

Bulletin No. 160
Issue 1
January, 1941

TELETYPE

PRINTING TELEGRAPH SYSTEMS

ADJUSTMENTS
TYPE BAR PAGE PRINTER
(MODEL 20)

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CORPORATION

SUBSIDIARY OF

Western Electric Company

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CHARACTER SENT

LINE SIGNAL

CHARACTER SENT	UNSHIFT	IMPULSES					
		START	1	2	3	4	5
A	A						
B	B						
C	C						
D	D						
E	E						
F	F						
G	G						
H	H						
I	I						
J	J						
K	K						
L	L						
M	M						
N	N						
O	O						
P	P						
Q	Q						
R	R						
S	S						
T	T						
U	U						
V	V						
W	W						
X	X						
Y	Y						
Z	Z						
\$!						
1	ff						
2	+						
3	?						
4	*						
5	ff						
6	ib						
7	&						
8	-						
9	ff						
0	ff						
:	:						
;	:						
'	:						
!	:						
↑	⊙						
↓	⊙						
.	.						
BELL	.						
RET	.						
SHIFT	.						
UNSHIFT	.						
LINE FEED	.						
SPACE	.						

□ - SPACING IMPULSES
 ■ - MARKING IMPULSES

ADJUSTMENTS OF THE TYPE BAR PAGE PRINTER (MODEL 20)

The following adjustments are arranged in a sequence that would be followed if a complete readjustment of the printer were undertaken. This fact should be kept in mind when a single adjustment is to be made.

When the text of any adjustment in this bulletin specifies the setting up of a certain character or function, the following method should be used:

Rotate the main shaft until the printing bail is in its extreme rear position. Hold the front edges of those vanes down which correspond with the marking impulses of the combination (see code chart for code combination) to be set up. Then rotate the main shaft in accordance with the instructions outlined in that particular adjustment specification.

The spring tension values given in this bulletin were derived from measurements made with Teletype spring scales. These spring scales are calibrated for use in a vertical pull position. When used in any other position, the reading is an indicated value. Therefore, in order to obtain the proper spring value readings, the spring scales which are included in the Teletype printer catalog tool list should be used.

NOTE: In all the figures of this bulletin, fixed pivot points are designated by solid black circles.

Typing Unit Adjustments

INSTRUCTIONS FOR REMOVING THE TYPE BAR CARRIAGE FROM THE TYPING UNIT

To do this, operate the carriage return lock bar (Figure 46), and move the carriage to the extreme right. Operate the dashpot lever (Figure 46), locking the carriage in this position. Hold the carriage return spring drum so that the spring cannot unwind. Then unhook the draw strap from the carriage and hook the eyelet of the strap onto the margin bell hammer spring post (Figure 44). Move the right margin adjusting screw arm (Figure 17) to the rear. Operate the carriage return lock bar again and remove the carriage by sliding it off to the right.

Plunger Guide Roller Bracket Adjustment (Figure 1) - See Note (A)

There should be not more than .010" clearance between either the right or left end of the pull bar bail and the stripper plate when the bail is moved to its extreme forward position (See Figure 4). Also the flanged guide roller should be parallel, or within .002" of being parallel to the surface of the plunger, and both guide rollers should rotate freely.

To adjust the position of the pull bar bail with relation to the stripper plate, loosen the plunger guide roller bracket mounting screws and move the bracket to the right or left. To adjust the flanged roller with relation to the plunger, move the roller end of the bracket up or down with the mounting screws friction tight. Tighten the mounting screws.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1)

(A) These requirements should be checked with the type bar carriage removed.

✓ Plunger Roller Eccentric Mounting Stud Adjustment (Figure 1) - See Note (A)

There should be some play, not more than .004", between the pull bar bail plunger and the rollers. Check for this play throughout the entire travel of the plunger.

Adjust the position of the eccentric mounting stud to obtain this requirement.

THE TYPE BAR SEGMENT ASSEMBLY SHOULD BE REMOVED FOR CHECKING THE TWO FOLLOWING SPRING TENSION REQUIREMENTS:

NOTE: To check the two following requirements, remove the type bar backstop (Figure 6), unhook the ribbon carrier from the ribbon oscillator lever (Figure 12), and remove the type bar segment mounting screws (Figure 2). Hold the pull bars out of engagement with the code bar mounting plate (as an aid, use a piece of string or wire under the pull bars), and slide the assembly forward.

✓ Pull Bar Spring Tension (Figure 2) - See Notes (A) and (B)

With any spring unhooked from its pull bar, hook an 8 oz. scale in the spring eye and pull vertically. It should require 2-1/2 to 3-1/2 ozs. to pull the spring to its position length.

✓ Ribbon Feed Pawl Spring Tension (Figure 3) - See Notes (A) and (B)

With the pull bar bail (Figure 4) in its extreme rear position and the carriage held in its normal position, unhook the ribbon feed pawl spring from its post. With an 8 oz. scale held in a horizontal position and hooked in the spring eye, it should require 2-1/4 to 3-1/4 ozs. to pull the spring to its position length.

Replace the type bar segment assembly, the type bar backstop, and the ribbon carrier. Care should be taken to get the ribbon lockout bar and detent spring (Figure 14) and the ribbon oscillator lever (Figure 12) in their respective slots.

✓ Code Bar Mounting Plate Adjustment (Figure 4)

With the pull bar bail in its extreme rear position, move the code bars to the right. Then move the pull bar bail opposite the pull bar humps. There should be .008" to .020" clearance between the humps on all pull bars (except the blank pull bar) and the pull bar bail. With the code bars moved to their left position, there should be a like clearance between the blank pull bar hump and the pull bar bail.

NOTE: When checking this adjustment all the play of the pull bar bail should be taken up in a direction to make the clearance a minimum.

(A) These requirements should be checked with the type bar carriage removed.

(B) These requirements should be checked with the type bar segment assembly removed from the type bar carriage.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

To adjust, remove the bell crank mounting plate assembly (Figure 15) from the type bar carriage assembly, being careful not to bend the bell crank retainers. Position the code bar mounting plate by means of its elongated mounting holes to secure the specified clearance.

Ribbon Feed Shaft Bearing Plates Adjustment (Figures 5 and 6) - See Note (A)

The left end of the ribbon feed shaft should be flush with the inner end of the left vertical feed shaft bevel gear teeth, when the ribbon feed shaft is in its left position and the left vertical feed shaft bevel gear is held in engagement with the ribbon feed shaft gear. A like condition should exist when the ribbon feed shaft is in its right position and the right vertical feed shaft bevel gear is held in engagement with it.

To adjust, loosen the mounting screws of both right and left ribbon spool brackets and move the brackets up as far as the elongated mounting holes will permit. Tighten the mounting screws with the brackets vertical.

Adjust the right bearing plate by means of its clamping nuts to meet the first requirement. Adjust the left bearing plate in a like manner with the ribbon feed shaft in its right position to meet the latter requirement.

Ribbon Feed Shaft Detent Spring Adjustment (Figure 5) - See Note (A)

The center of the ribbon feed shaft detent roller should be at the same height as the center of the ribbon feed shaft, and the shaft detent should travel equally on either side of the detent roller when the shaft is moved from its extreme left to its extreme right position or vice versa.

To adjust, loosen the mounting screws of the ribbon feed shaft detent spring, and position the spring.

Ribbon Feed Shaft Detent Spring Pressure (Figure 5) - See Note (A)

Move the ribbon feed shaft to its extreme left position. Hook a 32 oz. scale over the detent roller hub and pull horizontally toward the rear of the type bar carriage. It should require 19 to 23 ozs. to start the roller moving away from the detent. Then move the ribbon feed shaft to its extreme right position and check the pressure of the detent spring in the same manner. These two pressures should be within 2 ozs. of being equal.

To increase or decrease the spring pressure, remove the spring and bend it. To equalize the pressure, position the spring to right or left.

(A) These requirements should be checked with the type bar carriage removed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Vertical Ribbon Feed Shafts Adjustment (Figure 6) - See Note (A)

The lower ends of the right and left vertical ribbon feed shafts should be flush with the outside edges of their respective bevel gears.

Adjust by means of the bevel gear set screws, being sure that when the set screws are tightened they bear against the flat faces on the shafts.

Ribbon Spool Brackets Adjustment (Figure 6)

With the ribbon feed shaft in its left position, the left vertical ribbon feed shaft should have some end play, not more than .015", during one revolution of the vertical ribbon feed shaft bevel gear. The right vertical ribbon feed shaft should have a like amount of end play, when the ribbon feed shaft is in the right position.

NOTE: When checking the vertical feed shaft for end play, take up the bearing play of the ribbon feed shaft in a direction to make the end play of the vertical feed shaft a maximum.

Adjust both right and left ribbon spool brackets by means of their elongated mounting holes to meet this requirement, being sure that the brackets are vertical.

Ribbon Spool Shaft Spur Gears Adjustment (Figure 7)

The ribbon spool shafts should have some end play not more than .006".

To adjust, loosen the set screws of the vertical ribbon feed shaft spur gears and move the gears out of engagement with their respective ribbon spool shaft spur gears. Then position the ribbon spool shaft spur gears by means of their set screws. When tightening the set screws make certain that they bear against the flat faces on the shafts.

Vertical Ribbon Feed Shaft Spur Gears Adjustment (Figure 7)

Both right and left vertical ribbon feed shaft spur gears should line up with their respective ribbon spool shaft spur gears.

To adjust, position the vertical ribbon feed shaft spur gears by means of their set screws making sure that the set screws bear against the flat faces on the shafts.

Ribbon Spool Cups Adjustment (Figure 8)

The centers of the ribbon rollers should be $3/4$ " to $7/8$ " in front of a line through the centers of the ribbon spool shafts. There should be no bind between the ribbon spool shaft spur gears and the vertical ribbon feed shaft spur gears at any point in their engagement.

To adjust, position each ribbon spool cup by means of the nut on its ribbon spool cup bushing. When tightening the nut, take up the play between the ribbon spool cup bushing and the bracket in a direction to make the play between the spur gears a maximum. (See Figure 7 for location of parts).

(A) These requirements should be checked with the type bar carriage removed.

NOTE: After making a single adjustment, check related adjustments.

(See paragraph 1, page 1).

Vertical Ribbon Feed Shaft Spring Tension Adjustment (Figure 8)

Move the ribbon feed shaft to the right, thus disengaging its gear from the gear on the left vertical feed shaft. Hook an 8 oz. scale onto the pin on the left ribbon spool shaft and pull in a horizontal direction. It should require 2-1/2 to 3-1/2 ozs. to start the shaft turning. Move the ribbon feed shaft to the left and in the same manner check the spring tension of the right vertical ribbon feed shaft.

To adjust, position the collars on the vertical feed shafts (Figure 7), by means of their set screws to obtain the proper tension.

Ribbon Reverse Arms Ribbon Guide Slot Adjustment (Figure 9)

The ribbon guide slot should be .025" to .035" wide and the straight upright piece should clear the angled arm by .010" to .020".

To adjust, bend the upright ends of the ribbon reverse arms.

Ribbon Reverse Shafts Adjustments (Figure 9) - See Note (A)

There should be .040" to .060" clearance between the bottoms of the ribbon spool cups and the upper ends of the ribbon reverse shafts when the ribbon reverse arms are held up against the ribbon spool brackets.

To adjust, loosen the ribbon reverse arm set screw and if necessary the collar set screws and the left ribbon reverse shaft link. Position the shaft while holding the ribbon reverse arm up against the ribbon spool bracket and then tighten the ribbon reverse arm set screw. Adjust the right ribbon reverse shaft in the same manner.

Ribbon Reverse Shafts Collars Adjustment (Figure 9)

The ribbon reverse shafts should have some end play, not more than .008", and the ribbon reverse shaft collars should be positioned so that there is 1/4" to 5/16" between the centers of the set screws and the edges of their respective ribbon spool brackets.

To adjust, position the collars by means of their set screws while holding both ribbon reverse arms forward against their stops.

Ribbon Reverse Shafts Links Adjustment (Figure 10) - See Note (A)

The ribbon reverse bail should clear both left and right ribbon reverse pawls .015" to .040" when the pull bar bail is in its extreme rear position and both the left and right ribbon reverse arms are held forward against their stops.

(A) These requirements should be checked with the type bar carriage removed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

When checking the .015" clearance between either ribbon reverse pawl and the ribbon reverse bail, the play in the ribbon reverse bail should be taken up in a direction to make the clearance a minimum. When checking for the .040" clearance, the play in the ribbon reverse bail should be taken up in a direction to make the clearance a maximum.

To adjust, position the ribbon reverse shafts links by means of their set screws. At the same time see that the ribbon reverse pawl links do not bind at their shoulder screws.

Ribbon Reverse Pawl Spring Tension (Figure 10) - See Note (A)

With the ribbon feed shaft in its left position and the pull bar bail in its extreme forward position, hold the carriage so that the ribbon spool cups are down. Then hook an 8 oz. scale in the notch of the left reverse pawl and pull horizontally toward the rear of the carriage. It should require 1 to 2 ozs. to start the pawl moving. Move the ribbon feed shaft to its right position and, in the same manner, check the tension of the right ribbon reverse pawl spring.

Ribbon Reverse Bail Spring Compression (Figure 10) - See Note (A)

With the type bar carriage held so that the ribbon spool cups are in a downward position, hook a 4 lb. scale in the corner at the left end of the ribbon reverse bail, and pull horizontally toward the front of the carriage. It should require 2 to 4 lbs. to start the ribbon reverse bail moving. Measure the right spring compression at the right end of the ribbon reverse bail for this requirement in the same manner.

Type Bar Backstop Adjustment

With the pull bar bail in its extreme rear position, there should be not less than .010" clearance between the backstop and the pull bars when the type bars are held in the guide. Make this check on the two end pull bars and the middle pull bar.

To adjust, set the up and down position of the type bar backstop by means of its elongated mounting holes to meet this requirement. (See Figure 6 for location of parts.)

NOTE: When making this adjustment, it is desired that the end type bars rest against the backstop along the entire width of the backstop. It is permissible, however, to allow a clearance of not more than .010" between the front end of the type bar and the backstop.

Ribbon Shift Lever Bracket Adjustment (Figures 11 and 12) - See Note (A)

The ribbon oscillator lever should move freely in its slot when its spring is unhooked.

To adjust, position the ribbon shift lever bracket by means of its enlarged mounting holes. Replace the ribbon oscillator lever spring.

Ribbon Oscillator Lever Spring Torsion (Figure 11) - See Note (A)

With the ribbon shift lever spring removed, hook an 8 oz. scale over the lower end of the ribbon oscillator lever and pull horizontally toward the rear of the type bar

(A). These requirements should be checked with the type bar carriage removed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

carriage. It should require 2-1/2 to 3-1/2 ozs. to start the oscillator lever moving. Replace the ribbon shift lever spring.

Ribbon Shift Lever Spring Tension (Figure 11) - See Note (A)

With the ribbon oscillator lever spring unhooked from the oscillator lever, apply the push end of a 12 lb. scale, held in a vertical position, to the ribbon shift lever at the place where the ribbon oscillator spring is mounted. It should require 1 to 1-3/4 lbs. to start the shift lever moving. Replace the ribbon oscillator lever spring.

Margin Bell Pawl Spring Tension (Figure 12) - See Note (A)

Hook an 8 oz. scale, held in a horizontal position, over the margin bell pawl, just above the stop, and pull in line with the spring. It should require 1/2 to 1-1/2 ozs. to start the pawl moving.

Ribbon Lockout Bar Detent Spring Pressure (Figure 13)

NOTE: This adjustment applies only to those printers equipped with the standard (non-adjustable) ribbon lockout bar.

With the ribbon oscillator extension held clear of the ribbon lockout bar and the lockout bar pushed in, hook a 32 oz. scale over the end of the lockout bar and pull directly in line with the bar. It should require 16 to 32 ozs. to pull the lockout bar out to its unoperated position.

Ribbon Lockout Bar Detent Spring Pressure (Figure 14)

NOTE: This requirement applies only to those printers equipped with the adjustable ribbon lockout bar.

With the ribbon lockout bar in its unoperated position (extreme right), and with the push end of a 12 lb. scale bearing against the ribbon lockout bar and pushing directly in line with the bar, it should require from 1-1/4 to 2-1/4 lbs. to disengage the ribbon lockout bar detent spring from its notch in the lockout bar.

Mounting of the Bell Crank Assembly (Figure 15)

Place the bell cranks in their lowest position, with respect to the code bars, by means of their eccentric bushings. Then mount the bell crank assembly as follows: First, mount the right end of the bell crank assembly with one of its mounting screws so that it is friction tight. Then rotate the assembly clockwise and engage the six bell cranks with their respective code bars. Replace the left mounting screw and tighten both screws. (See page 47 for final adjustment).

(A) These requirements should be checked with the type bar carriage removed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

THE FOLLOWING ADJUSTMENT APPLIES TO PRINTERS EQUIPPED WITH A THREE-SECTION PULL BAR SPRING BRACKET:

Right and Left Pull Bar Spring Brackets Adjustments (Figure 16)

With the pull bar bail in its extreme rear position, the end pull bar and the eighth pull bar from the end should have a slight amount of play, not more than .004" between the type bar and the bracket when the type bar is in the guide.

To adjust, loosen the right and left pull bar spring bracket mounting screws and position the spring brackets; tighten the mounting screws.

NOTE: If the second, third, fourth, fifth, sixth, or seventh pull bar binds against the bracket when its respective type bar is moved to the type bar guide by hand, readjust the bracket so that all eight pull bars are free and so that the end pull bar and at least one of the other seven pull bars have not more than .004" end play between the type bars and the bracket when their respective type bars are in the type bar guide.

Adjust the left pull bar spring bracket in a similar manner.

Right Margin Adjusting Screw Arm Spring Pressure (Figure 17) - See Note (A)

With the notch in the right margin adjusting screw arm engaged with the detent spring, hook a 4 lb. scale over the adjusting screw and pull at right angles to the arm toward the rear of the type bar carriage. It should require 2 to 4 lbs. to disengage the arm from the detent spring.

Carriage Support and Pull Bar Bail Plunger Rollers Adjustment - See Note (A)

The three carriage support rollers and the pull bar bail plunger roller should turn freely without end play.

To adjust, loosen the lock nuts and adjust the cone nuts. The rollers should turn freely without end play after lock nuts are tightened. (See Figure 21 for location of parts).

REMOVE THE THREE THUMB SCREWS THAT FASTEN THE TYPING UNIT TO THE BASE.

REMOVE THE TYPING UNIT AND REST IT ON ITS RIGHT SIDE.

Main Shaft Adjustment

When the main shaft is rotated, the selector cams on the selector cam sleeve should line up with their respective selector levers.

To adjust, loosen the four screws that hold the main shaft bearing brackets, and position the main shaft. Then tighten the bearing bracket mounting screws.

(A) These requirements should be checked with the type bar carriage removed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Main Shaft Jaw Clutch Throwout Lever Adjustment (Figure 18)

With the clutch driven member fully cammed out of engagement with the driving member, by the clutch throwout lever, there should be .010" to .020" clearance between the ends of the clutch teeth. The clutch throwout lever should be free from binds and should have no perceptible end play.

Adjust by means of the clutch throwout lever pivot screws.

Main Shaft Jaw Clutch Throwout Lever Spring Tension

Place the typing unit on its left side and rotate the main shaft until the clutch teeth are fully engaged. Hook an 8 oz. scale, held in a horizontal position, over the clutch throwout lever at the spring hole, and pull at right angles to the throwout lever. It should require 2-1/2 to 4 ozs. to start the lever moving. (See Figure 18 for location of parts).

Main Shaft Jaw Clutch Spring Tension (Figure 19)

Place the typing unit on its right side. Rotate the main shaft until the low part of the printing bail cam is toward the bottom of the printer. With the teeth of the clutch driven member resting against the teeth of the driving member, but not engaged, hook a 32 oz. scale on the driven member in line with the low part of the printing bail cam and pull vertically downward. It should require 22 to 26 ozs. to separate the clutch teeth.

NOTE: After checking the 22 to 26 oz. pull, with the positive clutch teeth still separated, gradually reduce the tension exerted by the scale on the driven clutch member. The clutch teeth should engage, top to top, before the scale reading drops to 10 ozs.

Spacing Shaft Lower Bearing Bracket Adjustment (Figure 20)

There should be a minimum amount of play without binding at any point of engagement between the spacing shaft gear and the main shaft spacing gear during one complete revolution of the spacing shaft gear.

To adjust, place the typing unit in its normal upright position; unhook the carriage return operating lever spring from the spring post; move the eccentric away from the bearing bracket and position the bracket by means of its elongated mounting holes. Replace the carriage return operating lever spring and reposition the eccentric against the bearing bracket.

REPLACE THE TYPE BAR CARRIAGE IN ACCORDANCE WITH THE FOLLOWING INSTRUCTIONS:

Instructions for Replacing the Type Bar Carriage on the Typing Unit

Shift the platen to the shift position and rotate the main shaft until the printing bail is in its rear position. Then move the right margin adjusting screw arm on the carriage to the rear, so that it is approximately 45 degrees

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

from vertical. Hold the carriage in the right hand and rest the left front carriage support roller on the right end of the front carriage track, making sure that the carriage guide screw engages the slot in the carriage track. Move the carriage slowly to the left until the rear carriage support roller rests on the upper track. Operate the carriage return lock bar, and move the pull bar bail to its rearmost position by pushing on the right pull bar bail roller with the right thumb. Move the carriage farther to the left, making sure that the bell cranks engage their respective vanes, and that the right front carriage support roller and guide screw properly engage the front carriage track. When the carriage has been moved far enough to the left to permit the right margin adjusting screw to clear the spacing stop lever, restore the right margin adjusting screw arm to its normal vertical position, and then shift the carriage to its extreme right position and lock it in place by operating the dashpot lever. Hold the carriage return spring drum so that the spring cannot unwind. Then unhook the eyelet of the draw strap from the margin bell hammer spring post, and hook it over its mounting post on the carriage. Operate the carriage return lock bar to permit the carriage to return to its extreme left position.

Printing Bail Adjustment (Figure 21)

The pull bars should clear the code bars .010" to .050" when the main shaft is rotated until the printing bail is in its extreme rear position.

Check this adjustment with the type bar carriage in both its extreme right and left positions, and with the play in the pull bars taken up in a direction to make the clearance a minimum.

To adjust, position the printing bail by means of its adjusting screw and lock nut.

REMOVE THE TYPE BAR CARRIAGE.

Function Lever Bail Adjustment - One-Piece (Figure 22)

On typing units equipped with the one-piece function lever bail, the position of this bail should be as follows:

- (a) With the carriage return combination selected and the main shaft rotated until the carriage return function lever is drawn completely into selection with the vanes, the travel of the function lever bail should be blocked by the selected function lever and the front edge of the right projection of the function lever bail should be flush, within .005" of the top front edge of the rear prong of the carriage return function lever.
- (b) With the line feed combination selected and the main shaft rotated, until the line feed function lever is drawn completely into selection with the vanes, the travel of the function lever bail should be blocked by the selected function lever and the front edge of the left projection of the function lever bail should be flush within .005" of the top front edge of the rear prong of the line feed function lever.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

- (c) There should be .040" to .060" clearance between the rear edge of the No. 0 vane and the front edge of the function levers, when the main shaft is rotated until the printing bail is in its extreme rear position and the No. 0 vane is held midway between its marking and spacing positions.

To adjust, remove the line feed push bar and loosen the function lever bail mounting screw nuts. Move the function lever bail to its rearmost position and tighten the mounting screw nuts. Then select the carriage return combination and reposition the right end of the function lever bail to meet the requirements specified in paragraph (a). Next select the line feed combination and adjust the left end of the function lever bail to meet the requirements specified in paragraph (b). Finally, rotate the main shaft until the printing bail is in its extreme rear position and check for the requirement specified in paragraph (c). If this latter requirement is not met, it will be necessary to add or remove shims between the function lever bail and its mounting brackets and readjust both ends of the bail. Replace the line feed push bar.

ON TYPING UNITS EQUIPPED WITH TWO-PIECE FUNCTION LEVER BAIL ASSEMBLY, THE TWO FOLLOWING ADJUSTMENTS APPLY:

Function Lever Bail Adjustment - Two-Piece (Figure 22)

There should be .040" to .060" clearance between the rear edge of the No. 0 vane and the front edges of the function levers when the main shaft is rotated until the printing bail is in its rearmost position and the No. 0 vane is held midway between its marking and spacing positions.

To adjust, position the function lever bail by means of its elongated mounting holes.

Blocking Plate Adjustment (Figure 22)

The position of the blocking plate should be as follows:

- (a) With the carriage return combination selected and the main shaft rotated until the carriage return function lever is drawn completely into selection with the vanes, the travel of the function lever bail should be blocked by the selected function lever and the front edge of the right projection of the function lever bail should be flush within .005" of the top front edge of the rear prong of the carriage return function lever.
- (b) With the line feed combination selected and the main shaft rotated until the line feed function lever is drawn completely into selection with the vanes, the travel of the function lever bail should be blocked by the selected function lever and the front edge of the left projection of the function lever bail should be flush within .005" of the top front edge of the rear prong of the line feed function lever.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

To adjust, remove the line feed push bar, and position the blocking plate by means of its slotted holes to meet the foregoing requirements. Replace the line feed push bar.

Selector Vanes Adjustment (Figure 22)

The forked arms of the Nos. 0, 1, 2, 3, 4, and 5 vanes should line up with their respective "T" levers. When the printing bail is in its extreme rear position, each vane should have some end play not more than .004.

To adjust, loosen the vane clamping screws and position the vanes by means of their pilot screws. Tighten the clamping screws.

Function Bail Spring Tension (Figure 23)

With the function bail in its extreme rear position, unhook the function bail spring from the front spring post and hook a 4 lb. scale in the spring eye. It should require 2 to 3 lbs. to stretch the spring to its position length.

Printing Bail Spring Tension Adjustment (Figure 24)

Rotate the main shaft until the printing bail is in its extreme rear position. Hook a 12 lb. scale over the left end of the adjusting lever, so that the hook on the scale engages the lever directly in the rear of the spring notch in the lever, and pull in line with the spring. It should require 7-1/2 to 8-1/2 lbs. to start the lever moving.

Adjust by means of the spring adjusting lever screw.

Selector Lever Spring Tension (Figure 25)

Place the typing unit on its right side. With the vanes in the marking position, rotate the main shaft until the function lever bail rests on the selected unshift function lever. Move the swords manually to the spacing position. Hook a 32 oz. scale over the end of each selector lever at the cam sleeve assembly and pull in line radially to the main shaft. It should require 6 to 10 ozs. to start each selector lever moving.

Hold the swords away from the "T" levers and check each vane for freeness.

Selector Separator Plates Adjustment (Figure 26)

The leaf springs on all separator plates, except the front and rear plates, should exert a light pressure upon the swords. In order to make this adjustment, it is necessary to remove the separator plates. The left springs should be bent at the narrow portions so that the ends will project .050" to .060" below the under surfaces of the straight portions.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Selector Armature Adjustment (Figure 27)

NOTE: If the printer is equipped with the armature detent, unhook the spring from the detent before making this adjustment.

Rotate the main shaft until the No. 0 selector lever is on the peak of its cam. Hold the No. 0 sword against the upper separator plate without bending the latter and take up the armature end play in a direction to reduce the clearance to a minimum. Under these conditions, the armature should be free on its pivot screws with barely perceptible end play, and there should be some clearance, not more than .008" between the No. 0 sword and the lower surface of the armature locking wedge.

To adjust, loosen the upper pivot screw lock nut and position the pivot screw (a quarter turn of the screw is equivalent to approximately .062"). Tighten the upper pivot screw lock nut. To obtain the correct armature end play, remove the armature bracket, loosen the lower pivot screw lock nut and position the lower pivot screw. Tighten the lower pivot screw lock nut and replace the armature bracket.

If there is more than .008" clearance, remove the armature bracket, loosen the lower pivot screw lock nut and position the lower pivot screw. Tighten the lock nut and position the armature bracket.

Selector Armature Bracket Link Adjustment (Figures 28 and 29)

The position of the armature bracket should be such that a line through the center of the No. 0 sword extends approximately through the centers of the armature pivot screws, when the swords are held midway between the stop posts by means of the No. 72581 gauge pins.

To adjust, proceed as follows:

Remove the range finder; unhook the locking lever spring; loosen the magnet bracket mounting screws, and move the bracket to its rearmost position. Loosen the armature bracket mounting screws, the link screw, and back off the armature stops. Move the bracket eccentric out of the way, so that it will not interfere with the adjustment. Rotate the main shaft until No. 0 selector lever rests on the peak of its cam.

Hold the swords in a position midway between the two stop posts, by means of the gauge pins inserted between the stop posts and the swords. Be sure that both the armature extension arms are between the arms of the swords. With the swords held in this position, place the No. 73370 locating gauge over the end of the No. 0 sword, so that the two legs of the gauge are against the ends of the sword arms. Move the bracket to a position where both armature extension arms are against the flat surface between the legs of the gauge.

Hold the bracket in this position and tighten the link screw only. Remove the locating gauge and the two gauge pins.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Selector Armature Bracket Adjustment (Figure 29)

The position of the armature bracket should be such as to provide some clearance, not more than .040", between each sword and either stop post under the following conditions:

Rotate the main shaft until the No. 0 selector lever is resting on the peak of its cam. With the armature in its unoperated (spacing) position, move the spacing arm of the No. 0 sword against the armature extension.

Place a .040" wire gauge against the spacing stop post and rotate the armature slowly toward the marking position. The blade of the sword should strike the .040" gauge before the armature leaves the spacing arm of the sword. Under these conditions, the armature will move the sword to not more than .040" of the stop post.

Remove the .040" gauge and repeat the above procedure. The armature should leave the spacing arm of the sword before the blade of the sword strikes the spacing stop post. Under these conditions, there will be some clearance between the sword and the stop post.

Unhook the armature spring at its adjusting screw and with the selector armature in its operated (marking) position, move the marking arm of the No. 0 sword against the selector armature extension. Then rotate the armature slowly toward the spacing position until the armature just leaves the marking arm of No. 0 sword. Check the clearance between the No. 0 sword and the marking stop post in the same manner as described in the foregoing.

With each selector lever on the peak of its cam, each associated sword should be tried for the foregoing requirement of some clearance, not more than .040", between each sword and the stop posts.

To adjust, tighten the armature bracket mounting screws just enough so that the bracket may be moved by tapping it lightly. By rotating the bracket on its pivot, the clearance between the sword and the stop posts may be regulated. If this clearance is more than .040", move the bracket in a direction to bring the armature toward the sword. If there is no clearance, move the bracket in the opposite direction to bring the armature away from the sword.

After the bracket is set and both screws are tightened, move the bracket eccentric against the bracket and tighten the screw. The eccentric and link will, therefore, determine the position of the bracket. The bracket may be removed by simply removing the two bracket screws. In replacing, the bracket should be held against the eccentric stop, while the two bracket screws are tightened.

THE FOLLOWING ADJUSTMENT APPLIES TO PRINTERS EQUIPPED WITH OR WITHOUT THE ARMATURE DETENT OR ARMATURE STOP PLATE AND OPERATED AT A SPEED LESS THAN 318 OPERATIONS PER MINUTE.

Armature Stops Adjustment (Figure 30)

NOTE: If the printer is equipped with an armature stop plate, the stop plate should be positioned so that it is ineffective before making this adjustment.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

The No. 0 sword arms (right and left) should clear the associated arms of the selector armature extension .040" to .042" when the front edge of the opposite sword arm is against its armature extension arm and the No. 0 selector lever is on the high part of its cam.

To adjust the clearance of the right arm, reposition the armature stop screw with the armature in its unoperated position. (See Figure 29).

To adjust the clearance of the left arm, reposition the armature stop nut with the armature in its operated position. If necessary, pinch the nut to make it tight on its screws. Recheck the right arm and replace the locking lever spring.

THE FOLLOWING ADJUSTMENT APPLIES TO PRINTERS NOT EQUIPPED WITH THE ARMATURE DETENT BUT EQUIPPED WITH THE ARMATURE STOP PLATE AND OPERATED AT SPEEDS GREATER THAN 318 OPERATIONS PER MINUTE.

Armature Stops Adjustment (Figure 31)

NOTE: Before making this adjustment, back off the armature stop screw and nut so that they are ineffective.

Turn the main shaft until the No. 0 selector lever is on the peak of its cam. With the spacing arm of the No. 0 sword against the spacing side of the armature extension, there should be a clearance of .056" to .058" between the side of the armature extension and the No. 0 sword on the marking side (See Figure 31-A). Now place the armature and sword in the marking position. There should be a clearance of .030" to .034" between the side of the armature extension and the No. 0 sword on the spacing side (See Figure 31-B).

To adjust, loosen the armature stop plate mounting screws and position the stop plate. Tighten the mounting screws.

Armature Locking Wedge Adjustment (Figure 25)

There should be .008" to .012" clearance between the point of the armature locking wedge and the point of the locking lever when the locking lever is on the long high part of the locking cam and the two points are in line.

To adjust, position the locking wedge forward or backward in its slot in the armature extension by means of the locking wedge lock nut.

Armature Locking Lever Spring Tension (Figure 25)

With the locking lever on the high part of the locking cam, hook a 32 oz. scale in the spring hole of the locking lever and pull in line with the spring. It should require 10 to 14 ozs. to start the lever moving.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Stop Lever Eccentric Screw Adjustment (Figure 32) - See Note (C)

The stop lever on the range finder assembly should overtravel the latching surface of the trip latch .004" to .006".

To adjust, position the eccentric by means of its lock nut, making certain that when tightening the nut, the adjustment is not disturbed.

Stop Lever Spring Tension (Figure 33) - See Note (C)

With the trip latch plunger held operated, hook an 8 oz. scale at the end of the stop lever on the range finder assembly. It should require 3/4 to 1-1/4 ozs. to start the lever moving.

Trip Latch Spring Compression (Figure 32) - See Note (C)

When measuring this requirement, the range finder assembly should be held in a horizontal position. Apply the push end of an 8 oz. scale, held in a vertical position, to the trip latch as near to the stop latch as possible and push upward. It should require 1 to 1-1/2 ozs. to start the trip latch moving.

Replace the range finder assembly. Care should be taken that the trip latch plunger does not jam against the armature trip-off eccentric screw when remounting.

Armature Trip-Off Eccentric Screw Adjustment (Figure 34)

There should be some clearance not more than .002" between the stop lever and the trip latch when the armature is in the unoperated position and the main shaft is rotated until the stopping edge of the stop lever is directly below the latching surface of the trip latch.

The trip latch plunger should have at least .002" end play (See Figure 32) when the armature is held against the marking stop and the stop lever is clear of the latching surface of the trip latch.

To adjust, position the armature trip-off eccentric screw by means of its lock nut to meet the first requirement. The latter requirement serves as a check on the trip-off eccentric screw adjustment and also on the adjustment of the armature stops.

Magnet Bracket Adjustment (Figure 29)

There should be .002" to .007" clearance between each magnet core and the armature anti-freeze strip when the armature is against the operated stop nut (marking stop). The faces of the cores should be parallel to the face of the armature.

(C) These requirements should be checked with the range finder removed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

To adjust, position the bracket by means of its enlarged mounting holes.

Armature Detent Mounting Bracket Adjustment (Figure 35)
(For Printers Equipped With Armature Detent)

Replace the armature detent spring and remove the armature spring. Depress the trip latch spring so that the trip latch plunger will be away from the armature trip-off eccentric screw. Hook an 8 oz. scale over the armature extension. An equal pull should be required to move the armature detent pin over the armature detent when going to both the marking and spacing positions.

To adjust, loosen the detent mounting bracket lock nuts and position the bracket. Tighten the lock nuts and replace the armature spring.

Armature Detent Spring Tension (Figure 35)
(For Printers Equipped With Armature Detent)

Unhook the detent spring from the bracket and hook an 8 oz. scale in the spring eye. It should require $3\frac{1}{2}$ to $4\frac{1}{2}$ ozs. to pull the detent spring to its position length. Replace the detent spring.

Platen Unit Pilot Screws Adjustment

The platen unit should be midway between the side frames and should be free on its bearings without side play.

To adjust, place the typing unit in its normal upright position and disconnect the line feed and shift vertical links at the upper shoulder screws. Unhook the platen balance spring and the shift detent spring. Then position the platen unit by means of its pilot screws to meet the foregoing requirements. Reconnect the line feed and shift vertical links and replace the platen balance spring and the shift detent spring. (See Figures 36 and 39 for location of parts).

Platen Shift-Unshift Stop Post Adjustment

The top and bottom surfaces of the platen shift-unshift stop post should be parallel to a line through the center of the platen detent roller screw and the platen pilot screw.

To adjust, loosen the platen shift-unshift stop post nut and rotate the post. (See Figure 36 for location of parts).

REPLACE THE TYPE BAR CARRIAGE.

Shift Stop Screw Adjustment

With the platen in the shift position and the letter "N" type bar held lightly against the platen, the face of the letter "N" should conform to the curvature of the platen, when viewed along the axis of the platen. A further check may be made

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

by inserting a sheet of paper with a carbon in the printer and pressing the letter "N" firmly against the platen. The impression made on the paper should be of uniform shade.

To adjust, raise the shift stop screw if the shading is lighter at the bottom of the character and lower it if the shading is lighter at the top. (See Figure 36 for location of parts).

Unshift Stop Screw Adjustment

With the platen in the shift position (up), print the letter "W" on the platen. Then with the platen in the unshift position (down), the figure "2" should be in direct alignment with the letter "W" when the figure "2" is printed directly on the platen.

Adjust by means of the unshift stop screw. (See Figure 36 for location of parts).

REMOVE THE TYPE BAR CARRIAGE.

Shift, Unshift, and Line Feed Function Lever Spring Tensions (Figure 37)

Place the typing unit on its right side. Select the blank combination and rotate the main shaft until the printing bail is in its extreme forward position. Hook a 32 oz. scale over the rear extension of the unshift, shift, and line feed function levers just in front of the lobes which engage the push bars and pull horizontally at right angles to the rear extension. It should require 14 to 18 ozs. to start each of these function levers moving. When checking these tensions, the push bars should be held away from the function levers.

Space Function Lever Spring Tension (Figure 37)

With the space function lever resting against the vanes, but not selected, hook a 32 oz. scale over the rear extension of the lever, just in front of the lobe, and pull horizontally at right angles to the rear extension. It should require 12 to 16 ozs. to start the space function lever moving. When checking this tension, the letters push bar should be held away from the function lever.

Block Printing and Spacing Cut-Out Function Lever Spring Tension

NOTE: The following spring tension applies to all function levers, regardless of their location in the typing unit, which block printing and spacing but perform no other function.

Rotate the main shaft until the printing bail is in its extreme rear position. Then unhook the function lever spring from the spring plate. Hook a 32 oz. scale in the spring eye. It should require 22 to 30 ozs. to stretch the spring to its position length.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Function Bail Blade Adjustment (Figure 38)

NOTE: If the shift and unshift mechanism has not been adjusted, it will be necessary to loosen the shift lever bracket mounting screws and move the bracket to its extreme rear position, before proceeding with the "Function Bail Blade Adjustment."

With the unshift, line feed, and shift function levers alternately selected and the main shaft rotated until the travel of the function lever bail is blocked by the selected function lever, there should be .004" to .015" clearance between the rear edge of No. 0 vane and the bottom of a notch in the selected function lever. With the unshift on space cut-out lever (Figure 37) released from the lower extension of the space function lever, place the platen in the unshift position, select the space combination, and rotate the main shaft until the function lever bail roller just leaves the cam surface of the space function lever. Under this condition, there should be .004" to .015" clearance between the rear edge of No. 0 vane and the bottom of a notch in the space function lever.

To adjust, loosen the function bail blade mounting screws until they are friction tight. Select the unshift function lever and raise or lower the right end of function bail blade by means of its elongated mounting holes to secure the specified clearance between the rear edge of No. 0 vane and the bottom of a notch in the unshift function lever. Then select the line feed function lever and raise or lower the left end of the function bail blade to secure the specified clearance between the rear edge of No. 0 vane and the bottom of a notch in the line feed function lever. Tighten the mounting screws. If like requirements are not met when the shift and space function levers are selected, it may be necessary to readjust both ends of the function bail blade.

Shift and Unshift Adjustment

FIG 36

With the shift-unshift detent and platen balance springs removed and the shift and unshift combinations alternately selected, the shift-unshift stop post should move to within .010" to .025" of the shift and the unshift stop screws respectively, when the main shaft is rotated and the selected push bar is moved to its rearmost position when operated by the function bail blade. The platen should be placed in the unshift position (down) before selecting the shift combination and in the shift position (up) before selecting the unshift combination.

To adjust, place the shift lever bracket in the middle of the adjustment provided by the elongated mounting holes and tighten the mounting screws. Place the typing unit on its right side and rotate the main shaft until the function bail is in its extreme forward position. Adjust the turnbuckle on the shift-unshift link so as to equalize (within .010") the clearance between the function bail blade and the shoulder on the shift push bar, (when the platen is in the unshift position) with the clearance between the function bail blade and the shoulder on the unshift push bar, (when the platen is in the shift position). Then select the shift and unshift combinations alternately and check for the specified clearances between the shift-unshift stop post and the shift and unshift stop screws. If either of these clearances is greater than .025", move the shift lever

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

bracket toward the front of the unit, if less than .010" move it toward the rear, after which a slight readjustment of the shift-unshift link turnbuckle may be necessary to bring both clearances within the specified limits. Replace the shift-unshift detent spring and platen balance spring. (See Figures 36 and 37 for location of parts).

Platen Balance Spring Tension (Figure 39)

With the platen in the unshift position, unhook the platen balance spring from the platen unit side frame and hook a 12 lb. scale in the spring eye. It should require $3\frac{1}{2}$ to 5 lbs. to pull the spring to its position length. Replace the spring.

Shift-Unshift Detent Adjustment

When the platen is shifted from the unshift to the shift position, the detent roller should ride equally on either side of the detent.

To adjust, position the shift-unshift detent by means of its eccentric shoulder screw. (See Figure 36 for location of parts).

Shift-Unshift Detent Spring Tension (Figure 36)

Hook a 25 lb. scale over the extension on the shift-unshift detent and pull in line with the spring. It should require from 10 to 14 lbs. to start the detent moving.

Shift and Unshift Push Bars Spring Tensions (Figure 37)

Select any character and rotate the main shaft until the printing bail is in its extreme forward position. Place the push end of an 8 oz. scale directly beneath the notch on the push bar and push horizontally at right angles to the bar. It should require 3 to 5 ozs. to start the push bar moving.

Platen Shaft Adjustment

The platen shaft should have some end play not more than .004".

To adjust, position the friction assembly on the platen shaft by means of its set screws. (See Figure 50-B for location of parts).

Single-Double Line Feed Detent Adjustment

When the single-double line feed lever is shifted from the single to the double line feed position, the hump on the detent spring should travel equally on either side of the detent. (See Figure 36 for location of parts).

To adjust, position the detent by means of its mounting screw.

Single-Double Line Feed Detent Spring Pressure - (Figure 36)

With the single-double line feed lever in the single line feed position, hook a 4 lb. scale, held in a horizontal position, over the extension of the lever and pull toward the front of the typing unit. It should require $1\frac{1}{4}$ to $3\frac{1}{4}$ lbs. to move the lever to the double line feed position.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

✓
Line Feed Detent Lever Adjustment

With the single-double line feed lever in the single line feed position (up), and the line feed bail operated by hand, the line feed pawl, when sliding off the rear edge of the single-double line feed lever, should just miss the edge of a tooth on the ratchet. (See Figure 36 for location of parts).

To adjust, loosen the detent lever eccentric screw nut (Figure 39) and turn the eccentric screw so as to rotate the platen by means of the detent lever. Tighten the detent lever eccentric screw nut and check the adjustment for all the teeth on the line feed ratchet.

NOTE: There are two positions of the detent lever eccentric screw which will provide correct adjustment. Use the position which applies the least tension to the detent lever spring and be sure that the detent roller rests in the bottom of a notch on the detent ratchet.

✓
Line Feed Link Turnbuckle Adjustment (Figure 36)

With the single-double line feed lever in the single line feed position, select the line feed combination and rotate the main shaft until the line feed push bar is being stripped from the function bail blade. Under this condition, the platen should rotate one line space, the detent roller should rest in the hollow between two ratchet teeth, and there should be some clearance, not more than .015", between the line feed pawl and the front face of a tooth on the ratchet. Check each tooth on the ratchet for this clearance.

When gauging these clearances, the play in the line feed mechanism should be taken up in a direction to make the clearance a maximum by pressing forward on the line feed pawl. To obtain this requirement, place the typing unit on its right side and adjust the length of the line feed link by means of its turnbuckle.

Line Feed Push Bar Spring Tension ✓

With the typing unit on its left side and the printing bail in its extreme rear position, apply the push end of an 8 oz. scale to the push bar, just to the rear of the function lever extension and push horizontally at right angles to the bar (See Figure 37). It should require $1\frac{1}{2}$ to $2\frac{1}{2}$ ozs. to start the push bar moving.

Line Feed Detent Lever Spring Tension (Figure 39) ✓ 616's

With the typing unit resting in its normal upright position, hook a 4 lb. scale over the end of the detent lever and pull in line with the spring. It should require $2\frac{1}{2}$ to $3\frac{1}{2}$ lbs. to start the detent lever moving.

Line Feed Pawl Spring Tension (Figure 36) ✓

With the single-double line feed lever in the double line feed position and the line feed pawl in its unoperated position, hook an 8 oz. scale under the line feed pawl, just to the rear of the notch and pull up vertically. It should require 2 to 4 ozs. to start the pawl moving.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

✓
Line Feed Check Screw Adjustment (Figure 39)

The line feed check screw should drop in the fifteenth notch from the detent roller. (When counting the notches, start with the notch just above the detent roller). There should be some clearance, not more than .020", between the front face of the screw and the face of the tooth, at the point of minimum clearance, when the check screw is held in the bottom of a notch on the ratchet.

To adjust, loosen the line feed check screw lock nut and position the check screw to meet the foregoing requirements. Tighten the lock nut. Rotate the platen roll and check the clearance in each notch of the ratchet. If necessary, loosen the clamping nut of the line feed check post stop screw and back off the stop screw before making this adjustment. Tighten the clamping nut.

✓
Line Feed Check Post Stop Screw Adjustment (Figure 39)

When the line feed check post stop screw is held down against the casting, there should be .015" to .030" clearance between the line feed check screw and each tooth on the detent ratchet, when the platen is rotated.

To adjust, loosen the check post clamping nut and position the stop screw, before tightening the clamping nut, see that the line feed check post is against the inner side of the casting and the end of the line feed check lever shaft is flush with the outer surface of the casting. Tighten the clamping nut.

✓
Line Feed Check Lever Adjustment (Figure 39)

With the line feed combination selected and the main shaft rotated until the line feed pawl has reached its farthest travel in rotating the platen, the line feed pawl lever should be in contact with the check lever, there should be some clearance, not more than .015", between the lower edge of the line feed check screw and the bottom of any notch in the detent ratchet.

To adjust, loosen the check lever set screw and position the check lever. (See Figure 36 for location of parts). Before tightening the set screw, see that the shaft has some end play, not more than .004".

NOTE: When checking the clearance between the check screw and the ratchet, the play of the line feed check lever shaft in its right bearing should be taken up to make this clearance a maximum.

✓
Line Feed Check Lever Spring Tension (Figure 36)

With the line feed pawl in the forward position, hook an 8 oz. scale under the head of the check lever set screw and pull at right angles to the set screw. It should require 2 to 3 ozs. to start the lever moving.

✓
Pressure Roller Release Shaft Collars Adjustment (Figure 40)

The pressure roller release shaft should have some end play not more than .004". With the right collar against the casting, there should be 5/32" to 7/32" clearance between the boss just to the rear of the platen shaft boss, and the pressure roller release shaft arm, when the arm is opposite the boss.

NOTE: After making a single adjustment, check related adjustments. (See paragraph 1, page 1).

Adjust the clearance of the release shaft arm by means of the right collar and adjust the end play by means of the left collar.

Pressure Roller Release Cams Adjustment (Figure 41)

With the pressure roller release shaft arm in its rear position, the high parts of the pressure roller release cams should rest on the high parts of the release levers.

To adjust, position the cams on the release shaft by means of their set screws.

Pressure Roller Tension Springs Adjustment (Figure 41)

With the release shaft arm in its forward position, hook a 12 lb. scale over the lower end of the spring adjusting lever, just above the spring, and pull in line with the spring. It should require 5 to 6 lbs. to start the adjusting lever moving.

Adjust by means of the spring adjusting lever screw.

Pressure Roller Release Lever Shafts Adjustment

With the inner surface of the paper chute mounting extensions against the casting, the outer ends of the release lever shafts should project beyond the outer surfaces of the paper chute mounting extensions by not more than $1/32$ ". (See Figure 40 for location of parts).

To adjust, position the release lever shafts by means of their set screws.

Paper Chute Springs Tension (Figure 42-B)

With the pressure roller release shaft arm in its rear position, hook an 8 oz. scale over the rear edge of the paper chute, midway between the side frames, and pull at right angles to the rear flat surface of the paper chute. It should require 2 to 4 ozs. to start the paper chute moving.

Paper Fingers Adjustment (Figure 42-B)

The paper finger shaft stop arm should clear its stop post $.004$ " to $.020$ " when both paper fingers are resting against the platen. When paper $8\frac{1}{2}$ " wide is used, the outer edge of the lower portion of each finger should be within $3/32$ " of the end of the rubber portion of the platen, and should not extend beyond the ends of the rubber portion of the platen. When paper narrower than $8\frac{1}{2}$ " is used, the left finger should be moved inward correspondingly.

To adjust, first position the right paper finger by means of its set screw to provide the specified clearance between the stop arm and the stop post. Then set the left paper finger to correspond to the width of the paper.

Paper Fingers Shaft Spring Tension (Figure 42-B)

Hook a 32 oz. scale over the paper finger shaft stop arm, just above the stop post, and pull in line with the spring. It should require 14 to 18 ozs. to start the stop arm moving.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Paper Straightener Rod Stops Adjustment (Figure 42-B) ✓

When the paper straightener rod is in its extreme upward position, there should be a clearance of .030" to .050" between the straightener rod and the blocking edge of the stops.

To adjust, position the stops by means of their elongated holes.

Paper Straightener Rod Springs Tension (Figure 42-B) ✓

Hook a 32 oz. scale over the ends of the levers where the springs are hooked and pull in line with the springs. It should require 8 to 12 ozs. to start the levers moving.

Paper Guides Adjustment (Figure 42-A) ✓

The outer side of both paper guides should be .040" to .050" from the shoulder on their respective ends of the straightener rod.

To adjust, position the guides on the shaft by means of their set screws.

Spacing Escapement Pawl Operating Arm Adjustment (Figure 43) ✓

With the line feed combination selected and the main shaft rotated until the function lever bail rests on the line feed function lever, there should be .020" to .040" clearance between the rear spacing escapement pawl and the low part of the spacing escapement ratchet.

To adjust, loosen the spacing escapement pawl operating arm mounting screws and position the arm. Tighten the mounting screws.

Spacing Escapement Pawl Spring Tension (Figure 43) ✓

Rotate the main shaft until the printing bail is in its extreme rear position. Hook a 32 oz. scale under the front spacing escapement pawl at the place where it rests against the escapement pawl operating arm, and pull vertically upward. It should require 10 to 14 ozs. to start the pawl moving.

Margin Bell Hammer Adjustment (Figure 44) *unlike*

With the bell hammer arm resting against the stop post, there should be .020" to .060" clearance between the bell and the bell hammer.

To adjust, bend the bell hammer arm along its entire length, avoiding a sharp bend at any point.

Margin Bell Hammer Spring Tension (Figure 44)

Hook a 32 oz. scale over the bell hammer arm, directly below the spring, and pull in line with the spring. It should require 10½ to 13½ ozs. to start the arm moving.

Signal Bell Hammer Spring Tension (Figure 45-A) ✓

With the bell latch bar in its latched position, hook an 8 oz. scale over the upper end of the bell hammer arm extension, and pull at right angles to the inner straight edge of the extension. It should require 3 to 5 ozs. to start the bell hammer moving.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Signal Bell Latch Bar Latch Shims Adjustment (Figure 45-A) ✓

Set the typing unit on its right side. With the platen in the unshift position (down) and the bell combination selected, rotate the main shaft until the printing bail is in its extreme forward position. There should be .004" to .010" clearance between the bell latch bar and the lobe on the rear extension of the bell function lever. When checking this clearance, the front shoulder of the bell latch bar should be fully latched on its latch.

To adjust, add or remove shims between the latch and the function lever comb.

Signal Bell Latch Bar Latch Adjustment (Figure 45-A) ✓

With the main shaft rotated until the function bail is in its extreme rear position, there should be a clearance of .010" to .020" between the front shoulder of the bell latch bar and its latch. When checking this clearance, the shoulder on the bell reset bar should be fully engaged with the function bail blade.

To adjust, position the bell latch bar latch to the front or rear by means of its elongated mounting holes.

Signal Bell Hammer Backstop Adjustment (Figure 45-A) ✓

With the bell latch bar in its latched position, there should be .020" to .040" clearance between the bell hammer arm extension and the bell operating lever.

To adjust, position the backstop by means of its elongated mounting holes.

Signal Bell Operating Lever Spring Tension (Figure 45-A) ✓

Remove the bell reset bar spring. With the rear shoulder of the bell latch bar resting against the bell latch bar latch, hook a 4 lb. scale under the head of the bell operating lever screw and pull parallel to the latch bar. It should require 1-1/4 to 2-1/4 lbs. to start the lever moving.

Replace the bell reset bar spring.

Signal Bell Reset Bar Spring Tension (Figure 45-B) ✓

Rotate the main shaft until the function bail is in its extreme forward position. With the front shoulder of the latch bar resting against the latch, hook an 8 oz. scale over the reset bar just in front of the shoulder, and pull at right angles to the reset bar. It should require 3 to 5 ozs. to start the reset bar moving.

Bell Function Lever Spring Tension (Figure 45-A) ✓

Select any character and rotate the main shaft until the bell function lever rests against the vanes, but is not selected. Hook a 4 lb. scale over the rear extension of the bell function lever, just in front of the lobe that engages the bell latch bar, and pull at right angles to the lever. It should require 1-3/4 to 2-1/4 lbs. to start the lever moving.

Carriage Return Latch Bar Latch Shims Adjustment ✓

With the "0" combination selected and the main shaft rotated until the printing bail is in its extreme forward position, there should be .004" to .010" clearance between the carriage return latch bar and the lobe on the rear extension

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

of the carriage return function lever. When checking this clearance, the shoulder on the carriage return latch bar should be fully latched on the latch. (Similar to "Signal Bell Latch Bar Latch Shims Adjustment," Figure 45-A).

To adjust, add or remove shims between the carriage return latch bar latch and the function lever comb. (See Figure 46 for location of parts).

Carriage Return Latch Bar Latch Adjustment ✓

With the main shaft rotated until the function bail is in its extreme rear position, there should be .010" to .020" clearance between the shoulder on the carriage return latch bar and the latch. When checking this clearance, the shoulder on the carriage return reset bar should be fully engaged with the function bail blade. (Similar to "Signal Bell Latch Bar Latch Adjustment," Figure 45-A).

To adjust, position the latch to front or rear by means of its elongated mounting holes. (See Figure 46 for location of parts).

Carriage Return Lock Bar Latch Eccentric Screw Adjustment (Figure 46) ✓

With the front end of the dashpot lever held in its extreme left position, there should be .006" to .015" clearance between the lower edge of the carriage return lock bar latch and the upper edge of the lock bar. When checking this clearance, all the play between the lock bar and the shoulder stud should be taken up in a direction to make this clearance a minimum.

Adjust by means of the lock bar latch eccentric screw.

NOTE: There are two positions of the eccentric screw at which the proper adjustment can be obtained. Use the position which gives the greater tension to the latch spring.

Carriage Return Lock Bar Latch Spring Tension (Figure 46) ✓

With the carriage return lock bar latch unlatched (resting on the upper part of the carriage return lock bar), hook a 32 oz. scale over the latch, just below the spring and pull parallel to the lock bar. It should require 7 to 10 ozs. to start the latch moving.

Carriage Return Lock Bar Adjustment (Figure 46) ✓

With the carriage return lock bar in its latched position and the shoulder of the lock bar held against the edge of the latch, there should be a clearance of .010" to .020" between the teeth of the carriage return clutch members.

Adjust the length of the lock bar by means of its sliding joint to obtain this clearance.

NOTE: Before making the foregoing adjustment, loosen the mounting screw of the carriage return clutch driven member and take up the play between the driven member and its mounting screw in a counterclockwise direction with respect to the shaft as viewed from the lower end of the shaft. Tighten the mounting screw.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Carriage Return Operating Lever Stop Screw Adjustment (Figure 46)

With the carriage return combination selected and the main shaft rotated until the carriage return function lever just trips the carriage return latch bar off its latch, there should be some clearance, not more than .020", between the lock bar shoulder and the edge of the lock bar latch. When checking this clearance, all the play in the lock bar connections should be taken up in a direction to make the clearance a minimum. This can best be done by pulling outward on the lock bar.

To adjust, set the height of the carriage return operating lever stop screw.

Carriage Return Reset Bar Spring Tension (Figure 46)

With the typing unit resting on its right side, the function bail in its extreme forward position, and the carriage return latch bar tripped off its latch, hook an 8 oz. scale over the reset bar, just in front of the shoulder and pull horizontally at right angles to the reset bar. It should require 3 to 5 ozs. to start the reset bar moving.

Carriage Return Function Lever Spring Tension (Figure 46)

With any character selected and the main shaft rotated until the carriage return function lever is resting against the vanes, but not selected, hook a 4 lb. scale over the rear extension of the function lever, just in front of the lobe that engages the latch bar, and pull at right angles to the lever. It should require 1-3/4 to 2-1/4 lbs. to start the lever moving.

Carriage Return Operating Lever Spring Tension (Figure 46)

With the shoulder of the carriage return latch bar against its latch, and the carriage return operating lever spring unhooked from the spring post, hook a 12 lb. scale in the spring eye. It should require 5 to 7 lbs. to pull the spring to position length.

Carriage Return Clutch Spring Compression (Figure 46)

With the shoulder of the carriage return latch bar resting against its latch and the carriage return lock bar latch held away from the lock bar, apply the push end of a 12 lb. scale to the end of the carriage return clutch fork (where the latch link is assembled) and push down as nearly in line with the latch link as possible. It should require 1-1/2 to 2-1/2 lbs. to start the driving clutch member moving away from the driven member.

Dashpot Lever Spring Tension

Unhook the dashpot lever spring from the spring post in the dashpot lever and hook a 32 oz. scale in the spring eye. With the front end of the dashpot lever in its extreme right position, it should require 18 to 24 ozs. to extend the spring to its position length.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

✓
Spacing Stop Lever Bracket Adjustment (Figure 47)

The lower end of the spacing stop lever should clear the driving disc of the main shaft .060" to .080". With the stop lever held against the stop on the bracket by means of its spring, there should be a clearance of .040" to .080" between the lower left edge of the stop lever and the right side of a tooth on the spacing stop sleeve, when the tooth is opposite the lever.

Adjust the stop lever bracket vertically by means to its enlarged mounting holes to meet the first requirement and adjust it horizontally to meet the latter requirement.

Spacing Stop Lever Spring Tension (Figure 47)

With a 32 oz. scale held in a horizontal position and hooked over the upper end of the stop lever, pull toward the right. It should require 8 to 12 ozs. to start the lever moving.

Carriage Guide Screws Adjustment (Figure 21)

With the type bar carriage in position on the typing unit and the printing bail in its extreme rear position, there should be some clearance, not more than .008", between the upper surface of the guide screw heads and the upper surface of the groove in the front carriage track. Check for this clearance over the entire travel of the carriage.

Adjust by means of the guide screws and lock nuts.

Code Bar Bell Cranks Adjustment

The code bars should be carried firmly against their stops in both the marking and spacing positions, when the all marking and all spacing combinations are alternately set up in the selector and the main shaft rotated until the function levers are lifted free from the rear edges of the vanes. With the all marking combination selected, move the vanes, one by one, from the marking position to the spacing position and allow them to return to the marking position slowly. Note any of the code bars which are not carried firmly against their stops. (See Figure 48 for location of parts).

Set up the blank or all spacing combination on the selector and repeat the foregoing procedure. Again note any of the code bars which are not carried firmly against their spacing stops. If it is found that all the code bars are carried against the stops in the spacing position, and not in the marking position, or vice versa, it will be necessary to loosen the mounting screws and adjust the position of the bell crank mounting plate (up or down). If the plate is moved upward, the code bars may be caused to move farther toward the left, which is their marking position. If, however, it is found that only one or two of the code bars fail to be carried firmly against their stops in both the marking and spacing positions, the travel of the code bars may be adjusted by means of the bell crank eccentric bushings.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

When the bell crank assembly is finally adjusted, all five of the code bars should rest firmly against the marking and spacing stops, when the vanes are in their respective marking and spacing positions. Make sure that the upper end of the bell cranks do not engage the code bars deeply enough to bind.

Spacing Rack Adjustment (Figure 49)

There should be some backlash, not more than .006", between the spacing gear and the spacing rack along the entire travel of the rack.

To adjust, loosen the spacing rack mounting screws and adjust the rack toward the front or rear.

Locking Function Lever Spring Tension (Figure 23)

Rotate the main shaft until the printing bail is in its extreme rear position. Unhook the locking function lever spring from the spring bracket and hook a 64 oz. scale in the spring eye. It should require 40 to 50 ozs. to pull the spring to its position length. Replace the spring.

Carriage Return Spring Drum Adjustment

Rotate the main shaft until the printing bail is in its extreme rear position. Hook a 12 lb. scale over the lower part of the right ribbon spool bracket, and pull in a line parallel to the carriage track. It should require 3-3/4 to 4-1/4 lbs. to start the carriage moving away from its extreme left position. When measuring this tension, the carriage return lock bar should be held, approximately in its latched position so as to disengage the clutch teeth, and the dashpot lever should be held in its operated position.

To adjust, wind up the carriage return spring by rotating the center shaft of the drum to increase the tension, and operate the carriage return drum escapement lever to decrease the tension.

Paper Spindle Drag Spring Adjustment (Figure 50-A)

Insert an empty paper spindle in the slots, and lock it in place with the retaining plates. With both ends of the spindle shaft in the bottom of their slots, apply the push end of a 12 lb. scale to the left end of the spindle shaft and push toward the right side of the typing unit. It should require 5 to 8 lbs. to start the spindle moving. This pressure may be adjusted by bending the spindle drag spring.

Platen Friction Assembly Adjustment (Figure 50-B)

Move the pressure roller release shaft arm to its extreme rear position. Unhook the line feed detent lever spring, and place the platen handle vertically upward. Hook an 8 oz. scale over the end of the handle and pull horizontally toward the front of the typing unit. It should require 6 to 8 ozs. to start the platen rotating. Replace the detent lever spring. This tension may be regulated by means of the adjusting nuts on the friction assembly.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Send-Receive "T" Lever Friction Washer (Figure 51-A)

With the printing bail in its extreme rear position, move the "T" lever so that there is .040" to .060" clearance between the "T" lever and the universal function lever extension. Hook an 8 oz. scale under the right extension of the "T" lever, just to the left of the universal function lever extension and pull up vertically. It should require 5 to 6-1/2 ozs. to start the lever moving.

Universal Function Lever Spring Tension (Figure 51-A)

With the printing bail in the extreme rear position, hook a 32 oz. scale under the extreme front end of the universal function lever extension and pull vertically upward. It should require 14 to 17 ozs. to start the lever moving.

Blank Function Lever Spring Tension (Figure 51-A)

With the printing bail in its extreme rear position, hook a 32 oz. scale over the upper end of the blank function lever and pull horizontally toward the rear of the unit. It should require 10-1/2 to 15-1/2 ozs. to just start the lever moving.

Send-Receive Mechanism Plate Adjustment (Figure 52)

With the left arm of the "T" lever in contact with the blank function lever extension, there should be some clearance, not more than .008", between the right arm of the "T" lever and the universal function lever extension when the blank or all spacing combination is selected and the main shaft rotated until the blank function lever is completely selected, stopping rotation at the point where the function lever bail roller just leaves the cam surface of the blank function lever.

To adjust, loosen the send-receive mechanism plate mounting screws and position the plate by means of its elongated mounting holes. Tighten the mounting screws. When making this adjustment, the intermediate lever should be clear of the blank function lever extension.

- NOTE: (a) On typing units equipped with blank printing-spacing cutout function lever, it will be necessary to stop rotation of the main shaft at the point where the function lever bail comes to rest on top of the blank printing-spacing cutout function lever, when setting up the condition referred to in the preceding paragraph.
- (b) On typing units where the blank and universal function levers are omitted, the send-receive mechanism plate should be adjusted so as to provide .020" to .030" vertical clearance between both ends of the function lever spring plate and the send-receive mechanism plate.

Intermediate Lever Stop Bracket Adjustment (Figure 52)

First select the blank or all spacing combination and rotate the main shaft until the intermediate lever toe is under the blank function lever extension. See that

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

the intermediate lever is approximately vertical. Then select the "T" combination and rotate the main shaft until the printing bail is in its extreme forward position. During this latter operation the left end of the intermediate lever toe should move to a point at least 1/16" to the right of the blank function lever extension.

To adjust, loosen the intermediate lever stop bracket mounting screws and position the bracket by means of its elongated mounting holes. Tighten the mounting screws.

Intermediate Lever Spring Tension (Figure 51-A)

With the printing bail in its extreme rear position, move the "T" lever so that its right end is in contact with the universal function lever extension and hold the reset lever so that its upper edge is horizontal. Then hook an 8 oz. scale over the intermediate lever just above the spring arm and pull horizontally toward the left of the typing unit. It should require 3/4 to 1-1/2 ozs. to start the lever moving.

Motor Plate Adjustment

There should be a barely perceptible amount of backlash between the motor pinion and the highest point on the main shaft gear. The lateral alignment of the motor pinion and the main shaft gear should be such that the center line of the gear coincides with a vertical line through the center of the hole in the motor pinion.

When printers are equipped with motors not having elongated mounting holes, adjust as follows:

- (a) Place the typing unit on an adjusted base with motor assembly and tighten the three mounting thumb screws. Facing the front of the base unit and with the keyboard removed from the base, visually check the lateral alignment of the motor pinion and the main shaft gear to determine if a center line of the gear coincides with a vertical line through the center of the hole in the motor pinion. If these lines do not coincide, remove the typing unit from the base unit and loosen the four motor mounting screws.

Replace the typing unit on the base unit, and shift the motor, by taking up the play between the drilled motor mounting holes and the motor mounting screws, until the two lines previously mentioned coincide. If there is insufficient play in the motor mounting holes to permit the motor to be shifted sufficiently to cause the lines to coincide, shift the motor as much as possible in order to obtain the best possible lateral alignment of the motor pinion and the main shaft gear. See that the edges of the motor base are parallel to the respective edges of the motor plate. Then remove the typing unit and tighten the four motor mounting screws.

- (b) Loosen the rear motor plate mounting screw and the lock nut on the motor plate adjusting screw. Slightly loosen the two front motor plate mounting screws to prevent stripping of the threads while making the following adjustment.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Replace the typing unit and tighten the three mounting thumb screws. By means of the motor plate adjusting screw, adjust the vertical position of the motor pinion until there is a barely perceptible amount of backlash between the motor pinion and the highest point on the main shaft gear. This high point may be found by turning the main shaft for one complete revolution. Start the motor and carefully readjust the vertical position of the motor pinion by means of the adjusting screw until the gear noise is reduced to a minimum. Tighten the three motor plate mounting screws and the adjusting screw lock nut and recheck the backlash between the gears.

Caution: Care should be exercised in adjusting the vertical position of the motor pinion while the motor is running in order to avoid damaging the main shaft gear or reducing the speed of the motor as the result of too close a mesh between the gear and the pinion.

NOTE: When printers are equipped with motors having elongated mounting holes, make adjustments (a) and (b) as described in the foregoing, except that in making adjustment (a) the motor must be shifted until the center line of the gear also passes through the center of the hole in the motor pinion as nearly as it is possible to determine by eye.

Send-Receive Reset Lever Upper Adjusting Screw Adjustment (Figure 51-B)

There should be .004" to .006" clearance between the upper edge of the intermediate lever toe and the bottom of the blank function lever extension under the following conditions:

With the printing bail in its extreme rear position and the send-receive lever in the send position (up), move the toe of the intermediate lever under the blank function lever extension. Then select the "T" combination and rotate the motor until the intermediate lever is moved to a position where the blank function lever extension overlaps the toe of the intermediate lever by one half the thickness of the blank function lever extension and check for the required clearance.

Adjust by setting the height of the reset lever upper adjusting screw.

Left Margin Adjusting Screw Adjustment (Figure 46)

The first character of a line should print within 1/16" of the specified margin, normally 7/8" from the left end of the platen.

To adjust, turn the left margin adjusting screw in and lock the carriage in place by operating the dashpot lever so that the carriage is in a position to print a character 7/8" (plus or minus 1/16") from the left edge of the platen. Make sure that the carriage return clutch members are fully engaged. Then reposition the adjusting screw, so that when the lock nut is slightly tightened to take up the end play in the threads and a horizontal pull of 8 lbs. is exerted on the dashpot lever (new style) applied with a 12 lb. scale at right angles to the curved surface 1/32" behind the margin adjusting screw (10 lbs. on old style lever applied just in front of the shoulder), there is a slight clearance (not more than .002") between the end of the screw and the dashpot lever. Turn the left margin adjusting screw one-sixth turn in a direction to eliminate this clearance and tighten the lock nut.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Right Margin Adjusting Screw Adjustment (Figure 47)

The printer should normally print seventy-two characters on a line before spacing is blocked by the spacing stop pawl.

To adjust, return the carriage to the left end of the line and back off the right margin adjusting screw. Then with the right margin adjusting screw arm in engagement with its detent, space the carriage one less space than the number of characters desired per line, that is, seventy-one spaces for normal lines of seventy-two characters. (The carriage should then be in position to print the last character for the desired length of line.) Adjust the stop screw so that the spacing stop pawl is moved within .015" to .030" from a projection on the spacing stop sleeve.

Ribbon Oscillator Lever Adjustment

With the ribbon lockout bar in its unoperated position, (pulled outward toward the right) the ribbon should fully cover any character as it is being printed and the top edge of the ribbon should not be above the bottom edge of the printed character when the printing has been completed and the main shaft clutch has disengaged.

To adjust, shift the platen to the shift position (up) and loosen the ribbon oscillator lever clamping screw and nut. Position the ribbon oscillator lever and tighten the screw and nut. Then check this adjustment with the platen in the unshift position (down). (See Figure 53 for location of parts.)

Ribbon Lockout Bar Adjustment (Figure 54)

NOTE: This adjustment applies only to those printers equipped with the adjustable ribbon lockout bar.

Hold the ribbon carrier down and move the ribbon lockout bar to the left against its stop. The ribbon should be locked sufficiently below the printing line to prevent printing of any portion of the characters.

To adjust, remove the ribbon, ribbon carrier, and the type bar guide from its adapter plate and loosen the ribbon lockout bar adjusting screws. Move the platen to the unshift position. Hold the ribbon oscillator down and move the ribbon lockout bar to the left against its stop, the lockout bar extension sliding over the top of the ribbon oscillator. Push the lockout bar extension down so that the ribbon oscillator extension is held firmly against the type bar guide adapter plate; also, hold the right end of the ribbon lockout bar down and tighten the lockout bar adjusting screws. Replace the type bar guide, ribbon carrier, and the ribbon.

With the ribbon lockout bar in its operated position and with a 12 lb. scale hooked over the end of the ribbon lockout bar, and pulling directly in line with the bar, it should not require more than 5 lbs. to move the lockout bar out to its unoperated position.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Spacing Clutch Torque (Figure 55)

After the motor has run for at least 10 minutes, hold the carriage return lock bar operated and hook a 32 oz. scale at the bottom of the uppermost projection on the spacing stop sleeve. With the main shaft rotating pull horizontally toward the rear of the typing unit until the leading edge of the uppermost projection is approximately vertical. It should require 14 to 19 ozs. to hold the spacing stop sleeve stationary.

Margin Signal Bell Adjustment

The margin signal bell cam should be approximately 1/16" from the right side frame.

To adjust, loosen the thumb screw and position the cam. Tighten the thumb screw. (See Figure 44 for location of parts).

Selector Clutch Torque (Figure 56)

With the motor running at least 10 minutes, hook a 32 oz. scale to the selector cam sleeve stop arm. It should require 14 to 18 ozs. to hold the sleeve stationary.

Bail Cam Unit Friction Clutch Torque (Figure 56)

Remove the function bail spring and hold the printing bail away from its adjusting screw. With the printer running on a closed line, hook a 32 oz. scale over the screw head on the cam unit, and pull horizontally at right angles to the main shaft. It should require 20 to 24 ozs. to move the cam opposite to its normal direction of rotation.

Dashpot Vent Screw Adjustment

The carriage should return from its right stop to its left stop without bouncing and with minimum shock, when the carriage return lock bar is held in its latched position.

Adjust by means of the dashpot vent screw and lock nut.

Keyboard Adjustments

Lock Loop Spring Tension (Figure 57)

Rotate the transmitting cam sleeve until the lock loop roller is resting on the low part of its cam. Hook an 8 oz. scale in the lock loop spring hole and pull in line with the spring. It should require 4 to 5 ozs. to start the lock loop moving.

Locking Lever Shaft Bracket Adjustment (Figure 57)

With all the contact levers on the high parts of their cams, there should be some clearance, not more than .010", between the contact levers and the locking levers, when the locking levers are pressed downward by hand to make this clearance a minimum. Also the locking levers should travel equally on either side of the lock loop blade, when the "4" and "Y" keys are alternately depressed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

To adjust, add or remove shims between the locking lever shaft bracket and the keyboard casting to meet the first requirement and, before tightening the bracket mounting screws, position the bracket laterally to meet the second requirement.

Selector Bar Assembly Bracket Shims Adjustment (Figure 58)

When the "Q" key lever is fully depressed, all other key levers should have some play between the leather upstop and the selector bars. There should also be some clearance, not more than .030" between the high portion of the front selector bar (A-1) and the key levers in line with the high portions of the selector bars.

To adjust, add or remove shims under the selector bar assembly bracket.

Selector Bar Assembly Bracket Position

The selector bar assembly bracket should be parallel to the rear key lever guide. The lower ends of the locking levers should fully engage their respective locking lever forks and there should be some clearance between the sides of the locking levers and the adjacent selector bars.

To adjust, loosen the selector bar assembly bracket mounting screws and position the bracket. Tighten the mounting screws.

Transmitting Contacts Gap Adjustment (Figure 57)

With any contact lever on the high part of its cam, the contact gap should be .020" to .025".

Bend the shorter contact springs to obtain this clearance.

Contact Spring Pressure (Figure 59)

With any contact lever on the low part of its cam, it should require a pressure of 4-1/2 to 5-1/2 ozs. to open the contact, when the push end of an 8 oz. scale is applied to the contact spring just above the contact point.

To adjust, bend the longer contact springs. Recheck the contact gap adjustment.

Clutch Spring Compression (Figure 60)

Hook a 32 oz. scale to the clutch driven member projection and pull directly in line with the shaft. It should require 9 to 12 ozs. to separate the clutch teeth.

Clutch Adjustment (Figure 58)

There should be .005" to .015" clearance between the clutch teeth when the clutch is fully disengaged.

To adjust, position the clutch throw-out lever by means of shims placed between the throwout lever post and the bracket.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Lock Loop Roller Adjustment

NOTE: This adjustment applies only to those keyboards equipped with lock loops having an elongated hole for the roller pivot screw.

Rotate the keyboard shaft until the clutch teeth are disengaged. Press the lock loop roller against its cam to fully disengage the clutch teeth and position the locking levers directly below the lock loop blade to make the clearance a minimum. Under these conditions, there should be .008" to .015" clearance between the lock loop blade and the locking lever having the least clearance.

To adjust, position the roller pivot screw by means of its elongated mounting hole. (See Figure 57 for location of parts.)

Trip-Off Pawl Stop Plate Adjustment

With the trip-off pawl resting against the stop plate and the intermediate pawl against its eccentric, there should be .070" to .030" clearance between the trip-off pawl and the intermediate pawl.

To adjust, loosen the intermediate pawl eccentric lock nut and position the eccentric until the screw driver slot is in a horizontal position and the high part of the eccentric is toward the front of the unit. Loosen the trip-off pawl stop plate mounting screws and position the stop plate. Tighten the intermediate pawl eccentric lock nut and the trip-off pawl stop plate mounting screws.

Universal Bar Bearing Brackets Adjustment (Figure 58)

- (a) The universal bar bearing brackets should be in their rearmost position and parallel to the front edge of the selector bar assembly bracket. There should be .060" to .080" clearance between the key levers and the universal bar.

To adjust, add or remove shims under the universal bar bearing bracket.

- (b) Right Bracket Position

When the universal bar is held against the shoulder on the pilot screw, the universal bar extension should be approximately midway between the 5th and 6th key levers.

To adjust, loosen the right bracket mounting screws and position the bracket to the right or left. Tighten the mounting screws.

- (c) Left Bracket Position

The universal bar should be free on its pivots and should have some end play, not more than .008".

To adjust, loosen the left bracket mounting screws and position the bracket. Tighten the mounting screws.

NOTE: After making a single adjustment, check related adjustments. (See paragraph 1, page 1).

(d) After making adjustments (b) and (c) recheck adjustment (a).

Intermediate Pawl Eccentric Adjustment (Figure 58)

There should be .050" to .060" clearance between the trip-off pawl and the intermediate pawl, when the trip-off pawl is resting against the end of the stop plate and the intermediate pawl is against its eccentric.

To adjust, position the intermediate pawl eccentric.

Clutch Throwout Lever Eccentric Adjustment

The intermediate pawl should be held firmly between the clutch throwout lever eccentric and the intermediate pawl eccentric, when the clutch throwout lever is resting on the low part of the clutch driven member.

To adjust, position the clutch throwout lever eccentric. (See Figure 58 for location of parts.)

Trip-Off Pawl Eccentric Adjustment (Figure 61)

Rotate the keyboard shaft until the clutch driven member is stopped by the clutch throwout lever. Lift the clutch throwout lever and rotate the shaft slightly so that the clutch throwout lever will rest on the raised surface of the clutch driven member. Hold the clutch throwout lever against the raised surface of the driven member and at the same time hold the clutch throwout lever eccentric against the clutch throwout lever. Under this condition, the end of the trip-off pawl should clear the end of the intermediate pawl by not more than .004" when a key lever is slowly depressed.

Adjust by means of the trip-off pawl eccentric screw.

NOTE: The high part of the eccentric should be positioned toward the rear of the keyboard in making this adjustment. If necessary, bend the rear extension of the trip-off pawl stop plate so that, with the trip-off pawl in its operated position, there is at least .002" clearance between the formed up end of the stop plate and the lower edge of the trip-off pawl.

Clutch Throwout Lever Spring Tension

With the clutch teeth engaged and the clutch throwout lever resting against the low part of the clutch driven member, hold the intermediate pawl against its eccentric; at the same time hook an 8 oz. scale over the throwout lever just above the spring hole and pull in line with the spring. It should require 1-1/2 to 2-1/2 ozs. to start the lever moving. (See Figure 58 for location of parts.)

Trip-Off Pawl Spring Tension (Figure 62)

Unhook the trip-off pawl spring. With an 8 oz. scale hooked in the spring eye, it should require 3-1/2 to 4-1/2 ozs. to pull the spring to position length.

NOTE: After making a single adjustment, check related adjustment.
(See paragraph 1, page 1).

Transmitting Cam Sleeve End Play (Figure 63)

The transmitting cam sleeve should have some end play, not more than .002".

To adjust, position the bushing in the rear bearing bracket by means of its adjusting nuts.

Key Lever Spring Tension Adjustment (Figure 64)

The openings between the ends of all key lever springs, except the spacer key lever spring, should measure 1-3/16". The spacer key lever spring should measure 1-15/16" across the opening between the ends. Adjust by bending the springs.

Adjustments of the Center Contact Governor

Speed Adjusting Wheel Friction Washer Spring Tension Adjustment (Figure 65 - See Note (D))

Turn the adjusting wheel so that the tension on the governor contact is 13 to 14 ozs. Measure this tension by hooking a 32 oz. scale over the contact spring arm next to the contact and pulling parallel to the speed adjusting spring.

To measure the pressure of the speed adjusting wheel friction washer, insert a bank pin in the leather rim (radially), and hook a 32 oz. scale over the pin, at the periphery of the adjusting wheel, and pull at right angles to the radius. It should require 16 to 20 ozs. to start the wheel moving.

To adjust this tension, remove the friction washer and bend the large projections.

Inner and Outer Disc Contact Spring Adjustment (Figure 66 - See Note (D))

- (a) The distance from the inner surface of the governor cover to the highest point on the contact springs should be 25/32" to 27/32".
- (b) Place a "D" socket wrench over the nut, located in the center of the governor cover, that is used to hold the contact springs in place. With a six inch scale, measure the radial distance from the vertical surface of the wrench to the point where the scale touches the curved surface of the inner disc contact spring. This distance should be 17/32" to 19/32".
- (c) In a similar manner, measure the distance from the wrench to the point of the contact on the outer disc contact spring. This distance should be 7/16" to 1/2".

Adjust by bending the inner and outer disc contact springs.

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- (D) These requirements should be checked with the governor adjusting bracket, the brush spring plate, and the governor cover removed.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Governor Brush Spring Plate Bracket Adjustment

The spring plate bracket should be positioned to meet the following requirements:

- (a) A line through the center of the outer disc should pass through the centers of both contact brushes (Figure 67).
- (b) The surface of the brush spring plate bracket on which the brush spring plate is mounted should be in line with the outer surface of that part of the governor cover on which the target is mounted (Figure 67).
- (c) The bracket should be parallel to the edge of the motor base plate.

To adjust, position the brush spring plate bracket by means of its enlarged mounting holes.

Governor Brush Spring Pressure (Figure 67)

(a) Inner Disc Brush Spring:

Hook an 8 oz. scale over the inner disc brush spring, just to the right of the carbon contact brush as viewed from the rear of the motor and pull horizontally away from the motor.

It should require 4-1/2 to 5-1/2 ozs. to start the brush moving away from the disc.

(b) Outer Disc Brush Spring:

Apply an 8 oz. push scale against the outer brush spring, just to the right of the carbon contact brush as viewed from the rear of the motor, and push horizontally toward the motor. It should require 4-1/2 to 5-1/2 ozs. to start the brush moving away from the disc.

- (c) Both contact brushes should lie flat against their respective discs, and the outer edges of the brushes should be flush with or not more than 3/64" inside the outer edges of the disc.

To obtain the correct brush spring pressure, remove and bend the brush springs.

Governor Adjusting Bracket Adjustment (Figure 67)

There should be .020" to .060" clearance between the speed adjusting wheel and the speed adjusting surface on the bracket.

Adjust by bending the governor adjusting bracket.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Speed Adjusting Lever Stop Plate Adjustment

There should be .006" to .050" clearance between the adjusting lever wearing strip and the governor when the adjusting lever is held against the stop plate.

To adjust, position the adjusting lever stop plate by means of its elongated mounting holes. (See Figure 67 for location of parts.)

Governor Shims Adjustment (Figure 67)

There should be at least .006" clearance between the adjusting lever wearing strip and the adjusting wheel, when the wheel is opposite the wearing strip and all the end thrust of the motor armature is taken up in a direction to make this clearance a minimum.

Adjust by means of shims placed on the armature shaft between the governor hub and the end frame casting of the motor.

Synchronous Motor Adjustment

ON SYNCHRONOUS MOTORS HAVING A SINGLE STARTING CONTACT, THE STARTING SWITCH SHOULD MEET THE FOLLOWING REQUIREMENTS:

NOTE: These requirements should not be checked unless the motor has been taken down or there is reason to believe the starting switch is out of adjustment.

Starting Switch Adjustment (Figure 68)

It is important that the starting switch be properly adjusted, for if the starting switch fails to open, leaving the starting winding on continuously, the motor starting winding will burn out. If the starting switch fails to close altogether, the motor may not start or may run backward, damaging the printer.

To adjust the starting switch, proceed as follows:

- (a) Remove the motor unit from the base. Remove the motor pinion and the motor fan (or handwheel, if the motor is equipped with a handwheel).
- (b) Take out the switch end shield screws and pull out the switch end shield about half an inch.
- (c) Remove the two switch mounting screws, taking care that the shims between the switch bracket and the end shield are not lost. Note the number and thickness of the shims at each end of the switch bracket so that later they may be reassembled properly. Remove the end shield.

Centrifugal Weight Spring Tension

Remove the centrifugal weight springs and check the weights and centrifugal mechanism push collar for freeness. Check the tension of the springs as follows:

NOTE: After making a single adjustment, check related adjustment.
(See paragraph 1, page 1).

With one end of the spring held stationary, hook an 8 oz. scale in the other end and pull until the spring measures 1-3/4" over all. The scale reading should be 3-3/4 to 4-1/4 ozs.

Starting Switch Contact Spring Tension

With the starting switch contact spring resting against the contact backstop and the bracket held so that the contact spring clears the rotor shaft and the centrifugal mechanism push collar, hook an 8 oz. scale over the contact spring just below the backstop and pull at right angles to the spring. It should require 1/2 to 1 oz. to start the contact spring moving away from the backstop.

Adjust by bending the contact spring to meet this requirement. Care should be taken to avoid bending this spring excessively.

Replace the centrifugal weight springs.

Replacing the Starting Switch

Replace the switch end shield on the shaft. Remount the starting switch on the switch end shield, making certain that the shim pile-up is equal on both sides of the switch bracket. Tighten the two switch mounting screws by alternately tightening each one a little at a time until both are tight.

See that there is a fibre washer between the rotor and the pinion end shield. Replace the switch end shield screws and employ the same procedure as used in tightening the switch mounting screws.

Starting Switch Contact Bracket Adjustment

A test set, consisting of a No. 82862 collar in conjunction with resistors and a milliammeter wired as shown in Figure 69, is used in connection with this adjustment.

With a 110 volt DC battery and motor connected as shown, it may be seen that when the starting switch contacts are closed, no current will flow through the meter. With the contacts open, however, battery will flow through the meter limited by the resistors and motor windings.

- (a) With the test set connected to the motor as shown in Figure 69, check the starting switch contact bracket as follows:

Fasten the No. 82862 collar on the rotor shaft at the switch end of the motor, so that there is 1/32" clearance between the collar and the motor end shield. (The No. 82862 collar is not a part of the motor, but is a tool used for checking this adjustment.)

Press against the end of the rotor shaft until the No. 82862 collar is against the end shield, and slowly turn the rotor one complete revolution, observing the meter on the test set. The meter needle should remain on zero, indicating that the contacts remain closed.

If the contacts open, shims should be added between the starting switch bracket and the motor end shield.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

- (b) Loosen the No. 82862 collar set screws and relocate the collar so that there is 1/16" clearance between the collar and the motor end shield. The rotor shaft should again be pressed until the collar is against the end shield and slowly turned one complete revolution. During this time, the meter should read not less than .010 ampere, indicating that the contacts remain open. If the contacts close, shims should be removed from between the starting switch bracket and the motor end shield. If the shims are removed, recheck paragraph (a).

NOTE: Care should be taken that the shim pile-up is equal at both ends of the switch bracket.

Remove the No. 82862 collar from the rotor shaft.

- (c) Apply the push end of a 12 lb. scale against the fan end of the shaft and push parallel with the shaft. It should require at least 7 lbs. pressure to start the shaft moving.

Replace the motor pinion and the fan (or handwheel, if the motor is equipped with a handwheel).

Replace the motor unit on the base and check the motor plate adjustment.

IF IT IS NECESSARY, FOR ANY REASON, TO REMOVE THE STARTING SWITCH OR CENTRIFUGAL MECHANISM, PROCEED AS FOLLOWS:

Removing the Starting Switch or Centrifugal Mechanism (Figure 68)

- (a) Remove the motor unit from the base, and remove the motor pinion and motor fan (or handwheel, if the motor is equipped with a handwheel).
- (b) Take out the switch end shield mounting screws.
- (c) Pull out the switch end shield slightly and remove the switch mounting screws, taking the same precautions as noted in paragraph (c) of the starting switch adjustment.
- (d) Unsolder the stator leads connected to the starting switch.
- (e) Remove the ball bearing. A bearing puller should be used, and care should be taken so as not to dent the brass covering that encloses one face of the bearing, or to burr the shaft. Never use a hammer, chisel, or any tool of that nature, directly against the face of the inner or outer ring.

NOTE: When handling the bearing, it is of the utmost importance that no dirt be allowed to enter the bearing. Dirt, grit, dust, or foreign matter of any kind acts as an abrasive, which when ground between the revolving balls, will wear out the races. Before replacing, it is

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

well to wash the bearing in kerosene or gasoline and then spin the bearing to remove the dirt. When laying a bearing down, lay it on a clean piece of paper - never on a dirty bench or table top. New bearings should not be unwrapped until ready to be used.

- (f) The starting switch may now be removed. To remove the centrifugal mechanism, remove the two mounting screws.

Assembling the Starting Switch or Centrifugal Mechanism (Figure 68)

- (a) Assemble the centrifugal mechanism to the rotor by means of the two centrifugal mechanism mounting screws, making certain that the insulator has been mounted properly between the mechanism and the rotor.
- (b) Place the fibre push collar washer on the switch end of the rotor shaft in front of the centrifugal mechanism push collar.
- (c) Insert the rotor partly in the stator with the switch end partly out of the frame.
- (d) Place the starting switch on the shaft against the push collar washer, with the contact spring toward the rotor. With the contact points of the starting switch in the upward position, solder the two wires, that are tied together, to the upper terminal of the starting switch.
- (e) Before replacing the bearing, wipe the shaft clean and examine for burrs or corrosion. If necessary, use emery cloth, dressing down the shaft just enough to remove inequalities of the surface and any burr on the shoulder of the shaft, to insure proper seating of the bearing. Now wipe the shaft clean and apply a trace of machine oil to the part of the shaft that seals the bearing. Replace the ball bearing on the switch end of the rotor shaft with the shielded side of the bearing facing the rotor. The bearing has what is known as a "light tap" fit, that is, the bearing fits on the shaft so that a series of light taps will drive it in place. The best tool to use is a piece of pipe or tubing, preferably of brass, which is just large enough to slip over the shaft and to bear only on the inner ring. Never apply pressure of any kind to the outer ring, the balls, or the retainer, as this is likely to injure the bearing. It is absolutely essential that the bearing be started straight and that the blows be light. See that the bearing is solidly up against the shaft shoulder. Pack the bearing with approved lubricant.
- (f) Place a felt washer and a retaining washer in the order given in the switch end shield.
- (g) Slide the switch end shield over the switch end of the rotor shaft, inserting the ball bearing in the machined recess of the switch end shield.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

- (h) Adjust the starting switch, following the instructions given under "Starting Switch Adjustments."

To remove or replace the ball bearing on the pinion end of the rotor, proceed as follows:

- (a) Remove the motor unit from the base and remove the motor pinion and motor fan (or handwheel, if the motor is equipped with a handwheel).
- (b) Take out the pinion end shield mounting screws and remove the end shield.
- (c) Proceed as in paragraph (e) of "Removing the Starting Switch or Centrifugal Mechanism."

To replace the bearing on the pinion end of the rotor, proceed as follows:

- (a) Proceed as in paragraph (c), "Assembling the Starting Switch or Centrifugal Mechanism."
- (b) Assemble in the pinion end shield the following in the order given: felt washer, cup washer, thrust spring, and thrust spring washer.
- (c) Replace the end shield mounting screws, tightening alternately each screw a little at a time until they are both tight.

ON SYNCHRONOUS MOTORS HAVING A THREE BRUSH STARTING SWITCH, THE SWITCH SHOULD MEET THE FOLLOWING REQUIREMENTS:

NOTE: These requirements should not be checked unless there is reason to believe the starting switch is out of adjustment.

- (a) Remove the motor unit from the base and remove the motor fan and pinion.
- (b) Remove the switch end shield screws and the switch commutator mounting screws. Remove the switch end shield.
- (c) Pull out the rotor until the brush holder spring is accessible and remove the spring.
- (d) The tension of the spring for 60 cycle motors should measure 3 to 3-3/4 ozs. when extended to a length of 5 inches, using an 8 oz. scale. The tension of the spring for 50 cycle motors should measure 1-1/2 to 2-1/2 ozs. when extended to a length of 5 inches, using an 8 oz. scale.
- (e) The brush holders should be mounted by means of the center set of mounting holes and should be free.
- (f) The brush holder stop pins should be safely within the holes of the fibre disc when all the play in the brush holders has been taken up to make the engagement of the pins with the disc a minimum.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

- (g) Replace the brush holder spring, making certain that the spring eyes are fully engaged with each other.
- (h) Replace the switch commutator screws and tighten the two screws alternately a little at a time until both screws are tight.
- (i) Replace the switch end shield screws using the same precaution in tightening as above.
- (j) Apply the push end of a 12 lb. scale against the fan end of the shaft and push parallel with the shaft. It should require at least 7 lbs. pressure to start the shaft moving.
- (k) Replace the motor fan and pinion. Replace the motor unit on the base and check the motor plate adjustment.

Base Unit Adjustments

Motor Unit Slip Connection Springs Adjustment

- (a) With the motor unit in position on the base, hook a 4 lb. scale under one of the end motor unit slip connection end springs, just above the head of the terminal screw on the motor connection block, and pull at right angles to the spring toward the front of the base. It should require 2 to 4 lbs. to just break contact. Measure the pressure of the opposite end slip connection spring in the same manner. This pressure can be regulated by removing the motor unit and bending the springs.
- (b) With the motor unit removed and a straight edge placed across the two end springs, there should be some clearance not more than .015" between the two inner springs and the straight edge. Adjust by bending the two inner springs.

Line Jack Springs Adjustment

It should require 1 to 2 lbs. pressure, using a 12 lb. scale, on the curved part of the jack spring to just open the contacts. With the typing unit in position on the base, the line jack contacts should be separated .020" to .060".

Bend the long contact spring to obtain these requirements.

Keyboard Jack Springs Adjustment

It should require 1 to 2 lbs. pressure, using a 12 lb. scale, on the curved part of the jack spring to just open the contact. With the keyboard inserted in the base, the keyboard jack springs should be separated .025" to .075". All slip connection springs should be in line.

To adjust, first remove the four base plate mounting screws and the base plate. Then remove the four screws that hold the slip connection mounting plate assembly to the base, so that the bakelite cover can be removed, and then replace the four

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

screws. Next, measure the pressure of the two keyboard jack springs. With the keyboard inserted in the base, the keyboard jack springs should now be separated by .005" to .025". This clearance may be measured from above the base by inserting a wire gauge between the contact springs. Bend the long contact spring of the two jack springs to obtain this spring tension and bend the short contact spring to meet this contact gap. (After the bakelite cover is replaced, the jack contact springs should be separated .025" to .075"). Remove the keyboard from the base and with a straight edge laid across the two keyboard jack springs, align the other slip connection contact springs by bending, so that they just touch the straight edge. Remove the four slip connection mounting plate screws, and insert the bakelite cover in its original position. Replace the four mounting screws previously removed. Finally, install the base plate on the base by means of its mounting screws.

Typing Unit Slip Connection Spring Adjustment

Remove the typing unit from the base. Hold a straight edge flush against the left rear milled surface on the base and extend the straight edge over the printer slip connections. There should be 7/8" clearance (plus or minus 1/64") between the straight edge and the curved part of the springs. Bend the slip connection springs to obtain this clearance.

Adjustments of Send-Receive-Break Mechanism Having Single Upper Contact

Upper Contact Lever Spring Tension (Figure 70-A)

Unhook the lower contact lever spring from the bracket and the safety pawl spring. With the send-receive handle in the send position (up), hook an 8 oz. scale over the spring bar on the upper contact lever, and pull up vertically. It should require 5-1/2 to 6-1/2 ozs. to start the lever moving. Rehook the safety pawl spring and the lower contact lever spring.

Lower Contact Lever Spring Tension (Figure 70-A)

With the lower contact lever spring unhooked from the bracket and the send-receive handle in the send position (up), hook a 32 oz. scale in the spring eye. It should require 9 to 11 ozs. to pull the spring to its position length. Rehook the spring.

Safety Pawl Spring Tension (Figure 70-B)

Hook an 8 oz. scale over the end of the lower extension on the safety pawl and pull at right angles to the extension. It should require 1-1/4 to 2-1/4 ozs. to start the pawl moving.

Send-Receive-Break Contact Springs Adjustment (Figure 70-C)

Viewing the base from the front, the send-receive-break contact springs are numbered 1, 2, 3, 4, 5, and 6, from left to right.

(A) Move the send-receive handle to the send position (up).

(a) All contact points should meet across their entire surface

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

- (b) There should be some clearance, not more than .004", between the fibre insulator on the lower end of contact spring No. 4 and the lower contact lever to the right of it.

Adjust by bending contact spring No. 4.

- (c) There should be a clearance of .015" to .020" between contacts No. 3 and No. 4. No. 1 contact should not bear against contact No. 3.

Adjust by bending contact spring No. 3.

- (d) Contact No. 1 should exert a pressure against contact No. 2. Hook an 8 oz. scale over contact spring No. 1 just below the contact point and pull horizontally to the left. It should require 3 to 4 ozs. to just separate the contacts.

Adjust by bending contact spring No. 1.

- (e) There should be a slight clearance, not more than .004", between the fibre insulators on contact springs No. 1 and No. 3.

Adjust by bending contact spring No. 2 and recheck the pressure of contact spring No. 1.

- (B) Move the send-receive handle to the receive position (down).

- (a) With left end of the upper contact lever held against the notch in the safety pawl, the fibre insulator on the No. 6 contact spring should clear the upper extension of the upper contact lever by .015" to .020".

Adjust by bending contact spring No. 5.

- (b) Contact spring No. 6 should exert a pressure on contact spring No. 5. Hook an 8 oz. scale over contact spring No. 6, just above the contact point, and pull horizontally to the right. It should require 4-1/2 to 5-1/2 ozs. to just open the contacts.

Adjust by bending contact spring No. 6 and recheck the clearance between the upper contact lever extension and the fibre insulator on the No. 6 contact spring.

Adjustments of the Send-Receive-Break Mechanism Having Two Upper Contacts

Viewing the base from the front, the send-receive-break contact springs are numbered 1, 2, 3, 4, 5, and 6, from left to right. (See Figure 70).

NOTE: After making a single adjustment, check related adjustments. (See paragraph 1, page 1).

Stop Lever Plate Adjustment (Figure 71-A)

With the left end of the upper contact lever held up against the stop lug on the stop lever plate, there should be .004" to .015" clearance between the shoulder in the notch in the upper contact lever and the top of the lower contact lever.

To adjust, position the stop lever plate by means of its mounting screw.

Break Lever Adjusting Plate Adjustment (Figure 71-B)

There should be some clearance, not more than .015", between the rear upper corner of the beveled edge on the left end of the upper contact lever and the lower front edge of the stop lug on the stop lever plate, when the break lever is slowly operated by hand until the two edges are just opposite each other.

To adjust, position the break lever adjusting plate by means of its clamping screw.

Stop Lug Adjustment (Figure 72-A)

The upper extension of the stop lever should rest against the stop lug on the mounting bracket when the stop lever is in its unoperated position, and there should be some clearance, not more than .030", between the rear side of the upper contact lever and the front edge of the stop lever plate.

To adjust, if necessary, bend the stop lug on the mounting bracket.

Upper Contact Lever Spring Tension (Figure 73-B)

With the send-receive handle in the send position (up), and the No. 3 contact spring held away from the extension on the upper contact lever, hook an 8 oz. scale under the left end of the upper contact lever at the spring hole and pull up vertically, in line with the spring. It should require 3 to 5 ozs. to start the upper contact lever moving.

Stop Lever Spring Tension (Figure 72-A)

With the stop lever resting against the stop lug on the mounting bracket, hook an 8 oz. scale in the spring mounting hole in the stop lever, and pull in line with the spring. It should require 1 to 2 ozs. to start the stop lever moving.

Send-Receive-Break Contact Springs Adjustment

- (a) All contact springs and points should be in line.
- (b) With the send-receive handle in the send position (up), there should be some clearance, not more than .008", between the fibre insulator on the lower end of No. 1 contact spring and the extension on the lower contact lever to the right of it.

When checking this clearance, the lower contact lever should be held firmly against its stop (Figure 73-A).

Adjust by bending contact spring No. 2.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

- (c) Contact No. 1 should exert a pressure against contact No. 2 (Figure 73-A). Hook an 8 oz. scale on contact spring No. 1, just below the contact point, and pull horizontally toward the left. It should require 1 to 2 ozs. to just separate contacts No. 1 and No. 2.

Adjust by bending contact spring No. 1.

- (d) Recheck (b).
- (e) There should be a clearance of at least .015" between No. 3 and No. 4 contacts (Figure 73-A).

Adjust by bending contact spring No. 3.

- (f) Move the send-receive handle to the receive position (down) and make sure that No. 3 and No. 4 contacts close.

- (g) There should be at least .015" clearance between No. 1 and No. 2 contacts. (See Figure 72-C).

Adjust by bending contact spring No. 2. Recheck (b).

- (h) Contact No. 3 should exert a pressure against contact No. 4. Hook an 8 oz. scale on contact spring No. 3 just above the contact point, and pull horizontally toward the left. It should require 1 to 2 ozs. to just separate contacts No. 3 and No. 4. (See Figure 72-C).

Adjust by bending contact spring No. 4.

- (i) Recheck (e).
- (j) With the left end of the upper contact lever held against the notch in the stop lever plate, the fibre insulator on No. 6 contact spring should clear the extension on the upper contact lever by at least .008". (See Figure 71-A). Make certain that contacts No. 5 and No. 6 are separated by at least .015" when the break lever is operated. (See Figure 72-B).

Adjust by bending contact spring No. 6.

- (k) Contact No. 6 should exert a pressure against contact No. 5. Hook an 8 oz. scale around contact spring No. 6 just above the contact point, and pull horizontally toward the right. It should require 4-1/2 to 5-1/2 ozs. to just separate contacts No. 5 and No. 6. (See Figure 72-C).

Adjust by bending contact spring No. 5.

- (l) Recheck (j).

Control Relay Adjustments

- (A) For break operation, the control relay should be adjusted to meet the following requirements: (See Figure 74-A).

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

- (a) With the relay plunger held operated, there should be .005" to .010" clearance between the contact surfaces of the outer and middle contact springs.

Adjust by bending the outer contact spring.

- (b) With the plunger held operated, there should be .025" to .030" clearance between the contact surfaces of the inner and middle contact springs.

Adjust by bending the inner contact spring.

- (c) When an 8 oz. scale is hooked over the middle contact spring at the side of the contact and pulled horizontally at right angles to the contact spring, it should require 5 to 6 ozs. to cause the middle contact spring to break contact with the inner contact spring.

Adjust by bending the middle contact spring.

- (d) Recheck (b).

- (B) For make operation, the control relay should be adjusted to meet the following requirements: (See Figure 74-B).

- (a) Hold the relay plunger operated and hook a 32 oz. scale over the end of the outer contact spring and pull horizontally, at right angles to the contact spring. It should require 12 to 16 ozs. to cause the outer contact spring to break contact with the middle contact spring.

Adjust by bending the outer contact spring.

- (b) With the relay plunger held operated, there should be .030" to .040" clearance between the contact surfaces of the inner and middle contact springs.

Adjust by bending the inner contact spring.

- (c) Hook an 8 oz. scale over the middle contact spring at the side of the contact and pull horizontally at right angles to the contact spring. It should require 1-1/2 to 2 ozs. to cause the middle contact spring to break contact with the inner contact spring.

Adjust by bending the middle contact spring.

- (d) Recheck (b).

The operating current for the control relay should be between .050A. and .060A. when adjusted for either make or break operation.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

NOTE: For Receiving Only Printer Covers

The following instructions apply to send-receive-break mechanism having single upper contact.

When the printer is used with a receiving only cover, it is necessary to reposition the send-receive handle, as shown in Figure 75-A, to provide clearance for the printer cover. Normally, the send-receive handle is positioned below the latch handle with the projecting lug on the operating end pointing upward. Remove the shoulder screw and lock nut used to mount the send-receive handle and latch handle to the bracket. Turn the send-receive handle over and position it above the latch handle, with the projecting lug on the operating end pointing downward, as shown in Figure 75-A. Insert the shoulder screw and replace the lock nut.

The following instructions apply to send-receive-break mechanism having two upper contacts.

When the printer is used with a receiving only cover, it is necessary to reposition the send-receive lever, the break lever adjusting plate, the adjusting screw and nut, and the send-receive lever and break lever bushing. (See Figure 75-B).

Unhook the break lever spring, loosen the mounting screw nut and remove the screw.

Loosen the adjusting screw nut and remove the adjusting screw and break lever adjusting plate.

Remount the break lever adjusting plate as shown in Figure 75-B, making certain that the screw does not extend beyond the break lever.

Insert the bushing with the short shoulder on the outside.

Place the send-receive lever as shown in Figure 75-B with the projecting lug to the rear and mount the assembly on the bracket.

Replace the break lever spring.

Speed Setting

When A.C. or D.C. governed motor units are used, a tuning fork is supplied for the purpose of regulating the motor speed. The fork is equipped with shutters attached to the ends of the tines. On the rim of the motor flywheel is attached a speed target of alternate black and white spots. (See Figure 67-B).

To check the speed, turn the target lamp on and tap the fork lightly to start it vibrating. Hold the fork close to the eye and view the moving spots on the target.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

through the fork shutters. If the motor is running at the correct speed, the spots will appear to be stationary. If the motor is running too fast, the spots will appear to be moving in the direction in which the motor is rotating; if too slow, in the opposite direction. The motor speed may be increased by pushing against the speed adjusting lever (mounted on top of the motor next to the flywheel). The speed may be decreased by pressing the governor adjusting bracket toward the flywheel, so that the finger on the bracket comes in contact with the adjusting wheel on the governor.

NOTE: There is a possibility of setting the speed incorrectly, due to getting a speed multiple; i.e., the speed could be half the desired speed, or twice the speed, or some other multiple, but the spots would appear to be stationary through the fork shutters. This should be kept in mind if trouble is experienced in the operation of the printer.

No speed setting is required on units equipped with synchronous motors, since they are constant speed motors.

Orientation

Mounted to the left of the main shaft of the printer is the range finder assembly used for the purpose of orientating the receiving printer to the incoming signals.

Before taking the orientation range, set the armature spring (Figure 29) to a position where it will measure 6 to 6-1/2 ozs. tension. Now "4Y" (the figure "4" and the letter "Y" sent alternately) should be transmitted to the printer continuously while the range is being taken.

While "4Y" is being received, loosen the index arm thumb screw and shift the index arm toward "Zero" until errors begin to appear in the "4Y". Then move it back slowly until these errors disappear. This position indicates one limit of the orientation range. Note the position on the scale.

Repeat the same performance toward the opposite end of the scale to find the other limit.

After the two limits (or extreme positions of perfect printing) have been found, the index arm of the range finder should be set midway between these two points.

Now turn the armature spring adjusting screw in a clockwise direction until errors show in the "4Y". Then from this point, count the number of turns in a counterclockwise direction necessary to bring the spring to its high limit (where "4Y" fails). Half this number of turns backward (in a clockwise direction) will position the adjusting screw midway between its two failing points, or in the middle of the armature spring range. Lock the screw in this position.

The orientation range should be rechecked after the armature spring range has been taken.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

Line Current

Between 50 and 60 milliamperes at 110 volts, direct current, is required for the operating coils.

Operating Coil Resistance

The 110 volt coils (No. 197) measure 115 ohms each.

Local Power Requirements

The printers are usually equipped with either 110 volt A.C. or 110 volt D.C. motors requiring approximately 100 watts for their operation.

LUBRICATION SPECIFICATION

The oil and grease specified in the supplement furnished with this bulletin should be used to lubricate the printer and associated units.

Unless otherwise specified, one or two drops of oil at each of the places indicated will be sufficient. Use oil for lubrication at all of the places listed below, except where the use of grease or oil-grease-oil is specified.

GENERAL

Oil both loops of all helical springs that exert a nominal tension of less than 2-1/2 pounds.

Apply grease to both loops of all helical springs that exert a nominal tension of 2-1/2 pounds or more.

TYPE BAR CARRIAGE ASSEMBLY

1. Type bars - at segment slot.
2. Code bars - at posts.
3. Code bar bell cranks - on wearing surfaces.
4. Pull bar bail guide rollers and guide surface (oil-grease-oil).
5. Plunger surface and rollers, surface of pull bar bail guide post (oil-grease-oil).
6. Operating roller (oil-grease-oil).
7. Carriage support rollers - three.
8. Ribbon reverse bail.
9. Ribbon feed shaft bearing - 3 oil holes.
10. Ribbon feed pawl.

NOTE: After making a single adjustment, check related adjustments.
(See paragraph 1, page 1).

11. Ribbon feed pawl operating lever pivot screw and wearing surface.
12. Ribbon feed ratchet - teeth.
13. Ribbon lockout bar - at type bar segment slot.
14. Ribbon feed shaft bearings - upper and lower.
15. Ribbon feed mechanism gears.
16. Ribbon spool shafts bushings - remove spools.
17. Ribbon reverse shafts - upper and lower bearings, arms, pawls, and levers.
18. Margin bell pawl.
19. Ribbon shield lever and roller.
20. Oscillator lever shoulder screw and carriage casting slot.
21. Type bar carriage rack, space shaft pinion and travel.
22. Ribbon reverse detent.
23. Ribbon feed shaft detent - grease. ←

TYPING UNIT LESS THE TYPE BAR CARRIAGE ASSEMBLY

A. Platen Unit

1. Shaft bearings (one in each shaft hub).
2. Line feed detent lever mounting shoulder screw.
3. Line feed detent roller.
4. Single-double line feed lever between flat spring and detenting cam and where single-double line feed lever fits into groove in platen shaft hub.
5. Line feed pawl and operating lever shoulder screws.
6. Shift detent roller - (grease). ←
7. Platen unit pivot bearings.
8. Upper ends of line feed and shift vertical links.
9. Paper knife supporting arms and paper guide bearings.
10. Paper straightener lever bearings.
11. Paper straightener rod supporting lever bearings.
12. Pressure roller release shaft and crank bearings.

13. Pressure roller release cams, crank and shoulder screws.
14. Pressure roller shafts - bearing surface.
15. Pressure roller sleeves (one drop each).
16. Letters and figures stop screws - grease ends.
17. Platen friction disc assembly - saturate felt washer with oil (separate discs).
18. Paper spindle bearings.
19. Line feed check lever shaft bearings.
20. Line feed detent ratchet - (apply grease sparingly).

B. Main Shaft

1. Hold right end of printer up about 6" and remove oil plug. - Fill shaft until oil runs out of the left end.
2. Main clutch sliding member (oil freely).
3. Main clutch throwout lever pivots - (oil-grease-oil).
4. Main shaft friction washers - saturate with oil (separate discs).
 - (a) Selector unit assembly - 2 friction washers.
 - (b) Spacing clutch friction washer.
5. Locking lever cam felt washers on selector cam assembly.
6. Selector cam sleeve - each cam peak.
7. Main shaft right ball bearing - (oil-grease-oil).
8. Main shaft left ball bearing.
9. Thrust bearing - end balls.
10. Spacing clutch spring coils - (permitting oil to flow between prongs of driven member of spacing clutch and worm gear sleeve).
11. Spring (coils) which compresses friction washers of selector cam assembly - (oil will flow between prongs of nut on main shaft and friction disc which engages with this nut).
12. Cam unit and spacing clutch, oil holes.
13. Main clutch camming surface.
14. Main shaft cam surfaces - (grease).
15. Spacing escapement ratchet teeth - (grease).

C. Selector Unit

(Note: Be careful not to get oil between the pole faces of the selector magnets and the magnet armature.)

1. Armature bearings - two.
2. Trip latch plunger, trip latch and bell crank lever and stop lever of range finder assembly.
3. Swords and selector levers - drop oil between separating plates of swords and levers.
4. "T" levers - (all points of contact).
5. Armature locking lever.
6. Locking wedge - at point of engagement with locking lever.
- *7. Armature detent - bearing.
- *8. Armature detent pin - where it comes in contact with detent-grease.

Note: Selector cam sleeve is listed under Main Shaft.

*For printers equipped with armature detent.

D. Bail Unit Assembly

1. Bail assembly shaft bearings - fill oil cup - (two oil cups - new style).
2. Between spacing pawls.
3. Function bail and printing bail operating arm bearings.
4. Function lever bail roller - two bearings (oil-grease-oil).
5. Roller surface to have film of grease.
6. Function bail and printing bail operating arm and rollers (oil-grease-oil).
7. Printing bail blades where plunger operating roller engages blades.
8. Printing bail adjusting screw head - (grease).

E. Vane Frame Assembly

1. Function levers in vane frame slot.
2. Function levers in slots in break mechanism plate.
3. Function levers push bars and latch bars - in function lever comb.
4. Vane pilot screws - bearings.
5. Send-receive-break mechanism, intermediate lever mounting screw, and operating lever mounting screw - (Be careful not to get oil on friction spring washer of send-receive-break mechanism "T" lever).
6. Vanes front edges - where bell crank slotted ends slide in engagement with vanes.
7. Sixth vane detent roller.
8. Locking function lever - (apply grease in notches).

F. Spacing Shaft Assembly

1. Spacing shaft - upper bearing, oil; lower bearing, fill oil cup.
2. Carriage return clutch members prongs.
3. Spacing gear, lower - (grease).

G. Carriage Return Mechanism

1. Carriage return latch bar at point of engagement with latch - (grease).
2. Carriage return clutch release fork and operating lever bearings.
3. Carriage return push bar and latch bar operating lever shoulder screw.
4. Carriage return locking bar bell crank link shoulder screw.
5. Carriage return spring drum bearing.
6. Carriage return spring release lever shoulder screw.
7. Clutch release fork link shoulder screw.
8. Locking bar bell crank upper cross bar casting shoulder screw.
9. Locking bar and locking bar bell crank shoulder screw.
10. Locking bar latch and left-hand side frame shoulder screw.
11. Dashpot piston rod - one drop oil rubbed over surface of piston.

12. Dashpot lever mounting shoulder screw, and roller mounting pilot screw. (Grease at point of contact with left-hand margin adjusting screw.)
13. Type bar carriage assembly - upper and lower, track surface.
14. Carriage return spring - through oil holes in drum.
15. Spacing stop lever and shoulder screw.
16. Carriage return operating lever stop screw - (grease).

H. Bell Function

1. Bell striker arm and arm operating lever - bearings.
2. Bell push bar and latch bar shoulder screw.
3. Bell latch bar at point of engagement with latch - (grease).

I. Shift-Unshift Mechanism

1. The figures and letters push bars shoulder screw.
2. Bell crank lever and operating lever shoulder screw.
3. Bell crank lever and operating lever joint.
4. Shift vertical link, lower end and detent lever shoulder screw.

J. Line Feed Function

1. Line feed push bar and bell crank lever shoulder screw.
2. Bell crank lever mounting shaft.
3. Vertical link and bell crank lever, lower end, shoulder screw.
4. Margin bell shaft - 2 bearings.

MOTOR UNIT

1. Motor pinion - (grease).
2. Motor bearing oilers - two.
3. Motor speed lever - pilot screw.

BASE

Send-Receive-Break Mechanism

1. Operating lever and safety pawl release lever shoulder screw.
2. Contact operating lever - shoulder screw - (also drop oil between lever and rear surface of send-receive-break mechanism bracket).

3. Reset lever shoulder screw - (also drop oil between reset lever and rear surface of bracket.)

KEYBOARD

A. Lubrication on Bottom Side of Keyboard

1. Universal bar pilot screw - bearings.
2. Trip-off pawl link - joint.
3. Key levers on key lever shaft and in rear comb.
4. Selector bars - in guide slots.
5. Shift rockers - bearings and links.
6. Locking levers - at locking lever forks.

B. Lubrication on Top Side of Keyboard

1. Key levers - in front comb.
2. Space bar loop - on space bar loop shaft.
3. Keyboard shaft - two oil cups.
4. Keyboard clutch - sliding member.
5. Cams - apply light film of grease to surfaces of all cams.
6. Locking loop - pilot screw, bearings and roller.
7. Contact lever pivoting shaft and guiding comb.
8. Locking levers in locking lever comb.
9. Clutch throwout lever - bearings.
10. Trip-off and clutch lever pawls.
11. Keyboard gear - (grease).

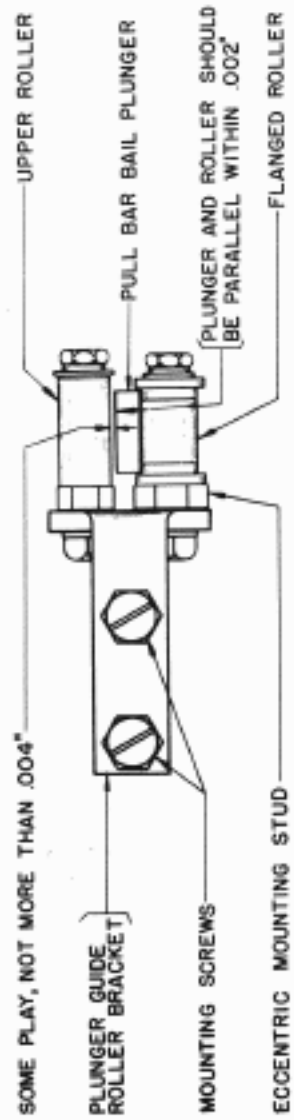


FIGURE 1

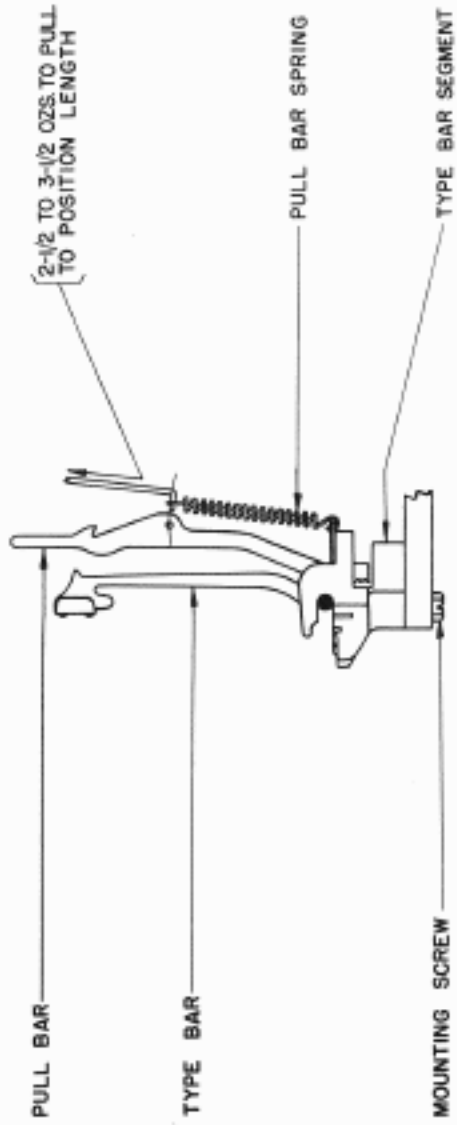


FIGURE 2

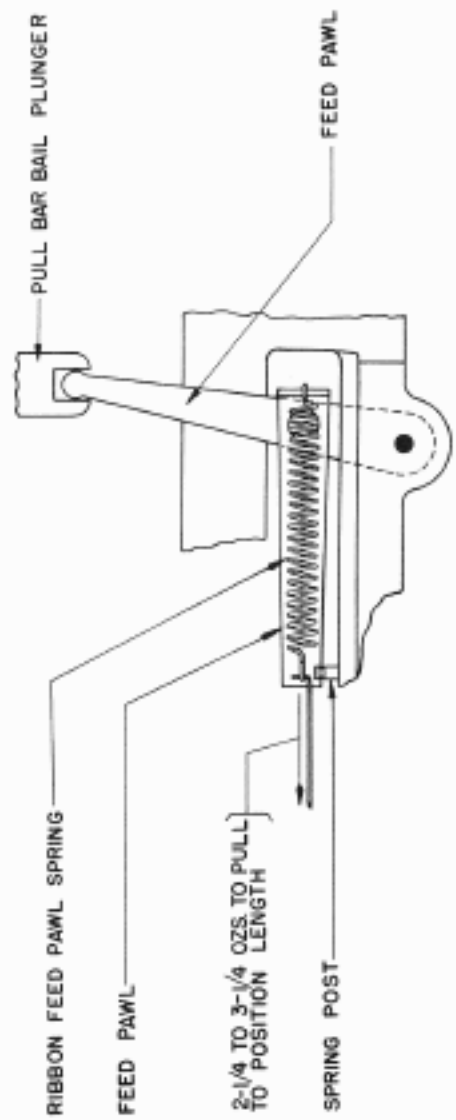


FIGURE 3

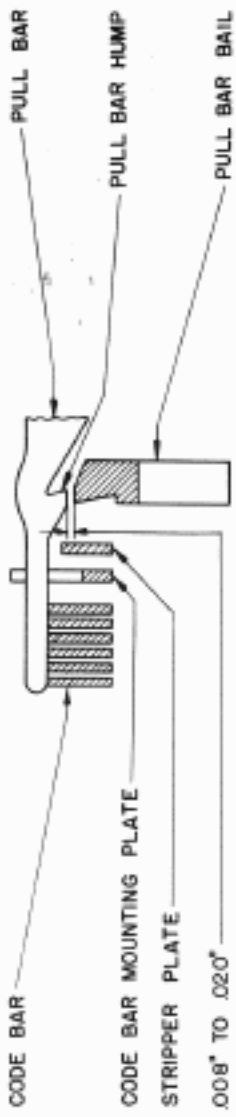


FIGURE 4

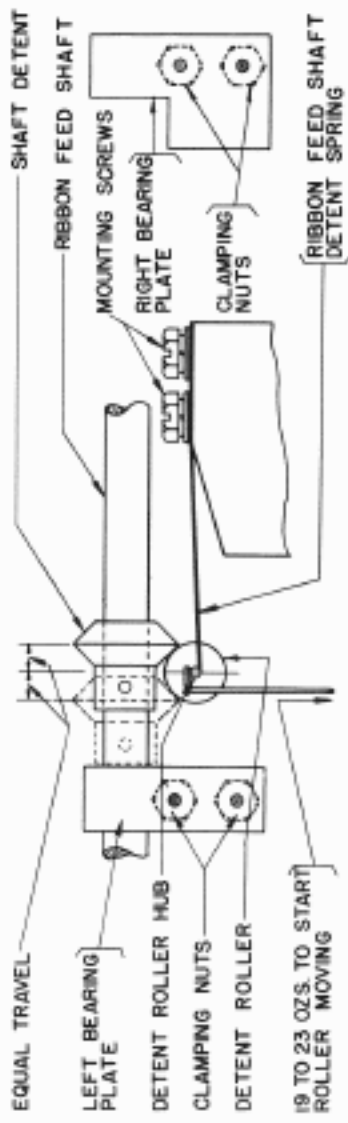


FIGURE 5

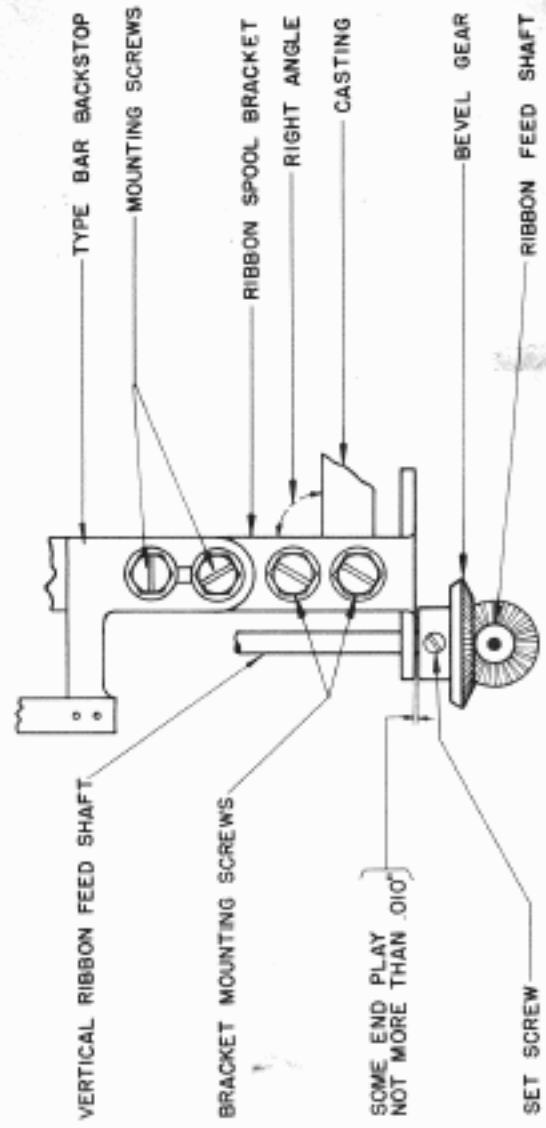


FIGURE 6

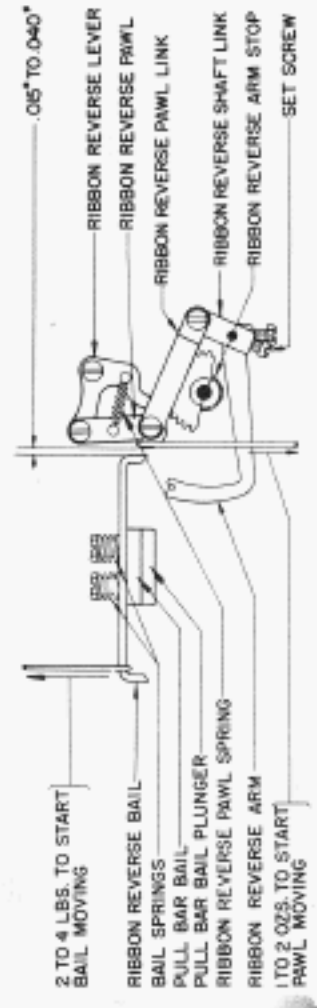


FIGURE 10

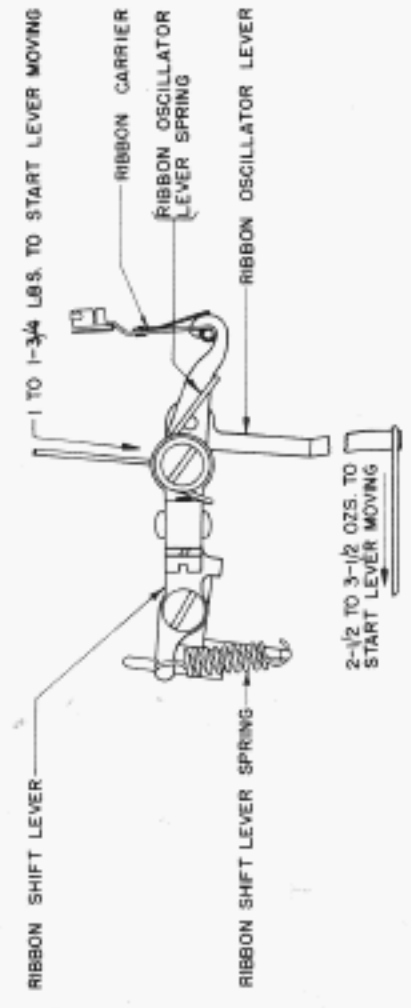


FIGURE 11

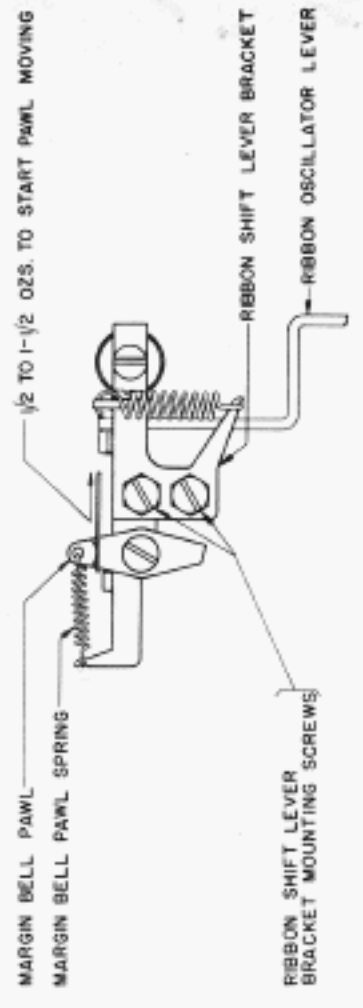


FIGURE 12

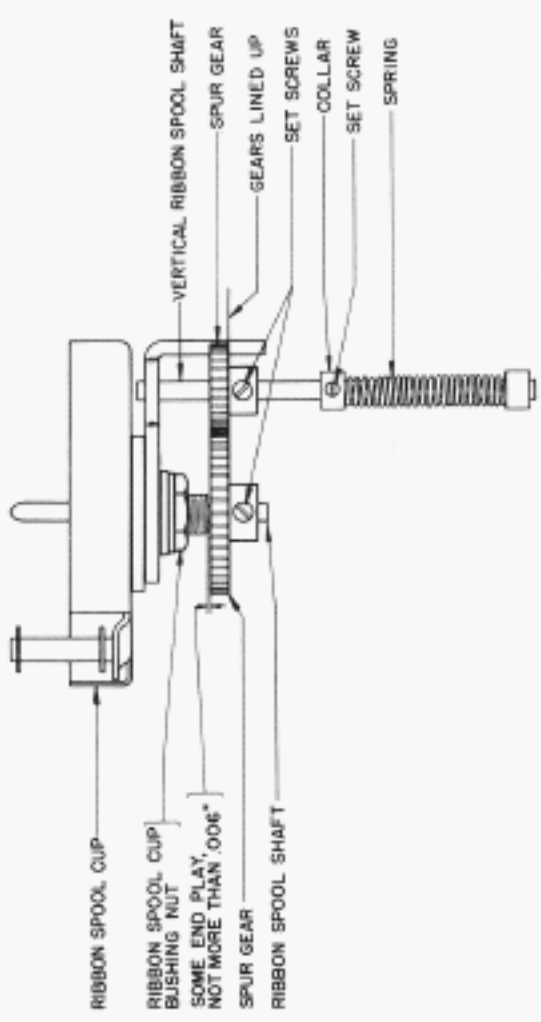


FIGURE 7

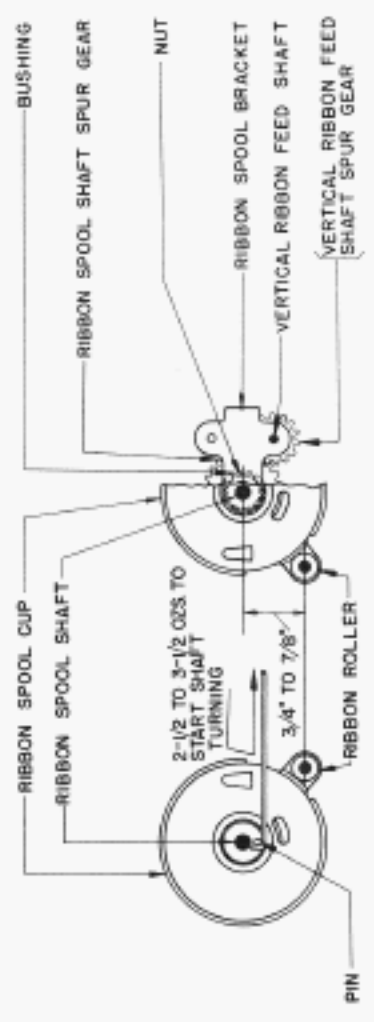


FIGURE 8

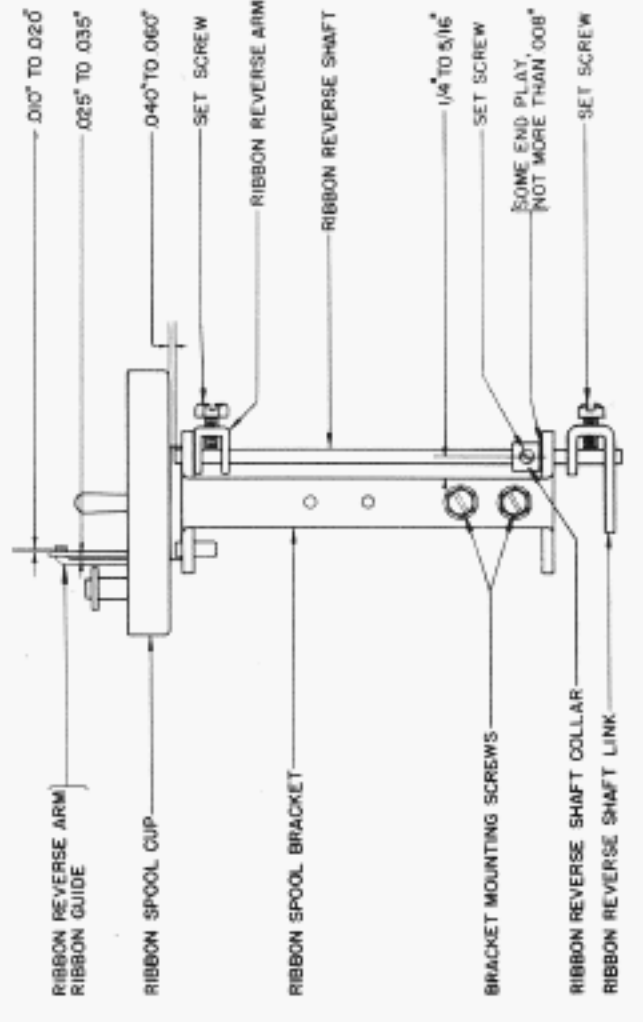


FIGURE 9

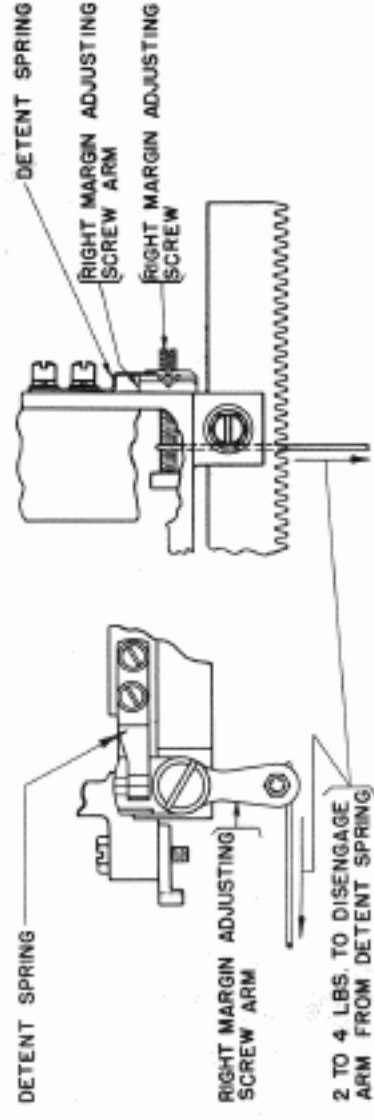


FIGURE 17

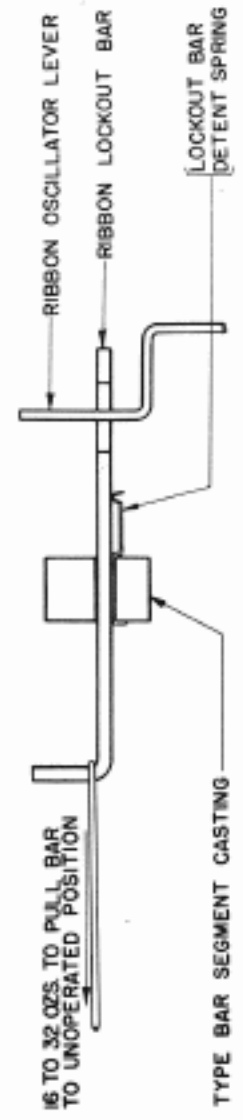


FIGURE 13

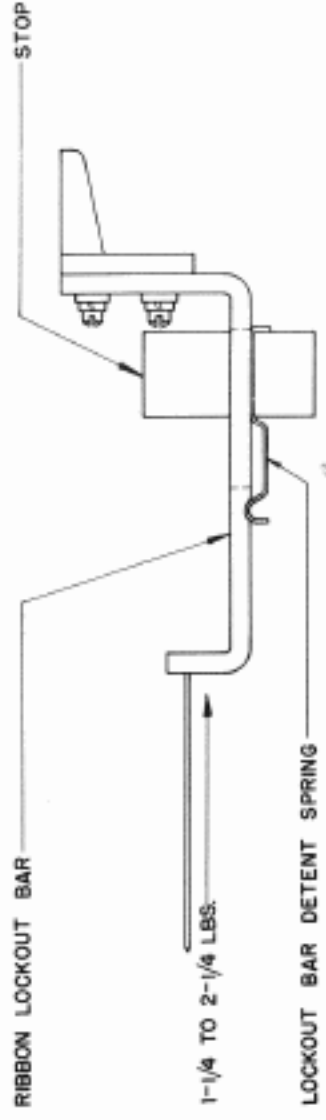


FIGURE 14

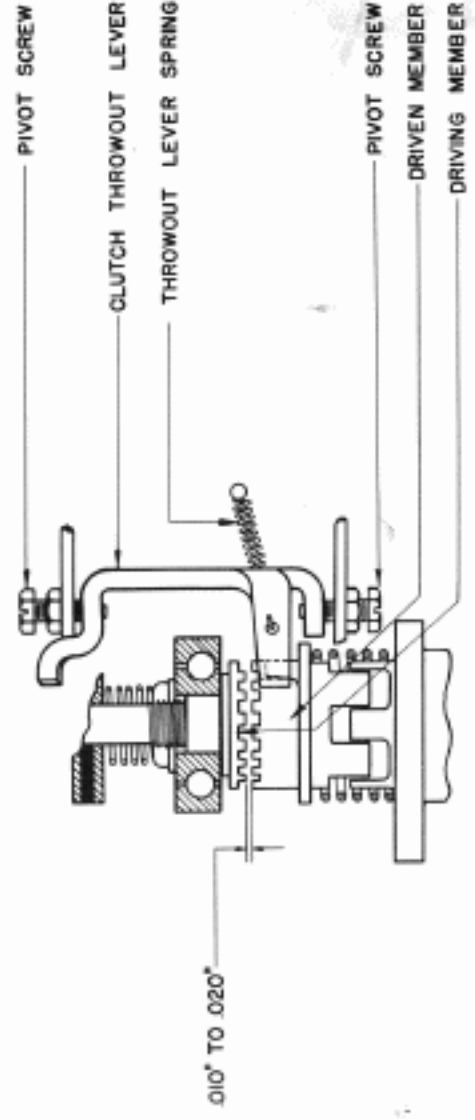


FIGURE 18

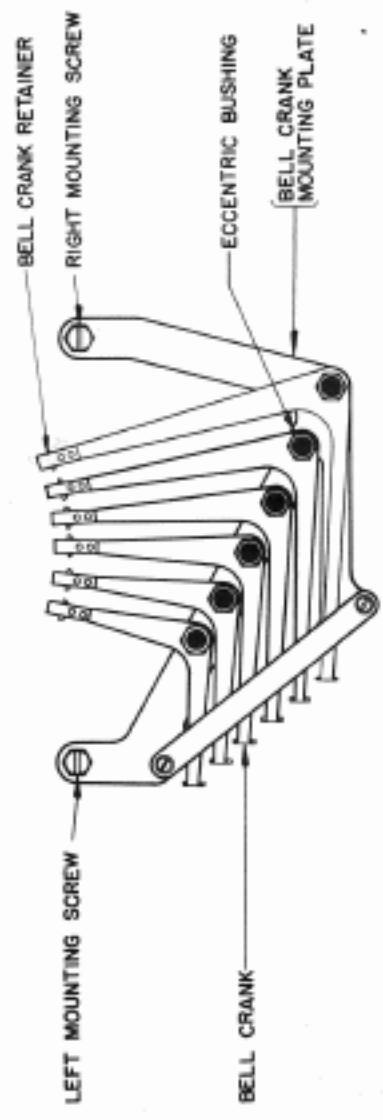


FIGURE 15

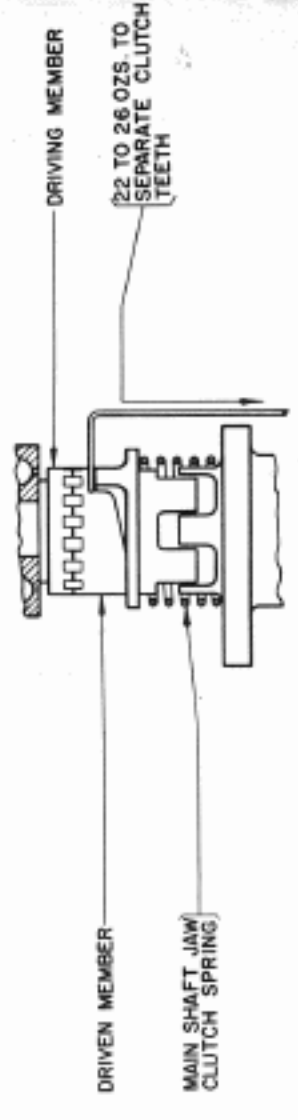


FIGURE 19

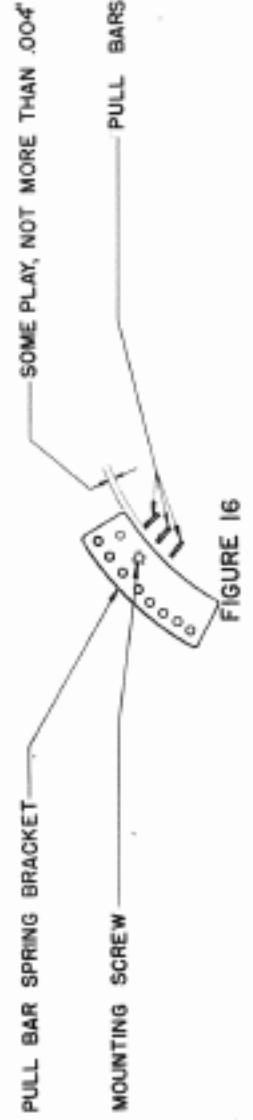


FIGURE 16

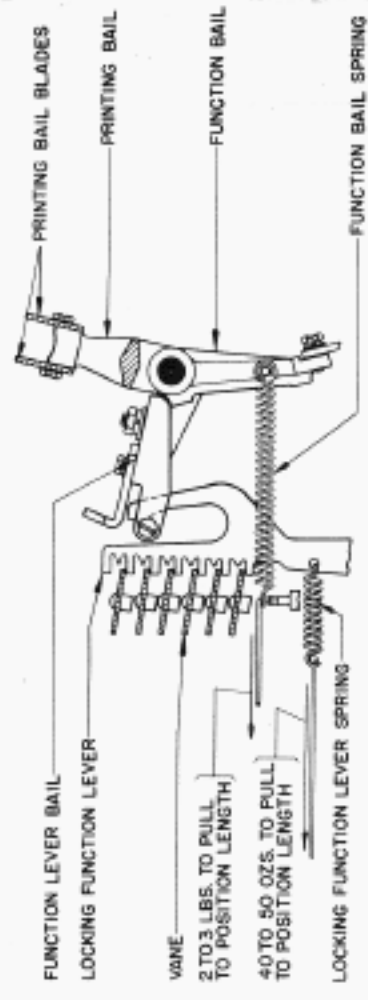


FIGURE 23

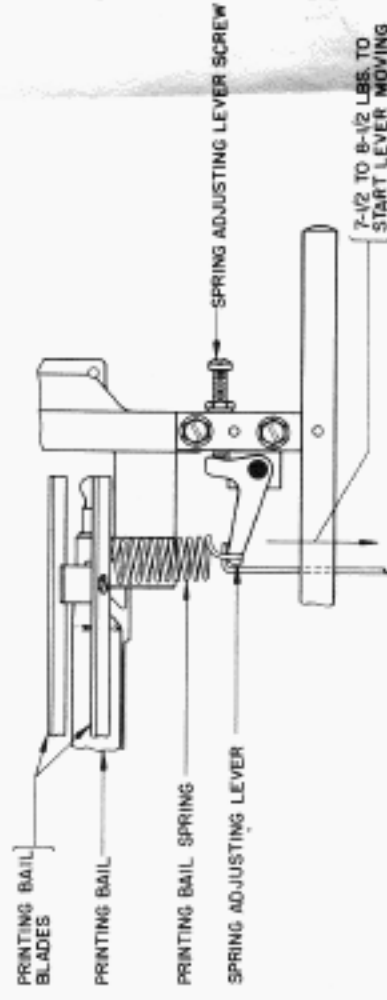


FIGURE 24

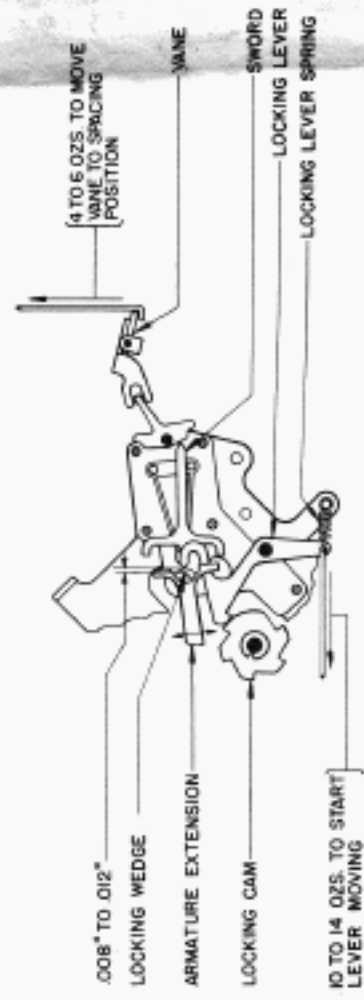


FIGURE 25



FIGURE 26

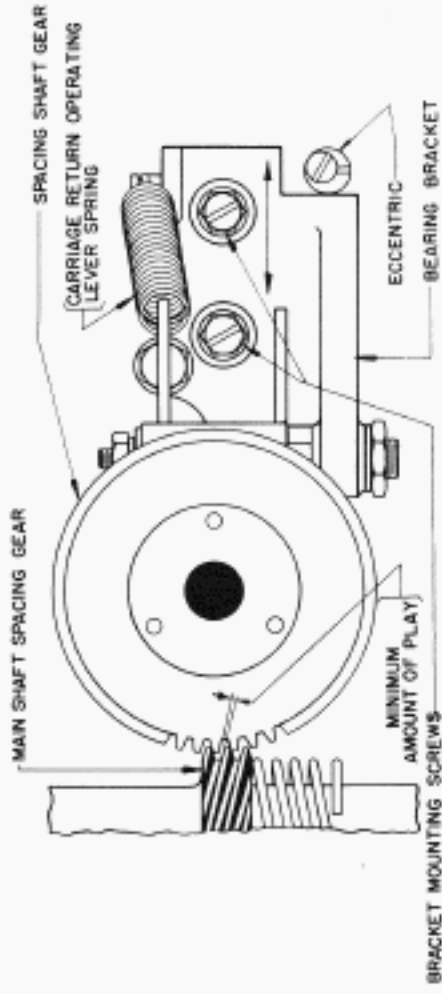


FIGURE 20

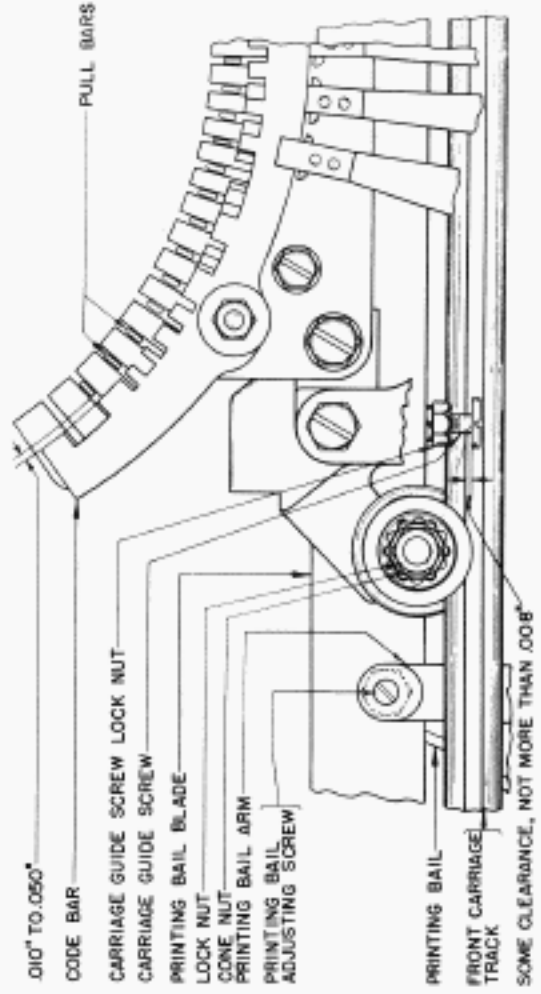


FIGURE 21

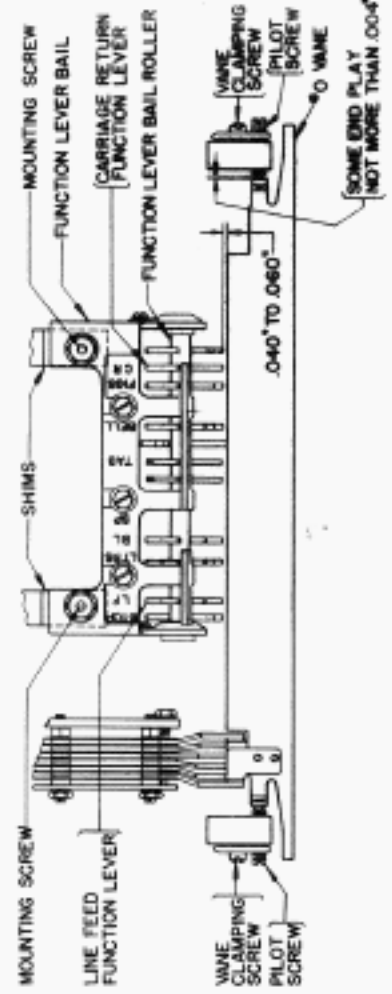


FIGURE 22

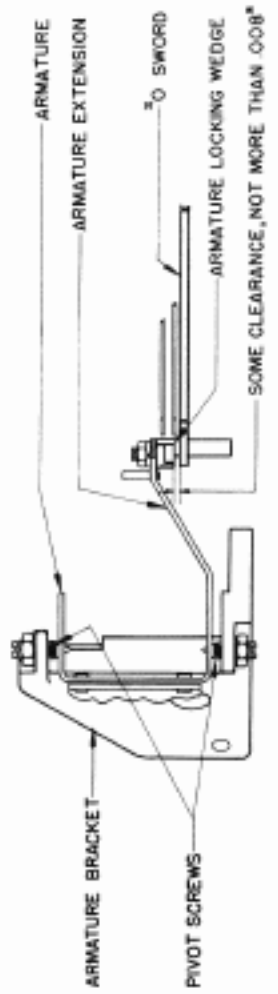


FIGURE 27

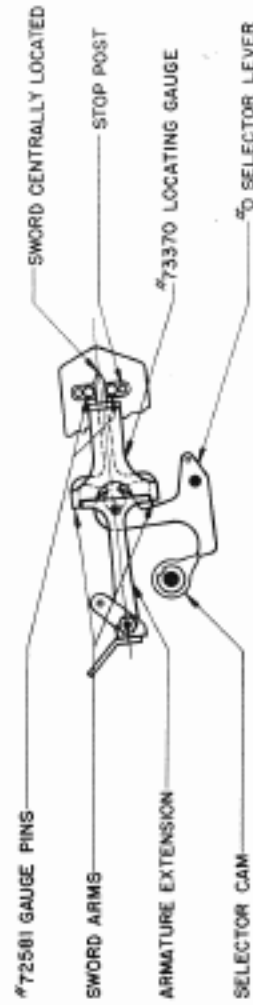


FIGURE 28

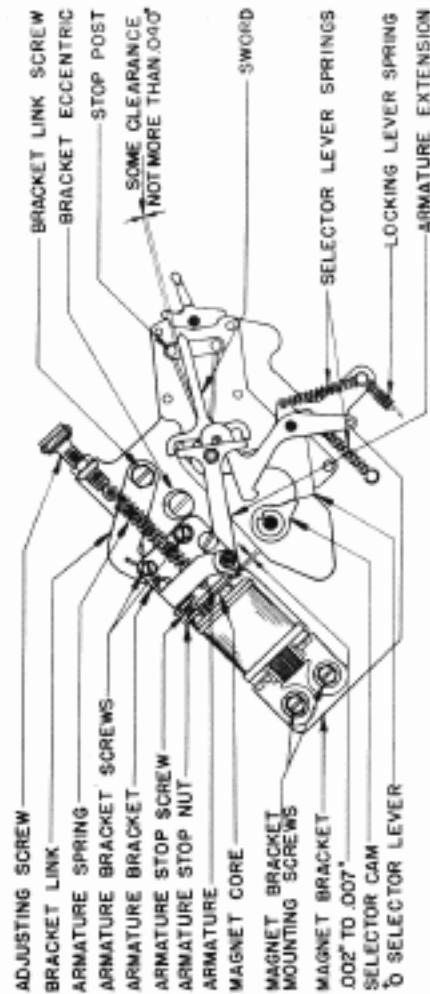


FIGURE 29

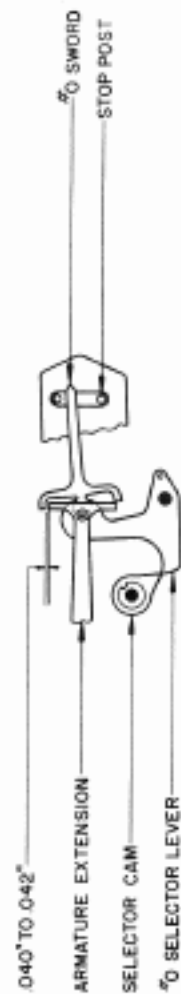


FIGURE 30

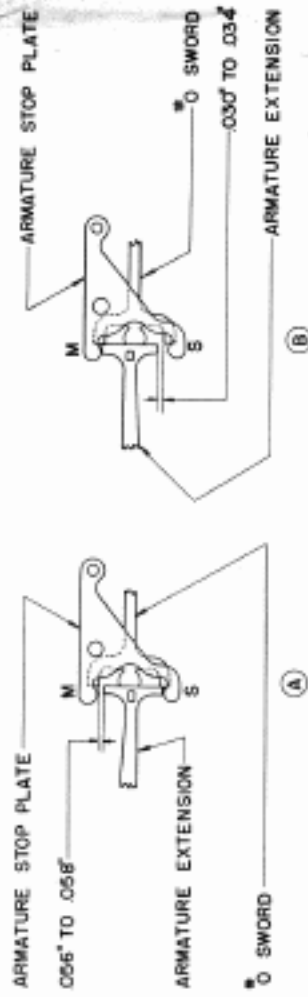


FIGURE 31

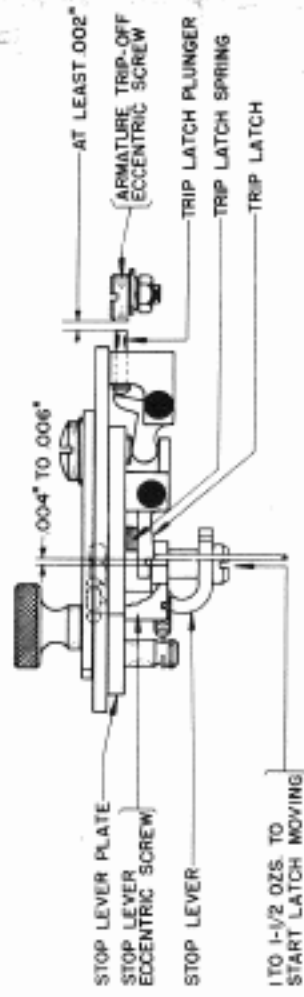


FIGURE 32

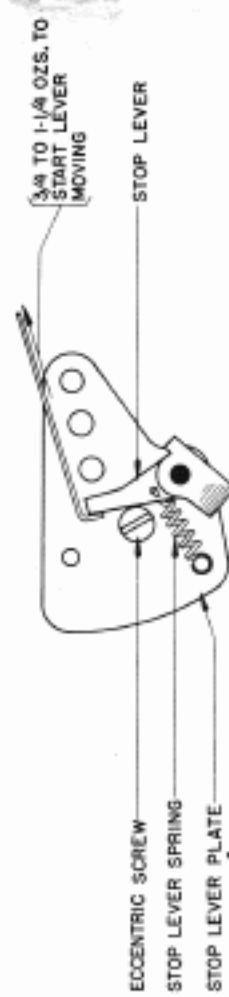


FIGURE 33

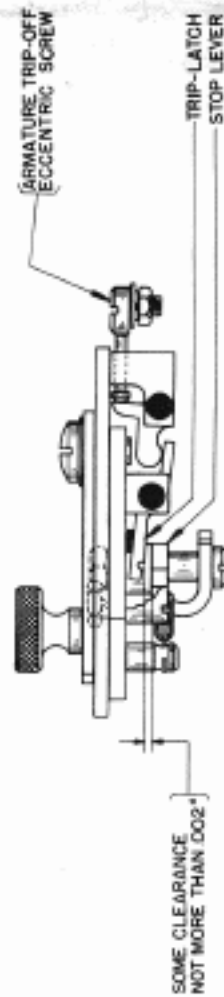


FIGURE 34

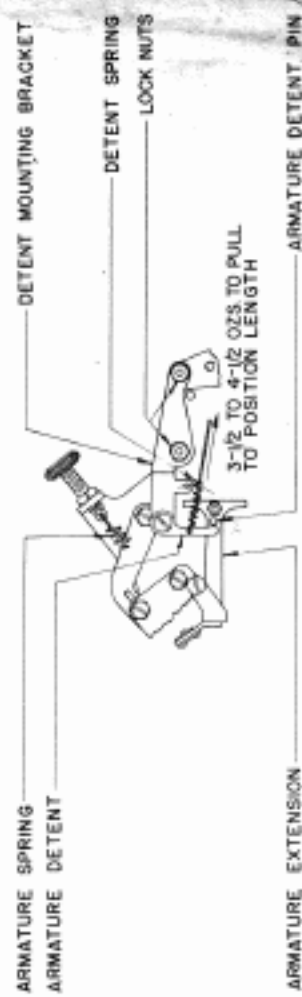


FIGURE 35

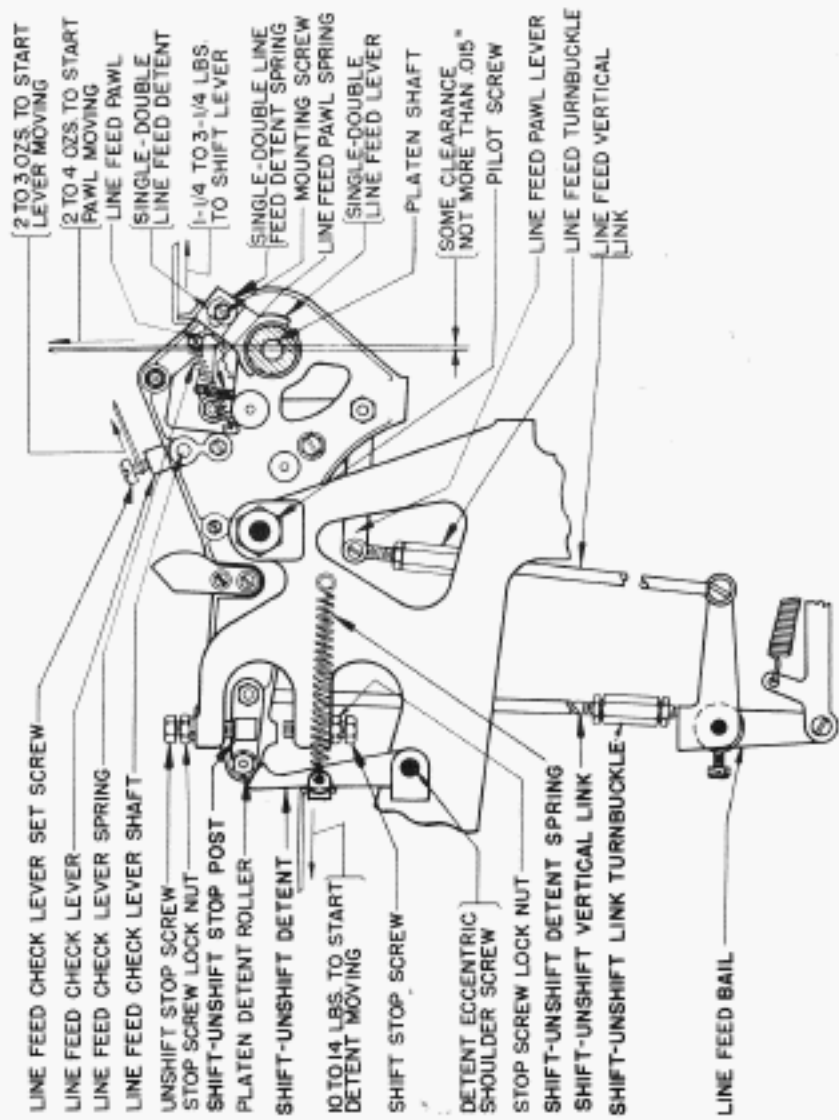


FIGURE 36

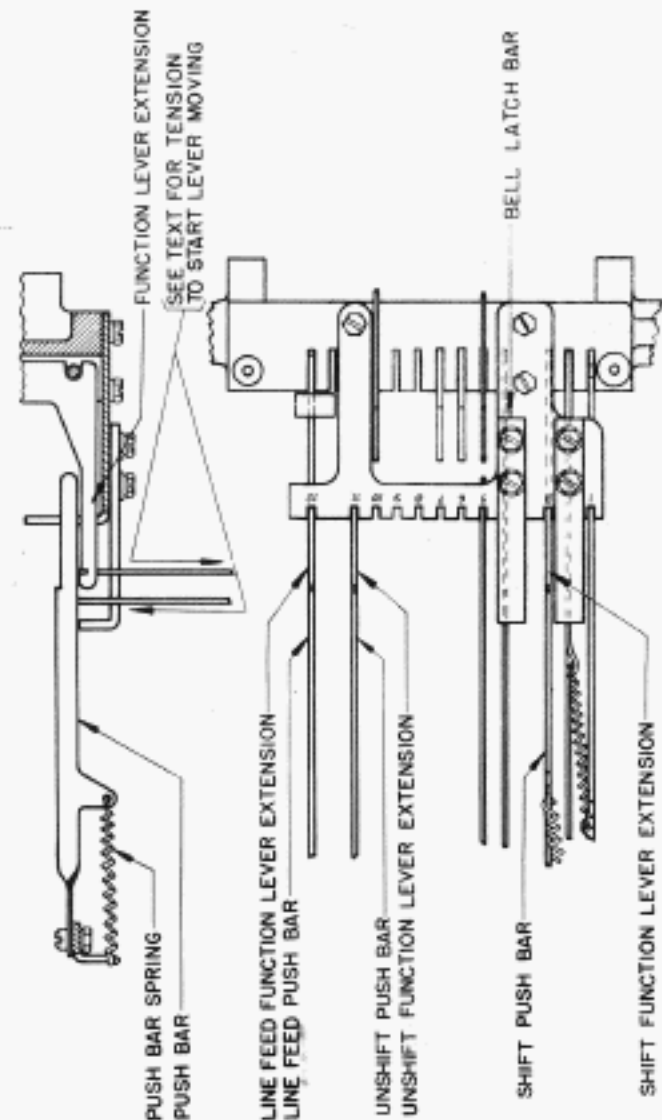


FIGURE 37

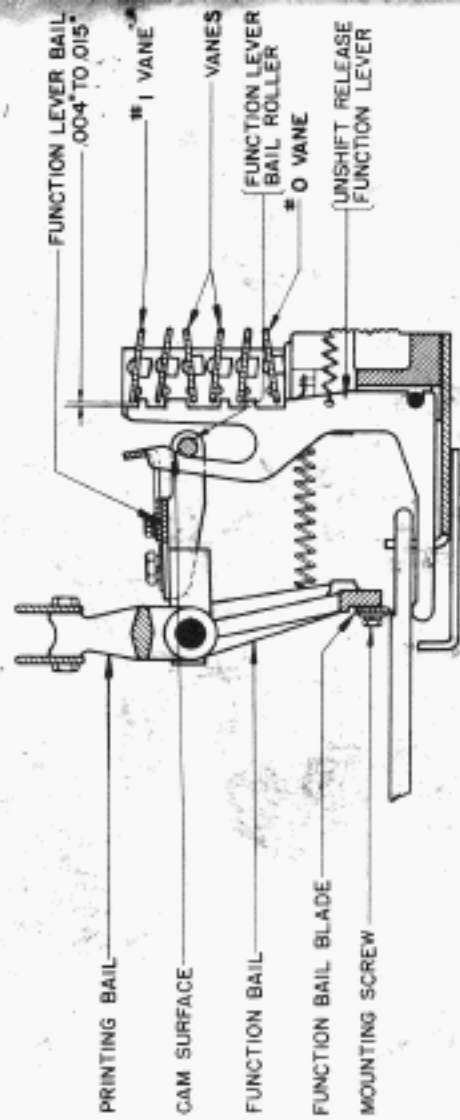


FIGURE 38

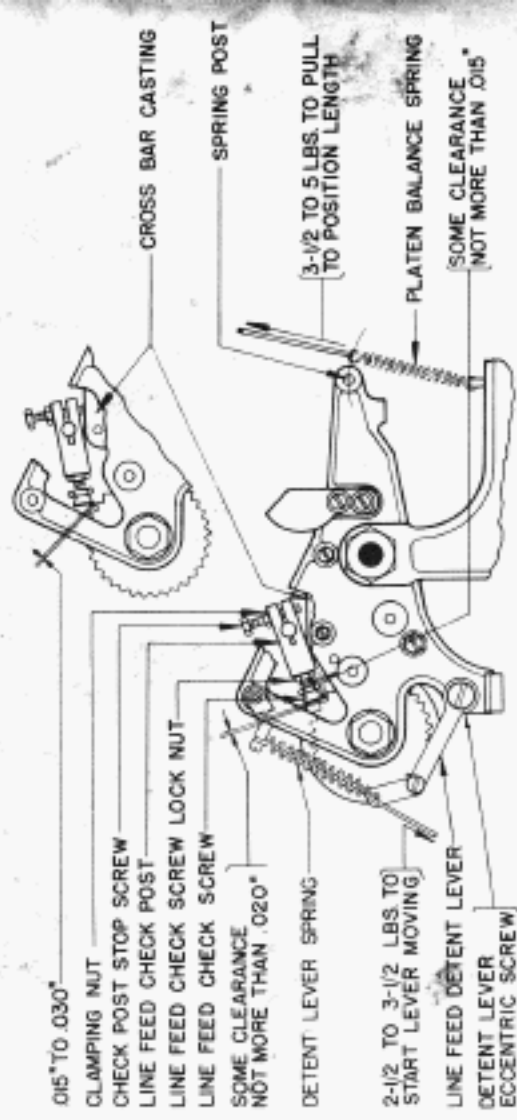


FIGURE 39

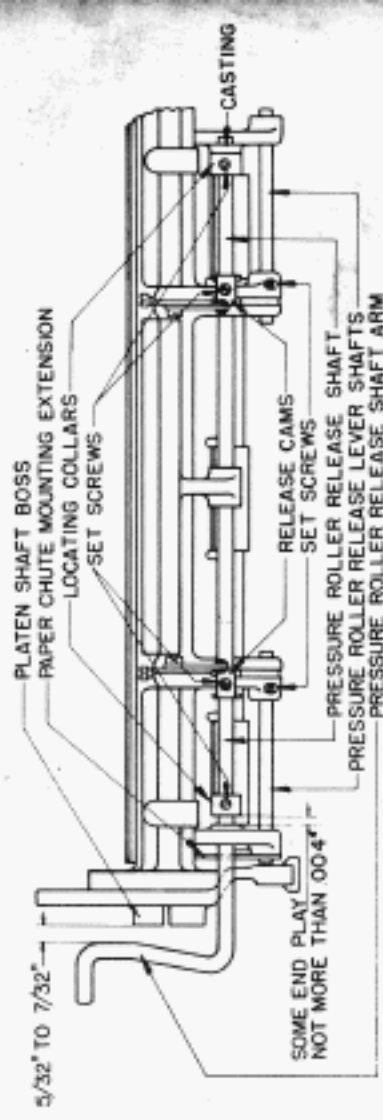


FIGURE 40

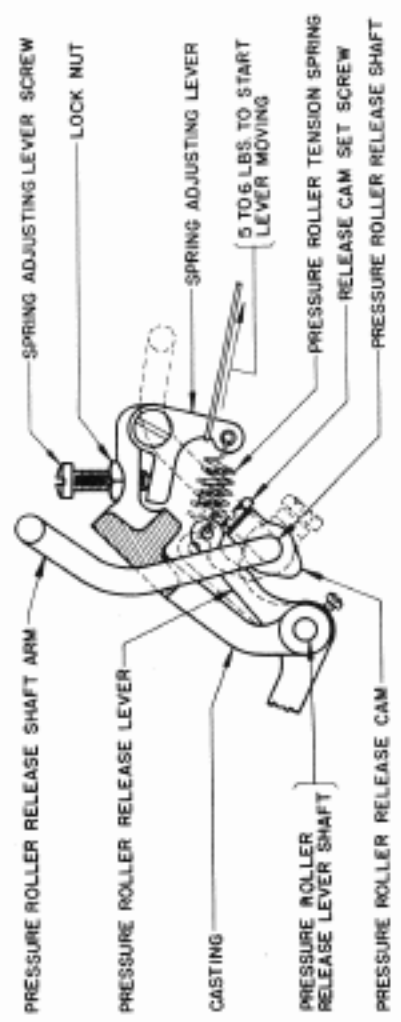


FIGURE 41

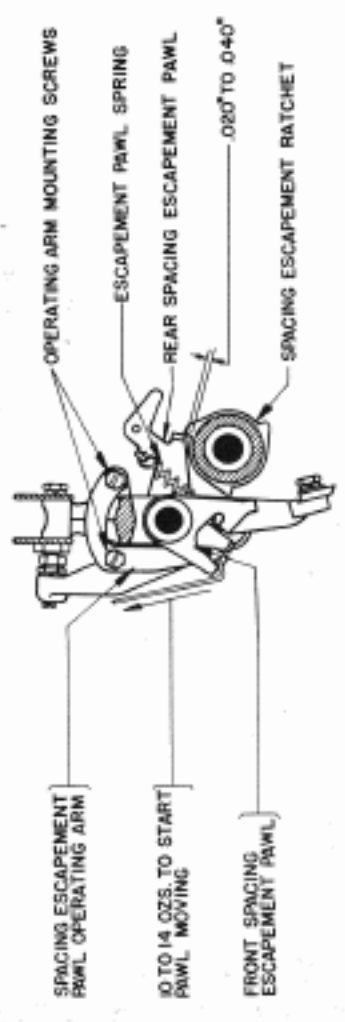


FIGURE 43

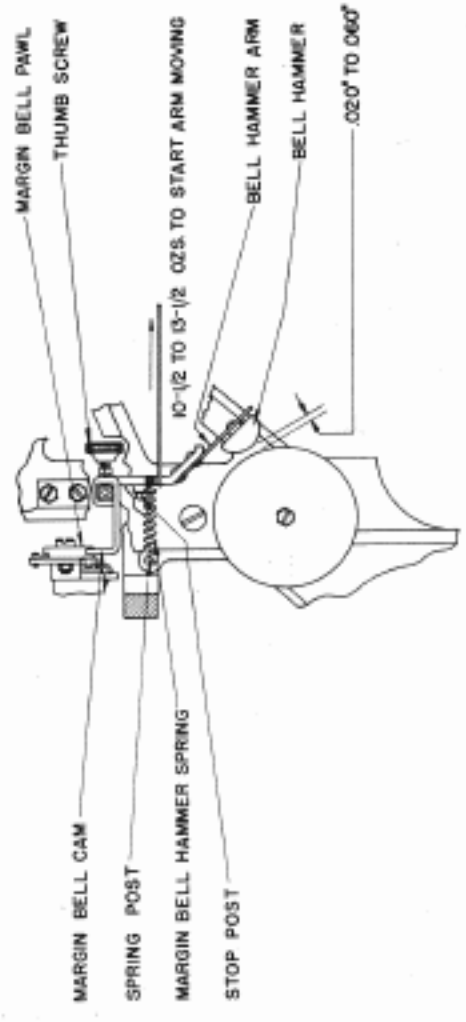


FIGURE 44

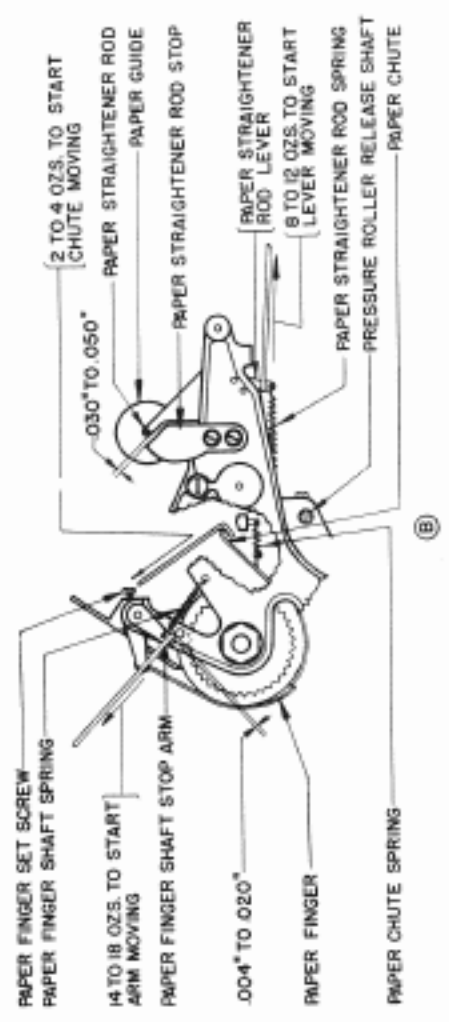


FIGURE 42

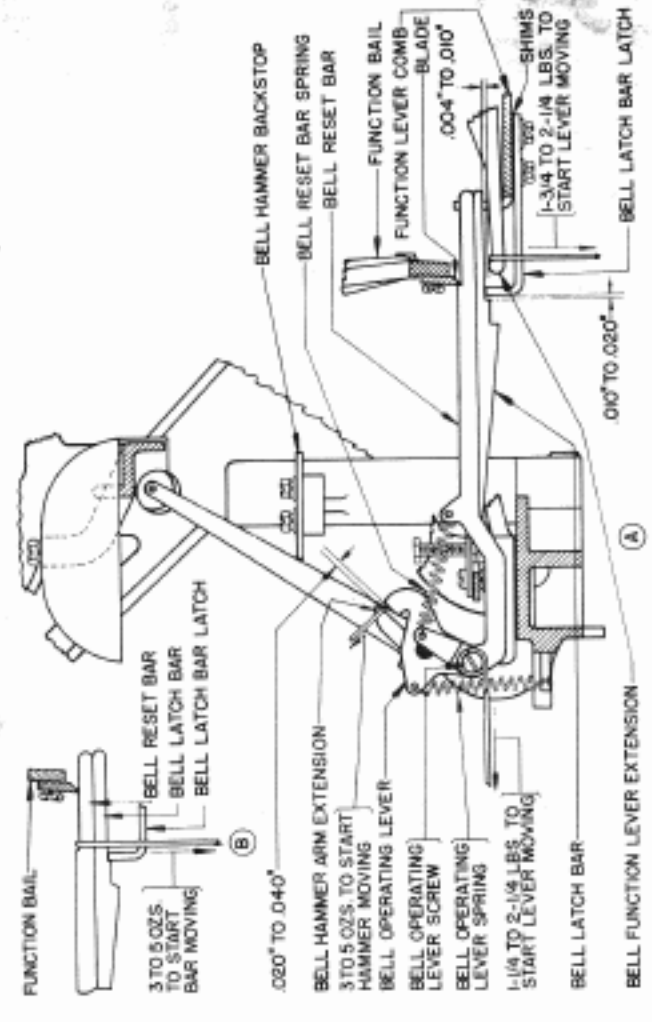


FIGURE 45

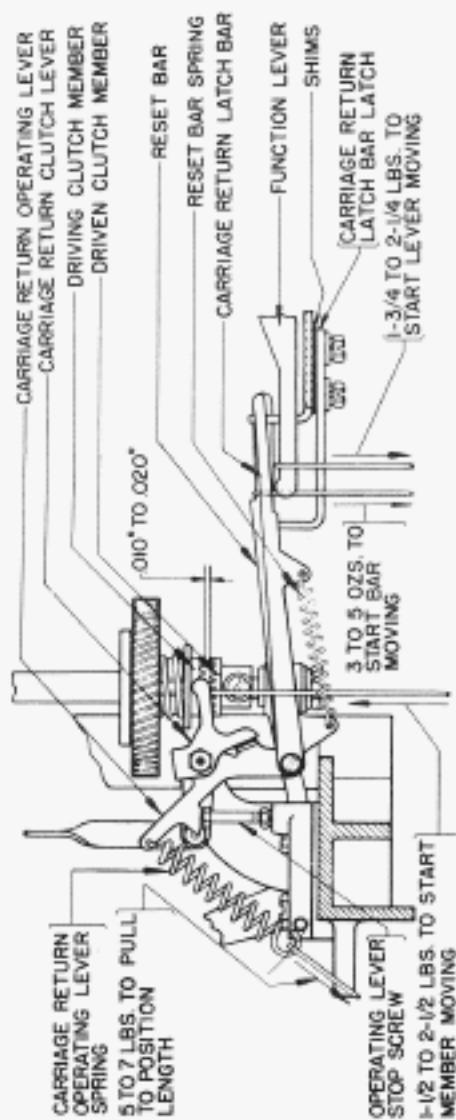
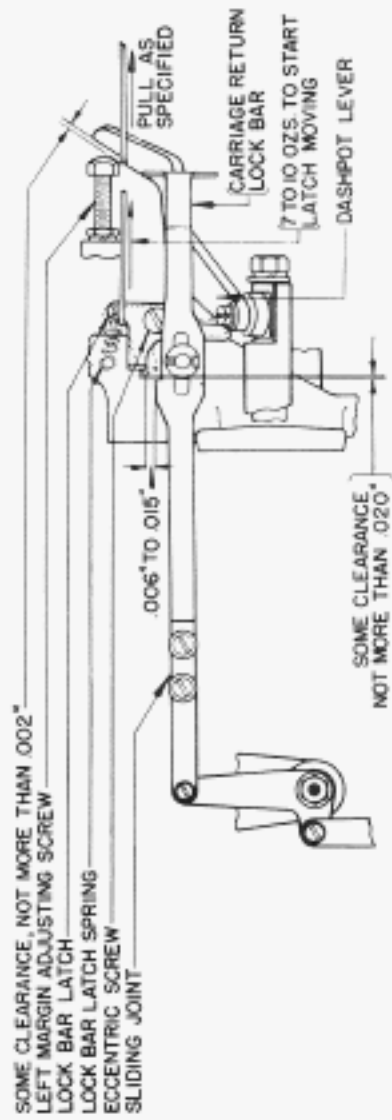


FIGURE 46

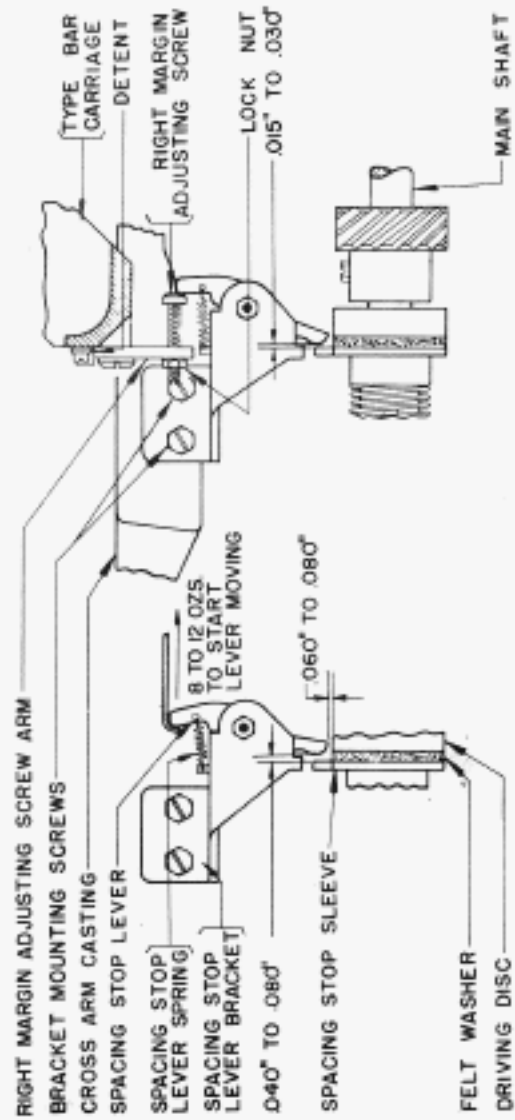


FIGURE 47

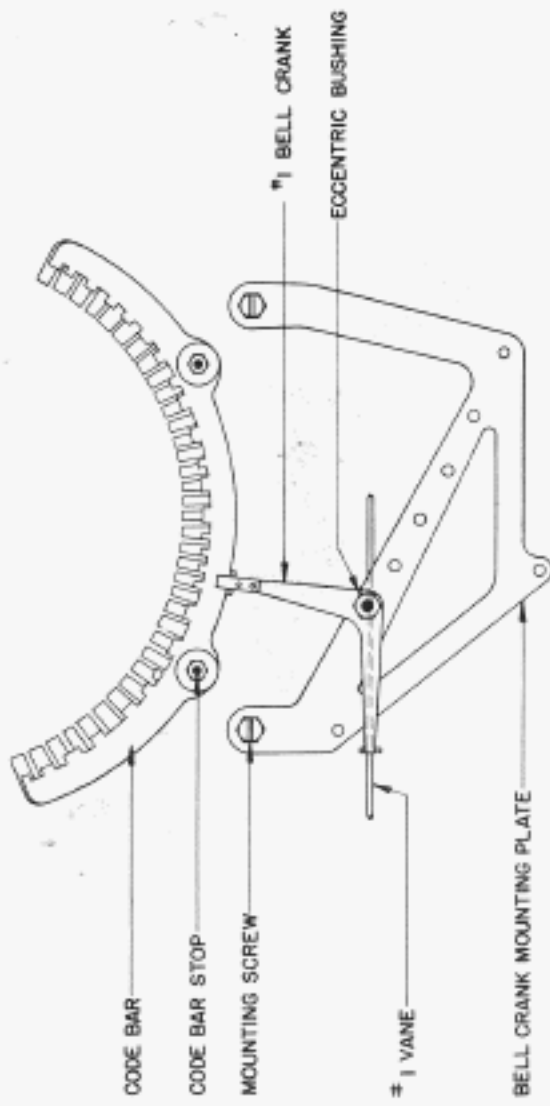


FIGURE 48

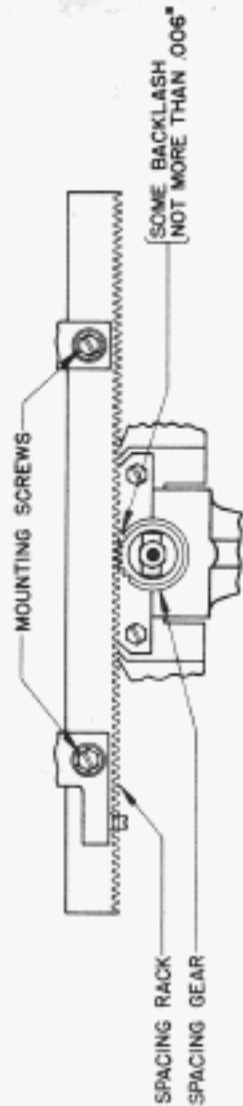


FIGURE 49

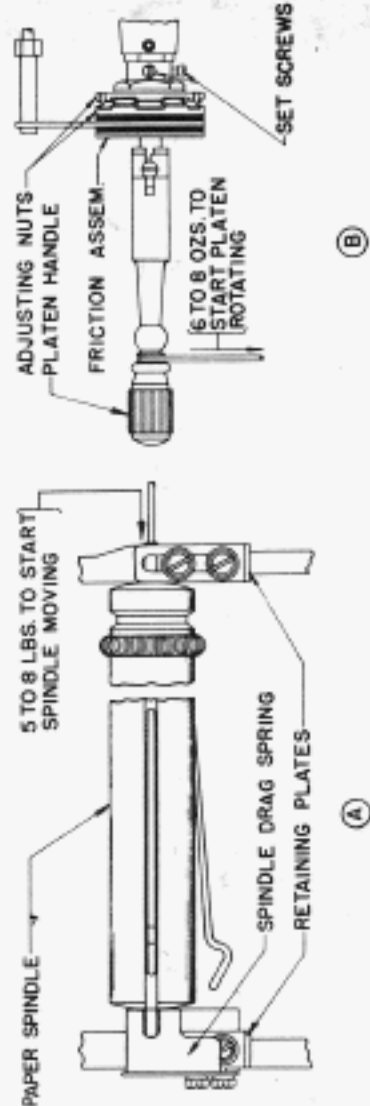


FIGURE 50

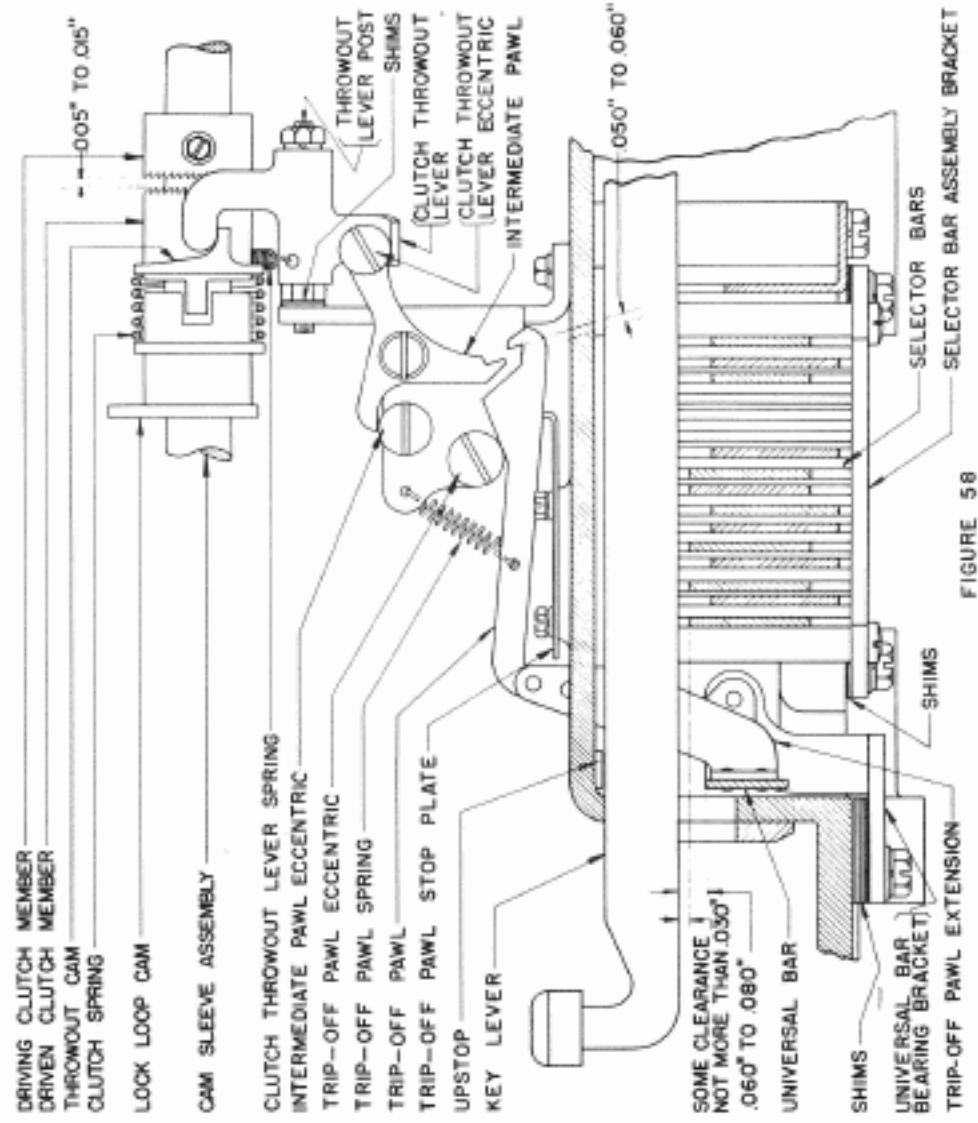


FIGURE 58

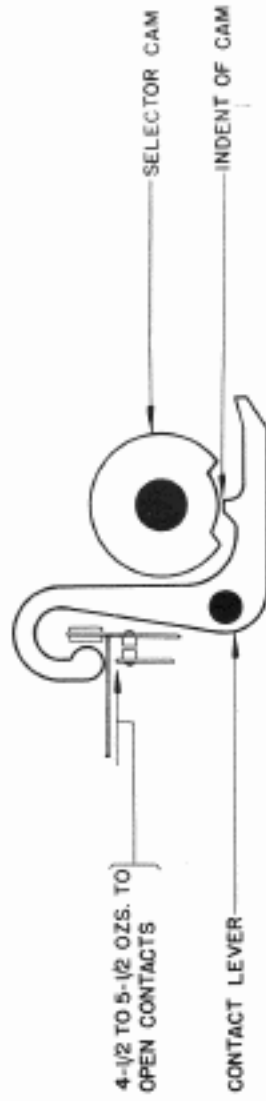


FIGURE 59

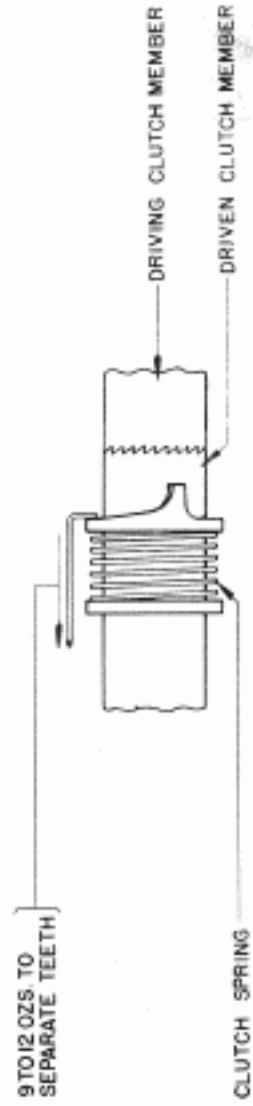


FIGURE 60

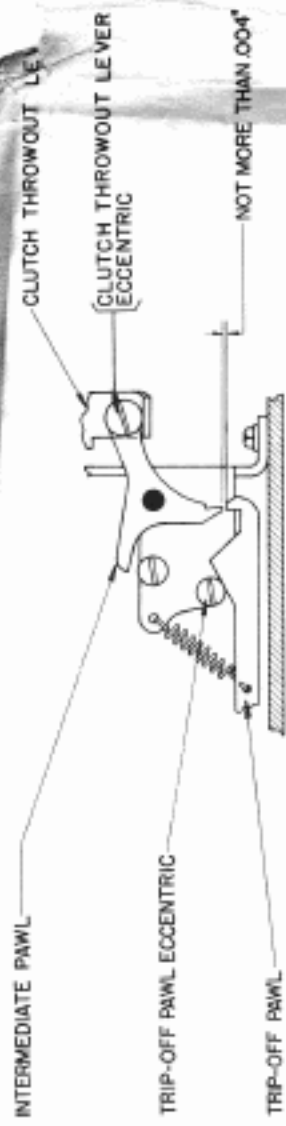


FIGURE 61

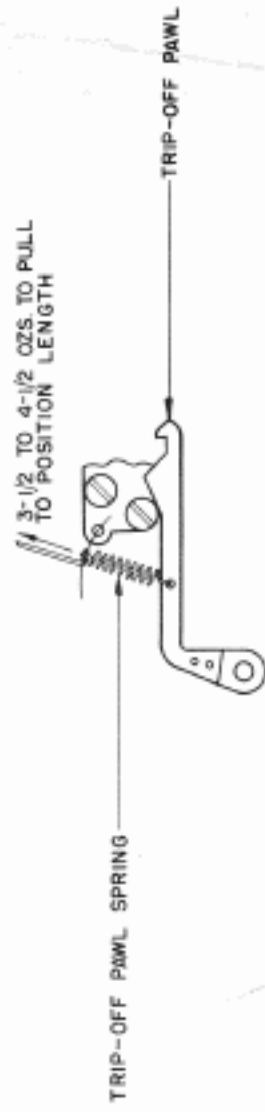


FIGURE 62

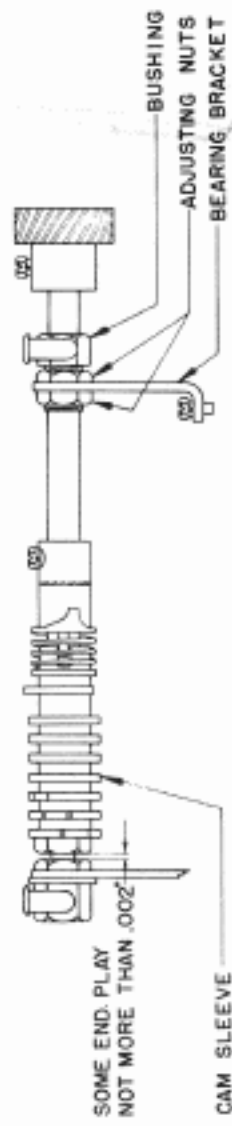


FIGURE 63

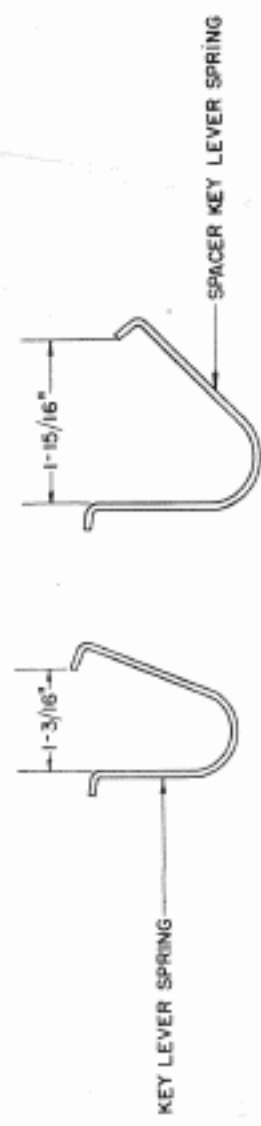


FIGURE 64

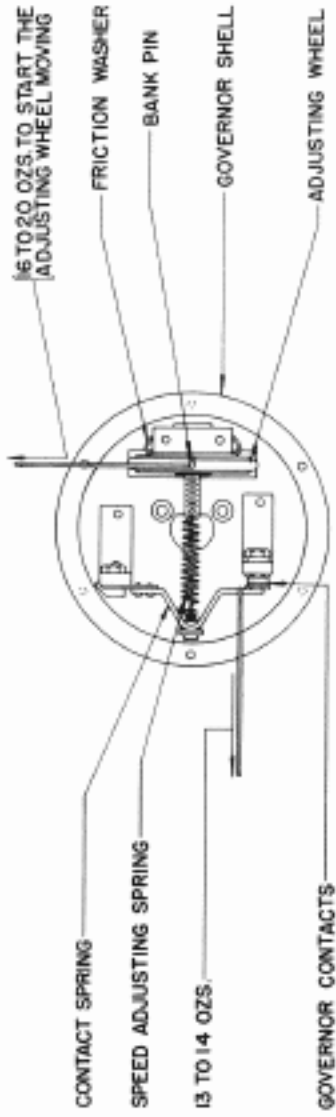


FIGURE 65

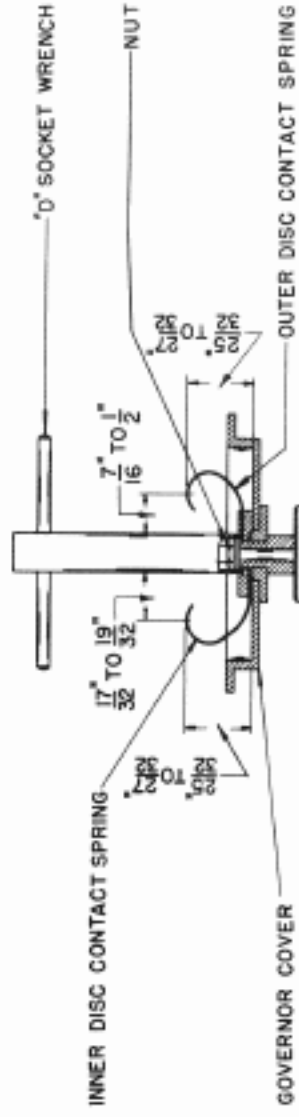


FIGURE 66

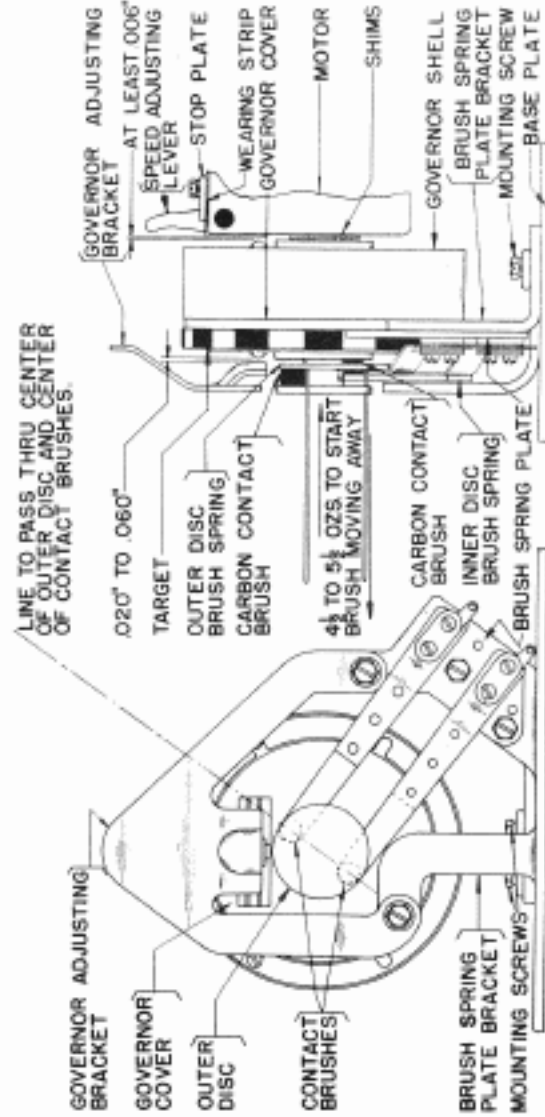


FIGURE 67

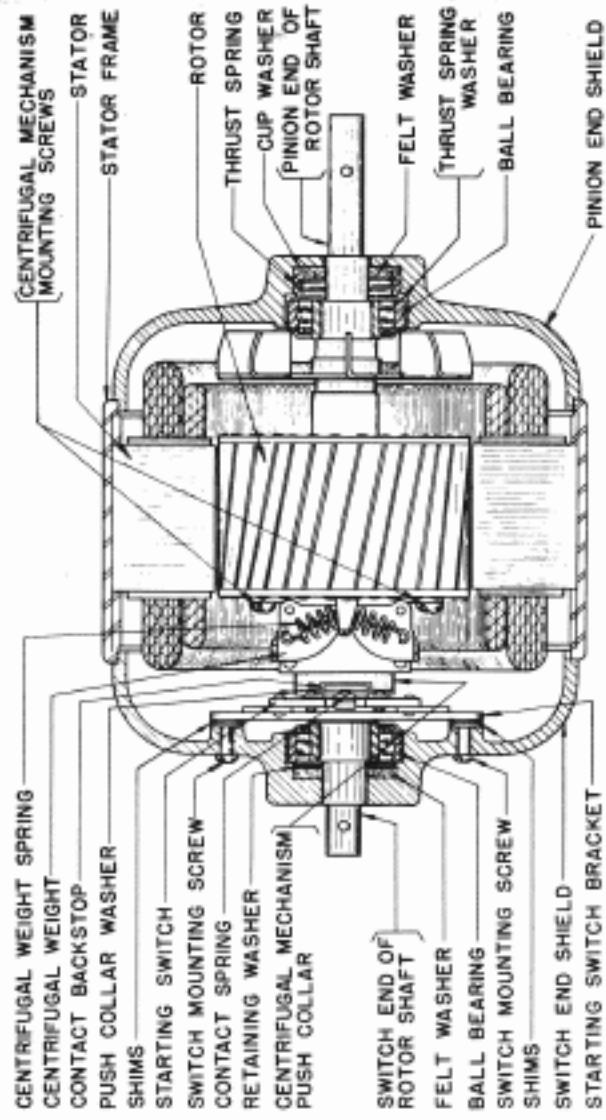


FIGURE 68

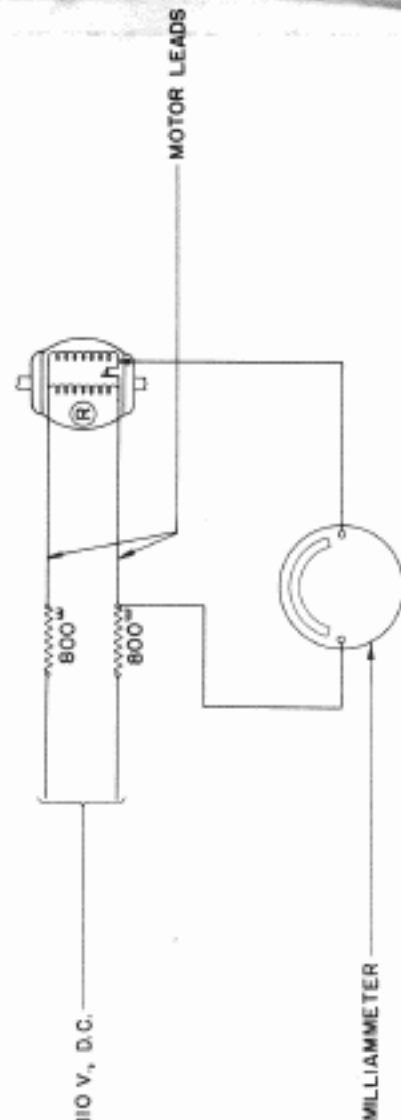


FIGURE 69

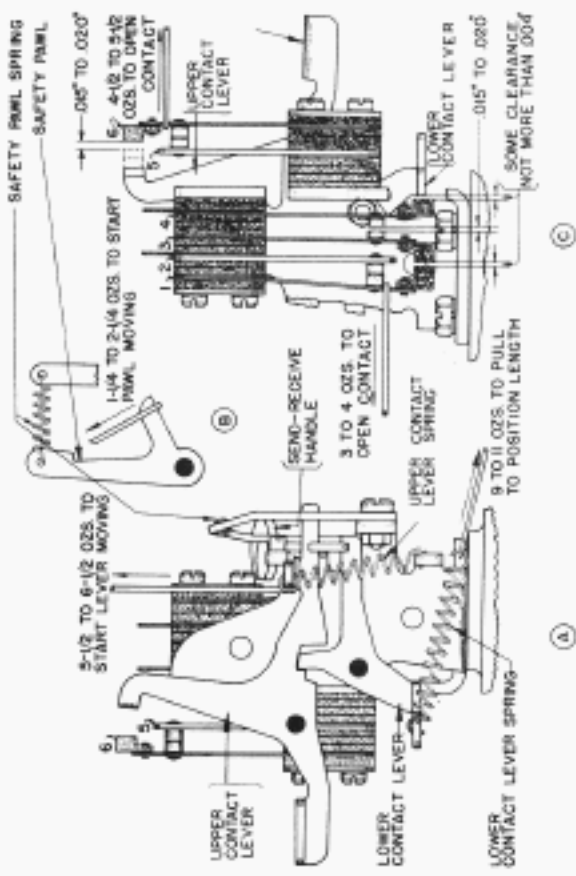


FIGURE 70

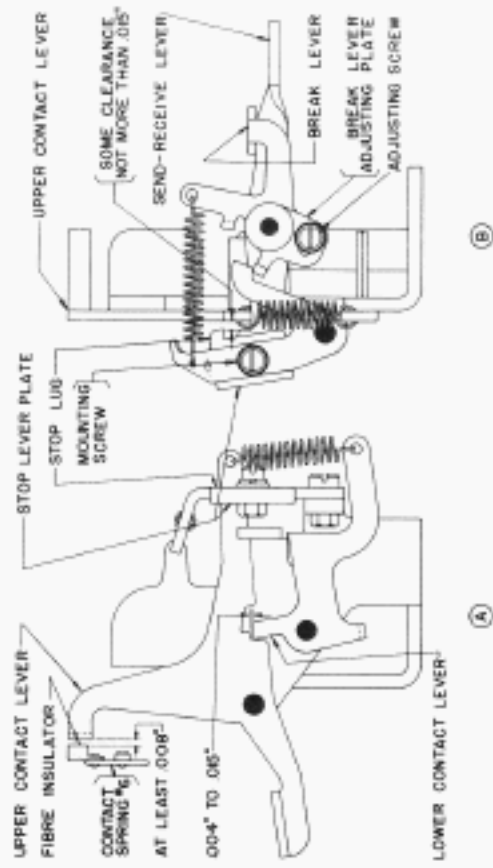


FIGURE 71

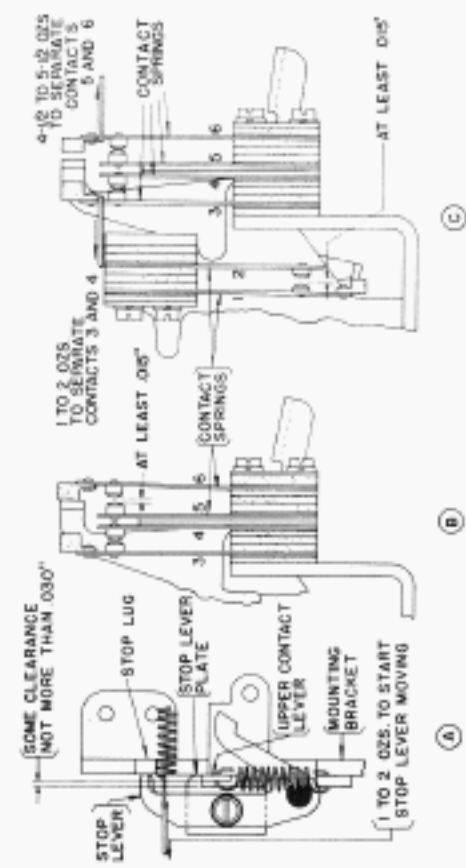


FIGURE 72

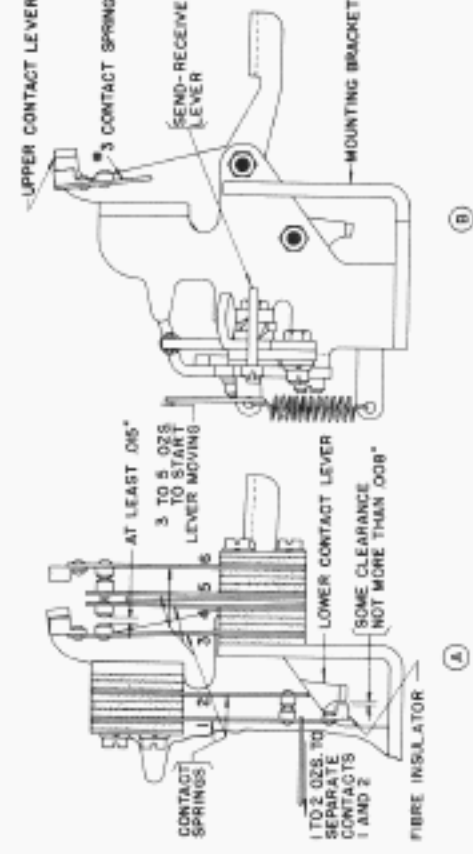


FIGURE 73

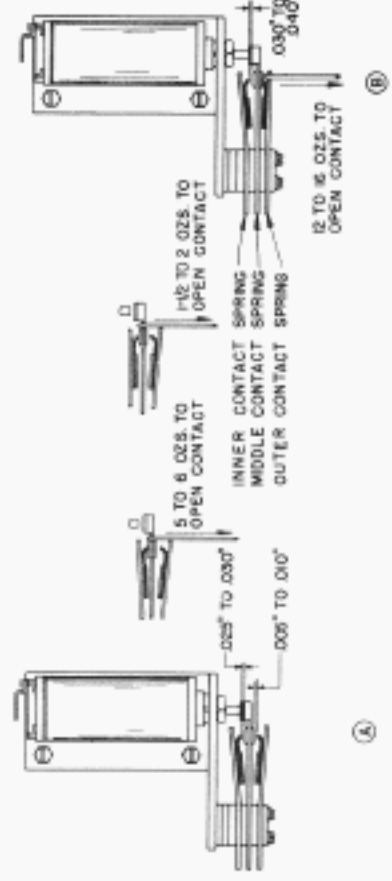


FIGURE 74

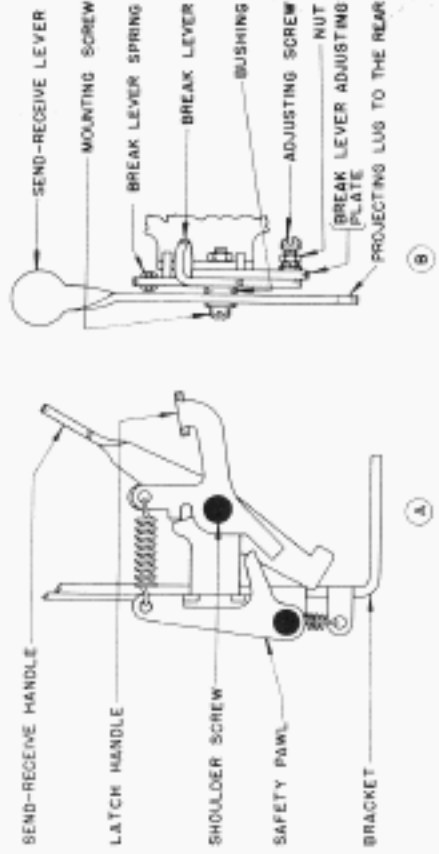
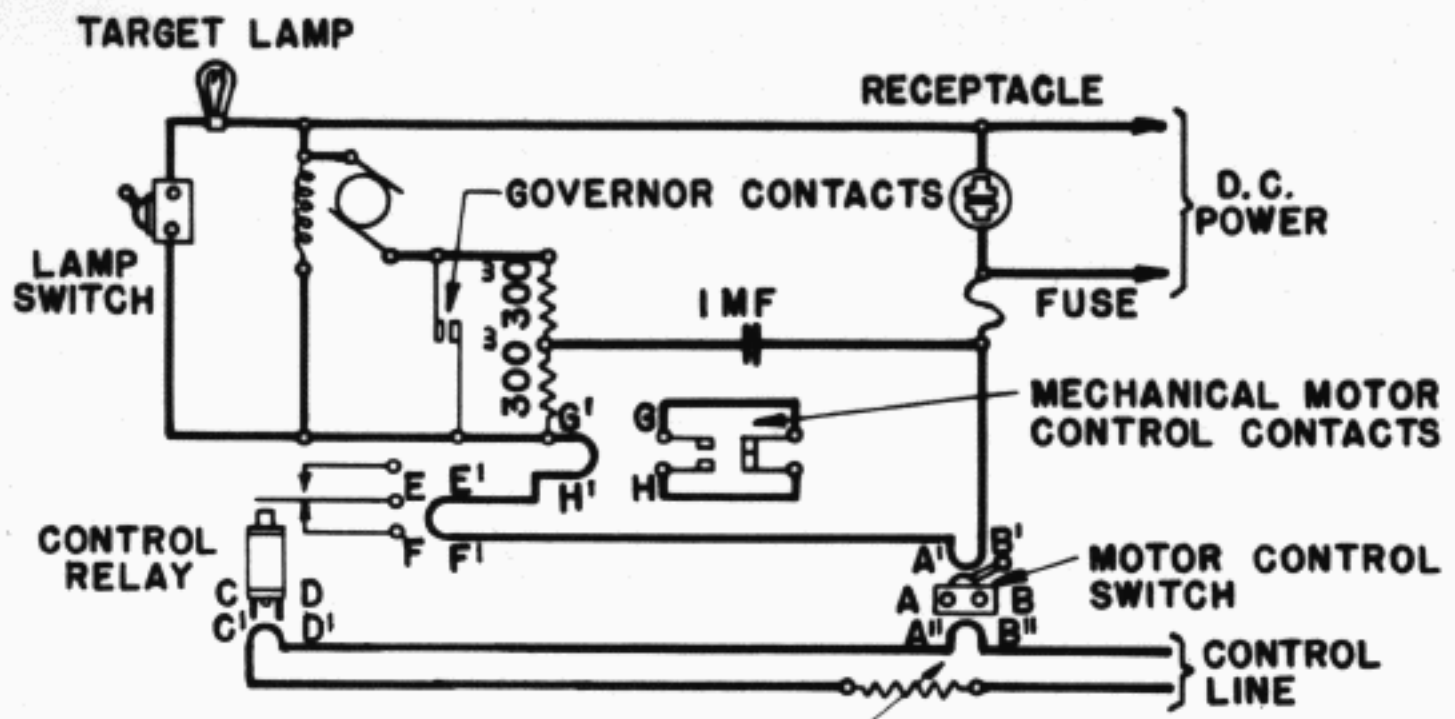
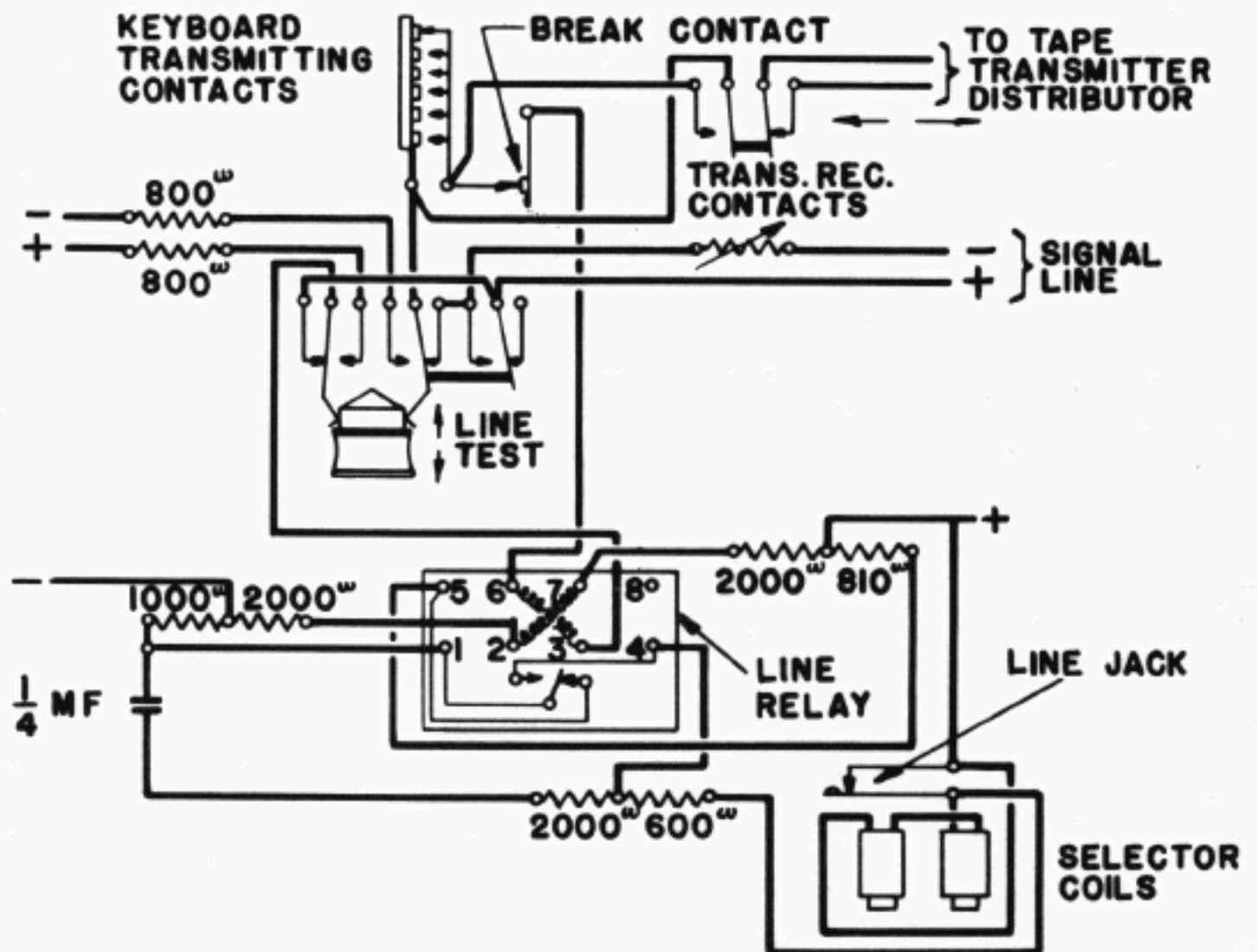


FIGURE 75



MOTOR AND MOTOR CONTROL CIRCUITS.



LINE AND RELAY CIRCUITS.