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ROYAL TYPEWRITER

MAINTENANCE AND REPAIR

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

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ROYAL TYPEWRITER MAINTENANCE AND REPAIR

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CHAPTER 1
INTRODUCTION

1. Scope

This manual contains information necessary for the maintenance and repair of Royal standard typewriters. It deals with only those phases of operation that are necessary to enable the repairman of Royal standard typewriters to best perform maintenance, adjustment, and repair functions. Although the individual mechanisms of the typewriter are closely interrelated, this manual treats each mechanism in a separate chapter in order to clarify instructions on maintenance and repair.

2. Orientation

Throughout this manual, front indicates the keyboard side as the operator faces the machine; rear, the side opposite the keyboard side; right, the side on the operator's right; and left, the side on the operator's left.

CHAPTER 2

DESCRIPTION, MAINTENANCE AND REPAIR TOOLS

3. Description

The Royal standard typewriter is a segment shift machine. Each standard model may be equipped with carriages of several different lengths, the length of the carriage being indicated in the serial number of the machine. The serial number is located on the top right side beneath the carriage.

4. Maintenance and Repair Tools

The following special tools for the maintenance and repair of Royal standard typewriters are included in Tool Set, Office Machine Repair (Federal Stock Number 5180-00-19004; QM Stock Number 41-T-03538-075).

Quantity	Item	Federal stock No.	Quartermaster stock No.
1	Bender, paper pan	5120-359-6466	41-B-00543-000
1	Bender, type bar 7½"	5120-359-6468	41-B-00546-000
1 set (2)	Bender, vibrator arm, 5½"	5120-359-6467	41-B-00545-140
1	Screwdriver and split-nut adjuster, segment ball race	5120-359-6563	41-S-01731-000
1	Screwdriver and split-nut adjuster, segment lock	5120-359-6562	41-S-01720-000
1	Wire, segment fulcrum	5120-359-6598	41-W-00424-000
1	Wrench, alining	5120-359-6645	41-W-03784-050
1	Wrench, open-end, 9/64" x 5/16", ribbon bichrome arm	5120-359-6646	41-W-03785-000
1	Wrench, open-end, 9/64" x 7/32", ribbon bichrome arm	5120-359-6647	41-W-03786-000
1	Wrench, open end, ¼" x ¼"	5120-359-6648	41-W-03787-000
1	Wrench, open 5/16" x 5/16"	5120-359-6649	41-W-03788-000
1	Wrench, open-end, 3/8" x 3/8"	5120-359-6650	41-W-03788-025
1	Wrench, open-end, 13/32" x 13/32"	5120-359-6651	41-W-03789-000
2	Wrench, open-end, 7/16" x 7/16", motion	5120-359-6652	41-W-03790-000

CHAPTER 3

COVER PLATES

5. General

Cover plates (fig. 1) are designed to protect the machine from foreign matter and to discourage unauthorized personnel from tampering with the internal mechanism. The plates also minimize the noise of the machine. They will be removed when necessary for the maintenance and repair of parts.

6. Top Cover Plate

a. Removal.

(1) Raise top cover plate (1, fig. 1) and disengage ribbon from vibrator.

(2) Remove ribbon and ribbon spools.

(3) Remove ribbon spool cup binding screws and ribbon spool cups (4).

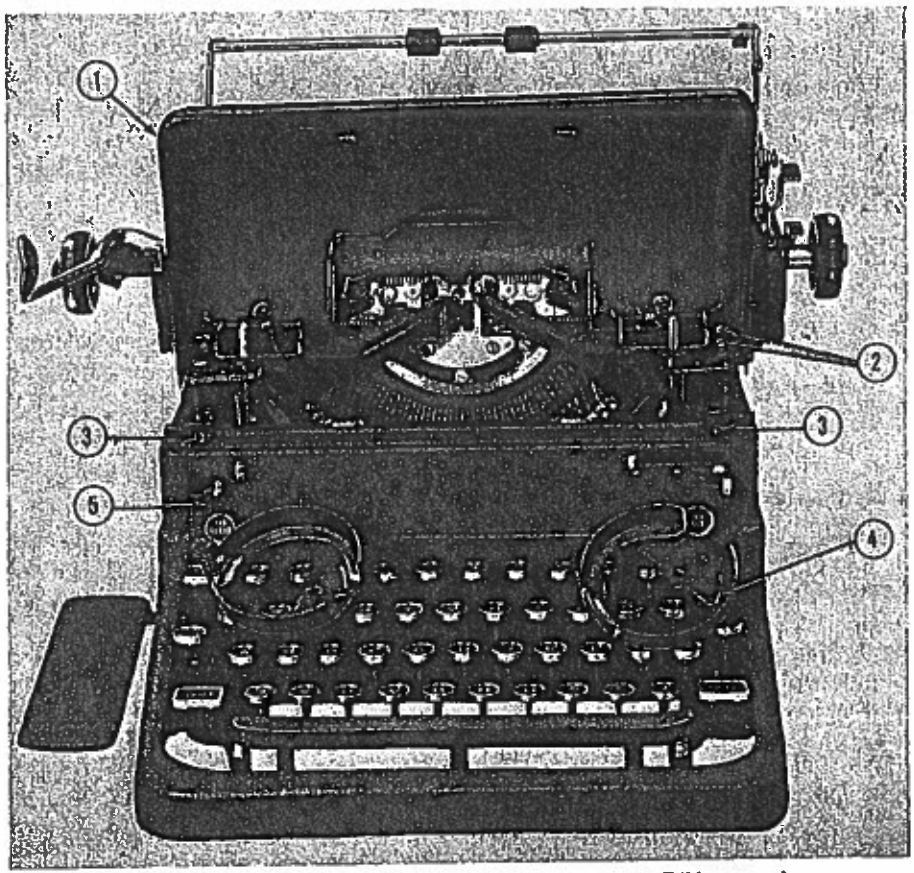
(4) Remove top cover plate binding screws (2) and top cover.

b. Adjustment After Removal. If necessary, form lips on cover plate to insure a snug fit.

c. Installation.

(1) Replace top cover plate in proper position and replace binding screws.

(2) Replace ribbon spool cups and binding screws.



1 Top cover plate
2 Top cover plate binding screws
3 Front cover plate binding screws, upper
4 Ribbon spool cups
5 Front cover plate

Figure 1. Royal standard typewriter cover plates, front view.

(3) Replace ribbon spools and ribbon.
(4) Replace ribbon in vibrator.

7. Front Cover Plate

a. Removal.
(1) Remove upper front cover plate binding screws (3, fig. 1).
(2) Loosen lower front cover plate binding screws and tabulator key-set screw locknut and screw.
(3) Remove tabulator set key.
(4) Loosen tabulator clear key-set screw locknut and screw.
(5) Remove tabulator clear key and remove front cover plate (5).

b. Adjustments After Removal. Replace lip springs if broken or worn.

c. Installation.
(1) Replace front cover plate and tabulator clear key.
(2) Tighten tabulator clear key-set screw locknut and screw.
(3) Replace tabulator set key and tighten tabulator key-set screw locknut and screw.
(4) Replace and tighten upper and lower front cover plate binding screws.

8. Left Carriage End Cover Plate

a. Removal.
(1) Remove left carriage end cover plate binding screws.
(2) Remove left carriage end cover plate.

b. Installation.
(1) Replace left carriage end cover plate.
(2) Replace and tighten left carriage end cover plate binding screws.

9. Left Back Cover Plate

a. Removal.
(1) Remove left back cover plate binding screws and center binding screw.
(2) Remove left back cover plate.

b. Installation.
(1) Replace left back cover plate.
(2) Replace and tighten left back cover plate binding screws and center binding screw.

10. Right Carriage End Cover Plate

a. Removal.
(1) Loosen right cylinder knob setscrews and remove cylinder knob.
(2) Remove right carriage end cover plate binding screws and right carriage end cover plate.

b. Installation.
(1) Replace right carriage end cover plate and binding screws.
(2) Replace cylinder knob and tighten screws.

11. Right Back Cover Plate

a. Removal.
(1) Remove right back cover plate binding screw and drawband anchor screw.
(2) Loosen right back cover plate center binding screw and remove right back cover plate.
(3) Replace drawband anchor screw.

b. Installation.
(1) Remove drawband anchor screw.
(2) Replace right back cover plate and center binding screw.
(3) Replace drawband anchor screw and right back cover plate binding screw.

12. Right Side Cover Plate

a. Removal.
(1) Remove touch control binding screw and touch control knob.
(2) Center carriage, stand machine on back, and reach in from bottom of machine and push out on bottom of right side cover plate.

b. Adjustment After Removal. If necessary, form clamps to insure a snug fit.

c. Installation.
(1) Replace right side cover plate.
(2) Replace touch control knob and touch control binding screw.

13. Left Side Cover Plate

a. Removal. Reach in from bottom of machine and push out on bottom of left side cover plate.

b. Adjustment After Removal. If necessary, form clamps to insure a snug fit.

c. Installation. Place top of left side cover plate in proper position and push in on bottom until properly seated.

CHAPTER 4

CARRIAGE MECHANISM

14. General

Proper fitting of the carriage (fig. 2) is essential in the control of the alinement of type. Loose play must be reduced to the minimum. An understanding of the functions and methods of adjustment of the component assemblies is necessary before adjustment of the mechanism as a whole.

15. Components

a. Ball Bearings and Pinions.

(1) *Function.* Two ball bearings seated in pinions (6, fig. 2) are positioned to provide a smoothly operating carriage.

(2) *Adjustment.* The bearings roll between the lower rail (4) and the upper rail (9) at the same time pinions mesh with teeth on the lower and upper rails. To adjust properly, place ball bearings and pinions on the lower rail in positions marked on rail. See that left pinion is three teeth from end of rail when carriage is to extreme left and right pinion is three teeth from end of rail when carriage is to extreme right. Always place pinions with beveled side down.

b. Carriage Clamps.

(1) *Function.* Five carriage clamps (5, fig. 2), which hook beneath the lower rail to insure a snug fit, adjust the carriage to the lower rail.

(2) *Adjustment.* Two binding screws in slanting elongated slots fit the clamps to the carriage. The slots allow the clamps to be adjusted up, down, right, or left. Be sure that ball bearings and pinions are properly positioned before adjusting carriage clamps. Adjust carriage clamps as follows:

(*a*) Place each carriage clamp in position with two binding screws.

(*b*) Turn binding screws to a snug position. Do not tighten.

(*c*) Adjust outside clamps first by tapping each clamp lightly with small hammer until slight friction occurs between clamp and lower rail.

(*d*) Carefully tap clamps down until friction is removed to insure a close fit without friction.

(*e*) Adjust clamps from outside in by method given in (*c*) and (*d*) above.

c. Support Rail.

(1) *Function.* The support rail (2, fig. 2) supports the rear of the carriage by means of the tabulator rack roll (1), which moves freely back and forth along the rail. The tabulator rack roll must run the entire length of the support rail on the bottom inside edge of the rail.

(2) *Adjustment.* Two binding screws (3) fitted in elongated slots fasten the rail to the support rail brackets. The slots allow adjustment of the rail up or down. Adjust the support rail as follows:

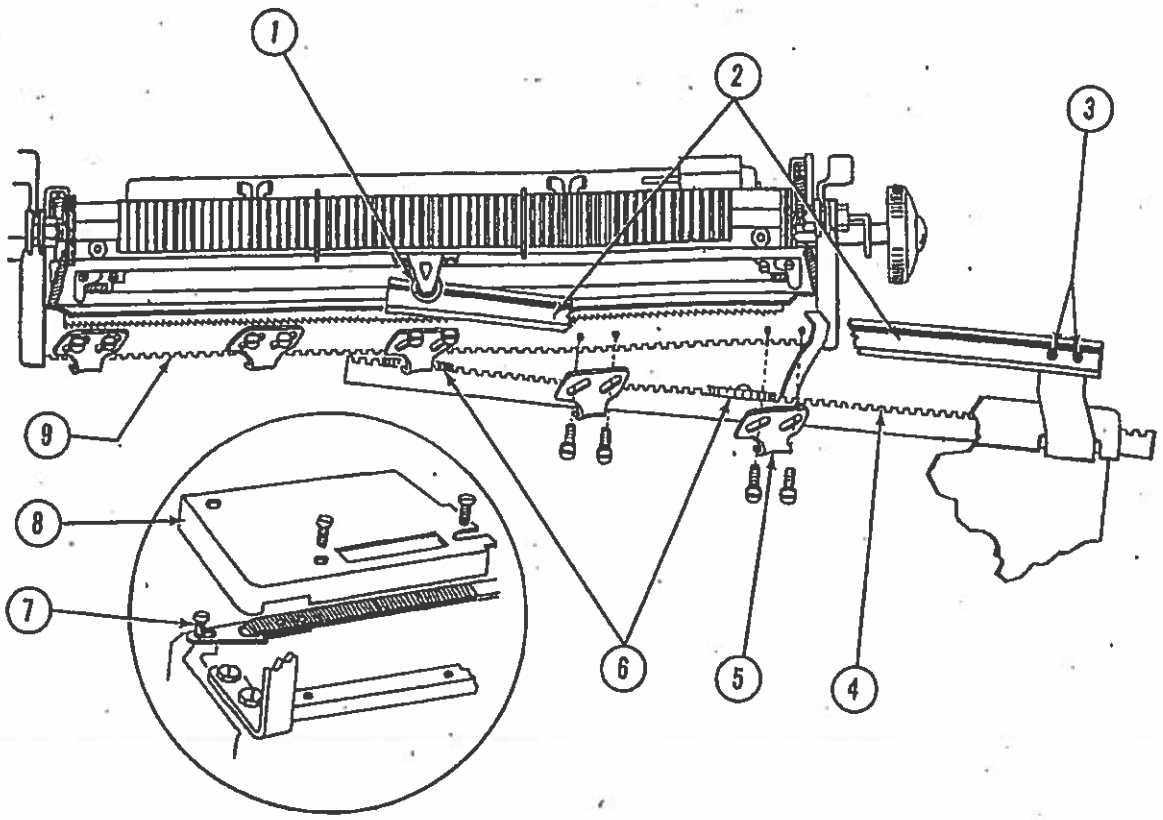
(*a*) Move carriage entire length of machine. If tabulator rack roll does not contact bottom inside edge of support rail its entire length, loosen support rail binding screws to a snug fit.

(*b*) Tap lightly on support rail with hammer to position rail properly, allowing tabulator rack roll to ride entire length of bottom inside edge of support rail.

(*c*) Tighten binding screws.

d. Carriage Guide Rod and Guide Rod Roll.

(1) *Function.* The carriage guide rod, fitted to the rear underside and extending the full width of the carriage, rides on the guide rod roll and forms support and a smooth riding surface for the rear of the



1 Tabulator rack roll
2 Support rail
3 Support rail binding screws
4 Lower rail
5 Carriage clamps
6 Ball bearings and pinions
7 Drawband anchor stud
8 Cover plate
9 Upper rail

Figure 2. Carriage mechanism.

carriage. The guide rod roll must contact the guide rod its entire length.

(2) *Adjustment.* At the same time the support roll is adjusted (*a* above), the contact between the guide rod and the guide rod roll is adjusted. Check by moving the carriage from one end of machine to the other. If contact adjustment is not true, readjust support rail. After adjusting this contact, be sure to leave tabulator rack roll and support rail properly adjusted.

16. Adjustments Without Removal

a. Before attempting adjustment of the carriage to the frame, see that all screws and nuts in the carriage ends are tightened to insure a solid carriage unit.

b. When fitting the carriage to the machine, it is to the mechanic's advantage to leave out the cylinder and the feed roll parts in order to allow easy access to the backspace and tabulator brake adjustments.

17. Removal and Installation

a. Removal.

(1) Facing the rear of the machine, disconnect drawband (par. 19*a*) from carriage and hook to drawband anchor screw.

(2) Remove two carriage clamps and loosen center carriage clamp.

(3) Move carriage to within 1 inch of the end of machine.

(4) Tilt carriage back to disengage tabulator rack roll from support rail and to disengage center carriage clamp.

(5) Slip backspace rack lock arm through opening between carirage rack bail and carriage end.
(6) Lift carriage from machine.

b. Installation.

(1) Position ball bearings and pinions (par. 15*a*).
(2) Replace carriage, feeding backspace lock rack arm through opening between carriage end and rack bail. Tilt carriage and move to left about 1 inch so that tabulator rack roll returns to its position in carriage support rail. The ball bearings and pinion should move in with the carriage.
(3) Adjust clamps *a*(2) above.)
(4) Replace drawband to anchor screw.

CHAPTER 5

MAINSPRING MECHANISM

18. General

The mainspring mechanism (fig. 3) supplies the tension necessary to pull the carriage from right to left and to wind the ribbon from one spool to another. Never increase tension of mainspring to overcome a bind. Before making any adjustment to the mainspring mechanism, be sure that the carriage is free. It is necessary to understand the functions and adjustments of the component assemblies before removal and installation of the mainspring mechanism.

19. Components

a. Drawband.

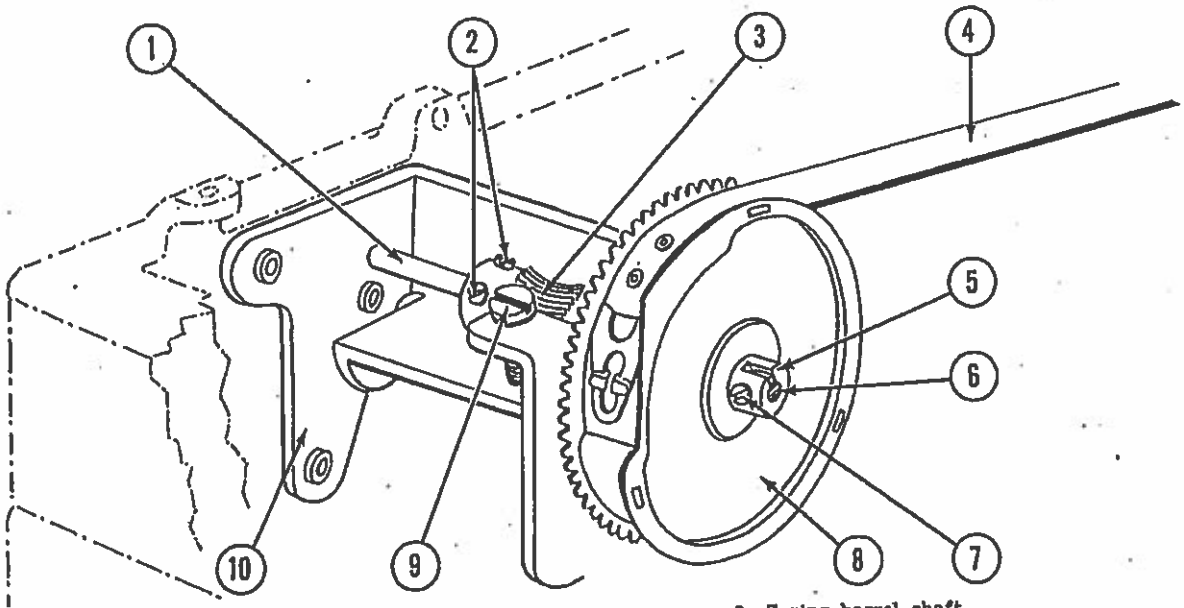
(1) *Function.* The drawband (4, fig. 3), connected from a stud on the spring barrel to a small extension on the right end of the carriage, transfers the tension of the mainspring to the carriage.

(2) *Adjustment.* Be sure that the drawband is placed on the machine with folded edge down.

b. Spring Barrel.

(1) *Function.* The spring barrel (8, fig. 3) houses the mainspring and transfers the spring tension to the drawband and to the ribbon feed mechanism. The spring barrel turns on ball bearings. The teeth on the outer edge of the spring barrel motivate the ribbon feed.

(2) *Adjustment.* To free spring barrel of end shake, turn spring barrel hub adjusting nut.



1 Spring barrel shaft
2 Worm gear setscrews
3 Worm gear
4 Drawband
5 Spring barrel hub
6 Spring barrel shaft
7 Spring barrel hub setscrew
8 Spring barrel
9 Mainspring adjuster
10 Spring barrel bracket

Figure 3. Mainspring mechanism.

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c. Mainspring Adjuster and Worm Gear.

(1) *Function.* The gears of the mainspring adjuster (9, fig. 3) are meshed with the worm gear (3) on the spring barrel shaft (1) to secure proper adjustment.

(2) *Adjustment.* To increase tension on mainspring, turn mainspring adjuster counterclockwise. To decrease tension, turn adjuster clockwise.

d. Spring Barrel Shaft.

(1) *Function.* The spring barrel shaft (1, fig. 3) supports the spring barrel and the worm gear.

(2) *Adjustment.* To avoid all end shake in the spring barrel shaft, be sure that the small raised part of the shaft fits into the slot in the spring barrel hub (5).

e. Spring Barrel Bracket.

(1) *Function.* The spring barrel bracket (10, fig. 3), held to the frame of the machine by three binding screws, supports the entire mainspring assembly.

(2) *Adjustment.* Tighten the three binding screws securely.

20. Removal and Installation

a. Removal.

(1) Turn mainspring adjuster (9, fig. 3) clockwise to release all tension on mainspring. Position worm gear setscrews (2) so that they may be easily loosened.

(2) Remove drawband (4).

(3) Face front of machine and remove segment fulcrum wire retaining screws.

(4) Remove type bars and type-bar links numbers 1 and 2, lettered Q and A, to permit passage of spring barrel shaft (1) under bottom rail.

(5) Face left side of machine and loosen spring barrel hub setscrew (7).

(6) Loosen worm gear setscrews and push spring barrel shaft toward front of machine until it clears the spring barrel hub (5).

(7) Lift out spring barrel (8).

b. Installation.

(1) Face left side of machine and place spring barrel in machine.

(2) Insert spring barrel shaft (1, fig. 3) into spring barrel hub (5), making certain that shaft goes through backspace pawl swinging arm and backspace pawl lift lever and into spring barrel bracket.

(3) Place spring barrel worm gear into position.

(4) Insert spring barrel shaft into worm gear and end of shaft into position in spring barrel bracket so that flat sides of shaft are in line with worm gear setscrews and protrusions on end of shaft fit into slots of spring barrel hub.

(5) Tighten worm gear setscrews and spring barrel hub setscrew.

(6) Turn spring barrel clockwise four revolutions and attach drawband to stud and to anchor screw.

(7) Replace type bars and type bar links numbers 1 and 2.

(8) Replace segment fulcrum wire retaining screws.

CHAPTER 6

LINE SPACE MECHANISM

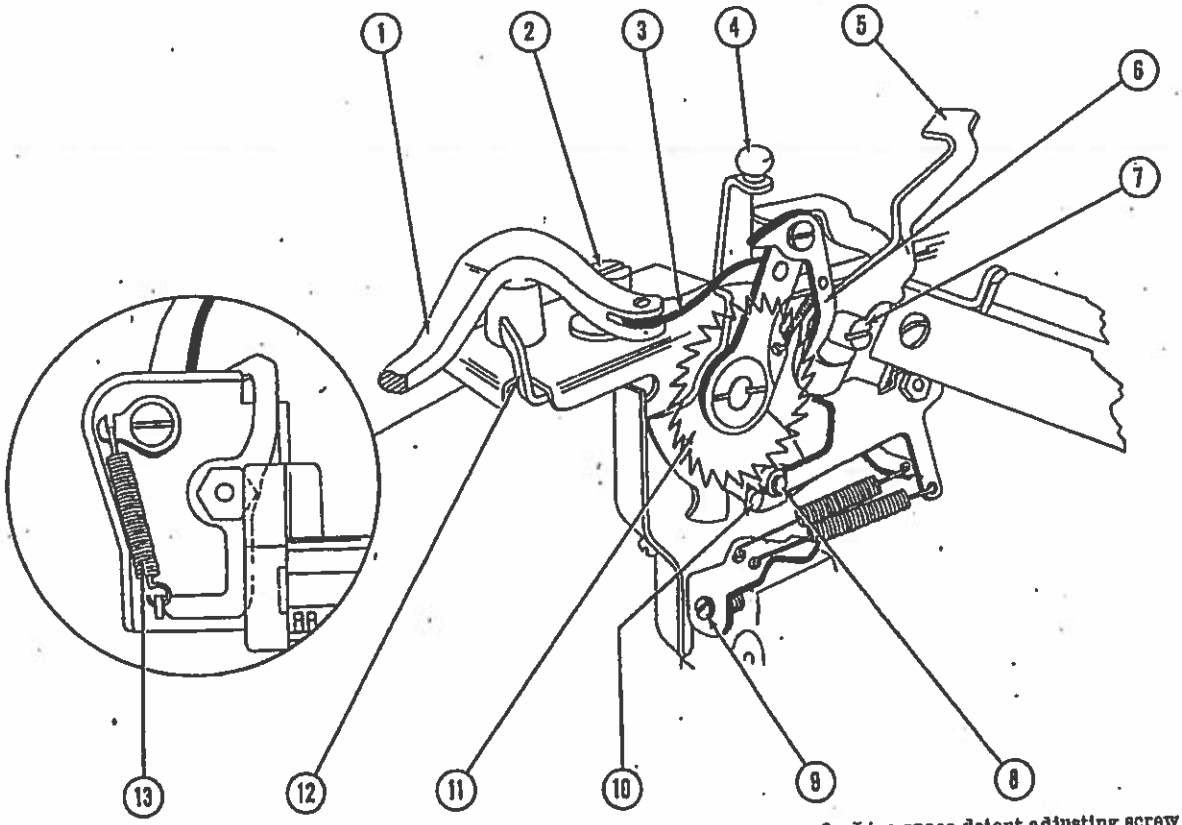
21. General

For proper operation of a typewriter, the line space, variable, and paper feed mechanisms are interdependent. The line space mechanism (fig. 4) is designed to rotate the cylinder. It raises the typing paper 1, 2, or 3 spaces within one operation. There are 28 spaces in a complete revolution of the cylinder. If all adjustments of the line space mechanism have been made and the number of spaces in a complete revolution of the cylinder varies from the required number, install new parts. Before making any adjustments to line space mechanism, be sure that all parts are free acting and in good condition.

22. Components

a. Line Space Lever.

(1) *Function.* The line space lever (1, fig. 4), when pushed from left to right, rotates the cylinder toward the rear of the machine.



1 Line space lever
2 Line space lever eccentric stop screw
3 Line space pawl link
4 Line space selector
5 Line space detent release lever
6 Line space pawl
7 Line space pawl eccentric stop screw
8 Line space detent roll
9 Line space detent adjusting screw
10 Line space selector detent
11 Cylinder ratchet
12 Line space lever stop
13 Line space lever spring

Figure 4. Line space mechanism.

(2) *Operation.* When the lever is in full inactive position, it is at rest against the line space lever stop (12). The line space lever eccentric stop screw (2) stops the movement of the lever. A locknut on the bottom of the line space lever eccentric stop screw holds the stop and the stop screw in place. The opposite end of the stop serves as a hook for the line space lever spring (13). The spring also hooks to a stud washer fastened to the end of the fulcrum bolt of the line space lever and thus returns the lever to its inactive position.

(3) *Adjustment.* The line space lever should be free on its pivot, and the line space lever spring should have enough tension to return the lever to its inactive position. To adjust tension, stretch or shorten spring as necessary.

b. Line Space Pawl Link Assembled.

(1) *Function.* The line space pawl link (8, fig. 4) transfers the power from the line space lever (1) to the line space pawl (6).

(2) *Operation.* The line space pawl link is attached to the line space pawl link arm by a rivet that is installed in manufacture. This rivet acts as a pivot point and should be free at all times. The line space pawl is attached to the link with a screw and a collar. The collar fits around the screw and acts as a shoulder on which the pawl pivots. Do not attempt to replace the screw unless the collar is in position, because this would leave the pawl with excess end shake and would not assure proper engagement of the pawl with the ratchet. The lower extension of the link is held in position by the line space pawl arm bushing.

(3) *Adjustment.* See that line space pawl arm bushing is tightened securely in machine. When tightening bushing, check for binds in line space mechanism.

c. Line Space Pawl.

(1) *Function.* The line space pawl (6, fig. 4), motivated by the line space lever (1), travels along the upper edge of the ratchet shield until it drops over the end, catches the nearest tooth of the ratchet, and rotates the ratchet until the line space lever is stopped by the line space lever eccentric stop screw (2).

(2) *Operation.* The pawl spring pulls the pawl into the ratchet teeth. The line space pawl should be free on its pivot point.

(3) *Adjustment.* See that line space pawl spring has enough tension to seat a pawl properly in ratchet. Decrease tension by stretching spring; increase tension by clipping spring to shorten. Be careful when making adjustments, because the spring is very delicate. If necessary, replace spring.

d. Line Space Lever Eccentric Stop Screw.

(1) *Function.* The line space lever eccentric stop screw (2, fig. 4) limits the movement of the line space lever.

(2) *Adjustment.* Adjust line space lever eccentric stop screw so that it limits movement of line space lever at same time detent roll seats between two teeth of cylinder ratchet. Slowly bringing line space lever to the right, determine necessary adjustment by watching detent roll drop into position in teeth of ratchet. When adjusting line space lever eccentric stop screw, loosen binding nut on bottom of screw on bottom of line lever eccentric stop screw and turn screw with a screwdriver.

e. Line Space Pawl Eccentric Stop Screw.

(1) *Function.* The line space pawl eccentric stop screw (7, fig. 4) acts as a secondary limit to prevent excessive rearward movement of the ratchet.

(2) *Adjustment.* Adjust line space pawl eccentric stop screw so that there is a slight clearance between line space pawl and eccentric stop screw when line space lever is held to the right. To check for proper adjustment, hold line space lever to the right as far as possible and try to turn cylinder toward rear of machine. There should be only slight additional movement.

f. Cylinder Ratchet. The cylinder ratchet (11, fig. 4) is held in a stationary position by seating the detent roll between 2 teeth of the ratchet. The standard ratchet has 28 teeth. All other ratchets

are marked by a numeral indicating the number of teeth. There is no way to adjust the cylinder ratchet. If it is worn, replace with a new ratchet. (For further information on the operation of the cylinder ratchet, see par. 24*c*.)

g. Line Space Detent Roll.

(1) *Function.* The line space detent roll (8, fig. 4), seated between two teeth of the ratchet, holds the cylinder stationary and forces type to print in a straight line. The line space detent roll should always be in perfect condition to control the line of writing.

(2) *Adjustment.* Replace detent roll if it becomes pitted, worn, or out of round and thus causes writing line to become uneven. To adjust line space detent spring, turn line space detent adjusting screw counterclockwise to increase tension and clockwise to decrease tension.

h. Line Space Detent Release Lever.

(1) *Function.* The line space detent release lever (5, fig. 4), when pulled forward, disengages the detent roll from the teeth of the ratchet and allows the cylinder to turn freely.

(2) *Adjustment.* Tighten line space pawl eccentric screw nut if there is end shake in lever.

i. Line Space Selector. The line space selector (4, fig. 4) allows the operator to select 1-, 2-, or 3-line spacing as may be desired. The selector positions the selector shield and thus governs the entry of the line space pawl into the teeth of the ratchet.

j. Line Space Selector Detent.

(1) *Function.* The line space selector detent (10, fig. 4) seats into any one of three grooves on the bottom side of the selector shield and holds the shield stationary in the selected position.

(2) *Adjustment.* The line space selector detent tension is adjusted at the same time the line space detent spring tension is adjusted (*g* above).

CHAPTER 7

VARIABLE MECHANISM

23. General

The variable mechanism (fig. 5) is designed to change the line of writing from one set pattern to another. The return of the cylinder end (4) into mesh with the cylinder ratchet (7) by means of fractional cylinder end tension determines the proper operation of the variable mechanism. Check to see that all parts of the variable mechanism are in good condition and that there are no binds in the fractional cylinder end (4) or the line space release rod (3).

24. Components

a. Cylinder Knob.

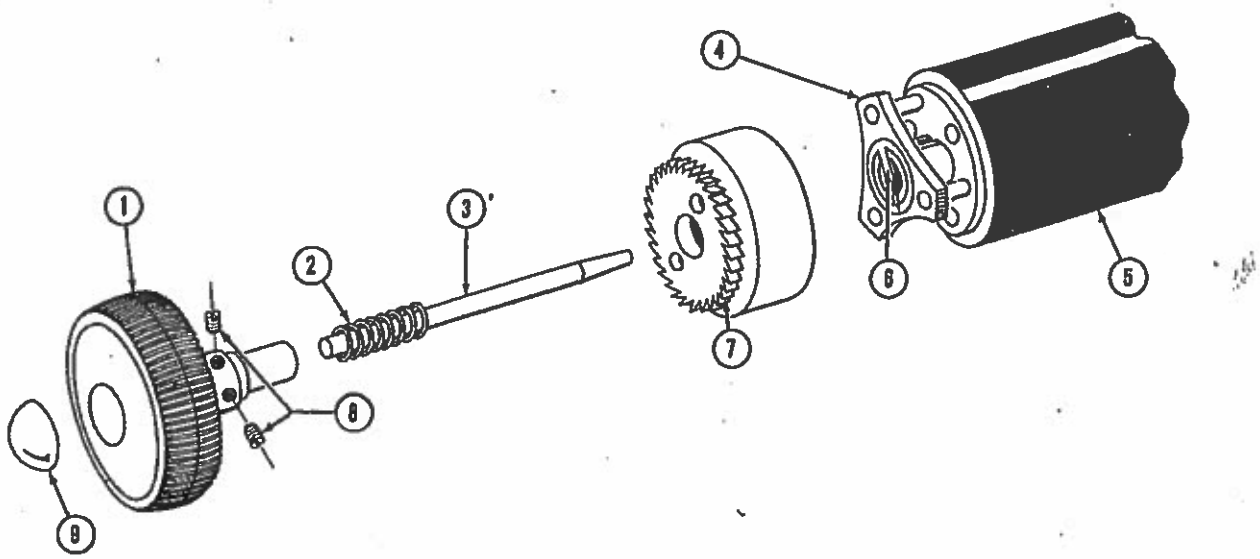
(1) *Function.* The cylinder knob (1, fig. 5) houses the variable knob and the line space release rod and spring (*b* below). The knob is used to rotate the cylinder by hand.

(2) *Adjustment.* The cylinder knob must be positioned for the proper clearance between the release rod and the tongue washer (*b* (3) below). In case of any malfunction, replace cylinder knob with new cylinder knob assembled.

b. Variable Knob and Line Space Release Rod.

(1) *Structure.* The variable knob and the line space release rod are sweated together in manufacture. If at any time they become separated, do not try to rejoin them. Replace with a new cylinder knob assembled.

(2) *Function.* The variable knob (9, fig. 5), when pushed in, depresses the line space



1 Cylinder knob
2 Line space release rod spring
3 Line space release rod
4 Fractional cylinder end
5 Cylinder
6 Tongue washer
7 Ratchet
8 Cylinder knob setscrews
9 Variable knob

Figure 5. Variable mechanism.

release rod (3). The release rod releases the fractional cylinder end (4) from the ratchet (7). The line space release rod spring (2) returns the line space release rod and the variable knob to the inactive position.

(3) *Adjustment.*

(*a*) The line space release rod spring is not adjustable. If release rod and variable knob are not returning to the inactive position, check for binds. If no binds are present and spring does not have enough tension to return variable knob and release rod to inactive position, replace with new cylinder knob assembled.

(*b*) A slight clearance should exist between the line space release rod (3, fig. 5) in the inactive position and the tongue washer (6) to keep the line space release rod from limiting the movement of the fractional cylinder end (4) to the inactive position. To obtain this clearance, position cylinder knob (1) on cylinder shaft, fitting release rod into slot in cylinder shaft. Be sure that release rod is straight. If it is bent it will bind in slot of cylinder shaft and cause fractional cylinder end to remain disengaged from cylinder ratchet (*c* below).

c. Cylinder Ratchet.

(1) *Function.* The variable teeth inside the cylinder ratchet (7, fig. 5) come into mesh with the teeth of the fractional cylinder end (4) and stop any independent rotation of the cylinder.

(2) *Operation.* When the variable knob is depressed, the fractional cylinder end (*e* below) is disengaged from the teeth inside the cylinder ratchet, thus allowing the cylinder to rotate independently. As the variable knob is released, the fractional cylinder end is allowed to engage itself into the teeth inside the cylinder ratchet.

(3) *Adjustment.* The cylinder ratchet is not adjustable. If variable teeth inside cylinder ratchet are worn, replace ratchet with new cylinder ratchet.

d. Fractional Cylinder End Tongue Washer.

(1) *Function.* The fractional cylinder end tongue washer (6, fig. 5) serves as a contact point for the line space release rod.

(2) *Operation.* The tongue washer is seated into a slot in the fractional cylinder end. When the variable knob is depressed, the line space release rod contacts the tongue washer and disengages the cylinder end from the cylinder ratchet.

(3) *Adjustment.* If tongue washer slips out of position in slot of fractional cylinder end, press washer very carefully back into position with a small screwdriver. Place washer so that its tongue can move back and forth in slot of cylinder shaft without creating a bind.

e. Fractional Cylinder End.

(1) *Function.* The fractional cylinder end (4, fig. 5) is attached to the cylinder by three binding screws. When in mesh with the cylinder ratchet, the cylinder end prevents any movement of the cylinder.

(2) *Operation.* Three tension springs in the cylinder end return it to a normal inactive position. When the fractional cylinder end shifts from the active position to the inactive position, it moves on three studs.

(3) *Adjustment.* If teeth on fractional cylinder end are worn, replace with a new cylinder end or a new cylinder. If cylinder end tension springs are not seated properly in holes within core of cylinder and do not have enough tension to return cylinder end into mesh with cylinder ratchet, replace with new springs. If the three studs in cylinder end are loose and cause play in cylinder resulting in an uneven writing line, firmly rerivet studs in position.

CHAPTER 8

PAPER FEED MECHANISM

25. General

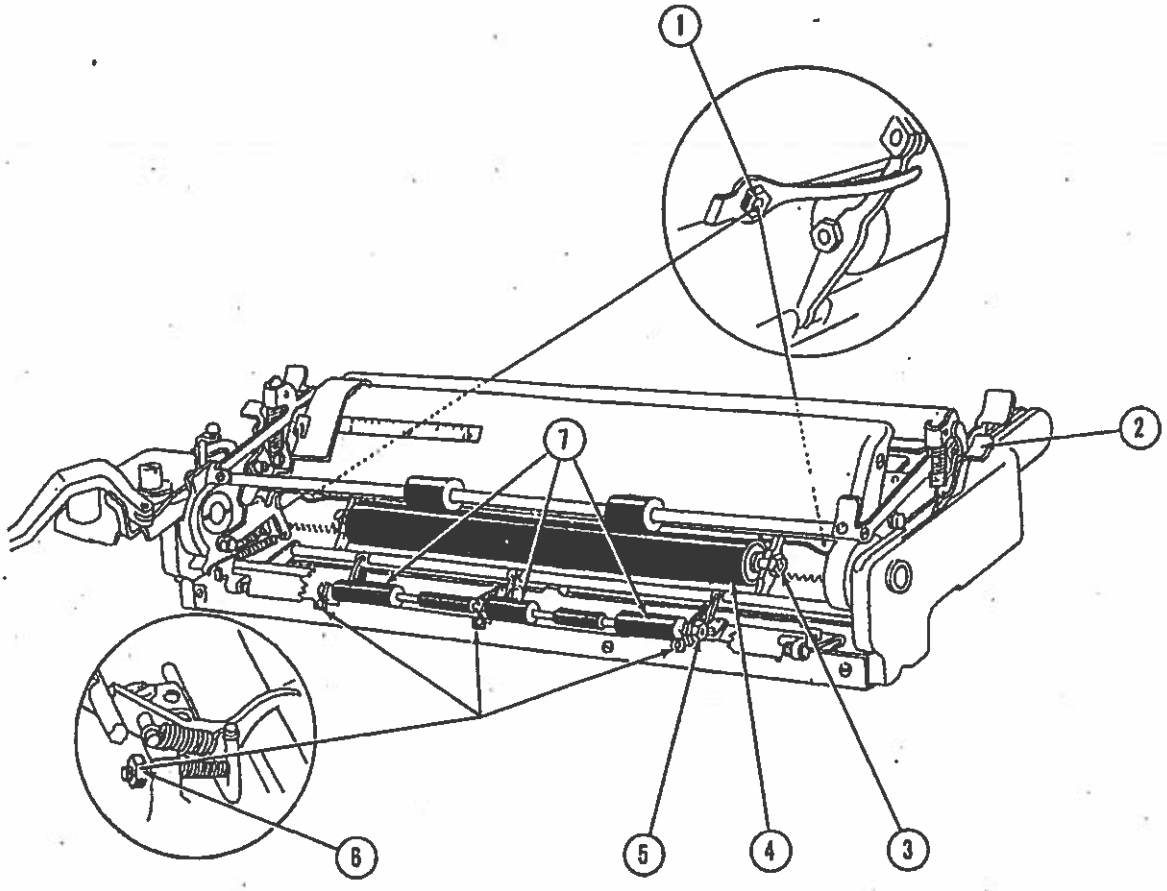
The paper feed mechanism (fig. 6) feeds the paper from line to line and positions the paper for typing.

26. Components

a. Cylinder.

(1) *Function.* The cylinder, or platen (not shown in fig. 6) provides the backing necessary for a type impression. When the paper feeds into the machine, it curves around the cylinder. The paper bail holds the paper flush against the cylinder to insure a clear-type impression and to decrease the noise when the type strikes the paper.

(2) *Cleaning.* Check cylinder when trouble occurs in paper feed mechanism because



1 Large feed roll adjusting nut
2 Feed roll release lever
3 Large feed roll rod nut
4 Large feed roll
5 Small feed roll rod nut
6 Small feed roll adjusting screws and locknuts
7 Small feed rolls

Figure 6. Paper feed mechanism.

of carbon collecting on the surface. Foreign matter collecting on the cylinder will create a glossy appearance and cause the cylinder to lose traction and thus allow paper to slip. Clean off gloss with alcohol or a similar cleaning substance.

(3) *Adjustment.*

(*a*) Check to see that cylinder is round. If the cylinder is not round, the feed rolls will not have even pressure against the cylinder and the ring and cylinder will be affected. Rotate cylinder rapidly and replace cylinder if it appears to have too much wobble.

(*b*) When cylinder binds on carriage ends, shave off cylinder end with a platen end reamer. The cylinder must turn freely without end shake. Be careful not to make clearance between cylinder end and carriage end plate excessive, because too much clearance will create end shake in cylinder.

b. Cylinder Shaft.

(1) *Description.* The cylinder shaft extends from beyond both ends of the carriage through the entire length of the cylinder. The left end of the shaft is slotted to allow the tongue washer to slip over the end. A small hole approximately 1½ inches from the right end of the shaft seats the fractional line space alining screw, which prevents any movement of the cylinder without the shaft turning. A flat surface beside the hole seats the cylinder setscrew. Flat surfaces on both ends of the cylinder shaft seat the cylinder knob setscrews. Proper setting of the screws forces the cylinder shaft to turn with the cylinder knob.

(2) *Function.* The cylinder shaft holds the cylinder in position and provides a pivot upon which the cylinder rotates.

(3) *Adjustment.* Replace cylinder shaft if if it is not perfectly straight. When replacing shaft, be sure not to disengage tongue washer from variable end of cylinder.

c. Paper Pan.

(1) *Description.* The paper pan (not shown in fig. 6), located just beneath the cylinder, is held in position by two small binding screws. A large opening in the center of the paper pan allows the large feed roll to pass through and contact the cylinder. Several smaller openings in the front edge of the pan allow the small feed rolls to pass through and contact the cylinder.

(2) *Function.* The paper pan guides the paper around the curvature of the cylinder and prevents the paper from binding on the feed rolls.

(3) *Adjustment.* Position paper pan to allow six sheets of paper plus carbon to pass freely between paper pan and cylinder. Using a paper pan twister, form paper pan in line with bottom of large feed roll.

d. Large Feed Roll.

(1) *Description.* The large feed roll must be perfectly round. It is held in position by two large feed roll arms, which hang from the feed roll arm support. The roll revolves on a shaft and extends almost the entire length of the cylinder.

(2) *Function.* The large feed roll (4, fig. 6) in the rear holds the paper against the cylinder and feeds it to the small feed rolls (7) in front.

(3) *Adjustment.*

(*a*) Check roll and replace if it is not perfectly round. A maladjusted or swollen feed roll will cause poor paper feed. The tension of the feed roll on both ends of the feed roll shaft should be equal but not excessive.

(*b*) To test for uniform tension, insert two strips of paper between cylinder and large feed roll and pull these strips of paper for slippage.

(*c*) To increase tension, turn large feed roll adjusting nut (1, fig. 6) clockwise; to decrease tension, turn nut counterclockwise. To gain access to adjusting nuts from rear of carriage, move carriage to right and left and tilt machine up on its front frame cross member.

e. Large Feed Roll Arm Support.

(1) *Description.* The large feed roll arm support extends from one end of the carriage to the other. The large feed roll tension adjusting springs and nuts are located on the underside of the support. Two binding screws on each of the car-

riage ends fasten the support of the carriage.

(2) *Function.* The large feed roll arm support supports the arms that hold the feed roll and also supports the paper pan.

(3) *Adjustment.*

(*a*) Check to see that the four binding screws securely fasten roll arm support into position.

(*b*) If adjusting nuts (1, fig. 6) do not secure proper feed roll pressure, the feed roll release rod may be limiting the feed roll support arms. To correct this trouble, form tip of roll support arm rearward and thus allow more forward movement of feed roll.

f. Small Feed Rolls.

(1) *Description.* Three small feed rolls (7, fig. 6) are located in front of the large feed roll. They revolve on a shaft and are separated by metal or plastic spacers. The rolls must be perfectly round.

(2) *Function.* The small feed rolls receive the paper from the large feed roll and continue feeding it toward the line of writing.

(3) *Adjustment.*

(*a*) Check and replace rolls if they are not perfectly round. Maladjusted or swollen feed rolls cause poor paper feed. Carbon streaks on typing paper indicate that feed rolls are applying uneven tension. Small feed roll tension should be equalized across the three small feed rolls. The tension should be slightly less than tension on large feed roll.

(*b*) Before testing and adjusting tension, be sure that rolls are clean and free on their shaft. If shaft needs oil, oil sparingly. If tension springs do not provide proper tension, replace with new springs. If a bind occurs, remove spacer between small feed rolls and shave down rough spots.

(*c*) To test for uniform tension, insert three strips of paper between small feed rolls and cylinder and pull these strips of paper for slippage.

(*d*) Adjust tension by means of small feed roll adjustment screws. To gain access to these adjustment screws, remove top rail cover, front lower edge of carriage. The top rail cover is held in position by three screws. To reach the two outer screws, move carriage to right and left; to reach center screw, raise type bar cover, position segment in shift lock, and move carriage slightly to left of type bar guide. After moving top rail cover, loosen locknuts on small feed roll adjusting screws (6, fig. 6) and turn screws clockwise to increase tension and counterclockwise to decrease tension. Tighten locknuts after making proper adjustments.

g. Small Feed Roll Support Arms.

(1) *Function.* The small feed roll support arms hold the small feed rolls in position. When feed roll pressure is released, support arms drop and thus lower feed rolls away from cylinder.

(2) *Adjustment.* Adjust small feed roll support arms only if after adjusting tension adjusting screws and replacing tension springs (*f*(2) above) it is still impossible to obtain tension on small feed rolls. Form small feed roll support arms to allow feed rolls to apply more pressure to cylinder.

h. Feed Roll Release Mechanism.

(1) *Description.* The feed roll release mechanism consists of the feed roll release lever (2, fig. 6), feed roll release rod pinion, and the feed roll release rod.

(2) *Function.* The feed roll release mechanism lowers the rolls from the underside of the cylinder and allows the paper to pass freely around the cylinder.

(3) *Operation.* When the release lever is pulled forward, it rotates the release rod pinion and the release rod. When the rod turns, the support arms are cammed out of the flat surfaces of the rod, allowing the feed rolls to drop away from the cylinder.

(4) *Adjustment.*

(*a*) If release lever gear slips a tooth of release rod pinion, remove release lever from carriage end and replace it so that the last tooth of lever gear is in mesh

with the first tooth of release rod pinion.

(*b*) If feed roll support arms are worn and cause feed roll release mechanism to fail to operate properly, replace feed roll support arms.

(*c*) Adjust left release rod bracket to remove end shake in release rod.

i. Paper Holder Assembly.

(1) *Function.* The paper holder assembly feeds the paper around the cylinder and holds it firmly against the cylinder.

(2) *Adjustment.*

(*a*) To obtain even tension for bail rolls of paper holder assembly, form front of paper rod assembly by hand.

(*b*) Adjust small half-moon-shaped collars, located on outside ends of carriage guide rod, so that collars limit rearward movement of paper holder. Be sure that collars contact paper holder with same amount of pressure on both sides.

j. Card Guide Assembly.

(1) *Description.* The card guide assembly is composed of the card guide bracket, which is fastened to the lower rail by two binding screws fitted in elongated slots; the card guide scales, which are bolted to the bracket; two card guide fingers; and two card guide release levers. When the card guide is not in use, the two card guide fingers can be placed in inactive position by depressing card guide release levers to enable the operator to have better vision of the paper. A small spring on each release lever holds the fingers in active position. When the release lever is depressed, the spring pulls the finger to inactive position.

(2) *Function.* The card guide assembly is designed to help cards or heavy paper conform to the curvature of the cylinder.

(3) *Adjustment.* Adjust card guide assembly to center between cylinder and ribbon vibrator.

CHAPTER 9

ESCAPEMENT MECHANISM

27. General

The escapement mechanism (fig. 7) controls the space-by-space movement of the carriage. The escapement mechanism includes a series of links and levers; the universal bar; the escapement frame; the escapement rocker assembly; rack, pinion, and escapement wheel assembly; and the spacebar. The interrelated movements of these parts effect the escapement trip.

28. Escapement Trip

a. When the key lever (25, fig. 7) is depressed, it pulls the key lever link (26) down.

b. The key lever link pulls and pivots the front link (27) down and toward the front of the machine.

c. The front link pulls the type bar lever link (28) forward.

d. The type bar lever link pulls the type bar lever (29) forward.

e. The type bar lever pulls the type bar link (30) which pivots the type bar up to the cylinder and creates a type impression. The type bar lever also pulls the universal bar link (28) forward.

f. When the universal bar link is pulled forward, it pulls the universal bar (18).

g. As the universal bar moves forward, a small plate attached to the bar contacts the trip roll and pivots the lower half of the escapement rocker (8) toward the front of the machine.

h. As the rocker pivots, the upper half moves toward the rear of the machine and allows the loose dog (12) to release the escapement wheel tooth (2), which then contacts the escapement roll (13).

i. When the rocker starts back to the normal position, the roll releases the tooth, and the tooth contacts the check pawl (3), which pivots and allows the tooth to pass.

j. The next escapement wheel tooth moves into position against the loose dog and thus completes the escapement trip.

29. Universal Bar

a. Description. The universal bar (fig. 8) is suspended from a small extension (1) of the mainspring barrel bracket (10, fig. 8) and the adjustable universal bar bracket (2, fig. 8) fastened to the rear of the machine. The universal bar houses the ribbon adjusting screw. On the right side of the bar is an extension provided for the line lock mechanism to lock the universal bar when the carriage has reached the right margin.

b. Function. The universal bar, motivated by the key lever and link and the type bar lever and link, rocks the escapement rocker (par. 28*g*).

c. Adjustment. The universal bar must be free on its pivot points and must be free from end shake. In case of end shake on the universal bar, loosen the two universal bar binding screws, adjust the right universal bar bracket, and then tighten the screws. Be sure that the universal bar fulcrum nut (8, fig. 8) is tight.

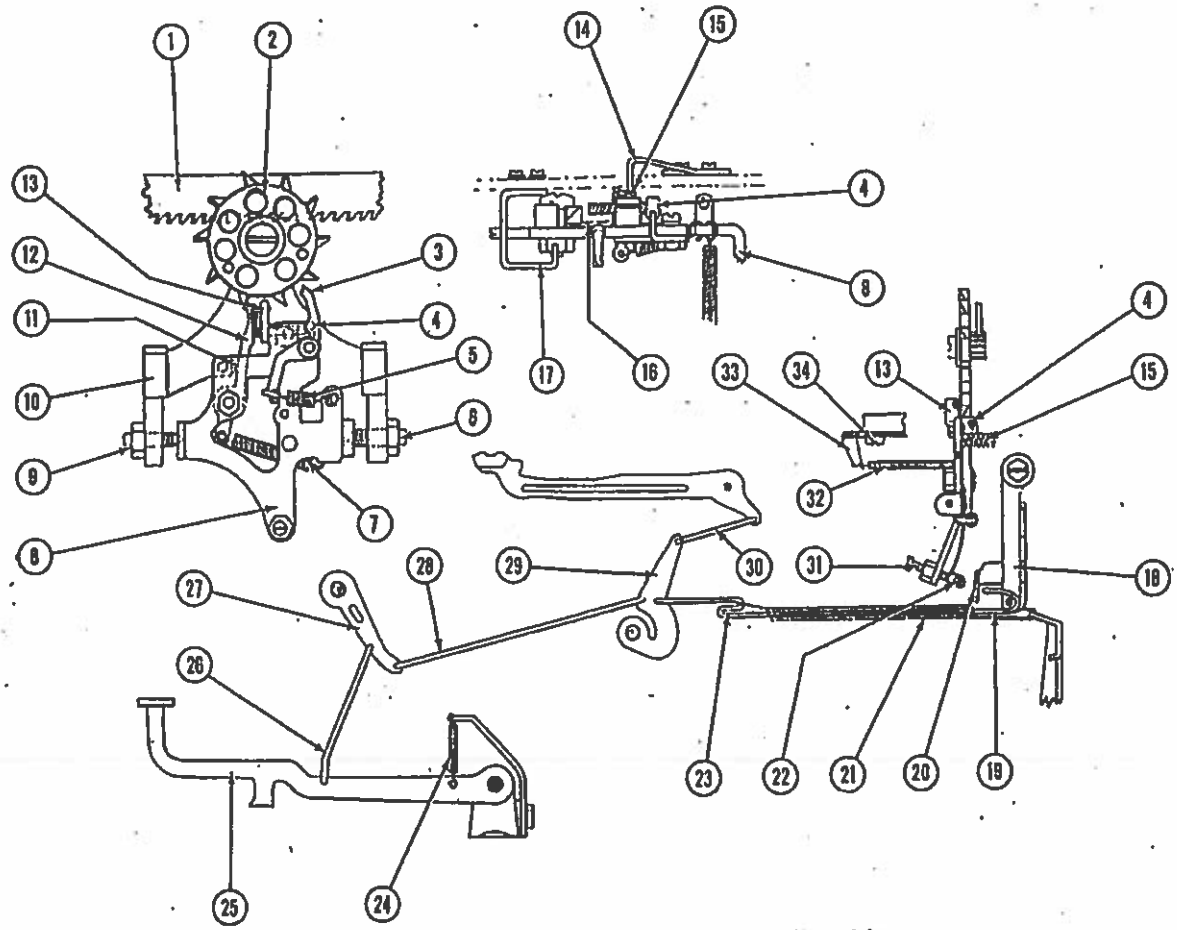
30. Escapement Frame

a. Description. The escapement frame (10, fig. 7), attached to the lower rail, is held in position by two binding screws. A small brace, held in position on the left side of the center bracket with two binding screws, supports the rear of the escapement frame.

b. Function. The escapement frame provides mounting support for the escapement rocker assembly, escapement wheel and pinion, and parts of the backspace, tabulator, and ribbon mechanisms.

c. Removal. Remove frame from machine by loosening binding screws.

d. Installation. Position frame on machine and tighten binding screws securely.



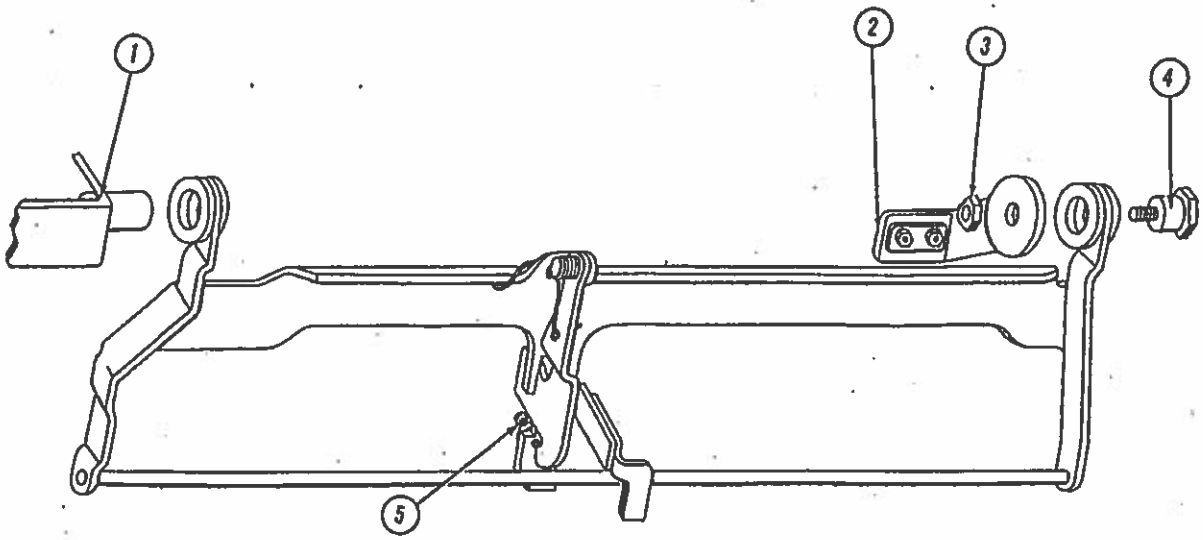
1 Carriage rack
2 Escapement wheel
3 Escapement check pawl
4 Rocker drop screw
5 Escapement check pawl spring
6 Right-hand pivot screw
7 Loose dog spring
8 Escapement rocker
9 Left-hand pivot screw
10 Escapement frame
11 Loose dog stop
12 Loose dog
13 Escapement roll
14 Rear limit plate
15 Kickback spring
16 1/64-inch clearance
17 Front limit plate
18 Universal bar
19 Individual trip adjustment
20 Universal bar trip plate
21 Universal bar link spring
22 Trip roll
23 Universal bar link
24 Key lever spring
25 Key lever
26 Key lever link
27 Front link
28 Type bar lever link
29 Type bar lever
30 Type bar link
31 Trip adjusting screw
32 Rocker return spring
33 Adjustable plate
34 Plate adjusting screw

Figure 7. Escapement unit.

31. Escapement Rocker Assembly

a. Rocker.

(1) *Position.* The rocker (8, fig. 7) is held in position in the escapement frame by two pivot screws (6 and 9), each having a locknut. The rocker must rock freely on its pivot screws. If the pivot screws are too tight, the rocker will bind. The rocker is in inactive position when the front edge of the loose dog is flush with the front edge of the escapement wheel tooth and in active position when the escapement wheel tooth slips off the loose dog. The 6 o'clock position of the rocker is preset in manufacture and is controlled by the left rocker pivot screw. The



1 Mainspring barrel bracket extension
2 Universal bar bracket
3 Fulcrum nut
4 Universal bar fulcrum
5 Ribbon adjusting screw

Figure 8. Universal bar.

rocker is motivated by the action of the universal bar (par. 20*b*).

(2) *Function.* The pivoting of the rocker moves the loose dog off the escapement wheel tooth and thus releases the tooth to pass the escapement roll (par. 28*h*).

(3) *Adjustment.*

(*a*) Adjust right rocker pivot screw (6, fig. 7) to remove all end shake.

(*b*) Do not try to adjust left rocker pivot screw (preset in manufacture) (9).

(*c*) Form front limit plate (17) to obtain inactive position of rocker, with front edge of loose dog flush with edge of escapement wheel tooth.

(*d*) Adjust trip adjusting screw (31) so that escapement trip takes place when type head is three-eighths of an inch from cylinder. If, after this trip adjustment, the trip of several type bars varies, adjust the separate type bars by forming the universal bar link (23) near the universal bar.

b. Rocker Limit Plates.

(1) *Function.*

(*a*) The front limit plate (17, fig. 7) controls the inactive position of the rocker.

(*b*) The rear limit plate (14) limits the rearward movement of the rocker. A slight clearance should always exist between the rocker and the rear limit plate.

(2) *Adjustment.*

(*a*) If the rocker does not rest in its inactive position, form the front limit plate toward the front or rear of the machine, as necessary, to aline the loose dog and the escapement wheel tooth.

(*b*) To obtain a slight clearance between the rocker and the rear limit plate, form the rear limit plate toward the front or rear, as necessary. When testing for this clearance, hold the type bar against the cylinder.

c. Rocker Springs.

(1) *Return spring.*

(*a*) *Function.* The rocker return spring (32, fig. 7), connected from the rocker to an adjustable plate on the underside of the escapement frame, determines the speed with which the rocker will return to the front limit plate.

(*b*) *Adjustment.* To adjust the tension of the return spring, loosen binding screws and reposition plate ((*a*) above).

(2) *Kickback spring.*

(*a*) *Function.* The rocker kickback spring (15, fig. 7) kicks the rocker from the rear of the machine towards the front.

(*b*) *Adjustment.* Replace kickback spring if tension is not sufficient.

d. Loose Dog.

(1) *Position.* The loose dog (12, fig. 7) is fastened to the rocker by a pivot screw and locknut. The loose dog must be free on its pivot. The loose dog washer fits between the loose dog and the rocker and establishes a 1/64-inch clearance (16) between the loose dog and the escapement roll. A tension spring (7) applies tension to the loose dog and thus pivots the dog against the loose dog stop (11). The tension of the escapement wheel is much greater than that of the tension spring and easily forces the loose dog against the rocker drop screw.

(2) *Function.* The loose dog holds the escapement wheel and thus prevents any movement when the rocker is in active position.

(3) *Adjustment.*

(*a*) Replace loose dog tension spring if tension is not sufficient to return dog to dog stop.

(*b*) Do not tamper with loose dog washer except in cases when the operator has a heavy touch or when he holds the key down too long and creates a recoil action in the rocker. In such cases, replace washer with a thinner washer, decreasing the distance between the dog and the escapement roll (18, fig. 7).

e. Escapement Roll.

(1) *Position.* The escapement roll (18, fig. 7) revolves on a bearing soldered to the rocker.

(2) *Function.* The revolving of the roll on the bearing reduces the friction created by the escapement wheel tooth slipping off the roll during the escapement trip (par. 28*i*).

(3) *Adjustment.* Replace escapement roll if it does not turn freely on its bearing.

f. Escapement Check Pawl.

(1) *Position.* The escapement check pawl (8, fig. 7) is fastened to the rocker by a pivot screw and nut. When the escapement wheel tooth moves off the escapement roll, it contacts the check pawl, which pivots and allows the tooth to pass (par. 28*i*). The check pawl tension spring (5) applies tension to the check pawl, which pivots and allows the tooth to pass (par. 28*i*).

(2) *Function.* The escapement check pawl prevents backlash of the escapement wheel when backspacing, tabulating, or moving the carriage to the left margin.

(3) *Adjustment.*

(*a*) Adjust escapement check pawl only when escapement rocker locks in the active position and prohibits operation of the machine. This occurs when the roll and check pawl are jammed between the teeth of the escapement wheel. To adjust, form check pawl upward, changing position of escapement wheel slightly and increasing the distance between roll and pawl.

(*b*) Replace escapement check pawl spring if tension is not sufficient to return pawl to its inactive position.

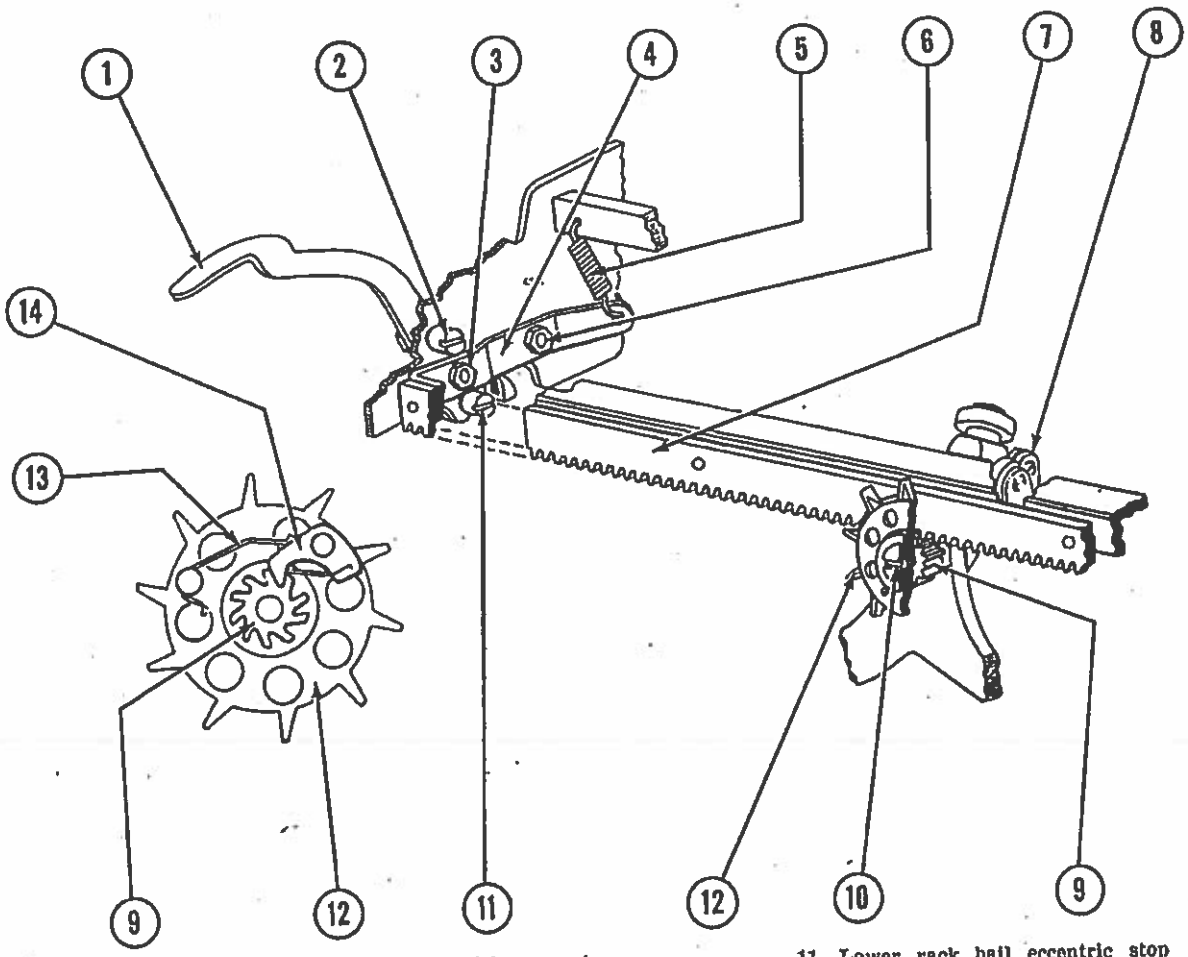
32. Carriage Rack, Pinion, and Escapement Wheel Assembly

a. General. The carriage rack, pinion, and escapement wheel assembly (fig. 9), although grouped as a part of the escapement mechanism, actually serves as a tie-in mechanism between the carriage mechanism and the escapement mechanism. The style of type produced by the machine governs the kind of rack, pinion, and escapement wheel on the machine. Pica type has 10 letters per inch of writing line and elite type has 12 letters per inch. Pica parts and elite parts cannot be interchanged.

b. Carriage Rack.

(1) *Position.* The carriage rack (7, fig. 9), located on the underside of the carriage, is fastened to the rack bail (4) by four binding screws. The bail holds the rack in its proper position.

(2) *Operation.* The bail pivots on two fulcrum nuts (6), one at each end, allowing the carriage to be lifted out of mesh with the pinion (9). Tension springs (5) at each end of the bail hold the bail against the lower rack bail eccentric stop screws (11). The upper rack bail eccentric stop screws (2) limit the upward movement



1 Rack release lever
2 Upper rack bail eccentric stop screw
3 Rack bail adjusting stud
4 Rack bail
5 Tension spring
6 Fulcrum nut
7 Carriage rack
8 Wheel shaft nut
9 Pinion
10 Escapement wheel shaft head
11 Lower rack bail eccentric stop screw
12 Escapement wheel
13 Pinion pawl spring
14 Pinion pawl

Figure 9. Rack, pinion, and escapement wheel assembly.

of the rack; the lower screws, the downward movement. The rack release levers (1) pivot the rack bail and disengage the rack from the pinion. Thus the carriage moves freely across the machine. When the rack release levers are depressed, the rack should clear the teeth of the pinion by one-sixteenth inch.

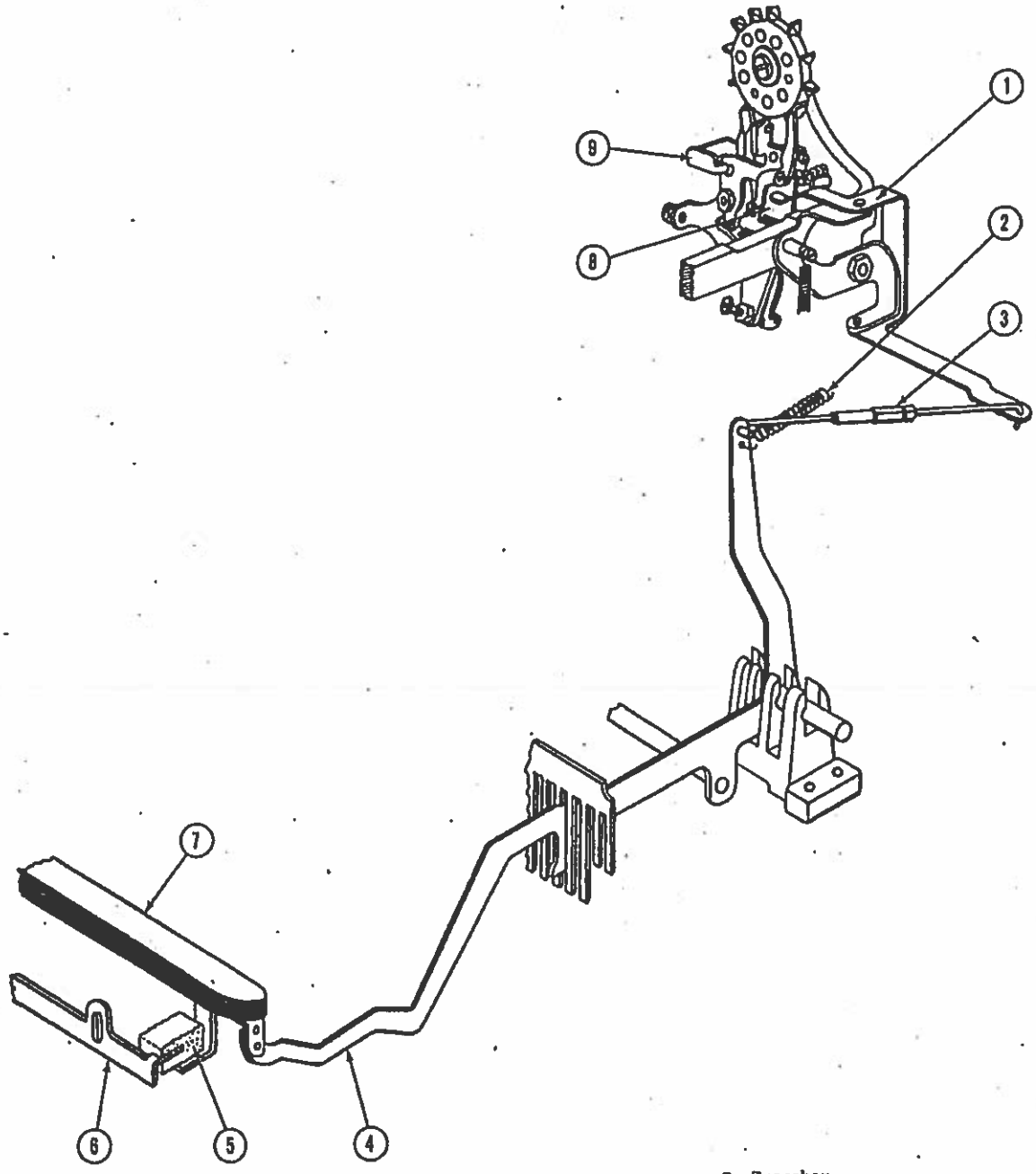
(3) *Function.* The carriage rack transfers tension of the mainspring from the carriage to the escapement wheel.

(4) *Adjustment.*

(*a*) To remove end shake from carriage rack, adjust rack bail by tightening rack bail adjusting stud (3, fig. 9), and locknut on right inside edge of rack bail (facing rear of machine).

(*b*) Adjust lower rack bail eccentric stop screws (11) to allow rack to mesh into pinion with approximately two-thirds of rack tooth meshed with pinion. If the rack is not deep enough into the pinion, the machine will skip spaces. If the rack is too deep, it will create a harsh grinding noise and excess friction.

(*c*) Adjust upper rack bail eccentric stop screws (2) to allow 1/16-inch clearance between rack and pinion with rack release levers depressed.



1 Spacebar trip arm
2 Spacebar spring
3 Spacebar link and adjusting nut
4 Spacebar key lever
5 Spacebar buffer
6 Spacebar buffer support
7 Spacebar
8 Escapement rocker plate
9 Rocker limit plate

Figure 10. Spacebar mechanism.

(*d*) Replace rack bail tension springs (5) if tension is not sufficient to return rack in mesh with pinion.

(*e*) Adjust the two eccentric screws that thread into the two fulcrum nuts of rack bail to remove all excess upward movement from rack release levers.

c. Pinion.

(1) *Position.* The pinion (9, fig. 9) should be placed on the escapement wheel shaft

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with the teeth of the pinion facing the direction opposite the teeth of the escapement wheel. The pinion pawl (14) should be seated in the teeth of the pinion.

(2) *Function.* The pinion transfers the carriage tension to the escapement wheel (12) by exerting force on the pinion pawl. The pinion pawl, riveted to the escapement wheel, forces the escapement wheel to turn. Upon the carriage return action, the pinion turns clockwise and forces the pawl out of engagement with the pinion teeth. The pinion turns freely without the escapement wheel turning.

(3) *Adjustment.* Check to see that small spring located on pinion pawl is applying pressure to pawl, keeping it in engagement with pinion. If pinion pawl is worn, replace pinion pawl.

d. Escapement Wheel.

(1) *Position.* The escapement wheel is fitted to a shaft on the upper section of the escapement frame by means of a split nut and a setscrew that locks the nut in position.

(2) *Function.* The escapement wheel, when controlled by the escapement rocker, controls the space-by-space movement of the carriage.

(3) *Adjustment.*

(*a*) Remove carriage.

(*b*) Loosen setscrew and adjust locknut (8, fig. 9) on end of escapement wheel shaft to remove end shake.

(*c*) After adjustment, tighten setscrew.

33. Spacebar Mechanism

a. Function. The spacebar mechanism (fig. 10) releases the carriage space by space without creating a type impression.

b. Operation. When the spacebar (7) is depressed, it pivots the spacebar key levers (4) and causes the spacebar link and adjusting nut (3) to be pulled toward the front of the machine. The spacebar link pivots the spacebar trip arm (1), which tilts the escapement rocker toward the rear of the machine and motivates an escapement trip.

c. Adjustment.

(1) Never adjust spacebar until all escapement rocker adjustments (par. 31*a*(3)) have been made. Keep a clearance of .005 to .010 inch between spacebar trip arm (1, fig. 10) and escapement rocker when trip arm is in inactive position. To obtain this clearance, lengthen or shorten spacebar link (3). To shorten link, loosen locknut and turn ends of link clockwise; to lengthen, turn counterclockwise. Tighten locknut.

(2) After the first escapement trip takes place, adjust spacebar to have ⅛-inch additional downward movement. To make this adjustment, loosen binding screws of spacebar buffer support (6), position support, and tighten screws.

CHAPTER 10

RIBBON MECHANISMS

Section I. RIBBON FEED MECHANISM

34. General

The ribbon feed mechanism (fig. 11) feeds the ribbon from one spool to another to prevent the type from striking the same section of the ribbon each time the key lever is depressed. The ribbon feeds when the carriage is moved to the left in typing, tabulating, and in depressing the spacebar or when the carriage is moved by hand with the carriage release levers depressed. The ribbon feeds from front to rear, the center of the ribbon passing freely through the ribbon vibrator. The ribbon feed is motivated by the action of the mainspring barrel gear (30).

35. Wormshaft Assembly

a. Shaft.

(1) *Position.* The shaft (14, fig. 11) is held in position by the mainspring barrel bracket at the rear and the reverse detent at the front. All parts of the wormshaft assembly are securely fastened to the shaft by setscrews. The wormshaft universal joint, about three-fourths of an inch from the mainspring barrel, is designed to allow the front half of the shaft to move up or down when the ribbon reverse action is taking place.

(2) *Function.* The wormshaft transfers the power from the mainspring barrel gear to the ribbon feed mechanism.

(3) *Adjustment.* Too much end shake will cause the worm ratchet pawl (5, fig. 11) to drop down between the detent bracket and the ratchet (1). To remove end shake in the wormshaft, loosen setscrew in worm gear and apply slight rearward pressure to the shaft. While applying pressure to the shaft, move the worm gear as far forward as possible and tighten setscrew. Do not move gear far enough forward to cause it to bind.

b. Wormshaft Pinion.

(1) *Position.* A large and a small pinion (29, fig. 11) are spot-welded together and located at the rear of the wormshaft.

(2) *Function.* The large pinion meshes with the mainspring barrel gear (30), causing the gear to revolve and turn the pinion gear. The small pinion is engaged by the pinion case pawl. As the carriage moves to the left, the small pinion applies pressure to the pinion case pawl driving the wormshaft. As the carriage moves to the right, the pinion case pawl slips over the teeth of the small pinion, allowing the ribbon feed wormshaft to remain stationary.

(3) *Adjustment.* For proper adjustment, position wormshaft pinion and case as far forward on wormshaft as possible.

c. Pinion Case.

(1) *Position.* The wormshaft pinion case, directly behind the wormshaft pinion, is positioned as far forward on the wormshaft as possible. The wormshaft pinion case setscrew (28, fig. 11), seated on a flat surface on the rear end of the shaft, binds the pinion case to the wormshaft.

(2) *Function.* The pinion case houses the pinion pawl. The pinion pawl is fastened to the pinion case, and the pinion case pawl spring (27) supplies tension necessary to keep the pawl in engagement with the small pinion.

(3) *Adjustment.*

(*a*) Replace pinion case if pinion pawl becomes loose.

(*b*) Replace pinion pawl spring if tension is not sufficient to keep pawl engaged with pinion.

d. Ribbon Reverse Cam.

(1) *Position.* The ribbon reverse cam (11, fig. 11) is fastened to the shaft just be-

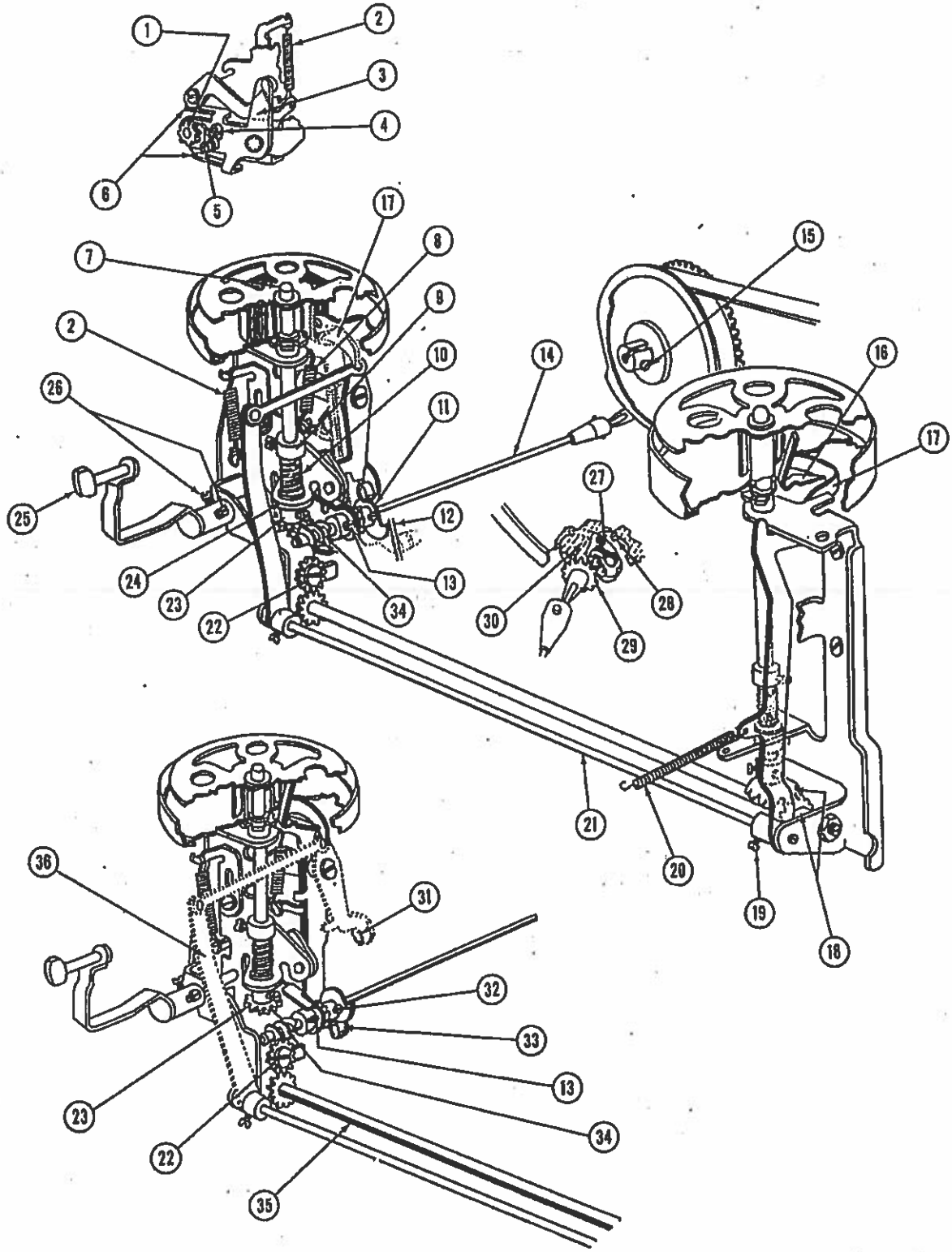


Figure 11. Ribbon mechanism.

hind the reverse detent and is held by a setscrew seated on a flat surface on the shaft. The cam moves the shaft up or down to reverse the feed of the ribbon.

(2) *Function.* See paragraph 41*e*.

(3) *Adjustment.* See paragraph 41*e*.

e. Worm Gear.

(1) *Position.* The worm gear (34, fig. 11) is fastened to the front end of the shaft by a setscrew seated on a flat surface of the shaft.

(2) *Operation.* The worm gear is always meshed with either the left ribbon spool shaft spur gear (23) or the idler gear (22), depending upon the direction the ribbon is feeding. The worm ratchet (1) is fitted just behind the worm gear, with the reverse detent pawl engaged in the ratchet. The pawl prevents the ratchet from turning backwards when the carriage is moving to the right. A tension spring (4) supplies the necessary tension to keep the pawl engaged in the ratchet. An upper and a lower limit plate limit the worm gear in its up-and-down movement.

(3) *Function.* The worm gear transfers the power from the wormshaft to the ribbon spool shafts.

(4) *Adjustments.*

(*a*) Form upper limit plate so that it limits upward movement of worm gear when worm gear is meshed with left ribbon spool shaft spur gear (23).

(*b*) Form lower plate so that it limits downward movement of worm gear when worm gear is meshed with idler gear.

(*c*) Replace worm gear if teeth are worn, broken, or bent.

36. Ribbon Spool Assembly

a. Ribbon Spools.

(1) *Position.* There are two ribbon spools, right and left. The ribbon winds from one spool to the other. The spool trip arm (16, fig. 11) on the underside of each spool extends up into the center portion of the spool.

(2) *Operation.* The loop in the end of the ribbon fits over the spool trip arm and prevents the ribbon from disengaging itself from the spool during the reversing of the ribbon feed. When the ribbon reaches the end of its movement, it forces the spool trip down. The spool trip arm contacts the automatic reverse arm, forces it rearward, and brings about the ribbon reverse. A light spring on the ribbon spool supplies tension to the spool trip arm and forces it toward the active position. Winding the ribbon on the spool overcomes the tension of the spring and holds the trip arm in inactive position. Two extensions on the bottom of each ribbon spool fit into a spur gear approximately three-quarters of an inch from the top of the shaft and cause the spool to turn when the shaft is turning.

(3) *Adjustment.* If tension is not sufficient to move trip arm in position to contact automatic reverse arm, replace ribbon spool trip arm tension springs.

b. Ribbon Spool Cups.

(1) *Position.* Each ribbon spool cup, left and right, is held in position on top of the ribbon spool bracket (24, fig. 11) by two

Figure 11. Ribbon mechanism—Continued.

1 Worm ratchet
2 Reverse arm spring
3 Reverse arm
4 Ratchet pawl spring
5 Ratchet pawl
6 Reverse arm extension limits
7 Spool shaft
8 Automatic reverse arm spring
9 Tension spring collar
10 Spool shaft tension spring
11 Ribbon reverse cam
12 1/64-inch clearance
13 Worm gear setscrew
14 Wormshaft
15 Setscrew
16 Spool trip arm
17 Automatic reverse arm
18 Bevel gears
19 Automatic reverse shaft arm setscrew
20 Automatic reverse arm spring
21 Automatic reverse shaft
22 Idler gear
23 Ribbon spool shaft spur gear
24 Spool bracket
25 Ribbon reverse handle
26 Reverse handle setscrews
27 Pinion case pawl spring
28 Wormshaft pinion case setscrews
29 Wormshaft pinion
30 Spring barrel gear
31 Automatic reverse roll (right)
32 Reverse cam setscrew
33 Automatic reverse roll (left)
34 Worm gear
35 Ribbon feed shaft
36 Automatic reverse lever

binding screws. Each cup is marked with an arrow indicating the path in which the ribbon must travel when winding on or off the spool. Each cup must be low enough to prevent the spool from binding against it.

(2) *Adjustment.* If spool binds against cup, form spool cup down until spool clears cup.

c. Ribbon Spool Brackets.

(1) *Position.* The ribbon spool brackets (24, fig. 11) are fastened to the sides of the machine by two binding screws each.

(2) *Function.* The brackets support the ribbon spool cups, spool shafts, feed shaft, idler gear, and most of the ribbon reverse parts.

d. Ribbon Spool Shafts.

(1) *Position.* The ribbon spool shafts extend through openings in the ribbon spool brackets. A small collar separates the spur gear at the top of the shaft from the bracket. The spur gear on the bottom of the left spool shaft prevents the shaft from riding up. The right ribbon spool shaft adjusting collar located above the bevel gear on the bottom of the right spool shaft prevents the shaft from riding up.

(2) *Operation.* The bevel gear of the spool shaft meshes with the bevel gear of the ribbon feed shaft (35, fig. 11). When the ribbon feed shaft is turned by the worm gear, it turns the right ribbon spool shaft.

(3) *Function.* The spool shaft tension spring (10) prevents backlashing of the ribbon when tabulating or when moving the carriage by means of the carriage release levers.

(4) *Adjustment.*

(*a*) Position spur gear on bottom of shaft to remove end shake in left ribbon spool shaft.

(*b*) Position collar on bottom of shaft to remove end shake in right ribbon spool shaft.

(*c*) Adjust shaft tension springs to create a slight drag on shaft. This adjustment will prevent a ribbon backlash and will force the ribbon to wind tight.

37. Idler Gear

a. Position. The idler gear (22, fig. 11) is fastened to the lower inside edge of the left ribbon spool bracket by a fulcrum screw.

b. Function. The idler gear reverses the direction of the power received from the worm gear and transfers the power to the spur gear of the ribbon feed shaft. The idler gear must be free on its shaft.

38. Feed Shaft

a. Position. The feed shaft (35, fig. 11) extends from the bottom of the right ribbon spool bracket to the bottom of the left ribbon spool bracket. The feed shaft adjusting screw on the right ribbon spool bracket and the shaft extension that fits into a hole in the left ribbon spool bracket hold the feed shaft in position.

b. Function. The feed shaft bevel gear, fastened on the right end of the shaft by setscrews, transfers the power of the feed shaft to the right ribbon spool shaft. The feed shaft spur gear, on the left end of the shaft, meshes with the idler gear. A small collar, fitted onto the shaft, separates the spur gear from the bracket and keeps the spur gear alined with the idler gear.

c. Adjustment.

(1) Adjust feed shaft bevel gear to mesh with right spool shaft bevel gear without binding.

(2) Use feed shaft adjusting screw to prevent end shake of shaft.

Section II. RIBBON REVERSE MECHANISM

39. General

The ribbon reverse mechanism (fig. 11) reverses the direction of the ribbon feed by either the manual or the automatic reverse.

40. Manual Reverse

The manual reverse consists of the following parts:

a. Reverse Handle.

(1) *Position.* The reverse handle (25, fig. 11), extending through an opening in the front cover plate, is fastened to the reverse arm shaft by two setscrews (26).

(2) *Function.* The reverse handle is positioned on the shaft so that when the ribbon feed release handle is moved to the

left the reverse arm (*b* below) will hold the worm gear (34, fig. 11), out of mesh with the idler gear (22) and the left spool shaft spur gear (23).

(3) *Adjustment.* If adjustment is necessary, loosen handle setscrews, position handle, and then tighten setscrews.

b. Reverse Arm.

(1) *Position.* The reverse arm (3, fig. 11), is fastened to the reverse arm shaft.

(2) *Operation.* When the reverse handle is moved from one position to another, the reverse arm moves the worm gear back and forth from the idler gear to the left ribbon spool spur gear. The worm ratchet pawl (5) and pawl spring (4) are attached to the reverse arm. A small roller bearing on the upper extension of the reverse arm contacts the reverse detent, and tension from the detent tension spring holds the reverse arm up or down.

(3) *Adjustment.* In making adjustments, form limit plates on reverse arm to limit meshing of worm gear with idler or spur gear to a distance approximately two-thirds of a tooth.

c. Reverse Detent.

(1) *Position.* The reverse detent is attached to the left ribbon spool bracket by a fulcrum screw.

(2) *Operation.* An adjustable plate on the detent spring holds the detent against the roller on the reverse arm. When the reverse action is taking place, the reverse arm roller is moving from one side of the detent to the other. Once the roller has moved to one side of the detent, it is held in that position by the detent until the automatic reverse takes place or the ribbon reverse handle is moved.

(3) *Adjustment.* Raise or lower adjustable plate to adjust tension. Too much tension will create a sluggish or delayed reverse.

d. Ribbon Feed Release.

(1) *Position.* The ribbon feed release, located to the right of the reverse handle, is held in position by a fulcrum screw.

(2) *Operation.* When the release lever is held to the left, it cams the ribbon reverse lever to a little less than one-half its normal movement, throwing the worm gear out of mesh with both the idler gear and the spur gear. This enables the operator to turn the spools by hand.

41. Automatic Reverse

The automatic reverse consists of the following parts:

a. Automatic Reverse Arm (Left).

(1) *Position.* The automatic reverse arm (left) (17, fig. 11) is located under the left ribbon spool cup. The arm is attached to the left spool bracket by a long fulcrum screw which also holds the right reverse lever in position.

(2) *Operation.* The lower automatic reverse roll (33) on the bottom of the arm moves into the path of the reverse cam (11). When the cam contacts the roll, it pushes the worm gear out of engagement with the idler gear and into engagement with the spur gear, reversing the feed of the ribbon. The automatic reverse arm (left) must be free of binds.

(3) *Function.* The arm alines the roll with the reverse cam when in its active position.

(4) *Adjustment.*

(*a*) If roll does not aline with reverse cam, form arm as may be necessary to bring roll in alinement.

(*b*) If tension is not sufficient to return arm to its inactive position, replace spring.

b. Automatic Reverse Arm (Right).

(1) *Position.* The automatic reverse arm (right) (17, fig. 11) is located under the right ribbon spool cup. The arm is fastened to the automatic reverse shaft and held secure by a setscrew.

(2) *Operation.* As the automatic ribbon spool trip arm (16) drops down, it contacts the reverse arm and pivots it toward the rear of the machine. As the right reverse arm pivots toward the rear of the machine, it rotates the reverse shaft.

(3) *Adjustment.* A tension spring (20) on the arm supplies tension to return the arm to the inactive position. If tension of tension spring is not sufficient to return arm to its inactive position, replace spring.

c. *Automatic Reverse Shaft.*

(1) *Position.* The automatic reverse shaft (21, fig. 11), located at the bottom of the right reverse arm, extends from the right ribbon spool bracket to the left ribbon spool bracket. The reverse arm (17) and lever (36) are held to the shaft by setscrews.

(2) *Operation.* As the reverse arm pivots toward the rear of the machine, it rotates the shaft, which in turn causes the reverse lever to move toward the rear of the machine.

(3) *Adjustment.* To remove end shake, position reverse arm and lever as close to end of shaft as possible without creating a bind.

d. *Automatic Reverse Lever.*

(1) *Position.* The automatic reverse lever (36, fig. 11) is located at the end of the automatic reverse shaft. The lever extends upward from the reverse shaft to its first joint and toward the rear of the machine. The rear extension is attached to the second joint and extends downward behind the reverse cam.

(2) *Operation.* The rear extension pivots on a fulcrum screw. When it is motivated by the reverse shaft, it moves the reverse roll into the path of the reverse cam. The reverse cam contacts the roll and kicks the worm gear out of engagement with the spur gear and into engagement with the idler gear.

e. *Reverse Cam.*

(1) *Position.* The reverse cam (11, fig. 11), located on the wormshaft just behind the worm gear, is held secure by a setscrew seated in a flat surface on the wormshaft.

(2) *Function.* A high edge of the cam contacts the roll and forces the shaft either up or down. The reverse cam clears the reverse rolls by one sixty-fourth inch when rolls are in inactive position.

(3) *Adjustment.* Position cam on wormshaft so that clearance for lower roll will be correct. To adjust clearance for upper roll, loosen automatic reverse arm setscrew, position roll correct distance from cam, and then tighten setscrew. It may be necessary to make several attempts to properly adjust the upper roll.

Section III. RIBBON COVER MECHANISM

42. General

The ribbon cover mechanism (fig. 12) controls the up-and-down movement of the ribbon to cover the typeface. The mechanism may be set in black, red, or stencil position. In the black position, the upper half of the ribbon is raised to cover the typeface; in the red position, the lower half of the ribbon is raised sufficiently high to cover the typeface; and in the stencil position, the ribbon does not rise at all but remains retracted so that the typeface strikes directly against the stencil.

43. Adjustments Before Removal

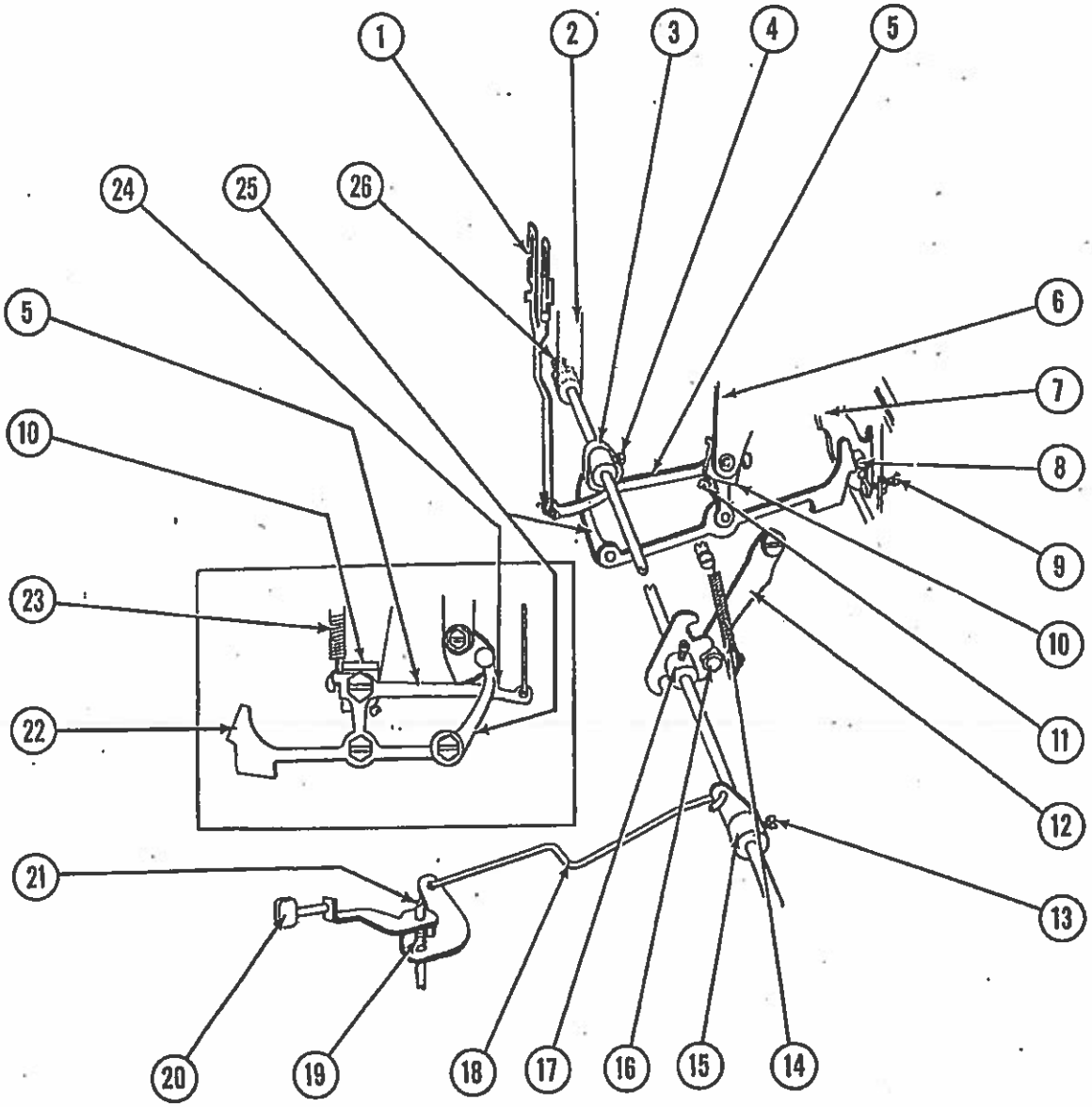
Before attempting any adjustments to the ribbon cover mechanism, make all shift and trip adjustments. Check ribbon to see that, with segment in nonshift position, top of ribbon is one-sixteenth inch above flat top of type guide. Check vibrator to see if it moves freely. It may be necessary to form the extensions clamping around the type guide to eliminate binds. Check slash (/) and one-half (½) keys by holding typeface against ribbon to see that tops of characters print and bottoms of characters do not bleed. Bleeding occurs only if a two-color ribbon is used.

44. Components

a. *Vibrator Link.*

(1) *Position.* The vibrator link (22, fig. 12) is connected to the bichrome lever (25) and the lower extension of the vibrator arm (5).

(2) *Operation.* When the universal bar moves, the ribbon throw adjusting screw (9), located on the universal bar, contacts the ribbon lift lever (7) and forces the lever toward the front of the machine. The stud (8) on the ribbon lift lever contacts the heel of the vibrator link and pushes the link toward the front of the machine. When the stud contacts the upper part of the link heel, the link will be pushed farther toward the front of the machine. When the stud contacts the lower part of the heel, the link travels



1 Vibrator
2 Left end vibrator arm support
3 Bichrome cam
4 Bichrome cam setscrew
5 Vibrator arm
6 Vibrator arm support
7 Lift lever
8 Lift lever stud
9 Ribbon throw adjusting screw and locknut
10 Vibrator armrest
11 Vibrator armrest setscrew
12 Index detent arm
13 Camshaft lever setscrew
14 Index detent spring
15 Bichrome camshaft lever
16 Index detent roll
17 Bichrome index
18 Bichrome handle link
19 Bichrome handle shaft spring
20 Bichrome handle
21 Bichrome handle shaft
22 Vibrator link
23 Ribbon vibrator arm spring
24 Ribbon vibrator arm forming point
25 Bichrome lever
26 Camshaft adjusting screw

Figure 12. Ribbon cover mechanism.

328184—55——5

a shorter distance. The vibrator link must be freed of any binds.

b. Vibrator Arm.

(1) *Position.* The vibrator arm (5, fig. 12) is fastened to the vibrator arm support. Its lower extension is fastened to the vibrator link.

(2) *Operation.* When the vibrator link moves forward, it pivots the vibrator arm at its support connection and throws the front end of the arm toward the top of the machine. A tension spring connected from the rear end of the arm to the top of the support returns the arm to its normal position.

(3) *Adjustment.* The vibrator arm contacts the cam at the same time the type strikes the paper. Test by holding type head of any type bar against cylinder and checking upward movement of vibrator arm. If there appears to be additional upward movement of arm, turn ribbon throw adjusting screw clockwise until movement is eliminated. If the arm contacts the cam too soon, it will choke the type bar and prevent it from striking the cylinder as it should. To eliminate this choking, turn ribbon throw adjusting screw counterclockwise. After making adjustment, check to see that tops of characters will print. If arm contacts cam properly and tops of characters do not print, form front end of arm (24) up, using a vibrator arm bender. If letters bleed, form arm down.

c. Vibrator Armrest.

(1) *Position.* The vibrator armrest (10, fig. 12) is located on the support bushing between the vibrator arm and the arm support.

(2) *Function.* The vibrator armrest limits the inactive position of the vibrator arm. The vibrator armrest setscrew (11) locks the armrest in position.

(3) *Adjustment.* Loosen armrest setscrew and raise armrest as high as it will go to obtain proper normal position of ribbon. Tighten setscrew to a snug fit. Push vibrator down until top of ribbon is one-sixteenth inch above flat top of type guide before tightening setscrew completely.

d. Vibrator Arm Support.

(1) *Position.* The vibrator arm support (6, fig. 12) is located inside the escapement frame. The support is held in position by two binding screws.

(2) *Function.* The vibrator arm support provides a pivot point for the vibrator arm.

(3) *Adjustment.* Tighten binding screws securely.

e. Vibrator.

(1) *Position.* The vibrator (1, fig. 12), cotter-pinned to the front end of the vibrator arm, extends upward between the cylinder and the type guide. The lower end of the vibrator is connected to the vibrator arm by a cotter pin.

(2) *Operation.* Two small extensions on the vibrator are shaped around the type guide and thus form a channel to keep the up-and-down motion of the vibrator on a vertical plane. The ribbon is fed through slots in the upper end of the vibrator.

(3) *Adjustment.*

(*a*) Replace cotter pin that connects lower end of vibrator to vibrator arm if pin becomes worn.

(*b*) Form vibrator extensions, shaping them around the type guide to insure free movement and eliminate binds.

f. Bichrome Cam.

(1) *Position.* The bichrome cam (8, fig. 12), near the left end of the bichrome camshaft, is fastened to the shaft by a setscrew.

(2) *Function.* The cam limits the upward movement of the vibrator arm.

(3) *Operation.* The bichrome lever (25), fastened from the cam to the vibrator link (22), forces the heel of the vibrator link to change position when the position of the cam is changed.

(4) *Adjustment.* See that setscrew is seated properly on flat surface of camshaft.

g. Bichrome Handle.

(1) *Position.* The bichrome handle (20, fig. 12) is located on the right side of the front of the machine. The handle shaft extends through the handle and fits into holes in the right ribbon spool bracket. The shaft is held in position by a set-

screw. A small spring (19), fitted over the end of the shaft, holds the shaft seated in the spool bracket. The front end of the handle extends through the cover plate.

(2) *Adjustment.* To adjust handle, loosen handle setscrew, position handle on shaft so that it will aline with opening in front cover plate, and tighten setscrew.

h. Bichrome Handle Link.

(1) *Position.* The bichrome handle link (18, fig. 12) is connected from the bichrome handle to the camshaft lever.

(2) *Operation.* When the handle is moved, the link moves the shaft lever and rotates the shaft.

(3) *Adjustment.* Form front of bichrome handle link to prevent link from disengaging bichrome handle.

i. Bichrome Camshaft Lever.

(1) *Position.* The bichrome camshaft lever (15, fig. 12), located on the right end of the camshaft, is held in position by a setscrew.

(2) *Function.* When the bichrome camshaft lever is moved, it moves the camshaft.

(3) *Adjustment.* Be sure that camshaft lever setscrew is seated properly on flat surface of camshaft.

j. Bichrome Index and Detent.

(1) *Position.* The bichrome index (17, fig. 12) is located on the camshaft approximately 2 inches to the left of the camshaft lever. The index is held in position by a setscrew.

(2) *Operation.* The bichrome index has three notches into which the detent roll (16) may seat. When the detent roll is seated in any one of the index notches, the camshaft is held stationary with the bichrome handle, bichrome cam, and vibrator link held in the selected index position. The detent is held to the right side of the escapement frame by a fulcrum screw. The bichrome index detent tension spring (14) provides tension necessary to keep the detent roll seated in the index.

(3) *Adjustment.* Be sure that index setscrew is seated properly on flat surface of camshaft.

k. Camshaft.

(1) *Position.* The camshaft extends from the right end of the lower rail to the left end of the vibrator arm support.

(2) *Function.* The camshaft supports the camshaft lever, bichrome index, and bichrome cam.

(3) *Adjustment.* Remove end shake by turning camshaft adjusting screw (26, fig. 12) clockwise. Be sure that screw is not too tight, for camshaft must be free to turn.

l. Bichrome Stencil Stop.

(1) *Position.* The bichrome stencil stop handle, extending through the front cover plate, is fastened to the frame by the upper front binding screw on the right side of the machine.

(2) *Function.* The bichrome stencil stop prevents the bichrome handle from being accidentally moved into the stencil position. The stop must be released before the bichrome handle can be moved into the stencil position.

(3) *Operation.* When the bichrome handle is moved from the stencil position, the stop automatically resets.

CHAPTER 11

TABULATOR MECHANISM

45. General

The tabulator mechanism (fig. 13) allows the operator to move the carriage and position the paper to preset spacing. It aids the operator in indenting and column writing. Before attempting any adjustments to the tabulator mechanism, fit carriage to frame of machine and make all escapement adjustments (pars. 29–33). Any binds in the carriage will prevent a true tabulator adjustment. The tabulator mechanism consists of three assemblies.

46. Tabulator Key Lever Assembly

a. Function. The tabulator key lever assembly raises the carriage rack out of mesh with the pinion and stops the carriage after it has moved the desired number of spaces.

b. Components. The tabulator key lever assembly is composed of the key lever, link, link lever, lift arm rod, lift lever, finger link lever, finger, and center stop bracket.

c. Operation.

(1) The tabulator key lever (14, fig. 13), located in the upper right corner of the keyboard, is held in position by the key lever fulcrum rod. When the key lever is depressed, it pivots on the fulcrum rod and moves the upright section of the lever toward the front of the machine.

(2) The tabulator link (15), pulled toward the front of the machine, pulls the tabulator link lever (10).

(3) The lever, attached to the tabulator lift arm rod (16), rotates the rod toward the front of the machine.

(4) The lift arm rod extension (17) contacts the lift lever plate (18) and pivots the lift lever (20).

(5) The front edge of the lift lever contacts the lower edge of the carriage rack bail and moves the rack out of mesh with the pinion.

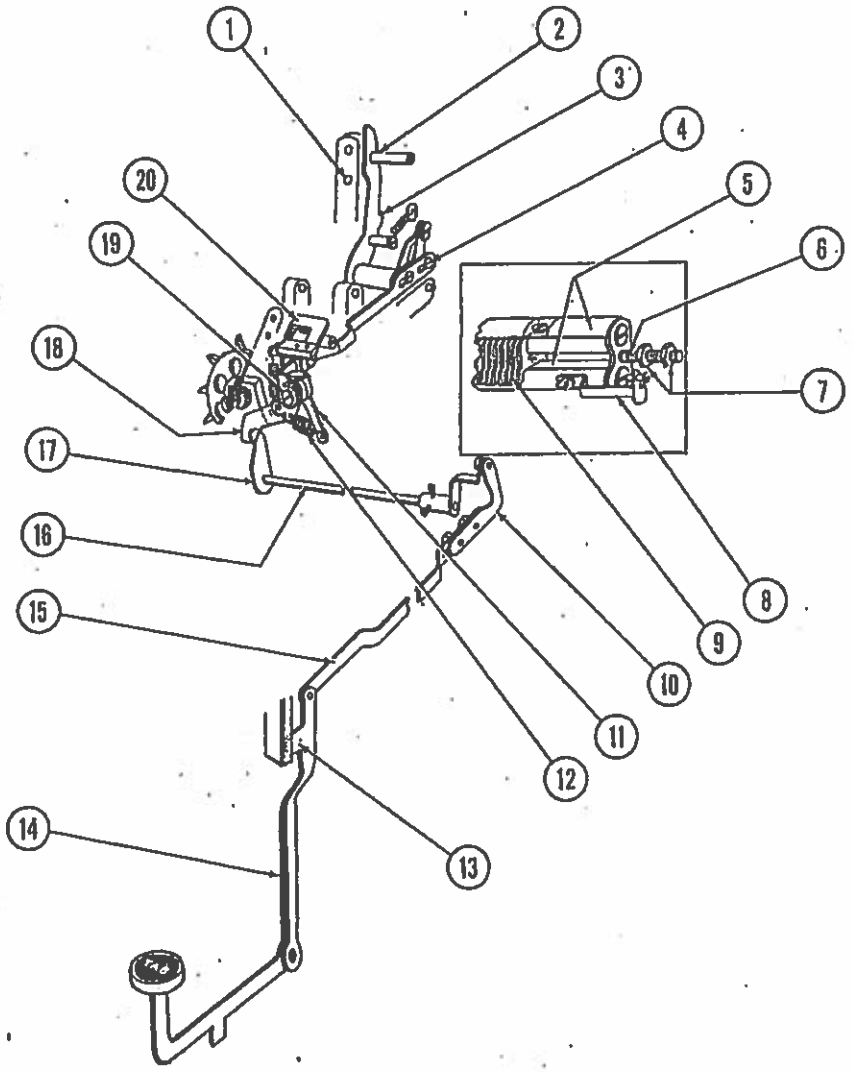
(6) The tabulator finger link lever (4), attached to the lower edge of the lift lever, is pulled forward and pulls the tabulator finger (2) forward.

(7) The tabulator finger moves into position to contact a set tabulator stop.

d. Adjustments. Adjust the tabulator key lever assembly before adjusting any other tabulator assembly. Check all moving parts to see that there are no binds. To adjust the tabulator key lever assembly—

(1) Loosen tabulator adjusting screws and position tabulator link (15, fig. 13) so that tabulator key lever extension (13) contacts ribbon spool bracket and tabulator finger extension (3) contacts center stop bracket (1) at the same time lift lever (20) disengages carriage from pinion. Tighten screws. Do not allow lift lever to raise rack too high, because this will make lift lever bind against rack bail. While the tabulator key lever is down, it is possible to reach under the carriage and raise the rack bail by hand. If the rack bail does not have slight additional movement, the lift lever is raising the rack too high or the upper rack bail eccentric stop screws (2, fig. 9) are being positioned too low.

(2) If it is impossible to obtain this adjustment with the tabulator link, it will be necessary to form the lift lever plate (18, fig. 13). After adjusting lift lever and key lever, loosen tabulator finger link lever adjusting screws. Position tabulator finger so that, with key lever de-



1 Center stop bracket
2 Tabulator finger
3 Tabulator finger extension
4 Tabulator finger link lever
5 Upper and lower stop retaining arms
6 Tabulator rack yoke
7 Yoke locknuts
8 Tabulator rack and carriage end brace
9 Tabulator stop
10 Tabulator link lever
11 Tabulator brake friction lever
12 Tabulator brake friction lever spring
13 Tabulator key lever extension
14 Tabulator key lever
15 Tabulator link
16 Tabulator lift arm rod
17 Lift arm rod extension
18 Lift lever plate
19 Tabulator brake gear
20 Tabulator lift lever

Figure 13. Tabulator mechanism.

pressed, there is a 1/32-inch clearance between finger and unset tabulator stops. Tighten screws.

(3) If it is impossible to obtain the adjustment with the tabulator finger link lever, it will be necessary to shorten the finger link lever by forming.

(4) Once the 1/32-inch clearance is obtained, form tabulator finger extension (3) so that it contacts center stop bracket (1) when tabulator key lever is fully depressed.

47. Tabulator Rack Assembly

a. Position. The tabulator rack assembly, located at the extreme rear of the carriage, extends through both ends of the carriage and is held in position by four locknuts, two on each end.

b. Function. The rack contains a stop (9, fig. 18) for each space of the carriage to stop the carriage at preset positions.

c. Components.

(1) *Upper and lower stop retaining arms.* The tabulator rack upper and lower stop retaining arms (5, fig. 18) extend across the entire length of the tabulator rack. Slots in the retaining arms hold the stops and prevent them from slipping out of position.

(2) *Rack yokes (left and right).* The tabulator rack yokes (6), connecting the upper and lower retaining arms, are fastened to the ends of the arms by binding screws. The yoke studs extend through the ends of the carriage. Locknuts (7) inside and outside the carriage ends securely hold the rack assembly in position.

(3) *Rack ties.* Two tabulator rack ties fitted into slots in the retaining arms pull the retaining arms together and thus offer better support to the stops.

(4) *Stops.* The tabulator stops are fitted between the retaining arms. Each stop has a small spring that applies tension against the lower arm and prevents the stop from moving in and out of position because of vibration.

(5) *Rack and carriage end braces (left and right).* The tabulator rack and carriage end braces (8), located on the front edge of the tabulator rack, connect the rack to the carriage end.

(6) *Rack roll.* The tabulator rack roll (1, fig. 2), located on the bottom of the lower retaining arm, is held in position by two binding screws.

d. Operation. When a tabulator stop is in a set position, it is forced out toward the rear of the machine; and when the tabulator key lever is depressed, the tabulator finger moves into the path of the set stop and stops the movement of the carriage.

e. Adjustments.

(1) Set tabulator rack so that it will stop carriage at proper selected position. To check rack position, set a tabulator stop, depress tabulator key lever, and hold until carriage has stopped. Backspace carriage one space, depress tabulator key lever, and hold. The carriage will move one-third of a space. Upon release of the tabulator key lever, the carriage travels the remaining two-thirds of a space and stops.

(2) If rack adjustment is necessary, loosen binding screws holding tabulator rack to carriage end braces and move tabulator rack to right or left through use of the four rack yoke locknuts (7, fig. 18). Tighten rack yoke locknuts to a snug fit, tighten binding screws in carriage end braces, and then tighten rack yoke locknuts securely.

48. Tabulator Brake Assembly

a. Function. The tabulator brake assembly, attached to the upper part of the tabulator lift lever, limits the speed of the carriage when tabulating.

b. Components. The tabulator brake assembly is composed of the brake gear bracket, brake gear friction hub, brake gear, brake gear spring, brake friction lever, and brake friction lever spring.

c. Operation.

(1) The tabulator brake, attached to the lift lever, moves upward as the lift lever pivots.

(2) As the lift lever lifts the rack out of mesh with the pinion, the brake gear (19, fig. 18) meshes with the rack.

(3) The brake gear turns freely for 7 or 8 spaces until the gear contacts a lug on the tabulator brake gear friction hub.

(4) Friction applied to the hub by the tabulator brake friction lever (11) retards the speed of the carriage and compels it to move at a steady speed.

(5) The tabulator brake gear spring, inclosed in the gear, returns the gear to its normal position in relation to the hub.

d. Adjustments. Adjust tabulator brake assembly after adjusting tabulator key lever and tabulator rack. The brake gear must mesh with the rack without bottoming.

(1) If brake gear meshes improperly with carriage rack, form upper arm of lift lever to acquire proper distance between top of lift lever and brake gear.

(2) Forming lift lever will necessitate readjustment of key lever. Adjust brake tension so that, without any tabulator stops set, the key lever is depressed and the carriage is stopped midway the machine by hand.

(3) When hand is released, the carriage does not move. Release and depress tabulator key lever again and carriage will move remaining distance across machine.

(4) To decrease brake tension, raise right end of tabulator brake friction lever spring (12), setting the spring end loop in a higher notch on the brake lever; to increase tension, drop spring to a lower notch.

CHAPTER 12

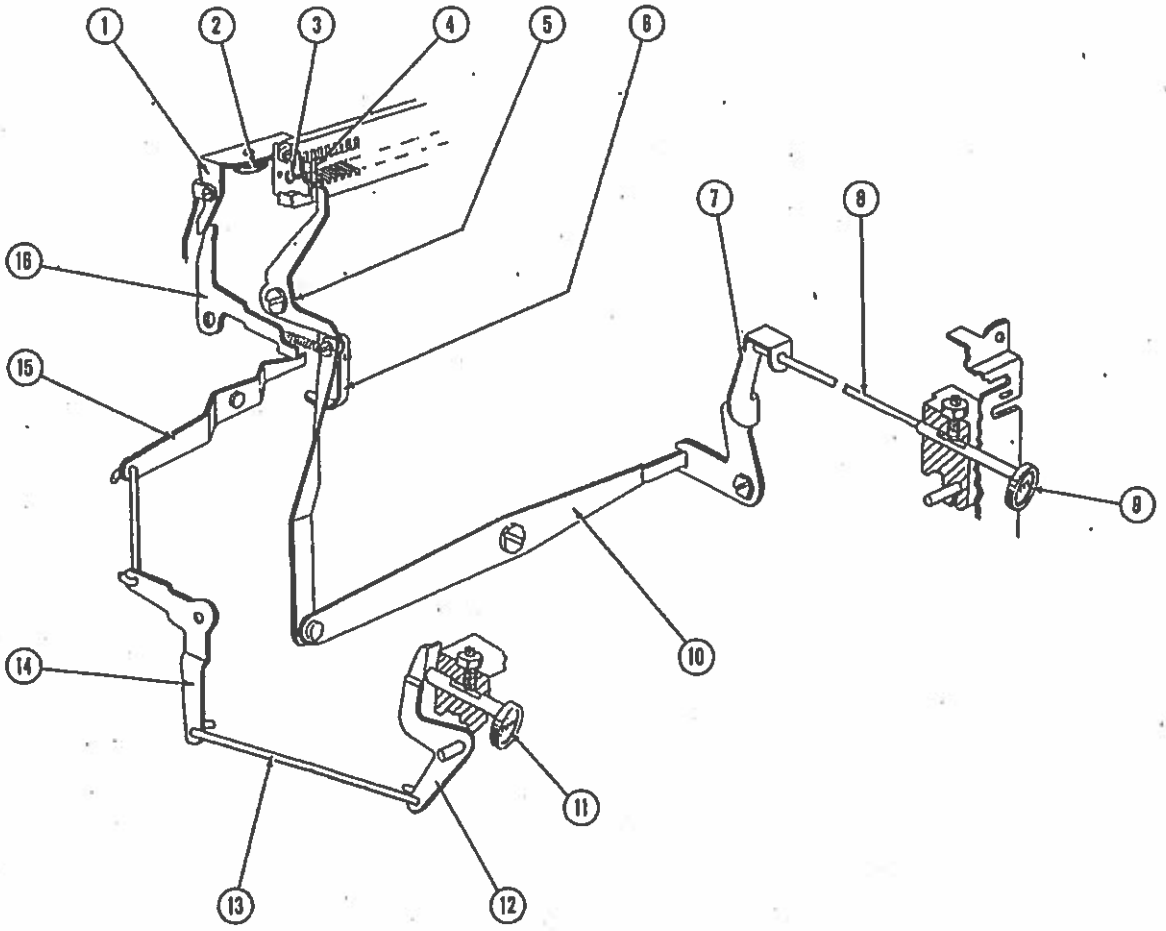
KEY SET AND CLEAR KEY MECHANISM

49. General

The key set and clear key mechanism (fig. 14) is closely related to the tabulator mechanism. It enables the operator to set and clear any stops in the tabulator rack. The key set and clear key mechanism is composed of two separate assemblies.

50. Key Set Assembly

a. Function. The key set assembly is designed to enable the operator to set the tabulator stops by positioning the carriage to the desired stop and pushing the tabulator set key located on the right side of the front panel.



1 Stop release roll bracket
2 Stop release roll
3 Stop
4 3/16-inch clearance
5 Stop set arm
6 Stop set arm extension
7 Set key stem crank
8 Set key stem
9 Set key
10 Stop set arm lever
11 Clear key
12 Stop release arm
13 Clear key link
14 Stop release crank
15 Stop release lever
16 Stop release bell crank

Figure 14. Key set and clear mechanism.

b. Components. The key set assembly is composed of the set key, set key stem, set key stem crank, stop set arm lever, and stop set arm.

c. Operation.

(1) Push set key (9, fig. 14), which in turn pushes set key stem (8) toward rear of machine.

(2) The set key stem, fitted into a hole in the set key stem crank (7), pivots the crank.

(3) The lower end of the crank, fitted over the right end of the stop set arm lever (10), pivots the lever and forces the upright section of the lever upward.

(4) The upright section of the lever pivots the stop set arm (5), which is attached to the end of the lever.

(5) The upper end of the arm contacts the stop (3) and pushes it into a set position.

d. Adjustments. Do not attempt adjustment of key set assembly until after adjusting tabulator mechanism.

(1) To aline stop set arm with tabulator stop, form arm to left or right as may be necessary, using a ribbon vibrator arm bender.

(2) To adjust for the necessary 3/16-inch clearance (4, fig. 14) between arm and stop, form stop set arm extension (6) so that it will contact frame of machine and limit position of arm.

(3) After adjusting stop set arm for alinement and normal position, it may be necessary to adjust arm for proper throw. To increase throw of arm, form upper part of set key stem crank (7) toward front of machine. To decrease throw, form crank toward rear of machine.

51. Clear Key Assembly

a. Function. The clear key assembly enables the operator to clear all set stops by placing the carriage at the extreme left margin, pushing the clear key, and moving the carriage to the right margin.

b. Components. The clear key assembly is composed of the clear key and link and the stop release arm, crank, crank link, lever, bell crank, roll, and roll bracket.

c. Operation.

(1) Push clear key (11, fig. 14) and cause clear key stem to contact and pivot stop release arm (12).

(2) The stop release arm pulls the clear key link (13) forward and pivots the stop release crank (14).

(3) The stop release crank pulls down on the left end of the stop release lever (15) and pivots the lever.

(4) The right end of the lever contacts and pivots the stop release bell crank (16).

(5) The upright section of the bell crank contacts the lower extension of the stop release roll bracket (1) and moves it toward the rear of the machine.

(6) The upper part of the bracket moves the attached stop release roll (2) towards the front of the machine and into the path of the set tabulator stops.

(7) As the carriage moves from right to left, the roll contacts the beveled edges of the stops and pushes the stops back into the inactive position.

d. Adjustment. Do not attempt adjustment of clear key assembly until after adjusting tabulator and key set mechanisms. The only adjustment to the clear key mechanism is to get proper active and inactive positions of the stop release roll. In the inactive position, the roll clears the set tabulator stops. With the clear key pushed in, the stop release roll moves to the active position and rests lightly against the unset tabulator stops. To obtain the proper active position of the roll, shorten or lengthen the clear key link by forming. To obtain the proper inactive position, form the clear roll bracket stop, located on left side of clear roll bracket facing rear of machine.

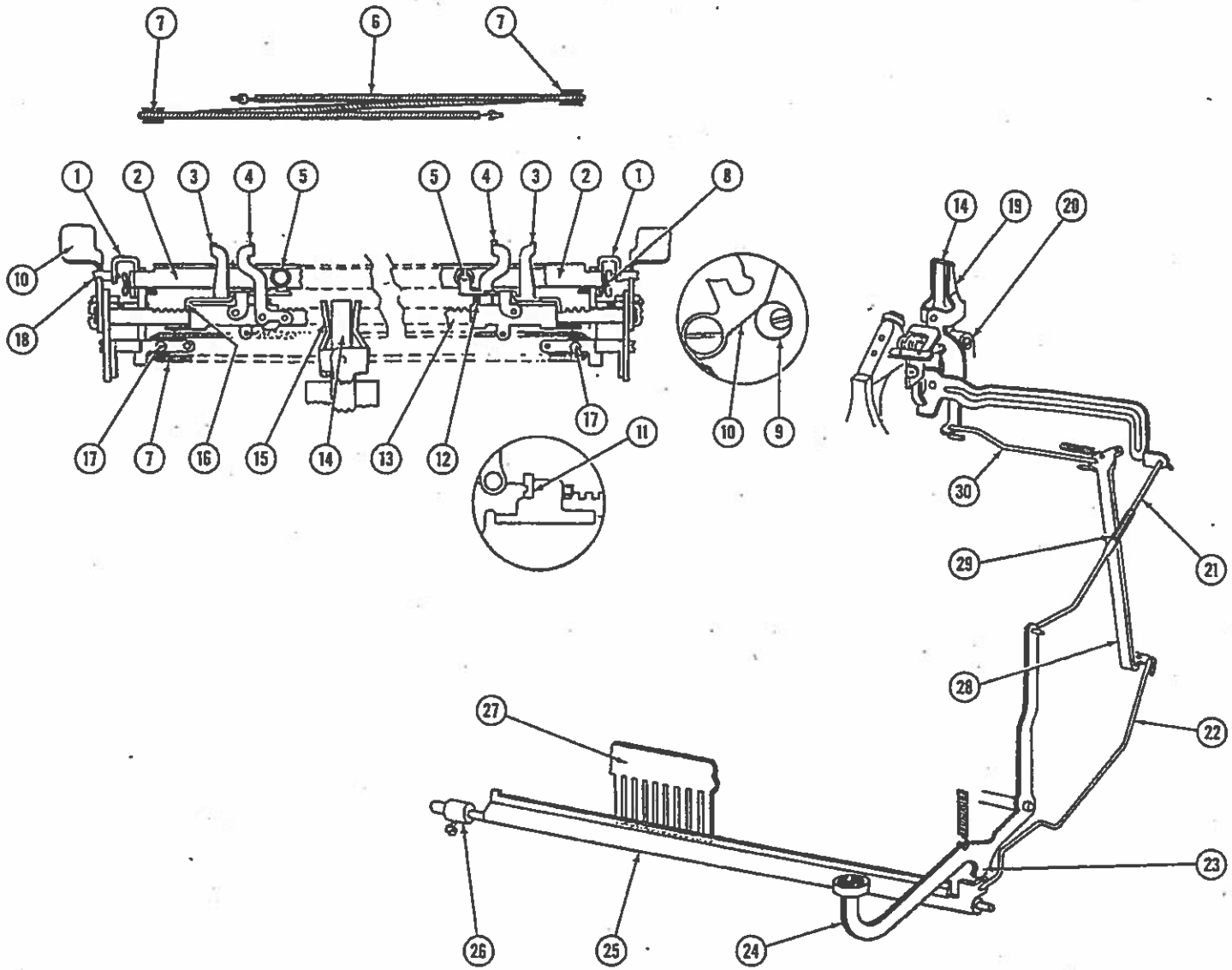


Figure 15. Margin mechanism.

CHAPTER 13

MARGIN MECHANISM

52. General

The margin mechanism (fig. 15) allows the operator to obtain an even margin on both sides of the typing paper.

53. Margin Stop Assembly

a. Function. The margin stop assembly, located on the rear of the carriage, stops the movement of the carriage at any preset position.

b. Components. The margin stop assembly is composed of the margin stops, stop handles, stop handle spring and retainer, stop rod, and stop locator.

c. Operation.

(1) The margin stops, left and right, are fitted to the stop rod (13, fig. 15), so that they are free to slide.

(2) Each stop has a stationary handle (4) fastened to it by two binding screws, and a bail handle (3) fastened to it by two fulcrum screws. The bail handle has on one end a tooth (16), which engages the teeth of the rod, and on the other end a set spring roll (5).

(3) The bail handle has a spring (12) on a retainer between the handle and the stop. The spring tension keeps the tooth engaged in the teeth of the arm.

(4) When the roll is depressed, the handle pivots and lifts the tooth out of the arm.

(5) The right stop has a small arm hanging down which trips the bell trip arm and rings the bell approximately 7 or 8 spaces before the carriage stops.

(6) Each stop has a banking screw (11) fitted to the back side. When the carriage returns to the end of the margin, the screw contacts the margin stop locator (15) and stops the movement of the carriage.

(7) After the contact, the locator has additional movement which allows the bail handle tooth to seat itself in the rod.

(8) The locator and the line lock lever (19), fastened to the center post (14) by a pin, pivot toward the post. A tension spring on the bottom of the locator holds the top of the locator away from the post.

d. Adjustments.

(1) When carriage stops beyond set margin, the margin is overthrowing; when carriage stops short of set margin, the margin is banking. End shake in the margin stop rod causes these malfunctions. Tighten margin stop rod securely by means of binding screw on left end and locknut on right end to free rod of end shake.

(2) Adjust center stop post fulcrum screw (20, fig. 15) to eliminate end shake in center stop post.

Figure 15. Margin mechanism—Continued.

1 Bail adjusting arm
2 Margin release bails
3 Margin stop bail handle
4 Margin stop stationary handle
5 Set spring roll
6 Margin stop set spring
7 Pulley
8 Bail fulcrum screw
9 Eccentric stop washer
10 Margin release levers
11 Banking screw
12 Bail handle spring
13 Stop rod
14 Center stop post
15 Margin stop locator
16 Bail handle tooth
17 Pulley fulcrum screw and nut
18 Bail lift screw
19 Line lock lever
20 Center stop post fulcrum screw
21 Margin release link
22 Line lock link
23 Heel
24 Margin release key lever
25 Line lock bail
26 Line lock bail bearing
27 Key lever guide
28 Line lock crank
29 Link adjusting nut
30 Line lock crank link

(3) Lengthen or shorten margin release link with link adjusting nut (29) so that center stop post will cover three thirty-seconds of an inch of banking screw.

(4) Check margin stop banking screws for proper position as follows:

(*a*) Set margin stops at any normal position.

(*b*) Move carriage so that banking screw lightly contacts margin stop locator. Continue moving carriage slowly until banking screw forces locator against center stop post.

(*c*) Apply slight additional pressure and pinion pawl will drop into teeth of pinion. If pawl does not drop into pinion at proper time, adjust banking screw.

(5) Check margin stop locator to see that it stops margin at proper time. Check as follows:

(*a*) Set carriage midway machine with margin set at any normal position.

(*b*) Pull margin release lever forward and release slowly, watching margin stop handle tooth engage teeth of margin rod. If handle tooth seats on top of a margin rod tooth, form locator for proper adjustment.

54. Margin Bail Assembly

a. Function. The margin bail assembly, located above the margin stops, is attached to the tabulator rack by a fulcrum screw at each end. The margin bail assembly releases and sets the margins.

b. Components.

(1) *Margin release bails.* The margin release bails (2, fig. 15), located above the margin stops, are fastened to the tabulator rack by fulcrum screws (8).

(2) *Margin release levers.* The margin release levers (10), located outside the carriage ends, are held in position by the margin stop rod fulcrum screw on the left end and the margin stop rod nut on the right end.

(3) *Eccentric stop washers.* Eccentric stop washers (9) are in the rear of each lever. The washer positions the lever so that the bail lift screw (18) is located centrally in the notch of the lever.

c. Operation.

(1) The right lever operates the forward bail and the left lever operates the rear bail.

(2) When the lever is pulled forward, the lever slot contacts the bail lift screw fastened to the bail adjusting arm (1, fig. 15) and cams the screw into the slot of the lever. The release bail, contacting the margin stop handle roll, pivots the handle and lifts the handle tooth out of the stop rod.

(3) When the lever is pushed rearward, the handle roll is released and the handle tooth is allowed to reseat in the margin rod.

d. Adjustment. Form bail adjusting arms so that when release levers are pulled forward the tooth of the margin stop handle will clear the margin rod teeth by one sixty-fourth to one thirty-second inch.

55. Set Spring Assembly

a. Function. The set spring assembly, located beneath the margin stops, applies constant tension on the stops toward the center stop post.

b. Components.

(1) *Set spring.* The margin stop set spring (6, fig. 15), connected with one end to each margin stop, extends from each stop to the far end of the carriage and around a pulley (7).

(2) *Set spring guard.* The set spring guard is fastened to the machine by two brackets attached to the inside of the carriage ends.

(3) *Pulleys.* The pulleys, attached to the guard brackets, turn on fulcrum screws (17).

c. Operation. When the margin is released, the set spring pulls the margin stops toward the opposite side of the machine.

d. Adjustments. Replace set spring if it has not enough tension to pull the margin stops together.

56. Line Lock Assembly

a. Function. The line lock locks the key levers so that the operator does not strike over type at the margin. The right margin stop motivates the line lock assembly.

b. Components. The line lock assembly is composed of the center stop post, line lock lever, crank link, crank, link, and bail.

c. Operation.

(1) The line lock locks the key levers when the right margin stop contacts the line lock lever.

(2) The lever pivots on its pin and forces the line lock crank link (30, fig. 15) toward the right side of the machine.

(3) The line lock crank link pivots the line lock crank (28), fastened to the frame of the machine, and the crank pulls the line lock link (22) toward the rear of the machine.

(4) The line lock link, hooked to the line lock bail (25), pivots the bail beneath the heel (23) of the key levers. The bail in this position prevents depression of key levers.

d. Adjustments.

(1) Adjust line lock assembly to lock key levers when carriage stops at margin.

(2) Aline line lock lever with center stop post by forming lever so that front edge will be flush with front edge of center stop post.

(3) Adjust throw of line lock bail by forming line lock lever (19, fig. 15) toward or away from center stop post, as necessary.

(4) If line lock crank extension does not limit movement of universal bar when crank is in active position, carriage will skip when margin release key lever (24) is depressed and will create banking of left margin when carriage is returned. Form extension to limit universal bar at time of line lock.

(5) Form line lock link to allow line lock bail to clear key levers in the inactive position.

(6) The line lock bail should rest lightly against key lever guide (27) in the active position. Adjust line lock bail bearing (26) to remove end shake in bail without creating a bind.

57. Margin Release Assembly

a. Function. The margin release allows the operator to release the margin and to type beyond the preset margin without disturbing the position of the margin stops.

b. Components. The margin release assembly is composed of the margin release key lever and the margin release link.

c. Operation.

(1) When the margin release key lever (24, fig. 15) is depressed, it pivots on the key lever fulcrum rod and pulls the margin release link (21) toward the front of the machine.

(2) The link pivots the center post (14), moving the top of the post toward the rear of the machine. This movement allows the margin stop to bypass the post and the carriage to move space by space for typing.

d. Adjustments. Adjust margin release link adjusting nut to lengthen or shorten link so that center post covers three thirty-seconds of an inch of margin stop banking screw. This should automatically force the post to clear the banking screw when the margin release key lever is depressed. If center post does not clear banking screw, form center post extension.

CHAPTER 14

SHIFT MECHANISM

58. General

The shift mechanism (fig. 16) shifts the segment downward and thus allows the uppercase characters to print. The shift mechanism consists of the key lever assembly, the shift arm assembly, and the segment assembly.

59. Key Lever Assembly

a. Function. The key lever assembly operates the shift mechanism by depression of the key lever.

b. Components. The key lever assembly is composed of the shift key lever, shift frame arm link spring, shift lock key lever, shift lock arm, and shift lock lever spring.

c. Operation.

(1) The shift key lever (9, fig. 16), when depressed, pivots on the shift key lever fulcrum rod and pulls the shift frame arm (6) toward the front of the machine.

(2) The shift frame extension (12) contacts the frame of the machine and thus limits the movement of the key lever.

(3) To lock the shift key lever, depress the shift lock key lever (7). The shift lock key lever stud (8), resting on top of the shift lock arm (11), forces the lever downward until the shift key lever lock eccentric (10) seats in the end of the shift lock arm and locks the shift key lever in the active position.

60. Shift Arm Assembly

a. Function. The shift arm assembly transfers the power from the key lever assembly to the segment.

b. Components. The shift arm assembly is composed of the shift frame arm, shift link, shift arm, shift rod, shift balance spring hook arms, and shift pull arms.

c. Operation.

(1) When the shift frame arm (6, fig. 16) is pulled toward the front of the machine, the arm pulls the shift link (5) in the same direction.

(2) The shift link moves forward until the back side of the elongated hole contacts the stud on the shift arm (16) and pivots the arm toward the front of the machine.

(3) The arm pivots the shift rod (15) and thus forces the shift balance spring hook arms (14) downward and pulls the shift pull arms (17).

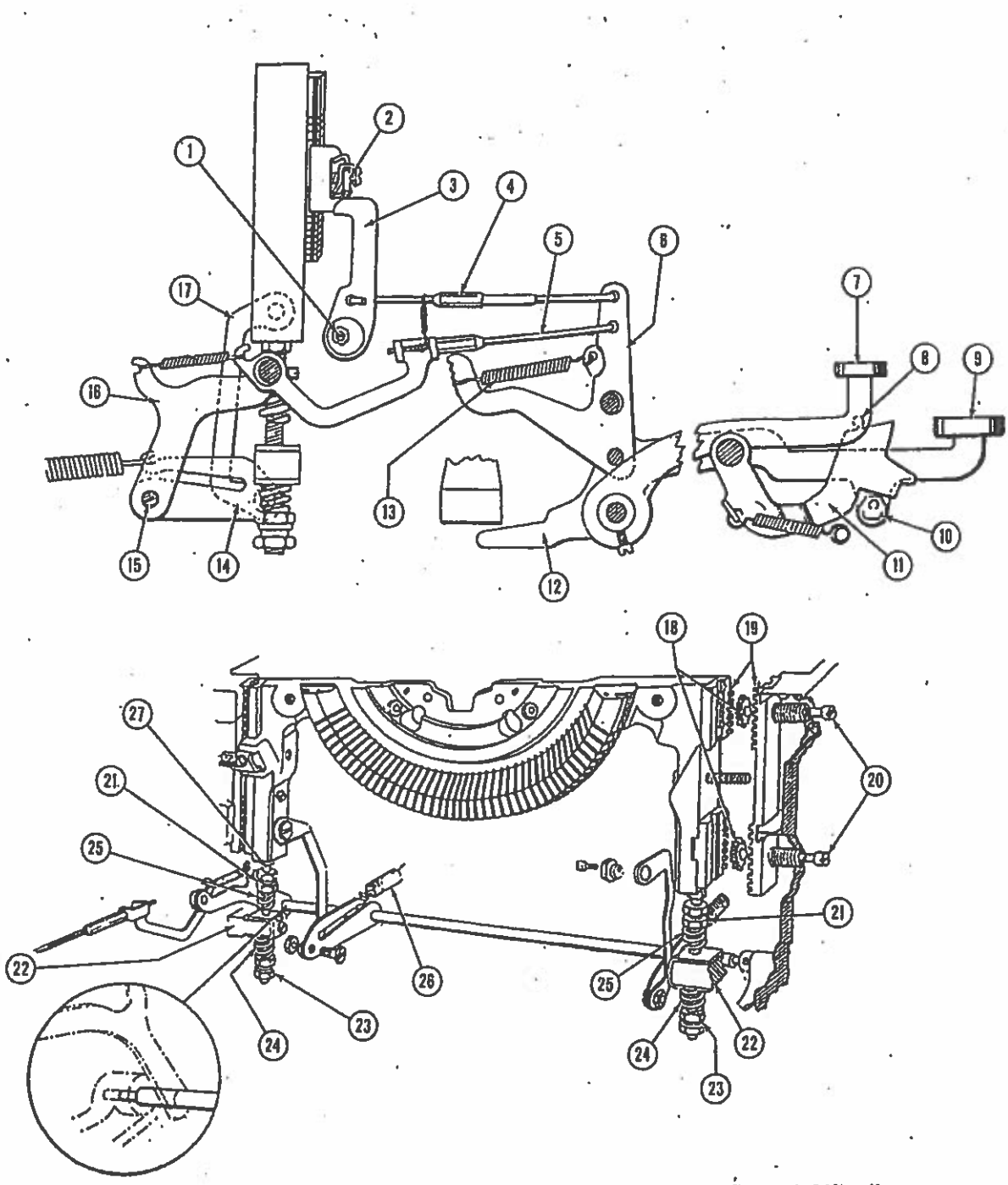
(4) The shift pull arms, fastened to the segment, pull the segment down in position for the uppercase characters to print.

61. Segment Assembly

a. Function. The segment, in the center of the machine and extending from one side to the other, supports all the type bars. It is shifted up and down by the shift key to allow lowercase and uppercase characters to print.

b. Components. The segment assembly is composed of the segment, segment rails, segment shift stop rod, and segment lock.

c. Operation. The segment travels up and down on ball bearings and pinions (18, fig. 16) fitted between the segment shift rails (19). Each of the two segment shift rails on each side of the segment fits over a ball bearing and pinion. The ball bearings and pinions seat between the segment and the segment shift rail, which is fastened to the frame of the machine. The segment shift stop rods (27) on both sides of the segment extend down from the segment through the shift stop cushions (22). A segment lock eccentric stud and locknut (1) fastens the segment lock (3) to the frame of the machine. When the lock is under the lock plate (2), it limits the downward movement of the segment. When the shift key is de-



1 Segment lock eccentric stud
2 Lock plate
3 Segment lock
4 Shift lock link
5 Shift link
6 Shift frame arm
7 Shift lock key lever
8 Shift lock key lever stud
9 Shift key lever
10 Shift key lever lock eccentric
11 Shift lock arm
12 Shift frame extension
13 Shift frame arm link sprlug
14 Shift balance spring hook arms
15 Shift rod
16 Shift arm
17 Shift pull arms
18 Ball bearings and pinions
19 Segment shift rails
20 Segment rail adjusting screws
21 On-feet adjusting nuts
22 Shift stop cushions
23 Motion adjusting nuts
24 Lower shift stops
25 Upper shift stops
26 Shift balance springs
27 Segment shift stop rod

Figure 16. Shift mechanism.

pressed, the lock moves from under the lock plate and the segment is pulled down. Springs on the segment shift stop rods contact the shift stops (24 and 25) and control the up-and-down movement of the segment.

62. Adjustments to Shift Mechanism

a. General. Make adjustments to shift mechanism in the following order:

(1) Remove any end shake in segment by use of segment rail adjusting screws (20, fig. 16).

(2) Shorten or lengthen adjusting nut on shift link (5) so that segment lock will move from beneath segment before segment begins to move downward.

(3) Make on-feet adjustment (*b* below) and be sure that both upper shift stops (25) contact shift stop cushions (22) at the same time.

(4) Make motion adjustment (*c* below). Be sure that both lower shift stops (24) contact shift stop cushions (22) at the same time.

(5) Adjust segment lock (3) by use of segment lock eccentric stud so that there is no downward movement of segment when lock is in active position. Be sure that no binds are created between lock and segment when adjustment is made.

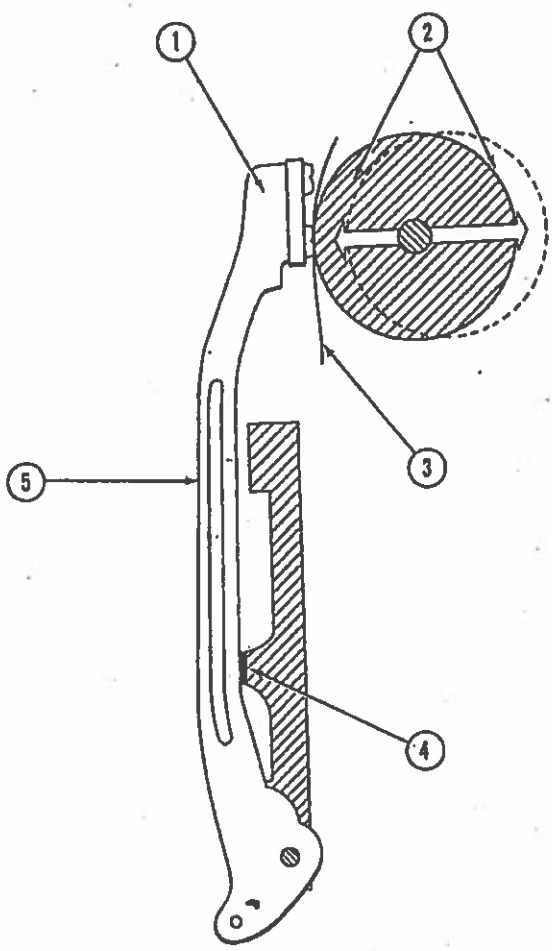
(6) Form key lever extension so that it will allow 1/16-inch additional downward movement of key lever after segment has stopped moving. This additional movement allows for release of shift lock.

(7) Adjust shift frame arm link spring (13) so that segment does not continue to depress after upper shift stops have limited on shift stop cushions.

(8) If tension of shift balance springs (26) is not sufficient to return segment to lowercase position, replace springs.

b. On-Feet Adjustment. On-feet adjustment of the shift mechanism consists of adjusting the segment so that the curved surface of the type head fits the curvature of the cylinder perfectly. Use on-feet adjusting nuts (21, fig. 16), located below segment legs on shift stop rod, in making this adjustment.

(1) *Purpose.* The purpose of the on-feet adjustment is to produce a uniformly dark type impression.

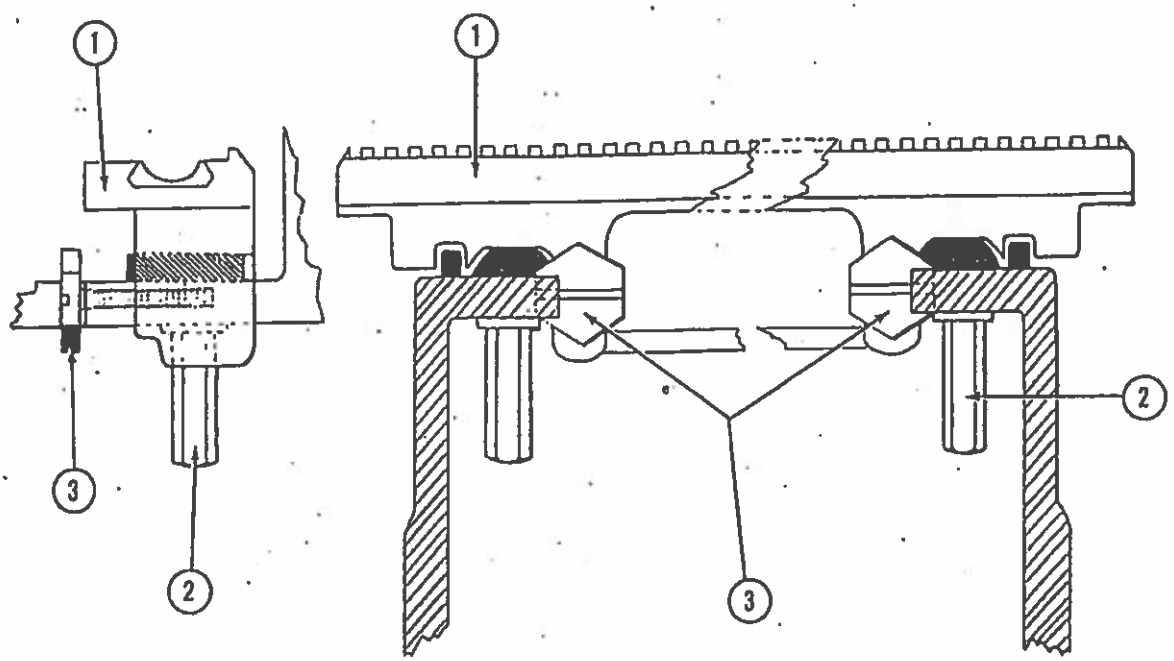


1 Type head
2 Cylinder
3 One sheet of paper
4 Segment abutment ring
5 Type bar

Figure 17. Ring and cylinder, showing proper adjustment.

(2) *Preliminary check.* To determine whether the on-feet adjustment is necessary, check machine by lowering segment to shift position and typing each character 2 or 3 times as lightly as possible. If the characters are uniformly dark, no adjustment is necessary. If the majority of the characters type lighter at the bottom, raise segment; if the majority type lighter at the top, lower segment. To raise or lower segment, loosen on-feet adjusting locknuts and nuts on each shift stop rod. Turn the two adjusting nuts the same number of turns until the impressions are uniform.

(3) *Tension check.* Insert a strip of paper



1 Bottom rail 2 Bottom rail binding screw 3 Ring and cylinder adjusting screws

Figure 18. Ring and cylinder, showing adjusting screws.

between stop and cushion on each side of machine to check tension of upper shift stop against shift stop cushions. Pull out strips of paper and see that the two strips have an equal amount of drag. Tighten locknuts to lock on-feet adjusting nuts in position.

c. Motion Adjustment.

(1) *Purpose.* The motion adjustment consists of alining uppercase and lowercase characters so that bottom of characters will print in a true line.

(2) *Preliminary check.* Type a row of uppercase and lowercase characters, alternating impressions. If the uppercase and lowercase characters print in a true line, no motion adjustment is necessary. If the lowercase character prints too high, lower segment; if it prints too low, raise segment. To move segment in desired direction, loosen motion adjusting nuts (23, fig. 16) and locknuts. Turn both motion adjusting nuts the same number of turns until characters are alined.

(3) *Tension check.* Insert a strip of paper between stop and cushion on each side of machine to check tension of lower shift stop against shift stop cushion. Pull out strips of paper and see that the two strips have an equal amount of drag. Tighten locknuts to lock motion adjusting nuts in position.

d. Ring and Cylinder Adjustment.

(1) *General.* To adjust ring and cylinder (fig. 17), position carriage to frame of machine so that, with one sheet of paper (8) inserted, type bar (5) in forward motion contacts segment abutment ring (4) and cylinder (2) at the same time. Before making the adjustment, be sure that the cylinder is perfectly round, with a diameter of 1.486 inches, and that all binds and end shake are removed from segment.

(2) *Purpose.* The purpose of the ring and cylinder adjustment is to prevent typeface from cutting ribbon and damaging cylinder.

(3) *Procedure.*

(*a*) Loosen bottom rail binding screws (2, fig. 18) and turn either left ring and cylinder adjusting screw (3) or right ring and cylinder adjusting screw (3), as necessary, until bottom rail (1) is

parallel with frame of machine. Turn binding screws to a snug fit.

(*b*) Insert a strip of paper between cylinder (2, fig. 17) and type bar (5) and place a finger against type bar at abutment ring (4), holding type head (1) against paper and cylinder. Pull paper out, noting drag applied.

(*c*) Insert strip of paper between type bar (5) and abutment ring (4) and place finger on type head (1) to hold it against cylinder. Pull paper out, noting drag applied. Drag at both points should be equal.

(*d*) Make tests (*b*) and (*c*) above at each end of carriage.

(*e*) After determining direction rail should be moved, turn ring and cylinder adjusting screws (3, fig. 18) the same number of turns.

(*f*) After making adjustment, tighten bottom rail binding screws (2).

(*g*) If during the ring and cylinder adjustment the escapement, ribbon cover, segment, key set, and tabulator mechanisms are thrown out of adjustment, readjust these mechanisms.

CHAPTER 15

BACKSPACE MECHANISM

63. General

The backspace mechanism (fig. 19) backs the carriage one space at a time to allow the operator to retype an impression. The mechanism consists of the backspace key lever assembly and backspace guide assembly.

64. Backspace Key Lever Assembly

a. Components. The backspace key lever assembly is composed of the backspace key lever, pawl lift lever, and pawl swinging arm.

b. Operation.

(1) The backspace key lever (11, fig. 19), when depressed, pivots the backspace pawl lift lever (12), located behind the mainspring on the drum shaft.

(2) The right end of the lift lever contacts the backspace pawl and starts the pawl moving upward to the carriage rack.

(3) When the lift lever contacts the backspace pawl, the backspace pawl swinging arm (4), located on the main spring drum shaft between the drum and the lift lever with the upper end fastened to the backspace pawl, forces the pawl upward.

65. Backspace Guide Assembly

The backspace guide, attached to the left side of the escapement frame, holds the backspace pawl and its components.

a. Components. The backspace guide assembly is composed of the backspace pawl, escapement wheel stop, rack lock, and guide.

b. Operation.

(1) The lift lever (12, fig. 19) contacts the pawl fitted to the upper portion of the backspace guide (8).

(2) The pawl moves upward, engaging the rack and moving the carriage to the right.

(3) The pawl moves the carriage until the backspace key lever extension limits the downward movement of the backspace key lever.

(4) As the pawl is moving to the right, the backspace escapement wheel stop (7), fastened to the front side of the pawl, moves to the right, stopping the escapement wheel and preventing it from turning with the pinion.

(5) The backspace rack lock (1), located on the rear edge of the backspace guide, is pivoted downward by the guide post (14), which is attached to the pawl, until the lock limits on the carriage rack bail.

(6) The lock locks the carriage rack in mesh with the backspace pawl and the escapement pinion.

66. Adjustments of Backspace Mechanism

With each depression of the backspace key lever the carriage should move one space to the right. Make all escapement adjustments before adjusting backspace.

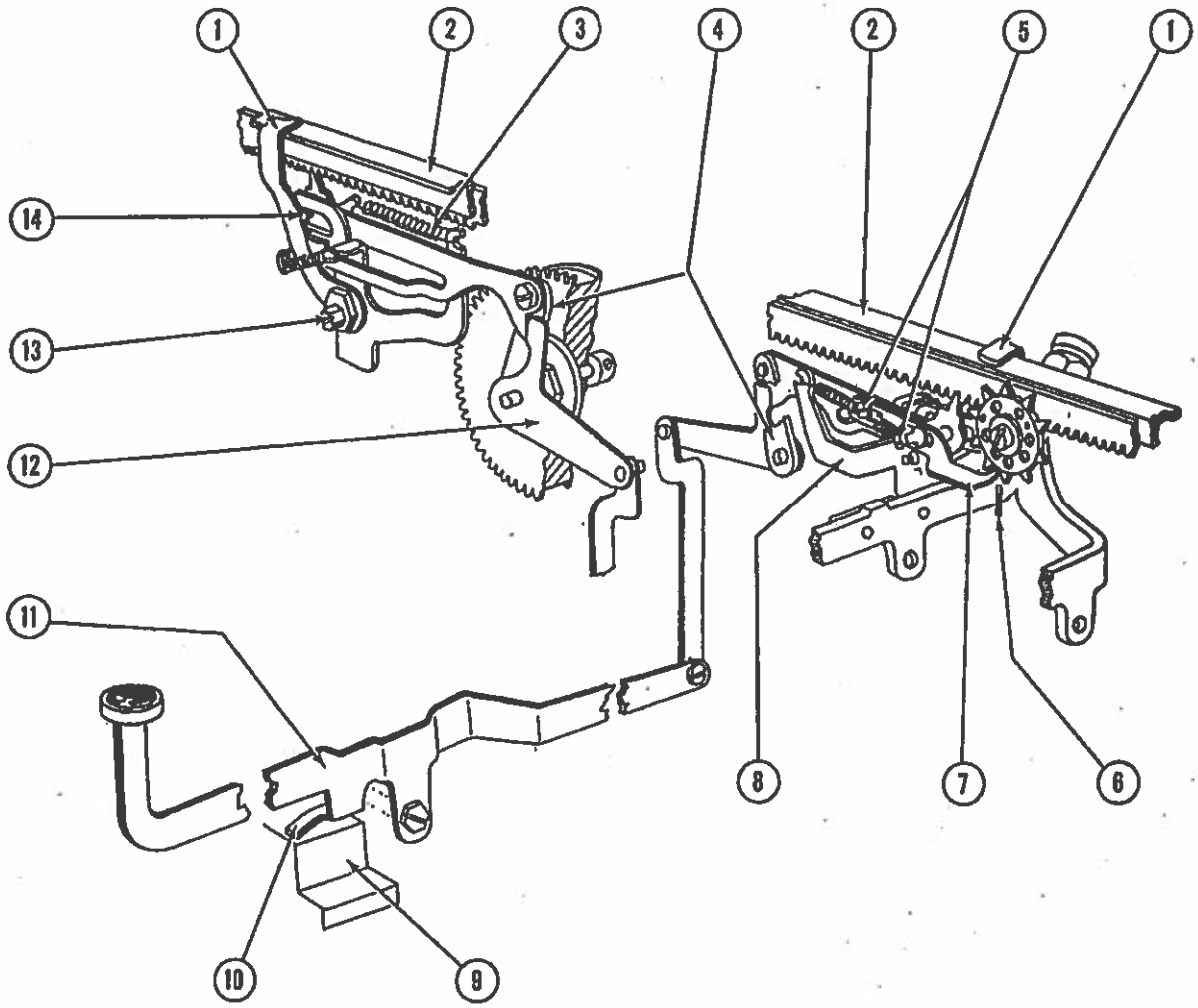
a. Adjust key lever so that key lever extension (10, fig. 19) limits downward movement of key lever (11) just after pinion pawl has dropped into pinion. To make this adjustment, form key lever extension up or down with backspace key lever bender. Form upright section of key lever to allow a slight clearance between lift lever and pawl.

b. Adjust end shake of backspace pawl swinging arm (4) by adjusting mainspring drum to rear of machine. Be sure not to create binds in swinging arm or in lift lever.

c. The backspace pawl must rest directly beneath the carriage rack, with a slight clearance between the pawl and rack. Adjust clearance by adjusting position of backspace guide (8).

d. Adjust backspace escapement wheel stop (7) so that there is a $\frac{1}{32}$-inch clearance between stop and escapement wheel tooth with key lever depressed.

e. Adjust backspace rack lock (1) by use of rack lock eccentric (18) so that rack will hold carriage rack in mesh with pawl.



1 Backspace rack lock
2 Carriage rack
3 Backspace pawl spring
4 Pawl swinging arm
5 Backspace escapement wheel stop adjusting screws
6 1/32-inch clearance
7 Backspace escapement wheel stop
8 Backspace guide
9 Key lever bracket
10 Backspace key lever extension
11 Backspace key lever
12 Backspace pawl lift lever
13 Rack lock eccentric
14 Pawl guide post

Figure 19. Backspace mechanism.

CHAPTER 16
ALINEMENT

67. General

Alinement of type pertains to the relation of the characters to one another as they appear in the typewritten work. Proper alinement of characters consists of even horizontal spacing, proper positioning on the writing line, and uniformly even printing. Before attempting to aline the type, make sure that shift (par. 62), escapement (pars. 29–33), and ribbon cover (pars. 43 and 44) adjustments are correct. The type bars must move freely in the segment and enter the type guide without hindrance.

68. Alinement Check

The uppercase N is used as a guide for alining the uppercase characters, and the lowercase n is used as a guide for the lowercase characters. Type all characters several times. If a majority of characters vary from the N in the same direction, center the character N first to avoid the necessity of adjusting all the type.

69. Alinement Methods

a. Lowering Character. To lower character (fig. 20) if it prints higher than the master character, use one of the following methods:

(1) Place mauling pliers (1) on back side of type bar (2) and crimp type bar. Crimping back side of type bar throws type head forward and lowers printed character in relation with the master N.

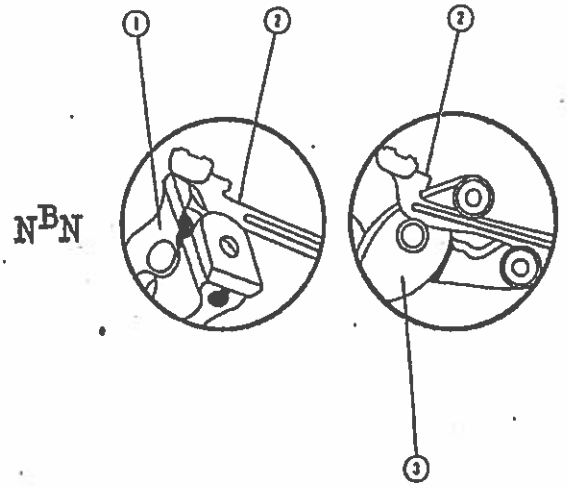
(2) Use type bar rollers (3), bending type bar toward cylinder.

b. Raising Character. To raise character (fig. 21) if it prints lower than the master character, use one of the following methods:

(1) Place mauling pliers (2) on front side of type bar (1) and crimp type bar. Crimping front side of type bar throws type head backward and raises printed character in relation with the master N.

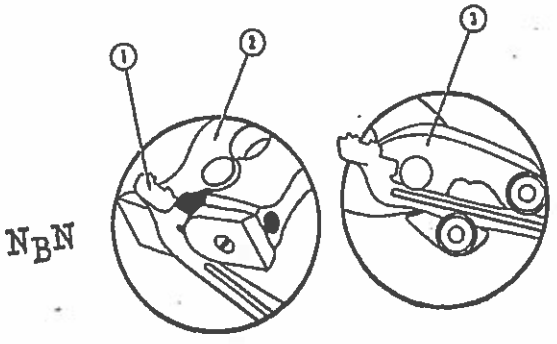
(2) Use type bar rollers, (3), bending type bar away from cylinder.

c. Moving Character Laterally. Move character to left or right to insure proper horizontal spacing if character prints too close to preceding



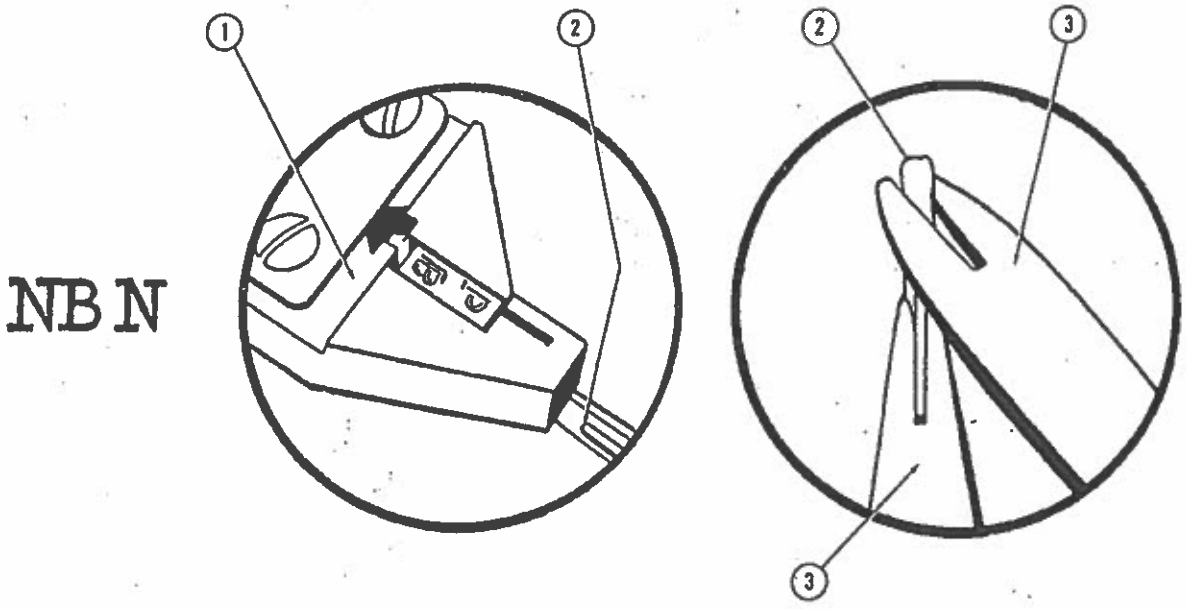
1 Mauling pliers 2 Type bars 3 Type bar rollers

Figure 20. Lowering character.



1 Type bar 2 Mauling pliers 3 Type bar rollers

Figure 21. Raising character.



1 Type bar offsetting pliers 2 Type bar 3 Type bar twisters

Figure 22. Moving character laterally.

master character or too far from master character. Use one of the following methods for lateral movement of character (fig. 22):

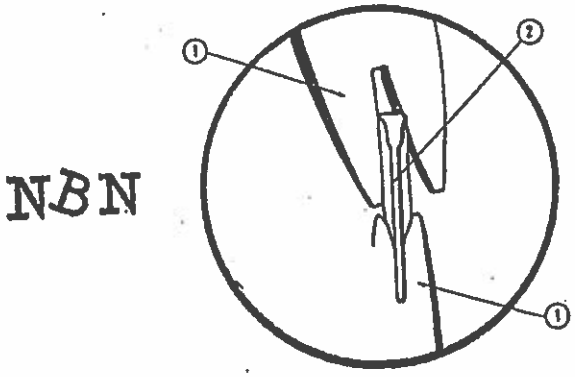
(1) If printed character shows a full typed impression but is out of position, use type bar offsetting pliers (1) to adjust position.

(2) If character is not printing fully, the position is due to a twisted type head. Use type bar twisters (3) to adjust position.

(3) Bend type bar (2) slightly.

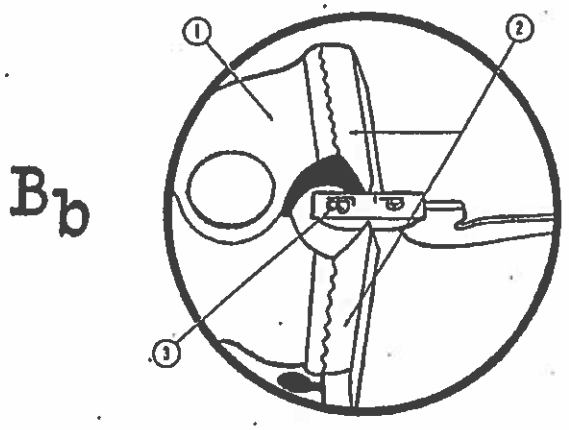
d. Straightening Character. To straighten character if it is twisted (fig. 23), use type bar twisters (1), one holding and one twisting.

e. Raising Lowercase Character. To raise lowercase character (fig. 24) if it prints lower than its uppercase character, use mauling pliers (1) with cutting jaws (2) attached. These pliers crimp type head (3) so that uppercase and lowercase characters spread apart slightly.



1 Type bar twisters 2 Type bar

Figure 23. Straightening character.



1 Mauling pliers 2 Cutting jaws 3 Type head

Figure 24. Raising lowercase character.

CHAPTER 17

DISASSEMBLY AND REASSEMBLY

70. Carriage Assembly

a. Removal. See paragraph 17*a*.

b. Disassembly.

(1) Remove left cylinder knob setscrews and left cylinder knob.

(2) Pull forward on right cylinder end cover plate and remove fractional line space alining screw and cylinder setscrew.

(3) Pull right cylinder knob and cylinder shaft out of machine by lifting right end up and out to right of machine.

(4) Pull ratchet release forward and remove line space drum.

(5) Remove paper pan binding screws and lift paper pan from carriage.

(6) Remove front and rear feed rolls and shafts.

(7) Facing rear of carriage, remove left and right margin bail lift screws and left and right margin bail fulcrum screws.

(8) Remove margin bails.

(9) Remove left and right carriage end brace screws and locknuts and outside left and right tabulator rack nuts.

(10) Tighten inside left and right tabulator rack nuts, move tabulator rack to right or left to disengage on end of rack, and remove rack.

(11) Remove left margin release lever fulcrum nut, margin release lever, and margin release lever detent spring resting on heel of release lever.

(12) Remove right margin release lever fulcrum screw, margin release lever, and margin release lever detent.

(13) Back off margin stop rod nut, located on left end of rod inside carriage end, and disconnect left and right rack bail tension springs.

(14) Disconnect margin stop set springs from margin stops, move stop rod to left, and pull rod, with stops attached, out of machine to right.

(15) Remove left and right margin stop set spring guard bracket binding screws and margin stop set spring guard.

(16) Remove nut from upper left rack bail eccentric stop screw and remove release lever spring washer. Be careful not to deform washer. Remove upper left rack bail eccentric stop screw.

(17) Remove lower left rack bail eccentric stop screw nut and screw and then remove left rack release lever.

(18) Remove nut from upper right rack bail eccentric stop screw and remove release lever spring washer. Be careful not to deform washer. Remove upper right rack bail eccentric stop screw.

(19) Remove lower right rack bail eccentric stop screw nut and screw and remove right rack release lever.

(20) Remove left rack bail bearing nut and screw and right rack bail binding nut and screw. Remove rack bail from carriage.

(21) Remove left and right paper bail arm fulcrum screws.

(22) Disconnect paper bail left arm spring and paper bail right arm spring and remove paper bail holder rod and arms.

(23) Remove paper bail frame fulcrum screw and nut and disengage paper bail frame stud from right carriage end plate. Then remove paper bail frame.

(24) Remove feed roll release lever pivot screw and nut and then remove feed roll release lever.

(25) Facing front of carriage, remove rear feed roll arm support binding screws located on the right end of the support outside the carriage end. Then remove ratchet release lever fulcrum screw and locknut and ratchet release lever.

(26) Remove rear feed roll arm support binding screw (left) and lockwasher located on top of support. Lift out paper table and feed roll arm support. Be careful not to deform left end of support.

(27) Remove line space lever and pawl arm link screw and line space lever spring anchor binding screw.

(28) Remove line space lever tension spring and tension spring anchor.

(29) Remove line space lever, line space pawl arm bushing nut, and pawl arm bushing.

(30) Remove line space pawl arm, including link, line space selector, and pawl arm washer.

(31) Remove right cylinder scale bracket binding screws, scale bracket, and scale.

o. Reassembly.

(1) Replace line space pawl arm, including link, pawl arm washer, line space selector, pawl arm bushing, and bushing nut. Tighten nut, leaving pawl arm and selector free to pivot.

(2) Replace line space lever, lever spring anchor, lever spring, and spring anchor binding screw. Tighten binding screw, leaving lever free to pivot.

(3) Replace paper table and feed roll support arm. Check to see that feed roll hangers are positioned in slots on feed roll release rod.

(4) Replace rear feed roll arm support binding screw and lockwasher on top of support on left end. Replace both binding screws on right end. Check to see that feed roll hangers release properly and that paper table pivots freely.

(5) Replace ratchet release lever and line space pawl eccentric and locknut.

(6) Replace feed roll release lever, pivot screw, and locknut. Be careful not to strip threads of pivot screw.

(7) Replace paper bail frame stud in hole in right carriage end plate. Replace bail fulcrum screw and locknut. Tighten locknut, leaving frame free to pivot.

(8) Replace paper holder bail rod and arms, left and right bail arm fulcrum screws, and left and right bail arm springs.

(9) Replace carriage rack bail and left and right rack bail bearing nuts and screws. Tighten nuts, leaving bail free to pivot.

(10) Replace right rack release lever and right lower rack bail eccentric stop screw and nut.

(11) Replace upper rack bail eccentric stop screw and thin spring washer on outside end of screw. Replace and tighten nut, leaving release lever free to pivot.

(12) Replace left rack release lever and left lower rack bail eccentric stop screw and nut.

(13) Replace upper rack bail eccentric stop screw and thin spring washer on outside end of screw. Replace and tighten nut, leaving release lever free to pivot.

(14) Facing carriage from rear, replace margin stop set spring guard and left and right binding screws.

(15) Replace margin stop rod, with margins attached, replacing the left end first. Move rod to right, making sure the square shoulder seats properly in carriage end.

(16) Thread nut at left end of rod, inside carriage end, outward until it rests snugly against carriage end. Connect rack bail tension springs.

(17) Replace left margin release lever and lever pivot nut. Tighten nut, leaving lever free to pivot. Replace left margin release lever detent.

(18) Replace right margin release lever and pivot screw. Tighten screw, leaving lever free to pivot.

(19) Replace tabulator rack between carriage ends. Thread inside locknuts until they contact inside edge of carriage end.

(20) Replace outside locknuts in position on ends of tabulator rack. Replace left and right carriage end brace binding screws and locknuts.

(21) Replace left and right margin release bails and thin spring washer between bails on left side. Replace short fulcrum screw on left and thin spring washer between tabulator rack end and margin release bail.

(22) Replace long fulcrum screw on right.

(23) Facing front of machine, replace front feed rolls and shaft in feed roll hangers,

with short spacer to left. Replace back feed roll and shaft.

(24) Replace paper pan and paper pan binding screws. Check feed rolls to see that they are not binding against paper pan.

(25) Replace cylinder ratchet and insert cylinder so that fractional cylinder end fits into ratchet and right end of cylinder seats properly on right side of carriage. Be careful not to dislocate tongue washer.

(26) Insert cylinder shaft into right carriage end bearing and into cylinder, alining hole in shaft with hole in cylinder end.

(27) Replace fractional cylinder alining screw and cylinder setscrew.

(28) Replace left cylinder knob and knob setscrews. Check knob for binds against carriage end.

(29) Replace left front cylinder scale spring, front cylinder scale, and right scale spring.

(30) Replace right front cylinder scale bracket and bracket binding screws. Check bracket and remove binds.

71. Lower Rail Assembly

a. Removal.

(1) Remove drawband and release all tension from mainspring.

(2) Disconnect spacebar link from bar trip arm and remove type bar rest bracket binding screws and rest bracket.

(3) Lift up on bichrome handle to disengage bottom of shaft from hole in ribbon spool bracket. Push down on bichrome handle and disengage shaft from upper hole in ribbon spool bracket. Be careful not to lose handle shaft spring.

(4) Disconnect bichrome handle from bichrome link. Disconnect bichrome link from bichrome shaft lever and remove link.

(5) Remove backspace pawl pivot screw and front screw in tabulator finger link lever.

(6) Loosen carriage backrest binding screws located on left side of escapement frame. Remove left and right bottom rail binding screws.

(7) Start lifting bottom rail out of machine, with escapement and ribbon cover mechanism attached.

(8) Disengage ball mechanism from rear of escapement frame and vibrator from type guide.

(9) Remove lower rail assembly and left and right lower rail seats.

b. Disassembly.

(1) Remove ribbon vibrator cotter pin and ribbon vibrator.

(2) Loosen card guide scale bracket binding screws and remove card guide scale bracket.

(3) Remove tabulator rack lift lever fulcrum screw and lift lever.

(4) Loosen carriage guide rod roller setscrew and remove rod roller.

(5) Remove center and front vibrator link screws and remove vibrator link.

(6) Disconnect rocker return spring from adjustable plate and loosen right rocker pivot screw locknut.

(7) Loosen pivot screw from rocker, slip kickback spring down until it clears escapement frame, and remove escapement rocker.

(8) Loosen escapement wheel shaft adjusting nut setscrew and remove shaft adjusting nut from escapement wheel shaft.

(9) Pull escapement wheel forward out of escapement frame and pull escapement pinion off escapement wheel shaft.

(10) Disconnect vibrator arm tension spring, remove vibrator arm fulcrum screw, and remove vibrator arm.

(11) Loosen vibrator armrest setscrew and remove vibrator armrest.

(12) Loosen bichrome camshaft pivot screw locknut and back out bichrome camshaft pivot screw until it clears bichrome camshaft.

(13) Hold bichrome detent out of mesh with bichrome index and pull up on bichrome camshaft to remove it from machine.

c. Reassembly.

(1) Replace bichrome cover shaft and reseat bichrome detent in index.

(2) Tighten bichrome camshaft pivot screw and pivot screw locknut.

(3) Replace vibrator armrest and armrest setscrew.

(4) Replace vibrator arm, vibrator arm fulcrum screw, and vibrator arm tension spring.

(5) Replace escapement pinion on escapement wheel shaft, with teeth of pinion facing in opposite direction from those of escapement wheel. Be sure that pinion pawl meshes properly with pinion.
(6) Replace shaft adjusting nut, tighten enough to remove all end shake in shaft, and tighten adjusting nut setscrew.
(7) Replace escapement rocker and rocker kickback spring. Tighten pivot screw until it reseats in rocker, leaving rocker free to rock.
(8) Tighten pivot screw locknut and connect rocker return spring to adjustable plate.
(9) Replace vibrator link and front and center vibrator link screws.
(10) Replace rod roller and tighten roller setscrew.
(11) Replace tabulator rack lift lever and lift lever fulcrum screw.
(12) Replace card guide scale bracket and bracket binding screws.
(13) Replace ribbon vibrator and vibrator cotter pin.

d. Installation.

(1) Replace left and right lower rail seats.
(2) Replace lower rail assembly, with escapement and ribbon cover mechanisms attached.
(3) Reseat vibrator into type guide and engage bell mechanism located at rear of escapement mechanism.
(4) Replace left and right bottom rail binding screws and tighten carriage backrest binding screws located on left side of escapement frame.
(5) Replace front screw in tabulator finger link lever and backspace pawl pivot screw.
(6) Replace bichrome link and connect link to bichrome shaft lever and bichrome handle.
(7) Replace handle shaft spring over upper end of handle stud and insert upper end of stud into upper hole in ribbon spool bracket. Push stud upward and seat bottom end of stud into bottom hole in ribbon spool bracket.
(8) Replace type bar rest bracket and binding screws. Connect spacebar link to bar trip arm.
(9) Replace drawband on mainspring drum. Hook to anchor stud.
(10) Adjust tension of mainspring.

72. Segment Assembly

a. Disassembly.

(1) Remove left and right segment wire retainer screws and wire retainers.
(2) Insert a segment wire into left side of segment and push installed segment wire one-half inch out right side of segment wire hole.
(3) Remove segment wire so that one type bar and type bar link can be removed at a time. Be careful not to interchange type bars and type bar links.
(4) Remove segment lock plate binding screw and segment lock plate.

b. Removal of Segment.

(1) Insert segment special assembly screws (tool number S–162) through segment and into outer segment rails. Hand-tighten screws to hold outer ball races together against segment so that segment can be removed from base as a unit.
(2) Remove adjusting screws at rear end of tabulator link.
(3) Remove pivot screw at front of tabulator link and remove tabulator link.
(4) Turn machine on back and remove pivot screw at top of left shift pull arm.
(5) Remove shift pull arm eccentric and setscrew at top of right shift pull arm.
(6) Remove left and right motion adjusting nuts and locknuts.
(7) Replace machine on its feet.
(8) Facing machine from right side, remove upper segment rail adjusting screw binding screw. Back adjusting screw out even with outside edge of machine frame.
(9) Remove lower segment rail adjusting screw binding screw. Back adjusting screw out even with outside edge of machine frame.
(10) Facing machine from left side, remove upper and lower segment rail binding screws.
(11) Remove segment.

c. Installation of Segment.

(1) With machine on its feet, replace segment.

(2) Facing machine from left side, replace upper and lower segment rail binding screws.
(3) Facing machine from right side, tighten lower segment rail adjusting screw and lower segment rail adjusting screw binding screw.
(4) Tighten upper segment rail adjusting screw and adjusting screw binding screw.
(5) Turn machine on back and replace left and right motion adjusting nuts and locknuts.
(6) Replace shift pull arm eccentric and setscrew at top of right shift pull arm. Replace pivot screw at top of left shift pull arm.
(7) Replace machine on its feet and replace tabulator link and link pivot screw at front of link.
(8) Replace adjusting screws at rear end of tabulator link.
(9) Remove segment special assembly screws.

d. Reassembly.

(1) With machine on its feet, replace segment lock plate and segment lock plate binding screw.
(2) Insert segment wire into right side of segment and replace type bars one at a time as wire is pushed into segment.
(3) Replace left and right segment wire retainers and retainer screws.

73. Ribbon Assembly

a. Disassembly.

(1) Remove worm gear setscrew.
(2) Loosen reverse cam setscrew and pinion case setscrew.
(3) Push wormshaft toward front of machine until it drops out of its rear pivot bearing.
(4) Push wormshaft toward rear of machine until worm gear clears reverse arm.
(5) Remove wormshaft, including worm gear, reverse cam, wormshaft pinion, and pinion case.
(6) Remove automatic reverse lever fulcrum screw and left automatic reverse lever.
(7) Pivot upper reverse roll up toward front of machine and allow it to hang over keyboard.
(8) Loosen reverse handle setscrews. Pull handle forward and remove it from machine.
(9) Push reverse arm to rear and disengage arm from left ribbon spool bracket.
(10) Remove reverse arm.
(11) Remove right ribbon spool bracket binding screws. Be careful not to lose small spacing collar at left end of ribbon feed shaft.
(12) Disengage right end of ribbon feed shaft from right ribbon spool bracket.
(13) Disengage right end of reverse shaft from right ribbon spool bracket and remove right ribbon spool bracket.
(14) Disengage left end of ribbon feed shaft from left ribbon spool bracket. Be careful not to lose small spacing collar at left end of ribbon feed shaft.
(15) Pull ribbon feed shaft, with shaft collar, out through right side of machine.
(16) Disengage left end of reverse shaft from left ribbon spool bracket.
(17) Remove left ribbon spool bracket binding screws, reverse arm detent tension spring, and adjustable bracket.
(18) Remove left ribbon spool bracket.
(19) Lift right ribbon spool bracket and loosen right ribbon spool shaft bevel gear setscrews.
(20) Remove right ribbon spool shaft bevel gear.
(21) Loosen setscrew in end-shake adjusting collar at bottom of right ribbon spool shaft and remove collar.
(22) Loosen spool shaft tension spring adjusting collar setscrew.
(23) Pull right ribbon spool shaft up far enough to remove spool shaft tension spring and adjusting collar.
(24) Remove right ribbon spool shaft and ribbon spool shaft spacer from right ribbon spool bracket.
(25) Release right ribbon spool bracket and lift left ribbon spool bracket.
(26) Remove idler gear fulcrum screw and idler gear.
(27) Loosen left ribbon spool shaft spur gear setscrews and remove spur gear.
(28) Loosen spool shaft tension spring adjusting collar setscrew.

(29) Lift left ribbon spool shaft high enough to remove spool shaft tension spring adjusting collar.

(30) Remove left ribbon spool shaft and ribbon spool shaft spacer from left ribbon spool bracket.

b. Reassembly.

(1) Replace left ribbon spool shaft spacer and left ribbon spool shaft into left ribbon spool bracket.

(2) Lift left ribbon spool shaft high enough to replace spool shaft tension spring adjusting collar and tighten collar setscrew.

(3) Replace spur gear and tighten both setscrews.

(4) Replace idler gear and idler gear fulcrum screw.

(5) Release left ribbon spool bracket and lift right ribbon spool bracket.

(6) Replace right ribbon spool shaft spacer and right ribbon spool shaft into right ribbon spool bracket.

(7) Lift right ribbon spool shaft high enough to replace spool shaft adjusting collar and tension spring.

(8) Tighten spool shaft tension spring adjusting collar setscrew.

(9) Replace end-shake adjusting collar on bottom of right ribbon spool shaft and tighten setscrew.

(10) Replace right ribbon spool shaft bevel gear, tighten setscrews, and release right ribbon spool bracket.

(11) Replace left ribbon spool bracket.

(12) Replace reverse arm detent tension spring adjustable bracket, detent tension spring, and ribbon spool bracket binding screws.

(13) Replace left end of reverse shaft in left ribbon spool bracket.

(14) Insert, from right side of machine, ribbon feed shaft with collar attached.

(15) Be sure to have small spacing collar on left end of feed shaft. Insert left end of shaft into left ribbon spool bracket.

(16) Replace right ribbon spool bracket and insert right end of reverse shaft into bracket.

(17) Be sure to have small spacing collar on right end of feed shaft. Insert right end of shaft into right ribbon spool bracket.

(18) Replace ribbon spool bracket binding screws.

(19) Replace reverse arm in left ribbon spool bracket.

(20) Replace reverse handle and tighten setscrews.

(21) Pivot upper reverse roll into its normal position.

(22) Replace left automatic reverse lever and automatic reverse lever fulcrum screw.

(23) Replace wormshaft, worm gear, reverse cam, wormshaft pinion, and pinion case.

(24) Insert shaft into rear pivot bearing and tighten pinion case setscrew.

(25) Position reverse cam and tighten setscrew.

(26) Tighten worm gear setscrew.

CHAPTER 18

TROUBLESHOOTING

74. General

The troubleshooting information contained herein is designed to assist the mechanic in determining and eliminating causes of unsatisfactory operation. Troubleshooting consists of observing the trouble, checking possible causes, and correcting the trouble when the cause is found. Since malfunctions often are due to a combination of conditions, the mechanic must always rely somewhat on his own judgment. If the troubleshooting chart is consulted frequently, it will teach the mechanic to make his own diagnosis correctly and will give him a good fundamental understanding of the influence the various adjustments have on one another.

75. Troubleshooting Chart

Trouble	Possible Cause	Remedy
Carriage sticking	Carriage clamp too loose or too tight	Raise or lower clamp in elongated slots.
	Support rail too high or too low	Raise or lower support rail in elongated slots.
	Magic margin levers in forward position	Return levers to inactive position.
	Margin set spring guard binding on guide rod roller.	Form set spring guard brackets.
	Card guide scales creating bind	Form card guide scale brackets.
	Friction in ribbon movement	Check ribbon feed mechanism for binds.
	Automatic ribbon reverse locking because of trouble in spool trip arm, automatic reverse rolls, or reverse cam.	Check ribbon reverse adjustments (par. 41).
	Binding wormshaft	Replace wormshaft, if bent.
	Worm gear too far forward or pawls not engaged properly with pinion or worm ratchet.	Use same procedures as for ribbon reverse adjustments (par. 41).
	Ribbon twisted or damaged	Replace ribbon or rewind ribbon on spool.
	Mainspring tension weak	Turn mainspring tension adjuster counterclockwise.
	Escapement wheel binding	Adjust escapement wheel shaft adjusting nut toward rear, or replace shaft if bent.
	Rack interfering with escapement pinion pawl.	Straighten rack bail.
	Rack too deeply meshed in pinion	Adjust lower rack bail eccentric stop screws.
	Carriage support rail roller binding	Oil the ball bearings inside roller or replace roller.
	Drawband disengaged, tension relaxed	Turn mainspring drum four turns, connect drawband, and check ribbon feed and reverse for binds.
Paper feed or line spacing uneven.	Pitted or glossy cylinder	Resurface, clean, or replace cylinder.
	Eccentric cylinder	Replace cylinder.
	Cylinder rubber loose on core	Replace cylinder.
	Feed rolls flattened, too hard or glossy	Replace feed rolls.
	Uneven feed roll tension	Adjust feed roll tension.
	Feed rolls binding on shaft	Clean and oil shaft. Replace feed rolls if necessary.

75. Troubleshooting Chart—Continued

Trouble	Possible Cause	Remedy
Paper feed or line spacing uneven—Continued	Feed roll support arm binding screws loose	Tighten screws.
	Paper pan binding	Form paper pan to aline with bottom of rear feed roll.
	Cylinder end loose on core	Tighten screws. Replace cylinder if core threads are stripped.
	Fractional cylinder end teeth worn	Replace fractional cylinder end.
	Variable teeth inside ratchet worn	Replace ratchet.
	Ratchet detent roller pitted	Replace ratchet detent.
	Line space eccentric stop screws out of adjustment.	Adjust lever eccentric stop screw and pawl eccentric stop screw.
	Fractional line space release sticking	Check for binds.
	Paper holder rolls binding	Remove rolls and clean bearings.
	Paper holder roll tension uneven	Form paper holder roll rod.
	Carbon copies or carbon paper wrinkling	Use paper feed adjustments (par. 20).
Shift sticking or sluggish	Segment ball races too tight	Adjust segment rail adjusting screws.
	Shift frame levers sticking in key lever guide.	Straighten shift key levers.
	Shift locks out of adjustment	Adjust shift lock eccentric. Adjust segment lock eccentric stud.
	Shift link interfering or bent	Form shift link.
	Improper tension on shift balance springs	Form shift balance spring hook arms.
	Shift stop rods binding on base lugs	Form shift stop rods.
	Shift pull arms not parallel	Adjust shift pull arm eccentric.
Writing blurred or uneven	Poor or damaged ribbon	Replace ribbon.
	Cylinder too hard or too soft	Replace cylinder.
	Type bars striking type guide	Aline type.
	Ring and cylinder adjustment incorrect	Make proper ring and cylinder adjustment and check all other adjustments.
	Bichrome adjustments incorrect	Make proper bichrome adjustments.
	Trip or back limit out of position	Make the proper trip adjustment. Form back limit plate.
	Poor alinement	Aline type.
	Pitted cylinder	Replace cylinder.
Type bars or keys sticking or colliding.	Segment slots dirty	Clean segment slots.
	Type bars striking type guide	Form type bars.
	Type bar links binding	Form type bar lever.
	Key levers sticking in key lever guide	Straighten key levers.
	Foreign matter in machine	Clean machine.
Crowding or piling	Binding carriage	See carriage adjustments (pars. 15 and 16).
	Friction in ribbon movement	See ribbon feed adjustments (pars. 35–38).
	End play in rack ball	Adjust rack ball adjusting stud.
	End play in cylinder	Adjust right cylinder knob.
	Trip or back limit out of adjustment	Make proper trip adjustment or form back limit plate.
	Escapement wheel shaft binding	Adjust escapement wheel shaft adjusting nut to rear, or replace shaft if bent.
	Damaged bottom rail, pinion, or bearing	Replace damaged part.
	Rack not meshing properly with pinion	Adjust lower rack ball eccentric stop screws.
Skipping	Rack not meshing properly with pinion	Adjust lower rack ball eccentric stop screws.
	Worn or broken rack	Replace rack.
	Broken pinion	Replace pinion.
	Type bar trip too close to cylinder	Adjust master trip adjusting screw.
	Escapement plate spring too weak	Increase tension of spring.
	Spacebar trip delayed	Adjust buffer support. Adjust spacebar link if necessary.
	Escapement dog loose	Tighten escapement dog pivot screw.
	First and second trip too close together	Replace loose dog washer with thin washer.

75. Troubleshooting Chart—Continued

Trouble	Possible Cause	Remedy
Colors bleeding or ribbon not rising enough.	Uneven trip	Form universal bar links.
	Ribbon throw adjusting screw out too far	Turn ribbon throw adjusting screw in.
	Incorrect bichrome adjustments	Make proper bichrome adjustments (par. 44).
	Ribbon spools binding	Lower spool cups or raise top cover plate.
	Loose bichrome cam or index	Tighten setscrews.
	Bent vibrator arm support	Straighten arm support.
	End play in universal bar	Adjust right universal bar bracket.
Ribbon movement binding	Play in ribbon spool shafts	Adjust spur gear on left shaft and end-shake adjusting collar on right shaft.
	Spools binding on top cover plate	Form top cover plate bumpers.
	Gears not meshing properly	Reposition ribbon feed gears.
	Binding wormshaft	Reposition worm gear. Replace wormshaft if bent.
	Ribbon wormshaft pawls out of engagement	Make sure pawls are properly engaged in worm ratchet and wormshaft pinion.
Ribbon not reversing	Ribbon movement binding	See ribbon feed mechanism adjustments (pars. 35–38).
	Reverse levers binding or bent	Remove binds or straighten.
	Reverse lever springs disconnected or weak	Connect springs. Replace if weak.
	Ribbon spool trip arm not contacting automatic reverse levers.	Form automatic reverse levers.
	Insufficient mainspring tension	Increase tension.
	Automatic reverse rolls not moving the reverse cam past the center position.	Form the automatic reverse rolls up or back. Release or add tension to the reverse handle tension spring.
	Reverse cam out of position on wormshaft	Reposition reverse cam.
	Bind in reverse or release handles	Remove binds. Leave handle free to pivot.
Margins uneven	Margin stop banking screw out of adjustment.	Adjust banking screw.
	Margin stop locator out of position	Form locator.
	Margin stop bails too low	Form bail adjusting arms.
	Line lock lever out of adjustment	Form line lock lever.
	End shake in center stop post	Adjust center stop pivot screw.
	Rocker drop screw out of adjustment	Readjust rocker drop screw.
Tabulator skipping or halting.	Tabulator finger contacting tabulator stop incorrectly.	Reposition tabulator link lever, or form tabulator finger extension.
	Tabulator rack too far to right or left	Adjustable tabulator rack adjusting nuts.
	Maladjusted brake tension	Adjust tension properly (par. 48).
	Escapement rack too high or too low	Adjust tabulator link.
	Tabulator rack lift lever out of adjustment	Adjust tabulator link.
	Rack release levers holding rack too high	Form bottom of release levers.
	Tabulator stop set arm interfering with tabulator rack.	Adjust stop set arm to normal position.
	End shake in carriage rack bail	Adjust rack bail adjusting stud.
	Rocker drop screw holding escapement wheel out of position.	Readjust rocker drop screw.
Backspace not spacing or overthrowing.	Rocker drop screw out of adjustment	Adjust rocker drop screw.
	Improper mesh between rack and pinion	Adjust lower rack bail eccentric stop screws.
	Backspace guide bent or loose	Replace if bent. Tighten binding screws if loose.
	Escapement wheel stop out of adjustment	Adjust to 1/32-inch clearance between wheel stop and wheel tooth.
	Rack lock too high, too low, or binding	Remove bind. Adjust rack lock eccentric.
	Backspace key lever bent	Straighten backspace key lever.

CHAPTER 19

CLEANING AND LUBRICATION

76. Cleaning

The rust-resistant finish of the Royal standard typewriter makes it seldom necessary to completely dismantle a machine for cleaning. The general cleaning procedures are as follows:

a. Remove cover plates, ribbon, and all rubber parts, because most cleaning fluids swell or decompose rubber.

b. Remove all lose dirt with compressed air. Removal of loose dirt hastens the subsequent cleaning and diminishes contamination of the cleaning fluid.

c. Place machine in parts cleaner with solution covering machine. Agitate solution by means of compressed air for 5 or 10 minutes.

d. Remove machine and allow to drain for several minutes.

e. Remove excess cleaning fluid by means of compressed air.

f. Lubricate as described in paragraph 77.

g. Clean all rubber parts by wiping with a cloth moistened with alcohol. Dry with a clean cloth.

h. Clean frame and cover plates with soap and water or a diluted ammonia solution.

77. Lubrication

The Royal standard typewriter has no fast rotating bearings; therefore there is no need for continuous lubrication. However, a periodic oiling of all moving parts is necessary. The frequency of lubrication depends upon local conditions. Observe the following instructions:

a. Always clean machine before oiling.

b. Spray machine with a light-base nongumming oil before replacing rubber parts.

c. Allow machine to drain 10 minutes and then wipe off excessive oil.

d. Lubricate paper feed roll shafts and paper holder rolls with a lightweight oil.

e. Be sure all oil is kept away from ribbon and all points where the oil may spot or stain the paper.

CHAPTER 20

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

78. Shipment and Limited Storage

Prepare Royal standard typewriters for shipment and limited storage in the following manner:

a. Clean machine as instructed in paragraph 76.

b. After cleaning, coat machine with atomized spray of type P–9 preservative.

c. Remove rubber feet from base of machine, place in cotton bag, and tie bag to body of typewriter.

d. Tie ribbon spools to ribbon cups.

e. Block carriage rails with carriage packing clamps, carriage dowel pins, carriage brace studs, or fixed wedges.

f. Tie rack release lever down.

g. Secure carriage in a fixed position by tying or by use of manufacturer's carriage retention clamps if available.

h. Tie feed roll release lever down.

i. Place a wad of lint- and dust-free cellulosic cushioning material in type bar nest to hold type bars in place.

j. Cover all sharp protruding points on machine with dust-free cellulosic cushioning material and fasten with tape.

k. Tie one or two cloth bags of silica gel (equivalent of 1 pound) securely to machine in such a manner that machine will not be damaged in transit.

l. Place standard typewriter cover, supplied with machine, over machine and tie in position.

m. Wrap machine with grade C moldable paper.

n. Place machine in moistureproof barrier bag.

o. Carefully collapse barrier bag by hand pressure and heat-seal open side to make it airtight and moistureproof.

p. Attach machine encased in barrier bag to a wooden base by running four bolts through base and placing rubber or felt washers at least one-half inch thick on the bolts as shock absorbers. Manufacturer's springs may be used instead of washers. Screw bolts through barrier material into foot-screw mounting points.

q. Screw wooden base, with machine attached, to the crate with 1¾-inch No. 8 flathead wood screws, spaced not less than 3 inches apart on ends and 5 inches apart on sides.

r. The crate used for packing, constructed of material ¾ inch thick and 2¼ inches wide, must be 21½ inches long, 18½ inches wide, and 12 inches deep.

79. Demolition to Prevent Enemy Use

On receipt of orders from designated person in authority, destroy typewriters as completely as time, means, and personnel permit. Priority will be given to the obliteration or destruction of all unit identification lettering or markings, all serial numbers, and all manufacturer's nameplates. Smash typewriters and components with a sledge or other heavy instrument; burn with kerosene, gasoline, fuel oil, flame thrower, or incendiary bomb; detonate with firearms, grenades, TNT, or other explosives. In the absence of other means, bury, sink, or scatter parts and components.

APPENDIX

REFERENCES

DA Pam 310–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Lubrication Orders, and Modification Work Orders.
SR 310–20–5	Index of Administrative Publications.
SR 310–20–6	Index of Blank Forms.
TB QM 26	Standard Repair Procedures for Office Appliances with Repair Shop Equipment and Tool List.
DA Supply Manual QM 5–51, 52	FSC Group 51, Hand Tools; Class 5110 Hand Tools, Edged, Nonpowered; Class 5120 Hand Tools, Nonedged, Nonpowered; Class 5130 Hand Tools, Power Driven; Class 5140 Tool and Hardware Boxes; Class 5180 Sets, Kits, and Outfits of Hand Tools. FSC Group 52, Measuring Tools: Class 5210 Measuring Tools, Craftsman's; Class 5280 Sets, Kits, and Outfits of Measuring Tools.

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