CAR RET, LINE FEED, and 1, 2, CAR RET, LINE FEED and 1, CAR RET, LINE FEED and note the printed copy. *f.* Press the FIGS key, then the spacebar several times. Note the operation of the platen. *g.* Press the FIGS key, then the S(BELL) key several times, and listen for the ring of the signal bell when the S(BELL) key is pressed. *h.* Press the FIGS and LTRS keys alternately several times. Note the operation of the platen. *i.* Check the remote motor stop on standard communication teletypewriters by pressing the FIGS key then the H(STOP) key. Note the motor operation. *j.* Check the remote motor stop on weather communication teletypewriters by pressing the FIGS key, then the BLANK key, followed by the H(STOP) key. Note the motor operation. *k.* Place the BREAK switch in the BREAK position, then release it. Note the operation of the motor. *l.* Repeat *i* and *k* above for standard communication teletypewriters and *j* and *k* above for weather communication teletypewriters, several times. *m.* While the motor is running, place the BREAK switch in the BREAK position, hold it there for several seconds, and note the operation of the teletypewriter being tested. *n.* Press the FIGS key; then press the LTRS key. Note the operation of the platen. *o.* Press and hold down the spacebar or a letter key. Press and hold down the REPEAT key for several seconds. Note the operation of the teletypewriter. *p.* Press the FIGS key; then press the following keys in the order given: CAR RET, LINE FEED 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. Repeat the number sequence until the margin bell rings. Count the figures printed; then continue with the number sequence until the carriage returns to the left-hand margin. *q.* Press the LINE FEED and CAR RET keys. Press and hold down a letter key and the REPEAT key until the automatic carriage-return function has been performed at least twice. Note the printed copy. *r.* Press the spacebar several times; then press the manual CAR RET button, a letter key, then the LINE FEED key. Repeat several times and note the printed copy. *s.* Depress the manual space button and note the movement of the carriage. *t.* Wind the ribbon manually, almost to the end of the spool. Press keys (at random) and observe the ribbon-reverse operation. This is to be done in both directions. *Note.* This can be done by holding one end of the ribbon-reverse beam midway between its upper and lower positions, then turning one of the ribbon spool locks by hand. *u.* Press keys at random and observe the operation of ribbon lifter and ribbon feed.	*a.* The motor governor target should appear to be motionless. (When not more than 3 spots pass a given point in 10 seconds, this requirement is considered to have been met.) *b.* The keyboard transmitter should operate each time a key is pressed, but the typing unit should not print or perform any other function. *c.* The platen should move the paper two spaces each time the LINE FEED key is pressed. *d.* The platen should move the paper one space each time the LINE FEED key is pressed. *e.* The figure 1 should be in a straight line vertically at the left margin. *f.* The platen should rise to the upper case and remain there. *g.* The signal bell should ring each time the S(BELL) key is pressed after the FIGS key is pressed. *h.* The platen should rise to the figures position when the FIGS key is pressed and return to the letters position when the LTRS key is pressed. The action will be distinct, with no indication of binding. *i.* The motor should stop each time the FIGS and H(STOP) keys are pressed in that order. *j.* The motor should stop each time the FIGS, BLANK, and H(STOP) keys are pressed in that order. *k.* The motor should not start until the BREAK switch is released and then it must start. *l.* Same as *i* and *k* above for standard communication teletypewriters, or the same as *j* and *k* above for weather communication teletypewriters. *m.* The teletypewriter being tested should run open, without typing, as long as the switch is held in the BREAK position. *n.* The platen should shift to the letters position when the LTRS key is pressed. *o.* The teletypewriter should repeat any character or operation, except CAR RET, when the REPEAT key and character or operation keys are held down. *p.* The margin bell should ring when the 66th number is printed. There should be 72 legible characters printed before the carriage returns to the left-hand margin. *q.* The printed copy should indicate that 72 characters on standard communication teletypewriters, or 76 characters on weather communication teletypewriters, are printed before the automatic carriage return and line feeding takes place. Automatic carriage return and line feeding will take place each time the carriage reaches the right-hand margin. *r.* The printed copy should indicate that the carriage returns to the left margin each time the manual CAR RET button is pressed. The letters will appear in a straight line vertically. *s.* The carriage should move from the left to the right while the manual space button is held depressed. *t.* The ribbon-reverse mechanism should operate and reverse the direction of movement of the ribbon as soon as the spool empties in either direction. *u.* The ribbon lifter should lift the ribbon high enough to provide inking for each printing operation and return the ribbon below the line being printed and should feed smoothly.
5	*TS–352(*)/U:* FUNCTION switch: DC CURRENT Range switch: 100 MA. *TS–383B(*)/GG:* RUN-STOP switch: STOP. LINE-DIST switch: DIST. VIEW-TRANSMIT switch: TRANSMIT. BIAS-END DIST switch: neutral. MARK-ZERO-SPACE switch: ZERO. Character selecting switch: TEST MESSAGE. STOP PULSE switch: ON. MOTOR switch: OFF.	MOTOR switch: OFF. POWER switch: ON. LINE SELECTOR switch: 20. DC POWER switch: ON. SEND-LOCK switch: LOCK.	*a.* Connect the equipment as indicated in D, figure 3–3. *b.* Remove the cover nut from the LINE CURRENT rheostat and adjust it for a 20-ma indication on the TS–352(*)/U meter. *c.* Place the POWER switch in the OFF position. *d.* Connect the equipment as indicated in C, figure 3–3. Place the POWER and the MOTOR switches at ON. Place the TS–383(*)/GG MOTOR switch in the ON position and the RUN-STOP switch to RUN. *e.* Rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the upper range limit. *f.* Rotate the rangefinder dial slowly toward the lower limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the lower range limit. *g.* Subtract the figure recorded in *f* above from the figure recorded in *e* above to obtain the range of the teletypewriter. Divide the range by 2; then add this figure to the low limit or subtract it from the upper limit and set the rangefinder dial at this point. *h.* Place the teletypewriter MOTOR and POWER switches at OFF; place the TS–383(*)/GG RUN-STOP switch in the STOP position. *i.* Place the teletypewriter POWER switch in the ON position and adjust the LINE CURRENT rheostat for a 60-ma indication on the TS–352(*)/U meter. Place the POWER switch in the OFF position. *j.* Connect the equipment as shown in C, figure 3–3. Place the teletypewriter POWER switch in the ON position; place the TS–383(*)/GG RUN-STOP switch in the RUN position. *k.* Rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the upper range limit. *l.* Rotate the rangefinder dial slowly, toward the lower limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the lower range limit. *m.* Subtract the figure recorded in *l* above from the figure recorded in *k* above to obtain the range of the teletypewriter. Divide the range by 2; then add this figure to the low limit or subtract it from the upper limit and set the rangefinder dial at this point. *n.* Place the TS–383(*)/GG RUN-STOP switch in the STOP position and the MOTOR switch in the OFF position. Place the teletypewriter SEND-LOCK switch in the SEND position. *o.* Type at least five lines of the following test message: THE QUICK BROWN FOX JUMPED OVER A LAZY DOG'S BACK 1234567890. Check the printed copy for errors, proper spacing, print alinement, and proper line feed.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* None. *g.* The range should not be less than— (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisions on the rangefinder dial for 100-wpm operation. *h.* None. *i.* None. *j.* None. *k.* None. *l.* None. *m.* The range should not be less than: (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisions on the rangefinder dial for 100-wpm operation. *n.* None. *o.* The printed copy should be error-free with the letters evenly spaced, and in straight lines, vertically and horizontally. Lines should be single spaced.

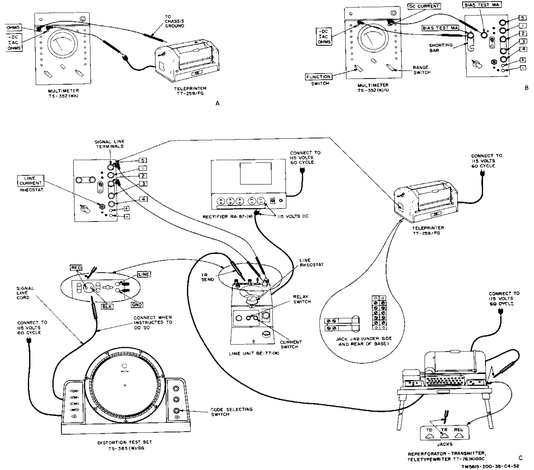

Figure 3-4. Operational tests, Teleprinter TT-259/FG.

3–7. Operational Test, Teleprinter TT–259/FG

(fig. 3–4)

a. Test and Other Equipment.
Multimeter TS–352(*)/U
Distortion Test Set TS–383 (*)/GG
Line Unit BE–77–(*)
Rectifier RA–87–(*)
Teletypewriter Reperforator-Transmitter TT–76(*)/GGC

b. Test Connections and Conditions. Connect test and other equipment only when instructed to do so in the test procedure. Step No. 1 is to be performed with the dust cover installed on the teletypewriter.

c. Test Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	N/A	POWER switch: OFF.	*a.* Plug the power cord into a 115-volt 60-cycle ac outlet. *b.* Place the TT–259/FG POWER switch in the ON and OFF positions several times. *c.* Remove the power cord from the ac outlet and remove the dust cover from the teletypewriter.	*a.* None. *b.* The copy lamp should light and the motor should start each time the POWER switch is placed in the ON position. *c.* None.
2	*TS–352(*)/U:* FUNCTION switch: OHMS. Range switch: RX10000.	POWER switch: ON. DC POWER switch: ON. LINE SELECTOR switch: 60.	*a.* Calibrate the TS–352(*)/U resistance scale by touching the tips of the test leads together and adjusting the OHMS ZERO ADJ. knob until a 0-ohm indication is obtained on the meter. *b.* Connect the TS–352(*)/U as shown in A, figure 3–4. Observe the indication on meter of the TS–352 (*)/U. *c.* Remove the TS–352(*)/U test lead from the power cord and connect it to signal line terminal 3. Observe the indication on the meter of the TS–352(*)/U.	*a.* None. *b.* The TS–352(*)/U meter should indicate not less than 5 megohms. *c.* Same as *b* above.
3	*TS–352(*)/U:* FUNCTION: DC CURRENT. Range switch: 50 MA.	POWER switch: OFF.	*a.* Connect the equipment as shown in B, figure 3–4. Place the TT–259/FG POWER switch in the ON position. *b.* Loosen the locknut on the TT–259/FG variable BIAS resistor and adjust the resistor until an indication of 12 ma is observed on the TS–352(*)/U meter. Tighten the locknut. *c.* Place the TT–259/FG POWER switch in the OFF position, disconnect the TS–352(*)/U test leads, and replace the shorting bar on the TT–259/FG BIAS TEST MA terminals. Note. Insulating material must be inserted between jack J4B (fig. 3–4) contacts when the LINE SELECTOR switch is in the TEST position.	*a.* None. *b.* None. *c.* None.
4	*RA–87–(*):* POWER switch: ON *BE–77–(*):* METER switch: MA Current switch: LOCAL CURRENT SUPPLY. Relay switch: RELAY OUT-OF CIRCUIT. LINE RHEOSTAT: midpoint rotation. *TT–76(*)/GGC:* SELECTOR switch: I KEYBOARD switch: LOCK. LIGHT switch: ON POWER switch: ON MOTOR switch: OFF.	POWER switch: ON. DC POWER switch: ON. LINE CURRENT rheostat: maximum counter clockwise. LINE SELECTOR switch: TEST.	*a.* Connect the equipment as shown in C, figure 3–4. *b.* Adjust the TT–259/FG LINE CURRENT rheostat for a 60-ma indication on the BE–77–(*) meter. If necessary, readjust the BE–77–(*) LINE RHEOSTAT until the above indication is obtained. *c.* Place the TT–76(*)/GGC KEYBOARD switch in the ON position. *d.* Set the TT–259/FG line-feed lever for double spacing (the position toward the front of the teletypewriter) and press the TT–76(*)/GGC LINE FEED key and a letter key several times. Observe the printed copy on the TT–259/FG. *e.* Set the TT–259/FG line-feed lever for single spacing (the position toward the rear of the teletypewriter) and press the TT–76(*)/GGC LINE FEED key and a letter key several times. Observe the printed copy on the TT–259/FG. *f.* On the TT–76(*)/GGC, press the following keys in the order given: FIGS, CAR RET, LINE FEED, 1, 2, 3, 4, CAR RET, LINE FEED, 1, 2, 3, CAR RET, LINE FEED, 1, 2, CAR RET, LINE FEED, 1, CAR RET, LINE FEED. Note the position of the figure 1 in each line on the TT–259/FG. *g.* On the TT–76(*)/GGC, press the FIGS key, then the spacebar several times. Note the operation of the platen on the TT–259/FG. *h.* Press the TT–76(*)/GGC FIGS and LTRS keys alternately several times. Note the operation of the platen on the TT–259/FG.	*b.* None. *c.* None. *d.* The printed copy should indicate that the platen moves the paper two lines each time the LINE FEED key is pressed. *e.* The printed copy should indicate that the platen moves the paper one line each time the LINE FEED key is pressed. *f.* The figure 1 should be in a straight line vertically at the left margin and single spaced. *g.* The platen should rise to the upper case and remain there. *h.* The platen should rise to the figures position when the FIGS key is pressed and return to the letters position when the LTRS key is pressed. The action will be distinct, with no indication of binding.
			i. Check the motor stop by pressing the TT–76(*)/GGC FIGS key, then the H (STOP) key. Note the TT–259/FG motor stop operation. *j.* On the TT–76(*)/GGC, press the BREAK switch, then release it. Note the TT–259/FG motor stop operation. *k.* Repeat *i* and *j* above several times. *l.* While the motor of the TT–259/FG is running, press the TT–76(*)/GGC BREAK switch and hold it down for several seconds. Note the operation of the TT–259/FG. *m.* Press the TT–76(*)/GGC FIGS key; then press the TT–259/FG LTRS key. *n.* Press the TT–76(*)/GGC LINE FEED then the CAR RET keys; then press and hold down a letter key and the REPEAT key until the automatic carriage-return function has been performed at least twice. Note the TT–259/FG printed copy. *o.* On the TT–259/FG, press and hold down the manual space button several seconds, then press the CAR RET button. Repeat the operation several times and note the carriage movement. *p.* On TT–259/FG, wind the ribbon manually, almost to the end of the spool. This can be done by holding one end of the ribbon-reverse beam midway between its upper and lower positions and turning one of the ribbon spool locks by hand. On TT–76(*)/GGC, press keys at random and observe the ribbon-reverse mechanism on the TT–259/FG. This is to be done in both directions. *q.* Press the TT–76(*)/GGC keys at random and note the operation of the TT–259/FG ribbon lifter and the ribbon movement.	*i.* The TT–259/FG motor should stop. *j.* The TT–259/FG motor should not start until the BREAK switch is released and then it must start. *k.* Same as *i* and *j* above. *l.* The TT–259/FG will run open, without typing, as long as the BREAK switch of the TT–76(*)/GGC is held in the BREAK position (down). *m.* The platen of the TT–259/FG should rise to the figures position, then return to the letters position when the TT–259/FG LTRS key is pressed. *n.* The TT–259/FG printed copy should indicate that the 74th character is printed about one-third the distance from the right marking after the carriage-return and line-feed operation. This will be followed by another line-feed operation and another character, printed about 1 inch from the left margin, followed by still another line-feed operation. The carriage moves on to the left margin and the next character starts the new line. *o.* The carriage will move from the left to the right while the manual space button is held down and will return to the left margin when the manual CAR RET button is pressed. *p.* The ribbon-reverse mechanism should operate and reverse the direction of the ribbon movement as soon as the spool empties in either direction. *q.* The ribbon on the TT–259/FG should be lifted high enough to permit printing each character. The ribbon should drop below the printed line after each character is printed. Ribbon feed should take place and be even each time a character is printed.
			r. Place the TT–76(*)/GGC POWER switch in the OFF position and remove the TR send (black) plug from the BE–77–(*) jack. Insert the TS–383(*)/GG signal line plug into the BE–77–(*) jack. On the TT–259/FG, remove the test lead from signal line terminal 5 and connect it to signal line terminal 4; remove the test lead from signal line terminal 2 and connect it to signal line terminal 1. Note. When performing this test, the insulating material (installed as part of step 4 above) must be removed from between the contacts of jack J4B.	*r.* None.
5	Same as last indicated at the end of step 4, except: *TS–383(*)/GG:* MOTOR switch: ON RUN-STOP switch: STOP LINE-DIST switch: DIST BIAS-REND DIST switch: neutral. VIEW-TRANSMIT switch: TRANSMIT MARK-ZERO-SPACE switch: ZERO STOP PULSE switch: ON Character selecting switch: TEST MESSAGE.	Same as step 4, except: LINE SELECTOR switch: 20	*a.* Adjust the TT–259/FG LINE CURRENT rheostat for a 20-ma indication of the BE–77–(*) meter. If necessary readjust the BE–77–(*) LINE RHEOSTAT until the above requirement is met. *b.* Place the TS–383(*)/GG RUN-STOP switch in the RUN position. *c.* Rotate the TT–259/FG rangefinder dial slowly, toward the upper limit of its range, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the upper range limit. *d.* Rotate the TT–259/FG rangefinder dial slowly, toward the lower limit of its range until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the lower range limit. *e.* Subtract the figure recorded in *d* above from the figure recorded in *c* above to obtain the range of the TT–259/FG. *f.* Place the TS–383(*)/GG RUN-STOP switch in the STOP position and the TT–259/FG LINE SELECTOR switch to 60. *g.* Adjust the TT–259/FG LINE CURRENT rheostat for a 60-ma indication on the BE–77(*) meter. If necessary readjust the BE–77–(*) LINE RHEOSTAT until the above requirement is met. *h.* Place the TS–383(*)/GG RUN-STOP switch in the RUN position. *i.* Repeat *c*, *d*, and *e* above. Divide the range by 2; then add this figure to the low limit or subtract it from the upper limit and set the rangefinder dial at this point. *j.* Place the TS–383(*)/GG RUN-STOP switch in the STOP position and the MOTOR switch in the OFF position. *k.* Place the TT–76(*)/GGC POWER switch in the ON position and insert the TR send (black) plug into the BE–77–(*) jack. *l.* Repeat *g* above. *m.* Type the following test message on TT–76(*)/GGC so that five lines will be printed on the TT–259/FG: THE QUICK BROWN FOX JUMPED OVER A LAZY DOG'S BACK 1234567890. Check the TT–259/FG printed copy with the tape from the TT–76(*)/GGC.	*a.* None. *b.* None. *c.* The range should not be less than: (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisions on the rangefinder dial for 100-wpm operation. *f.* None. *g.* None. *h.* None. *i.* Same as *c* above. *j.* None. *k.* None. *l.* None. *m.* The TT–259/FG printed copy should be identical with the TT–76(*)/GGC tape and should be error free. The letters should be evenly spaced in straight lines vertically and horizontally. The lines should be single spaced.

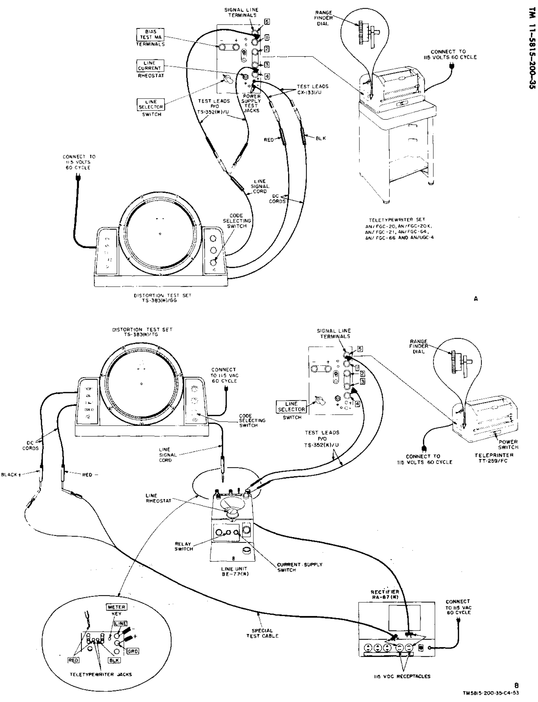

Figure 2-5. Receiving bias and distortion tests.

3–8. Receiving Bias and Distortion Tests

(fig. 3–5)

a. Test and Other Equipment.

Distortion Test Set TS–383(*)/GG
Rectifier RA–87–(*)[a]
Line Unit BE–77–(*)[a]

b. Test Connections and Conditions. Connect the test and other equipment (except the TT–259/FG) as shown in A, figure 3–5. If the unit to be tested is a Teleprinter TT–259/FG, connect the TT–259/FG and the test and other equipment as shown in B, figure 3–5. Adjust the TT–259/FG LINE CURRENT rheostat for a 60-ma indication on the BE–77–(*) meter. If necessary, readjust the BE–77–(*) LINE RHEOSTAT until the requirement is met.

c. Test Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	*TS–383(*)/GG:* RUN-STOP switch: STOP LINE-DIST switch: DIST BIAS-END DIST switch: Neutral VIEW-TRANSMIT switch: VIEW MARK-ZERO-SPACE switch: ZERO Character selecting switch: R or Y STOP PULSE switch: ON MOTOR switch: ON RA–87–(*): [a] POWER switch: ON BE–77–(*): [a] METER switch: MA Current switch: LOCAL CURRENT SUPPLY Relay switch: RELAY OUT OF CIRCUIT	MOTOR switch: ON POWER switch: ON LINE SELECTOR switch: 60 DC POWER: ON SEND-LOCK switch: [b] LOCK	*a.* Observe illuminations on the TS–383(*)/GG scale. The neon lamp should be lighted for 100 scale divisions for each selected marking impulse and 142 scale divisions for the stop pulse.	*a.* None.
			b. Set the TS–383(*)/GG RUN-STOP switch to RUN, the VIEW-TRANSMIT switch to TRANSMIT, and the character selecting switch to TEST MESSAGE.	*b.* None.
			c. Rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the upper range limit.	*c.* None.
			d. Rotate the rangefinder dial slowly, toward the lower limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the lower range limit.	*d.* None.
			e. Subtract the lower range limit (*d* above) from the upper range limit (*c* above) and record this figure as the range of the teletypewriter. Divide the range by 2; then add this figure to the low limit or subtract it from the upper limit and set the rangefinder dial at this point.	*e.* The range should not be less than: (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisons on the rangefinder dial for 100-wpm operation.
2	Same as step 1 except: TS–383(*)/GG: BIAS-END DIST switch: BIAS MARK-ZERO-SPACE switch: MARK	Same as last indicated in step 1 above.	*a.* Adjust the TS–383(*)/GG distortion control until the mark pulses (portions of the scale where the lamp is lighted) occupy: (1) 135 scale divisions for 60-wpm operation. (2) 130 scale divisions for 100-wpm operation.	*a.* None.
			b. Set the TS–383(*)/GG RUN-STOP switch to RUN, the VIEW-TRANSMIT switch to TRANSMIT, and the character selecting switch to TEST MESSAGE.	*b.* None.
			c. Rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the upper range limit.	*c.* None.
			d. Set the TS–383(*)/GG MARK-ZERO-SPACE switch to SPACE.	*d.* None.
			e. Rotate the rangefinder dial slowly, toward the lower limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indications as the lower range limit.	*e.* None.
			f. Compute the maximum bias that may be received as follows: (1) For 60-wpm operation: maximum bias = upper range − lower range $35+\frac{(c\text{ above})\quad(e\text{ above})}{2}$ (2) For 100-wpm operation: maximum bias = upper range − lower range $30+\frac{(c\text{ above})\quad(e\text{ above})}{2}$	*f.* The maximum bias should not be less than: (1) 40 percent for 60-wpm operation. (2) 35 percent for 100-wpm operation.
3	Same as step 1 except: TS–383(*)/GG: BIAS-END DIST switch: END DIST MARK-ZERO-SPACE switch: SPACE	Same as last indicated in step 2 above.	*a.* Adjust the TS–383(*)/GG distortion control until the mark pulses (portions of the scale where the lamp is lighted) occupy: (1) 65 scale divisions for 60–wpm operation. (2) 70 scale divisions for 100–wpm operation.	*a.* None.
			b. Set the TS–383(*)/GG RUN-STOP switch to RUN, the VIEW-TRANSMIT switch to TRANSMIT, and the character selecting switch to TEST MESSAGE.	*b.* None.
			c. Rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the upper range limit.	*c.* None.
			d. Set the TS–383(*)/GG MARK-ZERO-SPACE switch to MARK.	*d.* None.
			e. Rotate the rangefinder dial slowly, toward the lower limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the dial indication as the lower range limit.	*e.* None.
			f. Compute the maximum end distortion that may be received as follows: (1) For 60–wpm operation: Maximum end distortion = upper range − lower range $35+\frac{(c\text{ above})\quad(e\text{ above})}{2}$ (2) For 100–wpm operation: Maximum end distortion = upper range − lower range $30+\frac{(c\text{ above})\quad(e\text{ above})}{2}$	*f.* Maximum end distortion should not be less than— (1) 35 percent for 60–wpm operation. (2) 30 percent for 100–wpm operation.
			g. Add the figure recorded in step 2*c* to the figure recorded in step 2*e* and divide the sum by 2. Record the answer as the bias tolerance orientation point.	*g.* None.
			h. Add the figure recorded in *c* above to the figure recorded in *e* above and divide the sum by 2. Record the answer as the end distortion orientation point.	*h.* None.
			i. The internal bias can be determined by comparing the bias tolerance orientation point figure obtained in *g* above with the end distortion orientation point figure obtained in *h* above.	*i.* The difference between the two figures should not exceed 6 points.

[a] Use when testing Teleprinter TT–259/FG.
[b] Not applicable to Teleprinter TT–259/FG.

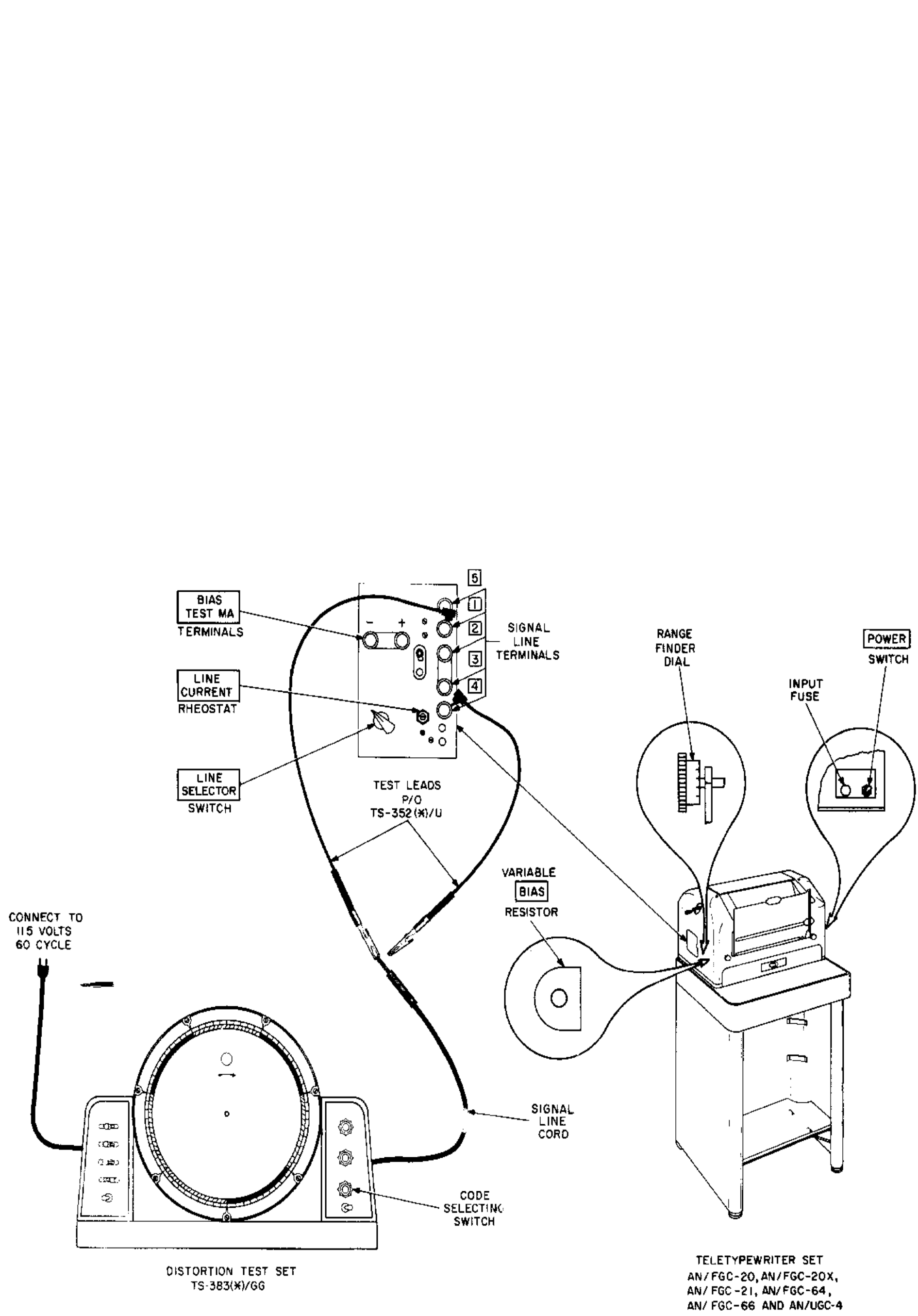

Figure 3-6. Transmitting bias tests.

3–9. Transmitting Bias Tests (Not Applicable to TT–259/FG)

(fig. 3–6)

a. Test Equipment. Distortion Test Set TS–383(*)/GG

b. Test Connections and Conditions. Connect the equipment as shown in figure 3–6.

c. Test Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	*TS–383(*)/GG:* MOTOR switch: ON RUN-STOP switch: RUN LINE-DIST switch: DIST. BIAS-END DIST switch: neutral. VIEW-TRANSMIT switch: TRANSMIT. MARK-ZERO-SPACE switch: ZERO. Character selecting switch: R or Y. STOP PULSE: ON	MOTOR switch: ON POWER switch: ON DC POWER switch: ON LINE SELECTOR switch: 60. SEND-LOCK switch: LOCK.	*Note.* The following tests are to be made while continuously sending R or Y signals from the TS-383(*)/GG.	
			a. Rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to show in the printed copy. Stop turning the dial and record the dial indication as the upper range limit.	*a.* None.
			b. Rotate the rangefinder dial slowly, toward the lower limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the scale indication as the lower range limit.	*b.* None.
			c. Subtract the lower range limit (*b* above) from the upper range limit (*a* above) and record this figure as the range.	*c.* The range should not be less than: (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisions on the rangefinder dial for 100-wpm operation.
			d. Add the figure recorded in *a* above to the figure recorded in *b* above, divide the sum by 2 and record this figure for use in step 2.	*d.* None.
			e. Place the TS–383(*)/GG MOTOR switch in the OFF position and disconnect the TS–383(*)/GG from the equipment being tested.	*e.* None.
2	N/A	MOTOR switch: ON POWER switch: ON DC POWER switch: ON SEND-LOCK switch: SEND LINE SELECTOR switch: TEST	*Note.* The following tests are to be made while continuously sending R or signals from the teletypewriter keyboard. Hold the R or Y key and the YREPEAT key depressed.	
			a. Rotate the rangefinder dial slowly, toward the upper limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the scale indication as the upper range limit.	*a.* None.
			b. Rotate the rangefinder dial slowly, toward the lower limit of its scale, until errors begin to appear in the printed copy. Stop turning the dial and record the scale indication as the lower range limit.	*b.* None.
			c. Subtract the lower range limit (*b* above) from the upper range limit (*a* above) and record this figure as the range of the teletypewriter.	*c.* The range should not be less than— (1) 72 divisions on the rangefinder dial for 60-wpm operation. (2) 60 divisions on the rangefinder dial for 100-wpm operation.
			d. Add the figure recorded in *a* above to the figure recorded in *b* above and divide the sum by 2. Record this figure and set the rangefinder dial at this figure.	*d.* None.
			e. The keyboard bias is obtained by comparing the figure obtained in step 1*d* with the figure obtained in *d* above.	*e.* The difference should not exceed 6 points.
			f. Place the teletypewriter POWER switch in the OFF position. Disconnect the power cord and replace the cover nut on the LINE CURRENT rheostat.	*f.* None.

3–10. Summary of Performance Standards

Note. When testing Teleprinter TT–259/FG, omit performance standards that pertain to the keyboard of the teletypewriter.

Personnel may find it convenient to arrange the checklist in a manner similar to that shown below.

TELETYPEWRITER SETS AN/FGC–20, AN/FGC–20X, AN/FGC–21, AN/FGC–64, AN/FGC–66, AND AN/UGC–4, AND TELEPRINTER TT–259/FG

	Performance standard
1. INSULATION RESISTANCE TEST	
a. Between the base casting and each prong of the input plug.	*a.* Not less than 5 megohms resistance.
b. Between the base casting and signal line terminal 4.	*b.* Not less than 5 megohms resistance.
2. MOTOR TEST	
a. Motor speed adjustment (series-governed motor).	*a.* Not more than three white target spots pass any given point in any direction in 10 seconds.
b. Motor stop (standard communication keyboards).	*b.* The motor should stop when the H(STOP) key is pressed after the FIGS key is pressed.
c. Motor stop (weather communication keyboards).	*c.* Motor should stop when the H(STOP) key is pressed after the FIGS and the BLANK keys are pressed.
d. Motor start.	*d.* After *b* and *c* above, the motor should start when the BREAK switch is placed in the BREAK position then returned to the LINE position.
3. OPERATIONAL TEST	
a. Printing.	*a.* Teletypewriter should print at least 10 lines of perfect copy.
b. Type alinement.	*b.* Each line of the printed characters should be straight and evenly spaced.
c. SEND-LOCK switch.	*c.* Keyboard transmitter will operate, but no function will be performed by the typing unit.
d. Orientation range limits (20- or 60-ma operation).	*d.* Orientation range limits should not be less than— (1) 72 scale divisions at 60 wpm. (2) 60 scale divisions at 100 wpm.
e. Single line-feed operation.	*e.* With the line-feed lever in the rear position, the paper should advance one line when the LINE FEED key is pressed.
f. Double line-feed operation.	*f.* With the line-feed lever in the forward position, the paper should advance two lines when the LINE FEED key is pressed.
g. Signal bell operation.	*g.* The signal bell should ring each time the S (BELL) key is pressed after the FIGS key is pressed.
h. Carriage-return operation.	*h.* Carriage should return to left margin when CAR RET is pressed.
i. Copy lights.	*i.* The lamps should light when the LIGHT switch is in the ON position.
j. Break operation.	*j.* Teletypewriter should run open without typing as long as the BREAK switch is held in the BREAK position.
k. Manual LTRS operation.	*k.* Platen, in figures position, will shift to LTRS position when the manual LTRS button is pressed.
l. LTRS and FIGS shift.	*l.* The platen should rise each time the FIGS key is pressed and should move down (after FIGS) when the LTRS key is pressed.
m. Margin bell.	*m.* The margin bell should ring when the 66th character is printed.
n. REPEAT key operation.	*n.* Teletypewriter will repeat any character or function, except CAR RET, when the REPEAT key and the character of function keys are held down.
o. Automatic carriage return.	*o.* Carriage should return to the left margin automatically when the 72d (standard) or 76th (weather) character is received by the typing unit.
p. Manual carriage return.	*p.* Carriage should return to the left-hand margin when the manual CAR RET button is pressed.
q. Manual space operation.	*q.* Carriage should move from left to right while the manual space button is held depressed.
r. Ribbon reverse.	*r.* The ribbon should reverse direction as soon as either spool empties.
s. Ribbon lift and feed.	*s.* The ribbon should be lifted high enough to provide inking for each printing operation and return below the line being printed and should feed evenly with each typing operation.
4. BIAS AND END DISTORTION TEST	
a. Range (zero distortion).	*a.* At least 72 points.
b. Bias tolerance.	*b.* Not less than 40% for 60-wpm operation and not less than 35% for 100-wpm operation.
c. End distortion tolerance.	*c.* Not less than 35% for 60-wpm operation and not less than 30% for 100-wpm operation.
d. Internal bias tolerance.	*d.* Not more that 6 points.
e. Keyboard bias.	*e.* Not more than 5 points.

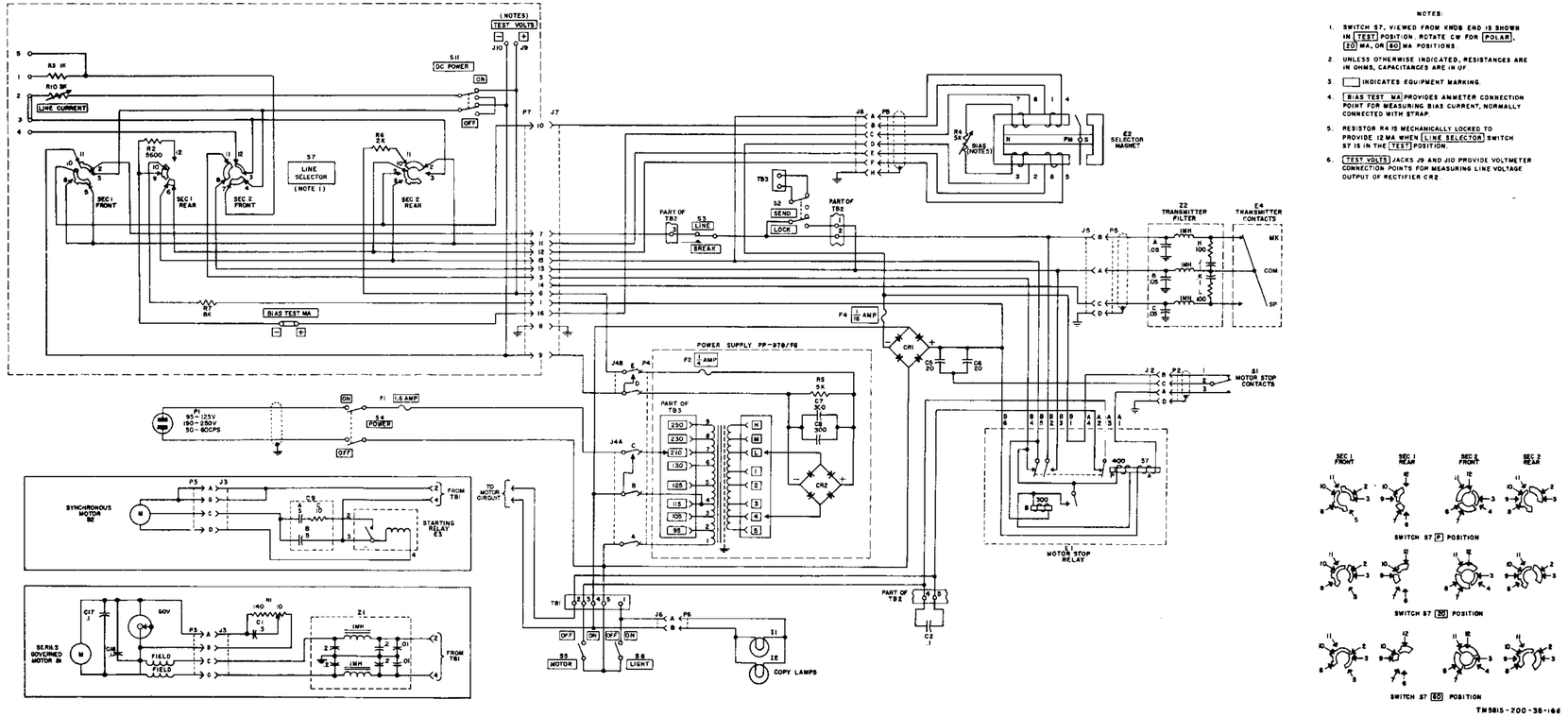

Figure 4-2. Teletypewriters TT-98A/FG and TT-98B/FG, TT-100/FG and TT-100B/FG and Power Supply PP-978/FG, schematic diagram.

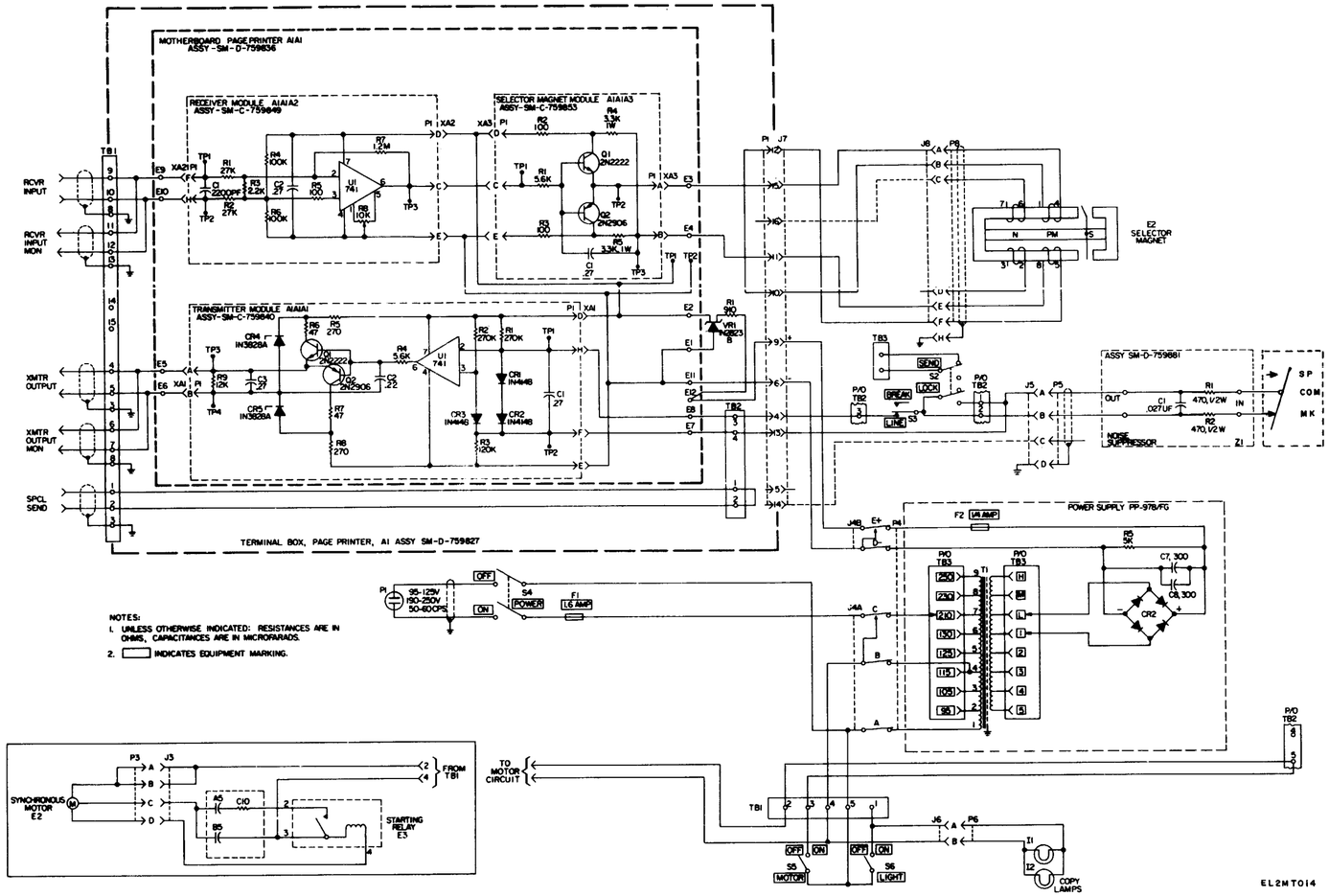

Figure 4-2.1 Teletypewriters TT-664(*)/FG, TT-665/FG, and TT-688(*)/FG, schematic diagram.

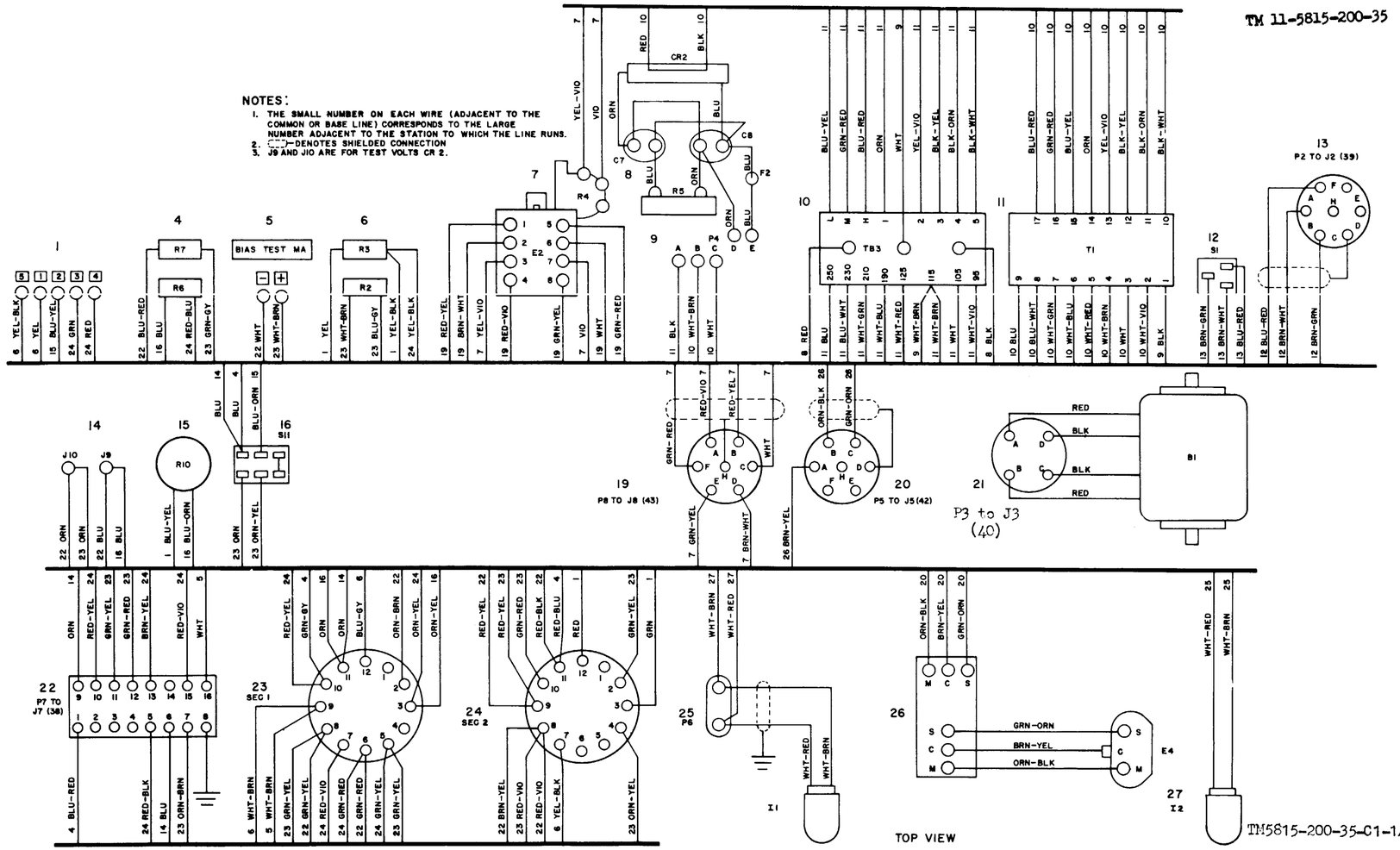

Figure 4-3. Teletypewriters TT-98A/FG and TT-98B/FG, TT-300/FG and Power Supply PP-978/FG, wiring diagram (part 1 of 2).

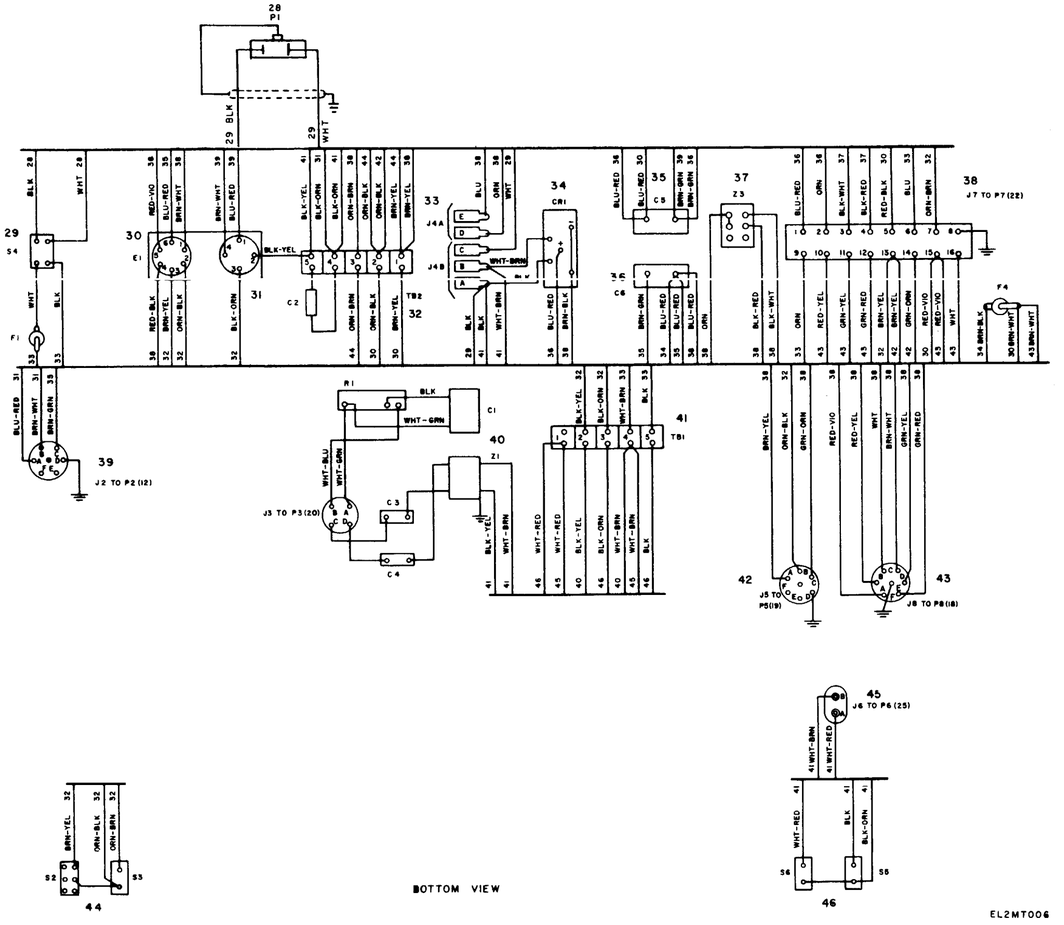

Figure 4-3. Teletypewriters TT-98A/FG and TT-98B/FG, TT-300/FG and Power Supply PP-978/FG, wiring diagram (part 2 of 2)

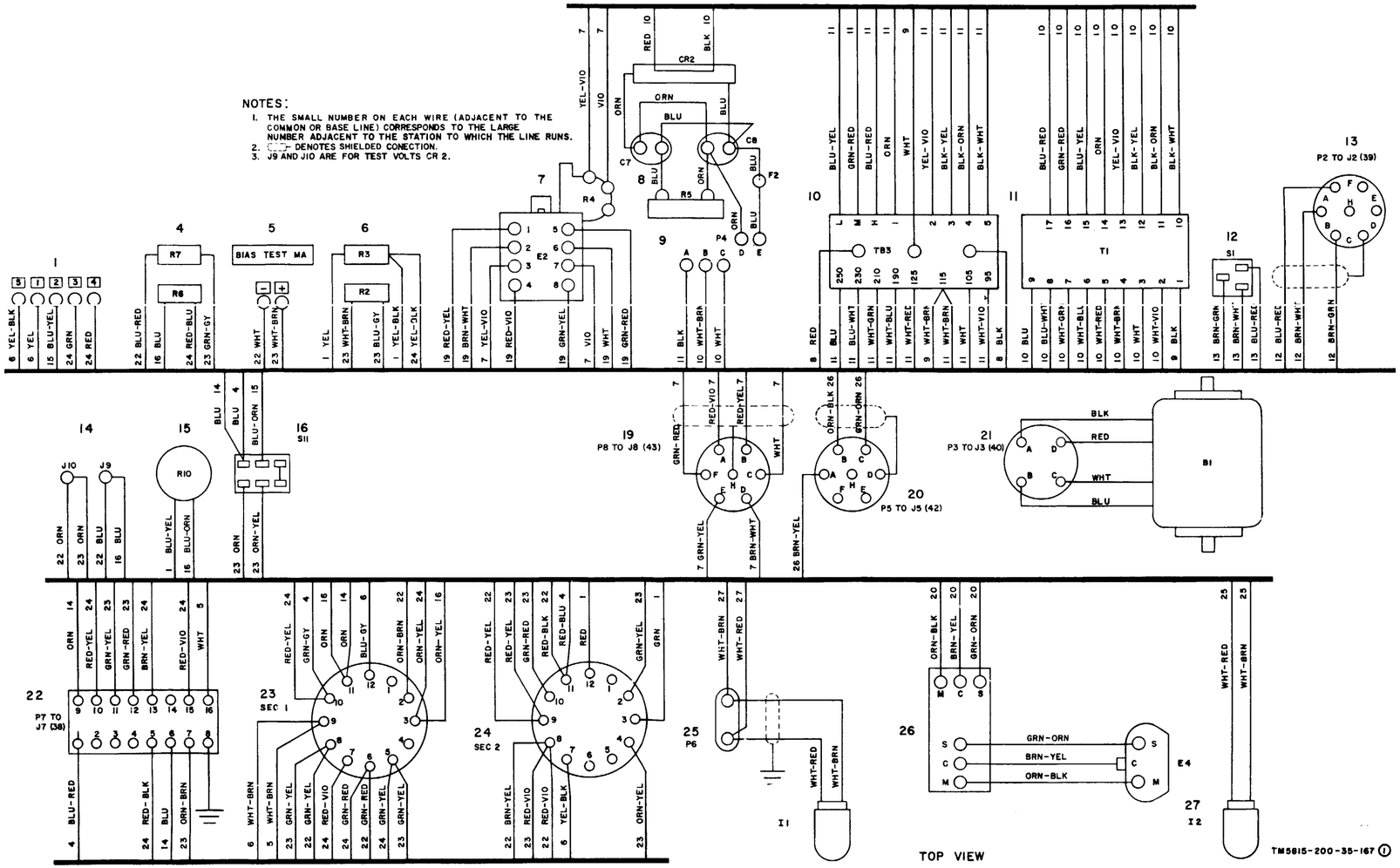

Figure 4-4. Tetetypewriters TT-100/FG and TT-100B/FG, and Power Supply PP-978/FG, wiring diagram (part 1 of 2).

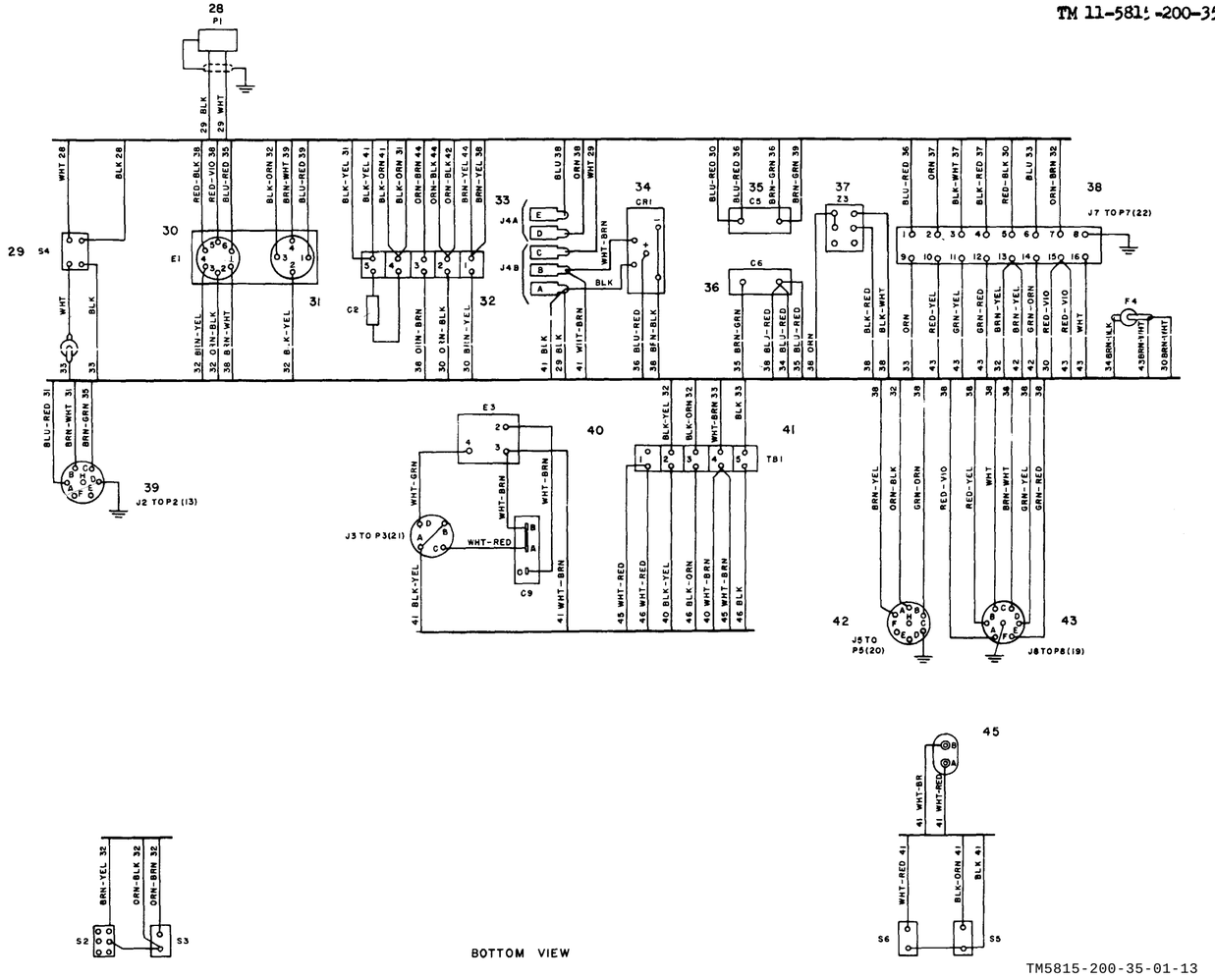

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Figure 4-4. Teletypewriters TT-100/FG and TT-100B/FG, and Power Supply PP-978/FG, wiring diagram (part 2 of 2)

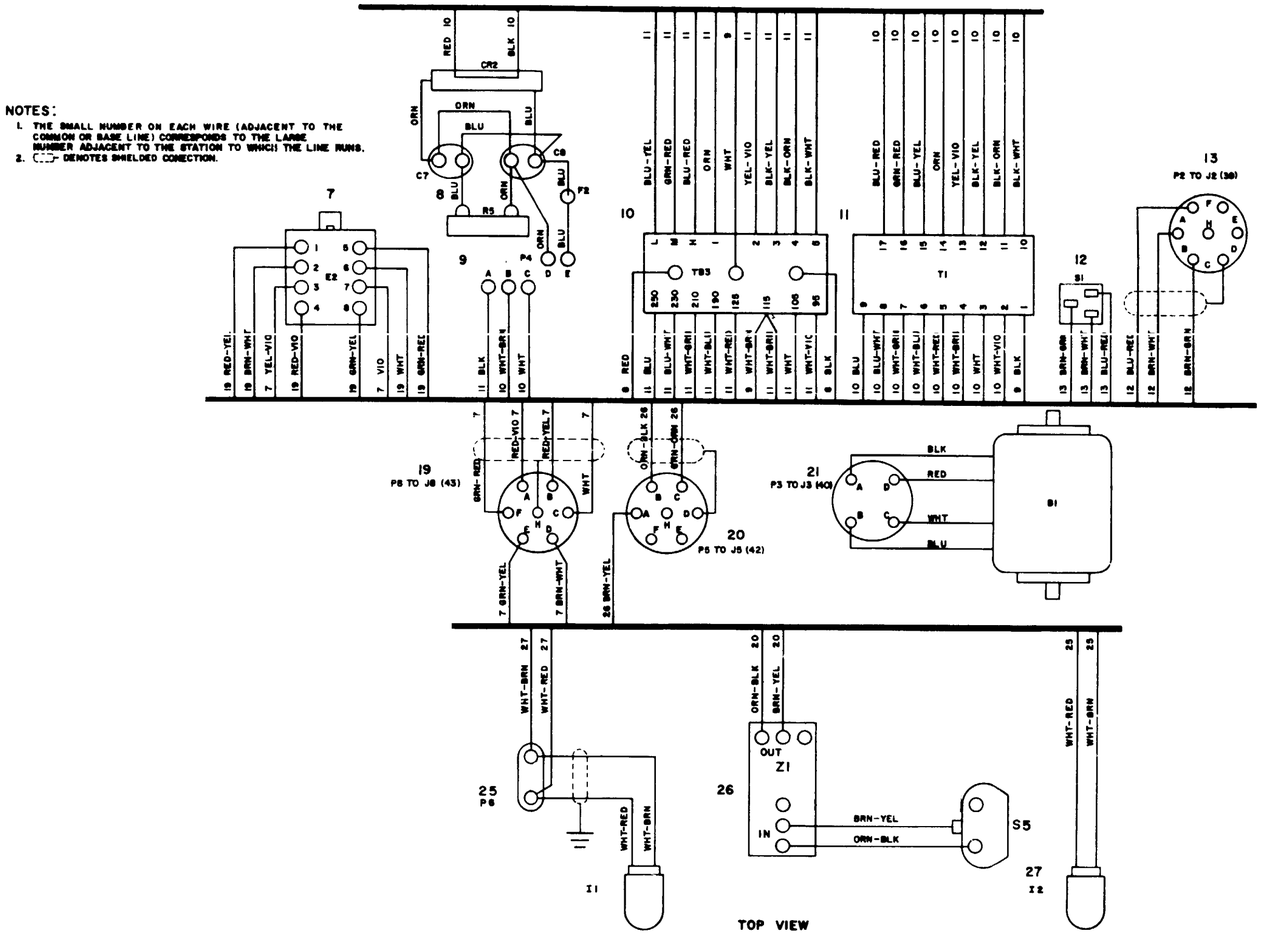

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Figure 4-4.1.(1) Teletypewriters TT-664(*)/FG and TT-665/FG and Power Supply PP-978/FG, wiring diagram.

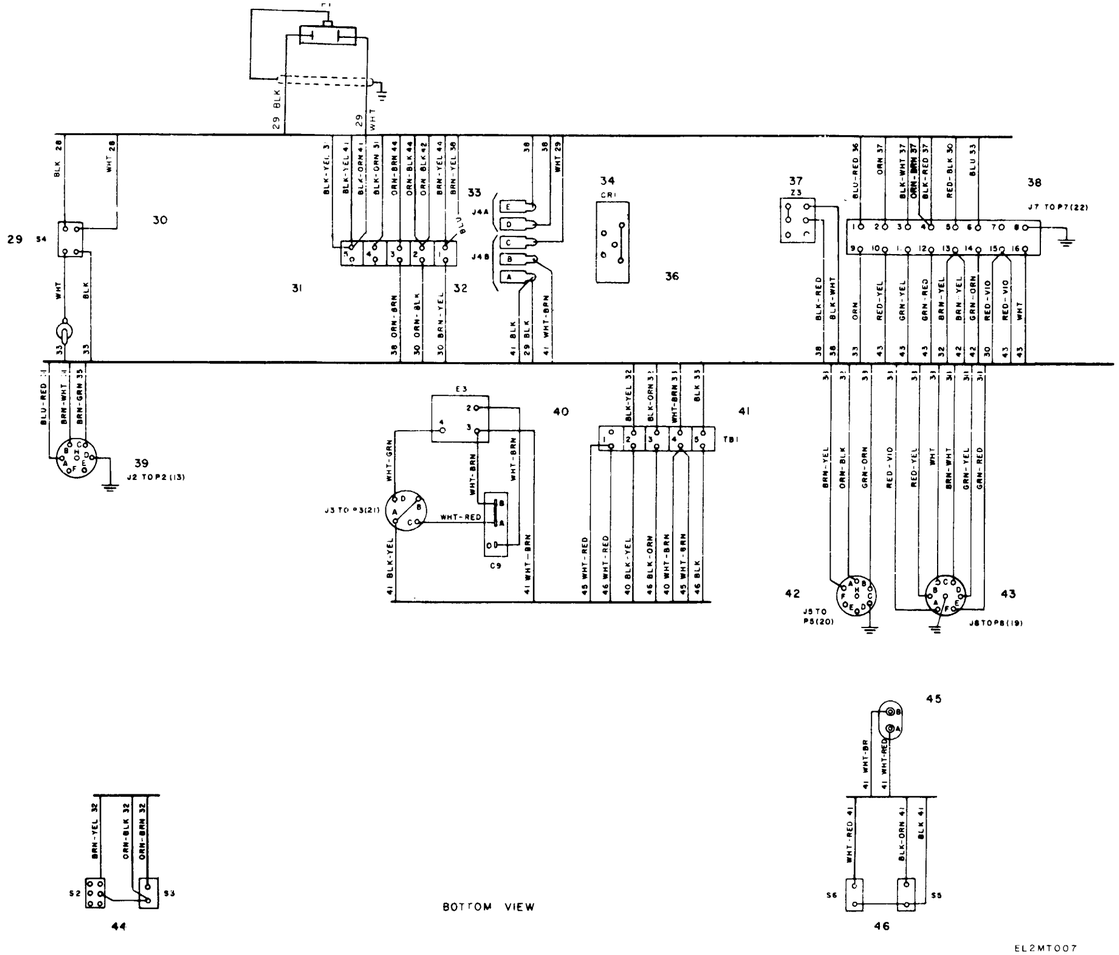


Figure 4-4.1.(2) Teletypewriters TT-664(*)/FG and TT-665/FG and Power Supply PP-978/FG, wiring diagram.

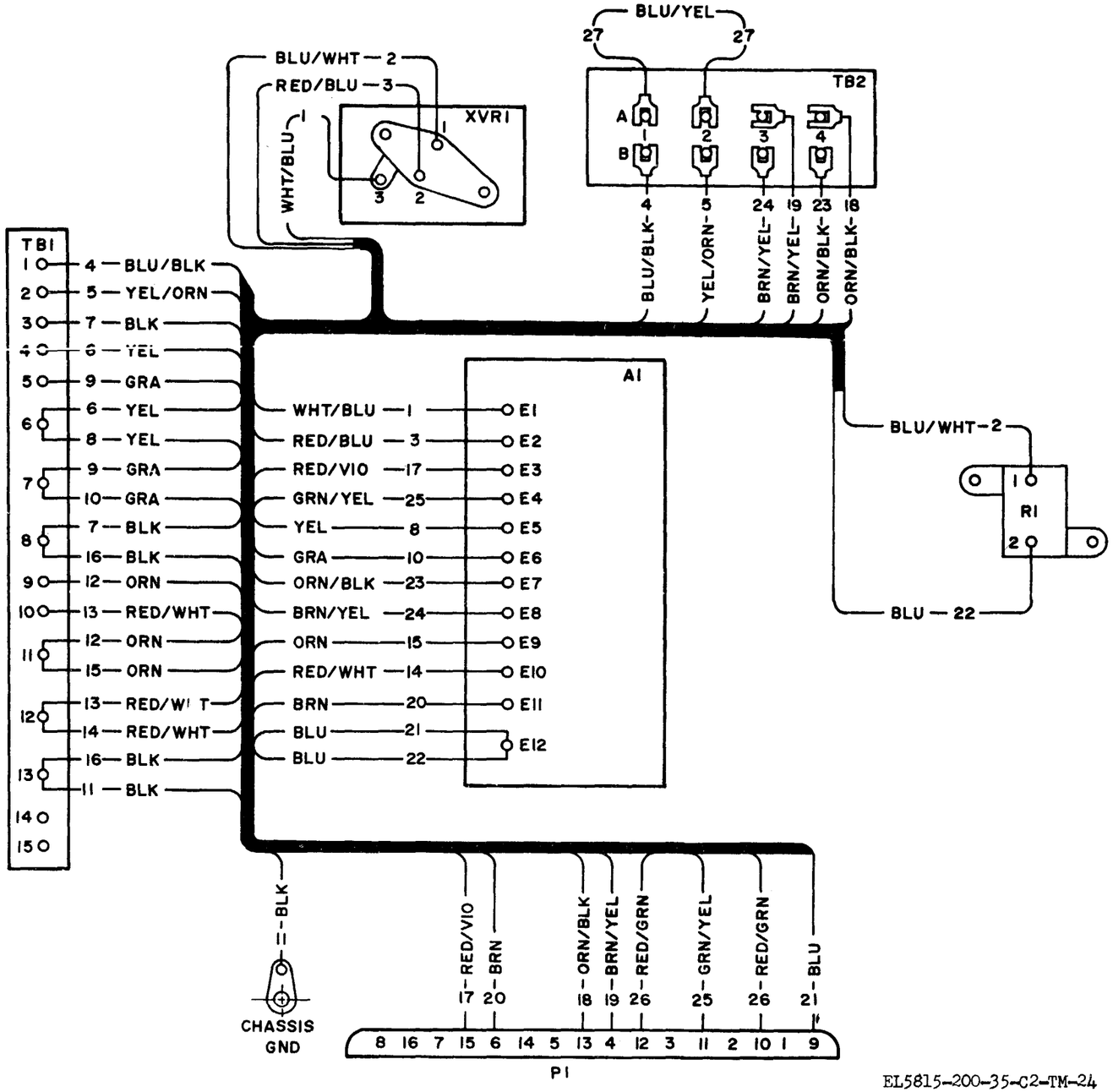


Figure 4-4.2. Teletypewriters TT-664(*)/FG and TT-665/FG terminal box, wiring diagram.

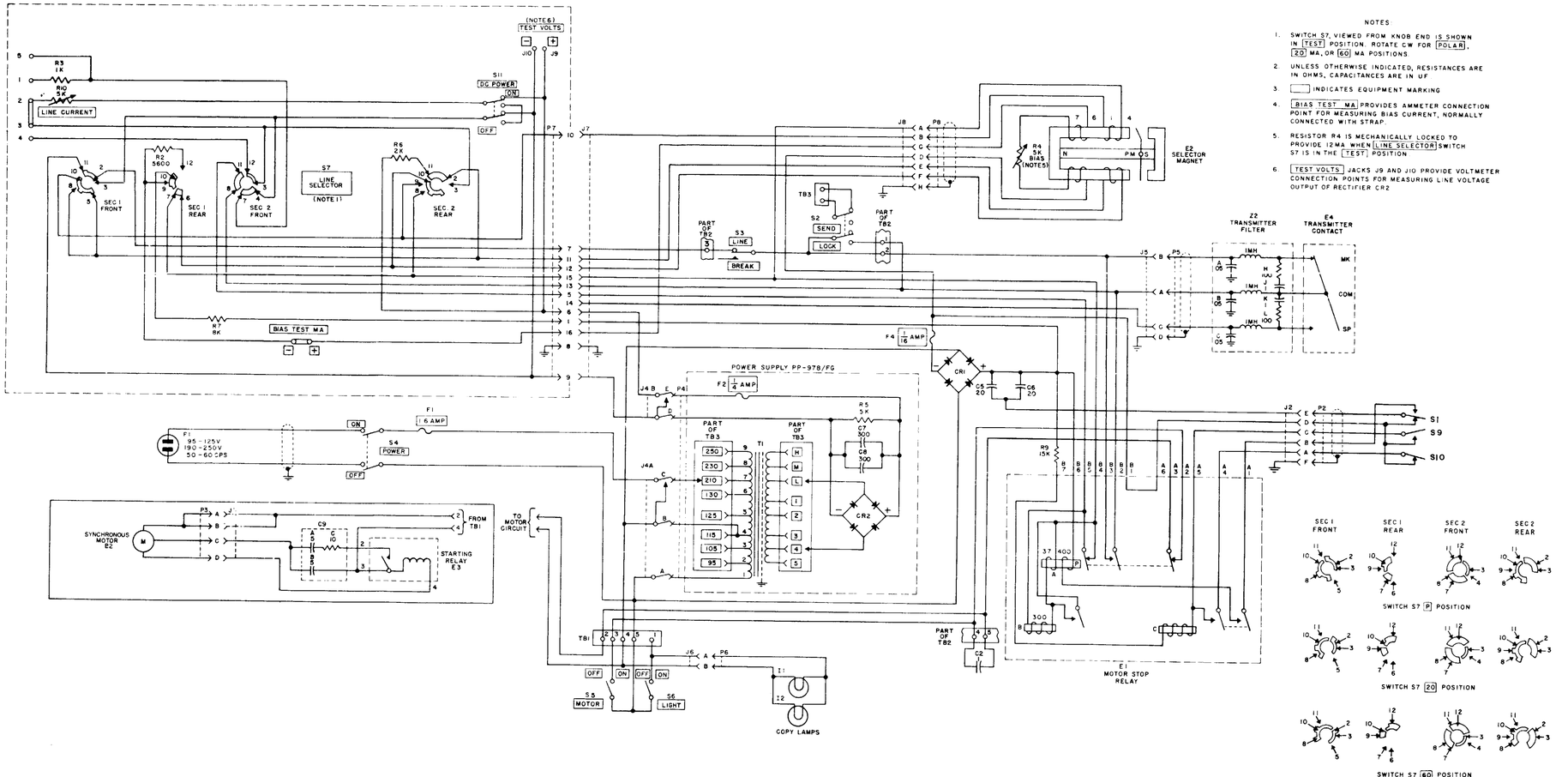


Figure 4-5. Teletypewriter TT-99/FG, and Power Supply PP-978/FG, schematic diagram.

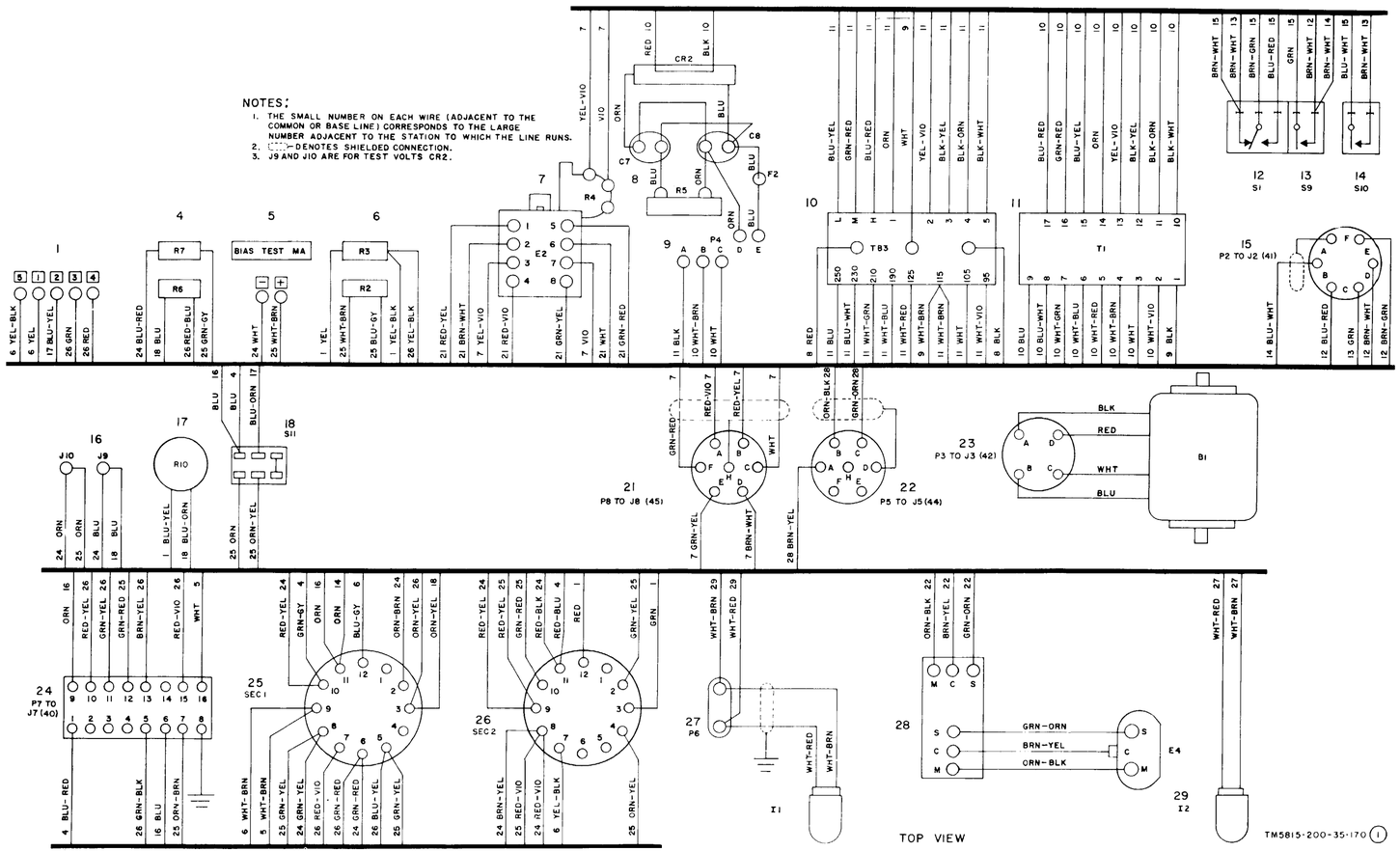


Figure 4-6. Teletypewriter TT-99/FG, and Power Supply PP-978/FG, wiring diagram (part 1 of 2).

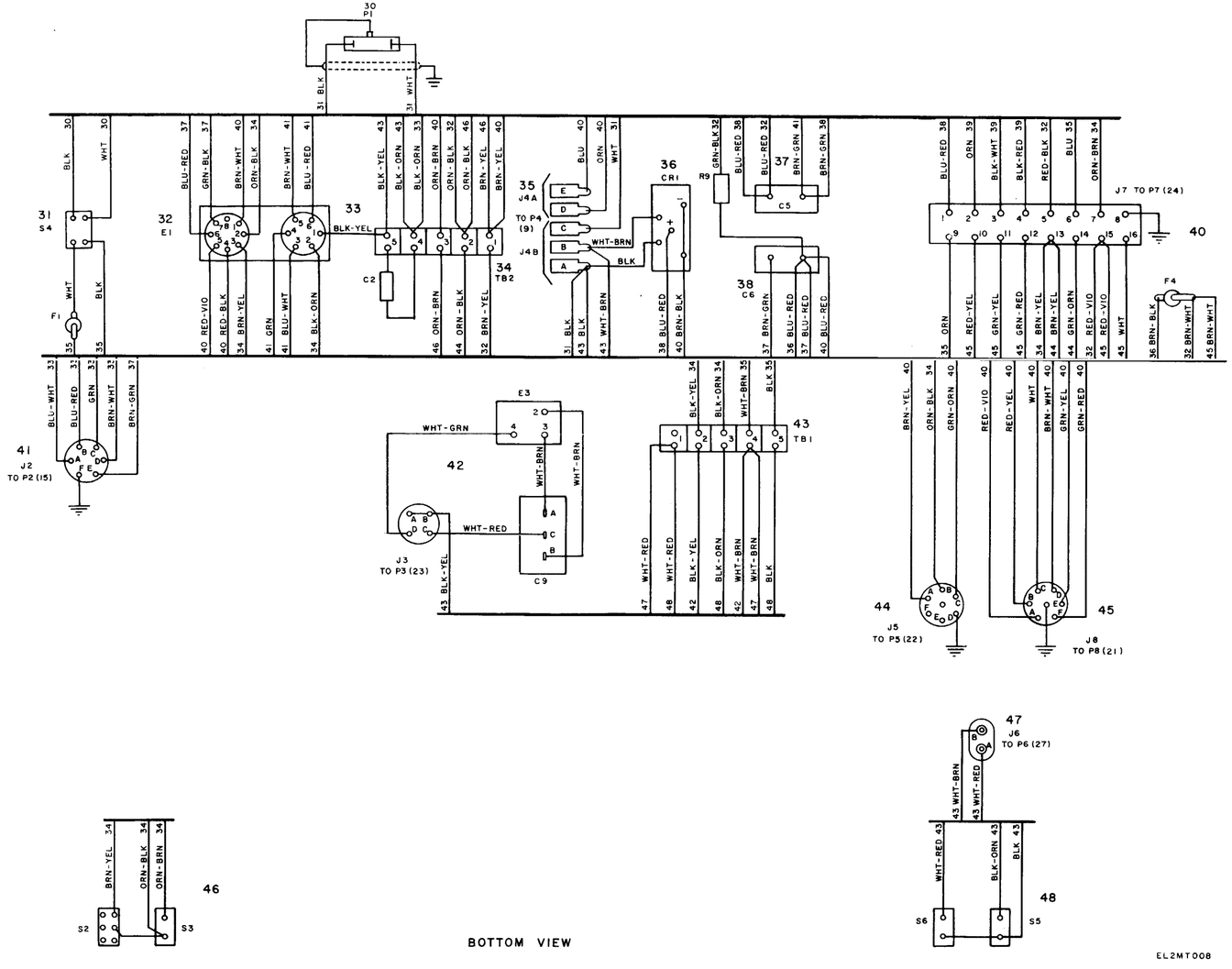
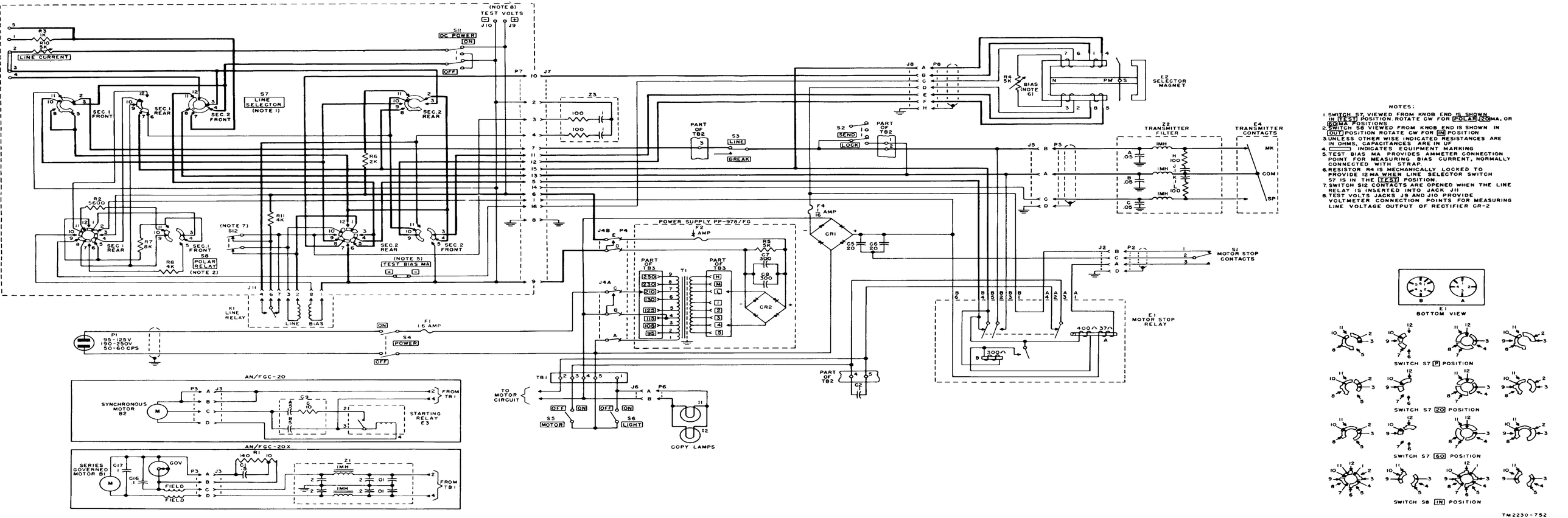


Figure 4-6. Teletypewriter TT-99/FG, and Power Supply PP-978/FG, wiring diagram (part 2 of 2)



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 OTHER WISE 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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BOTTOM VIEW

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Figure 4-7. Teletypewriter TT-98/FG and Power Supply PP-978/FG, schematic diagram.

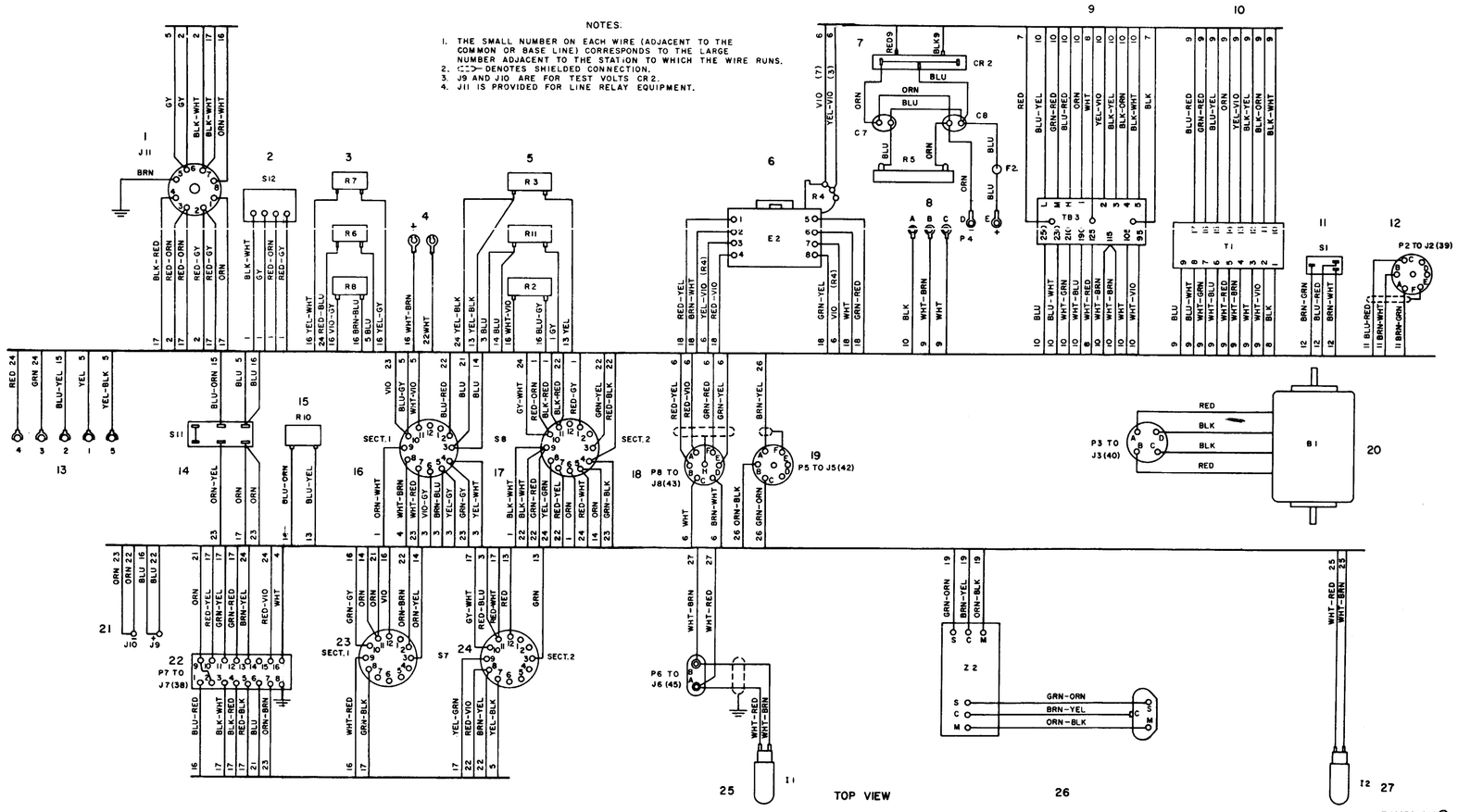


Figure 4-8. Teletypewriter TT-98/FG, and Power Supply PP-978/FG, wiring diagram (part 1 of 2).

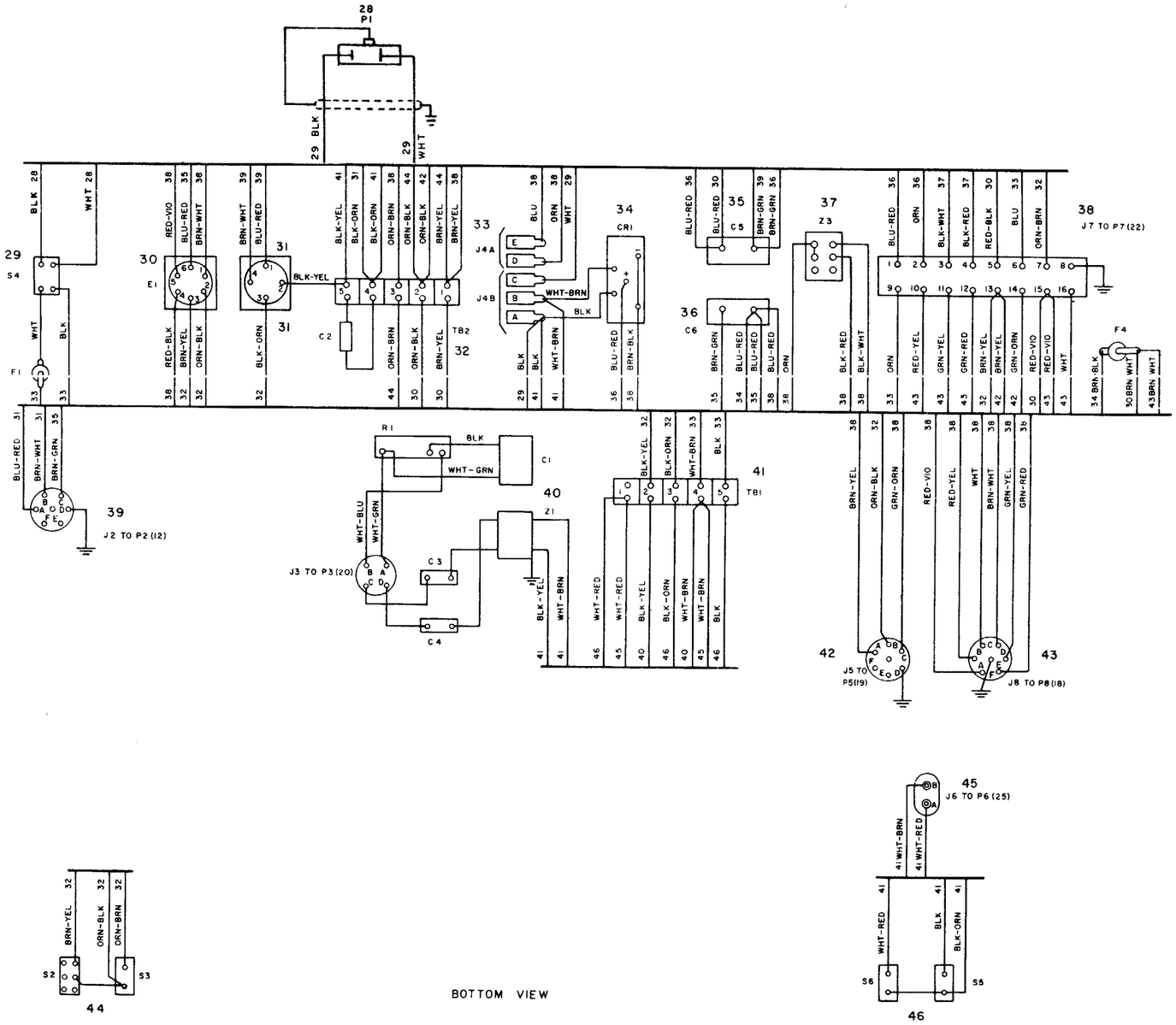


Figure 4-8. Teletypewriter TT-98/FG, and Power Supply PP-978/FG, wiring diagram (part 2 of 2).

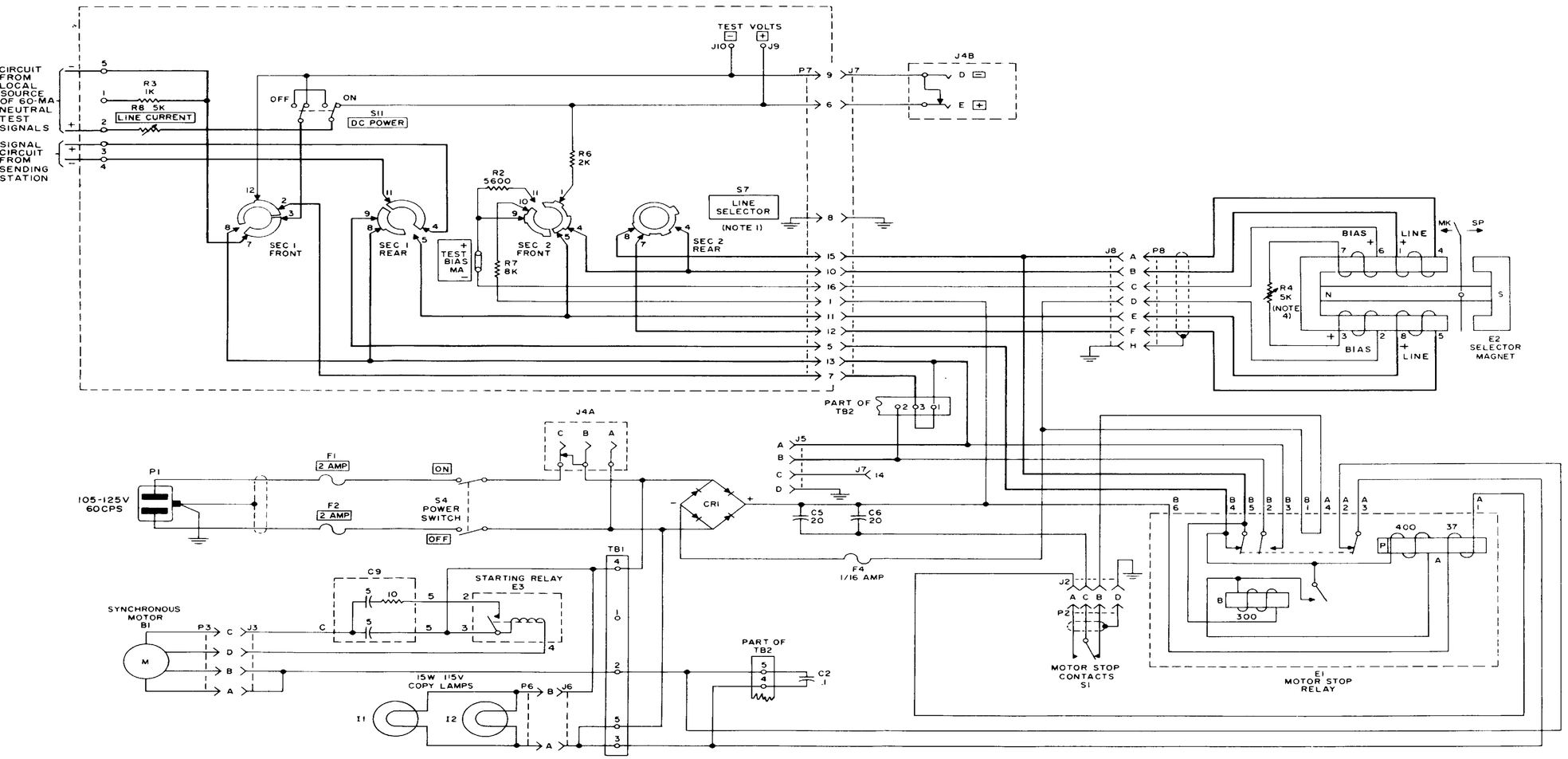
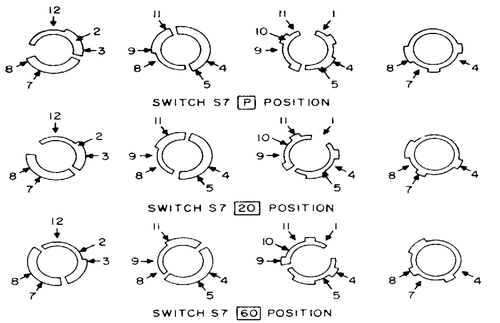


Figure 4–9. Teleprinter TT–259/FG, schematic diagram.

NOTES

1 SWITCH S7, VIEW FROM KNOB END IS SHOWN IN [TEST] POSITION. ROTATE CW FOR [POLAR], [20] MA, OR [60] MA POSITIONS.

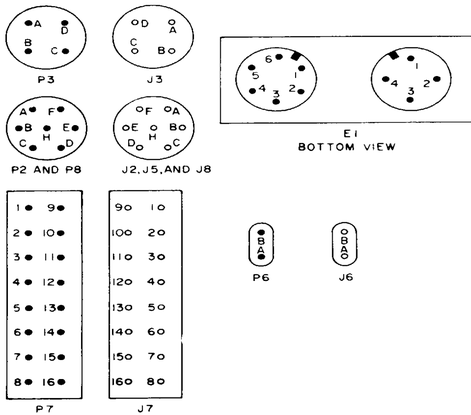


2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.

3. [ ] INDICATES EQUIPMENT MARKING.

4. RESISTOR R4 IS MECHANICALLY LOCKED TO PROVIDE 12 MA WHEN [LINE SELECTOR] SWITCH S7 IS IN THE [TEST] POSITION.

5. PLUGS AND JACKS VIEWED FROM PIN OR RECEPTACLE END



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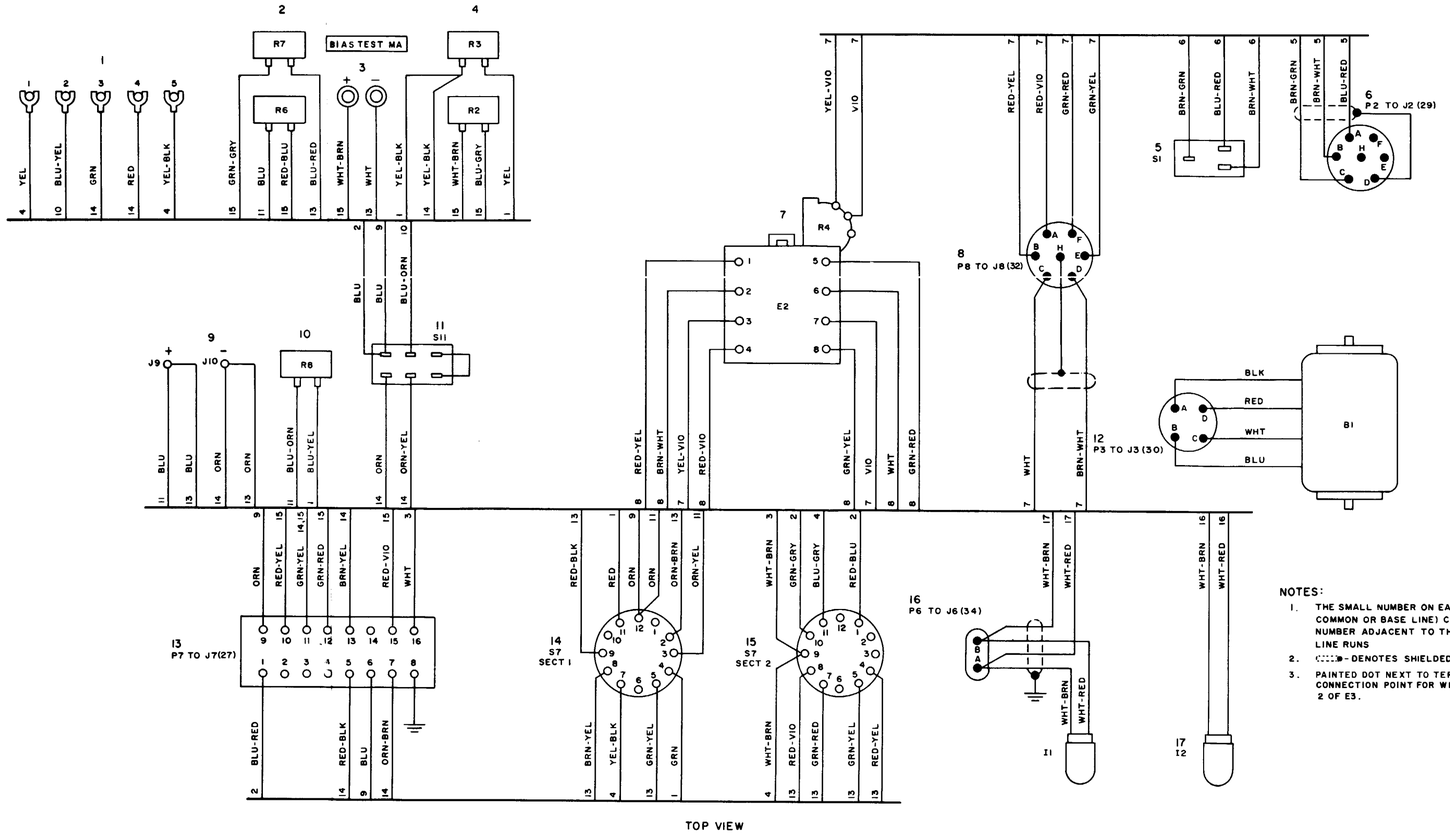


Figure 4-10. Teleprinter TT-259/FG, wiring diagram (part 1 of 2).

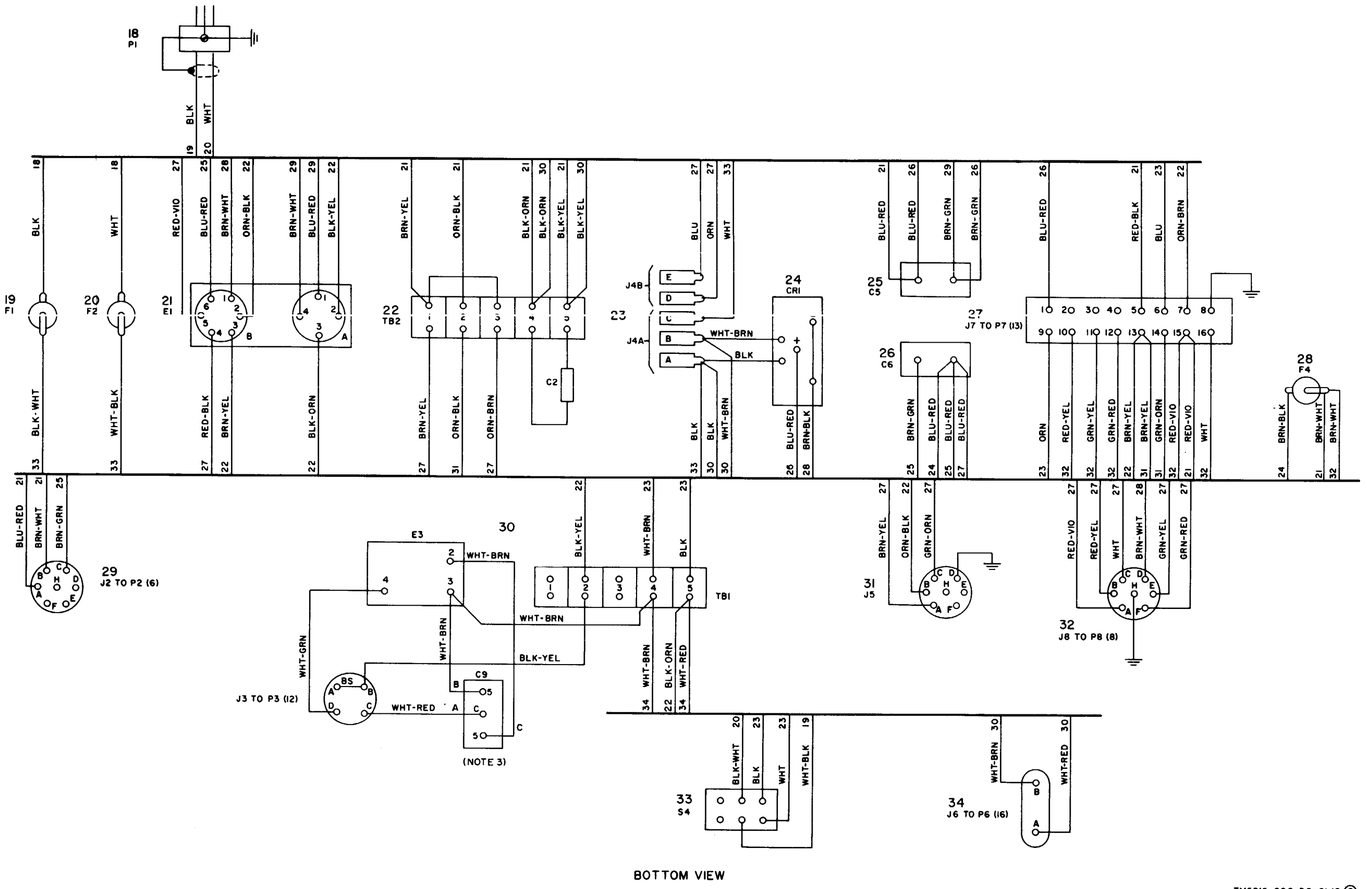
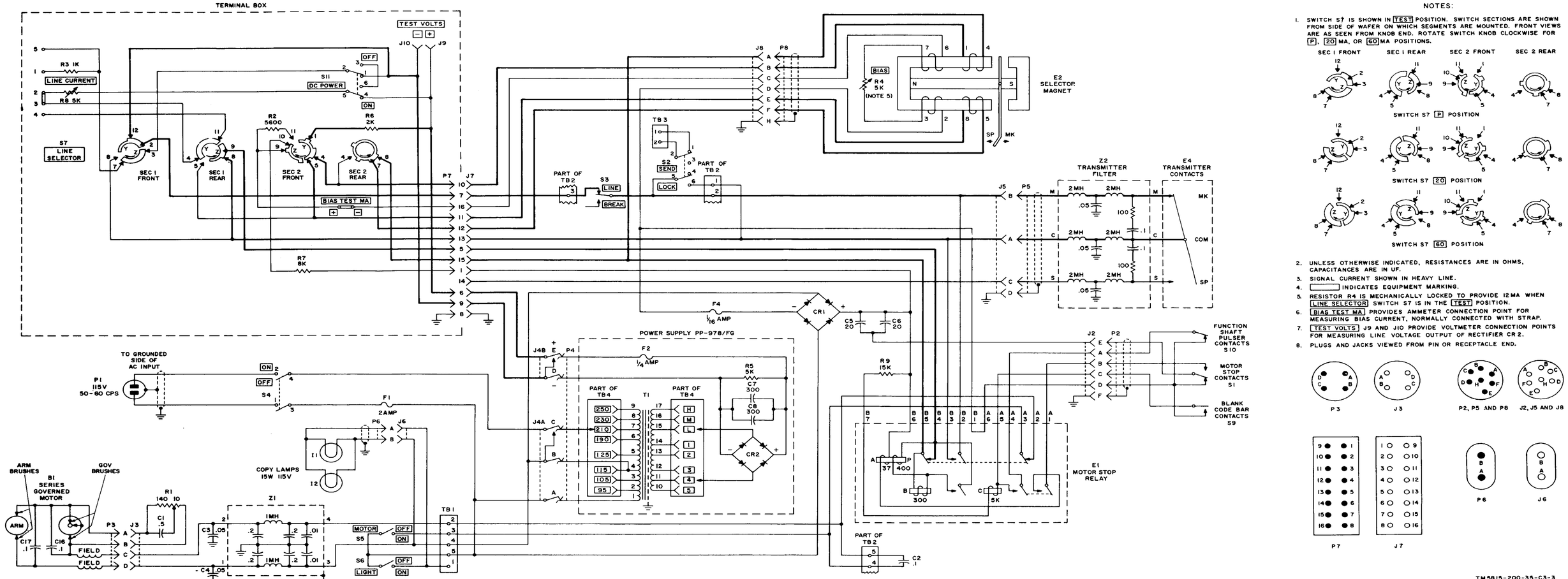


Figure 4-10. Teleprinter TT-259/FG, wiring diagram (part 2 of 2).



NOTES:

1. SWITCH S7 IS SHOWN IN TEST POSITION. SWITCH SECTIONS ARE SHOWN FROM SIDE OF WAFER ON WHICH SEGMENTS ARE MOUNTED. FRONT VIEWS ARE AS SEEN FROM KNOB END. ROTATE SWITCH KNOB CLOCKWISE FOR P, 20 MA, OR 60 MA POSITIONS.

2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
3. SIGNAL CURRENT SHOWN IN HEAVY LINE.
4. [ ] INDICATES EQUIPMENT MARKING.
5. RESISTOR R4 IS MECHANICALLY LOCKED TO PROVIDE 12MA WHEN LINE SELECTOR SWITCH S7 IS IN THE TEST POSITION.
6. BIAS TEST MA PROVIDES AMMETER CONNECTION POINT FOR MEASURING BIAS CURRENT, NORMALLY CONNECTED WITH STRAP.
7. TEST VOLTS J9 AND J10 PROVIDE VOLTMETER CONNECTION POINTS FOR MEASURING LINE VOLTAGE OUTPUT OF RECTIFIER CR2.
8. PLUGS AND JACKS VIEWED FROM PIN OR RECEPTACLE END.

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Figure 4-11. Teletypewriter TT-293/FG and Power Supply PP-978/FG, schematic diagram.

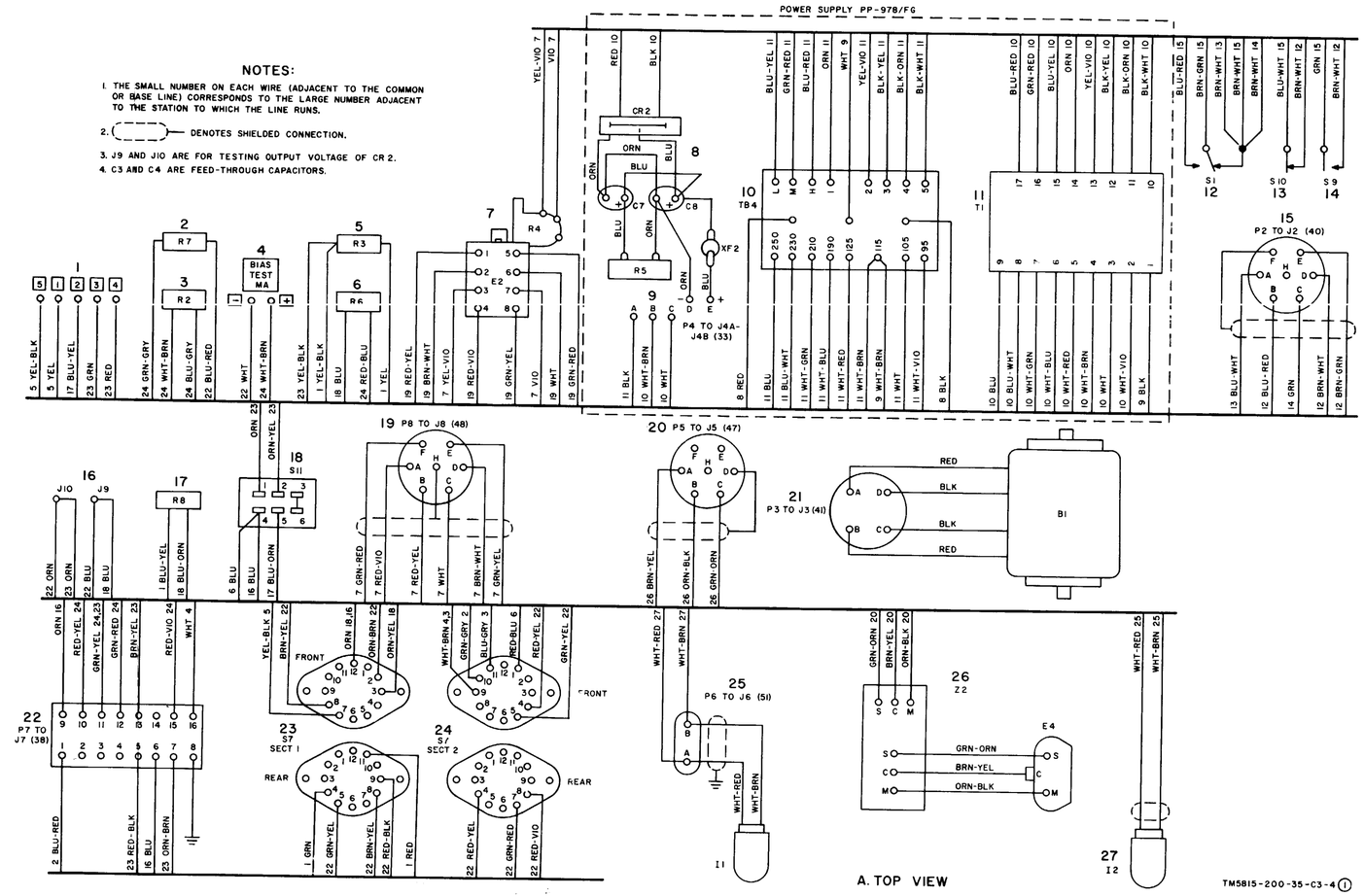

Figure 4-12. Teletypewriter TT-293/FG and Power Supply PP-978/FG, wiring diagram (part 1 of 2).

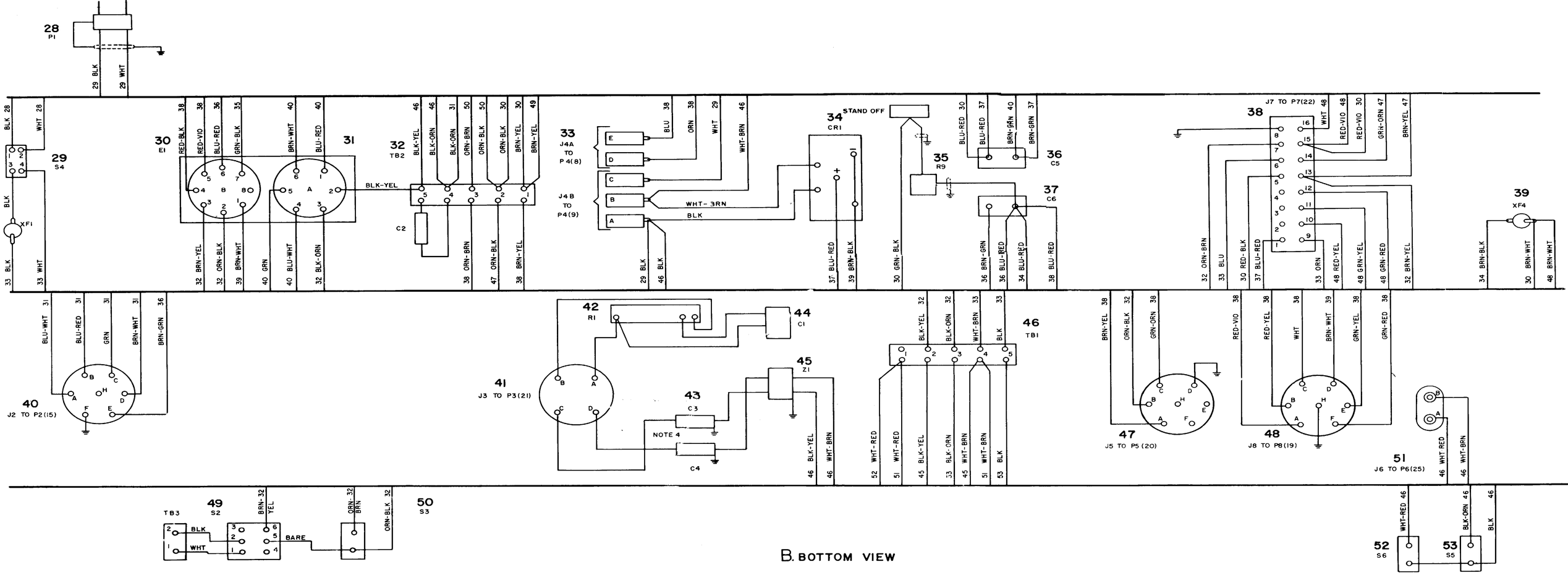

Figure 4-12. Teletypewriter TT-293/FG and Power Supply PP-978/FG, wiring diagram (part 2 of 2).

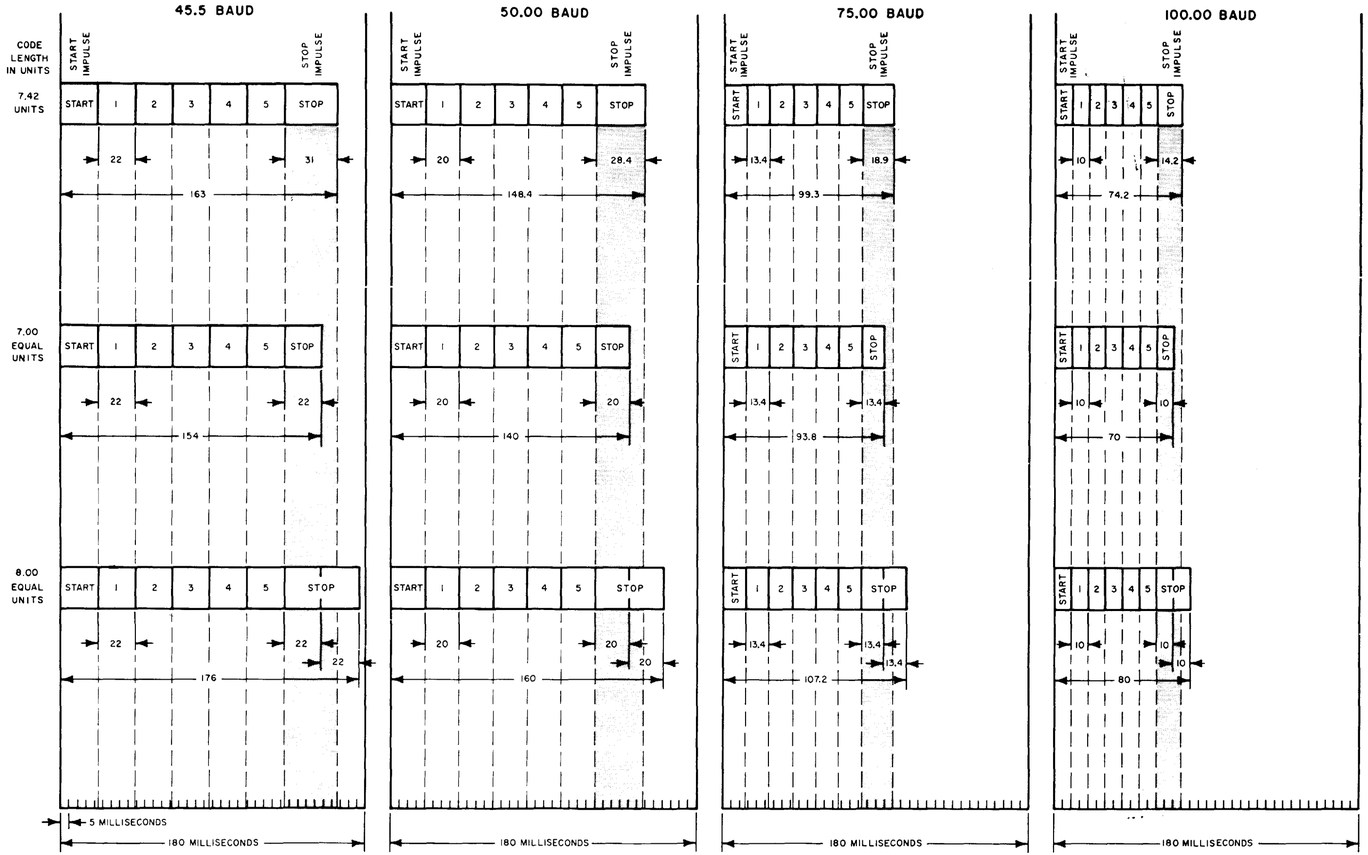

Figure 4-13. Code impulse chart.