

WAR DEPARTMENT TECHNICAL MANUAL  
TM 11-352

*This manual supersedes TM 11-352, December 1943, and TB 11-352-1, December 1944.*

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PRINTER TG-7-A  
and  
TELETYPEWRITERS  
TG-7-B and TG-37-B

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WAR DEPARTMENT . FEBRUARY 1946

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BY ORDER OF THE SECRETARY OF WAR:

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Refer to FM 21-6 for explanation of distribution formula.

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## DESTRUCTION NOTICE

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**WHY** — To prevent the enemy from using or salvaging this equipment for his benefit.

**WHEN** — When ordered by your commander.

**HOW** —

1. **Smash**—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.
2. **Cut**—Use axes, handaxes, machetes.
3. **Burn**—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.
4. **Explosives**—Use firearms, grenades, TNT.
5. **Disposal**—Bury in slit trenches, fox holes, other holes.

Throw in streams. Scatter.

### USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

**WHAT** —

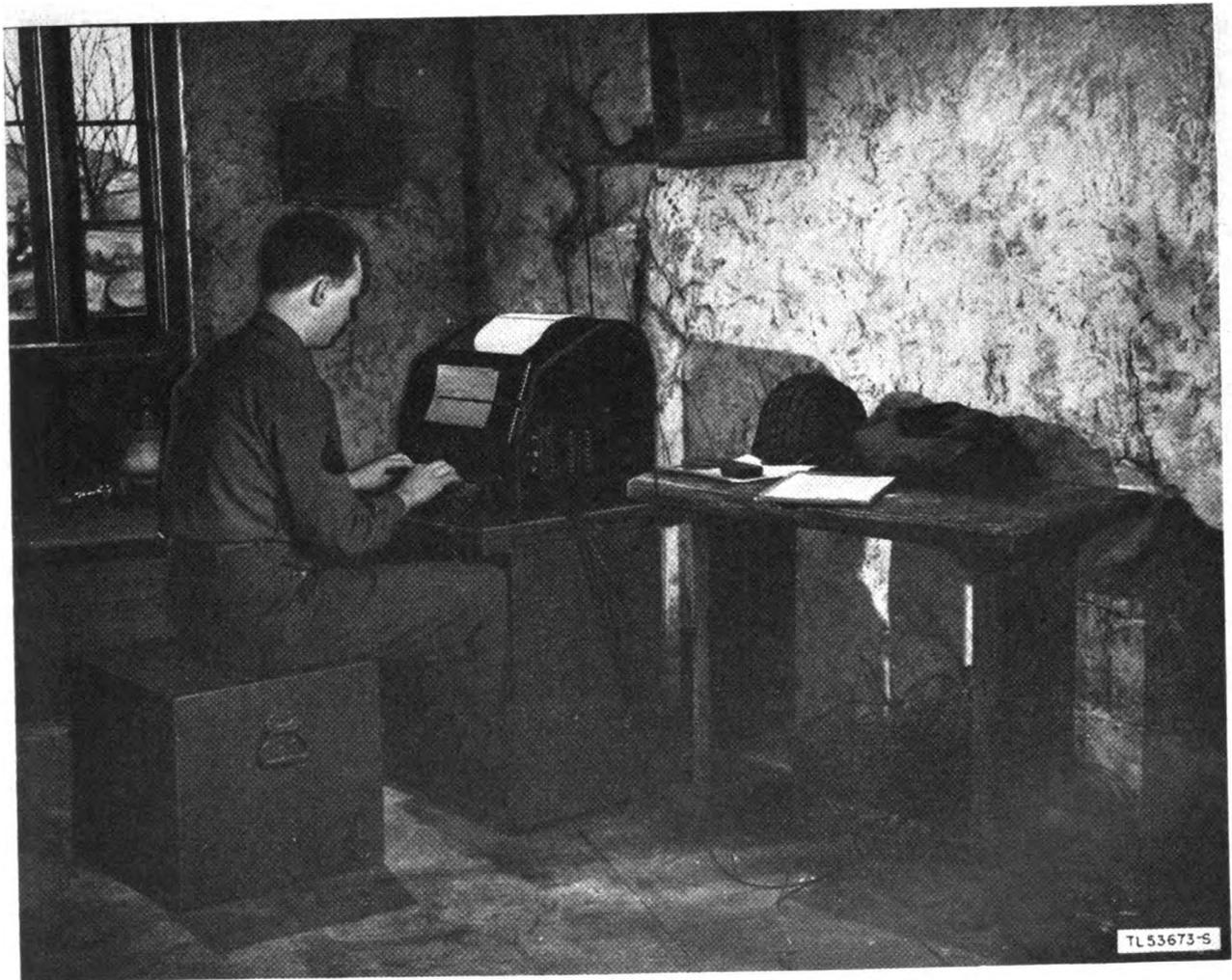
1. **Smash**—Teletypewriter typing unit, base, motor unit, keyboard, cover, and chests.
2. **Cut**—All power and signal cords and wiring.
3. **Burn**—Technical Manuals, records, and teletypewriter chests.
4. **Bury or scatter**—Any or all of the above pieces after smashing, breaking, and burning.

## DESTROY EVERYTHING

## SAFETY NOTICE

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Severe shock may result from contact with current-carrying parts of this equipment. Be sure that the power is off before touching terminals and conductors with bare hands. All test leads should be insulated.



## PART ONE

### INTRODUCTION

#### Section I. DESCRIPTION

##### I. General

a. SCOPE. This manual furnishes descriptive information and detailed maintenance and repair instructions for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B. This equipment is normally installed with related teletypewriter equipment and is not capable of operating except when used with other equipment. Throughout TM 11-352 references will be made to the related Technical Manuals which provide detailed information on planning layouts, installation, operation, and maintenance of the various teletypewriter sets or systems, in which, or with which, one or more Printers TG-7-A or Teletypewriters TG-7-B and TG-37-B are commonly used.

<i>TM No.</i>	<i>Technical Manual</i>
11-354	Telegraph Printer Sets (Teletypewriter) EE-97 and EE-98, Teletypewriter Sets EE-97-A, EE-98-A, and EE-102
11-358	Telegraph Central Office Set TC-3
11-355	Telegraph Terminal CF-2-A (Carrier)
11-355B	Telegraph Terminal CF-2-B (Carrier)
11-2009	Telegraph Terminal CF-6 (Carrier)
11-2004	Repeater Set TC-18 (Terminal, Telegraph)
11-2005	Repeater Set TC-19 (Intermediate)

Additional information concerning other related Technical Manuals is furnished in appropriate sections throughout this manual, and

appendix II lists the Technical Manuals for other equipment, sets, and systems with which Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B are also used.

b. CHARACTERISTICS. Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B are portable field teletypewriters designed to interchange typewritten messages by electrical means between two or more points. With the exception of minor modifications and changes, the main parts of the keyboard and typing units are identical with those in standard Teletype Model 15 page-printing machines. The line signal circuit has been modified for use with an external line relay and the power supply circuit has been changed, making it possible to operate the series governed motor on either 115-volt direct current, 115-volt, 25-cycle alternating current (a-c), or 115-volt, 50-60 cycle alternating current. A mechanical motor control feature is provided whereby the motors of all teletypewriters connected in the same circuit may be started by opening the signal line (depressing the SEND-REC-BREAK key) and stopped by transmitting the upper case "H" signal combination from the keyboard of any teletypewriter. Two rugged wooden chests are furnished with each teletypewriter. The larger chest provides a convenient operating table for the teletypewriter and the smaller chest is used as a seat by the operator. After necessary power supplied and terminal equipment such as line relays, are connected, these teletypewriters may be used to send or receive messages over direct-wire circuits and various types of carrier and radio channels. Like other model 15 machines, these teletypewriters will both send and receive but will complete but one of these functions at a time. The machines are as easy to operate as an ordinary typewriter and are capable of sending or receiving up to 60 words per minute.

c. NOMENCLATURE. Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B are referred to in this Technical Manual as teletypewriters. Such nomenclature refers to any one or all of the above three models. The term teletypewriter chest, when used in this manual, includes, if applicable, the chest furnished with Printer TG-7-A, in addition to the chests furnished with Teletypewriters TG-7-B and TG-37-B.

## 2. Table of Components

The principal parts and units with their associated Signal Corps stock numbers are listed below. The list is arranged to show which items are packed in each of the three shipping containers used for export shipment.

a. PRINTER TG-7-A (SIGNAL CORPS STOCK No. 4T2.13A-1) (fig. 1). Older teletypewriters are stock numbered 4T2.13-1 (par. 9).

Quantity	Pkg. No.	Signal Corps stock No.	Item	Remarks
1	1/3	4TBP108/210	Typing unit.....	See par. 9 for older machines.
3		6M1175	Ribbon, black, Underwood.	2 running spares.
1	2/3	4TBB47	Teletypewriter base.	3 cords listed below are furnished as part of the base.
1		3E4163-3	Cord, 6 ft 2-conductor.	Power cord, attached to power selector unit and terminates in 2 prong male plug.
1		3E1484	Cord CD-484	Black shell plug.
1		3E1485	Cord CD-485	Red shell plug.
1		4TBK24JX	Keyboard	See par. 6 for older machines.
1		4TMU27	Motor unit.....	
1		4TC146	Cover (teletypewriter).	
1		4T103443	Front cover plate	
1		4T91750	Copy holder	
5		4T103286	Fuse, 1.6 amp, 250 v.	
1		4T103628	Speed indicator	
1		4T103370	Chest CH-50-A	
1			TM 11-352	Packed in Chest CH-50-A.
1	3/3	4T103368	Chest CH-62-A	

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts. Stock numbers are indicated in this table for identification purposes only.

b. TELETYPEWRITER TG-7-B (SIGNAL CORPS STOCK No. 4T2.28A-4) (frontispiece). Older teletypewriters are stock numbered 4T2.28A-1, A-2, or A-3. (See par. 9.)

Quantity	Pkg. No.	Signal Corps stock No.	Item	Remarks
1	1/3	4TBP114/110	Typing unit.....	See par. 9 for older machines.
3		6M1175	Ribbon, black, Underwood.	2 running spares.
1	2/3	4TBB49	Teletypewriter base.	3 cords listed below are furnished as part of the base.
1		3E4163-3	Cord, 6 ft 2-conductor.	Power cord, attached to power selector unit and terminates in 2 prong male plug.
1		3E1484	Cord CD-484	Black shell plug.
1		3E1485	Cord CD-485	Red shell plug.
1		4TBK23JX	Keyboard	See par. 6 for older machines.
1		4TMU27	Motor unit.....	
1		4TC146	Cover (teletypewriter).	
1		4T103443	Front cover plate	
1		4T91750	Copy holder	
2		4T103286	Fuse, 1.6 amp, 250 v.	1 running spare.
1		4T105229	Chest CH-50-B	
1			TM 11-352	Packed with Chest CH-50-B.
1	3/3	4T105367	Chest CH-62-B	

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts. Stock numbers are indicated in this table for identification purposes only.

c. TELETYPEWRITER TG-37-B (SIGNAL CORPS STOCK No. 4T2.23A-1). Older teletypewriters are stock numbered 4T2.23-1 (par. 9).

Quantity	Pkg. No.	Signal Corps stock No.	Item	Remarks
1	1/3	4TBP118/221	Typing unit.....	
3		6M1175	Ribbon, black, Underwood.	2 running spares.
1	2/3	4TBB49	Teletypewriter base.	3 cords listed below are furnished as part of the base.
1		3E4163-3	Cord, 6 ft 2-conductor.	Power cord, attached to power selector unit and terminates in 2 prong male plug.
1		3E1484	Cord CD-484	Black shell plug.
1		3E1485	Cord CD-485	Red shell plug.
1		4TBK23KS	Keyboard	
1		4TMU27	Motor unit.....	
1		4TC146	Cover (teletypewriter).	
1		4T103443	Front cover plate	
1		4T91750	Copy holder	
1		4T103286	Fuse, 1.6 amp, 250 v.	
1		4T105229	Chest CH-50-(*)	
1			TM 11-352	Packed in Chest CH-50-(*)
1	3/3	4T105367	Chest CH-62-(*)	

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts. Stock numbers are indicated in this table for identification purposes only.

(\*) This symbol refers to Chests CH-50-A, CH-50-B, CH-62-A, and CH-62-B.

### 3. Description of Printer TG-7-A

a. GENERAL. Printer TG-7-A is a model 15 (Teletype Corporation) page printing teletypewriter which has been modified by the Army for tactical (field) use. Originally manufactured at a time when it was necessary to rush the development of tactical equipment, a num-

ber of parts and some wiring were left in place although they are seldom used. When it is set up and ready for use this model is 20 inches wide, 19 inches long, 42 inches high, and weighs approximately 225 pounds. It consists principally of a base, motor unit, keyboard, typing unit, cover, and chests.

b. BASE. The base is a metal casting designed to furnish secure mounting for the other units

of the printer. It is securely fastened to the bottom of the associated chest CH-50-A by four bolts. A pad of felt is placed between the base and the bottom of the chest to which it is fastened. The line relay mounting brackets and resistor assembly, wiring, and motor control relay are mounted on the base but are used

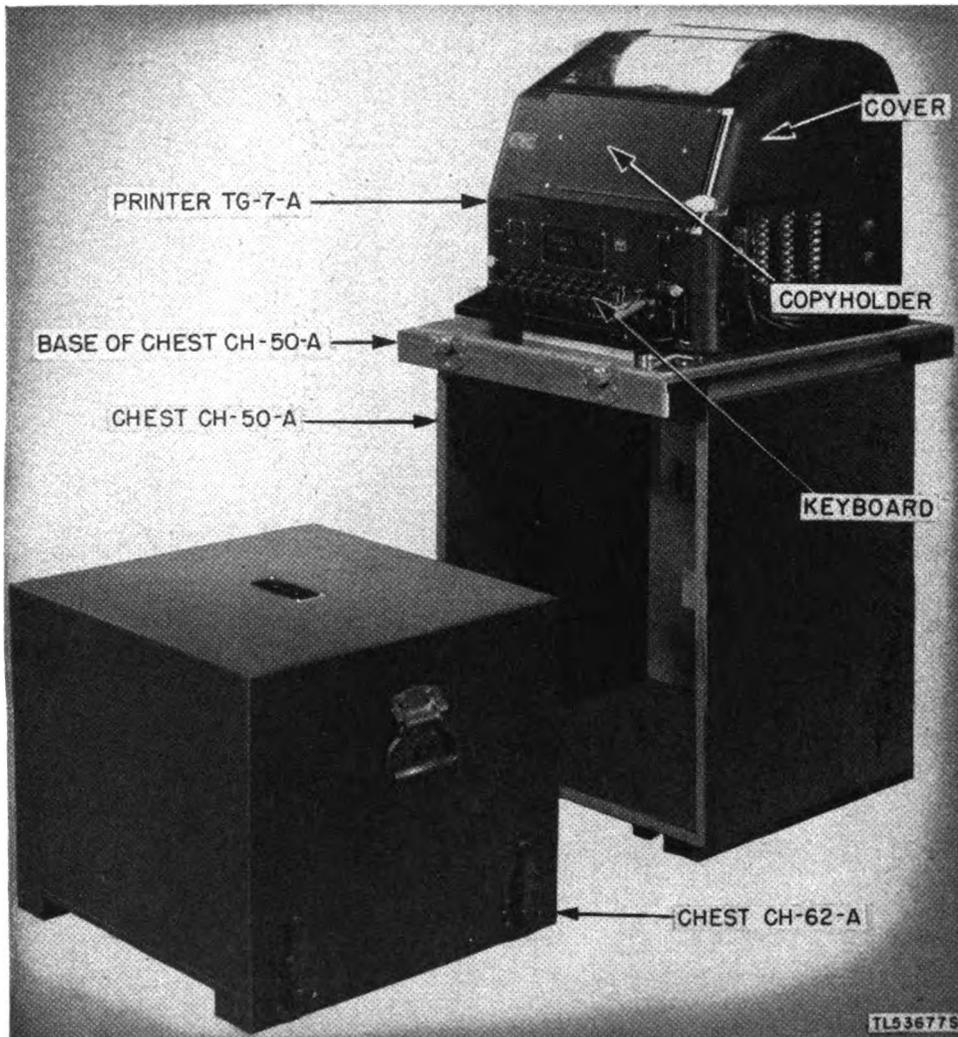


Figure 1. Printer TG-7-A set up ready for use.

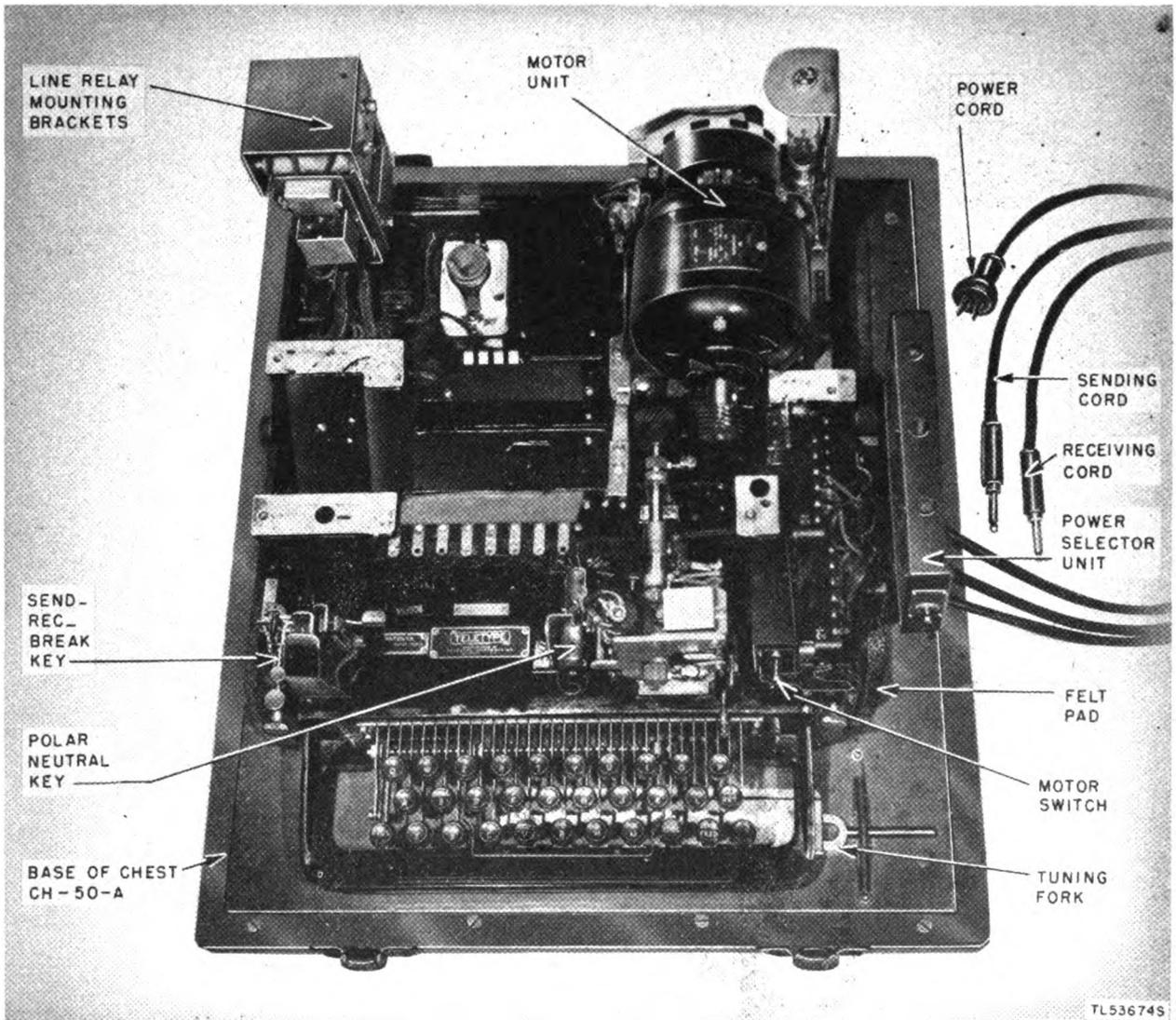
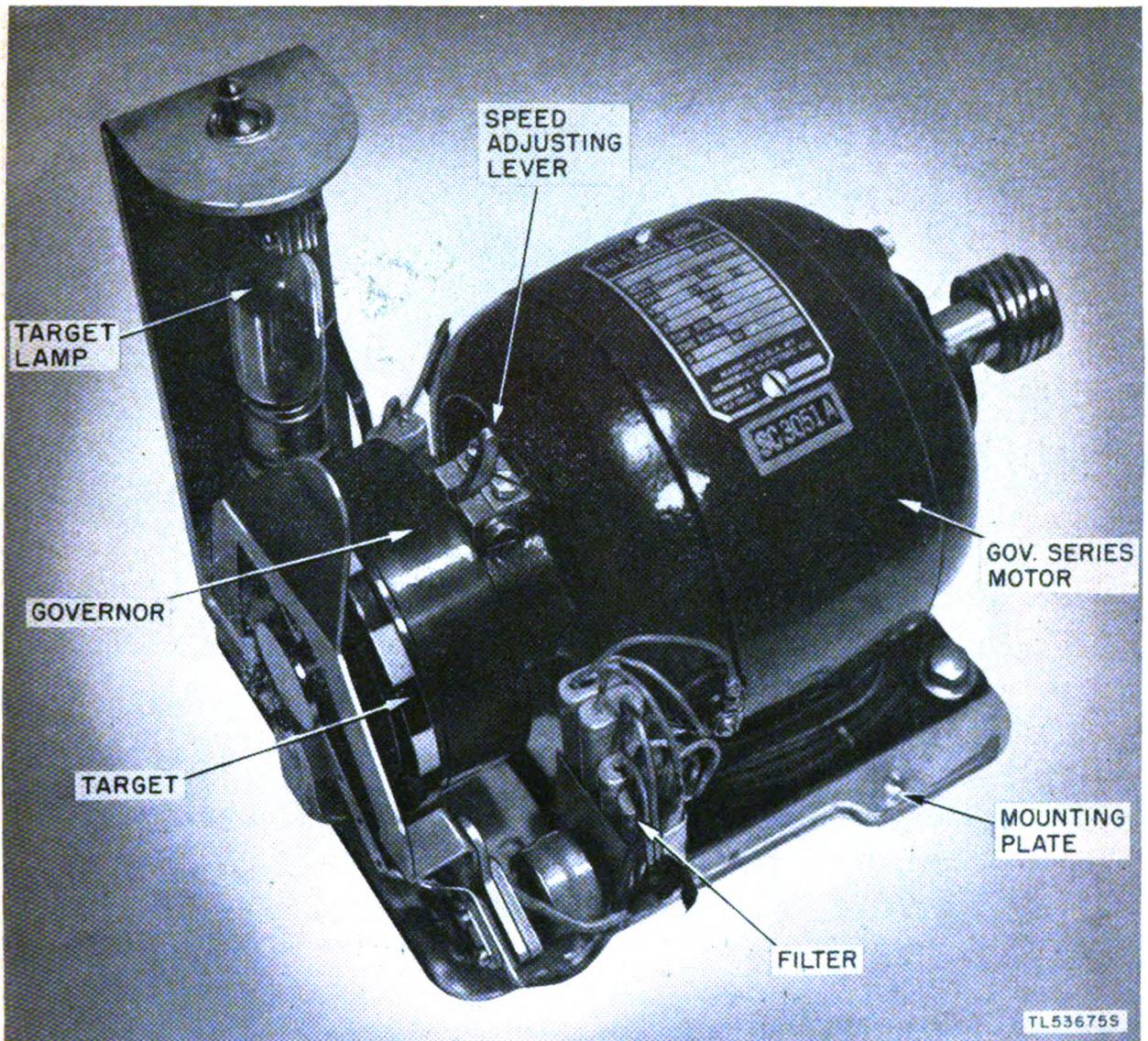


Figure 2. Printer TG-7-A base.

assembly and switch is attached to the right side of the base. The switch is used to regulate the resistors of the power selector unit so that the teletypewriter may be operated on either 115-volt, alternating-current (a-c), 50-60-cycle, 115-volt direct-current (d-c) or 115-volt a-c, 25-cycle power sources. Three cords are attached to the power selector unit and are used to connect the teletypewriter to other teletypewriter equipment and a power source. The *sending* cord which terminates in a black-shell plug, and the *receiving* cord which terminates in a red-shell plug are used to connect the tele-

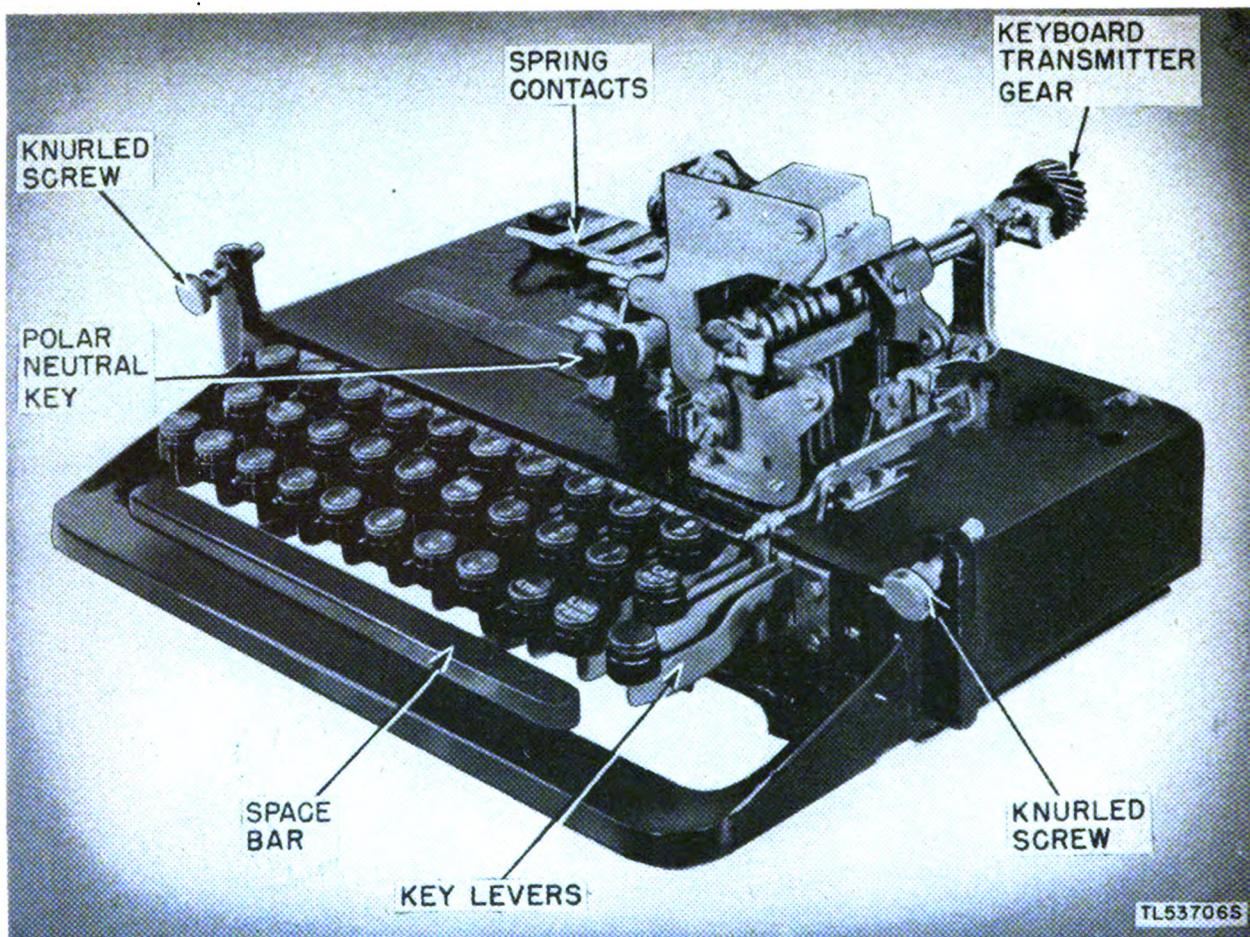
typewriter to other teletypewriter equipment. The *power cord* terminates in a two-prong male plug and is used to connect the teletypewriter to a power outlet. A power leads filter designed to suppress radio frequency induction in the external power wiring is available for installation on Printer TG-7-A. MWO SIG 11-353-1, furnishes instructions for installing the power leads filter (Signal Corps stock No. 4T102874) on the base above the terminal block. The filter is installed in the position illustrated in figure 8 which shows the same filter furnished with Teletypewriter TG-7-B.



*Figure 3. Printer TG-7-A motor unit.*

c. **MOTOR UNIT.** The motor unit is mounted on the rear of the teletypewriter base and is held securely in place by three removable screws. It consists of a governed series motor, a filter for suppressing radio interference, and a lamp for illuminating the target on the gov-

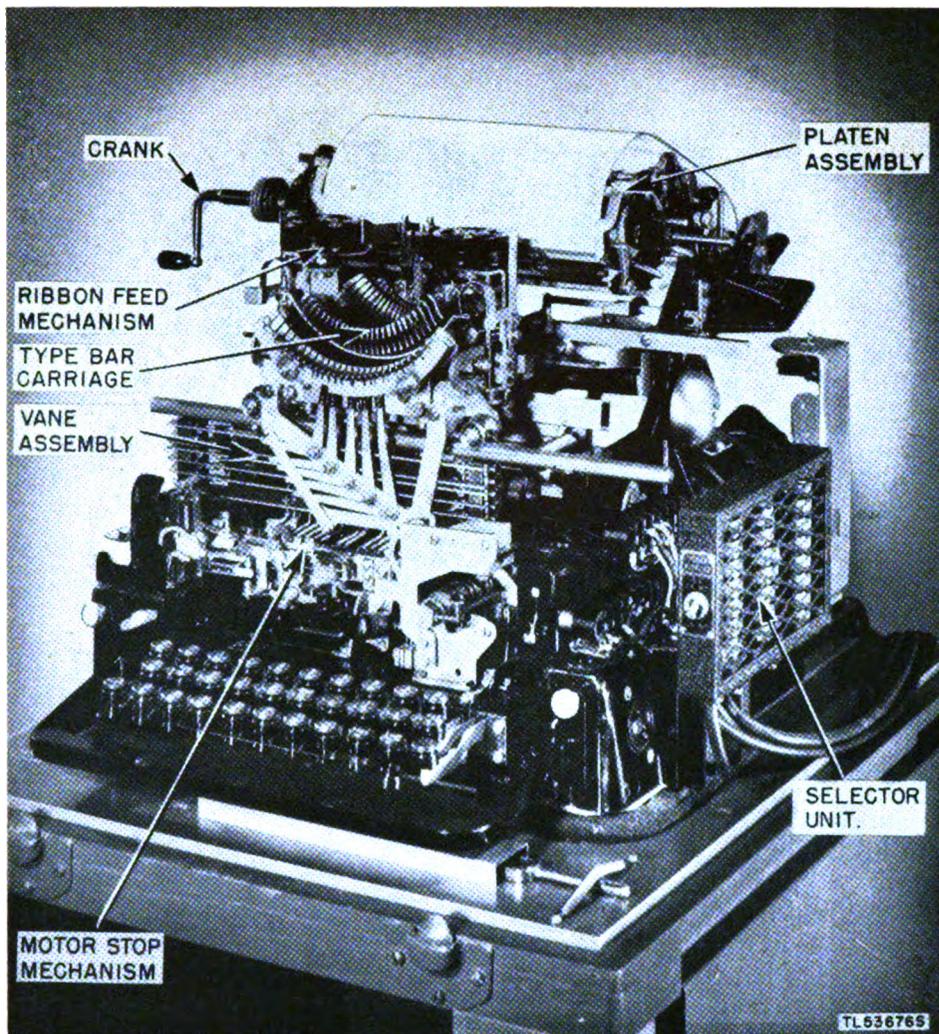
ernor. All these parts are bolted to a mounting plate. The complete unit is taken off the base by removing the three screws holding the mounting plate to the teletypewriter base and lifting straight up.



*Figure 4. Printer TG-7-A keyboard.*

*d. KEYBOARD.* The keyboard is designed so that it mounts into the front of the base and is held in place by two knurled screws. It consists of key levers, space bar, spring contacts for making electrical connection to the base, a polar neutral key (not wired in circuit) which is used for polar or neutral operation, and a keyboard transmitter all fitted on a cast metal

frame. The gear of the keyboard transmitter meshes with the main shaft. The key levers are equipped with standard communication key tops (alphabet, numerals 1 to  $\phi$ , and customary punctuation marks). To remove the keyboard, loosen the two knurled screws and slide it out from the base.



*Figure 5. Printer TG-7-A typing unit assembled with base and keyboard.*

e. **TYPING UNIT.** The typing unit is mounted on the teletypewriter base and held in place by three large thumbscrews. The main shaft, selector unit, typebar carriage, and other operating parts and assemblies are contained in the typing unit. The motor stop mechanism is attached to the front of the typing unit. The type bar carriage, equipped with an automatic ribbon feed mechanism and standard communication type pallets, moves back and forth on the front track above the vane assembly. Paper feeds through the platen assembly from a roll

of paper mounted on the rear of the typing unit. A crank fits on the left end of the platen roll and extends through a hole in the teletypewriter cover. Most of these parts and assemblies are shown in figure 5. The typing unit is normally adjusted to print 72 characters on a line at a speed of 368 operations per minute (opm) which is about 60 words per minute. It may be adjusted for 404 opm when operated with British teletypewriter systems as discussed in appendix I.

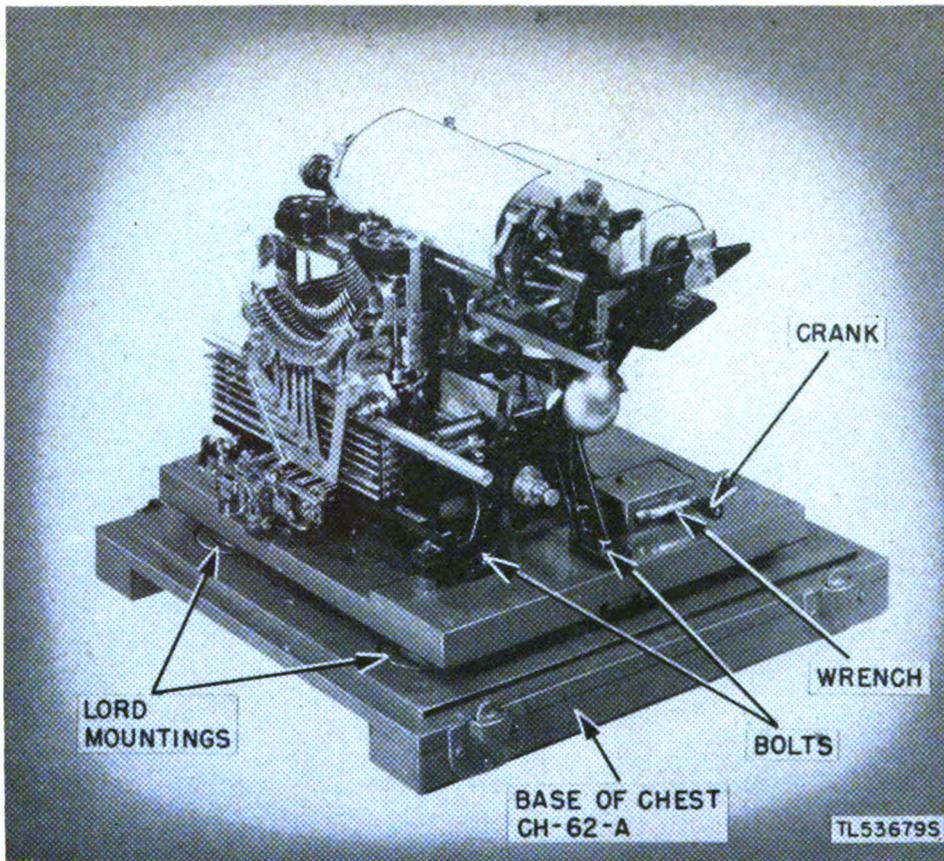
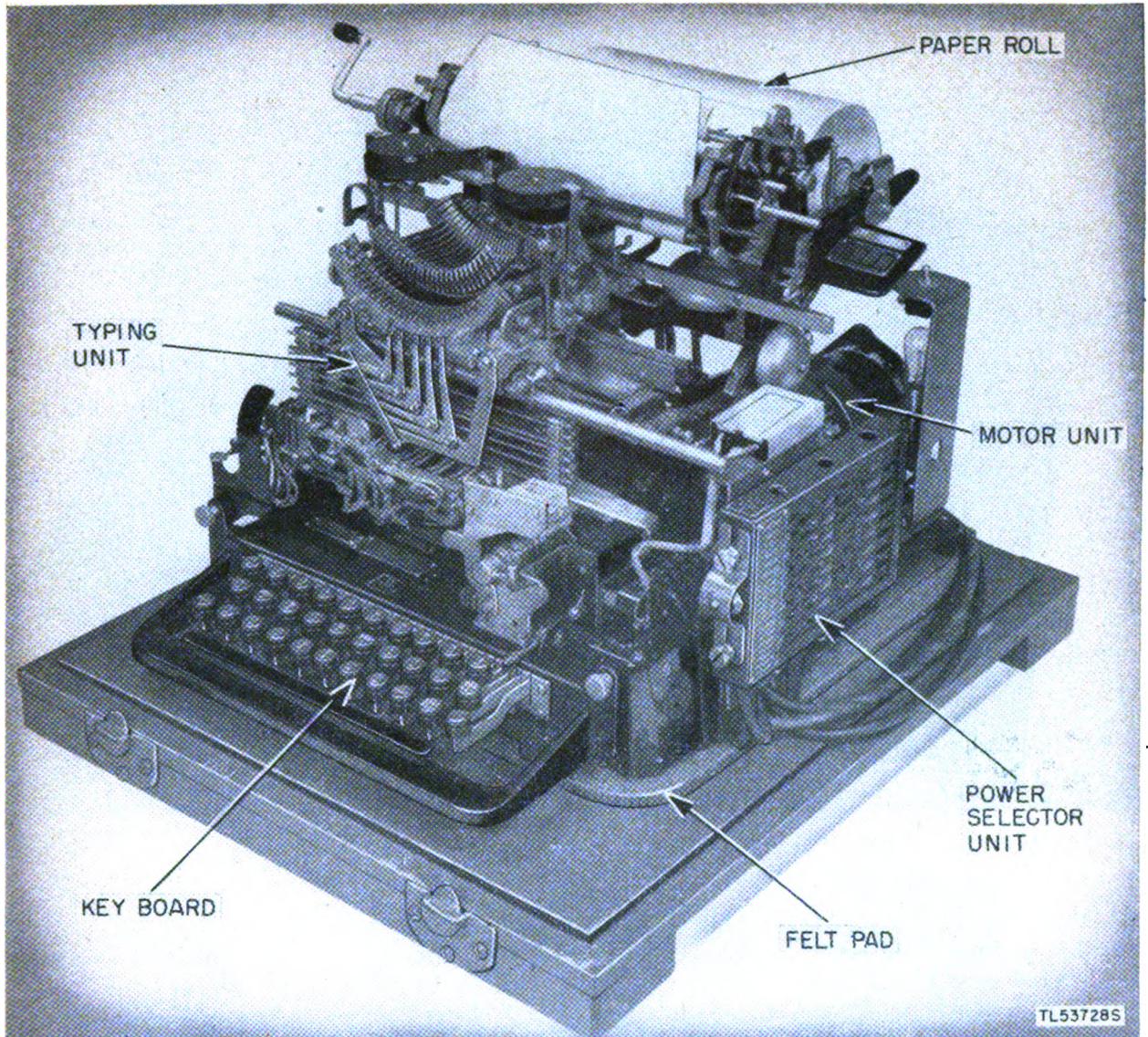


Figure 6. Typing unit bolted to mounting frame on base of chest.

*f.* COVER. A removable metal cover incloses the motor unit, typing unit and base. The cover is constructed to allow easy access to the various switches and units of the printer which must be reached during normal operation. Felt padding which lines the inside of the cover protects the operating parts of the teletypewriter. A copyholder is attached to the front of the cover. (See fig. 1.)

*g.* CHESTS. The two wooden chests for transporting the Printer TG-7-A are designated Chests CH-50-A and CH-62-A. (See fig. 17.) Chest CH-50-A is used to transport the tele-

typewriter base, keyboard, and cover. A metal compartment on the base of the chest holds the tuning fork used to check motor speeds. (See fig. 2.) Chest CH-62-A is equipped with a wooden block drilled to receive the platen crank and the wrench used for tightening the typing unit mounting bolts. Spring clips hold the crank and wrench in place. The mounting frame for the typing unit is attached to the base of the chest by four Lord mountings which are designed to absorb some of the shock received during transportation. The typing unit is secured to this mounting frame by three bolts.

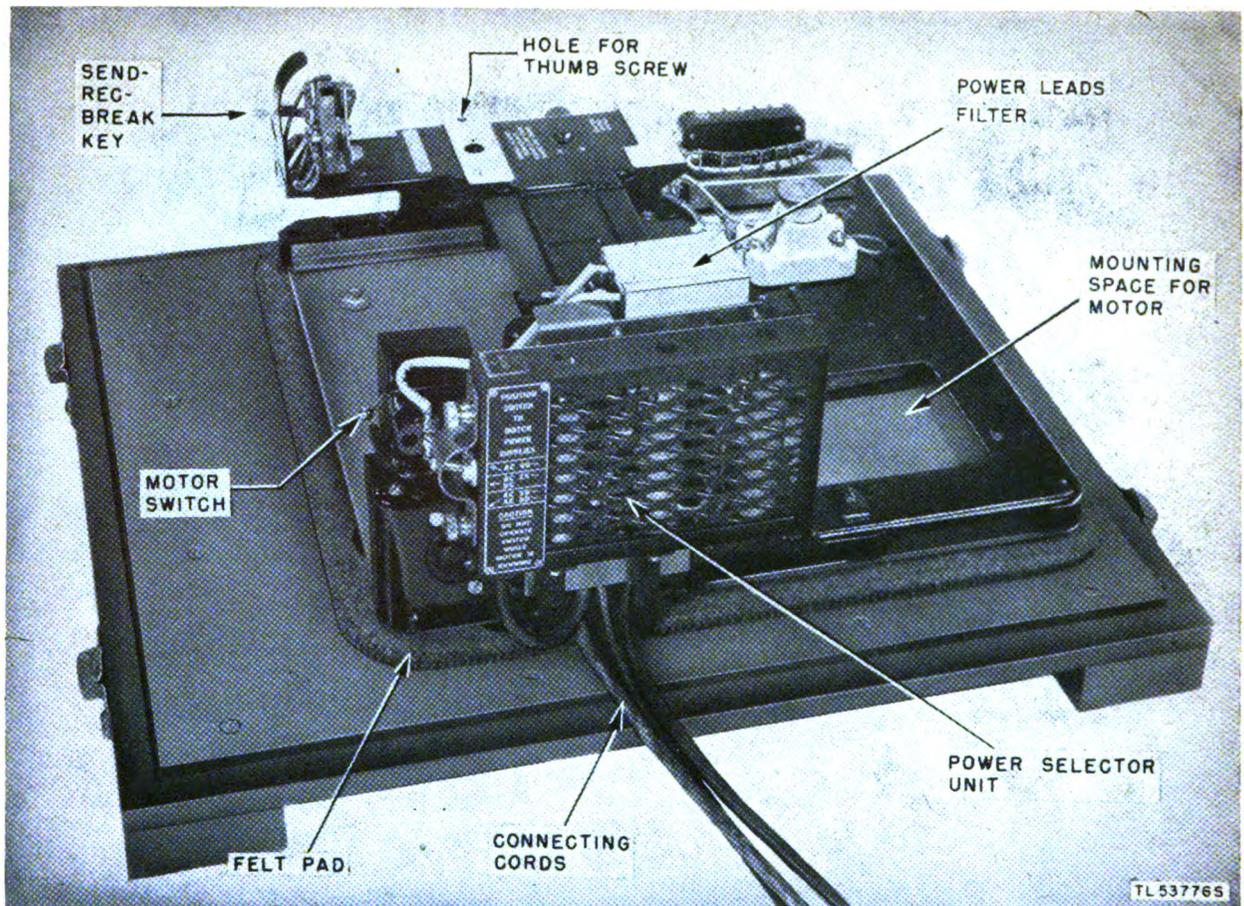


*Figure 7. Teletypewriter TG-7-B base, keyboard, and typing unit assembled.*

#### 4. Description of Teletypewriter TG-7-B

*a. GENERAL.* Teletypewriter TG-7-B is similar to Printer TG-7-A with a few exceptions. Slight differences in the appearance of the units and assemblies result from the omission of certain parts and wiring that were provided but not used in Printer TG-7-A. Improvements have been made in the power supply circuit to permit operation of the motor on 115-volt a-c 40-cycle power sources when desired. The

component parts of Teletypewriter TG-7-B discussed below are interchangeable with those of Printer TG-7-A. The additional descriptive information furnished in this paragraph also applies to Printer TG-7-A but is furnished here because Teletypewriter TG-7-B is the most commonly used of the three teletypewriters discussed in this manual. See appendix I, for information on interoperation with British teletypewriters.



*Figure 8. Teletypewriter TG-7-B base less motor unit.*

b. **BASE.** The base of Teletypewriter TG-7-B may be easily recognized by comparing it to the base of Printer TG-7-A, as the line relay mounting brackets and resistor assembly, its wiring, and the motor control relay provided with the latter have been omitted. The base is constructed and fastened to the bottom of carrying Chest CH-50-B with a felt pad between the base and the chest in the same manner that Printer TG-7-A base is fastened to the base of its chest. The SEND-REC-BREAK key on the left, and the motor OFF-ON switch on the right, are the same as the key and switch used with Printer TG-7-A. The power selector provides for different resistor combinations permitting operation on 115-volt a-c 50-60 cycle, 115-volt d-c or 115-volt a-c 25-cycle, and 115-volt a-c 40-cycle power sources. The sending cord equipped with a black-shell plug, the receiving cord equipped with a red-shell plug, and the power cord and plug are identical with the

cords and plugs used with Printer TG-7-A and interchangeable with the cords used with many other models of teletypewriters.

c. **MOTOR UNIT.** Identical motor units equipped with a governed series motor and filter are used with Printer TG-7-A, and Teletypewriters TG-7-B and TG-37-B.

d. **KEYBOARD.** With the exception of certain minor changes, the keyboard provided with Teletypewriter TG-7-B is identical with the keyboard provided with Printer TG-7-A. The keyboards may be interchanged without modification as the polar neutral key provided with Printer TG-7-A, and omitted from Teletypewriter TG-7-B, is not required for normal tactical operation.

e. **TYPING UNIT.** With the exception of minor changes in small parts due to substitution of materials or improvements in design, Teletypewriter TG-7-B and Printer TG-7-A typing units are similar. While certain parts are not

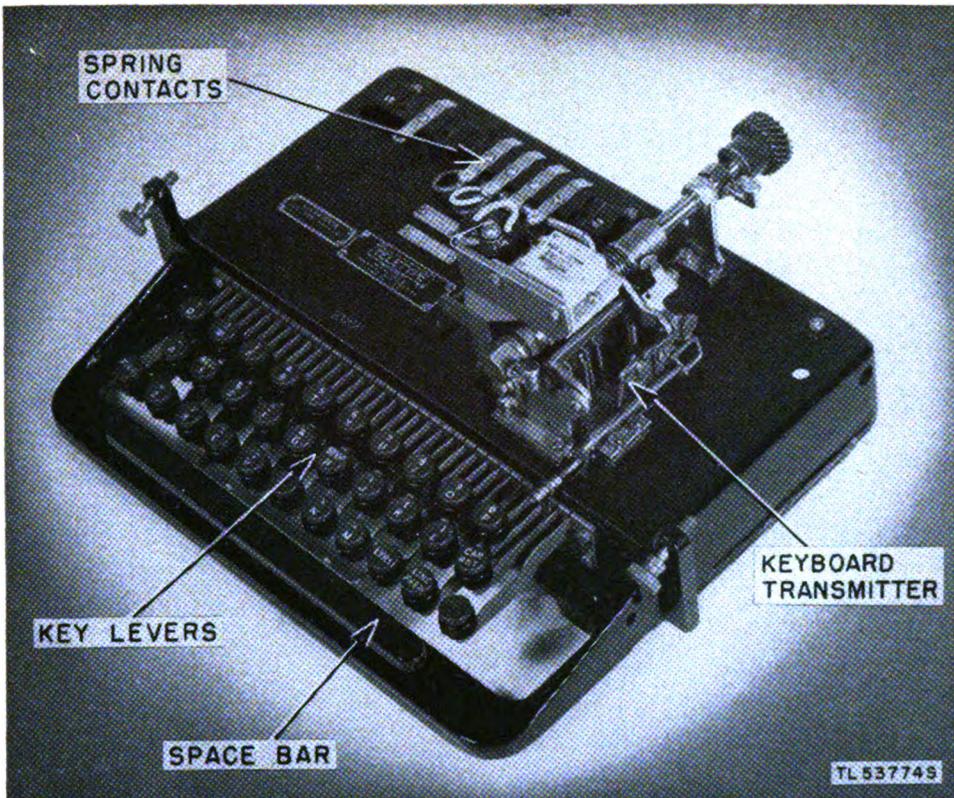


Figure 9. Teletypewriter TG-7-B keyboard.

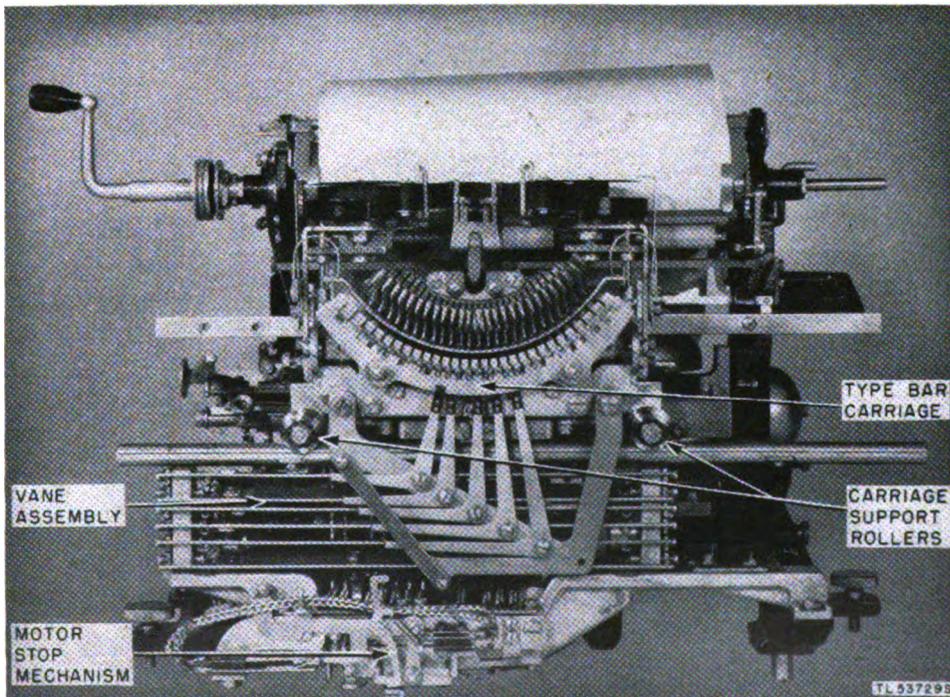


Figure 10. Front view of Teletypewriter TG-7-B typing unit.

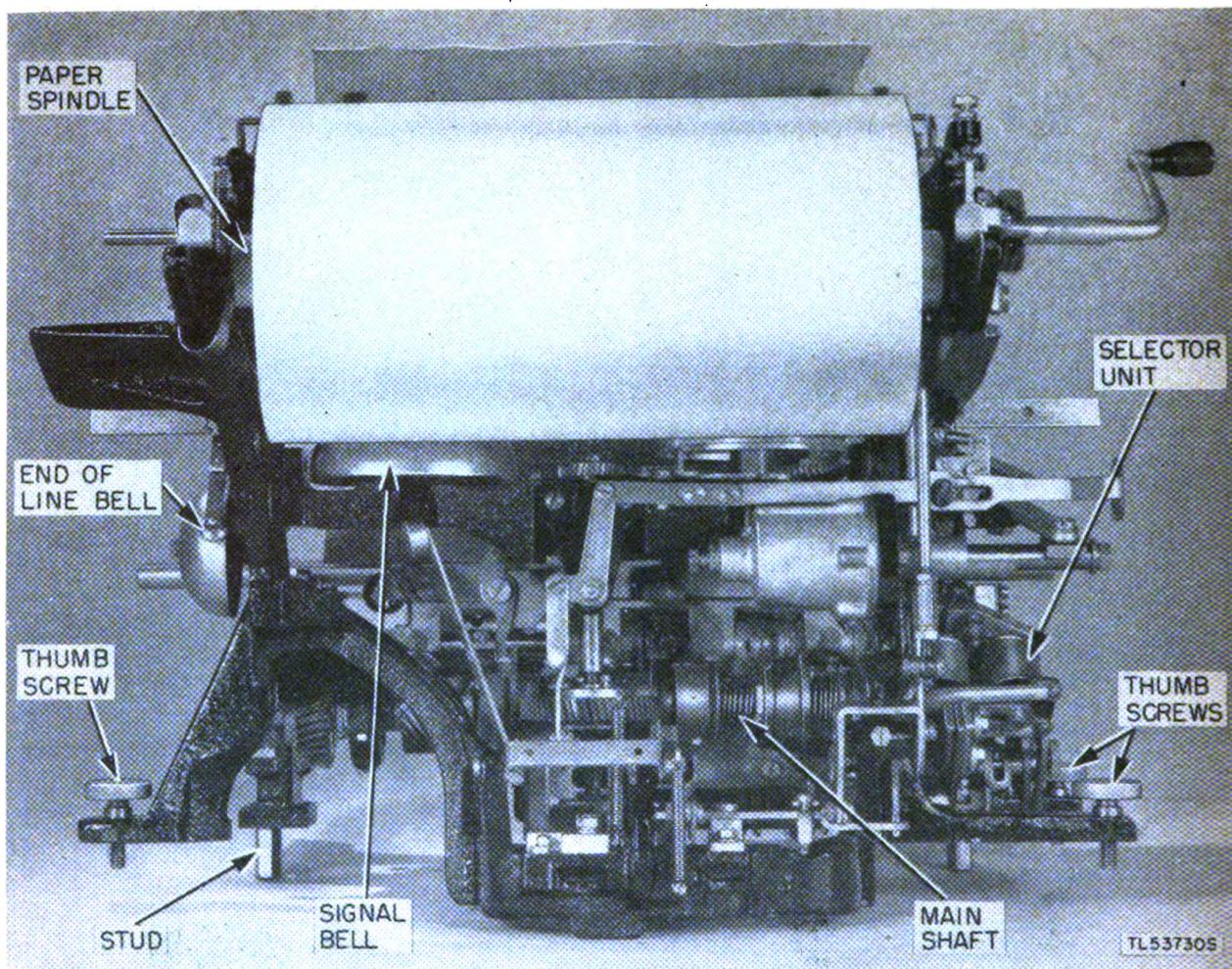


Figure 11. Rear view of Teletypewriter TG-7-B typing unit.

interchangeable, the complete typing units could be exchanged if another typing unit of the same model were not available. The three thumbscrews which hold the typing unit in place when it is mounted on the base can be seen in figure 11. The location of the main shaft, selector unit, paper spindle which holds the roll of paper, signal bell, and end-of-line bell can also be seen in figure 11. The type bar carriage is a separate assembly which is mounted on rollers and moves back and forth across the front of the typing unit.

f. COVER. The same metal cover furnished with Printer TG-7-A is provided with Teletypewriter TG-7-B.

g. CHESTS. The two wooden chests furnished as part of the Teletypewriter TG-7-B are the same as those furnished with Printer TG-7-A, and are designated Chests CH-50-B and CH-62-B.

### 5. Description of Teletypewriter TG-37-B

Teletypewriter TG-37-B is identical with Teletypewriter TG-7-B with the exception of the type pallets and keytops which include the weather symbols necessary for transmitting weather data. Teletypewriter TG-37-B is commonly referred to as the weather teletypewriter to distinguish it from the teletypewriters which print only the standard characters and symbols used for ordinary messages.

## 6. Differences in Models

a. GENERAL. The figures 12 and 13 show the differences between the characters and symbols used for weather reports and those used for ordinary messages. Printer TG-7-A and Tele-

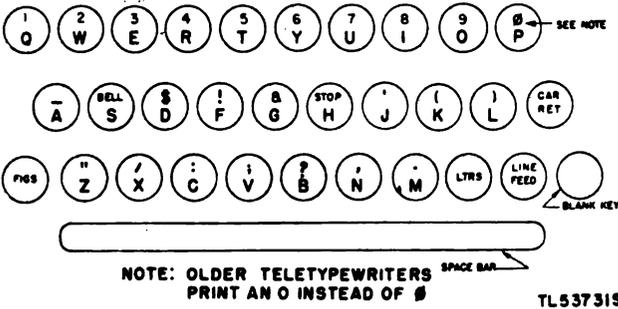


Figure 12. Illustration of standard communication keyboard.

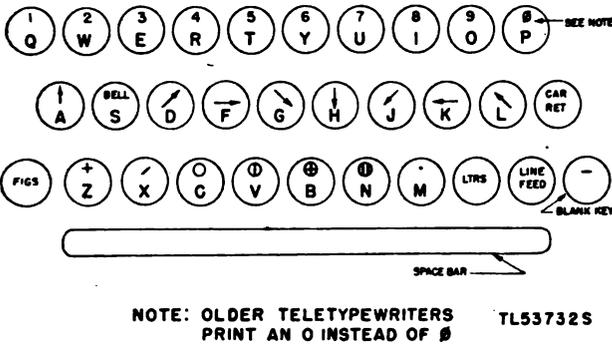


Figure 13. Illustration of weather keyboard.

typewriter TG-7-B are equipped with the communication keyboard shown in figure 12. Teletypewriter TG-37-B is equipped with the weather keyboard shown in figure 13. All of the differences are in the characters printed and the functions performed when the platen is in the figures position.

b. DIFFERENCES IN EARLIER AND LATER MODELS. (1) The differences in the manufacturer's code numbers of items furnished with earlier and later models are given in the following chart:

Item	Printer TG-7-A	Teletypewriter TG-7-B	Teletypewriter TG-37-B	Teletypewriter TG-7-B (Russian)
Complete teletypewriter:				
early models.....	2.13-1, 2.22A-1.	2.28A-1, A-2, A-3	*.....	2.29-1
late models.....	2.13A-1.....	2.28A-4.....	2.23A-1.....	2.30-1
Base:				
early models.....	BB45.....	BB49.....	*.....	BB49
late models.....	BB49.....	BB49.....	BB49.....	BB49
Keyboard:				
early models.....	BK24FX.....	BK23JX.....	*.....	BK29KO
late models.....	BK24JX.....	BK23JX.....	BK23KS.....	BK29KO
Typing unit:				
early models.....	BP108/97.....	BP114/210.....	*.....	BP48/136
late models.....	BP108/210.....	BP114/210.....	BP118/221.....	BP48/136
Speed indicator.....	103628.....	†.....	†.....	104983

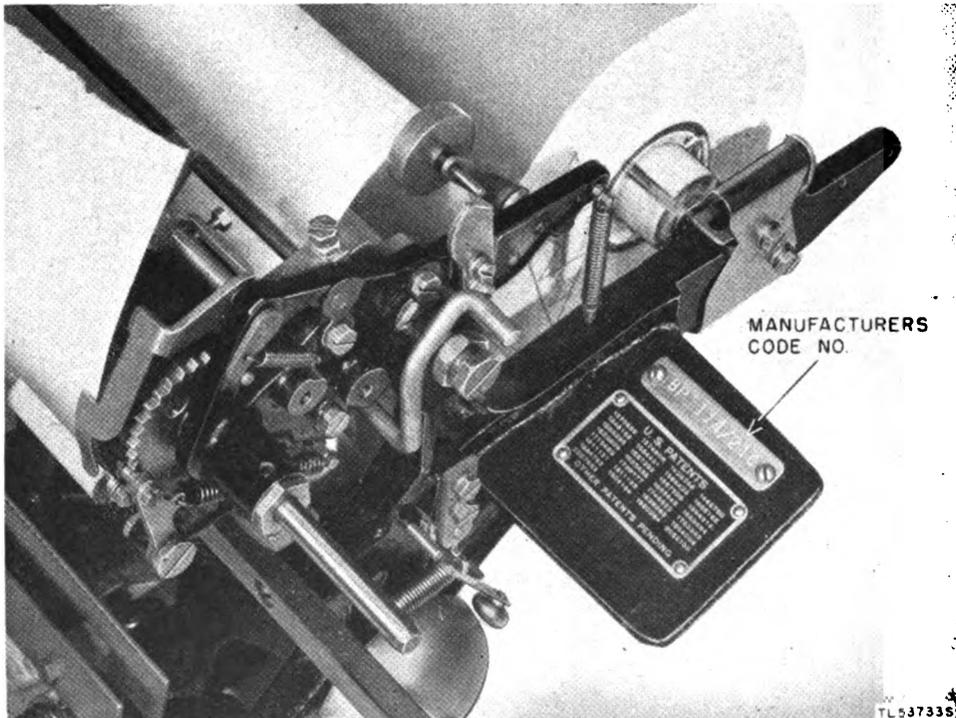


Figure 14. Typical illustration of manufacturer's code number designation.

(2) Earlier models of teletypewriters were furnished with covers equipped with an old-style lid stop arm and bracket which was subject to breakage. MWO SIG 11-352-1, furnishes instructions for replacing the old-style parts with the new stop arm (Signal Corps stock No. 104572). The manufacturer's code numbers for the various models of teletypewriter covers do not indicate whether the old or new-style stop arm is included. Additional information will be found in the related topics concerning covers in section XIII and appendix III.

(3) The ribbon reverse mechanism furnished on earlier models has been replaced with an improved mechanism. The improved mechanism has been installed on many teletypewriters in accordance with the instructions furnished in TB 11-352-1. Information concerning the improved mechanism is included in the related topics throughout this manual.

c. DIFFERENCES IN EQUIPMENT AND OPERATING FEATURES. The chart below furnishes a ready reference of the differences in the Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B previously described.

Component	Printer TG-7-A	Teletypewriter TG-7-B	Teletypewriter TG-37-B	Component	Printer TG-7-A	Teletypewriter TG-7-B	Teletypewriter TG-37-B
1. Type pallets....	Standard on type basket.	Standard on type basket.	Weather on type basket.	7. Automatic remote motor control.	Operated by hitting figures key upper case H.	Operated by hitting figures key upper case H.	Operated by hitting figures key upper case blank & H.
2. Keytops.....	Standard.....	Standard.....	Weather.	8. Power supply resistor assembly and switch.	115-volt d-c..... 115-volt 25-cycle a-c. 115-volt 50-60-cycle a-c. (See figure 5.)	115-volt d-c..... 115-volt 25-cycle a-c. 115-volt 40-cycle a-c. 115-volt 50-60-cycle a-c. (See figure 7.)	Same as TG-7-B  See figure 7
3. Number of characters on one line.	72.....	72.....	76.	9. Tuning fork....	Packed with cover and unit (Chest CH-50-A)	Omitted.....	Omitted.
4. Line relay mounting with associated resistors, spark suppression capacitor, and radio filter.	Installed on base.	Omitted.....	Omitted.	10. Chests.....	CH-50-A..... CH-62-A.....	CH-50-B..... CH-62-B.....	CH-50-(*) CH-62-(*)
5. Polar neutral switching key.	Installed on keyboard.	Omitted.....	Omitted.				
6. Motor control relay for separate line motor control.	Installed on base.	Omitted.....	Omitted.				



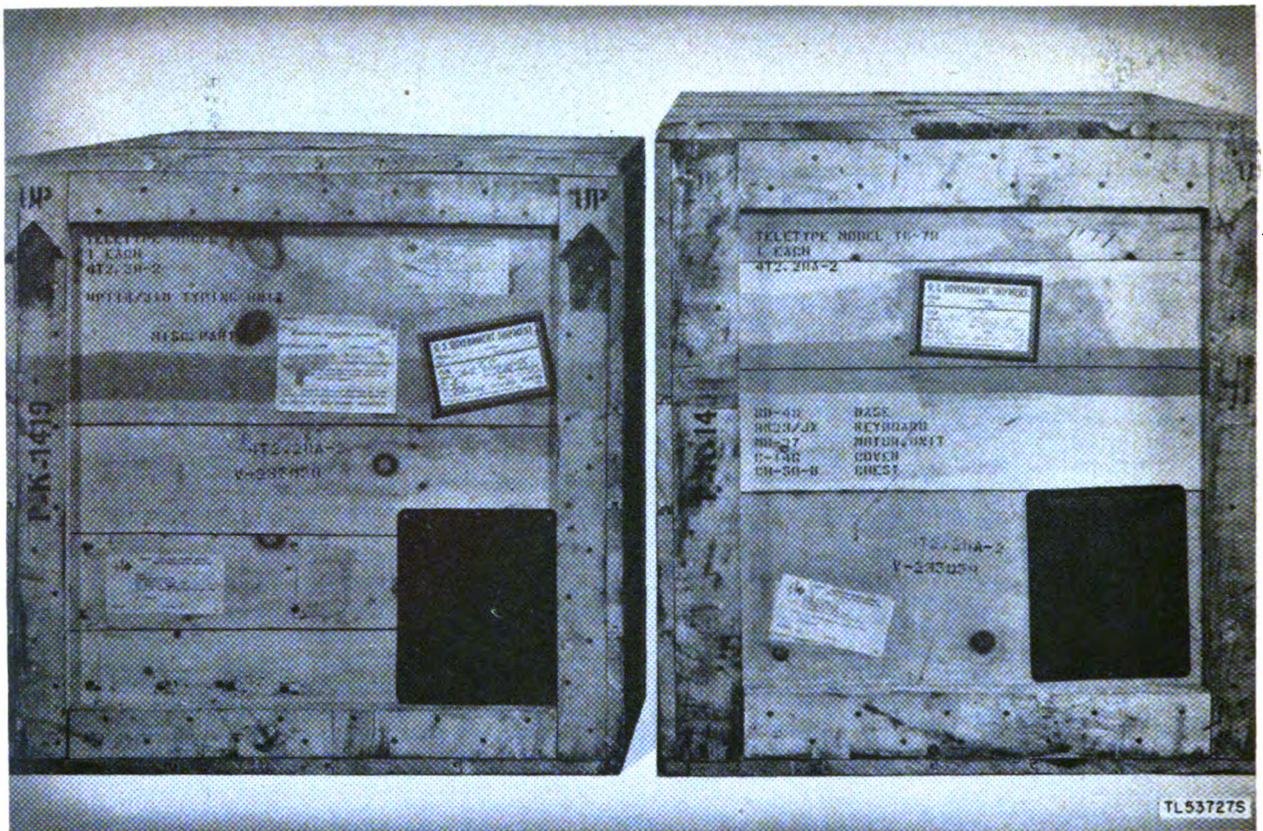


Figure 16. Complete teletypewriter packed in two shipping boxes.

### 8. Packing Data for Domestic or Short Distance Shipments

Listed below are the contents and approximate weights, dimensions, and volumes of two shipping boxes used whenever the equipment may require additional protection from the weather and handling during shipment and storage.

This arrangement is not considered satisfactory for overseas shipment.

Pkg. No.	Contents of box	Weight (lb.)	Width (in.)	Length (in.)	Height (in.)	Volume (cu. ft.)
1/2	Chest CH-50-(*).	153	23 3/4	23 3/4	22	8.4
2/2	Chest CH-62-(*).	97	22	21	20	5.4

## 9. Packing Data for Local Transportation and Storage

The two wooden chests provided with each teletypewriter are rugged and reasonably weather-proof. Figure 37 shows how the cover of the chests is fastened to the base by four latches. The chart below shows the dimensions and weights of the two chests when packed.

Item	Weight (lb.)	Width (in.)	Length (in.)	Height (in.)	Volume (cu. ft.)
Chest CH-50-(*).....	138	20¾	25¾	19	5.3
Chest CH-62-(*).....	87	19	18	17	3.3

### Section II.

## GENERAL FUNCTIONING OF EQUIPMENT

### 10. Functioning of Transmitting and Receiving Mechanisms

a. TRANSMITTING MECHANISM (fig. 18). The sending contacts in the keyboard transmitting mechanism are used to send electrical code impulses which cause all teletypewriters connected in the same circuit to print a copy of the message sent by the keyboard operator.

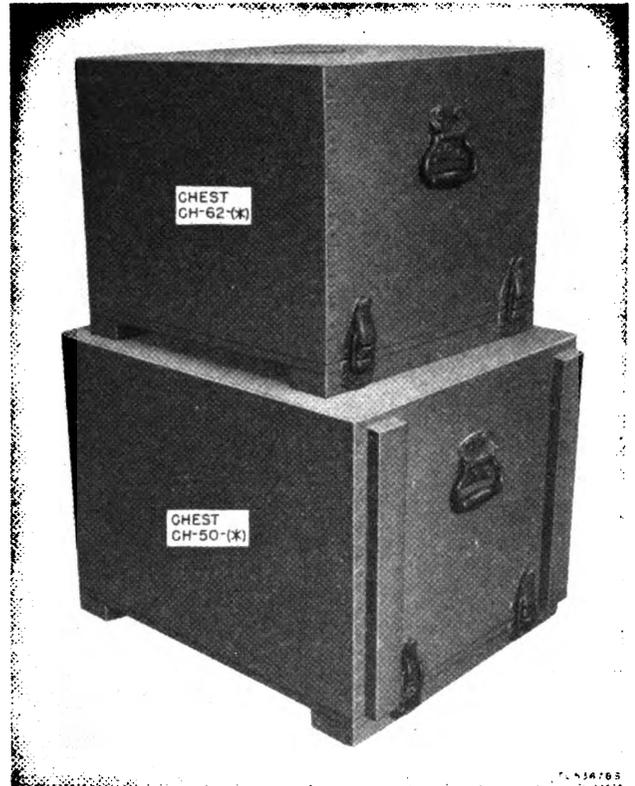


Figure 17. Complete teletypewriter packed for transportation and storage.

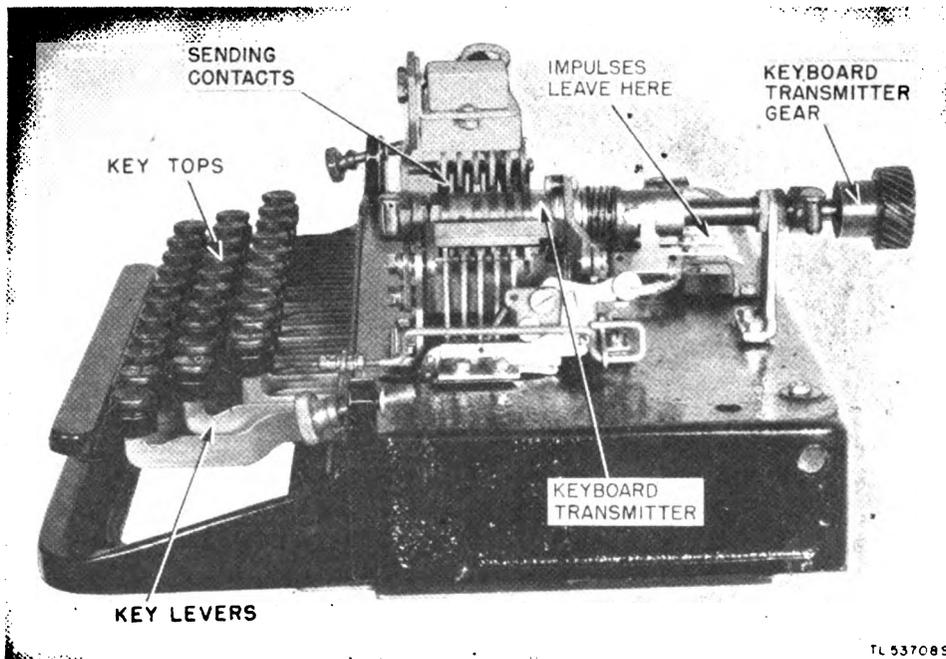


Figure 18. Transmitting mechanism.

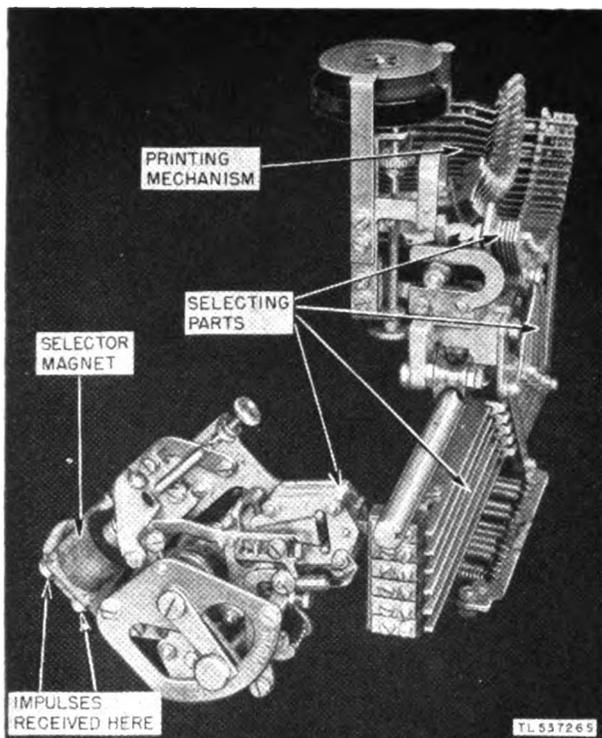


Figure 19. Receiving mechanism.

*b.* RECEIVING MECHANISM (fig. 19). The selector magnet in the receiving mechanism is controlled by the code impulses received from a transmitting mechanism and translates them into related mechanical movements of certain parts. The selection of a particular combination of positions for these parts determines the character to be printed or the function (such as carriage return or line feed) to be completed by the typing unit of the teletypewriter.

## 11. General Theory of Teletypewriter Transmission

Figure 20 is a diagrammatic illustration of the keyboard transmitting mechanism on one teletypewriter sending a series of current (marking) and no-current (spacing) impulses. These impulses are received by the selector units in the receiving mechanisms on the typing units at both the distant and sending teletypewriters. A motor unit provides each teletypewriter with the mechanical power required to operate various parts in the transmitting and receiving mechanisms. The speed at which the parts operate is determined by the speed of the motor and the ratio of the gears which connect the motor to a main drive shaft.

## 12. Common Features of Connecting Facilities and Equipment

*a.* A simplified schematic diagram of two interconnected teletypewriters is shown in figure 21. The opening and closing of the sending contacts in either teletypewriter operates both receiving relays, which in turn operate both selector magnets. Teletypewriter circuit connections involving wire, radio, or carrier terminal equipment are all designed for neutral operation in d-c circuits to each teletypewriter. Therefore, the sending contacts and selector magnet function the same with all types of connecting facilities or equipment. In any connection the armatures of all selector magnets are pulled up (operated) when a current of approximately 60 milliamperes flows through their windings (marking interval) and are released when no current flows (spacing interval).

*b.* The type of circuit used between two or more teletypewriters varies depending on the distance and type of facilities available. However, the general functioning of Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B is always the same, as explained in *a* above. Figure 22 illustrates a number of the facility and equipment lay-outs with which the teletypewriters are designed to operate. In each case the circuit between Teletypewriter TG-7-( ) and associated line unit, telegraph switchboard, telegraph repeater, or carrier telegraph terminal has a current of approximately 60 milliamperes when the circuit is closed (marking) and no current when the circuit is opened (spacing).

## 13. Five-Unit Start-Stop Teletypewriter Code

The signaling code used to transmit messages between teletypewriters consists of five selecting impulses used in various combinations of current and no-current intervals and two synchronizing impulses. These synchronizing impulses consist of one start and one stop impulse. Each group of five selecting impulses is preceded by a start (no-current) impulse and followed by a stop (current) impulse. These start and stop impulses are used to maintain synchronism between the sending and receiving teletypewriters as described in paragraph 14. Figure 23 shows graphically the complete five-unit start-stop teletypewriter code.

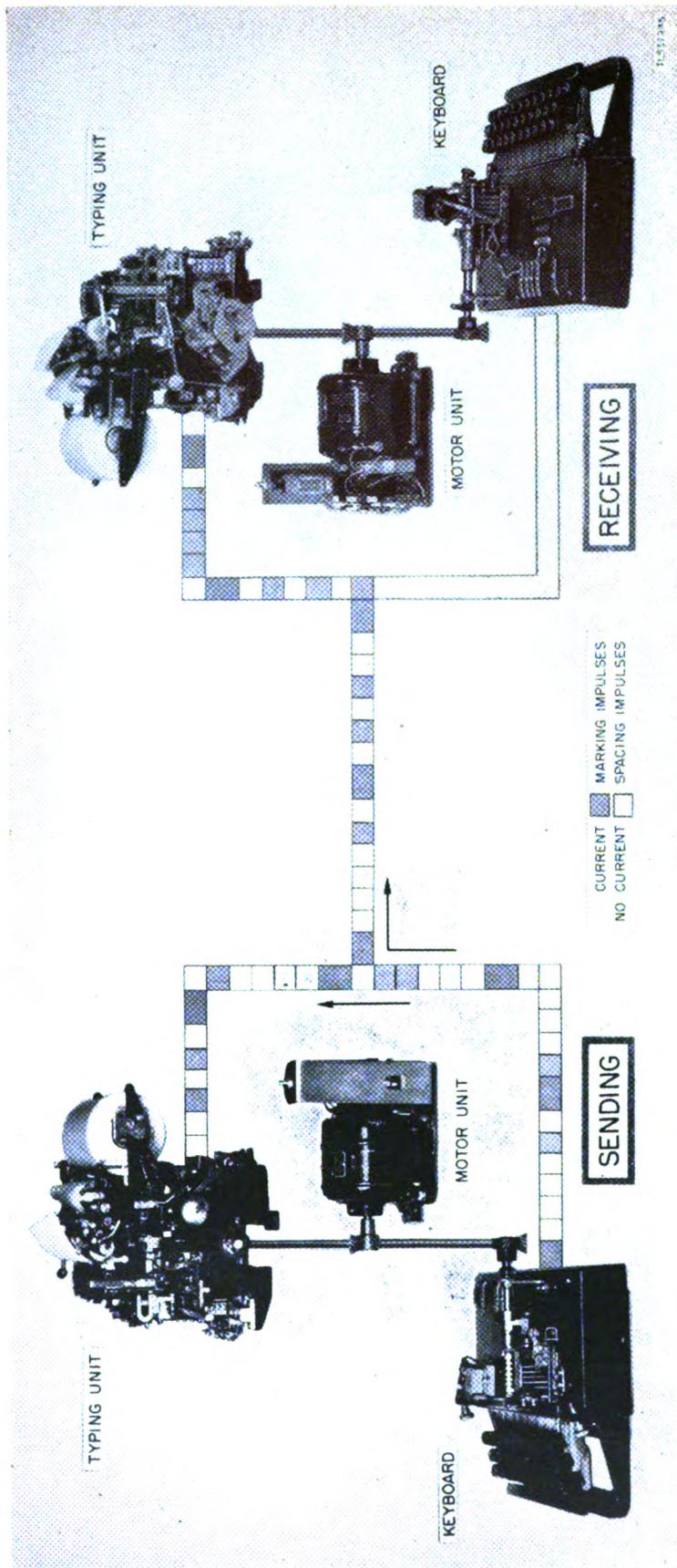
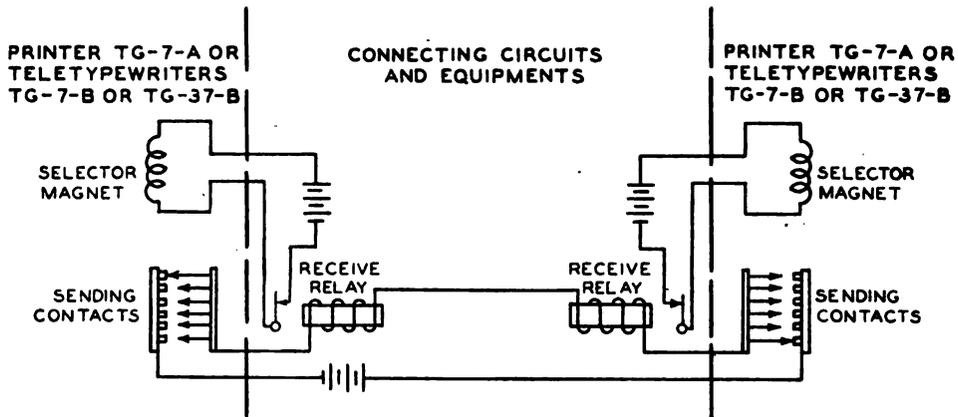


Figure 20. Diagrammatic illustration of teletypewriter transmission.



TL53722-5

Figure 21. Simplified schematic diagram of interconnected teletypewriters.

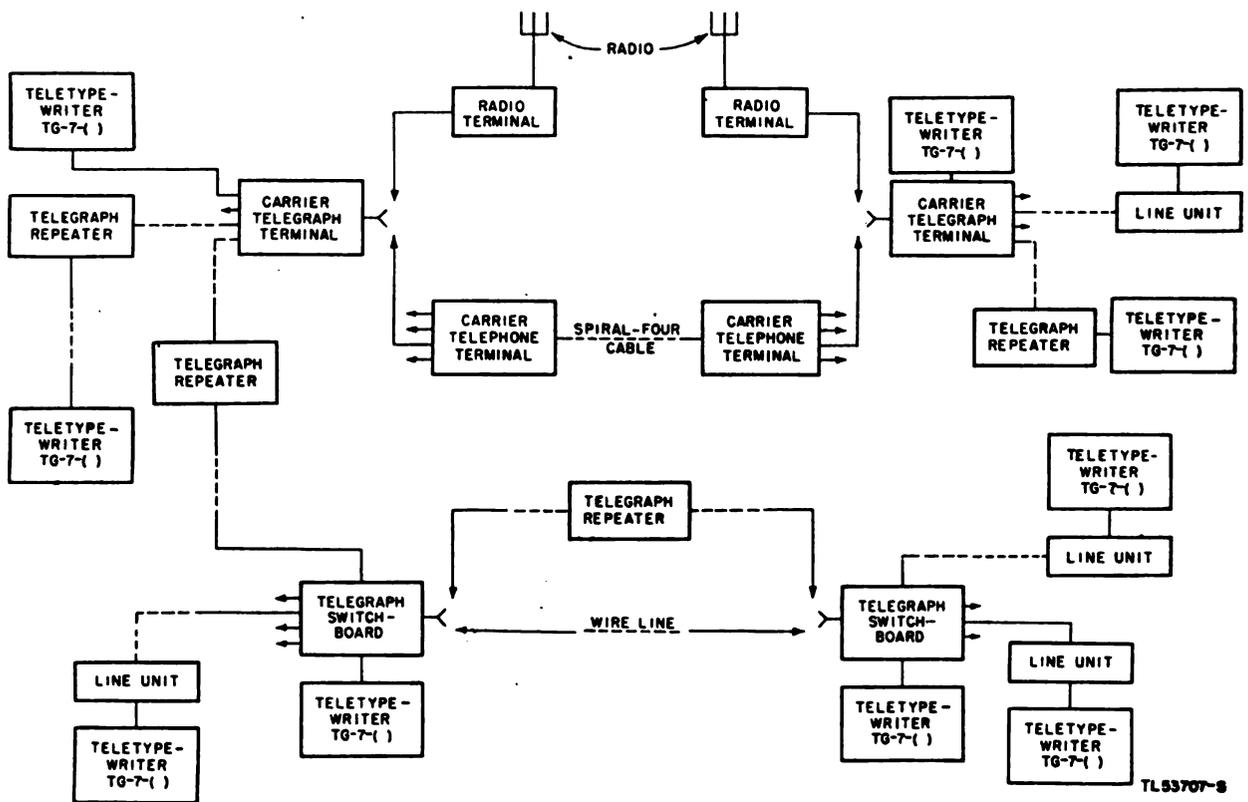
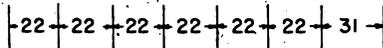


Figure 22. Block diagram of typical facility and equipment lay-outs.

PLATEN POSITION

PLATEN POSITION		IMPULSES						
LTRS	FIGS.	START	SELECTING					STOP
TG-7-A, TG-7-B, AND TG-37-B	TG-7-A AND TG-7-B		1	2	3	4	5	
A	-	↑	█	█	█	█	█	█
B	?	⊕	█	█	█	█	█	█
C	:	○	█	█	█	█	█	█
D	\$	↖	█	█	█	█	█	█
E	3	3	█	█	█	█	█	█
F	!	→	█	█	█	█	█	█
G	&	↘	█	█	█	█	█	█
H	STOP	↓	█	█	█	█	█	█
I	8	8	█	█	█	█	█	█
J	'	↙	█	█	█	█	█	█
K	(	←	█	█	█	█	█	█
L	)	↗	█	█	█	█	█	█
M	.	.	█	█	█	█	█	█
N	,	⓪	█	█	█	█	█	█
O	9	9	█	█	█	█	█	█
P	0	0	█	█	█	█	█	█
Q	1	1	█	█	█	█	█	█
R	4	4	█	█	█	█	█	█
S	BELL		█	█	█	█	█	█
T	5	5	█	█	█	█	█	█
U	7	7	█	█	█	█	█	█
V	;	⓪	█	█	█	█	█	█
W	2	2	█	█	█	█	█	█
X	/	/	█	█	█	█	█	█
Y	6	6	█	█	█	█	█	█
Z	"	+	█	█	█	█	█	█
BLANK	-		█	█	█	█	█	█
FUNCTIONS	CAR RET		█	█	█	█	█	█
	LINE FEED		█	█	█	█	█	█
	SPACE		█	█	█	█	█	█
	LTRS		█	█	█	█	█	█
	FIGS		█	█	█	█	█	█



IMPULSE LENGTHS IN MILLISECONDS AT STANDARD SPEED OF 60 WORDS PER MINUTE



\* FIGS BLANK H FOR MOTOR STOP ON TG-37-B TL 53786-S

Figure 23. Five-unit start-stop teletypewriter code.

### 14. Synchronism

All teletypewriters equipped with the same type of gear combination and motor can be adjusted to operate at the same average speed. Figure 24 shows the motor governor, which controls the speed of the teletypewriter within very close limits. The remaining small differences in speed could still cause the receiving mechanism to get out of step gradually with the transmitting mechanism, except for the control exercised by the start and stop impulses in the teletypewriter code. This control is accomplished by designing the receiving mechanism to complete one revolution for each group of five selecting impulses quickly enough to have time to stop and wait for the next start impulse. Small variations in speed cause the receiving mechanism to wait only a few thousandths of a second more or less than the normal waiting period before the next start impulse. This arrangement keeps all teletypewriters connected in the same circuit in exact synchronism by insuring that the receiving mechanisms are always in the right position at the beginning of each group of five selecting impulses.

### Section III. ASSEMBLY AND DISASSEMBLY

Note. The information in this section is intended to present the unpacking procedures applicable to the several packing arrangements currently in use. The different arrangements encountered will depend upon whether the equipment has been packaged for overseas shipment, packed for domestic (other than overseas) shipment or simply arranged in the carrying chests for transportation and storage by the using organization.

### 15. Unpacking Oversea Packing Cases

a. GENERAL Teletypewriter equipment may be easily damaged during unpacking. When unpacking, cut metal bands, remove blocks and wedges, tops, sides, etc., of the cases in the exact sequence shown for the type of packing involved.

(1) The packing cases should be sorted out by complete sets and unpacked in a location

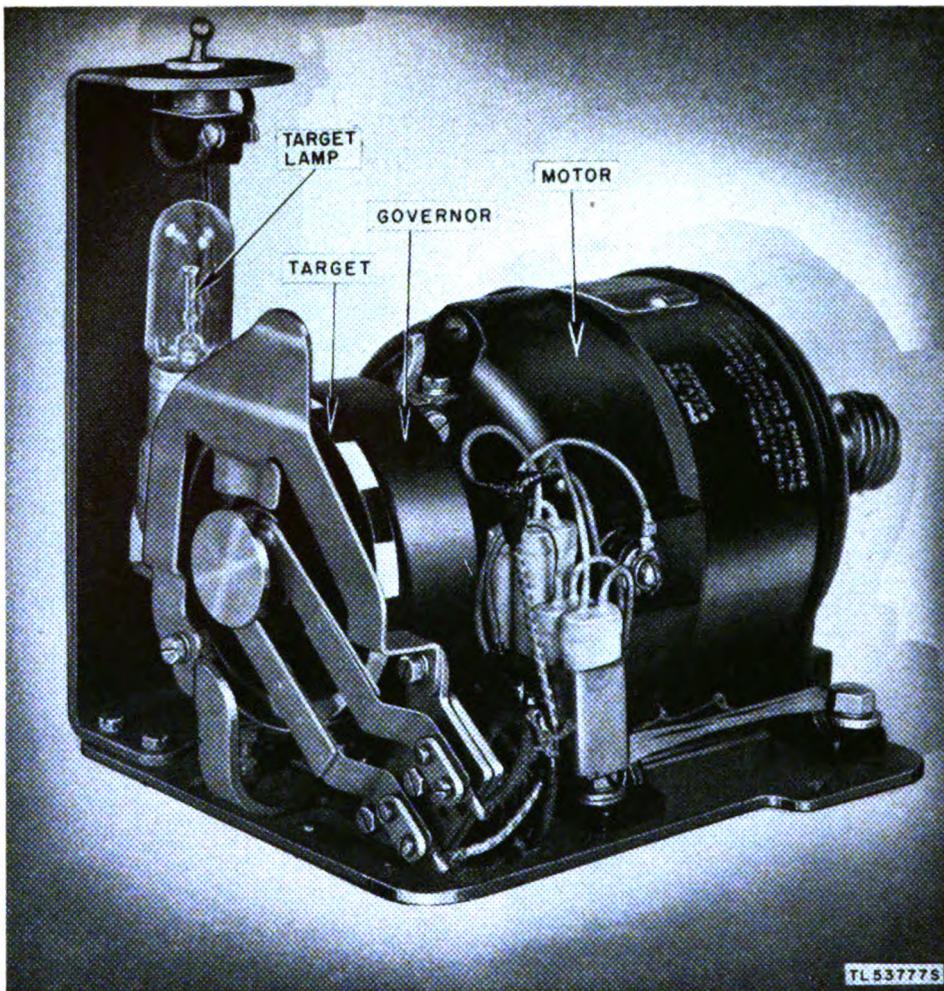


Figure 24. Governor end of motor unit.

where the equipment will not be subject to dust, dirt, or moisture entering the apparatus.

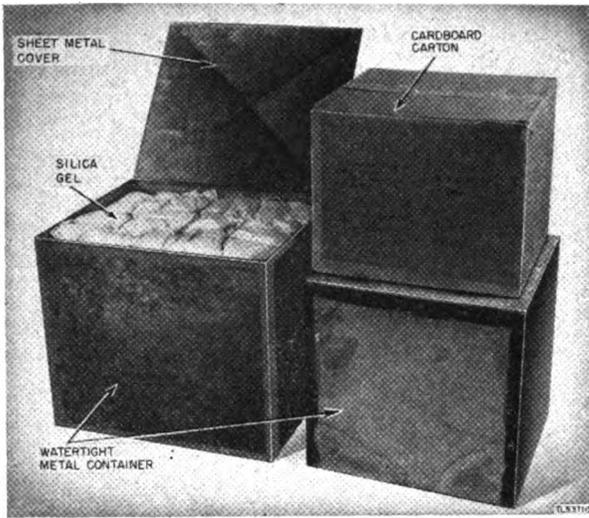
(2) Packing cases for teletypewriter equipment have an orange band painted around them to indicate that the case contains Signal Corps equipment. Each of the three cases required for one complete teletypewriter is marked with a round orange disk and stenciled with the package numbers 1/3, 2/3, and 3/3 respectively. These package (case) numbers are listed in paragraph 2 as a reference for the contents of each oversea shipping container. The marking on each of the three cases used in typical oversea shipment of one teletypewriter is illustrated in figure 25.

Open the largest case first and use it as a workbench to set the equipment on as it is unpacked and assembled.

b. UNPACKING OVERSEA SHIPPING CONTAINERS. Inside the two larger cases will be found watertight sheet metal containers, and in the smaller case, a cardboard carton similar to those shown in figure 26. The wooden packing cases should be opened as follows:

- (1) Cut the steel straps and fold the sharp ends back as a safety precaution. (See fig. 25.)
- (2) Remove the nails, using a nail puller, from the top of the packing case. Prying the top or sides off the case may result in damage to the equipment.

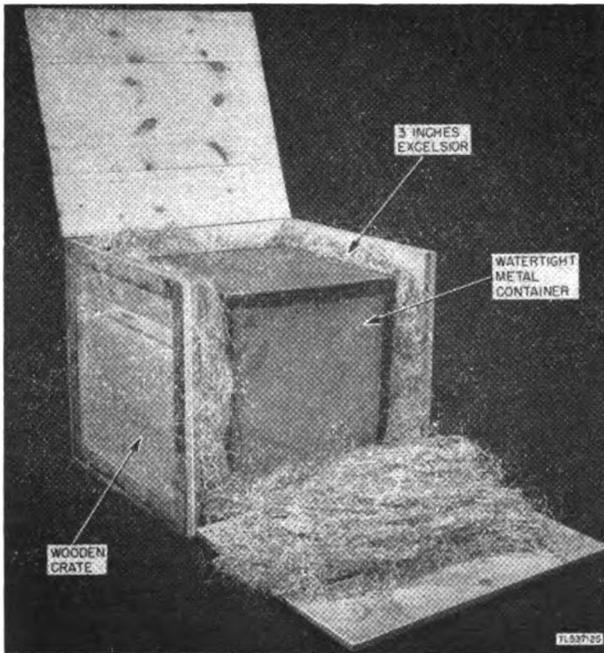




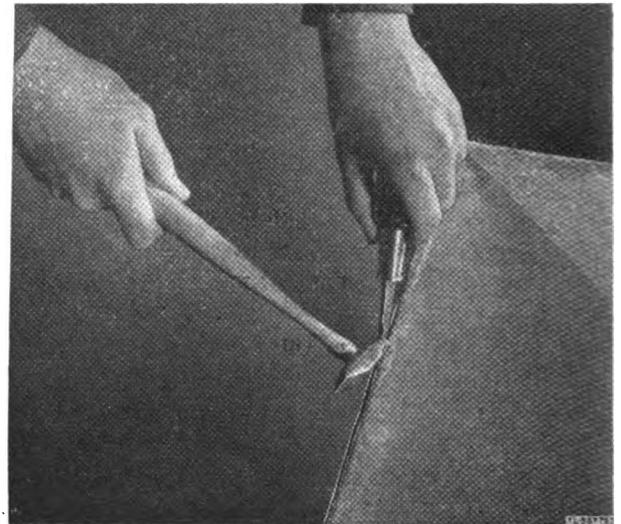
**Figure 26. Typical overseas packaging containers.**



**Figure 28. Opening metal container with wooden block.**



**Figure 27. Arrangement of metal container in wooden case.**



**Figure 29. Opening metal container with screwdriver.**

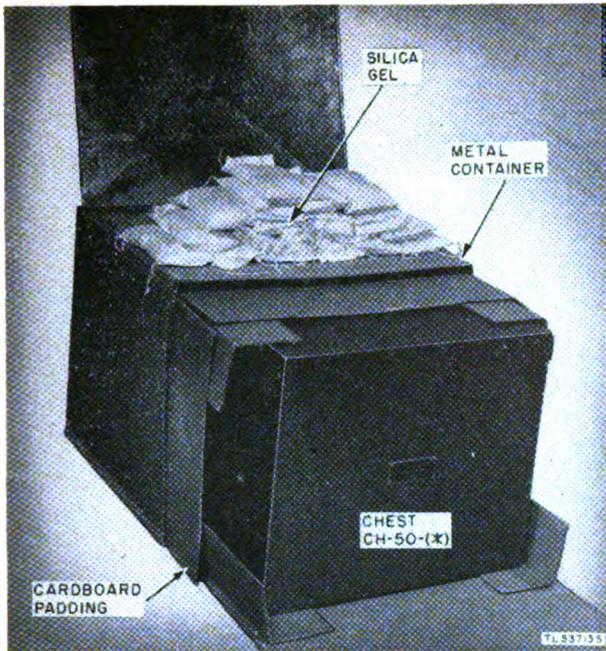


Figure 30. Removing Chest CH-50-(\*) from metal container.

## 16. Uncrating Typing Unit

Avoid possible damage to the typing unit by uncrating in the exact sequence of steps listed below.

- a. With typing unit in upright position, remove two wedgelocks from each side. (See fig. 32.)
- b. Remove two wood screws from each of four vertical corner members and remove outer crate.
- c. Remove two wood screws holding wooden top frame to wooden front frame.
- d. Remove wooden top frame from typing unit.
- e. Remove wooden front frame from typing unit.

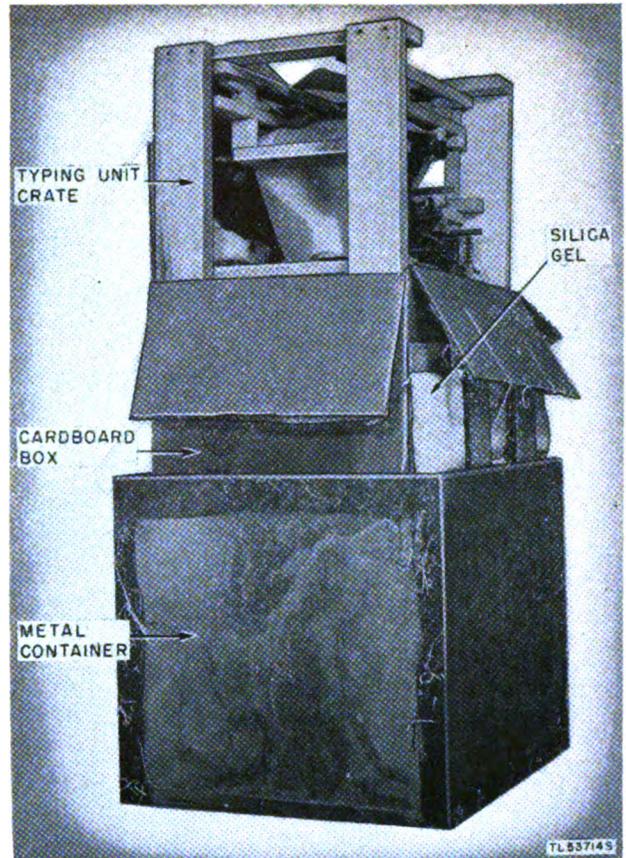
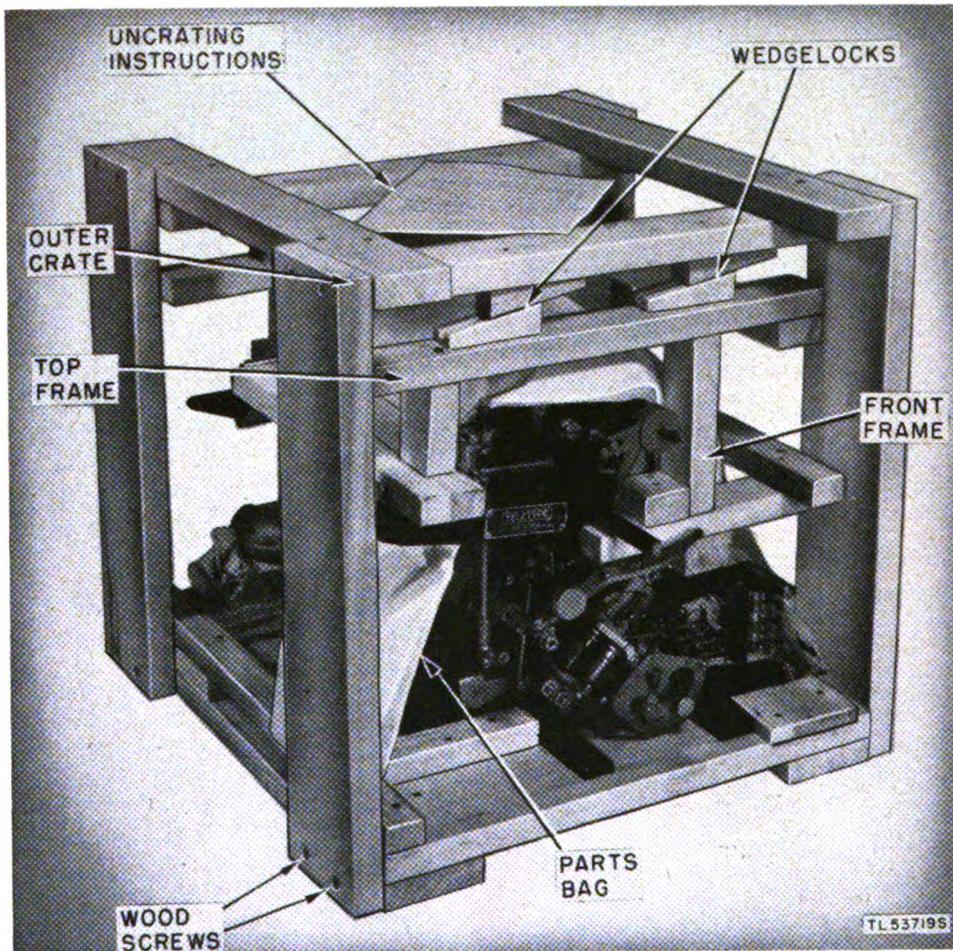
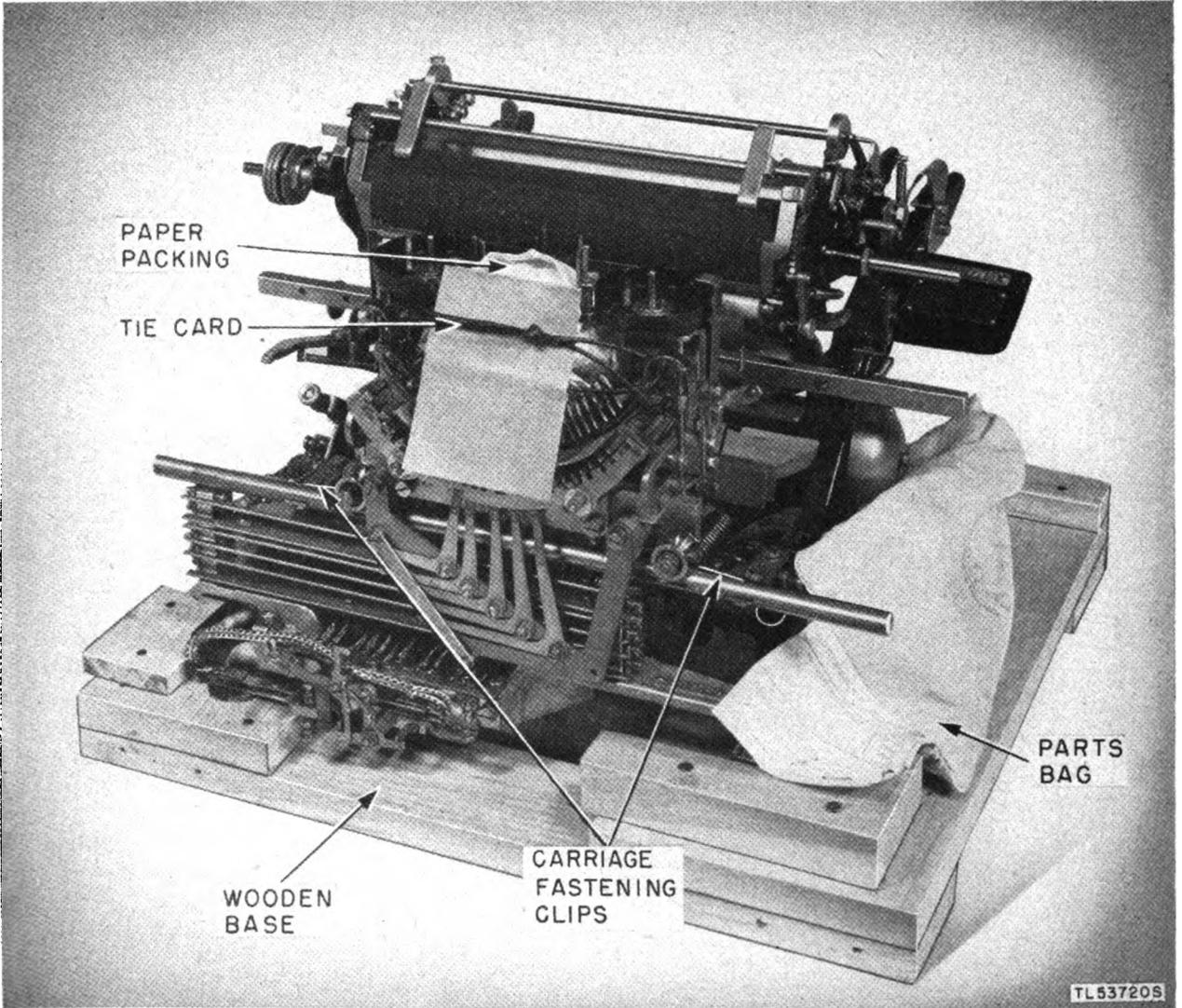


Figure 31. Removing typing unit from metal container.

- f. Remove the tie cord and paper packing from type bar carriage (fig. 33).
- g. Detach parts bag and remove paper roll spindle, crank, and ribbon spools and assemble on unit. (See fig. 34.)
- h. Remove carriage fastening clips from both ends of carriage, detaching right end first.
- i. Remove wire holding bell at rear of unit.
- j. Lift typing unit from wooden base when ready to assemble teletypewriter.



*Figure 32. Typing unit crate.*



*Figure 33. Typing unit crate with top and front frame removed.*

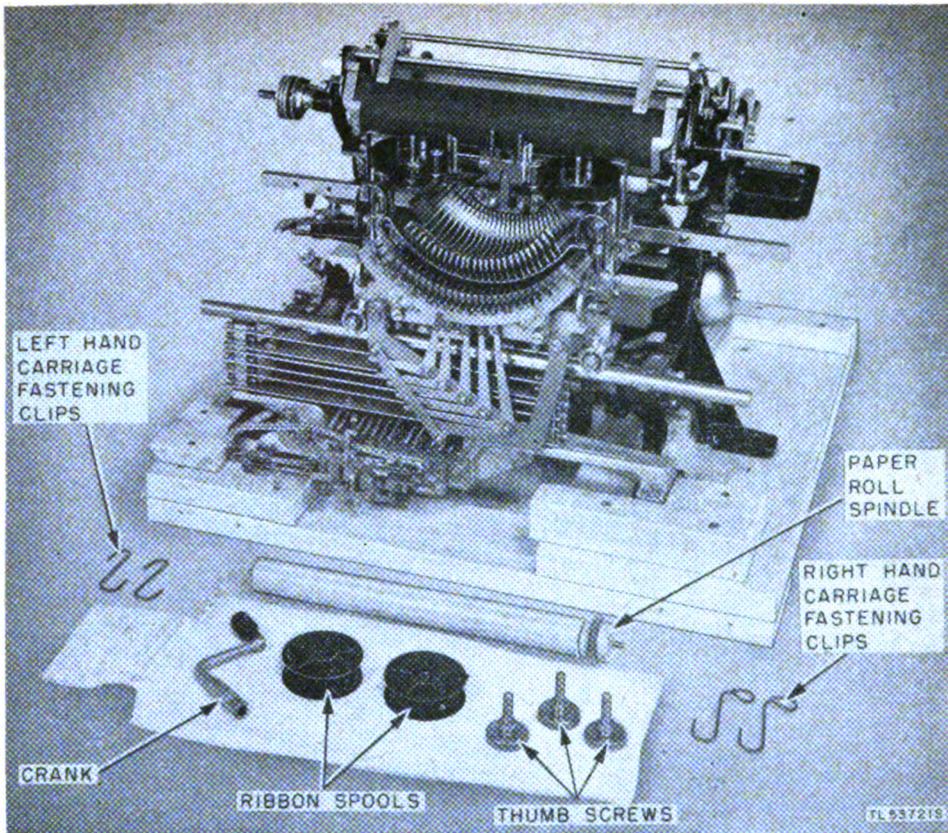


Figure 34. Contents of parts bag.

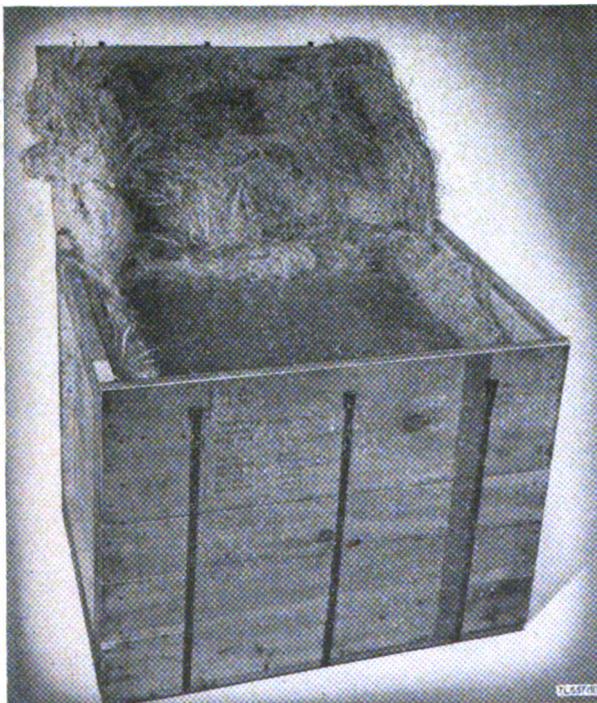


Figure 35. Typical packing case for domestic shipments.

## 17. Unpacking Domestic Packing Cases

a. Teletypewriters packed for domestic (other than overseas) shipment may be received in two shipping cases similar to the one shown in figure 35. Cut the metal straps and remove the nails and cover as described in paragraph 15.

b. No special instructions are required to open the cartons used to protect the chests. In some instances heavy packing paper may be used in place of the cartons shown in figure 36.

## 18. Unpacking Carrying Chests

a. The carrying chests used with Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B are especially designed to permit the teletypewriter to be assembled and connected for use in a very few minutes. Removing the cover consists of unfastening four latches and lifting the cover straight up. Figure 37 shows the covers of the two carrying chests removed.

b. The typing unit is fastened to the base of Chest CH-62-(\*) by three special clamps. A

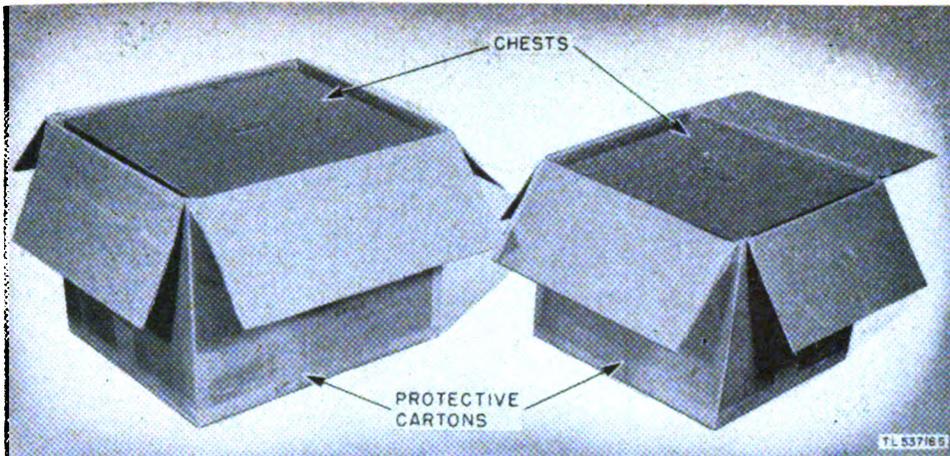


Figure 36. Protective cartons for Chests CH-50-(\*) and CH-62-(\*) .

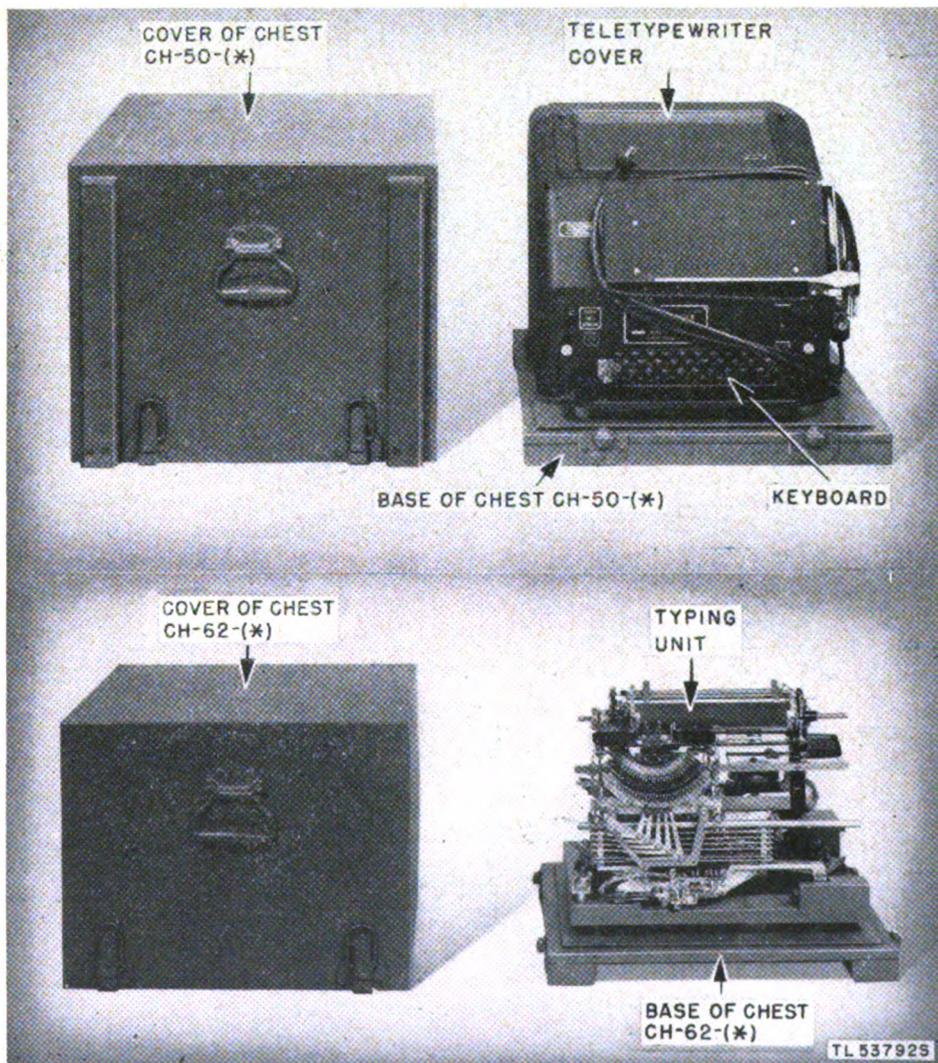


Figure 37. Chests CH-62-(\*) and CH-50-(\*) with covers removed.

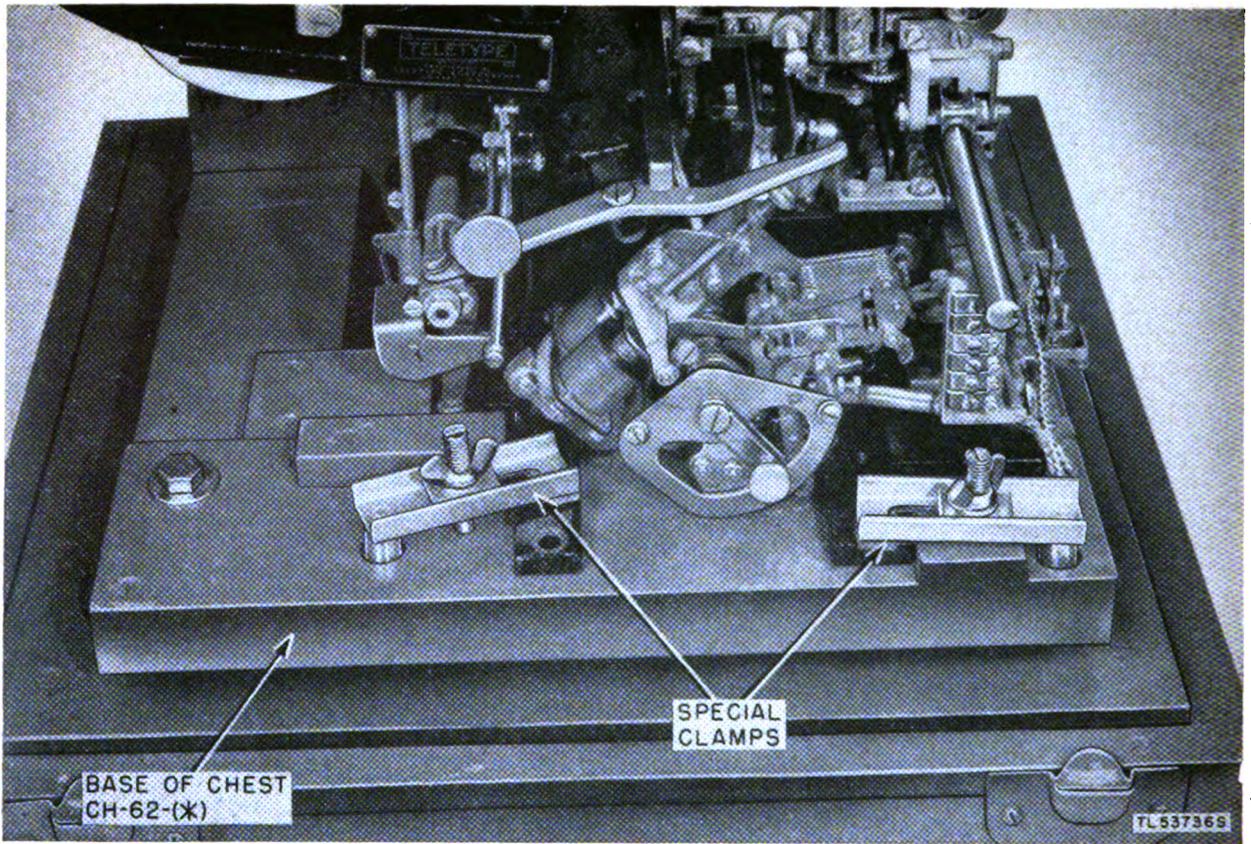


Figure 38. Close-up of special clamps holding typing unit to base of chest.

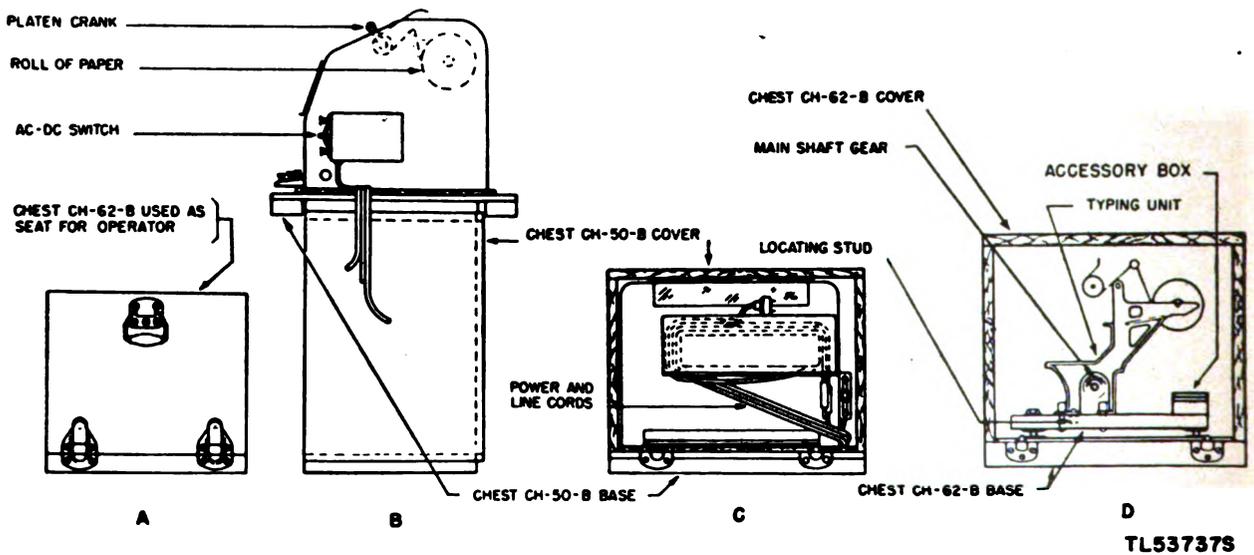


Figure 39. Outline of teletypewriter set up for use.

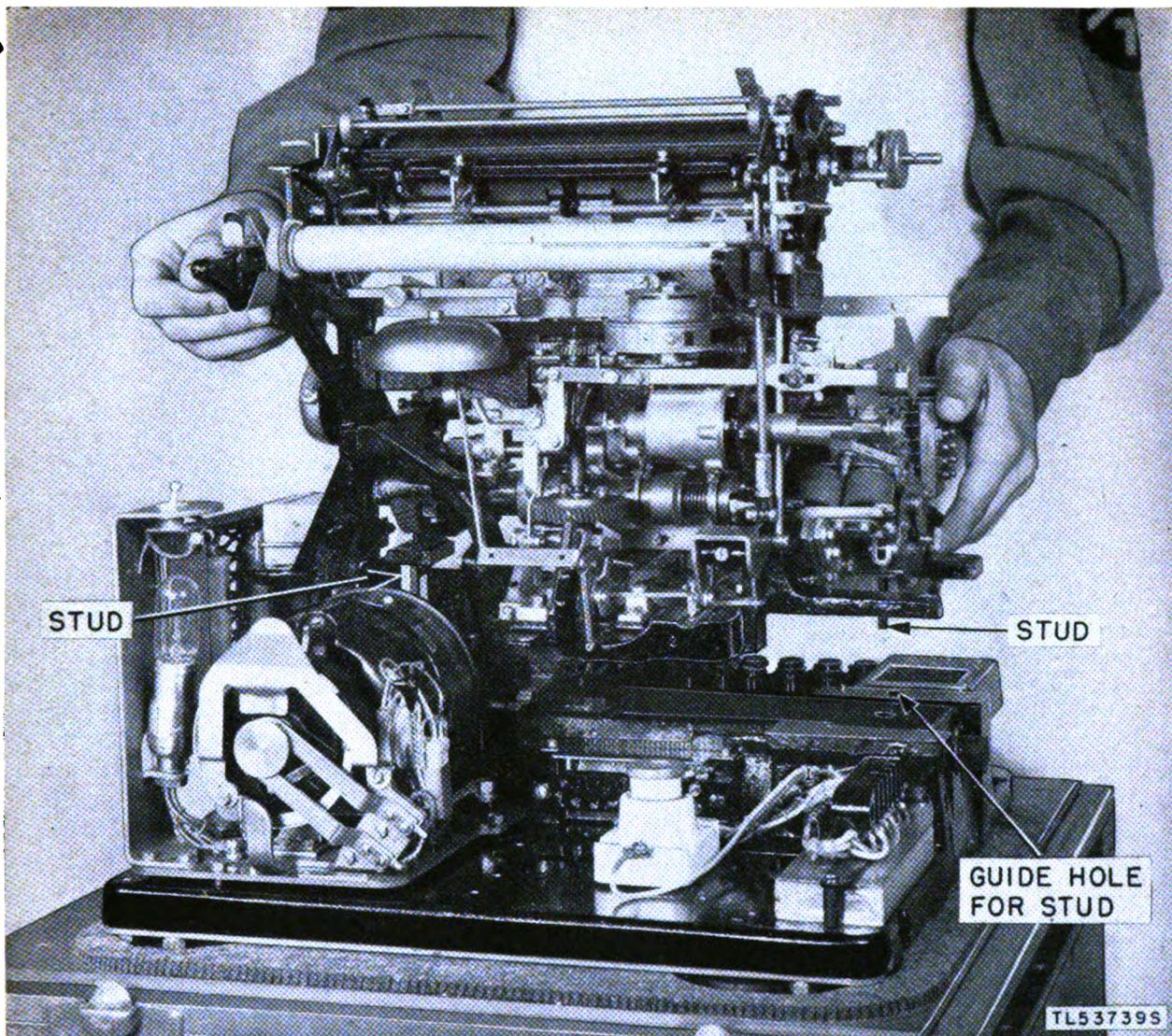


Figure 40. Lowering typing unit on to base.

close-up view of two clamps is shown in figure 38. A few of the earlier models were fastened with mounting screws in place of the clamps illustrated.

c. No special clamps or fasteners are required for the contents of Chest CH-50-(\*) as all parts remain in the same general position when the teletypewriter is assembled ready for use. Instructions for assembling the teletypewriter are furnished in paragraph 19.

### 19. Assembly Instructions

a. GENERAL. The same procedure is used in setting up Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B for operation. Teletypewriter TG-7-B will be used for illustrations.

Figures 39A and 39B show (in outline) Teletypewriter TG-7-B set up ready for use. Figures 39C and 39D show the teletypewriter place in Chest CH-50-B and Chest CH-62-B and ready for transportation or limited storage.

b. ASSEMBLY PROCEDURE. The teletypewriter can be quickly and easily set up for operation by performing the work in the following sequence:

(1) Place the cover of Chest CH-50-B on end with open side towards the intended position for the operator.

(2) Place the base of Chest CH-50-B and the teletypewriter equipment mounted on it on top of the chest cover as shown in figure 39B.

(3) Remove teletypewriter cover from the

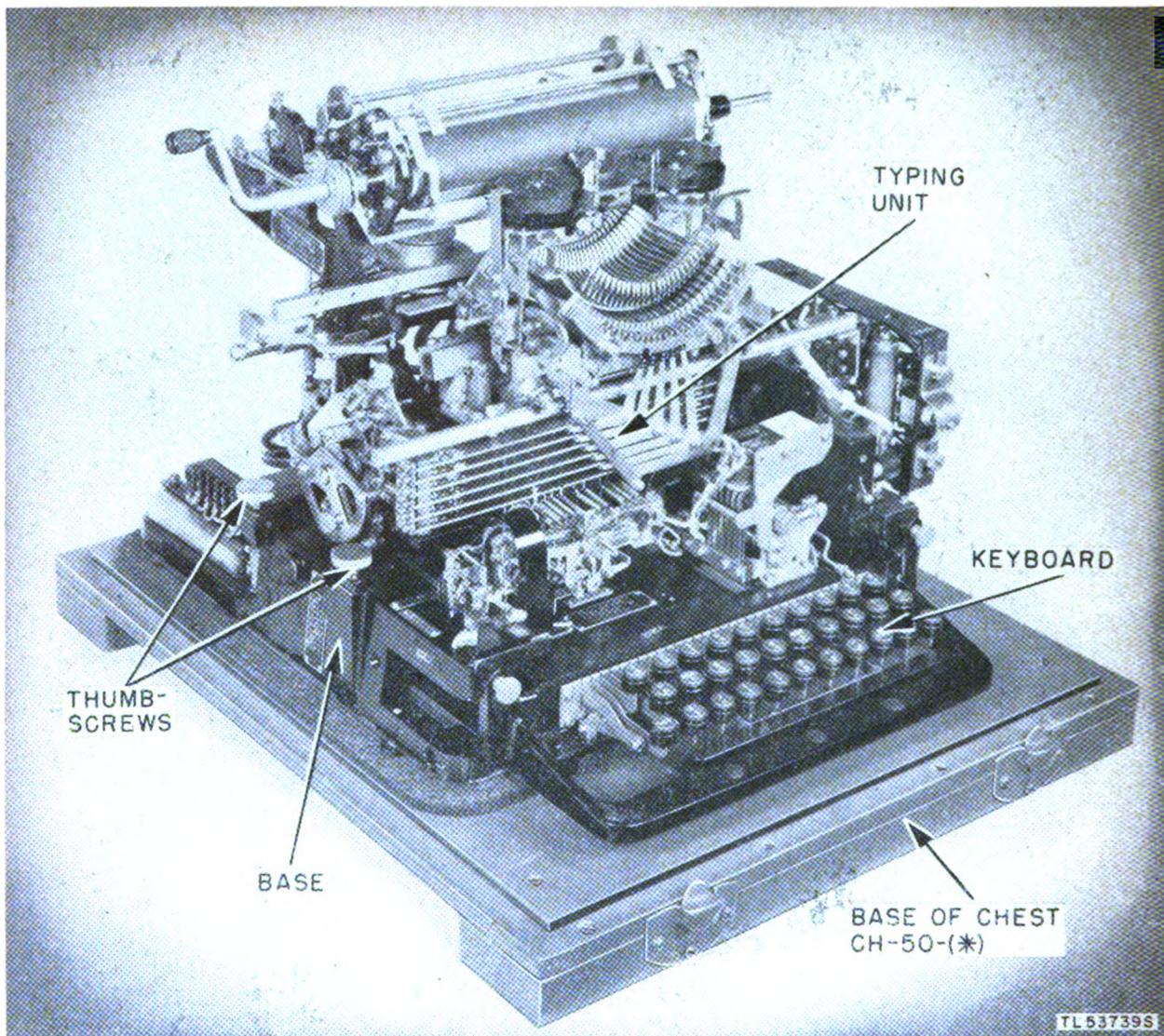


Figure 41. Typing unit fastened to base.

base of Chest CH-50-B. This leaves the teletypewriter base accessible for mounting the typing unit.

(4) Loosen the wingnuts on the special clamps to remove the typing unit from the base of Chest CH-62-B. (Earlier models of Printer TG-7-A require the removal of three mounting screws with a special wrench carried in the chest.) Remove the typing unit by lifting it in the manner illustrated in figure 40. The small metal projections used as hand holds are constructed as part of the typing unit frame.

*Note.* Holding the typing unit in this manner prevents injury to the fingers and damage to delicate parts of the teletypewriter mechanism.

(5) Place the typing unit on the base as shown in figure 41 by lining up the holes for

the three thumbscrews and lowering the typing unit straight down so that the studs will enter the guide holes. Rock the typing unit gently back and forth once or twice to work the gears into mesh. The fiber gear on the main shaft is easily damaged by being forced against the steel pinion on the motor. To insure that the gears are properly meshed, rotate the motor shaft by hand for a few turns before fastening the typing unit to the base.

(6) Remove the platen crank and three thumbscrews from accessory box on base of Chest CH-62-B.

(7) Place the three thumbscrews in the associated holes in the frame and tighten them firmly in place. The location of two of the

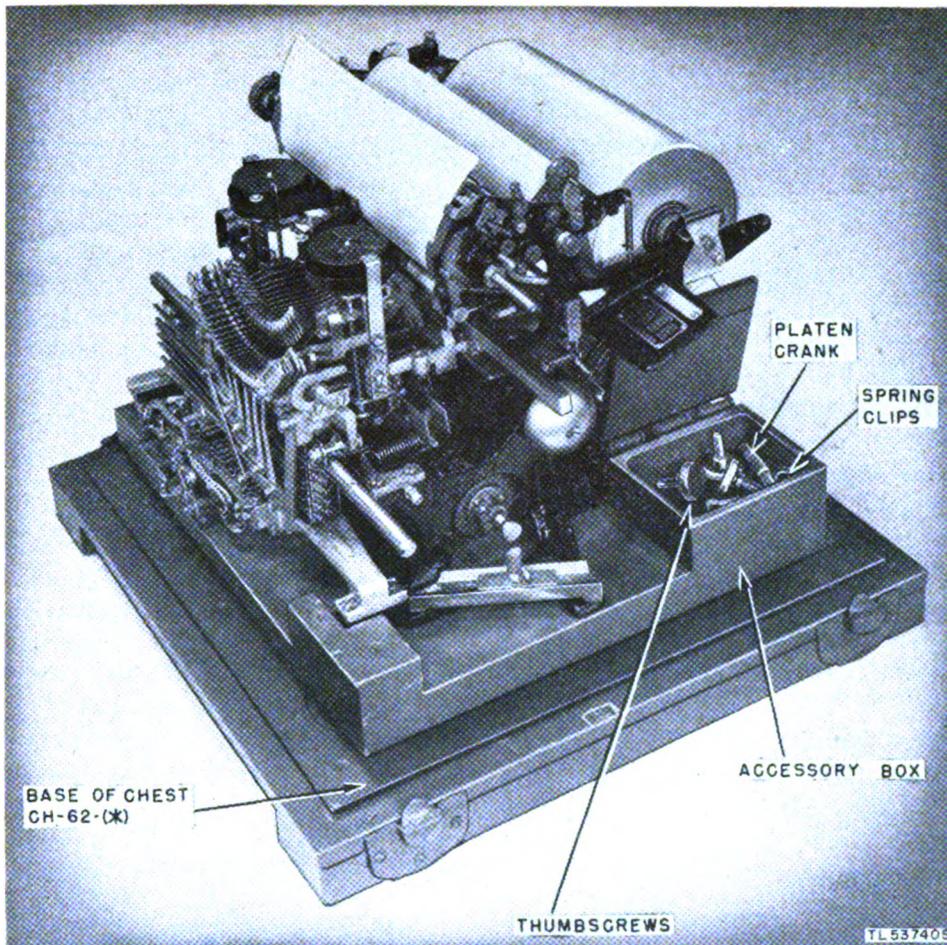


Figure 42. Contents of Chest CH-62-(\*) accessory box.

thumbscrews on the left side of the base is shown in figure 41. The remaining thumbscrew is placed in a corresponding place on the right side of the base.

(8) Remove the carriage fastening clips from both ends of type bar carriage, detaching right end first.

(9) Place the teletypewriter cover over the typing unit, making certain that the cover locating studs on the base enter the channels on the cover sides. Rock cover gently to front and rear until it settles upon the felt base pad.

(10) Insert the platen crank in the hole near the top of the left side of the cover and push it into place on the end of the platen shaft.

(11) Latch Chest CH-62-B cover on Chest CH-62-B base. Position chest as shown in figure 1 to be used as a seat by the operator.

*Note.* In prescribing the above assembly procedure, it is assumed that the teletypewriter was in normal working order when it was packed in the chests. When the exact condition is not known complete the checks, ad-

justments, and repairs listed in paragraph 20 before completely assembling the teletypewriter.

## 20. Physical Checks

a. During or immediately after the assembly of the teletypewriter, and in all cases before the teletypewriter is connected to other equipment, check the following items.

(1) General physical inspection of entire teletypewriter to determine that no damage has occurred during shipment. (When damaged apparatus is received, complete repairs when possible in accordance with instructions in part five or return the equipment for replacement as directed by the local commander.)

(2) Entire teletypewriter to determine that no excelsior or packing material has entered the moving parts. (See par. 34, for cleaning instructions when necessary.)

(3) All mechanical parts for lubrication. (See section VII for lubrication instructions.)

(4) Motor, fuse, switches, cords and plugs to make sure that all connections and moving parts are in good physical condition. (See part three, and part five for additional information.)

b. At least one teletypewriter ribbon will be furnished with each teletypewriter. See paragraph 25 for instructions on placing new ribbons.

c. Paper is not normally supplied as part of the teletypewriter but will be furnished in varying quantities packed with other parts of teletypewriter sets and systems. (See par. 24, for instructions on installing paper.)

## 21. Disassembly and Repacking

a. GENERAL. Remove the teletypewriter from service and disconnect or remove all wiring and cording from associated equipment before starting to disassemble. To arrange the equipment in the chests as shown in figures 39C and 39D the teletypewriter is disassembled as follows:

(1) Remove cover of Chest CH-62-(\*).

(2) Remove platen crank from platen shaft and place in accessory box on Chest CH-62-(\* base. (See fig. 42.)

(3) Remove teletypewriter cover.

(4) Remove the three knurled thumbscrews securing the typing unit, and place the thumbscrews in accessory box. (See fig. 42.)

(5) Remove the typing unit from the teletypewriter assembly, place on Chest CH-62-(\* base, as shown in figure 38, and tighten the wingnuts on the three special clamps.

*Note.* Some early models were equipped with mounting screws requiring a wrench. These were also carried in the accessory box when they were not in use.

(6) Press carriage-return lock bar (at left rear of typing unit) and return the type-bar carriage to approximately the center of the typing unit. Hook a special fastening clip on the left roller of the type-bar carriage and hook the other end of the clip on the frame. Hook another fastening clip on the right roller and draw the type bar carriage as far right as it will go and snap the other end of the clip on the frame. The type-bar carriage held securely

by the clips where it cannot shift in either direction is shown in figure 33.

(7) Replace teletypewriter cover.

(8) Wrap power and line cords around copyholder, as shown in figure 39C.

(9) Place each chest cover over proper base, and latch.

b. REPACKING FOR SHIPMENT. (1) The exact procedure for repacking for shipment will depend upon the material available and the conditions under which the equipment is to be shipped. The unpacking instructions given in paragraphs 15 and 17 will be followed in reverse order.

(2) Whenever practical, place a dehydrating agent such as silica gel inside the chests. Protect the chests with a waterproof paper barrier similar to that shown in figure 43. Seal the seams in the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior (or like material) padding between the paper barrier or protective cartons and the packing case. (See fig. 27.)

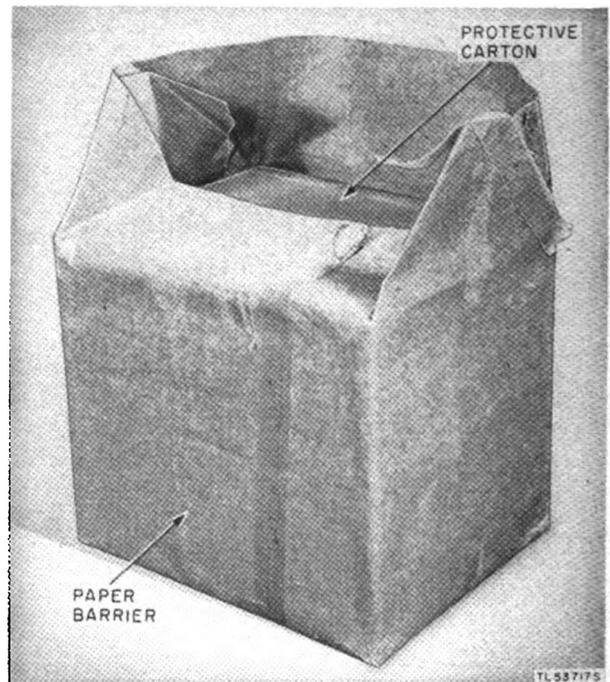


Figure 43. Typical paper barrier.

## PART TWO

# OPERATING INSTRUCTIONS

*Note.* For information on destroying this equipment to prevent enemy use, see the destruction notice at the front of this manual.

### Section IV. CONNECTIONS AND PREOPERATIONAL ADJUSTMENTS

*Note.* The instructions in this section are limited to general information which applies to the more common uses of the teletypewriter with other equipment and those connections which are required to test the equipment when other equipment is not involved.

#### 22. Power Supply and Ground Connections

*a.* GENERAL. Determine the kind of current and voltage of the power supply before connecting the power cord. To position the power selector switch, loosen the clamping screws in the locking clamp, move the selector handle to the desired position, and tighten the clamping screws. (See fig. 8.) The power selector switch on Printer TG-7-A is not equipped with a clamp.

*b.* TELETYPEWRITERS TG-7-B AND TG-37-B POWER SUPPLY. Teletypewriters TG-7-B and TG-37-B may be operated from either dc or ac with the frequencies and voltages listed below:

(1) Power selector switch in top position; 115-volts, 40-cycle ac.

(2) Power selector switch in middle position; 115-volts, dc or ac 25 cycles.

(3) Power selector switch in bottom position; 115-volts, 50-60 cycle ac.

*c.* PRINTER TG-7-A POWER SUPPLY. Printer TG-7-A may be operated from dc or ac with the following frequencies and voltages:

(1) Power selector switch in top position; 115-volts dc or ac 25 cycles.

(2) Power selector switch in bottom position; 115-volts, 50-60 cycles ac.

*d.* GROUNDING ARRANGEMENTS. A ground is required at each teletypewriter installation to minimize hazard to equipment and personnel from lightning and other sources of high voltage, to reduce crossfire interference, and to

complete the d-c path for ground-return telegraph circuits. *It is important that each item of equipment be connected to a low-resistance ground by conductors capable of carrying more than the maximum current which may come in contact with any part of the teletypewriter system.* Ground connections should be made as prescribed in the installation procedure of the technical manual for the set or system with which the teletypewriter is being installed.

#### 23. Connections to Other Equipment

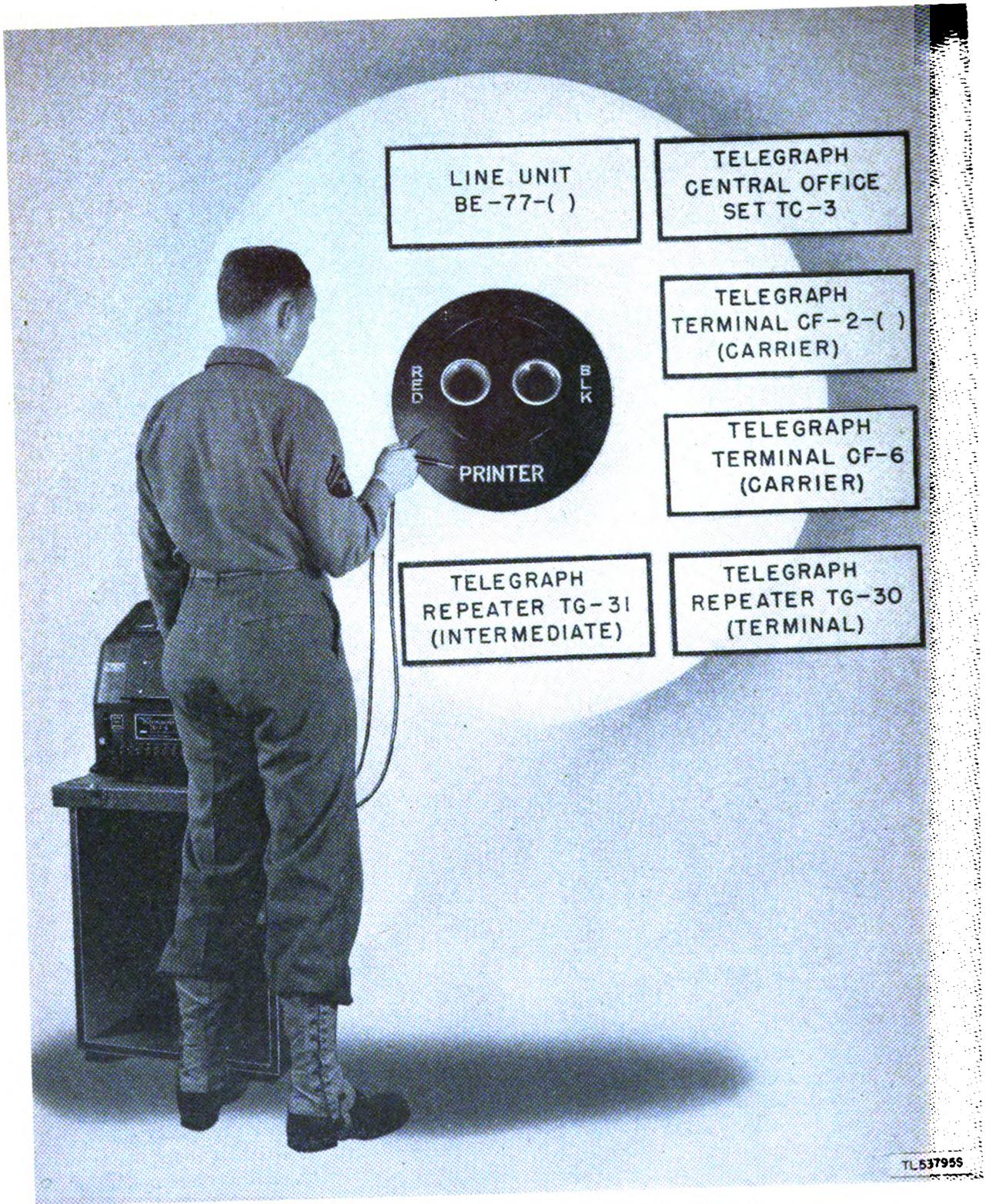
*a.* The teletypewriter sending and receiving circuits are usually connected to the associated equipment by placing the plug with the black shell in the send jack and the plug with the red shell in the receive jack of the line relay, telegraph switchboard, carrier telegraph terminal or other equipment with which the teletypewriter is being used. A typical jack is illustrated in figure 44.

*b.* When the teletypewriters are used in large signal centers or for special purposes, the connections may be wired directly to the terminal block in the teletypewriter in place of using the cord and plug connections. A typical connection to the terminal block is shown in figure 45. See part five for information on local test connections.

#### 24. Installing Paper in Teletypewriters

*a.* Open the front (glass) and rear (metal) top covers. Push back the retaining plates (fig. 46) and remove the spindle. Insert the spindle in a new roll of paper. The round spring on the spindle should be on the right-hand side of the roll as viewed when facing the teletypewriter.

*b.* With the paper feeding from underneath the roll, place the spindle in the right-hand groove and then in the left-hand groove. Push the retaining plates forward to lock the spindle



TL537955

Figure 44. Typical jack connection to associated equipment.

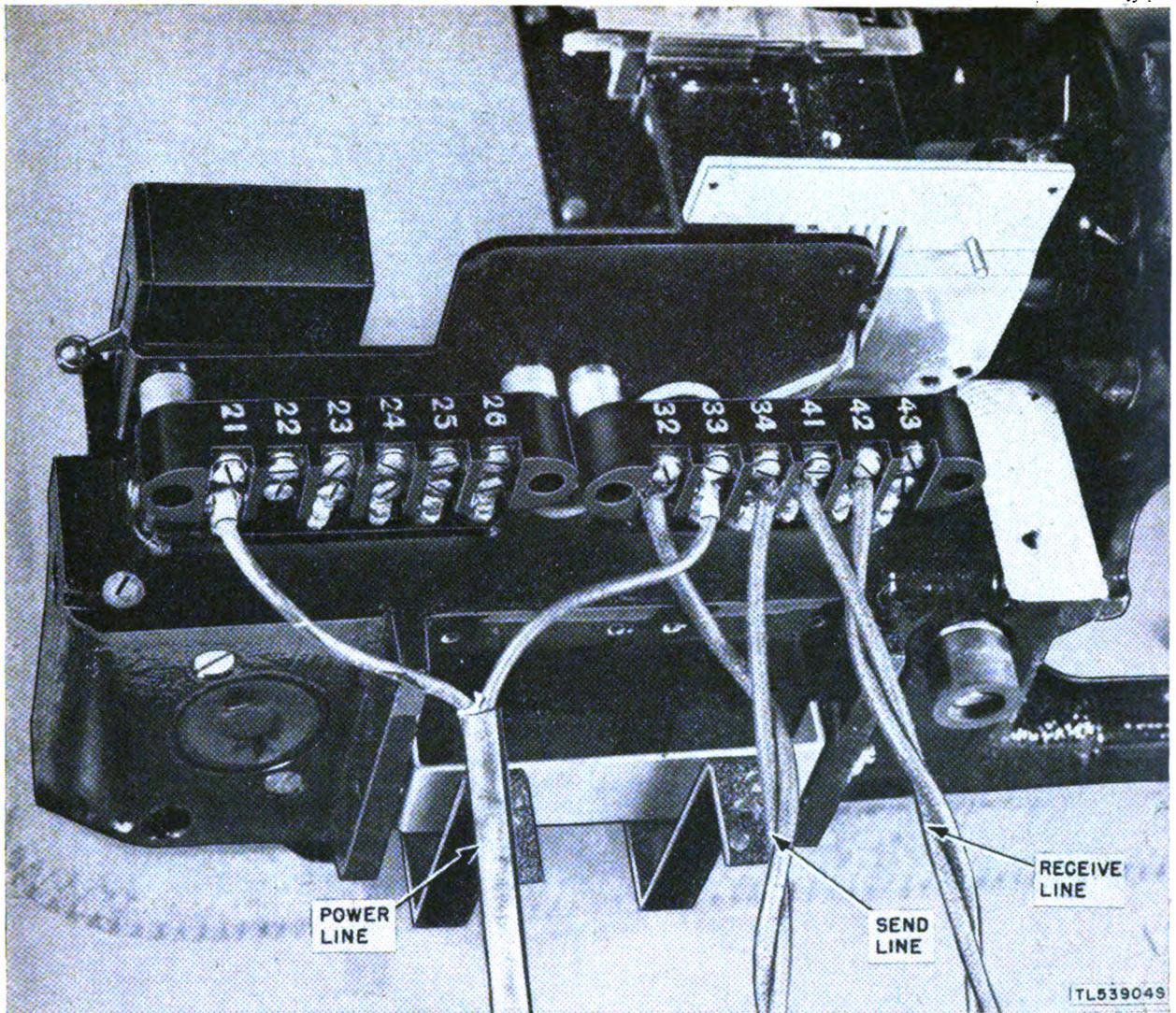


Figure 45. Terminal block connections for send and receive circuits.

in place. Feed the paper over the paper-straightener rod and fold the end of the paper to square it off. Bring it up between the platen and under the paper fingers by turning the platen crank, and do not disturb the ribbon. Push back the pressure-roller-release shaft arm, straighten the paper as in an ordinary typewriter, and pull the arm forward.

c. Close the rear cover and roll the paper up over it, using the platen crank. Close the front cover.

## 25. Installing Ribbons in Teletypewriters

a. Make sure that the new ribbon has a hook fastened to each end and a reversing eyelet securely fastened at each end about 4 inches from

the hooks. The spool may be either metal or fiber, but it must have small holes placed around the center hole to engage the ribbon spool driving pin on the ribbon-spool shaft.

b. Engage the hook of the ribbon in the hub of the empty spool and wind a few turns of the ribbon on it. Be certain that the reversing eyelet has been wound on to the spool in this process.

c. Facing the machine, place the ribbon spools on the shaft so that the ribbon feeds from the back of each spool without twisting. Turn each spool slightly on the shaft until the spool engages the driving pin on the ribbon-spool shaft.

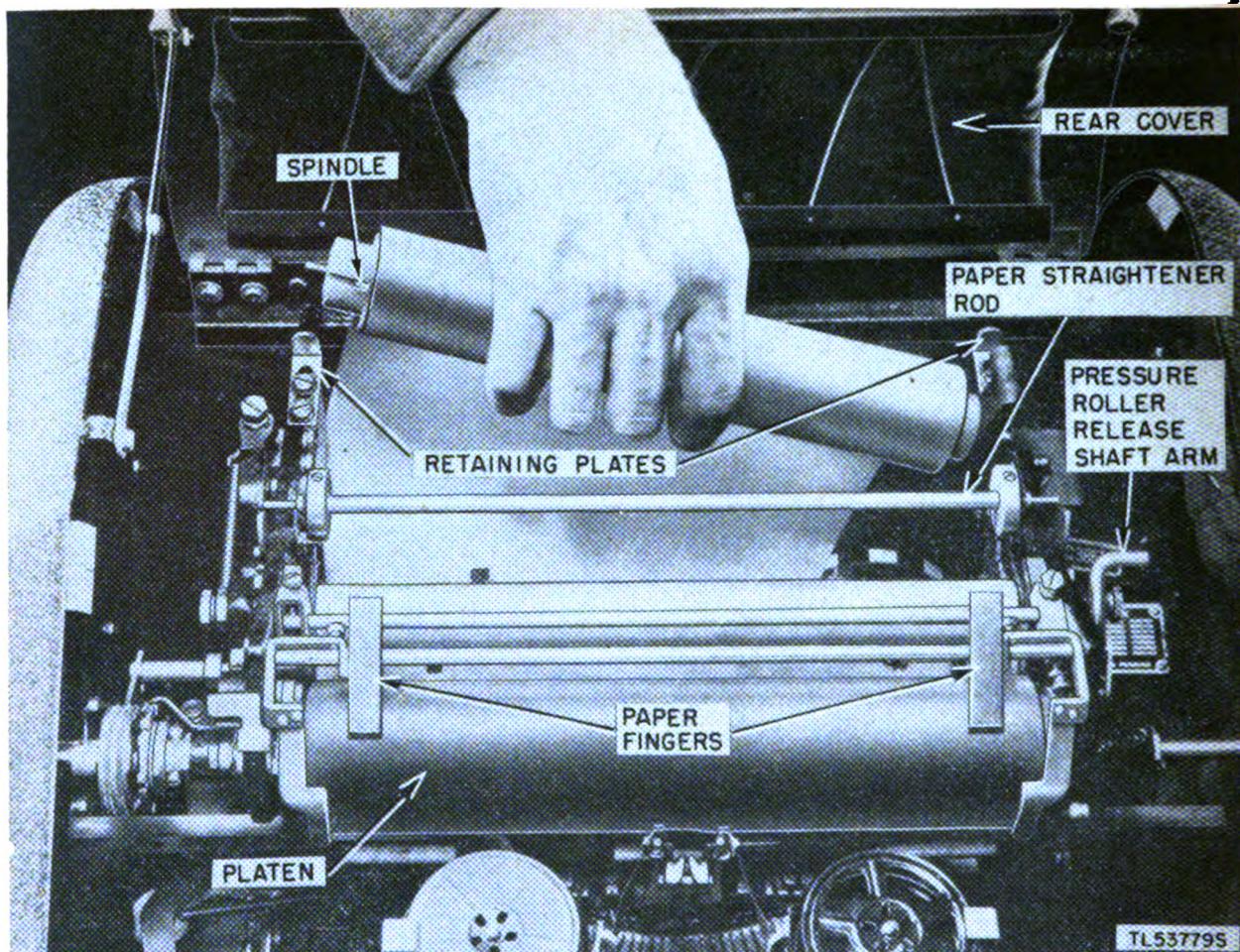


Figure 46. Installing paper in teletypewriter.

d. Thread the ribbon forward around both ribbon rollers, through the slots in the ribbon reverse arms, across the ribbon carrier, and under the carrier hooks. (See fig. 47.) Be sure that the ribbon remains in the slots and that both reversing eyelets are between the ribbon spools and the ribbon reverse arms. Check to eliminate slack in ribbon.

## 26. Checking and Adjusting Motor Speed

*Note.* See appendix I for information on checking and adjusting motor speed for interoperation with British teletypewriter equipment.

a. GENERAL. Printers TG-7-A and Teletypewriters TG-7-B and TG-37-B are all equipped with the same type series governed motors. The motors of all teletypewriters in the same circuit or net must be set to operate at the same speed before satisfactory operation is possible. The speed of the motor may be checked by the use of a tuning fork (speed indicator) and tar-

get or by an alternate (timing) method. The governor, mounted on the end of the motor shaft, similar to a flywheel, uses centrifugal force to open a set of contacts connected in the motor circuit, and thus controls the normal operating speed of the motor. Detailed functioning of the governor is explained in section X. Wiring diagrams for the complete teletypewriters include wiring diagrams of the motor circuit. The normal speed of the motor may be varied by turning the speed adjusting wheel which extends through an opening in the face of the governor, by means of an adjusting lever. A breaking or a releasing action takes place and the speed of the motor varies accordingly.

b. DESCRIPTION OF TARGET AND TUNING FORK. A target of alternate black and white spots is painted around the outer rim of the governor and is used with a speed indicator

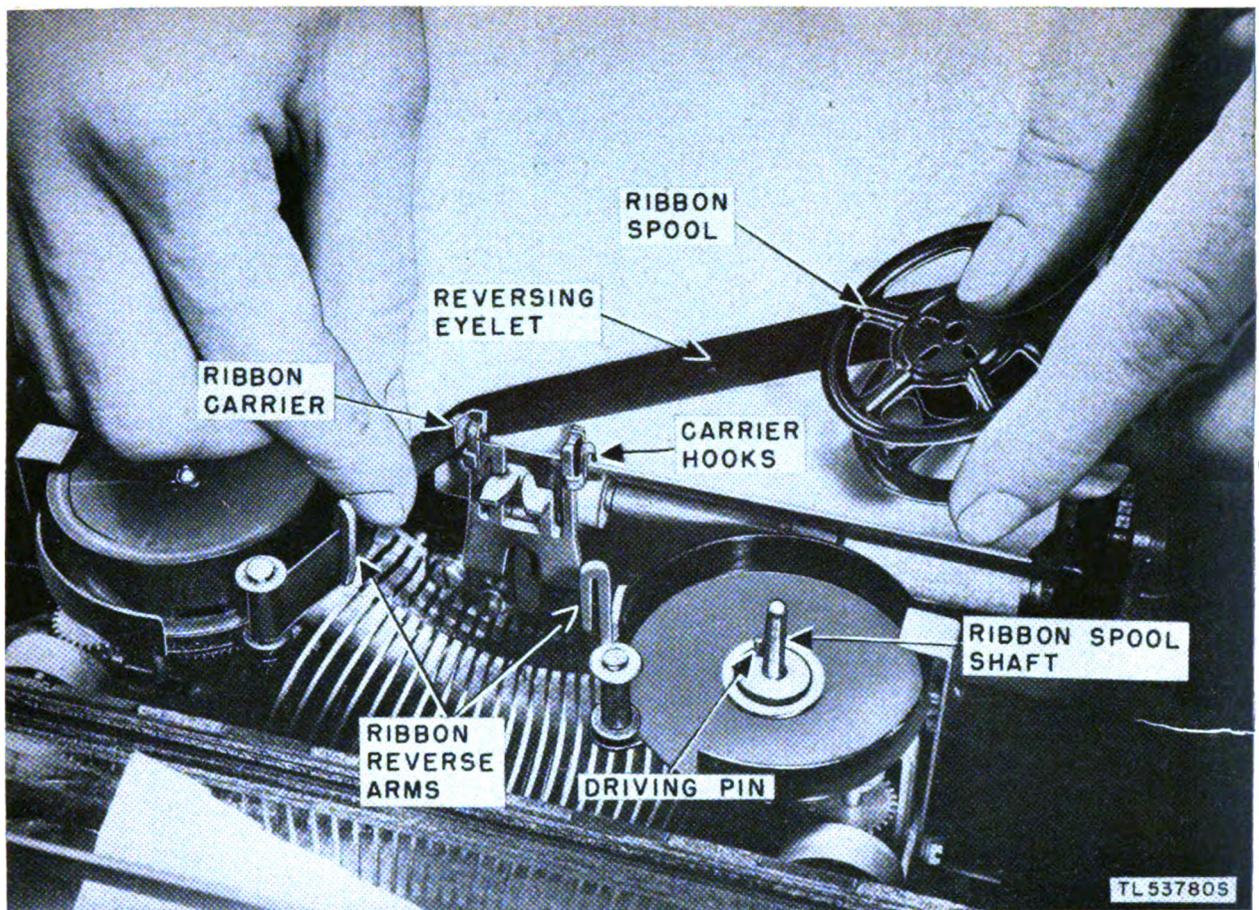


Figure 47. Installing ribbon in teletypewriter.

(tuning fork) to check the motor speed visually. Although the number of spots on a target varies, the methods of using the target in setting motor speeds remain unchanged. Tuning forks, made of flexible metal and equipped with a slit shutter on one end, are constructed to vibrate at certain speeds. By striking the side of the tuning fork against the hand, the shutter is made to vibrate. By holding the slit on the shutter close to the eye, the spots on the target may be viewed. This is called *scanning*. When the proper fork is used for scanning, the spots will appear to be motionless or moving slowly in the same direction in which the governor is turning. The 87.6 cycle tuning fork is normally used in adjusting the speed.

c. CHECKING AND ADJUSTING WITH TARGET AND TUNING FORK. Before attempting to adjust the speed of the motor, allow the motor to run from 3 to 5 minutes. Always adjust motor

under normal load condition. To provide a normal load (operating) condition, depress the space bar and hold it down.

(1) Using the 87.6 vibrations per second (vps) tuning fork, strike it against the palm of the hand to start it vibrating.

(2) Scan the target by holding it as close to the eye as necessary to view the target.

(3) Adjust the speed, by means of the adjusting bracket and lever (fig. 48) until the target, as viewed through the tuning fork, appears to stop. The motor is then synchronized at its proper speed (1800 rpm).

(4) If the spots appear to be moving in the same direction in which the motor is turning, the speed is too fast. Decrease the speed by momentarily pressing and releasing the governor adjusting bracket. (See fig. 48.)

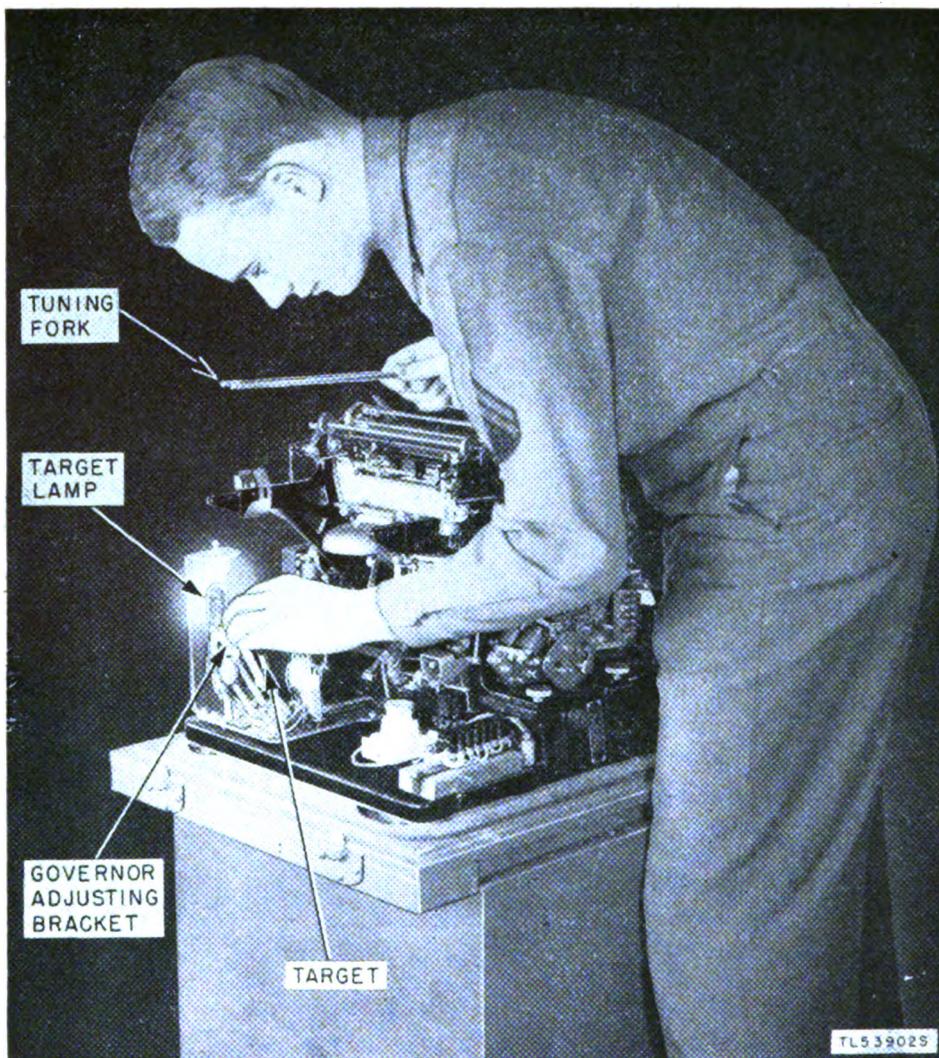


Figure 48. Checking and adjusting motor speed by target and tuning fork.

(5) If the spots appear to be moving in an opposite direction from which the motor is turning, the speed is too slow. Increase the speed by *momentarily pressing and releasing* the speed adjusting lever. (See fig. 3.)

*Note.* Because it is difficult to adjust the governor so that the spots on the target appear to stand still, adjust the governor so that the spots appear to stop or to travel very slowly in the direction of rotation of the motor. If the spots appear to be jumping back and forth or to disappear suddenly, there is probably governor contact trouble. Turn off the target lamp (if one is used) when the speed has been checked.

*d.* CHECKING AND ADJUSTING BY THE TIMING METHOD. The tuning fork for checking motor speeds of Teletypewriters TG-7-B and TG-37-B is furnished as a component of Tool Equip-

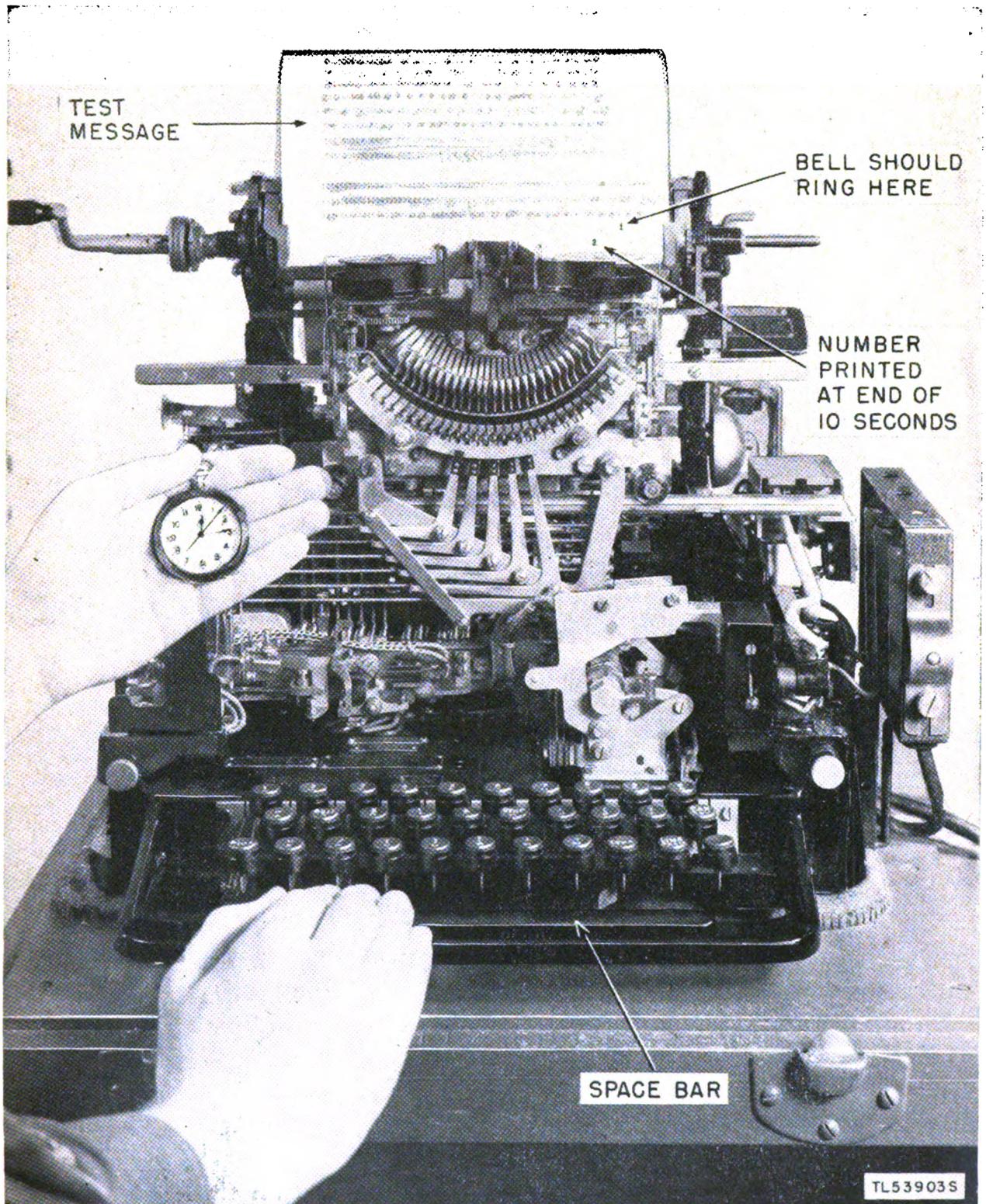
ment TE-50. If the proper tuning fork is not available, the following alternate method may be used.

(1) With the motor switch on, and the proper connections made to a power source, operate the CARRIAGE RETURN and LINE-FEED keys on the keyboard.

(2) Print the numbers 1 through  $\phi$  in groups of 10 characters across the entire page.

(3) Operate the CARRIAGE RETURN and LINE-FEED keys.

(4) Depress the space bar and hold it down for 10 seconds. This should be accurately timed with a watch. At the end of 10 seconds, release the space bar and operate any numeral key.



*Figure 49. Checking motor speed by timing method.*

(5) Compute the number of spaces the type-bar carriage traveled during the 10 second interval. If the motor is correctly timed, the type-bar carriage will have traveled 61 spaces. If the number of spaces is more or less than 61, adjust the governor as follows:

(a) More than 61—Decrease the speed of the motor.

(b) Less than 61—Increase the speed of the motor.

e. **RECHECKING MOTOR SPEED.** A quick recheck of the motor speed can be made on a teletypewriter which is known to be otherwise properly adjusted. After the motor is warmed up, start with the type bar carriage at the returned (extreme left) position and check the time which elapses after the space bar is depressed until the margin bell rings. The speed of the motor is correct when the margin bell rings at the end of 11 seconds.

## 27. Setting Range Finder

a. The procedure for setting of the range finder is the same after arrangements have been made to connect the selector magnet (cord

with red-shell plug) in a circuit where a long series of alternate R and Y impulses may be received. The R and Y impulses may be transmitted from the local keyboard through the cord with red-shell plug or received from other teletypewriter equipment. In all cases, the current in the selector magnet should be approximately 60 milliamperes. An explanation of the use of a local test circuit which may be used to provide the necessary current when no other teletypewriter equipment is available is given in section XII. Specific numerical settings of the range finder for initial and periodic line-ups of complete sets and systems are furnished in the Technical Manuals for the sets and systems.

b. After arrangements have been completed to receive a continuous series of alternate R and Y impulses in the selector magnet, proceed as follows to check and adjust the setting of the range finder:

(1) Loosen the index-arm thumbscrew of the range-finder mechanism (fig. 50) and move the index-arm toward the zero on the scale until errors begin to appear in the printed letters R and Y.

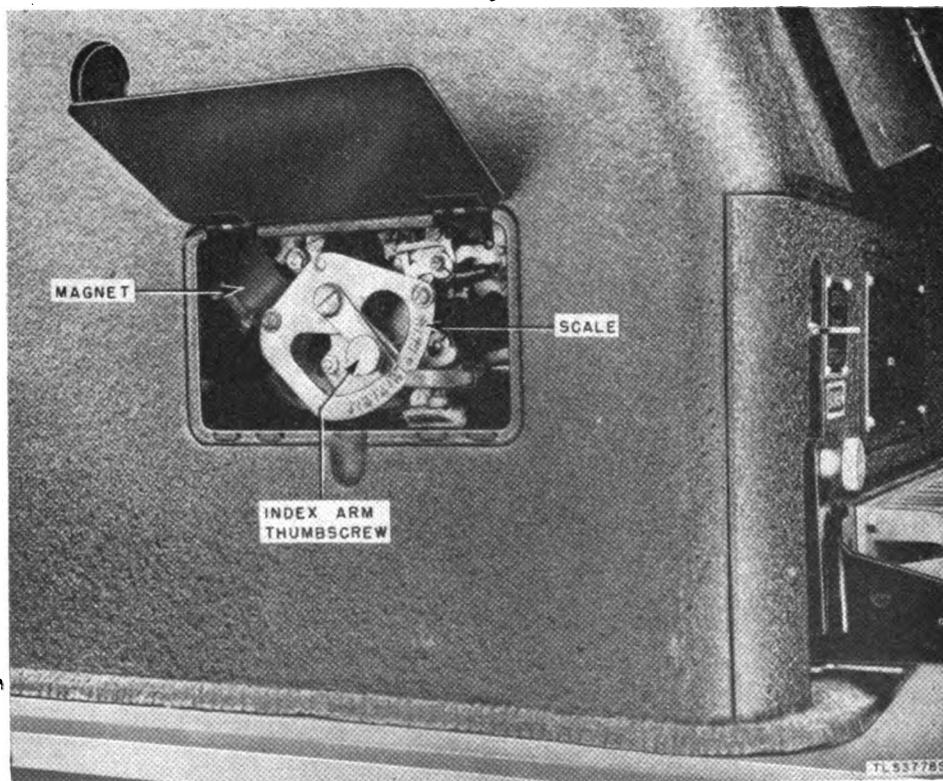


Figure 50. Range-finder mechanism.

(2) Move the arm *slowly* back toward the high end of the scale until the errors disappear.

(3) Note the low-limit scale reading.

(4) Move the arm toward the high end of the scale until errors again begin to appear.

(5) Move the arm *slowly* back toward the low end of the scale until the errors disappear.

(6) Note the high-limit scale reading.

(7) A teletypewriter, in good condition, should give a lower scale reading between 10 and 15, and an upper scale reading between 85 and 90. Add the low and high readings and divide the result by two to find the scale reading for best operation. (For example, a low reading of 15 plus a high reading of 90 gives 105, which, when divided by 2, gives a scale setting of 52.5, for best operation.)

(8) Set the index arm at the scale reading for best operation (as determined above) and tighten the thumbscrew securely.

## 28. Local Operating Tests

a. GENERAL. Detailed instructions for line-up procedure required for each set or system will be furnished in the related Technical Manual. The tests given in this paragraph are limited to those required to test the teletypewriter regardless of the equipment with which it is used. The method used to connect the teletypewriter in a local test circuit is given in section XII. The testing procedure listed below assumes that all connections, fuses, etc., have been placed and a visual inspection has been made to insure that the teletypewriter has been properly lubricated and no damaged parts can be seen. The cover is left off the teletypewriter until the operation is determined to be satisfactory.

b. OPERATING TESTS. Complete the tests in the sequence shown and see section XII for corrective action when any difficulty is encountered.

(1) Start the motor by moving motor switch to ON position.

(2) Check and adjust the motor speed as described in paragraph 26.

(3) Place SEND-REC-BREAK key in SEND position and test and set the range finder as described in paragraph 27.

(4) Turn the crank to be sure that the paper feeds evenly and does not tear. Continue to observe paper feeding during remainder of tests.

(5) Operate the carriage-return and line-feed keys. Test the line feed for both single and double spacing between lines by operating the single-double line-feed lever to the desired position.

(6) Type at least three consecutive copies of the test paragraph, "THE (space) QUICK (space) BROWN (space) FOX (space) JUMPED (space) OVER (space) THE (space) LAZY (space) DOG (FIGS) ' (LTRS) S (space) BACK (space) (FIGS) 123456789φ (LTRS) (CAR RET) (CAR RET) (LINE FEED) followed by the upper case characters remaining on weather symbol or communication type keyboards."

(7) Observe the action of the ribbon-feed mechanism while typing to be sure it oscillates and feeds each time a character is typed.

(8) Hold the space bar down to check the continuous spacing feature of the keyboard.

(9) Test the manual carriage-return feature by operating the carriage-return lock bar.

(10) Test the setting of the margin warning bell by typing CAR RET, LINE FEED, FIGS followed by 123456789φ repeated until it can be determined that the margin bell on Printer TG-7-A and Teletypewriter TG-7-B (communication keyboards) rings on the 66th character and Teletypewriter TG-37-B (weather keyboard) rings on the 70th character. (See fig. 49.)

(11) Test the remote motor control stop feature by typing CAR RET, LINE FEED, FIGS, and STOP (upper case H).

(12) Test operation of the signal bell by typing FIGS AND BELL (upper case S).

(13) Test the remote control "start" feature by a 2- or 3-second BREAK signal (SEND-REC-BREAK key held in extreme downward position).

(14) With the SEND-REC-BREAK key in the REC position test the keyboard to be sure that the sending mechanism is inoperative and nothing can be typed (transmitted).

(15) With the SEND-REC-BREAK key in

the SEND position, type two consecutive blank characters to determine that the send-receive-break mechanism will automatically move to the REC position.

(16) With the SEND-REC-BREAK key in SEND position type one blank character alternately with other letter or number characters to determine that single blank characters do

not affect the SEND position of the SEND-REC-BREAK key.

(17) Place the cover on the teletypewriter and test the opening and closing of all doors.

(18) Try the cutting edge of the glass window by tearing off sections of paper in the same manner that messages are removed from the typing unit.

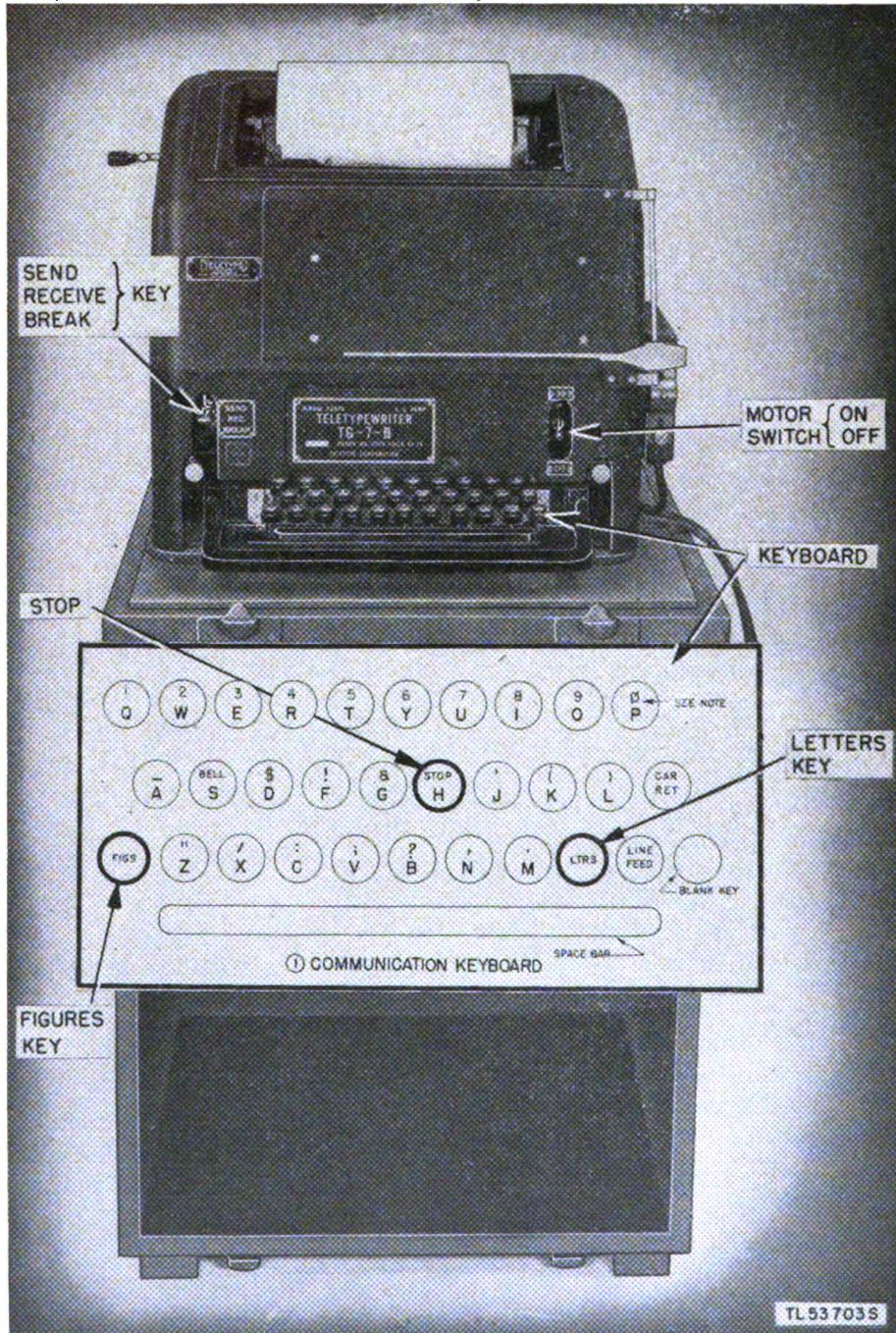


Figure 51. Teletypewriter arranged for local operating tests.

# PART THREE

## MAINTENANCE INSTRUCTIONS

*Note.* The preventive maintenance instructions in this part will serve as a guide for any of the installations or groups of equipment for which this equipment is designed.

*Do not attempt unauthorized maintenance on this equipment.*

### Section V.

## PREVENTIVE MAINTENANCE TECHNIQUES

### 29. Meaning of Preventive Maintenance

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment when the equipment is not in the operating circuit. Preventive maintenance operations are designed to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish it from trouble shooting and repair. The prime function of preventive maintenance, is to prevent break-downs and, therefore, the need for repair. The prime function of trouble shooting and repair is to locate and correct existing defects. The importance of preventive maintenance cannot be over-emphasized. The entire system of teletypewriter communication depends upon each set's being in operation when it is needed and upon its operating efficiently. It is vitally important that teletypewriter operators and repairmen maintain their equipment properly.

*Note.* Most of the operations in this section are first echelon (operator) and second echelon (organization repairmen) maintenance. Some operations in section VII, lubrication, and section VIII, moistureproofing, are third or higher echelon maintenance.

### 30. Description of Preventive Maintenance Techniques

a. GENERAL. Most of the mechanical and electrical parts used in teletypewriter equipment require routine preventive maintenance. Those requiring maintenance differ in the amount and kind required. Because hit-or-miss maintenance techniques are not reliable, definite and specific instructions are needed. This section

contains these specific instructions and serves as a guide for personnel assigned to perform the six basic maintenance operations: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the following lettering system is used for the six operations:

F—Feel	C—Clean
I—Inspect	A—Adjust
T—Tighten	L—Lubricate

The first two operations, completed with the aid of necessary tools and test equipment, establish the need for the other four. The selection of operations is based on a general knowledge of field needs. For example, dust encountered on dirt roads during cross-country travel filters into the equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the performance of necessary tightening, cleaning, adjusting, and lubricating operations, equipment becomes undependable and subject to break-down.

b. FEEL (F). The feel operation is used most often to check rotating machinery, such as the motor, cams, shafts, etc., and to determine if electrical connections, bushings, etc., are overheated. Feeling indicates the need for lubrication or the existence of similar types of defects requiring correction. Many motors used in teletypewriter equipment operate at relatively high temperatures. The maintenance man must become familiar with the normal operating temperatures of the equipment in order to be able to recognize signs of overheating.

*Note.* It is important that the feel operation be performed as soon as possible after shut-down and always before any other maintenance is done.

c. INSPECT (I). Insepection is the most important operation in the preventive mainten-

ance program. The inspector must now how to check for required clearances, tensions, and adjustments of the various types of mechanical assemblies. A careless observer will overlook the evidences of minor trouble. Although these minor defects may not interfere with performance of the equipment, valuable time and effort can be saved if they are corrected before they lead to major break-downs. Make every effort to become thoroughly familiar with the indications of normal functioning, in order to be able to recognize the signs of defective equipment. Inspection consists of carefully observing and checking the individual units systematically with tools, gauges, etc., (when they are required). Notice state of cleanliness, lubrication, amount of wear, adjustment and placement, tightness, clearance, tension, overheating, and moisture accumulation. Inspect for the conditions as follows:

(1) Cleanliness, by carefully examining all surfaces of the units for accumulation of dust and dirt and excessive oil or grease. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth, mildew, and moisture accumulation.

(2) Inadequate or excessive lubrication.

(3) Excessive wear, as indicated by loose fittings, bearings, etc.

(4) Adjustment and placement, by determining that all mechanical and electrical parts are properly adjusted and in their original positions.

(5) Tightness, by testing any connection, assembly, or mounting that is normally fastened in a rigid position.

**Caution:** Before tightening any screws, bolts, or nuts, determine whether or not they are part of some adjustment. If so, tighten in accordance with detailed requirement and adjustment procedures given in part five, and check all related adjustments.

(6) Clearance between specified points, by feeling, sighting, or inserting gauges as specified for item inspected.

(7) Spring tensions, by using the appropriate special spring scale in the exact manner shown in the illustration accompanying each spring tension requirement.

(8) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; by leakage of insulating

compounds; and by oxidation of metal contact surfaces.

**d. TIGHTEN (T).** This operation applies only to soldered connections, bolts, screws, and fasteners holding items rigidly in place. Solder loose or broken soldered connections. Correct tightening procedure requires the use of the proper type and size of tools. Do not tighten screws, bolts, and nuts carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

**Caution:** Do not tighten parts or apparatus requiring clearance or tension adjustment.

**e. CLEANING (C).** (1) This operation as applied to external surfaces of chests, boxes, covers, panels, frames, etc., is the normal cleaning process.

(2) Cleaning equipment interiors including delicate electrical and mechanical parts requires detailed specific instructions for each assembly and unit. This cleaning is normally performed as part of the preventive maintenance routines described in paragraphs 34 to 42.

(3) Detailed cleaning instructions for major overhauls are given in part five.

(4) Scheduled items marked with letter "C" need not be cleaned *each* time they are inspected. Under some conditions, however, it may be necessary to complete the cleaning of a unit before starting the other operations. Clean all parts only when inspection shows that it is necessary.

**f. ADJUST (A).** Adjustments are made only when they are necessary to restore normal operating conditions. Use extreme care in selecting the proper tools and gauges before making adjustments. Many adjustments must be made in a particular sequence. *Each* adjustment must meet *all* requirements for clearance, spring tension, speed, and other tolerance limits. If *one* adjustment is changed, *all* related adjustments must be checked. This check may involve a certain amount of duplication, but there are no practical short cuts when making overlapping functional adjustments. Detailed instructions for specific requirements and adjustments are given in part five.

**g. LUBRICATE (L).** Lubrication refers to the application of oil or grease to all rotating shafts and bearings, cam rollers, sliding surfaces, and other moving parts. It may include the application of oil to metal surfaces on parts of the equipment. All lubrication should be completed in accordance with instructions in section VII.

### 31. Introduction to Preventive Maintenance Procedure

a. The preventive maintenance procedure in this section is divided in two classes, work which can be completed while the teletypewriter remains in service, and work which requires that the teletypewriter be taken out of service.

(1) The first class of work is limited to the operations performed on the teletypewriter exterior, that portion of the keyboard which is accessible while the teletypewriter is in service, and the carrying chests. Instructions for this work are given in paragraphs 32 and 33.

(2) The second class of work includes the operations which require that the cover, typing unit, type-bar carriage, keyboard, and motor unit be removed from their mounting surfaces before the preventive maintenance work is started.

(3) Detailed information on the different individual test requirements and adjustments of complicated parts and mechanisms are not included in this section. The preventive maintenance check list in section VI includes references to the related instructions in requirements and adjustments, section XIV, which apply to the preventive maintenance procedures included in this section.

b. See section VII for lubrication instructions and section VIII for moistureproofing and fun-gproofing instructions.

c. Preventive maintenance procedures for common classes of parts have been grouped as follows:

	<i>Paragraph</i>
Cords, cables, and wiring .....	35
Terminal blocks and slip connections .....	36
Keys and switches .....	37

d. Detailed preventive maintenance instructions are arranged by paragraphs as follows:

	<i>Paragraph</i>
Preparation for preventive maintenance inspection (teletypewriter out of service)....	34
Typing unit less type-bar carriage .....	38
Type-bar carriage .....	39
Keyboard .....	40
Motor unit .....	41
Base .....	42

e. When worn, bent or defective parts are found, they should be repaired or replaced as discussed in part five.

f. After all preventive maintenance work including lubrication has been completed and the

teletypewriter has been assembled, make the following test and adjustments:

- (1) Motor speed.
- (2) Range finder setting.
- (3) Local operating tests.

*Note.* ALWAYS CHECK RELATED ADJUSTMENTS WHEN ANY ADJUSTMENT IS MADE.

### 32. Preventive Maintenance for Chests

a. **INSPECT.** Inspect the chests for excess dirt, cracks, missing or broken screws, bolts, or nuts; bent, rusted, or otherwise damaged latches, and worn or damaged Lord mountings (found on Chest CH-62-(\*) only).

b. **TIGHTEN.** Tighten all loose screws, bolts, and nuts.

c. **CLEAN.** Clean the outer surfaces of the chests with a piece of clean cheesecloth moistened slightly in water. Moisten the cloth with a little dry-cleaning solvent (SD) to remove oil, grease, or gummy deposits. Clean the inner surfaces of the chests with a dry brush or with cheesecloth as mentioned above. Oil may be used to remove rust from the metal surfaces of the chests.

### 33. Preventive Maintenance for Teletypewriter Exterior (Teletypewriter in Service)

a. **GENERAL.** The instructions given below apply to the exterior surfaces of the teletypewriter (teletypewriter cover) and the section of the keyboard which is accessible without removing the cover.

b. **COVER.** (1) *Inspect.* Inspect the cover for broken cover glass, loose screws, broken or damaged hinges, damaged copyholder, and scratches.

(2) *Tighten.* Tighten all loose screws.

(3) *Clean.* (a) Wipe the cover glass with a clean piece of cheesecloth dipped in water. Polish it with a piece of clean, dry cheesecloth.

(b) Remove dust and dirt from the outside surfaces of the cover by wiping it with a piece of clean cheesecloth moistened slightly in water. Moisten the cloth with a little dry-cleaning solvent (SD) to remove oil, grease, or gummy deposits.

(c) Remove dust from the inside of surfaces of the cover by using a brush. Clean cheesecloth may be used but the lint has a tendency to cling to the inside padding and may cause damage to the moving parts of the teletypewriter. If this operation necessitates

the removal of the cover, perform the necessary work when the teletypewriter is taken out of service for a routine as outlined in paragraph 34.

c. **KEYBOARD.** The operations performed on the keyboard while the teletypewriter is in service consists of cleaning the outer surfaces of the keyboard, the key tops, and key levers as described in paragraph 40.

### 34. Preparation for Preventive Maintenance Inspection (Teletypewriter out of Service)

a. For a thorough preventive maintenance inspection the teletypewriter must be taken out of service and partially disassembled as outlined in *b* below.

b. Take the following preparatory steps to facilitate inspection of the various units and parts.

(1) When a table, bench, or box is not available use the cover of either chest, Chest CH-50-(\*) or CH-62-(\*), as a workbench. If practicable, lay the cover of the chest upright on several thicknesses of newspaper, cloth or other material to protect the edges from scuffing and also to serve as a catch for small parts which may fall during disassembly of the equipment.

(2) Disconnect the power and connecting cords.

(3) Remove the teletypewriter cover and place it where it will not be damaged.

(4) Fold a length of cheesecloth into a pad about 18 inches square and six or eight layers thick. If necessary, four or five thicknesses of any clean, lint-free cloth can be used.

(5) Place the cloth pad on the workbench.

(6) Remove the keyboard and place on several thicknesses of paper or cloth.

(7) Remove the roll of paper and the paper spindle from the typing unit. Remove the ribbon from the type-bar carriage.

(8) Remove the typing unit from the base and place it in its upright position on the paper or cloth.

(9) Remove the type-bar carriage from the typing unit and place it on a piece of newspaper or cloth to catch any oil or grease that may be on the parts. See related topics in section XIII for complete instructions on removal of the type-bar carriage.

**Caution:** Be extremely careful in handling the typing unit and type-bar carriage. Units that have been dropped require a major over-

haul and thorough testing before being put back into service. Lift the typing unit as shown in figure 40.

### 35. Cords, Cables, and Wiring

a. **GENERAL.** The preventive maintenance procedure given in this paragraph applies to the wiring located in the base, on the typing unit, keyboard, and motor unit. Wiring includes all cords, cables, and wiring placed at factory, at signal depot, or by installers and mechanics. Wires which are tied together with cords are sometimes referred to as wiring harness. Wiring on equipment operated in all kinds of weather and moved on all kinds of roads gets severe punishment. Watch its condition closely.

b. **INSPECT. (I)** (1) Inspect the wiring for cracked or deteriorated insulation, frayed or cut insulation at the connecting and supporting points, and improper placement which strains wire or connections. Watch for kinks and improper supports.

(2) Inspect all ground connections for dirt, rust, corrosion, and loose connections. An open or loosely connected grounded point may interfere with the operation of the equipment, and may also nullify the protection for operating personnel.

c. **TIGHTEN (T).** Tighten loose fasteners, cable clamps, wiring connections. Solder loose or broken soldered connections.

d. **CLEAN (C).** Clean connector straps when they are dirty or corroded. The easiest way to clean a dirty connector is to remove it, scrub it with a brush dipped in dry-cleaning solvent (SD), and dry it thoroughly with a cloth. Clean corroded connectors with #000 sandpaper. It is important that the entire contact surface of the connector be clean.

### 36. Terminal Blocks and Slip Connections

Terminal blocks, which are used as receiving, connecting, and distributing points for electrical circuits, consist of a strip of insulation and one or more types of connecting devices. These connecting devices may be either soldered terminals, screw terminals, contact springs or contact lugs. They require little preventive maintenance, especially if the wiring has not been changed.

a. **CLEAN (C).** Clean the terminal blocks, when necessary, with a dry brush. Wipe off excessive moisture with a *clean dry cloth*. When

necessary, use a cloth moistened with dry-cleaning solvent (SD) to clean the insulation strips. Wipe thoroughly with a cloth and then brush the block to remove all lint. Remove and clean corroded, loose, or dirty connecting devices with a piece of crocus cloth. Carbon tetrachloride should be used to clean the electrical contacts of all connecting devices.

b. **INSPECT (I)**. Inspect terminal blocks for cracks, breakage, dirt, and loose connections or mounting screws. Carefully examine connections for mechanical defects, dirt, and corrosion.

c. **TIGHTEN (T)**. Tighten loose screws, lugs, and mounting bolts. Use a screw driver of the correct size. Do not exert too much pressure. Solder any loose or broken soldered connections.

d. **ADJUST (A)**. Adjust the spring tension of the contact springs when necessary. To increase the spring tension, grasp the spring near its point of attachment with either a spring bender or a pair of duckbill pliers. Twist the pliers or spring bender slightly in the direction in which tension is desired and move the tool continuously along the slight bow in the spring. Try the action of the contact after each adjustment. Be careful to keep all soldered connections intact.

*Note.* Loose soldered connections should be repaired only by an experienced mechanic. See related topics in section XII.

### 37. Keys and Switches

a. **GENERAL**. All keys and switches on the teletypewriters are grouped as a common class. No specific information is provided for any particular key or switch.

b. **INSPECT (I)**. Inspect the mechanical action of each key or switch and look for signs of dirt, or corrosion of the key or switch; examine the action of the switch by flipping the control knob or toggle, or by pressing the key lever and noting the freedom of movement and the amount of spring tension. Check to see that the contacts are clean.

c. **CLEAN (C)**. Wipe off excessive moisture with a *clean, dry cloth*. Clean the exterior surfaces of keys and switches with a stiff brush moistened in dry-cleaning solvent (SD) and polish the surfaces with a piece of cloth. Clean corroded and dirty contacts when necessary, with the burnishing tool. When contacts have deep pits caused by burning or arcing, use the

contact file to resurface them, and polish with a burnishing tool.

d. **TIGHTEN (T)**. Tighten loose screws, lugs, and mounting bolts. Remove loose connections which are dirty or corroded and clean them before tightening, or soldering. Solder any loose or broken soldered connections.

e. **ADJUST (A)**. Adjust keys and switches in accordance with specifications given in section XIV.

### 38. Typing Unit Less Type-Bar Carriage

a. **CLEAN (C)**. To simplify description of the cleaning procedures, instructions for cleaning the type bar carriage, which is a major assembly of the typing unit, are given in paragraph 39 below. To clean the remainder of the typing unit, proceed as follows:

(1) Place the typing unit on the workbench. Remove all old grease and oil that has gathered dirt and dust. Use a piece of clean, dry cheesecloth or other lint-free cloth folded over the end of Screw driver TL-44 to get between the vanes, inside of the printing bail, between the function levers, and into other hard-to-reach places.

(2) Use a clean area of the cheesecloth as soon as one area becomes soiled with oil or grease. Loop a piece of cloth over the fingers and wipe all readily accessible surfaces.

**Caution:** Do not wipe dirty grease or other foreign matter into bearings. Remove as much of the dirty grease as possible with the tip of the screw driver or an orange stick. Wipe each bearing with a piece of clean cheesecloth.

(3) Loosen both range-finder retaining screws. Remove the left-hand screw completely and slip the range finder off the remaining screw (with the slotted screw hole). Use a clean piece of cheesecloth folded over the end of a screw driver to remove oily deposits of dirt, dust, paper lint, etc., from the outer surfaces of the selector mechanism and range finder.

(4) Flush the selector mechanism by pouring a small amount (about 1 tablespoonful) of dry-cleaning solvent (SD) between the separator plates. Repeat the flushing process if necessary.

b. **INSPECT (I)**. Check the following parts for deficiencies as indicated:

(1) Frame casting for cracks or other damage.

(2) Loose, broken or missing mounting screws.

(3) All levers, vanes, rollers, bearings, shafts, and gears to determine that all parts move freely and are not bent, broken, or excessively worn.

(4) Missing, broken, or distorted springs.

(5) Main shaft and associated gears, bearings, cams, clutches, and springs for binding, excessive wear, or other damage.

c. **TIGHTEN (T)**. Tighten loose screws, bolts, or nuts if they are not part of some adjustment.

d. **ADJUST (A)**. Make all necessary adjustments in accordance with detailed requirements in section XIV.

e. **LUBRICATE (L)**. See section VII for instructions on lubrication.

f. **REMOVE**. Remove the typing unit from the workbench and place on paper to protect the treated unit.

### 39. Type-Bar Carriage

Place the type-bar carriage on the workbench.

a. **CLEAN (C)**. (1) Fold a piece of clean cheesecloth into a pad about 8 inches wide and four or five layers thick.

(2) Insert the pad between the type bars and the backstop to catch the dirt and excess dry-cleaning solvent (SD).

(3) Wipe the faces of the type bar pallets with a piece of cheesecloth moistened in dry-cleaning solvent (SD). Be careful not to bend the type bars. After the pallets are dry, brush them with a dry, typewriter brush (part of Tool Equipment TE-50). Repeat the process if necessary. Tilt the type-bar carriage and flush the segment slots with dry-cleaning solvent (SD).

b. **INSPECT (I)**. Inspect the type-bar carriage for the following:

(1) Missing mounting screws, bolts, and loose parts.

(2) Frame for cracks or other damage.

(3) Each bell crank, code bar, and type bar to determine that all parts move freely and are not bent or broken.

(4) Each type bar for missing or damaged pallets.

(5) Levers, gears, shafts, and bearings for signs of excessive wear, loose parts, or damage.

(6) Missing, broken, or distorted springs.

c. **TIGHTEN (T)**. Tighten all loose screws, bolts, and other parts which are not involved in an adjustment.

d. **ADJUST (A)**. Make all required adjustments in accordance with instructions in section XIV.

e. **LUBRICATE (L)**. See section VII for instructions on lubrication.

f. **REMOVE**. Remove the type-bar carriage from the workbench and place on paper.

### 40. Keyboard

Place the keyboard on the workbench.

a. **CLEAN (C)**. Do not disassemble the keyboard for ordinary cleaning. Refer to part five for major overhaul cleaning. For routine cleaning follow the procedure outlined below:

(1) Clean the key tops with a cloth slightly moistened with water. Wipe off excessive moisture with a *clean, dry cloth*.

**Caution:** Do not use dry-cleaning solvent (SD) or carbon tetrachloride on rubber key tops.

(2) Remove all oil, grease, dust, and dirt from the outside surfaces of the keyboard by wiping it with a clean cheesecloth.

(3) Clean between the key levers and around the transmitting mechanism with a stiff brush.

b. **INSPECT (I)**. Inspect the keyboard for the following:

(1) Casting for cracks or other damage.

(2) Loose, broken, or missing mounting screws.

(3) All levers, pawls, latches, and cams to determine that all parts move freely and are not bent, broken, or excessively worn.

(4) Broken, missing, or illegible key tops.

(5) Missing, broken, or distorted springs.

(6) Transmitting shafts and associated gear, clutch, and bearings for binding and wear.

c. **TIGHTEN (T)**. Tighten only those loose parts which are not part of an adjustment.

d. **ADJUST (A)**. See section XIV before making any adjustments.

e. **LUBRICATE (L)**. See section VII for lubrication instructions.

f. **REMOVE**. Remove the keyboard from the work bench and place on paper.

### 41. Motor Unit

**Note.** Normally the motor unit will not be removed from the base during preventive maintenance routines.

a. **INSPECT (I)**. Check the following parts as outlined.

(1) Motor and motor unit base for cracks and other damage.



Figure 52. Tools and materials contained in Tool Equipment TE-50.

## Tools and materials contained in tool equipment TE-50

Ref. No.¹	Signal Corps stock No.	Item	Ref. No.²	Signal Corps stock No.	Item
1	6Q17979	CASE CS-78.	42	6C1841	CARBON TETRACHLORIDE: 8-oz. metal can; technical grade.
2	6R9006	RULE: steel; 6".	43	6N7831	SOLDER M-31: resin core.
3	4T2215	GAUGE: tape.	44	6N8683	TAPE TL-83: friction; cotton; ¾" wide.
4	4T96368	GAUGE: set of assembly; wire; 0.006" to 0.025".	45	6N8692	TAPE TL-192: rubber; ¾" wide.
5	4T106163	GAUGE: set of cylindrical; wire; 0.030" to 0.060".	46	6R4813	PLIERS TL-13: side-cutting; 6".
6	4T96366	GAUGE: set of assembly; wire; 0.065" to 0.080".	47	6R4628	PLIERS TL-128: long-chain nose.
7	4T96355	GAUGE: set of assembly; flat; 0.002" to 0.010".	48	6R4735-6	PLIERS: duck bill; 6".
8	4T72831	PIN: gauge.	49	6R4603	PLIERS TL-108: diagonal-cutting; 8".
9	4T73517	GAUGE: perforation of feed wheel.	50	6R55006	WRENCH TL-111: adjustable single end; ¾" capacity; 6" long.
10	4T73370	GAUGE: armature locating.	51	4T87697	WRENCH: open; ½"-¾".
11	4T95368	SCREWDRIVER: hex.	52	4T4638	WRENCH: open; ¾"-¾".
12	6R17260	SCREWDRIVER: 2" blade; ¾" tip; 4 ½" over-all.	53	4T96386	WRENCH: open; ¾"-¾".
13	6R15121	SCREWDRIVER: 1 ½" blade; ½" tip; 5 ½" over-all.	54	4T74871	WRENCH: open; 0.388".
14	6R18310	SCREWDRIVER TL-21: 2 ½" blade; ¾" tip; 6 ½" over-all.	55	4T96367	WRENCH: open; ¾"-¾".
15	6R19005-1	tip; 13 ½" over-all.	56	4T138-36	WRENCH: open; ¾"-¾".
16	6Q31014	SCREWDRIVER: screw-holding; 10" blade; ¾" tip; 13 ½" over-all.	57	6Q50004	HAMMER: riveting; 4 oz.
17	6Q90229	HANDLE TL-14: file; wood; 4" over-all.	58	6Q17979/C2	CASE: for tuning fork.
18	4T138-55	KNIFE TL-28.	59	4T104684	TUNING FORK: 96.19 vps; Teletype No. 104684.
19	4T138-68	SCALE: 8 oz.	60	6Q17979/C2	CASE: for tuning fork.
20	4T4641	SCALE: 12 lb.	61	4T103628	TUNING FORK: 87.6 vps; Teletype No. 103628.
21	4T75765	HOOK: spring; pull.	62	6R24617	SOLDERING IRON TL-117: 110-v, 70- to 100-w; with cord and plug.
22	4T75803	HOOK: spring; push.	63	4T138-23	WRENCH: socket; ¾".
23	4T77018	CASE: for small tools.	64	4T138-22	SCREWDRIVER, hex.
24	8A805	CHEESELOTH: bleached; 36" wide.	65	4T89954	WRENCH: socket; ¾".
25	4C9914.5/51	TOOL ROLL: empty.	66	4T89955	WRENCH: socket; ¾".
26	6M751	PAPER: cleaning; Bell Seal bond.	67	6Z7306	OILER: 6 oz; ¼" x 4 ½" spout; 1 drop force feed control.
27	6Z2000	CLOTH: emery; crocus; 9" x 11".	68	6C300	GUN: grease; Teletype No. 89975.
28	6Z7500-000	PAPER: sand; flint; 4000; 9" x 11".	69	6Z6870	MAGNET M-126: bar; steel; 6 x ¾ x ¼".
29	6Z9000-0	CLOTH: emery; 40; 9" x 11".	70	6Q38124-6	FILE: half-round; smooth; 6".
30	6M213	BRUSH: typewriter; toothbrush style.	71	6Q39033-6	FILE: flat; second cut; 6".
31	6Z1567	BRUSH: sash tool; oval; No. 2.	72	6R57400-5	WRENCH: socket; Bristol; for No. 5 fluted setscrews.
32	6X7360	ORANGE STICK: WECO No. KS-4320.	73	6Z4002	FLASHLIGHT TL-122: includes bulb.
33	6Z7072	MIRROR: dental; WECO No. 376A; 6 ½" x ¼" over-all.	74	3F4470-236	TEST UNIT I-236: 5 ½ x 3 ¾ x 3 ¾"; includes neon lamp and target lamp.
34	4T96617	TOMMY.	75	6Z8626	TAPE: relay cleaning; ¼" wide; WECO No. KS-6028.
35	4T102876	STONE: contact.	76	6R16510	SCREWDRIVER TL-44: 8" or 8 ½" blade; ¾" tip; insulated wood handle; 13" or 13 ½" over-all.
36	4T138-30	FILE: contact.			
37	4T96963	BURNISHER: contact.			
38	4T72003	BENDER: spring.			
39	4T72574	TOOL: locking ball; finger holding.			
40	4T72575	TOOL: finger bending.			
41	4T87698	STONE: carborundum.			

¹ Reference numbers refer to figure 52.

² This list was compiled on 15 May 1945 and is based on ASF Signal Supply Catalog pamphlet Sig 6-TE-50, April 1945.

(2) Loose, broken, or missing mounting screws.

(3) Feel the motor to determine if it is overheated.

b. **TIGHTEN (T)**. Tighten loose screws and bolts which are not part of an adjustment.

c. **CLEAN (C)**. When cleaning the motor unit, do not remove the motor unit base unless absolutely necessary.

(1) Remove all oil, grease, and other foreign matter from the outer surfaces of the motor unit by wiping with a dry cloth.

(2) Remove the motor brushes occasionally. Clean the brushes and the inside of the brush holders with a cloth moistened with dry-cleaning solvent (SD). During this operation check the condition of the carbon brushes.

*Note.* Scratch an identifying mark on the upper surface of each carbon brush upon its removal in order to facilitate replacing the brush into its proper brush holder after cleaning. Replace brushes only when it is evident that they will not last until the next scheduled routine.

(3) Clean any accumulations of grease, dirt, or other foreign matter from the outside surfaces of the governor shell by wiping with a piece of clean, dry cheesecloth. Dampen the cloth with dry-cleaning solvent (SD) to remove any gummy deposits. Also, clean the governor brush springs, mounting bracket, and the speed adjusting bracket. Fold a piece of cloth over the end of the screw driver to clean the hard-to-reach places.

**Caution:** Do not take the governor apart for cleaning only, unless there is reason to believe it is very dirty internally and the dirt may be a source of trouble.

d. **ADJUST (A)**. Make necessary adjustments to all parts as prescribed in section XIV. For check and adjustment of motor speed see paragraph 26.

e. **LUBRICATE (L)**. Lubrication instructions are contained in section VII.

## 42. Base

*Note.* Normally the base and motor unit are treated at the same time to prevent misalignment of the motor which often results when the motor unit is removed and not properly replaced.

Place the base on the workbench.

a. **CLEAN (C)**. Wipe all oil and grease from the base. Use a piece of cheesecloth folded over the tip of a screw driver to get into hard-to-reach places. Be careful not to break any of the leads of the base wiring.

b. **INSPECT (I)**. Inspect for the following:

(1) Casting for cracks and other damage.

(2) Loose, broken, or missing mounting screws.

(3) See paragraphs 35, 36, and 37 for other points to be inspected.

c. **TIGHTEN (T)**. Tighten loose screws, bolts, and other parts not involved in adjustments. Other points to be tightened are given in paragraphs 35, 36, and 37.

d. **ADJUST (A)**. See section XIV for the required adjustments.

e. **LUBRICATE (L)**. See section VII for points to be lubricated.

f. **REMOVE**. Remove the base from the work bench.

## 43. Preventive Maintenance Tools, Materials, Schedules, and Records

*Note.* Before starting preventive maintenance, have on hand all tools and materials needed in performing the operations listed in the preventive maintenance check list.

a. **TOOLS**. All required tools are furnished with Tool Equipment TE-50 (fig. 52), which is especially designed for maintenance of teletypewriter equipment.

The list of tools and materials contained in Tool Equipment TE-50 is as shown on page 52.

b. **MATERIALS**. All materials listed below may be secured through regular supply channels.

Item	Signal Corps stock No.
Orange stick (WECo code No. KS-6320).....	6X7360
Cheesecloth, bleached 36" wide.....	8A805
Cloth, emery; crocus, 9" x 11" sheets (spec No. 42C56-Navy).....	6Z2000
Carbon tetrachloride.....	6G184.1
Oil, Lubricating, Preservative, Special, U. S. Army spec No. 2120.....	6G1318.1
Grease, Lubricating, Special, Ordnance spec No. AXS-637.....	6G673.7
Paper, cleaning, Bell Seal bond, 1/4" x 2 1/2" (WECo code No. KS-7188).....	6M750
Paper, sand flint #0000 9" x 11" sheets, Federal spec No. P-P-111. Solvent, Dry Cleaning, Federal spec No. P-S-661a.....	6Z7500-0000

*Note.* Gasoline will not be used as a cleaning fluid for any purpose. Solvent, Dry Cleaning, is available as a cleaning fluid through established supply channels. Oil, Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not on hand. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: where inflammable solvents cannot be used because of the fire hazard, and for cleaning electrical contacts including relay and SEND-REC-BREAK key contacts, plugs, commutators, etc.

SHEET NO. 1		PREVENTIVE MAINTENANCE ROUTINE SCHE										
YEAR 1945		JANUARY			FEBRUARY			MARCH				
5. TG-7-B		DATE SCHEDULED	10	20	30	10	20	28	10	20	30	24 HOURS DAILY OPERATION
SERIAL NO. ON CHESTS 3063		DATE COMPLETED	9	20	30							
AVERAGE NUMBER OF HOURS OF OPERATION DAILY	24	COMPLETED BY	GN	YJ	YJ							
6. TG-7-B		DATE SCHEDULED	--	15	30	--	15	28	--	15	30	12 HOURS DAILY OPERATION
SERIAL NO. ON CHESTS 3170		DATE COMPLETED	-	14	31							
AVERAGE NUMBER OF HOURS OF OPERATION DAILY	12	COMPLETED BY		MK	MK							
7. TG-37-B		DATE SCHEDULED	--	--	30	--	--	28	--	--		8 HOURS DAILY OPERATION
SERIAL NO. ON CHESTS 1832		DATE COMPLETED	-	-	29							
AVERAGE NUMBER OF HOURS OF OPERATION DAILY	8	COMPLETED BY			MK							

TL 53725-S

Figure 53. Typical preventive maintenance routine schedule.

c. PREVENTIVE MAINTENANCE SCHEDULES AND RECORDS. Prepare a chart showing the various teletypewriters in the installation, the average number of hours of operation daily, the dates routines are scheduled, the dates the routines are completed, and initials or other designation of person completing routine. If desired, one chart can cover the entire teletypewriter set, of which the teletypewriter is a part. Base the schedule upon accurate information and revise it from time to time as conditions change. The record form used may cover time intervals of 1 month, 2 months, or any other interval desired by the officer in charge of the installation. A typical preventive maintenance routine schedule for a teletypewriter installation is shown in figure 53. The recommended time intervals for equipment routines are:

Equipment in operation 12 to 24 hours daily—Routine every 10 days.

Equipment in operation 8 to 12 hours daily—Routine every 15 days.

Equipment in operation 8 hours or less daily—Routine every 30 days.

The above time intervals for equipment routines are based on operating conditions which prevail when the temperature is moderate and air is relatively free of dirt, sand, and excessive amounts of dust and moisture. When equip-

ment is being operated in localities where there are extreme temperatures, excess moisture, dust, dirt, or sand, or other adverse conditions, the routine schedules should be established on whatever intervals are necessary to keep the equipment in satisfactory operating condition.

## Section VI.

### PREVENTIVE MAINTENANCE CHECK LIST

#### 44. Preventive Maintenance Check List for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B

The following check list is a summary of the preventive maintenance to be performed on the teletypewriters. The time intervals shown on the check list may be reduced at any time by the local commander. However, for best performance of the equipment, the operations must be performed at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are second echelon maintenance. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITA appear in the Operations column, the item to be treated must be inspected (I), tightened (T), and adjusted (A).

## Section VII. LUBRICATION

*Notes.* A War Department Lubrication Order is not issued on Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B.

Item No.	Operations <sup>1</sup>	Item (routine)	Par. No.	When performed	Eche- lon
1	C	Teletypewriter (exterior).....	33	Daily	1st
2	IT	Cover.....	33		2d
3	IA	Motor speed.....	26	Daily	1st
4	C	Chests.....	32	Daily	1st
5	IT	Chests.....	32		2d
6	IA	Range finder setting.....	27	X	2d
<i>Typing unit (less type-bar carriage)</i>					
7	IT	General over-all mechanical condition	38	X	2d
8	IA	Armature trip-off eccentric screw adjustment	252	X	2d
9	IA	Selector armature end play.....	233	X	2d
10	I	Function ball cam roller.....	38	X	2d
11	I	Function lever bail roller pivot bearings	38	X	2d
12	I	Printing ball cam roller.....	38	X	2d
13	IA	Platen assembly.....	269	X	2d
14	IA	Dash pot.....	343	X	2d
15	IA	Left-hand margin adjustment.....	335	X	2d
16	ICA	Motor stop contacts.....	36, 247	X	2d
17	IOA	Slip connections.....	36, 367	X	2d
18	L	Entire mechanism.....	48	X	2d
<i>Type-bar carriage</i>					
19	C	All mechanical parts.....	39	X	2d
20	ITA	General mechanical condition.....	39, 184	X	2d
21	IA	Ribbon mechanism.....	195-198	X	2d
22	L	Entire mechanism.....	48, 184	X	2d
<i>Keyboard</i>					
23	CIT	General over-all mechanical condition	40	X	2d
24	IOA	Transmitting contacts.....	36, 346	X	2
25	ITC	Wiring and slip connections.....	35, 36	X	2d
26	L	Entire mechanism.....	48	X	2d
<i>Base</i>					
27	C	All mechanical parts.....	42	X	2d
28	ITA	General mechanical condition.....	42, 364-367	X	2d
29	ITOA	SEND-REC-BREAK Key.....	42, 368-373	X	2d
30	ITC	Switch (motor).....	37	X	2d
31	ITC	Terminal blocks and slip connections	36	X	2d
32	IC	Wiring.....	35	X	2d
33	ITC	Cords and plugs.....	35	X	2d
34	L	Entire base mechanism.....	48	X	2d
<i>Motor unit</i>					
35	C	Exterior of motor unit.....	41	X	2d
36	FIT	General mechanical condition.....	41	X	2d
37	IT	Motor pinion gear.....	41	X	2d
38	ICA	Motor brushes and commutator.....	162, 164, 383	X	2d
39	ICA	Governor.....	41, 374-380	X	2d
40	ITC	Switch and wiring.....	35, 37	X	2d
41	L	Motor unit.....	48	X	2d

**NOTE**—X in When performed column is determined by average hours of use:

	Normal temperatures	Tropical temperatures
Up to 8 hours per day.....	every 30 days.....	every 15 days
8 to 12 hours per day.....	every 15 days.....	every 10 days
12 to 24 hours per day.....	every 10 days.....	every 7 days

<sup>1</sup>F, Feel; I, Inspect; T, Tighten; C, Clean; A, Adjust; L, Lubricate.

### 45. Recommended Lubricants

The following table lists the lubricating materials necessary in servicing the teletypewriters:

Approved symbols	Standard nomenclature
GL.....	Grease, Lubricating, Special
PS.....	*Oil, Lubricating, Preservative, Special
OE 10.....	*Oil, Engine, SAE 10

\* When the temperature is so high that special preservative lubricating oil (PS) runs off the parts, engine oil, SAE 10 (OE 10), may be used in place of it.

### 46. Detailed Lubrication Instructions

**a. GENERAL.** The location of the parts of the teletypewriter to be lubricated are shown in figures 54 through 65. The type of lubricant to be used and the specific instructions for lubricating each part are given in paragraph 48 following. The lubrication instructions listed are based on normal operating conditions, with the equipment in service for an average of 8 hours a day. Under these conditions the lubrication interval is once every 30 days. See preventive maintenance check list, (par. 44). When equipment is operated more than 8 hours a day, reduce the intervals. When equipment is operated in tropical climates, a further reduction in the interval is required. Do not lubricate the equipment with the motor running.

**Caution:** Do not apply lubricants in excess of the quantities recommended. Wipe off excess oil.

**b. METHODS OF APPLYING GREASE.** (1) *Filling of grease gun.* Fill the grease gun furnished as part of Tool Equipment TE-50 in the following manner:

(a) Unscrew the lubricant tube from the cap casting.

(b) Place the open end of the lubricant tube over the opening in the filling washer in the can of proper lubricant. Press down on the lubricant tube until the tube is filled.

*Note.* If the cans of lubricant on hand are not equipped with filling washers, press the metal follower against the back end of the lubricant tube and fill the lubricant tube by using a clean wooden paddle or the fingers. Tamp the lubricant down solidly in the tube

by pounding the closed end sharply against the palm of the hand. Continue to add lubricant and tamp until the tube is completely filled.

(c) Screw the lubricant tube back into the cap casting just enough to hold the tube in place. Insert a rod, screw driver, pencil, or similar object through the perforated end of the lubricant tube and press the metal follower into the tube to expel any air that may be trapped in the tube. When the lubricant begins to ooze past the threads, tighten the lubricant tube securely into the cap casting.

(d) Operate the handle back and forth several times until lubricant is pumped from the nozzle. The grease gun is then ready for use. If the lubricant does not flow from the nozzle in a solid stream when the handle is operated, it is an indication that all the air has not been expelled from the lubricant tube. Invert the gun and pound the cap casting end against the palm of the hand to jar the lubricant into the pump cylinder.

(2) *Greasing pressure fittings.* To grease parts that are equipped with pressure fittings, place the nozzle of the grease gun squarely against the grease fittings and operate the handle.

**Caution:** Test the grease gun *before* greasing pressure fittings to determine how much grease is injected for each full operation of the handle. DO NOT OVERLUBRICATE EQUIPMENT.

(3) *Greasing flat surfaces.* To grease flat surfaces, hold the nozzle of the grease gun against the surface, tilted at an angle of approximately 45°. Operate the handle until sufficient grease is ejected. If the surface is long, operate the handle slowly and at the same time move the nozzle of the gun along the surface to form a continuous ribbon of lubricant. The lubricant may be pumped out onto the fingers or the end of a screw driver for transfer into hard-to-reach places that cannot be reached directly with the grease gun.

c. METHODS OF APPLYING OIL. (1) *Filling of oiler.* Fill the oiler furnished as part of Tool Equipment TE-50 by unscrewing the top and remove the pump. Fill the tube with proper lubricant and replace the pump. Tighten the top.

(2) *Use of oiler.* After filling the oiler, or when starting to use the oiler after it has been standing for some time, operate the pump

handle until oil is forced out of the nozzle and then adjust the stop beneath the pump handle for the desired flow of oil. Turn the adjusting stop in a counterclockwise direction to reduce the flow of oil and in a clockwise direction to increase the flow of oil.

*Note.* The adjustable stop beneath the pump handle may be moved to one side to make the stop inoperative.

(3) *Use of wire for applying oil.* A piece of #22 B & S gauge wire dipped ½ inch into the oil and immediately touched to the lubrication point is an approved method of applying 1 or 2 drops of oil. The main advantage of this method is that it avoids overlubrication.

## 47. Preparation for Lubrication

a. GENERAL. To thoroughly lubricate the teletypewriter it must be taken out of service and partially disassembled as outlined in c below.

b. GREASE GUN. Fill the grease gun and oiler (part of Tool Equipment TE-50) as outlined in paragraph 46b and c.

c. PREPARATION. Take the following preparatory steps to facilitate lubrication of the various parts and units.

(1) Disconnect the power during the lubricating process.

(2) Remove the cover.

(3) Remove the roll of paper and paper spindle from the typing unit.

(4) Remove the typing unit from the base, then remove the type bar carriage.

(5) Remove the keyboard.

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

e. LUBRICATION. Lubricate the teletypewriter in accordance with the charts given in paragraph 48 below. Items need not be lubricated in the sequence given in the charts, but all points listed *must* be lubricated.

## 48. Lubrication Charts for Teletypewriters

The charts in this paragraph list the points to be lubricated on the teletypewriters, the type of lubricant, and the quantity to be applied. The item numbers listed are grouped to include all the points of lubrication on each unit of the teletypewriter. The same numbers are shown on the accompanying illustrations.

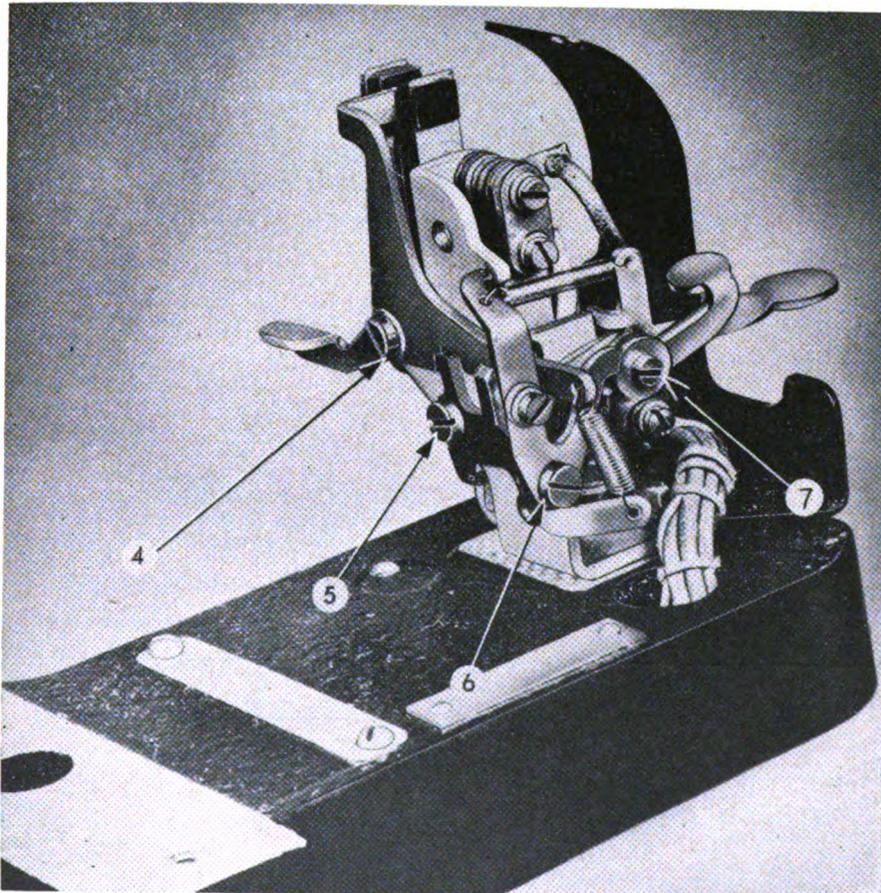
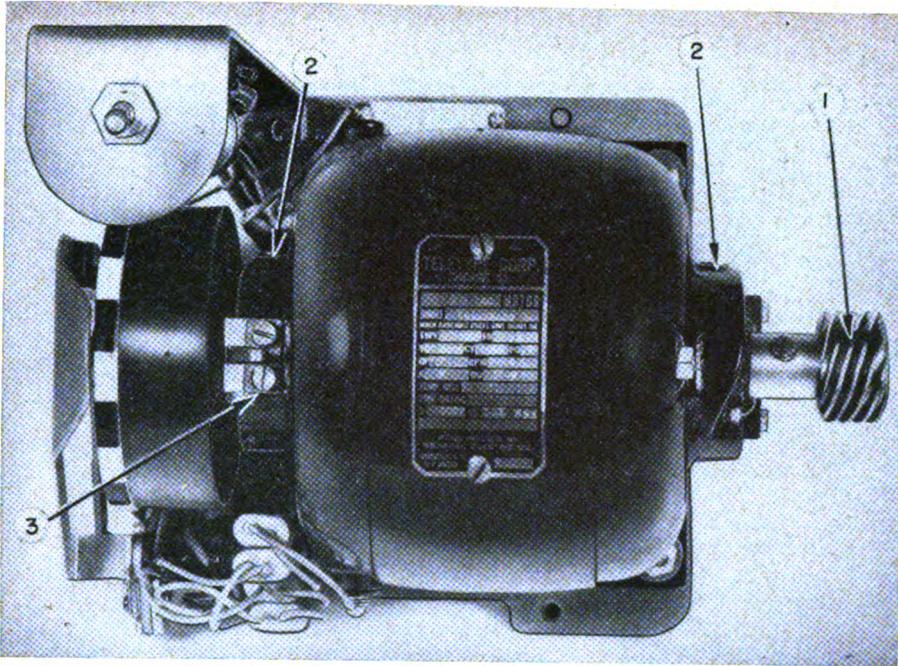


Figure 54. Lubrication points for motor unit and base. TL53921-S

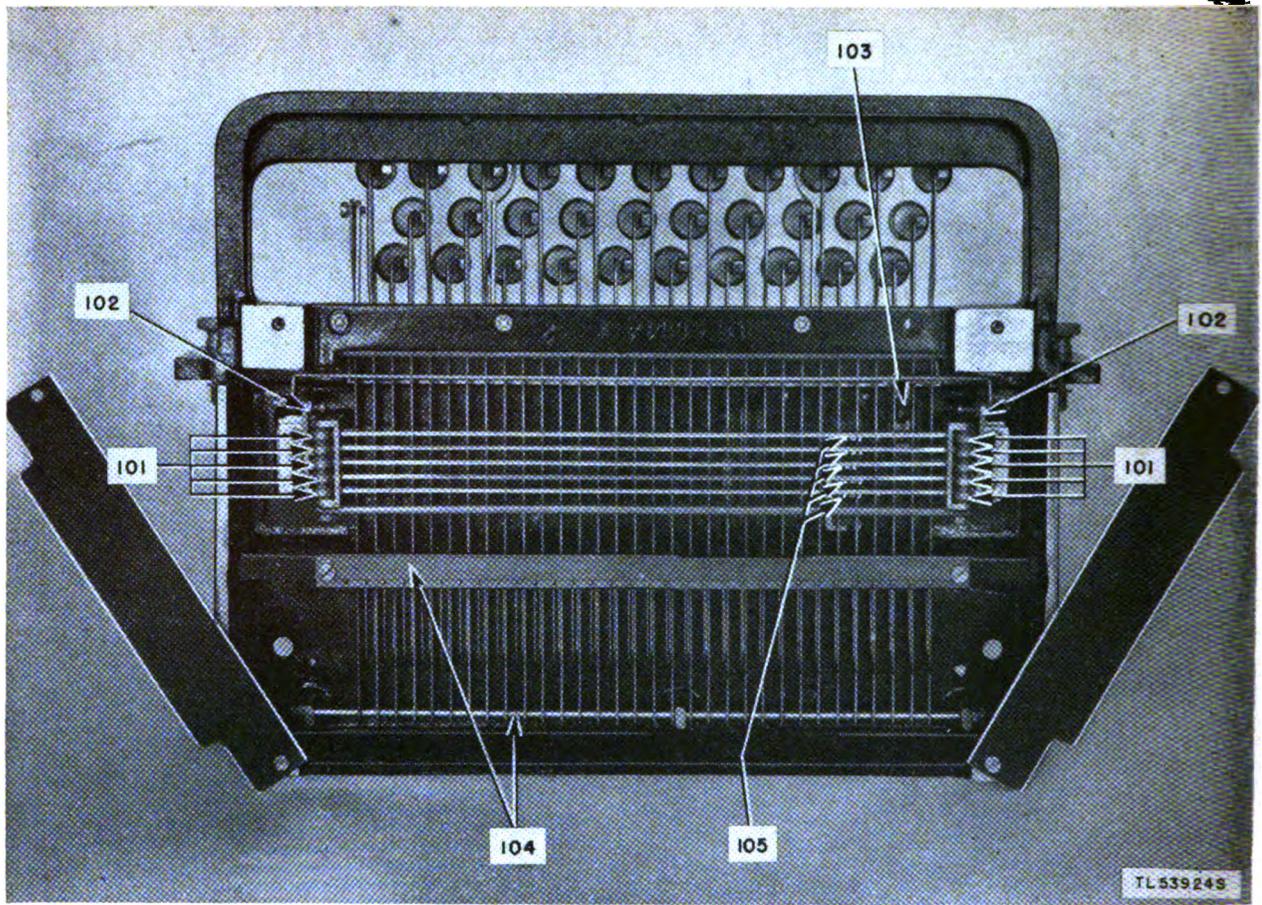


Figure 55. Lubrication points for bottom of keyboard.

a. MOTOR UNIT AND BASE.

Item No.	Name of part	Lubricant	Method and quantity
1	Motor pinion.....	GL	Apply sparingly.
2	Motor bearing oilers (2).....	OE	4 or 5 drops in each.
3	Motor speed lever-pilot screw.....	PS	1 or 2 drops.
4	Operating lever shoulder screw.....	PS	Do.
5	Lower contact lever shoulder screw.....	PS	Do.
6	Stop lever shoulder screw.....	PS	Do.
7	Send-Rec-Break Lever mounting screw.....	PS	Do.

b. LUBRICATION ON BOTTOM OF KEYBOARD.

Item No.	Name of part	Lubricant	Method and quantity
101	Selector bars in slots and rollers.....	PS	1 or 2 drops.
102	Universal bar pilot screw on bearings.....	PS	Do.
103	Trip off pawl link joint.....	PS	Do.
104	Keylevers on keylever shaft and in rear comb.	PS	Do.
105	Locking levers between pins in selector bars.	PS	Do.

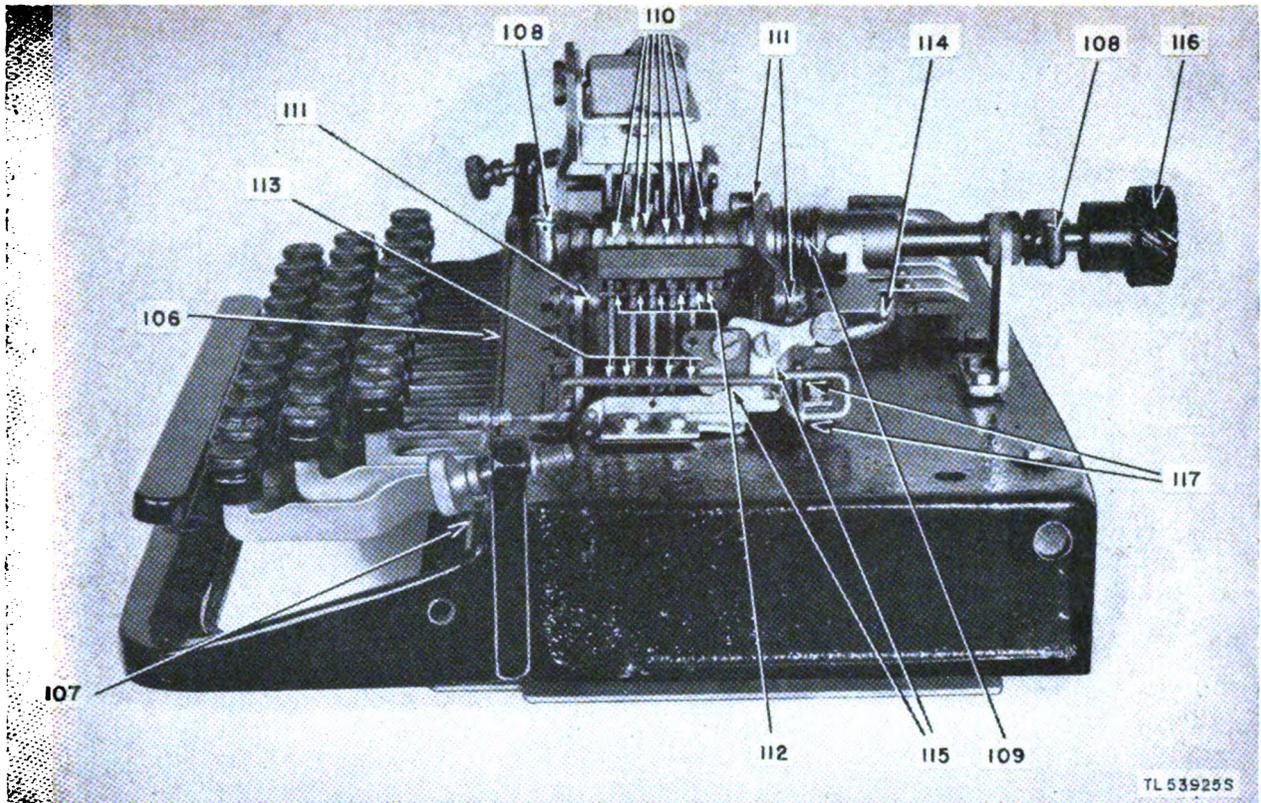


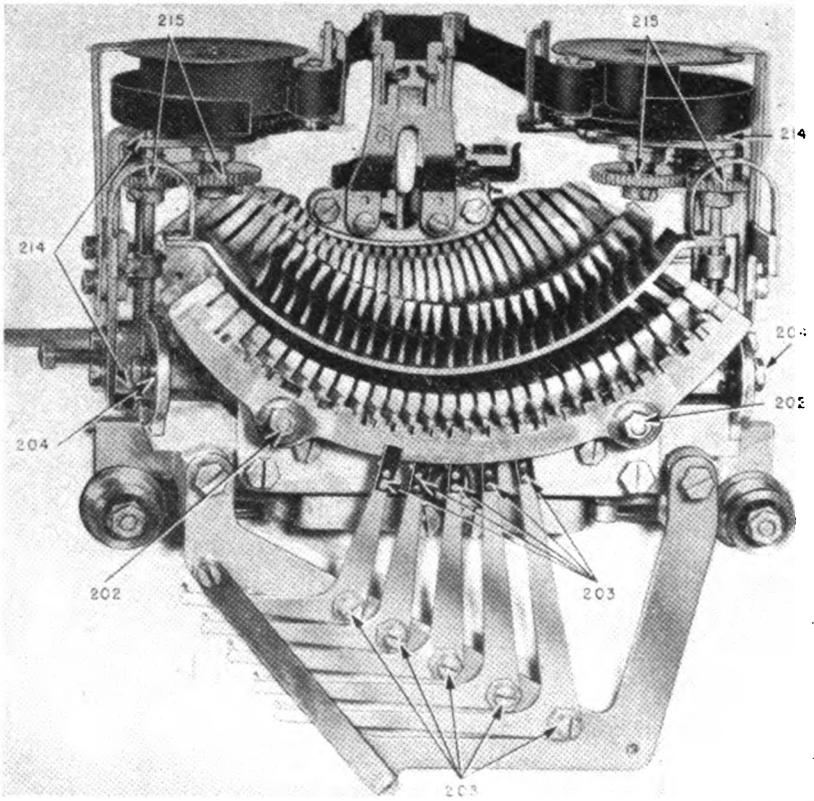
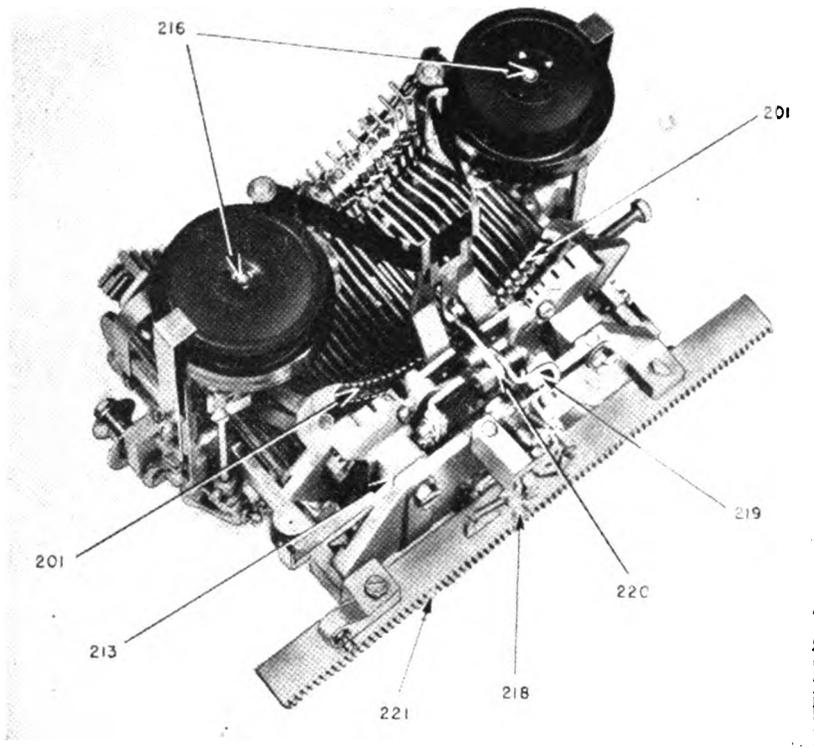
Figure 56. Lubrication points for top of keyboard.

c. LUBRICATION ON TOP SIDE OF KEYBOARD.

Item No.	Name of part	Lubricant	Method and quantity
106	Keylevers in front Comb.....	PS	1 or 2 drops.
107	Space bar loop on space bar loop shaft.....	PS	Do.
108	Keyboard shaft (2 oil cups).....	PS	Fill cups.
109	Keyboard clutch-sliding member.....	PS	1 or 2 drops.
110	Cams, on surfaces.....	GL	Apply a light film.
111	Locking loop-pilot screw bearings and rollers.	PS	1 or 2 drops at each point.
112	Contact lever pivoting shaft and guiding comb.	PS	Do.
113	Locking levers in locking lever comb.....	PS	1 or 2 drops.
114	Clutch throw-out lever bearings.....	PS	Do.
115	Trip-off and intermediate lever pawls.....	PS	Do.
116	Keyboard transmitter gear.....	PS	Apply sparingly.
117	Repeat space rod on each bearing point and points of contact.	PS	1 or 2 drops.

d. TYPE BAR CARRIAGE ASSEMBLY.

Item No.	Name of part	Lubricant	Method and quantity
201	Type bars at segment slot.....	PS	1 or 3 drops.
202	Code bars at posts.....	PS	Do.
203	Code bar bell cranks on wearing surfaces.	PS	Do.
204	Pull bar ball on guide rollers and guide surface.	GL	Apply sparingly.
205	Plunger surface and rollers.....	GL	Do.
206	Plunger roller.....	GL	Do.
207	Carriage support rollers.....	PS	1 or 2 drops.
208	Ribbon reverse bail.....	PS	Do.
209	Ribbon feed shaft bearing.....	PS	Do.
210	Ribbon feed pawl operating lever.....	PS	Do.
211	Ribbon feed pawl pivot screw.....	PS	Do.
212	Ribbon feed ratchet.....	PS	Do.
213	Ribbon lockout bar at type bar segment slot.	PS	Do.
214	Ribbon feed shaft on upper and lower bearings.	PS	Do.
215	Ribbon feed mechanism.....	PS	Apply sparingly to gears.
216	Ribbon spool shafts on bushings (remove spools).	PS	2 or 3 drops.
217	Ribbon reverse shafts, upper and lower bearings, arms, pawls, and levers.	PS	1 or 2 drops.
218	Margin bell pawl.....	PS	Do.
219	Ribbon shift lever and roller.....	PS	Do.
220	Oscillator lever shoulder screw and carriage casting slot.	PS	Do.
221	Type bar carriage rack, space shaft pinion and travel.	PS	Do.
223	Ribbon feed shaft detent.....	GL	Apply sparingly.



TL53926-S

Figure 57. Lubrication points, front and back of type bar carriage.



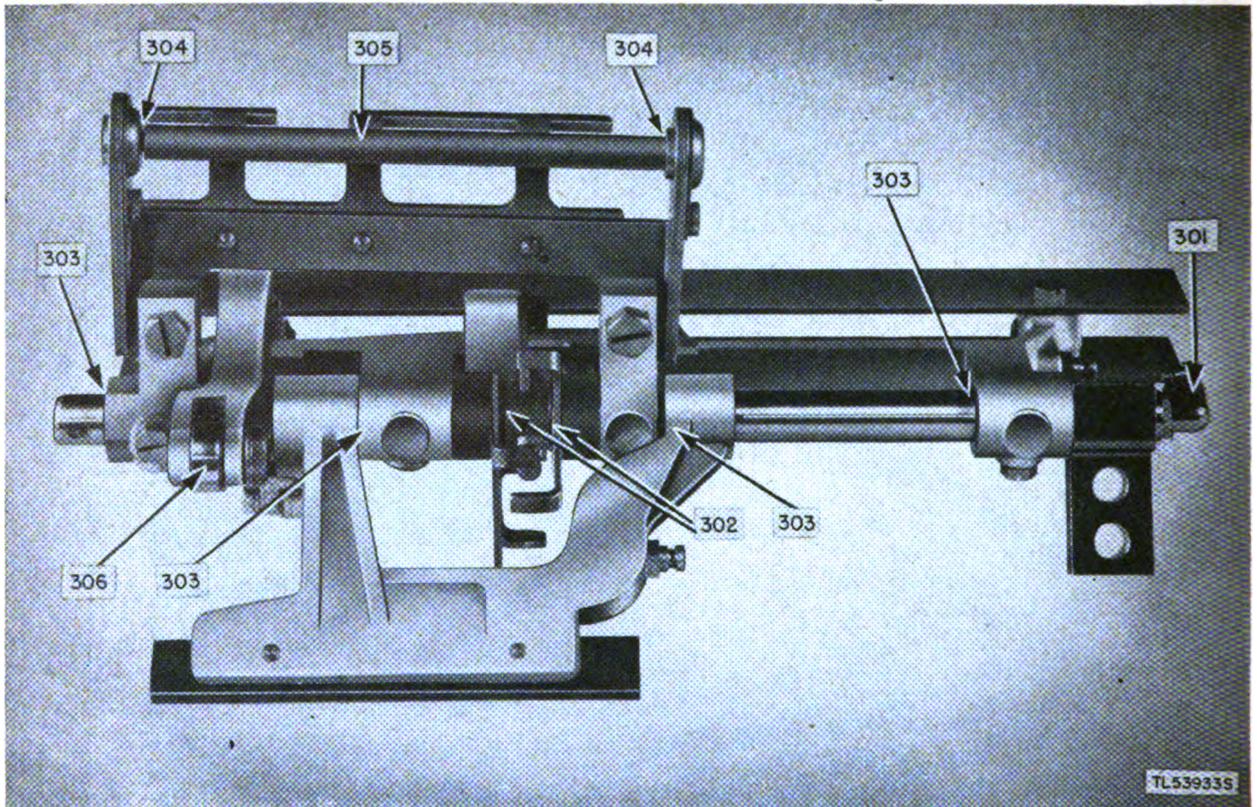


Figure 59. Lubrication points for bail unit assembly.

e. TYPING UNIT.

Item No.	Name of part	Lubri- cant	Method and quantity	Item No.	Name of part	Lubri- cant	Method and quantity
301	Ball assembly shaft bearings (2 oil cups).	PS	Fill cups.	315	Vanes front edges where bell cranks slotted ends slide in engagement with vanes.	PS	1 or 2 drops.
302	Between spacing pawls.....	PS	1 or 2 drops.	316	Sixth vane detent roller.....	PS	Do.
303	Function bail and printing bail operat- ing arm bearings.	PS	1 or 2 drops at each point.	317	Locking function lever.....	GL	Apply grease in notches.
304	Function lever ball roller (two bearings).	GL	Apply sparingly.	318	Spacing shaft in upper bearing; lever bearing fill oil cup.	PS	1 or 2 drops.
305	Roller surface.....	GL	Apply film of grease.	319	Carriage return clutch members prongs.	PS	Do.
306	Function bail and printing bail operat- ing arm and rollers.	GL	Apply sparingly.	320	Spacing gear (lower).....	GL	Apply sparingly.
307	Printing bail blades where plunger operating roller engages blades.	PS	1 or 2 drops.	321	Carriage return latch bar at point of engagement with latch.	GL	Do.
308	Printing bail, adjusting screw head.....	GL	Apply sparingly.	322	Carriage return clutch release fork and operating lever bearings.	PS	1 or 2 drops.
309	Function levers in vane frame slot.....	PS	1 or 2 drops.	323	Carriage return push bar and latch bar operating lever shoulder screw.	PS	Do.
310	Function levers in slot in break mech- anism plate.	PS	Do.	324	Carriage return locking bar bell crank link shoulder screw.	PS	Do.
311	Push bars and latch bars in function lever comb.	PS	Do.	325	Carriage return spring drum bearing....	PS	Do.
312	Sixth vane extension spring in slot in letters push bar.	PS	1 or 2 drops.	326	Carriage return spring release lever shoulder screw.	PS	Do.
313	Vane pilot screw bearings.....	PS	Do.	327	Clutch release fork link shoulder screw..	PS	Do.
314	Send-Rec-Break mechanism Intermedi- ate lever mounting screw, and reset lever pivot screw (care must be taken not to get oil on friction spring washer of Send-Rec-Break mechanism "T" lever).	PS	Do.	328	Locking bar bell crank upper cross bar casting shoulder screw.	PS	Do.
				329	Locking bar and locking bar bell crank shoulder screw.	PS	Do.

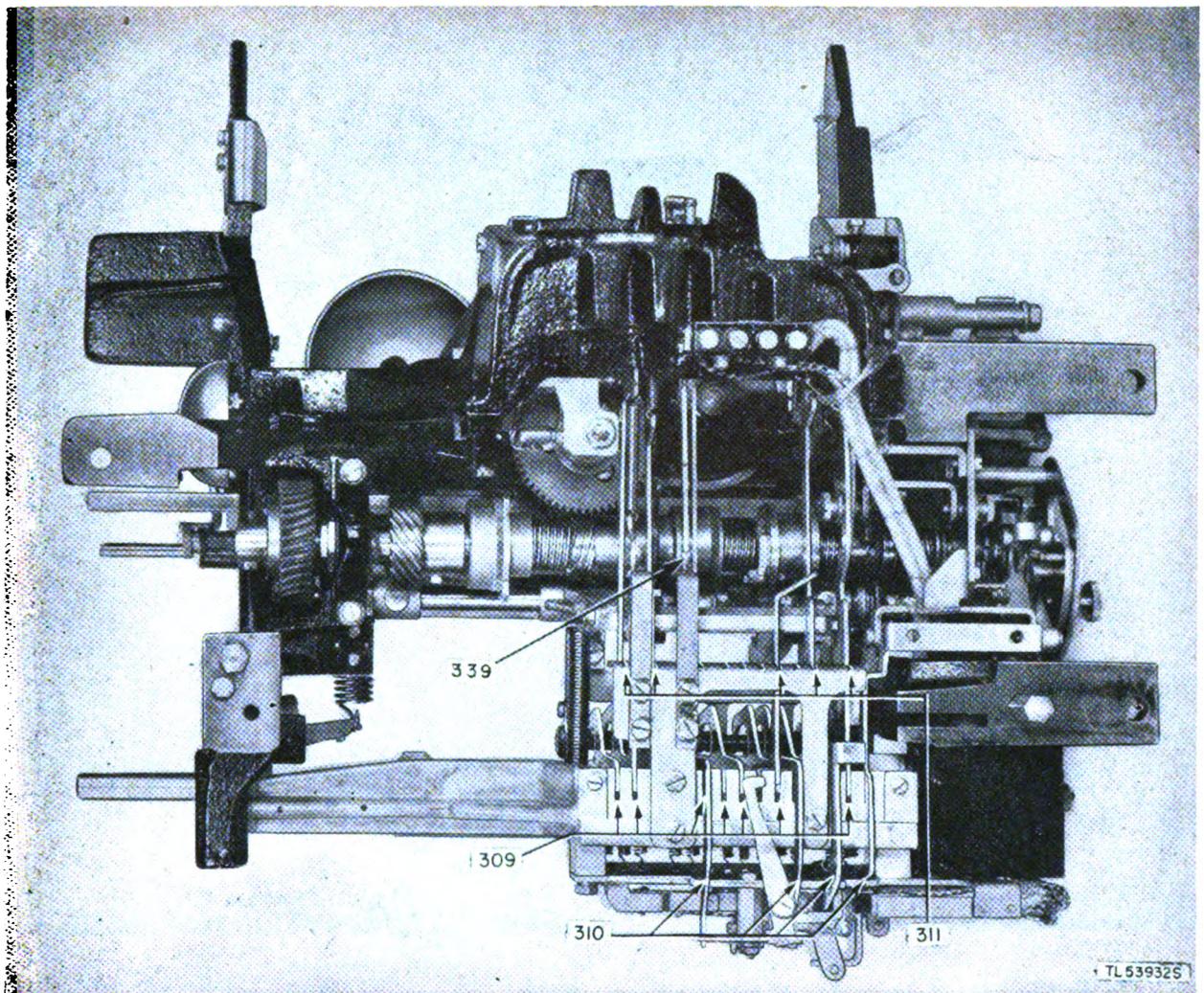


Figure 60. Lubrication points, bottom of typing unit.

Item No.	Name of part	Lubricant	Method and quantity	Item No.	Name of part	Lubricant	Method and quantity
330	Locking bar latch and left hand side frame shoulder screw.	PS	1 or 2 drops.	340	The "figures" and "letters" push bar shoulder screw.	PS	1 or 2 drops.
331	Dashpot piston rod rubbed over surface of piston.	PS	1 drop.	341	Bell crank lever and operating lever shoulder screw.	PS	Do.
332	Dashpot lever mounting screw, and roller mounting pilot screw at point of contact with left hand margin adjusting screw.	GL	Apply sparingly.	342	Bell crank lever and operating lever joint.	PS	Do.
333	Type bar carriage assembly on upper and lower track surfaces.	PS	1 or 2 drops.	343	Shift vertical link, lower and detent lever shoulder screw.	PS	Do.
334	Carriage return spring through oil holes in drum.	PS	Do.	344	Line feed push bar and bell crank lever shoulder screw.	PS	Do.
335	Spacing stop lever and shoulder screw...	GL	Apply sparingly.	345	Bell crank lever mounting shaft.....	PS	Do.
336	Carriage return operating lever stop screw.	GL	Do.	346	Vertical link and bell crank lever, lower end, shoulder screw.	PS	Do.
337	Bell striker arm and arm operating lever bearings.	PS	1 or 2 drops.	347	Margin bell shaft, 2 bearings.....	PS	Do.
338	Bell push bar and latch bar shoulder screw.	PS	Do.	351	Main Shaft.....	PS	Hold right end of teletypewriter up about 6 inches and remove oil plug. Fill shaft until oil runs out of the left end.
339	Bell latch bar at point of engagement with latch.	GL	Apply sparingly.				

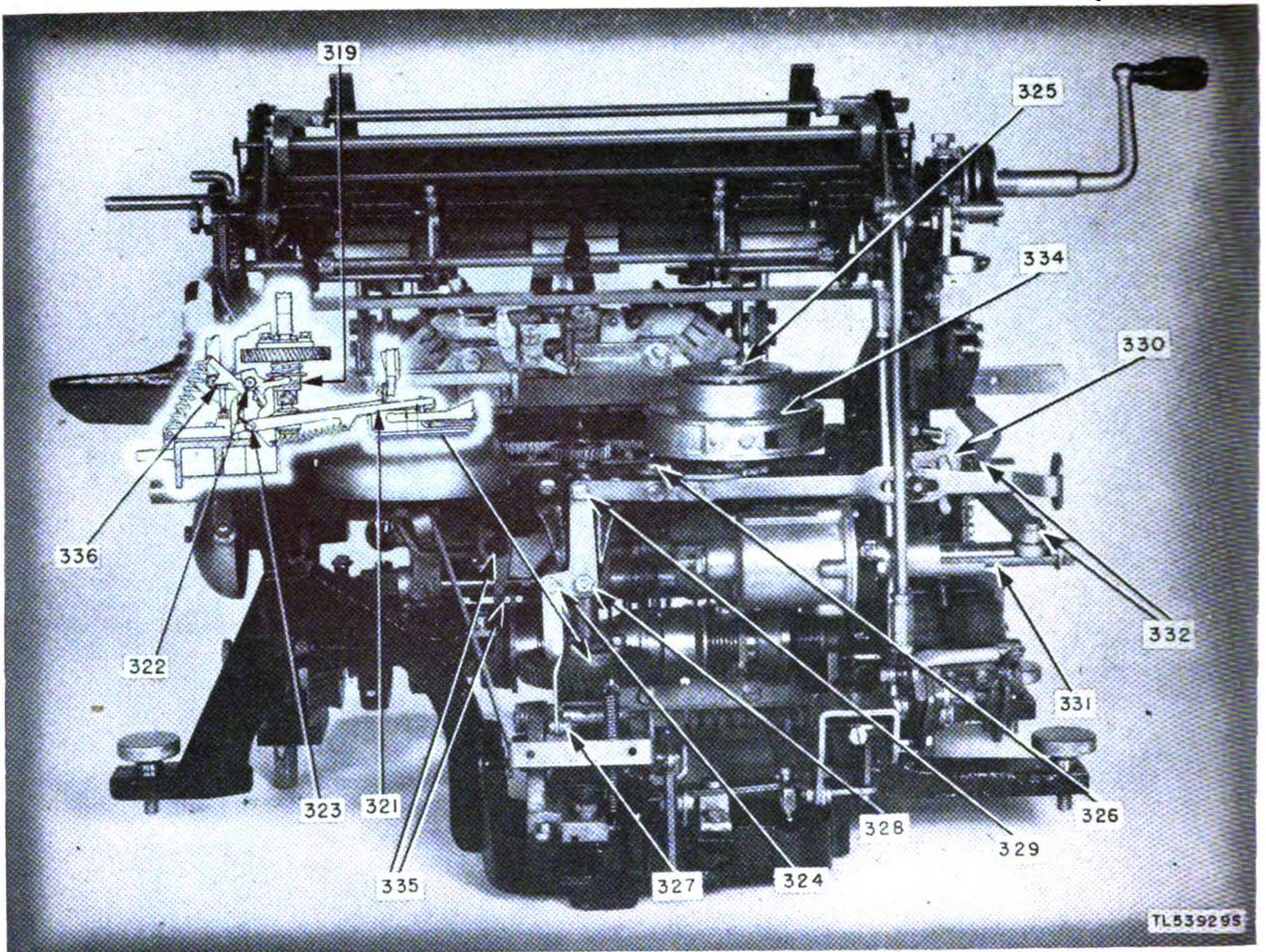


Figure 61. Lubrication points for carriage return mechanism.

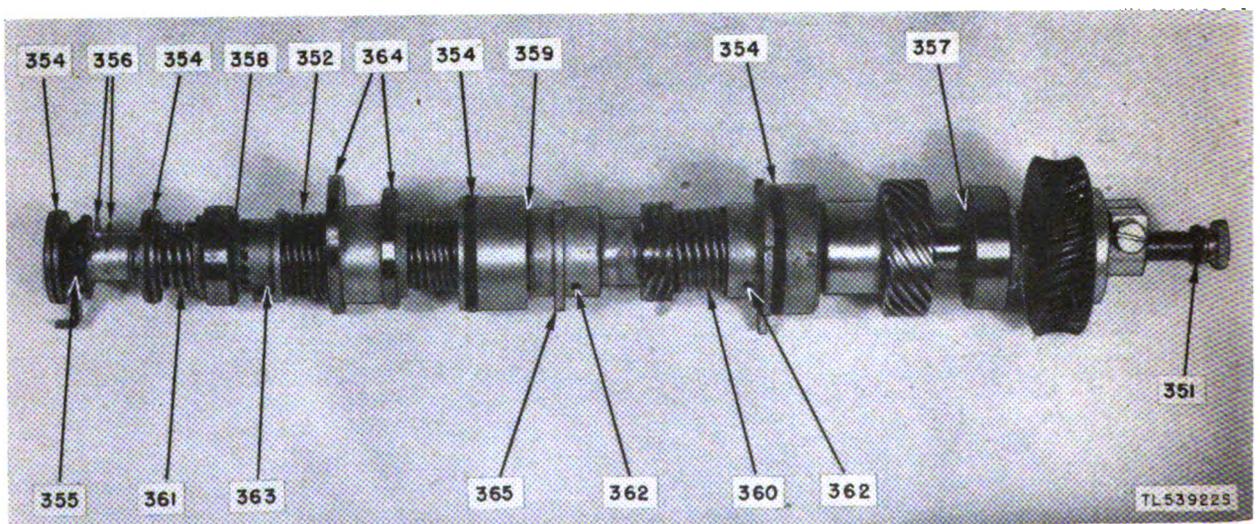


Figure 62. Lubrication points of main shaft.

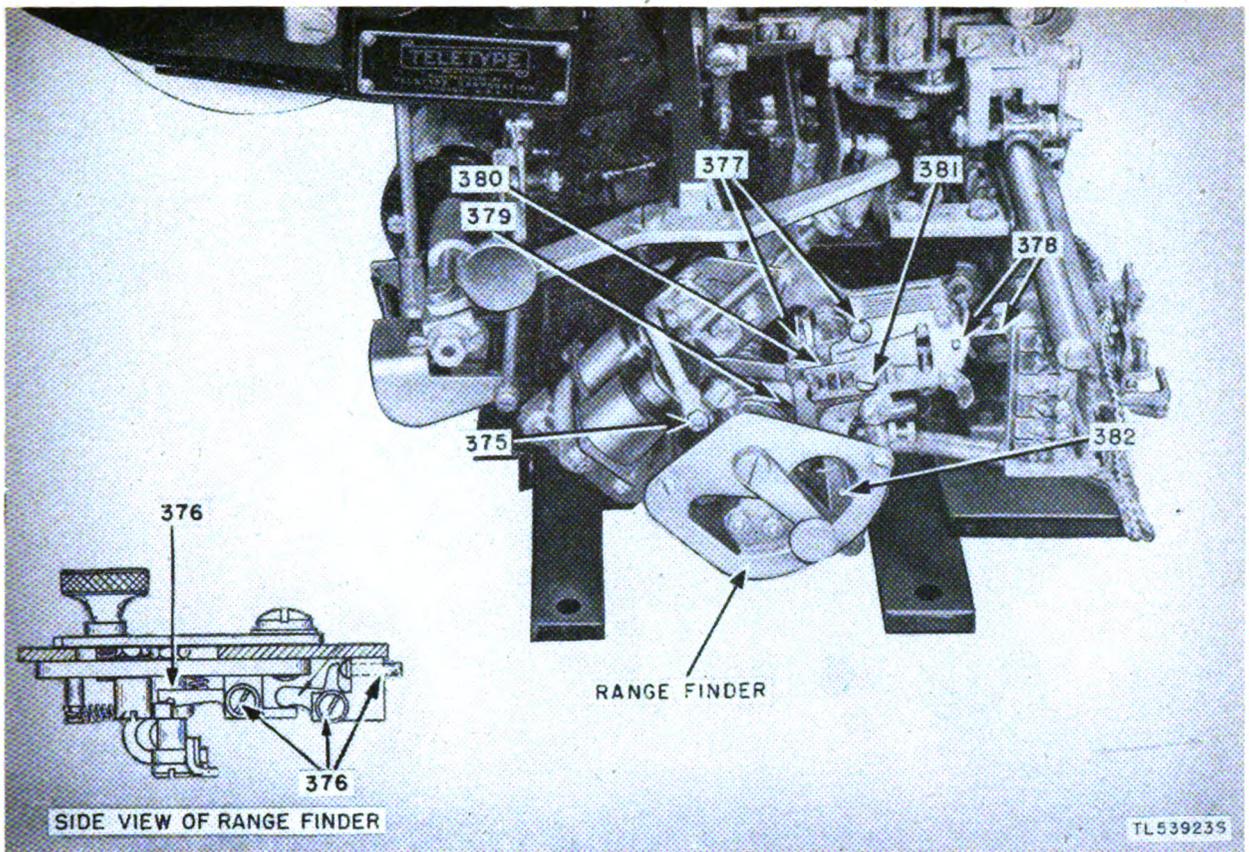


Figure 63. Lubrication points for selector mechanism.

Item No.	Name of part	Lubricant	Method and quantity
352	Main clutch sliding member.....	PS	Oil freely.....
353	Main clutch throw-out lever pivots.....	GL	Apply sparingly.
354	Main shaft friction washers.....	PS	Saturate with oil.
355	Locking lever cam, felt washers on selector cam assembly.	PS	1 or 2 drops.
356	Selector cam sleeve on each cam peak...	OE	Do.
357	Main shaft right ball bearing.....	GL,PS	Apply 1 or 2 drops of PS, turn shaft; apply thin coat of GL; turn shaft a few turns; apply 1 or 2 drops of PS.
358	Main shaft left ball bearing.....	GL,PS	Same as above.
359	Thrust bearing on end balls.....	PS	1 or 2 drops.
360	Spacing clutch spring coils.....	PS	Permit oil to flow between prongs of driver member of spacing clutch and worm gear sleeve.

Item No.	Name of part	Lubricant	Method and quantity
361	Spring which compresses friction washers of selector cam assembly.	PS	Apply sparingly to coils (oil will flow between prongs of nut on main shaft and friction disk which engages this nut).
362	Cam unit and spacing clutch in oil holes.	PS	1 or 2 drops.
363	Main clutch camming surface.....	PS	Do.
364	Main shaft cam surfaces.....	GL	Apply sparingly.
365	Spacing escapement ratchet teeth.....	GL	Do.
375	Armature bearings (2).....	PS	1 or 2 drops.
376	Trip latch plunger, trip latch and bell crank lever and stop lever of range finder assembly.	PS	Do.
377	Swords and selector levers between separating plates.	PS	Do.
378	"T" levers on all points of contact.....	PS	Do.
379	Armature locking lever.....	PS	Do.
380	Locking wedge at point of engagement with locking lever.	PS	Do.
381	Motor stop pawls shoulder screw and lever bearings.	PS	Do.

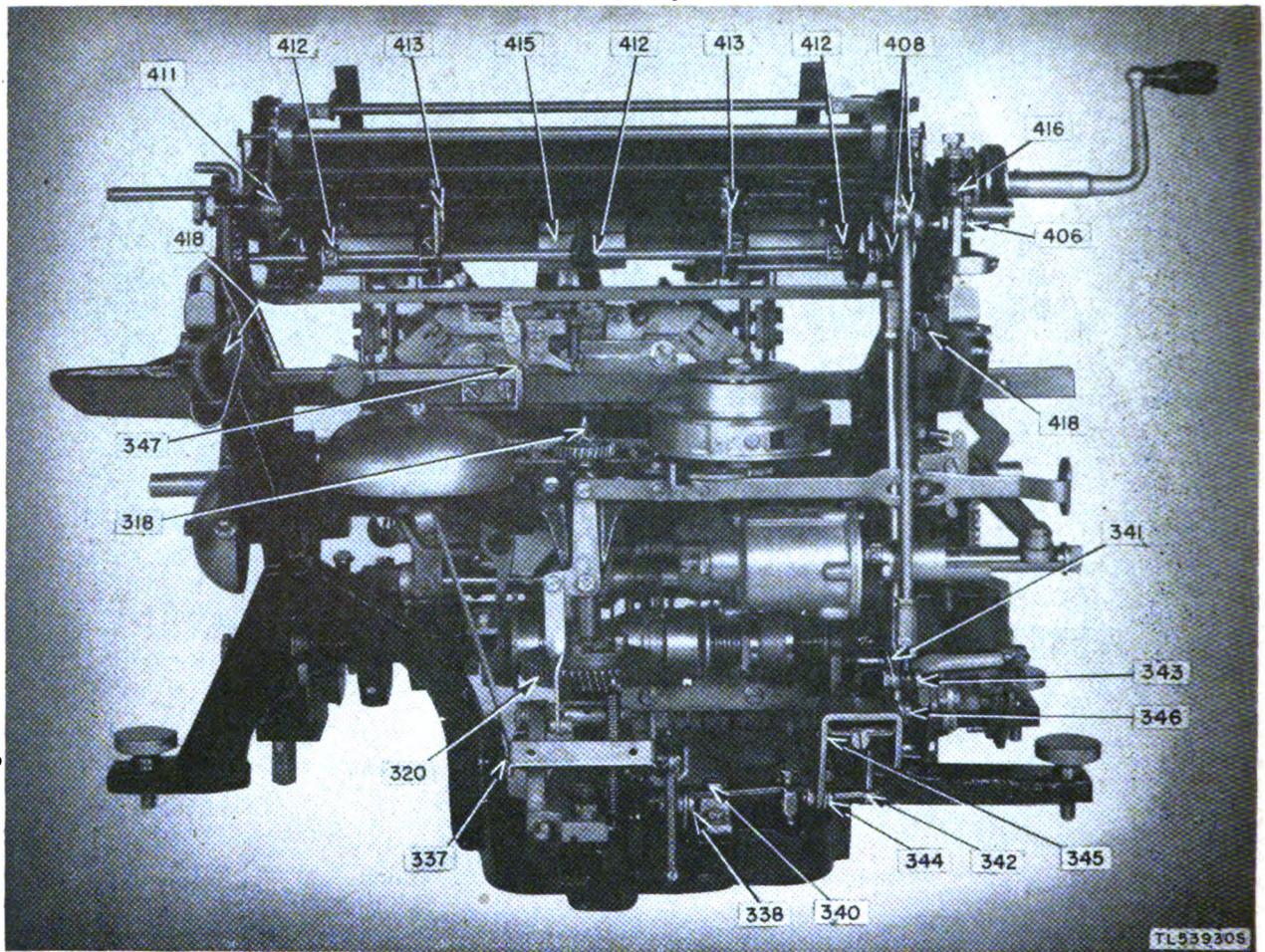


Figure 64. Lubrication points back of typing unit.

Item No.	Name of part	Lubricant	Method and quantity	Item No.	Name of part	Lubricant	Method and quantity
382	Release lever bearings, contact lever bearing and where contact lever protrudes through break mechanism plate.	PS	Do.	410	Paper straightener lever bearings.....	PS	1 or 2 drops.
401	Shaft bearings in each shaft hub.....	PS	1 or 2 drops.	411	Paper straightener rod supporting lever bearings.	PS	Do.
402	Line feed detent lever mounting shoulder screw.	PS	Do.	412	Pressure roller release shaft and crank bearings.	PS	Do.
403	Line feed detent roller.....	PS	Do.	413	Pressure roller release cams crank and shoulder screws.	PS	Do.
404	Single-double line-feed lever between flat spring and denting cam and where single-double line feed lever fits into groove in platen shaft hub.	PS	Do.	414	Pressure roller shafts on bearing surface.	PS	Do.
405	Line feed pawl and line feed lever shoulder screw.	PS	Do.	415	Pressure roller sleeves.....	PS	1 drop on each.
406	Shift detent roller.....	GL	Apply sparingly.	416	Letters and figures stop screws.....	PS	Grease ends.
407	Platen unit pivot bearings.....	PS	1 or 2 drops.	417	Platen friction disk assembly, felt washer (separate disks).	PS	Saturate with oil.
408	Line feed and shift vertical links.....	PS	Do.	418	Paper spindle bearings.....	PS	1 or 2 drops.
409	Paper knife supporting arms and paper guide bearings.	PS	Do.	419	Line feed check lever shaft bearings.....	PS	Do.
				420	Line feed detent ratchet.....	GL	Apply sparingly.
				421	Left end of platen shaft before installing platen.	PS	1 or 2 drops.

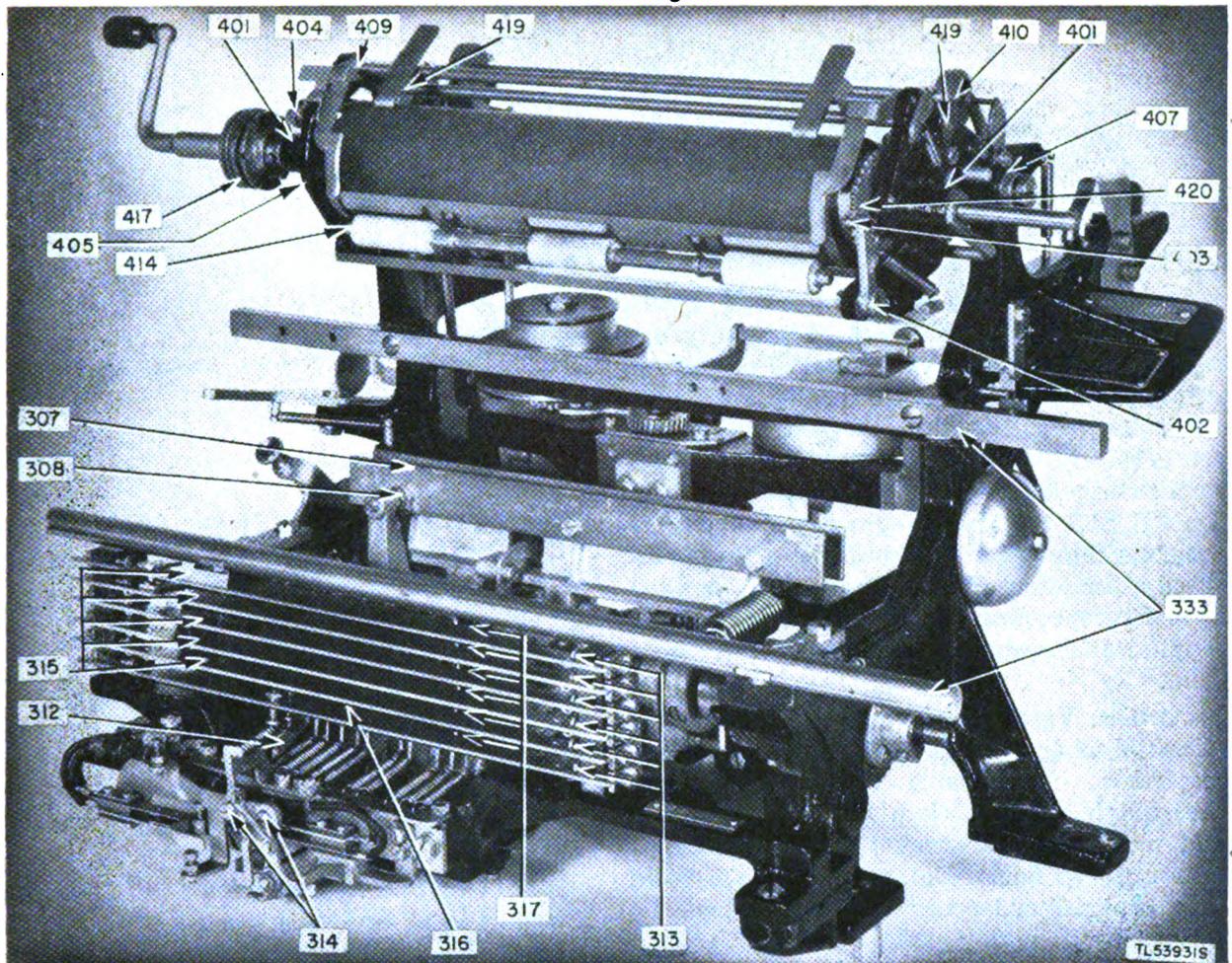


Figure 65. Lubrication points front of type unit.

**f. MOTOR UNIT BEARINGS.** (1) The motor bearings are packed with grease before the motor leaves the factory and under ordinary operating conditions need no additional lubrication for approximately 2 months. At the regular lubricating intervals one or two strokes of the plunger of the gun should apply sufficient grease to each bearing.

(2) To lubricate, press the nozzle of the gun against the ball oiler pressure fitting and force the grease into the hole by pushing on the plunger of the gun. Care should be taken that the bearings are not overloaded. Overloading will result in the grease oozing out of the end castings and being thrown on other parts of the mechanism. After lubricating, the motor should be run for a few minutes and then any excess grease that has been forced out of the ends of the castings should be wiped off. Each

time that the gun is used for lubricating a motor bearing, the plunger should first be depressed slightly to make sure that grease will be delivered.

## Section VIII. MOISTUREPROOFING AND FUNGIPROOFING

### 49. General

When operated in tropical areas where temperature and relative humidity are extremely high, Signal Corps equipment requires special attention. These are some of the problems met:

a. Resistors, capacitors, coils, chokes, etc., fail because of the effects of fungus growth and excessive moisture.

b. Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils,

chokes, etc., causing eventual break down.

c. Hook-up wire and wiring harness insulation break-down. Fungus growth accelerates deterioration.

d. Moisture forms electrical leakage paths on terminal blocks and insulating strips, causing flash-overs and crossfire.

## 50. Treatment

A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied with a spray gun or brush. See TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

**Caution:** Varnish spray may have poisonous effects if inhaled. To avoid inhaling spray, use respirator if available; otherwise, fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

## 51. Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B

a. PREPARATION. Make all repairs necessary for proper operation of the equipment.

b. DISASSEMBLY. When disassembling equipment, do not interchange the components from one machine to another.

(1) Unhook the four catches at the base of the Chest CH-50-(\*) and remove the cover of the chest. (Cover is not to be treated.)

(2) Lift off the teletypewriter cover. (Cover is not to be treated.)

(3) Loosen the two knurled screws holding the keyboard and remove the keyboard. (Keyboard is to be treated.)

(4) Remove the four machine screws securing the guide plates at each end of the bottom of the keyboard base and remove the plates. (Plates are not to be treated.)

(5) Remove the four nuts and washers on the under side of the base of Chest CH-50-(\*)

and remove the teletypewriter base. (Base of Chest CH-50-(\*) is not to be treated.)

(6) Remove the four machine screws and lockwashers securing the power resistor assembly to the mounting brackets on the right-hand side of the base and remove the resistor and grill assembly. Do not disconnect the cord.

(7) Remove the eight bolts and lockwashers securing bottom cover plate to the teletypewriter base and remove the plate. (Plate is not to be treated.)

(8) Loosen the screws securing the two cable clamps beneath the teletypewriter base and swing the clamps away from the cable.

(9) Loosen the two machine screws securing the resistor cover at the top of the polar relay mounting bracket on the left-hand rear of the teletypewriter base and remove cover. (Cover is not to be treated.)

*Note.* This applies to Printer TG-7-A only. The polar relay mounting bracket is not provided with Teletypewriter TG-7-B and TG-37-B.

(10) Loosen the two machine screws securing the ON-OFF motor switch cover on right-hand front of the teletypewriter base and slide the cover off. (Cover is not to be treated.)

(11) Tighten down all the terminal connecting screws.

(12) Unhook the four catches at the base of Chest CH-62-(\*) and remove the cover. (Cover is not to be treated.)

(13) Remove the four cap screws securing the typing unit to the base of the chest, using the wrench provided with the equipment, or loosen the three wingnuts and mounting clamps securing the typing unit on later models of Teletypewriters TG-7-B and TG-37-B. Separate base of chest and the typing unit. (Base of the chest is not to be treated.)

c. CLEANING. Clean all dirt, dust, rust, and fungus from the equipment to be processed. Clean all oil and grease from the surfaces to be varnished.

(1) When the wiring is in good electrical condition but covered with an oil film too heavy to be removed, do not apply coating material to the wiring. If possible, replace the wiring.

(2) When wiring that is faulty or oil-soaked is replaced, treat the new wiring with coating material if the wire has not been treated with a fungicidal lacquer during manufacture.

**Caution:** Unless cleaning is done very carefully and thoroughly, the effectiveness of the

moistureproofing and fungiproofing operation will be impaired.

*d. MASKING.* No masking of the equipment is required.

*e. DRYING.* Dry the teletypewriter base, keyboard, and typing unit assemblies at 160° F, for a period of from 2 to 3 hours.

*f. VARNISHING.* (1) Use a brush to apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, spec No. 71-2202 (stock No. 6G1005.3), or equal). Allow each coat to air-dry 15 to 20 minutes at the temperature specified in *e* above before applying the next coat.

(2) Apply varnish immediately after the equipment is dried. If varnish is not applied immediately, moisture may condense on the equipment. Varnish applied over moisture peels off readily after the varnish has dried.

(3) Apply the varnish by brush to all soldered connections, screw terminal connections, terminal blocks, accessible edges of phenolic and fibre insulation, resistors, capacitors, magnet coils, retardation coil, and all wiring and wiring harness insulation which is free from an oil film.

**Caution:** DO NOT ALLOW COATING MATERIAL TO GET ON THE ELECTRICAL CONTACTS, COMMUTATOR SEGMENTS, MAGNET POLE FACES, MAGNET ARMA-

TURE, OR OTHER PARTS WITH CRITICAL ELECTRICAL OR MECHANICAL REQUIREMENTS.

*g. REASSEMBLY.* (1) Reassemble the equipment and adjust for proper operation.

(2) Make a complete operational check of the equipment and lubricate if necessary to be sure it is in good operating condition.

(3) If the unit does not operate after reassembly, check the electrical connections for presence of varnish coating. Varnish coating on electrical connections acts as an insulating material. Recheck the reassembly operation. Component parts may have been improperly replaced or power leads connected to the wrong terminals.

*h. MARKING.* Mark the letters MFP and the date of treatment near the nameplate on the typing unit and on the base of the teletypewriter near the SEND-REC-BREAK key.

*Example:* MFP—6 Apr 45

## 52. Moistureproofing and Fungiproofing after Repairs

If, during repair, the coating of protective varnish has been punctured or broken, and if complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

**PART FOUR**  
**AUXILIARY EQUIPMENT**

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(Not used)

## PART FIVE

### REPAIR INSTRUCTIONS

*Note.* Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on WD AGO Form 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form 54 (Unsatisfactory Report). If Form 54 is not available, prepare the data according to the sample form reproduced in figure 66.

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#### Section IX. GENERAL REPAIR PROCEDURE

##### 53. Outline of Repair and Adjustment Procedure

Service failures can be kept to a minimum by careful handling of the equipment during installation, by completing preventive maintenance as specified in part three, and by thoroughly investigating and correcting all troubles which are encountered. When service faults are discovered, a definite plan of corrective maintenance procedure will reduce both the length of time the equipment is in trouble and the amount of work required to complete the repairs. An outline of the information furnished in part five for assistance in locating and correcting defects in various parts and circuits follows:

*a.* DETAILED FUNCTIONING OF EQUIPMENT. Section X includes a complete explanation of the purpose and operation of the various parts and circuits. An understanding of how the various mechanisms function will greatly assist in determining when the equipment is operating correctly and when it requires repairs or when it is not practical to attempt repairs and therefore should be replaced.

*b.* TOOLS AND TEST EQUIPMENT. Sections V and XI describe the tools and test equipment normally required to accurately check all of the clearances, spring tensions, speed of rotation, and other adjustments to determine that the entire teletypewriter is functioning properly.

*c.* TROUBLE LOCATING. Section XII describes methods of isolating and locating different troubles and provides step-by-step analysis procedures in the form of trouble analysis charts.

*d.* REPAIR AND REPLACEMENT. Section XIII furnishes recommended procedures for the re-

pair and replacement of those parts and units which experience the most wear.

*e.* REQUIREMENTS AND ADJUSTMENTS. Section XIV groups in one section all of the test requirements and adjustment values required to make a complete check and adjustment of entire teletypewriter mechanism.

##### 54. Unsatisfactory Equipment Report

*a.* When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, WD AGO Form 468, should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C.

*b.* When trouble in equipment used by the Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form 54 should be filled out and forwarded to the Commanding General, Air Technical Service Command, Wright Field, Dayton, Ohio, in accordance with AAF Regulation 15-54. If form is not available, prepare the data according to the sample form reproduced in figure 66.

#### Section X. DETAILED FUNCTIONING OF EQUIPMENT

##### 55. Introduction to Detailed Functioning of Equipment

*a.* This section explains in detail the purpose and functional operation of the various parts and assemblies. Appropriate illustrations and reference diagrams are included to clarify the different operations which combine to change the action of typing on the keyboard into particular groups of electrical impulses, also the related operations which in turn translate the

**WAR DEPARTMENT  
UNSATISFACTORY EQUIPMENT REPORT**

FOR TECHNICAL SERVICE Signal Corps	MATERIEL	DATE 10 JUS 45	
FROM 761 Signal Repair Co Signal Corps Signal Officer, Blue Army	761 Signal Repair Co Signal Corps Signal Officer, Blue Army	STATION APO 202 San Francisco 9	REPORTING OFFICER TECHNICAL SERVICE
TO Signal Officer, Blue Army	COMPLETE MAJOR ITEM	STATION APO 101 San Francisco 9	
DESCRIPTION Teletypewriter TU-0-B	MODEL N. S. A. No. 1234-Phils-44	DATE RECEIVED 12 Aug 44	
MANUFACTURER Ribbon Reverse ATB	SERIAL NO. 5678		
DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE 4774354 Ribbon reverse ATB Teletypewriter Co Ribbon fails to reverse			
DATE OF INITIAL TROUBLE 12 Dec 44	REASON FOR FAILURE Improvement design of ribbon reverse arm and shaft.	TOTAL PERIOD OF OPERATION BEFORE FAILURE YEARS MONTHS DAYS HOURS MINUTES	
OPERATING IN TROPICS Operating in tropics an average of 20 hours daily during this period. Tightened setcrew 9 different times.			
RECOMMENDATIONS (If additional copies required, see back of form)			
TYPE NAME, GRADE, AND ORGANIZATION W. R. Red, 2d Lt Sig C 761 Signal Repair Co	ORIGINATING OFFICER W. R. Red		
TO CHIEF NAME, GRADE, AND STATION	FIRST ENDORSEMENT OFFICER	STATION	DATE

1. It is suggested that the staff of technical service concerned be referred to the following instructions for proper identification, design, or operation when to submit:

2. This form will be used for reporting mechanical, design, or construction defects in electrical, mechanical, radio, telephone, and printing materiel with a view to improvement and correcting such defects, and for use in recommending modifications of materiel.

3. This form will not be used for reporting failures, broken material, defects or malfunctions of materiel resulting from the wear and tear of materiel or from the use of materiel in the field.

4. Reports of defective materiel should be filed with the staff of technical service. (However, the report should be so marked as to indicate its nature as a report of defective materiel.)

5. This form should be used to submit reports on the following: (a) Defective materiel; (b) Defective materiel; (c) Defective materiel; (d) Defective materiel; (e) Defective materiel; (f) Defective materiel; (g) Defective materiel; (h) Defective materiel; (i) Defective materiel; (j) Defective materiel; (k) Defective materiel; (l) Defective materiel; (m) Defective materiel; (n) Defective materiel; (o) Defective materiel; (p) Defective materiel; (q) Defective materiel; (r) Defective materiel; (s) Defective materiel; (t) Defective materiel; (u) Defective materiel; (v) Defective materiel; (w) Defective materiel; (x) Defective materiel; (y) Defective materiel; (z) Defective materiel.

6. This form will be used to submit reports on the following: (a) Defective materiel; (b) Defective materiel; (c) Defective materiel; (d) Defective materiel; (e) Defective materiel; (f) Defective materiel; (g) Defective materiel; (h) Defective materiel; (i) Defective materiel; (j) Defective materiel; (k) Defective materiel; (l) Defective materiel; (m) Defective materiel; (n) Defective materiel; (o) Defective materiel; (p) Defective materiel; (q) Defective materiel; (r) Defective materiel; (s) Defective materiel; (t) Defective materiel; (u) Defective materiel; (v) Defective materiel; (w) Defective materiel; (x) Defective materiel; (y) Defective materiel; (z) Defective materiel.

7. This form will be used to submit reports on the following: (a) Defective materiel; (b) Defective materiel; (c) Defective materiel; (d) Defective materiel; (e) Defective materiel; (f) Defective materiel; (g) Defective materiel; (h) Defective materiel; (i) Defective materiel; (j) Defective materiel; (k) Defective materiel; (l) Defective materiel; (m) Defective materiel; (n) Defective materiel; (o) Defective materiel; (p) Defective materiel; (q) Defective materiel; (r) Defective materiel; (s) Defective materiel; (t) Defective materiel; (u) Defective materiel; (v) Defective materiel; (w) Defective materiel; (x) Defective materiel; (y) Defective materiel; (z) Defective materiel.

8. This form will be used to submit reports on the following: (a) Defective materiel; (b) Defective materiel; (c) Defective materiel; (d) Defective materiel; (e) Defective materiel; (f) Defective materiel; (g) Defective materiel; (h) Defective materiel; (i) Defective materiel; (j) Defective materiel; (k) Defective materiel; (l) Defective materiel; (m) Defective materiel; (n) Defective materiel; (o) Defective materiel; (p) Defective materiel; (q) Defective materiel; (r) Defective materiel; (s) Defective materiel; (t) Defective materiel; (u) Defective materiel; (v) Defective materiel; (w) Defective materiel; (x) Defective materiel; (y) Defective materiel; (z) Defective materiel.

9. This form will be used to submit reports on the following: (a) Defective materiel; (b) Defective materiel; (c) Defective materiel; (d) Defective materiel; (e) Defective materiel; (f) Defective materiel; (g) Defective materiel; (h) Defective materiel; (i) Defective materiel; (j) Defective materiel; (k) Defective materiel; (l) Defective materiel; (m) Defective materiel; (n) Defective materiel; (o) Defective materiel; (p) Defective materiel; (q) Defective materiel; (r) Defective materiel; (s) Defective materiel; (t) Defective materiel; (u) Defective materiel; (v) Defective materiel; (w) Defective materiel; (x) Defective materiel; (y) Defective materiel; (z) Defective materiel.

Figure 66. Unsatisfactory Equipment Reports.

**WAR DEPARTMENT  
UNSATISFACTORY REPORT**

(Use AFM No. 11-44 for Information on Proper Use of this Form)

TO BE FILLED BY THE REPORTER DATE SUBMITTED 27 Mar 45	LEAVE BLANK A. S. SERIAL No. SERIAL No.	STATION APO 202 San Francisco 9	
REPORTING OFFICER Signal Officer, Blue Army	REPORTING OFFICER Signal Officer, Blue Army	STATION APO 101 San Francisco 9	
DESCRIPTION Teletypewriter TU-0-B	MODEL N. S. A. No. 1234-Phils-44	DATE RECEIVED 12 Aug 44	
MANUFACTURER Ribbon Reverse ATB	SERIAL NO. 5678		
DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE 4774354 Ribbon reverse ATB Teletypewriter Co Ribbon fails to reverse			
DATE OF INITIAL TROUBLE 12 Dec 44	REASON FOR FAILURE Improvement design of ribbon reverse arm and shaft.	TOTAL PERIOD OF OPERATION BEFORE FAILURE YEARS MONTHS DAYS HOURS MINUTES	
OPERATING IN TROPICS Operating in tropics an average of 20 hours daily during this period. Tightened setcrew 9 different times.			
RECOMMENDATIONS (If additional copies required, see back of form)			
TYPE NAME, GRADE, AND ORGANIZATION W. R. Red, 2d Lt Sig C 761 Signal Repair Co	ORIGINATING OFFICER W. R. Red		
TO CHIEF NAME, GRADE, AND STATION	FIRST ENDORSEMENT OFFICER	STATION	DATE

ROUTING  
FOR APPROVAL AND THE OFFICE CONCERNED BY THE REPORTING OFFICER.  
FOR THE COMMANDING GENERAL, SIGNAL CORPS, U. S. ARMY, WASHINGTON, D. C. (AFM No. 11-44)

W. R. Red  
WILLIAM BLANK  
Capt, Air Corps  
Communications Officer

**EXPEDITE**

1. DESCRIPTION OF UNSATISFACTORY CONDITION: The Spring Retainer is part of the punch block assembly of the U.S. Army Signal Corps TU-0-B-1. Shortly after the punch block was assembled, the spring retainer in three of the machines snapped at the end section. The spring retainer and punch block in service due to lack of spares. The third was too badly broken to repair.

2. PROBABLE CAUSES: Evidently too much strain is put on the arm section of this part especially the farther arm which is considerably smaller in width and thickness.

3. RECOMMENDATIONS: The spring retainer should be made of non-heat or a heavier metal. Spares should be provided with each set.

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electrical impulses into a typewritten message. Information in this section is particularly intended to assist in setting up and following through the complete sequence of functional operations in the different assemblies and units. The information is arranged by actions or functions of the parts or subassemblies describing how they rotate or move to accomplish a given purpose. To simplify the tracing of successive and overlapping actions and functions a number of step-by-step sequence of operation charts are furnished. While the information in this section parallels in some respects the information in section XIV, each section is intended for a different purpose. All of the test and adjustment procedures involved in repairing teletypewriters have been grouped together for ready reference in the requirements and adjustment section, and no testing or adjusting data is furnished in this section.

b. The information furnished in the individual paragraphs of this section applies particularly to Printers TG-7-A, and Teletypewriters TG-7-B and TG-37-B, assuming that they are in normal operating condition with an external line relay and necessary power supplies properly connected. Information is not furnished on all the possible modifications and optional features which might be encountered when these teletypewriters are connected with teletypewriter equipment used by foreign nations. See general functioning of equipment, section II, when information is required on the basic features of the five-unit start-stop teletypewriter code including the fundamental plan of synchronism on which the satisfactory operation of teletypewriter systems depends.

## 56. Detailed Functioning of Equipment Index

The special index listed below groups the functioning of the parts and subassemblies by their closest physical relationship to the larger assemblies and units of the teletypewriters.

<i>Item</i>	<i>Paragraph</i>
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<i>Item</i>	<i>Paragraph</i>
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## 57. Basic Principles of Operation

a. FIVE-UNIT START-STOP TELETYPEWRITER CODE. See paragraph 13 for illustrations and explanation of the various combinations of impulses transmitted from the keyboard and received by the typing unit.

b. SYNCHRONISM. See paragraph 14 for discussion of the relationship between the speed

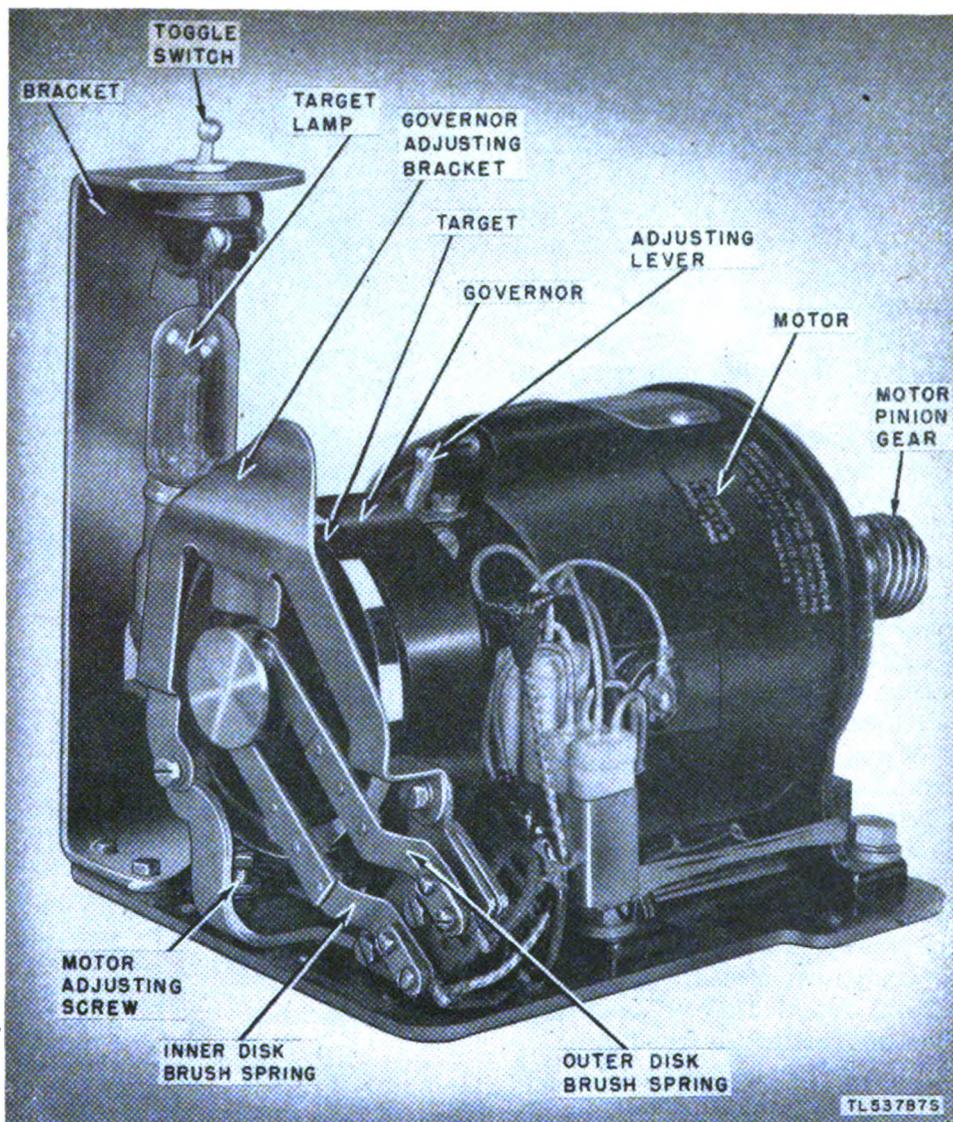


Figure 67. Motor Unit.

of the motors, gears used, and the start-stop features of the teletypewriter code, all of which must be coordinated before the receiving mechanism and transmitting mechanism will operate in unison, insuring that the impulses will be received and translated correctly. The detailed descriptions and operation of the selector cam sleeve in paragraph 60 includes an explanation of the part played by the design of the selector cam sleeve in synchronizing the receiving mechanism to the incoming code impulses.

## 58. Motor Unit

*a.* DESCRIPTION AND PURPOSE. The purpose of the motor unit is to supply mechanical power through the rotation of the main shaft to the

various power-driven parts of the keyboard (sending mechanism) and typing unit (receiving and printing mechanisms) and to control the speed at which the parts will move. The motor unit includes a motor base, mounted on a bracket (fig. 67), a lamp, and a switch used to illuminate the speed target on the governor. The series-governed motor is the same type used in other tactical teletypewriter equipment and is especially designed to provide dependable service under tactical field conditions. The governor controls the speed of the motor within close limits of 1,800 rpm regardless of slight variations in the voltage of the power supply. The functioning of the governor is described in paragraph 59.

b. **OPERATION.** The motor will operate continuously at 1,800 rpm as long as either ac or dc of 105—125 volts is connected to it. The use of a tuning fork with the target on the rim of the governor to test the speed of the motor is discussed in paragraph 26c; another method described in paragraph 26d can be used when the teletypewriter is functioning normally. This method requires a watch for timing how many characters or functions are completed by the teletypewriter operating at top speed in a period of 10 seconds. After it has been determined by test that the motor is running either too slow or too fast, the speed adjusting wheel on the governor is turned until the desired speed is secured.

## 59. Governor

a. **DESCRIPTION AND PURPOSE.** The governor (fig. 68) is attached to the end of the motor shaft opposite to the end which mounts the pinion and resembles the flywheel of an ordinary motor. A speed-adjusting wheel extends through the governor cover and is turned by means of the governor adjusting bracket and speed adjusting lever. A target of alternate black and white spots is painted around the outer rim of the governor and is used with a speed indicator (tuning fork) to check the motor speed visually. When viewed through the shutters of the speed indicator, the spots on the target should appear stationary. This governor and an associated resistor control the speed of the motor. The associated resistor is connected across the governor contacts.

b. **OPERATION.** (1) When the governor contacts are opened (by centrifugal force of the contact arm overcoming spring tension) the resistor is connected in series with the motor windings. The voltage applied to the motor windings minus the amount of voltage drop across the resistor is less than the external

voltage supply. The reduced voltage results in a slower motor speed.

(2) When the governor contacts are closed, the resistor is short-circuited, and the full external voltage supply is applied to the motor windings. This results in an increase in motor speed.

(3) The speed at which the governor contacts open and close is controlled by the degree of tension in the spring. The speed of the motor is regulated by turning the speed-adjusting wheel to which the spring is fastened in a direction which will increase or decrease the tension of the spring.

## 60. Main Shaft

a. **DESCRIPTION AND PURPOSE.** The main-shaft assembly mounted on and extending horizontally across the typing unit is an assembly of gears, bearings, cams, and clutches arranged to distribute power from the motor to the mechanically operated parts of the teletypewriter. The complete assembly determines the speed of rotation and timing of the various cam actions in both the keyboard and typing unit for any given rpm of the motor furnishing the driving power.

b. **OPERATION.** When the motor is turning, continuous rotation of the shaft results from the main-shaft gear, located near the right end of the shaft, being meshed with the motor pinion gear. Power is then distributed from the shaft to the various parts of the teletypewriter through clutches, cams, and gears. (See fig. 69.) The selector cam sleeve fitted over the left end of the main shaft provides power for the selector unit through the medium of a friction clutch, formed by two pairs of steel disks separated by a felt washer. Operation of the main-shaft clutch under control of the selector unit causes the function bail cam and the printing bail cam to rotate with the main shaft. The

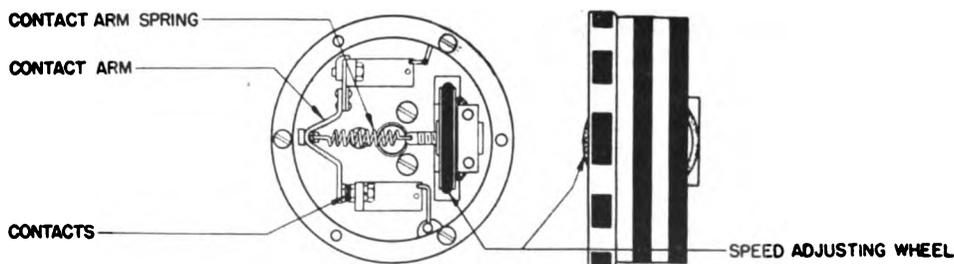


Figure 68. View of governor.

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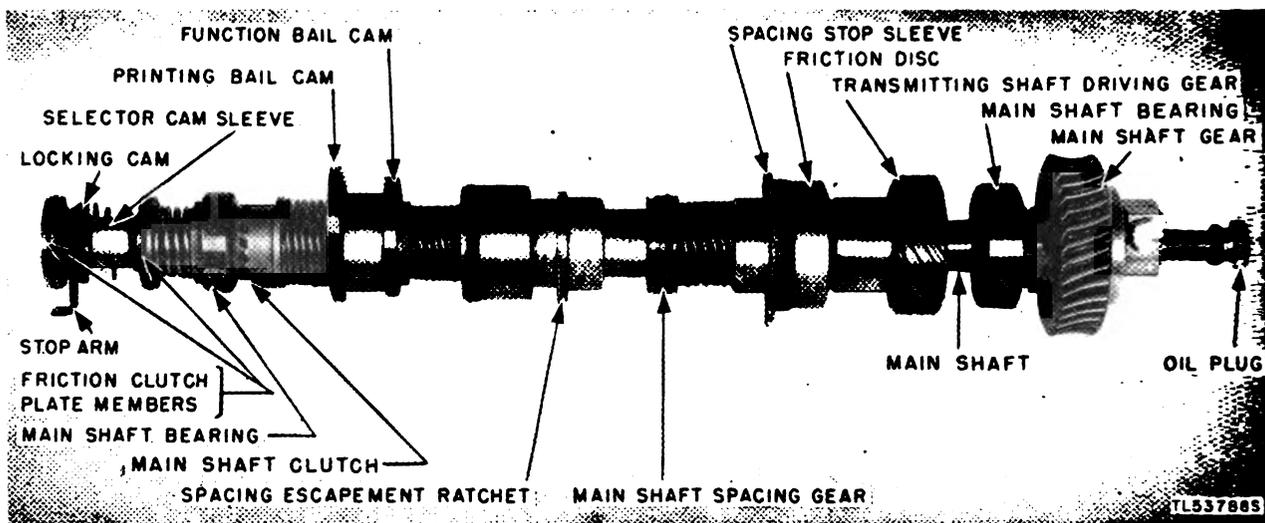


Figure 69. Main shaft.

function bail cam and the printing bail cam in turn operate the function bail and the printing bail in the typing unit. The main-shaft spacing gear meshed with the spacing shaft gear in the typing unit provides power to the spacing mechanism and is described in paragraph 79. The transmitting shaft driving gear furnishes power for the keyboard transmitting shaft.

## 61. Keyboard (Transmitting Unit)

*a. DESCRIPTION AND PURPOSE.* The keyboard transmitting unit includes the sending contacts and all of the associated mechanism required to change the action of depressing a typing key into a particular group of five marking and spacing impulses preceded by a start impulse and followed by a stop impulse. The power to rotate the transmitting mechanism is secured through the transmitting shaft gear (fig. 70) meshed with the driving gear on the main shaft. (See fig. 69.) The motor, therefore, furnishes the power to operate the moving parts of the transmitting mechanism and determines the speed with which they operate. The purpose and operating action of the transmitting cam sleeve, selector bars, universal bar, vertical locking levers, start-stop and locking cam, and space repeat feature are described in separate paragraphs of this section.

*b. OPERATION.* The transmitting cams are normally held stationary because the clutch members (driven and driving) on the transmitting shaft are held apart by the clutch throw-out lever. When either a key or the space bar

is depressed, the driven member of the clutch moves into mesh with the driving member, causing the transmitting cams to revolve and thereby open and close the sending contacts. At the end of the revolution, the driven member of the clutch is disengaged by the clutch throw-out lever and the transmitting cams stop until the next key or space bar is depressed. (See fig. 71.)

## 62. Transmitting Cam Sleeve

*a. DESCRIPTION AND PURPOSE.* The seven cams in the keyboard transmitting unit are all arranged as a single cam sleeve mounted on the transmitting shaft. (See fig. 71.) Each cam is round in shape and has a notch which receives an extension on the related contact lever. The driven clutch member is slipped over the transmitting shaft and is connected by long notches so it can slide into engagement with the driving clutch member. When engaged the driving clutch member furnishes the necessary power to revolve the transmitting cams. The design and mounting of the cams is such that the start, marking, spacing, and stop impulses transmitted by the sending contacts are of the desired length.

*b. OPERATION.* When the depression of a key or the space bar engages the clutch, the transmitting cam sleeve immediately starts to revolve. This forces the individual cams one after the other to operate the sending contact riding on the related cams.

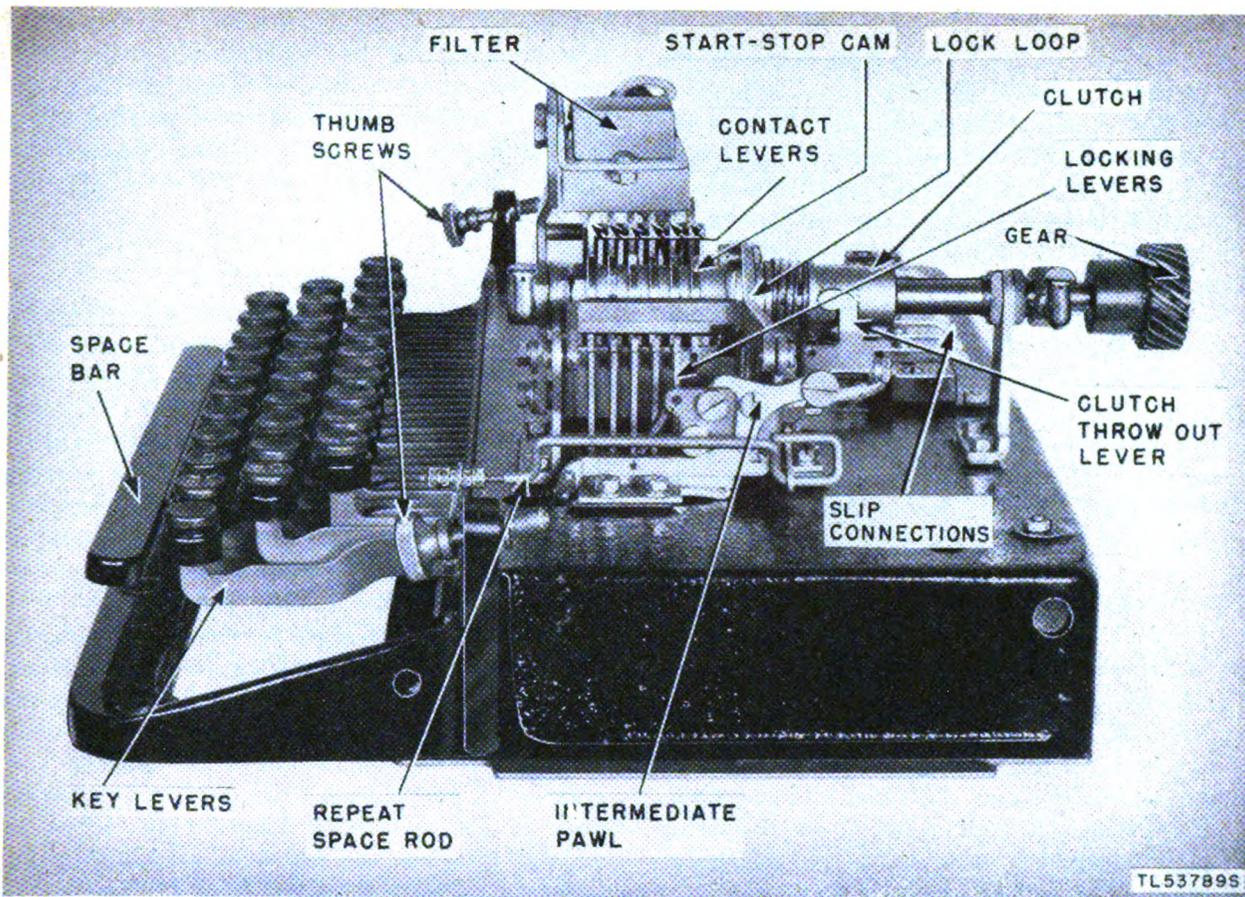


Figure 70. Teletypewriter keyboard.

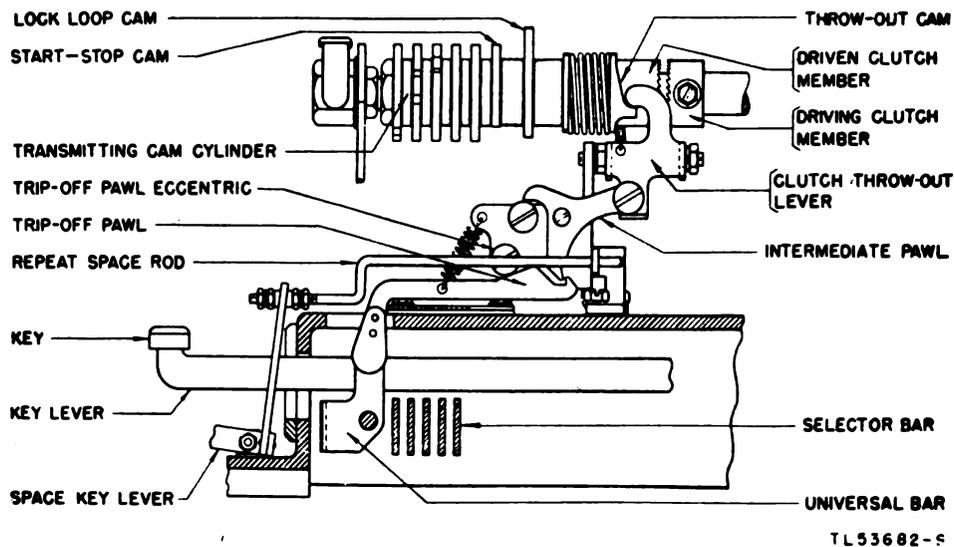


Figure 71. Cross-section of keyboard.

### 63. Selector Bars

a. DESCRIPTION AND PURPOSE. Beneath the key levers are five selector bars extending across the width of the keyboard. The selector bars are provided with saw-tooth notches (fig. 72), shaped according to the requirements of the signaling code. These bars rest on rollers and are guided at each end so that they may be easily moved endwise to engage and position the vertical locking levers.

b. OPERATION. When either a key or the space bar is depressed, the key levers strike the slanting sides of the selector bar notches. The downward pressure on these saw-tooth notches moves the selector bars either to the right or to the left. Each selector bar engages a vertical locking lever near its right end and positions the lever to correspond with the code impulse to be transmitted.

### 64. Universal Bar

a. DESCRIPTION AND PURPOSE. The universal bar (fig. 71) is mounted on pivots and extends horizontally across the bottom of the keyboard unit where all keys and the space bar will strike it when they are depressed. It is connected through the trip-off pawl to the clutch throw-out lever.

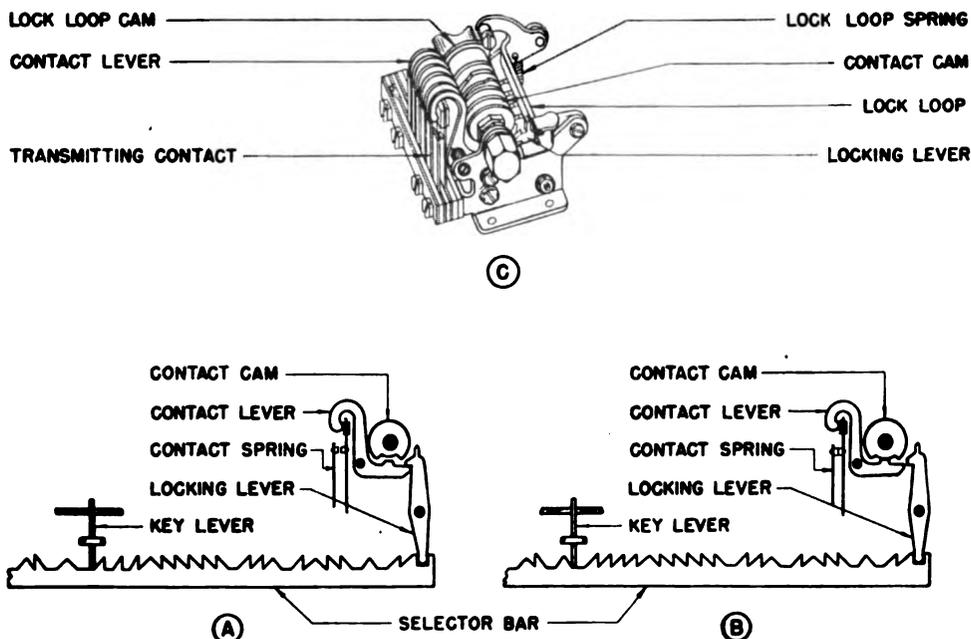
b. OPERATION. When any key or the space bar is depressed, in addition to setting the se-

lector bars by moving them to the right or the left as described in paragraph 63, they also cause the universal bar to rotate on its pivots in such a manner that the trip-off pawl operates the intermediate pawl, which releases the clutch throw-out lever, and the sending cams (fig. 72c) start turning.

### 65. Vertical Locking Levers

a. DESCRIPTION AND PURPOSE. Each of the five vertical locking levers are mounted with their lower ends firmly engaging a recess in the right end of a selector bar. (See fig. 72.) The vertical locking levers are designed to control the movement of a contact lever in a manner which permits the contacts to close when the contact lever is in one position and prevents them from closing when it is in the opposite position.

b. OPERATION. When the selector bar moves the upper end of the locking lever to the left for a spacing impulse, the locking lever engages the contact lever and prevents the contact lever from rising into the indent of the turning cam and holds the circuit open for that impulse. (See fig. 72a.) When the selector bar moves the locking lever to the right for a marking impulse, the locking lever does not interfere with the movement of the contact lever. (See fig. 72b.) Then, as the cam turns, the contact lever



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Figure 72. Vertical locking lever.

rides on the surface of the cam, rises into the indent, and the contact lever closes its contact, sending out a marking impulse. As the five transmitting cams turn, the impulses, either marking or spacing, are transmitted in succession.

### 66. Start-Stop Cam

*a. DESCRIPTION AND PURPOSE.* The start-stop cam (fig. 71), has the same general appearance as the other cams and controls the sixth contact lever which opens and closes a contact to produce both the start and stop impulses.

*b. OPERATION.* The start-stop contact is opened at the beginning of each revolution of the camshaft to transmit the start (spacing) impulses and is held open during the transmission of the five selecting impulses. After the fifth impulse has been transmitted the start-stop contact is closed, sending the stop (marking) impulse to the line. The contact remains closed until a key or the space bar is depressed and the transmitting cycle is started again.

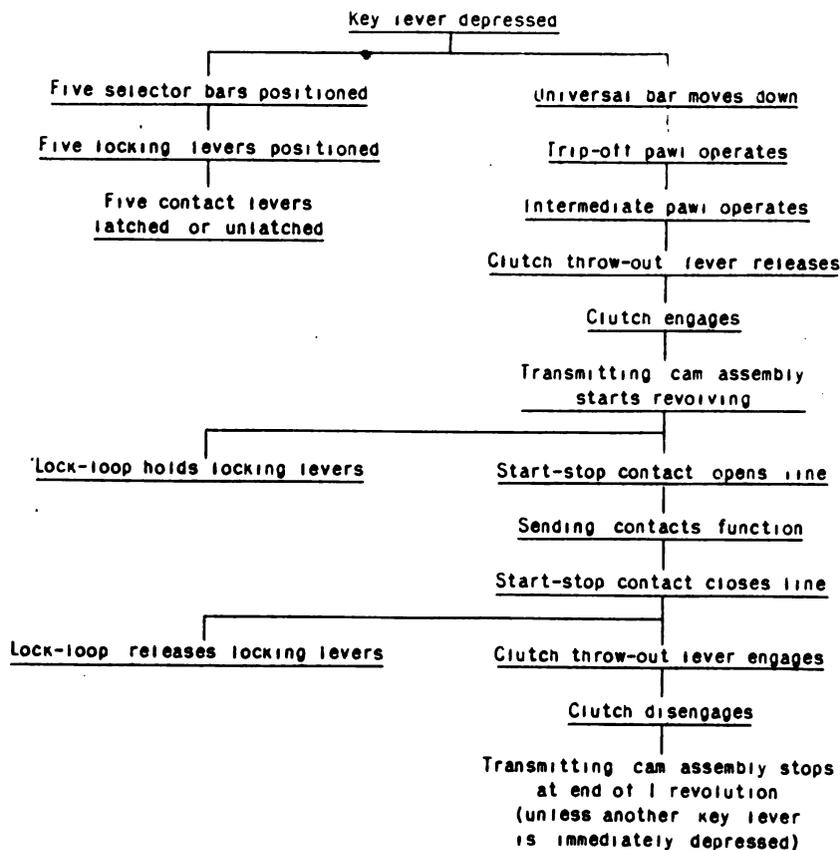
### 67. Lock-Loop Cam

*a. DESCRIPTION AND PURPOSE.* The lock-loop cam (fig. 71), is slightly larger than the other cams and is located on the end of the transmitting cam sleeve nearest the clutch. This cam and the associated lock-loop controls the keyboard locking levers in such a manner that only one selection can be made at a time.

*b. OPERATION.* As the transmitting cam sleeve completes a revolution, the lock-loop and the keys and space bar may be operated to set up a new selection. As soon as the selection is completed and the transmitting cam sleeve starts turning, the lock-loop cam moves the lock-loop to its down position which holds the locking levers in position while the impulses are being transmitted.

### 68. Sequence Chart for Keyboard Functioning

Figure 73 is a chart showing the sequence of operation for the parts and subassemblies of the keyboard transmitting unit as described in preceding paragraphs of this section.



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Figure 73. Sequence chart for keyboard functioning.

## 69. Space Repeat

*a. DESCRIPTION AND PURPOSE.* The keyboard is equipped with a space-repeat device which permits the transmission of continuous spaces as long as the space bar is depressed. The space-repeat rod is the connecting link between the space key lever and the intermediate pawl.

*b. OPERATION.* When the space key lever is depressed, a space-repeat rod (fig. 71), which is connected to the key lever extension will rotate the intermediate pawl. (See fig. 71.) The intermediate pawl will, in turn, hold the clutch throw-out lever out of engagement with the throw-out cam on the clutch driven member. Thus, the transmitting cam sleeve will be permitted to revolve continuously until the space key lever is released. For instructions on the adjustment of the space-repeat device see section XIV.

*c. OPERATION FOR SINGLE SPACE.* Normally, when the space bar is depressed, the space-repeat rod attached to the key-lever extension (fig. 71) moves the intermediate pawl forward, which holds the clutch throw-out lever out of engagement with the projection on the driven clutch. Thus, the transmitting cam sleeve can revolve continuously until the space bar is released. When adjusted for a single space, the space bar functions in the same manner as the key levers and must be released and again depressed for each space.

## 70. Typing Unit (General)

*a. DESCRIPTION AND PURPOSE.* The typing unit includes in one assembly all of the mechanism required to convert the code impulses into a typewritten page-form message. The detailed functioning of the various parts and subassemblies of the typing unit are arranged to group the individual functions which occur as a train of actions. The detailed information and associated illustrations are arranged in separate paragraphs immediately following this paragraph.

*b. OPERATION.* The functional operations discussed in paragraphs 85 to 99 concerning the typing unit may be summarized as follows. All mechanically operated parts of the typing unit receive their driving power from the main-shaft assembly which is directly connected through the main-shaft gear to the pinion located on the end of the motor shaft. As long as the motor is running, power is immediately

available through the various clutches, cams, and gears to move and rotate the various parts of the typing unit at the speed required to synchronize their action with the code impulses received by the selector magnet. The selector magnet through the associated selecting mechanism determines whether one of the type bars is to be thrown against the platen, causing a character or symbol to be printed or one of functions listed below to be completed.

Platen *line feeds.*

Typing carriage *spaces.*

Typing carriage *returns.*

Platen shifts from letters to *figures.*

Platen unshifts from figures to *letters.*

Blank.

Signal *bell* operates.

Mechanical motor *stop* opens.

The charts and lists showing the sequence of operations for the different trains of action are furnished as appropriate with the associated text material.

## 71. Selector Unit

*a. DESCRIPTION AND PURPOSE.* The selector unit located on the left end of the typing unit (figs. 74, 75, and 76) consists of a selector magnet, a selector armature, five selector levers, five swords, five T-levers, a selector mounting plate with posts and springs, and the range finder assembly. The selector mechanism is designed to translate the marking (current) and spacing (no-current) impulses received from the line into a series of mechanical motions which will cause the vanes on the front of the typing unit to be positioned in accordance with the character or function assigned to each combination of five selecting impulses. The selector mechanism is controlled by the armature of the selector magnet which receives the code impulses from the line. Normally, the armature of this magnet is pulled up and the stop arm is against the stop lever which in turn is held by the trip latch. Because the stop arm which is a part of the selector cam sleeve is engaged with the stop lever, the cam sleeve does not revolve. (See fig. 75.)

*b. OPERATION.* When a start impulse, which is spacing (no-current), is received, the armature is released and pulled away from the magnet pole pieces by the armature spring. The trip latch is moved out of engagement with the stop lever, releasing the stop arm, and allowing

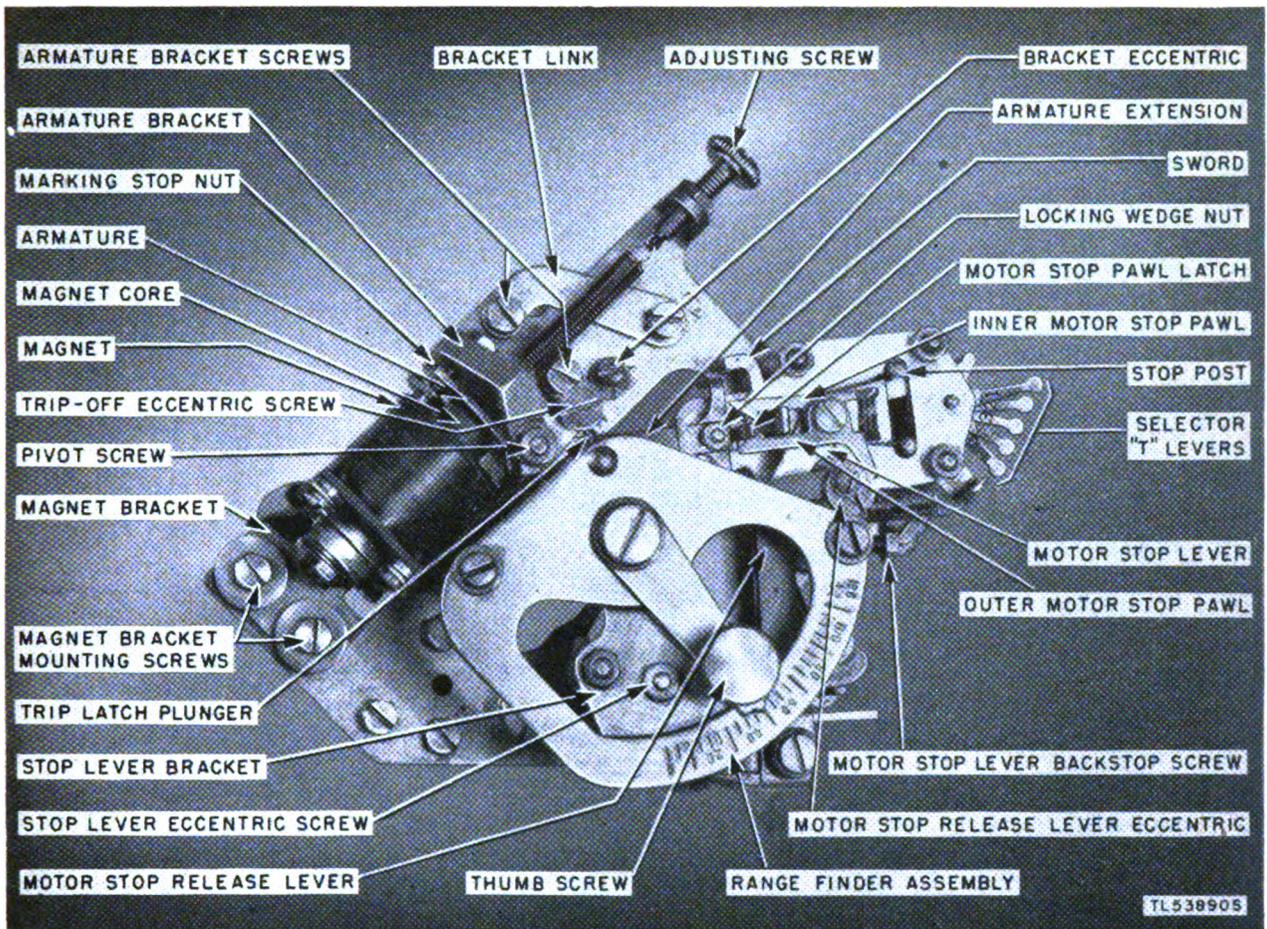


Figure 74. Selector unit.

the cam sleeve to revolve with the shaft. Each of the vanes in turn is operated by a selector cam through a T-lever, a sword, and a selector lever. (See fig. 76.) The train of action resulting from the positioning of the vanes is discussed in paragraph 73.

## 72. Orientation of Selecting Mechanism (Range Finder)

a. DESCRIPTION AND PURPOSE. Directly associated with the selector magnet is a range-finder assembly (fig. 74). A stop lever, trip latch, index arm, scale, and thumbscrew are the principal parts of the range finder. The range finder is designed to adjust the relation between the start of the selector cam sleeve and the time the selector cams operate the selector levers. Adjusting the range finder for most favorable operation of the selecting mechanism is sometimes described as either orienting or taking the range of the teletypewriter.

b. OPERATION. The index arm is moved toward first one and then the other end of the scale to determine exactly where the teletypewriter fails to print. Midway between these points is the most favorable position to utilize the receiving margin of the selector mechanism. The index arm is held, when set, by a thumb-screw. See paragraph 27 for information on when and how to test and set the range finder.

## 73. Example of Selector Unit Operation

As an example of how the selector unit operates, assume the code for the letter E is received. Upon the reception of the start impulse (no-current impulse), the armature moves away from the magnet and pushes the trip-latch plunger (fig. 75), which causes the trip-latch bell crank to move the trip-latch out of engagement with the stop lever, releasing the stop arm. The selector cams start to revolve and the No. 1 selector cam engages No. 1 se-

lector lever, when the first impulse (marking or current) of the letter E has been received from the line. The magnet armature is pulled up, bringing the upper end of the armature extension up into the path of the upper sword arm. When the No. 1 cam engages the No. 1 selector lever, this lever is turned counterclockwise, carrying with it the sword which strikes the upper end of the armature extension and is turned clockwise about its pivot. (See fig. 76, point A.) The sword is then positioned so that

2, 3, 4, and 5 vanes are moved so that the front edges are up. With the front edges of the vanes, the corresponding code bars are moved right by the connecting bell cranks to the unoperated position. With the front edges of the vanes in lower position, the corresponding code bars are moved left to the operated position. With the No. 1 code bar to the left, and Nos. 2, 3, 4, and 5 code bars to the right, one notch in each code bar is opposite the E pull bar. The sixth cam (fig. 79), releases the main-shaft clutch,

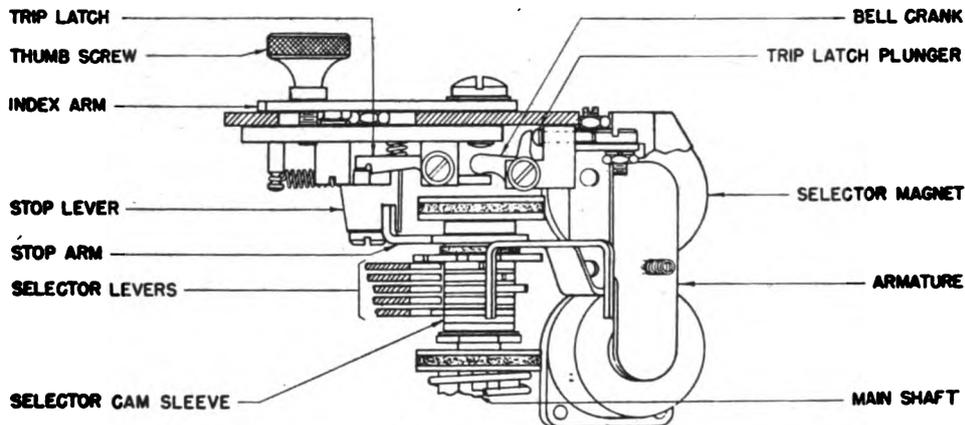


Figure 75. Cross-section of selector unit.

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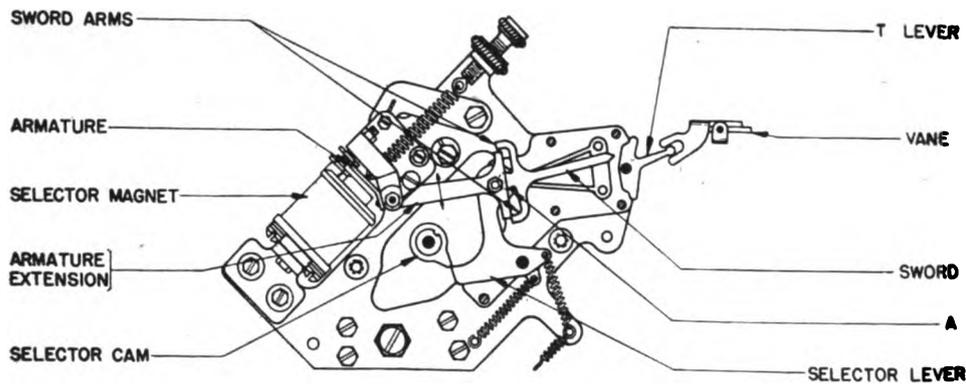


Figure 76. Side view of selector unit.

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when the No. 1 cam clears the selector lever, the selector-lever spring moves the sword against the T-lever and brings the front edge of the No. 1 vane down. Since no current is received while Nos. 2, 3, 4, and 5 cams are engaging their selector lever, the magnet armature is released and the armature extension moves down so that the lower end of the armature is in the path of the lower sword arm. (See fig. 76.) As the Nos. 2, 3, 4, and 5 cams engage the Nos. 2, 3, 4, and 5 selector levers, the Nos.

allowing the printing bail and function bail to make one complete revolution. The printing bail cam permits the printing bail to be pulled forward by its spring. The E pull bar pulled down by its spring into the path set up by the code bars, and the pull-bar bail moved by the printing bail, carries the pull bar forward, causing the type bar to strike the platen, printing the letter E. A sequence chart for the operation of the selecting mechanism is shown in figure 78.

## 74. Locking Cam and Locking Lever

*a. DESCRIPTION AND PURPOSE.* The locking cam has five high and five low portions on its periphery against which the locking lever is held by its spring. (See fig. 77.) The purpose of the cam and locking lever is to hold the armature extension arms firmly in position while the swords are being positioned by striking the armature extension arms.

*b. OPERATION.* During that part of each code impulse when the swords are being positioned by striking the armature extension arms (at the time when any cam is operating the corresponding selector lever), a low portion of the locking cam is in contact with the locking lever. The armature extension is then held firmly in position by the U-shaped extension of the locking lever engaging the locking wedge on the armature extension. When the locking lever is riding on the high portion of the locking cam, the locking-lever extension is held away from the locking wedge and the armature is free to move in response to the impulse being received.

insures that printing or function will not be performed before all the impulses are received.

*b. OPERATION.* The sixth cam on the selector cam sleeve releases the main-shaft clutch allowing the printing and function-bail cams to make one complete revolution. (See fig. 79.) At the end of each revolution of the printing and function-bail cams, the clutch-stop arm engages the cam surface on the driven clutch member and moves it out of mesh with the driving clutch member. Immediately after the fifth impulse has been received, and just as the fifth selector lever is sliding down from the peak of its cam, the peak of the sixth cam strikes the clutch throw-out arm and moves the clutch-stop arm out of engagement with the projection on the driven clutch member. The spring then moves the driven clutch member into mesh with the driving member. Immediately after the completion of the selection of any character or function, the printing and function-bail cams (fig. 79) turn one revolution, which causes the printing of that character or the operation of that

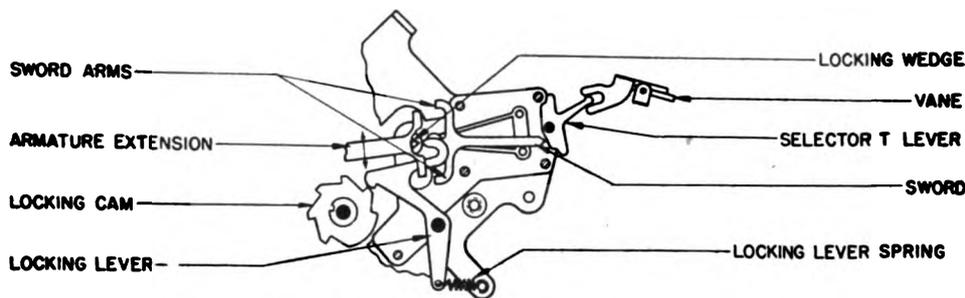


Figure 77. Locking lever operation.

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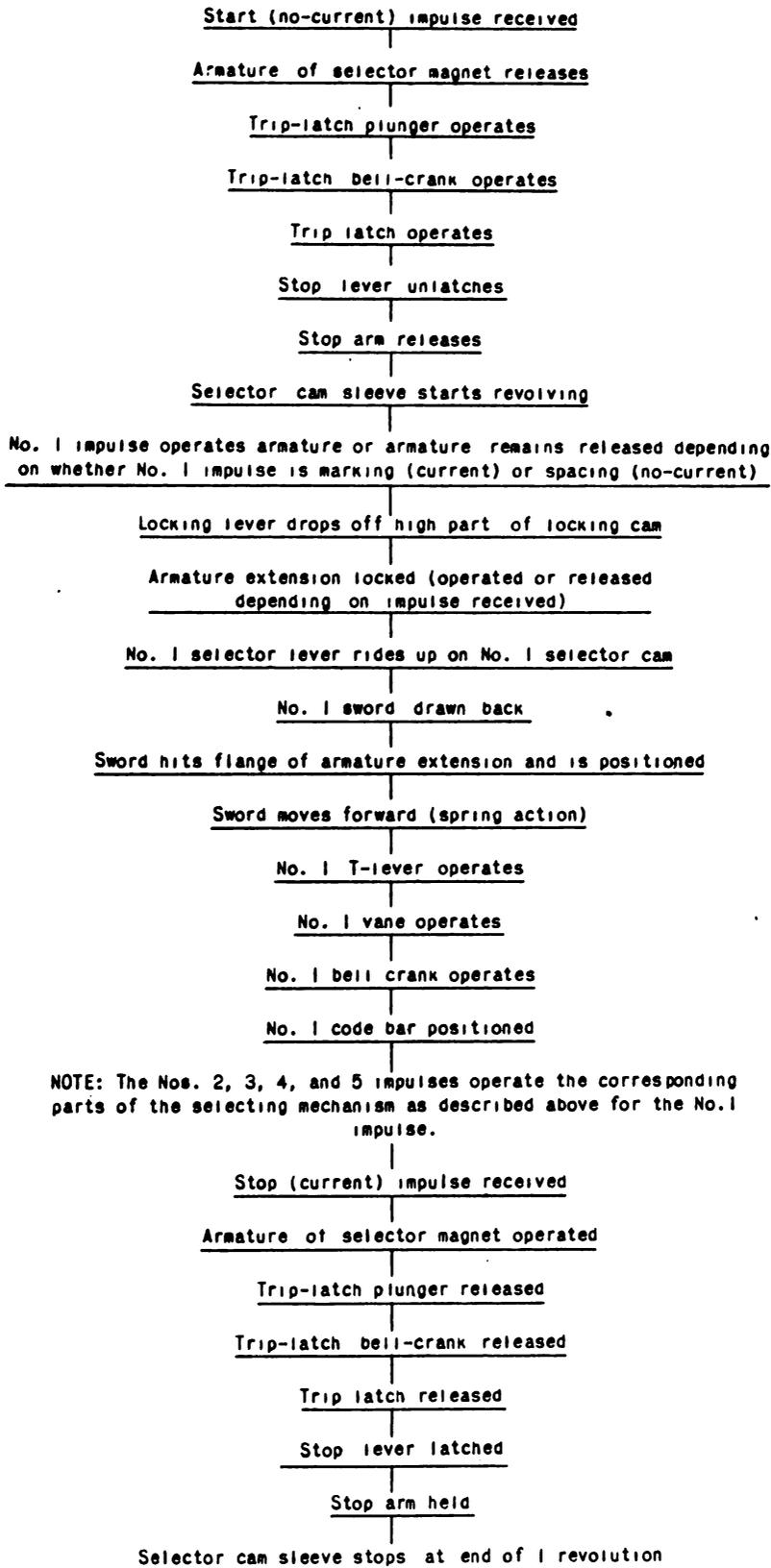
## 75. Main-Shaft Clutch Throw-out Lever

*a. DESCRIPTION AND PURPOSE.* The main-shaft clutch throw-out lever (fig. 79) consists of the clutch-stop arm, throw-out lever spring, and throw-out arm. It is designed so that the extension of the clutch-stop arm rides on the driven clutch member of the main shaft and the throw-out arm rides on the sixth cam. The clutch throw-out lever cams the driven clutch member out of engagement with the driving clutch member. After camming the driven member out of engagement with the driving member it blocks the rotation of the printing and function-bail cams until all five impulses have been received by the selector mechanism. This

function. Any character or function may be selected while the printing of the previous selection is taking place.

## 76. Printing

*a. DESCRIPTION AND PURPOSE.* On the bail mounting shaft are mounted the printing bail, the printing-bail operating arm, the function bail, and the two spacing escapement pawls. The printing-bail spring, attached to the right end of the printing-bail casting, holds the printing bail against the upper end of the bail-operating arm and holds the operating-arm roller against the printing-bail cam on the main shaft. The tension of the spring causes the printing



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Figure 78. Sequence chart for operation of selecting mechanism.

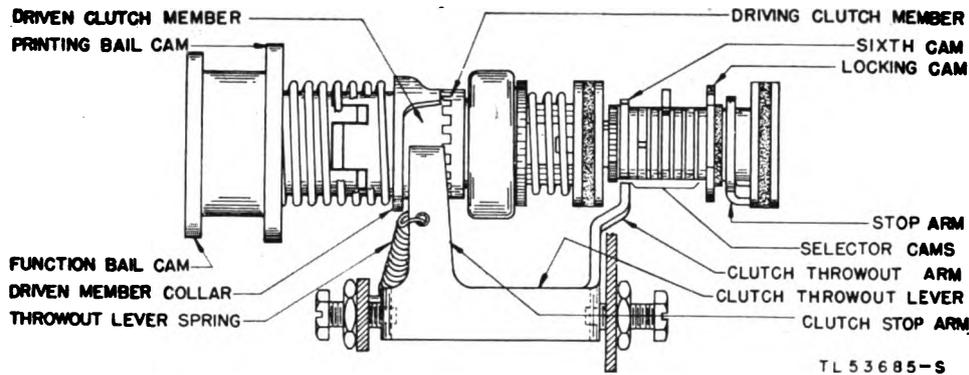


Figure 79. Section of main shaft.

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bail to follow the upper end of the operating arm and moves the pull-bar bail forward. The position of the printing-bail cam determines the position of the printing bail (fig. 82), except as noted in paragraph 77. The purpose of this mechanism is to control the completion of the operating (printing or function) cycle which follows immediately after the selecting cycle.

**b. OPERATION.** The actual printing of characters is not caused by the printing bail but by the pull-bar bail which the printing bail controls through the pull-bar plunger roller. The roller (when the type-bar carriage is in place) is set between the printing-bail blades (figs. 80 and 93), allowing the carriage to move from left to right, and the pull-bar bail to be moved backward and forward by the printing bail regardless of the position of the type-bar carriage. At the end of each revolution of the printing-bail cam, the printing-bail operating-arm roller comes to rest on the high portion of its cam. The printing bail is then in its extreme rear position, carried there against the tension of the printing-bail spring.

## 77. Type Bar Carriage Printing Mechanism

**a. DESCRIPTION AND PURPOSE.** The printing mechanism on the type bar carriage consists essentially of a pull-bar bail, pull bars, type bars, and necessary mounting parts. The actual printing is done mechanically, that is, the type bars are thrown at the platen by the pull-bar bail. Located between the printing bail blades (when the type-bar carriage is mounted in place) is a plunger roller (fig. 80) which extends downward from the pull-bar bail plunger. Thus the movement of the printing bail applies a reciprocating motion to the pull-bar bail for the purpose of actuating the pull bars.

**b. OPERATION.** The type bar to be selected is determined by the setting of the five code bars, which are moved into position by the bell cranks (fig. 80) under the control of the vanes. The code bars (fig. 84) are so arranged that notches on their upper sides will be lined up, permitting the selected pull bar to move down into the path of the pull-bar bail. As the pull-bar bail moves forward, it will allow all pull bars to rest on the code bars under the tension of the pull-bar springs. The selected pull bar will drop into the notch set up for it in the code bars, which will position it lower with respect to the bail than the other pull bars. As the pull-bar bail continues on its forward stroke, it will engage a notch on the selected pull bar, but will clear all unselected pull bars. The forward movement of the selected pull bar will cause its associated type bar to strike the platen. Before the pull-bar bail reaches the limit of its forward travel, a stripper plate (fig. 91), located below the pull bars, cams the selected pull bar off the bail and momentum carries the type bar against the platen. As the roller on the printing-bail arm rides to the high part of its cam to complete the printing cycle, the printing and pull-bar bails will be moved to their rear position. The pull bars will then be raised clear of the code bars so that they are free to respond to a new selection.

## 78. Locking Function Lever

**a. DESCRIPTION AND PURPOSE.** The locking function lever is the first on the right of the function levers, which are mounted behind the vanes. The locking function lever (fig. 81) locks or holds the vanes in the selected position until a character is printed or a function has been performed.

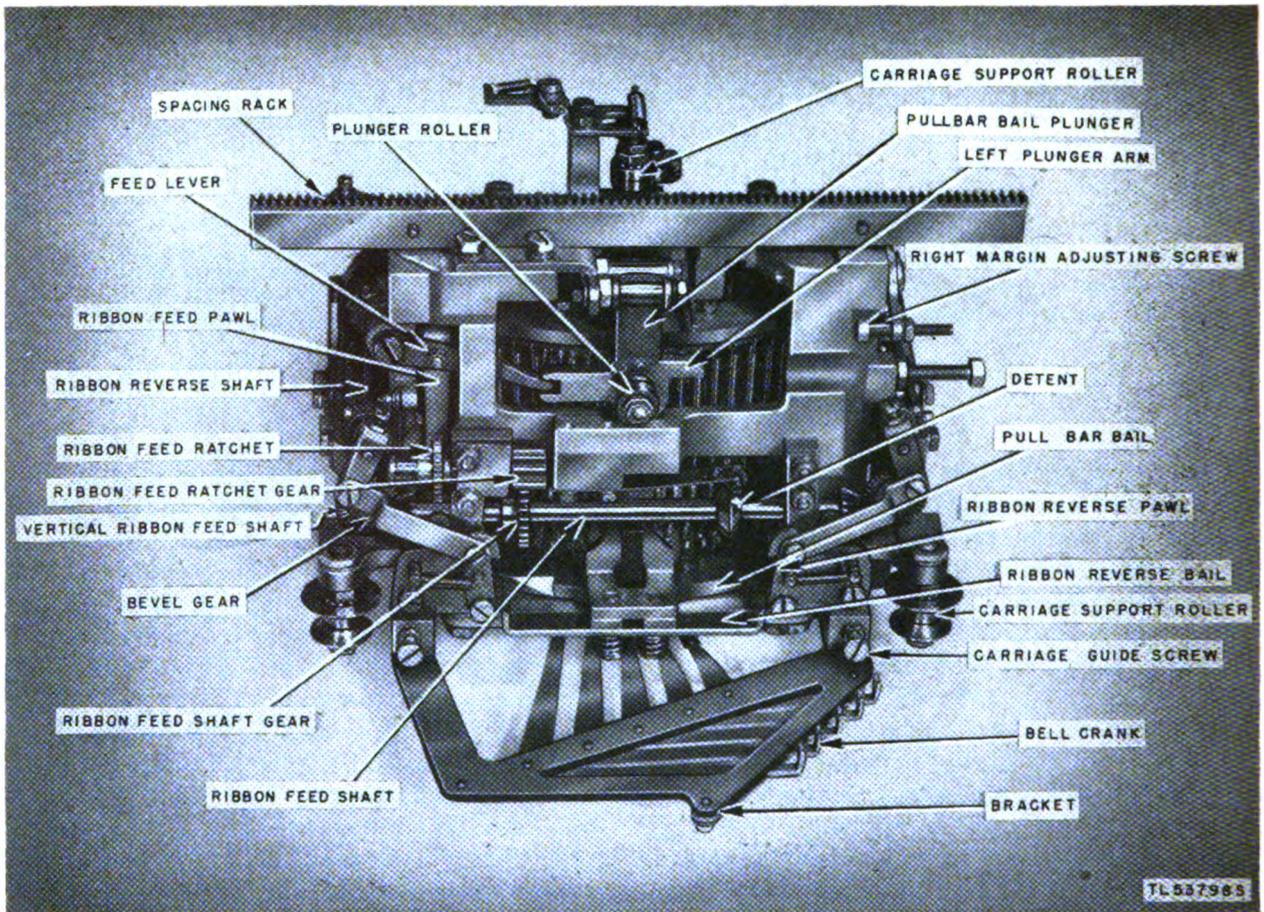


Figure 80. Bottom view of type-bar carriage.

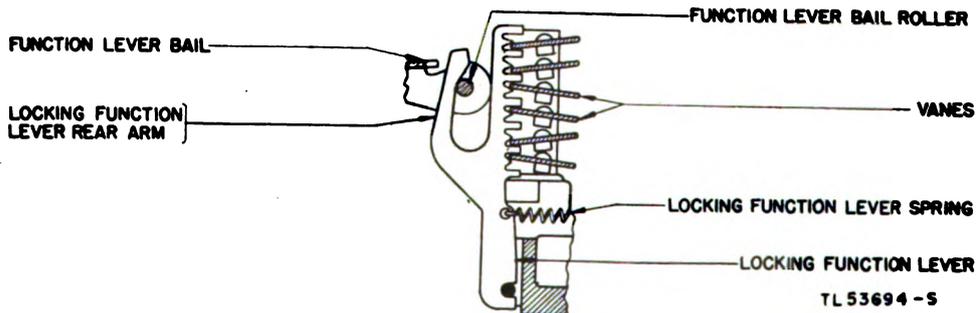


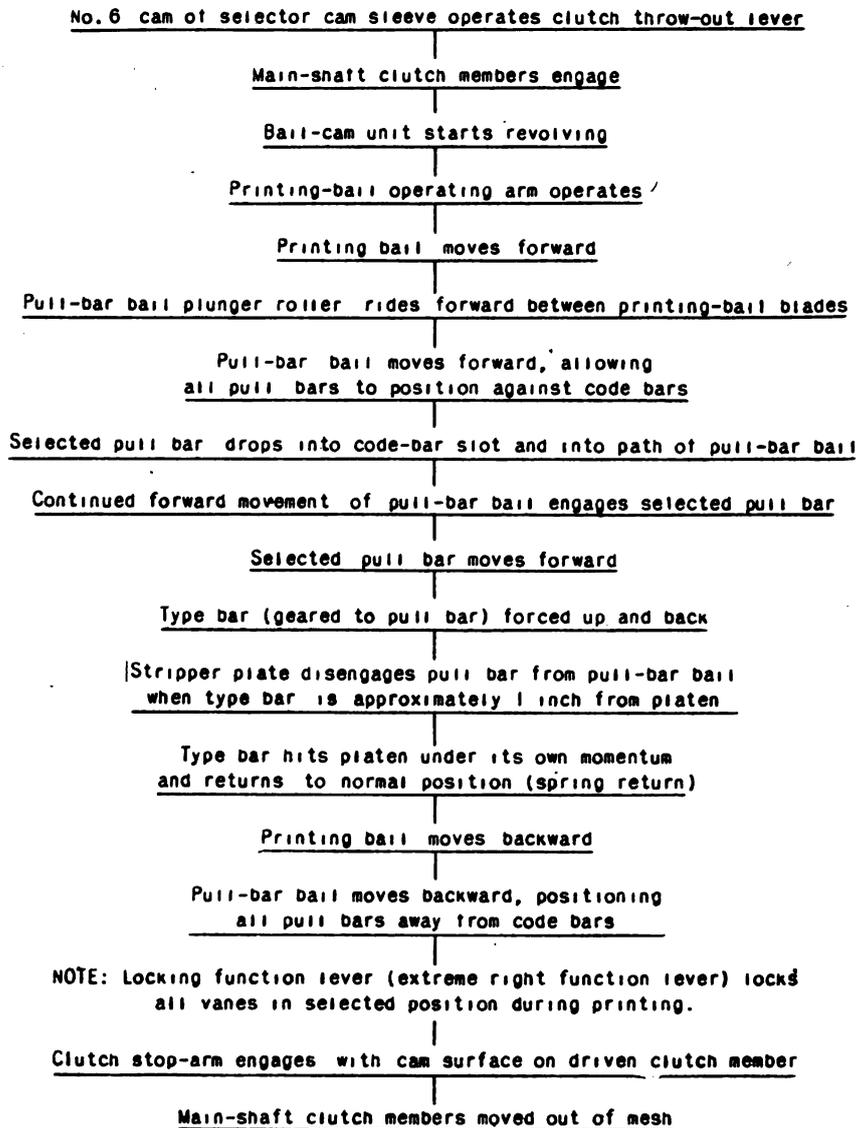
Figure 81. Locking function lever.

b. OPERATION. When the printing bail moves forward, the function-lever bail roller moves downward off the high parts of the function-lever rear arm, allowing the locking function-lever spring to pull the lever against the rear edges of the vanes. The locking function lever engages each vane, whether in the marking or spacing position, locking the vanes in the selected position until the printing-bail cam has revolved completely. The operation of the re-

maining function levers is described under the related functions. A sequence chart for the operation of the printing mechanism is shown in figure 82.

## 79. Spacing

a. DESCRIPTION AND PURPOSE. Proper spacing between characters requires the type-bar carriage to be moved with each character printed. The type-bar carriage is moved by the



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Figure 82. Sequence chart for printing mechanism.

spacing gear which is meshed with the spacing rack (fig. 84) and is facilitated by three carriage support rollers, two of which operate on the front track and one on the rear track (figs. 83 and 84). The spacing rack is mounted on the rear of the type-bar carriage casting and the pinion is attached to the upper end of the spacing shaft. The spacing shaft, extending downward, passes through the spacing shaft gear. Just above its lower bearing the spacing shaft mounts the carriage return clutch, the lower member of which is rigidly attached to the shaft. The return-clutch members are in engagement at all times except when the carriage is being returned from the end of a line. The

function of the clutch is described in paragraph 89. The spacing shaft gear meshes with the spacing pinion on the main shaft as previously described in paragraph 60. Spacing is controlled from the printing bail through the medium of the escapement pawls.

b. OPERATION. The spacing action is as follows: with the printing bail in its rear position, the rear escapement pawl is engaged with one of the teeth on the spacing escapement ratchet, thus holding the ratchet and spacing gears stationary. (See fig. 86b.) As the printing bail starts to move forward, the escapement pawl operating arm strikes the lower end of the rear pawl, thereby moving it out of engagement

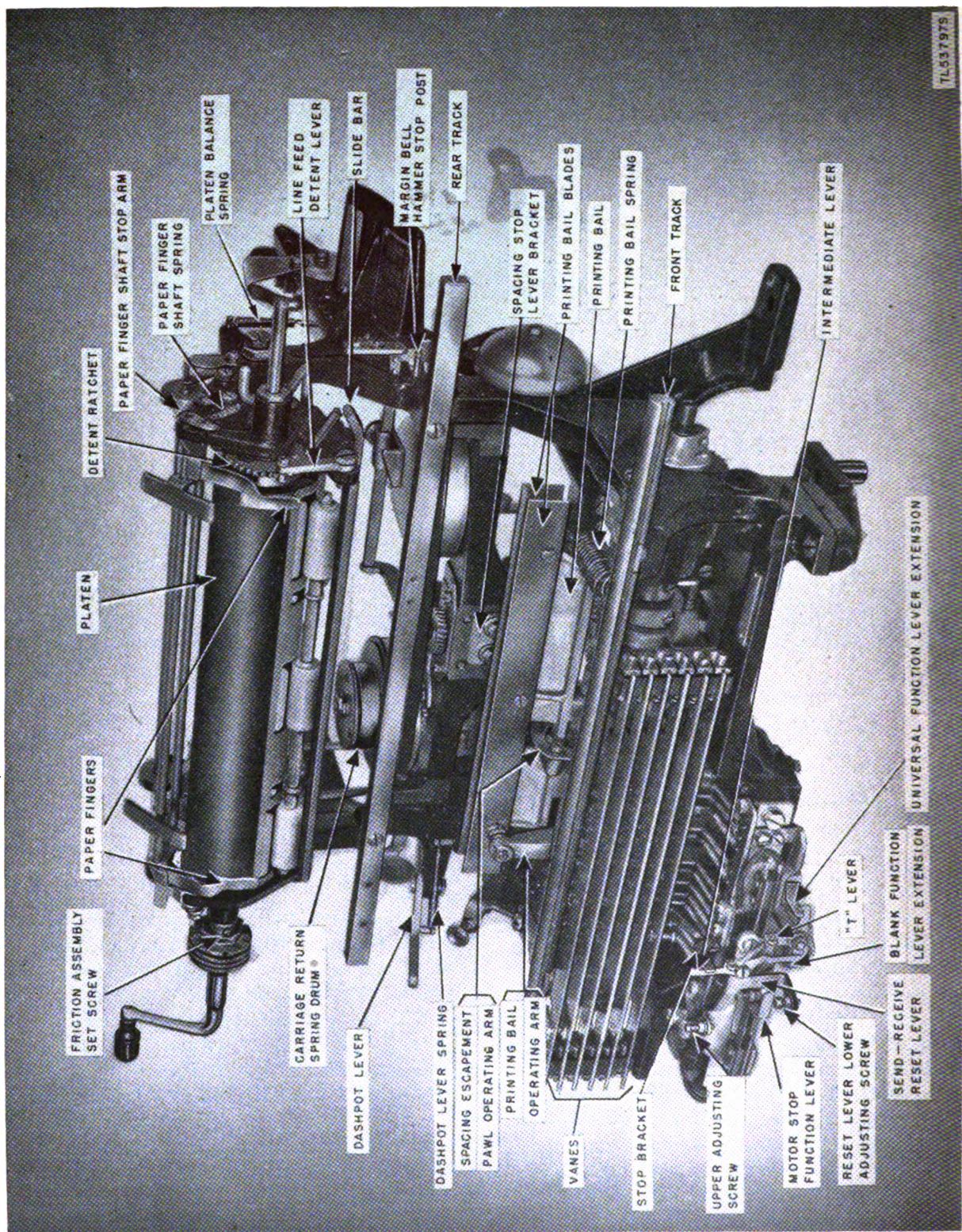


Figure 88. Front view of typing unit.

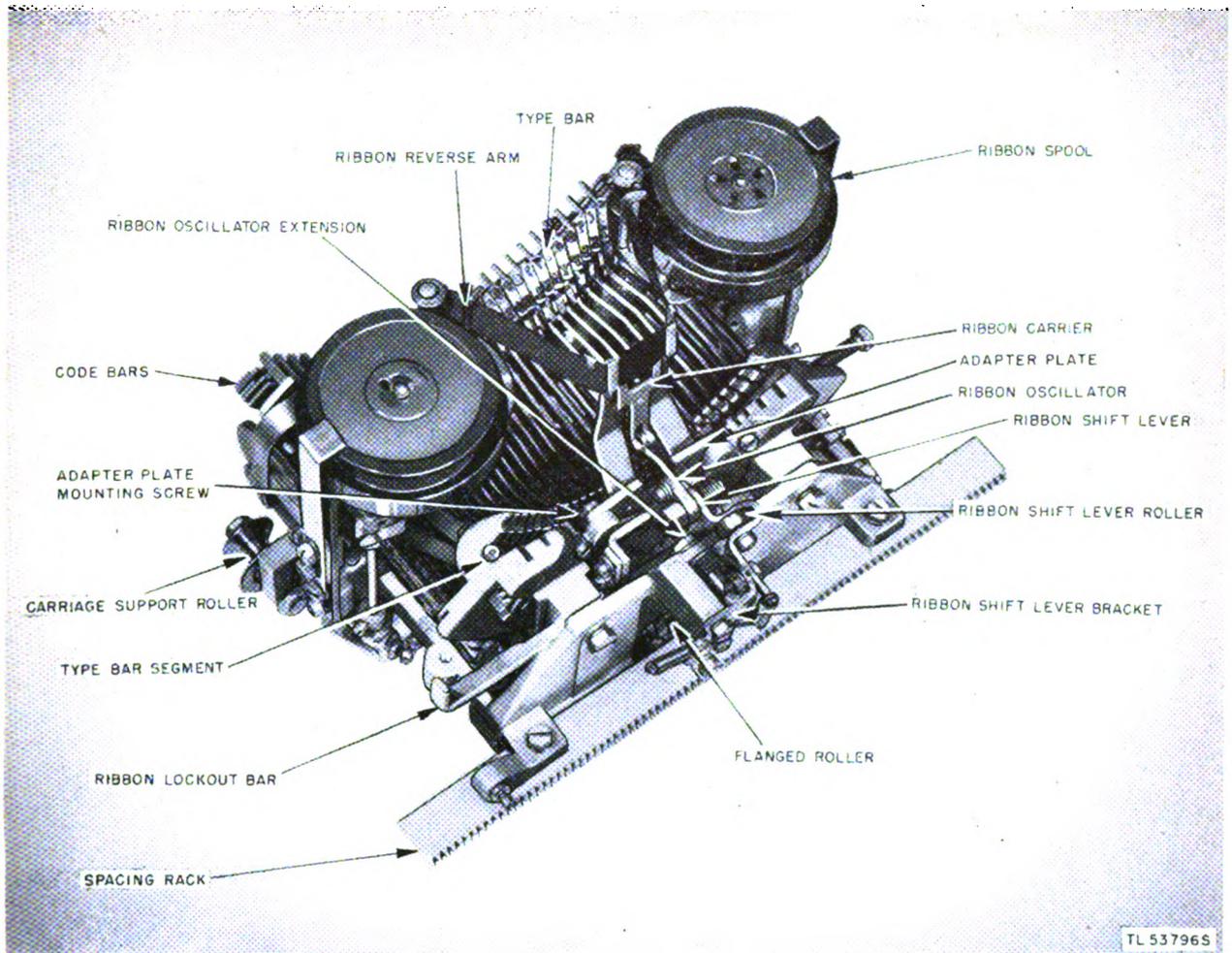


Figure 84. Rear view of type bar carriage.

with the tooth on the escapement ratchet. At the same time the front escapement pawl moves against the ratchet and into the path of another tooth which it will engage after the ratchet has traveled one-sixth of a space. *The printing operation then takes place.* Near the end of the return stroke of the printing bail, the operating arm lifts the front escapement pawl out of engagement with the escapement ratchet and at the same time the rear pawl moves against the ratchet. This action will allow the spacing mechanism to revolve sufficiently to space the carriage five-sixths of a space at the end of which the rear escapement pawl will engage a tooth on the ratchet. The remaining one-sixth of a space will be added preceding the printing of the next character as described in the foregoing. A sequence chart for the spacing operation is shown in figure 85.

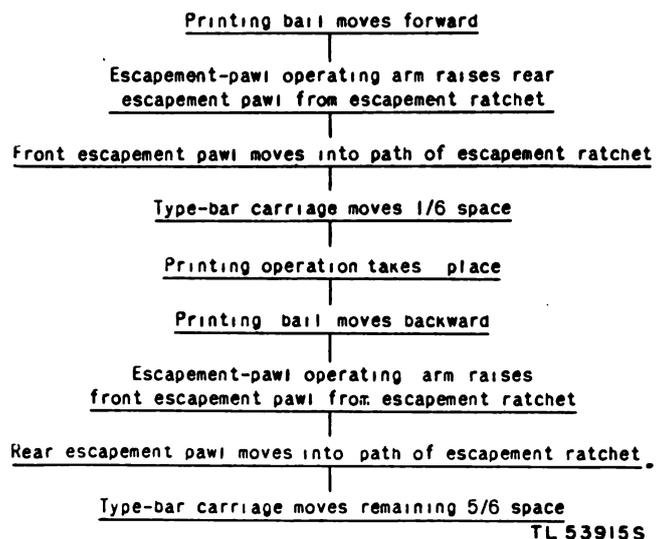


Figure 85. Sequence chart for spacing operation.

When the type-bar carriage reaches the end of a line, the right margin adjusting screw (fig. 86) moves the spacing stop lever into the path of a projection on the spacing stop sleeve, thus blocking rotation of the spacing mechanism and preventing further spacing of the carriage.

cam which pivots the shaft, thus moving the bell hammer away from the bell, against the tension of its spring. When the bell pawl has been spaced beyond the cam, the bell hammer will be released and its spring will cause the hammer to strike the bell.

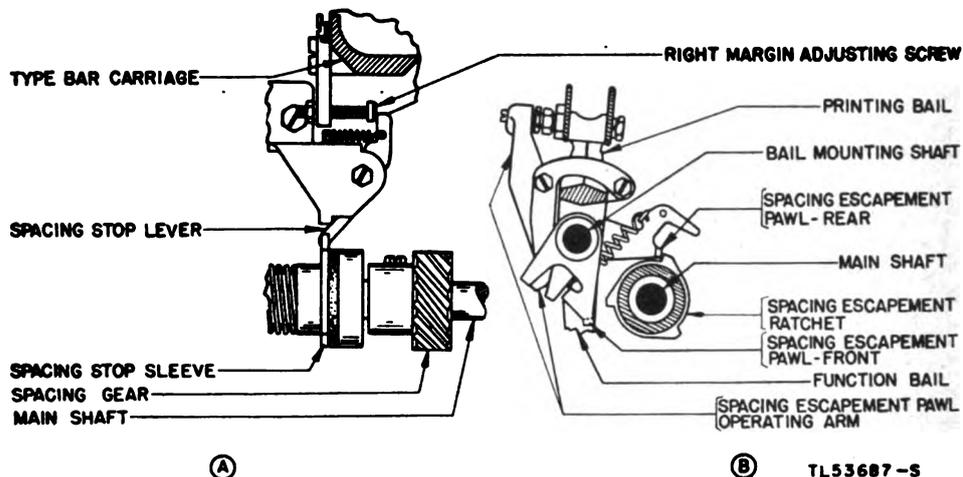


Figure 86. Spacing stop mechanism.

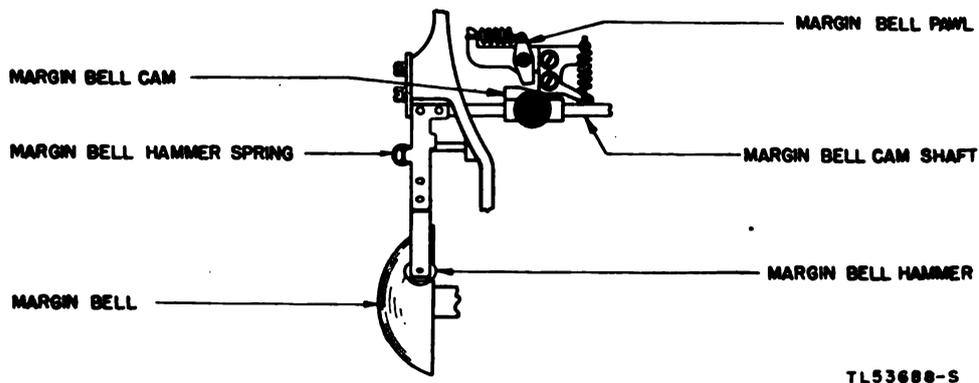


Figure 87. Margin-bell mechanism.

### 80. Margin Signal Bell

*a.* DESCRIPTION AND PURPOSE. A margin bell is mounted in a vertical position on the right side of the typing unit (figs. 87 and 88) to act as a warning to the operator as the type-bar carriage approaches the end of the line. A bell hammer which strikes the bell is attached to the margin bell camshaft. An adjustable cam is fastened on the camshaft and forces the shaft to pivot when depressed.

*b.* OPERATION. The margin-bell pawl on the type-bar carriage will depress the margin-bell

### 81. Ribbon-Feed Mechanism

*a.* DESCRIPTION AND PURPOSE. The type-bar carriage ribbon mechanism consists of two ribbon-spool cups together with associated parts. (See figs. 84 and 89.) The entire assembly resembles the ribbon mechanism of any standard typewriter. Each ribbon-spool cup is mounted on a bracket, with a vertical ribbon-feed shaft and a ribbon-reverse shaft. The vertical ribbon-feed shaft makes contact with the horizontal ribbon-feed shaft. The end of the ribbon-feed lever engages the notched extension on the



pull-bar bail plunger. (See fig. 89.) The ribbon-feed pawl, which moves the ribbon-feed ratchet, is attached to the ribbon-feed lever. The ribbon-reverse mechanism is described in paragraph 82.

*b. OPERATION.* With each operation of the pull-bar bail plunger, the ribbon-feed ratchet and the ribbon-feed ratchet gear are advanced one tooth. The shaft mounting the ribbon-feed ratchet and the ribbon-feed ratchet gear impart motion to the ribbon-feed shaft, through the ribbon-feed shaft gear. The left or right ribbon-feed shaft gear meshes with the left or right vertical ribbon-feed shaft gear. The vertical ribbon-feed shaft causes the ribbon-spool shaft to revolve. The ribbon-spool shaft then turns the ribbon spools.

## 82. Ribbon-Reverse Mechanism

*a. DESCRIPTION AND PURPOSE.* The ribbon-reverse mechanism consists of the ribbon-reverse arm, ribbon-reverse shaft and their associated parts. (See figs. 84 and 90.) This mechanism is provided to automatically reverse the ribbon when an eyelet near the end of the ribbon becomes engaged with the ribbon-reverse arm.

*b. OPERATION.* Assuming that the ribbon is being wound on the right ribbon spool and is almost unwound from the left ribbon spool, the eyelet, fastened near the end of the ribbon, en-

gages and moves the left ribbon-reverse arm. The arm, fastened to the left ribbon-reverse shaft, moves the left ribbon-reverse pawl into the path of the ribbon-reverse bail. (See fig. 90.) As the ribbon-reverse bail moves toward the rear, it engages the left ribbon-reverse pawl, moving the ribbon-feed shaft to the left. The ribbon-feed shaft gear on the right is disengaged and the gear on the left is engaged. The ribbon is then wound on the left ribbon spool. The reversing operation takes place the same way on the right side of the assembly when the eyelet near the right end of the ribbon engages with the right ribbon-reverse arm.

## 83. Ribbon Oscillator Mechanism

*a. DESCRIPTION AND PURPOSE.* The normal position of the ribbon, as on a typewriter, is below the printing line in order not to obscure the printing. The raising of the ribbon for printing and the lowering of the ribbon after printing is done by the ribbon-oscillator assembly. (See fig. 92.) The ribbon-oscillator mechanism consists of a shift lever, ribbon shield, oscillator arm, oscillator-arm spring, oscillator-arm extension, shift-lever roller, and shift-lever spring all mounted on the ribbon-oscillator bracket.

*b. OPERATION WITH PLATEN IN LETTERS POSITION.* The ribbon-oscillator arm extension, fastened to its arm by an adjusting screw, is

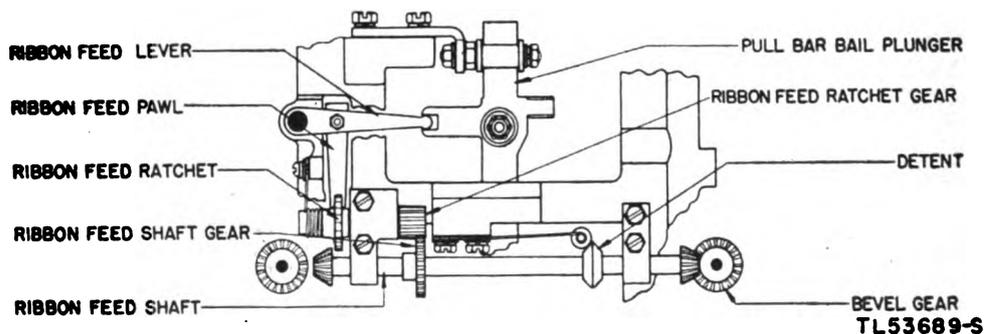


Figure 89. Ribbon-feed mechanism.

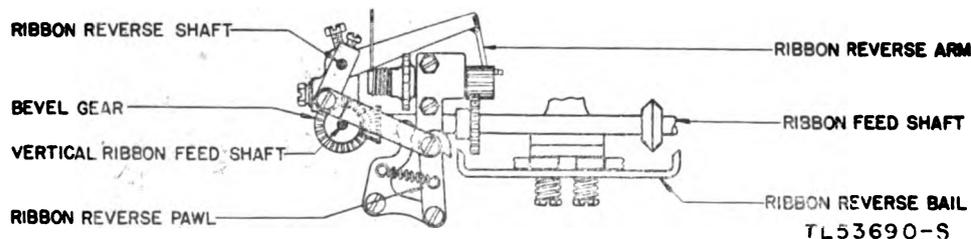


Figure 90. Ribbon-reverse mechanism.

moved to the rear by an extension on the pull-bar bail plunger, and rides in a slot in the carriage casting. When the pull-bar bail moves forward, the ribbon-oscillator arm spring raises the arm, causing the ribbon shield, attached to the front end of the arm, to raise the ribbon into the path of the type pallet. When the pull-bar bail moves to the rear, it exerts pressure on the ribbon-oscillator arm extension, causing the mechanism to bring the ribbon below the printing line.

c. OPERATION WITH PLATEN IN FIGURES POSITION. The height to which the ribbon oscillator raises the ribbon is determined by the position of the ribbon-shift-lever roller. Both

the oscillator arm and the extension are pivoted on the ribbon-shift lever. The shift-lever spring holds the shift-lever roller against the slide bar, which is mounted on the under side of the platen assembly. When the platen shifts to the figures position, the shift-lever roller moves up with the slide bar and allows the shift-lever spring to pull the ribbon-oscillator assembly and ribbon to the raised printing line.

#### 84. Overlap of Selecting Cycle and Printing or Function Cycle

The normal speed of tactical teletypewriters in use throughout the Army is 368 operations per minute. Through the use of an overlap arrange-

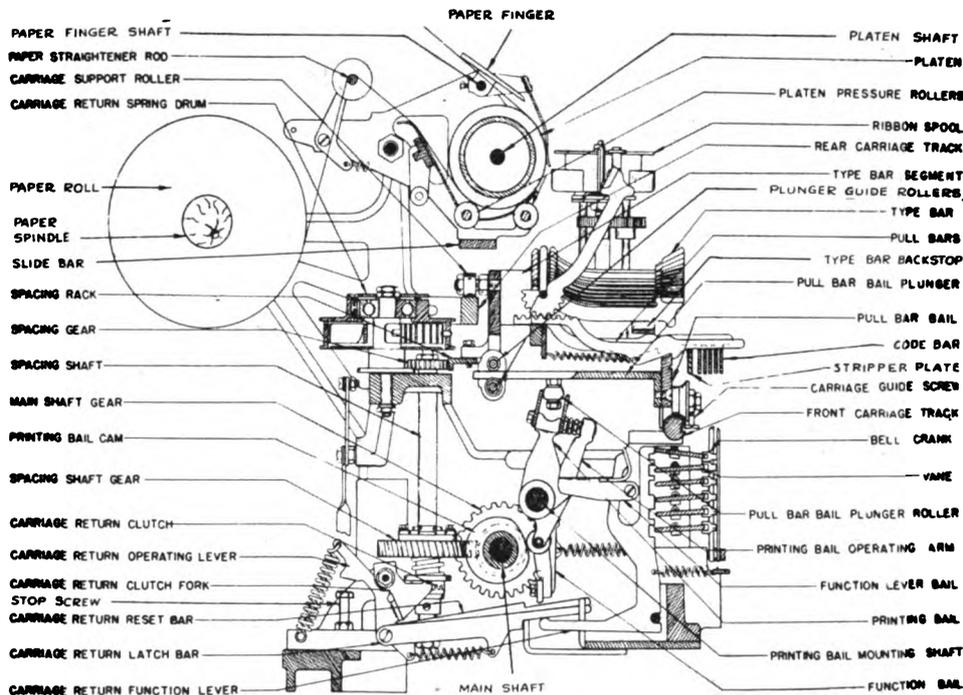


Figure 91. End view of typing unit.

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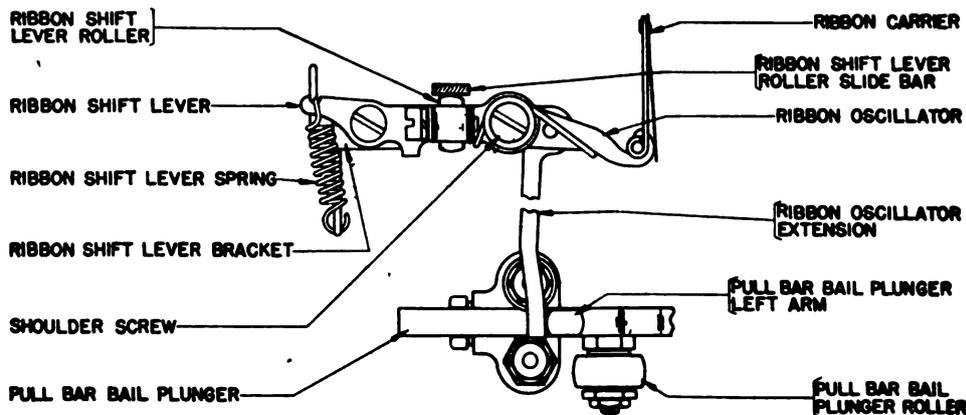


Figure 92. Ribbon oscillator mechanism.

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ment, the teletypewriter can perform a printing or function operation while the next selection is being set up on the keyboard transmitter unit, transmitted and stored in the receiving mechanism by setting the swords in the new selection order. Tension springs on the selector levers supply the energy required to complete the selection for the next printing or function operation, when the mechanism is unlocked after a completed operation. Chart A shows the relationship between the operation of the previous selection and the setting up of the next selection when the teletypewriter is operating at 368 opm.

bail, attached to the printing bail, holds the function levers away from the vanes. As the printing bail moves forward, the function-lever bail roller moves down off the high portion of the rear arm of the function levers permitting the function-lever springs to pull their levers against the vanes. The forward arms of the function levers are notched so that when a function combination is set up on the vanes, the selected function lever moves forward farther than the other function levers. The function lever extension then moves the selected push bar upward and into the path of the function bail.

Chart A

Operation of previous selection	Locking of previous selection	Impulses of next selection being received and or stored	Positioning of next selection on vanes, bell cranks and code bars	TIME REQUIRED TO RECEIVE ONE SELECTION
Selector-cam sleeve stopped	Not locked	STOP		
Printing-bail and function-bail cams start to revolve—printing and function bails start moving.	Locking function lever starts forward to engage vanes.	START	Selector-cam sleeve assembly starts revolving for the next selection.	
Pull-bar bail engages selected pull bar, or function bail engages a push bar.	Locked	1	Sword positioned and new selection stored.	
Letter printed or function operation performed.	Locked	2	Same as above.	
Printing and function bails start returning to normal position.	Locked	3	Same as above.	
Printing and function bails nearly normal.	Unlocked	4	Vanes 1, 2, 3, and 4 are set simultaneously.	
Printing and function bails normal—main shaft clutch throw-out lever engaged by sixth cam.	Not locked	5	No. 5 vane is positioned.	

## 85. Operation of Functions

*a. DESCRIPTION AND PURPOSE.* There are two types of operations which can be performed by the typing unit. The first embodies those mechanical actions which are *directly* necessary to the actual printing of a character. The second type of operation, which embodies mechanical action *supplementary* to the printing of a character, or which alters the position of various mechanisms, is known as a function. Ten functions which generally are found on standard models and which may be added to as desired, are: bell, blank, carriage return, figures (shift), letters, line feed, motor stop, and space. The completion of these functions is accomplished through separate function levers located behind the vanes in the front of the typing unit.

*b. OPERATION.* When the printing bail is in its normal (rear) position, the function lever

## 86. Function Bail

*a. DESCRIPTION AND PURPOSE.* The function bail is mounted on the bail-mounting shaft. It is used to operate some of the functions, and is moved by the function bail cam. The function bail has a blade attached to its lower extremity which engages the function push bars.

*b. OPERATION.* The function-bail spring holds the function-bail cam roller against its cam at all times. After the printing bail and the function-lever bail move far enough to release the function levers, the function-bail roller starts to ride up on the high part of its cam. The function-bail blade moves toward the rear, engaging and operating any function push bar that may have been moved into its path by the selected function lever. The function-bail roller then rides to the low portion of the function-bail cam, and the function-bail returns to its

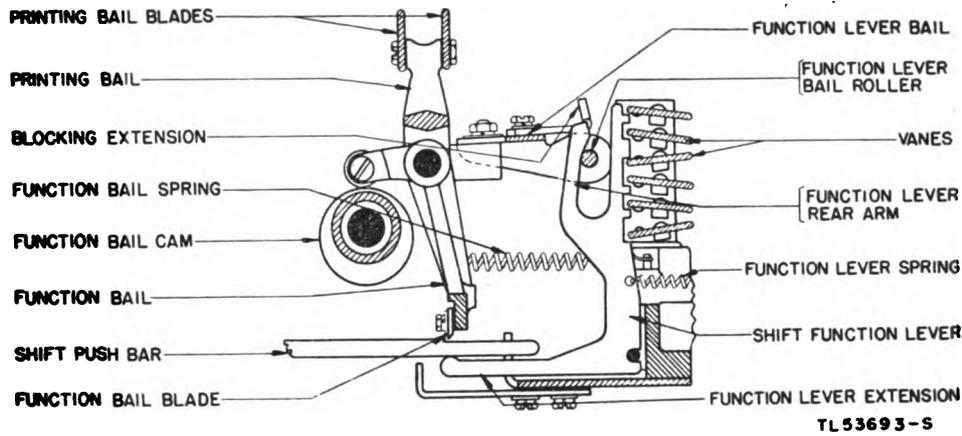


Figure 93. Function lever mechanism.

forward position. The bail cam unit on the main shaft has not yet completed its revolution at this point, so the function-bail roller comes to rest. The roller comes to rest beyond the low part, at a point about one-half of the distance to the high part.

### 87. Position of Function Levers

The position of the function levers in the function lever comb are listed below showing the designations seen from top and from bottom of the typing unit.

Number on bottom	Function lever	Designation on top
1	Locking.....	(none).
2	Carriage return.....	CR
3	Figures shift.....	FIG
4	Bell.....	BELL
5	Universal.....	(none).
6	(Vacant).....	TAB
7	Printing and space suppressor.....	(none).
8	(Sixth vane detent).....	(none).
9	Unshift on space.....	SP
10	Blank.....	BL
11	Letters shift.....	LTRS
12	Line feed.....	LF
(none)	Motor stop.....	STOP

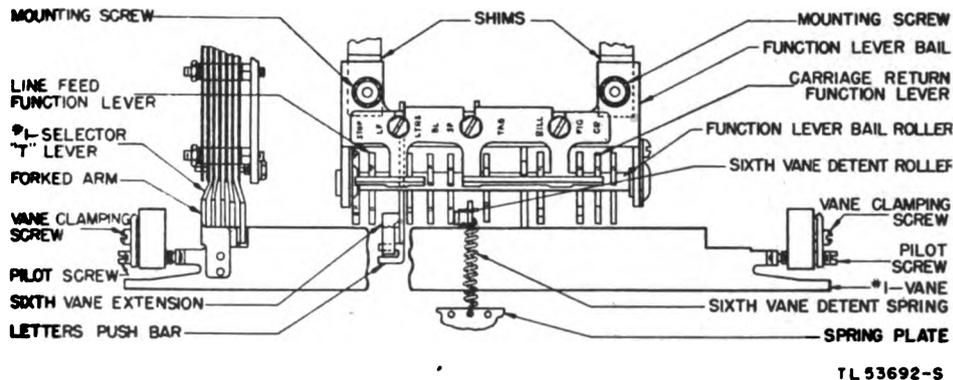


Figure 94. Function levers.

*Note.* When in the selected position, the carriage return, line feed, figures, letters, signal bell, and motor stop function levers will be in the path of the blocking plate extensions on the function-lever bail. This will prevent the printing bail from moving forward far enough to permit the type-bar carriage to space. Paragraph 79 describes spacing in detail.

## 88. Function Suppression

For normal communications operation, the teletypewriter is arranged to suppress printing and spacing on both upper and lower case blank combination. For weather report service, this is true for only the lower case blank combination. Also carriage return and line feed are normally operative on both upper and lower case combinations; however, on weather report service this is true only on the lower case carriage return and line-feed combinations.

## 89. Carriage Return

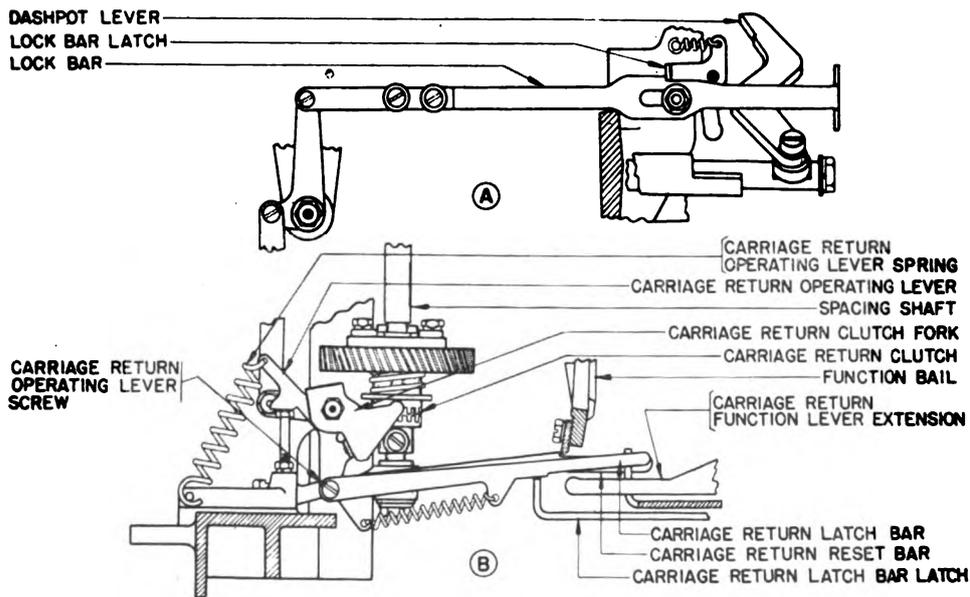
*a. DESCRIPTION AND PURPOSE.* Carriage return is one of the functions performed by the teletypewriter. The carriage return function lever is the second function lever from the right. A complete description of the function levers is contained in paragraph 85. The carriage return function returns the type-bar carriage to the left-hand margin of the page. A spring drum (fig. 91) supplies the motive force to pull the type-bar carriage to the left of the platen by means of the draw strap. The draw strap is connected behind the extreme right end of the type-bar carriage casting and to a post on the spring drum.

*b. OPERATION.* (1) When the carriage-return function lever (second from the right) moves into engagement with the vanes, the function-lever extension moves the carriage-return latch

bar (fig. 95) upward out of engagement with its latch. This releases the carriage-return operating lever which, actuated by its spring, moves the carriage-return clutch fork upward so as to disengage the upper carriage clutch member from the lower member. The spacing shaft is then free to rotate independently of the spacing shaft gear and thereby permits the type bar carriage to be returned to its extreme left position by the carriage-return spring (within the carriage-return drum) through the medium of the draw strap. (See fig. 88.)

(2) The notch on the reset bar will then be engaged by the function bail and the reset bar will be moved toward the rear. As the reset bar and the carriage-return latch bar are both pivoted on the same operating lever screw, the latch bar will be reset into engagement with its latch. (See fig. 95.) In the meantime, the function-lever bail will have been returned to its upper position and the carriage-return function lever extension will have been moved down below the latching surface of the carriage-return latch bar.

(3) As the carriage-return clutch fork disengages the carriage-return clutch, it also actuates a lock bar (fig. 95) which is linked to it. The sliding motion of the lock bar permits a shoulder on its upper edge to pass under and engage a lock-bar latch mounted above the lock bar. Engagement of the lock-bar latch will



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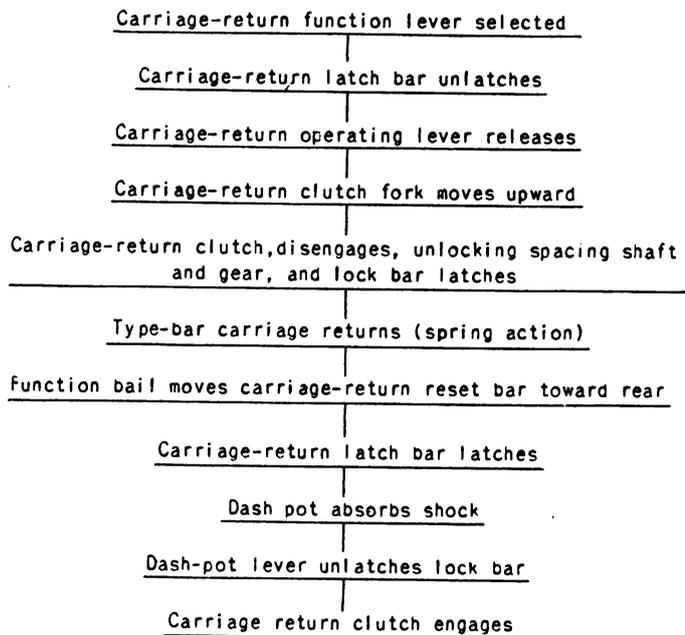
Figure 95. Carriage-return mechanism.

cause the carriage-return clutch to be held disengaged until the carriage has fully returned to the extreme left position.

(4) Just before the carriage reaches its extreme left position, a left margin adjusting screw (fig. 86) attached to the carriage, strikes the front end of a centrally pivoted dashpot plunger into the dashpot air chamber and thereby absorbs the shock. (See fig. 95.)

(5) At the end of its travel, the dashpot lever strikes the lower end of the lock-bar latch, thus releasing the lock and allowing the carriage-return clutch members to engage.

(6) With the carriage-return latch bar in engagement with the latch-bar latch, and the driven and driving members of the spacing clutch in engagement, the carriage-return mechanism is in position to receive the next carriage-return selection. A sequence chart for the carriage return function is given in figure 96.



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Figure 96. Sequence chart for carriage return.

c. **MANUAL CARRIAGE RETURN.** To permit hand operation of the carriage return, the lock bar extends beyond its latch (fig. 95) and can be reached through a hole in the left side of the cover. Pressure on the lock bar disengages the spacing shaft clutch and causes the type-bar carriage to return to the left-hand margin of the page.

## 90. Figures (Shift)

a. **DESCRIPTION AND PURPOSE.** The figures-shift function lever, third from the right, when selected, starts the train of action which moves the platen to the figures printing position. For a description of the function lever and its operation see paragraph 85. The force to move the platen comes from the function bail through the push bar, shift link, and shift lever to the rear end of the platen assembly.

*Note.* The shift detent holds the platen assembly firmly in either the figures or letters position.

b. **OPERATION.** Selection of the figures function lever raises the figures shift push bar, so as to bring its notch into the path of the function-bail blade. (See fig. 97.) This push bar, when moved by the function bail, will rotate the right end of a shift link to which it is connected, toward the rear of the teletypewriter and the left end of the link toward the front. (See fig. 97.) As the shift link pivots, a shift

lever, which is connected to its left end, will rotate counterclockwise and exert a downward pull on a shift vertical link which extends upward from the shift lever to the platen bracket. The rear of the platen assembly will be moved downward and held there by its detent while the platen roll will rise to the figures (shifted) position.

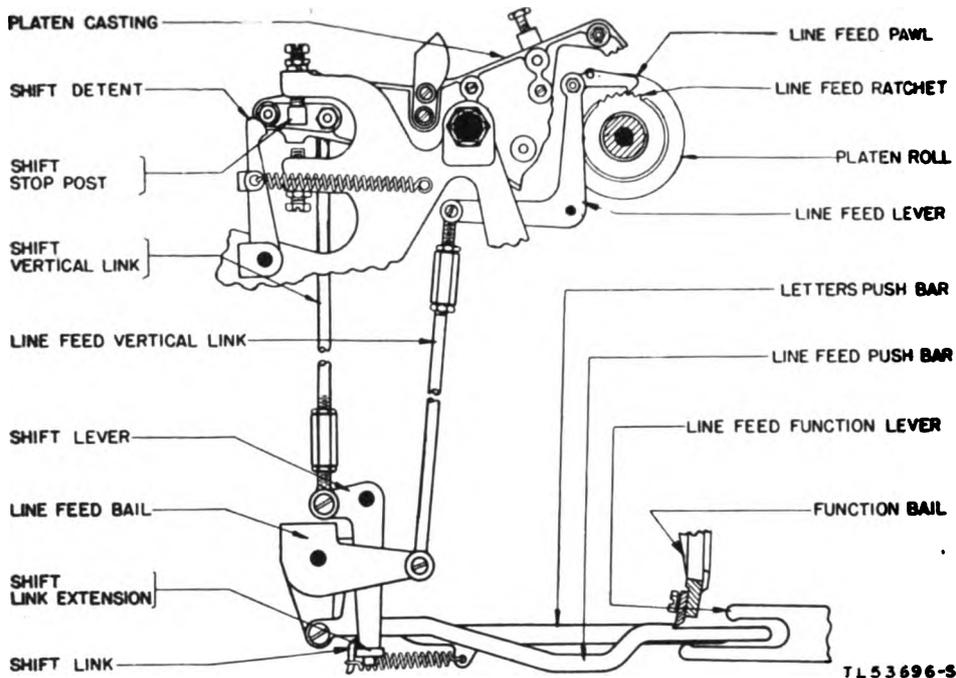


Figure 97. Platen-shift and line-feed mechanism.

### 91. Letters (Shift)

The letters push bar is connected to the left side of the shift link. When the letters push bar is operated by the function bail, the action on the platen assembly will be reversed, thus bringing the platen down to the letters position.

### 92. Sixth Vane

The sixth vane controls the operation of the signal bell and the motor stop functions through their function levers. The lower end of the spring attached to the sixth vane fits into the notch in the forward end of the letters push bar. With the platen in the letters position, the rear edge of the sixth vane moves up, blocking the signal-bell and motor-stop function levers from engagement with the vanes. When the FIGURES key is depressed, the letters push bar moves forward causing the rear edge of the sixth vane to go to the lower position, allowing the signal-bell or motor-stop function lever to be selected and operated.

### 93. Spacing Function

Spacing other than that accompanied by printing (such as spacing between words, etc.) is accomplished in the same manner as that described in paragraph 79, except that there is no pull bar to be selected.

### 94. Unshift-on-Space

The teletypewriter may be arranged to shift the platen to the letters position on both the space and letters combination by means of the space function lever. (See fig. 98.) When the unshift-on-space feature is not required, the unshift-on-space cut-out lever is moved into engagement with the space function lever projection, making it inoperative. If the unshift-on-space cut-out lever is moved out of engagement with the space function lever projection, the space function lever extension moves upward on a space combination and raises the letters-unshift push bar into the path of the function bail. (See fig. 97.) The platen is then shifted to its letters position.

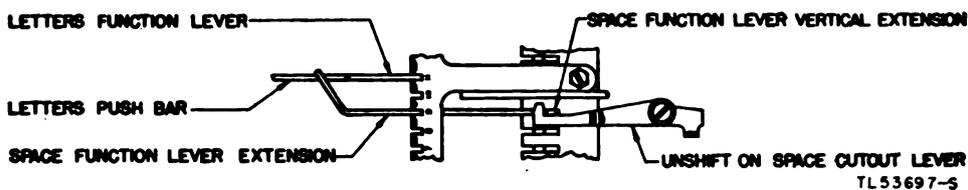


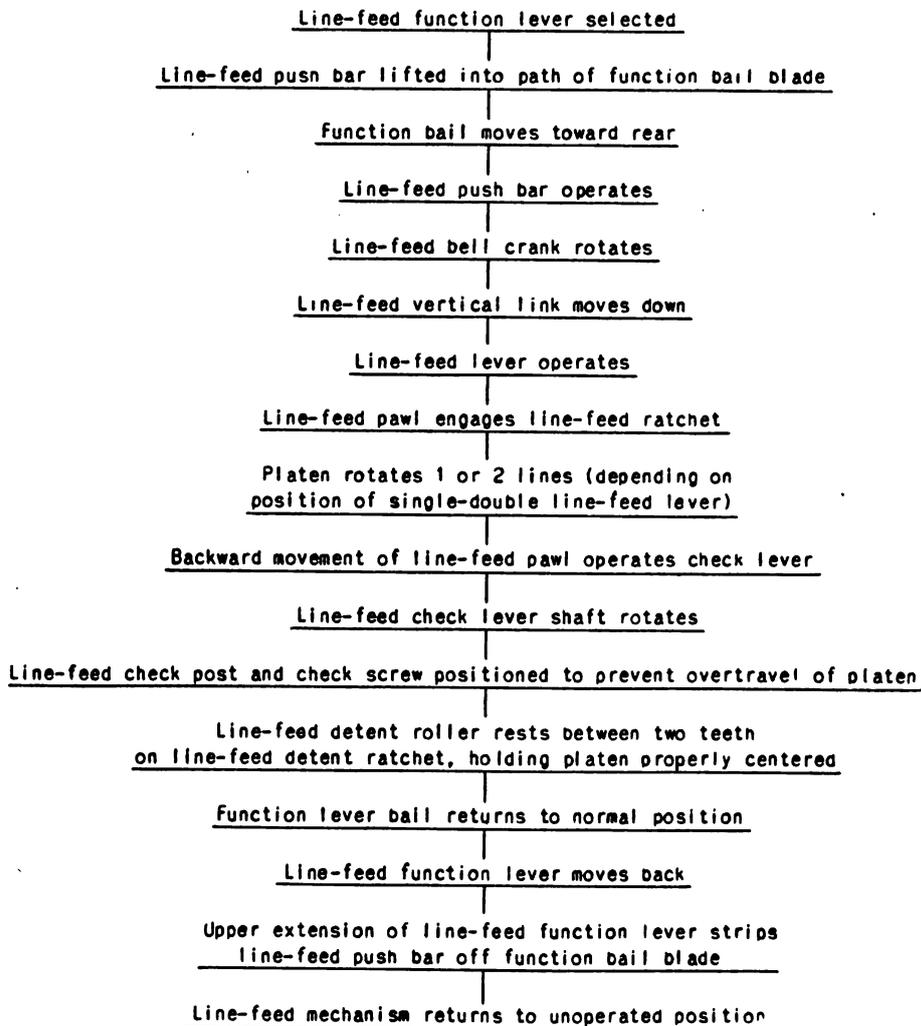
Figure 98. Unshift on space cut-out lever.

## 95. Line Feed

*a. DESCRIPTION AND PURPOSE.* The feeding of paper, like other functional operations of the teletypewriter, is done mechanically through a train of parts. The train starts with the first function lever on the left and continues through the push bar, line-feed bell crank, vertical link, feed lever, feed pawl, and feed ratchet (fig. 97). Motion is supplied the train by the function bail which transfers it to the platen by the feed ratchet which is attached to the left end of the platen. To maintain proper line interval when feeding paper, a train consisting of the check lever, check lever shaft, check post, check screw, detent ratchet, and detent assembly is provided. Operation of the check lever, check-lever shaft, check post and check screw stops the turning of the platen.

The detent ratchet, attached to the end of the platen, and the detent arm assembly hold the platen in position for printing.

*b. OPERATION.* (1) When the line-feed function lever, second from the left, is selected, its lower extension raises the line-feed push bar into the path of the function-bail blade. (See fig. 93.) When the function bail moves toward the rear of the teletypewriter, the line-feed push bar rotates the line-feed bail, thus pulling the line-feed vertical link downward. Downward movement of the vertical link will operate the line-feed lever which, in turn, will move the line-feed pawl into engagement with the line-feed ratchet and thereby rotate the platen one line space. When the line-feed function lever is returned to its normal position by the function-lever bail, the upper extension of this



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*Figure 99. Sequence chart for line feed.*

function lever will strip the line-feed push bar off the function-bail blade.

(2) After each line feeding operation, a roller on the detent-lever (fig. 83) locates itself between two teeth on a detent ratchet, thus regulating the space between lines, and holding the platen firmly in position during each line of printing. A sequence chart for the line-feed function is shown in figure 99.

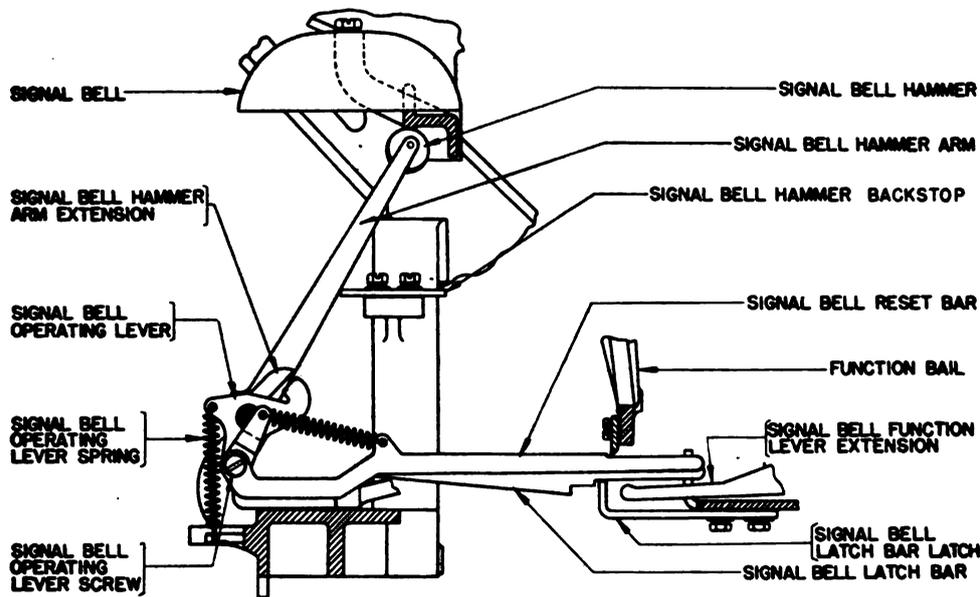
## 96. Single-Double Line Feed

*a.* DESCRIPTION AND PURPOSE. The line-feed ratchet is attached to the left-hand end of the platen (fig. 97) and is designed for either single or double line-feed operation. Several saw-tooth notches on the ratchet are provided to receive the adjustable line-feed pawl.

are provided. (See fig. 91.) The paper-straightener rod is used to guide the paper as it is unwound from the roll. It is also used as a slack rod to prevent the paper from tearing. The pressure rollers hold the paper firmly against the platen to prevent slippage while line feeding.

## 98. Signal Bell

*a.* DESCRIPTION AND PURPOSE. The signal bell mounted horizontally at the rear of the typing unit (fig. 100) is provided as an audible signal to attract the operator's attention. It is connected to its associated function lever by means of levers and the bell hammer. The bell hammer will strike the signal bell once each time the related typing key is depressed on the



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Figure 100. Signal bell mechanism.

*b.* OPERATION. The single-double line-feed lever, in its lower position, allows the line-feed pawl to engage two teeth, causing the platen to turn a double line space. When the single-double line-feed lever is in its upper position, the line-feed pawl can engage only one tooth on the line-feed ratchet, which turns the platen a single line space.

## 97. Paper Feeding

To facilitate paper feeding, a paper-straightener rod and a series of platen pressure rollers

keyboard of any teletypewriter operating in the same circuit.

*b.* OPERATION. (1) When the bell-function lever is selected, its extension (fig. 100) raises the bell-latch bar from its latch. This releases the bell-operating lever, which is rotated by the spring connected to it and strikes the bell-hammer arm extension causing it to throw the bell hammer against the bell.

(2) The bell-reset bar and the bell-latch bar, both pivoting on the bell-operating lever screw, are reset by the function bail as it returns to

its rear position and the blade engages the notch on the reset bar. A sequence chart for the signal bell function is shown in figure 101.

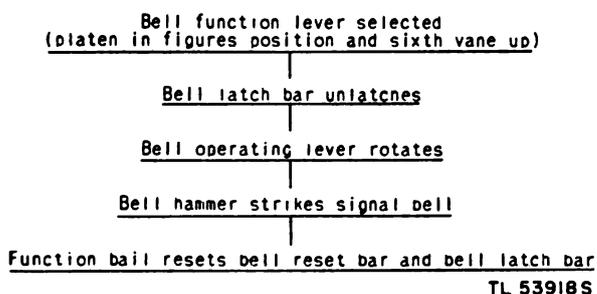


Figure 101. Sequence chart for signal bell.

## 99. Mechanical Motor Stop

a. DESCRIPTION AND PURPOSE. Mechanical motor stop is a functional operation of the teletypewriter. The motor-stop function lever (fig. 102) is selected when the STOP (upper case H) key lever is depressed. For a description of the function lever see paragraph 85. This function not only stops the motor of the sending teletypewriter but will also automatically stop the motor of all teletypewriters operating in the same line signal circuit. All motors may be restarted by momentarily opening the line-signal circuit.

b. MOTOR-STOP OPERATION. (1) When the motor-stop function lever is selected and moves forward, its lower-rear extension raises the motor-stop lever. This latches the inner motor-stop pawl onto the thick part of its latch on the armature extension. (See fig. 105.)

(2) Simultaneously, the front extension of the motor-stop function lever closes the left-hand motor contacts, and as the rear extension of the motor-stop contact lever moves up, the front extension moves down against the tension of its spring. This opens the right-hand motor-stop contacts.

(3) As both pairs of contacts are wired in multiple, the motor will not stop until the motor-stop function lever is returned to its normal position and the left-hand contacts open. These contacts hold the motor circuit closed until the receiving selector cam sleeve comes to rest, which insures the disengagement of the main shaft clutch before the motor stops.

c. START MOTOR OPERATION. (1) To start the motors again, the line must be opened for a short interval by depressing the break lever. (See fig. 106.) This moves the upper contact extension against the line contact insulator. The line is opened, the selector armature extension is moved downward by the armature spring, and the upper end of the motor-stop lever, having moved forward a slight distance, is again stopped when its outer pawl catches the cut-away portion of the motor-stop pawl latch.

(2) When the line signal circuit is closed again, the armature moves to its operated position, the outer motor-stop pawl unlatches the armature extension, and the motor-stop function lever returns to its normal position. The extension on the lower portion of the motor-stop function lever, which has been holding the motor-stop contact lever away from the right-

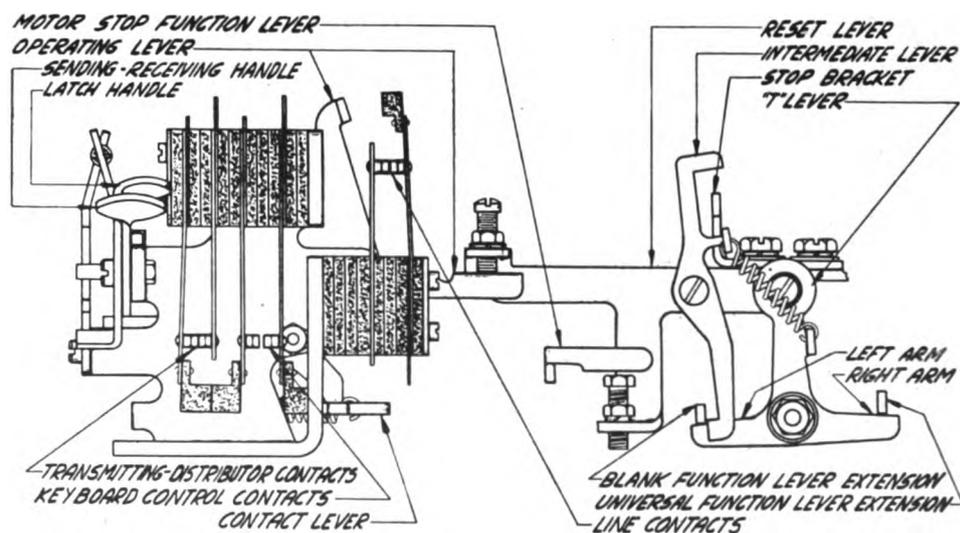
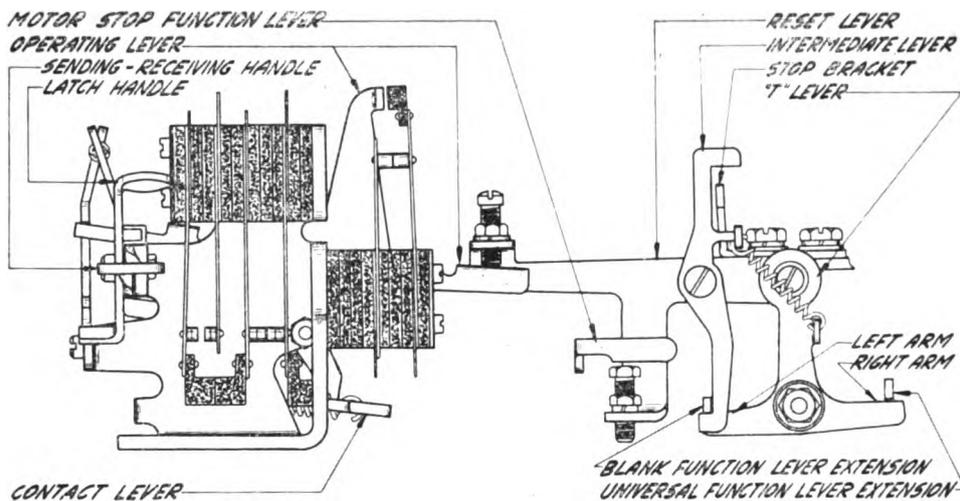


Figure 102. Keyboard locking mechanism in unoperated position. TL53700-S



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Figure 103. Keyboard locking mechanism in operated position.

hand motor-stop contacts, will now permit the spring to move the front extension of the motor-stop lever upwards, closing the motor-stop contacts.

**d. KEYBOARD LOCKING OPERATION.** When the motor-control function is operated, the forward end of the motor-stop function lever moves downward against the lower screw on the reset lever and closes the keyboard-control contacts, locking out the keyboard transmission. The reset lever in turn moves the contact-operating lever as described in paragraph 101.

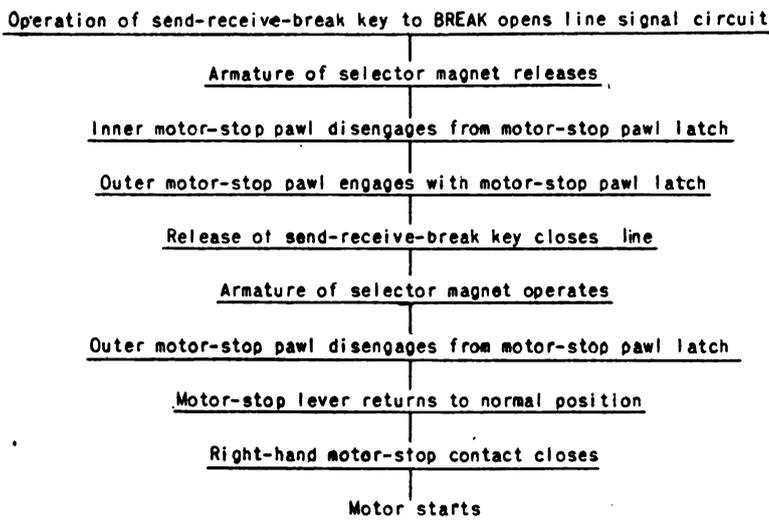
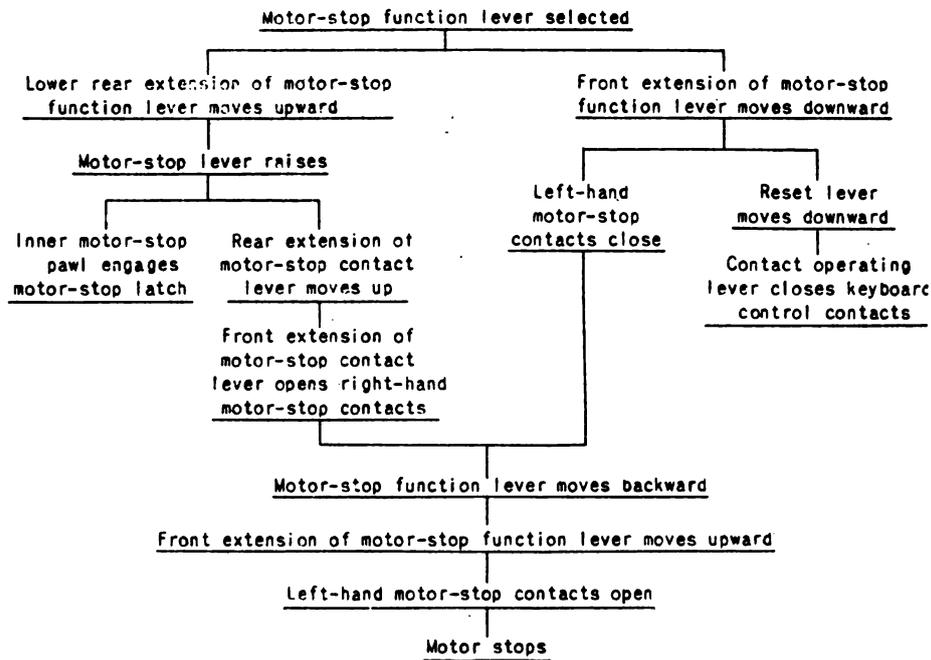
**e. MOTOR-STOP RELEASE LEVER.** The motor-stop release lever eliminates the possibility of the selector-cam sleeve coming to rest with the armature locking lever in the low part of its cam. (See fig. 105.) For example, immediately after the FIGS and H keys have been depressed and before the motor has stopped, if the line accidentally opens releasing the selector magnet armature, the selector-cam sleeve should revolve beyond the stopping point, and it is possible that the armature locking lever might come to rest in an indent in its cam. If the cam stops in this position, the armature extension is not free to respond to the next open line interval, making it impossible to operate the mechanical motor control. To avoid such a condition, a mechanism is arranged so that when the locking lever is in an indent in the locking cam, the motor-stop release lever is not permitted to latch onto the armature-extension

latch. This is done by means of the motor-stop release lever. When the locking lever is in an indent, it comes into contact with the release-lever stud which holds the eccentric at the upper end of the motor-stop release lever against the lower end of the outer motor-stop pawl, preventing the pawl from latching with the motor-stop pawl latch. Thus the motor stop cannot function and the motor continues to rotate until the selector cam is stopped from rotating by the stop lever, and the locking lever is on the long, high part of its cam. A sequence chart for the remote motor control function is shown in figure 104.

## 100. Send-Receive-Break Key

**a. DESCRIPTION AND PURPOSE.** The send-receive-break key is mounted on the front left-hand corner of the base and extends through a slot in the front of the cover. (See fig. 106.) The key has three positions: SEND, REC (receive), and BREAK. With the key in the SEND position, sending and receiving are both possible, while in the REC position only receiving is possible. The BREAK position is to send break signals to the distant operator or for starting teletypewriters equipped with mechanical motor control mechanism. The associated contacts and parts are discussed in paragraph 99.

**b. MANUAL OPERATION.** The send-receive-break key can be moved to the SEND or REC position by pushing the send-receive lever up



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Figure 104. Sequence chart for remote motor control.

or down. The latch lever stops the key in the REC position when it is being moved downward. To send a break, push the latch lever, which releases the send-receive-break key and permits it to move into the BREAK position. When the pressure is removed, the key moves back into the REC position.

c. MECHANICAL OPERATION. The SEND-REC-BREAK key is operated mechanically to the REC position by two successive depressions of the blank key, or if the line is opened for a time interval equivalent to at least two revolu-

tions of the keyboard camshaft. The associated contacts and parts are discussed in paragraph 101.

### 101. Blank Function (Keyboard Locking Mechanism)

a. DESCRIPTION AND PURPOSE. The keyboard locking mechanism is composed of a set of six contacts, the upper contact lever, lower contact lever, contact lever spring, send-receive-break levers, latch lever, and stop lever plate, all mounted on a bracket at the front left-hand

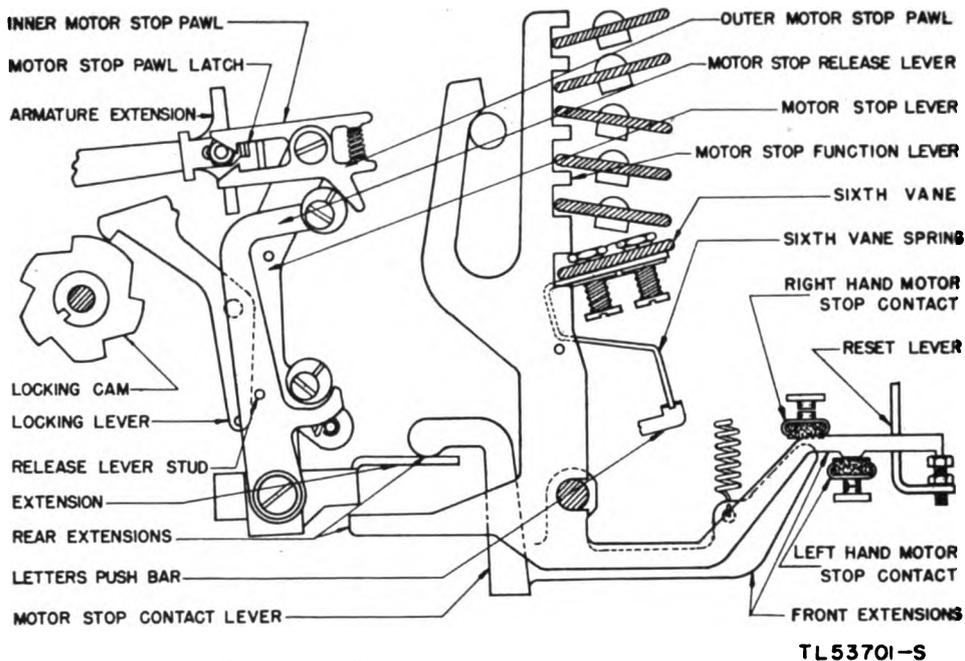


Figure 105. Mechanical motor-stop mechanism.

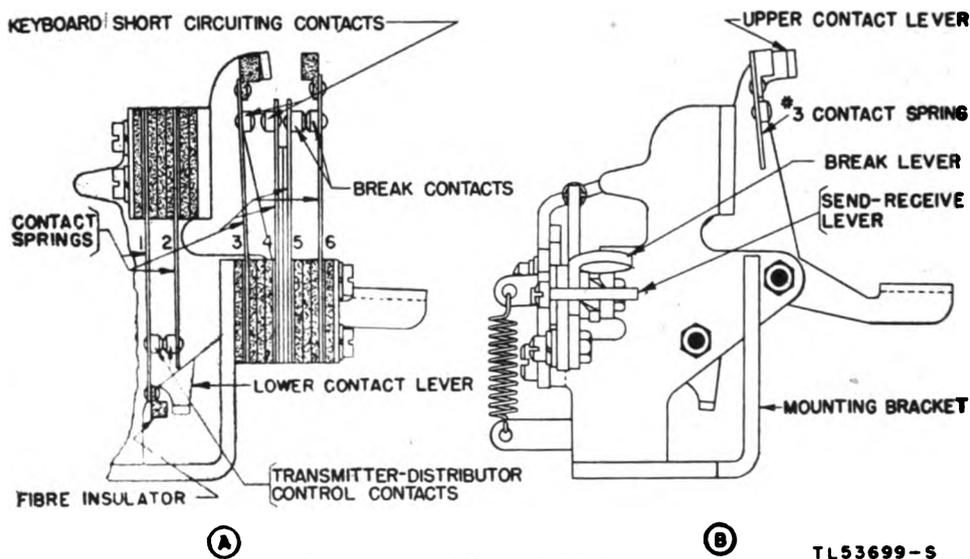


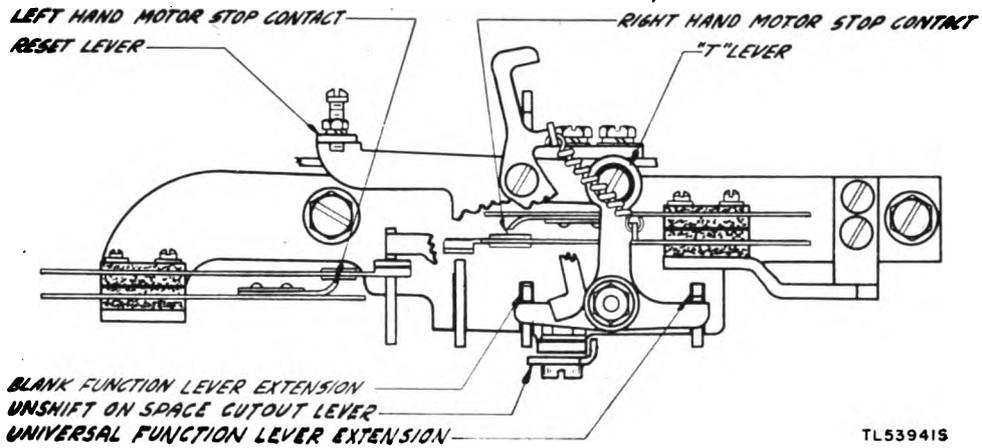
Figure 106. SEND-REC-BREAK key.

corner of the base. The SEND-REC-BREAK key is operated mechanically to the REC position by two successive depressions of the blank key, closing the keyboard control contacts, and short-circuiting the sending contacts of all teletypewriters on the circuit. Sending by any keyboard is impossible until the send-receive-break key of that teletypewriter is restored by hand to the SEND position. The procedure above also serves as a break-in feature, permitting a receiving operator to stop a transmission from a distant station whether the message is coming

from an automatic tape transmitter or a hand-operated keyboard.

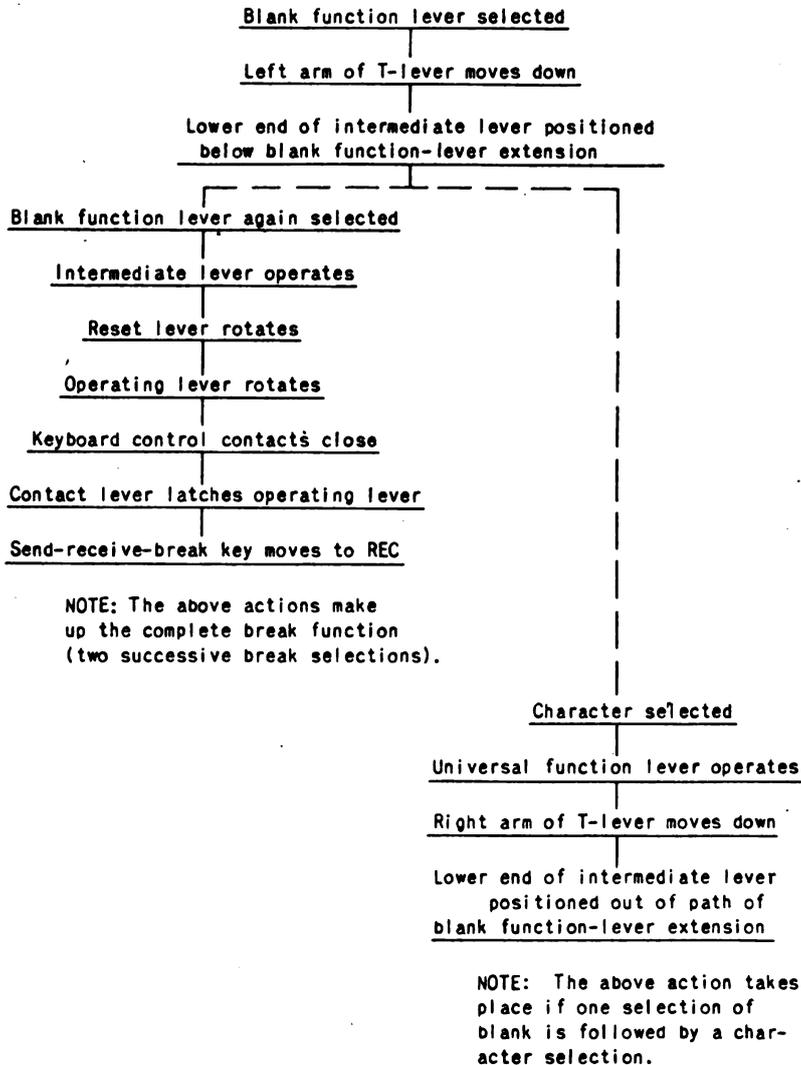
b. MECHANICAL OPERATION. (1) As the blank function lever moves forward after selection, its extension moves downward, carrying with it the left arm of the T-lever.

(2) The left arm of the T-lever is moved downward, which also moves the reset lever and intermediate lever to the left. This places the lower end of the intermediate lever under the blank function lever extension, and it is held there by its spring.



TL53941S

Figure 107. Mechanical motor-stop contacts.



TL 53920 S

Figure 108. Sequence chart for blank function.

(3) As the function lever bail returns to its normal position the blank-function lever extension moves upward, permitting the toe of the intermediate lever to be positioned below the blank-function lever extension, by the intermediate lever spring.

(4) The blank key is again depressed and the blank-function lever extension again moves downward, carrying with it the intermediate lever.

(5) As the intermediate lever moves downward, it moves the reset lever downward, which in turn moves the right arm of the operating lever downward and its upper arm to the right.

(6) The movement of the upper arm of the operating lever to the right allows the keyboard control contacts to close by means of the tension in the contact spring, and at the same time releases the operating pawl whose spring moves the send-receive key to its lower position.

(7) As the printing bail operating arm roller rides up onto the high part of the printing bail cam, the function-lever bail is moved upward, which causes the function-lever bail roller to engage the cam surface of the rear arm of the blank-function lever, moving the blank-function lever out of engagement with the vanes. Thus, the blank-function lever is returned to its normal position and the operation of the blank function has been completed. A sequence chart for the blank function is shown in figure 108.

c. **MANUAL OPERATION.** The keyboard mechanism may be locked out by operating the SEND-REC-BREAK key by hand to the REC position. The sending circuit is shorted out as described in *a* above.

## 102. Polar-Neutral Key (Printer TG-7-A Only)

a. **DESCRIPTION AND PURPOSE.** The polar-neutral key provided on the keyboard furnished with Printer TG-7-A is a two-position key mounted on top of the keyboard at the left of the transmitting contact assembly. (See fig. 4.) It is designed to change from polar operation to neutral operation or *vice versa* by operating the key when Printer TG-7-A is wired for use with an internal polar relay.

*Note.* Printer TG-7-A is equipped with a relay mounting bracket which, in normal operation, is not completely wired into the internal circuits. See the wiring diagram for Printer TG-7-A for the changes necessary to permit use of an internal line relay.

b. **OPERATION.** When an internal line relay is used and the polar-neutral key is in the neutral (pulled-out) position, the circuit is closed through the bias (2-7) winding of the polar relay. Placing the key in the polar (pushed-in) position opens the circuit through the bias (2-7) winding.

## 103. Ribbon Lock-out

The ribbon lock-out (fig. 84) is for locking the ribbon below the printing line when stencils are to be cut. When the ribbon lock-out bar is moved inward manually it engages the ribbon-oscillator extension, holding the oscillator assembly in the lower position, with the ribbon below the printing line, to allow the type bar pallets to strike directly against the stencil and makes an impression on the stencil material.

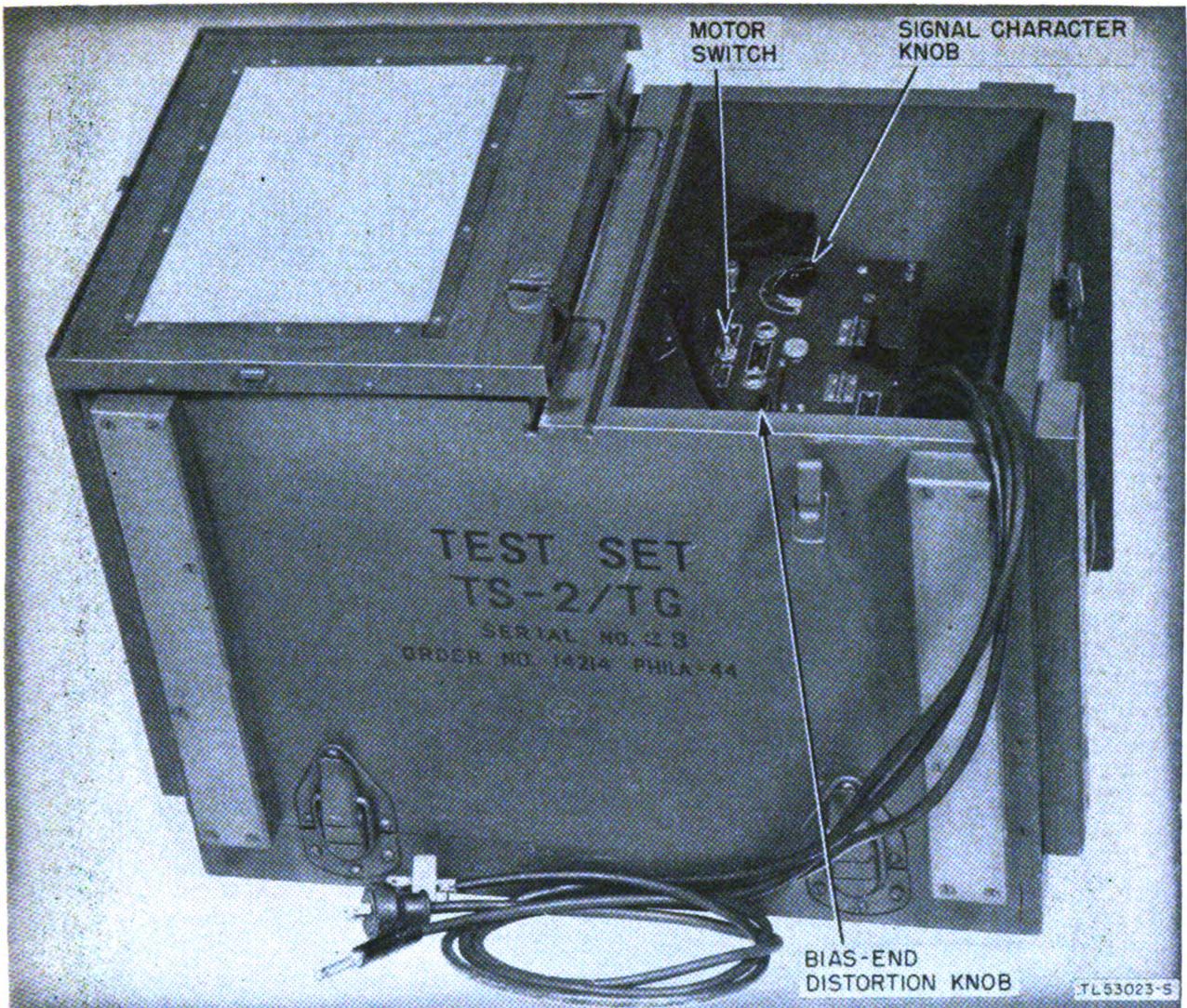
## Section XI. TEST EQUIPMENT

### 104. Test Sets

a. **GENERAL.** Any of the commonly used volt-ohm-milliammeters are satisfactory for testing the current flow in, and continuity, insulation or resistance of the electrical circuits in the teletypewriter. The subparagraphs below give a brief description and the purpose of the test sets most frequently used by teletypewriter repairmen.

b. **TEST SET TS-2/TG.** Test Set TS-2/TG (fig. 109) is a portable motor-driven unit arranged to transmit normal or distorted signals for testing teletypewriter circuits and checking the efficiency of start-stop selector units on teletypewriters. It sets up two types of distortion, marking or spacing bias, and marking or spacing end distortion. Any one of four test signals: R, Y, SPACE, or a test message, may be transmitted continuously by the test set. For a detailed description of this test set, see TM 11-2208.

c. **DISTORTION TEST SET TS-383/GG.** Distortion Test Set TS-383/GG (fig. 110) is a motor-driven unit normally used in the larger repair shops. In addition to the characters and functions transmitted by Test Set TS-2/TG, Distortion Test Set TS-383/GG will transmit the Y, T, O, M, V, and LETTERS characters and functions. These transmissions are sent either undistorted or with a controlled degree of distortion up to approximately 100 percent. Dis-



*Figure 109. Test Set TS-2/TG with chest cover open.*

ortion Test Set TS-383/GG is also designed to receive and analyze distortion in the transmitting circuit of a teletypewriter. See TM 11-2217 for a complete description of this test set.

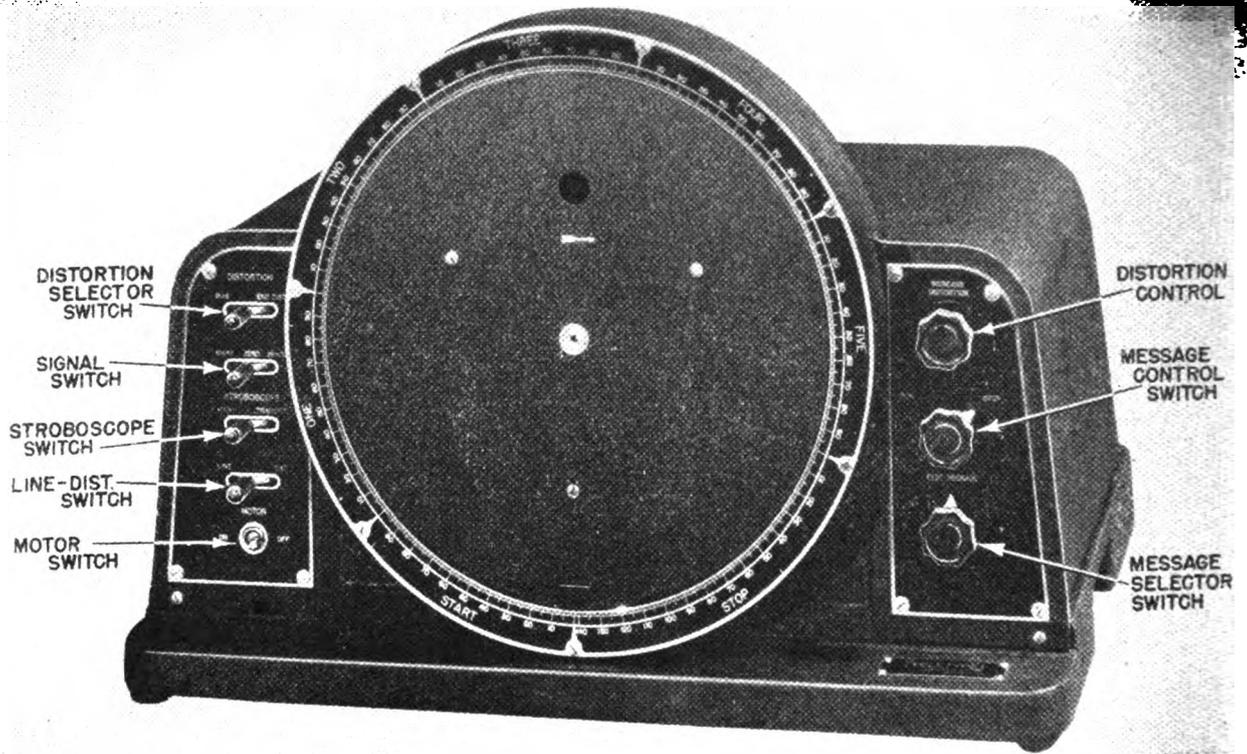
*d.* **MULTIMETER TS-380/U.** Multimeter TS-380/U (Signal Corps stock No. 3F7127) (fig. 111) is a small portable volt-ohm-milliammeter designed for the measurement of a-c and d-c voltage, d-c current, and resistance. Figure 111 shows the Multimeter TS-380/U which is typical of the many different meters supplied with various tool equipments.

*e.* **TEST UNIT I-236.** Test Unit I-236 (fig. 112) is designed to check the continuity of teletypewriter circuits, to differentiate between a-c

and d-c voltages, to check fuses, and to test capacitors. See TM 11-2056 for a complete description of this test unit.

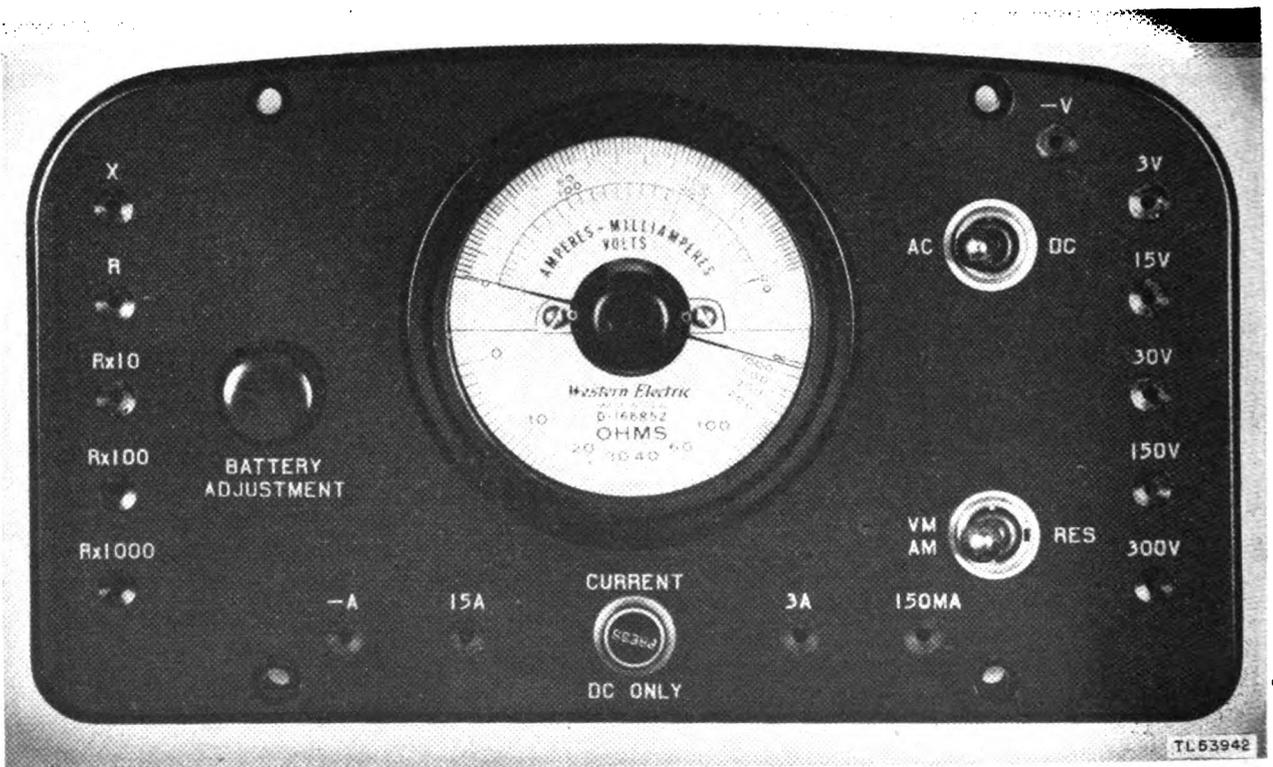
### 105. Additional Tools

*a.* **GENERAL.** The detailed repair instructions in section XIII refer to the use of certain tools which are not furnished as part of Tool Equipment TE-50. These additional tools, or their equivalents, are usually available in higher echelon maintenance kits intended for use where extensive teletypewriter repairs are completed. In some instances where the tools are not available, suitable substitutes may be improvised. See paragraph 37 and figure 52 for a complete listing and illustration of tools fur-



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Figure 110. Distortion Test Set TS-383/GG.



TL53942

Figure 111. Multimeter TS-380/U.

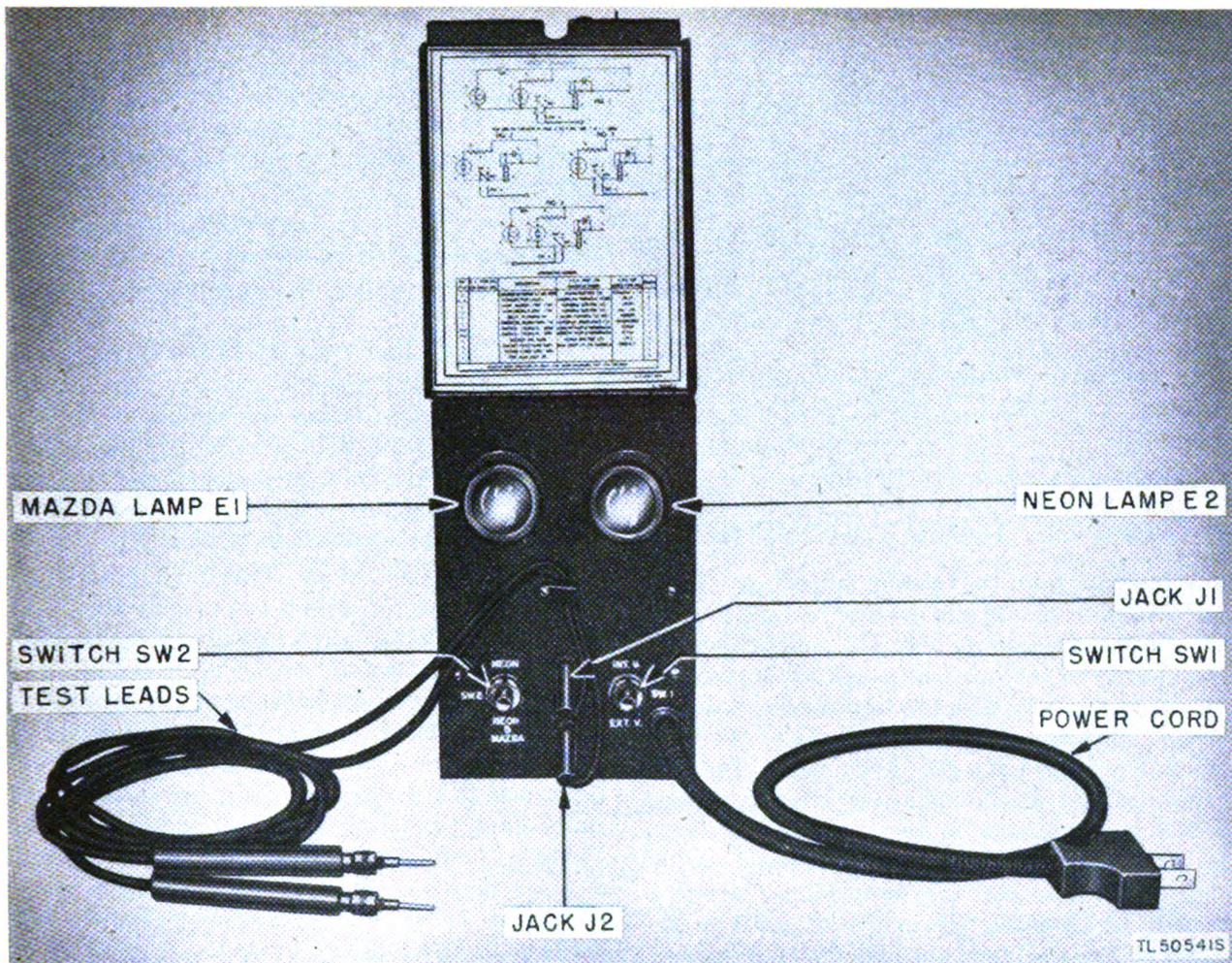


Figure 112. Top view of Test Unit I-236.

nished in Tool Equipment TE-50. The additional tools are listed in *b* below.

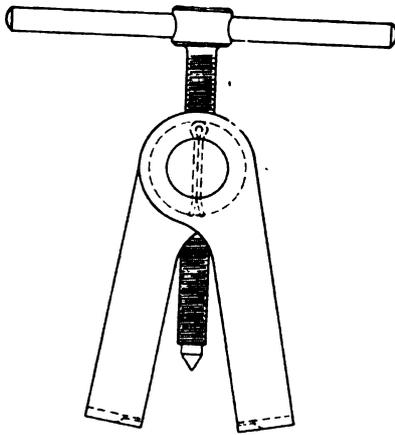
*b.* LIST OF ADDITIONAL TOOLS. Figure 113 illustrates the bearing puller which is included among the additional tools referred to in the test and repair instructions. The Signal Corps stock numbers of the tools are listed in the table below.

Signal Corps stock No.	Name of tool	Description
4T84020	Bearing puller.....	Designed for removing all types of teletypewriter motor armature bearings.
6R46290	Undercutter, mica.....	Designed for cutting commutator segments.
4T74803	Hand wheel.....	Metal wheel approximately 2' in diameter with extension which screws onto right end of main shaft.
6R4774-6	Pliers, short-nose.....	Heavy, 6" long, 1" wide; general use.

*c.* DRILLS, TAPS, DIES, CLAMPS, ETC. A set of various sizes of drills (carbon or high-speed steel) and either a hand drill or an electrical drill should be available for making new parts or reworking old parts. A set of taps and dies for several common sizes of screws and bolts should also be available. Clamps may be any type of suitable size.

*d.* WELDING AND BRAZING EQUIPMENT. In emergencies, many broken parts may be welded or brazed. However, this procedure is very difficult and should be performed *only* by personnel thoroughly skilled in welding and brazing techniques.

**Caution:** Welded or brazed parts must be properly aligned and free of excessive build-ups which would reduce clearances below the minimum requirements.



TL 54475-S

Figure 113. Bearing puller.

## Section XII. TROUBLE SHOOTING

### 106. Introduction to Trouble Shooting

a. GENERAL. There are several factors to consider before proceeding with the actual locating of trouble. No definite rules can be laid down as to the exact procedure to be followed because of wide variations in the experience of the personnel working with the equipment. The information and trouble-analysis charts in this section are intended to provide both a step-by-step procedure for the inexperienced and a ready reference for the experienced trouble shooter. In all cases, the origin of the trouble report or the manner in which the trouble was detected will determine the procedure to be followed.

b. SOURCE OF TROUBLE REPORTS. Figure 114 is an example of a typical trouble record. Troubles reported may be divided into two classes:

(1) Troubles that are reported in such a manner that they may be due either to a failure of the teletypewriter or a failure in other equipment or connecting facilities. In some cases, these troubles may be intermittent and re-

TELETYPEWRITER TROUBLE RECORD							
TG-7-B MODEL		86794 BASE	SERIAL NUMBERS 101284 KEYBOARD 101284 MOTOR UNIT		81754 TYPING UNIT	SET NO. 12	
DATE	TIME	REPORTED BY	TROUBLE REPORTED	DISPOSITION	DATE	TIME	CLEARED BY
17 JAN	0725	W.E.C.	MOTOR FAILS TO START.	REPLACED MOTOR FUSE.	17 JAN	0728	N.H.G.
26 JAN	1045	P.O.C.	PAPER TEARS.	READJUSTED PAPER GUIDE.	26 JAN	2005	W.R.R.
2 FEB	1030	W.E.C.	PRINTS INCORRECT LETTERS AT TIMES.	TIGHTENED SCREW IN RANGE-FINDER ASSEMBLY.	3 FEB	0630	R.F.H.

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Figure 114. Typical trouble record.

quire extensive routine checks of all equipment and facilities before they can be definitely located. The substitution of teletypewriters or units known to be in good condition is frequently the fastest method of proving which part of the circuit is the source of the intermittent trouble.

(2) Troubles which are readily apparent or which are definitely identified by a trouble report as being located in a particular part or unit.

c. TROUBLES DETECTED BY INSPECTION. Trouble found during routine check of the equipment or while inspecting the equipment during a major overhaul will usually be definite in nature. In some cases, however, these troubles may require detailed analysis using special testing equipment discussed in section XI.

d. TROUBLE ANALYSIS. Thorough knowledge of the sequence of operation for each functioning element in the teletypewriter is of fundamental importance in analyzing trouble. The trouble shooter must be able to prove quickly whether trouble is in a particular assembly or in other parts of the teletypewriter. The appearance of a particular operating failure may immediately indicate the exact location of the faulty adjustment or the damage; if not, it will be necessary to determine with exactness these functions which are operating properly and those which are failing to do so.

e. PROCESS OF ELIMINATION. By determining which of the transmitting, receiving, and common functions of the teletypewriter do and which do not operate properly, the trouble shooter will eliminate the possibility of wasting considerable time and effort. The trouble-analysis chart listing the most commonly observed faults is of considerable assistance in determining the best sequence and testing procedure for a particular condition. By sending to and receiving from a second teletypewriter, the trouble is proved to be in either the transmitting, receiving, or common functions. A local or dummy testing circuit can also be used when a second teletypewriter is not readily available. When a definite observed fault has been found, see paragraph 107, for the related list of indicated conditions and select the items that would logically be the cause of the fault.

f. LOCALIZING TROUBLE. When it has been determined either by observation or testing which of the units or functions are causing

the trouble the next step is to isolate or localize the trouble in a particular electrical circuit or mechanical element. The trouble-analysis charts listed in paragraph 107 provide reference data

for both electrical and mechanical failures. Information on the best procedures for locating the more common troubles are furnished in paragraphs 126 and 133.

### 107. List of Trouble Conditions for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B

Paragraph	Chart	Condition	Observed fault
108	A	.....	Fails to start.
109	B	Starts.....	Runs open.
110	C	Runs closed.....	Cannot send.
111	D	Runs closed.....	Cannot receive.
112	E	Prints.....	Range finder has poor range.
113	F	Prints.....	Scrambled letters or occasional errors.
114	G	Prints.....	Fails to shift or unshift.
115	H	Prints.....	Fails to line feed properly.
116	I	Prints.....	Fails to space properly.
117	J	Prints.....	Fails to carriage return properly.

### Teletypewriter operates correctly except:

Paragraph	Chart	Condition	Observed fault
118	K	.....	Ribbon remains motionless or does not oscillate.
119	L	.....	Ribbon does not reverse.
120	M	.....	Bell does not operate. (Letter S prints correctly.)
121	N	.....	Letter S does not print (signal bell operates with platen in letters position).
122	O	.....	Motor stop fails to operate.
123	P	.....	More or less than 72 characters per line or margins uneven.
124	Q	.....	Margin bell does not operate on 66th character.
125	R	.....	Teletypewriter emits grinding noise.

### 108. Trouble-Analysis Chart A—Teletypewriter Fails To Start

Item No.	Items to be inspected or checked	Possible trouble	Corrective action	Reference data		
				Detailed function	Repairs	Adjustments
1	Power source.....	Open, low voltage, poor voltage regulation.	Use another power source.			
2	Fuse, motor ckt.....	Fuse open or missing.	Replace with good fuse.			
3	Motor-stop contacts.....	Open or dirty.....	Clean, check tension and continuity.	Par. 199.....		Par. 247.
4	Motor-stop mechanism.....	Contacts do not close.	Adjust.....	Par. 99.....		Par. 239.
5	Governor contacts.....	Open, dirty or burned away.	Clean or replace and adjust.	Par. 59.....	Par. 152.....	Par. 382.
6	Base contacts.....	Open contacts between base and typing unit.	Clean and adjust cont.			Par. 367.
7	Motor (internal).....	Open windings, poor brushes.	Replace brushes or motor.	Par. 58.....	Par. 153.....	Par. 383.
8	Main shaft.....	Clutches dry, or bearings frozen tight.	Locate and correct trouble in typing unit.	Par. 60.....	Par. 172, 173.	

Note. See figures 115 to 119 inclusive, for schematic diagrams of the teletypewriters.

## 109. Trouble-Analysis Chart B—Motor Starts but Teletypewriter Runs Open

Item No.	Items to be inspected or checked	Possible trouble	Corrective action	Reference data		
				Detailed function	Repairs	Adjustments
1	External circuits.					
	a. Line to outside.....	Line open or shorted..	Inform wire chief.			
	b. D-c voltage source ..	No voltage, voltage low, or wrong polarity.	Replace fuse, or reverse polarity.			
	c. Line unit.....	Jacks dirty, or line fuse blown, or open wiring. Switches in wrong position.	Replace fuse, correct switch positions, or replace unit.	TM 11-359.....		TM 11-359.
	d. Signal turn-over.....	Space received instead of mark.	Reverse line leads if on polar operation.	See TM 11-2005.		
2	Wiring.....	Damaged or excessively oil soaked.	Repair or replace.			
3	Selector magnet circuit..	Circuit open or shorted	Check back from receiving plug.	Par. 132.....		Par. 367.
4	Keyboard transmitter circuit.	Circuit open.....	Check back from black SEND plug.	Par. 131.....	Par. 169.....	Par. 366.
5	Selector trip-off eccentric screw.	Operates trip-latch when armature is in mark position.	Adjust.....	Par. 71.....		Par. 252.
6	Main-shaft clutch throw-out lever.	Loose spring.....	Adjust.....	Par. 75.....		Par. 218, 219.
7	Base contacts.....	Contacts dirty or open	Clean and adjust.....			Par. 367.

## 110. Trouble-Analysis Chart C—Teletypewriter Runs Closed but Cannot Send

1	SEND-REC-BREAK key.	Key in receive position.	Move key to SEND position.	Par. 100.....		Par. 368-373.
2	Transmitter contacts and wiring.	Contacts or wiring shorted.	Locate and remove short circuit.	Par. 131.....	Par. 169.....	Par. 346, 347.
3	Transmitter plug.....	Plug shorted.....	Remove short or replace plug.	Par. 131.....		
4	Trip-off pawl eccentric screw. (keyboard).	Trip-off pawl does not engage intermediate pawl.	Readjust eccentric screw.	Par. 64.....		Par. 357.
5	Trip-off pawl spring.....	Spring weak or broken	Readjust or replace spring.	Par. 64.....		Par. 359.
6	External connections...	Send jack shorted, or defective relay in Line Unit BE-77-( ).	Check operation with another Line Unit BE-77-( ).	TM 11-359..		

## 111. Trouble-Analysis Chart D—Teletypewriter Runs Closed but Cannot Receive

1	External equipment....	Improper relay adjustment. Improper switch positions.	See TM on external equipment.	TM 11-359.		
2	Selector armature spring.	Spring loose or broken.	Adjust or replace.....			Par. 235.
3	Selector armature.....	Armature pivots binding.	Loosen and adjust....	Par. 71.....		Par. 233.
4	Selector trip-off eccentric screw.	Does not operate trip-latch plunger.	Adjust.....	Par. 71.....		Par. 252.
5	Main-shaft clutch throw-out lever.	Not operated by sixth cam of selector cams.	Adjust.....	Par. 75.....		Par. 218, 219.
6	Vanes.....	Vanes stuck in LTRS or FIGS position. Bell cranks not on vanes properly.	Adjust clearances.....	Par. 77, 85 ..		Par. 228.

Notes. See figures 115 to 119 inclusive, for schematic diagrams of the teletypewriters.

## 112. Trouble-Analysis Chart E—Teletypewriter Prints but Range Finder Has Poor Range

Item No.	Items to be inspected or checked	Possible trouble	Corrective action	Reference data		
				Detailed function	Repairs	Adjustments
1	Motor.....	Speed incorrect.....	Adjust with tuning fork.	-----	Par. 148.....	Par. 26.
2	Motor governor.....	Governor contacts burned.	Clean or replace.....	Par. 59.....	Par. 160.....	Par. 382.
3	Line current.....	Too low or too high..	Adjust to 60 ma or use line relay and adjust bias.	TM 11-359.	-----	-----
4	Selector armature spring.	Improper tension.....	Adjust.....	Par. 71.....	-----	Par. 235.
5	Selector armature pivots.	Too tight.....	Adjust.....	Par. 71.....	-----	Par. 233.
6	Binding of swords, T-levers, vanes, bell cranks, or code bars.	Adjustments too tight, wrong lubricant, or dirt in moving parts.	Clean and adjust.....	Par. 71..... Par. 77..... Par. 85.....	-----	Par. 232. Par. 228. Par. 316.
7	Bell cranks.....	Improper adjustment.	Readjust.....	Par. 77, 85	-----	Par. 316.
8	Selector cam sleeve.....	Worn	Replace.....	Par. 71.....	-----	Par. 217.
9	Teletypewriter at other end of circuit.	Teletypewriter slow or fast.	Request check motor speed.	-----	-----	-----
10	Selector mechanism.....	Improper adjustment.	Make complete adjustment.	Par. 71.....	-----	Par. 231-238, 249-253.

## 113. Trouble-Analysis Chart F—Teletypewriter Prints but Scrambles Letters or Prints Occasional Errors

1	Line current.....	Too low or too high..	Adjust to 60 ma or adjust line relay bias if using receive relay.	TM 11-359..	-----	-----
2	Range finder assembly.	Improper setting.....	Adjust to center of operating limits.	Par. 72.....	-----	Par. 249-252.
3	Keyboard sending contacts.	Contacts dirty or improperly adjusted.	Clean and adjust.....	-----	Par. 169.....	Par. 346, 347.
4	Motor speed..... a. Too high. b. Too low.	Shorted governor contacts, or governor adjustment. Governor adjustment. Contacts burned. Excessive main-shaft friction clutch drag.	Adjust speed with tuning fork. Adjust speed with tuning fork. Clean or replace. Lubricate main-shaft gears, and clutches.	Par. 59..... Par. 59..... Par. 59.....	----- Par. 160..... Par. 172, 173	Par. 26. Par. 26. Par. 382.
5	See also chart E. Items 1 to 10 inclusive.	-----	-----	-----	-----	-----

## 114. Trouble-Analysis Chart G—Teletypewriter Prints but Fails To Shift or Unshift

1	Figures and letters stop-screws.	Improper adjustment.	Adjust.....	Par. 90, 91 ..	-----	Par. 256, 257.
2	Shift detent.....	Detent spring too strong.	Adjust.....	Par. 90, 91 ..	-----	Par. 265.
3	Function bail spring...	Spring too weak.....	Adjust tension.....	-----	-----	Par. 229.
4	Shift link turnbuckle...	Turnbuckle loose.....	Adjust turnbuckle.....	Par. 90, 91 ..	-----	Par. 263.
5	Letters and figures function levers.	Improper spring tension, or spring broken.	Adjust, or replace.....	-----	-----	Par. 258.
6	Function bail blade.....	Blade broken or chipped.	Replace.....	Par. 86.....	-----	Par. 261.

*Note.*—See figures 115 to 119 inclusive, for schematic diagrams of the teletypewriters.

### 115. Trouble-Analysis Chart H—Teletypewriter Prints but Fails To Line-Feed Properly

Item No.	Items to be inspected or checked	Possible trouble	Corrective action	Reference data		
				Detailed function	Repairs	Adjustments
1	Single-double line-feed detent.	Wrong adjustment....	Adjust.....	Par. 96.....	-----	Par. 270, 271.
2	Line-feed function lever spring.	Spring broken or missing.	Replace.....	-----	-----	Par. 258.
3	Line-feed Link turn-buckle.	Adjustment.....	Adjust.....	Par. 95.....	-----	Par. 273.
4	Line-feed detent spring.	Missing or broken....	Replace.....	-----	-----	Par. 275.
5	Line-feed detent.....	Adjustment.....	Adjust.....	Par. 95.....	-----	-----
6	Pressure roller release cam.	Wrong position or wrong adjustment.	Adjust.....	-----	-----	Par. 282.
7	Pressure roller springs.	Missing or broken....	Replace.....	-----	-----	Par. 283.
8	Line-feed check screw..	Adjustment.....	Adjust.....	Par. 95.....	-----	Par. 277.
9	Line-feed check lever..	Adjustment.....	Adjust.....	Par. 95.....	-----	Par. 279.
10	Line-feed check lever spring.	Missing or broken....	Replace, and adjust..	-----	-----	Par. 280.
11	Line-feed pawl spring..	Missing or broken....	Replace.....	-----	-----	Par. 276.
12	Function bail blade....	Blade chipped or broken.	Replace.....	Par. 86.....	-----	Par. 261.

### 116. Trouble-Analysis Chart I—Teletypewriter Prints but Fails To Space Properly

1	Space function lever spring.	Broken or missing....	Replace.....	-----	-----	Par. 259.
2	Spacing escapement pawl operating arm.	Arm bent or screw missing.	Replace and adjust....	Par. 79.....	-----	Par. 291.
3	Spacing rack.....	Teeth missing, or rack broken.	Replace.....	Par. 79.....	-----	Par. 317.
4	Right margin adjusting screw.	Improper adjustment..	Adjust.....	Par. 79.....	-----	Par. 336.
5	Carriage guide screw..	Screw binding.....	Adjust.....	Fig. 91.....	-----	Par. 315.
6	Carriage support rollers	Rollers bind.....	Adjust or replace....	Fig. 91.....	-----	Par. 216.
7	Spacing lever stop bracket.	Adjustment.....	Adjust.....	Par. 79.....	-----	Par. 313.
8	Carriage return lock-bar latch.	Adjustment.....	Adjust.....	Par. 89.....	-----	Par. 304, 305.
9	Left margin adjustment screw.	Screw too far in....	Adjust.....	Par. 89.....	-----	Par. 335.
10	Spacing stop-lever spring.	Broken or missing....	Adjust.....	-----	-----	Par. 314.

### 117. Trouble-Analysis Chart J—Teletypewriter Prints but Fails To Carriage Return Properly

1	Carriage-return drum spring.	Weak tension, unhooked, or broken.	Tighten, engage, or replace.	Par. 89.....	-----	Par. 320.
2	Carriage-return draw-strap.	Unhooked or broken..	Adjust, or replace....	Par. 89.....	-----	-----
3	Carriage guide-screw..	Binding.....	Adjust.....	Fig. 91.....	-----	Par. 315.
4	Carriage-support roller bearings.	Rollers binding.....	Lubricate, adjust or replace.	Fig. 91.....	-----	Par. 316.
5	Carriage-return function-lever spring.	Missing or broken....	Replace.....	-----	-----	Par. 309.
6	Carriage-return reset bar spring.	Missing or broken....	Replace.....	-----	-----	Par. 308.
7	Carriage-return operating-lever spring.	Missing, broken, or weak.	Replace.....	-----	-----	Par. 310.
8	Carriage-return latch-bar latch.	Bent or rounded edge. Adjustment.	Repair or replace. Adjust.	Par. 89.....	-----	Par. 302, 303.
9	Reset-bar spring.....	Missing or broken....	Replace.....	-----	-----	Par. 308.
10	Carriage-return operating lever stop.	Stop does not allow lever to disengage clutch.	Adjust.....	Par. 89.....	-----	Par. 307.
11	Spacing-shaft lower bearing bracket adjustment.	Improper clearance between gears.	Adjust.....	-----	-----	Par. 221.
12	Spacing-rack adjustment.	Rack binding.....	Adjust.....	-----	-----	Par. 317.
13	Function bail blade....	Chipped or broken....	Replace.....	Par. 86.....	-----	Par. 261.

Notes. See figures 115 to 119 inclusive, for schematic diagrams of the teletypewriters.

### 118. Trouble-Analysis Chart K—Teletypewriter Prints but Ribbon Remains Motionless or Does Not Oscillate

Item No.	Items to be inspected or checked	Possible trouble	Corrective action	Reference data		
				Detailed function	Repairs	Adjustments
1	Ribbon spool-shaft and feed-shaft spur gears, and vertical and horizontal feed-shaft bevel-gears.	Gear setscrews loose or missing. Spur gears do not mesh.	Adjust, tighten and replace missing parts.	Par. 81		Par. 196, 197.
2	Vertical feed-shaft collar.	Collar loose	Adjust collar for correct spring compression.	Par. 81		Par. 199.
3	Horizontal feed-shaft detent-spring.	Missing or improper adjustment.	Replace, adjust	Par. 81		Par. 193.
4	Ribbon	No slug near end to operate ribbon-reverse arm.	Replace ribbon			Par. 25.
5	Ribbon-reverse shaft link adjustment.	Improper link position	Adjust	Par. 82		Par. 202.
6	Ribbon feed-pawl spring.	Loose or missing	Replace			Par. 190.
7	Ribbon oscillator-lever spring.	Spring loose or broken	Replace	Par. 83		Par. 207.
8	Ribbon oscillator-lever.	Broken or caught in slot.	Replace, adjust	Par. 83		Par. 337.
9	Ribbon lock-out bar	In locked-out position.	Change position	Par. 83		Par. 338.
10	Ribbon spool	Not seated on spool shaft and pin.	Adjust			Par. 25.

### 119. Trouble-Analysis Chart L—Teletypewriter Prints but Ribbon Does Not Reverse

1	Ribbon reversing eye-lets.	Missing or too near ribbon end.	Replace ribbon			Par. 25.
2	Ribbon feed-shaft detent spring.	Spring adjustment	Adjust	Par. 81		Par. 193.
3	Vertical ribbon-feed shaft collar.	Collar loose	Adjust and tighten	Par. 81		Par. 199.
4	Ribbon-reverse link	Improper angular adjustment.	Adjust and tighten	Par. 82		Par. 202.
5	Ribbon-reverse pawl springs.	Missing or broken	Replace and check tension.	Par. 82		Par. 203.

### 120. Trouble-Analysis Chart M—Teletypewriter Prints but Bell Does not Operate (Letter "S" Prints Correctly)

1	Bell function-lever spring.	Missing or broken	Replace			Par. 301.
2	Sixth vane	Vane binds or connecting links missing or broken.	Adjust, or replace defective parts.	Par. 92		Par. 227.
3	Function-bail blade	Missing or broken	Replace	Par. 86		Par. 261.
4	Bell hammer arm	Arm binds at pivots	Adjust pivots	Par. 98		
5	Bell operating-lever spring.	Missing or broken	Replace	Par. 98		Par. 299.
6	Bell reset-bar spring	Missing or broken	Replace	Par. 98		Par. 300.
7	Bell hammer backstop	Adjustment	Adjust	Par. 98		Par. 298.
8	Signal bell latch bar	Bar worn, or latch adjustment.	Replace, adjust	Par. 98		Par. 291.

### 121. Trouble-Analysis Chart N—Teletypewriter Prints but Letter "S" Does not Print and Signal Bell Operates when Platen Is in Letters Position

1	Sixth vane	Vane is binding. Vane extension out of adjustment or broken.	Adjust	Par. 93		Par. 227.
2	Signal bell function lever.	Broken or chipped at sixth vane.	Replace	Par. 98		
3	Bell latch-bar latch	Missing, bent or broken.	Replace	Par. 98		Par. 291.
4	Bell latch bar	Defective	Replace	Par. 98		Par. 291.

Note. See figures 115 to 119 inclusive, for schematic diagrams of the teletypewriters.

## 122. Trouble-Analysis Chart O—Teletypewriter Prints but Motor Stop Fails To Operate

Item No.	Items to be inspected or checked	Possible trouble	Corrective action	Reference data		
				Detailed function	Repairs	Adjustments
1	Sixth vane.....	Binds or does not operate.	Adjust.....	Par. 92.....		Par. 227.
2	Motor-stop lever bracket.	Bracket loose.....	Adjust.....	Par. 99.....		Par. 240.
3	Motor-stop pawl spring	Missing or broken.....	Replace.....	Par. 99.....		Par. 245.
4	Motor-stop pawl back-stop.	Adjustment.....	Adjust.....	Par. 99.....		Par. 243.
5	Motor-stop pawl back-stop screw.	Binds stop pawls.....	Adjust.....	Par. 99.....		Par. 242.
6	Motor-stop lever eccentric.	Adjustment.....	Adjust.....	Par. 99.....		Par. 241.
7	Motor-stop release lever.	Eccentric adjustment.....	Adjust.....	Par. 99.....		Par. 244.
8	Contact spring.....	Incorrect tension or contact clearance.	Adjust contact clearance or tension.			Par. 247.
9	Motor-stop contacts.....	Contacts fused, shorted internally, or effectively shorted by wiring.	Open motor-stop contacts, locate and clear shorts.	Par. 99.....		Par. 327, 328.
10	Motor-stop function lever spring.	Tension adjust. Spring missing or broken.	Adjust or replace.....			Par. 247.
11	Heavy motor-stop contact springs.	Adjustment.....	Bend to proper clearance.			Par. 327, 328.
12	Function bail blade.....	Chipped or broken.....	Replace.....	Par. 86.....		Par. 261.

## 123. Trouble-Analysis Chart P—Teletypewriter Prints More or Less than 72 Characters per Line, or Margins Are Uneven

1	Left margin adjusting screw.	Screw loose or missing.	Tighten or replace. Adjust in or out until left margin is even.	Par. 89.....		Par. 335.
2	Right margin adjusting screw.	Adjustment or wrong position.	Adjust for 72 characters per line. Adjust for even right margin.	Par. 79.....		Par. 336.
3	Right margin detent spring.	Loose or missing.....	Replace.....	Par. 79.....		Par. 209.
4	Carriage-return spring.	Incorrect spring tension.	Adjust.....	Par. 89.....		Par. 320.
5	Dashpot.....	Vent screw adjustment. Piston binding.	Adjust, lubricate.....	Par. 89.....		Par. 343.
6	Spacing stop lever.....	Binds.....	Lubricate, adjust.....	Par. 79.....		Par. 313, 314.

## 124. Trouble-Analysis Chart Q—Teletypewriter Prints but Margin Bell Fails To Operate on 66th Character

1	Bell hammer spring.....	Missing or broken.....	Replace.....	Par. 80.....		Par. 294.
2	Margin-bell cam.....	Adjustment.....	Adjust.....	Par. 80.....		Par. 340.
3	Margin-bell pawl spring	Missing or broken.....	Replace.....	Par. 80.....		Par. 209.
4	Margin-bell pawl.....	Binding or missing.....	Adjust or replace.....	Par. 80.....		
5	Bell hammer arm shaft.	Binding.....	Adjust.....	Par. 80.....		Par. 293.

## 125. Trouble-Analysis Chart R—Teletypewriter Prints but Emits Grinding Noise

1	Typing unit mounting screws.	Screws loose.....	Tighten.....	Par. 19.....		
2	Main-shaft bearings.....	Bearings broken or burned.	Replace and lubricate.			
3	Motor-mount adjusting screws.	Improper drive gear clearance.	Adjust.....			Par. 331.
4	Transmitting shaft.....	Fiber gear worn or bearings worn.	Replace worn parts.....	Par. 61.....		Par. 349.
5	Transmitter clutch throw-out lever.	Clutch clearance.....	Adjust.....	Par. 61.....		Par. 350.
6	Main-shaft clutch throw-out lever.	Improper clutch clearance.	Adjust.....	Par. 75.....		Par. 218.

Note. See figures 115 to 119 inclusive, for schematic diagrams of the teletypewriters.

## 126. Localization of Electrical Troubles

a. **GENERAL.** Electrical circuits in the teletypewriter are provided with connecting terminals at points where it will be necessary to connect or disconnect circuits or units. Do not disturb the wiring any more than necessary in testing and inspection. The majority of electrical troubles will be found at contacts in switches and jacks or where the insulation on wire or between metal parts has been damaged. The repairman must be familiar with the use of schematic and wiring diagrams and must use them while making point-to-point checks of the teletypewriter circuits until the fault is located. Schematic wiring diagrams of external equipment to which the teletypewriter is connected will furnish information which will be of great assistance to the repairman in setting up circuits for testing and localizing the teletypewriter trouble. Detailed procedure for localizing electrical troubles are furnished in paragraph 128 for the power circuit and in paragraphs 129, 130, and 131 for the signal circuits.

b. **TESTING PROCEDURE.** The actual procedure for locating electrical troubles will vary, depending on whether the work is being done by lower echelons using Test Unit I-236 or by higher echelons where more accurate testing equipment may be available. The basic principles remain the same for any given trouble but certain troubles such as part of a resistor shorted out or small variations in voltage cannot be accurately tested with Test Unit I-236. All of the more common troubles can be located with this test unit and the information in paragraph 127 and following paragraphs is arranged to start with the use of Test Unit I-236 and then give additional information for use by higher echelons involved in major overhauls of the equipment. When available, a milliammeter or a voltohmmeter may be used to indicate the location of electrical trouble.

c. **TESTING CAPACITORS.** Three possible trouble conditions that may occur in capacitors in the power and signal circuits are opens, shorts, and leakage (leakage is flow of current through a partially shorted capacitor). Detailed instructions for the use of Test Unit I-236 for testing capacitors are furnished in TM 11-2056. Two alternate testing methods are the spark test described in (1), (2), and (3) below, and the ohmmeter method described in (4) below.

**Caution:** Be extremely careful to avoid personal injury from shock when handling charged capacitors or leads connected to power supplies that are in operation.

(1) When Test Unit I-236 is not available, capacitors may be tested by the *spark test*. In the spark test the capacitor is charged and then discharged by shorting the capacitor terminals with a screw driver and observing any spark that occurs or by connecting the terminals of the capacitor to a telephone headset or test receiver and listening for any click that occurs. Instructions for making the spark test are given in (2) and (3) below:

(2) For capacitors with a value of 0.1 mf or greater, disconnect the capacitor leads from the equipment and connect to a d-c power source of 90 volts or higher by means of suitable insulated test leads. After the capacitor has been connected to the d-c power source for a few moments, remove one of the test clips from the power supply; **ALSO, REMOVE THE OTHER END OF THE SAME TEST LEAD FROM THE CAPACITOR** before turning off the power supply to prevent shorting the capacitor either through the bleeder resistor in the power supply or by accidentally shorting the leads. After giving the capacitor a charge, wait for 1 to 1½ minutes and then short-circuit the capacitor terminals with a screw driver. A spark should be seen if the capacitor is in good condition. If the capacitor is open, or partially or completely shorted, no spark will be seen.

(3) For capacitors with a value less than 0.1 mf, disconnect the capacitor leads from the equipment and charge as in (2) above. Wait 30 to 40 seconds after disconnecting the capacitor from the charging power supply and then connect the tips of a telephone headset or a test receiver across the terminals of the capacitor. A click should be heard in the receiver if the capacitor is in good condition. If the capacitor is open, or partially or completely shorted, no click will be heard. Be careful not to touch the bare metal on the tips of the headset cord when making this test.

(4) The *ohmmeter method* generally may be used to test capacitors having a value of 0.01 mf or more. When a good capacitor of sufficient size is connected to an ohmmeter, the needle will kick up-scale and then show open circuit. If the needle does not kick, the capacitor is open. A shorted capacitor gives a steady meter

reading somewhere between zero and infinity, depending upon the resistance of the short.

**d. TESTING RESISTORS AND CHECKING CIRCUIT CONTINUITY.** Resistors may be tested and circuit continuity may be checked with Test Unit I-236 (par. 127) or with an ohmmeter. Before measuring resistance or making continuity tests with any instrument that furnishes its own testing battery, completely disconnect the teletypewriter from external power and signal circuits, since false measurements may result and there is danger of damaging the measuring instrument. In most cases, resistances may be measured and circuit continuity checked without disconnecting any of the circuit elements. However, parts of circuits that are connected in parallel must be isolated before accurate tests or checks may be made. Connect individual circuits to the proper power supply for making point-to-point voltage checks and current flow tests. **DO NOT ATTEMPT TO MEASURE RESISTANCE WITH AN OHMMETER WHILE CURRENT FROM THE POWER SUPPLY IS FLOWING IN THE CIRCUITS.**

**e. CIRCUIT FOR TESTING.** Localizing electrical troubles in the signal circuit requires some means of providing a normal 60-milliampere current in the closed circuit (consisting of the send and receiving circuits connected in series). A test made using this arrangement is called operating in a *local* or *dummy circuit*, thus distinguishing it from a regular connection to a second teletypewriter. Inspections made after a major overhaul may be completed in a local circuit by using either a second teletypewriter as a standard for comparison, or by using special test equipment as described in paragraphs 129 and 104.

## 127. Use of Test Unit I-236 for Localizing Electrical Trouble

**a. GENERAL.** Test Unit I-236 furnished as part of Tool Equipment TE-50 is described in detail in TM 11-2056. Its uses in locating electrical troubles in the signal and power circuits are described in this paragraph as compared with the voltmeters and ohmmeters which will be used by higher echelons. Test Unit I-236 is particularly designed as a lightweight durable test set for use by lower echelons. It is used to test continuity and voltages in place of the separate more delicately con-

structed instruments normally used in higher echelons for major overhauls of teletypewriter equipment. To avoid duplicating information, the detailed discussions on localizing various electrical troubles are written to describe the use of the different test sets while *b* and *c* below explain how Test Unit I-236 is used by lower echelons in localizing electrical trouble.

**b. VOLTAGE CHECKING.** In localizing power troubles (par. 128), Test Unit I-236 is used in place of the a-c voltmeter in making on-line voltage checks of the various parts of the power circuit. The test leads of Test Set I-236 should be placed on the same terminals as required in checking with a voltmeter. The switches on Test Unit I-236 should be as follows: SW1 should be in the INT. V. position, and SW2 should be in the NEON & MAZDA position. For tests that indicate no voltage or low voltage, neither light will light. Voltages less than normal-line voltage can be compared by observing the change in brightness of the Mazda light on the line voltage and then on the voltage being tested.

**c. CHECKING CONTINUITY.** The continuity tests used in localizing electrical trouble in the signal circuits (par. 129), can be made with Test Unit I-236 in place of the ohmmeter as follows: Place SW1 on EXT. V., and SW2 on NEON, and place the power plug of the Test Unit I-236 in a 115 volt a-c or d-c power source. Place the test leads on the same terminals as required in the ohmmeter tests. Open circuits are indicated by the neon light not lighting. Shorts or high resistance between the leads are indicated by the neon light lighting. If the voltage used is 115 volts dc and SW2 is placed on NEON & MAZDA, resistances of greater than 200 ohms will cause the neon bulb not to light.

## 128. Localization of Electrical Power Trouble

Power troubles may show up in various ways. If the teletypewriter motor does not run or cannot be brought up to proper speed, the trouble may be either external or within the teletypewriter. The following step-by-step procedure is used to locate the trouble.

**a. TESTING LINE VOLTAGE.** Using Test Unit I-236 or an a-c voltmeter if the power supply is ac, or a d-c voltmeter if the power is dc, check the line voltage. If the line voltage is between 110 and 125 volts, with the teletype-

writer connected and the motor switch on, the trouble is within the teletypewriter.

b. **TESTING TELETYPEWRITER POWER CORD AND PLUG.** The trouble may be within the teletypewriter power wiring, or in the connection between the cord and the power outlet. Leave the power cord connector in the power outlet. With the teletypewriter cover removed, measure the voltage across terminals 21 and 33. (See schematic wiring diagram, fig. 115.) If the voltage is noticeably less than the voltage at the power outlet, the trouble is between the machine and the power source. If the trouble cannot be found in the cord connector or in the connection between the connector and the power outlet, then there is an open in the cord.

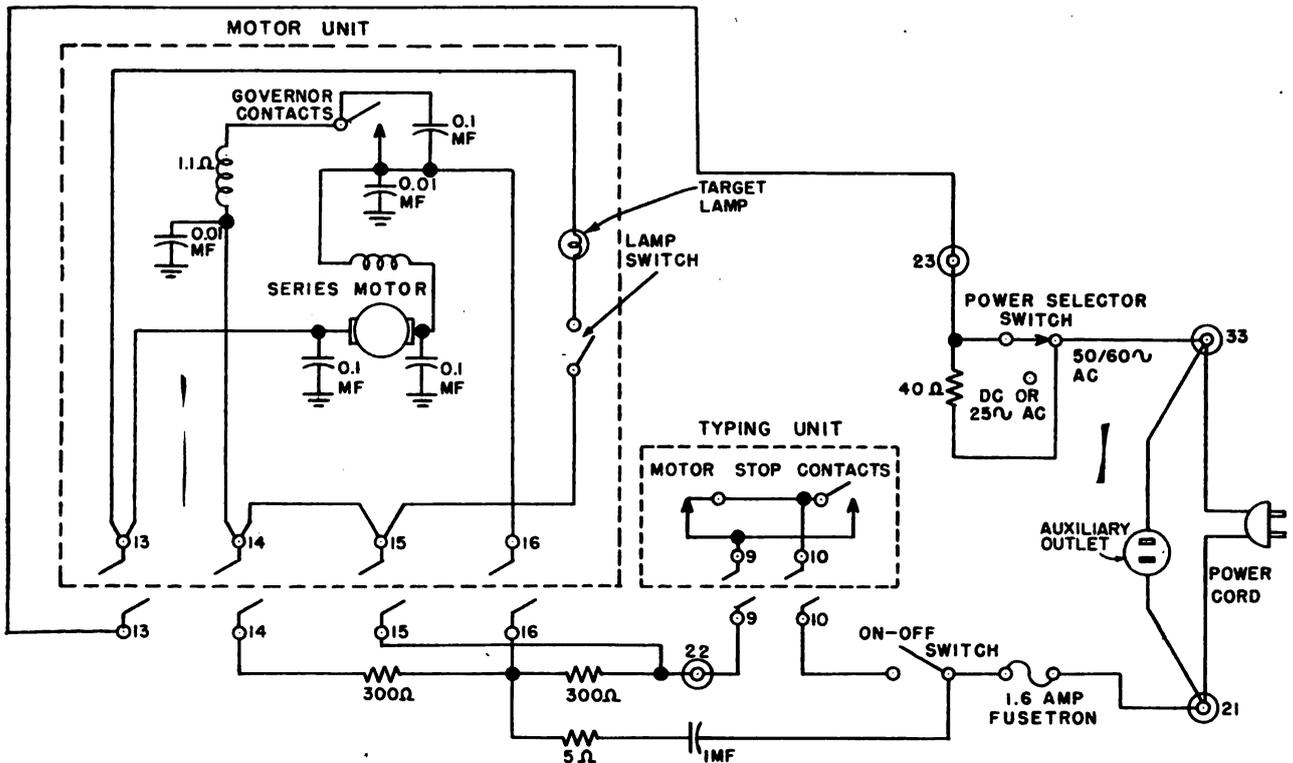
c. **TESTING LINE VOLTAGE-DROPPING RESISTORS AND POWER SELECTOR SWITCH.** When the power selector switch is in the 60-cycle position, the line voltage-dropping resistors are shorted out of the circuit. When the switch is in the d-c and 25-cycle a-c position, the maximum resistance is in series with the motor circuit. The voltage to the motor is the line voltage less the voltage drop across the series resistors,

and should never be less than 80 volts. When the switch is in the 50/60-cycle position, the voltage to the motor should be almost the same as the line voltage. To check the continuity of the line resistors, measure the voltage across terminals 21 and 23. (See fig. 115.) If the voltage measured is zero, there is an open in the resistor leads or the power selector switch leads.

d. **CHECKING MOTOR STOP CONTACTS IN TYPING UNIT.** Remove the typing unit and check the continuity of the motor stop circuit by measuring with an ohmmeter the resistance between contacts 9 and 10 of the typing unit. The resistance should be less than 1 ohm. Short contacts 9 and 10 of the base unit. If the motor runs, the trouble is in the contact adjustment between the typing unit and the base.

e. **CHECKING MOTOR FUSE.** Short terminals 9 and 10 of the base unit, turn the ON-OFF switch to ON, and momentarily short the fuse socket terminals. If the motor runs, replace the fuse.

f. **TESTING FOR VOLTAGE AT MOTOR TERMINALS.** Short terminals 9 and 10 of base unit,

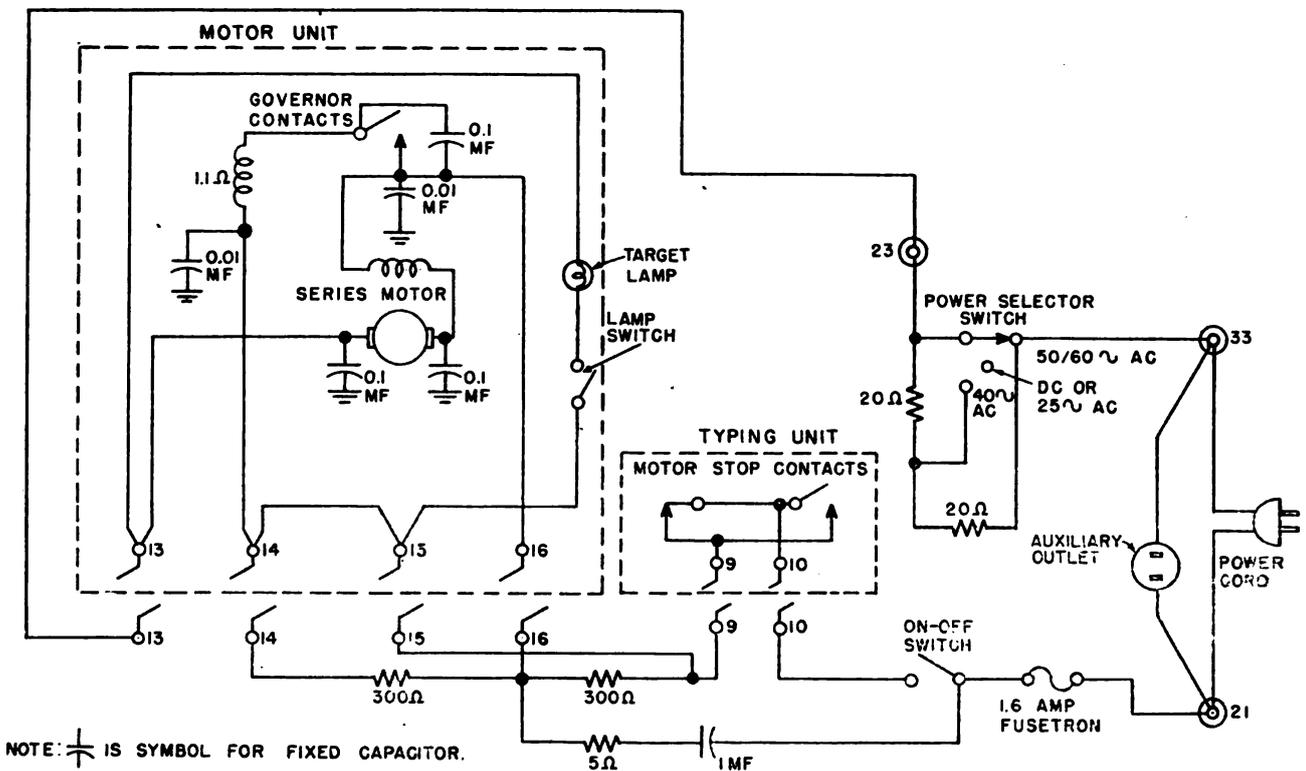


NOTE:  $\text{⦿}$  IS SYMBOL FOR FIXED CAPACITOR

$\text{⦿}$  TERMINALS ON BASE TERMINAL BLOCKS

TL53724S

Figure 115. Schematic wiring of Printer TG-7-A power circuit.



⊙ TERMINALS ON BASE TERMINAL BLOCKS

TL53723S

Figure 116. Schematic wiring of Teletypewriter TG-7-B and TG-37-B power circuit.

remove keyboard, and test for voltage across terminals 13 and 15 of base unit. If base unit wiring is not defective, the voltage should be at least 80 volts. If the line voltage is 50/60-cycle ac, and the power control switch is set on 50/60-cycle position, the voltage should be only one or two volts less than the line voltage. Check the voltage across terminals 13 and 15 of the motor. If the voltage is less than that measured in the base above, then the contacts are defective. If the proper voltage exists on the above motor terminals, the motor is faulty.

**g. TESTING FOR OPEN GOVERNOR CONTACTS.** If there is a voltage between terminals 13 and 15 of the motor, short the governor brush springs. If the motor speeds up, check the brush spring tension. The trouble will probably be in dirty or burned governor contacts or a broken governor spring.

**h. TESTING FOR OPENS IN WIRING WITHIN BASE UNIT.** If no voltage can be measured between terminals 13 and 15 of the base unit, the trouble can be localized by placing one voltmeter lead on terminal 21 and the other lead on each of the following terminals in turn: terminals of fuse, ON-OFF power switch terminals, terminals 10, 9 (short terminals 9 and

10 when making tests with typing unit removed), 22 (on Printer TG-7-A only), 14, 13, 23, and 33. Faults occur between the terminal where there is the first indication of voltage, and the preceding terminal. It is necessary to follow the appropriate wiring diagram closely when locating trouble in the above manner.

**i. LOCATION OF CROSSES.** Crosses between the motor circuit and either send or receive circuits, or both, may be the result of damaged insulation on adjacent leads and the bare copper wire making contact, or the terminals of a part in one circuit making contact with the terminals of a part or a lead with damaged insulation in the other circuit. Test for crosses as follows:

(1) Disconnect the teletypewriter from all external power and signal circuits.

(2) Connect one lead of Test Unit I-236 or an ohmmeter to one terminal of the power plug.

(3) Touch the other lead of Test Unit I-236 (or ohmmeter, whichever is used) to the tip and sleeve of the send (black) plug and the tip and sleeve of the receive (red) plug.

(4) Connect the lead of the Test Unit I-236 to the other terminal of the power plug and repeat the process.

(a) Any indication of a closed circuit signifies a cross.

(b) The position of the test leads that gives the greatest indication, usually, shows which sides of the circuits are crossed.

(5) Check these portions of the circuits carefully to locate the exact point of the cross.

*j. LOCATIONS OF GROUNDS.* Grounds in the motor circuit may be the result of insulation being worn off leads and the bare copper wire making contact with the frame of the equipment, defective capacitors, and terminals of capacitors, resistors, or other parts touching the frame of the equipment. Test for grounds as follows:

(1) Disconnect the teletypewriter from all external power and signal circuits.

(2) Connect one lead of Test Unit I-236 or an ohmmeter to the frame of the equipment.

(3) Touch the other lead to the terminals of the power plug.

(a) Any continuous indication signifies a ground on the motor circuit. (Disregard the few minor flashes of the neon lamp on Test Unit I-236 or the slight kick of the needle on the ohmmeter when the test leads are first connected to the equipment, since this is due to initial charging of capacitors in the circuit.)

(b) The terminal that gives the greatest indication, usually, shows which side of the power circuit is grounded.

(4) See TM 11-2056 and paragraph 127 for instruction on the use of Test Unit I-236, also to paragraph 126 for methods of testing capacitors, resistors, and circuit continuity.

## 129. Isolation of Trouble in Send or Receive Circuits

*a. GENERAL.* The actual connections used to arrange the send and receive circuits for testing will vary depending upon the equipment with which the teletypewriter is being operated. When no associated equipment is available to provide a 60-milliampere test circuit, a dummy circuit may be set up as described in *b* to *e* below.

*b. USE OF BATTERY, RESISTOR, AND MILLIAMMETER TO SET UP A TEST CIRCUIT.* Because of the resistance of the wiring and the selector magnets, a battery supply of at least 12 volts must be used. It is preferable to use a higher voltage and external protective resistance so that shorting out any part of the signal circuit

will not cause excessive current to damage the milliammeter. The test circuit must consist of the following circuit elements connected in series: the send and receive circuits, a d-c power source not to exceed 125 volts, a milliammeter, and a variable resistor whose resistance is sufficient to limit the current to 60 milliamperes (ma).

*Caution:* When shorting any part of the series circuit, make sure that sufficient resistance is left in the circuit to avoid damaging the milliammeter. For example, using 110-volt power source, there must always be 1,833 ohms in the series circuit to limit the current to 60 ma. or there must be  $16\frac{2}{3}$  ohms for every volt of power source voltage.

*c. SETTING UP DUMMY TEST CIRCUIT.* Figure 117 shows a dummy test circuit which may be used to localize electrical trouble when other teletypewriter equipment is not available.

*d. SETTING UP TEST CIRCUIT WITH LINE UNIT BE-77-( ).* The following steps are used in connecting the line unit as a dummy circuit.

(1) Connect power plug of Line Unit BE-77-( ) to a d-c power source such as Rectifier RA-87 (115 volts dc).

(2) Connect the send and receive plugs of the teletypewriter to the send and receive jacks of the line unit.

(3) Turn line rheostat of line unit to IN.

(4) Place relay switch of line unit to RE-LAY OUT OF CIRCUIT.

(5) Place power control switch of line unit to LOCAL.

(6) Adjust line rheostat until line unit meter reads 60 ma with the meter key in the MA position.

*Note.* Step (4) above connects the send and receive plugs in series when they are inserted into the line unit jacks. These line unit jacks are of the closed circuit type; therefore, removal of either plug leaves the remaining plug in a closed circuit.

*e. SETTING UP TEST CIRCUIT WITH SWITCHBOARD BD-100.* Following is one of the methods which can be used in connecting Switchboard BD-100 as a dummy circuit. The send and receive plugs are not inserted directly into the OPERATOR'S PRINTER jacks because the internal circuits of Switchboard BD-100 do not provide the series circuit furnishing 60 milliamperes required for the test. Instead, the send and receive plugs of the teletypewriter are wired in series and connected to a pair of line

terminals. This set-up permits the line current in the series circuit to be adjusted to 60 milliamperes as indicated by the meter on Switchboard BD-100.

(1) Fasten the shells of the teletypewriter send and receive plugs together with friction tape so that the tip and sleeve of each plug is exposed but held apart.

(2) Short the sleeves of both plugs together by wrapping 3 or 4 turns of cleaned bare copper wire around both plug sleeves. Twist the ends tight to hold the wire in place.

(7) Press the LINE CURRENT key corresponding to the line connected.

(8) Adjust the line current to 60 ma by adjusting the corresponding line rheostat.

### 130. Circuit Continuity Tests

a. When the test circuit is connected, current should flow, indicating that the send and receive circuits of the teletypewriter are closed. If no current flows, then an open must be present in either the send or receive circuit. To test the continuity of the receive circuit, short the

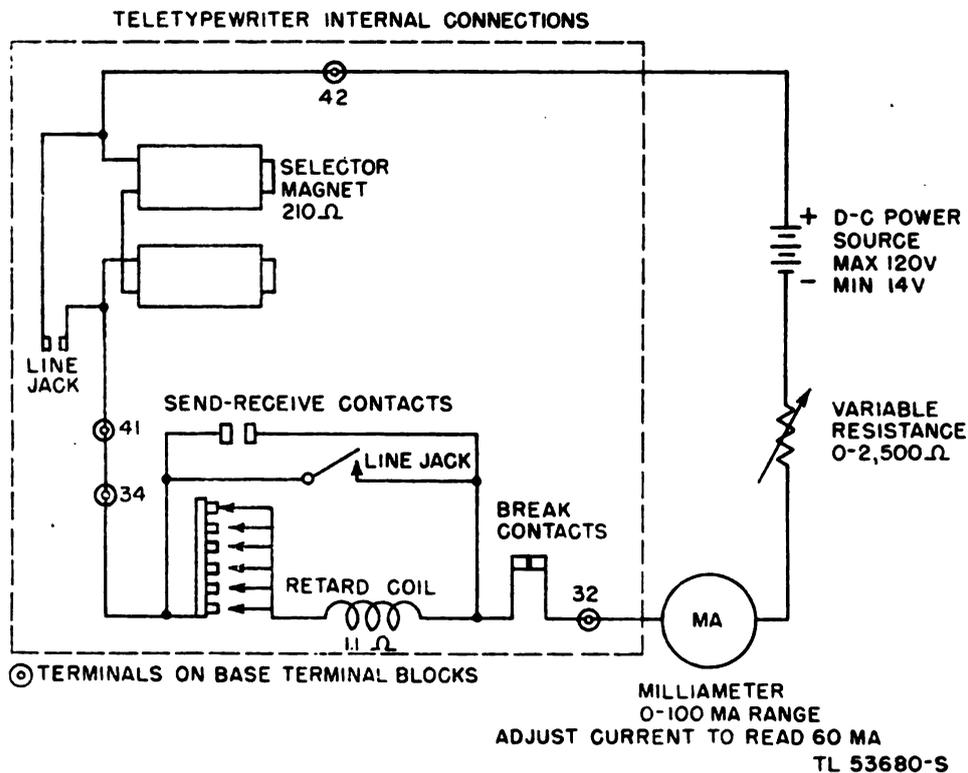


Figure 117. Schematic diagram of teletypewriter dummy circuit.

(3) Connect the plug tips to a vacant pair of line terminals of Switchboard BD-100 by a piece of 2-conductor insulated wire having test clips on one end. Snap one test clip on the tip of the red cord and the other clip on the tip of the black cord. Be sure the clips do not short the tip and sleeve of the plugs.

(4) Turn the line rheostat of the corresponding line to the IN position.

(5) Place the line current supply switch to LINE CURRENT SUPPLIED BY SWITCHBOARD position.

(6) Place the meter key to LINE CURRENT.

send plug, and to test the send circuit, short the receive plug (par. 129b). See paragraphs 131 and 132 for information on locating opens in the send and receive circuits.

b. When the circuit is closed, send RY's and test sentences with the keyboard to check the operation of the teletypewriter as a unit. If the teletypewriter operates without error, then the teletypewriter is trouble free. If the send circuit is shorted internally, the teletypewriter will run closed but will not transmit. If the receive circuit is shorted, the teletypewriter will run open. Results of these tests will definitely indicate whether the trouble is the send or receive circuit.

### 131. Localization of Trouble in Send Circuit

**a. GENERAL.** Trouble within the send circuit can be localized by the use of Test Unit I-236, an ohmmeter, or a voltmeter and battery in series. The send circuit consists of the black send plug and cord, break contacts, keyboard slip contacts and sending contacts in series, and the lockout contacts and base slip contacts in parallel with the circuit.

**b. LOCATION OF OPENS.** With the typing unit removed, attach test leads to the black send plug and short various parts of the send circuit in which the open might occur. When shorting some part of the circuit results in a low resistance indication in the test set, the open is within the part of the circuit shorted. Following are tests which will localize trouble to the most probable causes.

(3) *SEND-REC-BREAK key.* Short the break key. If the resistance reading is unaffected, the break key is operating properly.

(4) *Base wiring.* If the above tests fail to locate the trouble, place one end of the shorting wire on the sleeve of the black plug, and the other end on the following terminals in turn: terminal 32, break contacts; contact 54, keyboard contacts (with keyboard in place); contact 55, terminal 34, and the tip of the plug. The trouble will be found between the point where the test set indicates a short and the point where the test set indicates open.

**c. LOCATION OF SHORTS.** (1) *General.* Short circuits may be located in a similar manner as in locating open circuits in *b* above, except the circuit is opened at the various points of test. The test set is connected across the tip and

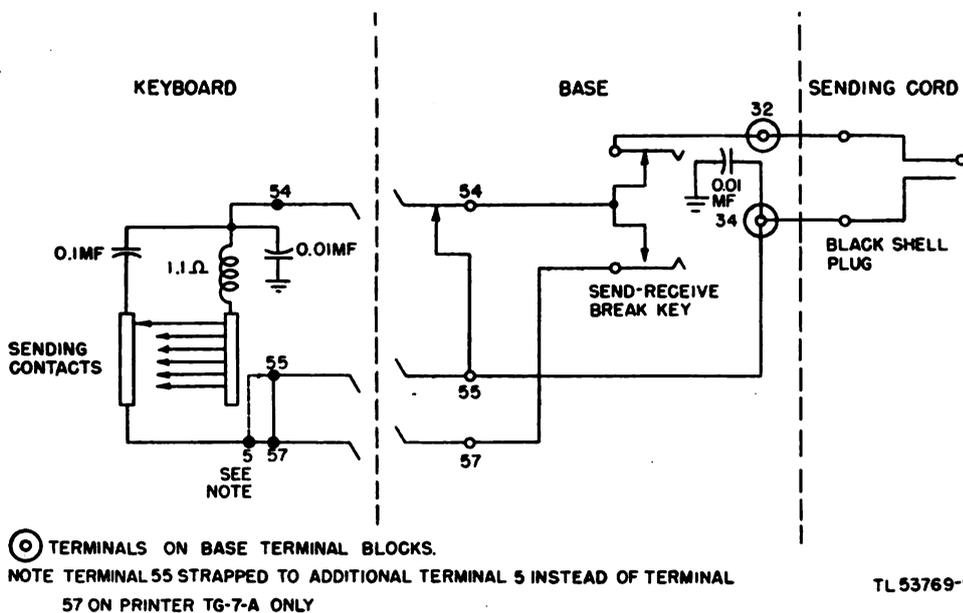


Figure 118. Schematic diagram of send circuit.

(1) *Plug or Cord Circuits.* Short terminals 32 and 34. (See fig. 118.) If test set does not indicate a short, the plug or cord circuit is open.

(2) *Keyboard.* Remove keyboard. The slip contacts in the base are normally open but the contacts close when the keyboard unit is removed. If meter indicates a closed circuit, trouble is in the keyboard. Replace keyboard and short the sending contacts and the retardation coil. The part of the circuit that was effectively removed by the short, and which makes the rest of the circuit continuous when shorted, is open.

sleeve of the send plug for all tests. The short will be found between the point in the circuit which, when clear, opens the send circuit, and the next point where breaking the circuit does not open the send circuit.

(2) *Base wiring.* To determine whether or not the trouble is in the base wiring, remove the typing unit and keyboard and open the keyboard slip contacts in the base. If this action removes the short, the trouble is not in the base wiring. If the short persists, make a point-to-point check by opening the circuit at the following points in turn: terminal 32, break contacts, transmitter lockout contacts, contacts 54

and 55, terminal 34, and send plug. The short can be found by following the procedure given in (1) above.

(3) *Keyboard*. Remove keyboard. Shorts within the keyboard can be checked by placing the test leads across terminals 54 and 57 and measuring the resistance as the transmitter contacts are opened.

d. **LOCATION OF CROSSES**. See paragraph 128*i* for the discussion of crosses between the motor, send, and receive circuits.

e. **LOCATION OF GROUNDS**. Grounds in the send circuits may be the result of the same conditions described under the discussion of the motor circuit in paragraph 128*j*. Except for the following change, perform the same test to locate grounds in the send circuit: touch the lead of Test Unit I-236 (or the ohmmeter, whichever is used) to the tip and sleeve of the send plug instead of to the terminals of the power plug. All other conditions discussed in paragraph 128*j* apply to the send circuit.

### 132. Localization of Trouble in Receive Circuit

a. **GENERAL**. Trouble within the receive circuit can be localized by the use of Test Unit I-236 or an ohmmeter. The receive circuit consists of the red receive plug and cord, the selector magnets, and wiring in parallel with the circuit.

b. **LOCATION OF OPENS**. With Test Unit I-236 or an ohmmeter, test for continuity of the receive circuit. (See fig. 119.) Connect the test equipment to the tip and sleeve of the red (receive) plug. If there is an indication of an open, the following tests should be made.

(1) *Typing unit*. Remove the typing unit and with Test Unit I-236 or an ohmmeter check the resistance between contacts 11 and 12 of the typing unit. The resistance should be about 210 ohms. Testing across the coils of selector magnet in series, the resistance should be about 210 ohms. The resistance of each coil when tested alone should be about 105 ohms. Test Unit I-236 will not measure resistance but it will indicate whether the resistance of the two coils are approximately equal. If the magnet circuit is clear, the open is in the base wiring.

(2) *Base wiring*. If the above tests fail to locate the open, then the open is in the receive cord or in the base wiring. The following tests will locate the open quickly and accurately. Connect the leads of Test Unit I-236 or an

ohmmeter to the tip and sleeve of the red (receive) plug. Connect a 4-foot length of insulated wire to the sleeve of the red plug, and with the other end of the wire short out various parts of the receive circuit by touching in successive order the following terminals and contacts: terminals 41, 61, 46 (on Printer TG-7-A only), 11, 12, 45 (on Printer TG-7-A only), 66, 42, and the red plug tip. The open will be between the first contact which shorts the receive plug when touched, and the preceding contact.

c. **LOCATION OF SHORTS**. Shorts in the receive circuit will prevent the full line current from reaching the selector magnets. Shorts may occur between two wires or between wires and metal parts. A short in the wiring will be indicated on the test set. Inspect the teletypewriter for shorts in the following sequence:

(1) *Base wiring*. Remove the typing unit and open the line jack and measure the resistance between the tip and sleeve of the red receive plug. If the meter indicates a short within the wiring, open the wiring at each of the following terminals in turn and measure the resistance at the tip and sleeve of the red plug; terminals 41, 61, 46 (on Printer TG-7-A only), 11, 12, 45 (on Printer TG-7-A only), 66, 42, and the plug terminals. The short is between the first terminal opened which does not remove the short indication of the meter, and the preceding terminal tested. See the schematic diagram for the teletypewriter being tested when tracing shorts.

(2) *Typing unit*. Remove the typing unit and test the resistance between contacts 11 and 12. The resistance should be about 210 ohms. A low-resistance reading indicates a short. Remove one of the leads at either of the selector magnets and measure the resistance of the two magnets in series. If the resistance is about 210 ohms, the short is not in the selector magnets but in wiring between the magnets and contacts 11 and 12 of the typing unit. Check the resistance between contact 11 (or 12) and the frame of the typing unit. The wiring is grounded if a short is indicated on the test set.

*Note*. The above tests are for locating trouble in teletypewriters which do not have the relay mounting block wired into the receive circuit.

d. **LOCATION OF CROSSES**. See paragraph 128*i* for the discussion of crosses between the motor, send, and receive circuits.

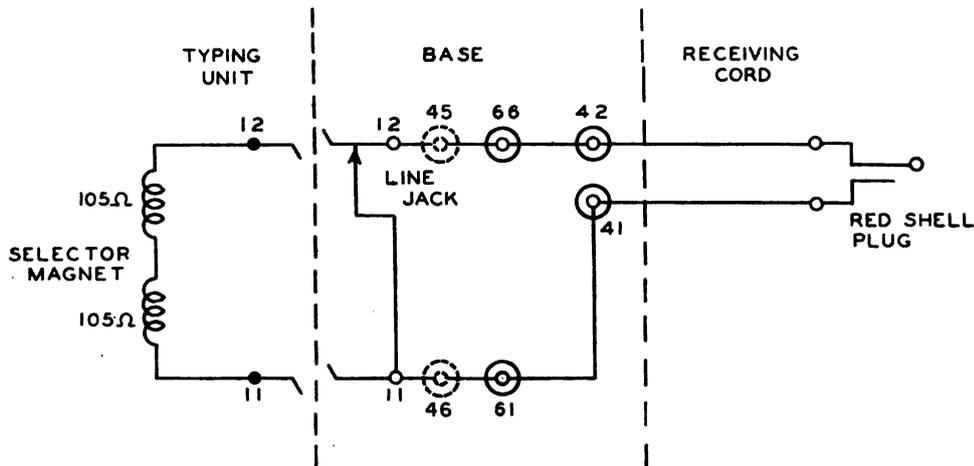
e. **LOCATION OF GROUNDS**. Grounds in the receive circuit may be the result of the same con-

ditions described under the discussion of the motor circuit in paragraph 128j. Except for the following change, perform the same test to locate grounds in the receive circuit: touch the lead of Test Unit I-236 (or the ohmmeter, whichever is used) to the tip and sleeve of the receive (red) plug instead of to the terminals of the power plug. All other conditions discussed in paragraph 128j apply to the receive circuit.

quicker when only one adjustment is faulty and the remainder of the mechanism is in good condition. In such cases only the related adjustments need to be checked.

**Caution:** In some cases evidences of faulty operation may be apparent only when the mechanism is power-driven.

b. Additional aid in locating mechanical troubles may be secured from records of previous troubles and adjustments.



- ⊙ TERMINALS ON BASE TERMINAL BLOCKS
- ⊕ ADDITIONAL TERMINALS USED ON PRINTER TG-7-A ONLY.

TL 53770-S

Figure 119. Schematic diagram of receive circuit.

### 133. Introduction to Localization of Mechanical Troubles

a. When a mechanical function has been observed either to fail to operate or to operate in a faulty manner, it is necessary to localize or isolate the trouble in a particular adjustment or series of adjustments. The experience of the repairman and the over-all condition of the equipment will indicate which of the following two methods is the better approach to various troubles.

(1) One method involves checking the individual requirement for *all* adjustments in the subassembly or mechanism. Use the related data found in the detailed requirements and adjustment procedures, section XIV, to determine the sequence to be followed.

(2) A second method involves setting up by hand the vanes or selecting mechanism and completing the operation by manually rotating the motor, shaft, gear, or cam that normally drives the assembly. This method is usually

c. The procedure for localizing mechanical trouble is divided into the effects of the trouble as follows:

- (1) Teletypewriter does not start.
- (2) Typing unit runs open.
- (3) Transmitter runs open.
- (4) Teletypewriter scrambles letters and functions.
- (5) Certain functions do not operate correctly.

### 134. Locating Trouble when Teletypewriter Does not Start

The following conditions should locate trouble if the teletypewriter will not start.

a. **ELECTRICAL TROUBLE.** See paragraph 128 for electrical power troubles. Electrical trouble in the motor circuit may be due to mechanical adjustments of contacts, and the tests for electrical trouble will accurately locate these troubles.

b. **EXCESSIVE MOTOR OR MAIN-SHAFT TORQUE.**

With the teletypewriter cover removed, turn the motor by hand in the direction of normal operation. If the motor cannot be easily turned by hand, make the following tests to locate the cause of the binding.

*c.* **BINDING AT MAIN-SHAFT DRIVE GEAR.** Remove screws that hold typing unit to the base. Turn the motor by hand again. If the motor turns easily, the motor pinion is binding on the main-shaft gear.

*d.* **MOTOR BEARINGS BIND.** Remove the typing unit, and turn the motor by hand. If the motor does not turn easily, the motor bearings are probably burned.

*e.* **MAIN SHAFT BINDS.** With the typing unit removed, turn the main shaft by hand. If the main shaft will not turn or if it turns with great effort, perform the following:

(1) Hold the selector armature to the mark position and turn the shaft, if possible, until the selector sleeve and bail cam do not move when the shaft is turned. If the main shaft still binds, the trouble is within the main shaft.

(2) Remove the main shaft and check the main-shaft bearings and the various friction clutches for excessive friction or binding.

*f.* **TRANSMITTER SHAFT BINDS.** (1) Check gear clearance of transmitter shaft drive gear when typing unit and keyboard are fastened in the base unit.

(2) Check binding of the transmitter shaft bearings.

### 135. Locating Trouble when Typing Unit Runs Open

Examine for the following situations if the typing unit runs open:

*a.* **ELECTRICAL TROUBLE.** With the teletypewriter cover removed, press the selector armature to the mark position. If the armature does not bind and the teletypewriter runs closed, the trouble is electrical. If the teletypewriter does not run closed with the armature in the mark position, the trouble is mechanical and within the typing unit.

*b.* **SELECTOR TRIP-OFF MECHANISM.** (1) Examine the selector sleeve when the selector armature is in the mark position. If the selector sleeve rotates under these conditions, the trouble is in the selector trip-off mechanism.

(2) Loosen the trip-off eccentric screw and turn the screw until the screw head does not touch the trip-latch plunger. If the selector cam

sleeve does not stop rotating, the trouble may be in the stop lever.

(3) Remove the typing unit, and turn the main shaft by hand while holding the stop lever from rotating. If the selector cam sleeve is stopped after one revolution, the trouble may be in the trip latch or in the trip-latch spring, or in a worn-stop lever.

*c.* **MAIN-SHAFT CLUTCH THROW-OUT LEVER.** If the selector sleeve does not rotate when the selector armature is in the mark position, but the bail cam continues to rotate, the trouble is in the clutch throw-out lever.

(1) With the typing unit removed and the selector armature held in the mark position, rotate the main shaft slowly and examine the throw-out clutch lever.

(2) If the clutch throw-out lever does not engage the clutch throw-out cam, check for a missing spring or a broken or missing clutch throw-out lever.

(3) If the clutch throw-out lever does engage the cam, check the clearance between the clutch jaws.

### 136. Locating Trouble when Transmitter Runs Open

If the transmitter runs open make the following checks on the transmitter clutch throw-out lever:

*a.* See if clutch throw-out lever engages the throw-out cam. Clutch throw-out lever spring may be missing or the clutch throw-out lever may be binding.

*b.* Adjustment of the clutch throw-out lever eccentric.

*c.* Adjustment of repeat space rod.

### 137. Teletypewriter Scrambles Letters and Functions

*a.* There are several possible sources of trouble external to the teletypewriter when it scrambles letters and functions. Such trouble may be due to the external line characteristics, improper line current, or external relays which cause a biased signal to be received even when the signal is sent with the teletypewriter keyboard. To eliminate line troubles, set up a dummy signal circuit as explained in paragraph 129.

*b.* If a second teletypewriter in good working condition is available, the trouble can be localized to a given unit by replacing the major

units of the defective teletypewriter with units from the equipment that is working properly. The following procedure can be used to locate trouble in a teletypewriter where replacement of units is not practicable.

**138. Testing Teletypewriter with Test Circuit**  
Adaptations of test circuits will vary with the experience of repair personnel. The sequence of testing given below is recommended for general use by all personnel involved in the repair of teletypewriters.

*a.* Set up a test circuit as explained in paragraph 129.

*b.* Type test sentences to see if errors still occur.

*c.* With the cover removed, check the code position of the vanes for each letter or operation. See figure 23 for the teletypewriter code. The first five vanes (counting from the top down) set up the code and the front edges of the vanes are tilted down for a mark signal and up for a space signal. The front edge of the sixth (bottom) vane tilts down when the platen is in the letters printing position and up for the figures printing position. The platen should move up or down to correspond with the desired function.

*d.* Use the RY combination to get complete reversal of the five selectors and vanes. Any vane that is sticking can be readily detected.

*e.* With the motor switch turned to OFF, operate the R and Y keys and slowly turn the motor in its normal direction of operation. Watch the operation of the selector unit and the selector armature. Poor transmitter contacts or contact adjustment may cause one or more of the transmitter contacts to space instead of mark.

*f.* With the typing unit removed, hold the vanes in the proper code positions for letters that will not print correctly and turn the main shaft by hand. If the letter is not operated, check the code bars to see if they are sticking or determine if the bell cranks require adjusting.

*g.* If no results are obtained from the test described in *a* through *f* above, the trouble is probably in the adjustment of the selector unit. After checking the tension of the selector armature spring, make a complete adjustment of the selector unit according to the requirements given in section XIV. Trouble in the selector

unit will be evident only if the teletypewriter is power-driven.

### **139. Locating Trouble when Certain Functions Do not Operate Correctly**

If the teletypewriter operates correctly with the exception of one or two functions or letters, the trouble is usually in the adjustments and parts common to the operation of only these functions or letters. In such cases, trouble is seldom found in the selecting mechanism, the vanes, or the code bars. The trouble can be quickly located by the following action.

*a.* With the typing unit removed, set the vanes by hand to the code of the function or letter, and the platen in the proper position, making sure that the sixth vane is also in the proper position. Turn the main shaft until the function bail and printing bails have been operated.

*b.* Watch the operation of the function lever or the code bars concerned. If the function lever operates but the function is not completed, examine the function bail as the main shaft is turned again. The trouble can be found by progressively following the action of the levers from the function lever to the final action of the function.

## **Section XIII. REPAIRS AND REPLACEMENTS**

### **140. General Repair Information**

*a.* This section describes the repairing and replacing of defective teletypewriter parts and does not duplicate information on preventive maintenance procedure furnished in part three. The repair instructions furnished are not intended as a complete shop guide listing every possible work operation that might be involved in large scale dismantling and repairing of salvaged teletypewriters. The procedures included are intended to prescribe the operations involved in replacing and repairing those parts, assemblies, and units subject to the greatest amount of wear.

*b.* Because of variations in service needs and in the repair and supply facilities available, definite rules cannot always be given specifying exactly which parts, assemblies, or units should be repaired and which should be replaced. As only a limited number of the many small teletypewriter parts can be satisfactorily repaired, the repair instructions consist primarily of de-

tailed disassembly, cleaning, replacement, re-assembly, adjustment, and lubrication procedures to be followed in overhauling a complete teletypewriter or repairing a single unit or assembly. Actual repair instructions are included for those parts and assemblies which can be satisfactorily repaired under average conditions.

c. Except in cases of extreme emergency, all repairs to teletypewriters should be completed by personnel thoroughly trained in teletypewriter maintenance. **IT IS AS IMPORTANT TO KNOW WHAT NOT TO DO AS WELL AS WHAT TO DO, WHEN MAKING TELETYPEWRITER REPAIRS.** Equipment operating with minor faults may fail completely as a result of efforts by inexperienced personnel to correct apparently simple defects.

d. Inspecting, cleaning, and lubricating completed while making repairs should be performed in accordance with preventive maintenance procedures described in part three and additional instructions in this part. All adjustments should be completed in accordance with the detailed requirements and adjustments in section XIV. See section VIII for moisture and fungiproofing instructions.

e. General instructions grouped in the paragraphs at the front of this section are intended for use when a complete unit is removed and another (new or repaired) unit is installed. The general instructions do not include disassembly, cleaning, repair, replacement, and reassembly information which applies only to the repairing and replacing of individual parts.

f. See the special index in paragraph 141 for the location in this section of detailed repair and replacement instructions for individual parts and subassemblies. The paragraphs are arranged to group the related topics for each of the principal assemblies.

#### 141. Special Index of Repair and Replacement Procedures (By Assemblies or Units)

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#### 142. Instructions for Removing Principal Teletypewriter Units

a. COVER. Remove platen crank by pulling straight out in line with the platen. Lift the cover straight up. (See fig. 1.)

b. TYPING UNIT. Remove three thumbscrews that fasten the typing unit to the base. (See fig. 41.) Remove the typing unit by lifting the unit straight up until it clears the base. (See fig. 40.)

c. **TYPE-BAR CARRIAGE.** To remove type-bar carriage from typing unit, operate carriage-return lock bar and move type-bar carriage to the extreme right. Operate the dash-pot lever and lock the carriage in this position. Remove the draw strap by grasping the carriage-return drum in one hand to remove the strain from the strap, and with the other hand, remove the strap from the pin on the carriage, and hook its eyelet on the margin bell hammer post. (See fig. 83.) Move the right margin-adjusting screw arm to the rear. Reoperate the carriage-return lock bar and the carriage will slide off to the right. (See fig. 120.)

(1) Arrange a clean place to work on a bench, table, or box. Make sure that dust or dirt will not fall or be blown into the mechanism while it is disassembled. When rough boards or other rough surfaces are used as a workbench, place several thicknesses of paper or some kind of cloth material on the boards to prevent small parts from becoming lost or dirty.

(2) Secure several small clean, cardboard, wood, or metal containers to keep the parts of different assemblies from becoming lost or mixed together.

(3) Arrange the necessary tools and materials where they will be readily accessible dur-

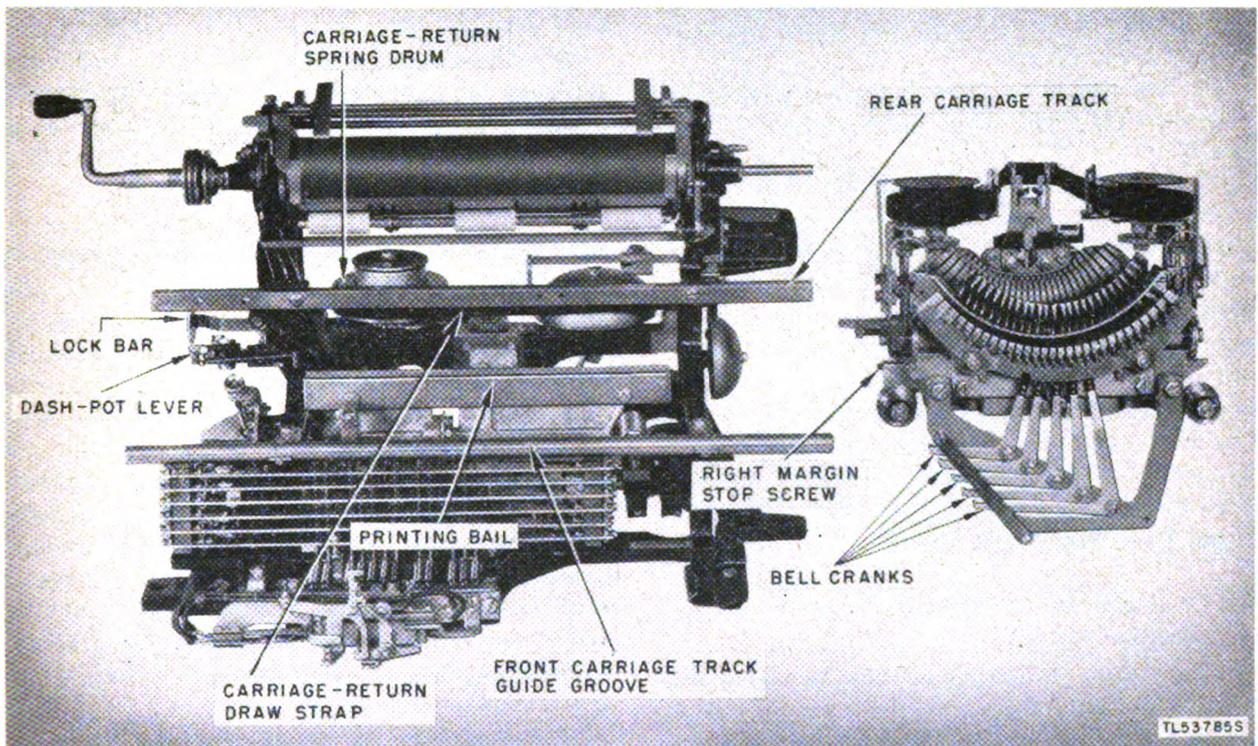


Figure 120. Removal of type-bar carriage.

d. **KEYBOARD UNIT.** Loosen two knurled screws fastening the keyboard to the base. (See fig. 70.) Remove the keyboard by pulling straight out to the front.

e. **MOTOR UNIT.** Remove three mounting screws that fasten the motor to the base. (See fig. 2.) Remove the motor.

### 143. General Disassembly and Reassembly Procedure

a. **PREPARATION FOR DISASSEMBLY.** Before starting to disassemble the teletypewriter, take the following preparatory steps.

ing the progress of the repair work. Be sure the containers used for the special cleaning operations are located where dirt will not enter them and they will not be easily upset.

#### b. DISASSEMBLY PROCEDURE.

(1) Disconnect the power and signal line connections, remove the teletypewriter cover, and dismount the typing unit, keyboard, motor unit, etc., in the manner described in subparagraphs below.

(2) Remove the ribbon, roll of paper, and any paper tags or forms that may be subject

to damage while the teletypewriter is being cleaned and repaired.

(3) Before disassembling the various units and assemblies, clean any excess quantities of oil, grease, or dirt from around the nuts, screws, and fasteners that must be loosened or removed so that the wrenches and other tools will fit them properly.

(4) Proceed to disassemble the various parts and assemblies using the particular tools designed for each item.

*Note. Do not disassemble any units or assemblies beyond the point necessary to thoroughly inspect and clean the entire mechanism and repair or replace any defective parts.*

(5) When small parts are disassembled, place them in a container and mark them to identify their origin.

(6) See index in appendix III for illustrations showing location of parts and part numbers.

(7) Vary the sequence with which the work is completed in any manner that will make it possible to speed up the work involved without sacrificing the quality. As an example, most experienced mechanics prefer to complete the cleaning, washing, drying, etc., of as many parts as possible before starting to repair, adjust and lubricate the various units. This permits an early and accurate appraisal of the number of parts requiring repair or replacement and the amount of time that will be required to complete the work.

#### 144. Instructions for Special Cleaning Procedures

*a. GENERAL.* Equipment that has been disassembled for major overhaul can be thoroughly cleaned by immersing and brushing the parts in containers of the appropriate cleaning fluids.

*Caution:* Do not immerse equipment wiring, resistors, capacitors, motor armature, or motor windings.

*b. USE OF SPECIAL CLEANING MATERIALS.* The following cleaning fluids normally available through supply channels, are satisfactory for use as described below.

(1) Use a soap and water solution to remove nonoily dirt from nonelectrical rubber and cellulose parts.

(2) Use cleaning compound stock No. 6G236 to remove oil, grease, gummy dirt. Soak 10 to 15 minutes and flush with very hot water.

(3) Use dry-cleaning solvent (SD) to remove oil, grease, gummy dirt, and paper lint.

(4) Use carbon tetrachloride only for cleaning electrical contacts.

(5) Use diacetone alcohol to remove ditto or hectograph ribbon stain from metal, rubber, or cellulose parts.

*c. DRYING.* (1) *Air blast.* Where compressed air is available, dry the parts by the air-blast method.

*Caution:* Use great care when using compressed air to prevent injury to personnel or the loss of parts.

(2) *Wiping.* Dry parts by wiping with a clean, dry cloth. Be careful to dry the cleaning fluid from all the crevices of the parts.

(3) *Oven drying.* Dry the parts in an improvised oven heated with electric lamps and adjusted to maintain a temperature of about 160° F. Leave parts in the oven from 1 to 2 hours.

#### 145. Inspection Procedure for Major Repairs

*a. GENERAL.* The inspection procedures for a major overhaul include all items listed in the preventive maintenance check list in part three together with additional items which may be inspected while the teletypewriter is disassembled. The inspection will be made to determine which parts are satisfactory for reuse, which require repairs, and which must be replaced with new parts. If the teletypewriter is damaged by foreign objects or during shipment, it may only be necessary to disassemble and inspect one of the principal units and give the remainder of the teletypewriter a preventive maintenance inspection.

*b. FREQUENCY OF MAJOR OVERHAULS.* Wide variations in the age and general physical condition of the teletypewriter and the experience of the lower echelon maintenance personnel who complete the preventive maintenance work will all affect the need for disassembling the equipment for a major overhaul. Differences in the climatic conditions under which the equipment is operated will also affect the length of time between major overhauls. Do not completely disassemble teletypewriters until the regular preventive maintenance inspection indicates that the general wear on the parts has reached the point where they should be disassembled to permit a thorough inspection. Teletypewriters operating from 8 to 12 hours per

day will ordinarily not require a complete overhaul by a higher echelon shop more often than at 6 or 8 month intervals. Teletypewriters operating less than 8 hours per day may be maintained in such condition that a complete overhaul is not warranted even at the end of a year in service; every old and well-worn equipment operating in tropical regions may require a major overhaul every third or fourth month. *In all cases the thoroughness of the preventive maintenance work performed by the second and third echelon personnel is the principal factor in determining how frequently the teletypewriter must be taken out of service and returned to a higher echelon shop for a major overhaul.*

c. **PROCEDURE.** Make the inspection on teletypewriters incidental to repairs after all parts have been thoroughly cleaned. Include all related items listed in the preventive maintenance check list in part three and in addition, include a thorough inspection of the wearing surfaces of gears, cams, levers, springs, bearings, etc., which can be inspected only after the equipment is disassembled. While the parts are disassembled, make a thorough inspection of the surfaces of all castings and supporting parts to determine that no breaks or cracks exist. Inspect the condition of all wiring, insulating strips, and terminal blocks while they are accessible. Check carefully the surface condition of all clutches, commutators, contacts, etc., and the end play of bearings in accordance with detailed instructions in other paragraphs of this section and related paragraphs in the requirements and adjustment data in section XIV.

#### 146. General Reassembly Procedure

All parts, subassemblies and units should be reassembled in accordance with the following provisions:

a. Replace all worn or broken parts that cause malfunctioning of the teletypewriter and adjust according to directions in the appropriate paragraph in section XIV. Replace, while the equipment is disassembled for checking and repair, any worn parts that have not caused trouble, but are likely to cause it before the next complete overhaul of the teletypewriter.

b. Assemble replaced parts and associated parts firmly. Tighten all screws, nuts, and bolts carefully.

c. All parts disturbed or replaced during repairs should be readjusted at the time of, or immediately after their assembly.

d. When dented or flattened areas prevent proper turning and adjusting, the damaged parts should be removed and repaired or replaced.

e. Bent or distorted parts may be restored to shape and reused, provided that no cracks result which would be likely to cause future failure in service and that hardened surfaces have not been softened by repairs.

f. If the locking edges of lockwashers removed during repairs are rounded, the lockwashers should be replaced by new ones.

g. Screws or nuts with damaged heads should be replaced.

h. When screws, nuts, or other parts are locked in place by locknuts, these parts should not be loosened or removed without first loosening the locknut. (Such a procedure is liable to damage the threads.) Loosened or removed parts should be set up tight on reassembly.

i. Slivers and sharp burrs that are a hazard should be removed when observed.

#### 147. Instructions for Replacing Principal Teletypewriter Units

The order of replacing the units will vary with the amount of repair work involved but in all cases the type-bar carriage should be mounted on the typing unit before placing the typing unit on the base.

a. **REPLACEMENT OF TYPE-BAR CARRIAGE.** (1) Shift the platen to the figures position and rotate the main shaft until the printing bail is in its rear position.

(2) Move the right margin adjusting screw arm on the carriage to the rear, so that it is approximately 45° from vertical.

(3) Hold the carriage in the right hand and rest the left front carriage support roller on the right end of the front carriage track, and make sure that the carriage guide screw engages the slot in the front carriage track.

(4) Move the carriage slowly to the left until the rear carriage support roller rests on the rear track.

(5) Operate the carriage-return lock bar, and move the pull-bar bail to its farthest rear position by pushing on the right pull-bar bail roller with the right thumb.

(6) Move the carriage farther to the left. Make sure that the bell cranks engage their respective vanes, that the right front carriage support roller and guide screw properly engage the front carriage track, and that the pull-bar bail plunger roller is between the printing bail blades.

(7) When the carriage has been moved far enough to the left to permit the right margin adjusting screw to clear the spacing stop lever, restore the right margin adjusting screw arm to its normal vertical position, and shift the carriage to its extreme right position and lock it in place by operating the dash-pot lever.

(8) Hold the carriage-return spring drum so that the spring cannot unwind.

(9) Unhook the eyelet of the draw strap from the margin bell hammer spring post, and hook it over its mounting post on the carriage.

(10) Operate the carriage-return lock bar to permit the carriage to return to its extreme left position.

**b. REPLACING THE MOTOR UNIT.** (1) The motor unit is mounted on the base after all repairs and lubrication is completed. The unit is placed on the base and pushed back against the spring contacts. Holding it in this position, put the three mounting screws in place. Tighten the two front screws and then back them off about  $\frac{1}{4}$  of a turn. Do not tighten the rear mounting screw until the typing unit is in place.

(2) See paragraph 218 for requirements and adjustments of the main-shaft drive gear clearances.

**c. REPLACING TYPING UNIT AFTER REPAIRS.**

(1) The typing unit should be completely assembled, all adjustments checked, and lubrication completed before mounting the typing unit on the base. If the motor unit has been removed from the base, it is usually replaced before mounting the typing unit.

(2) Lower the typing unit into place carefully to avoid damaging the gears and contact springs.

(3) Turn the motor shaft a few turns to insure that the gears are properly meshed and fasten the typing unit to the base with the three thumb-screws.

**d. REPLACING KEYBOARD AND COVER AFTER REPAIRS.** (1) Slide the keyboard into position on the base and tighten the two knurled screws.

(2) Place the cover down over the teletypewriter and install the platen crank.

## 148. Introduction to Motor Unit Repairs

a. Complete disassembly and overhaul of the motor unit should be made only when the motor starts to give trouble and then only by specially trained personnel.

b. The overhaul should include complete disassembly and cleaning of the motor, inspection and replacement or repair of burned governor contacts, worn end-ring brushes, worn commutator brushes, grooved or burned commutators, worn motor bearings, or poor insulation. The motor need not be completely disassembled to replace or repair brushes or governor parts, and these may require repairs or replacement more often than once every 6 months.

## 149. Disassembly of Motor for Major Repairs (fig. 121)

Use the following sequence of steps when disassembling the motor for repairs.

a. Remove the motor unit from the base.

b. Remove the motor pinion, governor brush bracket assembly, and the governor. Be careful and do not lose any of the shims that may be on the armature shaft between the governor hub and the end frame casting of the motor.

c. Remove any external bearing retainer screws.

d. Remove the brush-holder caps and remove the brushes.

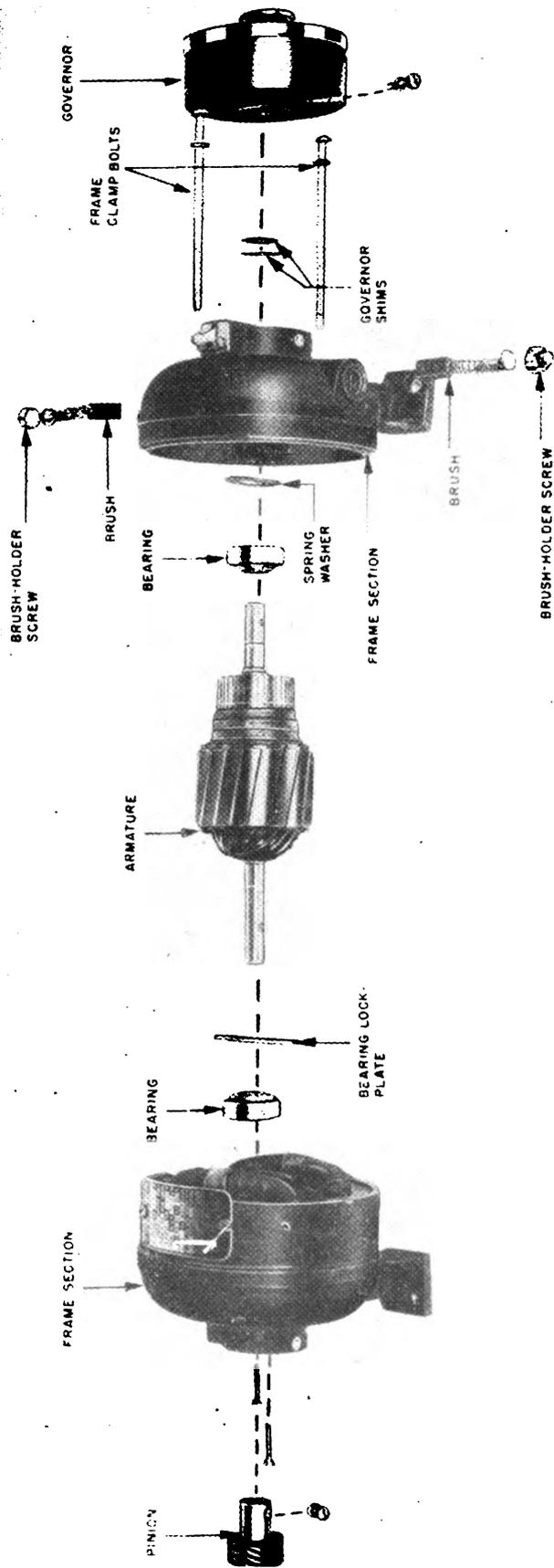
e. Remove the motor frame bolts or screws and separate the parts by prying gently with the blade of a screw driver. Lift out the armature. Do not drop the armature or damage the windings. Do not lose any of the parts, such as bearing retainers, spring washers, etc.

f. Remove the armature bearings using the No. 84020 bearing puller (not furnished as part of Tool Equipment TE-50).

**Caution:** Use the No. 84020 bearing puller on bearings which have a built-in dust shield with extreme care. Position the bearing puller so that pressure is exerted on the outer bearing race *only*. Pressure exerted on the dust shield will crush the shield and thereby destroy the bearing. *Do not attempt to pry the bearings off with a screw driver.*

## 150. Special Cleaning Instructions for Motor

The instructions given in this paragraph are for the cleaning of the internal parts of the motor. See 40c for instructions for cleaning the external parts of the motor.



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Figure 121. Disassembly of motor.

- a. Disassemble the motor. (See par. 149.)
- b. Clean all dust, paper lint, nonoily dirt, etc., from the stator and armature windings by brushing carefully with a clean, dry sash brush.

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

c. Clean all oil, grease, or gummy deposits from the face of the armature and stator by wiping with a piece of clean cheesecloth that has been dampened with dry-cleaning solvent (SD). Do not use an excessive amount of dry-cleaning solvent (SD).

d. Clean the end bells, bearings, motor pinion, and any other all-metal parts by immersing in a container of appropriate cleaning fluid. (See par. 144.) Be sure to dry and lubricate the parts as directed for each of the cleaning materials. Use a sash brush to remove dirt, grease, or gummy deposits.

e. Clean all dirt, dust, oil, grease, gummy deposits, or other foreign material from the commutator by rubbing with a piece of clean cheesecloth dampened with carbon tetrachloride. Be careful not to damage the windings.

**Note.** Discoloration of the commutator segments caused by carbon particles becoming imbedded in face of the segments should not be removed unless the commutator must be refinished because it is badly grooved or if the brushes spark excessively. See paragraph 152 for further information on resurfacing the commutator.

## 151. General Instructions for Replacement and Repair of Motor Armature

a. After long periods of operation, the commutators of series motors become worn and grooved by the brushes and require resurfacing as described in paragraph 152. If the surface of the commutator is not grooved deeply and has a smooth, even, grayish coating of oxide, no repairs are required unless there is excessive sparking at the brushes under load.

b. If there is excessive sparking of brushes on a commutator that is not grooved or pitted, clean the commutator with cloth moistened with carbon tetrachloride, turning the shaft over by hand after the brushes are removed as described in paragraph 153.

c. If there is still excessive sparking, remove the armature from the motor and clean the commutator lightly with #0000 sandpaper. To do this, wrap a piece of sandpaper around the commutator and rotate the armature in a lathe or between other fixed centers, holding the sandpaper lightly by hand.

**Note.** The copper commutator segments frequently become quite dark because of carbon particles from the carbon brushes which become imbedded in the commutator segments. This discoloration greatly increases the life of the segments. DO NOT polish to remove the discoloration unless the segments are deeply grooved.

d. Inspect the commutator carefully to determine if it is necessary to undercut the segment insulators. The top of the insulator must be below the level of the adjoining commutator bars, to prevent small carbon particles from the brushes lodging in the separators and shorting the bars.

e. Lower echelons should replace the motor when the commutator requires resurfacing and higher echelons should complete repairs or replace the motor in accordance with local instructions.

## 152. Resurfacing Motor Commutators

When authorized by local instructions the commutator may be resurfaced by experienced personnel as follows:

a. **REFINISHING COMMUTATOR SURFACE.** (1) Mount the motor armature between centers on a lathe so that the shaft does not run out of line more than .0005 inches. Make a series of light cuts across the entire width of the commutators with a sharp cutting tool. Continue the cuts until enough metal is removed to eliminate the grooves and rough spots in the surfaces. DO NOT REMOVE MORE METAL THAN NECESSARY.

(2) Polish the commutator with a strip of fine sandpaper (#000 or #0000) held in flat contact with the armature as it revolves in the lathe.

**Caution:** Do not attempt to smooth a rough commutator with sandpaper unless a lathe is available. DO NOT use emery cloth or carborundum paper as above carborundum particles may cause trouble in the electrical circuits.

b. **UNDERCUTTING COMMUTATOR BAR SEPARATORS (INSULATORS).** (1) Tool equipments furnished to the larger repair shops may be equipped with any one of several types of undercutting tools. Do not attempt to use special undercutting tools until the directions furnished with them have been carefully studied.

(2) If no standard undercutting tool is available, improvise a tool from a piece of hacksaw blade. Grind the sides of the teeth so that the total width of the teeth is a little less than the width of the separators. Hold this improvised

tool at an angle so that only one or two teeth are in contact with the mica, and draw the tool in a direction away from the windings. Repeat the process until the surface of the mica is  $\frac{1}{64}$  to  $\frac{1}{32}$  inch below the surface of the metal segments. Repeat for all the segments.

**Caution:** After the mica has been undercut between all segments, check to be sure that no slivers of metal remain in the slots. These slivers would short the commutator segments and burn out the windings when the motor was started.

### 153. General Instructions for Replacing Motor Brushes

a. In removing the brushes, note or mark the position so that the brush may be replaced in the same holder and with the same side uppermost. If the brush has a number stamped on the carbon, this may be used as a guide.

b. Inspect the brushes as follows:

(1) Check to be sure at least  $\frac{5}{16}$ -inch of brush material remains.

(2) Check to be sure the surface bearing on the commutator constitutes at least one-third of the brush face.

(3) The brushes should make contact across at least three-fourth of the long dimension of the brush face.

c. If the above requirements are not met, substitute a new brush which has been properly surfaced as described in the next paragraph.

### 154. Surfacing and Installing Motor Brushes

The methods of shaping the brush face to the proper curvature are as follows:

a. Wrap a piece of #0000 sandpaper around a sector of the armature under the brush holder.

b. Place the brush in the holder with the numbered or marked side up, bearing against the sandpaper under the normal pressure of the brush spring.

c. Turn the armature (around which the sandpaper is wrapped) back and forth by hand until the brush surface has the proper curvature. The last turning of the armature should be in the normal direction of rotation.

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

e. Wipe off the brush with a piece of cloth slightly moistened with carbon tetrachloride.

f. See that the pig tail inside of the brush

spring is intact, free from kinks, and will allow the brush spring to extend properly.

g. Clean out the brush holder with cloth moistened with carbon tetrachloride and wrapped around a screw driver blade or similarly shaped tool.

h. Reinsert old brushes in the same brush holder and with the same side uppermost.

i. Insert a new brush or a brush that has just been resurfaced with the numbered side up.

j. See that the brush moves freely in the brush holder. Check the pressure of the brush springs and see that they meet the specified requirements.

### 155. Replacing Armature Bearings

a. GENERAL. (1) Install new bearings if inspection of the old bearings indicates that the bearings are burned, cracked, badly worn, or injured in any way.

(2) Exercise great care in handling the bearings both before and after they are cleaned so that no dirt will get inside of the bearing races. Lubricate all bearings, including old bearings found to be in good condition by cleaning and inspecting; also lubricate new bearings with grease before being placed on the shaft. In addition to the lubrication factor, the grease aids in preventing dirt from entering the bearing while it is out of the motor. Use a paper washer placed over the exposed side of the bearing as a further aid to prevent dirt from entering the bearing.

b. INSTALLATION OF BEARINGS. (1) In the larger repair shops some type of arbor press or bench vise will, normally, be available. This can be used to press the bearings onto the armature shaft.

(a) Slip the bearings onto the armature shaft as far as they will go fingertight with the dust covers (when bearings are so equipped) nearest the windings.

(b) Prepare two blocks of hard wood of equal length and about 1 inch longer than the shaft extension. The hardwood block must be shaped to avoid any pressure on the ball bearing or outer race. Place one of these blocks on each side of the shaft, with one end bearing against the inner bearing race and the other against the rear vise or arbor press jaw. Place another block between the other end of the armature shaft and the other vise or arbor press jaw. Tighten vise very slowly until there

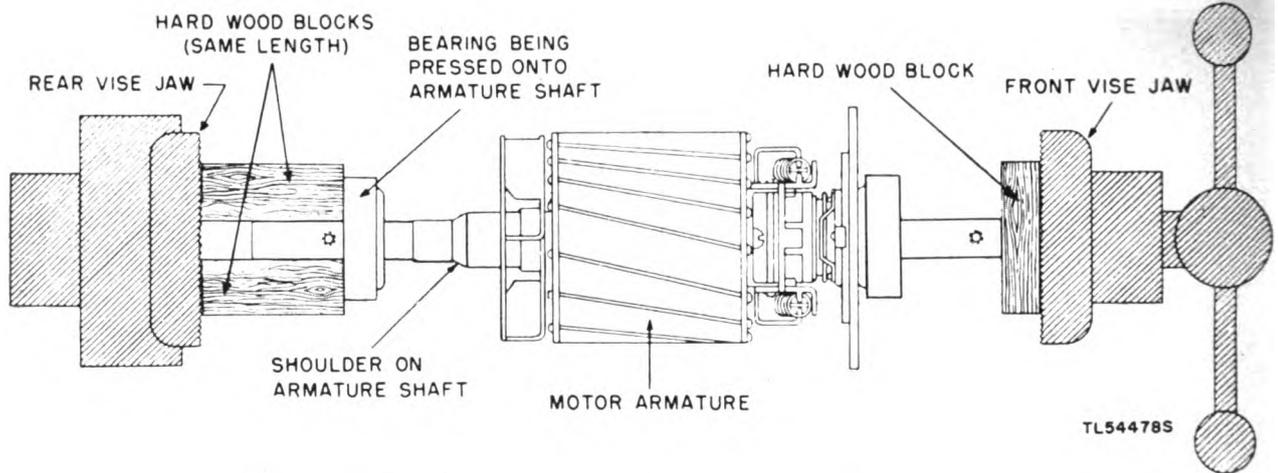


Figure 122. Pressing armature bearing onto its shaft by use of a vise.

is an even pressure exerted on both sides of the bearings. *Be careful not to bend the shaft.* Tighten the vise slowly until the bearing is pressed completely against the shoulder on the armature shaft. Repeat the procedure to mount the bearing on the other end of the armature shaft. Figure 122 shows the method of pressing a bearing on the armature shaft using a vise.

(2) When a suitable press or vise is not available and bearings must be installed on the motor shaft the following method may be used when authorized as a field expedient.

(a) Slide the bearings onto the armature shaft as far as they will go fingertight with the dust covers (when bearings are so equipped) placed nearest the winding.

(b) Prepare a piece of copper or brass pipe about 1 inch longer than the shaft extension and having an inside diameter slightly larger than the diameter of the armature shaft. Slip the copper or brass pipe onto the shaft so that it bears against the inner bearing race. If copper or brass pipe is not available, use iron pipe and a brass washer to keep from damaging the inner bearing race.

(c) Stand the armature on end with the pipe resting on the bench or work table. (See fig. 123.)

(d) Place a block of hardwood over the other end of the armature shaft and pound with careful, even strokes until the bearing is forced firmly against the shoulder of the shaft.

**Caution:** Be sure the pipe bears against the inner race of the bearing. Also, be careful not to bend or otherwise damage the armature or shaft.

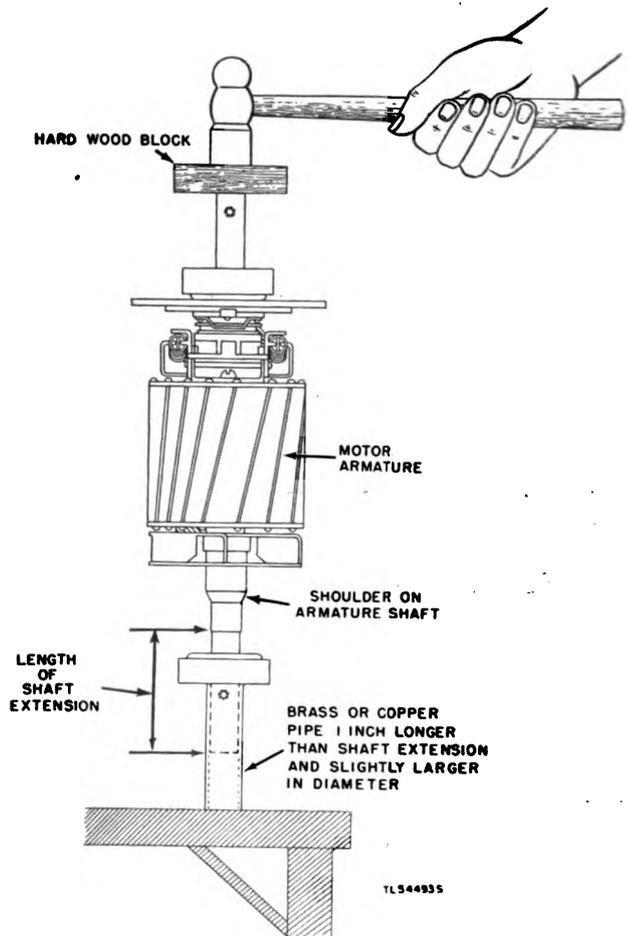


Figure 123. Mounting bearings on the armature shaft by use of hammer and soft metal pipe.

## 156. Reassembly of Motor

a. **PREPARATION.** Thoroughly clean and dry the motor before reassembling. Examine the bearings and parts which should be free from dirt before the reassembling is started.

b. **STEP-BY-STEP ASSEMBLING.** (1) Position the bearing retainer so that the holes match the position of the retainer screws.

(2) Insert armature into stator so that the bearing opposite the commutator end of the shaft enters the end bell. Do not use force as the bearing should enter the end bell without excessive effort.

(3) Remove the commutator brushes if they are still in the end bell, and place the end bell on the commutator end of the shaft. Gently tap the end bells into place.

(4) Replace the motor frame bolts and tighten opposite sides at the same time so as not to screw the end bells.

(5) Using a toothpick or piece of stiff wire, move the bearing retainer ring into position so that the retainer ring screws can be started. Tighten both retainer screws at the same time.

(6) Replace the motor pinion and pilot screw.

## 157. Introduction to Governor Repairs

a. **GENERAL.** Governor contacts cause considerable trouble when they are not in good condition. All governor contacts in good condition have an over-all grayish color. When the contacts become pitted, or if, for any other reason, the grayish color does not cover 75 percent of the contacting surfaces, *both* contacts should be replaced with new contacts as described in paragraphs 159 and 160.

**Caution:** Always replace governor contacts in pairs. Do not touch the contacting surfaces with the fingers because even minute deposits of moisture or dirt will cause arcing and pitting.

b. **CONTACTS IN SATISFACTORY CONDITION.** The surfaces of governor contacts may be covered with very small build-ups and craters and the governors still operate satisfactorily. Figure 124A shows an enlarged view of small build-ups and craters on a pair of contacts that are operating satisfactorily. The build-ups on one contact almost entirely match the craters on the opposite contact, thus giving a maximum of contacting surface. Contacts in this condition need not be replaced unless trouble is experienced in securing and maintaining the proper speed adjustment.

c. **COMMON CAUSES OF CONTACT TROUBLE.**

(1) Trouble due to poor surface condition is frequently the result of a previous attempt to burnish or file a new surface on old contacts. In such cases the build-ups have been removed as shown in figure 124B but the craters still exist with the result that the amount of contacting surface is reduced.

(2) A shift in the position of either contact (except while adjusting new contacts) will result in build-ups and craters being positioned as shown in figure 124C. This condition results in extremely erratic motor speed since practically all of the contacting surface has been lost.

## 158. Disassembly of Governor

When it is desired to completely disassemble the governor and governor brush assembly, proceed as follows:

a. Remove the screw holding the governor adjusting bracket to the brush spring plate bracket.

b. Remove the screw holding the governor adjusting bracket to the brush spring plate, and remove the adjusting bracket.

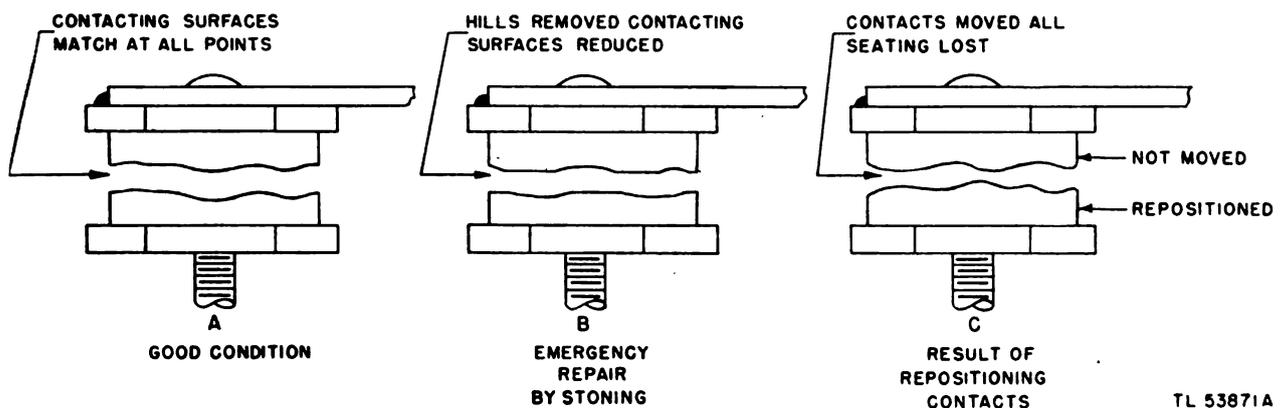


Figure 124. Enlarged diagrams of governor contact surfaces.

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Note. When the governor brush assembly does not require repair, merely loosen the screw in (2) above and raise the left end of the governor adjusting bracket so that it pivots (on the loose screw) to the right of the governor.

c. Remove the screws holding the brush springs in place, and remove the springs.

Note. If complete disassembly is not desired, the springs may be pushed aside to allow removal of the governor.

d. Loosen the screw holding the governor to the switch end of the rotor shaft and slip the governor from the shaft.

e. Remove the screws securing the target and governor cover, and remove the target and cover.

f. Unhook the No. 6326 spring. (See fig. 125.)

g. Loosen the screw which clamps the feather spring on the end of the No. 6314 contact spring (fig. 125), and lift the contact spring out of the governor shell.

h. Remove the nut and lockwasher on the No. 6320 contact screw (fig. 125) and lift out the contact screw.

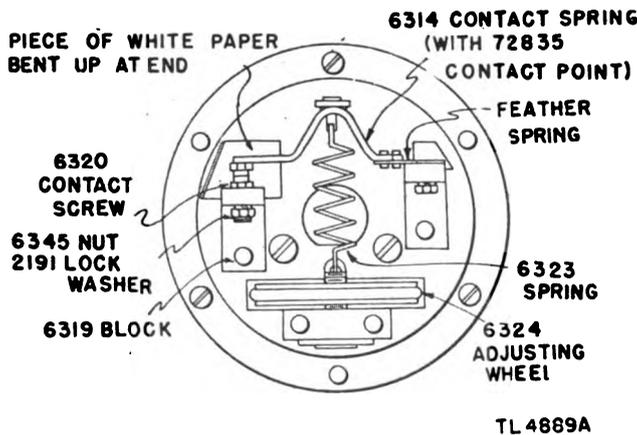


Figure 125. Internal view of governor.

### 159. Replacing Governor Contact Points

a. The contact points are made of tungsten material and are attached to the contact screw and spring by solder. Heat the old contact points with a soldering iron and remove the points. When a contact requires replacement, replace both the upper and lower contact points at the same time. This procedure tends to eliminate difficulties in seating the contacts.

b. Solder new points onto the contact screw and spring. Use a soldering iron. Do not heat the points excessively. The new point on the contact screw is properly aligned when the

contacting surface of the new point is perpendicular to a line through the center of the contact screw. (See fig. 126.) The new point of the contact spring is properly aligned when there is no appreciable gap between any part of the contacting surface of the new point and the straight edge when checked in the manner shown in figure 126.

Note. Old style No. 6314 contact springs were equipped with contact points which screwed into the spring and were bonded by a drop of solder at the end of the spring. New style are not threaded and the points are fastened to the contact springs only.

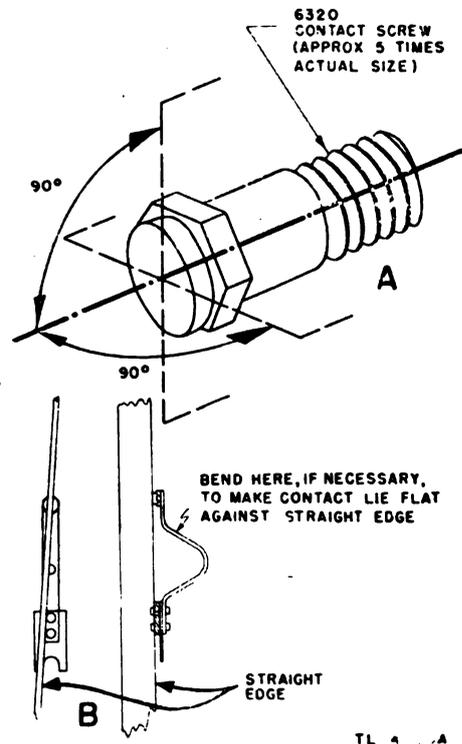


Figure 126. Alignment of new governor contact points.

### 160. Repair of Contact Points

For emergency operation when trouble is due to build-ups or pitting and new contact points are not available, remove both contacts and *lightly* dress them with a fine carborundum stone (part of Tool Equipment TE-50). A particularly large build-up may have to be knocked off with a screw driver and then dressed with the carborundum stone. BOTH CONTACTS SHOULD BE REPLACED AS SOON AS POSSIBLE. THIS IS NECESSARY TO AVOID MORE TROUBLE FROM BUILD-UPS AND PITTING WHICH FORM QUICKLY ON RE-SURFACED CONTACTS.

## 161. Reassembling Governor

a. Insert the No. 6320 contact screw into the hole in its mounting block. Place a No. 2191 lockwasher and a No. 6345 nut on the end of the contact screw. Tighten the nut securely.

b. Insert the feather spring of the No. 6314 contact spring under the clamp on its mounting block and tighten the clamp screw until the contact spring is held friction tight. The contact should remain slightly separated (approximately 0.005 inch).

c. Hook the No. 6323 spring onto the contact spring and turn the adjusting wheel until all tension is released. Contacts should return to the slightly separated position (b above).

d. Insert a piece of white paper behind the contacts as shown in figure 125.

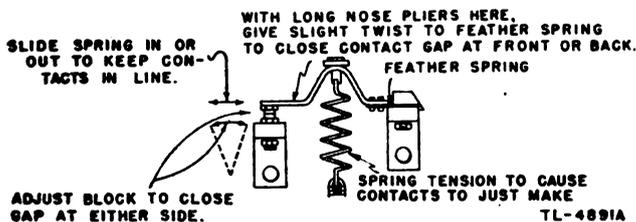


Figure 127. Positioning governor contacts.

e. Illuminate the contacts with a flashlight, or other small lamp, and turn the adjusting wheel until the contacts just touch.

f. Slide the contact spring to the right or left until the sides of the upper and lower contact points are in line. If a gap can be seen on either side of the contacts, loosen the contact mounting block retaining screw and move the top of the block to the right or left. At the same time, shift the contact spring to keep the contact points in line. (See fig. 127.) Tighten both the contact spring clamp screw and the contact mounting block retaining screw.

g. If a gap at the front or back of the contacts is noticed, use a pair of long-nose pliers to twist the feather spring on the end of the contact spring. (See fig. 127.) Repeat any of the operations that may be required until the contacts meet all requirements for position.

h. Turn the adjusting wheel so that the tension of the No. 6323 spring is near the midpoint of its range.

i. Reassemble the governor cover and target on the governor and remount the governor on the motor.

## 162. Inspection, Cleaning, and Repair of Governor Contact Disks

a. Governor contact disks should be cleaned with a piece of cloth dampened with carbon tetrachloride. A smooth, even grey coating of oxide is a desirable condition, and the contact disks should not be disturbed unless there is excessive sparking at the brushes.

b. To remove pits or burned spots from contact disks, use #0000 sandpaper held by hand and with the motor running at normal speed. A piece of cloth should be held with the sandpaper in such a way as to immediately wipe off the cuttings and particles.

c. The surface of contact disks should not be touched with the hand, as minute deposits of moisture or dirt will cause arcing and pitting.

## 163. Repair and Replacement of End-Ring Governor Brushes

a. Replace the No. 78403 carbon brushes on the tips of the end-ring governor contact springs when the brushes have worn down to  $\frac{1}{16}$  inch. Replace the individual brushes in the following manner when it is not desired to replace the entire brush assembly.

b. Unsolder the old brush from the spring. Clean out any solder remaining in the hole from which the brush was removed. Insert the new brush in the hole and solder firmly in place.

c. Place the governor brush assembly in proper position and tighten the mounting screws.

## 164. Testing Repaired Governors

a. After the governor is completely reassembled and adjusted new contacts are seated by running the motor on test for at least 1 hour. Check the speed every 15 minutes and immediately investigate any sudden change in the motor speed.

b. If the motor speed is erratic, disassemble the governor and recheck the contacts for build-ups and alignment. If build-ups are found, replace the contacts. After realigning the contacts reassemble the governor and run the motor again for 1 hour.

c. The operation of the governor is satisfactory if the motor speed has not changed appreciably at the end of the test run.

## 165. Introduction to Keyboard Repairs

a. All inspection, cleaning, repairing, replacement, and adjustment of keyboard parts should be completed with the keyboard removed from the base.

b. As most of the parts are exposed when the keyboard is removed from the teletypewriter, no special disassembly is required for general cleaning and inspection purposes. Instructions for disassembling the transmitting shaft assembly and transmitter (sending) contacts are furnished in paragraphs 168 and 169.

c. For ordinary repair cleaning see preventive maintenance cleaning instructions in 39a. When an excessive amount of dirt or gummy deposit is encountered, the wiring may be removed and the entire mechanism immersed and brushed, and then dried as described in paragraph 144.

d. For replacement of keyboard parts not described in this section, see requirements and adjustments, section XIV.

## 166. Replacing Key Tops

a. Replace all key tops that are so worn they are not readable and any missing key tops.

b. Key tops are removed from the key levers by turning the tops one-quarter turn in a clockwise direction and lifting them up. Replace the caps by arranging the cap in the normal position and pressing the cap down on the key lever while holding the key lever from underneath. The cap will snap into the proper position.

## 167. Replacement of Transmitter Shaft Driven Gear

a. Replace the driven gear if any of the teeth are missing, if the gear is badly worn, and when the requirements of paragraph 350 cannot be met.

b. To replace the gear, remove the gear pilot screw, and slide the gear from the transmitter shaft. Slide the new gear on to the shaft and replace the pilot screw.

c. The clearance between the driven gear and the transmitter shaft driving gear will have to be adjusted. (See par. 147.)

## 168. Replacement of Transmitter Shaft, Cam Sleeve, and Clutches

a. Replace the transmitter shaft if it is scored. Replace the clutches if teeth are broken

or the tips of the teeth are worn. Replace the cam sleeve if the cams are badly worn, if the cam bearing is badly scored, or if there is noticeable play between the shaft and the cam sleeve.

b. To replace transmitter shaft parts, loosen the bushing adjusting screws nearest the keyboard transmitter gear and remove the bushing. Move the transmitter contacts out of the path of the transmitter cam sleeve, and remove the cam sleeve from the transmitter contacts in the direction of the keyboard transmitter gear. Slide the cam sleeve, clutch spring, and moveable clutch from the shaft.

c. Replace the new parts in the reverse order that the parts were removed.

d. Adjust the transmitter shaft. (See par. 348.)

## 169. Repair or Replacement of Transmitter (Sending) Contacts

a. Do not clean or burnish transmitter contacts that are working properly. Clean contacts that are out of adjustment or causing trouble with carbon tetrachloride, remove build-ups with a contact file, and adjust the contacts according to paragraph 346.

b. Replace the contacts if the contact springs are broken or if the contacts are badly burned.

c. Replace transmitter contacts as a complete assembly when possible.

d. Dismount the contact assembly by removing two screws that fasten the contact assembly to the frame.

e. Remove the wiring to the contacts by unsoldering the connections at the terminals. Clean the wires of excess solder, attach to the new contacts, and solder the connections. Exercise care so as not to change the electrical connections to the transmitter contacts.

## 170. Introduction to Typing Unit Repairs

a. Instructions required for a major overhaul of the typing unit are grouped in the paragraphs immediately following this paragraph. The instructions are arranged by the principal assemblies and subassemblies of the typing unit for easy reference when repairs to a single item are necessary.

*Note.* Instructions for repairing the type bar carriage are furnished in paragraphs 176 and 177.

b. The various assemblies should be disassembled only to the extent necessary to com-

plete the work involved. Complete disassembly of the typing unit is warranted only when the unit has been subjected to sand, grit, or some corrosive element.

### 171. Removing and Disassembling Typing Unit Subassemblies

*a. RANGE FINDER ASSEMBLY.* (1) Remove the two screws that mount the range finder on the selector assembly. (See fig. 128.)

(2) Remove the bell crank screw and remove bell crank. Remove trip latch screw, and remove trip latch and spring. Remove stop-lever screw locknut and stop-lever screw. Remove stop-lever spring and stop lever.

*b. MOTOR STOP BRACKET ASSEMBLY.* Remove the two motor stop-lever-bracket mounting screws. Remove motor stop lever bracket assembly (figs. 83 and 107).

*c. REMOVAL OF SELECTOR ASSEMBLY.* Remove the three screws that mount the selector assembly on the typing unit frame. Carefully remove the selector assembly. It is necessary to move the vanes to separate the vanes from the T levers, and to move the main shaft throw-out clutch in a direction opposite to its spring pull in order to free the assembly. Handle the selector assembly with care so as not to damage the small parts. (See fig. 130.)

(1) *Removal of selector magnets.* The selector magnets may be removed from the selector assembly before or after the assembly has been removed from the typing unit. Remove the two screws that connect the line leads to the selector magnets. Remove the two screws that mount the magnet bracket to the selector unit. Remove the magnets and bracket as a unit. Replace the contact screws.

(2) *Removal of selector armature.* The selector armature may be removed before or after the selector unit has been removed from the typing unit. Loosen the outside selector armature pivot screw locknut, and remove the pivot screw. Remove the selector armature carefully by moving the armature in the direction of the removed pivot screw until the armature is clear of the opposite pivot screw, and withdraw the armature.

(3) *Removal of selector levers, swords, and T levers.* Remove the selector lever springs and the locking lever spring. Remove the five nuts and washers that clamp the separator plates together. Remove the separator plates, the

sword, T levers, selector levers, and locking lever.

*d. REMOVAL OF MAIN SHAFT.* The main shaft may be removed independently of other disassemblies. For detailed instructions see paragraph 172.

*e. REMOVAL OF PRINTING BAIL ASSEMBLY.* DO NOT REMOVE THE PRINTING BAIL ASSEMBLY UNLESS REPAIRS ARE NECESSARY. The type bar carriage must be removed before the printing bail assembly can be removed. Proceed as follows:

(1) Remove the printing bail spring and the function bail spring.

(2) Remove the two nuts and washers that fasten the function lever to the printing bail.

(3) Remove the two screws and lockwashers that fasten the right-hand bail bearing to the typing unit frame.

(4) Slide the bail assembly to the right until the left end of the bail shaft clears the left bail bearing, and then remove the assembly.

*f. REMOVAL OF THE SPACING SHAFT.* Remove the nut and screw that joins the carriage-return lock bar to the carriage-return bell crank. Remove the two horizontal screws that fasten the upper bearing block to the typing unit frame. Remove the two screws that fasten the upper bearing retainer plate. Remove the two screws that hold the carriage-return bracket against the typing unit frame. Remove the shaft by moving the shaft upward and out. Remove the carriage-return bracket and the attached parts.

### 172. Removing and Inspecting Main Shaft

*a. GENERAL.* Most repairs to the main shaft parts are made by replacing the part. Main shaft parts between the main bearing locknuts and the nearest shaft end can be replaced without removing the main shaft from the typing unit. (See fig. 172.) If the main shaft must be removed to get at the part that must be serviced or replaced, completely disassemble, clean, inspect, and lubricate the shaft before assembling it.

*b. REMOVAL OF MAIN SHAFT FROM TYPING UNIT.* (1) Remove typing unit from the tele-typewriter base and place the unit on its right side. (See fig. 128.)

(2) Remove the two screws that mount the range finder on the selector assembly, and remove the range finder.

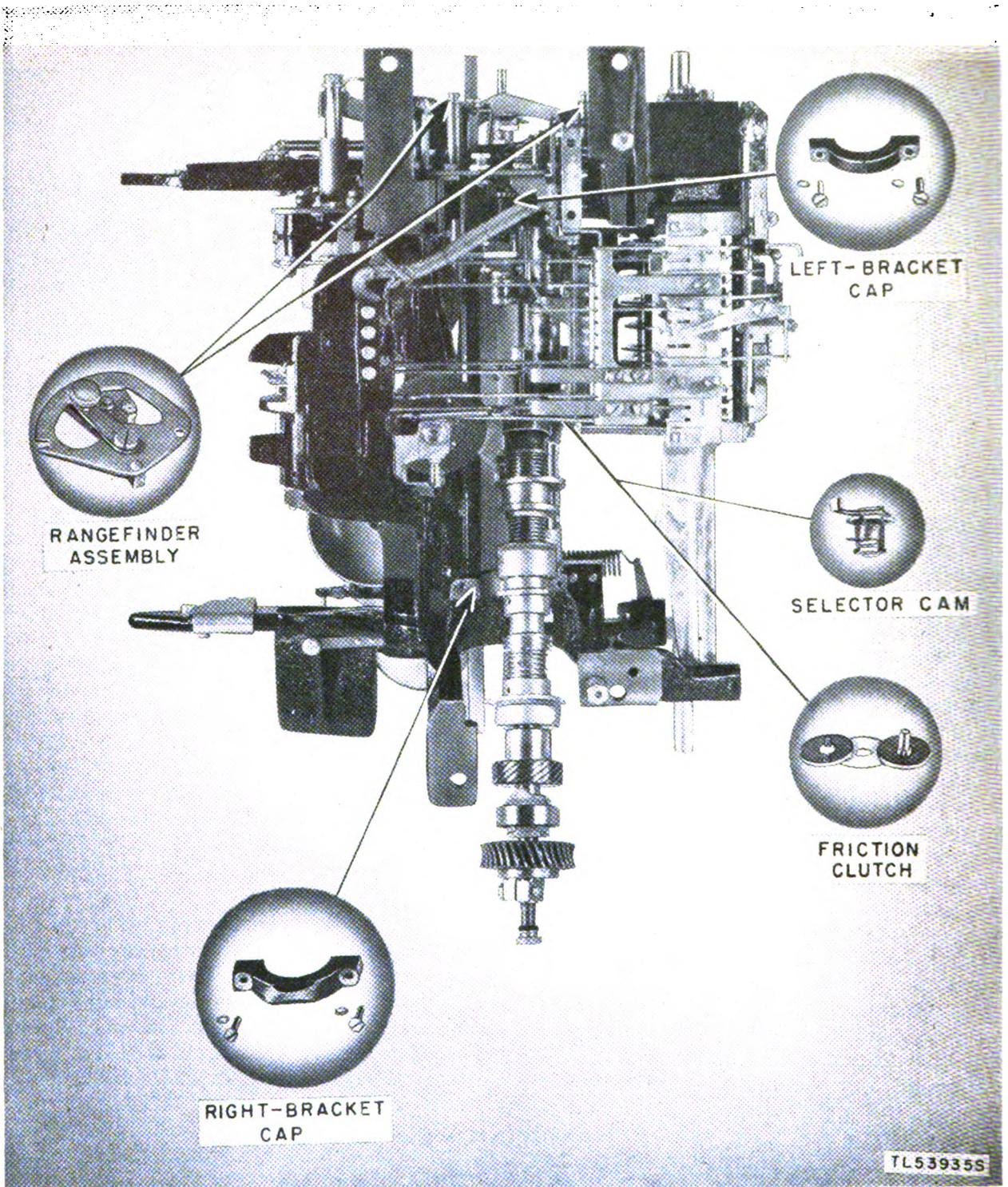


Figure 128. Removal of main shaft from typing unit.

(3) Remove the outer selector-cam friction-clutch plate, by turning the plate clockwise with a large screw driver, and remove the selector cam.

(4) Place the typing unit so that it rests on

its back side, and remove the four screws that hold the main bearing caps in place.

(5) Hold the main-shaft clutch throw-out lever away from the main shaft and remove the main shaft from the right end.

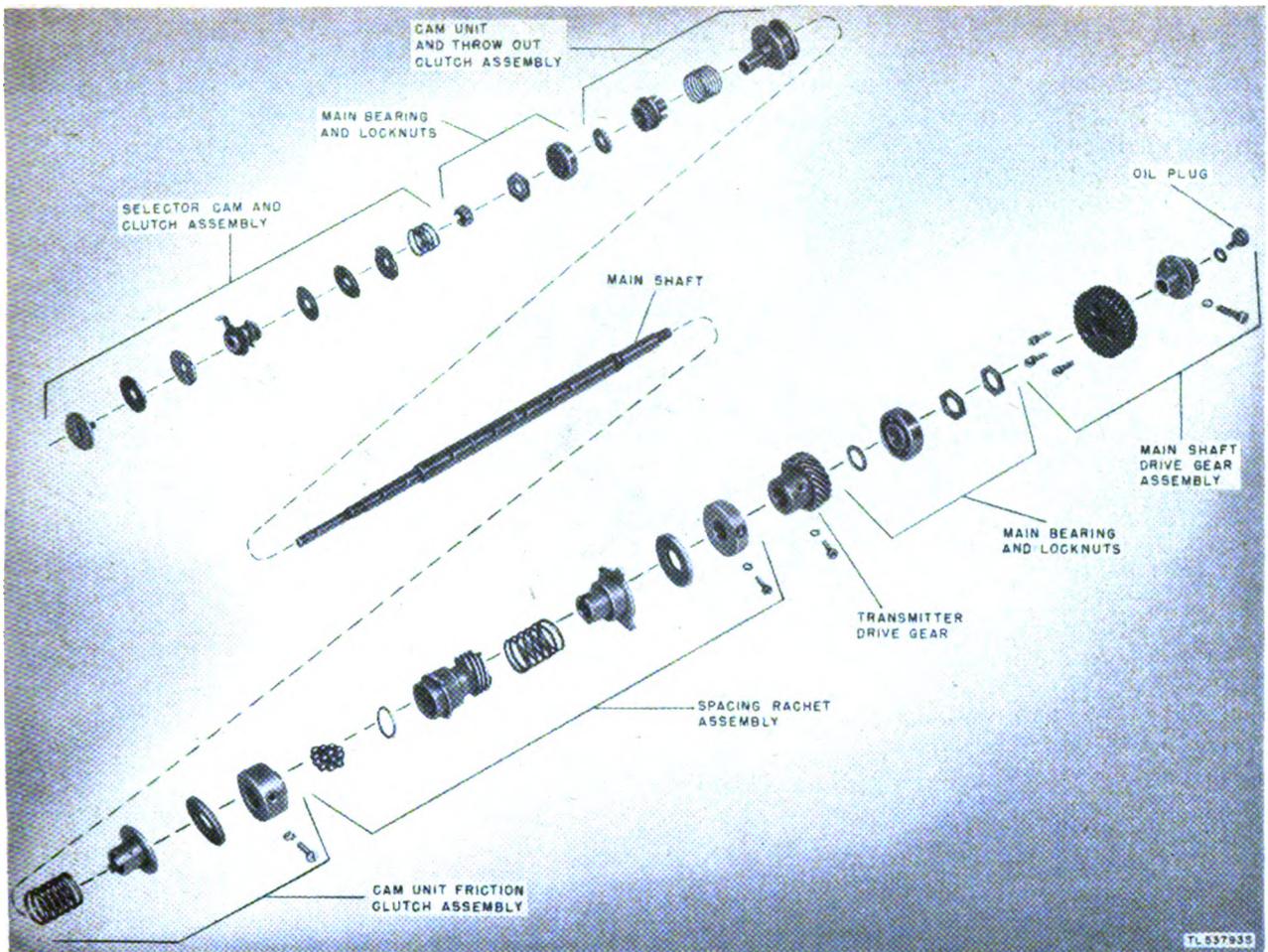


Figure 129. Main shaft parts in sequence of removal.

**c. REMOVAL OF MAIN SHAFT PARTS** (fig. 129). (1) *Removal of selector cam.* The selector cam may be removed from the main shaft without removing the shaft from the typing unit. See *b* (1), (2), and (3) above.

(2) *Removal of bail cam unit.* After removal of selector cam sleeve, remove selector unit friction spring. Grasp main-shaft drive gear in one hand and remove the main-shaft bearing locknuts by turning the nuts clockwise from the selector cam end. Remove the main-shaft clutch plates, the main-shaft clutch spring, and the bail cam unit. Remove the bail cam friction clutch spring and friction disk and washer.

(3) *Removal of space escapement ratchet.* Remove all parts from the main-shaft drive gear end. Remove oil plug. Remove main-shaft-gear clamping screw and remove main-shaft gear. Remove main-shaft-bearing locknuts, turning the nuts counterclockwise from the

main-shaft gear end. Remove main-shaft bearing. Remove transmitting-shaft driving-gear mounting screw and remove gear. Remove friction clutch, stop sleeve, and clutch spring. Hold the shaft vertical and lift off the spacing escapement ratchet and gear. Remove the thrust bearing race mounting screw. Slide the bearing race off the shaft carefully so as not to lose the ball bearings.

(4) *Removal of main shaft for replacement.* Steps 1, 2, and 3 will prepare the main shaft for replacement as far as disassembly.

### 173. Repairing and Replacing Main Shaft

**a. INSPECTION AND REPAIR PROCEDURE.** (1) *Gummy friction washers.* Gummy friction washers can usually be cleaned in dry-cleaning solvent (SD). Thoroughly dry and lubricate the washers with oil before reassembly. Replace any washers that have a hardened surface or have lost their absorbent qualities.

(2) *Selector cam unit.* When the selector cams become worn so that the requirements and adjustments of the selector mechanism given in section XIV cannot be met because the points of the selector cam are worn, replace the selector cam unit with a new unit.

(3) *Drive gear.* The main-shaft drive gear may be replaced without removing the main shaft. (See par. 172.) Replace the gear when it becomes badly worn or when the proper clearance cannot be obtained by adjustment. (See par. 320.) Replace the gear if any of the teeth are missing. If the new gear is supplied without the hub, disassemble the old gear unit by removing the three hub mounting screws and lockwashers and the old hub used with the new gear.

**b. REPLACING MAIN SHAFT.** (1) Remove the typing unit from the teletypewriter and place it on its back while the main shaft is being replaced. The main shaft can be replaced with the selector unit in place but the range finder assembly must be removed as described in paragraph 171.

(2) Remove the selector cam and preceding components from the main shaft if they are not already removed and slide the main shaft into place from the right side.

(3) Move the throw-out clutch lever until the main shaft will slide past and into place.

(4) Place the bearing caps on the main bearings and tighten screws just sufficiently to prevent the shaft from shifting. Be careful to place the bearing caps so that the beveled corner is on the same side as where the casting is beveled.

(5) Place the selector cam and associated parts on the end of the shaft. Make certain that the friction clutch plates face in the right direction, and that the selector cam ends fit into the slots of the driven clutch plates. After the driving clutch plate on the end of the shaft has been tightened, check to see if the selector cam can be turned by hand. The cam should turn without difficulty.

(6) See related paragraphs in section XIV for complete instructions on the adjustment of the main shaft and range finder which must be completed before the teletypewriter can be operated.

#### 174. Repairing Platen Assembly

*a. GENERAL.* Replace platens if they cannot be repaired locally and if the condition of the

platen is such that the paper will not feed, or if the surface has become sticky or has split. Keep the platen free from oils or cleaning solvents at all times. All repair work should be done with the platen removed from the teletypewriter.

**b. REMOVAL OF PLATEN FROM TYPING UNIT.** A step-by-step procedure for removing the platen follows:

(1) Remove the three pilot screws which mount the detent ratchet, located on the right side of the platen, to the shaft.

(2) Remove the platen shaft by sliding the shaft and friction clutch out to the left.

(3) Remove the platen being careful not to get oil or greasy dirt on the surface.

**c. CLEANING THE PLATEN.** Clean metal parts of the platen with a cloth dampened in dry-cleaning solvent (SD). Clean the rubber parts with soap and water, wipe off with a damp cloth and dry with a clean, dry cloth.

**d. PRESSURE ROLLERS.** Release the pressure roller springs, back out the shoulder screws, and remove the pressure rollers. *Do not wash the pressure rollers.*

**e. REMOVAL OF SHINY OR ROUGH PLATEN SURFACES.** Do not attempt the removal of deep cuts or breaks by the following method. Place platens in a lathe, and cut a new surface with #0000 sandpaper supported in back by a flat block. Only remove as much surface as is required to remove the rough spots. In the case of smooth platens, remove sufficient surface to feed paper.

**f. REASSEMBLY OF PLATEN.** Reverse the disassembly procedure when the platen is reassembled in the typing unit. The platen should be in the proper position before the pilot screws are inserted. With a flashlight or other small light, look down a pilot screw hole of the platen detent ratchet and turn the shaft until an indentation in the shaft can be seen. Screw in the pilot screw until it is tight. Move the shaft to determine if the pilot screw is centered and retighten the screw. Repeat the process until the screw will no longer turn. Insert the other two pilot screws and tighten.

#### 175. Reassembling Typing Unit Subassemblies

*a. GENERAL.* In general all subassemblies are reassembled in the reverse order in which they are disassembled. If the parts have been cleaned and the surfaces are free from oil, relubricate them as they are reassembled. Particular at-

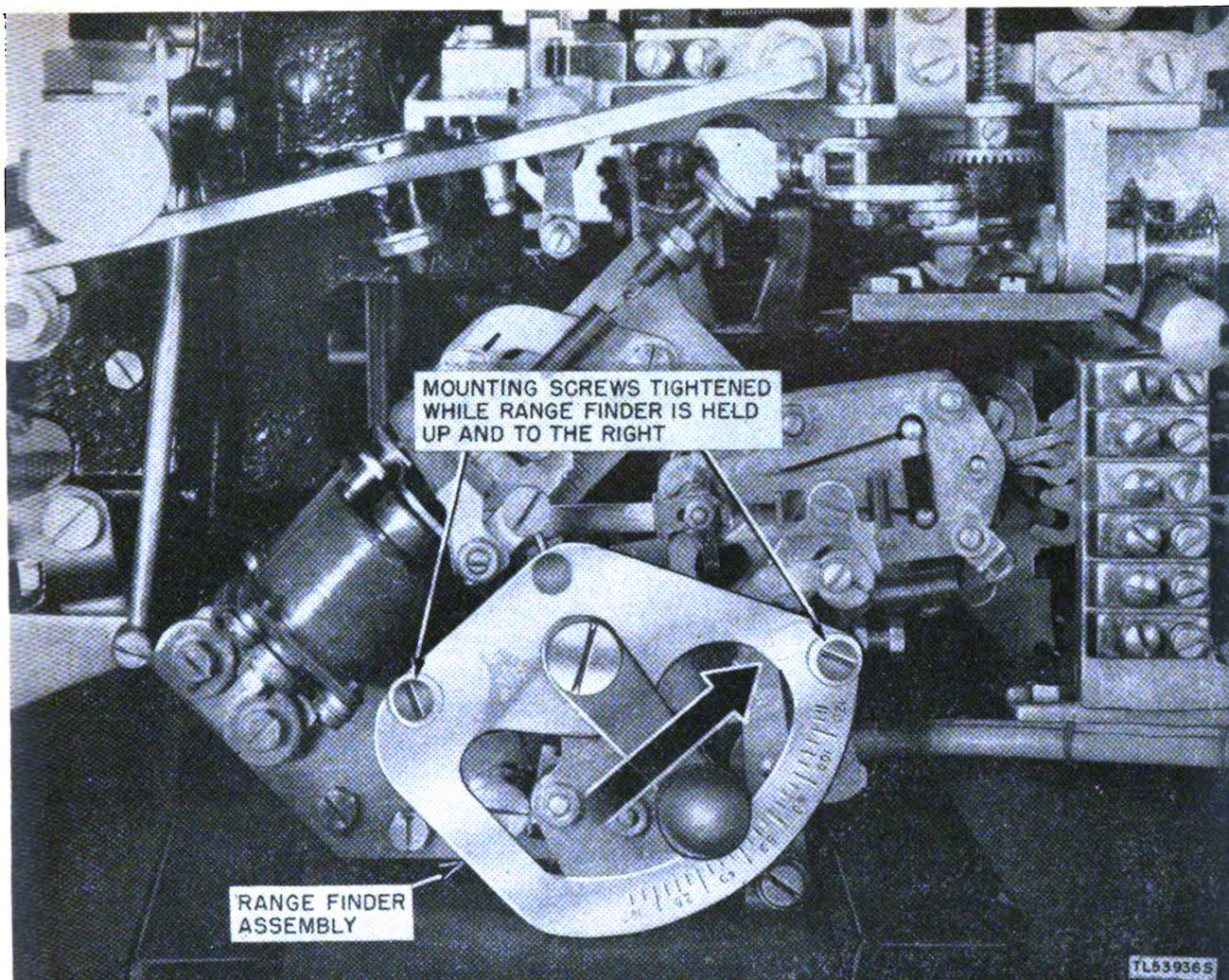


Figure 130. Replacing range finder.

tention should be given to all parts which are not easily accessible after the reassembling is completed.

**b. REPLACING THE RANGE FINDER ASSEMBLY.** By positioning the range finder in the following manner the range finder may be removed and reassembled without requiring the readjustment of the trip-off eccentric screw. After the mounting screws have been tightened, they should be backed off at least  $\frac{1}{2}$  turn. The play should then be taken up by exerting pressure to the right and up. Tighten the mounting screws.

**c. ADJUSTMENTS.** Any adjustments which have been altered in the process of disassembling, cleaning, repair, replacement, or reassembly of the parts must be completely readjusted according to the related instructions in section XIV.

## 176. Instructions for Disassembly of Type-bar Carriage

**a. REMOVAL OF CODE BARS.** Remove two screws holding the bell-crank bracket to the frame of the type-bar carriage. Remove the four nuts and washers from the two studs that hold the code bars to the carriage frame. Holding the code bars together, slide the bars and spacer washers out from the studs. Be careful not to lose washers that may stick to the outside of the code bars and fall off as the bars are lifted.

**b. REMOVAL OF PULL BARS AND TYPE BARS.** Remove the two fulcrum rod pilot screws. Slide the fulcrum rod out endways. Remove type bars. Remove pull-bar springs and pull bars. (See fig. 91.)

c. **REMOVAL OF PULL-BAR BAIL PLUNGER.** Remove bell-crank bracket. Remove the two screws that mount the pull-bar guide to the carriage frame, and remove the pull-bar guide. Remove the bail guide screws and remove the bail guides. Remove the two screws that hold the roller bracket and remove the roller bracket. Remove the two screws and springs that fasten the pull-bar bail to the plunger. Remove the bail to the front and remove the plunger to the rear. (See fig. 80.)

d. **REMOVAL OF RIBBON OSCILLATOR MECHANISM.** Remove two screws that mount the ribbon oscillator mounting bracket to the carriage frame. Remove the assembly including the margin bell pawl, the ribbon oscillator, and the ribbon oscillator springs and levers. (See fig. 84.)

e. **REMOVAL OF RIBBON FEED RATCHET MECHANISM.** Remove the two nuts that hold the ratchet bearing cap. Remove the ratchet shaft friction spring screw, and remove the ratchet shaft. Remove the screw that mounts the ribbon feed operating lever to the carriage, remove the ratchet pawl spring, and remove the ratchet pawl and lever.

## 177. Repairing and Replacing Type Bars

a. **GENERAL.** The decision to repair or replace faulty type bars should be made in accordance with authorized maintenance instructions for the organization involved.

b. **REPLACING TYPE BARS.** (1) Remove the type bar carriage, the ribbon, and two screws and the lockwashers that fasten the type-bar guide to the adapter plate. Unhook the ribbon carrier from the oscillator lever, and remove the type bar guide.

(2) Raise the type bar and move the bar beyond its operating top position. Hold the pull bar and lift out the type bar.

(3) Replace the new type bar in the type segment, and engage the pull bar so that the pull bar is even with the other pull bars when the type bar is in the rest position.

*Note.* New type bars that are oversize should be stoned down with a carborundum stone so that the type bar does not bind and has not more than 0.003-inch side play when against its backstop and 0.002-inch side play when in its typing position. Carefully clean all abrasive from type bar before assembling.

(4) Reassemble the type-bar guide and ribbon carrier and connect the oscillator lever to the ribbon carrier.

(5) Replace the type-bar carriage in the typing unit (par. 147).

c. **REPAIR OF TYPE-BAR PALLETS.** (1) Straighten toes with type-bar toe straightening tools.

(2) If necessary, reposition adapter plate. (See fig. 84.) To reposition the plate loosen its two mounting screws, adjust to proper position, then tighten the mounting screws.

(3) Adjust horizontal alignment by heating the pallet with the soldering tool and moving the pallet up or down by tapping.

(4) Straighten pallets by gripping type bar firmly with the short-nose pliers just below the pallet and bending the end of the type bar.

## 178. Reassembling Type-bar Carriage Parts

a. In general all parts are reassembled in the reverse order in which they are disassembled. If the parts have been cleaned and the surfaces are free from oil, relubricate them as they are reassembled. Give particular attention to all parts which are not easily accessible after the reassembling is completed.

b. Any adjustments which have been altered in the process of disassembling, cleaning, repair, replacement, or reassembly of the parts must be completely readjusted according to the related instructions in section XIV.

## 179. Instructions for Base Repairs

a. After the typing unit, motor unit, and keyboard have been removed from the teletypewriter base, the base plate can be easily removed as follows:

(1) Remove four nuts from the bolts fastening the teletypewriter base to the base of the chest.

(2) Lift the base from the base of the chest.

(3) Remove the four screws which fasten the base plate to the teletypewriter base.

b. All parts and wiring are accessible for inspection and should be cleaned as described in preventive maintenance cleaning instructions, paragraph 35, and special cleaning instructions in paragraph 144.

c. Inspect the wiring carefully for damage at fasteners and where it passes through openings in the casting or other parts. When the insulation has been seriously damaged or has been softened by oil and grease, replace the entire length of the wire. When several wires have been damaged, replace the entire harness.

Use rubber and friction tape for temporary repairs.

d. Clean all contacts with cloth dampened with carbon tetrachloride. Burnish the contacts and reposition when necessary. Refer to section XIV for instructions on spring tensions.

*Note.* See section VIII, moistureproofing and fungiproofing instructions, and treat the bottom of the base before reassembling the base plate.

e. Reassemble the base plate to the teletypewriter base and the base to the base of the chest in the reverse order of the instructions for disassembly in *a* above.

f. Clean cords, plugs, and terminal block connections on the top of the base as described in section V and replace any parts found on inspection to be seriously worn.

g. Instructions for the installation of a filter unit to suppress radio-frequency induction which may be transmitted from the teletypewriter to external power wiring are contained in MWO SIG 11-353-1. These instructions apply only to the earlier model teletypewriters not equipped with a power leads filter.

## 180. Instructions for Repair and Replacement of Cover

a. The repairs to the various parts of the cover are limited to cleaning as described in preventive maintenance instructions, paragraph 42, and straightening bent parts before refinishing as described in paragraph 182.

b. Replace a cracked or broken glass cover and missing screws.

c. When a cover or door mounting screw is broken and cannot be replaced, drill a hole with a small drill and tap it to accommodate a new flathead screw. Countersink the hole for the head of the new screw.

d. Replace the padding and facing that has become frayed which might drop into the mechanism.

e. Replace broken lid stop arm and bracket.

*Note.* For instructions on replacing old style stop arm (Signal Corps stock No. 4T82413) with later style stop arm (Signal Corps stock No. 4T104572) refer to MWO SIG 11-352-1.

## 181. Instructions for Repairing Chests

a. **INSPECTION.** The chest should be free from splits, holes or open glued joints. The chest handles and latches should operate without binding. Replace any chests which are damaged beyond correction by minor repairs. The follow-

ing instructions may be used in making minor repairs to the wooden chests.

b. **REPAIR OF WOODEN PARTS.** (1) Repair glued joints as follows: spread the joint with a wedge or screw driver, take care not to split or distort the wood and apply glue as far as possible in the open joint. Clamp the joint together until the glue has dried.

(2) Repair holes by fitting plugs to the holes and gluing the plugs in place. Cut the plugs off even with the surfaces of the chest.

(3) Replace cracked or broken sections by gluing or screwing in new pieces of wood. Use metal strips or small pieces of wood to repair holes which would allow moisture or dirt to enter the chests. Temporary repairs which prevent further damage to the chests will frequently save time later when the mechanism is overhauled.

c. **REPAIR OF METAL FITTINGS.** (1) Repair latch loops by making a new latch loop from heavy iron wire. Use one of the good latch loops as a pattern to shape the wire as a replacement loop.

(2) Bent latches may be removed, straightened, and replaced. Tighten any loose latches. If the woodscrew holes become enlarged, insert small pieces of wood so that the screws go in tightly.

d. **REFINISHING CHESTS.** See paragraph 182 for instructions on repairing the painted surfaces of chests.

## 182. Painting and Refinishing

a. When a touch-up job is required on painted surfaces of the chests or teletypewriters, apply paint with a small brush. When numerous scars and scratches warrant complete repainting, remove the cover, panels, etc., and complete the work where there is no possibility of damaging the teletypewriter mechanism. Use dry-cleaning solvent (SD) to soften, and sandpaper to clean rust spots and corroded metal surfaces.

**Caution:** Do not use steel wool. Minute particles of steel wool frequently enter the case and remain to cause harmful internal shorting or grounding of the circuits.

b. Only paint authorized and consistent with existing regulations should be used in painting or refinishing the chests or teletypewriter.

c. See section VIII for information on moistureproofing and fungiproofing after repairs.

### 183. Emergency Repairs

a. GENERAL. Under *emergency conditions* normal requirements for new replacement parts may have to be set aside and any available parts, assemblies, or units used to restore service.

*Note.* LOCALLY CONSTRUCTED OR TEMPORARILY REPAIRED PARTS AND NONSTANDARD ITEMS OR ADJUSTMENTS SHOULD BE USED TO RESTORE SERVICE ONLY UPON PROPER AUTHORITY AND SHOULD BE REPLACED OR READJUSTED AT THE EARLIEST POSSIBLE OPPORTUNITY.

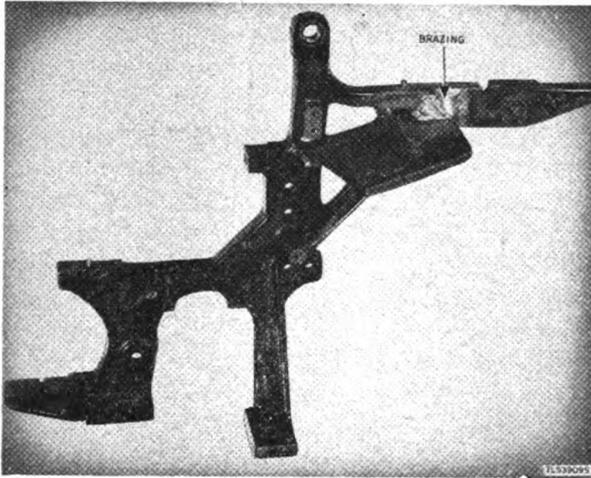


Figure 131. Repair by brazing.

b. CASTING REPAIRS. Frames of cast iron or steel may sometimes be repaired by brazing. Figure 131 illustrates a break repaired by brazing. Take great care in setting up broken castings for brazing especially when small errors in positioning cannot be corrected by adjustment.

c. STRIPPED THREADS. (1) When threads in parts have been stripped they can sometimes

be repaired by using the next larger size tap that has the same number of threads per inch, and by using the next larger size screw. For example, a No. 8-32 thread that has been stripped can be retapped with a No. 8-32 tap, and a No. 8-32 screw used instead of the No. 6-32 screw.

(2) When the above method is not suitable, repairs may sometimes be made by drilling a clearance hole for the screw, and soldering a steel hexagon nut over the hole on the side away from the screw (fig. 132).

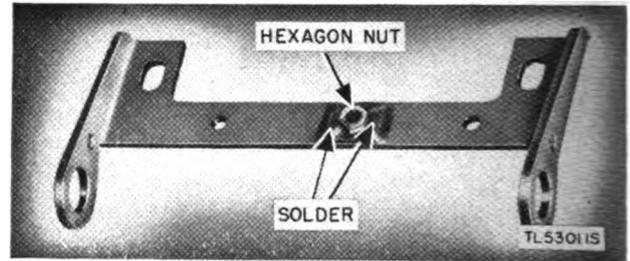


Figure 132. Repair of threads.

d. REPAIRS BY SOLDERING. Solder may be used in joining any metals which can be tinned, such as copper, brass, or steel; but the repairs must be made in such a way that there is little strain on the solder. Figure 133 shows a repair to a steel bar using solder and a piece of sheet metal bent in the form of a U. Both the sheet metal and the repaired part must be tinned using an acid flux. In case of the above example, a large area of solder holds each side of the broken part to the sheet metal, and the sheet metal gives the joint strength. When acid flux is used for tinning, the parts must be cleaned in hot water to remove the traces of acid left after soldering.

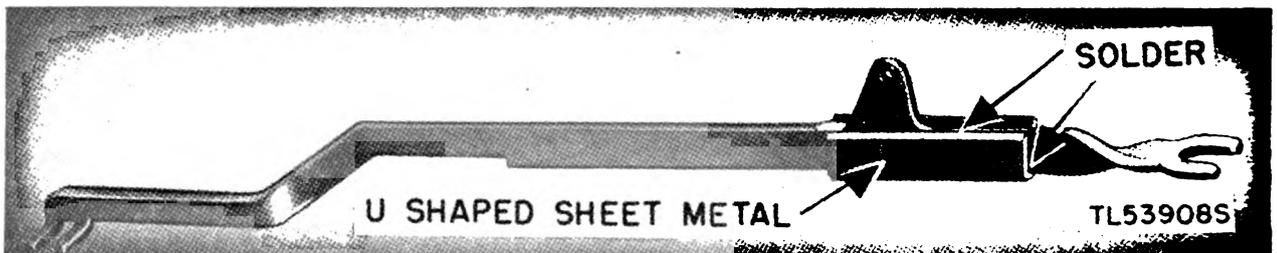


Figure 133. Repair by soldering.

e. TEMPERED METAL PARTS. (1) Parts such as small springs, broken near the ends, may sometimes be used by turning up a new end loop with a pair of pliers.

(2) Large springs and tools that are broken near the ends can sometimes be heated and bent into shape. Figure 134 shows a spring, the end of which has been repaired by heating and reshaping. Certain tools can be heated, reformed, hardened, tempered and resharpened in order to restore their usefulness.

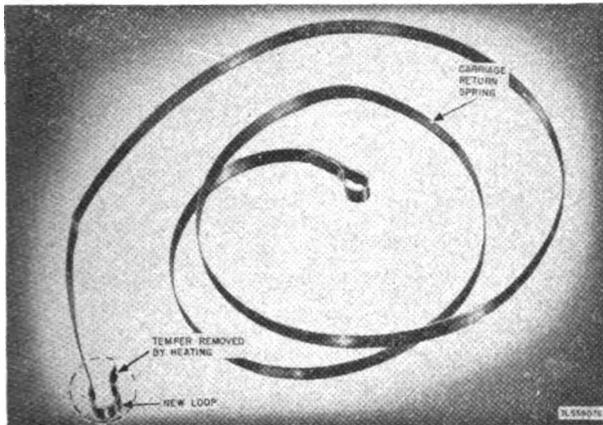


Figure 134. Repair of metal spring.

## Section XIV

### REQUIREMENTS AND ADJUSTMENTS

#### 184. Introduction to Test Requirements and Adjustment Procedures

a. GENERAL. The data in this section includes all test requirements and adjustments for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B. The information is arranged in the sequence that will normally be followed when a test and adjustment of a complete teletypewriter is undertaken.

b. INDEX. When a complete test and adjustment is not involved, reference should be made to the special requirement and adjustment index in this section to locate the desired information.

**Caution:** Always remember that a change in any one adjustment requires the checking of all related adjustments.

#### c. REQUIREMENT AND ADJUSTMENT INDEX.

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Clutch throw-out lever spring tension		358	Paper-finger shaft spring tension		287
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Code-bar mounting plate adjustment		191	Paper spindle drag spring adjustment		321
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Figures stop screw adjustment		257	Platen friction assembly adjustment		322
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Function bail spring adjustment		229	Platen-shift stop post adjustment		255
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Margin signal bell adjustment		340	Right motor-stop contact adjustment		327
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Motor-stop function lever		248	Selector cams adjustment		217
Motor-stop lever backstop screw adjustment		242	Selector clutch torque		341
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## 185. Details of Requirements and Procedures

The information in each paragraph is arranged under three headings: preparation, requirements, and adjustments.

*a. PREPARATION.* Necessary instructions for arranging the unit for testing or adjusting are furnished under this heading.

*b. REQUIREMENTS.* Measurements, spring tensions, setting, etc., that have been found to give the best results are furnished under this heading. Some requirements have a very small working margin and others have a large working margin. Owing to slight differences in various machines of the same model, some teletypewriters function much better when clearances are adjusted to minimum values recommended, and other teletypewriters give better results with clearances adjusted to maximum values. The same is true for spring tensions, air gaps, etc. Therefore, the requirements given in this

manual for clearances, spring tensions, etc., should be applied as necessary to give the best operation.

*c. ADJUSTMENTS.* Each adjustment is described in text and for emphasis is often indicated in the illustrations. The adjustments vary in nature, including replacing an old spring with a new one, bending a leaf spring with a spring bender, repositioning an eccentric screw, inserting shims between parts, etc. As a starting point when making adjustments set the clearances, etc., midway between the minimum and maximum values until it can be determined if more critical adjustments are required.

## 186. Preparation for Checking and Adjusting

*a. GENERAL.* Teletypewriter adjustments are made on the basis of various units and assemblies. To facilitate checking and adjusting, it is necessary to remove some of the units and assemblies, or to set up certain functions.

*b. REMOVING AND REPLACING ASSEMBLIES AND UNITS FROM ASSOCIATED EQUIPMENT.* Refer to disassembly and reassembly information in section XIII for detailed information when required.

*c. SETTING UP CERTAIN CHARACTER OR FUNCTION.* When the preparation for any adjustment specifies setting up a certain character or function, use the following method: Rotate the main shaft until the printing bail is in its extreme rear position. Hold down the front edges of the vanes which correspond with the marking impulses of the code combination to be set-up. (See fig. 23.) Then rotate the main shaft as directed in the particular adjustment.

*d. SPRING TENSION.* Spring tension values given in this manual were derived from measurements made with teletype spring scales, which are calibrated for use in a vertical pull position. When the scales are used in any other position, the reading is an indicated value. To get the proper spring value readings, use spring scales included in the teletypewriter tool kit as shown in the illustrations.

*e. FIXED PIVOTS.* Solid black circles on illustrations indicate fixed pivots.

## 187. Plunger Guide Roller Bracket (fig. 135)

*a. PREPARATION.* Remove the type-bar carriage. (See par. 142.)

*b. REQUIREMENTS.* The clearance between either the right or the left end of the pull-bar

bail and the stripper plate (fig. 138) should not be more than 0.010 inch when the bail is moved to its extreme forward position. Also, the flanged guide roller should be paralleled, or within 0.002 inch of being parallel, to the surface of the plunger, and both guide rollers should turn freely.

c. ADJUSTMENT. (1) To adjust the position of the pull-bar bail with relation to the stripper plate, loosen the plunger guide roller bracket mounting screws and move the bracket right or left.

(2) To adjust the flanged roller with relation to the plunger, move the roller end of the bracket up or down with the mounting screws friction-tight. Tighten the mounting screws.

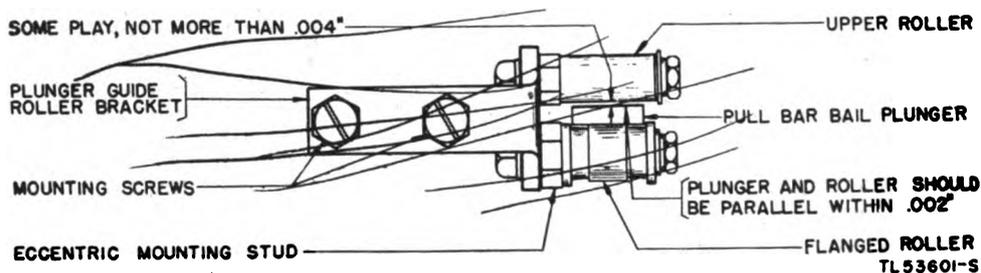


Figure 135. Plunger guide roller bracket.

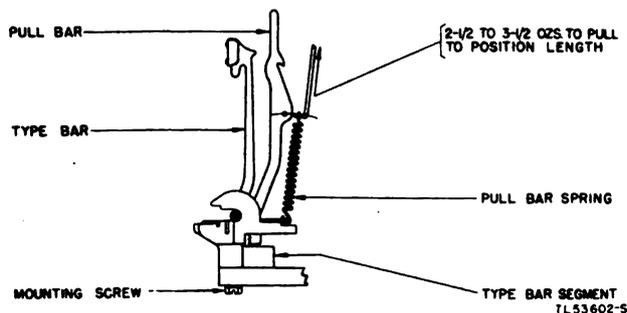


Figure 136. Pull-bar spring.

### 188. Plunger Roller Eccentric Mounting Stud (fig. 135)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. Play between the pull-bar bail plunger and the roller should be not more than 0.004 inch. Check the play throughout the entire travel of the plunger.

c. ADJUSTMENT. Turn the eccentric mounting stud right or left as required.

### 189. Pull-bar Spring (fig. 136)

a. PREPARATION. Remove the type bar carriage and the type bar segment assembly.

b. REQUIREMENTS. With any spring unhooked from its pull bar and an 8-ounce scale hooked in the spring eye, an upward pull of 2½ to 3½ ounces should be required to stretch the spring to position length.

c. ADJUSTMENT. Replace with a new spring.

### 190. Ribbon-feed Pawl Spring (fig. 137)

a. PREPARATION. Remove the type-bar carriage and the type-bar segment assembly.

b. REQUIREMENTS. With the pull-bar bail in its extreme rear position and the carriage held in its normal position, unhook the ribbon-feed pawl spring from its post. With an 8-ounce

scale held in a horizontal position and hooked in the eye spring, a pull of 2¼ to 3¼ ounces should be required to stretch the spring to its position length. Rehook the spring and remount the type-bar assembly, the type-bar backstop, and the ribbon carrier. Be careful to get the ribbon lockout bar and detent spring (fig. 148) and the ribbon-oscillator lever (fig. 148) in their slots.

c. ADJUSTMENT. Replace with a new spring.

### 191. Code-bar Mounting Plate (fig. 138)

a. PREPARATION. The type-bar carriage must be on the typing unit.

b. REQUIREMENTS. With the pull-bar bail in its extreme rear position, move the code bars to the right. Then move the code-bar bail opposite the pull-bar humps. Clearance between the humps on all pull bars (except the blank pull bar) and the pull-bar bail should be 0.008 to 0.020 inch. With the code bars moved to their left position, the clearance between the blank pull-bar hump and the pull-bar bail should also be 0.008 to 0.020 inch.

b. REQUIREMENTS. (1) The left end of the ribbon-feed shaft should be flush with the inner end of the left vertical feed shaft bevel gear teeth. When the ribbon-feed shaft is in its left position the left vertical feed-shaft bevel gear is held in engagement with the ribbon-feed shaft gear.

(2) A similar condition should exist when the ribbon-feed shaft is in its right position and the right vertical feed-shaft bevel gear is held in engagement with it.

c. ADJUSTMENT. Loosen the mounting screws on both right and left ribbon spool brackets,

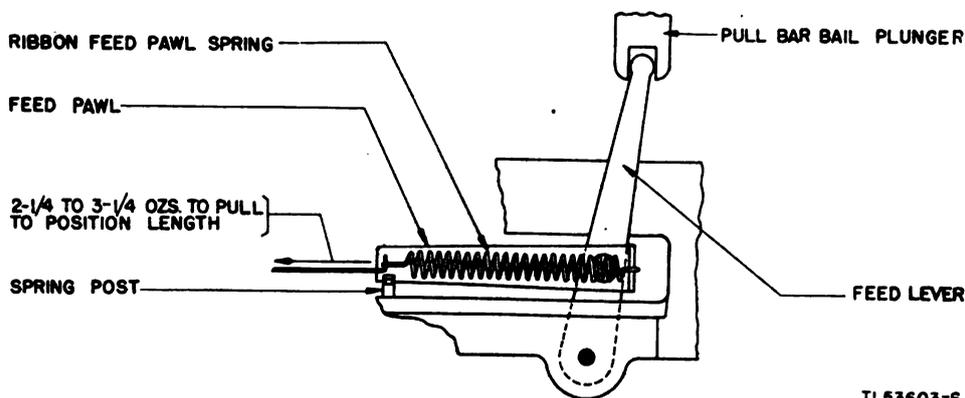


Figure 137. Ribbon-feed pawl and spring.

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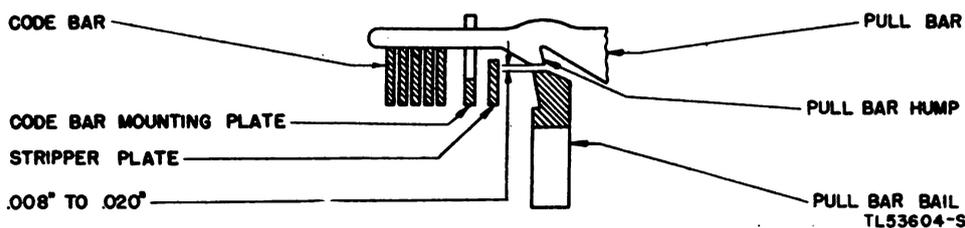


Figure 138. Code bars.

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c. ADJUSTMENT. Remove the bell-crank mounting plate assembly (fig. 150) from the type-bar carriage assembly, being careful not to bend the bell-crank retainer. Position the code-bar mounting plate to the specified clearance by means of its mounting slots. When this adjustment is checked, all the play of the pull-bar bail should be taken up in a direction to make the minimum clearance.

### 192. Ribbon-feed Shaft Bearing Plates (figs. 139 and 140)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

and move the brackets up as far as the mounting slots permit. Tighten the mounting screws with the brackets vertical. Adjust the right bearing plate by means of its clamping nuts to meet the first requirement. Adjust the left bearing plate the same way with the ribbon-feed shaft in its right position to meet the second requirement.

### 193. Ribbon-feed Shaft Detent Spring (fig. 139)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. (1) When the shaft is

moved from its extreme left to its extreme right position (or from the right to the left), the center of the ribbon-feed shaft detent roller should be just as high as the center of the ribbon-feed shaft, and the shaft detent should travel equally on both sides of the detent roller.

(2) Move the ribbon-feed shaft to its extreme left position. Hook a 32-ounce scale over the detent roller hub and pull horizontally toward the rear of the type-bar carriage. A pull of 19 to 23 ounces should be required to start the roller moving away from the detent. Move

#### 194. Vertical Ribbon-feed Shafts (fig. 140)

a. PREPARATION. Remove the type-bar carriage (par 142).

b. REQUIREMENTS. The lower ends of the right and left vertical ribbon-feed shafts should be flush with the outside edges of their respective bevel gears.

c. ADJUSTMENT. Loosen the bevel-gear set-screws. Move the bevel gears. Tighten the bevel-gear setscrews, making sure that when the set-screws are tightened they bear against the *flat surfaces* on the shafts.

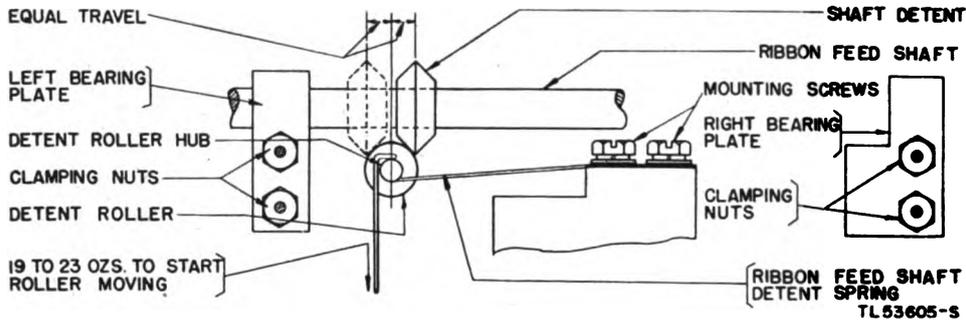


Figure 139. Ribbon-feed shaft detent.

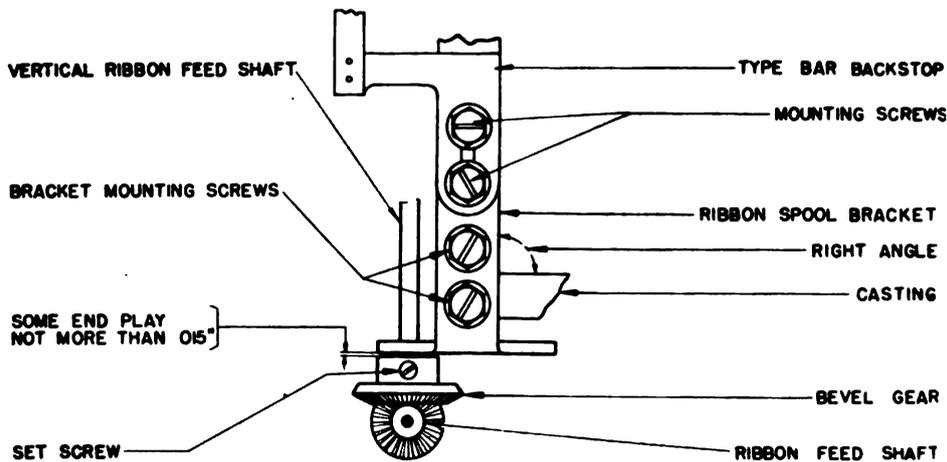


Figure 140. Vertical ribbon-feed shafts.

the ribbon-feed shaft to its extreme right position and check the pressure of the detent spring in the same way. The two pressures should be within 2 ounces of being equal.

c. ADJUSTMENT. (1) Loosen the mounting screws of the ribbon-feed shaft detent spring and move the spring.

(2) To increase or decrease the spring pressure, remove the spring and bend it. To equalize the pressure, move the spring to the right or the left.

#### 195. Ribbon Spool Brackets (fig. 140)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the ribbon-feed shaft in its left position, the left vertical ribbon-feed shaft should have some end play, but not more than 0.015 inch, during one revolution of the vertical ribbon-feed shaft bevel gear. The right vertical ribbon-feed shaft should have the same amount of end play when the ribbon-feed shaft is in its right position. When checking the ver-

tical feed shaft for end play, take up the bearing play of the ribbon-feed shaft in a direction which makes the least possible end play of the vertical feed shaft.

c. **ADJUSTMENT.** Move both the right and the left ribbon spool brackets by means of their mounting slots. Make sure the brackets are vertical. Check the type-bar backstop adjustment.

### 197. Vertical Ribbon-feed Shaft Spur Gears (fig. 141)

a. **PREPARATION.** For convenience, remove the type-bar carriage. (See par. 142.)

b. **REQUIREMENTS.** Both the right and the left vertical ribbon-feed shaft spur gears should line up with their ribbon-spool shaft spur gears.

c. **ADJUSTMENT.** Loosen the setscrews and move the spur gears. Tighten the setscrews,

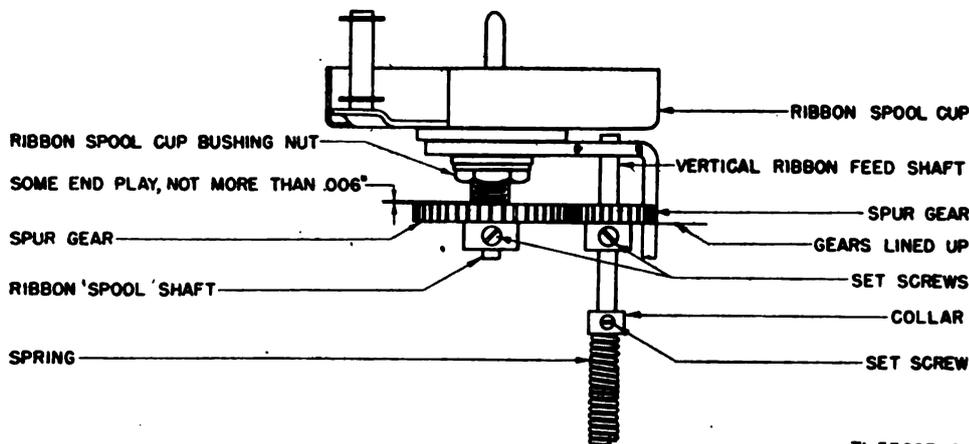


Figure 141. Ribbon-spool shaft.

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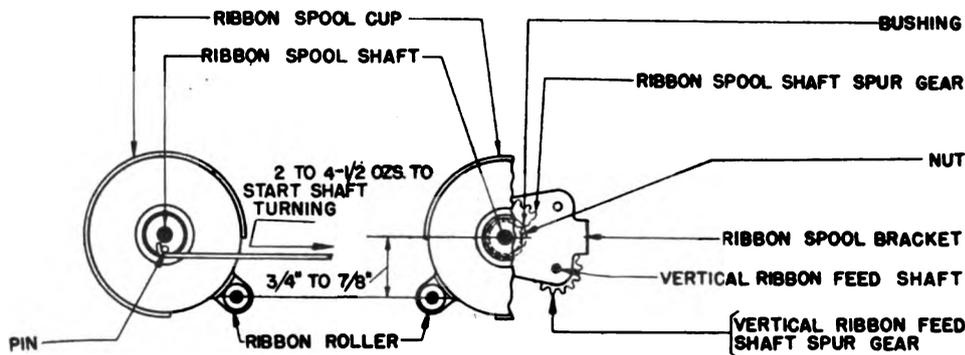


Figure 142. Ribbon-spool cups.

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### 196. Ribbon-spool Shaft Spur Gears (fig. 141)

a. **PREPARATION.** For convenience, remove the type-bar carriage.

b. **REQUIREMENTS.** The ribbon-spool shafts should have some end play, but not more than 0.006 inch.

c. **ADJUSTMENT.** Loosen the setscrews of the vertical ribbon-feed shaft spur gears and move the gears out of engagement with their ribbon-spool shaft gears. Loosen the setscrews on the ribbon-spool shaft spur gears. Move the ribbon-spool shaft spur gears. Tighten the setscrews. When tightening the setscrews make certain that they bear against the *flat surfaces* on the shafts.

making sure that they bear against the *flat surfaces* on the shaft.

### 198. Ribbon-spool Cups (fig. 142)

a. **PREPARATION.** For convenience, remove the type-bar carriage (par. 142).

b. **REQUIREMENTS.** The centers of the ribbon rollers should be  $\frac{3}{4}$  to  $\frac{7}{8}$  inch in front of a line through the centers of the ribbon-spool shafts. The ribbon-spool shaft spur gears and the vertical ribbon-feed shaft spur gears should not bind at any point in their engagement.

c. **ADJUSTMENT.** Loosen the nuts on the ribbon-spool cup bushings; position each cup, and tighten the nuts. When tightening the nuts,

take up the play between the ribbon-spool cup bushings and the brackets in a direction to make the maximum play between the spur gears. (See fig. 142.)

scale on the pin on the left ribbon-spool and pull in a horizontal direction. A pull of  $2\frac{1}{2}$  to  $3\frac{1}{2}$  ounces should be required to start the shaft turning. Move the ribbon-feed shaft

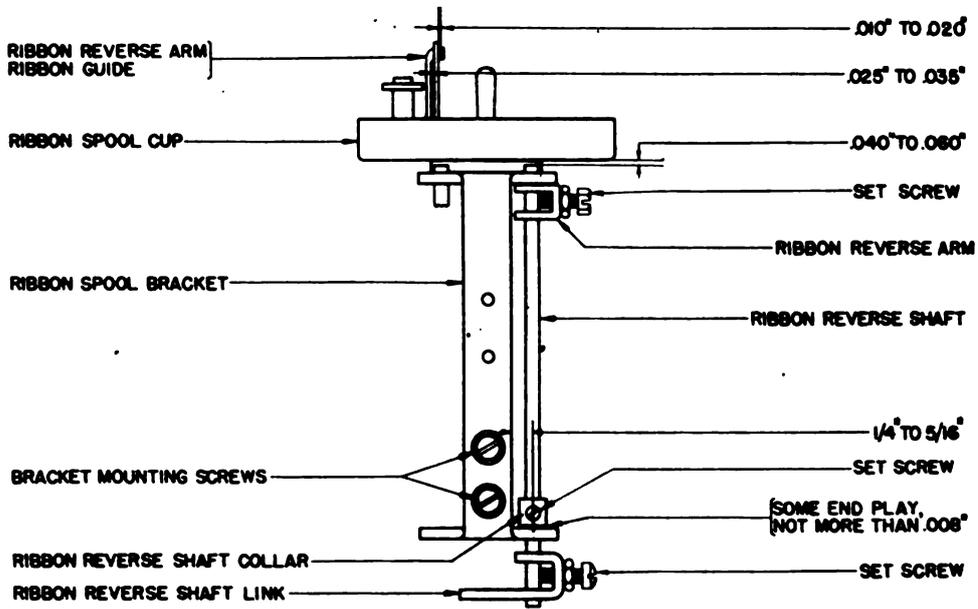


Figure 143. Ribbon-reverse shaft (old style).

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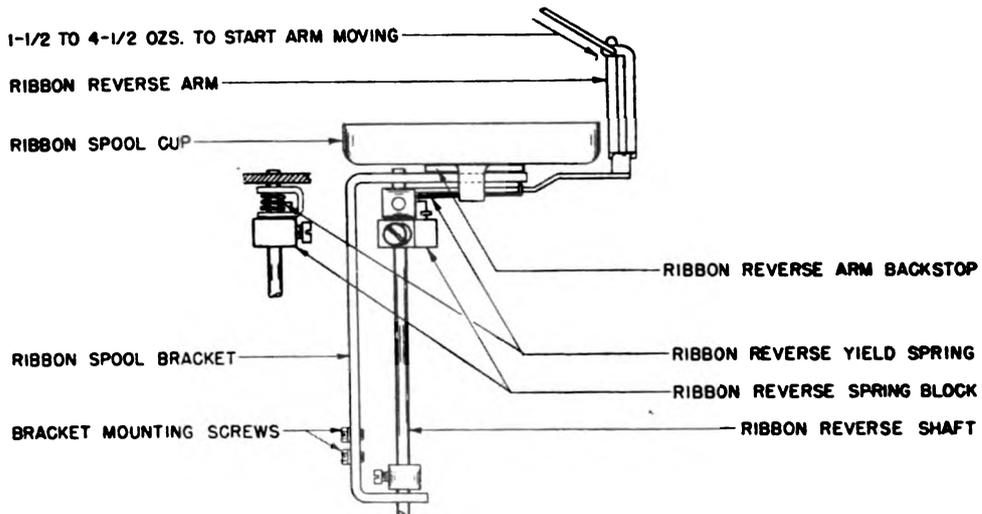


Figure 144. Ribbon-reverse shaft (new style).

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### 199. Vertical Ribbon-feed Shaft Spring (figs. 141 and 142)

a. PREPARATION. For convenience, remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. Move the ribbon-feed shaft to the right disengaging its gear from the gear on the left vertical feed shaft. Hook an 8-ounce

to the left, and in the same way check the spring tension of the right vertical ribbon-feed shaft.

c. ADJUSTMENT. Tighten the setscrews. To get the proper tension, loosen the setscrews and move the collars on the vertical feed shaft (fig. 141).

## 200. Ribbon-reverse Shaft (figs. 143 and 144)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. The clearance between the bottoms of the ribbon-spool cups and the upper ends of the ribbon-reverse shafts should be 0.040 to 0.060 inch when the ribbon-reverse arms are held up against the ribbon-spool brackets.

c. ADJUSTMENT. Loosen the setscrew of the ribbon-reverse arm and, if necessary, the setscrews of the collar and the link of the left ribbon-reverse shaft. Position the shaft while holding the ribbon-reverse arm up against the ribbon-spool bracket; then tighten the ribbon-reverse arm setscrew. Adjust the right ribbon-reverse shaft in the same way.

## 201. Ribbon-reverse Shaft Collar (fig. 143)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. The ribbon-reverse shafts should have some end play, but not more than 0.008 inch. The ribbon-reverse shaft collars should be positioned so that there is  $\frac{1}{4}$  to  $\frac{5}{16}$  inch between the centers of the setscrews and the edges of their ribbon-spool brackets.

c. ADJUSTMENT. Position the collars by means of their setscrews while holding both ribbon-reverse arms forward against their ribbon-spool brackets.

## 202. Ribbon-reverse Shaft Link (fig. 143)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. The ribbon-reverse bail should clear both the left and the right ribbon-reverse pawls by 0.015 to 0.040 inch when the pull-bar bail is in its extreme rear position and both the left and the right ribbon-reverse arms are held forward against their stops. When checking for the 0.015-inch clearance between

either ribbon-reverse pawl and the ribbon-reverse bail, take up the play in the ribbon-reverse bail in a direction to make the minimum clearance. When checking for the 0.040-inch clearance, take up the play in the ribbon-reverse bail in a direction to make the maximum clearance.

c. ADJUSTMENT. Loosen the setscrews, position the ribbon-reverse shaft links, and tighten the setscrews. At the same time make sure that the ribbon-reverse pawl links do not bind at their shoulder screws.

## 203. Ribbon-reverse Pawl Springs (fig. 145)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the ribbon-feed shaft in its left position and the pull bar in its extreme forward position, hold the carriage so that the ribbon-spool cups are down. Hook an 8-ounce scale in the notch of the left ribbon-reverse pawl and pull horizontally toward the rear of the carriage. A pull of 1 to 2 ounces should be required to start the pawl moving. Move the ribbon-feed shaft to its right position and, in the same way, check the tension of the right ribbon-reverse pawl spring.

c. ADJUSTMENT. Replace with new springs.

## 204. Ribbon-reverse Bail Springs (fig. 145)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the type-bar carriage held so that the ribbon-spool cups are down, hook a 4-pound scale in the corner at the left end of the ribbon-reverse bail; pull horizontally toward the front of the carriage. A pull of 2 to 4 pounds should be required to start the ribbon-reverse bail moving. Measure the right spring compression at the right end of the ribbon-reverse bail the same way.

c. ADJUSTMENT. Replace with new springs.

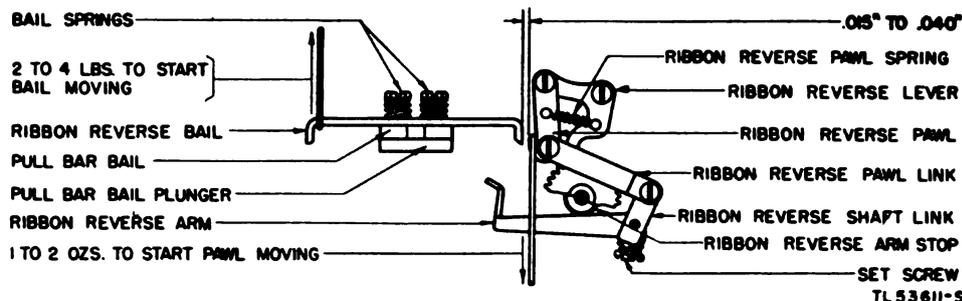


Figure 145. Ribbon-reverse mechanism.

### 205. Type-bar Backstop (fig. 140)

a. PREPARATION. For convenience, remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the pull-bar bail in its extreme rear position, clearance between the backstop and the pull bars should be not less than 0.010 inch when the type bars are held in the guide. Make this check on the two end pull bars and the middle pull bar.

c. ADJUSTMENT. Set the up-and-down position of the type-bar backstop by means of its mounting slots. (See fig. 140.) During this operation, it is desirable for the ends of the type bars to rest against the backstop along its entire width.

### 206. Ribbon-shift Lever Bracket (figs. 146 and 147)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. The ribbon-oscillator lever should move freely in its slot when its spring is unhooked.

c. ADJUSTMENT. Position the ribbon-shift lever bracket by means of its enlarged mounting holes. Rehook the ribbon-oscillator lever spring.

### 207. Ribbon-oscillator Lever Spring (fig. 146)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the ribbon-shift lever spring removed, hook an 8-ounce scale over the lower end of the ribbon-oscillator lever; pull horizontally toward the rear of the type-bar carriage. A pull of  $2\frac{1}{2}$  to  $3\frac{1}{2}$  ounces should be required to start the oscillator lever moving. Rehook the ribbon-shift lever spring.

c. ADJUSTMENT. Replace with a new oscillator lever spring.

### 208. Ribbon-shift Lever Spring (fig. 146)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the ribbon-oscillator lever spring unhooked from the oscillator lever, apply the push end of a 12-pound scale held in a vertical position to the ribbon-shift lever at the place where the ribbon-oscillator spring is mounted. A push of 1 to  $1\frac{3}{4}$  pounds should be required to start the shift lever moving. Rehook the ribbon-oscillator lever spring.

c. ADJUSTMENT. Replace with a ribbon-shift lever spring.

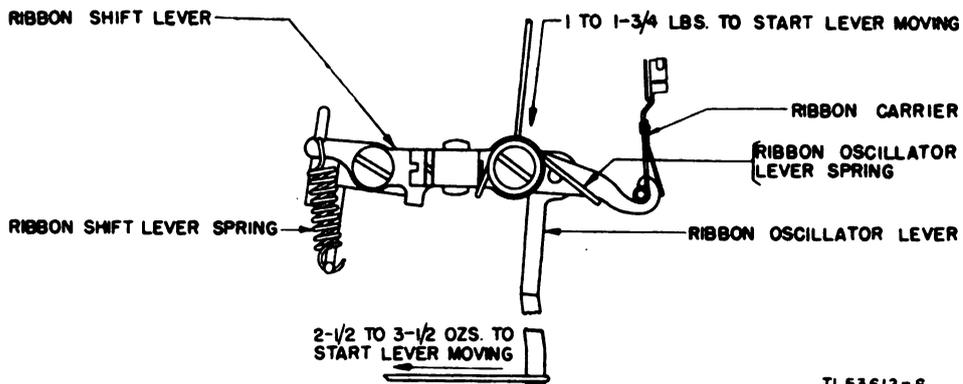


Figure 146. Ribbon-shift and ribbon-oscillator levers.

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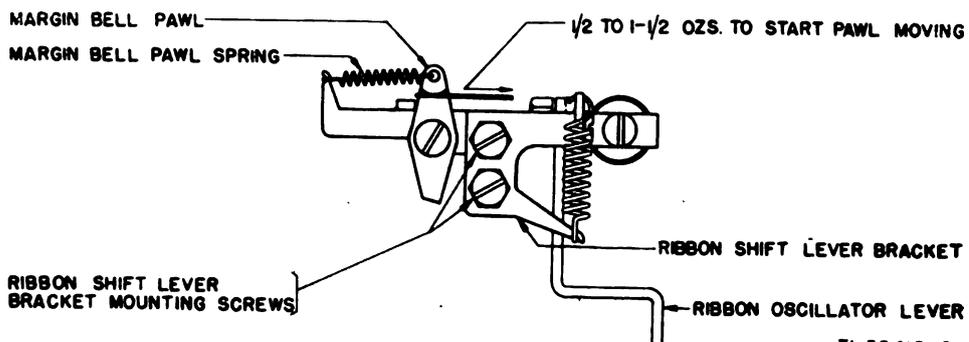


Figure 147. Margin-bell pawl.

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**209. Margin-bell Pawl Spring (fig. 147)**

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. Holding an 8-ounce scale in a horizontal position, hook the scale over the margin pawl, just above the stop; pull in line with the spring. A pull of  $\frac{1}{2}$  to  $1\frac{1}{2}$  ounces should be required to start the pawl moving.

c. ADJUSTMENT. Replace with a spring.

**211. Adjustable Ribbon Lockout Bar Detent Spring (fig. 149)**

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. Place the ribbon lockout bar in its unoperated position (extreme right). Apply the push end of a 12-pound scale against the ribbon lockout bar and push directly in line with the bar. A push of  $1\frac{1}{4}$  to  $2\frac{1}{4}$  pounds from

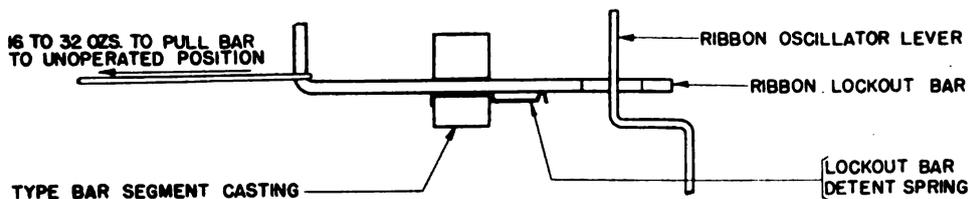


Figure 148. Nonadjustable ribbon lockout bar.

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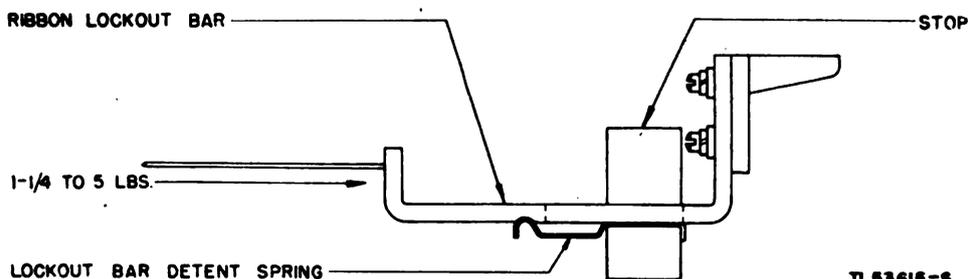


Figure 149. Adjustable ribbon lockout bar.

TL53616-S

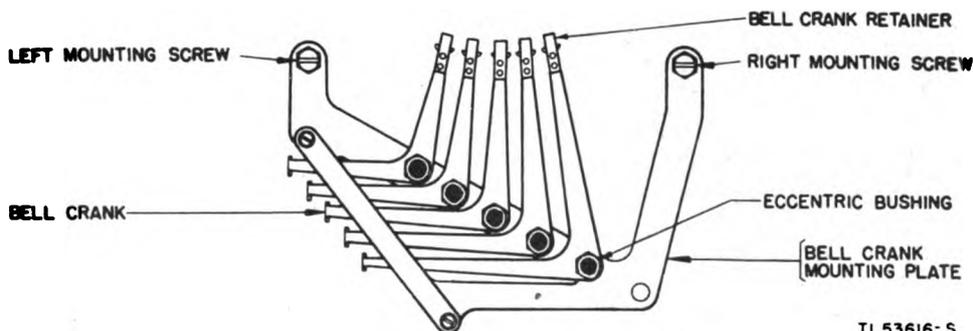


Figure 150. Bell crank assembly.

TL53616-S

**210. Nonadjustable Ribbon Lockout Bar Detent Spring (fig. 148)**

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the ribbon-oscillator extension held clear of the ribbon lockout bar and the lockout bar pushed in, hook a 32-ounce scale over the end of the lockout bar and pull directly in line with the bar. It should require 16 to 32 ounces to pull the lockout bar out to its unoperated position.

c. ADJUSTMENT. Replace with a new spring.

its notch in the lockout bar should be required.

c. ADJUSTMENT. Replace with a new spring.

**212. Mounting of Bell Crank Assembly (fig. 150)**

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. This is a preliminary adjustment only.

c. ADJUSTMENT. Place the bell cranks in their lowest position, with respect to the code bars, by means of the bell crank eccentric bushings.

Mount the right end of the bell crank assembly with one of its mounting screws so that it is friction-tight. Then turn the assembly clockwise and engage the five bell cranks with their respective code bars. Replace the left mounting screw and tighten both screws. (See par. 316 for directions on final adjustment of the code bars and bell cranks.)

### 213. Right Pull-bar Spring Bracket (fig. 151)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

*Note.* This paragraph applies only to teletypewriters equipped with three-section pull-bar brackets.

b. REQUIREMENTS. With the pull-bar bail in the extreme rear position, the right end pull bar and the fourth pull bar from the right end should have some play, but not more than 0.004 inch, between the right spring bracket and the type bar when the type bar is in its guide.

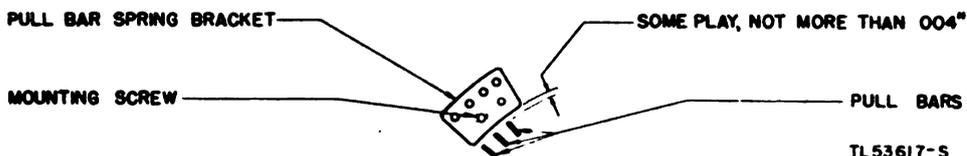


Figure 151. Pull-bar spring bracket.

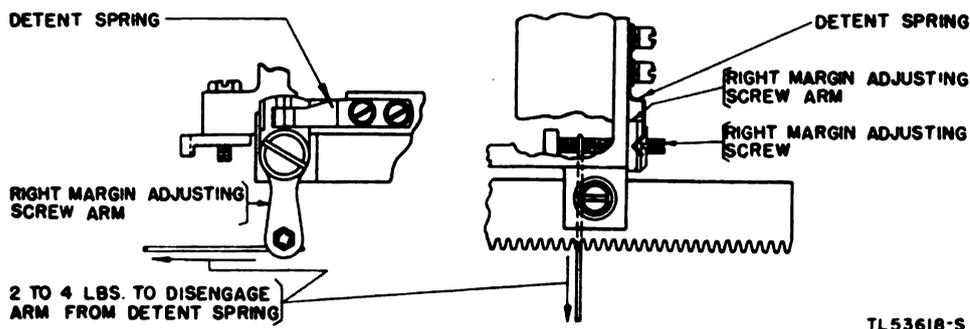


Figure 152. Right margin adjusting screw.

c. ADJUSTMENT. Loosen the mounting screw of the right pull-bar spring bracket and position the bracket. Tighten the screw. The second or the third pull bar from the end may bind against the spring bracket when its type bars are moved to the type-bar guide by hand. If so, readjust the spring bracket so that all four pull bars are free and so that the end pull bar and at least one of the other three pull bars have some play, but not more than 0.004 inch, between the type bars and the spring bracket. The type bars should be in the type-bar guide when this clearance is measured.

### 214. Left Pull-bar Spring Bracket (fig. 151)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

*Note.* This paragraph applies only to teletypewriters equipped with three-section pull-bar brackets.

b. REQUIREMENTS. With the pull bar in its extreme rear position, the left end pull bar and the third pull bar from the left end should have some play, but not more than 0.004 inch, between the left spring bracket and the type bar when the type bar is in its guide.

c. ADJUSTMENT. Loosen the mounting screw of the left pull-bar bracket and position the bracket. Tighten the screw. The second or third pull bar from the left end may bind against the bracket when its type bars are moved to the type-bar guide by hand. If so, readjust the spring bracket and the type bar when the type bar is in the type-bar guide.

### 215. Margin Adjusting Screw-arm Spring (fig. 152)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. With the notch in the right margin adjusting screw arm engaged with the detent spring, hook a 4-pound scale over the adjusting screw and pull at right angles to the arm toward the rear of the type-bar carriage. A pull of 2 to 4 pounds should be required to disengage the arm from the detent spring.

c. ADJUSTMENT. Replace with a new spring.

## 216. Carriage Support and Pull-bar Bail Plunger Rollers (fig. 156)

a. PREPARATION. Remove the type-bar carriage. (See par. 142.)

b. REQUIREMENTS. The three carriage support rollers and the pull-bar bail plunger roller should turn freely without end play.

c. ADJUSTMENT. Loosen the locknuts and adjust the cone nuts. The rollers should turn freely without end play after locknuts are tightened. (See fig. 156.)

## 217. Selector Cams

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. When the main shaft is turned, the selector cams on the selector-cam sleeve should line up with their respective selector levers.

c. ADJUSTMENT. Loosen the four screws that hold the main-shaft bearing brackets and position the main shaft. Then tighten the bearing bracket mounting screws.

## 218. Main-shaft Clutch Throw-out Lever (fig. 153)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. With the clutch-driven member fully out of engagement with the driving member, there should be 0.010 to 0.020 inch clearance between the ends of the clutch teeth. The clutch throw-out lever should not bind and should have no end play.

c. ADJUSTMENT. Reposition the clutch throw-out lever by means of its pilot screws.

## 219. Main-shaft Clutch Throw-out Lever Spring (fig. 153)

a. PREPARATION. Remove the typing unit from the base, remove the type-bar carriage, and place the typing unit on its left side. Turn the main shaft until the clutch teeth are fully engaged.

b. REQUIREMENTS. Hook an 8-ounce scale, held in a horizontal position, over the clutch throw-out lever at the spring hole. Pull at right angles to the clutch throw-out lever. A pull of  $2\frac{1}{2}$  to 4 ounces should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

## 220. Main-shaft Clutch Spring (fig. 154)

a. PREPARATION. Remove the typing unit from the base, remove the type-bar carriage, and place the typing unit on its right side. Turn the main shaft until the low part of the printing-bail cam is toward the bottom of the typing unit.

b. REQUIREMENTS. With the teeth of the clutch-driven member resting against the teeth of the driving member, but not engaged, hook a 32-ounce scale on the driven member in line with the lower part of the printing-bail cam; pull straight down. A pull of 22 to 26 ounces should be required to separate the clutch teeth. After checking the pull with the clutch teeth still separated, gradually reduce the tension of the scale on the clutch-driven member. The clutch teeth should engage, top to top, before the scale reading drops to 10 ounces.

c. ADJUSTMENT. Replace with a new spring.

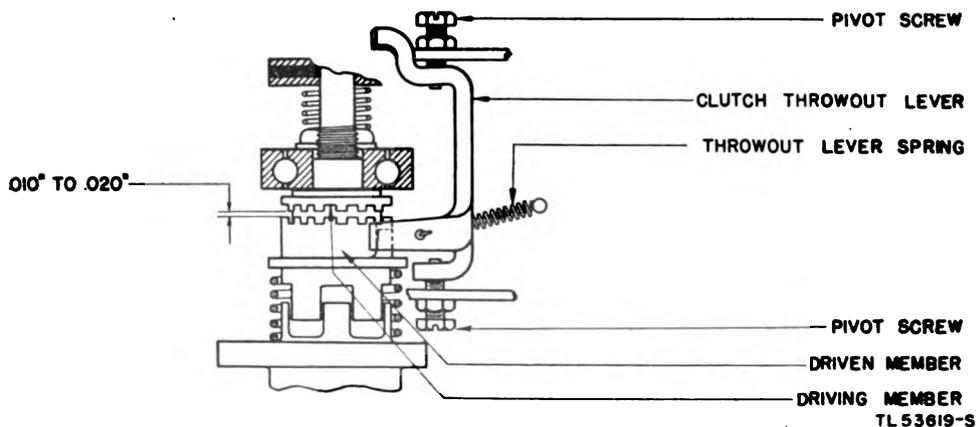


Figure 153. Main-shaft clutch.

## 221. Spacing-shaft Lower Bearing Bracket (fig. 155)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. During one complete revolution of the spacing-shaft gear, there should be the least possible amount of play without binding at any point of engagement between the spacing-shaft gear and the main-shaft spacing gear.

c. ADJUSTMENT. Unhook the carriage-return operating lever spring from the spring post. Move the eccentric away from the bearing bracket and turn the bracket by means of its mounting slots. Rehook the carriage-return operating lever spring and reposition the eccentric against the bearing bracket.

extreme right and extreme left positions, and with the play in the pull bars taken up in a direction to make the least possible clearance.

c. ADJUSTMENT. Position the printing bail by means of its adjusting screw and locknut.

## 223. Function Lever Bail (One-piece) (fig. 157)

a. PREPARATION. Remove the type-bar carriage from the typing unit after removing the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. (1) With the carriage-return combination selected, turn the main shaft until the carriage-return function lever is drawn completely into selection with the vanes. At this point the travel of the function-lever bail should be blocked by the selected function lever. The front edge of the right projec-

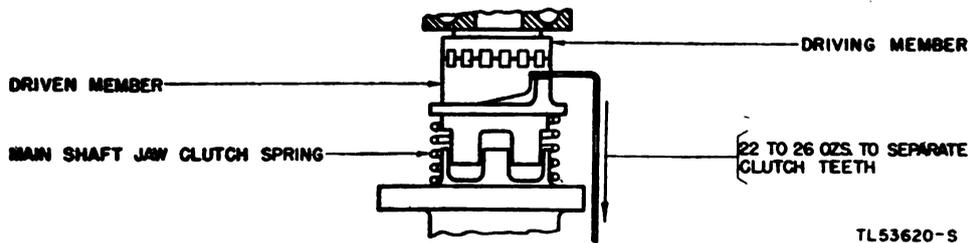


Figure 154. Main-shaft clutch spring.

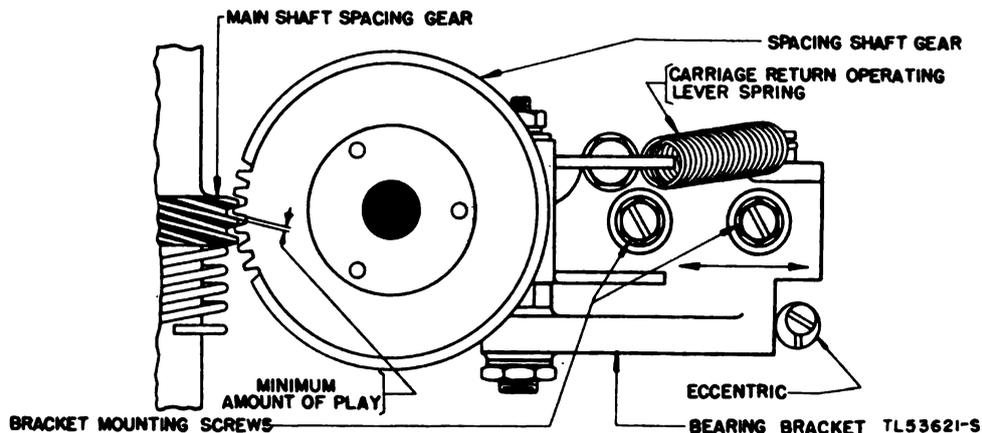


Figure 155. Spacing-shaft gear and lower bearing bracket.

## 222. Printing Bail (fig. 156)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. The pull bars should clear the code bars by 0.010 to 0.050 inch when the main shaft is turned until the printing bail is in its extreme rear position. Check this adjustment with the type-bar carriage in both its

tion of the function-lever bail should be flush, within 0.005 inch, with the top front edge of the rear prong of the carriage-return function lever.

(2) With the line-feed combination selected, turn the main shaft until the line-feed function lever is drawn completely into selection with the vanes. At this point the travel of the func-

tion-lever bail should be blocked by the selected function lever. The front edge of the left projection of the function-lever bail should be flush, within 0.005 inch, with the top front edge of the rear prong of the line-feed function lever.

(3) Turn the main shaft until the printing bail is in its extreme rear position, and hold the

(1) Select the carriage-return combination, and reposition the right end of the function-lever bail to meet the first requirement. (See *b*(1) above.)

(2) Select the line-feed combination and adjust the left end of the function-lever bail to meet the second requirement. (See *b*(2) above.)

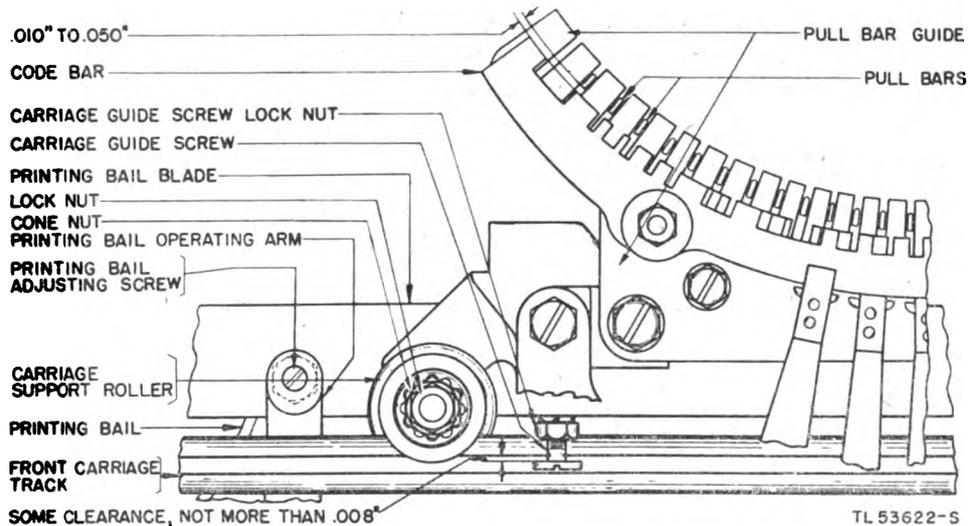


Figure 156. Printing bail and front carriage track adjustments.

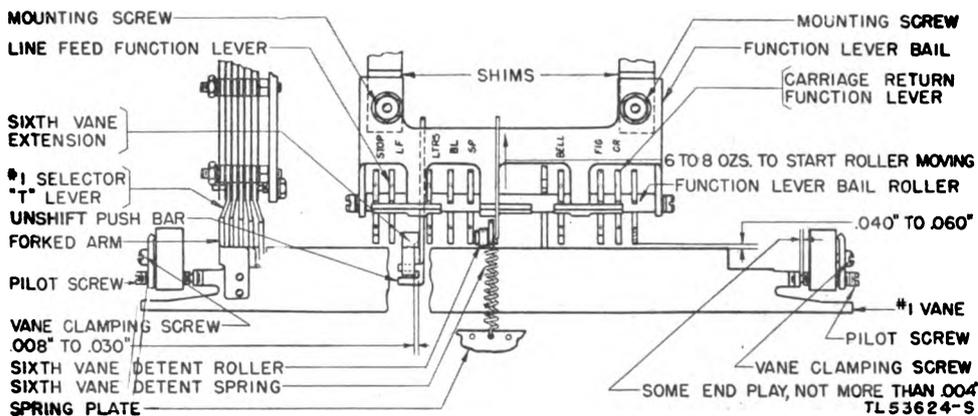


Figure 157. One-piece function-lever bail.

No. 1 vane halfway between its marking and spacing positions. There should be 0.040- to 0.060-inch clearance between the rear edge of the No. 1 vane and the front edge of the function levers, *except* the universal function lever.

*c. ADJUSTMENT.* Remove the line-feed push bar (fig. 176) and loosen the function-lever bail mounting screw nuts. Move the function-lever bail to its extreme rear position, and tighten the mounting screw nuts.

(3) Turn the main shaft until the printing bail is in its extreme rear position, and check the third requirement. (See *b*(3) above.) If this requirement is not met, add or remove shims between the function-lever bail and its mounting brackets, and readjust both ends of the bail. Replace the line-feed push bar.

*Note.* It is necessary to remove the line-feed push bar because the blocking plate is a permanent part of the one-piece function-lever bail.

## 224. Function-lever Bail (Two-piece) (figs. 157 and 158)

*a.* **PREPARATION.** Remove the typing unit from the base (par. 142); then remove the type-bar carriage from the typing unit.

*b.* **REQUIREMENTS.** Turn the main shaft until the printing bail is in its extreme rear position. Hold the No. 1 vane midway between its marking and spacing positions. There should be 0.040- to 0.060-inch clearance between the rear edge of the No. 1 vane and the front edges of the function levers.

*c.* **ADJUSTMENT.** Position the function-lever bail by means of its mounting slots.

(2) With the line-feed combination selected, turn the main shaft until the line-feed function lever is drawn completely into selection with the vanes. At this point the travel of the function-lever bail should be blocked by the selected function lever. The front edge of the left projection of the function-lever bail should be flush, within 0.005 inch with the top front edge of the rear prong of the line-feed function lever.

*c.* **ADJUSTMENT.** Remove the line-feed push bar (fig. 176), and position the blocking plate by means of its slotted holes. Replace the line-feed push bar.

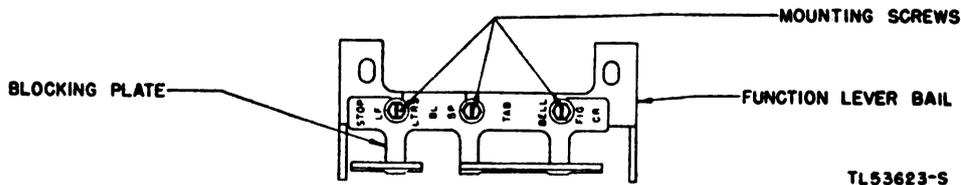


Figure 158. Two-piece function-lever bail.

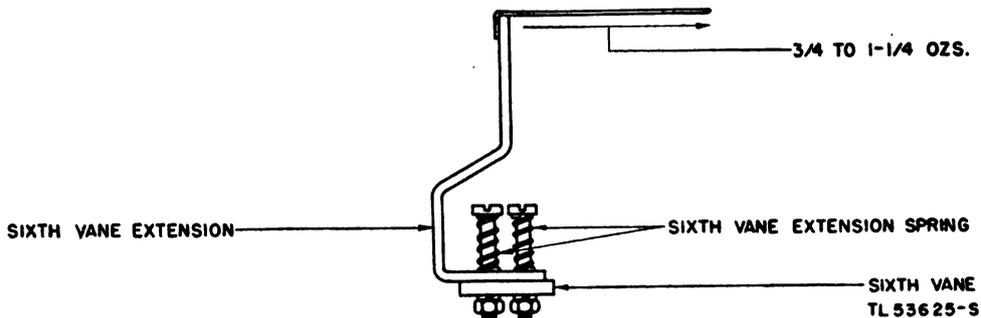


Figure 159. Sixth-vane extension and springs.

## 225. Blocking Plate (figs. 157 and 158)

*Note.* This adjustment applies only to typing units equipped with two-piece function-lever bails.

*a.* **PREPARATION.** Remove the typing unit from the base; then remove the type-bar carriage from the typing unit. (See par. 142.)

*b.* **REQUIREMENTS.** (1) With the carriage-return combination selected, turn the main shaft until the carriage-return function lever is drawn completely into selection with the vanes. At this point the travel of the function-lever bail should be blocked by the selected function lever. The front edge of the right projection of the function-lever bail should be flush, within 0.005 inch, with the top front edge of the rear prong of the carriage-return function lever.

## 226. Sixth-vane Extension Springs (fig. 159)

*Note.* This paragraph applies only to those typing units equipped with the new style sixth-vane extension. The sixth-vane extension is a formed piece of steel mounted on the sixth vane by means of shoulder screws and compression springs.

*a.* **PREPARATION.** Remove the typing unit from the base; then remove the type-bar carriage from the typing unit. (See par. 142.)

*b.* **REQUIREMENTS.** Loosen the left pivot screw and remove the sixth vane from the typing unit. Hold the vane in a horizontal position, with the vane extension up. Hook an 8-ounce scale over the upper end of the extension. Pull at right angles and toward the front of the vane. A pull of  $\frac{3}{4}$  to  $1\frac{1}{4}$  ounces should be required to start the extension moving away from the vane.

Check the spring compression in the opposite direction by hooking the scale over the end of the extension and pulling toward the rear of the vane. Replace the sixth vane.

c. ADJUSTMENT. Replace with new springs.

### 227. Sixth Vane (fig. 157)

a. PREPARATION. Remove the typing unit from the base; then remove the type-bar carriage from the typing unit. (See par. 142.)

b. REQUIREMENTS. Clearance between the right edge of the sixth-vane extension and the right end of the slot in the letters push bar should be 0.008 to 0.030 inch. The vane should have some end play, but not more than 0.004 inch.

c. ADJUSTMENT. Loosen the vane clamping screws and position the sixth vane by means of its pilot screws. Tighten the clamping screws.

b. REQUIREMENTS. With the function bail in its extreme rear position, unhook the function-bail spring from the front spring post and hook a 4-pound scale in the spring eye. A pull of 2 to 3 pounds should be required to stretch the spring to its position length. Rehook the function-bail spring.

c. ADJUSTMENT. Replace the spring.

### 230. Printing Bail (fig. 161)

a. PREPARATION. Remove the type-bar carriage from the typing unit. (See par. 142.) The typing unit may be removed from the base for convenience.

b. REQUIREMENTS. Turn the main shaft until the printing bail is in its extreme rear position. Hook a 12-pound scale over the left end of the adjusting lever so that the hook on the scale engages the lever directly in the rear of the

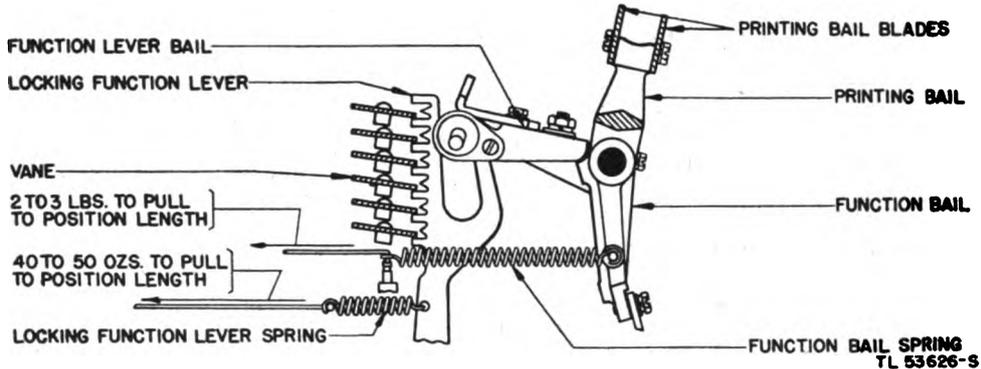


Figure 160. Printing and function bails and function-bail spring.

### 228. Selector Vanes (fig. 157)

a. PREPARATION. Remove the typing unit from the base; then remove the type-bar carriage from the typing unit. (See par. 142.)

b. REQUIREMENTS. The forked arms of vanes Nos. 1, 2, 3, 4, and 5 should line up with their T-levers. When the printing bail is in its extreme rear position, each vane should have some end play, but not more than 0.004 inch.

c. ADJUSTMENT. Loosen the vane clamping screws and position the vanes by means of their pilot screws. Tighten the clamping screws.

### 229. Function Bail Spring (fig. 160)

a. PREPARATION. Remove the type-bar carriage from the typing unit. (See par. 142.) The typing unit may be removed from the base for convenience.

spring notch in the lever. Pull in line with the spring. A pull of  $7\frac{1}{2}$  to  $8\frac{1}{2}$  pounds should be required to start the lever moving.

c. ADJUSTMENT. Increase or decrease the spring tension by turning the spring-adjusting lever screw.

### 231. Selector Lever Springs

a. PREPARATION. Remove the typing unit from the base (par. 142), remove the type-bar carriage from the typing unit, and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. With the vanes in the marking position, turn the main shaft until the function lever bail rests on the selected letters function lever. Move the swords by hand to the spacing position. Hook a 32-ounce scale over

the end of each selector lever at the cam sleeve assembly. Pull the scale in line with the selector lever straight out from the main shaft. A pull of 6 to 10 ounces should be required to start each selector lever moving. Hold the swords away from the T-levers and check each vane to see that it moves freely.

c. ADJUSTMENT. Replace the new springs.

surfaces of their straight portions.

c. ADJUSTMENT. Remove the separator plates and bend the narrow parts of the springs.

### 233. Selector Armature (fig. 164)

a. PREPARATION. Remove the typing unit from the base (par. 142), remove the type-bar carriage from the typing unit, and place the typing

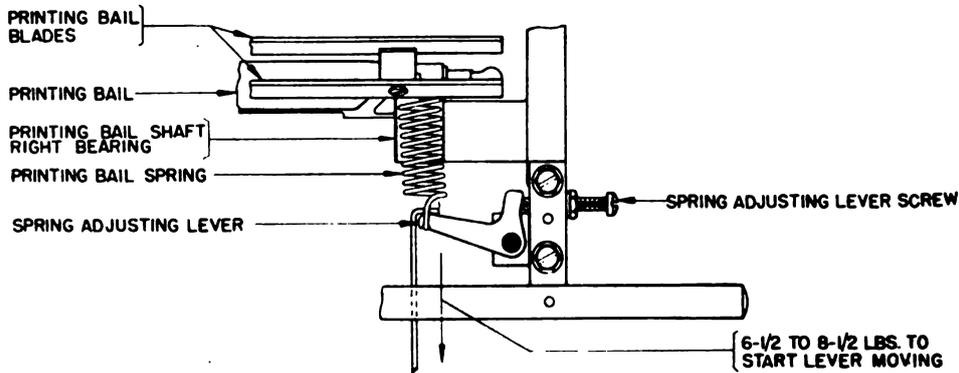


Figure 161. Printing-bail spring.

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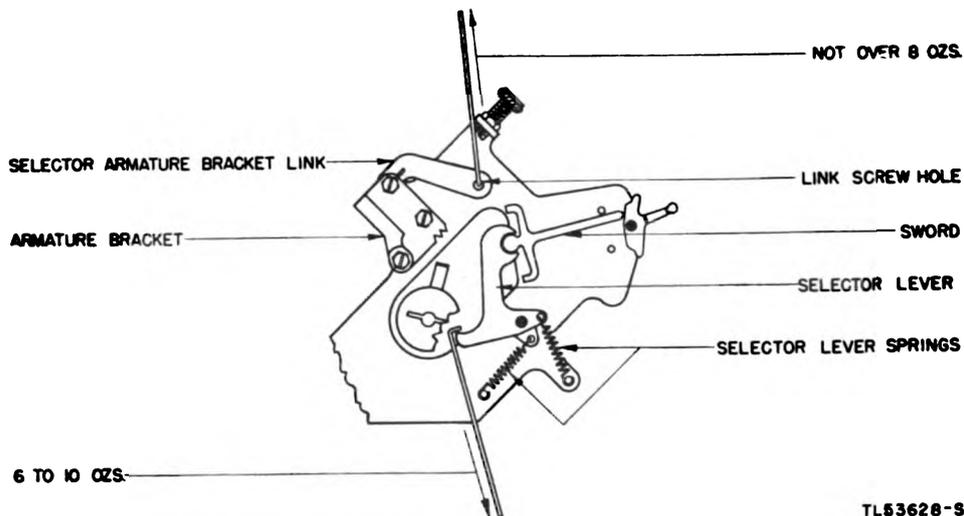


Figure 162. Selector lever springs.

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### 232. Selector Separator Plates (fig. 163)

a. PREPARATION. Remove the typing unit from the base (par. 142), remove the type-bar carriage from the typing unit, and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. The leaf springs on all separator plates, except the front and rear plates, should exert a light pressure on the swords. The ends of the leaf springs should project 0.045 to 0.055 inch below the under-

unit on its right side; then remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. The armature should be free on its pivot screws, and the end play should be just noticeable. There should be some clearance, but not more than 0.008 inch, between the No. 1 sword and the lower surface of the armature locking wedge under the following conditions.

(1) The No. 1 selector lever resting on the peak of its cam.

(2) The No. 1 sword held against the upper separator plate without bending the plate.

(3) Armature and play taken up in a direction to reduce the specified clearance to a minimum.

c. ADJUSTMENT. (1) If there is no clearance between the armature locking wedge and the No. 1 sword, loosen the locknut on the upper pivot screw and adjust the screw to get the right clearance (a one-quarter turn of the screw is equal to about 0.006 inch). Remove the armature bracket and adjust the lower pivot screw to get the correct armature end play. Mount the armature bracket.

(2) If clearance is more than 0.008 inch, remove the armature bracket and adjust the lower pivot screw. Mount the bracket, and adjust the armature end play by means of the upper pivot screw.

the No. 72581 gauge pins, the position of the armature bracket should be such that a line through the center of the No. 1 sword extends approximately through the centers of the armature pivot screws.

c. ADJUSTMENT. Unhook the locking-lever spring, loosen the magnet bracket mounting screws, and move the bracket to its extreme rear position. Loosen the armature bracket mounting screws, loosen the link screw, and back off the armature stops. Move the bracket eccentric out of the way, so that it will not interfere with the adjustment. Turn the main shaft until the No. 1 selector lever rests on the peak of its cam. Hold the swords in a position midway between the two stop posts by means of the gauge pins inserted between the stop posts and the swords. Be sure that both armature extension arms are between the arms of

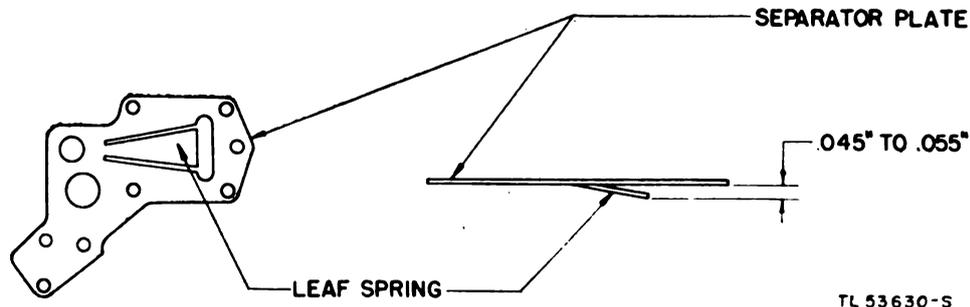


Figure 163. Selector separator plates.

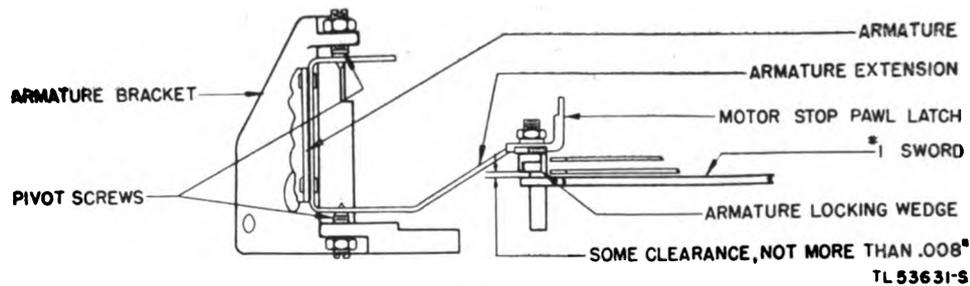


Figure 164. Selector armature.

### 234. Selector Armature Bracket Link (figs. 165 and 166)

a. PREPARATION. Remove the typing unit from the base (par. 142), remove the type-bar carriage from the typing unit, and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. When the swords are held midway between the stop posts by means of

the swords. With the swords held in this midway position, place the No. 73370 locating gauge over the end of the No. 1 sword, so that the two legs of the gauge are against the ends of the sword arms. Move the bracket to a position where both armature extension arms are against the flat surface between the legs of the gauge. Hold the bracket in this position and tighten the link screw only. Remove the locating gauge and the two gauge pins.

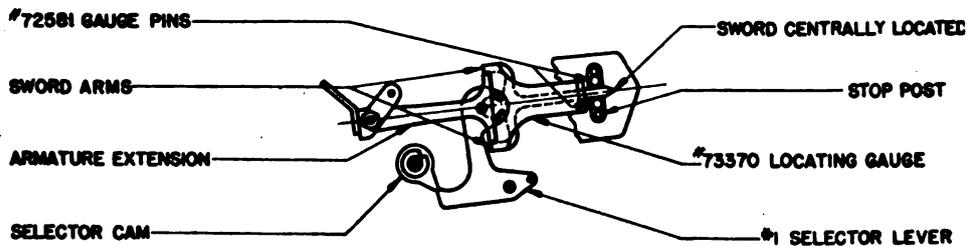


Figure 165. Use of No. 73370 locating gauge.

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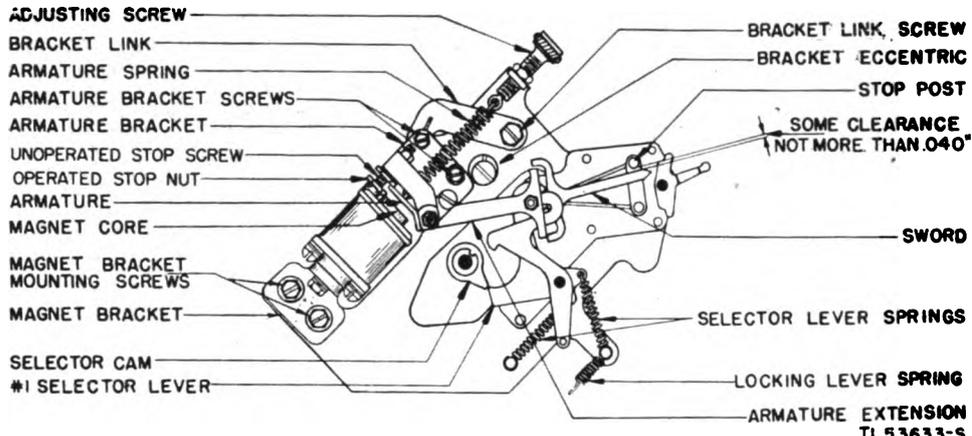


Figure 166. Selector magnet and armature mechanism.

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### 235. Selector Armature Bracket (fig. 166)

a. PREPARATION. Remove the typing unit from the base and place the unit on its right side. (See par. 142.)

b. REQUIREMENTS. (1) The armature bracket should be in a position which provides some clearance, but not more than 0.040 inch, between each sword and either stop post under the following conditions: Turn the main shaft until the No. 1 selector lever is resting on the peak of its cam. With the armature in its unoperated (spacing) position, move the spacing arm of the No. 1 sword against the armature extension. Place a 0.040-inch wire gauge against the spacing stop post and move the armature slowly toward the marking position. The blade of the sword should strike the 0.040-inch gauge before the armature leaves the spacing arm of the sword. Under these conditions, the armature moves the sword to within not more than 0.040 inch of the stop post.

(2) Remove the 0.040-inch gauge and repeat the procedure in (1) above. The armature should leave the spacing arm of the sword before the blade of the sword strikes the spacing stop post. Under these conditions, there is some clearance between the sword and the stop post.

(3) Unhook the armature spring at its adjusting screw. With the selector armature in its operated (marking) position, move the marking arm of the No. 1 sword against the selector armature extension. Then move the armature slowly toward the spacing position until the armature just leaves the marking arm of the No. 1 sword. Check the clearance between the No. 1 sword and the marking stop post in a similar manner.

(4) With each selector lever on the peak of its cam, the associated sword should be tried for the clearance of not more than 0.040 inch between sword and stop post.

c. ADJUSTMENT. (1) Tighten the armature bracket mounting screws just enough to allow the bracket to be moved by tapping it lightly. The clearance between the sword and the stop posts may be regulated by turning the bracket on its pivot. If this clearance is more than 0.040 inch, move the bracket in a direction to bring the armature toward the sword. If there is no clearance, move the bracket in a direction to bring the armature away from the sword.

(2) After the bracket is set and both screws are tightened, move the bracket eccentric against the bracket and tighten the screw. The

position of the bracket eccentric and link therefore, decides the position of the bracket. The bracket may be removed by simply removing the two bracket screws. In replacing the bracket, hold it against the eccentric stop while the two bracket screws are tightened.

### 236. Armature Stop (fig. 167)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Unhook the locking-lever spring.

b. REQUIREMENTS. The No. 1 sword arms (right and left) should clear the associated arms of the selector armature extension 0.040 to 0.042 inch when the front edge of the opposite sword arm is against its armature exten-

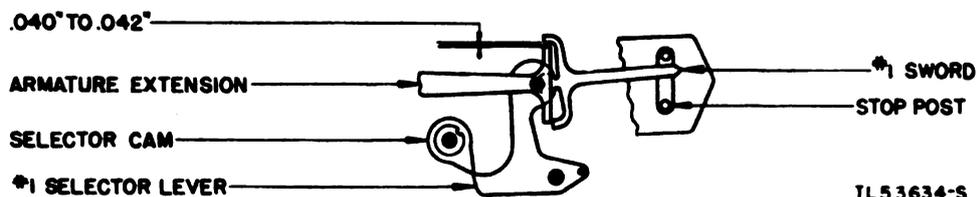


Figure 167. Sword arm clearance.

sion arm and the No. 1 selector lever is on the high part of its cam. Rehook the locking-lever spring.

c. ADJUSTMENT. (1) To adjust the right arm, reposition the armature stop screw with the armature in its unoperated position. (See fig. 166.)

(2) To adjust the left arm, reposition the armature stop nut with the armature in its operated position. If necessary, remove the nut and pinch the slotted portion (fig. 168) to make the nut fit tight on its screw. Recheck the right arm.

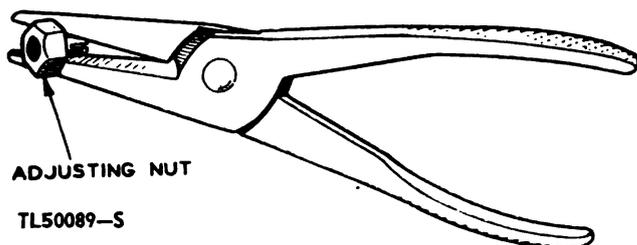


Figure 168. Pinching the armature stop nut.

### 237. Armature Locking Wedge (fig. 169)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Unhook the locking-lever spring.

b. REQUIREMENTS. There should be 0.008- to 0.012-inch clearance between the point of the armature locking wedge and the point of the locking lever when the locking lever is on the long, high part of the locking cam and the two points are in line. Rehook the locking-lever spring.

c. ADJUSTMENT. Loosen the locking-wedge locknut. Move the locking wedge forward or backward in its slot in the armature extension. Tighten the locknut. When making this adjustment on typing units equipped with mechanical motor-stop mechanism, set the motor-stop pawl latch so that the shoulder of the latch is against the front face of the armature extension. (See fig. 164.)

### 238. Armature Locking Lever Spring (fig. 169)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side.

b. REQUIREMENTS. With the locking lever on the high part of the locking cam, hook a 32-ounce scale in the spring hole of the locking lever and pull in line with the spring. A pull of 10 to 14 ounces should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

### 239. Motor-Stop (fig. 170)

Some teletypewriters are shipped with mechanical motor-stops arranged for starting and stopping by impulses over the signal line. Paragraphs 240 to 250 inclusive, concerning motor-stop adjustments, apply to teletypewriters so equipped.

### 240. Motor-Stop Lever Bracket (fig. 170)

a. PREPARATION. Remove the typing unit from the base (par. 140) and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. With the platen in the figures position, set the motor-stop combination

and then turn the main shaft slowly until the motor-stop function lever is completely selected. The latching surface of the inner motor-stop pawl should overtravel the extreme rear surface of the motor-stop pawl latch 0.010 to 0.025 inch when the armature is held in the marking position.

c. ADJUSTMENT. Position the motor lever bracket by means of its enlarged mounting holes. The motor-stop pawl backstop should not be in contact with the inner pawl.

#### 241. Motor-Stop Lever Eccentric (fig. 170)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

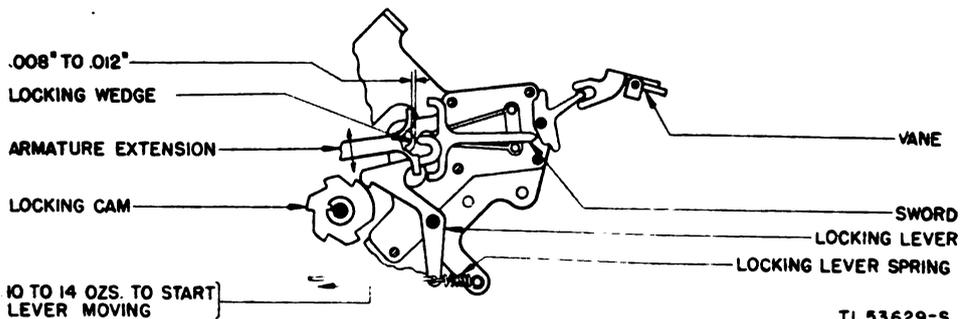


Figure 169. Armature locking wedge.

b. REQUIREMENTS. Turn the main shaft until the printing bail is in its extreme rear position and the locking lever is on the high part of the locking cam. Then, with the armature in the marking position, engage the inner motor-stop pawl with the motor-stop pawl latch. The motor-stop lever eccentric should be in contact with the lower arm of the motor-stop release lever when the release lever stud touches the locking lever.

c. ADJUSTMENT. Position the motor-stop lever eccentric.

#### 242. Motor-Stop Lever Backstop Screw (fig. 170)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. With the platen in the letters position, set up the motor-stop combination and turn the main shaft until the printing

bail is in its extreme forward position. Be sure that the motor-stop pawls are released from the latch. There should be some clearance, but not more than 0.002 inch, between the rear extension of the motor-stop function lever and the lower edge of the motor-stop lever.

c. ADJUSTMENT. Loosen the backstop screw locknut and position the backstop screw. Tighten the locknut.

#### 243. Motor-Stop Pawl Backstop (fig. 170)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. With the printing bail in its extreme rear position and the motor-stop

release lever eccentric moved away from the outer stop pawl, the motor-stop latch should clear both motor-stop pawls by an approximately equal distance (not less than 0.010 inch) when the armature is moved from the marking to the spacing position.

c. ADJUSTMENT. Loosen the backstop mounting nut and turn the backstop. Tighten the nut.

#### 244. Motor-Stop Release Lever Eccentric (fig. 170)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. Turn the main shaft until the printing bail is in its extreme rear position and the locking lever is on the high part of the locking cam. Then, with the armature in the marking position, engage the inner motor-stop pawl with the motor-stop latch. The motor-stop release lever eccentric should just touch the

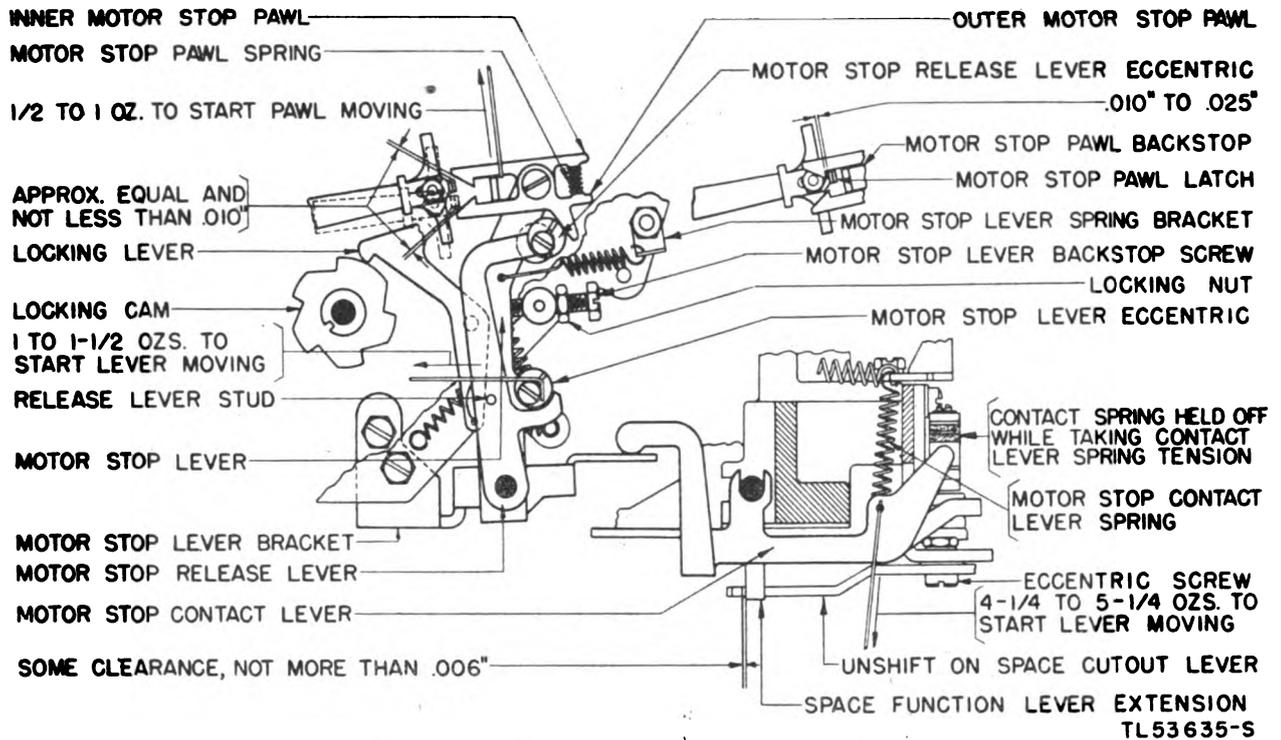


Figure 170. Mechanical motor-stop mechanism.

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outer motor-stop pawl when the lower arm of the motor-stop release lever is in contact with the motor-stop lever eccentric and the outer pawl is against the motor-stop pawl backstop.

c. ADJUSTMENT. Loosen the motor-stop release lever eccentric mounting screw. Position the motor-stop release lever eccentric. Tighten the mounting screw.

#### 245. Motor-Stop Pawl Spring (fig. 170)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. With the printing bail in its extreme rear position, hook an 8-ounce scale, held in a horizontal position, over the inner motor-stop pawl just in front of the backstop. Pull at right angles to the pawl. A pull of  $\frac{1}{2}$  to 1 ounce should be required to start the pawl moving.

c. ADJUSTMENT. Replace with a new spring.

#### 246. Motor-Stop Lever Spring (fig. 170)

a. PREPARATION. Remove the typing unit from the base (par. 142) and place the typing unit on its right side. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. Unhook the motor-stop contact-lever spring. With the motor-stop lever in the unoperated position, hook an 8-ounce scale over the head of the screw which mounts the motor-stop lever eccentric. Pull toward the rear of the teletypewriter. A pull of 1 to  $1\frac{1}{2}$  ounces should be required to start the lever moving. Rehook the spring.

c. ADJUSTMENT. Position the spring bracket on the post of the selector unit. Replace the motor-stop contact-lever spring with a new spring if moving the spring bracket does not cause the old spring to meet the requirements.

#### 247. Motor-Stop Contact-Lever Spring (fig. 170)

a. PREPARATION. Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. REQUIREMENTS. Hold off the contact spring if it rests on the motor-stop contact lever. Hook an 8-ounce scale in the contact-lever spring hole and pull in line with the spring. A pull of  $4\frac{1}{4}$  to  $5\frac{1}{4}$  ounces should be required to start the contact lever moving.

c. ADJUSTMENT. Replace with a new spring.

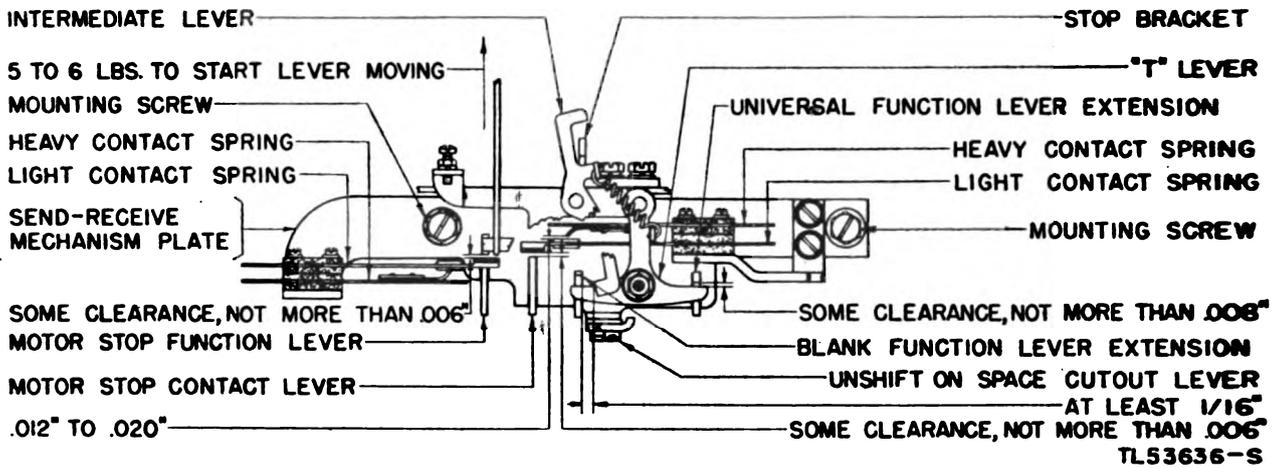


Figure 171. Mechanical motor-stop contacts.

### 248. Motor-Stop Function Lever (fig. 171)

a. PREPARATION. Remove the typing unit from the base (par. 142).

b. REQUIREMENTS. With the motor-stop function lever resting against the rear edges of the vanes, but not selected, hook a 12-pound scale under the extreme front end of the lever. Pull at right angles to the lever and toward the top of the teletypewriter. A pull of 5 to 6 pounds should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

### 250. Stop-Lever Spring (fig. 173)

a. PREPARATION. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. With the trip latch plunger held operated, hook an 8-ounce scale at the end of the stop lever on the range finder assembly. A pull of  $\frac{3}{4}$  to  $1\frac{1}{4}$  ounces should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

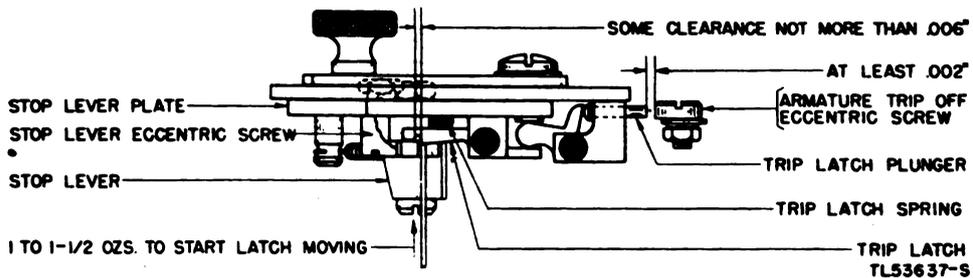


Figure 172. Range finder and stop lever.

### 249. Stop-Lever Eccentric Screw (fig. 172)

a. PREPARATION. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. The stop lever on the range finder assembly should over-travel the latching surface of the trip latch 0.004 to 0.006 inch.

c. ADJUSTMENT. Position the eccentric by loosening its locknut and turning the screw as required. When tightening the nut, be careful not to change the adjustment.

### 251. Trip Latch Spring (fig. 172)

a. PREPARATION. Remove the range finder assembly. (See par. 171.)

b. REQUIREMENTS. Hold the range finder assembly in a horizontal position. Apply the push end of an 8-ounce scale, held in a vertical position, to the trip latch as near to the stop lever as possible. Push up. A push of 1 to  $1\frac{1}{2}$  ounces should be required to start the trip latch moving.

c. ADJUSTMENT. Replace with a new spring.

## 252. Armature Trip-Off Eccentric Screw (fig. 174)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. (1) There should be some clearance, but not more than 0.002 inch, between the stop lever and the trip latch when the armature is in the unoperated position and the main shaft is turned until the stopping edge of the stop lever is directly below the latching surface of the trip latch.

(2) The trip latch plunger should have at least 0.002-inch end play (fig. 174) when the armature is held against the marking stop and the stop lever is clear of the latching surface of the trip latch.

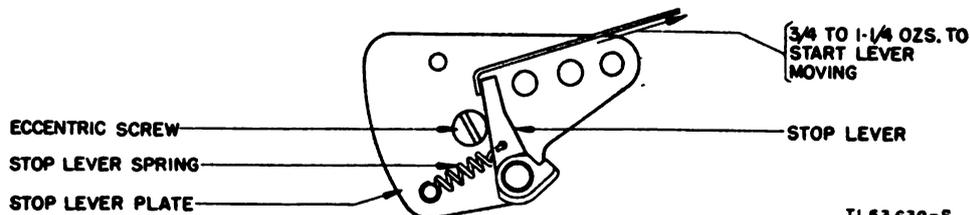


Figure 173. Stop-lever spring.

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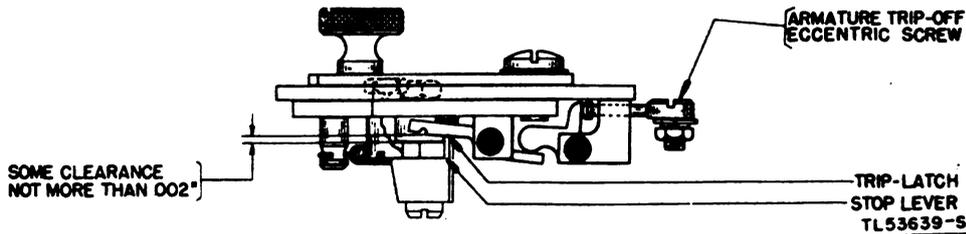


Figure 174. Armature trip-off eccentric screw.

c. ADJUSTMENT. (1) Position the armature trip-off eccentric screw by loosening its locknut and turning the screw to meet the first requirement. (See *b*(1) above.) Tighten the locknut.

(2) The second requirement (*b*(2) above) serves as a check on the trip-off eccentric screw adjustment and also on the adjustment of the armature stops.

## 253. Magnet Bracket (fig. 166)

a. PREPARATION. Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. REQUIREMENTS. There should be 0.002- to 0.007-inch clearance between each magnet core and the armature antifreeze strip when the armature is against the operated stop nut (marking stop). The faces of the cores should

be parallel to the face of the armature and the sides of the cores should align with the edges of the armature.

c. ADJUSTMENT. Position the bracket by means of its enlarged mounting holes.

## 254. Platen Unit Pilot Screws (figs. 175 and 178)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. The platen unit should be midway between the side frames; it should be free on its bearings, without side play.

c. ADJUSTMENT. With the typing unit in its normal upright position, disconnect the line-feed and shift vertical links at the upper

shoulder screws. Unhook the platen balance spring and the shift detent spring. Position the platen unit by means of its pilot screws. Reconnect the line-feed and shift vertical links; rehook the platen balance spring and the shift detent spring.

## 255. Platen-Shift Stop Post (fig. 175)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. The top and bottom surfaces of the platen-shift stop post should be parallel to a line through the center of the platen detent roller screw and the platen pilot screw.

c. ADJUSTMENT. Loosen the platen-shift stop post nut and turn the post. Tighten the nut.

## 256. Letters Stop Screw (fig. 175)

a. PREPARATION. The type-bar carriage should be in place on the typing unit.

b. REQUIREMENTS. With the platen in the letters position and the letter N type bar held lightly against the platen, the curved surface of the letter N should fit the curved surface of the platen. To check this fit, sight along the platen surface from one end of the platen. The contact of the two surfaces can best be seen if a light is placed on the side of the type bar away from the operator. To check further, insert a sheet of paper with a carbon in the tele-

b. REQUIREMENTS. The top of the figure 5 typed with the platen in the figures position should be in line with the top of the letter T typed with the platen in the letters position.

c. ADJUSTMENT. Raise or lower the figures stop screw.

## 258. Figures, Letters, and Line-Feed Function-Lever Springs (fig. 176)

a. PREPARATION. Remove the typing unit from the base (par. 142), remove the type-bar carriage from the typing unit, and place the typing unit on its right side.

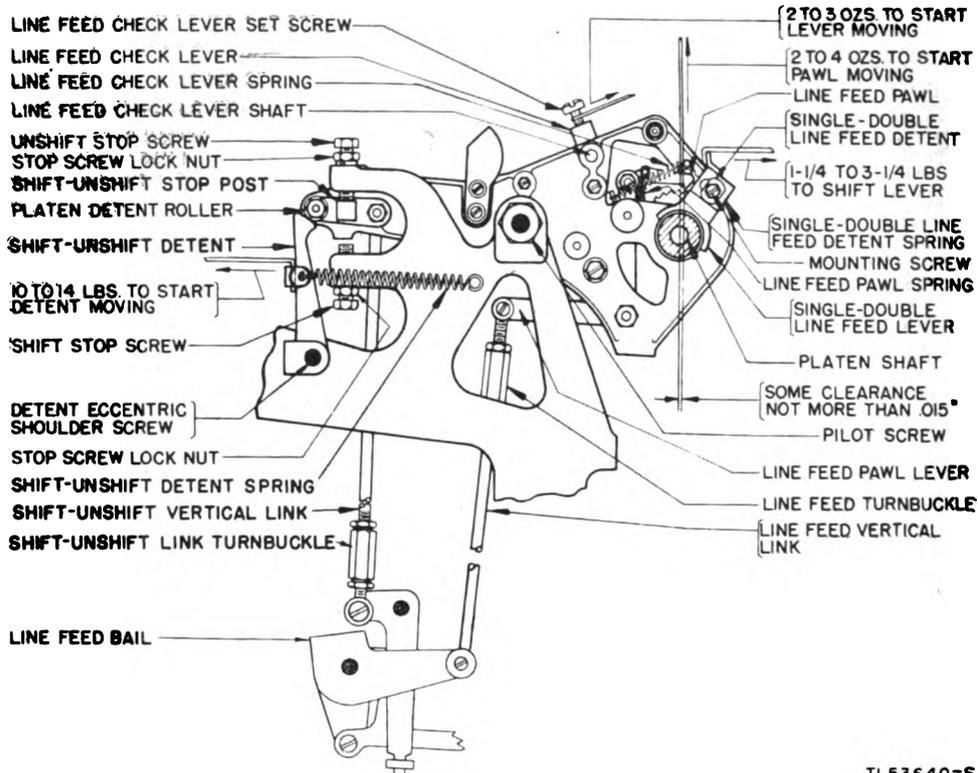


Figure 175. Platen-shifting mechanism.

typewriter and press the letter N firmly against the paper and platen. The impression made by the carbon on the paper should be of even shade.

c. ADJUSTMENT. If the shading is lighter at the bottom of the character, raise the letters stop screw. If the shading is lighter at the top, lower the screw.

## 257. Figures Stop Screw (fig. 175)

a. PREPARATION. The type-bar carriage should be in place on the typing unit.

b. REQUIREMENTS. Select the blank combination and turn the main shaft until the printing bail is in its extreme forward position. Hook a 32-ounce scale over the rear extension of the figures, letters, and line-feed function levers just in front of the lobes which engage the push bars. Pull horizontally at right angles to the rear extension. A pull of 15 to 19 ounces should be required to start each of these function levers moving. When checking the tensions, the push bars should be held away from the function levers.

c. ADJUSTMENT. Replace with the new springs.

### 259. Space Function Lever Spring (fig. 176)

a. PREPARATION. Remove the typing unit from the base, remove the type-bar carriage from the typing unit, and place the typing unit on its right side. (See par. 142.)

b. REQUIREMENTS. With the space function

### 260. Blank-Printing and Spacing Cut-Out Function Lever Spring

Note. This adjustment applies only to teletypewriters equipped with a special function lever (No. 74918) to prevent printing and spacing when the blank combination is selected.

a. PREPARATION. Remove the typing unit from the base (par. 142); then remove the type-bar carriage from the typing unit.

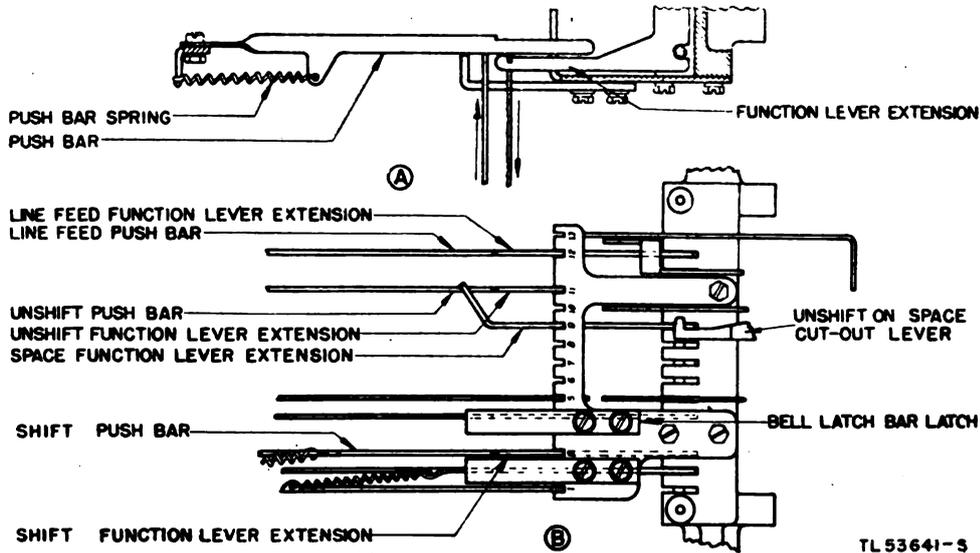


Figure 176. Function lever extensions.

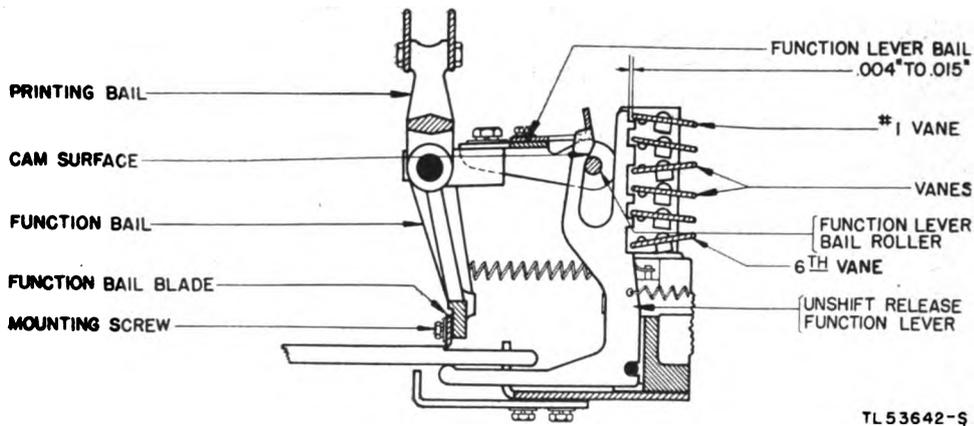


Figure 177. Function bail.

lever resting against the vanes, but not selected, hook a 32-ounce scale over the rear extension of the lever, just in front of the lobe. Pull horizontally at right angles to the rear extension. A pull of 12 to 16 ounces should be required to start the space function lever moving. When checking the tension, hold the letters push bar away from the function lever.

c. ADJUSTMENT. Replace with a new spring.

b. REQUIREMENTS. Turn the main shaft until the printing bail is in its extreme rear position. Then unhook the blank-printing and spacing cut-out function lever spring from the spring plate. Hook a 32-ounce scale in the spring eye. A pull of 22 to 30 ounces should be required to stretch the spring to its position length. Rehook the spring.

c. ADJUSTMENT. Replace with a new spring.

## 261. Function-Bail Blade (fig. 177)

*Note.* If the letters and figures shift mechanism has not been adjusted, it will be necessary to loosen the mounting screws of the shift bell crank operating lever bracket, and move the bracket to its extreme rear position, before proceeding with the function-bail blade adjustment.

*a. PREPARATION.* Remove the typing unit from the base; remove the type-bar carriage from the typing unit, and place the typing unit on its right side. (See par. 142.)

*b. REQUIREMENTS.* (1) With the figures, line-feed, and letters function levers alternately selected and the main shaft turned until the travel of the function-lever bail is blocked by the selected function lever, there should be 0.004- to 0.015-inch clearance between the rear edge of the No. 1 vane and the bottom of a notch in the selected function lever.

(2) With the unshift-on-space cut-out lever (fig. 176) released from the lower extension of the space function lever, place the platen in the figures position. Select the space combination and turn the main shaft until the function-lever bail roller just leaves the cam surface of the space function lever. Under this condition the clearance between the rear edge of No. 1 vane and the bottom of a notch in the space function lever should be 0.004 to 0.015 inch.

*c. ADJUSTMENT.* (1) Select the figures function lever. Raise or lower the right end of the function-bail blade in its mounting slots to get the specified clearance between the rear edge of the No. 1 vane and the bottom of a notch in the figures function lever.

(2) Select the line-feed function lever and adjust the left end of the function-bail blade up or down to get the specified clearance between the rear edge of the No. 1 vane and the bottom of a notch in the line-feed function lever.

(3) If the requirements are not met when the letters and space function levers are selected, readjust both ends of the function-bail blade until the requirements are met on all function levers.

## 262. Unshift-on-Space Cut-Out Lever (fig. 176)

*a. PREPARATION.* Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

*b. REQUIREMENTS.* (1) If it is desired that the platen return to the letters position when

the space combination is received, turn the unshift-on-space cut-out lever counterclockwise (as viewed from the bottom of the teletypewriter) against the stop. Tighten the locknut, to hold the cut-out lever in this position.

(2) If it is desired that the platen should not return to the letters position when the space combination is received, turn the unshift-on-space cut-out lever clockwise (as viewed from the bottom of the teletypewriter), so that the hooked end of the cut-out lever is to the rear of the space function lever extension and the cut-out lever touches the side of the space function lever extension.

(3) There should be some clearance, but not more than 0.006 inch, between the rear surface of the space function lever extension and the cut-out lever.

*c. ADJUSTMENT.* Remove the T-lever and the attached mechanism (fig. 171) from its mounting post; loosen the cut-out lever eccentric screw nut. Position the cut-out lever and the eccentric screw, and then tighten the locknut. Remount the T-lever and the attached mechanism.

## 263. Letters and Figures Shift (figs. 175 and 176)

*a. PREPARATION.* Remove the typing unit from the base. (See par. 142.)

*b. REQUIREMENTS.* (1) Remove the shift detent and platen balance springs. Place the platen in the figures position (up). Select the letters combination. Turn the main shaft until the function-bail blade moves the selected push bar to its extreme rear position. The shift stop post should move to within 0.010 to 0.025 inch of the letters stop screw.

(2) Place the platen in the letters position (down). Select the figures combination. Turn the main shaft until the function-bail blade moves the selected push bar to its extreme rear position. The shift stop post should move to within 0.010 to 0.025 inch of the figures stop screw.

*c. ADJUSTMENT.* (1) Place the shift bell crank operating lever bracket in the middle of the adjustment provided by the mounting slots. Tighten the mounting screws. Place the typing unit on its right side and turn the main shaft until the function bail is in its extreme forward position. The clearance between the function-bail blade and the shoulder on the let-

ters push bar when the platen is in the figures position should be equalized (within 0.010 inch) with the clearance between the function-bail blade and the shoulder on the figures push bar when the platen is in the letters position. Adjust the turnbuckle on the shift link to get this equalization.

(2) Turn the main shaft until the rear face of the function-bail blade is directly over the shoulder on either the letters or the figures push bar when that push bar is in its extreme forward position. Shift the platen by hand until the other push bar is in its extreme forward position. When the shoulder on one push bar is directly under the rear face of the function-bail blade, the shoulder on each push bar must be within 0.010 inch of being directly under the rear face of the function-bail blade. Select the letters and figures combinations one at a time and check for the specified clearances between the shift stop post and the letters and figures stop screws. (See *b* above.) If either of these clearances is greater than 0.025 inch, move the operating lever bracket toward the front of the unit. If either clearance is less than 0.010 inch, move the operating lever bracket toward the rear. After this operation a slight readjustment of the shift-link turnbuckle may be necessary to bring both clearances within the specified limits. Rehook the shift detent spring and platen balance spring.

#### 264. Platen Balance Spring (fig. 178)

*a.* PREPARATION. The typing unit may be on or off the base.

*b.* REQUIREMENT. With the platen in the letters position, unhook the platen balance spring from the platen unit side frame. Hook a 12-pound scale in the spring eye. A pull of 3½ to 5 pounds should be required to stretch the spring to position length. Rehook the spring.

*c.* ADJUSTMENT. Replace with a new spring.

#### 265. Shift Detent (fig. 175)

*a.* PREPARATION. The typing unit may be on or off the base.

*b.* REQUIREMENTS. When the platen is shifted from the figures to the letters position, the detent roller should ride equally on both sides of the detent.

*c.* ADJUSTMENT. Position the shift detent by loosening the locknut and turning the shift detent eccentric shoulder screw. Tighten the locknut.

#### 266. Shift Detent Spring (fig. 175)

*a.* PREPARATION. The typing unit may be on or off the base.

*b.* REQUIREMENTS. Hook a 25-pound scale over the extension on the shift detent and pull in line with the spring. A pull of 10 to 14 pounds should be required to start the detent moving.

*c.* ADJUSTMENT. Replace with a new spring.

#### 267. Sixth-Vane Extension (figs. 157 and 160)

*Note.* This adjustment applies only to teletypewriters equipped with the old-style sixth-vane extension (a flat spring formed from spring steel).

*a.* PREPARATION. Remove the typing unit from the base. (See par. 142.)

*b.* REQUIREMENTS. Unhook the sixth-vane detent spring from the spring plate. When the platen is shifted from the figures to the letters position, the sixth vane should travel equally on either side of the detent in the W-notch of the locking function lever. Rehook the sixth-vane detent spring.

*c.* ADJUSTMENT. Bend the sixth-vane extension. After the extension is bent, the letters push bar should not bind on the extension in either the letters or figures positions.

#### 268. Letters and Figures Push-Bar Springs (fig. 176)

*a.* PREPARATION. Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

*b.* REQUIREMENTS. Select any character and turn the main shaft until the printing bail is in its extreme forward position. Place the push end of an 8-ounce scale directly beneath the notch on lock push bar and push horizontally at right angles to the bar. A push of 3 to 5 ounces should be required to start either push bar moving.

*c.* ADJUSTMENT. Replace with new springs.

#### 269. Platen Shaft (fig. 191)

*a.* PREPARATION. The typing unit may be on or off the base.

*b.* REQUIREMENTS. The platen shaft should have some end play, but not more than 0.004 inch.

*c.* ADJUSTMENT. Position the friction assembly on the platen shaft by loosening the friction assembly setscrews and moving the friction assembly as required. Tighten the setscrews.

## 270. Single-Double Line-Feed Detent (fig. 175)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. When the single-double line-feed lever is shifted from the single to the double line-feed position, the hump on the detent spring should travel equidistant on either side of the detent.

c. ADJUSTMENT. Position the detent by loosening its mounting screw and moving the detent as required. Tighten the mounting screw.

## 271. Single-Double Line-Feed Detent Spring (fig. 175)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the single-double line-feed lever in the single line-feed position, hook a 4-pound scale, held in a horizontal position, over the extension of the lever; pull toward the front. A pull of  $1\frac{1}{4}$  to  $3\frac{1}{4}$  pounds should be required to move the lever to the double line-feed position.

c. ADJUSTMENT. Replace with a new spring.

## 272. Line-Feed Detent Lever (figs. 175 and 178)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the single-double line-feed lever in the single line-feed position (up), and the line-feed bell crank operated by hand, the line-feed pawl, when sliding off the rear edge of the single-double line-feed lever, should just miss the edge of a tooth on the line-feed ratchet.

c. ADJUSTMENT. Loosen the detent lever eccentric screw nut (fig. 178), and turn the eccentric screw to move the platen. Tighten the detent lever eccentric screw nut, and check the adjustment for all the teeth on the line-feed ratchet.

**Caution:** There are two positions of the detent lever eccentric screw which give the correct adjustment. Use the position which applies the least tension to the detent lever spring. Be sure that the detent roller rests in the bottom of a notch on the detent ratchet.

## 273. Line-Feed Link Turnbuckle (fig. 175)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. With the single-double line-feed lever in the single line-feed position,

select the line-feed combination; turn the shaft until the line-feed push bar is being stripped from the function-bail blade. Under this condition, the platen should turn one line space, the detent roller should rest in the hollow between two ratchet teeth, and there should be some clearance, but not more than 0.015 inch, between the line-feed pawl and the front face of a tooth on the ratchet for this clearance. When gauging clearances, the play in the line-feed mechanism should be taken up in a direction which will make the greatest possible clearance (by pressing forward on the line-feed pawl).

c. ADJUSTMENT. Place the typing unit on its right side. Adjust the length of the line-feed link by means of its turnbuckle.

## 274. Line-Feed Push-Bar Spring (fig. 176)

a. PREPARATION. Remove the typing unit from the base and place the typing unit on its left side. (See par. 142.)

b. REQUIREMENTS. With the printing bail in its extreme rear position, apply the push end of an 8-ounce scale to the push bar just to the rear of the function lever extension. Push horizontally at right angles to the bar. A push of  $1\frac{1}{2}$  to  $2\frac{1}{2}$  ounces should be required to start the push bar moving.

c. ADJUSTMENT. Replace with a new spring.

## 275. Line-Feed Detent Lever Spring (fig. 178)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the typing unit in its normal upright position, hook a 12-pound scale over the head of the detent roller mounting screw. Pull at right angles to the detent lever. A pull of 5 to 6 pounds should be required to start the detent lever moving.

c. ADJUSTMENT. Replace with a new spring.

## 276. Line-Feed Pawl Spring (fig. 175)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the single-double line-feed lever in the double line-feed position and the line-feed pawl in its unoperated position, hook an 8-ounce scale under the line-feed pawl, just to the rear of the notch. Pull straight up. A pull of 2 to 4 ounces should be required to start the pawl moving.

c. ADJUSTMENT. Replace with a new spring.

### 277. Line-Feed Check Screw (fig. 178)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. The line-feed check screw should drop in the twelfth notch from the detent roller when line-feed ratchets having 33 teeth are used, and in the fourteenth notch when ratchets having 37 teeth are used. (When counting the notches, start with the notch just above the detent roller.) When the check screw is held in the bottom of a notch on the ratchet there should be some clearance, but not more than 0.020 inch, between the front face of the screw and the face of the tooth, at the point of least clearance.

c. ADJUSTMENT. Loosen the line-feed check screw locknut and turn the check screw to meet the requirements. (See b above.) Tighten the locknut. Turn the platen roll and check the clearance in each notch of the ratchet. If necessary, loosen the clamping nut of the line-feed check-post stop screw and back off the stop screw before making the adjustment.

the line-feed check post is against the inner side of the casting and that the end of the line-feed check lever shaft is flush with the outer surface of the casting. Tighten the clamping nut.

### 279. Line-Feed Check Lever (fig. 178)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. Select the line-feed combination and turn the main shaft until the line-feed pawl has reached its farthest travel in turning the platen. The line-feed pawl lever should be in contact with the check lever. There should be some clearance but not more than 0.015 inch, between the lower edge of the line-feed check screw and the bottom of any notch in the detent ratchet.

c. ADJUSTMENT. Loosen the check lever setscrew and position the check lever. (See fig. 175.) Before tightening the setscrew, make sure that the shaft has some end play, but not more than 0.004 inch. When checking the clear-

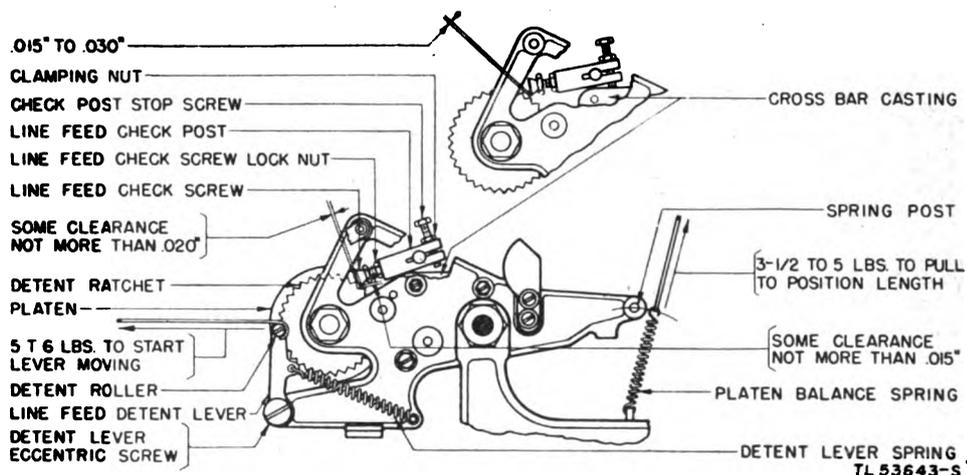


Figure 178. Line-feed check mechanism and platen balance spring.

### 278. Line-Feed Check-Post Stop Screw (fig. 178)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. Hold the line-feed check-post stop screw down against the casting. The clearance between the line-feed check screw and each tooth on the detent ratchet when the platen is turned should be 0.015 to 0.030 inch.

c. ADJUSTMENT. Loosen the check post clamping nut and turn the stop screw. Before tightening the clamping nut, make sure that

ance between the check screw and the ratchet, take up the play of the line-feed check lever shaft in its right bearing, obtaining the maximum clearance.

### 280. Line-Feed Check Lever Spring (fig. 175)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the line-feed pawl in the forward position, hook an 8-ounce scale under the head of the check lever setscrew and pull at right angles to the setscrew. A pull of

2 to 3 ounces should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

### 281. Pressure-Roller Release-Shaft Collars (fig. 179)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. The pressure-roller release shaft should have some end play, but not more than 0.004 inch. With the right collar against the casting, there should be  $\frac{5}{32}$ - to  $\frac{7}{32}$ -inch clearance between the boss just to the rear of the platen shaft boss and the pressure-roller release-shaft arm when the arm is opposite the boss.

c. ADJUSTMENT. Obtain the clearance of the release shaft arm by moving the right collar; adjust the end play by moving the left collar.

### 282. Pressure-Roller Release Cams (fig. 180)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the pressure-roller release-shaft arm in its rear position, the high parts of both of the pressure-roller release cams should rest on the high parts of their release levers.

c. ADJUSTMENT. Position the cams on the release shaft by loosening their setscrews and moving the cams as required. Tighten the setscrews.

### 283. Pressure-Roller Tension Springs (fig. 180)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the release shaft arm in its forward position, hook a 12-pound scale over the lower end of the spring-adjust-

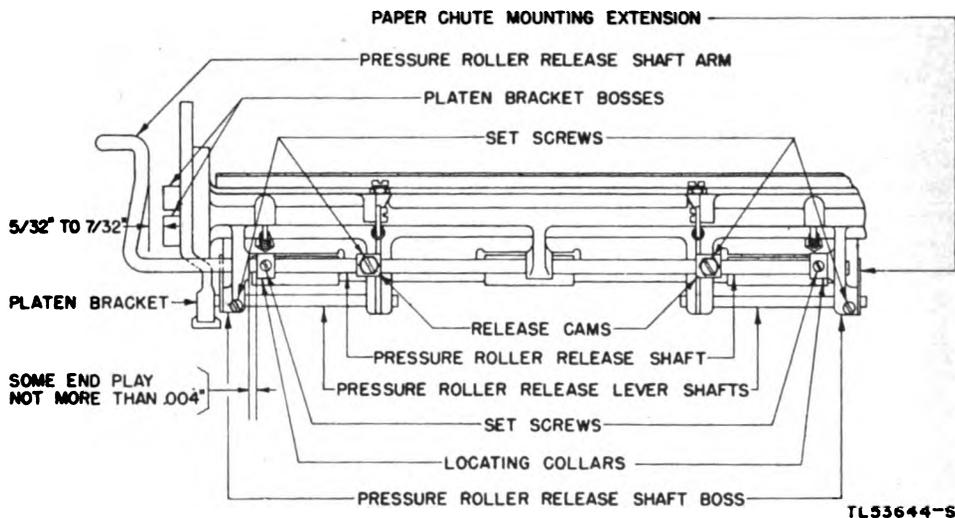


Figure 179. Pressure-roller release mechanism.

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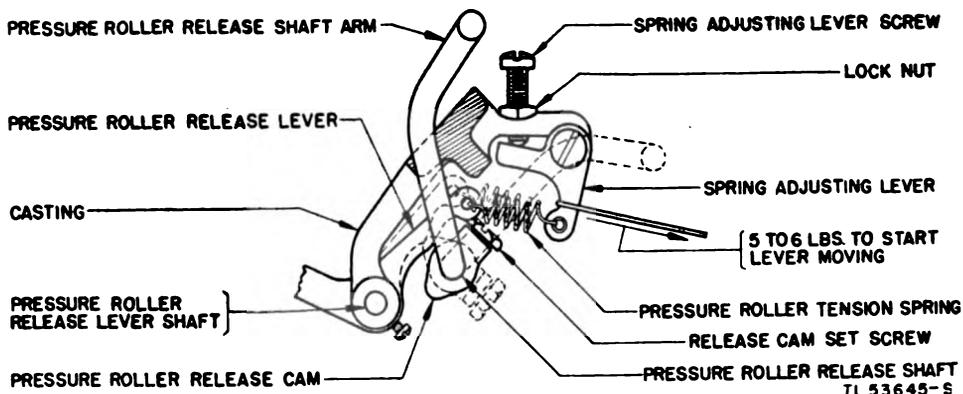


Figure 180. Pressure-roller release cams and tension springs.

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ing lever just above the spring. Pull in line with the spring. A pull of 5 to 6 pounds should be required to start the adjusting lever moving.

c. ADJUSTMENT. Loosen the locknut and turn the spring-adjusting lever screw. Tighten the locknut.

#### 284. Pressure-Roller Release-Lever Shafts (fig. 179)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the inner surface of the paper chute mounting extensions against the casting, the outer ends of the release-lever shafts should project beyond the outer surfaces of the paper chute mounting extensions by not more than  $\frac{1}{32}$  inch.

c. ADJUSTMENT. Position the release-lever shafts by loosening their setscrews and moving the shafts as required. Tighten the setscrews.

#### 285. Paper Chute Springs (fig. 181B)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the pressure-roller release-shaft arm in its rear position, hook an 8-ounce scale over the rear edge of the paper chute, midway between the side frames. Pull at right angles to the rear flat surface. A pull of 2 to 4 ounces should be required to start the paper chute moving.

c. ADJUSTMENT. Replace with new springs.

#### 286. Paper Fingers (fig. 181B)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With both paper fingers resting against the platen, the paper-finger shaft stop arm should clear its stop post by 0.004 to 0.020 inch. When paper  $8\frac{1}{2}$  inches wide is used, the outer edge of the lower portion of each finger should be flush with the edge of the platen. When paper less than  $8\frac{1}{2}$  inches wide is used, the left finger should be moved in toward the edge of the paper as much as necessary.

c. ADJUSTMENT. Loosen the setscrew and position the right paper finger to provide the specified clearance between the stop arm and the stop post. Tighten the setscrew. Set the left paper finger in the same manner to correspond to the width of the paper.

#### 287. Paper-Finger Shaft Spring (fig. 181B)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. Hook a 32-ounce scale over the paper-finger shaft stop arm, just above the stop post; pull in line with the spring. A pull of 14 to 18 ounces should be required to start the stop arm moving.

c. ADJUSTMENT. Replace with a new spring.

#### 288. Paper Straightener Rod Stops (fig. 181B)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. When the paper straightener rod is in its extreme forward position, the clearance between the straightener rod and the blocking edge of the stops should be 0.030 to 0.050 inch.

c. ADJUSTMENT. Position the stops by means of their slots. Tighten the mounting screws.

#### 289. Paper Straightener Rod Springs (fig. 181B)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. Hook a 32-ounce scale over the ends of the levers where the springs are hooked; pull in line with the springs. A pull of 8 to 12 ounces should be required to start the levers moving.

c. ADJUSTMENT. Replace with new springs.

#### 290. Paper Guides (fig. 181A)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. The outer side of each paper guide should be 0.040 to 0.050 inch from the shoulder on its end of the straightener rod.

c. ADJUSTMENT. Position the guides on the shaft by loosening their setscrews and moving the guides as required. Tighten the setscrews.

#### 291. Spacing - Escapement - Pawl Operating Arm (fig. 182)

a. PREPARATION. The typing unit should be on the base.

b. REQUIREMENTS. Select the line-feed combination and turn the main shaft until the function lever bail rests on the line-feed function lever. There should be 0.020- to 0.040-inch clearance between the rear spacing-escapement pawl and the low part of the spacing-escapement ratchet.

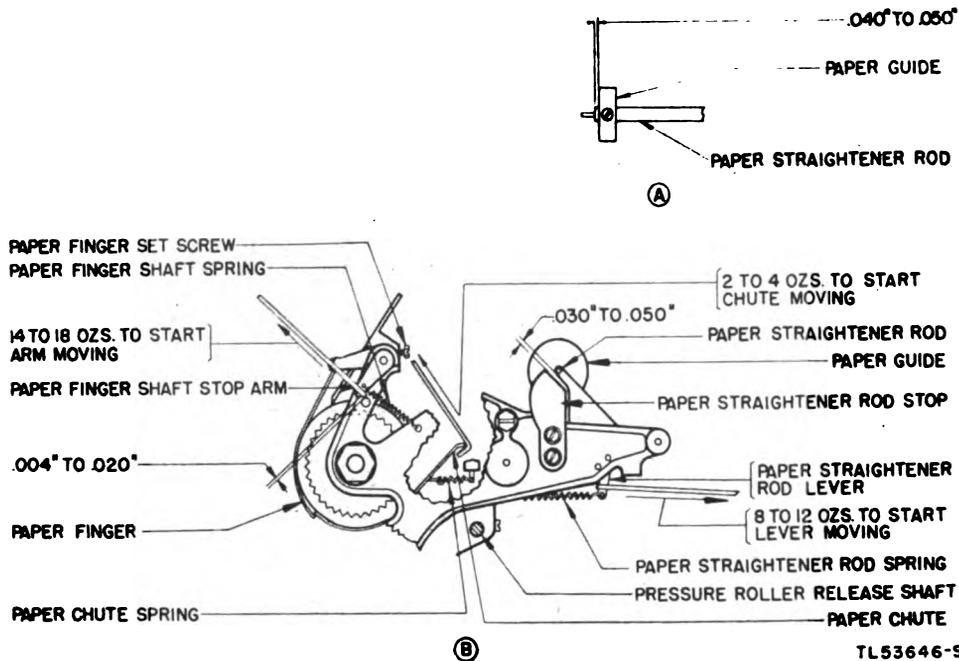


Figure 181. Paper chute, paper fingers, and paper straightener rod.

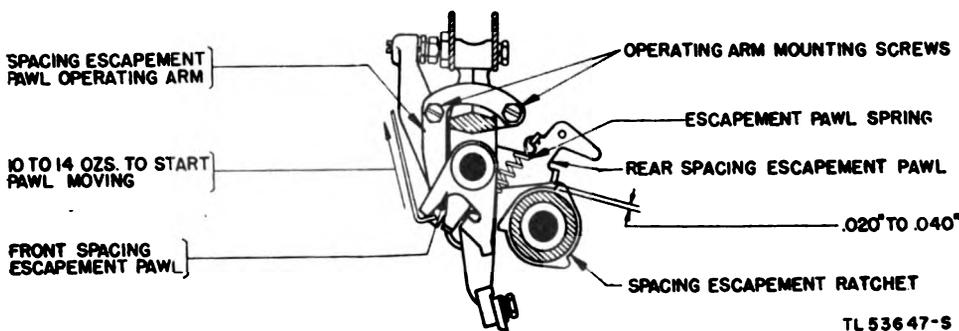


Figure 182. Spacing escapement pawls.

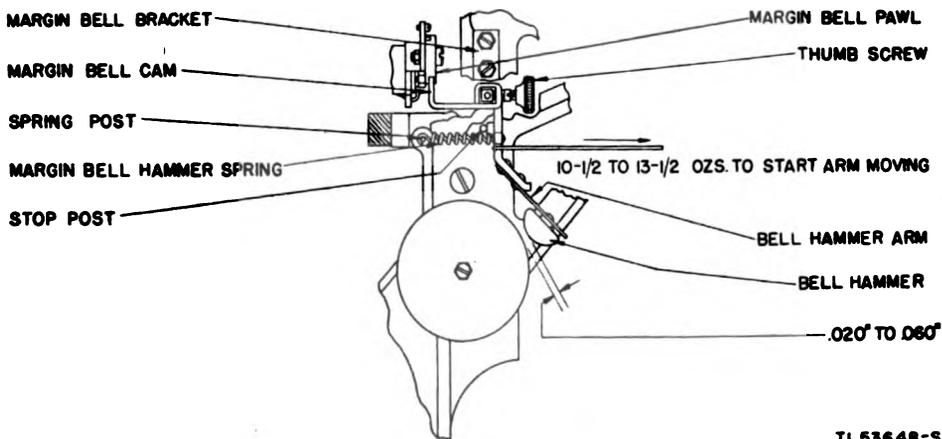


Figure 183. Margin bell hammer.

c. ADJUSTMENT. Loosen the spacing-escapement-pawl operating arm mounting screws and position the arm. Tighten the mounting screws.

## 292. Spacing - Escapement - Pawl Spring (fig. 182)

a. PREPARATION. Remove the typing unit from the base.

b. REQUIREMENTS. Turn the main shaft until the printing bail is in its extreme rear position. Hook a 32-ounce scale under the front spacing-escapement pawl at the point where the pawl rests against the escapement-pawl operating arm; pull straight up. A pull of 10 to 14 ounces should be required to start the pawl moving.

c. ADJUSTMENT. Replace with a new spring.

## 293. Margin Bell Hammer (fig. 183)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the bell hammer arm resting against the stop post, the clearance between the bell and the bell hammer should be 0.020 to 0.060 inch.

c. ADJUSTMENT. Bend the bell hammer arm along its entire length. Avoid a sharp bend at any point.

## 294. Margin Bell Hammer Spring (fig. 183)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. Hook a 32-ounce scale over the bell hammer arm directly below the spring, and pull in line with the spring. A pull of 10½ to 13½ ounces should be required to start the arm moving.

c. ADJUSTMENT. Replace with a new spring.

## 295. Signal Bell Hammer Spring (fig. 184A)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the bell latch bar in its latched position, hook an 8-ounce scale over the upper end of the bell hammer arm extension. Pull at right angles to the inner straight edge of the extension. A pull of 3 to 5 ounces should be required to start the bell hammer moving.

c. ADJUSTMENT. Replace with a new spring.

## 296. Signal Bell Latch-Bar Latch Shims (fig. 184A)

a. PREPARATION. Remove the typing unit from the base and place the unit on its right side. (See par. 142.)

b. REQUIREMENTS. With the platen in the letters position (down), set up the letter S combination; turn the main shaft until the printing bail is in its extreme forward position. When the front shoulder on the bell latch bar is fully latched on the latch, the clearance between the bell latch bar and the lobe on the rear extension of the bell function lever should be 0.004 to 0.010 inch.

c. ADJUSTMENT. Add or remove shims between the latch and the function lever comb.

## 297. Signal Bell Latch-Bar Latch (fig. 184A)

a. PREPARATION. Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. REQUIREMENTS. When the main shaft is turned until the function bail is in its extreme rear position, there should be a clearance of 0.010 to 0.020 inch between the front shoulder of the bell latch bar and its latch. When checking this clearance, the shoulder on the bell reset bar should be fully engaged with the function-bail blade.

c. ADJUSTMENT. Loosen the mounting screws and position the bell latch-bar latch to the front or rear by means of its mounting slots. Tighten the mounting screws.

## 298. Signal Bell Hammer Backstop (fig. 184A)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. With the bell latch bar in its latched position, the clearance between the bell hammer arm extension and the bell operating lever should be 0.020 to 0.040 inch.

c. ADJUSTMENT. Loosen the mounting screws and position the backstop by means of its mounting slots. Tighten the mounting screws.

## 299. Signal Bell Operating Lever Spring (fig. 184A)

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. Unhook the bell reset-bar spring. With the rear shoulder of the bell latch, hook a 4-pound scale under the head of the bell operating lever screw; pull parallel to the latch bar. A pull of 1¼ to 2¼ pounds should be required to start the lever moving. Rehook the bell reset-bar spring.

c. ADJUSTMENT. Replace with a new spring.

### 300. Signal Bell-Reset-Bar Spring (fig. 184B)

a. PREPARATION. Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. REQUIREMENTS. Turn the main shaft until the function bail is in its extreme forward position. With the front shoulder of the latch bar resting against the latch, hook an 8-ounce scale over the reset bar just in front of the shoulder; pull at right angles to the reset bar. A pull of 3 to 5 ounces should be required to start the reset bar moving.

c. ADJUSTMENT. Replace with a new spring.

### 302. Carriage-Return Latch-Bar Shims (fig. 185).

a. PREPARATION. Remove the typing unit from the base and place the unit on its right side. (See par. 142.)

b. REQUIREMENTS. With the letter O combination selected and the main shaft turned until the printing bail is in its extreme forward position, there should be 0.004 to 0.010 inch clearance between the carriage-return latch bar and the lobe on the rear extension of the carriage-return function lever. When this clearance is checked, the shoulder on the car-

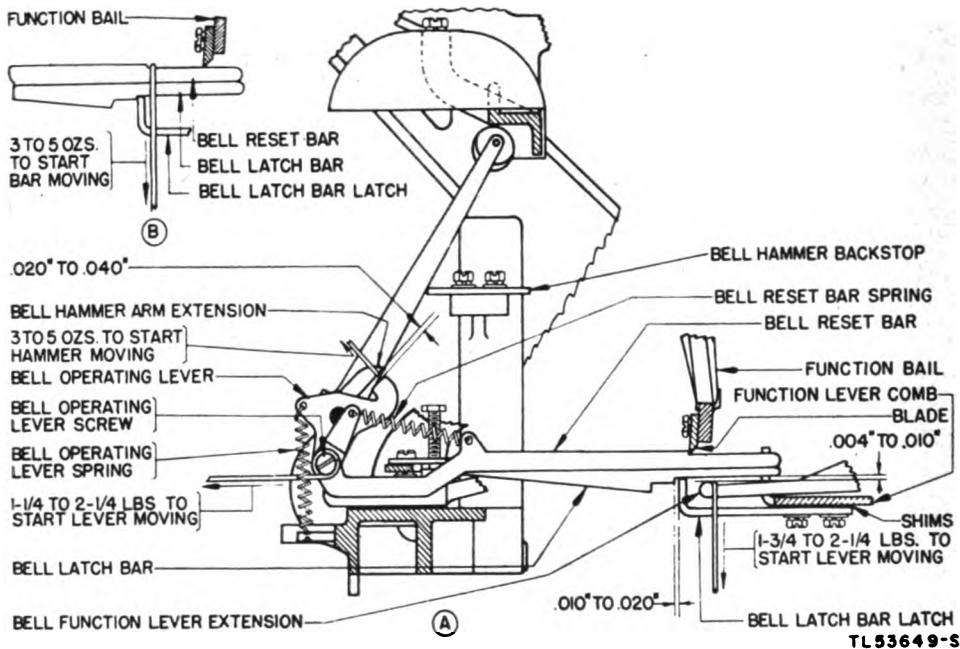


Figure 184. Signal bell mechanism.

### 301. Signal Bell Function Lever Spring (fig. 184A)

a. PREPARATION. Remove the typing unit from the base and place the unit on its right side. (See par. 142.)

b. REQUIREMENTS. Select any character and turn the main shaft until the bell function lever rests against the vanes, but is not selected. Hook a 4-pound scale over the rear extension of the bell function lever, just in front of the lobe that engages the bell latch bar; pull at right angles to the lever. A pull of 1¾ to 3¼ pounds should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

riage-return latch bar should be fully latched on the latch (similar to the signal bell latch-bar latch shims adjustment. (See par. 296 and fig. 184.)

c. ADJUSTMENT. Add or remove shims between the carriage-return latch-bar latch and the function-lever comb.

### 303. Carriage-Return Latch-Bar Latch (fig. 185)

a. PREPARATION. Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. REQUIREMENTS. With the main shaft turned until the function bail is in its extreme

rear position, the clearance between the shoulder on the carriage-return latch bar and the latch should be 0.010 to 0.020 inch. When this clearance is checked, the shoulder on the carriage-return reset bar should be fully engaged with the function-bail blade (similar to the signal bell latch-bar latch adjustment). (See par. 297 and fig. 184A.)

**c. ADJUSTMENT.** Loosen the mounting screws and position the latch to front or rear by means of its mounting slots. Tighten the mounting screws.

**c. ADJUSTMENT.** There are two positions of the lock-bar latch eccentric screw at which the proper adjustment can be obtained. Use the position which gives the greater tension on the latch spring.

### 305. Carriage-Return Lock-Bar Latch Spring (fig. 185)

**a. PREPARATION.** The typing unit may be on or off the base.

**b. REQUIREMENTS.** With the carriage-return lock-bar latch unlatched (resting on the upper

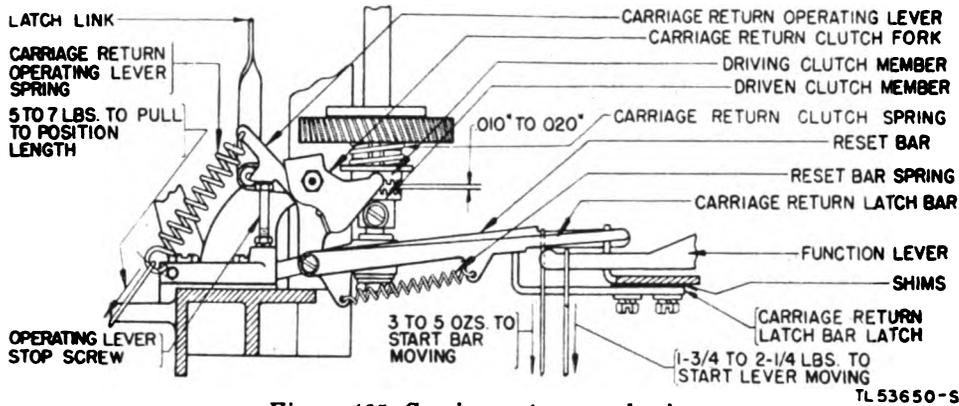


Figure 185. Carriage-return mechanism.

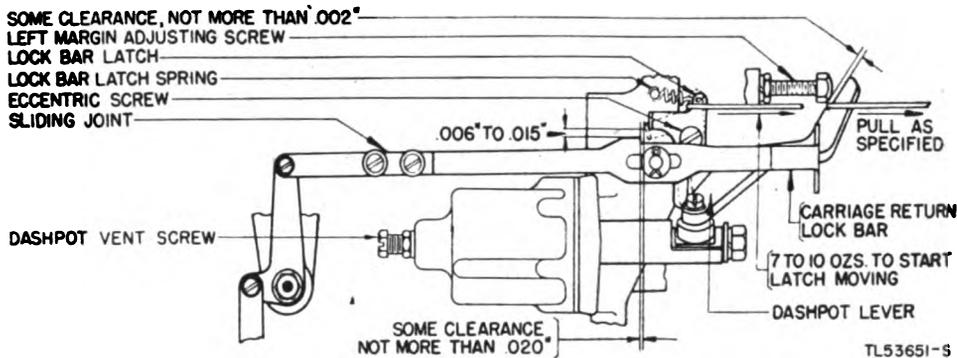


Figure 186. Lock-bar latch.

### 304. Carriage-Return Lock-Bar Latch Eccentric Screw (fig. 185)

**a. PREPARATION.** The typing unit may be on or off the base.

**b. REQUIREMENTS.** With the front end of the dash-pot lever held in its extreme left position, clearance between the lower edge of the carriage-return lock-bar latch and the upper edge of the lock bar should be 0.006- to 0.015-inch. When checking this clearance, take up all the play between the lock bar and the shoulder stud in a direction to make the least possible clearance.

part of the carriage-return lock bar), hook a 32-ounce scale over the latch just below the spring and pull parallel to the lock bar. A pull of 7 to 10 ounces should be required to start the latch moving.

**c. ADJUSTMENT.** Replace with a new spring.

### 306. Carriage-Return Lock Bar (fig. 185)

**a. PREPARATION.** Remove the typing unit from the base.

**b. REQUIREMENTS.** With the carriage-return lock bar in its latched position and the shoulder of the lock bar held against the edge of the

latch, the clearance between the teeth of the carriage-return clutch members should be 0.010 to 0.020 inch.

c. **ADJUSTMENT.** Loosen the mounting screw of the carriage-return clutch-driven member and take up the play between the driven member and its mounting screw counterclockwise as viewed from the lower end of the shaft. Adjust the length of the lock bar by means of its sliding joint. Tighten the mounting screw.

### 307. Carriage-Return Operating Lever Stop Screw (fig. 185)

a. **PREPARATION.** Remove the typing unit from the base.

b. **REQUIREMENTS.** With the carriage-return combination selected and the main shaft turned until the carriage-return function lever just trips the carriage-return latch bar off its latch, there should be some clearance, but not more than 0.020 inch, between the lock-bar shoulder and the edge of the lock-bar latch. When checking this clearance, take up all the play in the lock-bar connections in a direction to make the least possible clearance. This can be done by pulling out on the lock bar.

c. **ADJUSTMENT.** Change the height of the carriage-return operating lever stop screw.

### 308. Carriage-Return Reset-Bar Spring (fig. 185)

a. **PREPARATION.** Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. **REQUIREMENTS.** Move the function bail to its extreme forward position, and trip the carriage-return latch bar off its latch. Hook an 8-ounce scale over the reset bar, just in front of the shoulder, and pull horizontally at right angles to the reset bar. A pull of 3 to 5 ounces should be required to start the reset bar moving.

c. **ADJUSTMENT.** Replace with a new spring.

### 309. Carriage-Return Function Lever Spring (fig. 185)

a. **PREPARATION.** Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. **REQUIREMENTS.** Select any character and turn the main shaft until the carriage-return function lever is resting against the vanes, but not selected. Hook a 4-pound scale over the

rear extension of the function lever, just in front of the lobe that engages the latch bar, and pull at right angles to the lever. A pull of  $1\frac{3}{4}$  to  $2\frac{1}{4}$  pounds should be required to start the lever moving.

c. **ADJUSTMENT.** Replace with a new spring.

### 310. Carriage-Return Operating Lever Spring (fig. 185)

a. **PREPARATION.** Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. **REQUIREMENTS.** With the shoulder of the carriage-return latch bar against the latch and the carriage-return operating lever spring unhooked from the spring post, hook a 12-pound scale in the spring eye. A pull of 5 to 7 pounds should be required to stretch the spring to position length. Rehook the spring.

c. **ADJUSTMENT.** Replace with a new spring.

### 311. Carriage-Return Clutch Spring

a. **PREPARATION.** Remove the typing unit from the base and place the typing unit on its right side. (See par. 142.)

b. **REQUIREMENTS.** With the shoulder of the carriage-return latch bar resting against its latch and the carriage-return lock-bar latch held away from the lock bar, apply a 12-pound scale to the carriage-return fork opposite the place where the fork engages the carriage-return clutch. A pressure of  $1\frac{1}{2}$  to  $2\frac{1}{2}$  pounds should be required to start the driving clutch member moving away from the driven member.

c. **ADJUSTMENT.** Replace with a new spring.

### 312. Dash-Pot Lever Spring (fig. 186)

a. **PREPARATION.** The typing unit may be on or off the base.

b. **REQUIREMENTS.** Unhook the dash-pot lever spring from the spring post in the dash-pot lever, and hook a 32-ounce scale in the spring eye. With the front end of the dash-pot lever in its extreme right position, a pull of 18 to 24 ounces should be required to stretch the spring to its position length. Rehook the spring.

c. **ADJUSTMENT.** Replace with a new spring.

### 313. Spacing-Stop Lever Bracket (fig. 187)

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** (1) The lower end of the spacing-stop lever should clear the driving disk of the main shaft by 0.060 to 0.080 inch.

(2) With the stop lever held against the stop on the bracket by the stop-lever spring, there should be a clearance of 0.040 to 0.080 inch between the lower left edge of the stop lever and right side of a tooth on the spacing-stop sleeve, when the tooth is opposite the lever.

c. ADJUSTMENT. Loosen the mounting screws and move the stop-lever bracket up or down in its enlarged mounting holes to meet the first requirement. (See b(1) above.) Move the stop-lever bracket horizontally to meet the second requirement. (See b(2) above.) Tighten the mounting screws.

turn the guide screws up or down as required. Tighten the locknuts.

### 316. Code Bars and Bell Cranks (fig. 188)

a. PREPARATION. Place the type-bar carriage on the typing unit, and then place the typing unit on the base.

b. REQUIREMENTS. Alternately select the letters and blank combinations and turn the main shaft until the function levers are lifted from the rear edges of the vanes. When this is done, the code bars should be carried firmly against their stops in both the marking and the

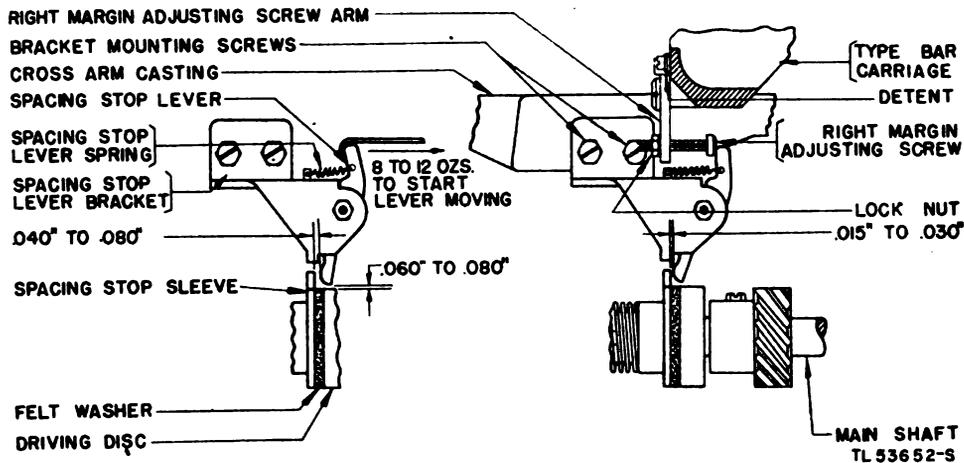


Figure 187. Spacing-stop mechanism.

### 314. Spacing-Stop Lever Spring (fig. 187)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. Hook a 32-ounce scale over the upper end of the stop lever, and pull horizontally toward the right. A pull of 8 to 12 ounces should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

### 315. Carriage Guide Screws (fig. 156)

a. PREPARATION. Place the type-bar carriage on the typing unit. The typing unit may be on or off the base.

b. REQUIREMENTS. With the printing bail in its extreme rear position, there should be some clearance, but not more than 0.008 inch, between the upper surface of the guide screw heads and the upper surface of the groove in the front carriage track. Check for this clearance along the entire travel of the carriage.

c. ADJUSTMENT. Loosen the locknuts and

spacing positions. Select the letters combination, move the vanes one by one from the marking to the spacing position, and let the vanes return slowly to the marking position. Check any code bars not carried firmly against their stops. Set up the blank combination, and repeat the operation. Again check any code bars not carried firmly against their stops.

c. ADJUSTMENTS. (1) If all the code bars are carried against the stops in the spacing position and not in the marking position, or vice versa, loosen the mounting screws and move the bell crank mounting plate up or down. Moving the plate up will cause the bars to move farther toward the left (toward the marking position).

(2) If only one or two code bars fail to be carried firmly against their stops in both marking and spacing positions, correct the travel of the code bars by turning the bell crank eccentric bushings.

(3) Make sure that the upper ends of the bell cranks do not engage the code bars deeply enough to bind.

### 317. Spacing Rack (fig. 189)

a. PREPARATION. The type-bar carriage is in place on the typing unit. The typing unit may be on or off the base.

b. REQUIREMENTS. There should be some backlash, but not more than 0.006 inch, between the spacing gear and the spacing rack along the entire travel of the rack.

lever against its pivoting shaft. Hook a 12-pound scale in the locking function lever spring eye. A pull of  $2\frac{1}{2}$  to  $3\frac{1}{8}$  pounds should be required to stretch the spring to position length. Rehook the spring.

c. ADJUSTMENT. Replace with a new spring.

### 319. Sixth-Vane Detent Spring (fig. 157)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. Hook an 8-ounce scale in the sixth-vane detent spring hole and pull in

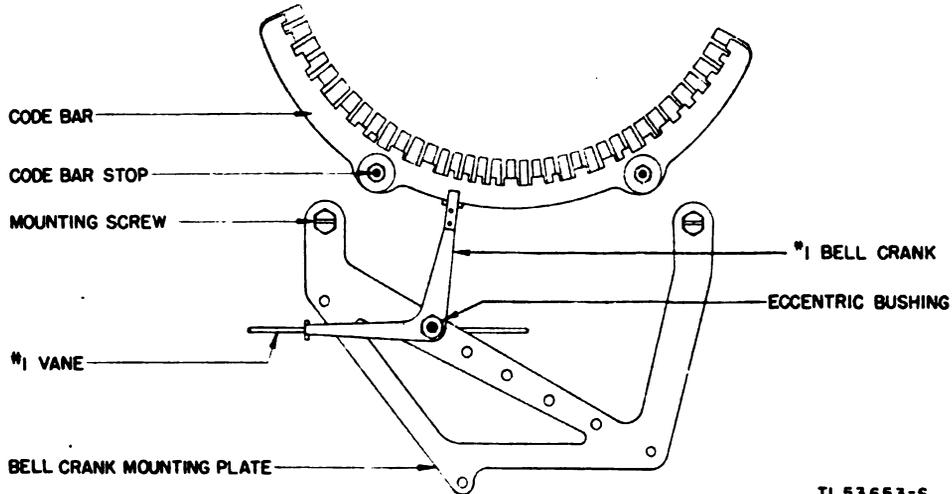


Figure 188. Code bar and bell crank.

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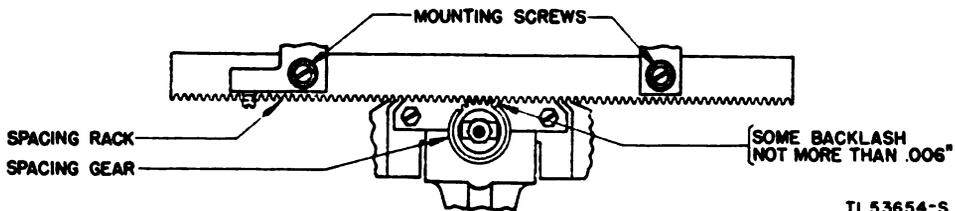


Figure 189. Spacing rack.

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c. ADJUSTMENT. Loosen the spacing rack mounting screws and move the rack toward the front or rear of the type-bar carriage. Tighten the mounting screws.

### 318. Locking Function Lever Spring (fig. 160)

a. PREPARATION. The type-bar carriage is placed on the typing unit. The typing unit may be on or off the base.

b. REQUIREMENTS. Turn the main shaft until the printing bail is in its extreme rear position. Unhook the locking function lever spring from the spring plate and hold the locking function

line with the spring toward the rear of the typing unit. A pull of 6 to 8 ounces should be required to start the roller moving away from the sixth vane.

c. ADJUSTMENT. Replace with a new spring.

### 320. Carriage-Return Spring Drum

a. PREPARATION. The typing unit may be on or off the base.

b. REQUIREMENTS. Turn the main shaft until the printing bail is in its extreme rear position. Hold the carriage-return lock bar approximately in its locked position to disengage the

carriage-return clutch teeth and hold the dash-pot lever in its operated position. Hook a 12-pound scale over the lower part of the right ribbon spool bracket, and pull in a line parallel to the carriage track. A pull of  $3\frac{3}{4}$  to  $4\frac{1}{4}$  pounds should be required to start the carriage moving away from its extreme left position.

c. **ADJUSTMENT.** To increase the tension, wind up the carriage-return spring by turning the center shaft of the drum. To decrease the tension, operate the carriage-return drum escapement lever.

### 321. Paper Spindle Drag Spring (fig. 190)

a. **PREPARATION.** The typing unit may be on or off the base.

b. **REQUIREMENTS.** Insert an empty paper spindle in the slots, and lock it in place with the retaining plates. With both ends of the spindle shaft in the bottom of their slots, apply the push end of a 12-pound scale to the left end of the paper spindle shaft and push toward the right side of the typing unit. A pressure of 5 to 8 pounds should be required to start the spindle moving.

c. **ADJUSTMENT.** Bend the spindle drag spring.

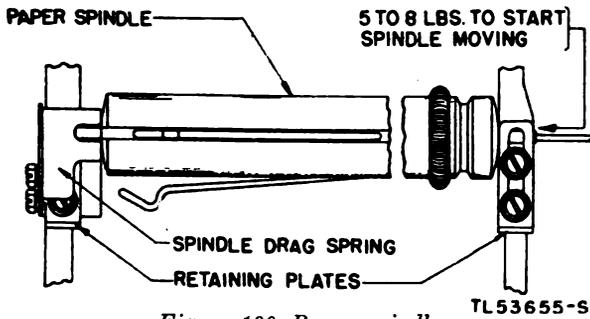


Figure 190. Paper spindle.

### 322. Platen Friction Assembly (fig. 191)

a. **PREPARATION.** The typing unit may be on or off the base.

b. **REQUIREMENTS.** Move the pressure-roller release-shaft arm to its extreme rear position. Unhook the line-feed detent lever spring, and place the platen handle straight up. Hook an 8-ounce scale over the end of the handle and pull horizontally toward the front of the typing unit. A pull of 6 to 8 ounces should be required to start the platen turning. Rehook the detent lever spring.

c. **ADJUSTMENT.** Increase or decrease the amount of friction by turning the adjusting nuts on the friction assembly.

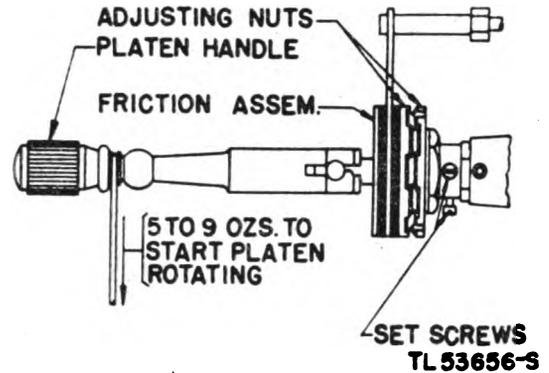


Figure 191. Platen friction assembly.

### 323. Send-Receive T-Lever Friction Washer (fig. 192A)

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** With the printing bail in its extreme rear position, move the T-lever so that the clearance between the T-lever and the universal function lever extension is 0.040 to 0.060 inch. Hook an 8-ounce scale under the right extension of the T-lever, just in front of the universal function lever extension, and pull straight up. A pull of 5 to  $6\frac{1}{2}$  ounces should be required to start the lever moving.

c. **ADJUSTMENT.** Replace with a new friction washer.

### 324. Universal Function Lever Spring (fig. 192A)

a. **PREPARATION.** The typing unit may be on or off the base.

b. **REQUIREMENTS.** With the printing bail in its extreme rear position, hook a 32-ounce scale under the extreme front end of the universal function lever extension and pull straight up. A pull of 14 to 17 ounces should be required to start the lever moving.

c. **ADJUSTMENT.** Replace with a new spring.

### 325. Blank Function Lever Spring (fig. 192A)

a. **PREPARATION.** The typing unit may be on or off the base.

b. **REQUIREMENTS.** With the printing bail in its extreme rear position, hook a 12-pound scale under the extreme front end of the blank func-

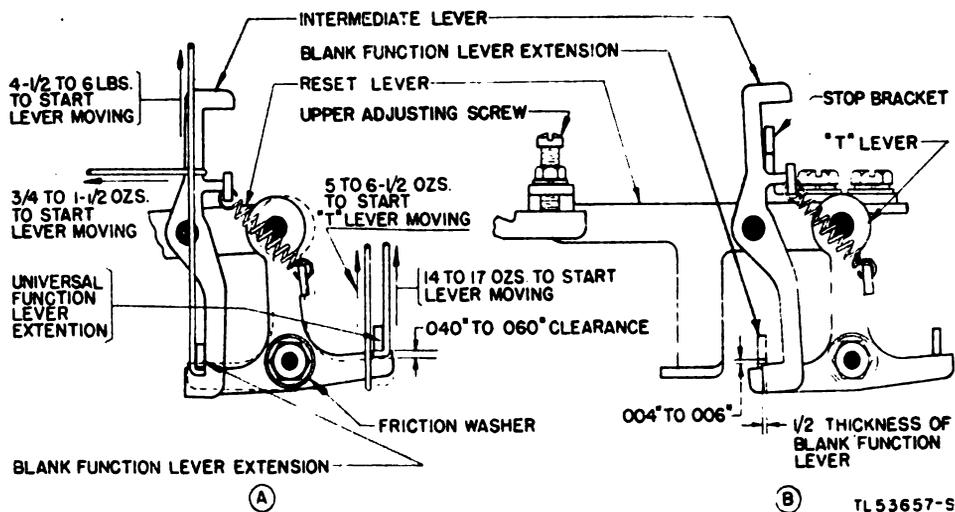


Figure 192. Blank intermediate lever.

tion lever extension and pull straight up. A pull of  $4\frac{1}{2}$  to 6 pounds should be required to start the lever moving.

c. **ADJUSTMENT.** Replace with a new spring.

### 326. Send-Receive Mechanism Plate (fig. 171)

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** (1) Select the blank combination. Turn the main shaft until the blank function lever is completely selected. Stop turning the shaft when the function lever bail roller just leaves the cam surface of the blank function lever. Under these conditions and with the left arm of the T-lever in contact with the blank function lever extension, there should be some clearance, but not more than 0.008 inch, between the right arm of the T-lever and the universal function lever extension.

*Note.* When setting up the above-named conditions on typing units equipped with a blank printing and spacing cut-out function lever, stop turning the main shaft when the function lever bail comes to rest on top of the blank printing and spacing cut-out function lever.

(2) On typing units from which the blank and universal function levers are omitted, the vertical clearance between both ends of the function lever spring plate and the send-receive mechanism plate should be 0.020 to 0.030 inch.

c. **ADJUSTMENT.** Make sure that the intermediate lever is clear of the blank function lever extension. Then position the send-receive mechanism plate by loosening the mounting screws and moving the plate in its mounting slots. Tighten the mounting screws.

### 327. Right Motor-Stop Contact (figs. 170 and 171)

*Note.* This adjustment applies only to teletypewriters equipped with a mechanical motor-stop mechanism.

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** (1) With the printing bail in its extreme rear position, the selector armature held in the marking (operated) position, and the inner motor-stop pawl engaged with its latch, there should be a slight clearance, but not more than 0.006 inch, between the insulated end of the light contact spring of the right motor-stop contacts and the upper end of the motor-stop contact lever.

(2) With the selector armature in the spacing (unoperated) position, and the outer motor-stop pawl engaged with the latch, the clearance between the contact points should be 0.012 to 0.020 inch.

c. **ADJUSTMENT.** (1) Bend the light contact spring, making sure that the heavy contact spring does not bear against the light spring.

(2) Bend the heavy spring of the right motor-stop contacts.

### 328. Left Motor-Stop Contacts (fig. 171)

*Note.* This adjustment applies only to teletypewriters equipped with a mechanical motor-stop mechanism.

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** (1) With the printing bail in its extreme rear position, there should be some clearance, but not more than 0.006 inch, between the insulated end of the light contact spring of the left motor-stop contacts and the lobe on the front extension of the motor-stop function lever.

(2) With the motor-stop function lever selected and the main shaft turned until the right motor-stop contact is just at the point of opening, the left motor-stop contacts should be at the point of closing.

c. **ADJUSTMENT.** (1) Bend the light contact spring, making sure that the heavy spring does not bear against the light spring.

(2) Bend the heavy contact spring of the left motor-stop contacts.

### 329. Intermediate-Lever Stop Bracket (fig. 171)

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** Select the blank combination and turn the main shaft until the intermediate-lever toe is under the blank function lever extension. Make sure that the intermediate lever is approximately vertical. Then select the T-combination and turn the main shaft until the printing bail is in its extreme forward position. During this last operation the left end of the intermediate-lever toe should move to a point at least  $\frac{1}{16}$  inch to the right of the blank function lever extension.

c. **ADJUSTMENT.** Position the intermediate-lever stop bracket by means of its mounting slots.

### 330. Intermediate-Lever Spring (fig. 192A)

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** With the printing bail in its extreme rear position, move the T-lever so that its right end is in contact with the universal function lever extension; hold the reset lever so that its upper edge is horizontal. Hook an 8-ounce scale over the intermediate lever just above the spring arm and pull horizontally toward the left of the typing unit. A pull of  $\frac{3}{4}$  to  $1\frac{1}{2}$  ounces should be required to start the lever moving.

c. **ADJUSTMENT.** Replace with a new spring.

### 331. Motor Plate

a. **PREPARATION.** The typing unit is in place on the base.

b. **REQUIREMENTS.** The lateral alignment of the motor pinion and the main-shaft gear should be such that the center line of the gear coincides with a vertical line through the center of the hole in the motor pinion. The backlash between the motor pinion and the highest point of the main-shaft gear should be barely perceptible.

c. **ADJUSTMENT.** (1) When a teletypewriter is equipped with a motor *not having* elongated mounting holes, place the typing unit on an adjusted base with motor assembly and tighten the three mounting thumbscrews. Remove the keyboard from the base. Face the front of the base unit and visually check the lateral alignment of the motor pinion and the main-shaft gear to see if a centerline through the main-shaft gear coincides with a vertical line through the center of the hole in the motor pinion. If these lines do not coincide, remove the typing unit from the teletypewriter base and loosen the three motor mounting screws. Replace the typing unit on the teletypewriter base. Shift the motor by taking up the play between the drilled motor mounting holes and the motor mounting screws, until the two lines previously mentioned coincide. If there is not enough play in the motor mounting holes to permit the motor to be properly aligned, shift the motor to obtain the best possible lateral alignment of the motor pinion and the main-shaft gear. The edges of the motor bases should be parallel to the corresponding edges of the motor plate. Remove the typing unit and tighten the three motor mounting screws.

(2) To correct the amount of backlash, loosen the rear motor plate mounting screw and the locknut on the motor plate adjusting screw. Slightly loosen the two front motor plate mounting screws to prevent stripping the threads while making the following adjustment. Replace the typing unit and tighten the three mounting thumbscrews. Turn the motor plate adjusting screw until the amount of backlash between the motor pinion and the highest point on the main-shaft gear is barely noticeable. The highest point may be found by turning the main shaft for one complete revolution. Start the motor and carefully readjust the ver-

tical position of the motor pinion by turning the adjusting screw until the gear noise is reduced to a minimum. Tighten the three motor plate mounting screws and the adjusting screw locknut. Recheck the backlash between the gears.

**Caution:** Care should be exercised in adjusting the vertical position of the motor pinion while the motor is running in order to avoid damaging the main-shaft gear or reducing the speed of the motor as the result of too close a mesh between the gear and the pinion.

*Note.* When teletypewriters are equipped with motors having elongated mounting holes: Make adjustments (1) and (2) as described in the above paragraph, except that in making adjustment (1) the motor must be shifted until the centerline of the gear also passes through the center of the hole in the motor pinion as nearly as it is possible to determine by eye.

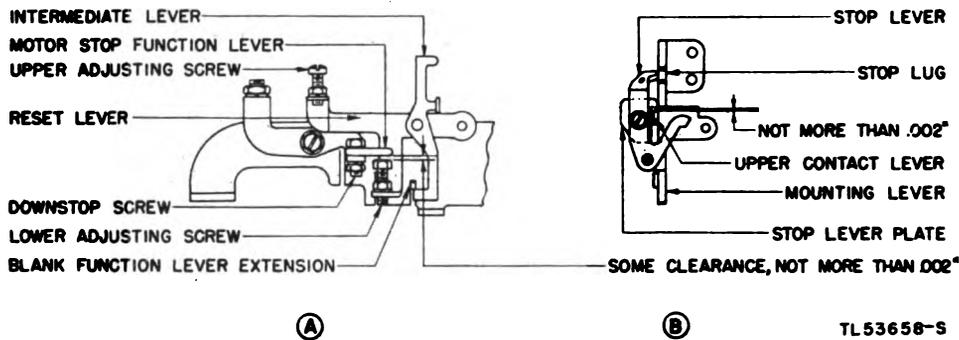


Figure 193. Reset lever adjustments.

### 332. Send-Receive Reset Lever Upper Adjusting Screw (fig. 192B)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. There should be a 0.004- to 0.006-inch clearance between the upper edge of the intermediate-lever toe and the bottom of the blank function lever extension under the following conditions: When the printing bail is in its extreme rear position and the send-receive-break key is in the SEND position (up), move the toe of the intermediate lever under the blank function lever extension. Select the T-combination and turn the motor until the intermediate lever is moved to where the blank function lever extension overlaps the toe of the intermediate lever by one-half the thickness of the blank function lever extension.

c. ADJUSTMENT. Raise or lower the reset lever upper adjusting screw.

### 333. Send-Receive Reset-Lever Lower Adjusting Screw (fig. 193A)

*Note.* Omit this adjustment when the typing unit is not equipped with a mechanical motor-stop mechanism.

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. Place the platen in the letters position (down). Select the motor-stop combination. Turn the motor until the printing bail is in its extreme forward position. Under these conditions and with the SEND-REC-BREAK key in the SEND position, there should be some clearance, but not more than 0.002 inch, between the head of the lower adjusting screws and the lower surface of the front extension of the motor-stop function lever.

c. ADJUSTMENT. Raise or lower the reset lever lower adjusting screw.

### 334. Send-Receive Reset-Lever Down Stop Screw (fig. 193)

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. With the SEND-REC-BREAK key in the SEND position (up) and the toe of the intermediate lever under the blank function lever extension, select the blank combination and turn the main shaft until the function lever bail roller just leaves the cam surface of the blank function lever. Depress the break key and immediately release it. The stop-lever plate should just latch the upper contact lever. (On bases equipped with SEND-REC-BREAK mechanism having two lower contacts, the safety pawl should latch the operating lever.) There should not be more than 0.002-inch clearance between the stop-lever plate and the upper contact lever (or between the safety pawl and the operating lever on

bases equipped with the send-rec-break mechanism having two lower contacts).

c. **ADJUSTMENT.** Raise or lower the reset-lever down stop screw.

### 335. Left Margin Adjusting Screw (fig. 185)

a. **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

b. **REQUIREMENTS.** The first character of a line should print within  $\frac{1}{16}$  inch of the specified margin, normally  $\frac{7}{8}$  inch from the left edge of the platen.

c. **ADJUSTMENT.** Turn the left margin adjusting screw in. Move the carriage by hand into position to print a character  $\frac{7}{8}$  inch plus or minus  $\frac{1}{16}$  inch from the left edge of the platen. Operate the dash-pot lever to lock the

justing screw arm in engagement with its detent, space the carriage 71 spaces. The carriage should then be in position to print the last character of the normal 72-character line. Adjust the stop screw so that the spacing-stop lever is moved to within 0.015 to 0.030 inch of a projection on the spacing-stop sleeve.

### 337. Ribbon-Oscillator Lever (fig. 194)

a. **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

b. **REQUIREMENTS.** With the ribbon lockout bar in its unoperated position (pulled out toward the right), the ribbon should cover fully any character as it is being printed. When the printing has been completed and the main-shaft clutch has disengaged, the top edge of

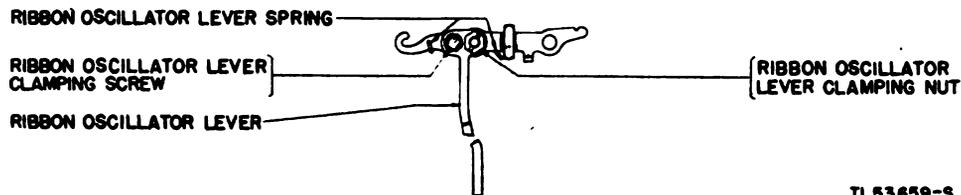


Figure 194. Ribbon-oscillator lever.

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carriage in place. Turn the adjusting screw out until there is a slight clearance (not more than 0.002-inch) between the end of the screw and the dash-pot lever when the adjusting screw locknut has been tightened and when a horizontal pull of 8 pounds is exerted on the dash-pot lever (new style). The pull is applied with a 12-pound scale at right angles to the curved surface  $\frac{1}{32}$  inch behind the margin adjusting screw. A pull of 10 pounds applied just in front of the shoulder is required for old-style (without a milled notch) dash-pot levers. Turn the left margin adjusting screw one-sixth turn in a direction to eliminate the clearance. Tighten the locknut.

### 336. Right Margin Adjusting Screw (fig. 187)

a. **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

b. **REQUIREMENTS.** The teletypewriter should normally print 72 characters on a line before spacing is blocked by the spacing-stop lever.

c. **ADJUSTMENT.** Return the carriage to the left end of the line and back off the right margin adjusting screw. With the right margin ad-

justing screw arm in engagement with its detent, space the carriage 71 spaces. The carriage should then be in position to print the last character of the normal 72-character line. Adjust the stop screw so that the spacing-stop lever is moved to within 0.015 to 0.030 inch of a projection on the spacing-stop sleeve.

c. **ADJUSTMENT.** Shift the platen to the figures position (up) and loosen the ribbon-oscillator lever clamping screw and nut. Position the ribbon-oscillator lever, and tighten the clamping screw and nut. Check this adjustment with the platen in the letters position (down).

### 338. Ribbon Lockout Bar (fig. 195)

*Note.* This adjustment applies only to teletypewriters equipped with the adjustable ribbon lock-out bar.

a. **PREPARATION.** Remove the typing unit from the base. (See par. 142.)

b. **REQUIREMENTS.** Hold the ribbon carrier down, and move the ribbon lock-out bar to the left against its stop. The ribbon should be locked far enough below the printing line to prevent printing any portion of the characters.

c. **ADJUSTMENT.** Remove the ribbon, ribbon carrier, and type-bar guide from the adapter plate, and loosen the ribbon lock-out bar adjusting screws. Move the platen to the figures position. Hold the ribbon oscillator down and move the ribbon lock-out bar to the left against the stop; the lock-out bar extension slides over the

top of the ribbon oscillator. Push the lock-out bar extension down so that the ribbon-oscillator extension is held firmly against the type-bar guide adapter plate. Hold the right end of the ribbon lock-out bar down and tighten the lock-out bar adjusting screws. Replace the type-bar guide, the ribbon carrier, and the ribbon. With the ribbon lock-out bar in its operated position, hook a 12-pound scale over the end of the ribbon lock-out bar, and pull directly in line with the bar. A pull of not more than 5 pounds should be required to move the lock-out bar to its unoperated position.

c. **ADJUSTMENT.** Saturate the felt washer with proper lubricating oil and recheck the requirement. (See *b* above.) If the requirement is not met, replace the spacing clutch spring with a new spring.

### 340. Margin Signal Bell (fig. 182)

*a.* **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

*b.* **REQUIREMENTS.** The margin signal bell should ring on the sixty-sixth printed character for lines 72 characters long.

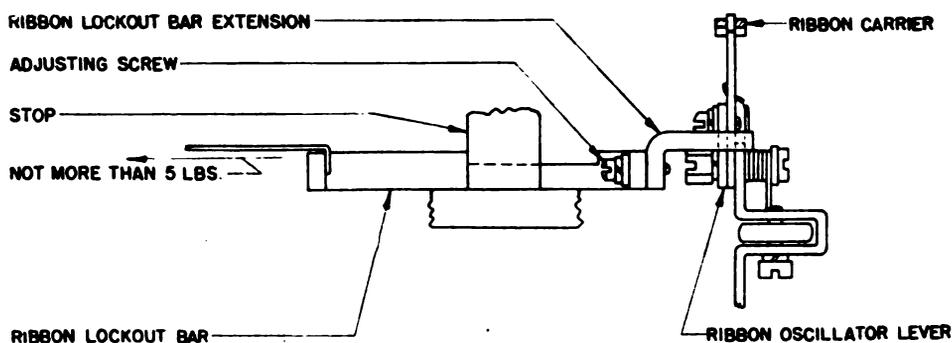


Figure 195. Ribbon lockout bar.

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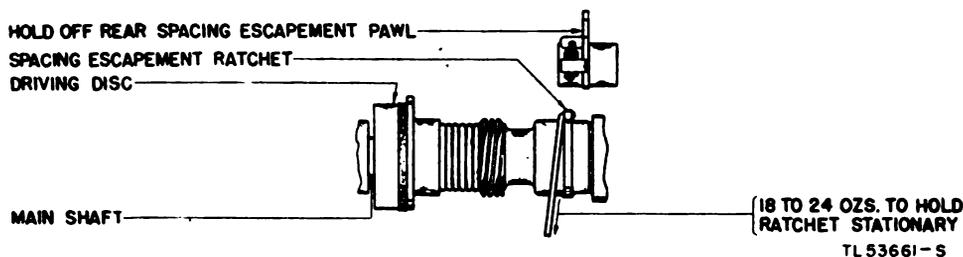


Figure 196. Main-shaft spacing gear.

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### 339. Spacing Clutch Torque (fig. 196)

*a.* **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

*b.* **REQUIREMENTS.** Run the motor for at least 10 minutes. Operate the lock bar. Hook a 32-ounce scale at the bottom of the uppermost projection on the spacing-stop sleeve. Pull horizontally toward the rear of the typing unit until the leading edge of the spacing-stop sleeve is approximately vertical. With the main shaft turning, a pull of 14 to 19 ounces should be required to hold the spacing-stop sleeve stationary.

*c.* **ADJUSTMENT.** Return the carriage to the left end of the line. Space the carriage 66 spaces to the right. Loosen the margin-bell cam thumbscrew. Adjust the cam so that its right side is in contact with the margin-bell pawl; tighten the thumbscrew.

### 341. Selector Clutch Torque (fig. 197)

*a.* **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

*b.* **REQUIREMENTS.** Run the motor for at least 10 minutes. Hook a 32-ounce scale to the selector-cam sleeve stop arm. A pull of 14 to 18

ounces should be required to hold the sleeve stationary.

c. **ADJUSTMENT.** Saturate the felt washers with the proper lubricating oil and recheck the requirement. (See *b* above.) If the requirement is not met, replace the cam-sleeve spring with a new spring.

### 342. Bail-Cam Unit Friction Clutch Torque (fig. 197)

a. **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

b. **REQUIREMENTS.** Remove the function-bail spring, and hold the printing bail away from its adjusting screw. With the teletypewriter running on a closed line (selector magnet energized or selector armature held in marking position by a toothpick to simulate a closed line), hook a 32-ounce scale over the screwhead on the cam unit and pull horizontally at right angles to the main shaft. A pull of 20 to 24 ounces should be required to move the cam in a direction opposite to its normal direction of rotation.

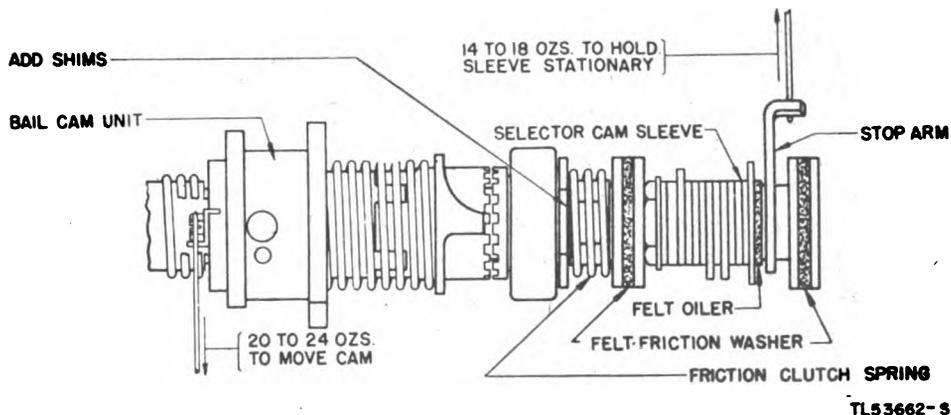


Figure 197. Bail-cam and selector-cam friction clutch.

c. **ADJUSTMENT.** Saturate the felt washer with the proper lubricating oil and recheck the requirement. (See *b* above.) If the requirement is not met, replace the bail-cam spring with a new spring.

### 343. Dash-Pot Vent Screw (fig. 186)

a. **PREPARATION.** The type-bar carriage is on the typing unit, and the typing unit is on the base.

b. **REQUIREMENTS.** When the carriage-return lock bar is held in its latched position, the car-

riage should return from its right margin stop to its left margin stop without bouncing and with minimum shock.

c. **ADJUSTMENT.** Loosen the dash-pot vent screw locknut, and turn the screw in or out as required. Tighten the locknut.

### 344. Lock-Loop Spring (fig. 198)

a. **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

b. **REQUIREMENTS.** Turn the transmitting-cam sleeve until the lock-loop roller rests on the low part of its cam. Hook an 8-ounce scale in the lock-loop spring hole and pull in line with the spring. A pull of 4 to 5 ounces should be required to start the lock loop moving.

c. **ADJUSTMENT.** Replace with a new spring.

### 345. Locking-Lever Shaft Bracket (fig. 198)

a. **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

b. **REQUIREMENTS.** (1) With all the contact levers on the high parts of their cams, there should be some clearance, but not more than 0.010 inch, between the contact levers and the

locking levers. When measuring this clearance, press the locking levers down by hand to make minimum clearance.

(2) When the letters and blank keys are depressed alternately, the locking levers should travel the same distance on either side of the lock-loop blade.

c. **ADJUSTMENT.** Add or remove shims between the locking-lever shaft bracket and the keyboard casting to meet the first requirement. (See *b* (1) above.) Before tightening the bracket mounting screws, position the bracket

from side to side to meet the second requirement. (See *b* (2) above.)

### 346. Transmitting Contact Gap (fig. 198)

*a.* PREPARATION. Remove the keyboard from the base. (See par. 142.)

*b.* REQUIREMENTS. With any contact lever on the high part of its cam, the contact gap should be 0.020 to 0.025 inch.

*c.* ADJUSTMENT. Bend the shorter contact springs.

### 348. Transmitting-Shaft Clutch Spring (fig. 200)

*a.* PREPARATION. Remove the keyboard from the base. (See par. 142.)

*b.* REQUIREMENTS. Hook a 32-ounce scale to the clutch-driven member projection and pull directly in line with the shaft. A pull of 9 to 12 ounces should be required to separate the clutch teeth.

*c.* ADJUSTMENT. Replace with a new spring.

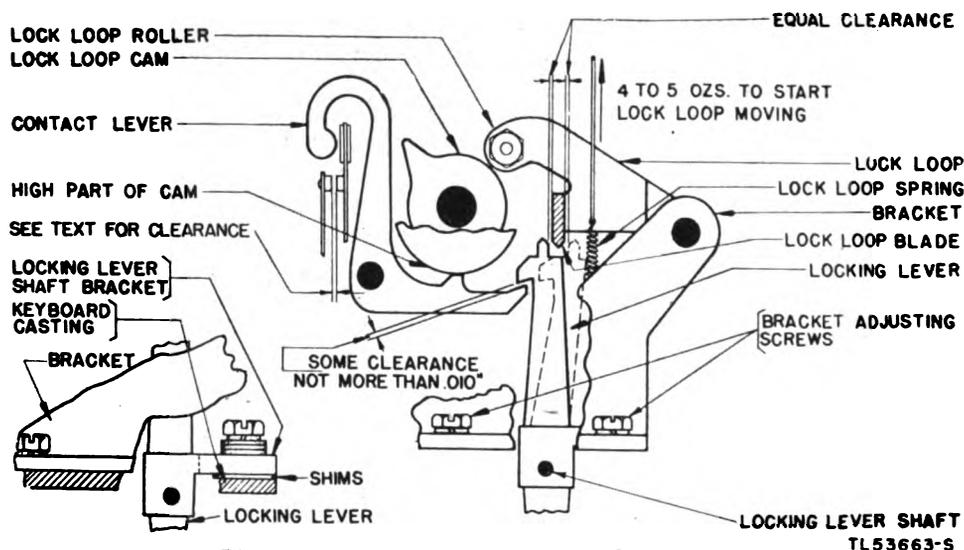


Figure 198. Transmitter contacts and lock loop.

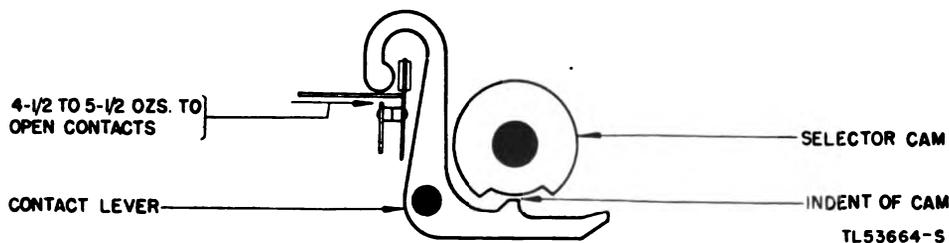


Figure 199. Transmitter contact springs.

### 347. Transmitting Contact Spring (fig. 199)

*a.* PREPARATION. Remove the keyboard from the base. (See par. 142.)

*b.* REQUIREMENTS. With any contact lever on the low part of its cam, apply the push end of an 8-ounce scale to each contact spring just above the contact point. A pressure of 4½ to 5½ ounces should be required to open the contact.

*c.* ADJUSTMENT. Bend the longer contact springs. Recheck the contact gap. (See par. 346.)

### 349. Transmitting-Cam Cylinder End Play (fig. 201)

*a.* PREPARATION. Remove the keyboard from the base. (See par. 142.)

*b.* REQUIREMENTS. The transmitting-cam cylinder should have some end play, but not more than 0.002 inch.

*c.* ADJUSTMENT. Position the bushing in the rear bearing bracket by turning its adjusting nuts.

### 350. Transmitting-Shaft Clutch (fig. 202)

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. When the clutch is fully disengaged, the clearance between the clutch teeth should be 0.005 to 0.015 inch.

c. ADJUSTMENT. Position the clutch throw-out lever by adding or removing shims between the throw-out lever post and the bracket.

lock-loop roller against its cam to disengage the clutch teeth fully. Position the locking levers directly below the lock-loop blade to make the minimum clearance. The clearance should be 0.008 to 0.015 inch between the lock-loop blade and the locking lever having the least clearance.

c. ADJUSTMENT. Position the roller pivot screw by loosening its locknut and moving the

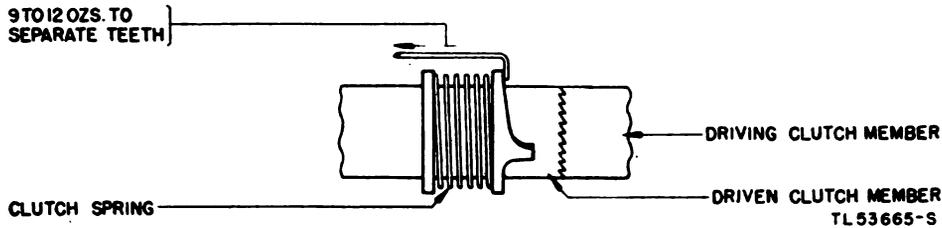


Figure 200. Transmitting-shaft clutch spring.

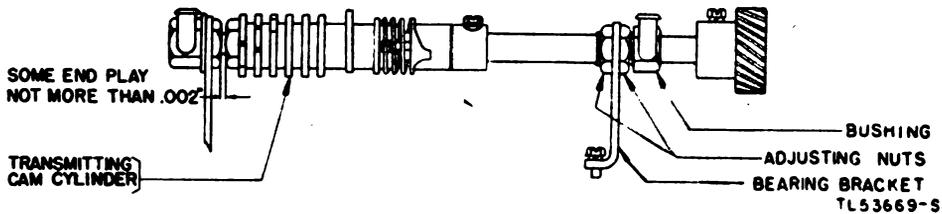


Figure 201. Transmitting shaft.

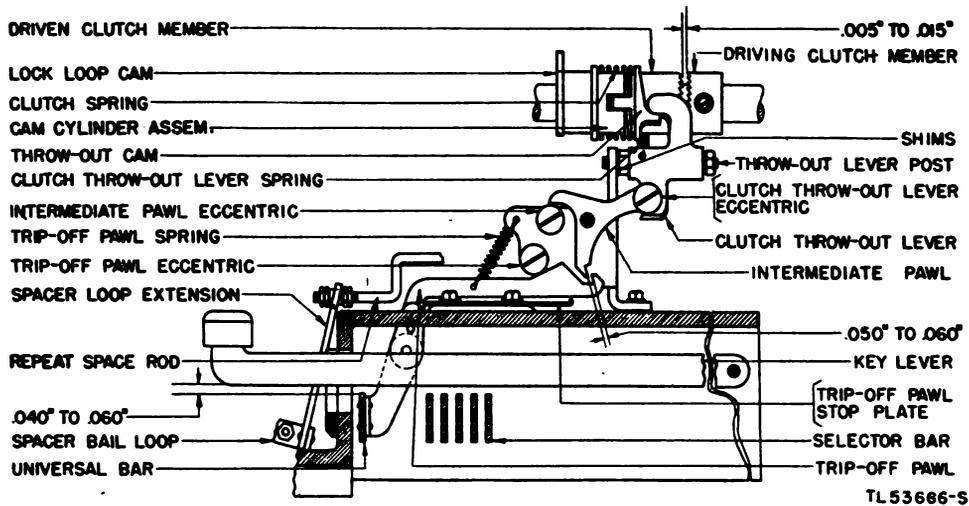


Figure 202. Clutch release mechanism.

### 351. Lock-Loop Roller (Adjustable) (fig. 198)

Note. This adjustment applies only to keyboards equipped with lock loops having slots for the roller pivot screw.

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. Turn the keyboard shaft until the clutch teeth are disengaged. Press the

screw in the slot as required. Tighten the locknut.

### 352. Lock-Loop Roller (Nonadjustable) (fig. 198)

Note. This adjustment applies only to keyboards equipped with lock loops not having slots for the roller pivot screws.

*a.* **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

*b.* **REQUIREMENTS.** Turn the keyboard shaft until the clutch teeth are disengaged. Press the lock-loop roller against its cam to disengage the clutch teeth fully. Position the locking levers directly below the lock-loop blade to make the minimum clearance. The clearance should be at least 0.008 inch between the lock-loop blade and the locking lever having the least clearance.

*c.* **ADJUSTMENTS.** Since the lock loops not having slots for the roller pivot screws are designed in such a way that the hole cannot be enlarged, the worn transmitting-cam sleeve must be replaced with a new transmitting-cam sleeve. In emergencies when new transmitting-cam sleeves cannot be obtained, build up the tip of the lock-loop cam with solder until the requirements (*b* above) are met.

### **353. Universal-Bar Pilot Screws (fig. 202)**

*a.* **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

*b.* **REQUIREMENTS.** The universal bar should have some end play, but not more than 0.010 inch. The universal-bar extension should be approximately in the middle of the space between the P and CAR RET key levers. Operate the trip-off pawl by depressing a key lever. The trip-off pawl should clear the sides of the stop-plate mounting screw and the locking-lever bracket.

*c.* **ADJUSTMENT.** Position the universal bar by loosening the pilot screw locknut and turning the pilot screws as required. Tighten the locknuts.

### **354. Trip-Off Pawl Stop Plate (fig. 202)**

*a.* **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

*b.* **REQUIREMENTS.** The clearance between all key levers and the universal bar should be 0.040 to 0.060 inch when the trip-off pawl is resting against the end of the stop plate.

*c.* **ADJUSTMENT.** Position the trip-off pawl stop plate by means of its mounting slots.

### **355. Intermediate-Pawl Eccentric (fig. 202)**

*a.* **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

*b.* **REQUIREMENTS.** When the trip-off pawl rests against the end of the stop plate and the

intermediate pawl is against its eccentric, the clearance between the trip-off pawl and the intermediate pawl should be 0.050 to 0.060 inch.

*c.* **ADJUSTMENT.** Position the intermediate-pawl eccentric by loosening the locknut and turning the eccentric screw as required. Tighten the locknut. There are two positions of the eccentric screw that give the correct clearance. Use the position where the high part of the eccentric is toward the rear of the keyboard.

### **356. Clutch Throw-Out Lever Eccentric (fig. 202)**

*a.* **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

*b.* **REQUIREMENTS.** When the clutch throw-out lever is resting on the low part of the clutch-driven member, the intermediate pawl should be held firmly between the clutch throw-out lever eccentric and the intermediate-pawl eccentric.

*c.* **ADJUSTMENT.** Position the clutch throw-out lever eccentric by loosening the locknut and turning the eccentric screw as required. Tighten the locknut. There are two positions of the eccentric screw that give the correct clearance. Use the position where the high part of the eccentric is toward the rear of the keyboard.

### **357. Trip-Off Pawl Eccentric (fig. 203)**

*a.* **PREPARATION.** Remove the keyboard from the base. (See par. 142.)

*b.* **REQUIREMENTS.** (1) With the clutch throw-out lever held against the high part of its cam and the clutch throw-out lever eccentric held against the clutch throw-out lever, the end of the trip-off pawl should clear the end of the intermediate pawl by not more than 0.004 inch.

(2) With the trip-off pawl in its operated position, the clearance between the formed-up end of the stop plate and lower edge of the trip-off pawl should be at least 0.002 inch.

*c.* **ADJUSTMENT.** (1) Loosen the locknut on the trip-off pawl eccentric screw and turn the eccentric as required. Tighten the locknut.

(2) Bend the rear extension of the trip-off pawl stop plate.

### 358. Clutch Throw-Out Lever Spring (fig. 202)

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. With the clutch teeth engaged and the clutch throw-out lever resting against the low part of the clutch-driven member, hold the intermediate pawl against its eccentric. At the same time hook an 8-ounce scale over the throw-out lever just above the spring hole and pull in line with spring. A pull of  $1\frac{1}{2}$  to  $2\frac{1}{2}$  ounces should be required to start the lever moving.

c. ADJUSTMENT. Replace with a new spring.

### 360. Key Lever Springs (fig. 205)

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. The openings between the ends of all key lever springs, except the spacer key lever (space bar) spring, should measure  $1\frac{3}{16}$  inches. The distance across the opening between the ends of the spacer key lever (space bar) spring should be  $1\frac{15}{16}$  inches.

c. ADJUSTMENT. Bend the springs.

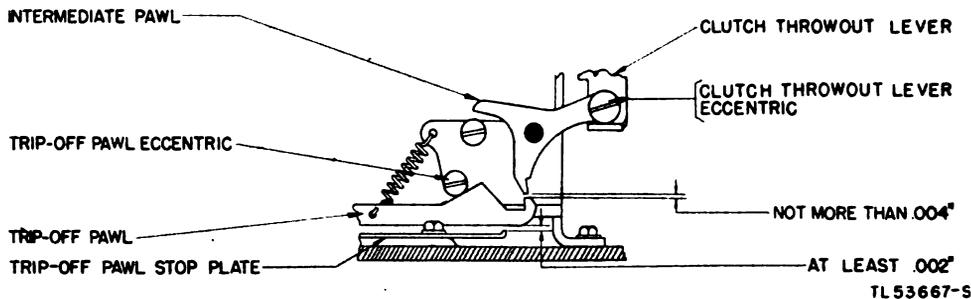


Figure 203. Trip-off eccentric screw.

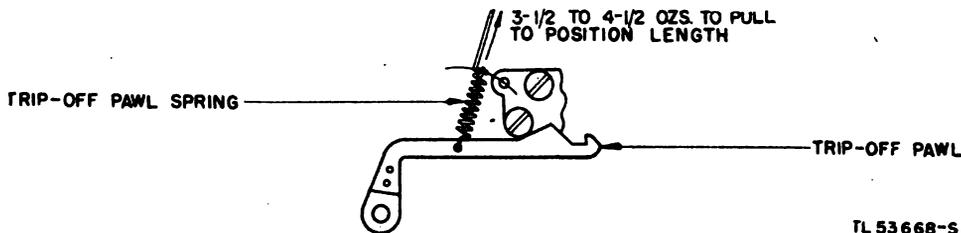


Figure 204. Trip-off pawl spring.

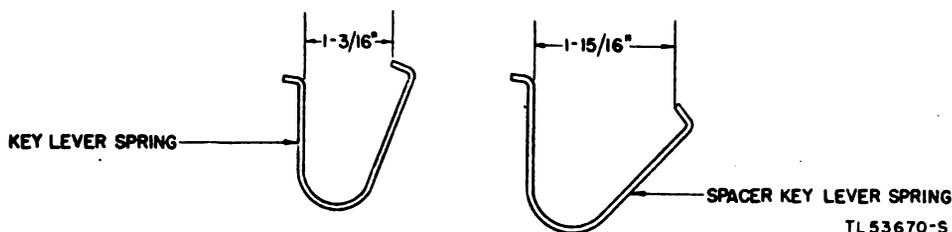


Figure 205. Key lever springs.

### 359. Trip-Off Pawl Spring (fig. 204)

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. Unhook the trip-off pawl spring. Hook an 8-ounce scale in the spring eye. A pull of  $3\frac{1}{2}$  to  $4\frac{1}{2}$  ounces should be required to stretch the spring to position length.

c. ADJUSTMENT. Replace with a new spring.

### 361. Repeat-Space Rod (fig. 206)

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. With the space bar fully depressed by being pushed down at the center, the clearance between the clutch throw-out lever and the high part of the throw-out cam should be 0.010 to 0.020 inch.

c. ADJUSTMENT. Move the repeat-space rod by turning its adjusting nuts.

### 362. Repeat-Space Rod Bracket (fig. 207)

*Note.* This adjustment applies only to a keyboard equipped with a repeat-space rod bracket having an enlarged mounting hole (0.205 inch in diameter) and a flat washer under the head of the bracket mounting screw.

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. When the space bar is fully depressed there should be some clearance, but not more than 0.008 inch, between the formed-up end of the repeat-space rod and the flat side of the transmitter rear bracket throughout the entire travel of the repeat-space rod. The front face of the repeat-space rod bracket should be parallel to the rear face of the transmitter gear bracket.

c. ADJUSTMENT. Position the repeat-space rod bracket by loosening the mounting screw and moving the bracket by means of its enlarged mounting hole. Tighten the mounting screw.

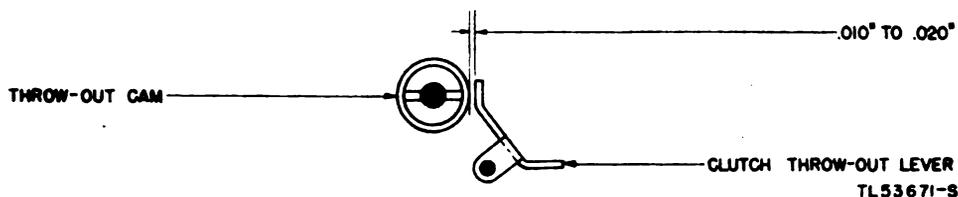


Figure 206. Clutch throw-out lever.

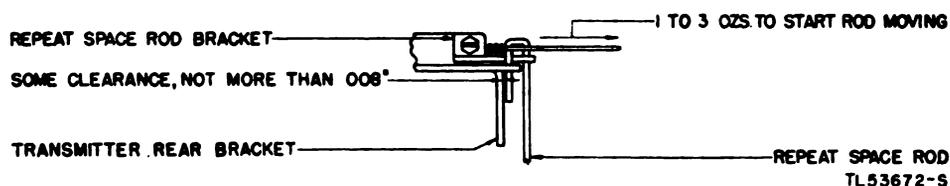


Figure 207. Space-repeat rod.

### 363. Repeat-Space Rod Spring (fig. 207)

a. PREPARATION. Remove the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. Hook an 8-ounce scale over the repeat-space rod, just in front of the spring hole, and pull in line with the spring. A pull of 1 to 2 ounces should be required to start the rod moving.

c. ADJUSTMENT. Replace with a new spring.

### 364. Motor Unit Slip-Connector Springs

a. PREPARATION. Remove the typing unit from the base. (See par. 142.)

b. REQUIREMENTS. (1) With the motor unit in position on the base, hook a 4-pound scale under one of the motor unit slip-connection end springs, just above the head of the terminal screw on the motor connection block. Pull toward the front of the base at right angles to the spring. A pull of 2 to 4 pounds should be required to separate the contacts. Measure the pressure of the opposite end slip-connection spring the same way.

(2) With the motor unit removed, place a straight edge across the two end springs. There should be some clearance, but not more than 0.015 inch, between the two inner springs and the straight edge.

c. ADJUSTMENT. Remove the motor unit from the base and bend the two inner springs.

### 365. Line-Jack Springs (fig. 208)

a. PREPARATION. Remove the typing unit and the keyboard from the base. (See par. 142.)

b. REQUIREMENTS. Apply the push end of a 12-pound scale to the curved part of the jack spring. A pressure of 1 to 2 pounds should be required to open the contacts. With the typing unit in position on the base, the line-jack contact should be separated 0.020 to 0.060 inch.

c. ADJUSTMENT. Bend the long contact spring.

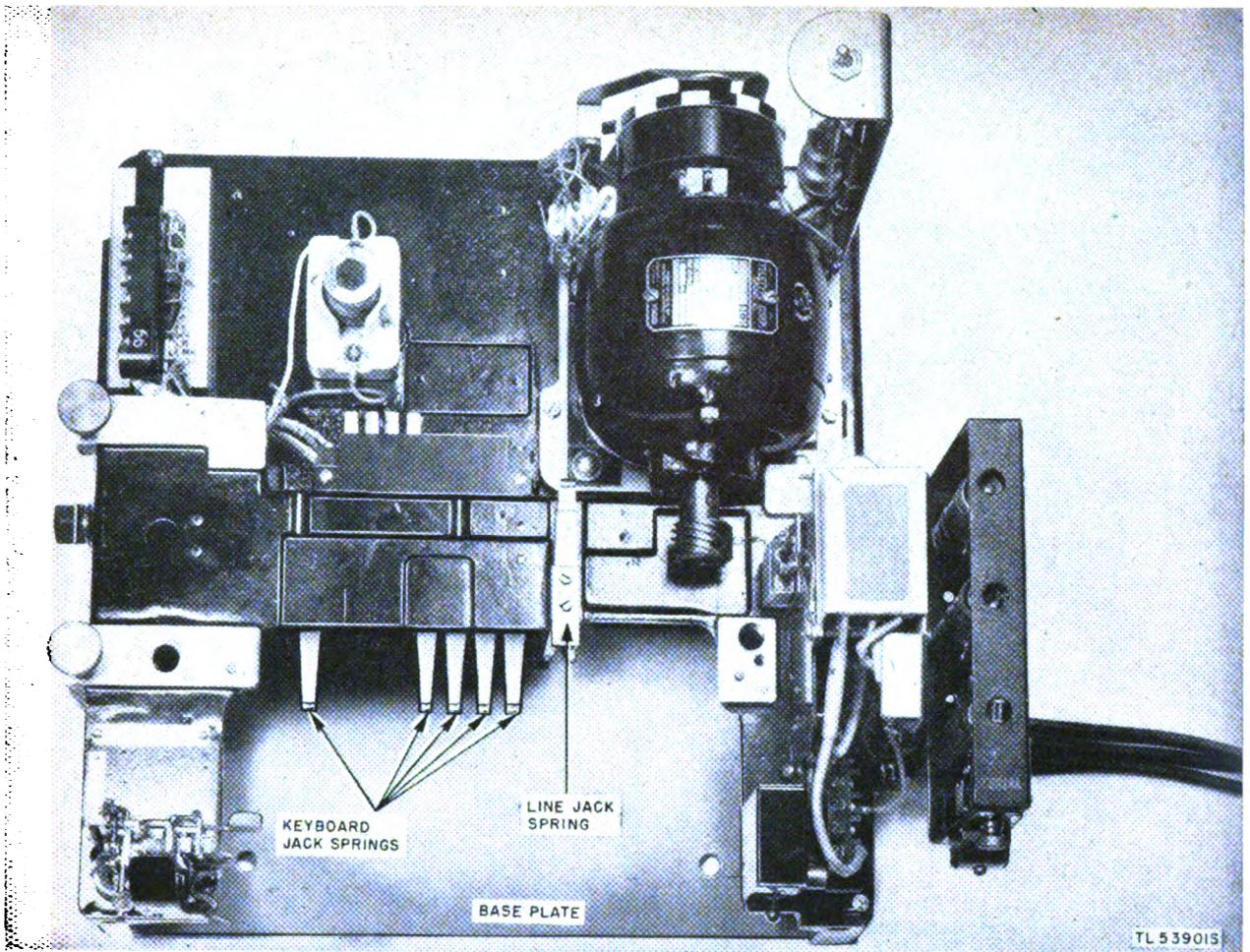


Figure 208. Teletypewriter TG-7-B base.

### 366. Keyboard Jack Springs Adjustment (fig. 208)

*a.* **PREPARATION.** Remove the typing unit and the keyboard from the base. Remove the four base plate mounting screws and the base plate. Remove the four screws that hold the slip-connection mounting plate assembly to the base, so that the bakelite cover can be removed, and then replace the four screws.

*b.* **REQUIREMENTS.** Measure the pressure of the two keyboard jack springs. With the keyboard inserted in the base the keyboard jack springs should now be separated by 0.005 inch to 0.025 inch. This clearance may be measured from above the base by inserting a wire gauge between the contact springs.

*c.* **ADJUSTMENT.** Bend the long contact spring of the two jack springs to obtain this spring tension and bend the short contact spring to provide this contact gap. (After the bakelite cover is replaced the jack contact springs should be separated by 0.025" to 0.075".) Remove the keyboard from the base and with a straightedge laid across the two keyboard jack springs, align the other slip-connection contact springs by bending, so that they just touch the straightedge. Remove the four slip-connection mounting plate screws, and insert the bakelite cover in its original position. Replace the four mounting screws previously removed. Finally install the base plate on the base by means of its mounting screws.

### 367. Typing Unit Slip-Connection Spring

a. PREPARATION. Remove the typing unit from the base.

b. REQUIREMENTS. Hold a straightedge flush against the left rear milled surface on the base and extend the straightedge over the typing unit slip connections. There should be  $\frac{7}{8}$  inch clearance (plus or minus  $\frac{1}{64}$  inch) between the straightedge and the top of the curved part of the springs.

c. ADJUSTMENT. Bend the slip-connection springs to obtain the necessary clearance.

lever plate, when the break lever is slowly operated by hand until the two edges are just opposite each other.

c. ADJUSTMENT. Position the break lever adjusting plate by means of its adjusting screw.

### 370. Stop Lug (fig. 210A)

a. PREPARATION. None required.

b. REQUIREMENTS. When the stop lever is in its unoperated position, the upper extension of the stop lever should rest against the stop lug on the mounting bracket. There should be

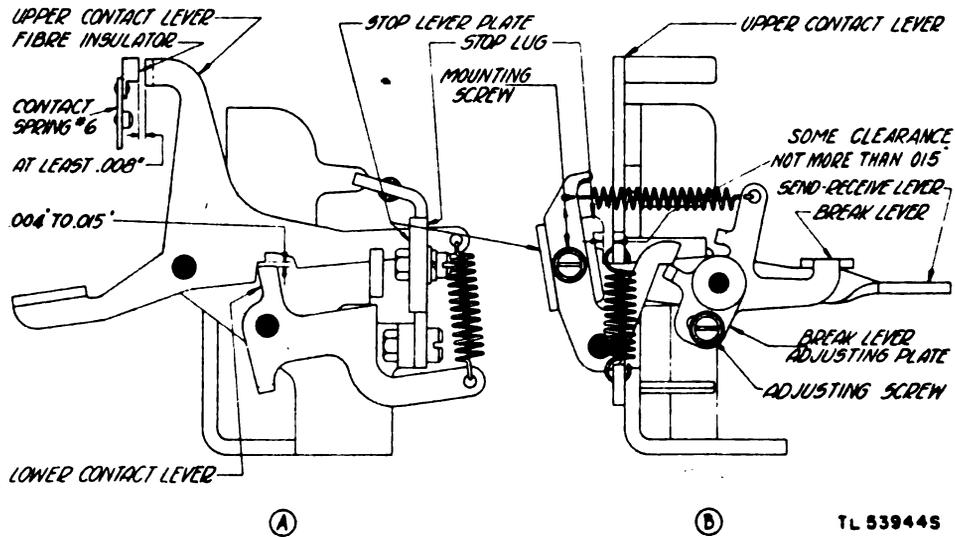


Figure 209. Stop lever plate adjustment.

### 368. Stop Lever Plate (fig. 209A)

a. PREPARATION. None required.

b. REQUIREMENTS. Hold the left end of the upper contact lever up against the stop lug on the stop lever plate. There should be 0.004 inch to 0.015 inch clearance between the shoulder in the notch in the upper contact lever and the top of the lower contact lever.

c. ADJUSTMENT. Position the stop lever plate by means of its mounting screw.

### 369. Break Lever Adjusting Plate (fig. 209B)

a. PREPARATION. None required.

b. REQUIREMENTS. There should be some clearance, not more than 0.015 inch, between the rear upper corner of the beveled edge on the left end of the upper contact lever and the lower front edge of the stop

some clearance, not more than 0.030 inch, between the rear side of the upper contact lever and the front edge of the stop lever plate.

c. ADJUSTMENT. Bend the stop lug on the mounting bracket.

### 371. Upper Contact Lever Spring (fig. 211B)

a. PREPARATION. None required.

b. REQUIREMENTS. Place the send-receive handle in the SEND (up) position and hold the No. 3 contact spring away from the extension on the upper contact lever. Hook an 8-ounce scale under the left end of the upper contact lever at the spring hole and pull up vertically, in line with the spring. It should require 3 to 5 ounces to start the upper contact lever moving.

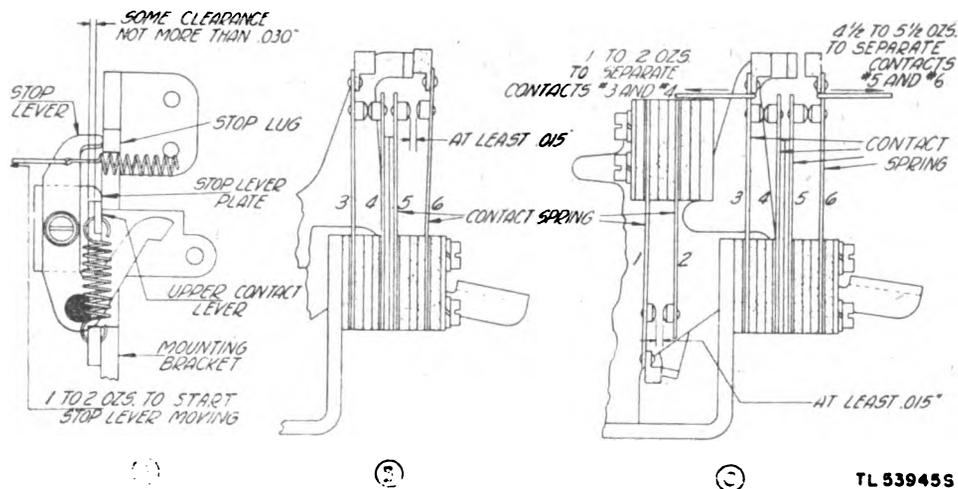
c. ADJUSTMENT. Replace with a new spring.

### 372. Stop Lever Spring (fig. 210A)

a. PREPARATION. None required.

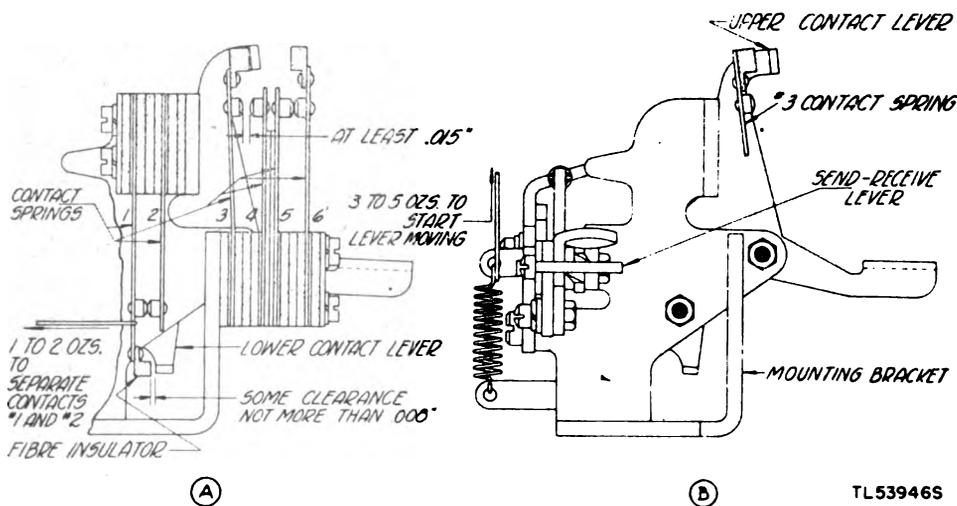
b. REQUIREMENTS. Operate the stop lever so that it rests against the stop lug on the mounting bracket. Hook an 8-ounce scale in the spring mounting hole in the stop lever and pull in line with the spring. It should require 1 to 2 ounces to start the stop lever moving.

c. ADJUSTMENT. Replace with a new spring.



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Figure 210. Stop lug adjustment.



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Figure 211. Upper contact lever adjustment.

### 373. Send-Receive-Break Contact Springs

a. PREPARATION. None required.

b. REQUIREMENTS. All contact springs and points should be in line.

(1) With the send-receive handle in the SEND (up) position, there should be some clearance, not more than 0.008 inch, between

the fiber insulator on the lower end of No. 1 contact spring and the extension on the lower contact lever to the right of the contact spring. When checking this clearance, hold the lower contact lever firmly against its stop. (See fig. 211A.)

(2) Contact No. 1 should exert a pressure against contact No. 2 (fig. 211A). Hook an 8-ounce scale around contact spring No. 1, just

below the contact point, and pull horizontally toward the left. It should require 1 to 2 ounces to just separate contacts No. 1 and No. 2.

(3) Recheck (1).

(4) There should be a clearance of at least 0.015 inch between No. 3 and No. 4 contacts. (See fig. 211A.)

(5) Move the send-receive handle to the RECEIVE (down) position and make sure that No. 3 and No. 4 contacts close.

(6) There should be at least 0.015 inch clearance between No. 1 and No. 2 contacts. Recheck (1).

(7) Contact No. 3 should exert a pressure against contact No. 4. Hook an 8-ounce scale around contact spring No. 3 just above the contact point and pull horizontally toward the left. It should require 1 to 2 ounces to just separate contacts No. 3 and No. 4. (See fig. 210C.)

(8) Recheck (4).

(9) Hold the left end of the upper contact lever against the notch in the stop lever plate. The fiber insulator on No. 6 contact spring should clear the extension on the upper contact lever by at least 0.008 inch. (See fig. 209A.) Make certain that contact No. 5 and No. 6 are separated by at least 0.015 inch when the break lever is operated. (See fig. 210B.)

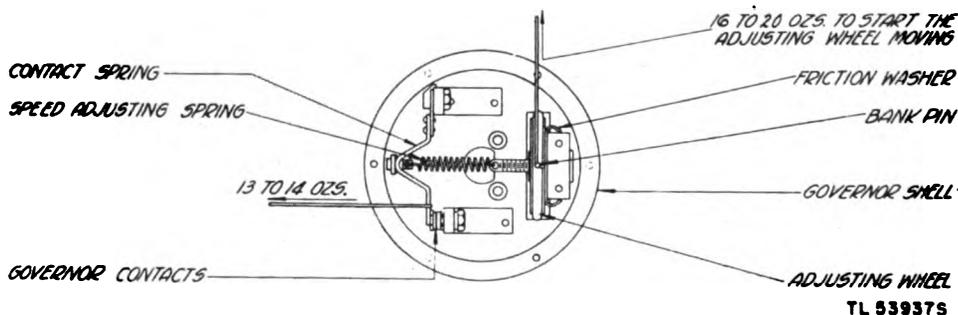


Figure 212. Governor-speed-adjusting wheel friction washer requirements.

(10) Contact No. 6 should exert a pressure against contact No. 5. Hook an 8-ounce scale around contact spring No. 6 just above the contact point, and pull horizontally toward the right. It should require  $4\frac{1}{2}$  to  $5\frac{1}{2}$  ounces to just separate contacts No. 5 and No. 6. (See fig. 210C.)

(11) Recheck (9).

c. ADJUSTMENT. Whenever an adjustment of a contact spring is required (see *b* above), bend the contact spring until it meets the requirements given above.

### 374. Governor-Speed-Adjusting Wheel Friction Washer (fig. 212)

a. PREPARATION. In order to check the requirements a preliminary adjustment must be made. Remove the target and governor cover.

Hook a 32-ounce scale over the contact spring near the contact (fig. 212) and pull in line with the speed adjusting spring. Turn the speed adjusting wheel to the right or left until a pull of 13 to 14 ounces just separates the governor contacts.

b. REQUIREMENTS. Hook a 32-ounce scale over a bank pin inserted radially in the leather of the speed adjusting wheel and pull at right angles to the radius. A pull of 16 to 20 ounces should be required to start the wheel moving.

c. ADJUSTMENT. Remove the friction washer and bend the large projections as required.

### 375. Governor Speed Adjusting Lever Stop Plate (fig. 213)

a. PREPARATION. None required.

b. REQUIREMENTS. There should be a clearance of 0.006 to 0.050 inch between the speed adjusting wearing strip and the governor shell when the speed adjusting lever is held against the stop plate.

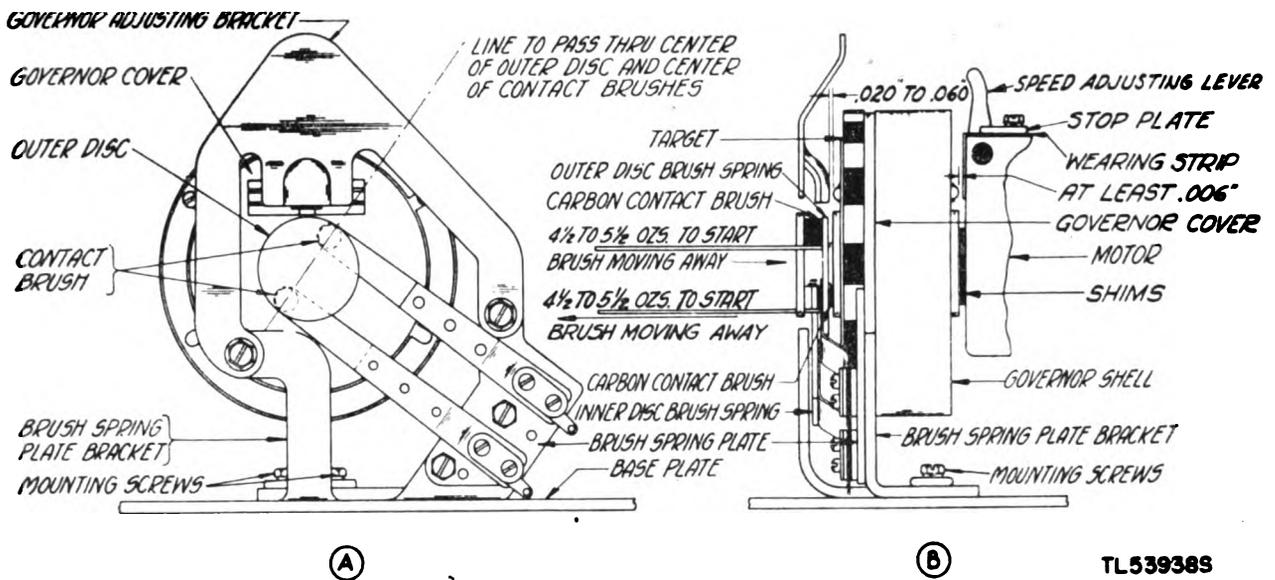
c. ADJUSTMENT. Loosen the two stop plate mounting screws and reposition the stop plate. Tighten the mounting screws.

### 376. Governor Shims (fig. 213B)

a. PREPARATION. None required.

b. REQUIREMENTS. With the governor speed adjusting lever in its unoperated position, there should be a clearance of at least 0.006 inch between the speed adjusting wearing strip and the adjusting wheel when the adjusting wheel is opposite the wearing strip and all the end play of the motor armature is taken up in a direction to make the clearance a minimum.

c. ADJUSTMENT. Increase or decrease the number of shims on the armature shaft between the governor hub and the end frame casting of the motor. (See fig. 213B.)



(A)

(B)

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Figure 213. End ring governor requirements.

### 377. Governor Inner and Outer Disk Contact Springs (figs. 213A and 214)

a. PREPARATION. Remove the governor brush spring plate, and the governor cover. (See fig. 213A.)

b. REQUIREMENTS. (1) The distance from the inner surface of the governor cover to the highest point on the contact springs should be  $\frac{25}{32}$  to  $\frac{27}{32}$  inch.

(2) Place a D socket wrench over the nut located in the center of the governor cover. Using a 6-inch scale, measure the radial distance from the vertical surface of the wrench to the point where the scale touches the curved surface of the inner disk contact spring. This distance should measure  $\frac{17}{32}$  to  $\frac{19}{32}$  inch.

(3) Measure the distance from the wrench to the point of contact on the outer disk contact spring in the same manner as described in b (2) above. This distance should measure  $\frac{7}{16}$  to  $\frac{1}{2}$  inch.

c. ADJUSTMENT. Bend the inner and outer disk contact springs as required. Avoid any sharp bends or the springs may break. Replace the governor cover.

### 378. Governor Brush Spring Plate Bracket (fig. 213A)

a. PREPARATION. Remount the brush spring plate if it was not remounted as part of the previous adjustment.

b. REQUIREMENTS. (1) A line through the center of outer disk should pass through the

center of each carbon contact brush. (See fig. 213B.)

(2) The surface of the brush spring plate bracket on which the brush spring plate is mounted, should be in line with the outer surface of that part of the governor cover on which the target is mounted. (See fig. 213B).

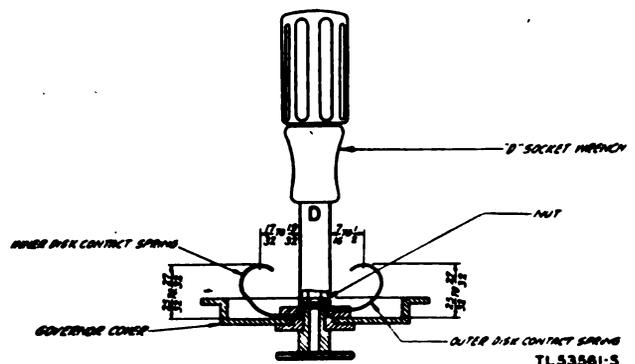


Figure 214. Governor inner and outer disk contact.

(3) The brush spring plate bracket should be parallel to the edge of the motor base plate.

c. ADJUSTMENT. Loosen the two brush spring plate bracket mounting screws and reposition the bracket. Tighten the mounting screws.

### 379. Governor Brush Spring Pressure (fig. 213B)

a. PREPARATION. None required.

b. REQUIREMENTS. (1) Apply an 8-ounce scale to the brush springs near the carbon brush and push (or pull) horizontally in line

with the armature shaft. A push (or pull) of  $4\frac{1}{2}$  to  $5\frac{1}{2}$  ounces should be required to start each brush moving away from its associated disk.

(2) Both carbon brushes should lie flat against their associated disks and the outer edges of the brushes should be flush with, or not more than  $\frac{3}{64}$  inch inside of the outer edge of the disks.

c. ADJUSTMENT. Loosen the two brush spring clamping screws and slip the brush springs out. Bend the springs as necessary. Remount the springs and position properly. Tighten the clamping screws.

### 380. Governor Brush Spring Tension (fig. 215)

a. PREPARATION. Remove the brush holder from its bracket.

b. REQUIREMENTS. Apply the push end of an 8-ounce scale to the end of each brush and push in line with the brush. A push of 3 to 4 ounces should be required to depress each brush to within 0.015 to 0.050 inch of the brush holder.

c. ADJUSTMENT. Replace the brushes having weak springs with new brushes and springs. Remount the brush holder on its bracket.

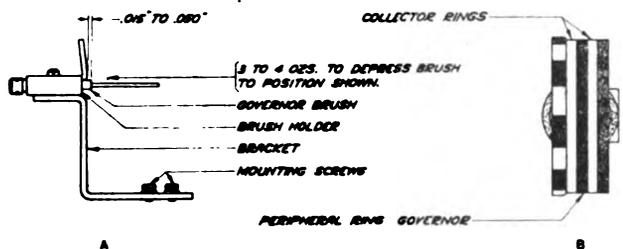


Figure 215. Peripheral ring governor brush requirements.

### 381. Governor Brush Bracket (fig. 215)

a. PREPARATION. None required.

b. REQUIREMENTS. The governor brushes should be centrally located with respect to the governor collector rings, and the ends of the brushes should project 0.015 to 0.050 inch beyond the brush holder.

c. ADJUSTMENT. Loosen the two brush-holder bracket mounting screws and reposition the bracket. Tighten the mounting screws.

### 382. Governor Contacts (fig. 216)

a. PREPARATION. Remove the target and governor cover. The governor also may be removed

to facilitate inspection or repair. Place a piece of white paper behind the contacts to aid in viewing them.

b. REQUIREMENTS. (1) The contacts should be positioned so that the top contact is directly above the bottom contact and the edges should be in line.

(2) The bottom surface of the upper contact and the top surface of the lower contact should be parallel when the contacts are touching (not touching on one side only).

(3) The surface of the contacts should be free of build-ups but may have small pits.

c. ADJUSTMENT. The adjustment of governor contacts generally is treated as a major repair since they must either be resurfaced or be replaced with new contact screws and springs. See section XIII for detailed repair procedure for governor contacts.

**Caution:** Do not attempt to make temporary adjustment by filing, stoning, burnishing the contacts, or changing the position of the contacts except for emergency operation.

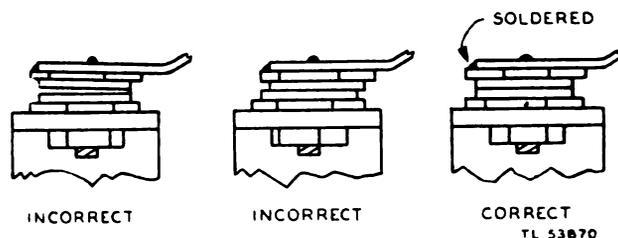


Figure 216. Governor contact alignment.

### 383. Motor Brushes

a. PREPARATION. Remove the brush-holder caps.

b. REQUIREMENTS. (1) The motor brushes should be free in their holders without excessive play and should be at least  $\frac{5}{8}$  inch long not including the brush spring or the spring mounting extension.

(2) At least  $\frac{1}{3}$  of the area of the ends of the brushes should be in contact with the commutator.

c. ADJUSTMENT. (1) Replace excessively worn or damaged brushes and brushes having weak springs with new brushes and springs.

(2) Resurface the ends of the brushes using fine sandpaper. (See par. 154 for one method that may be used.)

### 384. Selector Armature Spring (fig. 166)

*Note.* This adjustment is related to the setting of the range finder (par. 27) and should be made concurrently with the adjustment of the range-finder setting.

*a. PREPARATION.* Make all necessary adjustments as prescribed in paragraphs 187 to 383 inclusive. Assemble the teletypewriter and connect to a power outlet and, if possible, another teletypewriter.

*b. REQUIREMENTS.* A pull of 6 to 6½ ounces should be required to lift the armature spring from its hole in the adjusting screw.

*c. ADJUSTMENT.* Set the armature spring (fig. 166) to a position where it measures 6 to 6½ ounces tension. To position the spring, loosen the locknut on the adjusting screw and turn the screw. Print (or receive from another teletypewriter) the letters R and Y alternately while the range is being taken. While RY is being printed or received, loosen the index arm

thumbscrew and shift the index arm toward zero until errors begin to appear in the printed letters RY. Move the arm back slowly until these errors disappear. This position indicates one limit of the orientation range. Note the position on the scale. Repeat the same performance toward the opposite end of the scale to find the other limit. After the two limits (or extreme positions of perfect printing) have been found, set the index arm of the range finder midway between these two points. Turn the armature spring adjusting screw in a clockwise direction until errors show in the RY. From this point count the number of turns in a counterclockwise direction necessary to bring the spring to its high limit (where RY fails to print properly). Half this number of turns backward (a clockwise direction) position the adjusting screw midway between its two failing points. Lock the screw in this position. Recheck orientation.

## APPENDIX I

# INTEROPERATION OF BRITISH AND AMERICAN TELETYPEWRITERS

### I. Introduction

*a. GENERAL.* Joint military operations involving British and American forces in the same general area may require the interconnection of their teletypewriter systems. (The British use the term *teleprinter* rather than *teletypewriter*.)

*b. FEATURES.* The principal features of British teleprinter equipment which affect the operation of American teletypewriters are described in paragraph 385. The changes which must be made in the adjustment for operation of Printer TG-7-A and Teletypewriter TG-7-B to permit their interconnection with British teleprinters are discussed in paragraph 386. Teletypewriter TG-37-B is normally used in systems which are not directly interconnected with British teleprinters.

### 2. Features of British Equipment Compared with Printer TG-7-A and Teletypewriter TG-7-B

*a. SELECTING CODE.* The British teleprinter uses the same 5 unit start-stop selecting code as the American teletypewriters.

*b. CHARACTER DIFFERENCES.* There are very few differences in the keyboards of the two teletypewriters. In the lower case, there are no differences and the keys have the same relative position on the keyboards. In the upper case there are differences in D, F, G, H, J, S, V, and Z operations as listed in the following table:

*Keyboards*

Lower case		Upper case	
American	British	American	British
D	D	\$	Who are you
F	F	!	%
G	G	&	@
H	H	STOP	(£) (Pound symbol)
J	J	Bell	Bell
S	S	;	=
V	V	:	-
Z	Z		

*c. PRINTING.* American teletypewriters select and print each character in the same operating cycle. The British teleprinters however, do not print a character until the succeeding one is being received, with the result that a character is always stored in the teleprinter. The length of the line typed by the British teleprinter is 70 characters which cannot be changed, therefore, the change must be made in the American teletypewriter.

*d. TRANSMITTING.* The teleprinter ordinarily transmits polar impulses compared with the neutral impulses transmitted by Printer TG-7-A and Teletypewriter TG-7-B. Teleprinters are equipped with an automatic send-receive mechanism. When any keyboard key is depressed the circuit is put in the transmitting position, and as soon as the character has been sent the circuit returns automatically to receiving position. Therefore the machine is always in the receiving position except when a key is depressed.

*e. ANSWER-BACK FEATURE.* Some teleprinters are equipped with a special answer-back feature. When the upper case D is operated, the teleprinter receiving it automatically sends back its code station call.

*f. SIGNAL BELL.* A signal bell is not standard equipment on the British teleprinter. However, an attachment can be added to the teleprinter so that when upper case J is operated a contact is closed to operate an external signal bell.

*g. MOTOR CONTROL.* The British teleprinters are not designed for remote electrical motor control. These teleprinters have a timing device which, when the line remains marking for a period of approximately 90 seconds, automatically stops the motor. To restart the motor it is necessary to open the line.

*h. SPEED DIFFERENCES.* (1) *Normal American speed.* American equipment normally operates at 368.1 operations or characters per minute. This is equivalent to approximately 61 words per minute. The length of the signaling code

for each character is 7.42 units in which the start and five selecting impulses are each 1 unit in length, while the stop impulse is 1.42 units in length.

(2) *Normal British speed.* The teleprinter motor is a 24-volt d-c governed shunt motor designed to operate at 3000 revolutions per minute and does not have provision for easily adjusting the speed to 2740 revolutions per minute corresponding to the normal American speed of operation. British teleprinters normally operate at 400 operations per minute or approximately 67 words per minute. The length of the signaling code for each character is 7.50 units, in which the start and five selecting impulses are each 1 unit in length, while the stop impulse is 1.50 units in length.

(3) *Summary.* Since the British speed is 400 operations per minute, it is necessary to adjust the American equipment to operate at 404 operations per minute, in order to correct for the differences in length of the character signaling codes. Thus, if the British equipment transmits 7.5 unit characters at the rate of 400 opm (operations per minute), it will be necessary for the American equipment to transmit 7.42 unit characters at the rate of 404 opm.

### 3. Changes Necessary in Printer TG-7-A and Teletypewriter TG-7-B

*Note.* The information in this paragraph contains *only* the necessary *mechanical* changes needed to modify

the American teletypewriter for interoperation with British teleprinters. See the related teletypewriter set or system manual for information on installation and operation of American and British equipment connected in the same teletypewriter system. No internal electrical changes are involved.

a. **SPEED.** It is necessary that all machines on a network be adjusted to an equivalent number of operations per minute. The American machine must be speeded up to 404 operations per minute. To do this the motor speed is increased by changing the adjustment of the motor governor. A tuning fork which vibrates at 96.1 vibrations per second is used. The procedure for adjusting to the new speed is the same as that used with the regular tuning fork. See paragraph 26 for instructions on adjusting the motor speed.

b. **LENGTH OF TYPED LINE.** It is also necessary to change to number of characters per line on the American machine to correspond to the British line of 70 characters. This is done by resetting the right margin adjusting screw. A corresponding adjustment must be made on the end-of-line indicating bell, so it will ring on the 64th character.

c. **UNSHIFT-ON-SPACE FEATURE.** The unshift-on-space feature (par. 94) of the American teletypewriter must be made inoperative as the British machines are not equipped with such a feature. This concludes all of the mechanical changes necessary for interoperation.

## APPENDIX II

### REFERENCES

*Note.* For availability of items listed, check FM 21-6 and ASF Catalog SIG 2. Also see FM 21-6 for applicable Technical Bulletins, Supply Bulletins, Modification Work Orders, and Changes.

#### 1. Parts List

SIG 1, Introduction to ASF Signal Supply Catalog (when published).  
SIG 3, List of Items for Troop Issue.  
SIG 4-1, Allowances of Expendable Supplies.  
SIG 4-2, Allowances of Expendable Supplies for Schools, Training Centers, and Boards.  
SIG 5, Stock List of All Items.  
SIG 6, Sets (when published).  
SIG 7, Organizational Spare Parts.  
SIG 8, Higher Echelon Spare Parts.  
SIG 10, Fixed Plant Maintenance List.  
SB 11-10, Signal Corps Kit and Materials for Moisture-resistant and Fungi-resistant Treatment.

#### 2. Technical Manuals on Auxiliary Equipment and Test Equipment

TM 11-353, Installation and Maintenance of Telegraph Printer Equipment.  
TM 11-354, Telegraph Printer Sets (Teletypewriter) EE-97 and EE-98; Teletypewriter Sets EE-97-A, EE-98-A, and EE-102.  
TM 11-355, Telegraph Terminal CF-2-A (Carrier).  
TM 11-355B, Telegraph Terminal CF-2-B (Carrier).  
TM 11-356, Radio Teletype Terminal Equipment, AN/FGCI or AN/FGC-1X.  
TM 11-358, Technical Manual for Telegraph Central Office Set TC-3.  
TM 11-359, Line Units BE-77, BE-77-A, and BE-77-B.  
TM 11-954, Rectifier RA-43-B.  
TM 11-955, Rectifier RA-37.  
TM 11-957, Rectifier RA-87.  
TM 11-2004, Repeater Set TC-18 (Terminal).  
TM 11-2005, Repeater Set TC-19 (Intermediate).

TM 11-2042, Volt-ohm-ammeter per D-166852).

TM 11-2056, Test Unit I-236.

TM 11-2201, Reperforator Teletypewriter Sets TC-16 and TC-17).

TM 11-2203, Teletypewriter Set AN/TGC-1.

TM 11-2208, Test Set TS-2/TG.

TM 11-2215, Teletypewriters TT-5/FG and TT-6/FG.

TM 11-2216, Teletypewriters TT-7/FG and TT-8/FG.

TM 11-2217, Distortion Test Set TS-383/GG (Teletype Signal Testing Equipment).

TM 11-2220, Reperforator Transmitters TG-26-A and TG-27-A.

#### 3. Shipping Instructions

U. S. Army Spec No. 100-14A, Army-Navy General Specifications for Packaging and Packing for Oversea Shipment.

#### 4. Decontamination

TM 3-220, Decontamination.

#### 5. Demolition

FM 5-25, Explosives and Demolitions.

#### 6. Camouflage

FM 5-20, Camouflage, Basic Principles.

#### 7. Other Technical Publications

FM 21-8, Military Training Aids.

FM 21-40, Defense Against Chemical Attacks.

TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.

TB SIG 25, Preventive Maintenance of Power Cords.

TB SIG 64, Expedient Means of Determining Power Supply Frequency in the Field Using Line Unit BE-77-A or BE-77-B.

TB SIG 66, Winter Maintenance of Signal Equipment.

TB SIG 69, Lubrication of Ground Signal Equipment.

TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

TB SIG 75, Desert Maintenance of Ground Signal Equipment.

TM 1-455, Electrical Fundamentals.

TM 11-453, Shop Work.

TM 11-456, Wire Telegraphy.

TM 11-462, Signal Corps Reference Data.

TM 11-486, Electrical Communication Systems Engineering, General Information.

TM 11-487, Electrical Communications Systems Equipment.

TM 37-250, Basic Maintenance Manual.

## 8. Forms

WD AGO Form 468, Unsatisfactory Equipment Report. AAF Form 54, Unsatisfactory Report.

## 9. List of Abbreviations

Abbrev. (or symbol)	Term or quantity
AAF	Army Air Forces.
ac	alternating current (n).
a-c	alternating current (a).
AGO	Adjutant General's Office.
approx	approximately.
AR	Army Regulations.
ASF	Army Service Forces.
assem	assembly.
contd	continued.
cps	cycles per second.
dc	direct current (n).
d-c	direct current (a).
dwg	drawing.
F	Fahrenheit.
fig	figure.
hex	hexagonal.
hp	horsepower.
$\mu$	micro (1/1,000,000).
ma	milliampere.
mf, $\mu$ f	microfarad.
mtg	mounting.
No., Nos	number, numbers.
$\Omega$	ohm.
opm	operations per minute.
oz., ozs	ounce, ounces.
par	paragraph.
rec	receive.
ref	reference.
rpm	revolutions per minute. •
SIG C	Signal Corps.
SPDT	single-pole, double-throw.
spec	specification.
SPST	single-pole, single-throw.
subpar	subparagraph.
term	terminal.
v	volt.
vps	vibrations per second.
w	watt.
WD	War Department.

## 10. Glossary

The following glossary contains explanations of the technical terms used in this manual.

**Battery.** The term battery is normally used when referring to a group of dry cells or storage cells. In teletypewriter communication, it is common usage to refer to any d-c source used in the production of teletypewriter signals as *battery*.

**Function.** The term function refers to an operation performed by a teletypewriter such as carriage return, line feed, figures (shift), letters (shift), motor stop, bell, etc., that normally is not associated with a printed character.

**Mark impulses.** In neutral operation the term mark impulse refers to the closed circuit signal and the term space impulse refers to the open circuit signal. In other than neutral operation, the term mark impulse is applied to the circuit condition which produces the same result in the terminal equipment that a mark impulse produces in neutral operation. Similarly, the term space impulse is applied to the circuit condition which produces the same result in the terminal equipment that a space impulse produces in neutral operation.

**Neutral operation.** The term neutral operation refers to the system whereby marking signals are formed by current impulses of one polarity, either positive or negative, and spacing signals are formed by reducing the current to zero or nearly zero.

**Operations per minute.** The term operations per minute refers to the number of functions performed or characters printed per minute. The equipment goes through one complete cycle of operation for each function performed or character printed.

**Polar operation.** The term polar operation refers to the system whereby marking signals are formed by current impulses of one polarity and spacing signals by current impulses of equal magnitude but opposite polarity.

**Space impulses.** See mark impulse.

**Turn down.** The term turn down refers to machining the part in a metal-turning lathe to resurface the part.

**Undercut.** The term undercut refers to the operation of removing a portion of the insulation between the segments of motor commutators so that the insulation is below the surface of the adjoining segments.

## APPENDIX III

### MAINTENANCE PARTS

#### I. ASF Signal Supply Catalog Pamphlets

The following information was compiled on 17 July 1945. The appropriate pamphlets of the ASF Signal Supply Catalog for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B are:

##### Organizational Spare Parts

SIG 7-EE-97, or  
SIG 7-EE-98, or  
SIG 7-EE-102.

##### Higher Echelon Spare Parts

SIG 8-TG-7-A, TG-37, TG-15 through TG-22

For an index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG 2.

#### 2. Maintenance Parts for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B

a. GENERAL. The maintenance parts for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B are divided into the five principle groups of the equipment which are presented

in paragraphs 399 through 403. The groups covered are listed in *b* through *f* below.

*b.* GROUP 1. Group 1 covers all maintenance parts for the typing unit and also maintenance parts that are common to the units covered in *c* through *f*.

*c.* GROUP 2. Group 2 covers all maintenance parts for the base with filters, but excludes any parts covered by *b* above.

*d.* GROUP 3. Group 3 covers all maintenance parts for the keyboard with filters, but excludes any parts covered by *b* and *c* above.

*e.* GROUP 4. Group 4 covers all maintenance parts for the cover, front plate, copyholder, and chests, but excludes any parts covered by *b*, *c*, and *d* above.

*f.* GROUP 5. Group 5 covers all maintenance parts for the motor unit MU-25 using the No. 77953 motor, but excludes any parts covered by *b* through *e* above.

*Note.* The lists contained in paragraphs 399 through 403 contain first, second, and third echelon maintenance parts. Reference symbols are manufacturer's part numbers.

#### 3. Group 1. Maintenance Parts for Typing Unit and All Common Maintenance Parts

Major component	Ref. symbol	Signal Corps stock No.	Name of part and description	Fig.
	8508	4T8508	ARMATURE, electromagnet: steel, chromium plated; selector; irregular shape, 2" lg x 1 5/8" wd x 1 1/16" h approx overall.	225
	2451	4T2451	BALL, bearing: steel; spherical; 0.09375" ±0.00025" diam	226, 227
	74199	4T74199	BEARING, sleeve: eccentric; hardened steel; natural finish; 5/16" lg overall.	228
	74279	4T74279	BUMPER: leather; type-bar backstop bumper; 5.875" lg x 0.438" wd x 0.125" thk overall.	226
	8507	4T8507	CAM ASSEMBLY: sleeve; steel, soldered dipped; main shaft; 3/16" lg x 1 1/16" OD x 1 1/2" h overall; hole for shaft 0.2515" ID. 5 cams stamped #75230.	219
	177M	4T177M	COIL, solenoid: electromagnet; selector; single wound; DC 105 ohms DC resistance; 1 1/8" lg x 1" wd x 1 1/8" h overall.	225
	73588	4T73588	CONTACT, switch: phosphor bronze, copper contact; 2 3/8" lg x 1/4" wd x 1 1/4" h overall.	223, 232
	73593	4T73593	CONTACT, switch: phosphor bronze, bakelite insulated tip, copper contact; 2 3/8" lg x 1 1/4" wd x 1 1/4" h overall.	223, 232
	4812	4T4812	WICK, oiling: 3/8" lg x 1/8" diam overall.	220
	72521	4T72521	WICK, oiling: 1/4" lg x 3/32" diam overall.	219
	74755	4T74755	WICK, oiling: white; 1 3/4" ID, 3/16" OD, 1 5/16" thk; (tight matted).	219
	74756	4T74756	WICK, oiling: white; 1 1/2" ID, 0.728" OD, 1 5/16" thk; (tight matted).	219
	89881	4T89881	WICK, oiling: 3/4" diam x 3/16" lg.	219
	94693	4T94693	WICK, oiling: white wool felt; shaft oiler; 1 5/16" lg x 1/8" OD.	220
	41341	4T41341	HANDLE, crank: black fibre; 1" lg x 0.547" diam overall.	223

### 3. Group I. Maintenance Parts for Typing Unit and All Common Maintenance Parts—Con.

Major component	Ref. symbol	Signal Corps stock No.	Name of part and description	Fig.
	74161	4T74161	LATCH, lever: steel, nickel-finish; operates lock bar; $1\frac{1}{2}$ " lg x $\frac{7}{8}$ " wd x 0.344" thk overall, 0.065" thk stock. Carriage-return latch lever.	217
	34-4	4T34-4	NUT, hexagon: steel, zinc-plated, w/chromate finish; No. 10-32 thd; $\frac{3}{32}$ " thk; $\frac{5}{16}$ " across flats.	217, 218, 220-227, 229, 231
	34-11	4T34-11	NUT, hexagon: steel, nickel finish; No. 2-56 thd; $\frac{1}{16}$ " thk; $\frac{3}{16}$ " across flats.	225, 234, 237
	34-51	4T34-51	NUT, hexagon: steel; zinc-plated, chromate finish; No. 6-40 thd; $\frac{3}{32}$ " thk; $\frac{1}{4}$ " across flats; special.	221
	34-56	4T34-56	NUT, hexagon: steel, nickel finish; No. 4-40 thd; $\frac{1}{16}$ " thk; $\frac{1}{4}$ " across flats.	220, 224, 225, 233, 236, 237
	3598	4T3598	NUT, hexagon: steel; zinc-plated, with chromate finish; 6-40 thd; $\frac{3}{32}$ " thk; $\frac{1}{4}$ " across flats, special.	217, 220, 221, 223 to 229
	3599	4T3599	NUT, hexagon: steel, zinc-plated, w/chromate finish; #4-40 thd; $\frac{3}{32}$ " thk; $\frac{5}{16}$ " across flats.	223, 224, 226, 227, 230, 235
	3606	4T3606	NUT, hexagon: steel, zinc-plated, w/chromate finish; No. 6-40 thd; $\frac{1}{16}$ " thk; $\frac{1}{4}$ " across flats.	227, 228, 235
	71045	4T71045	NUT, hexagon: brass, chromium finish; 6-40 thd; $\frac{5}{16}$ " thk overall, hex. section 0.375" across flats; 0.031" thk.	225
	80516	4T80516	PIN, cotter: steel; 0.047" diam x $\frac{3}{64}$ " lg overall.	217
	71046	4T71046	SCREW, adjustment: brass, chromium-plated; hex. No. 6-40 thd class 3 fit x $\frac{1}{16}$ " lg on each end; $\frac{1}{16}$ " lg overall; hex. center $\frac{1}{32}$ " thk x $\frac{3}{8}$ " across flats, shoulder $\frac{1}{32}$ " wd x $\frac{3}{8}$ " diam, spl.	225
	33-111	4T33-111	SCREW, machine: FH; iron, nickel finish; 2-56 thd; $\frac{3}{16}$ " lg overall threaded $\frac{3}{8}$ " lg; head 0.160" diam.	226
	1026	4T1026	SCREW, machine: Fil H; steel; zinc-plate, w/chromate finish; 6-40 thd; $\frac{3}{8}$ " lg under head; thd full lg; head $\frac{1}{32}$ " diam x $\frac{1}{64}$ " thk; special.	221, 222, 224, 227
	1028	4T1028	SCREW, machine: binding head; steel, zinc-plated w/chromate finish; 4-40 thd; $\frac{1}{4}$ " lg under head; thd 0.219" lg; head $\frac{1}{4}$ " diam x 0.063" thk, special.	229, 232
	1160	4T1160	SCREW, machine: Fil H; steel, zinc-plated w/chromate finish; 6-40 thd; $\frac{5}{16}$ " lg; head 0.217" diam x 0.119" thk.	220, 222, 225, 228
	1161	4T1161	SCREW, machine: Fil H; steel; oxidized-copper finish; No. 6-40 thd; $\frac{1}{4}$ " lg; thd full lg; head 0.217" diam x 119" thk.	217, 223, 224, 226
	1162	4T1162	SCREW, machine: Fil H; steel, zinc plate, chromate finish; No. 4-40 thd; $\frac{1}{4}$ " lg under head; thd full lg; head 0.175" diam x 0.096" thk; special.	224, 225, 226, 227
	1168	4T1168	SCREW, machine: Fil H; steel: zinc-plated, w/chromate finish; 4-40 thd; $\frac{3}{16}$ " lg under head; thd $\frac{3}{32}$ " lg; head 0.176" diam x $\frac{1}{64}$ " thk; special.	218, 226, 227, 230
	1176	4T1176	SCREW, machine: Fil H; steel, zinc-plated w/chromate finish; 6-40 thd; $\frac{3}{16}$ " lg; head 0.217" diam x 0.119" thk.	224, 229, 231
	6745	4T6745	SCREW, machine: slotted hex. head; steel, zinc-plated, chromate finish; #10-32 thd; $\frac{1}{2}$ " lg under head; head 0.313" across flats, 0.125" thk.	217, 218, 220, 222, 223, 226
	6746	4T6747	SCREW, machine: slotted hex. head; steel, nickel finish; #6-40 thd; $\frac{5}{16}$ " lg under head; head $\frac{1}{4}$ " across flats, $\frac{3}{32}$ " thk.	217, 218, 220, 221, 222, 225
	6810	4T6810	SCREW, machine: slotted hex. head; steel, zinc-plated w/chromate finish; #10-32 thd; $\frac{3}{8}$ " lg; head $\frac{5}{16}$ " across flats, $\frac{1}{8}$ " thk.	217, 218, 221, 223, 229, 230
	6811	4T6811	SCREW, machine: slotted hex. head; steel, nickel finish; No. 6-40 thd; $\frac{5}{8}$ " lg; head $\frac{1}{4}$ " across flats, $\frac{3}{32}$ " thk.	217, 218, 219, 220
	6942	4T6942	SCREW, machine: eccentric; flat top, bind H; hardened steel, nickel finish; No. 4-40 thd; 0.281" lg with 0.250" lg thd; head 0.094" thk x 0.312" OD.	225, 236
	8472	4T8472	SCREW, machine: special; drill-rod steel, zinc plate chromate finish; round V-milled head; No. 2-56 thd; 0.188" lg with 0.188" lg thd; shoulder 0.093" square with one side rounded on 0.062" rad w/max thickness of 0.030" and located 0.010" from head; head 0.130" thk x 0.1875" OD w/2 milled surfaces 27° on each side of center line to a depth on head of 0.100"; armature locking stud.	225
	8539	4T8539	SCREW, machine: slotted hex. head; steel, nickel finish; No. 6-40 thd; $\frac{1}{2}$ " lg under head; head $\frac{1}{4}$ " across flats, 0.094" thk.	219, 220, 224 to 230
	8543	4T8543	SCREW, machine: Bind. H; steel, zinc-plate, w/chromate finish; No. 6-40 thd; $\frac{1}{4}$ " lg under head; head $\frac{1}{4}$ " diam x 0.062" thk.	224
	74059	4T74059	SCREW, machine: slotted hex head; steel; zinc-plate, chromate finish; No. 6-40 thd; $\frac{3}{16}$ " lg under head; head $\frac{1}{4}$ " across flats x $\frac{3}{32}$ " thk, (chamfered head).	222, 224, 229, 231, 232
	74986	4T74986	SCREW, machine: slotted hex. head; steel, nickel finish; No. 6-40 thd; $\frac{1}{32}$ " lg with $\frac{1}{32}$ " lg thd; head 0.040" thk x 0.250" across flats.	219, 220, 226, 227, 235
	91600	4T91600	SCREW, machine: stop, hex. head; steel, hardened, zinc plate, chromate finish; No. 6-40 thd; $\frac{3}{16}$ " lg with $\frac{3}{16}$ " lg thd; head $\frac{3}{32}$ " thk x $\frac{1}{4}$ " across flats.	221

### 3. Group 1. Maintenance Parts for Typing Unit and All Common Maintenance Parts—Con.

Major component	Ref. symbol	Signal Corps stock No.	Name of part and description	Fig.
	6801	4T6801	SCREW, pilot: cheese head; steel; nickel finish; No. 4-40 thd; $\frac{19}{64}$ " lg with $\frac{1}{16}$ " thd; head $\frac{3}{16}$ " diam x $\frac{1}{16}$ " thk; pilot $\frac{3}{64}$ " diam x $\frac{13}{64}$ " lg.	225
	70803	4T70803	SCREW, pivot: headless w/screwdriver slot; steel; No. 6-40 thd; 0.307" lg x 0.137" diam overall; thd $\frac{1}{32}$ " w/60 deg taper and 0.031" diam pivot point.	225
	74170	4T74170	SCREW, pivot: spel slotted head; steel; nickel finish; No. 10-32 thd; $\frac{7}{8}$ " lg w/ $\frac{1}{16}$ " thd; head $\frac{3}{16}$ " diam x $\frac{1}{16}$ " thk; pivot $\frac{3}{32}$ " diam x $\frac{3}{32}$ " lg.	222
	74536	4T74536	SCREW, set: flat Fil H; CH steel, nickel finish; No. 6-40 thd; 0.156" lg under head; thd full lg; head 0.156" diam x 0.078" thk; (slot 0.028" wd x 0.040").	223, 224, 228
	1030	4T1030	SCREW, shoulder: cheese head; steel, nickel finish; No. 6-40 thd; $\frac{1}{32}$ " lg, $\frac{1}{4}$ " lg thd; head $\frac{1}{4}$ " diam x $\frac{3}{32}$ " thk; shoulder $\frac{3}{16}$ " diam x $\frac{3}{32}$ " lg.	225, 237
	6800	4T6800	SCREW, shoulder: flattop Bind H; hardened steel; zinc plate, chromate finish; No. 6-40 thd; $\frac{3}{8}$ " lg with $\frac{1}{4}$ " lg thd; head $\frac{3}{32}$ " thk x $\frac{3}{32}$ " diam; shoulder $\frac{3}{16}$ " diam x $\frac{1}{8}$ " lg.	217, 218, 220, 224, 227, 236
	74020	4T74020	SCREW, shoulder: eccentric; spel head; hardened steel; chromate finish; No. 6-40 thd; $\frac{1}{32}$ " lg $2\frac{1}{4}$ " lg thd; head $\frac{13}{32}$ " diam x $\frac{3}{32}$ " thk; shoulder $\frac{3}{32}$ " diam x $\frac{1}{8}$ " lg.	224
	74171	4T74171	SCREW, shoulder: eccentric; flattop Bind H; hardened steel; chromate finish; No. 6-40 thd; $\frac{1}{2}$ " lg w/ $\frac{3}{16}$ " lg thd; head $\frac{3}{16}$ " diam x $\frac{3}{64}$ " thk; shoulder $\frac{7}{32}$ " diam x $\frac{1}{16}$ " lg.	217
	74361	4T74361	SCREW, shoulder: cheese head; case hardened, zinc plate, chromate finish; No. 6-40 thd; 0.629" lg w/ $\frac{3}{8}$ " lg thd; shoulder 0.187" OD x 0.254" lg; head 0.100" thk x 0.281" OD; (head chamfered 0.015").	224
	8896	4T8896	SHIM: contact mounting; steel; 6 vane extension shim; 0.140 ID, $\frac{5}{16}$ " OD, 0.005" thk.	220, 228, 236
	7602	4T7602	SPRING: compression; 0.012" music wire; $\frac{13}{64}$ " lg x $\frac{3}{64}$ " diam overall; special; (approx $7\frac{1}{2}$ turns w/open ends).	225
	74073	4T4703	SPRING: compression; 0.011" music wire; $\frac{5}{16}$ " lg x $\frac{1}{8}$ " diam overall; special; (approx 14 turns w/closed ends).	225
	4703	4T4703	SPRING: extension; 0.013" music wire; $\frac{9}{16}$ " lg x $\frac{5}{32}$ " diam overall; special; (approx 26 turns w/hook terminals, indexed 90°).	227
	7603	4T7603	SPRING: extension; 0.014" music wire; $\frac{3}{16}$ " lg x $\frac{5}{32}$ " diam overall; special; (approx 15 turns w/hook terminals, parallel).	225
	7612	4T7612	SPRING: extension; 0.018" music wire; $1\frac{3}{64}$ " lg x $\frac{13}{64}$ " diam overall; special; (approx 37 turns w/hook terminals, indexed 90°).	225
	7614	4T7614	SPRING: extension; 0.020" music wire; 0.775" lg x 0.133" diam overall; special; (approx 25 turns w/hook terminals indexed 90°).	225
	7615	4T7615	SPRING: extension; 0.020" music wire; 1" lg x $\frac{7}{32}$ " diam overall; special; (approx 29 turns w/hook terminals, parallel).	225
	7634	4T7634	SPRING: extension; 0.014" music wire; $\frac{1}{32}$ " lg x $\frac{11}{64}$ " diam overall; special; (approx 55 turns w/hook terminals, indexed 90°).	226, 227, 224
	45104	4T45104	SPRING: extension; 0.016" music wire; $\frac{1}{2}$ " lg x $\frac{5}{32}$ " diam overall; special; (approx 14 turns w/hook terminals, parallel).	224
	55063	4T55063	SPRING: extension; 0.020" music wire; $\frac{7}{64}$ " lg x $\frac{11}{64}$ " diam overall; spel; (approx 21 turns w/hook term, indexed 90°).	224
	55088	4T55088	SPRING: extension; 0.035" music wire; $1\frac{3}{64}$ " lg x $\frac{11}{16}$ " diam overall; special; (approx 42 turns w/hook term, parallel).	220, 221
	74015	4T74015	SPRING: extension; 0.063" music wire; $1\frac{5}{64}$ " lg x $\frac{5}{8}$ " diam overall; special; (approx 14 turns w/hook terminals, parallel).	220
	74707	4T74707	SPRING: extension; 0.020" music wire; $1\frac{13}{32}$ " x $\frac{1}{8}$ " diam overall; special; (approx 54 turns w/hook terminals, indexed 90°).	224
	74710	4T74710	SPRING: extension; 0.063" music wire; $1\frac{1}{16}$ " lg x $\frac{13}{64}$ " diam overall; special; (approx 27 turns w/hook terminals, indexed 90°).	224
	74712	4T74712	SPRING: extension; 0.022" music wire; $1\frac{1}{4}$ " lg x $\frac{13}{64}$ " diam overall; special; (approx 38 turns w/hook terminals, parallel).	217
	74760	4T74760	SPRING: extension; 0.024" music wire; $1\frac{1}{2}$ " lg x $\frac{3}{16}$ " diam overall; special; (approx 37 turns w/hook terminals, parallel).	220
	74882	4T74882	SPRING: extension; 0.185" music wire; $1\frac{1}{32}$ " lg x $\frac{1}{8}$ " diam overall; special; (approx 15 turns w/hook terminals, parallel).	221
	74961	4T74961	SPRING: extension; 0.030" music wire; 1" lg x $\frac{3}{16}$ " diam overall; special; (approx 21 turns w/hook terminals, indexed 90°).	222
	74962	4T74962	SPRING: extension; 0.024" music wire; $\frac{5}{64}$ " lg x $\frac{3}{16}$ " diam overall; special; (approx 21 turns w/hook terminals, indexed 90°).	222
	74988	4T74988	SPRING: extension; 0.012" music wire; $1\frac{3}{64}$ " lg x $\frac{13}{64}$ " diam overall; special; (approx 29 turns w/hook terminals, indexed 90°).	225
	76295	4T76295	SPRING: extension; 0.018" music wire; $\frac{5}{8}$ " lg x $\frac{3}{16}$ " diam overall; (approx 15 turns; hook ends indexed at 90°).	217
	78824	4T78824	SPRING: extension; 0.0165" music wire; $\frac{3}{32}$ " lg x $\frac{1}{8}$ " diam overall; special; (approx 18 turns w/hook terminals, indexed 90°).	225

### 3. Group 1. Maintenance Parts for Typing Unit and All Common Maintenance Parts—Con.

Major component	Ref. symbol	Signal Corps stock No.	Name of part and description	Fig.
	80926	4T80926	SPRING: extension; 0.035" music wire; 2 <sup>3</sup> / <sub>32</sub> " lg x 2 <sup>1</sup> / <sub>64</sub> " diam overall; special; (approx 41 turns w/hook terminals, indexed 90°).	220
	80945	4T80945	SPRING: extension; 0.016" music wire; 0.600" lg x 0.150" diam overall; special; (approx 20 turns, w/hook terminals, indexed 90°).	224
	82442	4T82442	SPRING: extension; 0.022" music wire; 5 <sup>9</sup> / <sub>64</sub> " lg x 7 <sup>1</sup> / <sub>32</sub> " diam overall; special; (approx 18 turns w/hook terminals, parallel).	218
	82463	4T82463	SPRING: extension; 0.013" music wire; 5 <sup>3</sup> / <sub>8</sub> " lg x 5 <sup>3</sup> / <sub>32</sub> " diam overall; special; (approx 28 turns w/hook terminals, parallel).	224
	82788	4T82788	SPRING: extension; 0.019" music wire; 1 <sup>1</sup> / <sub>32</sub> " lg x 1 <sup>1</sup> / <sub>4</sub> " diam overall; special; (approx 15 turns w/hook terminals, indexed 90°).	222
	82999	4T82999	SPRING: extension; 0.010" music wire; 1 <sup>1</sup> / <sub>32</sub> " lg x 3 <sup>3</sup> / <sub>64</sub> " diam overall; special; (approx 25 turns w/hook terminals, parallel).	226
	84575	4T84575	SPRING: extension; 0.010" music wire; 3 <sup>3</sup> / <sub>64</sub> " lg x 1 <sup>1</sup> / <sub>8</sub> " diam overall; (approx 25 turns w/hook terminals, parallel).	223
	86873	4T86873	SPRING: extension; 0.027" music wire; 6 <sup>1</sup> / <sub>64</sub> " lg x 3 <sup>1</sup> / <sub>16</sub> " diam overall; special; (approx 22 turns w/hook terminals, indexed 90°).	222
	74272	4T74272	SPRING: motor; carriage return; 0.020" clock spring steel, 3 <sup>3</sup> / <sub>8</sub> " wd; 2 <sup>1</sup> / <sub>4</sub> " diam x 3 <sup>3</sup> / <sub>8</sub> " thk overall including shipping clamp; special.	221
	74330	4T74330	SPRING: torsion; 0.034" music wire; coil 3 <sup>3</sup> / <sub>8</sub> " OD x 13 <sup>1</sup> / <sub>64</sub> " lg; 7 <sup>1</sup> / <sub>8</sub> " OD overall; spl; (approx 5 turns, right hand; one end hook parallel to coil; opposite end straight and tangent to coil).	226
	74359	4T74359	STRAP, carriage: black cotton webbing; 9 <sup>7</sup> / <sub>8</sub> " lg x 1 <sup>1</sup> / <sub>32</sub> " wd x 3 <sup>1</sup> / <sub>32</sub> " thk overall.	221
	103-27	4T103-27	WASHER, flat: steel, zinc plate, chromate finish; No. 4, 7 <sup>1</sup> / <sub>64</sub> " ID x 1 <sup>1</sup> / <sub>2</sub> " OD x 0.035" thk.	224, 226, 227, 230
	123-244	4T123-244	WASHER, flat: hardened steel, zinc plate, chromate finish; 9 <sup>1</sup> / <sub>64</sub> " ID x 3 <sup>3</sup> / <sub>8</sub> " OD x 0.036" thk.	217, 224
	3438	4T3438	WASHER, flat: steel hardened; zinc plate, chromate finish; 3 <sup>1</sup> / <sub>16</sub> " ID x 1 <sup>1</sup> / <sub>16</sub> " OD x 0.053" thk.	221, 222, 231, 232
	6861	4T6861	WASHER, flat: felt, white; 1 <sup>1</sup> / <sub>4</sub> " ID x 1 <sup>5</sup> / <sub>16</sub> " OD x 1 <sup>1</sup> / <sub>16</sub> " thk.	219
	7001	4T7001	WASHER, flat: steel, zinc plate, chromate finish; 9 <sup>1</sup> / <sub>64</sub> " ID x 1 <sup>5</sup> / <sub>64</sub> " OD x 0.055" thk.	225, 228
	7002	4T7002	WASHER, flat: steel, dull-nickel finish; 9 <sup>1</sup> / <sub>64</sub> " ID x 5 <sup>1</sup> / <sub>16</sub> " OD x 0.032" thk.	218, 220 to 230
	8330	4T8330	WASHER, flat: steel, hardened; zinc plate, chromate finish; 0.170" ID x 1 <sup>1</sup> / <sub>4</sub> " OD x 0.037" thk.	226, 227, 238
	34432	4T34432	WASHER, flat: steel, hardened; zinc plate, chromate finish; 3 <sup>1</sup> / <sub>16</sub> " ID x 1 <sup>1</sup> / <sub>32</sub> " OD x 0.036" thk.	217, 218, 220, 221
	72563	4T72563	WASHER, flat: felt; 1 <sup>1</sup> / <sub>2</sub> " ID x 1 <sup>1</sup> / <sub>16</sub> " OD x 1 <sup>1</sup> / <sub>16</sub> " thk.	219
	74085	4T74085	WASHER, flat: white felt; 1 <sup>1</sup> / <sub>2</sub> " ID x 1 <sup>5</sup> / <sub>16</sub> " OD x 9 <sup>1</sup> / <sub>64</sub> " thk.	219
	74100	4T74100	WASHER, flat: leather; 3 <sup>1</sup> / <sub>16</sub> " ID x 3 <sup>3</sup> / <sub>8</sub> " OD x 1 <sup>1</sup> / <sub>16</sub> " thk.	219
	74800	4T74800	WASHER, flat: white felt; 1 <sup>1</sup> / <sub>2</sub> " ID x 1 <sup>1</sup> / <sub>16</sub> " OD x 9 <sup>1</sup> / <sub>64</sub> " thk.	219
	76084	4T76084	WASHER, flat: felt, white; 9 <sup>1</sup> / <sub>16</sub> " ID x 1 <sup>1</sup> / <sub>16</sub> " OD x 1 <sup>1</sup> / <sub>16</sub> " thk.	223
	94694	4T94694	WASHER, flat: white felt; 7 <sup>1</sup> / <sub>64</sub> " ID, 13 <sup>1</sup> / <sub>32</sub> " OD, 1 <sup>1</sup> / <sub>8</sub> " thk; (soft felt).	217
	2191	4T2191 Same as 4A2900/2191 & 4A2279/W28	WASHER, lock: split ring "Never Slip" type; spring steel, white nickel finish; No. 6; 9 <sup>1</sup> / <sub>64</sub> " ID x 1 <sup>5</sup> / <sub>64</sub> " OD x 0.032" thk.	217 to 238, 240, 245, 246
	2322	4T2322	WASHER, lock: split ring, "Never Slip" type, spring steel, zinc plate, chromate finish; 0.259" ID x 7 <sup>1</sup> / <sub>16</sub> " OD x 0.045" thk.	217, 221, 226, 227
	2669	4T2669	WASHER, lock: split ring, "Never Slip" type, spring steel, dull nickel finish; 0.200" ID x 19 <sup>1</sup> / <sub>64</sub> " OD x 0.047" thk.	217 to 224, 226
	3640	4T3640	WASHER, lock: split ring, "Never Slip" type, spring steel, white nickel finish; 0.120" ID x 0.210" OD x 0.035" thk.	218, 220, 223 to 227
	3646	4T3646	WASHER, lock: split ring "Never Slip" type; steel, nicked; No. 8, 1 <sup>1</sup> / <sub>64</sub> " ID x 1 <sup>1</sup> / <sub>32</sub> " OD x 1 <sup>1</sup> / <sub>32</sub> " thk.	223, 231
	74283	4T74283	WASHER, spring: steel, hardened, parkerized; 13 <sup>1</sup> / <sub>64</sub> " ID x 3 <sup>3</sup> / <sub>8</sub> " OD x 0.010" thk stock, 0.025" thk overall; (curved shape).	217, 218, 223

### 4. Group 2. Maintenance Parts for Base with Filters, Excluding Parts Covered in Paragraph 3

	103286	3Z2601.31	FUSE, plug: 1.6 amp, 125 v; one time; ceramic body, medium screw base; 1 <sup>1</sup> / <sub>32</sub> " h x 1 <sup>1</sup> / <sub>8</sub> " diam; (fusotron, time lag).	229
	35-70	4T35-70	SPRING: extension; 0.010" music wire; 5 <sup>3</sup> / <sub>8</sub> " lg x 0.130" diam overall; (approx 37 turns w/hook terminals indexed 90°).	230
	75229	4T75229	SPRING: extension; 0.014" music wire; 3 <sup>9</sup> / <sub>64</sub> " lg x 1 <sup>1</sup> / <sub>64</sub> " diam overall; special; (approx 20 turns w/hook terminals, indexed 90°).	230
	2438	4T2438	WASHER, flat: brass; 7 <sup>1</sup> / <sub>64</sub> " ID x 1 <sup>1</sup> / <sub>4</sub> " ID x 0.034" thk.	232
	3650	4T3650	WASHER, flat: brass; 7 <sup>1</sup> / <sub>64</sub> " ID x 5 <sup>1</sup> / <sub>16</sub> " x 0.034" thk.	229, 232

5. Group 3. Maintenance Parts for Keyboard with Filter, Excluding Parts Covered in Paragraphs 3 and 4

Major component	Ref. symbol	Signal Corps stock No.	Name of part and description	Fig.
	7381	4T7381	CONTACT ASSEMBLY, switch: spring type; keyboard transmitting contacts; 6 sets form A; 2 1/4" lg x 2 1/8" wd x 3/32" d overall including screws.	236
	90438	4T90438	FELT, oiling: white back check felt; cam sleeve shaft; 1 1/32" OD x 7/8" lg.	236
	78946	4T78946	KEYTOP, spring cushion: (A -); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78947	4T78947	KEYTOP, spring cushion: (B ?); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78948	4T78948	KEYTOP, spring cushion: (C :); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78949	4T78949	KEYTOP, spring cushion (D \$); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78950	4T78950	KEYTOP, spring cushion: (E 3); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78951	4T78951	KEYTOP, spring cushion: (F !); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78952	4T78952	KEYTOP, spring cushion: (G &); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78954	4T78954	KEYTOP, spring cushion: (I 8); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78955	4T78955	KEYTOP, spring cushion: (J '); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244
	78956	4T78956	KEYTOP, spring cushion: (K ()); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244
	78957	4T78957	KEYTOP, spring cushion: (L )); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244
	78958	4T78958	KEYTOP, spring cushion: (M .); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78959	4T78959	KEYTOP, spring cushion: (N ,); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244
	78960	4T78960	KEYTOP, spring cushion: (O 9); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78962	4T78962	KEYTOP, spring cushion: (Q 1); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78963	4T78963	KEYTOP, spring cushion: (R 4); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78964	4T78964	KEYTOP, spring cushion: (T 5); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78965	4T78965	KEYTOP, spring cushion: (U 7); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78966	4T78966	KEYTOP, spring cushion: (V ); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244
	78967	4T78967	KEYTOP, spring cushion: (W 2); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78968	4T78968	KEYTOP, spring cushion: (X /); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78969	4T78969	KEYTOP, spring cushion: (Y 6); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78970	4T78970	KEYTOP, spring cushion: (Z ''); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244
	78971	4T78971	KEYTOP, spring cushion: (Blank); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244
	78972	4T78972	KEYTOP, spring cushion: (FIGS); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78973	4T78973	KEYTOP, spring cushion: (LTRS); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78976	4T78976	KEYTOP, spring cushion: (CAR RET); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78978	4T78978	KEYTOP, spring cushion: (LINE FEED); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	78980	4T78980	KEYTOP, spring cushion: (S BEL); green composition top with black metal base; 5/8" diam x 1/2" h overall.	244
	82607	4T82607	KEYTOP, spring cushion: (STOP-H); green composition top with black metal base; 5/8" diam x 1/2" h overall; (used on TG-7-A and TG-7-B only).	244

### 5. Group 3. Maintenance Parts for Keyboard with Filter, Excluding Parts Covered in Paragraphs 3 and 4—Con.

Major component	Ref. symbol	Signal Corps stock No.	Name of part and description	Fig.
	99564	4T99564	KEYTOP, spring cushion: (P Ø); green composition top with black metal base; $\frac{5}{8}$ " diam x $\frac{1}{2}$ " h overall; (press fit over disk on key lever).	244
	7409	4T7409	LEVER: hardened steel, zinc plate chromate finish; keyboard clutch; irregular shape; 1.500" lg x 0.810" wd overall, formed from 0.065" stock.	236
	89917	4T89917	SCREW, machine: eccentric; flattop Bind H; steel, nickel finish; No. 4-40 thd; $\frac{3}{8}$ " lg; Head $\frac{3}{8}$ " thk.	236
	35-89	4T35-89	SPRING: extension; 0.010" music wire; $\frac{1}{2}$ " lg x $\frac{1}{8}$ " diam overall; special; (approx 28 turns w/hook terminals indexed 90°).	217, 222
	2623	4T2623	SPRING: extension; 0.018" music wire; $\frac{13}{16}$ " lg x $\frac{13}{64}$ " diam overall; special; (approx 23 turns w/hook terminals indexed 90°).	236
	80392	4T80392	SPRING: loop; 0.049" diam music wire; key lever spacer; $2\frac{1}{4}$ " x $2\frac{1}{8}$ " x $\frac{3}{16}$ " h overall; ("U" shape loop one end 0.063" wd x 0.188" d; opposite end formed into hook 0.188" lg on 100° radius).	235
	90260	4T90260	SPRING: extension; 0.014" music wire; $\frac{3}{4}$ " lg x $\frac{13}{64}$ " diam overall; (approx 30 turns w/hook terminals, indexed 90°).	236
	2565	4T2565	SPRING: loop; key lever; 0.035" music wire; $1\frac{13}{16}$ " lg x $1\frac{11}{16}$ " wd x $\frac{3}{16}$ " d approx overall; (one end w/hook bend, other end w/right angle bend).	235

### 6. Group 4. Maintenance Parts for Cover, Front Plate, Copyholder, and Chests, Excluding Parts Covered in Paragraphs 3, 4, and 5

	80985	4T80985	SCREW, machine: FH; steel, oxidized copper; No. 4-40 thd; $\frac{1}{4}$ " lg/head 0.175" diam x 0.096" thk.	237
	74759 and 104990	4T82425	WINDOW: $\frac{1}{8}$ " thk; laminated nonshattering glass; $11\frac{19}{32}$ " lg x $6\frac{1}{4}$ " wd x $\frac{1}{4}$ " thk overall; (consists of one No. 104990 cover glass and two No. 74759 felt strips).	237

### 7. Group 5. Maintenance Parts for Motor Unit MU-27, Excluding Parts Covered in Paragraphs 3 through 6

	78399	4T78399	ARM ASSEMBLY, contact: nickel silver or steel w/zinc plate, chromate finish; u/a outer disk; $3\frac{3}{8}$ " lg x $\frac{7}{16}$ " wd x $\frac{19}{32}$ " h overall.	240
	78400	4T78400	ARM ASSEMBLY, contact: nickel silver or steel w/zinc plate, chromate finish; u/w inner disk; $3\frac{3}{8}$ " lg x $\frac{7}{16}$ " wd x $\frac{19}{32}$ " h overall.	240
	8094	4T8094	BRUSH, electrical contact: carbon; w/compression spring and end cap; $2\frac{3}{16}$ " lg x $\frac{3}{8}$ " OD overall; GE No. 5052405AA7.	238
	95936	3C1988	COIL, RF: choke; single winding layer wound; unshielded; 1.1 ohm DC resistance, 180½ turns #26 DCC wire; $\frac{7}{8}$ " diam x $\frac{5}{8}$ " lg; (WECo 225A).	233
	6314	4T6314	CONTACT ASSEMBLY, switch: governor; single tungsten cont $\frac{1}{2}$ " OD x $\frac{1}{16}$ " thk; $1\frac{29}{32}$ " lg x $\frac{3}{8}$ " h x $\frac{3}{8}$ " thk overall.	240
	6320	4T6320	SCREW, adjustment: steel, zinc plate, chromate finish; 0.385" lg w/hex head $\frac{1}{4}$ " across flats.	240
	74557	4T74557	LAMP, incandescent: 115V 15W; 17 clear; $2\frac{5}{8}$ " lg overall; intermediate screw base.	231

### 8. Alphabetical Index to Parts Identification Illustrations

Following is an alphabetical index to the parts identification illustrations for Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B.

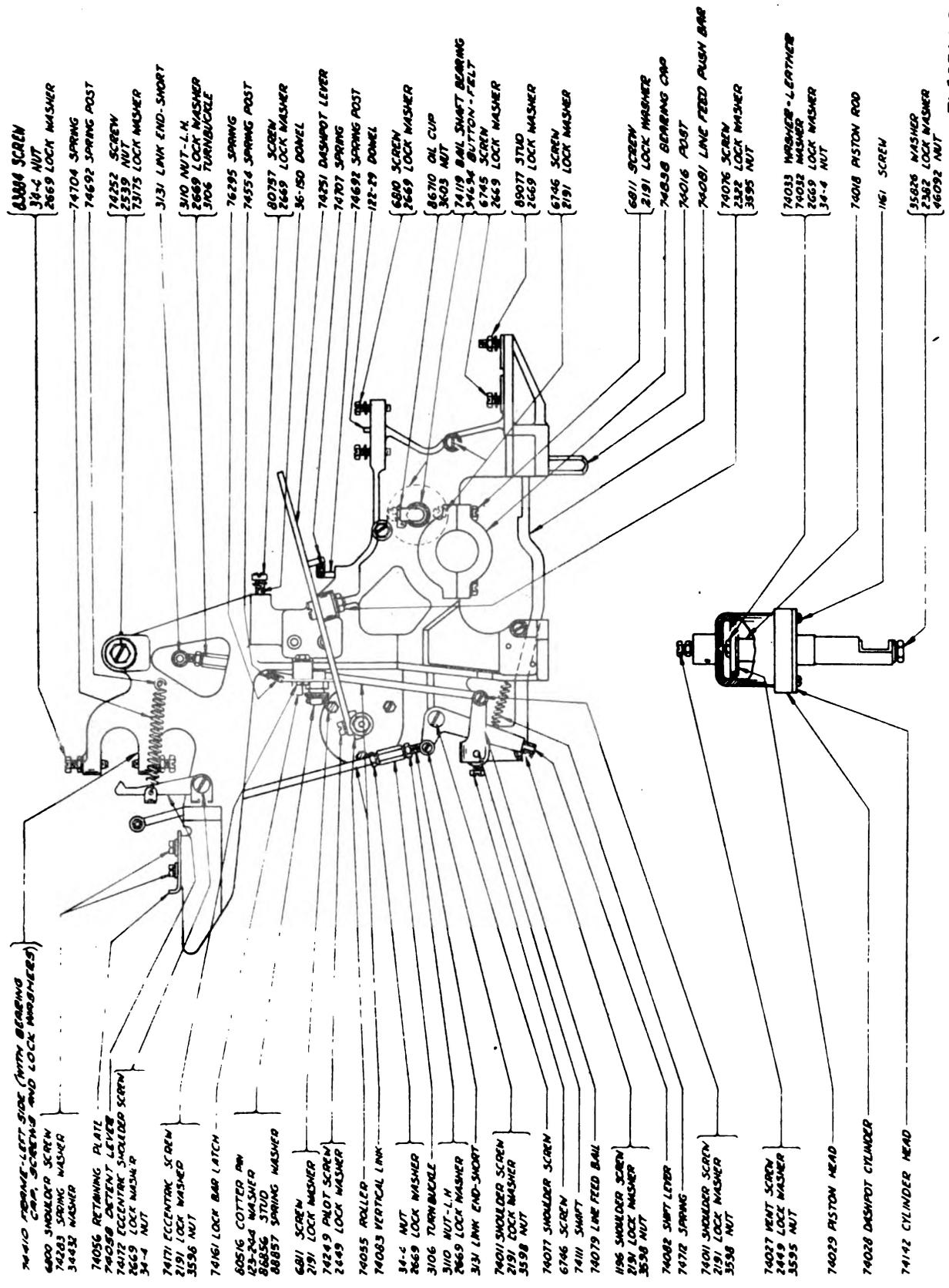
Part or assembly	Figure number	Part or assembly	Figure number
Base	229, 241	Cam sleeve, keyboard shaft	236
Base plate	229, 241	Cam sleeve, main shaft	219
Basket, type bar	226, 227	Capacitors	232, 233
Bells	218, 221	Carriage-return lock bar	221
Bell cranks	228	Carriage-return spring drum (assem)	221
Bell push bar	220	Center contact governor (assem)	238, 240
Cables	223, 229, 231, 235, 238	Chests CH-50-A, CH-50-B, and CH-50-F	229, 241
		Chest CH-62-A	242

<i>Part or assembly</i>	<i>Figure number</i>	<i>Part or assembly</i>	<i>Figure number</i>
Chests CH-62-B and CH-62-F .....	242, 243	Platen (assem) .....	224
Clamps, cable .....	229	Platen crank (assem) .....	223, 242
Code bars .....	244	Platen roll .....	223
Connection strip (assem) .....	230	Plugs .....	234
Contact mounting (assem) .....	236	Power cords (assem) .....	234
Control relay (assem) .....	232	Power leads filter (assem) .....	246
Control switch .....	229	Printing bail .....	220
Copyholder (assem) .....	237	Printing bail guides .....	228
Cords (assem) .....	234	Pull bars .....	244
Cover (assem) .....	237	Pull-bar springs .....	244
Cover front plate (assem) .....	237	Pull-bar stripper .....	228
Cover locating studs .....	229	Range finder (assem) .....	225
Dash pot .....	217	Rear cross bar .....	220
Draw strap .....	221	Relay base .....	231
Filters .....	233, 246	Relay connecting block .....	231
Frame, left side .....	217	Relay mounting bracket .....	229, 231
Frame, right side .....	218	Resistor unit (assem) .....	232
Function bail .....	220	Resistors .....	231, 232, 233, 234
Function levers .....	222	Resistor cage .....	234
Function lever bail (assem) .....	222	Ribbon lockout lever (assem) .....	226
Fusetron .....	229	Ribbon-reverse mechanism .....	227, 228
Fuse block .....	229	Selector bars .....	235
Gears .....	219, 221, 228, 236, 238	Selector unit .....	225
Governor .....	240	Selector vanes .....	222
Governor brush and speed adjusting bracket (assem) .....	238, 240	Send-receive-break mechanism (assem) .....	230
Governor .....	240	Set of gears .....	238
Guards .....	231	Set of key tops .....	244
Keyboard base .....	235	Set of type-bar pallets .....	244
Keyboard shaft .....	236	Shift push bar .....	220
Keyboard tracks .....	230	Sixth vane, with extension (assem) .....	220, 222
Key levers .....	235	Slip-connection mounting plate (assem) .....	230
Key tops .....	244	Spacer bar .....	235
Letters push bar .....	220	Spacing cross bar .....	221
Line and selector jack (assem) .....	231	Spacing rack .....	227
Line cords (assem) .....	234	Spacing shaft .....	221
Line-feed push bar .....	217	Spring cushion key tops .....	244
Line relay radio filter (assem) .....	233	Spring drum (assem) .....	221
Lord mounting (assem) .....	229, 241, 242	Target .....	238
Magnet .....	225	Target lamp .....	231
Main shaft .....	219	Terminal blocks (assem) .....	229, 232, 235
Margin adjusting screws .....	227	Terminal block and cable (assem) .....	220
Margin bell .....	218	Terminal strap .....	225
Message line guide (assem) .....	237	Test key .....	235
Motor .....	238, 239	Toggle switch (assem) .....	229, 231, 234
Motor-governor filter (assem) .....	233, 238	Tracks, keyboard .....	230
Motor plate .....	229, 238	Tracks, type-bar basket .....	226
Motor stop .....	245	Transmitter (assem) .....	236
Motor-stop contacts (assem) .....	223	Transmitting contact filter (assem) .....	233
Motor-stop locking (assem) .....	225	Tuning fork .....	241
Motor unit (assem) .....	238	Type bars .....	244
Nameplates .....	237, 238	Type-bar backstop (assem) .....	226
Operating bail roller (assem) .....	227	Type-bar basket (assem) .....	236, 237
Pads, felt .....	229, 237, 241	Type-bar pallets .....	244
Paper roll spindle .....	223	Universal bar .....	235
Pinion .....	238	Vaness .....	222

## 9. Parts Identification Illustrations

All parts used in Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B are illustrated in figures 217 to 244. The parts are shown in relation to the other parts of their immediate units or assemblies since identifica-

tion of individual parts is often difficult, if not impossible to make. The parts are common to Printer TG-7-A and Teletypewriters TG-7-B and TG-37-B unless otherwise noted. Parts used in older models only or in later models only are also noted.



TL5374 I-S

Figure 217. Frame parts, left side.

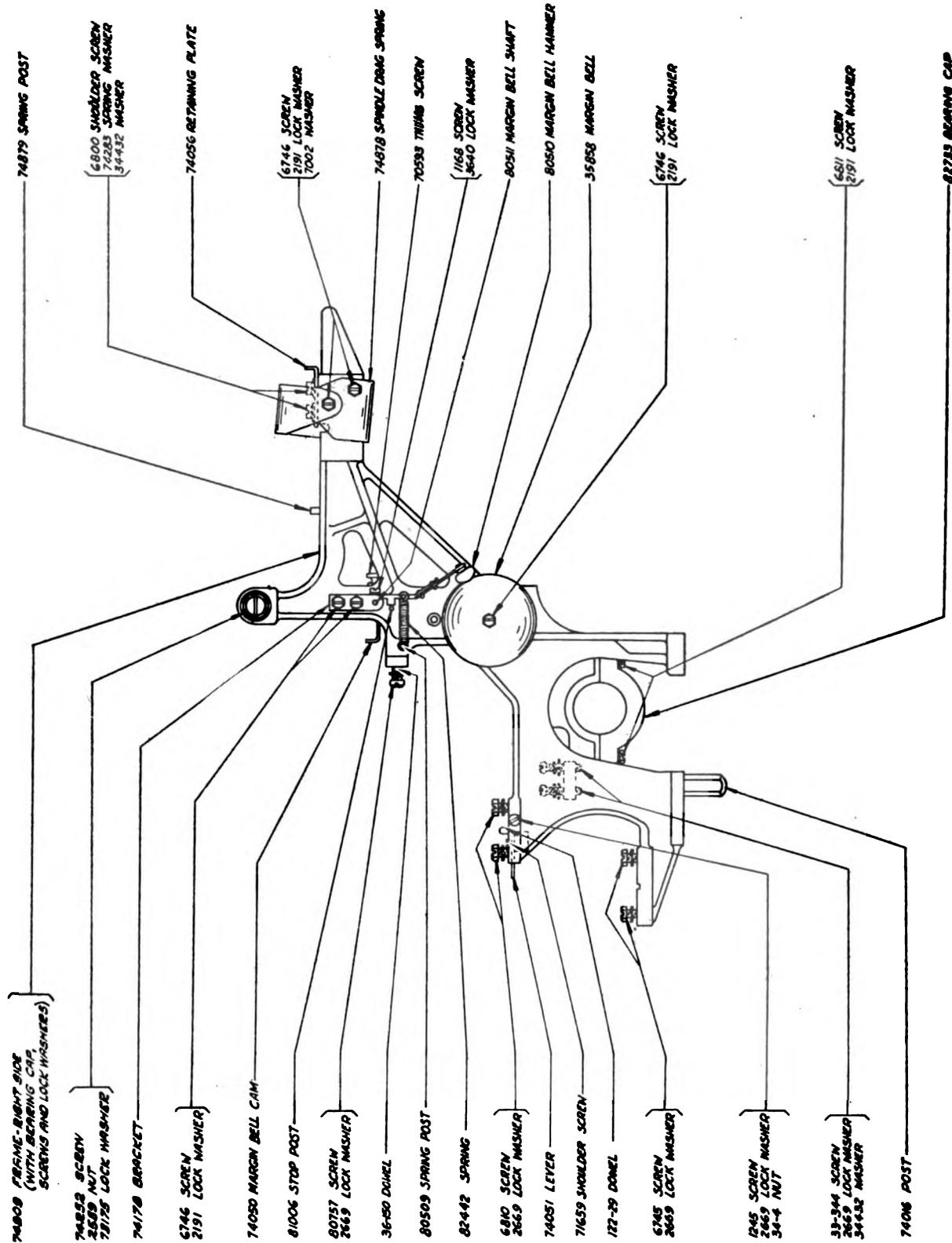


Figure 218. Frame parts, right side.

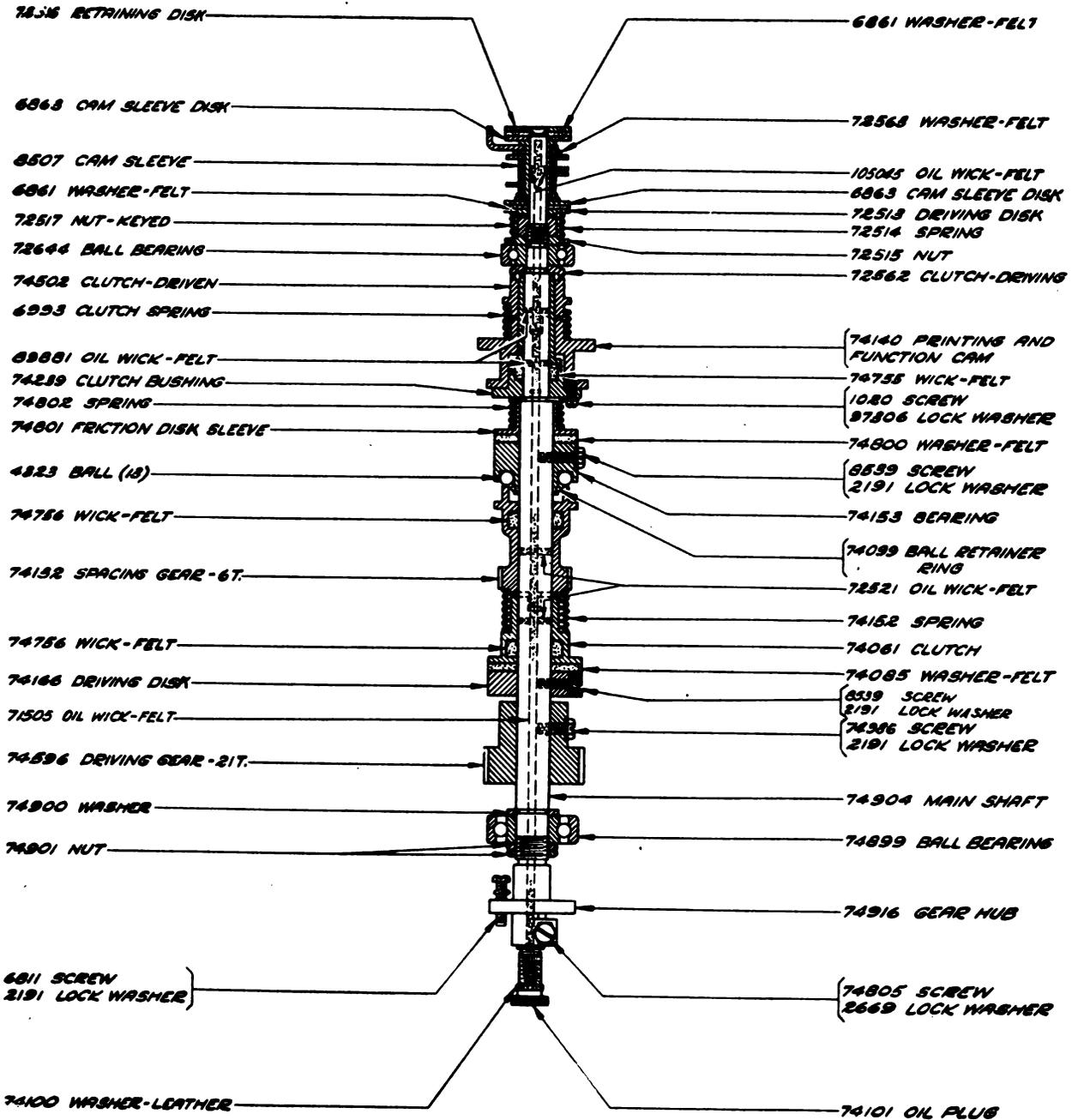


Figure 219. Main shaft parts.

TL537A2-S

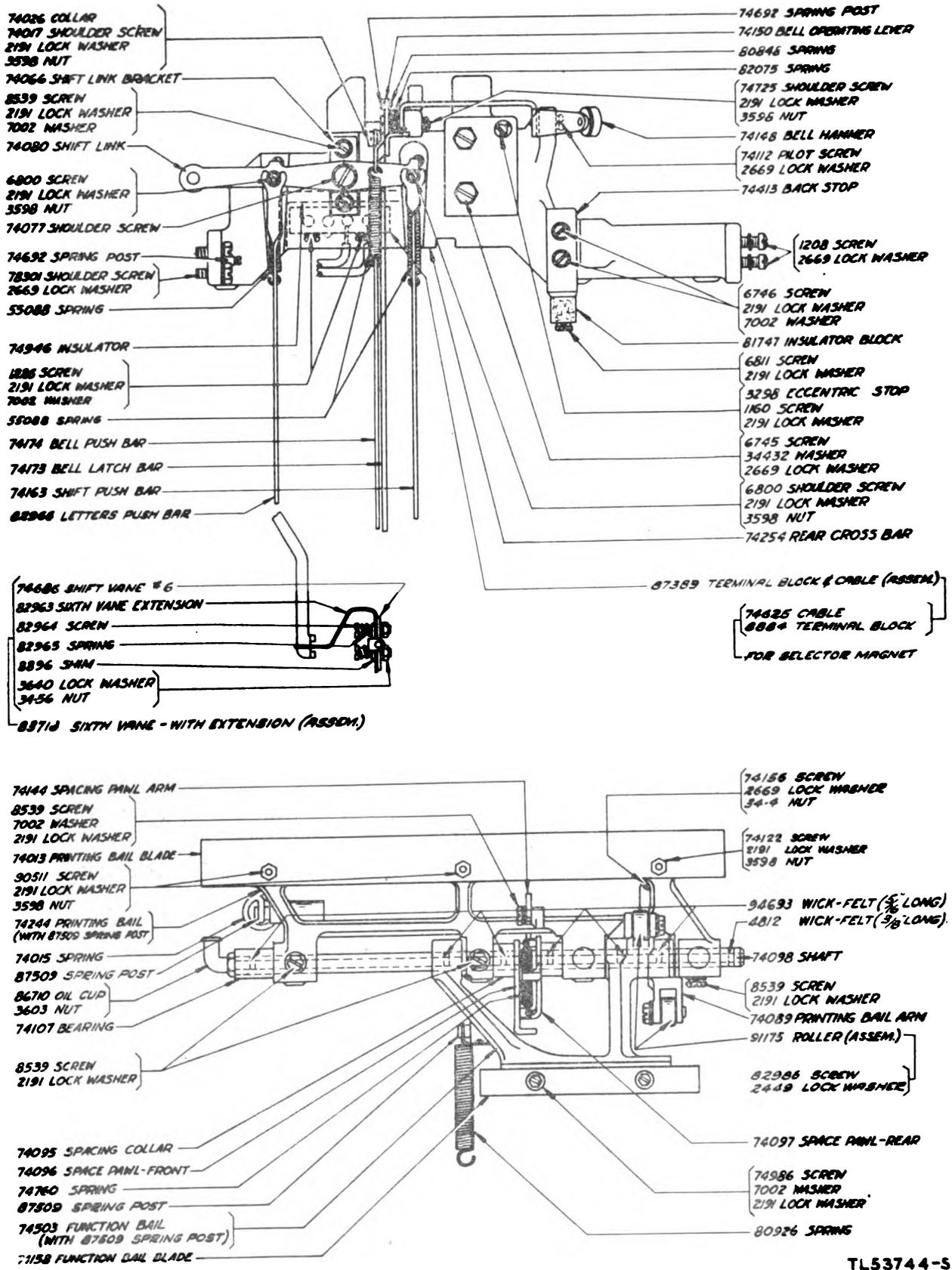


Figure 220. Rear cross-bar assembly parts and printing bail assembly parts.

TL53744-5

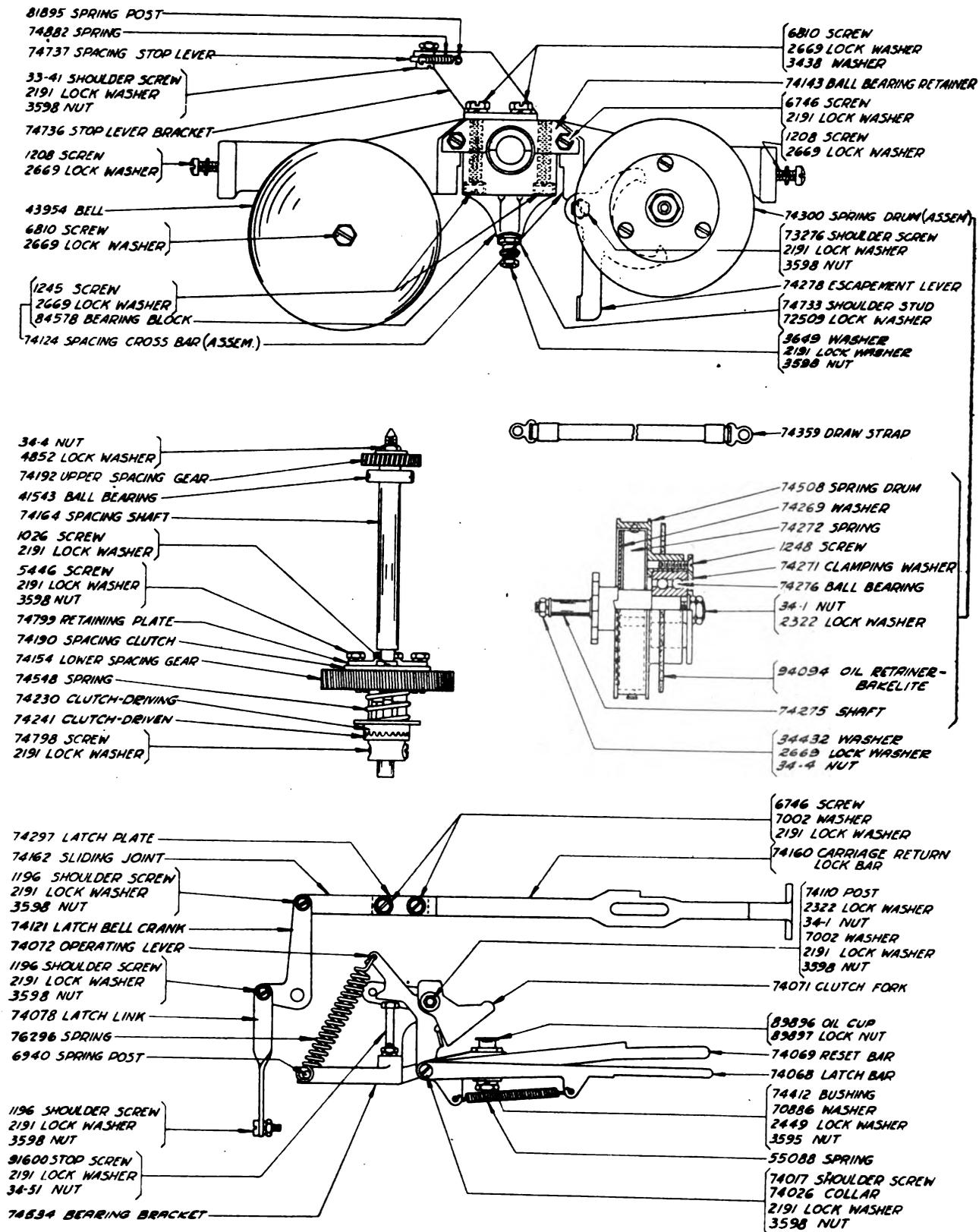
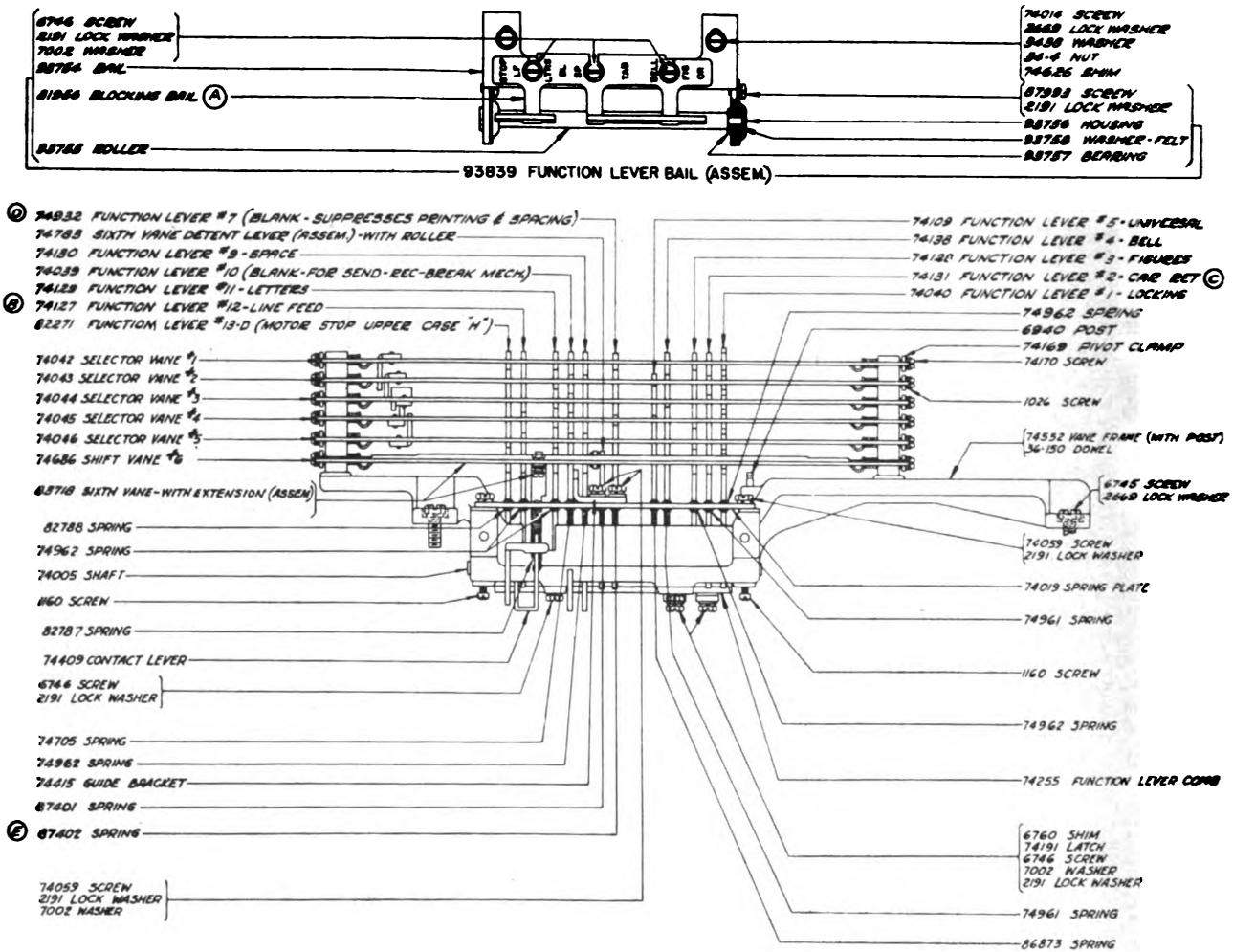


Figure 221. Carriage-return assembly parts.

TL53745-S



PARTS INDICATED BY (A), (B), ETC, ARE REPLACED IN THE TG-37-B BY THE FOLLOWING PARTS:

(A)	105381 BLOCKING BAIL	
(B)	84928 FUNCTION LEVER # 12 - LINE FEED	} OPERATE IN LETTERS POSITION ONLY
(C)	84927 FUNCTION LEVER # 2 - CAR RET	
(D)	84060 FUNCTION LEVER # 7 (BLANK-SUPPRESSES PRINTING AND SPACING IN LETTERS POSITION ONLY)	} OPERATE IN LETTERS POSITION ONLY
(E)	4708 SPRING	
	84061 FUNCTION LEVER # 7-BLANK (WITH SPRING)	

TL53746-S

Figure 222. Function lever assembly parts.

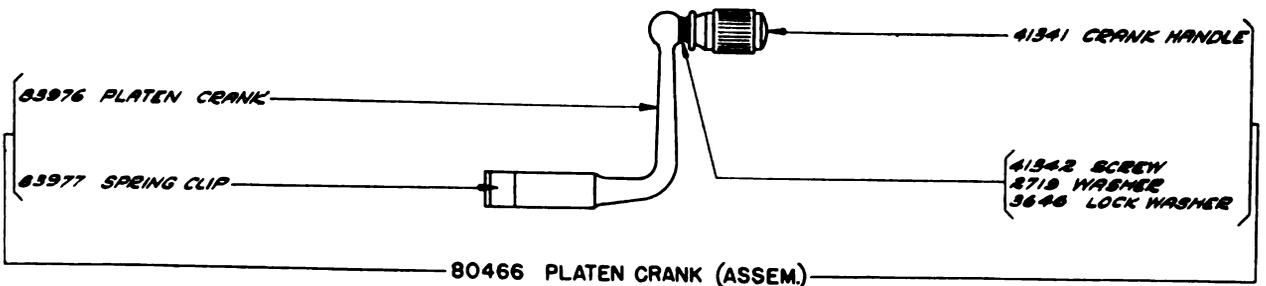
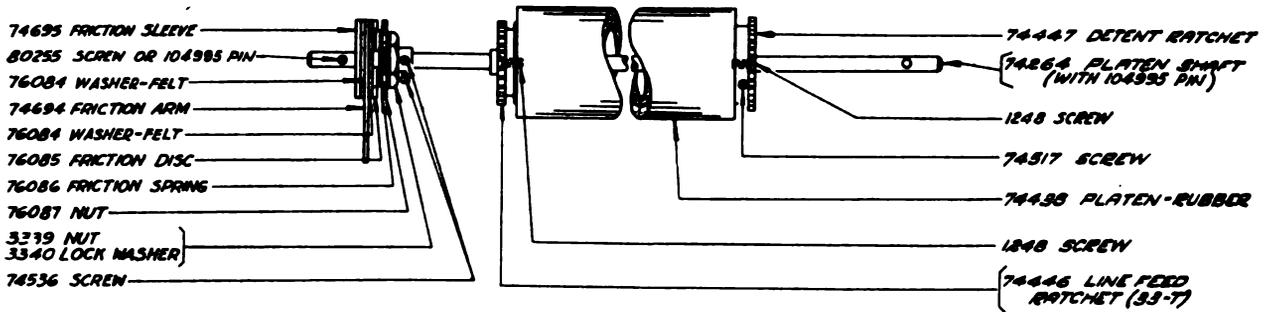
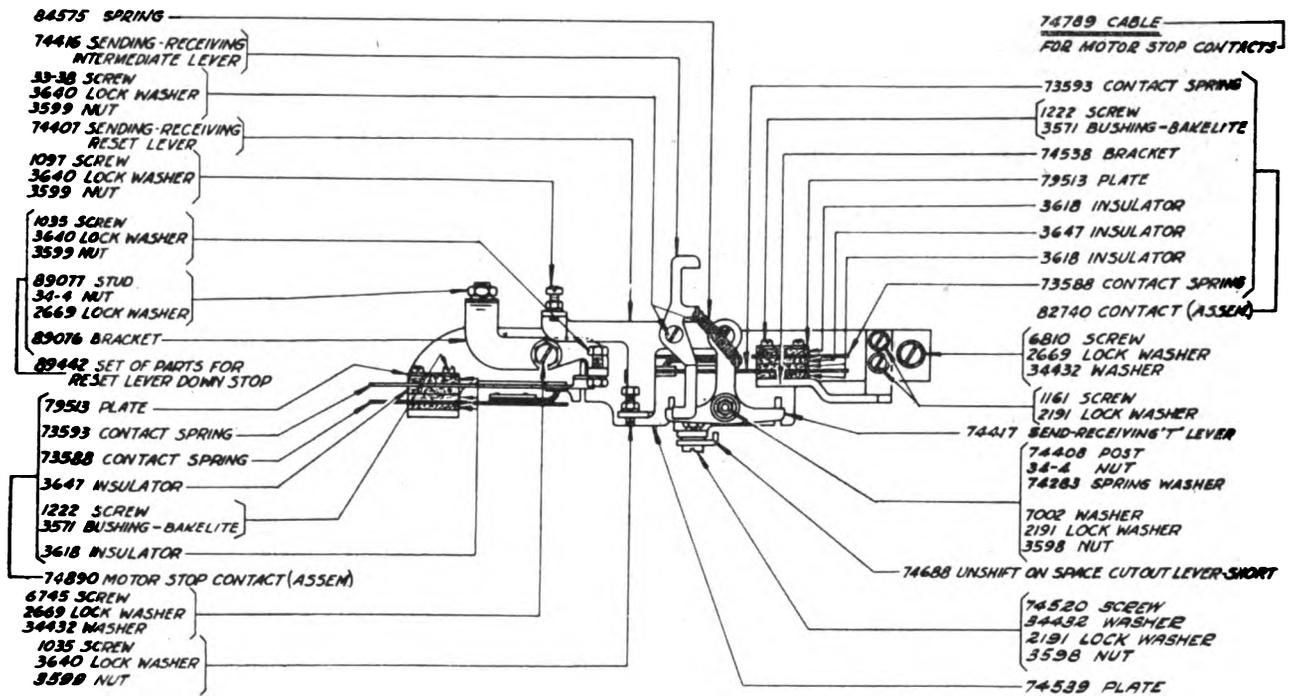
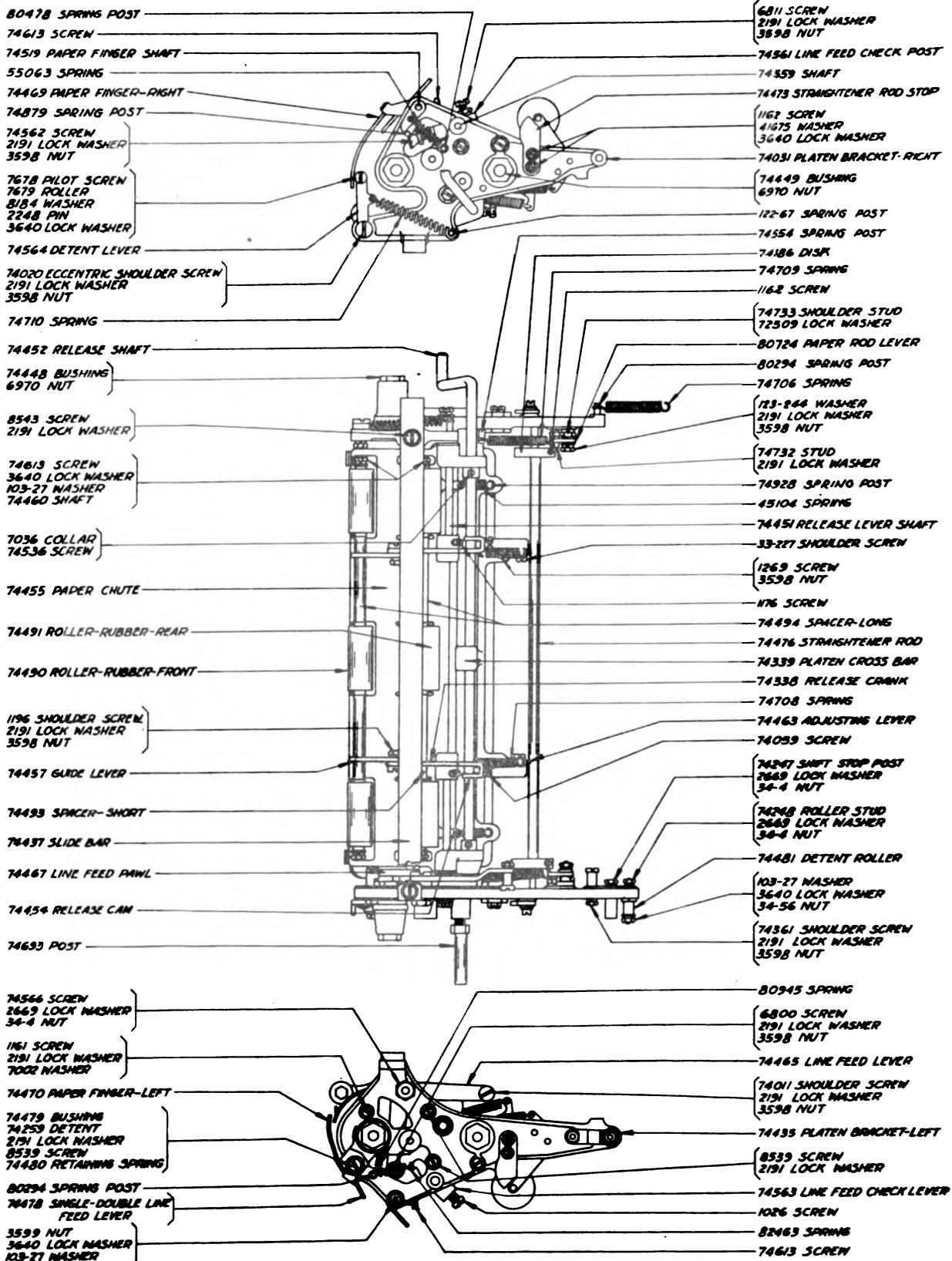


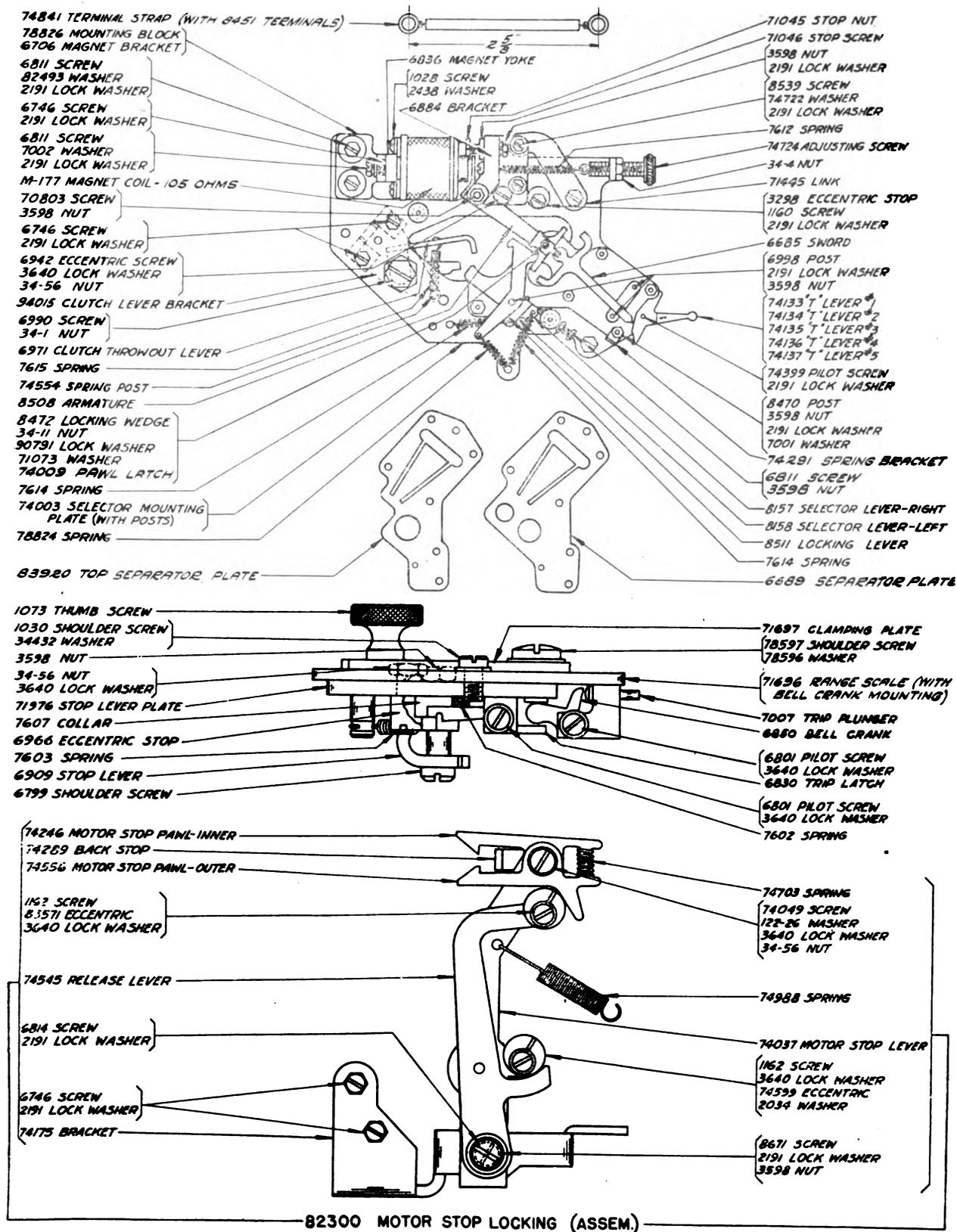
Figure 223. Motor-stop assembly parts and platen roll parts.

TL53747-S



TL53748-S

Figure 224. Platen assembly parts.



TL53749-S,

Figure 225. Selector unit parts and motor-stop locking assembly parts.

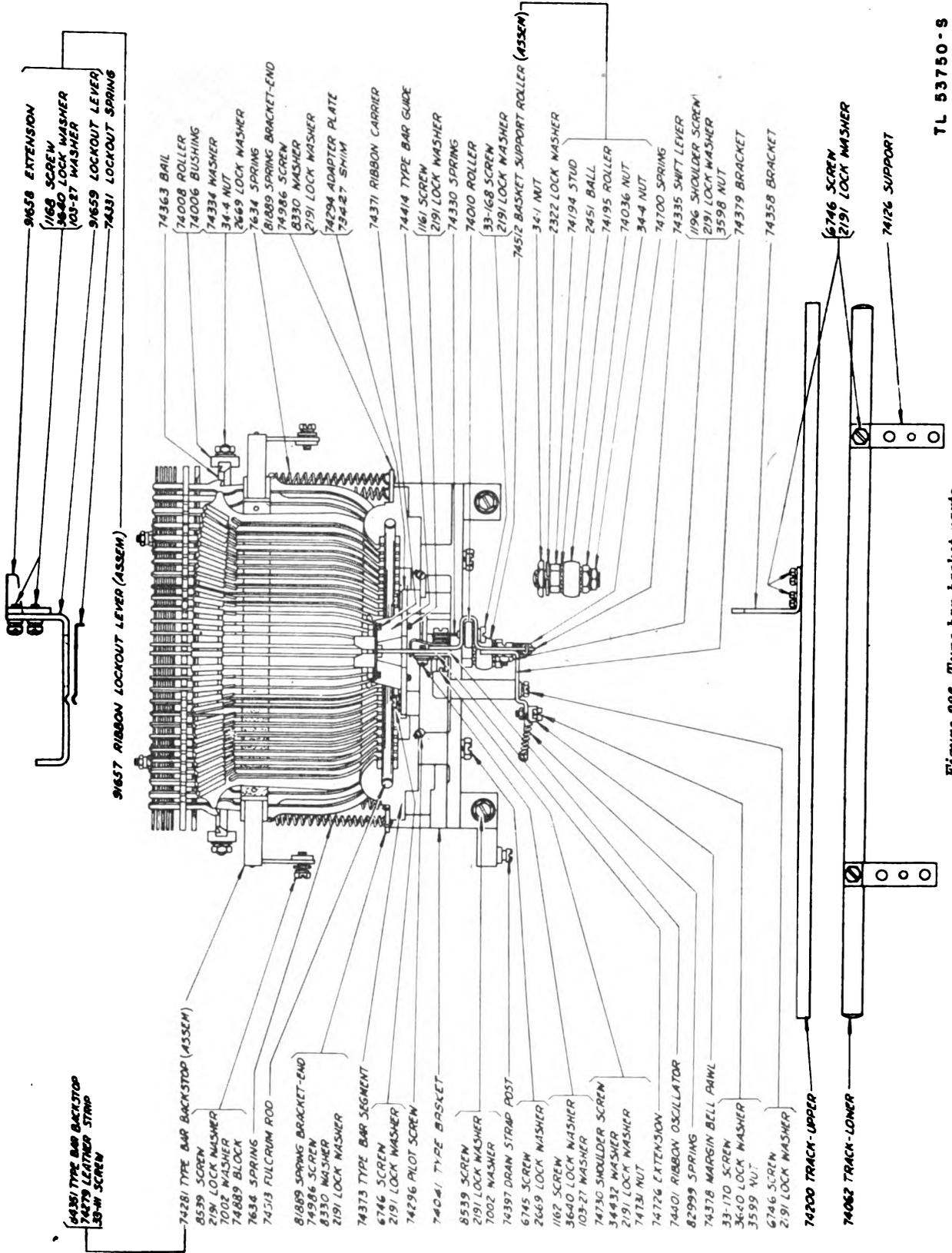


Figure 226. Type-bar basket parts.

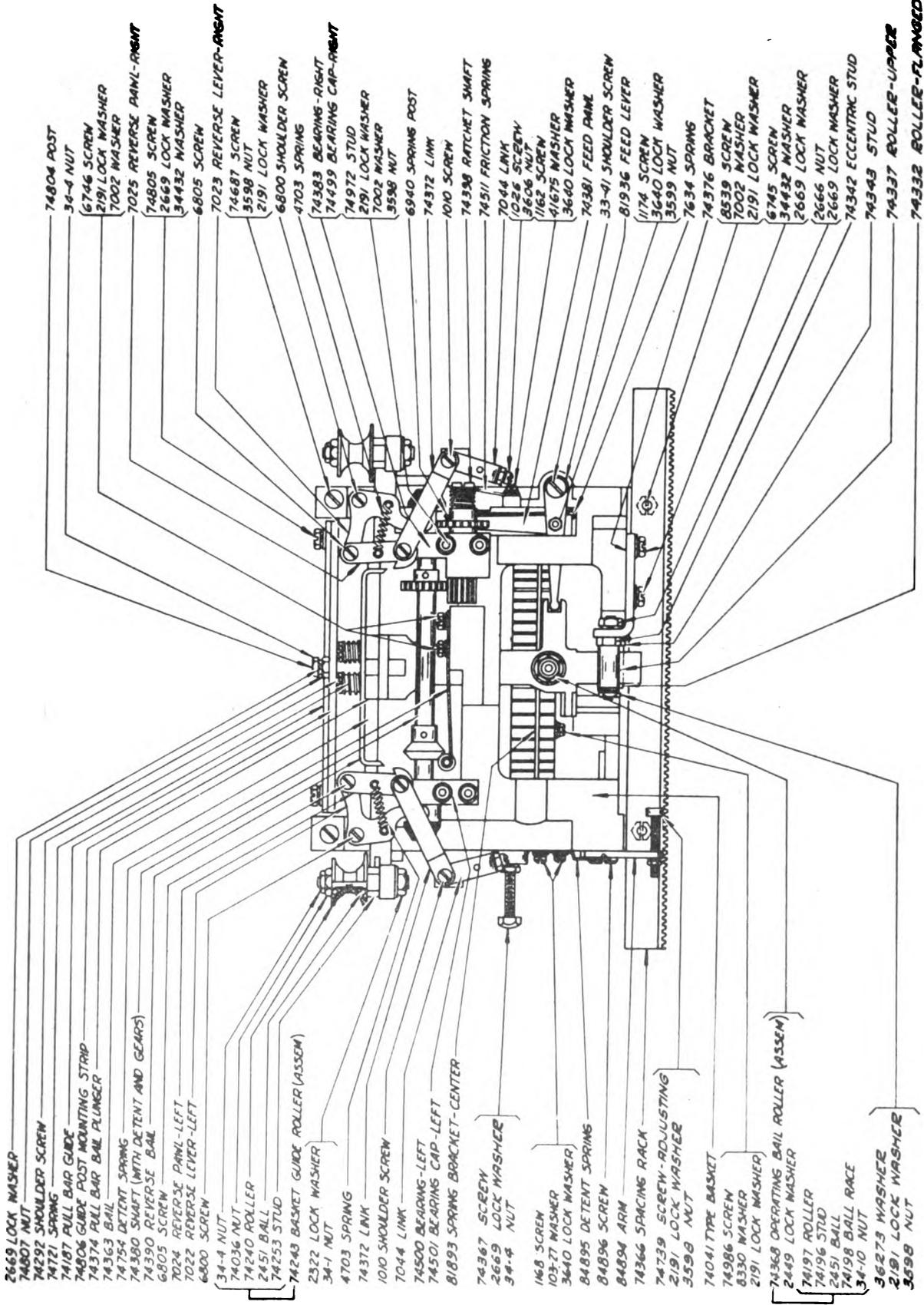
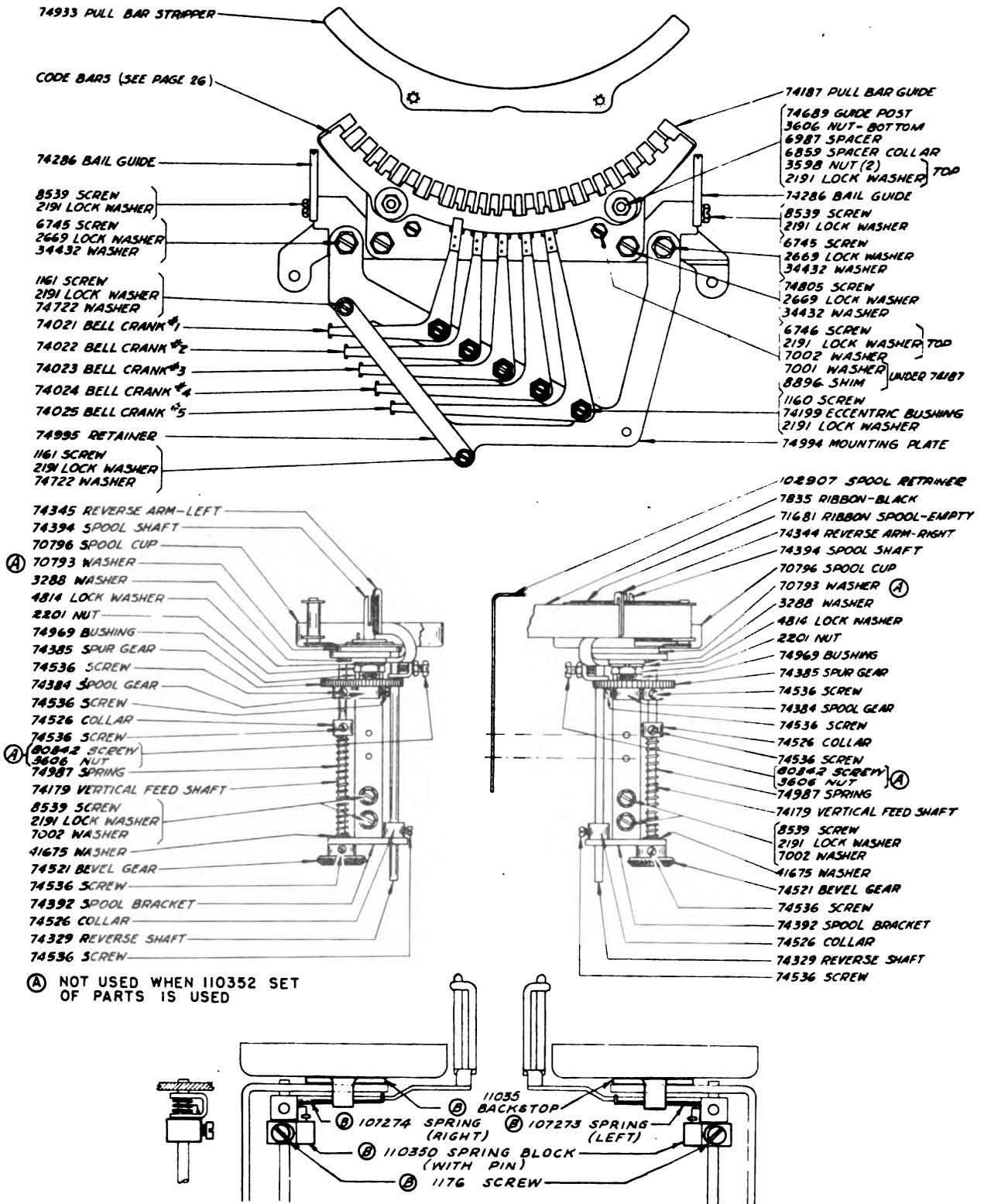


Figure 227. Type-bar carriage parts.

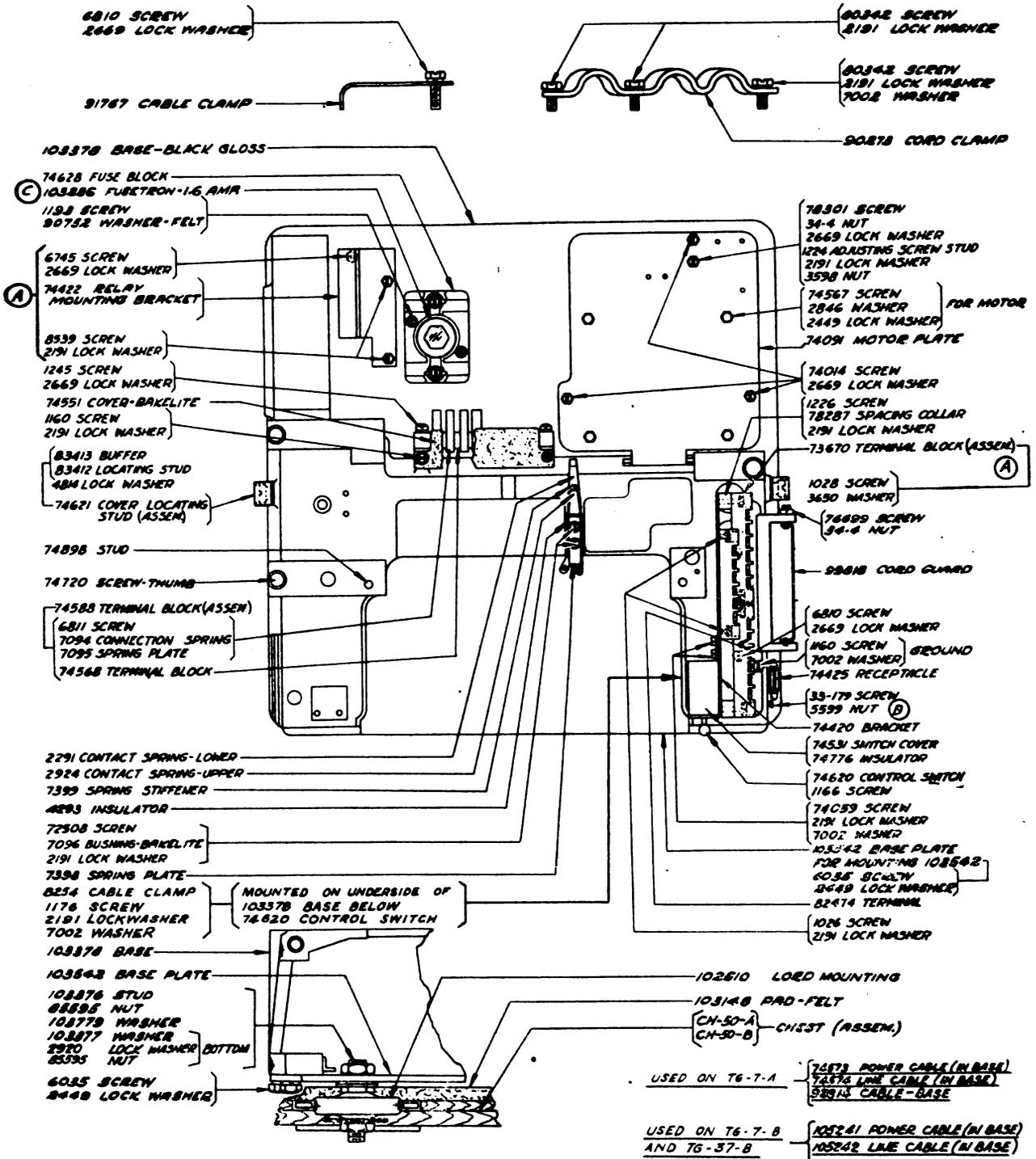
TL53751-S



110352 SET OF PARTS  
(INCLUDES PARTS MARKED (B))

TL53752-S

Figure 228. Bell crank parts and ribbon-feed mechanism parts.



- (A) USED ON TG-7-A ONLY
- (B) THREE 73670 TERMINAL BLOCKS USED ON TG-7-A. THIRD TERMINAL BLOCK (ON TOP) NOT USED IN TG-7-B AND TG-37-B
- (C) 103288 FUSETRON (1.4 AMP) USED ON OLDER MODELS
- (D) USED ON OLDER MODELS ONLY

TL53753-S

Figure 229. Base parts.

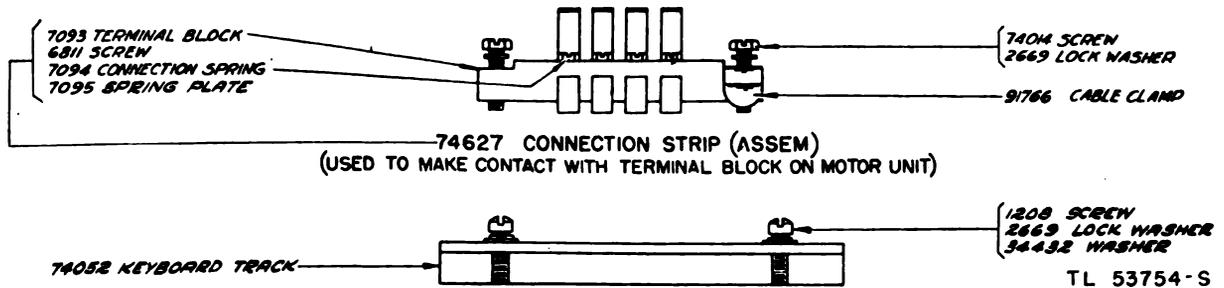
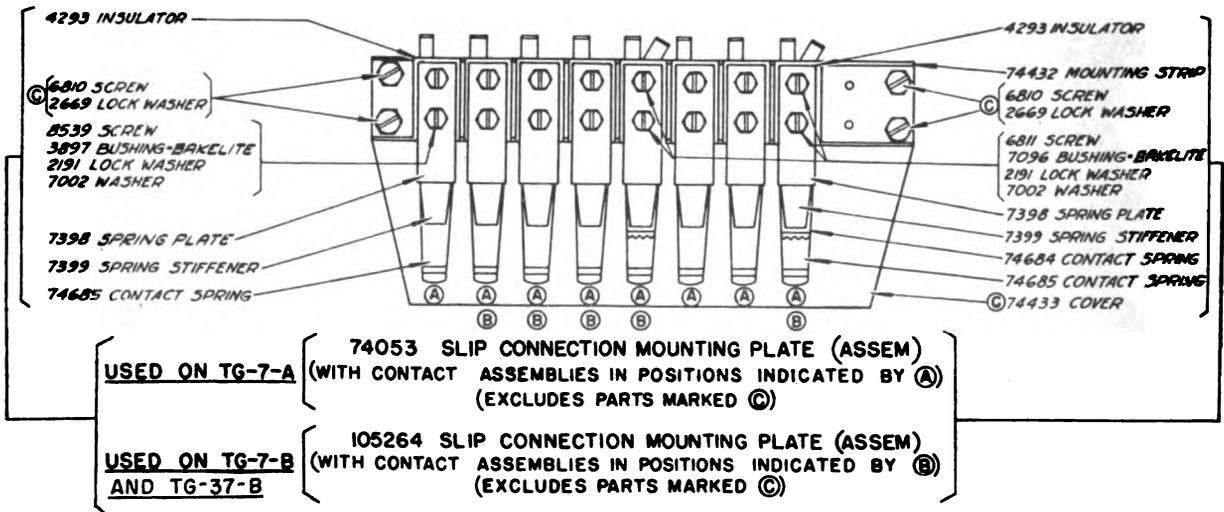
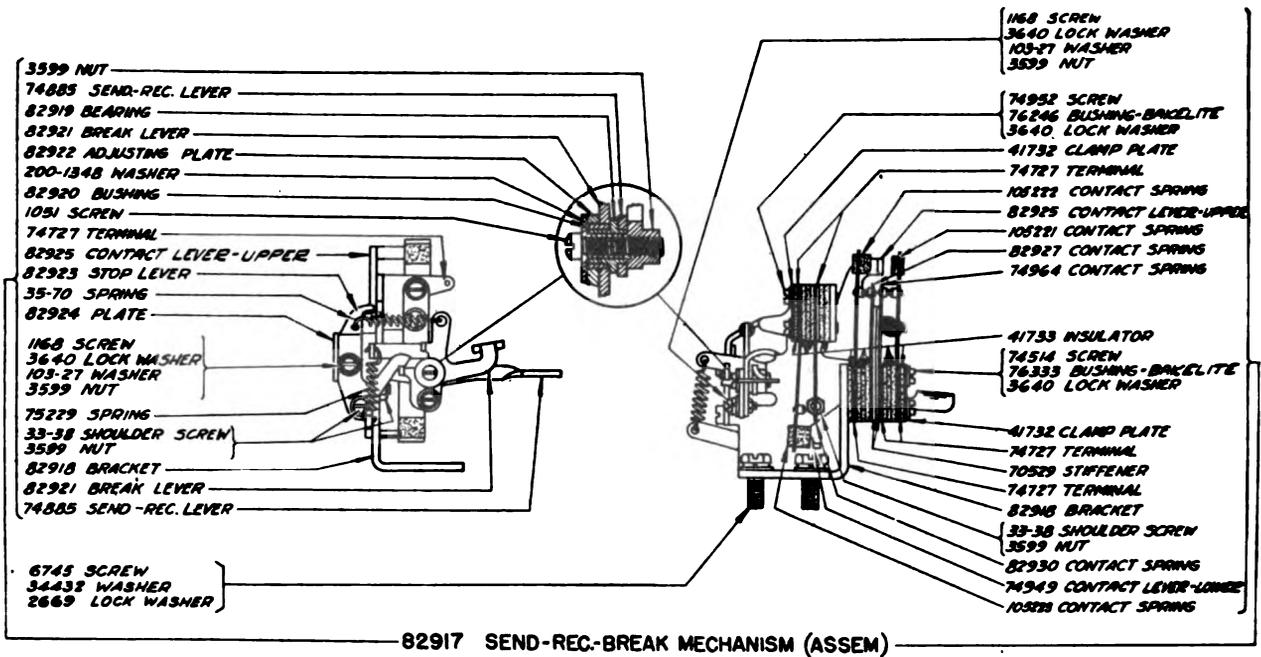
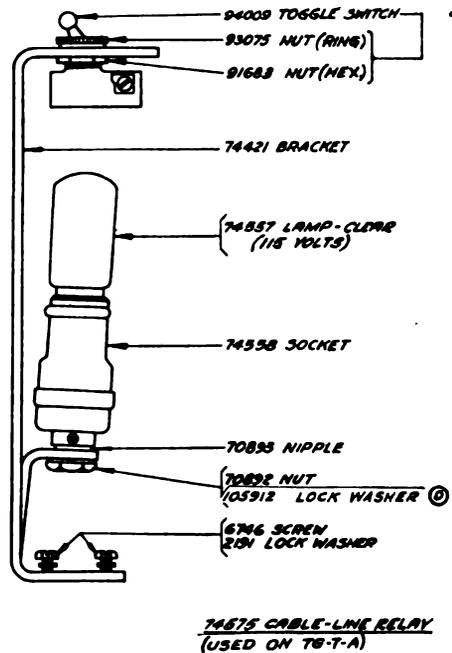
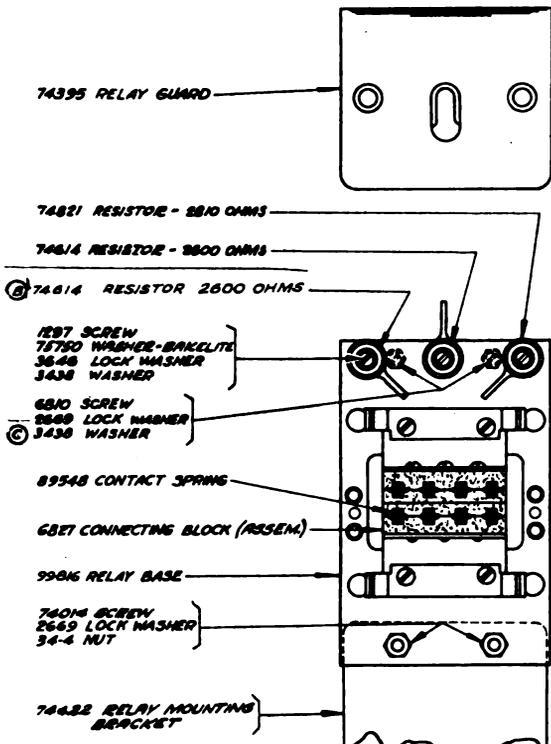
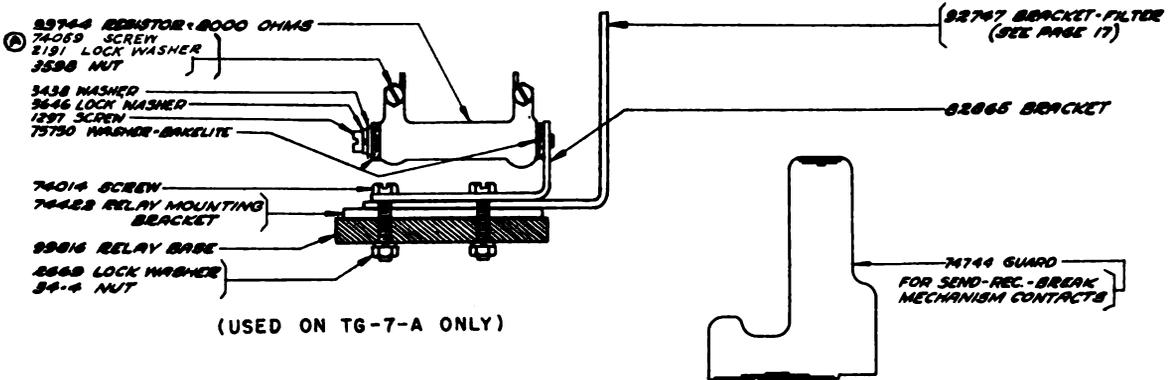
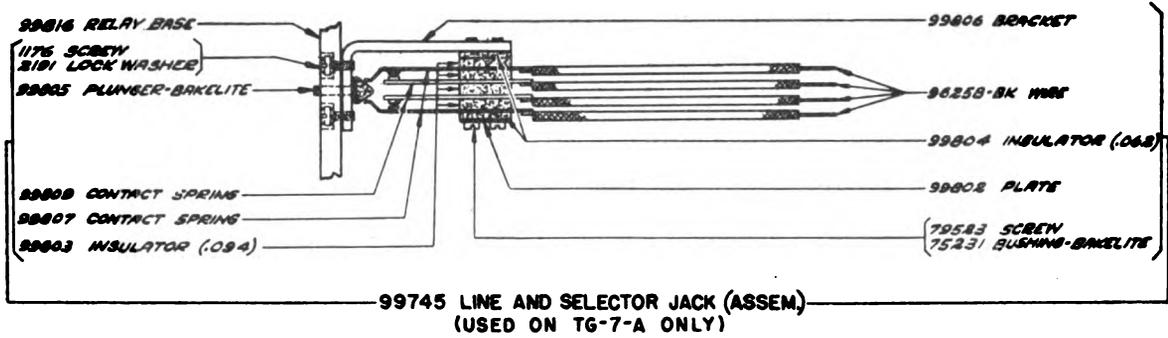


Figure 280. Send-receive-break mechanism parts and slip-connection mounting plate assembly parts.

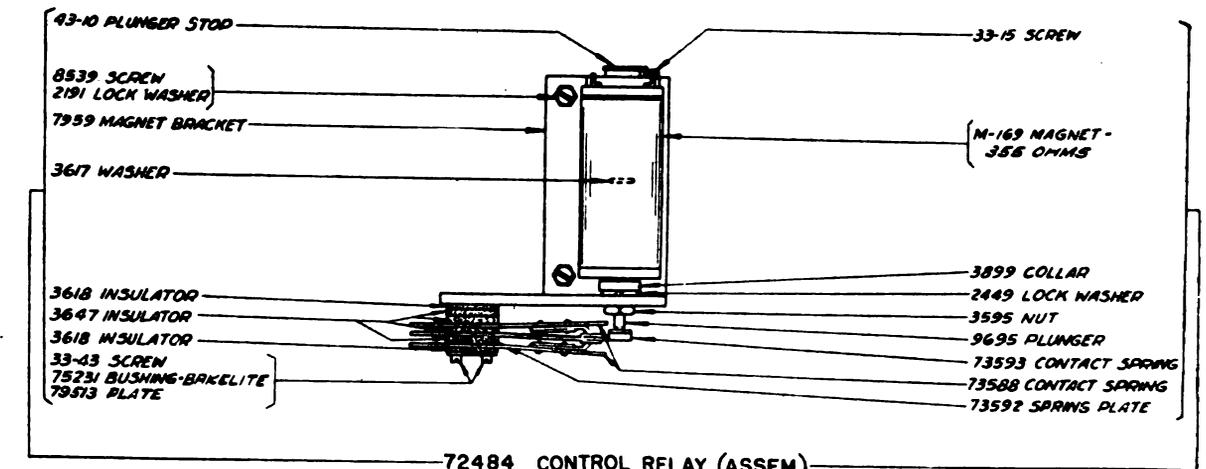


(USED ON TG-7-A ONLY)

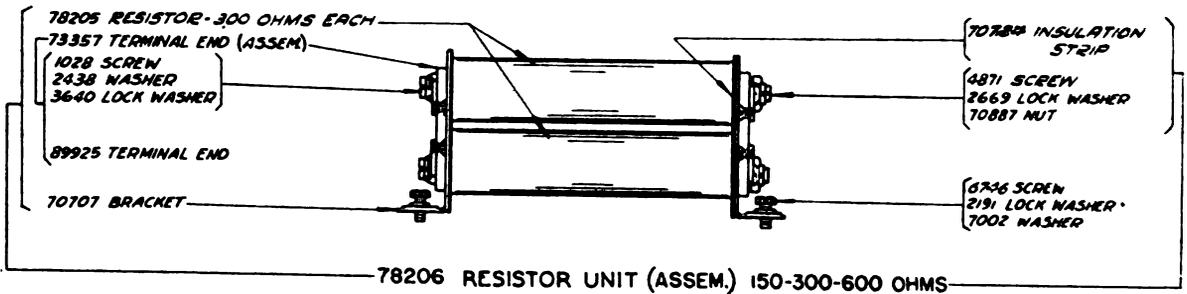
- (A) USED ON LATER MODELS ONLY
- (B) REPLACES 75436 RESISTOR (3000 OHMS) ON LATER MODELS ONLY
- (C) NOT USED ON LATER MODELS
- (D) REPLACES 73175 LOCK WASHER ON LATER MODELS ONLY

TL 53755-S

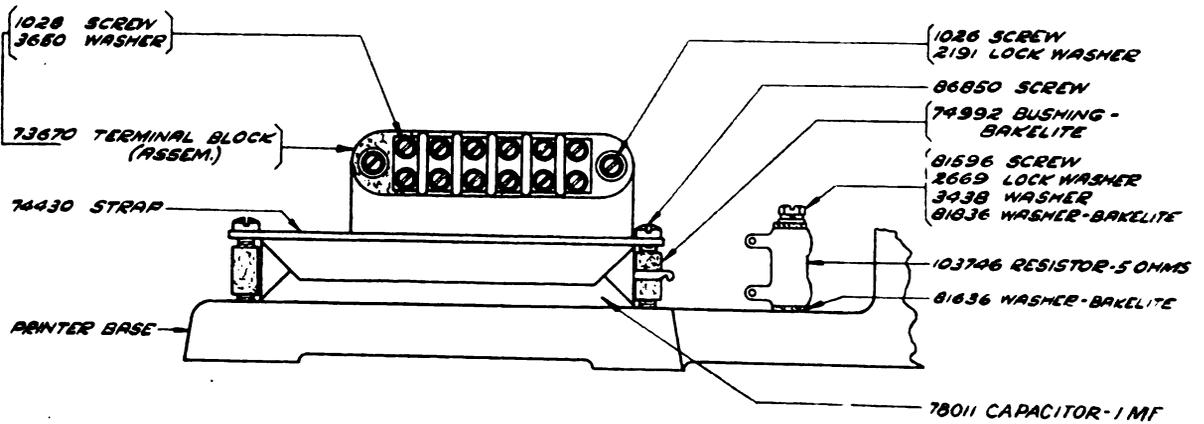
Figure 931. Relay mounting bracket parts and target lamp parts.



72484 CONTROL RELAY (ASSEM.)  
(WITH MOUNTING SCREWS)  
(USED IN TG-7-A ONLY)



78206 RESISTOR UNIT (ASSEM.) 150-300-600 OHMS



81841 CAPACITOR-1/4 MF

74682 SCREW

PRINTER BASE

(USED IN TG-7-A ONLY)

TL 53756-S

Figure 232. Resistor unit assembly parts and terminal block assembly parts.

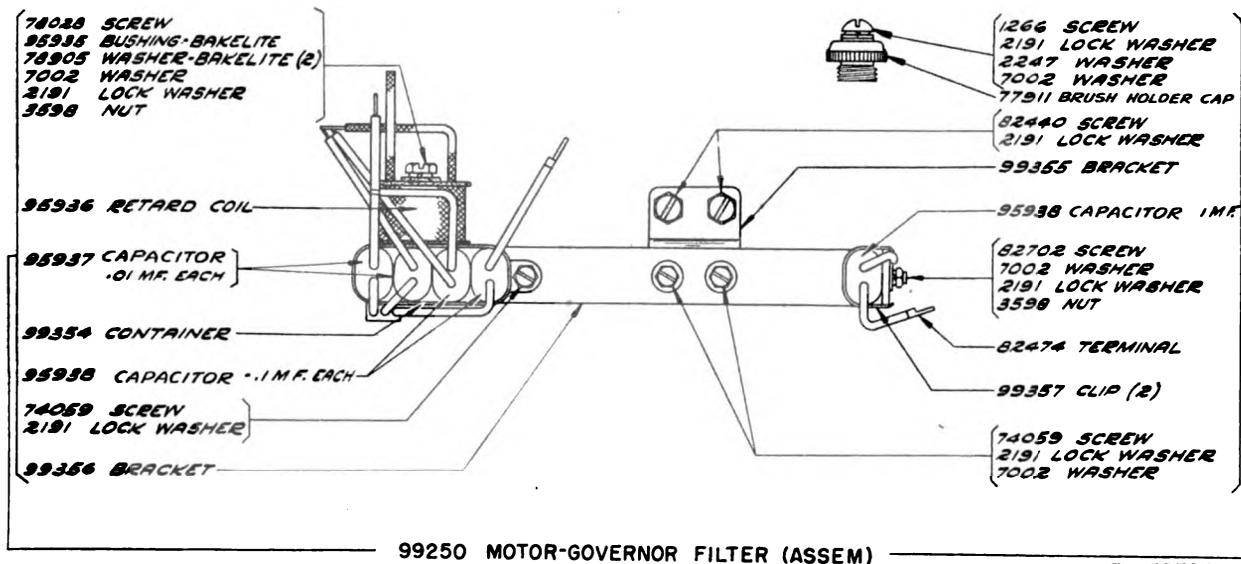
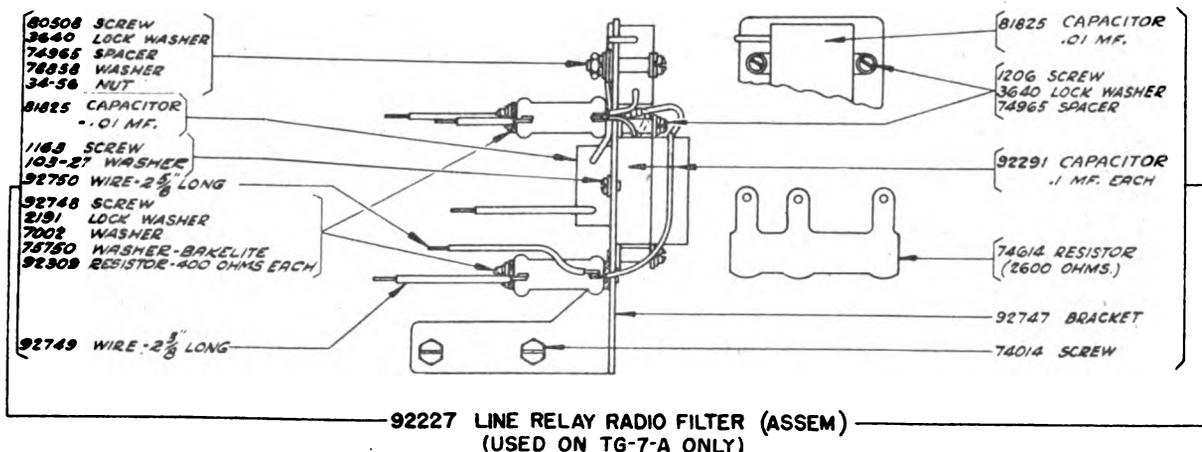
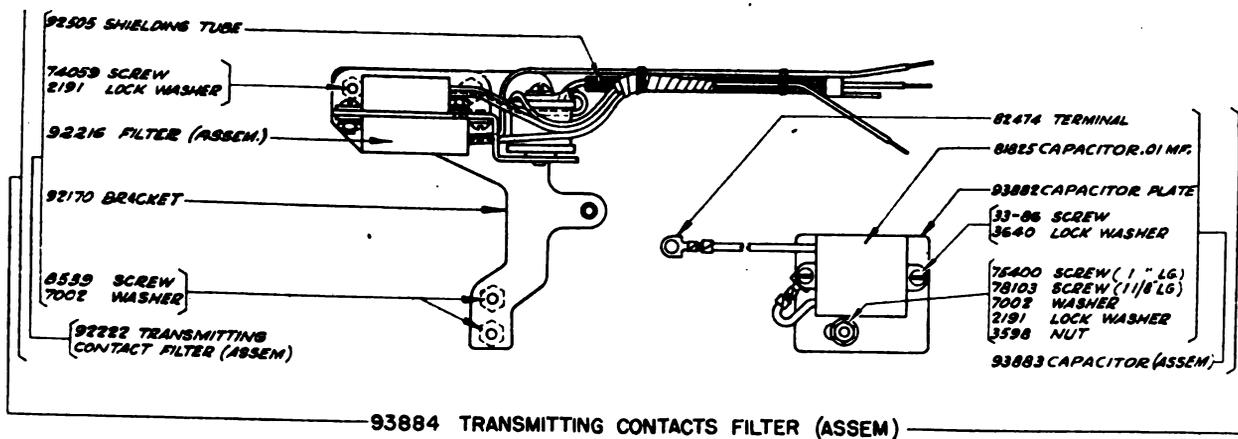
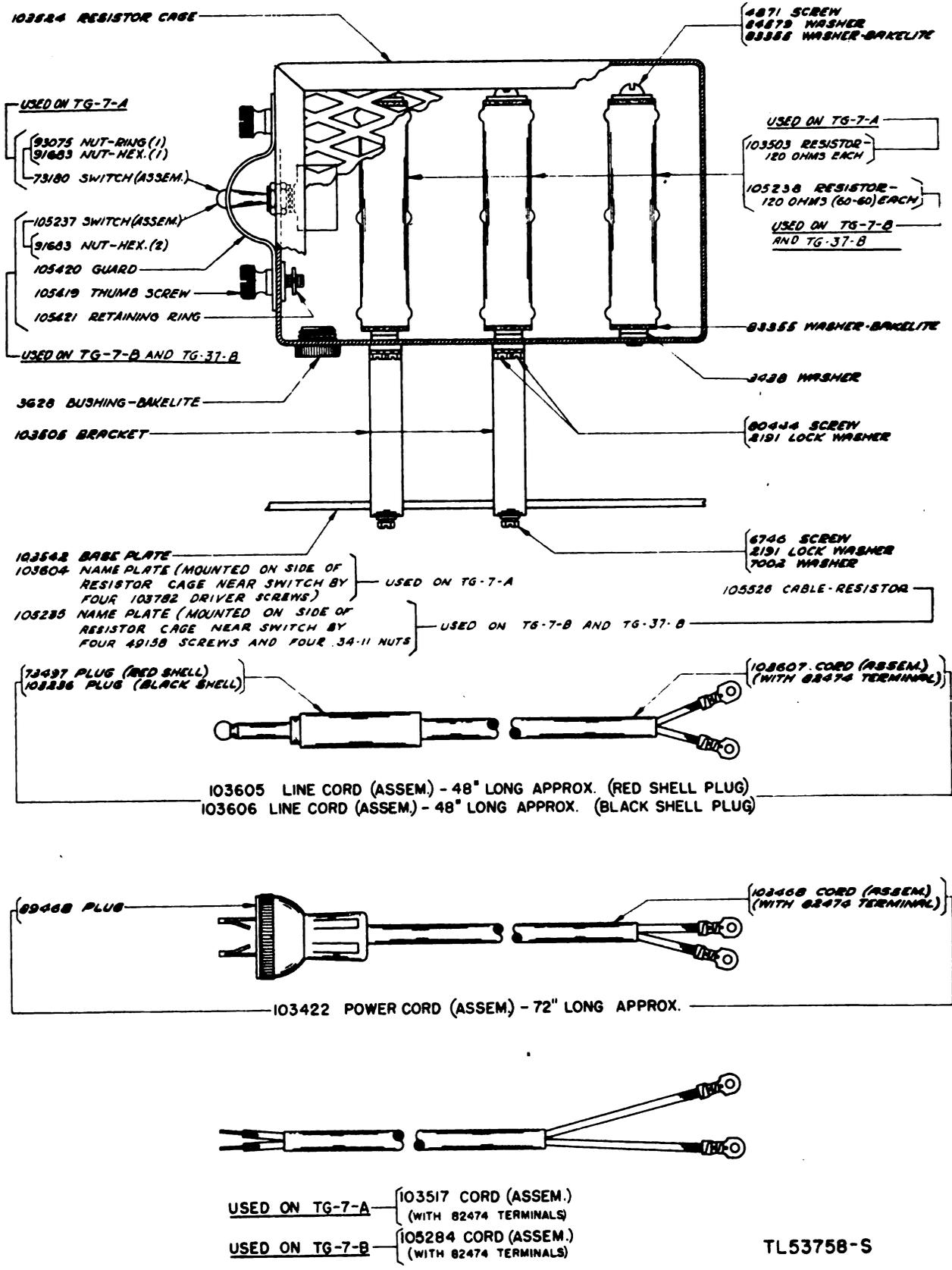


Figure 233. Filter assemblies parts.

TL 53757-S



TL53758-S

Figure 234. Power selector unit parts and cord assemblies parts.

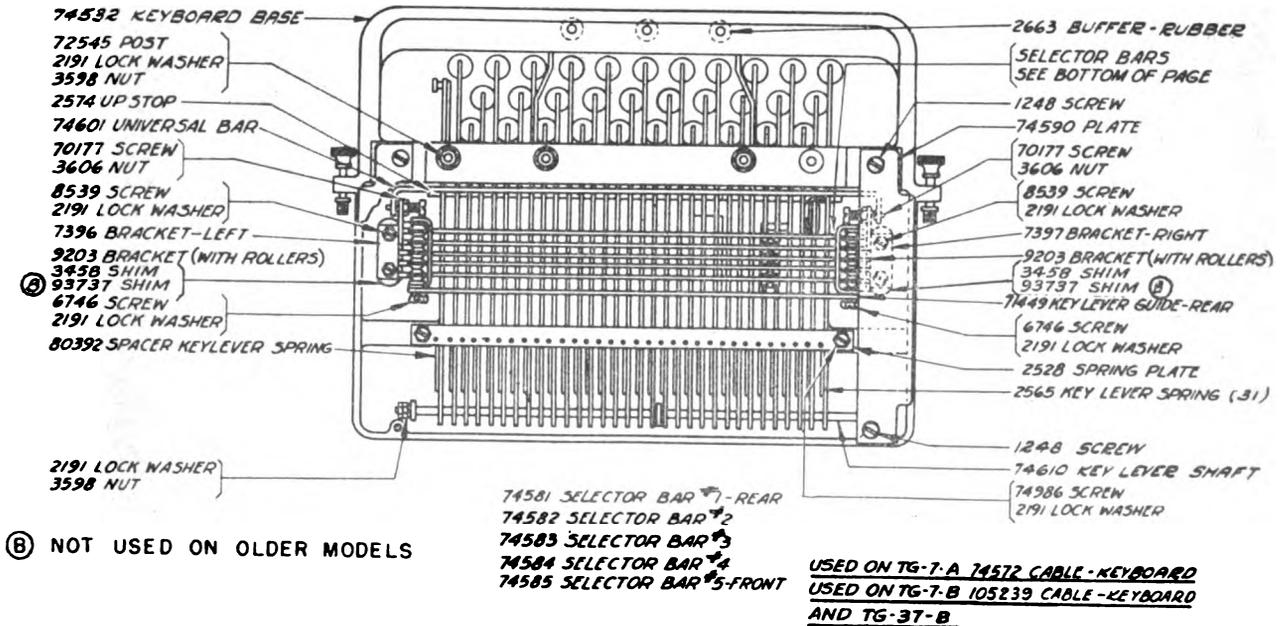
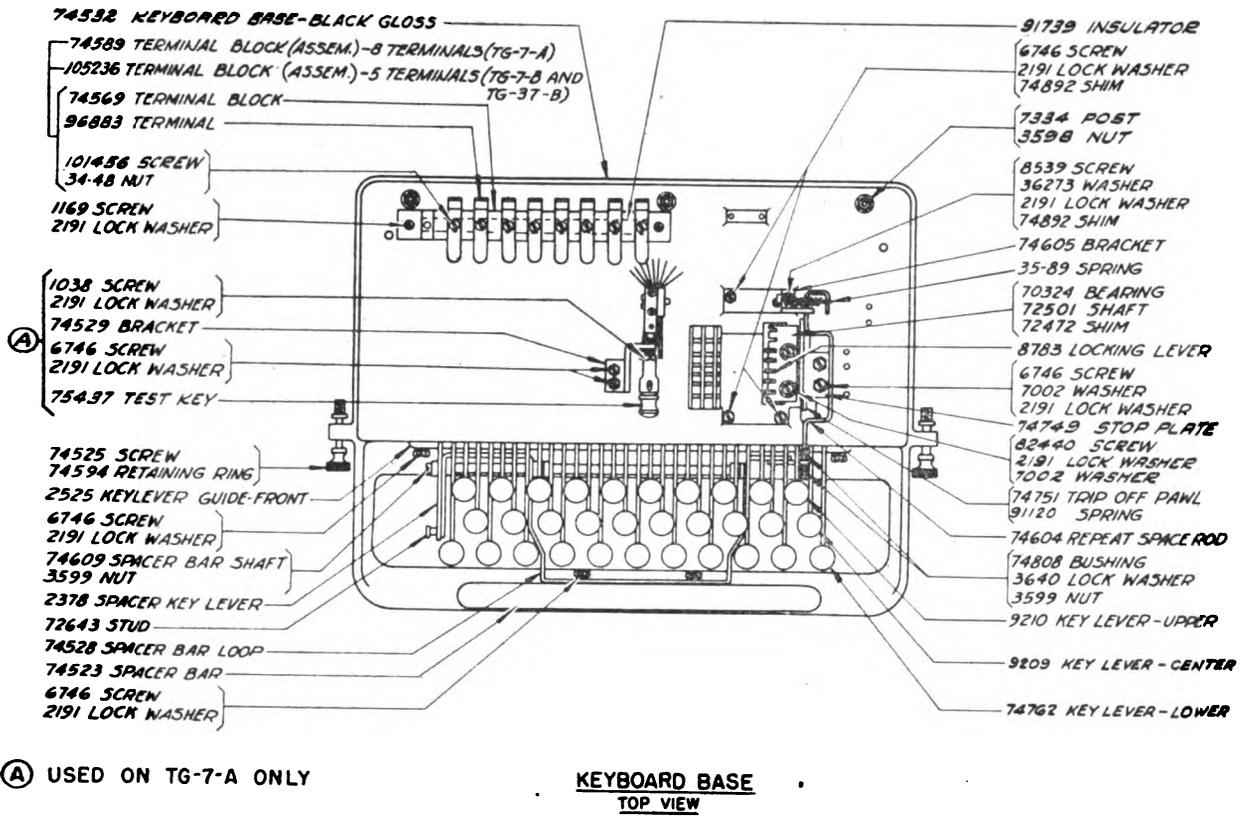
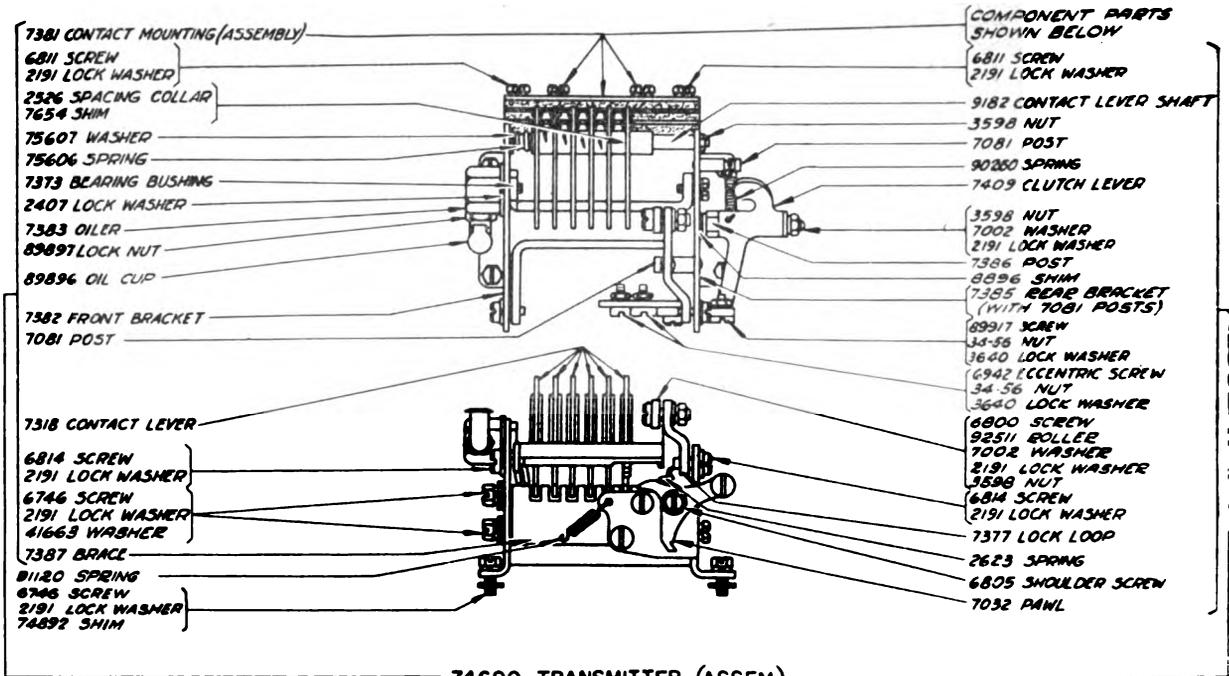
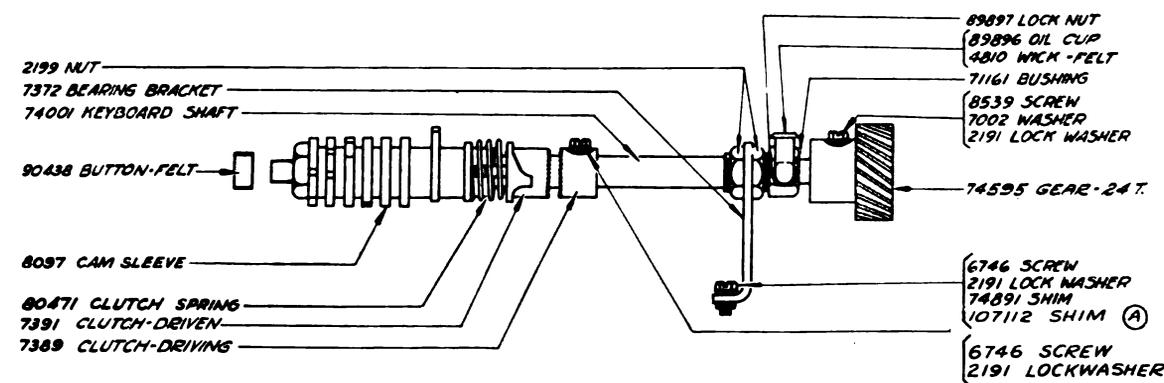
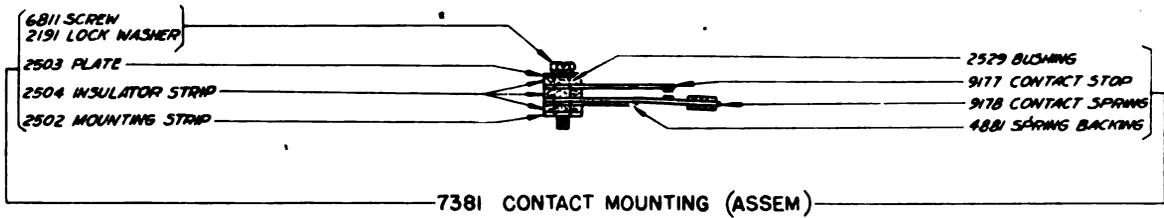


Figure 235. Keyboard parts.

TL 53759-S



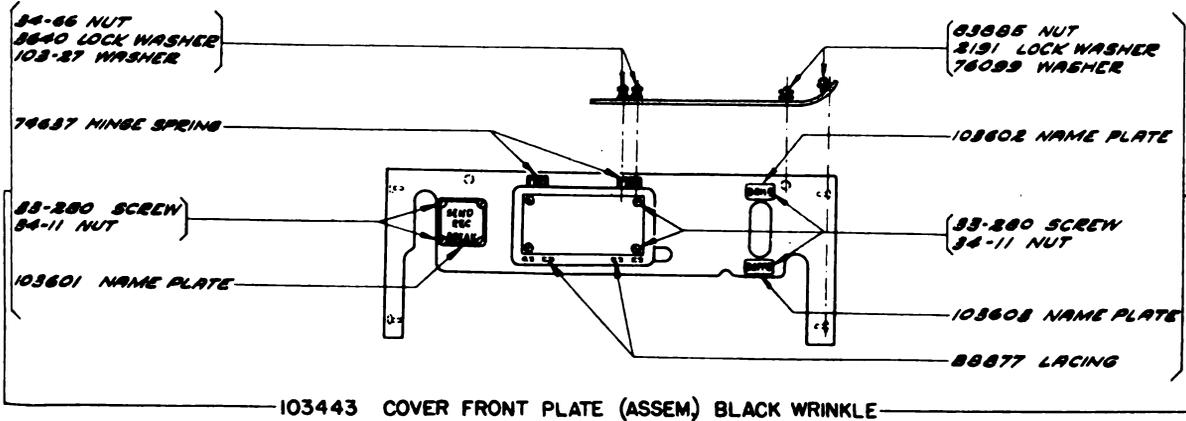
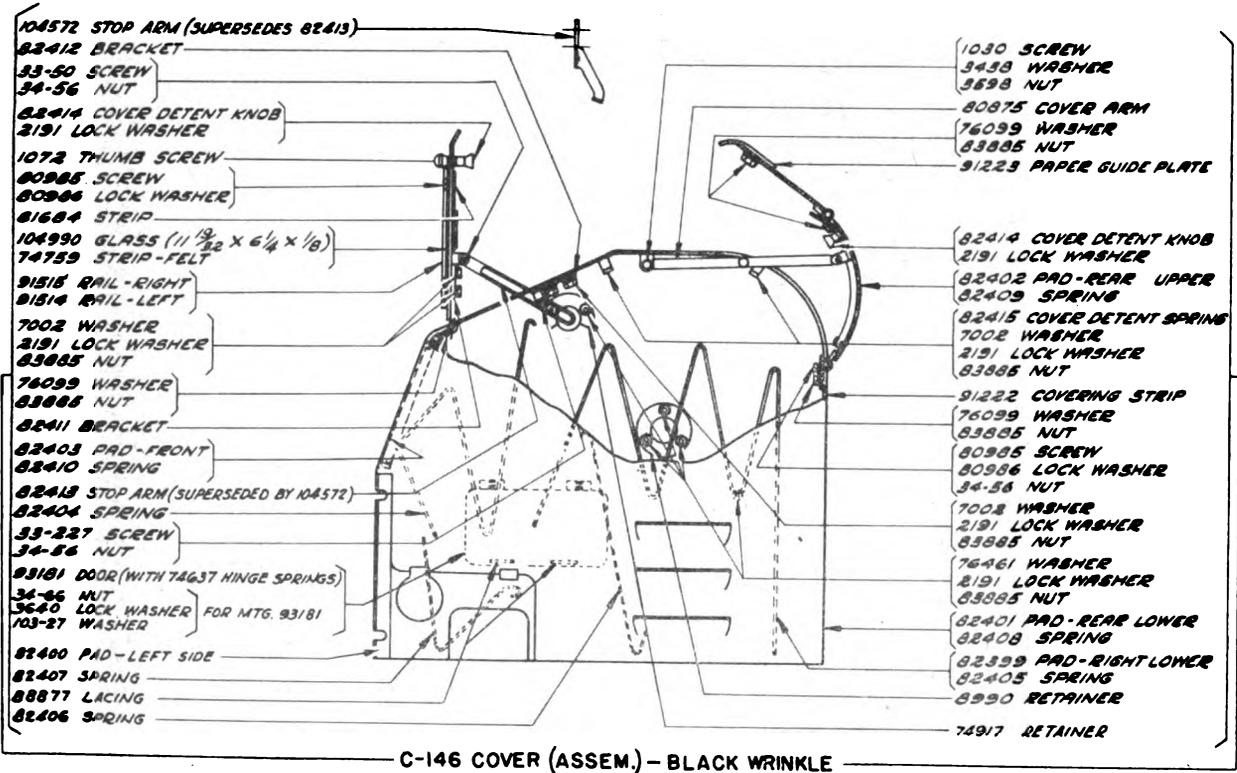
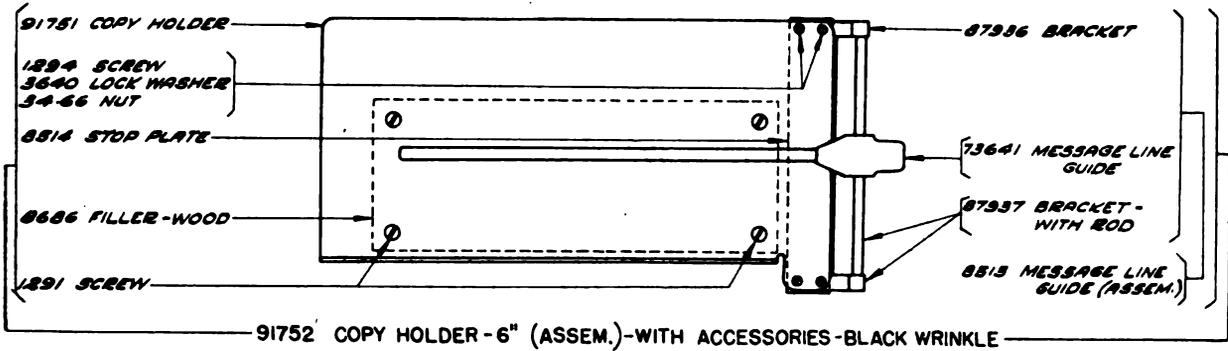
74690 TRANSMITTER (ASSEM)  
(WITH 7381 CONTACT MOUNTING ASSEM)



(A) NOT USED ON OLDER MODELS

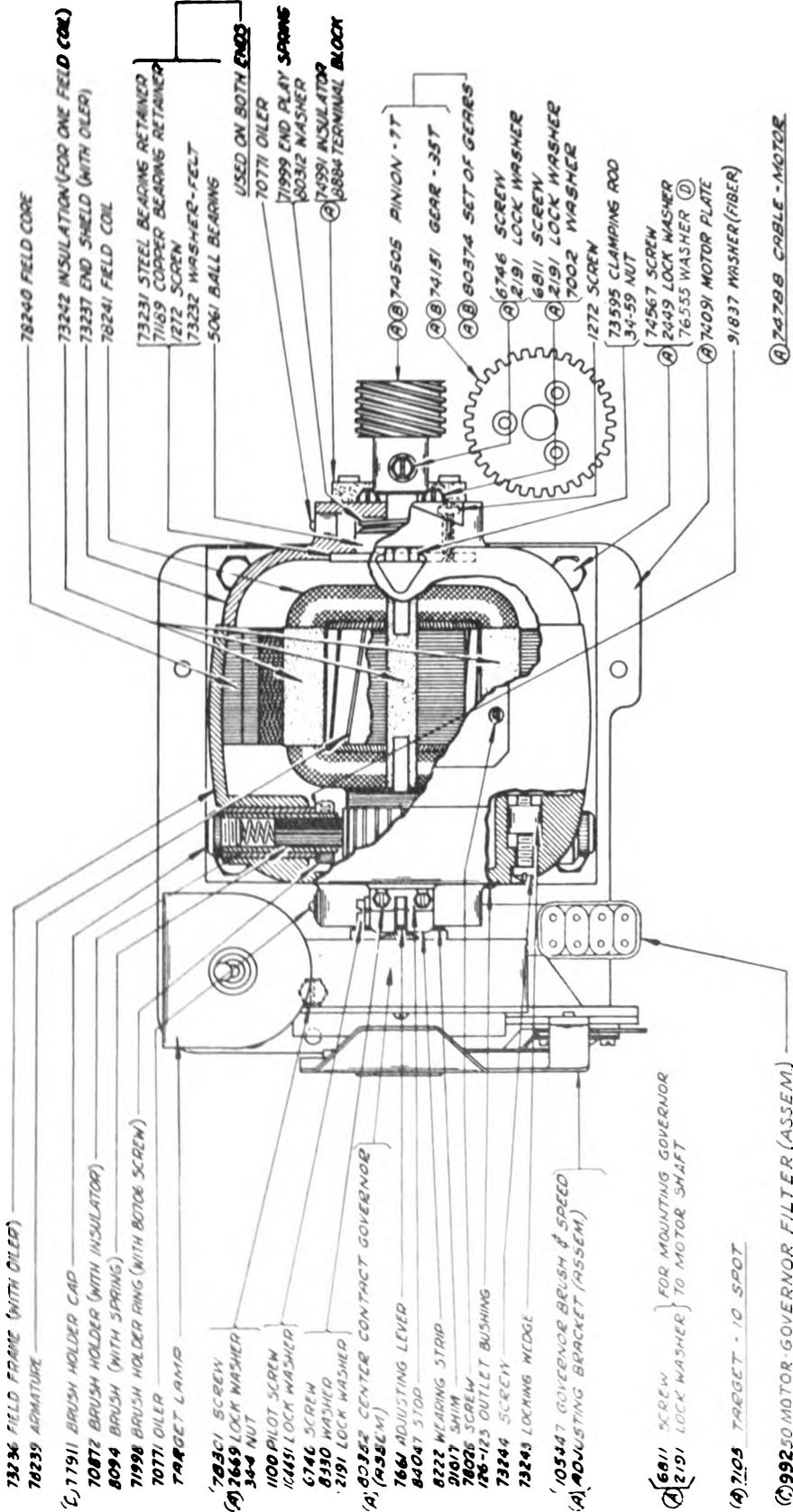
TL53760-S

Figure 236. Keyboard transmitter assembly parts.



TL53761-S

Figure 237. Cover assembly parts.

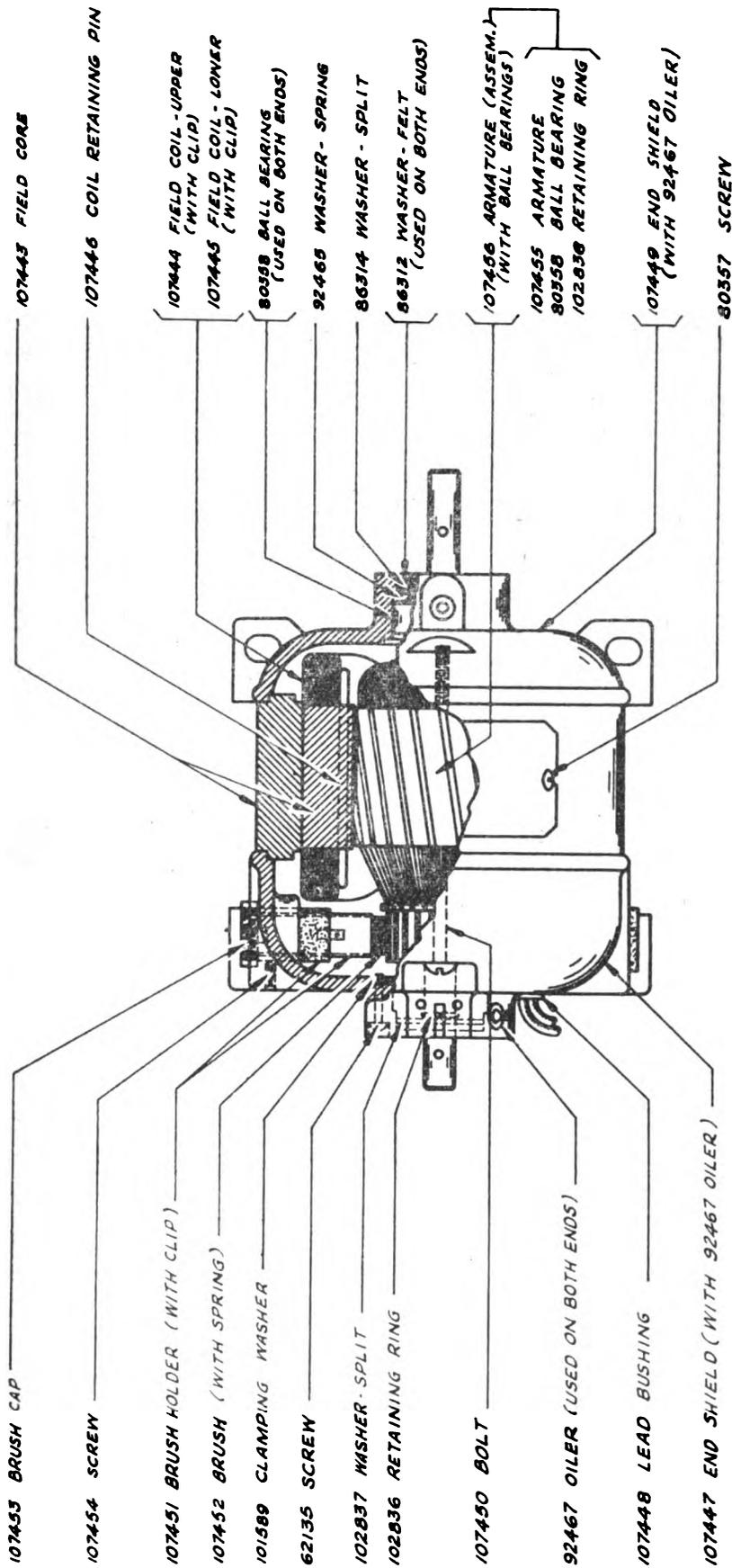


77953 SERIES MOTOR. 1/25 H.P., 115 V., A.C. 60 CYCLE (G. E. MODEL 32989 OR 5BAG5AA29). - EXCLUDES PARTS MARKED (A)

MU-27 MOTOR UNIT (ASSEM) INCLUDES ALL PARTS LISTED ON THIS PAGE EXCEPT PARTS MARKED (B)  
104036 MOTOR REPLACES 77953 MOTOR ON LATER MODELS.

(C) ON OLDER MODELS 99250 MOTOR-GOVERNOR FILTER OMITTED AND 70873 BRUSH HOLDER CAP USED INSTEAD OF 77911 BRUSH HOLDER CAP.

(D) 2846 WASHER USED IN PLACE OF 76555 WASHER ON OLDER MODELS.  
Figure 888. Motor unit parts.



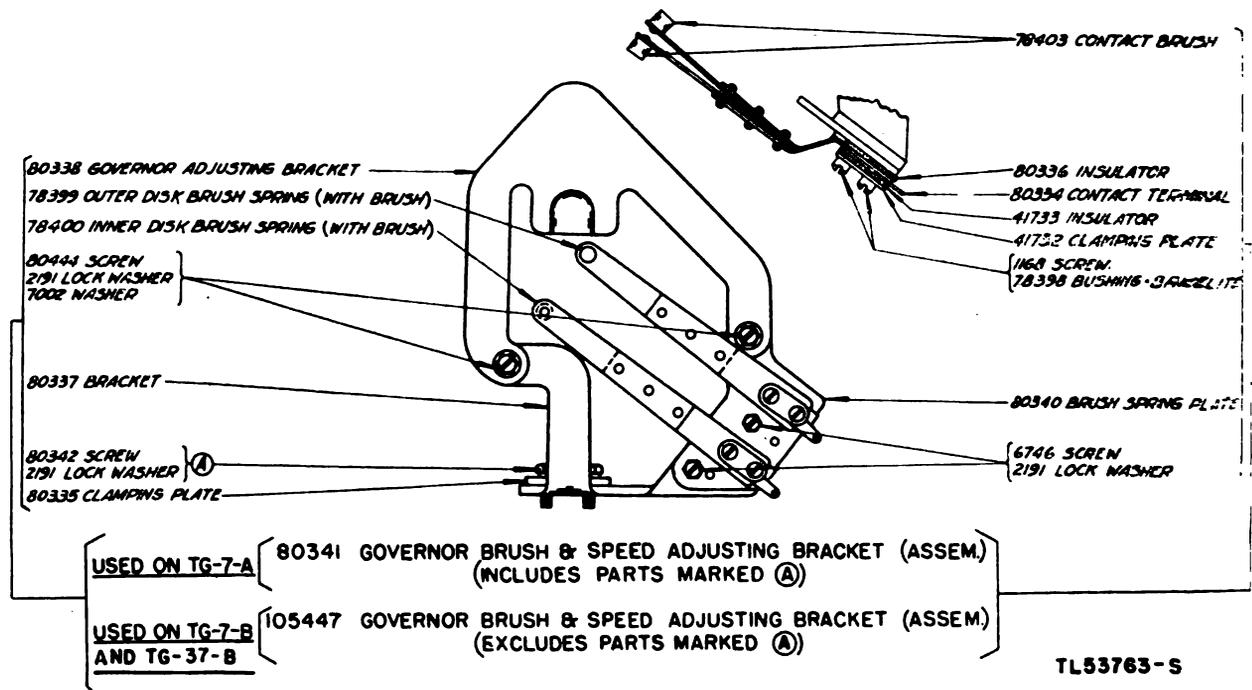
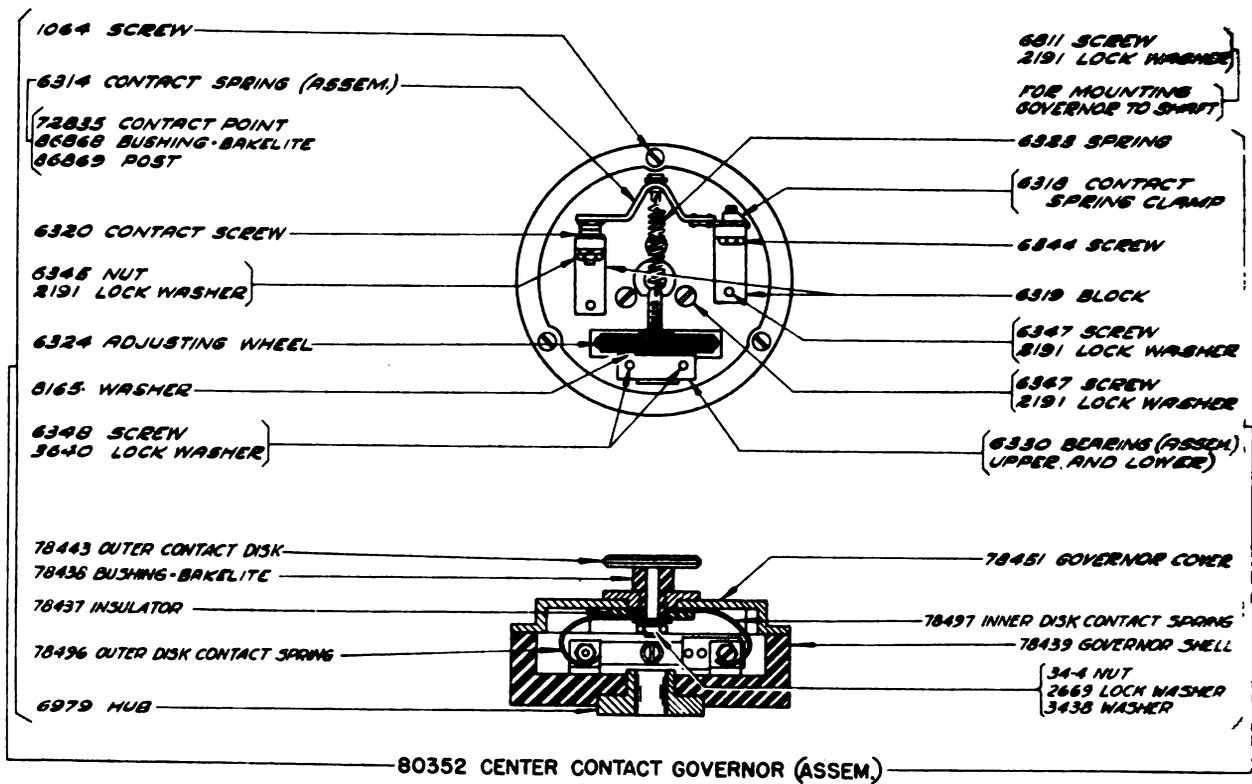
**HOLZER CABOT MOTOR**

104036 GOVERNED MOTOR, 1/25 H.P., 115 V., 50-60 CYCLE, A.C. SERIES (H.C. MODEL S-9050)

104038 MOTOR REPLACES 77953 MOTOR ON MU-27 MOTOR UNIT IN LATER MODELS

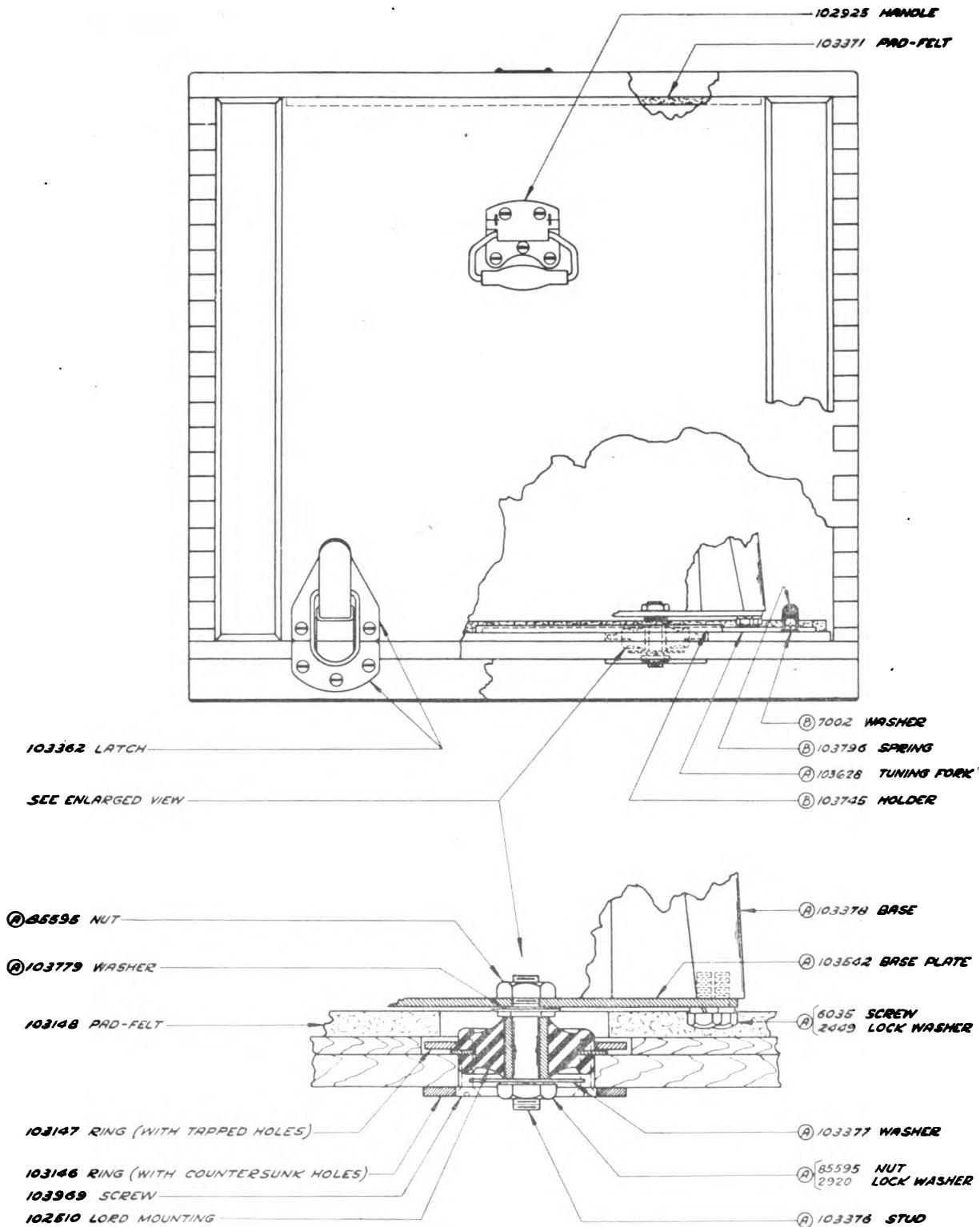
TL53767-S

Figure 259. Motor parts.



TL53763-S

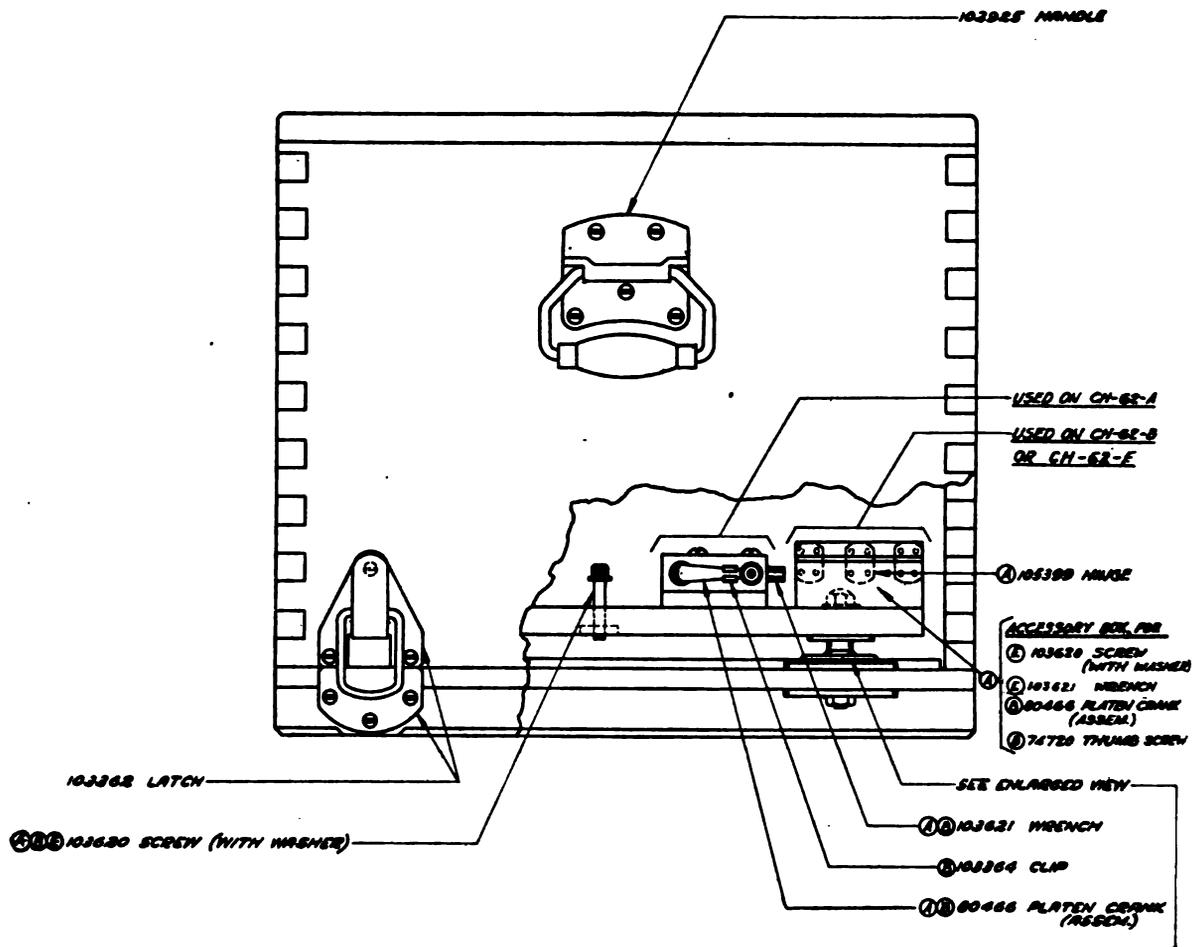
Figure 240. Governor parts.



103370 CHEST CH-50-A (ASSEM)  
(EXCLUDES PARTS MARKED (A))  
105229 CHEST CH-50-B OR CH-50-F (ASSEM)  
(EXCLUDES PARTS MARKED (A) AND (B))

TL53764-S

Figure 241. Chest CH-50-(\*) parts.



103608 SCREW-3" LONG  
103609 SCREW-2 1/2" LONG  
103610 WASHER

103611 SPACER

103147 RINGS (WITH TRAPPED HOLES)

103612 NUT  
2380 LOCK WASHER

103377 WASHER

103510 LORD MOUNTING

103145 RINGS (WITH COUNTERSUNK HOLES)

103368 SCREW

103377 WASHER

103368 CHEST CH-62-A (ASSEM.)  
(EXCLUDES PARTS MARKED (A))

105367 CHEST CH-62-B OR CH-62-F (ASSEM.)  
(EXCLUDES PARTS MARKED (B))

- (C) REPLACED BY 107091 LORD MOUNTING IN LATER MODELS OF CHEST CH-62-B OR CH-62-F
- (D) NOT USED IN LATER MODELS OF CHEST CH-62-B OR CH-62-F
- (E) REPLACED IN LATER MODELS OF CHEST CH-62-B OR CH-62-F BY 107078 AND 107079 CHANNEL CLAMPS AND ASSOCIATED PARTS

TL 53765-S

Figure 242. Chest CH-62-(\*) parts.

**107078 CHANNEL CLAMP-  
SHORT-LEFT SIDE**

**107080 CLAMP PLATE-  
LEFT SIDE**

**107079 CHANNEL CLAMP-  
LONG-RIGHT SIDE**

**107083 BOLT**

**107082 WING NUT**

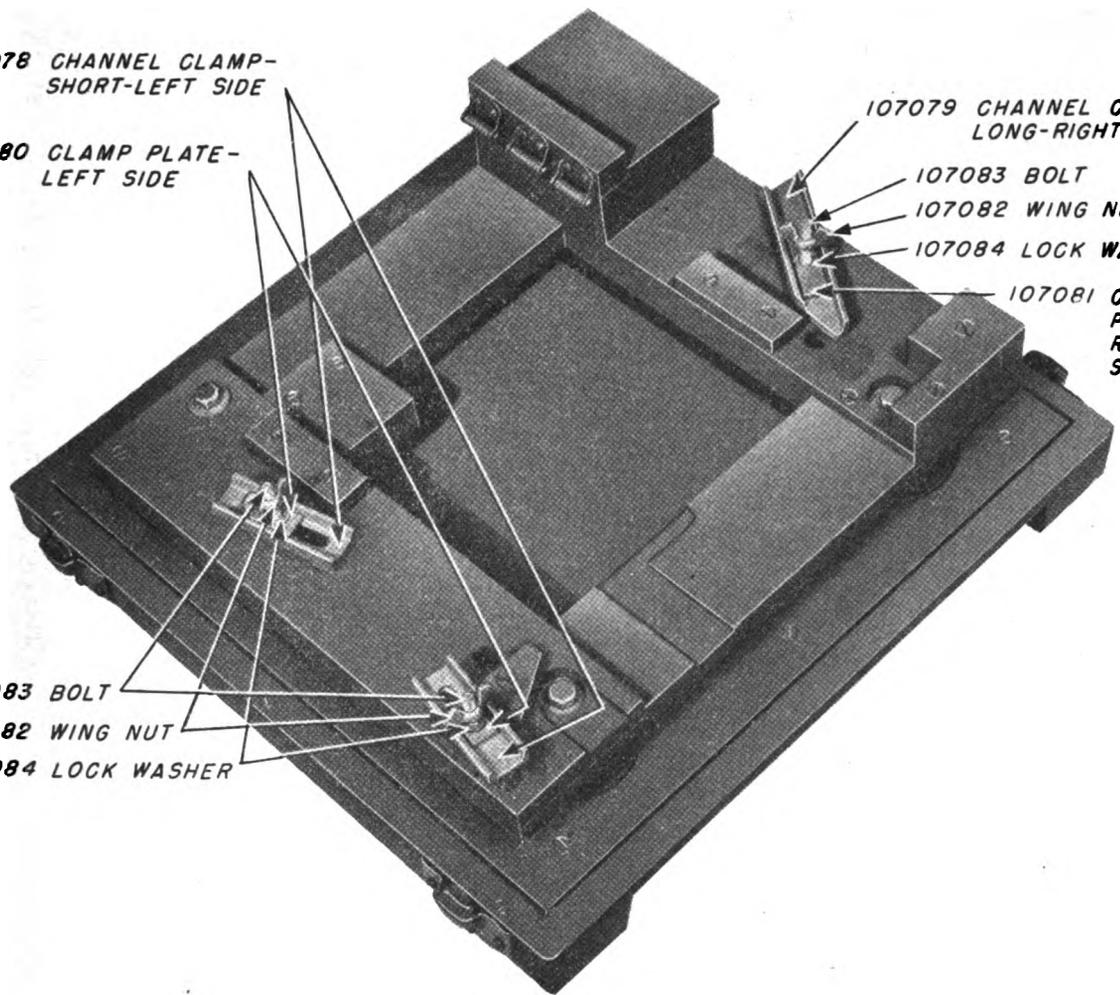
**107084 LOCK WASHER**

**107081 CLAMP  
PLATE-  
RIGHT  
SIDE**

**107083 BOLT**

**107082 WING NUT**

**107084 LOCK WASHER**



**PARTS LISTED ABOVE REPLACE 103620 SCREWS AND ASSOCIATED  
103621 WRENCH IN LATER MODEL OF CHEST CH-62-B OR CH-62-F TO  
IMPROVE MOUNTING ARRANGEMENT OF TYPING UNIT FOR TRANSPORTATION**



**91239 SPRING HOOK-  
LEFT**

**91240 SPRING HOOK-  
RIGHT**

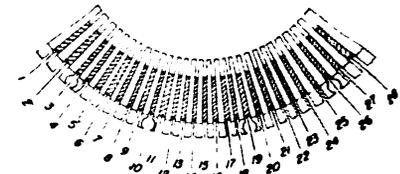
**SPRING HOOKS ARE USED IN LATER MODELS OF CHEST  
CH-62-B OR CH-62-F TO HOLD TYPE BAR CARRIAGE  
SECURELY DURING TRANSPORTATION.**

TL53771-S

*Figure 243. Improved parts for base of Chest CH-62-B or CH-62-F.*

NUMBER OF POSITION IN SEGMENT	PULL BARS		TYPE BARS (WITHOUT PALLETS)		TYPE-BAR PALLETS		TYPE BARS (WITH PALLETS)		PULL-BAR SPRING	SPRING CUSHION KEY TOPS	
	DESCRIPTION	PART NUMBER	NUMBER STAMPED ON TYPE BAR	PART NUMBER	DESCRIPTION	PART NUMBER	NUMBER STAMPED ON TYPE BAR	PART NUMBER		DESCRIPTION	PART NUMBER
1											
2	STANDARD	74106			-	Ⓐ 04025	2	07436		-	Ⓐ 00413
3	STANDARD	74106	3	74205	Z =	Ⓐ 74209	3	74043	7034	Z =	Ⓐ 70070
3	STANDARD	74106	3	74205	Z +	Ⓐ 02751	3	04736	7034	Z +	Ⓐ 00422
4	STANDARD	74106	4	74204	E ?	Ⓐ 74304	4	74044	7034	E ?	Ⓐ 70060
4	STANDARD	74106	4	74204	E -	Ⓐ 02183	4	04736	7034	E -	Ⓐ 00420
5	STANDARD	74106	5	74205	D ?	Ⓐ 74305	5	74045	7034	D ?	Ⓐ 70067
5	STANDARD	74106	5	74205	D ⊕	Ⓐ 02420	5	04737	7034	D ⊕	Ⓐ 00425
6	STANDARD	74106	6	74206	*P 0	Ⓐ 00560	6	102005	7034	*P 0	Ⓐ 00604
7	STANDARD	74106	7	74207	F 0	Ⓐ 74307	7	74047	7034	F 0	Ⓐ 70069
8	STANDARD	74106	8	74208	H .	Ⓐ 74308	8	74048	7034	H .	Ⓐ 70050
9	STANDARD	74106	9	74209	H ?	Ⓐ 74309	9	74049	7034	H ?	Ⓐ 70065
10	STANDARD	74106	10	74210	L J	Ⓐ 74310	10	74050	7034	L J	Ⓐ 70067
10	STANDARD	74106	10	74210	L \	Ⓐ 02154	10	04736	7034	L \	Ⓐ 00421
11	STANDARD	74106	11	74211	H Δ	Ⓐ 74311	11	74051	7034	H STOP	Ⓐ 02007
11	STANDARD	74106	11	74211	H †	Ⓐ 02151	11	04740	7034	H STOP	Ⓐ 100010
12	STANDARD	74106	12	74212	O 0	Ⓐ 74312	12	74052	7034	O 0	Ⓐ 70060
13	STANDARD	74106	13	74213	I 0	Ⓐ 74313	13	74053	7034	I 0	Ⓐ 70064
14	STANDARD	74106	14	74214	H .	Ⓐ 74314	14	74054	7034	H .	Ⓐ 70059
14	STANDARD	74106	14	74214	H ⊕	Ⓐ 04000	14	04742	7034	H ⊕	Ⓐ 00426
15	STANDARD	74106	15	74215	E 3	Ⓐ 74315	15	74055	7034	E 3	Ⓐ 70050
16	STANDARD	74106	16	74216	T 5	Ⓐ 74316	16	74056	7034	T 5	Ⓐ 70064
17	STANDARD	74106	17	74217	A -	Ⓐ 74317	17	74057	7034	A -	Ⓐ 70046
17	STANDARD	74106	17	74217	A †	Ⓐ 02147	17	04743	7034	A †	Ⓐ 00414
18	STANDARD	74106	18	74218	J .	Ⓐ 74318	18	74058	7034	J .	Ⓐ 70055
18	STANDARD	74106	18	74218	J †	Ⓐ 02152	18	04745	7034	J †	Ⓐ 00419
19	STANDARD	74106	19	74219	H Δ	Ⓐ 74319	19	74059	7034	H Δ	Ⓐ 70063
20	STANDARD	74106	20	74220	D 0	Ⓐ 74320	20	74060	7034	D 0	Ⓐ 70049
20	STANDARD	74106	20	74220	D †	Ⓐ 02140	20	04746	7034	D †	Ⓐ 00415
21	STANDARD	74106	21	74221	C :	Ⓐ 74321	21	74061	7034	C :	Ⓐ 70040
21	STANDARD	74106	21	74221	C ○	Ⓐ 02423	21	04747	7034	C ○	Ⓐ 00423
22	STANDARD	74106	22	74222	F †	Ⓐ 74322	22	74062	7034	F †	Ⓐ 70051
22	STANDARD	74106	22	74222	F →	Ⓐ 02149	22	04749	7034	F →	Ⓐ 00416
23	STANDARD	74106	23	74223	M 2	Ⓐ 74323	23	74063	7034	M 2	Ⓐ 70067
24	STANDARD	74106	24	74224	G Δ	Ⓐ 74324	24	74064	7034	G Δ	Ⓐ 74052
24	STANDARD	74106	24	74224	G \	Ⓐ 02150	24	04750	7034	G \	Ⓐ 00417
25	STANDARD	74106	25	74225	V :	Ⓐ 74325	25	74065	7034	V :	Ⓐ 70066
25	STANDARD	74106	25	74225	V ⊕	Ⓐ 02421	25	04752	7034	V ⊕	Ⓐ 00424
26	STANDARD	74106	26	74226	O 1	Ⓐ 74326	26	74066	7034	O 1	Ⓐ 70062
27	STANDARD	74106	27	74227	X /	Ⓐ 74327	27	74067	7034	X /	Ⓐ 70068
28	STANDARD	74106	28	74228	S '.	Ⓐ 74328	28	74068	7034	S BELL	Ⓐ 70060
									FIGS	Ⓐ 70072	
									LEFS	Ⓐ 70073	
									FOR ACT	Ⓐ 70076	
									LINE FEED	Ⓐ 70078	
									BLANK	Ⓐ 70071	

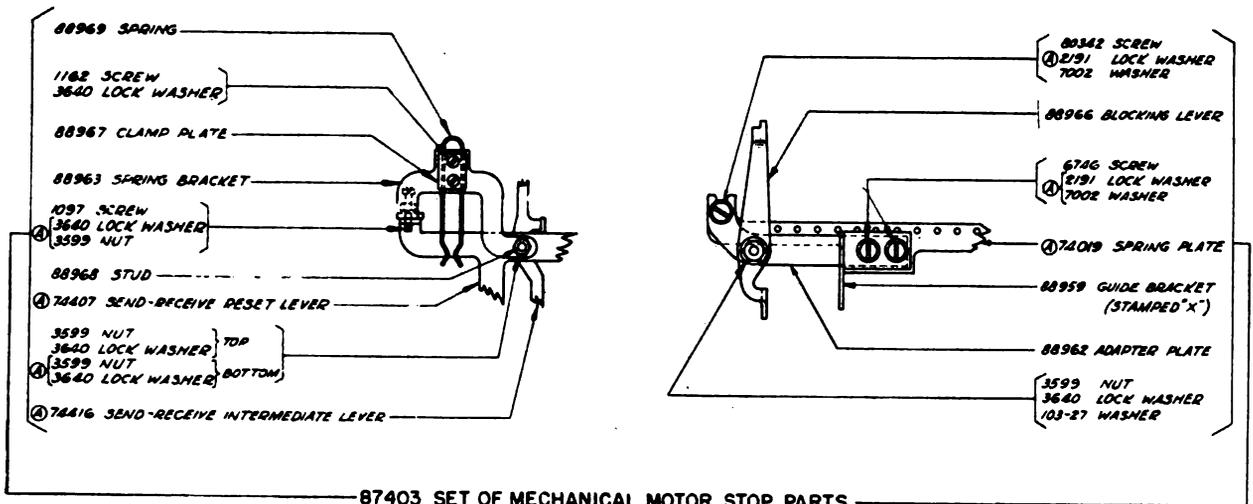
CODE BARS	
NO. STAMPED ON CODE BAR	CATALOG
10	74100
20	74101
30	74102
40	74103
50	74104



- Ⓐ PLUS Ⓑ - 103651 SET OF TYPE-BAR PALLETS (USED IN TG-7-A AND TG-7-B)
- Ⓐ PLUS Ⓒ - 105200 SET OF TYPE-BAR PALLETS (USED IN TG-37-B)
- Ⓒ - 82750 SET OF TYPE-BAR PALLETS (USED TO CONVERT TG-7-B TO TG-37-B)
- Ⓚ PLUS Ⓔ - 103652 SET OF SPRING CUSHION KEY TOPS (USED IN TG-7-A AND TG-7-B)
- Ⓚ PLUS Ⓕ - 107095 SET OF SPRING CUSHION KEY TOPS (USED IN TG-37-B)
- Ⓚ - 10644 SET OF SPRING CUSHION KEY TOPS (USED TO CONVERT TG-7-B TO TG-37-B)

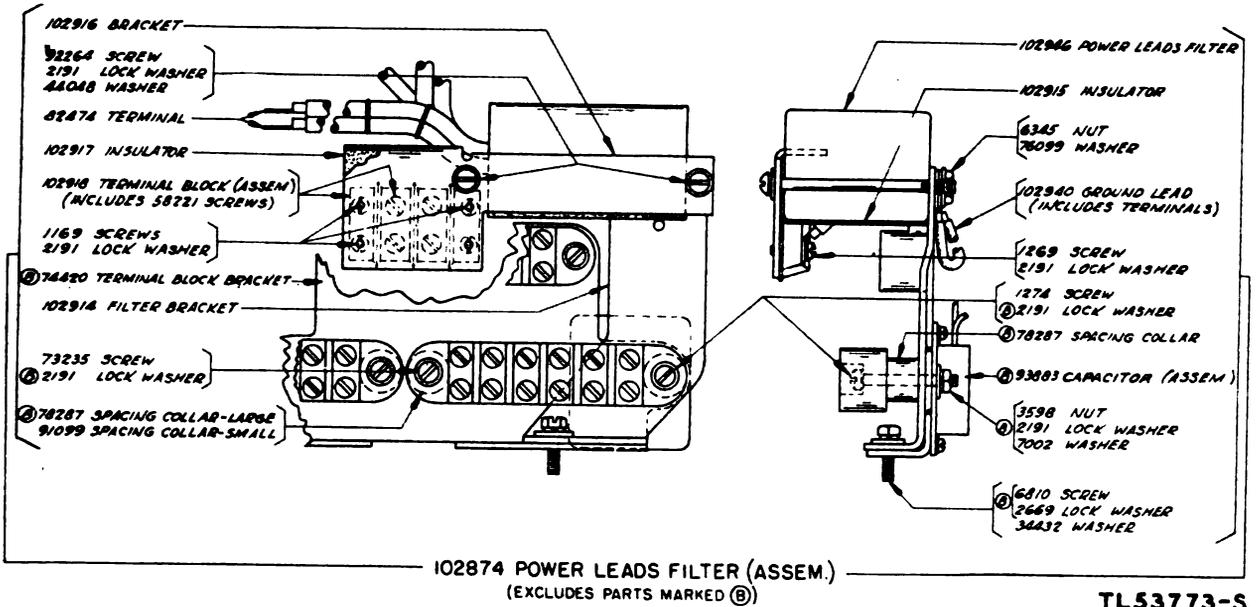
TL 53766-5

Figure 244. Pull bars, type bars, and key tops parts.



TL53772-S

Figure 245. Motor-stop parts for Teletypewriter TG-37-B.



TL53773-S

Figure 246. Power leads filter parts.



## 10. Numerical Index to Parts Identification Illustrations

All the parts used in teletypewriter equipment are assigned basic part numbers that remain fixed regardless of the equipment in which they are used. The part number is usually the only means of definite identification because of similarity of parts. This is especially true of springs, bolts, screws, nuts, washers, lockwashers, etc., which look alike but are different in material, tension, etc. The same parts are also

used in different assemblies and frequently use the name of the assembly as part of the descriptive name for each particular use. Some parts with the same name are different parts with different part numbers. Parts are listed in numerical order with the basic name and description of the part and parts identification illustrations in which the parts appear. A figure number is listed only once after a part regardless of the number of times the part appears in the *same* figure.

Part No.	Name of part	Fig. Nos.
C-146	Cover (assem.): black wrinkle	237
M-169	Magnet: 355 ohms	232
M-177	Magnet coil: 105 ohms	225
MU-27	Motor unit (assem.)	238
33-15	Screw: 2-56 x 1/8"	232
33-38	Screw: 4-40 shoulder	223, 230
33-41	Screw: 6-40 shoulder	221, 227
33-43	Screw: 2-56 x 3/4"	232
33-50	Screw: 4-40 shoulder	237
33-86	Screw: 4-40 x 1/8"	233
33-111	Screw: 2-56 x 9/64"	226
33-168	Screw: 6-40 pilot	226
33-170	Screw: 4-40 shoulder	226
33-179	Screw: 8-32 x 3/8"	229
33-227	Screw: 4-40 shoulder	224, 237
33-280	Screw: 2-56 x 3/16"	237
33-344	Screw: 10-32 x 3/4"	218
34-1	Nut: 1/4"-32 hex	221, 225, 226, 227
34-4	Nut: 10-32 hex	217, 218, 220 to 227, 229, 231, 238, 240
34-10	Nut: 8-40 hex	227
34-11	Nut: 2-56 hex	225, 234, 237
34-48	Nut: 6-32 hex	235
34-51	Nut: 6-40 hex	221
34-56	Nut: 4-40 hex	220, 224, 225, 233, 236, 237
34-59	Nut: 10-32 hex	238
34-66	Nut: 4-36 hex	237
35-70	Spring	230
35-89	Spring	235
36-150	Dowel	217, 218, 222
43-10	Plunger stop	232
103-27	Washer	224, 226, 227, 230, 233, 237, 245
122-26	Washer	225
122-29	Dowel	217, 218
122-67	Spring post	224
123-244	Washer	217, 224
126-123	Outlet bushing	238
200-1348	Washer	230
1010	Screw: 6-40 shoulder	227
1020	Screw: 6-40 x 1/4"	219
1026	Screw: 6-40 x 3/8"	221, 222, 224, 227, 229, 232
1028	Screw: 4-40 x 1/4"	229, 232
1030	Screw: 6-40 shoulder	225, 237
1035	Screw: 4-40 x 3/8"	223
1038	Screw: 6-40 x 9/32"	235
1051	Screw: 4-40 x 1/2"	230
1064	Screw: 6-32 x 1/4"	240
1072	Screw: 6-40 thumb	237
1073	Screw: 6-40 thumb	225
1097	Screw: 4-40 x 1 1/32"	223, 245
1100	Screw: 1/4"-32 pilot	238
1160	Screw: 6/40 x 9/16"	220, 222, 225, 228, 229

Part No.	Name of part	Fig. Nos.
1161	Screw: 6-40 x 1/4"	217, 223, 224, 226, 228
1162	Screw: 4-40 x 1/4"	224, 225, 226, 227, 245
1163	Screw: 4-40 x 3/16"	233
1166	Screw: 4-36 x 1/2"	229
1168	Screw: 4-40 x 3/16"	218, 226, 227, 230, 240
1169	Screw: 6-40 x 7/16"	235, 245
1174	Screw: 4-40 shoulder	227
1176	Screw: 6-40 x 3/16"	224, 229, 231
1193	Screw: 10-32 x 1/8"	229
1196	Screw: 6-40 shoulder	217, 221, 224, 226
1206	Screw: 4-40 x 9/16"	233
1208	Screw: 10-32 x 5/8"	220, 221, 230
1222	Screw: 2-56 x 1/2"	223
1224	Screw: 6-40 special	229
1226	Screw: 6-40 x 3/8"	220, 229
1245	Screw: 10-32 x 1"	218, 221, 229
1248	Screw: 6-40 x 1/2"	221, 223, 235
1266	Screw: 6-32 x 7/16"	233
1269	Screw: 6-40 x 1/2"	224, 246
1272	Screw: 6-40 x 1 1/16"	238
1274	Screw	246
1291	Screw: 6-32 x 3/4"	237
1294	Screw: 4-36 x 1/2"	237
1297	Screw: 6-40 x 2 1/16"	231
2034	Washer	225
2191	Lockwasher	217 to 238, 240, 245, 246
2199	Nut: 7/16"-32 hex	236
2201	Nut: 5/16"-32 hex	228
2247	Washer	233
2248	Pin	224
2291	Contact spring: lower	229
2322	Lockwasher	217, 221, 226, 237
2378	Spacer key lever	235
2382	Lockwasher	217
2407	Lockwasher	236
2438	Washer	232
2449	Lockwasher	217, 220, 221, 227, 229, 232, 241
2451	Ball	226, 227
2502	Mounting strip	236
2503	Plate	236
2504	Insulator strip	236
2525	Key lever guide: front	235
2526	Spacing collar	236
2528	Spring plate	235
2529	Bushing	236
2539	Nut: 3/8"-32 hex	217, 218
2565	Key lever spring	235
2574	Upstop	235
2623	Spring	236
2663	Buffer: rubber	235
2666	Lockwasher	227

Part No.	Name of part	Fig. Nos.	Part No.	Name of part	Fig. Nos.
2669	Lockwasher	217 to 224, 226 to 232, 238, 240, 246	6746	Screw: 6-40 x 5/16"	217, 218, 220, 221, 222, 225, 226, 227, 228, 231, 232, 234, 235, 236, 238, 240, 245
2719	Washer	223	6760	Shim	222
2846	Washer	229, 238	6799	Screw: 6-40 shoulder	225
2920	Lockwasher	229, 241, 242	6800	Screw: 6-40 shoulder	217, 218, 220, 224, 227, 236
2924	Contact spring: upper	229	6801	Screw: 4-40 pilot	225
3106	Turnbuckle	217	6805	Screw: 6-40 shoulder	227, 236
3110	Nut: 10-32 hex	217	6810	Screw: 10-32 x 3/8"	217, 218, 221, 223, 229, 230, 231, 246
3131	Link end: short	217	6811	Screw: 6-40 x 5/8"	217, 218, 219, 220, 224, 225, 229, 230, 236, 238, 240
3288	Washer	228	6814	Screw: 8-40 pilot	225, 236
3298	Eccentric stop	220, 225	6827	Connecting block	231
3339	Nut: 9/16"-32 hex	223	6830	Trip latch	225
3340	Lockwasher	223	6850	Bell crank	225
3438	Washer	221, 222, 231, 232, 234, 237, 240	6859	Spacer collar	228
3458	Shim	235	6861	Washer: felt	219
3571	Bushing: bakelite	223	6863	Cam sleeve disk	219
3595	Nut: 1/4"-32 hex	217, 221, 232	6909	Stop lever	225
3598	Nut: 6-40 hex	217, 220, 221, 223 to 229, 231, 233, 235, 236, 237, 246	6940	Spring post	221, 222, 227
3599	Nut: 4-40 hex	223, 224, 226, 227, 230, 235, 245	6942	Screw: 4-40 eccentric	225, 236
3603	Nut: 1/4"-32 hex	217, 220	6966	Eccentric stop	225
3606	Nut: 6-40 hex	227, 228, 235	6970	Nut: 3/8"-32 hex	224
3617	Washer	232	6971	Clutch throw-out lever	225
3618	Insulator	223, 232	6979	Hub	240
3628	Bushing: bakelite	234	6987	Spacer	228
3640	Lockwasher	218, 220, 223, 224, 225, 226, 227, 230, 232, 233, 235, 236, 237, 240, 245	6990	Screw: 1/4"-32 pilot	225
3646	Lockwasher	223, 231	6993	Clutch spring	219
3647	Insulator	223, 232	6998	Post	225
3649	Washer	221	7001	Washer	225, 228
3650	Washer	229, 232	7002	Washer	218, 220 to 230, 232 to 238, 240, 241, 246
3897	Bushing	230	7007	Trip plunger	225
3899	Collar	232	7022	Reverse lever: left	227
4293	Insulator	229, 230	7023	Reverse lever: right	227
4323	Ball	219	7024	Reverse pawl: left	227
4703	Spring	227	7025	Reverse pawl: right	227
4708	Spring	222	7032	Pawl	236
4810	Wick: felt	236	7036	Collar	224
4812	Wick: felt; 3/8" long	220	7044	Link	227
4814	Lockwasher	228, 229	7081	Post	236
4852	Lockwasher	221	7093	Terminal block	230
4871	Screw: 3/16"-24 x 4"	232, 234	7094	Connection spring	229, 230
4881	Spring backing	236	7095	Spring plate	229, 230
5061	Ball bearing	238	7096	Bushing: bakelite	229, 230
5446	Screw: 6-40 x 9/16"	221	7105	Target: 10 spots	238
5599	Nut: 8-32 hex	229	7318	Contact lever	236
6035	Screw: 1/4"-20 x 5/8"	229, 241	7334	Post	235
6314	Contact spring (assem)	240	7372	Bearing bracket	236
6318	Contact spring clamp	240	7373	Bearing bushing	236
6319	Block	240	7377	Lock loop	236
6320	Screw: 6-32 contact	240	7381	Contact mounting (assem)	236
6323	Spring	240	7382	Front bracket	236
6324	Adjusting wheel	240	7383	Oiler	236
6330	Bearing (assem): upper and lower	240	7385	Rear bracket (with 7081 posts)	236
6344	Screw: 6-32 x 11/32"	240	7386	Post	236
6345	Nut: 6-32 hex	240, 246	7387	Brace	236
6347	Screw: 6-32 x 3/8"	240	7389	Clutch: driving	236
6348	Screw: 4-36 x 3/4"	240	7391	Clutch: driven	236
6685	Sword	225	7396	Bracket: left	235
6689	Separator plate	225	7397	Bracket: right	235
6706	Magnet bracket	225	7398	Spring plate	229, 230
6745	Screw: 10-32 x 1/2"	217, 218, 220, 222, 223, 226 to 230	7399	Spring stiffener	229, 230
			7409	Clutch lever	236
			7602	Spring	235
			7603	Spring	225

Part No.	Name of part	Fig. Nos.	Part No.	Name of part	Fig. Nos.
7607	Collar	225	70803	Screw: 6-40 pivot	225
7612	Spring	225	70872	Brush holder: (with insulator)	238
7614	Spring	225	70873	Brush-holder cap	238
7615	Spring	225	70886	Washer	221
7634	Spring	226, 227, 244	70887	Nut: $\frac{3}{16}$ "-24 hex	232
7654	Shim	236	70892	Nut: $\frac{1}{8}$ "-27 hex	231
7661	Adjusting lever	238	70893	Nipple	231
7678	Screw: 4-40 pilot	224	71045	Nut: 6-40 special	225
7679	Roller	224	71046	Screw: 6-40 special	225
7835	Ribbon: black	228	71073	Washer	225
7959	Magnet bracket	232	71161	Bushing	236
8094	Brush: (with spring)	238	71189	Copper bearing retainer	238
8097	Cam sleeve	236	71445	Link	225
8157	Selector lever: right	225	71449	Key lever guide: rear	235
8158	Selector lever: left	225	71505	Oil wick: felt	219
8165	Washer	240	71659	Screw: 6-40 shoulder	218
8184	Washer	224	71681	Ribbon spool: empty	228
8222	Wearing strip	238	71696	Range scale: (with bell crank mounting)	225
8254	Cable clamp	226	71697	Clamping plate	225
8330	Washer	226, 227, 238	71976	Stop lever plate	225
8451	Terminals	225	71998	Brush-holder: with 80706 screw	238
8470	Post	225	71999	End play spring	228
8472	Locking wedge	225	72472	Shim	235
8507	Cam sleeve	219	72484	Control relay (assem): (with mounting screws)	232
8508	Armature	225	72501	Shaft	235
8511	Locking lever	225	72508	Screw: 6-40 x $\frac{3}{4}$ "	229
8513	Message line guide (assem)	237	72509	Lockwasher	221, 224
8514	Stop plate	237	72513	Driving disk	219
8539	Screw: 6-40 x $\frac{1}{2}$ "	219, 220, 224 to 230, 232, 233, 235, 236	72514	Spring	219
8543	Screw: 6-40 x $\frac{1}{4}$ "	224	72515	Nut: $\frac{5}{16}$ "-32 hex	219
8671	Screw: 6-40 shoulder	225	72516	Retaining disk	219
8686	Filler: wood	237	72517	Nut: $\frac{5}{16}$ "-32 special	219
8783	Locking lever	235	72521	Oil wick: felt	219
8884	Terminal block	220, 238	72545	Post	235
8896	Shim	220, 228, 236	72562	Clutch: driving	219
8990	Retainer	237	72563	Washer: felt	219
9177	Contact stop	236	72643	Stud	235
9178	Contact spring	236	72644	Ball bearing	219
9182	Contact lever shaft	236	72835	Contact point	240
9203	Bracket: with rollers	235	73175	Lockwasher	217, 218, 231
9209	Key lever: center	235	73180	Switch (assem)	234
9210	Key lever: upper	235	73231	Steel bearing retainer	238
9695	Plunger	232	73232	Washer: felt	238
34432	Washer	217, 218, 220, 221, 223, 225, 226, 227, 228, 230, 246	73235	Screw	246
36826	Washer	217	73236	Field frame: (with oiler)	238
35858	Margin bell	218	73237	End shield: (with oiler)	238
36273	Washer	227, 235	73242	Insulation: for one field coil	238
41341	Platen crank	223	73243	Locking wedge	238
41342	Screw: 8-40 x $\frac{1}{4}$ "	223	73244	Screw: 10-32 x $\frac{7}{8}$ "	238
41543	Ball bearing	221	73276	Screw: 6-40 shoulder	221
41663	Washer	236	73357	Terminal end (assem)	232
41675	Washer	224, 227, 228	73427	Shim	226
41732	Clamping plate	230, 240	73497	Plug: red shell	234
41733	Insulator	230, 240	73588	Contact spring	223, 232
43954	Bell	221	73592	Spring plate	232
44048	Washer	246	73593	Contact spring	223, 232
45104	Spring	224	73595	Clamping rod	238
46092	Nut: 10-32 hex	217	73641	Message line guide	237
49158	Screw	234	73670	Terminal block (assem)	229, 232
55063	Spring	224	74001	Keyboard shaft	236
55088	Spring	220, 221	74003	Selector mounting plate: (with posts)	225
58221	Screw	246	74005	Shaft	222
70177	Screw: 6-40 pilot	235	74006	Bushing	226
70324	Bearing	235	74008	Roller	226
70529	Stiffener	230	74009	Pawl latch	225
70593	Screw: 6-40 thumb	218	74010	Roller	226
70707	Bracket	232	74011	Screw: 6-40 shoulder	217, 224
70724	Insulation strip	232	74013	Printing bail blade	220
70771	Oiler	238	74014	Screw: 10-32 x $\frac{3}{4}$ "	222, 229, 230, 231, 233
70793	Washer	228	74015	Spring	220
70796	Spool cup	228	74016	Post	217, 218

Part No.	Name of part	Fig. Nos.	Part No.	Name of part	Fig. Nos.
74017	Screw: 6-40 shoulder	220, 221	74130	Function lever No. 9: space	222
74018	Piston rod	217	74131	Function lever No. 2: carriage return.	222
74019	Spring plate	222	74132	Spacing gear: 6 teeth	219
74020	Screw: 6-40 eccentric	224	74133	T-lever No. 1	225
74021	Bell crank No. 1	228	74134	T-lever No. 2	225
74022	Bell crank No. 2	228	74135	T-lever No. 3	225
74023	Bell crank No. 3	228	74136	T-lever No. 4	225
74024	Bell crank No. 4	228	74137	T-lever No. 5	225
74025	Bell crank No. 5	228	74138	Function lever No. 4: bell	222
74026	Collar	220, 221	74140	Printing and function cam	219
74027	Screw: 1/4"-32 special	217	74142	Cylinder head	217
74028	Dash-pot cylinder	217	74143	Ball bearing retainer	221
74029	Piston head	217	74144	Spacing pawl arm	220
74031	Platen bracket: right	224	74148	Bell hammer	220
74032	Washer	217	74150	Bell operating lever	220
74033	Washer: leather	217	74151	Gear: 35 teeth	238
74036	Nut: 10-32 hex	226, 227	74152	Spring	219
74037	Motor-stop lever	225	74153	Bearing	219
74039	Function lever No. 10: blank	222	74154	Lower spacing gear	221
74040	Function lever No. 1: locking	222	74156	Screw: 10-32 special	220
74041	Type basket	226, 227	74158	Function bail blade	220
74042	Selector vane No. 1	222	74160	Carriage-return lock bar	221
74043	Selector vane No. 2	222	74161	Lock bar latch	217
74044	Selector vane No. 3	222	74162	Sliding joint	221
74045	Selector vane No. 4	222	74163	Shift push bar	220
74046	Selector vane No. 5	222	74164	Spacing shaft	221
74049	Screw: 4-40 shoulder	225	74166	Driving disk	219
74050	Margin bell cam	218	74169	Pivot clamp	222
74051	Lever	218	74170	Screw: 10-32 pivot	222
74053	Slip connection mounting plate (assem).	230	74171	Screw: 6-40 eccentric	217
74055	Roller	217	74172	Screw: 10-32 eccentric	217
74056	Retaining plate	217, 218	74173	Bell latch bar	220
74058	Detent lever	217	74175	Bracket	220
74059	Screw: 6-40 x 1/2"	222, 224, 229, 231, 232	74178	Bracket	218
74061	Clutch	219	74179	Vertical feed shaft	228
74062	Track: lower	226	74180	Code bar No. 1-D	244
74066	Shift link bracket	220	74181	Code bar No. 2-D	244
74068	Latch bar	221	74182	Code bar No. 3-D	244
74069	Reset bar	221	74183	Code bar No. 4-D	244
74071	Clutch fork	221	74184	Code bar No. 5-D	244
74072	Operating lever	221	74185	Pull bar: standard	244
74076	Screw: 1/4"-32 shoulder	217	74186	Disk	224
74077	Screw: 10-32 shoulder	217, 220	74187	Pull bar guide	227, 228
74078	Latch link	221	74190	Spacing clutch	221
74079	Line-feed bail	217	74191	Latch	222
74080	Shift link	220	74192	Upper spacing gear	221
74081	Line-feed push bar	217	74194	Stud	226
74082	Shift lever	217	74195	Roller	226
74083	Vertical link	217	74196	Stud	227
74085	Washer: felt	219	74197	Roller	227
74089	Printing bail arm	220	74198	Ball race	227
74091	Motor plate	229, 238	74199	Eccentric bushing	228
74095	Spacing collar	220	74200	Track: upper	226
74096	Space pawl: front	220	74203	Type bar No. 3: without pallet	244
74097	Space pawl: rear	220	74204	Type bar No. 4: without pallet	244
74098	Shaft	220	74205	Type bar No. 5: without pallet	244
74099	Ball retainer ring	219	74206	Type bar No. 6: without pallet	244
74100	Washer: leather	219	74207	Type bar No. 7: without pallet	244
74101	Oil plug	219	74208	Type bar No. 8: without pallet	244
74107	Bearing	220	74209	Type bar No. 9: without pallet	244
74109	Function lever No. 5: universal	222, 245	74210	Type bar No. 10: without pallet	244
74110	Post	221	74211	Type bar No. 11: without pallet	244
74111	Shaft	217	74212	Type bar No. 12: without pallet	244
74112	Screw: 10-32 pilot	220	74213	Type bar No. 13: without pallet	244
74119	Bail shaft bearing	217	74214	Type bar No. 14: without pallet	244
74121	Latch bell crank	221	74215	Type bar No. 15: without pallet	244
74122	Screw: 6-40 x 3/4"	220	74216	Type bar No. 16: without pallet	244
74124	Spacing cross bar: (assem)	221	74217	Type bar No. 17: without pallet	244
74126	Support	226	74218	Type bar No. 18: without pallet	244
74127	Function lever No. 12: line feed	222	74219	Type bar No. 19: without pallet	244
74128	Function lever No. 3: figures shift.	222	74220	Type bar No. 20: without pallet	244
74129	Function lever No. 11: letters shift.	222	74221	Type bar No. 21: without pallet	244
			74222	Type bar No. 22: without pallet	244
			74223	Type bar No. 23: without pallet	244
			74224	Type bar No. 24: without pallet	244

Part No.	Name of part	Fig. Nos.	Part No.	Name of part	Fig. Nos.
74225	Type bar No. 25: without pallet	244	74345	Reverse arm: left	228
74226	Type bar No. 26: without pallet	244	74358	Bracket	226
74227	Type bar No. 27: without pallet	244	74359	Draw strap	221
74228	Type bar No. 28: without pallet	244	74361	Screw: 6-40 shoulder	224
74230	Clutch: driving	221	74363	Bail	226, 227
74239	Clutch bushing	219	74366	Spacing rack	227
74240	Roller	227	74367	Screw: 10-32 x 1/16"	227
74241	Clutch: driven	221	74368	Operating bail roller: (assem)	227
74243	Basket guide roller (assem)	227	74371	Ribbon carrier	226
74244	Printing bail: (with 87509 spring-post)	220	74372	Link	227
74246	Motor stop pawl: inner	225	74373	Type-bar segment	226
74247	Shift stop post	224	74374	Pull-bar bail plunger	227
74248	Roller stud	224	74376	Bracket	227
74249	Screw: 1/4"-32 pilot	217	74378	Margin bell pawl	226
74251	Dash-pot lever	217	74379	Bracket	226
74252	Screw: 3/8"-32 pilot	217, 218	74380	Shaft: (with detent and gears)	227
74253	Stud	227	74381	Feed pawl	227
74254	Rear cross bar	220	74383	Bearing: right	227
74255	Function lever comb	222	74384	Spool gear	228
74259	Detent	223	74385	Spur gear	228
74264	Platen shaft: (with 104995 pin)	223	74390	Reverse bail	227
74269	Washer	221	74392	Spool bracket	228
74271	Clamping washer	221	74394	Spool shaft	228
74272	Spring	221	74395	Relay guard	231
74275	Shaft	221	74397	Draw strap post	226
74276	Ball bearing	221	74398	Ratchet shaft	227
74278	Escapement lever	221	74399	Screw: (6-40 pilot)	225
74279	Strip: leather	226	74401	Ribbon oscillator	226
74281	Type-bar backstop (assem)	226	74407	Sending-receiving reset lever	223, 245
74283	Spring washer	217, 218, 223	74408	Post	223
74286	Bail guide	228	74409	Contact lever	222
74289	Back stop	225	64410	Frame: left (with bearing cap, screws, and lockwashers)	217
74291	Spring bracket	225	74412	Bushing	221
74292	Screw: 10-32 shoulder	227	74413	Back stop	220
74294	Adapter plate	226	74414	Type-bar guide	226
74296	Screw: 6-40 pilot	226	74415	Guide bracket	222
74297	Latch plate	221	74416	Sending-receiving intermediate lever	223, 245
74300	Spring drum (assem)	221	74417	Send-receiving T-lever	223
74303	Type-bar pallet: Z"	244	74420	Bracket	229, 246
74304	Type-bar pallet: K	244	74421	Bracket	231
74305	Type-bar pallet: B?	244	74422	Relay mounting bracket	229, 231
74307	Type-bar pallet: Y 6	244	74425	Receptacle	229
74308	Type-bar pallet: M	244	74430	Strap	232
74309	Type-bar pallet: U 7	244	74432	Mounting strip	230
74310	Type-bar pallet: L	244	74433	Cover	230
74311	Type-bar pallet: H 8	244	74435	Platen bracket: left	224
74312	Type-bar pallet: O 9	244	74437	Slide bar	224
74313	Type-bar pallet: I 8	244	74438	Platen: rubber	223
74314	Type-bar pallet: N	244	74446	Line-feed ratchet	223
74315	Type-bar pallet: E 3	244	74447	Detent ratchet	223
74316	Type-bar pallet: T 5	244	74448	Bushing	224
74317	Type-bar pallet: A	244	74449	Bushing	224
74318	Type-bar pallet: J	244	74451	Release lever shaft	224
74319	Type-bar pallet: R 4	244	74452	Release shaft	224
74320	Type-bar pallet: D 8	244	74454	Release cam	224
74321	Type-bar pallet: C	244	74455	Paper chute	224
74322	Type-bar pallet: F 1	244	74457	Guide lever	224
74323	Type-bar pallet: W 2	244	74460	Shaft	224
74324	Type-bar pallet: G &	244	74463	Adjusting lever	224
74325	Type-bar pallet: V	244	74465	Line-feed lever	224
74326	Type-bar pallet: Q 1	244	74467	Line-feed pawl	224
74327	Type-bar pallet: X /	244	74469	Paper finger: right	224
74328	Type-bar pallet: S	244	74470	Paper finger: left	224
74329	Reverse shaft	228	74473	Straightener rod stop	224
74330	Spring	226	74476	Straightener rod	224
74331	Lockout spring	226	74478	Single-double line-feed lever	224
74332	Roller: flanged	227	74479	Bushing	224
74334	Washer	226	74480	Retaining spring	224
74335	Shift lever	226	74481	Detent roller	224
74337	Roller: upper	227	74490	Roller: rubber; front	224
74338	Release crank	224	74491	Roller: rubber; rear	224
74339	Platen cross bar	224	74493	Spacer: short	224
74342	Eccentric stud	227	74494	Spacer: long	224
74343	Stud	227	74499	Bearing cap: left	227
74344	Reverse arm: right	228			

Part No.	Name of part	Fig. Nos.	Part No.	Name of part	Fig. Nos.
74500	Bearing: left	227	74644	Type bar No. 4: with pallet, K (	244
74501	Bearing cap: left	227	74645	Type bar No. 5: with pallet, B ?	244
74502	Clutch: driven	219	74647	Type bar No. 6: with pallet, Y 6	244
74503	Function bail: (with 87509 spring post).	220	74648	Type bar No. 8: with pallet, M	244
74505	Pinion	238	74649	Type bar No. 9: with pallet, U7	244
74508	Spring drum	221	74650	Type bar No. 10: with pallet, L )	244
74511	Friction spring	227	74651	Type bar No. 11: with pallet, H £	244
74512	Basket support roller (assem)	226	74652	Type bar No. 12: with pallet, O 9	244
74513	Fulcrum rod	226	74653	Type bar No. 13: with pallet, I 8	244
74514	Screw: 4-40 x 7/8"	230	74654	Type bar No. 14: with pallet, N ,	244
74517	Screw: 6-40 x 1/2"	223	74655	Type bar No. 15: with pallet, E 3	244
74519	Paper-finger shaft	224	74656	Type bar No. 16: with pallet, T 5	244
74520	Screw: 6-40 eccentric	223	74657	Type bar No. 17: with pallet, A -	244
74521	Bevel gear	228	74658	Type bar No. 18: with pallet, J ' /	244
74523	Spacer bar	235	74659	Type bar No. 19: with pallet, R 4	244
74525	Screw: 1/4"-32 thumb	235	74660	Type bar No. 20: with pallet, D \$	244
74526	Collar	238	74661	Type bar No. 21: with pallet, C :	244
74528	Spacer bar loop	235	74662	Type bar No. 22: with pallet, F !	244
74529	Bracket	235	74663	Type bar No. 23: with pallet, W 2	244
74531	Switch cover	229	74664	Type bar No. 24: with pallet, G &	244
74532	Keyboard base: black gloss	235	74665	Type bar No. 25: with pallet, V ;	244
74534	Bearing bracket	221	74666	Type bar No. 26: with pallet, Q 1	244
74536	Screw: 6-40 x 5/32"	223, 224, 228	74667	Type bar No. 27: with pallet, X /	244
74538	Bracket	223	74668	Type bar No. 28: with pallet, S ' /	244
74539	Plate	223	74670	Strap	232
74545	Release lever	225	74682	Screw: 10-32 x 1 1/8"	232
74548	Spring	221	74684	Contact spring	230
74551	Cover: bakelite	229	74685	Contact spring	230
74552	Vane frame: (with post)	222	74686	Shift vane No. 6	220, 222
74554	Spring post	217, 224, 225	74687	Screw: 6-40 x 5/8"	227
74556	Motor-stop pawl: outer	225	74688	Upshift-on-space cut-out lever: short.	223
74557	Lamp: clear; 115 volts	231	74689	Guide post	228
74558	Socket	231	74690	Transmitter (assem): (with 7381 contact mounting).	236
74559	Shaft	224	74692	Spring post	217, 220
74561	Line-feed check post	224	74693	Post	224
74562	Screw: 6-40 special	224	74694	Friction arm	223
74563	Line-feed check lever	224	74695	Friction sleeve	233
74564	Detent lever	224	74700	Spring	226
74566	Screw: 10-32 shoulder	224	74703	Spring	225
74567	Screw: 1/4"-20 x 9/16"	229, 238	74704	Spring	217
74568	Terminal block	229	74705	Spring	222
74569	Terminal block	235	74706	Spring	224
74572	Cable: keyboard	235	74707	Spring	217
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