

IBM

Customer Engineering
Reference Manual

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1403

Printer

IBM® Customer Engineering
Reference Manual

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P M ROUTINE

CODE	UNIT	FREQ (Weeks)	LUBRICATE	CLEAN	OBSERVE
5	DRIVE Type Array	4	Fill right oil reservoir in T-casting #6.	Clean type array with vacuum cleaner as required.	Check that reservoir never runs dry. Check that oil is being used (reaches chain).
	Type Array Drive		Fill plastic oil reservoir at rear of T-casting #9.		Check that reservoir never runs dry. Check that oil is being used.
2	PRINT Ribbon		Toggle plate pivot #6. Reverse toggle spring anchor #24. Skew roller pivot #6. Sense finger pivot #6.	Excessive oil and grease must be wiped from all areas to prevent any contamination of ribbon.	Check for wear.
5	DRIVE Ribbon Drive Unit	13	All gears #70 (light film). All bearings, pivots, and clutch shafts #6. Friction disk interposer stud and ball #6. Pinion spline #6.	Keep friction drag surfaces oil free. Excessive oil and grease must be wiped from all surfaces to prevent any contamination of ribbon.	Check for wear and binds. Check for correct operation. Lube only when surface appears dry.
0	BLOWERS Hammer Unit			Replace blower air filter as necessary.	
1	FEED Tractor		Light film of lubricate #70 on tractor drive gears, tractor ramps, and tractor shafts.		Check tractor adjustments as required.
	Stacker		Bevel drive gears #70. (Use light film of grease only). Friction drive shaft #6. Lift shaft #6.	Clean as necessary.	Check for broken friction springs as required. Check for wear on friction drive roll.
2	PRINT Hammer Unit		Hammer magnet armature pivots #6. Hammer surfaces that contact armatures (light film #6.) Armature backstops (light film #6.)		Check for loose hammers. Check for loose magnet coils. Check for worn residuals on hammer magnet face (core).
	Strip residual and strip residual fastening bands			Replace every 26 weeks	
	Type Array			Clean type array with vacuum cleaner as required.	Check for proper tension in chain (3/16" sag of slugs at front of type array when type array is held with front side down).
	Drum			Wipe off surface of timing disk with clean cloth.	Check and clean as necessary.
3	EMITTER Emitter	26	Emitter surface #6 (light film)		Check for worn brushes. Check for pitted surface.
	Contact Rolls		Contact roll bearings #6.	Clean contact rolls as necessary.	Check tape brushes for loose strands.
5	DRIVE Ribbon Drive Unit		Ribbon drive motor (2 oil cups) #6.		
	Hydraulic Unit		Blower motor (2 oil cups) #6.		Check timing belt for tension.
	6-8 Line Drive		Light film #70 on active surfaces of all gears, shift fork, camming plate, and detent wheels. Detent arm pivots and rollers #6.		Only when leakage is apparent, check proper hydraulic fluid level. (Approx. to bottom of coils).
9	MISC Frame T-Casting Phenolic Support Chock		Use light film of #24 on active surfaces of gears, slides, guides, and levers as required. Use #6 on bearings, bushings, and pivots as required.		Check for and binds. Check adjustments as required.
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Figure 1. IBM 1403 PM Routine

Preventive Maintenance

Approach to Preventive Maintenance

The prime objective of any maintenance activity is to provide maximum machine availability to the customer. Unless a preventive maintenance operation reduces machine downtime, it is unnecessary.

Do not adjust or disassemble a unit that is working properly, even if tolerances vary from specifications.

Be visually alert for trouble indications any time you service the machine. Look for corrosion, wear, cracks, burned contacts, and loose connections. Watch for filters clogged with dirt.

Preventive Maintenance Procedures

The three basic steps of preventive maintenance are clean, lubricate, and inspect. Do not do more than scheduled preventive maintenance on equipment which is operating satisfactorily. Refer to Figure 1.

Apply lubrication only in the quantity necessary to supply that immediate area involved. *Wipe off excess.* On the 1403, special care must be taken to keep lubricants away from:

- | | |
|----------------------|----------------|
| Ribbon | Cover seals |
| Paper path | Rubber dampers |
| Electrical wiring | Grommets |
| Magnetic clutch disk | |

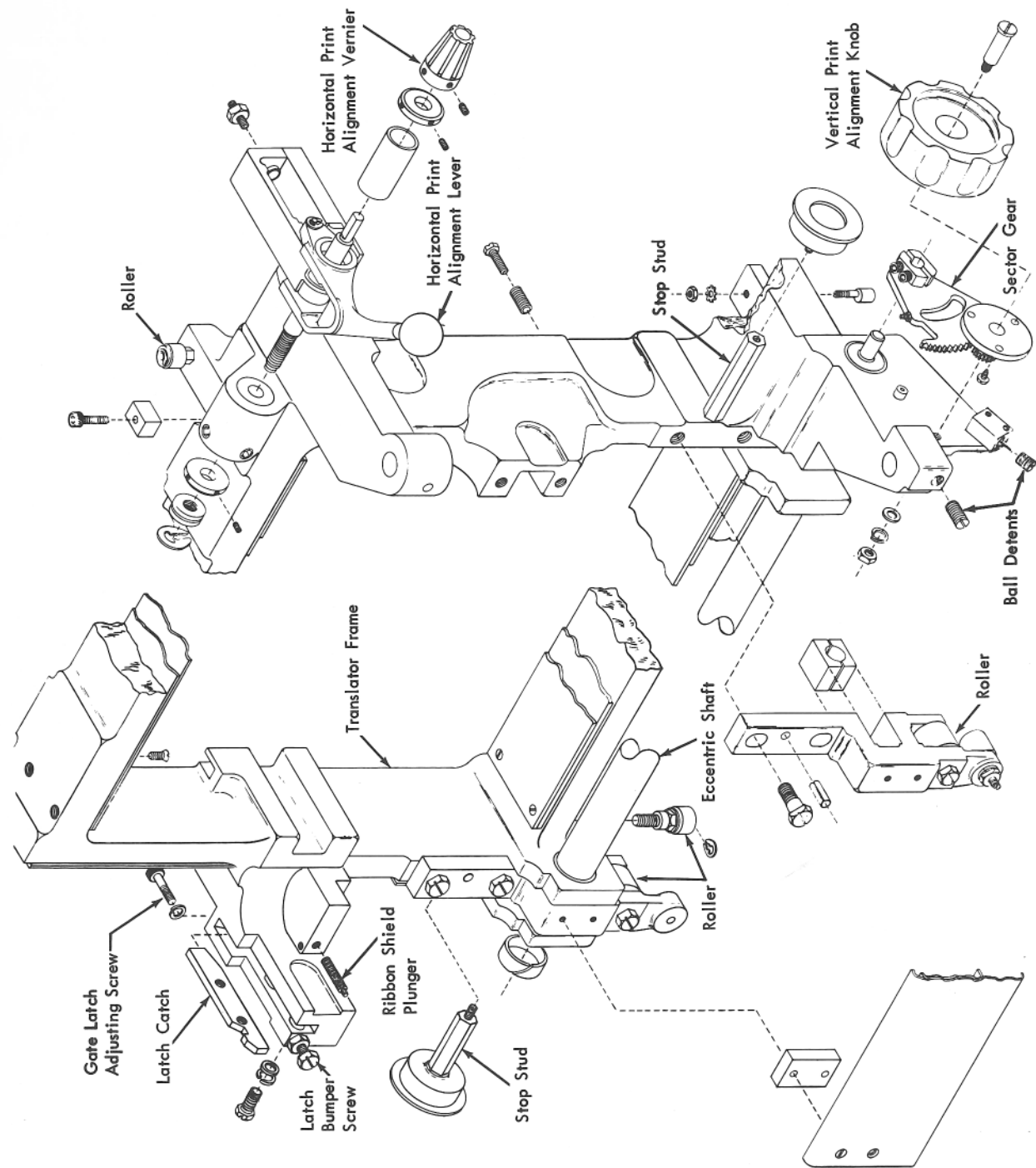


Figure 2. Translator Frame

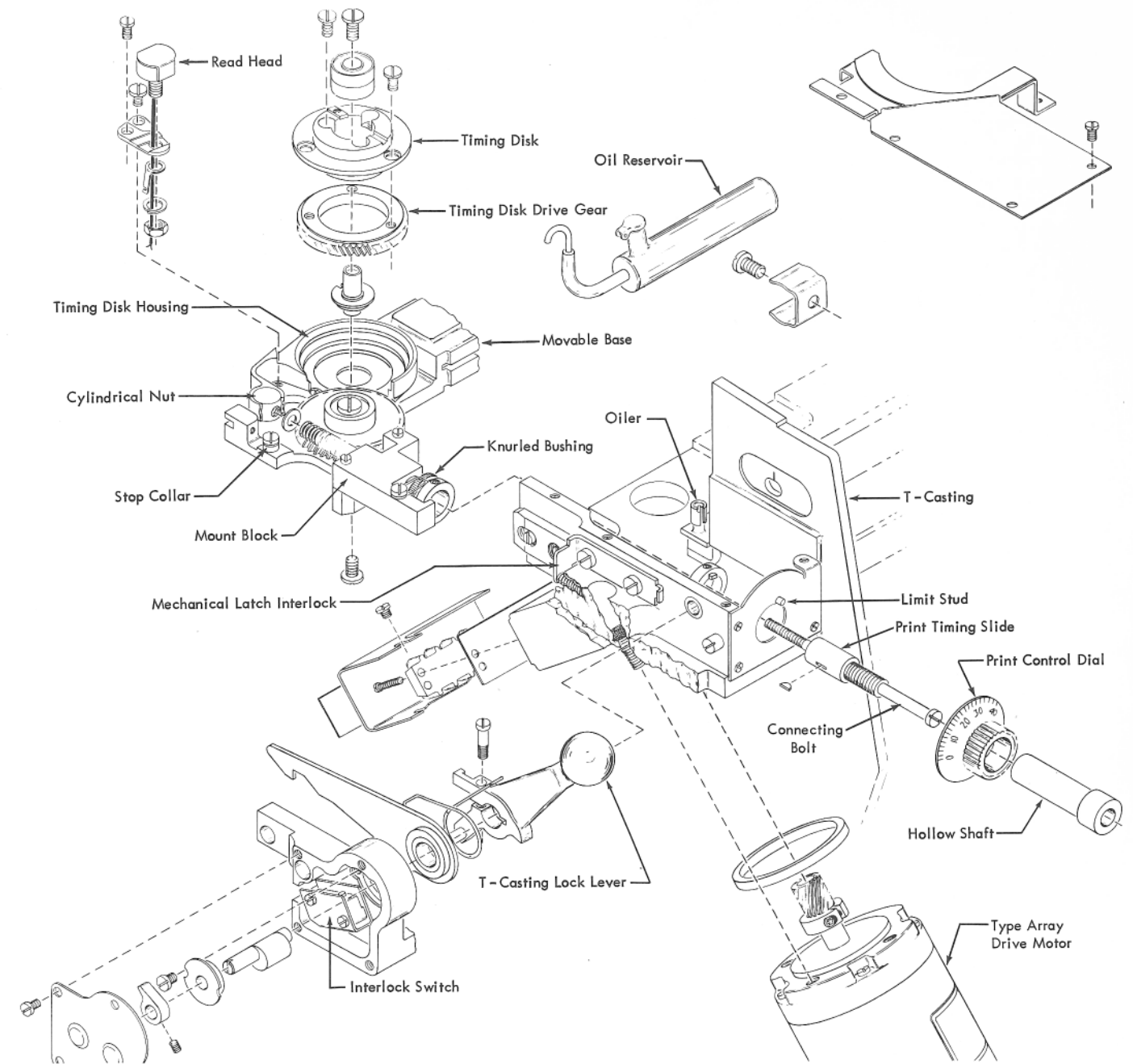


Figure 3. Left End of T-Casting

2. Set up the system.
 - a. Program to print continuous lines of H's.
 - b. Press the start key.
3. Position the read head for correct horizontal print alignment.
 - a. Hold the print control dial at the correct setting.
 - b. Position the cylindrical bolt. Turn the bolt with a screwdriver and determine the left and right limit of character cut off.
 - c. Turn the bolt to the position midway between the limits found.
4. Press the carriage stop key.
5. Examine the printing for alignment. Individual position misalignment can be corrected by adjusting individual hammer magnets for armature to core clearance.

Forms Width Vernier

1. Prepare to adjust vernier.
 - a. Remove knobs.
 - b. Remove the inner front cover.
 - c. Remove the gear guard.
 - d. Replace the knobs.
 - e. Locate the left forms tractors in corresponding slots in the tractor guide bars.
 - f. Locate the right forms tractors in corresponding holes in face of the removable slides.
 - g. Locate the forms tractors apart at the extremes of the guide bars.
2. Adjust the left tractor pin feeds horizontally (in a vertical line).

- a. Place a straight edge along the pin feeds to check for alignment.
 - b. Shift the tractor guide bars to align the pin feeds within 0.005". There are two screws in each end of the bar.
 - c. Keep the left horizontal surface of guide bar against the corresponding horizontal lip of the printer casting.
3. Adjust the right tractor pin feeds.
- a. Orient the horizontal adjusting screws and vertical drive collar to align the right pin feeds within 0.005" horizontally (in a vertical line).
 - b. Place a straight edge along the pin feeds to check for alignment.
 - c. It may be necessary to reposition the horizontal adjusting screws in relation to the collars and gears to obtain adjustment.
 - d. Position the friction nuts and collars for a maximum end play of 0.002".
4. The forms width vernier must operate with light finger force.
5. After this adjustment has been made, adjust the vertical position of the right ends of the upper and lower tractor guide bars for free movement of tractor assemblies.

Manual Clutch and Line-Selection Lever (Figure 4)

1. Prepare for adjustment.
 - a. Move the translator frame to the left.
 - b. Remove the front inner cover.
 - c. Remove the manual clutch knob.
 - d. Remove the manual advance knob.
 - e. Remove the rear 1403 cover.
2. Check the adjustment of the manual clutch and the line-selection lever assembly.
 - a. Check for clearance:
 - (1) For a minimum end play of the detent arms on the shaft.
 - (2) For a minimum of 0.025" between the detent and the detent wheel when the detent is inoperative.
 - (3) Between the tines of the shift fork and the slide gear hub.
 - b. Check for alignment:
 - (1) of the detent arms to the slots in the camming plate.
 - (2) of the detent wheels to the detent arms.
 - c. Check for correct operation that:
 - (1) the clutch shifts from 6- to 8-line drive and vice versa.
 - (2) the spring causes correct operation of the detent arms and wheels (there should be a force of 4½ to 6½ pounds on the detent arm).
 - (3) the detent arm roller seats fully in the detent wheel when the detent is operative.
3. If the conditions in step 2 are met, no further adjustment is necessary. Proceed to step 12.
4. Further prepare to adjust the manual clutch and line-selection lever assembly.
 - a. Unhook the detent arm springs.
 - b. Loosen both the detent wheels.
 - c. Slide the right detent wheel to the right.
 - d. Loosen the detent arm collars.
 - e. Slide the detent arms to the left.
 - f. Loosen the camming plate on the shift fork so that the plate is just free to slide.
 - g. Loosen the set screw that holds the camming plate stop rod.

- h. Wedge the paper between the shift fork tines and hub of shift gear to center around shift gear hub.
5. Position the shift fork on the shift rack for gear mesh and clearance.
- a. Detent the shift rack in 6-line drive at the right.
 - b. Position the shift fork on the shift rack so that the slide gear meshes with the 6-line driving and driven gears and has clearance to the casting.
 - c. Rotate the shift fork around the shift rack to center the shift fork around the shift gear hub.
 - d. Clamp the shift fork to the shift rack.
6. Align the detent arms to the camming plate.
- a. Set the slide gear to 6-line drive position.
 - b. Align the detent arms with the left two slots in the camming plate.
 - c. Tighten the collars to hold the detent arms in position.
7. Adjust for a clearance between the detent wheels and the detent arms of 0.025" with the manual clutch in either 6- or 8-line drive.
- a. Turn the 6- and 8-line gear idler to a position where it does not move when the slide gear is shifted from the 6-line drive to the 8-line drive or, vice versa.
 - b. Set the slide gear to the 8-line neutral position.
 - c. Slide the right detent wheel opposite the right detent arm.
 - d. Use the rubber band to hold the right arm against detent.
 - e. Adjust the camming plate roller stop to provide a 0.025" clearance between the detent arm and tooth of the right detent wheel.
 - f. Tighten the set screw to hold the camming plate roller stop rod.
 - g. Rehook the springs on the detent arms.
 - h. Clamp the camming plate to the shift fork.
8. Align the detent wheels to the detent arms.
- a. Set the manual clutch to 8-line neutral.
 - b. Align the left detent wheel to the left detent arm.
 - c. Clamp the left detent wheel to the tractor shaft.
 - d. Set the manual clutch to 6-line neutral.
 - e. Align the right detent wheel to the right detent arm.
 - f. Clamp the right detent wheel to the tractor shaft.
 - g. Check the operation of the manual clutch for four manually operated spaces.
 - h. Re-adjust as necessary.
9. Set the spring tension to provide 4½ to 6½ pounds force on the detent arm when it is engaged in the detent wheel.
10. Remove the paper from between the shift fork tines and the shift gear hub.
11. Position clutch interlock switch.
- a. Switch to make when the plunger is within ½" of bottoming in the grooves of the shift rod.
 - b. Position the switch to obtain this adjustment.
12. Replace the remaining parts in reverse order.

Forms Positioning

Tractor Shafts and Tractor Guide Bars

This procedure is given for the removal of the upper and lower tractors, the tractor guide bars, and the drive shafts. If only one set is to be removed, do only so much of each step that will allow the desired set to be removed.

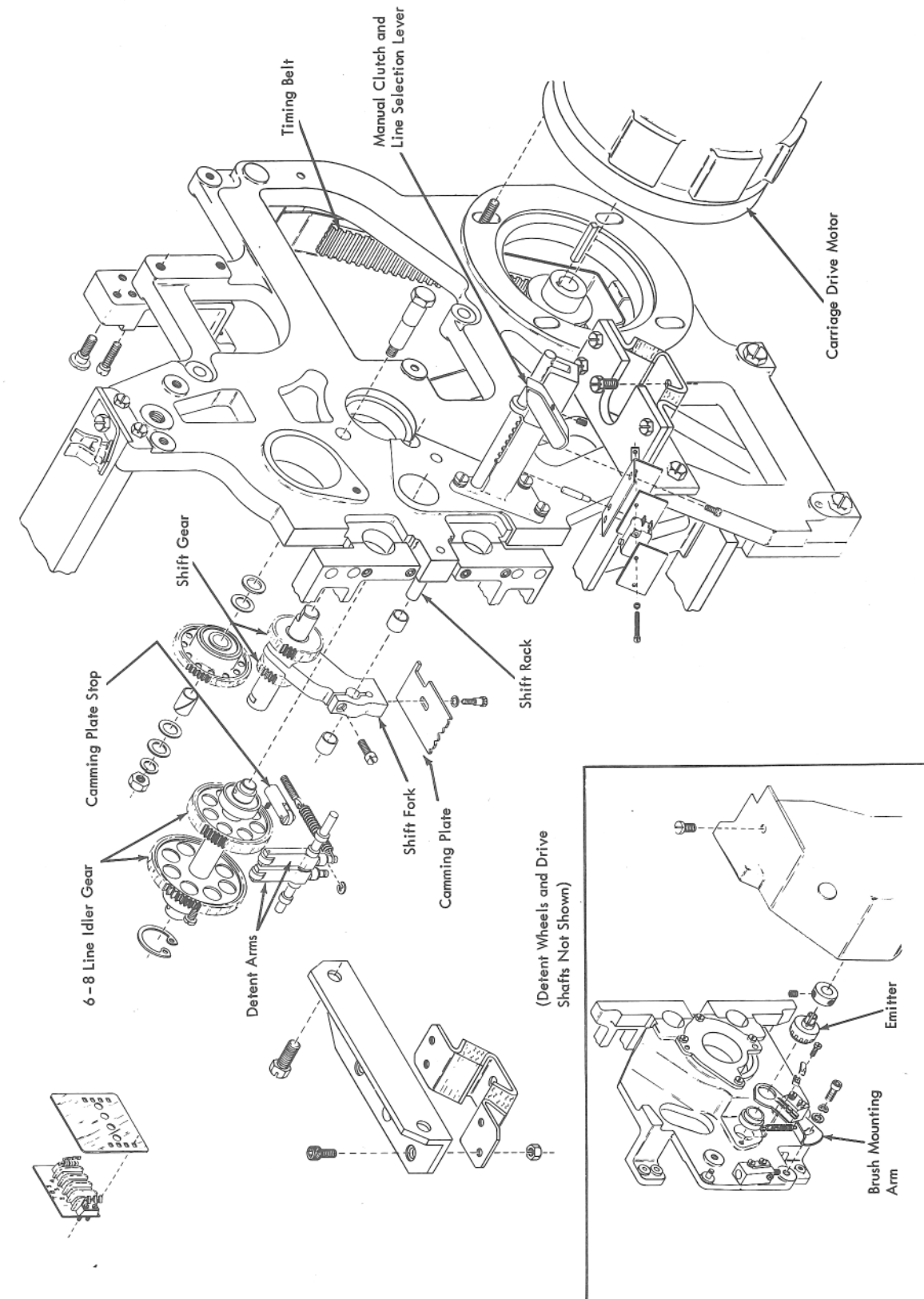


Figure 4. 6-8 Line Drive

Prepare to remove tractor guide bars and tractor drive shafts.

1. Remove the forms.
2. Remove the binary paper guides from the tractor guide bars.
3. Remove the inner front cover.
4. Remove the upper and lower forms guide bars with the jam bars attached.
5. Remove the jam contact mountings from the tractor guide bars.
6. Remove the wires from the form stop contacts at the terminal block.
7. Shift the T-casting to the left.
8. Remove the gear guard.

Separate vertical shaft of forms width vernier. Loosen the set screws in the vertical coupling of the forms width vernier. Move the vertical coupling up onto the upper shaft and lock to the shaft.

Remove the bearing caps.

1. Loosen the screws that prevent bearing end shake (at right).
2. Remove the two bearing holding screws (at right) for each bearing cap.
3. Shift T-casting to the right.
4. Remove the two bearing cap holding screws (at left) for each bearing cap.
5. Remove both bearing caps.

Remove the tractor guide bar and the tractor shaft.

1. Remove the two screws and the slide-retainer-plate at the left end of one of the tractor guide bars.
 2. Remove the two holding screws at the right end of the same tractor guide bar.
 3. Lift the tractors, the guide bar, and the shaft out and to the left to clear the T-casting.
- Repeat step 5 for other assembly.

Remove Individual Pin Feed

Prepare for removal.

1. Open the T-casting.
2. Remove the forms.
3. Open the tractor door.

Remove the tractor paper guides.

1. Remove the tractor paper guide farthest from the hinge of the door.
2. Remove the tractor guide on the other side of the pin feeds.

Align the pin-feed holding pins with the slot in the frame spacer plate (the end nearest the drive shaft).

1. Turn the tractor shaft until one holding pin aligns with the slot.
 2. Use a similar pin to push the installed pin towards the center of the machine.
 3. Repeat step 2 for the second holding pin.
- Remove the pin feed by lifting. Insert the new pin feed.

Replace the pin feed holding pins.

1. Insert the second pin.
2. Turn the tractor shaft until the first holding pin hole is aligned with the slot.
3. Insert the first pin.

NOTE: Pins are to be flush or slightly recessed.

Replace the tractor paper guides in reverse order. (See *Forms Tractor Adjustments*.)

Forms Tractor Adjustments

Adjust the belt tension.

1. Maintain parallelism between the axes of the rotation of the drive sprocket and of the movable sprocket.
2. Position the movable sprocket stud for a minimum slack at the point of tightest engagement.
 - a. Insure that belt tension is not excessive.
 - b. Tighten the sprocket stud.

Position beveled ramps.

1. The point of the ramp must point in the direction opposite to the belt motion.
2. Position the ramp for a clearance to the respective sprocket hub of 0.002" to 0.007".
3. Clamp in position.

Position the tractor paper guides.

1. Align the edge of the paper guide nearest the door pivot plate flush to the pivot plate.
 2. Position the underneath side of the paper guide flush against the edge of the spacer plate.
 3. With the conditions in steps 1 and 2 established, secure both paper guide and mounting block with their front surfaces flush to the front edge of the spacer plate.
 4. Position the lower edge of the adjacent paper guide against the lower edge of the paper guide nearest the door pivot, maintaining the upper edges parallel.
 5. Fasten the adjacent paper guide to the tractor frame.
- Position the tractor door for a clearance of paper guide plates to the door runners of 0.048" to 0.056".

1. Loosen the pivot plate.
2. Screw the door stop in below the correct door setting.
3. Insert two sets of feeler gages with the correct setting.
4. Force the door against the feeler gages.
5. Tighten the pivot plate.
6. Set the door stop to hold the door at the correct clearance.

Position the form stop switch to make when the form stop lever is within 1/2" of the front surface of the paper guide.

Position Upper and Lower Tractor Drive Shafts

First, check the forms width vernier. Prepare to adjust the drive shafts.

1. Position the left forms tractors in the corresponding slots in the tractor guide bar.
2. Position the right forms tractors in the corresponding holes in the face of the movable slides.
3. Place a form in the forms tractors.

Check the position of the upper drive shaft to the lower tractor drive shaft. The form must fit in tractors with a minimum slack in paper. Feed the forms manually and check for no elongation of the pin feed holes (this may occur under power).

If the condition just described is met, the adjustment is complete. Replace any remaining parts in reverse order. If necessary, adjust the upper tractor drive shaft in relation to the lower tractor drive shaft.

1. Loosen the upper tractor shaft drive gear.
2. Manually rotate the shaft to remove slack.
3. Clamp the drive gear to the shaft.

Replace any remaining parts in reverse order.

Install Tractors

This procedure refers to both the upper and the lower assembly. Place the tractor shaft and the guide bar in relative positions on a flat surface.

Install the tractors on the drive shaft.

1. Slide the drive shaft through the square drive hub on the right tractor.
 2. Turn the left tractor drive until the pins line up with those on the right tractor and, at the same time, the drive hub lines up with the drive shaft.
 3. Slide the drive shaft through the square drive hub on the left tractor.
- Install the tractors on the guide bar. Slide the guide bar through right and left tractors.

Replace Tractor Shafts and Guide Bars

Place the tractors, the guide bar, and the tractor shaft in the machine.

1. Set the assembly in the machine.
2. Insert the screws in the slide-retainer plate and the guide bar at the left and turn the screws in a few turns.
3. Insert the holding screws at the right end of the guide bar and turn in until nearly snug.

Repeat this step for the other assembly.

Install the bearing caps.

1. Slide the bearing and bearing retainer ring in position.
2. Place the bearing cap in position.
3. Insert the two right bearing cap holding screws and tighten until almost snug.
4. Insert the two left bearing cap holding screws and tighten.
5. Snug up the bearing end screws.
6. Tighten the right bearing cap holding screws.
7. Tighten the bearing end screws.

Repeat this step for the other assembly.

Position the tractor guide bars.

1. Slide the tractors apart to extreme positions.
2. Position the tractor guide bars against the lip on the printer casting at the left.
3. Shift the guide bars horizontally to vertically position the left tractor pins on the upper guide bar within 0.002" of the left tractor pins on the lower guide bar. Use a straight edge laid along the tractor pins for determining vertical alignment.

Connect the vertical shaft of the forms width vernier.

1. Loosen the set screws in the vertical coupling and slide into engagement with the upper and lower shaft.
 2. Clamp the coupling to both shafts.
- Perform the following adjustments:
1. Adjust the forms width vernier.
 2. Position the upper and lower tractor drive shafts.
- Replace the remaining parts in reverse order.

Tractor Jam-Detection Device Adjustments

This applies to both upper and lower detention devices. Check the jam-detection device.

1. The jam bail must rest against both the left and right tractor doors.
2. The rear edge of the bail mounting brackets must be flush to the rear side of the forms support bar.
3. When applied at operating edge of bail, the bail movement must be free.
4. A force of 1/2 pound (225 grams) must move bail away from the tractor door.
5. The switch plunger must be 0.010" to 0.015" past the toggle point when the bail is resting against the tractor doors.
6. The switch plunger must be free of the bail when the tractor doors are opened against the form guide support bar.

If these conditions in step 2 are met, no further adjustment is necessary.

Adjust the jam-detection bail.

1. Loosen the bail mounting brackets.
 2. Rest the bail against both form tractors.
 3. Position the rear edge of the mounting bracket flush to the rear side of forms guide support bar within 0.005".
 4. Tighten the mounting bracket in position.
- Adjust bail torsion spring.
1. Loosen the lock nut on the spring stud.
 2. Turn the screw and tighten the lock nut.
 3. Check for a 1/2 pound force to move the bail away from the tractors.
 4. Re-adjust as necessary.
- Position the bail switch.
1. Loosen the holding screws.
 2. Insure that the jam bar is against the tractor cover.
 3. Locate the switch so that the switch plunger is moved 0.010" to 0.015" past the toggle point.
 4. Tighten the holding screws.

Forms Stacker Assembly Adjustment

1. Stacker tension springs are to be adjusted to feed rolls to a point of tangency without compressing spring. (Too much tension will tear the paper).
2. Bevel gears on countershaft assembly, and friction drive shaft assembly are to be positioned for .002" to .004" wink and alignment of the crown points of each gear; i.e., full tooth engagement.
3. If the teeth do not engage correctly, both shafts will have to be repositioned. Check again for .002" to .004" wink after obtaining the correct tooth engagement.

Base Adjustments

Grounding of Forms Carts

Adjust the forms cart guides so that their contact springs press firmly against the sides of both the front and rear carts when they are in position.

Level Left Shock Mount

Level the left shock-mount support casting so that it is parallel to the printer casting within 1/8" in the:

1. left to the right plane.
2. front to the back plane.

Adjust the two front and back jackscrews to obtain this.

Remove Translator Frame (Figure 2)

Prepare to remove the translator frame.

1. Remove the forms.
 2. Remove the top paper guide.
 3. Remove the paper guide at the bottom of the translator frame.
 4. Remove the front paper guide (below the translator frame).
 5. Remove the ground wire to the translator frame.
 6. Lower the translator frame to the lowest position with the vertical print alignment knob.
 7. Remove the bumper stop stud,
 - a. from the left end of the translator frame.
 - b. from the right end of the translator frame.
- Remove the tractor shafts and the tractor guide bars. Remove the T-casting. Remove the hammer unit. Free the translator frame.

1. Remove both eccentric stop studs at the bottom rear of the translator frame.
2. Loosen both eccentric stop studs at the bottom front of the translator frame.
3. Remove the clip on the horizontal print alignment vernier shaft.
4. Unscrew the vernier shaft from the translator frame.
5. Move the horizontal print alignment lever to the extreme right.
6. Remove the stop blocks at the top front of the translator frame.

Remove the translator frame.

1. Lift the translator frame just enough to take the full weight of the frame.
2. Slide the bottom of the frame so that the frame is clear of the printer casting.
3. Tilt the top of the frame to the rear, and withdraw the frame from the front of the machine.

Re-install in reverse order.

Perform the following adjustments:

1. Position the translator frame.
 2. Position the T-casting front to rear (field).
 3. Position the T-casting vertically (field).
- Replace the remaining parts in reverse order.

Position Translator Frame (Figure 2)

Check that the six guide rollers rest against their respective guiding surfaces. Adjust for 0.002" minimum clearance between the printer casting and both:

1. Upper front guide blocks.
2. Lower rear guide studs.
3. Lower front guide studs.

Check for freedom of movement of the translator frame along the printer casting.

Remove Movable Base (Figure 5)

Prepare to remove movable base.

1. Remove the ribbon.
2. Remove the type array (cartridge assembly).
3. Remove the cover over the terminal block on the rear of the T-casting.
4. Snap out the plastic oil reservoir under the T-casting.
5. Remove the upper shield over the print control dial.
6. Remove the screws in the front shield of the print control dial.
7. Remove the screws in the movable base front gibs.
8. Remove the lower ribbon guide.
9. Work enough slack in the read head cable (untape the cables if necessary) to allow the movable base to be lifted clear of the T-casting.

Remove the movable base.

1. Carefully lift the base up off the eccentric bearing blocks.
2. Carefully raise the base so that the print control dial assembly clears the T-casting lock lever so that read head cable is not damaged.

Reassemble in reverse order and adjust the movable base during reassembly.

Remove Movable Base Eccentric Shaft (Figure 5)

Prepare for removal.

1. First, remove the movable base.
2. Remove the forms thickness control lever sector. Free the movable base eccentric shaft.
1. Support the right end of the eccentric shaft and the

drive-out pin (the small end is up) in the forms thickness control lever.

2. Remove the forms thickness control lever from the shaft.
3. Remove the friction clamp from the right end of the shaft. NOTE: The friction clamp provides the necessary friction to hold the thickness control lever in position (A to E) without binding. The shaft must move in the friction clamp for operator setting of the thickness control lever.

4. Loosen the screws in the collar that holds the right eccentric bearing block, and slide the collar to the right.
5. Remove the screws under the T-casting that holds the left and the right bearing blocks to the T-casting.

Remove the eccentric shaft.

1. Lift the left end of the eccentric shaft so that it clears the T-casting.

2. Withdraw the shaft to the left, carefully sliding the shaft through the right eccentric bearing block. CAUTION: The right eccentric holds the oil line and the wick that oils the type array.

Replace the movable base eccentric shaft in reverse order and adjust the movable base during assembly.

Adjust Movable Base (Figure 5)

Remove the ribbon and type array.

Check the adjustment of movable base.

1. The two eccentric shaft support bearings are seated against the front shoulders of the recess in the T-casting.
2. A wink of 0.002" exists between the motor drive gear and the type idler gear *at the point of tightest engagement*.
3. The movable base sets on the T-casting with a maximum vertical clearance of 0.001".
4. The movable base slides freely in the horizontal plane.

If the conditions just stated are met, no further adjustment is necessary. Replace the remaining parts in reverse order.

Further prepare to adjust the movable base.

1. Remove the cover over the terminal block on the rear of the T-casting.
2. Snap out the plastic oil reservoir under the T-casting. Adjust the clearance of the eccentric shaft support bearings to the front shoulders of the recesses in the T-casting.
1. Set the print impression control lever to E.
2. Loosen the mounting screws (under the T-casting) for the eccentric shaft support bearing.
3. Position the bearing against the front recess in the T-casting with a maximum clearance of 0.001".
4. Tighten the mounting screws.

Adjust the movable base to the T-casting for a maximum clearance of 0.001".

1. Tighten the two front gibs that hold the movable plate to the T-casting (screws under T-casting).
2. Loosen the screws in the lower ribbon guide bar (two ears hold the movable base against the T-casting).
3. Press down hard on the movable base.
4. Press the ears of the lower ribbon guide bar against movable base.
5. Tighten the screws in the lower ribbon guide bar while maintaining pressure as stated in steps 3 and 4.

Adjust the clearance of the motor drive gear to the type idler gear. (Type array was previously removed.)

1. Loosen the adjusting block screw. (The block is under the movable base, and fits over the stud in the T-casting. It positions the movable base right to left.)

2. Turn the idler gear to obtain the tightest mesh with the motor drive gear.
3. Slide the movable base left to right to obtain a wink between the idler gear and the motor drive gear of 0.002" *at the point of tightest engagement*.
4. Tighten the adjusting block screw and recheck clearance. Wink must be present with no stress on motor shaft. Replace the remaining parts in reverse order.

Remove T-Casting (Figure 5)

Prepare for removal.

1. Remove the ribbon.
 2. Remove the ribbon drive unit.
 3. Remove the type array (cartridge assembly).
 4. Remove the wires to the T-casting.
 5. Remove the front cover.
 6. Remove the right cover.
 7. Remove the inner front cover.
- Remove the movable base (or remove the read head).

Free the hinge pin.

1. Open the T-casting.
2. Remove the ribbon guide and print line indicator from the hinge.
3. From the rear side of the T-casting, drive pins from
 - a. upper eccentric bearing.
 - b. lower eccentric bearing.
4. Loosen the collars on the hinge pin.
5. Remove the screw that is screwed into the hinge pin through the horizontal hole in the upper arm of the T-casting.
6. Carefully close and lock the T-casting.
7. Loosen the set screw in the upper hinge pin bushing.
8. Loosen the set screw that locks lower eccentric bearing.

Remove the T-casting.

1. Remove the hinge pin and catch parts as they are freed by hinge pin.
2. Unlock the T-casting while supporting the weight of the casting.
3. Slide the T-casting out toward the front to clear the translator frame.

Replace T-Casting (Figure 5)

Prepare to reinstall the T-casting.

1. Insure that the hinge pin will slide through all parts.
2. Slide the hinge pin through the upper bearing hole in the T-casting.
3. Thread the upper eccentric bearing on the hinge pin.
4. Thread the lower eccentric bearing on the hinge pin.
5. Slide the hinge pin into the lower bearing hole in the T-casting.

Locate the eccentric bearings in the T-casting to enable, in a later step after the T-casting has been installed, the pinning of bearings to the hinge pin.

1. Locate the lower eccentric bearing rotationally.
 - a. Rotate the bearing around the hinge pin so that high side of the eccentric is to the right.
 - b. Further rotate the bearing so that the high side of the eccentric rotates 45° toward the rear.
 - c. Work the eccentric into the lower bearing hole.
 - d. Insert the taper pin (finger tight) into the bearing and the hinge pin.
2. Locate upper eccentric bearing rotationally.
 - a. Rotate the upper bearing around the hinge pin until it lines up with the upper bearing hole.

- b. Work the bearing into the upper hole.
 - c. Insert the taper pin (finger tight) into the bearing and the hinge pin.
3. Position the bearings vertically.
 - a. Slide the hinge pin and bearings vertically until the horizontal screw hole in the hinge pin is at the same level as the center of the horizontal hole in the upper arm of the T-casting.
 - b. Insert the set screw and lock the lower eccentric bearing to the lower arm of the T-casting.
 - c. Remove the taper pins.
 - d. Withdraw the hinge pin.

Prepare the translator frame for the T-casting replacement.

1. Place the bushing in the upper arm of the translator frame and lock the bushing as high as possible in the arm.
2. Place thrust washer over the jackscrew in the lower arm of the translator frame, align the hole centers, and scotch-tape the washer to the jackscrew.

Set the T-casting into position.

1. Gather all loose parts that fasten to the hinge pin (including the hinge pin) and set them on the printer so that they will be close at hand when needed.
2. Lift the T-casting into position on the translator frame, keeping the right end high so that the thrust washer is not dislodged.
3. Actuate the T-casting lock lever until the latch just engages the latch catch.

Install the hinge pin.

1. Slide the hinge pin through the bushing in the upper arm of the translator frame.
2. Slide the hinge pin through the upper eccentric bearing in the upper arm of the T-casting.
3. Thread the hinge pin through the loose parts in correct order and in correct relation to the T-casting.
4. Slide the hinge pin into the lower eccentric bearing.
5. Slide the hinge pin through the thrust washer into the jackscrew.

Fasten the eccentric bearings to the hinge pin.

1. Align the lower pin hole in the hinge pin to the pin hole in the lower bearing.
2. Insert the taper pin into the holes just aligned.
3. Align the pin hole in the upper eccentric bearing to the upper pin hole in the hinge pin.
4. Insert the taper pin into the holes just aligned.
5. Drive in both taper pins.

Position the hinge pin.

1. Turn the hinge pin until the high side of the eccentrics are to the right.
2. Insert the screw through the hole in the upper arm of the T-casting, and screw through the hinge pin.
3. Free the bushing in the upper arm of the translator frame, and force the bushing against the T-casting.

Perform these adjustments:

1. Position the T-casting front to rear (field).
 2. Position the T-casting vertically (field).
 3. Adjust the ribbon shield assembly.
- Replace remaining parts in reverse order.

Position T-Casting (Factory)

Position the T-casting vertically (factory specification and adjustment).

1. The lower T-casting bushing to be located vertically to provide 0.570" ±0.005" between the lower surface of

the hammer unit mounting slot in the translator frame and the top right surface of the movable base.

2. Adjust the shock block on the T-casting to obtain this dimension measured between the lower surface of the hammer unit mounting slot in the left side of the translator frame and the top left end of the movable base.

Position the T-casting front to rear (factory specification and adjustment).

1. With the print impression control lever set at C, the face of the type is to be positioned a distance of $0.716'' \pm 0.002''$ and parallel to the rear surface of the upper tractor guide bar within $0.002''$. This may be accomplished by the simultaneous adjustment of the eccentric pivot pin on the right end of the T-casting and the gate latch bumper screw on the left end of the translator frame.

Position T-Casting Horizontally—Field (Figures 2 and 5)

This adjustment depends upon the hammer unit being located correctly front to rear and the type array and movable base being adjusted correctly on the T-casting. If doubt exists as to the correctness of these prerequisites, the factory adjustments must be used.

Prepare to position the T-casting horizontally.

1. Remove the forms from the machine.
2. Remove the ribbon shield and print line indicator at the hinge.
3. Remove the upper paper guide support bar.
4. Remove the hammer cover (nose cone).
5. Remove the ribbon.
6. Set the print impression control lever to C.

Check the positioning of the T-casting horizontally.

1. Lock or hold the T-casting against the gate latch bumper screw on the left.
2. Check for a clearance between the face of the hammers and the rear top lip of the type cartridge of $0.078''$ (slight drag).
3. Check for this clearance both to the left and to the right.
4. If the clearance is correct, no adjustment is needed.

Replace the remaining parts in reverse order.

Position the T-casting horizontally.

1. Loosen the hinge pin set screw at the lower right end of T-casting.
2. Turn the vertical eccentrics by turning the hinge pin with a screwdriver to obtain the correct clearance at the right end.
3. Tighten the hinge pin set screw.
4. Loosen the gate latch bumper screw lock nut.
5. Turn the gate latch bumper screw to obtain the correct clearance at the left end. The latch position must be adjusted correspondingly. This adjustment is accessible from the rear of the machine (Figure 5).
6. Tighten lock nut.

Replace remaining parts in reverse order.

Position T-Casting Vertically—Field (Figure 5)

This adjustment depends upon the hammer unit being located correctly front to rear and the type array and movable base being adjusted correctly on the T-casting.

Prepare to position the T-casting vertically.

1. Use a two-part form and strip off the last copy, leaving the last carbon exposed to the hammers.

2. Set up processing unit to print one line of alternate W's and M's.

3. Remove the ribbon.
4. Latch T-casting closed.
5. Set the print impression control lever to A.

Check the vertical positioning of the T-casting.

1. Print one line of alternate W's and M's.
2. Open the T-casting.
3. Remove the forms.
4. Observe the imprint of the characters on the hammers.
5. If the imprint is located evenly between the upper and lower edges of the hammer faces, no further adjustment is necessary. Replace the ribbon.

Adjust the vertical position of the T-casting.

1. Position the right end of the T-casting.
 - a. Loosen the hinge pin bushing set screw in the upper arm of the translator frame.
 - b. Loosen the lower jackscrew lock nut on the lower right arm of the translator frame.
 - c. Turn the upper jackscrew lock nut to obtain the vertical adjustment.
 - d. Tighten the lower jackscrew lock nut.
 - e. Force the hinge pin bushing down and tighten the set screw.
2. Position the left end of the T-casting.
 - a. Loosen the chock block on the T-casting to obtain the vertical adjustment.
 - b. Slide the chock block on the T-casting to obtain the vertical adjustment.
 - c. Clamp the chock block to the T-casting.
3. Position the ribbon shield and the print line indicator. Refer to that adjustment.
4. Recheck the vertical position. Replace ribbon.

Adjust T-Casting Latch (Figure 3)

Remove the interlock switch cover. Check the adjustment of the T-casting latch.

1. Open the T-casting.
 - a. Operate the interlock detent and move the lock lever to the latched position (handle resting against stop stud).
 - b. Check that the high side of the eccentric is toward the front and provides positive locking action (high side $8^\circ \pm 1^\circ$ above the horizontal).
 - c. Check that the interlock switch just makes when the latch handle is $\frac{1}{16}''$ from the latch handle stop stud.
2. Close the T-casting.
3. Check that a 2- to 6-pound force (applied at the center of the ball) is required to operate latch.

If the conditions just stated are met, no further adjustment is necessary. Replace the interlock switch cover.

Position the eccentric shaft.

1. Open the T-casting.
2. Move the T-casting lock lever to the latched position (the handle resting against the stop stud).
3. Loosen the clamp screw in the handle.
4. Position the high side of the eccentric toward the front.
5. Further position the high side of the eccentric above the horizontal so that the latch just provides a positive locking action ($8^\circ \pm 1^\circ$ above the horizontal).
6. Clamp the handle to the eccentric shaft.

Adjust the interlock switch.

1. Position the latch handle $\frac{1}{16}''$ from the latch handle stop stud in latching position.

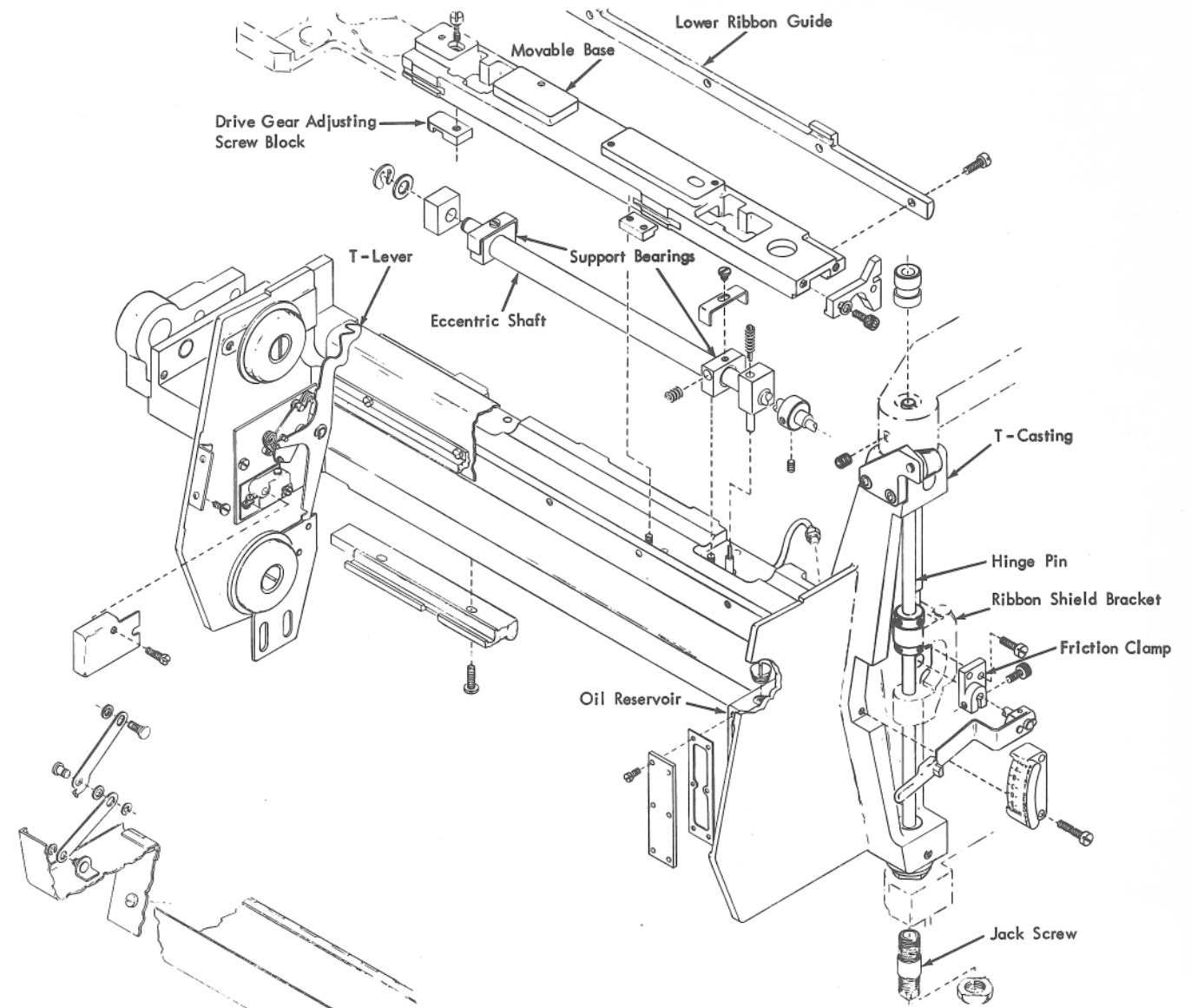


Figure 5. T-Casting

2. Position the interlock switch actuator on the eccentric shaft so that the interlock switch just makes.
3. Lock the actuator to the shaft.

Position the gate latch catch (Figures 2 and 3).

1. Loosen the gate latch catch holding screws.
2. Latch T-casting closed.
3. Turn the gate latch adjusting screw (socket head) to draw the T-casting against the gate latch bumper screw (hex head).

Adjust the latching force.

1. Turn in on gate latch adjusting screw $\frac{1}{16}''$ turn.
2. Tighten the holding screws.
3. Latch the T-casting and observe the latching force.
4. If the latching force is 2 to 6 pounds applied at the center of the ball, the adjustment is correct.
5. If the latching force is not correct, loosen the gate latch catch holding screws and re-adjust the adjusting screw as necessary.
6. Tighten the holding screws.

Replace interlock switch cover.

Type Array (Cartridge Assembly)

Type Array Removal

1. Remove the ribbon.
 2. Remove the four allen head screws which hold the type array.
 3. A stud at the right in the type array fits into a slot in the movable base to position the right end of the type array front to rear.
 4. The boss on the bottom of the drive sprocket fits into the bearing hole of the timing disk to align the left end of the type array front to rear and left to right.
 5. Lift out the array.
- Replace in reverse order. Be certain that the cartridge seats firmly on the base. Replace the ribbon.

Type Array Disassembly — Out of Machine (Figure 6)

1. First, read the following steps and decide which are necessary for the job at hand. *The platen should not be removed from the center plate. The factory adjustment of*

the four eccentric screws should not be changed. Also, notice that for a visual inspection, steps 3, 4 and 5 are not necessary. The steps are given so that a complete procedure will be available, if it is needed.

2. Prepare to disassemble the type array.
 - a. Remove the ribbon guide bar.
 - b. Loosen the three drive sprocket stud-holding screws.
 - c. Place the array upside down on a flat surface with the drive sprocket to the left.
 - d. Remove the six screws that hold the lower plate to the center plate.

CAUTION: Do not disturb the adjustment of the eccentric adjusting screws.

- e. Carefully remove the lower plate.
3. Chain removal procedures: Exercise extreme caution to *never* bend the chain in a smaller radius than the normal idler pulley radius. Failure to observe this causes the chain to kink or, possibly, to break.

- a. Remove the screw and washer in the drive sprocket stud.
- b. Remove the screws that hold the drive sprocket stud without turning the assembly over. This can be done by moving the assembly over the edge of the bench (table, etc.) far enough to get at the screws.
- c. Support the drive sprocket and chain, and remove the drive sprocket stud without turning the assembly over.

- d. Free the chain from the idler pulley end first by lifting the chain up and off the idler pulley. Carefully drape this end of the chain across the center of the idler pulley *being extremely careful not to kink the chain by causing it to bend in too small a radius.*
- e. At this point the chain is still engaged with the drive sprocket. Grasp chain carefully both front and rear and slide it to the left so as to free it from the drive sprocket. Do not use force. *Be careful not to kink the chain.*

- f. Remove the chain from the center plate and the drive sprocket from the idler pulley end. Be careful not to kink the chain.

- g. Carefully place the chain in a bath of IBM 6 oil until it is ready for re-assembly. *The receptacle for the oil bath must be large enough to accept the chain without causing damage due to kinking.*

4. Do not remove the platen from the center plate. This assembly is bonded and ground for alignment and clearance of the platen to the lips of the upper and lower plates.

5. Check the condition of the bond. If the bond is unsatisfactory (resulting in a tight chain), the cartridge should be replaced.

6. Idler pulley removal: To replace the idler pulley or lubricator,

- a. Turn the array over and rest it on the center plate.
- b. Remove the screw that holds the idler pulley stud.
- c. Remove the six screws that hold the upper plate to the center plate.

CAUTION: Do not disturb the adjustment of the eccentric adjusting screws.

- d. Turn the unit over so that the center plate is up.
- e. Lift the center plate and separate it from the upper plate far enough to permit removal of the idler pulley and stud without damaging the platen or lubricator spring.

7. Carry out chain cleaning procedure prior to reassembly of type array.

Center and Upper Plate Reassembly — Flat Idler Spring (Figure 6)

Assemble the center and upper plates.

1. Remove the type idler from the type idler stud.
2. Install the type idler stud to the upper plate.
 - a. Place the upper plate upside down on a flat surface.
 - b. Insert the type idler stud into its recess on the upper plate.
 - c. Insure that the stud is free of binds and that the spring returns the stud to the right.
 - d. Lift the upper plate and fasten the stud to it.
3. Install the center plate and the type idler to the upper plate.
 - a. Place the upper plate upside down on a flat surface.
 - b. Place the type idler in the correct relationship to the center plate.
 - c. Work the center plate and the type idler into position against the upper plate.
 - d. Fasten the type idler to the type idler stud.
 - e. Lift the upper plate and insert the upper plate holding screws.
 - f. While holding the upper plate against the eccentric adjusting screws (pushing the lip on the plate *away from the platen*), tighten the upper plate holding screws. The contact between the plate and the two eccentrics *must* be on the surface of the eccentric *away from the print line side of the cartridge.*

Center and Upper Plate Reassembly—Coil Idler Spring (Figure 6)

Assemble the center and upper plates.

1. Place the upper plate upside down on a flat surface.
2. Place the type idler with the stud and compression spring in correct relationship with the center plate.
3. Insure that the idler assembly is free to slide in its slot in the upper plate.
4. Lift the type array; insert the upper plate holding screws, and screw in until they are snug.

Chain to Type Array Reassembly (Figure 6)

1. Clean chain prior to re-installation in the array. *Use no solvents.*

- a. Soak the chain in a bath of IBM 6 oil while it is out of the array. Allow the chain to lie horizontally. Do not hang it vertically because of the danger of kinking or trapping foreign material between the type slugs. The receptacle for the oil *must be large enough to accept the chain without causing damage by kinking.*

- b. Lay the chain on a flat surface for cleaning ink and ribbon waste from the type with a brush. Brush the chain as it is held straight, *not where it is curved and the type slugs are open* as this is apt to force dirt between the "butts" of the type slugs. Use a stiff brush such as an IBM typewriter brush. Use a sweeping motion, *do not jab or dig with the brush.*

- c. Place the chain in a clean IBM 6 oil bath, and work the chain in the oil for several minutes.

- d. Repeat steps b and c until the chain looks clean. (Foreign material in between slugs will break a chain. Also, kinking the chain between slugs will break it.)
- e. Place the chain on a pad of paper towels to drain for 15 minutes before it is reassembled in the type array.

2. Prepare to reassemble the chain to the type array.
 - a. Loosen the holding screw for the type idler stud,

move the type idler to the left against the spring tension, and snug the holding screw to hold the type idler in this position.

- b. Place the upper plate upside down on a flat surface with the type idler to the right.

- c. Adjust the lubricator so that
 - (1) it does not touch the side of the type idler.
 - (2) it extends $\frac{1}{2}$ " beyond the periphery of the type idler.

- d. Place the drive sprocket in the center plate with
 - (1) the slot aligned left to right.
 - (2) the slot positioned toward the front so that it lies between the platen (at the front) and the bearing of the drive sprocket (at the center).

3. Reassemble the chain to the type array.
 - a. Carefully pick up the chain so that it does not kink.
 - b. Align the 9 with the filled slot stamped 9 in the drive sprocket. The 9 is on the "9 0" type slug.
 - c. Slide the drive sprocket $\frac{1}{4}$ " to the left keeping the 9 aligned with the slot.
 - d. Taking care to maintain timing, pick chain up front and back and slide to right. *Do not stress chain or use force in any way.*
 - e. Opposite end may now be placed over the idler pulley.

4. Because the upper plate is upside down, *insure that the chain is upside down.*

5. The type slugs are now on top of the lip of the upper plate. The chain must be aligned flat against the platen so that slugs will slip into position between the platen and lip.
 - a. Stroke the body of the slugs along the length of the type array just above the lip and below the type face.
 - b. *Do not use force.* Difficulty in getting slugs to slip between the platen and the lip of the upper plate may be an indication of a kinked chain or loose platen.

6. Fasten the type drive sprocket to the upper plate without turning the assembly over.

- a. Move the assembly over the edge of the bench (table, etc.) far enough to insert the drive sprocket stud; insert the stud.
- b. Insert and tighten the screw that holds the drive sprocket to the stud.
- c. Insert and tighten the drive sprocket stud holding screws.

7. Check the chain for freedom and alignment.
 - a. Insure that the chain rotates freely without binds.
 - b. Insure that the "9" is aligned with the slot in the drive sprocket.
 - c. Insure that the chain is installed correctly.

8. Loosen the holding screw for the type idler stud to permit the spring tension to help hold the chain in position.

- Lower Plate to Type Array Assembly (Figure 6)
1. Reassemble the lower plate.
 - a. Place the type array upside down on a flat surface with the drive sprocket to the left.
 - b. Carefully work the lower plate into position on the center plate, insuring that the lip on the lower plate slides over the chain.
 - c. Insure that the chain is under the lip of the lower plate.
 - d. Insert the six holding screws.
 - e. Stand the cartridge up on the upper and lower plates so that the print side of the cartridge is up.

- f. Loosen the six holding screws in each plate (upper and lower) to permit the weight of the center plate and chain to position the center plate. The bottoms of the eccentric dowels (side away from the platen) are resting on the holes in the upper and lower plates.
 - g. Tighten all holding screws.

2. Position the type idler.
 - a. Loosen the holding screw for the type idler stud to free the idler. Be certain the idler can move with the spring tension.

CAUTION: Block can be misaligned if loosened too much.

- b. Lift the sprocket end of the type array and stand the type array on the right end of a $.30^\circ$ angle (type idler down).

- c. Using your right thumb and middle finger, place your thumb on one side of the chain, your finger on the other. Work slack into the chain down from the drive sprocket end of the chain to the type idler end of the chain. Do this approximately four times.

- d. Tighten the holding screw in the type idler stud to the upper plate. Insure that the stud is not inadvertently knocked out of its slot in the upper plate.

- e. Check the position of the type idler stud by holding the type array so that the chain will hang down from between the upper and lower plates. Rotate the chain approximately 2° right and left a few times to insure that the chain will assume a natural drape down from the center plate. At the center of the type array, one half of the body of the type slug should be visible below the edge of the upper and lower plates.

3. Again check the chain for freedom and alignment.

- a. Insure that the chain rotates freely without binds by spinning the chain rapidly by hand in the normal direction of rotation. It should "coast" slightly after the finger is removed.

- b. Some spots of drag may be felt when the chain is turned very slowly. This does not necessarily indicate a bind as long as it meets the requirement of step a.
- c. Insure that the 9 is aligned with the slot in the drive sprocket.
- d. Insure that the chain is installed correctly.

4. Check the chain for freedom and clearance.

- a. The chain must move freely (with 400 to 600 gram force).

CAUTION: Do not use gram gage.

- b. Clearance between the lips on the upper and lower plates and type slugs must not exceed 0.003". Shadow printing results from this.

5. If the conditions of step 4 are not met,

- a. Do not disturb the factory adjustment of the eccentric adjusting screws.
- b. Check the re-assembly procedure.

- (1) Is the type idler stud positioned to give proper tension on the chain?

- (2) Is the chain correctly positioned beneath the lips of the upper and lower plates?

- (3) Was the chain properly cleaned with foreign material removed from between the type slugs?

- (4) Are the upper and lower plates correctly positioned against the four eccentric adjusting screws?

- (5) Was the chain lubricator (by the type idler) correctly positioned?

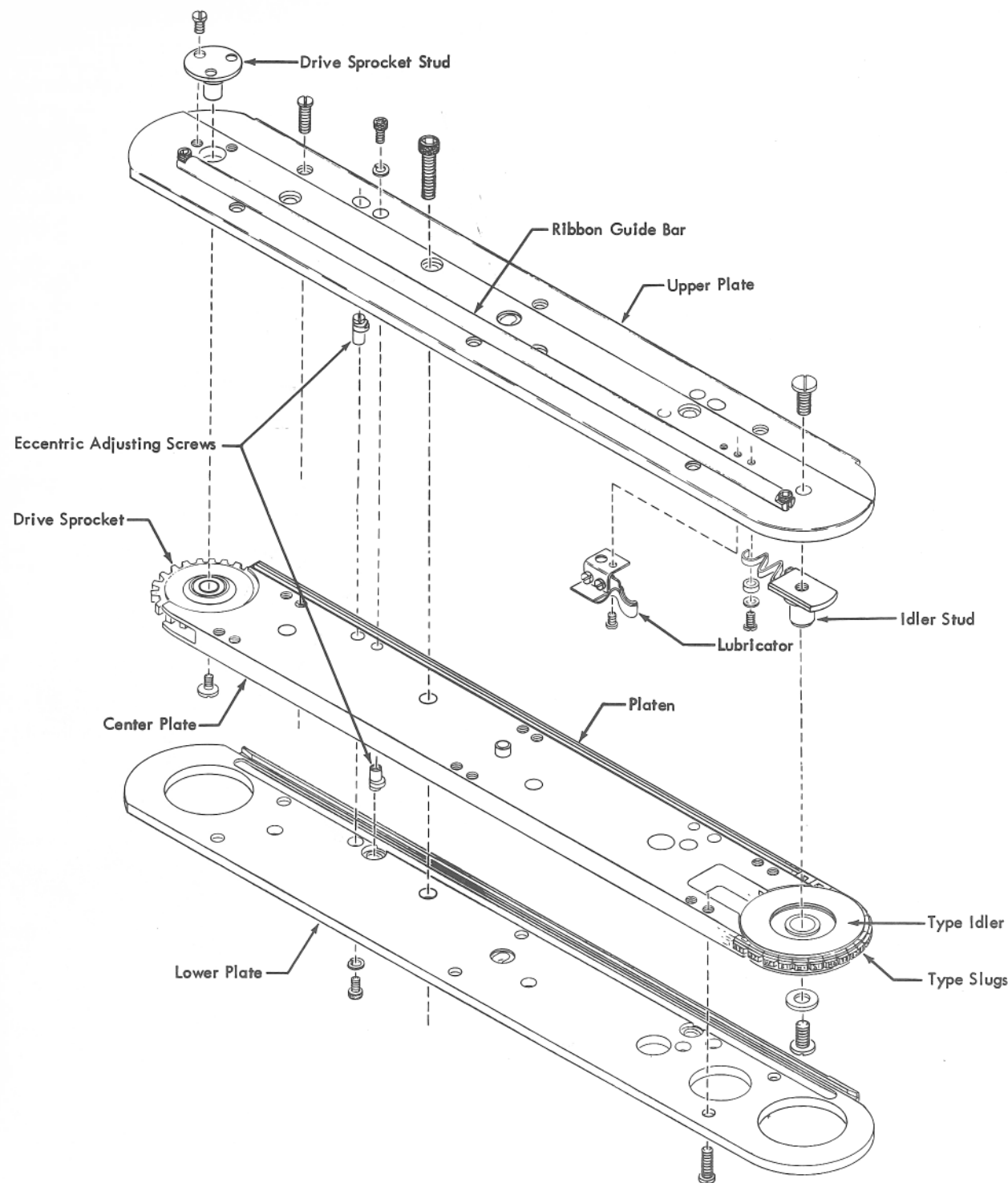


Figure 6. Type Array (Cartridge Assembly)

6. The factory adjustment of the eccentric adjusting screws for the upper and lower plates (two for each plate) should be changed *only in an emergency*. This adjustment sets the clearance between the platen (or the type slugs) and the lips of the upper and lower plates. This also adjusts the relationship between the drive sprocket and the path of the chain past the platen. The chain must travel in a

path that is tangent to the drive sprocket where the chain leaves the sprocket. In an emergency situation an attempt to make this adjustment can be made by adjusting the plates as close to the chain as possible with no binding of the chain. It should move freely with 400 to 600 gram force. *Do not use gram gage.*

7. Replace the ribbon guide bar.

Adjust Magnetic Read Head (Figure 3)

1. Remove the ribbon and type array.
2. Check the adjustment of the magnetic read head.
 - a. The read head must be positioned to obtain a clearance to the periphery of the magnetic timing disk of 0.003" to 0.001".
 - (1) Do not use a feeler gage between the read head and timing disk. The feeler gage may be shaved, and these shavings will form a flux bypass at the slots.
 - (2) Use a sheet of paper (carriage tape is good) to determine the high spots by inserting paper between the read head and the timing disk and rotating disk.
 - (3) Remove the paper.
 - b. At a timing speed of 750 rpm, minimum read head output voltage must be 100 millivolts peak to peak.
3. If the conditions stated in step 2 are met, no further adjustment is necessary. Proceed to step 5.
4. If the conditions stated in step 2 are not met, do one or more of the following:
 - a. check for cold solder joints at amplifier wire wrap.
 - b. magnetize the timing disk.
 - c. replace the read head.
 - d. replace the read head and magnetize timing disk.
5. Replace the remaining parts in reverse order.

Magnetize Timing Disk

1. Remove the 1403 cover on the right side.
2. Check that the connections to the amplifiers do not have cold solder connection at the wire wrap.
3. Use an edge connector insert that has a 2-watt 300-ohm resistor connected between pins Q and B, and has pin D jumpered to pin J.
4. Magnetize the timing disk.
 - a. Remove amplifier one.
 - b. Remove amplifier two.
 - c. Insert the altered edge connector into amplifier one receptacle.
 - d. Turn on the system power.
 - e. Run the timing disk for a few revolutions.
 - f. Turn off the system power.
 - g. Remove the edge connector.
 - h. Replace the amplifiers.
5. Check the output and rise time of the head signal.
6. If the rise time is slow, repeat step 4 but use an altered edge connector that has the 300-ohm resistor connected between pins Q and D and has pin B jumpered to pin J. This is necessary because of a reverse charge on the drum.
7. Check the output and rise time of the head signal.
8. Replace the cover on the right side.

Hammer Unit

Hammer Unit Removal (Figure 7)

1. First, glance through the following steps and decide which are necessary for the job at hand.
2. Prepare for removal.
 - a. Remove the forms.
 - b. Remove the top forms guide.
 - c. Remove the service mounts from the inside of the left front cover.
 - d. Slide the rear forms stacker down out of the way.
 - e. Open the rear door and remove the inside rear cover.
 - f. Remove the air hose and place out of way.

- g. Loosen the service mount holding screws on the translator frame.
- h. Install the service mount and tighten the screws.
- i. Remove the hammer unit holding screws.
3. Slide the hammer unit out on the service mount.
4. Disconnect the hammer unit from the printer.
 - a. Remove the rear cover from the unit.
 - b. Tilt the hammer unit up and remove the upper and lower covers over the magnets.
 - c. Separate quick disconnect electrical connections.
 - d. Tilt the hammer unit to the normal position and remove the cable brackets with the cables attached.
5. Remove the hammer unit from the service mount.
 - a. Tilt the hammer unit up (hammers up).
 - b. Remove the clips on the service mount hand screws.
 - c. Remove the hand screws.
 - d. Place your forearms with palms of hands up under hammer unit.
 - e. Carefully lift the hammer unit with both arms until the hammer unit is free of the service mount.
 - f. Tilt the unit toward you so that it cannot fall.
 - g. Withdraw the unit clear of the machine.
 - h. Place the unit on a flat surface.

6. Carefully re-install the hammer unit in reverse order. **CAUTION:** Do not let the unit drop. Insure that the magnet leads do not bind or interfere with magnet armatures when the covers are installed.

Position the Hammer Unit - Factory

1. Position the hammer unit front to rear (factory specification and adjustment).
 - a. The positioning of this unit is to be made with the T-casting locked in place and the print impression control lever set at C.
 - b. The hammer unit is to be positioned in the translator frame so that the front surface at both ends of the hammer unit casting (at print level) are located a distance of 1.3715" ±0.0015" from the face of the type characters.
 - c. Any single-type slug as measured at the ends of the type array must be parallel to the front surface of the hammer unit frames within 0.001".

Position the Hammer Unit - Field (Figure 7)

1. This adjustment depends upon the T-casting being located correctly front to rear and the type array and movable base being adjusted correctly on the T-casting. If doubt exists as to the correctness of these prerequisites, the factory adjustments must be used.
2. Prepare to position the hammer unit horizontally.
 - a. Remove the forms from the machine.
 - b. Remove the ribbon shield and print line indicator.
 - c. Remove the upper paper guide support bar.
 - d. Remove the hammer cover (nose cone).
 - e. Remove the ribbon.
 - f. Set the print impression control lever to C.
3. Check the positioning of the hammer unit horizontally.
 - a. Lock the T-casting against the gate latch bumper screw on the left.
 - b. Check for clearance of 0.078" between the hammer face and cartridge lip or 0.083" between the hammer and the type face.
 - c. Check for this clearance both to the left and to the right.
4. If the conditions of step 3 are met, no further adjustment is necessary. Proceed to step 6.

5. Position the hammer unit horizontally.
 - a. Loosen the hammer unit mounting screws (2 allen head screws).
 - b. Hold the hammer unit bushing stop (2).
 - c. Loosen the bushing stop lock nut (2).
 - d. Turn the hammer unit bushing stop in the direction of desired adjustment.
 - e. Tighten the bushing stop lock nut.
 - f. Tighten the hammer unit mounting screws.
 - g. Recheck the hammer unit position.

Hammer Magnet Assembly Removal

1. Prepare to remove hammer magnet.
 - a. Slide the hammer unit onto the service mount. (See *Hammer Unit Removal*)
 - b. Remove the cover over the hammer magnets.
 - c. Remove quick disconnect that goes to the hammer magnets.
 - d. Remove the hammer mounting bar assembly.
2. Remove the hammer unit magnet assembly.
 - a. Remove the magnet lead from quick disconnect fitting, using special removal tool P/N 461043.
 - b. Remove the holding screws for the hammer magnet assembly.
 - c. Lift the assembly from the mounting.
3. Replace the hammer magnet assembly.
 - a. Place the assembly into the mounting.
 - b. Insert the mounting screws and screw to fit snug.
 - c. Insert the eccentric adjusting tool and position for approximately the same air gap between the armature and the core at the coil end as other assemblies.
 - d. Tighten the mounting screws.
 - e. Insert the magnet leads into the quick disconnect plug.
4. Replace the remaining parts in reverse order.
5. Print and adjust hammer flight time as necessary.

Individual Hammer Magnet Coil Replacement

Only the upper hammer magnet coils may be replaced without removing the individual hammer magnet assembly from the hammer casting frame. By "upper" and "lower" is meant the configuration of the coil of the hammer magnet assembly, not the location on the hammer casting frame.

To attain access to either upper or lower hammer magnet assembly and to remove a lower hammer magnet assembly for coil replacement, refer to *Hammer Magnet Assembly Removal*. The upper hammer magnet assembly is P/N 474061 (qty. 50 or 66) and the lower is P/N 474060 (qty. 50 or 66). The individual coil for both is P/N 474051 (qty. 100 or 132).

1. After determining that the coil is defective, remove old coil by prying, cutting or driving it off the core using care not to disturb or damage the yoke itself.

2. Completely remove old adhesive remaining on core using IBM cleaning fluid, P/N 450608. Do not put cleaner on nylon residual.

3. Coat the four side surfaces of the core with 3M (EC 232 or 826) cement P/N 261096 using care not to allow any adhesive to touch top face of core. Do not use excessive amount.

4. Allow a minimum of two minutes for cement to set.
5. Place on new coil, pressing it to the bottom of the yoke.

6. Allow 15 to 20 minutes for the adhesive to dry. (Exposure to moderate heat will lessen drying time.)

Hammer Removal

1. Prepare for removal.
 - a. Open the T-casting.
 - b. Open the upper and lower forms guide support bars.
 - c. Remove the forms and move the tractors apart to their extreme limits.
 - d. Remove the binary paper guides from the tractor guide bars.
 - e. Remove the hammer cover.
 - f. Remove holding screws for the print impression control bar.
 - g. Slide the print impression control bar with the hammers and hammer mounting bar attached from the hammer unit. Do not handle the hammer springs.
 - h. Place the assembly on a flat surface.
2. Remove the hammer.
 - a. Remove the dowel screws that hold the impression control bar to the hammer mounting bar.
 - b. Carefully slide the print impression control bar out from inside the hammer assemblies.
 - c. Lift the hammer mounting bar and remove the hammer holding screw.
 - d. Lift out the hammer by gripping the base. Do not bend or scratch the springs.
3. Re-install in reverse order. Install the square inner surface of the hammer to the rear. Keep the rubber of the print impression control bar to the rear. Do not damage the hammers when inserting the print impression control bar. Visually inspect the hammer installed. Spacing between adjacent hammers should be 0.014" to 0.022".
4. Replace the remaining parts in reverse order.
5. Check the printing. If the spacing between the adjacent printed characters is different, it will be necessary to adjust the hammer magnet armature air gap.

Ribbon Unit

Ribbon Drive Unit Removal

1. Prepare for removal.
 - a. Remove the ribbon.
 - b. Remove the cover over the ribbon and drive.
 - c. Remove the wires to the ribbon drive unit.
2. Remove the ribbon drive unit.
 - a. Loosen the two screws on the right in the upper ribbon casting mounting gib.
 - b. Remove the three screws on the left in the gib.
 - c. Slide the drive unit to the left and raise it to clear the lower mounting bar.
 - d. Lower the drive unit to clear the upper gib.
3. Reassemble in reverse order, and position the unit during reassembly.

Position Ribbon Drive Unit

1. Locate the sense finger.
 - a. Engage the shift lever in the right stop position.
 - b. Loosen the screws in the lower support bar.
 - c. Position the left edge of the sense finger a maximum of $14 \frac{9}{64} \pm \frac{1}{64}$ " from the left upper base of the T-casting on which is mounted the ribbon spool-center.
 - d. Insure that the drive unit is as far to the right as possible in its locating slot when doing step c.
 - e. Tighten the screws in the lower support bar.

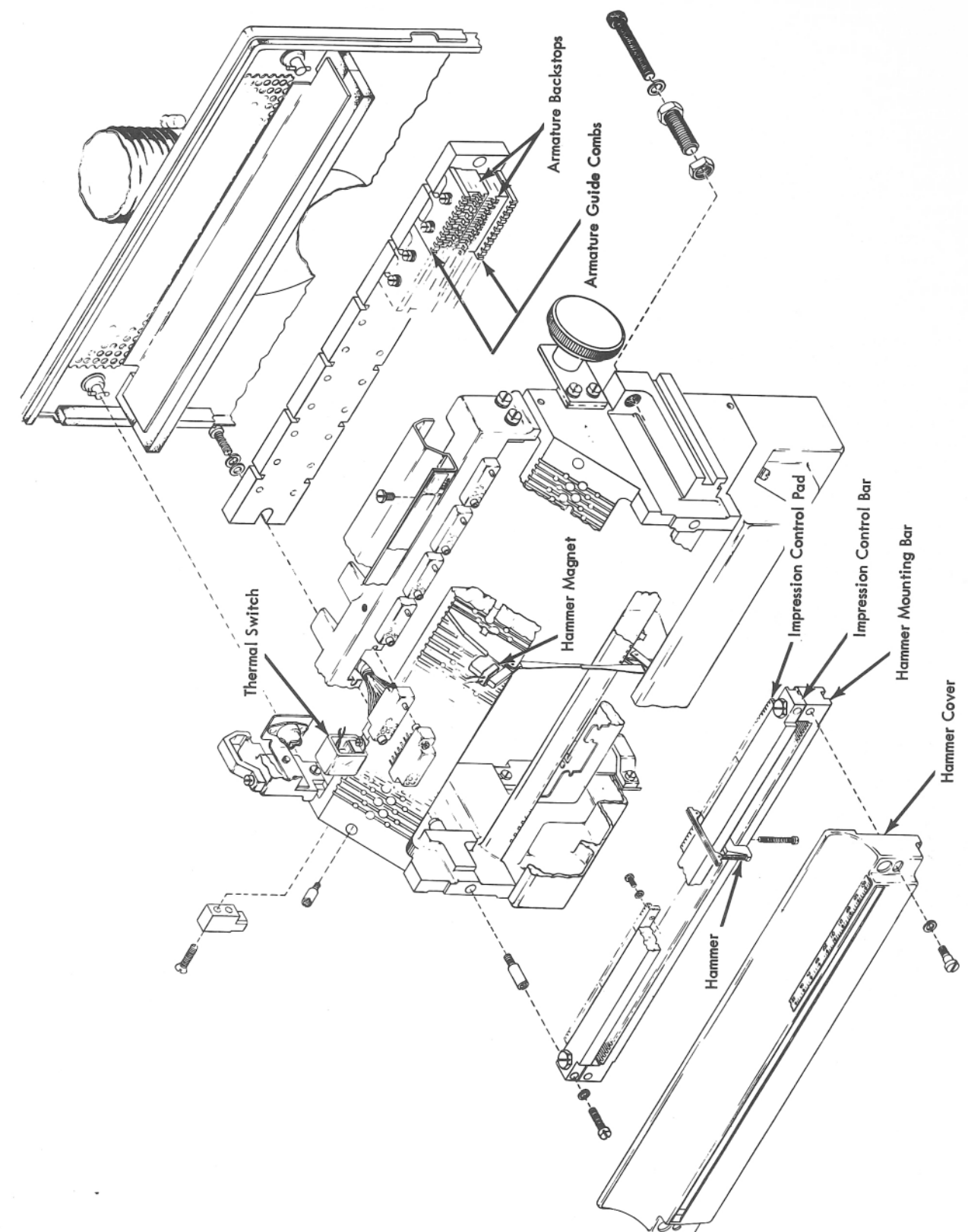


Figure 7. Hammer Unit

2. Provide freedom of movement.
 - a. Loosen the screws in the upper ribbon casting mounting gib.
 - b. Position the gib for a minimum clearance (0.003") to the ribbon casting without binding the casting as the unit is moved throughout its lateral range.
 - c. Tighten the screws in the gib.

Adjust Ribbon Skew

1. First insure that the ribbon drive unit
 - a. is adjusted correctly.
 - b. is located correctly.
2. To adjust for the ribbon to skew to the left when slightly unwinding from the upper spool, loosen the nut on the left hand ribbon spool center and push the shaft to the rear.
3. Adjust the angle of the correction roller on the correction arm (if adjustable) so that the ribbon
 - a. corrects to the right.
 - b. winds onto the upper spool with the best right edge alignment.
4. The eccentric in the ribbon skew wheel should be adjusted to assure clearance between the wheel and the ribbon when the skew lever is in the latched position.

Adjust Ribbon Shield and Print Line Indicator

1. Prepare to adjust ribbon shield assembly.
 - a. Open the T-casting.
 - b. Remove the ribbon.
 - c. Set the print impression control lever to E.
2. Check the adjustment of the ribbon shield and print line indicator for the following:
 - a. that the key on the ribbon shield bracket enters freely into the slot in the right end of the movable base.
 - b. that the left end of the ribbon shield bracket enters freely into the slot in the left end of the movable base.
 - c. that the ribbon shield is parallel to the top surface of the movable base within 0.005".
 - d. that the inner surface of the ribbon shield is within 0.005" to 0.008" of the lower cartridge ribbon guide at both ends.
 - e. that the double-headed screw has a clearance between the rear side of the inner head and front of the ribbon shield extension of 0.004" to 0.006".
 - f. that when the T-casting is being closed, the key slot on the left end of the ribbon shield permits free entry of the key on the translator frame.
3. If the conditions as stated in step 2 are met, no further adjustment is necessary. Proceed to step 9.
4. Position the ribbon shield bracket.
 - a. Loosen the collars on the T-casting hinge pin.
 - b. Position the ribbon shield bracket so that the key on the ribbon shield bracket enters freely into the slot in the right end movable base.
 - c. Tighten the collars on the T-casting hinge pin.
5. Position ribbon shield vertically.
 - a. Loosen the screws in the ribbon shield support.
 - b. Position the ribbon shield so that the key on the left end of the ribbon shield enters freely into the slot in the left end of the movable base.
 - c. Tighten the screws in the ribbon shield support.
6. Position the ribbon shield horizontally for a clearance of 0.005" to 0.008" to the cartridge lower ribbon guide.

- a. Turn the two set screws in the ribbon shield bracket at the right end of the movable base.
- b. Turn the set screw in the key slot at the left end of the movable base.
7. Position the double-headed screw,
 - a. with the ribbon shield set as in step 6.
 - b. for a clearance between the rear side of the inner head and the front face of the ribbon shield extension.
 - (1) at the right end of the movable base.
 - (2) of 0.004" to 0.006".
 - (3) by turning the screw.
 - c. Lock the screw in place.
8. Position the key slot on the left end of ribbon shield.
 - a. Loosen the key slot block mounting screws.
 - b. Position the ribbon shield in the movable base.
 - c. Lift the key slot block with the left middle finger, keeping the thumb on the type array and reaching around the left end of the T-casting.
 - d. Carefully close the T-casting while aligning the slot block to the key.
 - e. Lock the T-casting closed.
 - f. Tighten the upper slot block mounting screw.
 - g. Open the T-casting.
 - h. Tighten the lower slot block mounting screw.
9. Replace the ribbon.

Lower Ribbon and Brake Assembly Removal (Figure 8)

1. Remove the cover over the ribbon assembly.
2. Remove the ribbon.
3. Remove the cover over the lower ribbon drive.
4. Move the ribbon drive unit to the left.
5. Remove the retaining clip from the ribbon spindle shaft.
6. Remove the ribbon spindle shaft. CAUTION: Do not lose the key.
7. Remove the retaining clip from the drive gear shaft.
8. Remove the ribbon drive and brake assembly.
9. Re-assemble in reverse order.
 - a. Be certain the key is in the ribbon spindle shaft.
 - b. As the ribbon drive and brake assembly is installed, the reverse drag pawl must be lifted to engage the reverse drag friction ring.
 - c. Check the reverse drag pawl by turning the spindle. The upper pawl should ratchet when the upper spindle is turned in a counterclockwise direction when viewed from the spindle end. The lower pawl should ratchet when the lower spindle is turned in a clockwise direction when viewed from the spindle end.

Upper Ribbon Drive and Brake Assembly Removal (Figure 8)

1. Remove the cover over the ribbon assembly.
 2. Remove the ribbon.
 3. Remove the ribbon motor drive gear cover.
 4. Remove the sense arm spring.
 5. Remove the retaining clip to free the sense arm.
 6. Remove the sense arm assembly.
 7. Remove the cover over the upper ribbon drive.
 8. Move the ribbon drive unit to the left.
- CAUTION: Nylon friction disk will probably drop as the cover and spider spring assembly are removed. Remove the disk.
9. Remove the retaining clip from the ribbon spindle shaft.

10. Remove the ribbon spindle shaft. CAUTION: Do not lose the key.
11. Remove the horseshoe clip from the drive gear shaft.
12. Remove the ribbon drive and brake assembly.
13. Re-assemble in reverse order.
 - a. Be certain the key is in the ribbon spindle shaft.
 - b. As the ribbon drive and brake assembly is installed, the reverse drag pawl must be lifted to engage the reverse drag friction ring.
 - c. As the upper ribbon drive cover is installed, the nylon friction disk must be held in position and the spider spring must engage it properly.
 - d. Check the reverse drag pawl by turning the spindle. The upper pawl should ratchet when the upper spindle is turned in a counterclockwise direction when viewed from the spindle end. The lower pawl should ratchet when the lower spindle is turned in a clockwise direction when viewed from the spindle end.

Disassemble Ribbon Drive and Brake Assembly (Figure 8)

1. After the removal of the drive and brake assembly, stand the assembly up with the compression plate on top.
2. While holding the compression plates against spring tension, remove three horseshoe clips.
3. Remove the upper compression plate, taking care not to lose six compression springs which are now free.
4. Remove the six springs.
5. Remove the lower compression plate.
6. Remove the friction ring. CAUTION: Note the direction of the teeth on the friction ring. The teeth on the upper drive friction ring are opposite to the teeth on the lower drive friction ring. Therefore, these rings can be incorrectly assembled.
7. The friction surfaces of the friction ring, spool driver, and lower compression plate should be clean and free from oil.
8. Re-assemble in reverse order.
 - a. Insure that none of the six compression springs are lost.
 - b. Be certain that the friction ring is not installed backwards. After the assembly is in the machine, the upper pawl should ratchet when the upper spindle is turned in a counterclockwise direction when viewed from the spindle end. The lower pawl should ratchet when the lower spindle is turned in a clockwise direction when viewed from the spindle end.

Ribbon Clutch Adjustment - Out of Machine (Figure 8)

1. Prepare to adjust the ribbon clutch.
 - a. Remove the cover and the ribbon assembly.
 - b. Remove the ribbon.
 - c. Move the ribbon drive unit to the left.
 - d. Remove the cover over the left side of the lower ribbon drive.
2. Remove the lower ribbon drive (not necessary for clutch removal).
 - a. Remove the horseshoe clip on the lower ribbon drive assembly.
 - b. Remove the lower ribbon drive.
3. Free the ribbon clutch.
 - a. Remove the horseshoe clip on the ribbon clutch shaft.

- b. Remove the screws in the clutch magnet housing.
- c. Remove the clutch magnet housing.
4. Remove the ribbon clutch.
 - a. Hold the clutch shaft drive gear in the left hand to prevent it from falling.
 - b. Remove the ribbon clutch toward the right.
5. Check the adjustment of the ribbon clutch for
 - a. a clearance between the pinion and the shoulder on the clutch shaft of 0.001" to 0.004". NOTE: Step 5a applies to both tooth-style and friction clutches. Steps 5b through 8 apply to tooth-style clutches only.
 - b. a clearance between the clutch armature and the clutch drive ring of 0.028" to 0.032" when serrations in the armature are mated with the serrations in the cylindrical assembly.
 - c. a minimum clearance between serrations on the armature and on the cylindrical assembly of 0.003" when the armature is seated against the drive ring.
6. If conditions stated in step 5 are met, no further adjustment is necessary. Proceed to step 9.
7. Position the cylindrical assembly.
 - a. Seat the ribbon clutch output pinion against the cylindrical assembly.
 - b. Position the cylindrical assembly for a clearance between the pinion and the shoulder on the clutch shaft of 0.001" to 0.004".
 - c. Lock the cylindrical assembly to the shaft.
8. Adjust the clutch drive gear assembly for correct engagement (Figure 8).
 - a. Seat the pinion against the cylindrical assembly.
 - b. Push the armature to engage the serrations.
 - c. Position the clutch armature drive ring for a clearance to the armature of 0.028" to 0.032". A double set of screws (four, two in each hole) hold the ring.
 - d. Tighten the setscrews in the armature ring.
 - e. Seat the armature against the drive ring.
 - f. If a clearance between the serrations of the armature and the cylindrical assembly of 0.003" minimum does not exist, repeat adjustments from step c.
9. Replace the clutch shaft assembly in the machine, taking care that the small key stays in the shaft and that the shaft goes through the output pinion inside the drive housing. The clutch pinion and the output pinion must engage their gear trains as this reassembly is done. (A light pin-punch mark in the side of the key will help keep it in place if it is loose.)
10. Replace the clutch magnet.
11. Replace the horseshoe clip on the clutch shaft.
12. Check the clutch operation under power by manually operating the reversing arm.

Ribbon Drive Motor Positioning (Figure 8)

1. Position the motor gear.
 - a. Loosen the clamp screws.
 - b. Position the gear so that the correction lever arm and the sense finger arm are operated by the roller on the gear and so that gear meshes with both clutch shaft drive gears (0.040" between the motor bushing and the motor gear).
 - c. Tighten the clamp screws.
2. Position the motor.
 - a. Loosen the motor holding screws.
 - b. Position the motor to provide a wink of 0.001" to 0.005" between the motor drive gear and the clutch shaft drive gears at a point of tightest engagement.

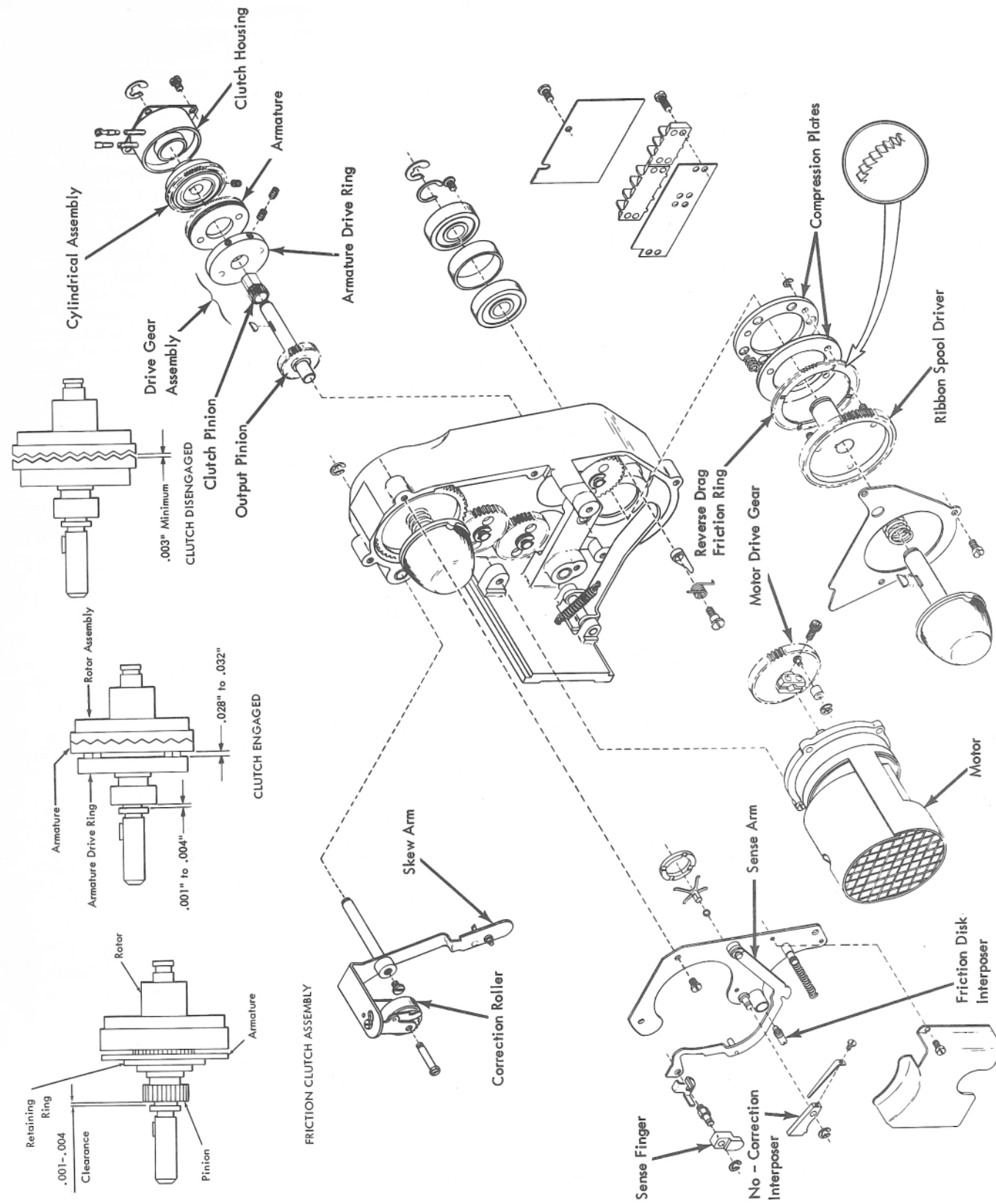


Figure 8. Ribbon Drive Unit

Hydraulic Unit

Hydraulic Unit Removal (Figure 9)

1. Remove the 1403 covers.
 - a. Remove the front cover.
 - b. Remove the rear cover.
 - c. Remove the top cover.
 - d. Remove the right cover.
 - e. Remove the front inner cover.
2. Clear the rear forms stacker area.
 - a. Slide the rear forms guide down.
 - b. Unfasten the negator spring from the rear forms guide.
 - c. Slide the negator spring all the way up.
3. Remove the gear guards.
 - a. Remove the guard over the emitter.
 - b. Remove the guard over the hydraulic drive belt.
 - c. Remove the guard over the stacker gears.
4. Remove the emitter.
 - a. Move the translator frame to the left.
 - b. Loosen the set screws that can be reached in the emitter collar.
5. Remove the emitter brush block arm.
 - a. Remove the arm spring.
 - b. Remove the holding screw.
 - c. Remove the retainer screw, retainer spring, and spring block.
 - d. Remove the emitter brush block arm.
 - e. Remove the emitter brush block arm pivot collar.
6. Prepare to remove hydraulic unit.
 - a. Remove the sense amplifier mounting plate.
 - b. Remove the blower.
 - c. Drain the oil from the reservoir.
 - d. Remove the carriage tape tension idler mounting plate.
 - e. Remove the screws from the rear heat sink resistor panel.

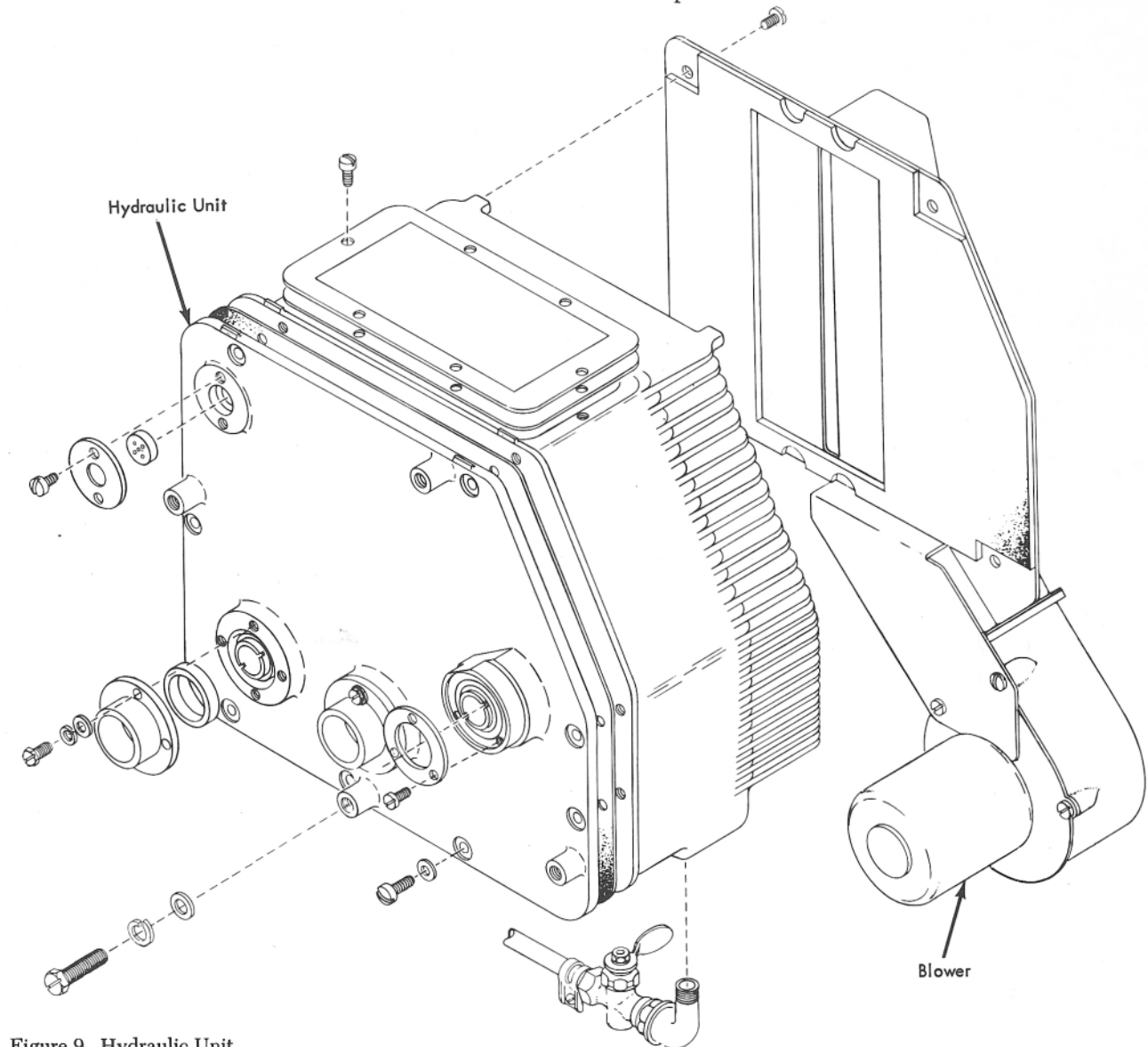


Figure 9. Hydraulic Unit

7. Free the hydraulic drive unit.
 - a. Remove the electrical connections.
 - (1) Remove the top cover on the reservoir.
 - (2) Unplug the wires within the unit.
 - (3) Remove the two screws in the plug on the left of the unit.
 - (4) Remove the wires from the unit.
 - (5) Replace the cover over the opening in the top of the reservoir, and replace two screws to hold the cover.
 - b. Remove the drive belt.
 - (1) Loosen the electric motor mounting screws.
 - (2) Lift the motor enough to free the drive belt.
 - (3) Clamp the motor at this position so that it may be used for support later.
 - (4) Remove the drive belt.
 - c. Remove three holding screws nearest the front (total of 4) for the hydraulic unit (in the reservoir mounting plate fastened to the printer casting).
 - (1) Remove the front holding screw.
 - (2) Remove the center lower holding screw.
 - (3) Remove the center upper holding screw.
8. Consider the problem of removing the hydraulic unit. The unit is now being held by the rear mounting screw and the boss around the output shaft. Care must be used not to damage this shaft as the unit is removed. If possible, it is recommended that two men remove this unit. The unit must be withdrawn straight out to the right until the output shaft is clear. The electric motor can be used as a rest while supporting the unit.
9. Remove the hydraulic unit.
 - a. Support the unit.
 - b. Remove the rear mounting screw.
 - c. Remove the unit straight out.

Hydraulic Unit Replacement

1. Use the utmost care in replacing this unit.
2. Follow the removal steps in the reverse order.
3. *Do not fill the hydraulic unit with used fluid.* Fill it with one gallon of new fluid (P/N 477567) which will provide the proper level (approximately to the bottom of the coils). Insure that the fluid drain is closed before filling.
4. Make any adjustments that are reflected by the work done inside the unit, and always include these:
 - a. the emitter brush.
 - b. the tape brushes dynamically.

Hydraulic Unit Reservoir Removal (Figure 9)

1. Remove the 1403 covers.
 - a. Remove the front cover.
 - b. Remove the rear cover.
 - c. Remove the top cover.
 - d. Remove the right cover.
 - e. Remove the front inner cover.
2. Determine whether the reservoir mounting plate (fastened to printer casting) has the reservoir fastened to it from the left or from the right.
3. If the reservoir is fastened from the left,
 - a. remove the hydraulic unit (See *Hydraulic Unit Removal*).
 - b. proceed to step 5.
4. If the reservoir is fastened from the right,
 - a. drain the oil from the reservoir.
 - b. remove the sense amplifier mounting plate.

- c. remove the blower.
- d. remove the carriage tape idler mounting plate.
- e. remove the screws from the rear heat sink resistor panel.
5. Remove the reservoir. Sixteen screws hold it in place.
6. Replace in a similar manner, but in reverse order.
7. Replace the remaining parts in reverse order.

Remove Control Valve Assembly (Figure 10)

1. Remove the 1403 covers.
 - a. Remove the front cover.
 - b. Remove the rear cover.
 - c. Remove the top cover.
 - d. Remove the right cover.
 - e. Remove front inner cover.
2. Determine whether the reservoir mounting plate fastened to the printer casting has the reservoir fastened to it from the left or from the right.
3. If the reservoir is fastened from the left,
 - a. remove the hydraulic unit. (See *Hydraulic Unit Removal*.)
 - b. Remove the reservoir. Eight screws hold it in place.
 - c. Remove the valve body assembly. Four screws hold it in position.
 - d. Proceed to step 10 of reassembly.
4. If the reservoir is fastened from the right, prepare to remove the reservoir.
 - a. Drain the oil from the reservoir.
 - b. Remove the sense amplifier mounting plate.
 - c. Remove the blower.
 - d. Remove the carriage tape idler.
 - e. Remove the screws from the rear heat sink resistor panel reservoir.
5. Remove the reservoir. Sixteen screws hold it in place. They are all accessible from the right.
6. Remove the wires from the terminal strip for the control magnets.
7. Remove the valve body assembly. Four screws hold it in place.
8. Replace in a similar manner but in reverse order.
9. Replace the remaining parts in reverse order.

Hydraulic Unit Reassembly (Figure 10)

1. The channel plate assembly should never be separated from the reservoir mounting plate (P/N 444320), unless a pump or motor is replaced.
2. Any time the hydraulic unit is disassembled where the channel plate assembly is separated from the reservoir mounting plate (P/N 444320), it is essential that the supporting bearing for the input shaft of each pump and for the output shaft be re-adjusted upon assembly.
3. Reassemble the channel plate assembly to the reservoir mounting plate as follows:
 - a. Insert the holding screws and leave them loose.
 - b. Place the aligning tool (P/N 450980) around the output shaft of the motor and over the boss on the reservoir mounting plate.
 - c. This tool will insure that the output shaft is centered in relation to the outside circumference of the boss. Consequently, the output shaft will be in alignment with the supporting bearing in the casting of the carriage.
 - d. Tighten the holding screws to fasten the channel plate assembly to the reservoir mounting plate.
 - e. Remove the aligning tool.

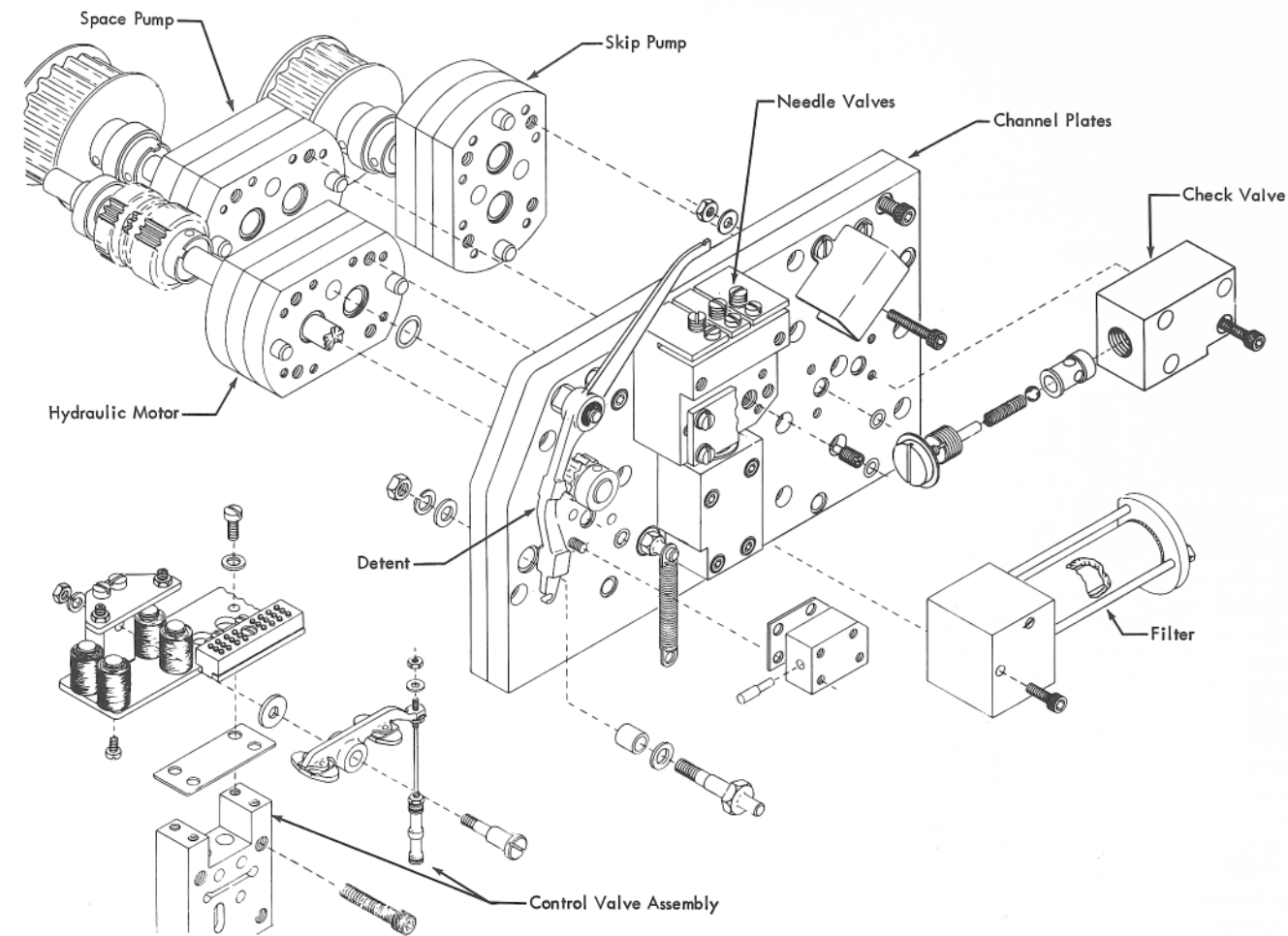


Figure 10. Hydraulic Unit—Exploded View

4. Install the pump and the motor oil seals. It is advisable to use new oil seals for the space pump and the skip pump to minimize the possibility of leakage.
5. Reassemble the components, with the exception of the pump pulleys, on the shafts of the pumps and on the shaft of the motor. Support each shaft as these components are pinned to it to prevent any bending of the shaft.
6. Reinstall the outboard bearing flanges as follows:
 - a. Slide the outboard bearing flanges in place around the pump shafts and snug the holding screws.
 - b. Each shaft must be able to rotate freely.
 - (1) Rotate each shaft through at least 360° to check for freedom from binds.
 - (2) It may be necessary to re-adjust the outboard bearing flange by tapping lightly into the correct position.
 - c. When the shaft rotates freely without binds, tighten the holding screws to fasten the outboard bearing flange securely.
 - d. Recheck each pump shaft for freedom of rotation after the holding screws have been tightened.
7. Reinstall the pulleys on the shafts, and fully support each shaft to prevent bending as the pulley is pinned to the shaft.
8. Check or make (as required) all hydraulic unit adjustments that can be made with the reservoir removed.

9. Replace the valve body assembly. Four screws hold it in position.
10. Replace the reservoir. Sixteen screws hold it in place.
11. Make the following replacement and adjustments:
 - a. replace the hydraulic unit.
 - b. adjust the space needle valve.
 - c. adjust the skip needle valve.
 - d. adjust the bypass needle valve.
 - e. adjust the single-space single shot.
 - f. adjust the emitter brush.
 - g. adjust the carriage tape brushes dynamically.

Hydraulic Pump Drive Belt Tension

Shift the drive motor in its slots to obtain $\frac{1}{8}$ " to $\frac{1}{2}$ " deflection of the belt halfway between the drive motor and the eject pump with a force of one pound (about 450 grams).

Carriage Controls

Space Control Magnets Adjustments

1. Spacing and skipping failures are usually caused by circuit malfunctions, in particular, the emitter brushes. The hydraulic unit is quite reliable; it should be the last place to check for malfunctions.

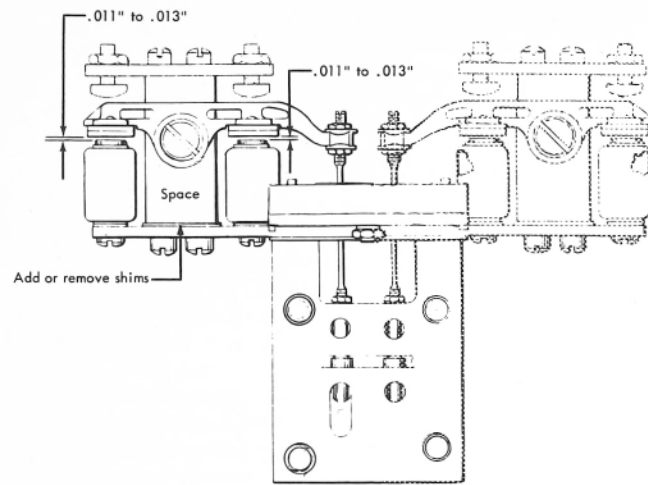


Figure 11. Positioning Space Magnet Armature

2. Remove the valve body assembly.
3. Turn off the printer main-line switch and leave off to prevent the operation of the carriage drive motor. Some of the following adjustments require that the system power be on so that the hydraulic unit space start and space stop magnets can be energized.
4. Add or remove the shims under the pivot support block to obtain .011" to .013" clearance between the start and stop magnet cores and the armature (Figure 11). The nominal clearance between the armature and the magnets when in the neutral (de-energized) position is 0.011" to 0.013". Some spool valve units have a 0.011" to 0.014" clearance which is correct. The spool valve adjustments are not critical. Normally, this adjustment will have to be changed only if related parts have been replaced.
5. Energize space stop magnets.
 - a. Connect the wires to the space stop magnets.
 - b. Insulate (tape) individually the ends of the other wires.
 - c. Turn on the system power.
6. With the space stop magnet energized, adjust the back stop screw nearest the operating rod for .005" to .008" clearance (preferably .005") between the armature and the stop magnet cores (Figure 12).
7. Turn off the system power.

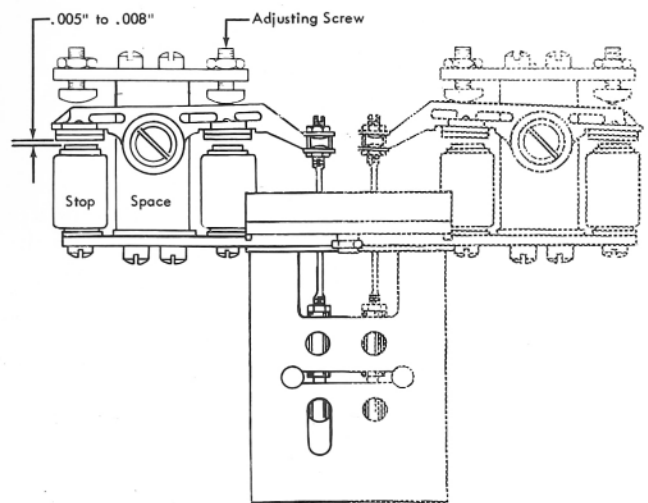


Figure 12. Space Magnet Stop Position

8. Energize space start magnets.
 - a. Remove the wires from the space stop magnet terminals and insert into the space start magnet terminals.
 - b. Turn on the system power.
9. With the space start magnet energized, adjust the backstop farthest from the operating rod for .005" to .008" clearance (preferably .005") between the armature and the start magnet cores (Figure 13).

NOTE: If it is objectionable to use a steel feeler gage in the preceding steps because of the attraction of the energized control magnets, the use of an IBM card to obtain these adjustments is permissible.
10. Slow operation will result from a clearance of less than .005". There are no residuals on the armatures or cores.
11. Turn off the system power.
12. Whenever this adjustment has been made, the space control valve adjustments must be checked or made.

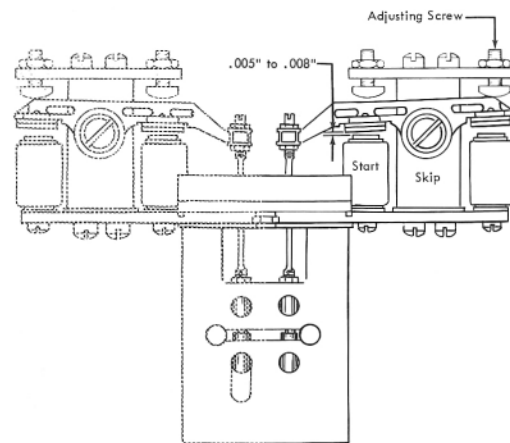


Figure 13. Space Magnet Start Position

Space Control Valves Adjustments

1. First, check, or adjust the space control magnets.
2. Insure that at least half of the lower threaded portion of the operating rod is screwed into the control valve and that the locking nut at the upper end of the control valve is tight.
3. Turn on the system power.
4. With the space start magnet energized, adjust the nuts at the top of the operating rod for .009" to .011" clearance between the top of the valve and the top surface of the rectangular port in the valve body (Figure 14).
 - a. This should result in .009" to .015" clearance between the bottom of the valve and the lower surface of the rectangular port with the stop magnet energized and the armature in the stop position (Figure 15).
 - b. The nominal adjustments of the .011" to .013" clearance and the .005" to .008" clearance for the control magnets will result in a .020" to .024" control valve travel.
 - c. If the .009" to .015" clearance does not fall within the prescribed dimensions, the space control magnets must be re-adjusted within tolerance, to obtain the correct clearance.
5. Turn off the system power.
6. Turn the tab on the lockwashers over to keep the nuts from loosening during operation.
7. Replace the valve body assembly.

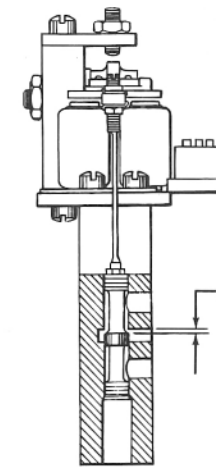


Figure 14. Space Valve Start Position

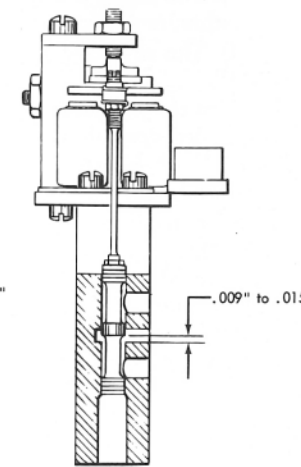


Figure 15. Space Valve Stop Position

Skip Control Magnets Adjustments

NOTE: Adjust in the same manner as Space Control Magnets Adjustments.

Skip Control Valve Adjustments

NOTE: Adjust in the same manner as Space Control Valves Adjustments.

Hydraulic Detent Stop Adjustments

1. Raise the tape brushes to prevent any possible damage to them during this adjustment (if the reservoir can be removed with hydraulic unit in machine).
2. Remove the reservoir that encloses the hydraulic unit.
3. Insure that the carriage is turned only in the forward direction. The emitter brushes may be damaged if the carriage is turned backwards (if the reservoir can be moved with hydraulic unit in machine).
4. Position the backstop with the high side of the eccentric down. This causes the detent arm pounding to tighten the holding nut.
5. Adjust the detent backstop for a clearance of .020" to .025" between the detent arm and the detent wheel when the arm is held against the backstop (Figure 16).
6. Replace the reservoir that encloses the hydraulic unit.

Space Needle Valve Adjustments

1. Set up the carriage.
 - a. Remove the paper from the carriage.
 - b. Tape the form stop contacts closed.
 - c. Engage the manual clutch in either the 6 or the 8 lines-per-inch position.
 - d. Install an unpunched carriage tape.
 - e. Lower the tape brushes.
2. Start the carriage by depressing the carriage restore key.
3. Before adjusting the needle valve, allow the carriage to idle for at least fifteen minutes to bring the oil temperature up to operating level. The hydraulic unit should be hot to the touch before the needle valve adjustments are made.
4. Loosen the lock screw for the center needle valve (the center right screw, Figure 17).

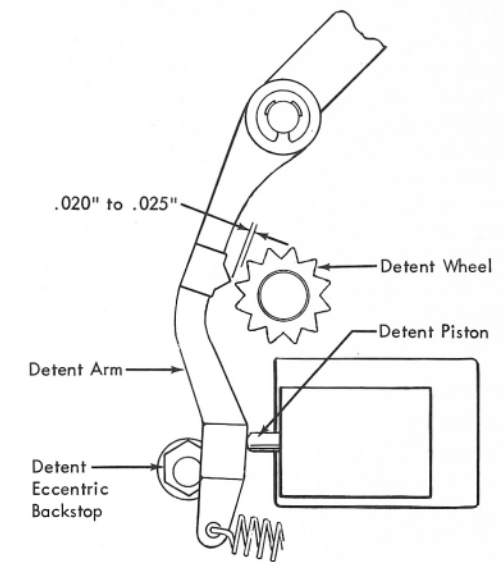


Figure 16. Detent Adjustment

5. Adjust the needle valve to cause the detent to nip as follows:
 - a. Hold a screwdriver against the detent arm at the notch.
 - b. Back off on the center left screw (Figure 17) until you can feel the detent nip the detent wheel. The impact will be transmitted through the screwdriver.
6. Adjust the needle valve to cause the detent to stop nipping:
 - a. Turn down on the center left screw until the detent stops nipping.
 - (1) Press down on the screwdriver, and feel the play between the detent arm and the detent stop stud.
 - (2) Turn down screw gradually until all play disappears.
 - b. Tighten the lock screw (the center right screw).
7. After this adjustment has been made, the skip needle valve must be adjusted.

Skip Needle Valve Adjustment (2-Speed Carriage Machines)

1. First, the space needle valve must be adjusted.
2. Set up the carriage. Check that
 - a. there is no paper in the carriage.
 - b. the form stop contacts are closed.
 - c. the manual clutch is engaged.
 - d. unpunched carriage tape is installed.
 - e. the tape brushes are lowered.
3. Start the carriage in a programmed skip to 1 before print. This should result in a skip to 1 at high speed with no stop impulse available.
4. Loosen the lock screw for the skip needle valve (the front right screw, Figure 17).
5. Adjust the skip needle valve as follows:
 - a. hold a screwdriver against the detent arm at the notch.
 - b. back off on the front left screw (Figure 17) until you feel the detent nip the detent wheel. The impact will be transmitted through the screwdriver.
 - (1) If no nipping is detected after turning out a maximum of five turns, stop the carriage motor so

that the hydraulic pumps are not moving. Turn down on the front left screw until it is closed. Then back off five full turns on this screw. Tighten the lock screw (the front right screw).

(2) If nipping is detected, adjust the needle valve to cause the detent to stop nipping. Turn down on the front left screw until the detent stops nipping. Press down on the screwdriver, and feel the play between the detent arm and the detent stop stud. Turn down screw gradually until all play disappears. Tighten the lock screw (the front right screw). Stop the carriage. After this adjustment has been made, the bypass needle valve must be adjusted.

Bypass Needle Valve Adjustments

- First, the following adjustments should be made:
 - the space needle valve.
 - the skip needle valve (on machines with two-speed carriage).
 - the single shots within the system that pertain to the carriage.
- Insure that the following adjustments are correct:
 - the tractors.
 - the tractor drive shafts.
 - the single-shots within the system that pertain to the carriage.
- Insure that the emitter brush is just fully made on a segment of the emitter.
- Set up the carriage.
 - Place the paper in the carriage.
 - Program for triple space before print.
 - Engage the manual clutch in the 6 lines-per-inch position.
 - Remove the upper front paper guides.
- Loosen the lock screw for the bypass needle valve (the rear right screw, Figure 17).

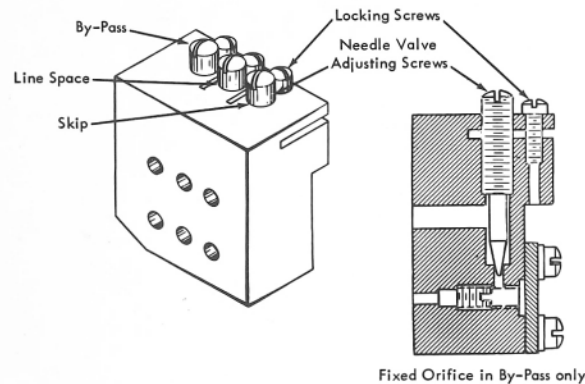


Figure 17. Needle Valves

- Turn in on the bypass needle valve (rear left screw) until it is closed.
- Disengage the detent arm by pressing down in the notch with a large screwdriver.
- Start the carriage by depressing the start key.
- Adjust the bypass needle valve as follows:
 - Draw line graphs across the paper while it is feeding.
 - Use the jam bar as a guide.
 - Move the pencil at a rate that will show from 4 to 10 triple spaces on a sheet 11 inches wide.

(3) Too much pencil pressure can cause a drag on the paper, and, therefore, an erroneous graph.

(4) The resulting graph should be similar to Figure 18.

- Turn out on the bypass needle valve until the line graph just resembles Figure 19. Turn out an additional $\frac{1}{8}$ or $\frac{1}{4}$ turn and lock in this position.
 - Tighten the lock screw (the rear right screw).
- Stop the machine.
 - After this adjustment has been made, the following must be adjusted:
 - the emitter brush.
 - the single-space single shot.
 - the tape drive sprocket and the carriage brushes.

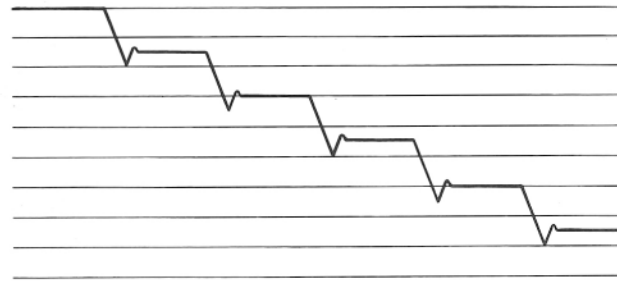


Figure 18. Bypass Closed Detent Inoperative

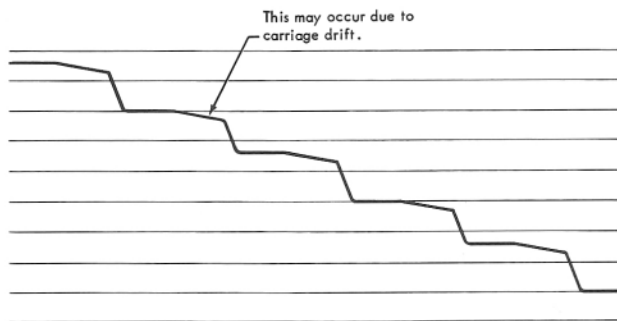


Figure 19. Bypass Adjusted Correctly

Single-Space Single-Shot Adjustments

- Insure that no binds exist when you manually turn the forms advance knob with the 6-8 knob in neutral.
- Set up the carriage.
 - Check that paper is in the carriage.
 - Check that upper front paper guides are removed.
 - Check that manual clutch is in 6 lines-per-inch drive position.
 - Program for single space before print.
- Start the carriage by depressing the start key.
- Draw line graphs on the paper while it is feeding.
 - Use the jam bar as a guide.
 - Move the pencil at the rate that will show from 4 to 10 single spaces on a sheet 11 inches wide.
 - Too much pencil pressure can cause a drag on the paper, and, therefore, an erroneous graph.
 - The resulting graph should be similar to Figure 20.
- Adjust single-space single-shot to produce the desired result (E2 brush single shot in 1401 system).

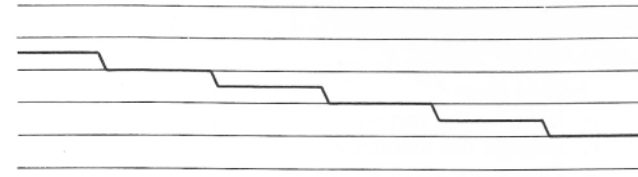


Figure 20. Single-Shot Adjusted Correctly

Emitter Brush Adjustments

- Insure that no binds exist when you manually turn the forms advance knob with the 6-8 knob in neutral.
- Set the emitter brushes in the brush holder for a projection beyond the brush holder of $\frac{3}{32} \pm \frac{1}{4}$ ".
- Set up the carriage.
 - Check that the paper is in the carriage.
 - Check that the upper front paper guides are removed.
 - Check that the manual clutch is in 6 lines-per-inch drive position.
 - Program for triple space before print.
- Start the carriage by depressing the start key.
- Draw line graphs on the paper.
- Shift the brush assembly until the line graph appears as shown in Figure 21.
 - There may be a slight overshoot (maximum allowable $\frac{1}{2}$ " on these graphs).
 - Some overthrow may be necessary on triple space 6 lines-per-inch to prevent excessive pull-in on double space 8 lines-per-inch.
- Check brush setting for double space.
 - Set the manual clutch to 8 lines-per-inch drive position.
 - Program for double space before print.
 - Start carriage and draw line graphs.
- Re-adjust the brush assembly as required for the best line graph of
 - double space 8 lines-per-inch.
 - triple space 6 lines-per-inch.
- After this adjustment has been made, adjust the tape drive sprocket and the carriage brushes.

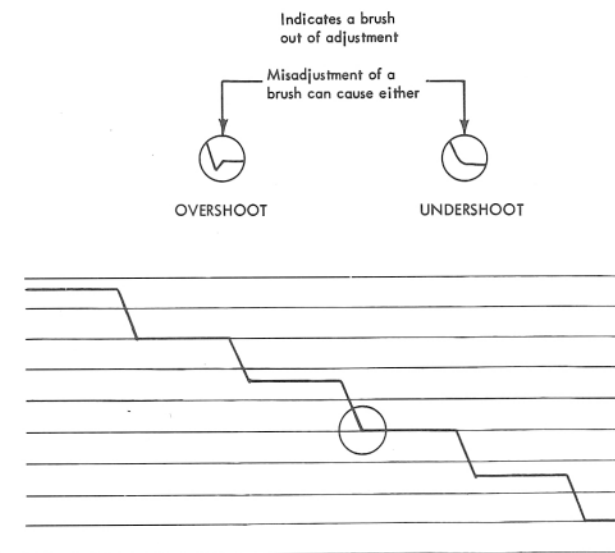


Figure 21. Emitter Brush Adjusted Correctly

Carriage Tape Brushes (Statically) Adjustments (Figure 23)

1. Position the tape brushes for $1" + \frac{1}{2}" - 0"$ projection from the brush holder (Figure 22). CAUTION: The range of adjustment should be held as close as possible because of possible difficulties in timing the stop brushes to the E1 brush.

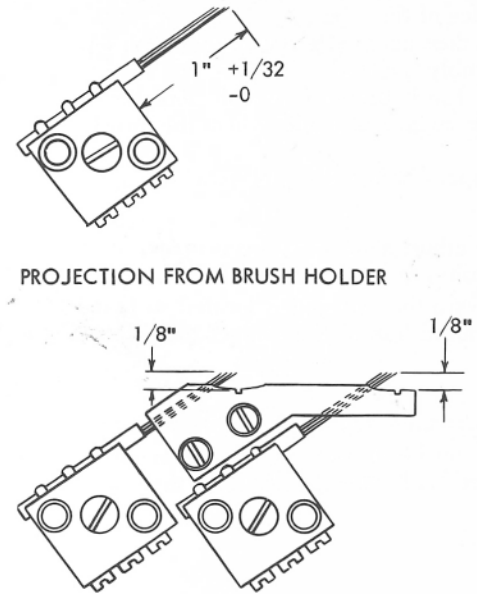


Figure 22. Carriage Tape Brush Projection

- Adjust the brush separator collars on the pivot rod so that the brushes are centered in separator slots and for minimum end shake of separator.
- Position the brush holders so that the toe of the shorter group of strands lines up with the scribed line on the brush separator when the brushes are held even with the separator.
- Position the brush separator eccentric stop stud for 0.050 ± 0.010 " clearance between the brush separator and the contact rolls.
- Adjust the brush separator rod with brush assembly open and so that brush tips are below active surface of separator a minimum of $\frac{1}{4}$ ".
- Align the brush tracking by shifting the tape drive sprocket on the shaft. NOTE: Do not shift the sprocket in such a way that the tape rides improperly between the contact rolls.
- Position the inner tape guide so that it is below the active surface of the tape drive sprocket 0.012 ± 0.001 ".
- Loosen the outer tape guide on the latch shaft and center the guide around the pin feeds in the drive sprocket (leave loose).
- Position the latch block within the limits of its mounting hole for these conditions when latched so that the
 - arc (cylindrical surface) of the outer tape guide is equally divided by the point of contact of the arc and the drive sprocket.
 - clearance from the bottom face (side that faces pawl) of latch block to upper side of latch pawl is 0.003 " to 0.006 ".
 - clearance from the stud in the separator (left side) to the brush frame is approximately 0.005 ".

10. Position the outer tape guide.
 - a. Rotate the guide around the latch shaft until the clearance between the arc and the drive sprocket is 0.010" to 0.020".
 - b. Clamp the guide.
11. Adjust the brush separator support plate so that
 - a. with the assembly open the brushes are below the active surface of the separator.
 - b. stop rod does not interfere with the brush separator as the assembly is closed.
12. Adjust the brush interlock switch actuator so that
 - a. interlock switch is made when the brushes are down.
 - b. switch opens before the latch pawl disengages the latch block.

13. After these adjustments have been made, adjust the carriage tape brushes dynamically.

CAUTION: Be sure the stop rod is located so that it will not contact the raised hub of the contact roll. Blown fuses may result.

Carriage Tape Brushes (Dynamically) Adjustments

1. Insure that no binds exist when you manually turn the forms advance knob with the 6-8 knob in neutral.

2. Set up the carriage for dynamic adjustment.
 - a. Insert a carriage tape punched with a hole in channel one.
 - b. Remove the forms.
 - c. Engage the manual clutch in 6-line drive.
 - d. Program a space to zero (no numeric bits) before print.
3. Set up the scope for
 - a. 1 ms/division horizontally.
 - b. 10v/division vertically.
 - c. Sync on negative shift of stop brush (at CE indicator panel on current machines or at pin 28 on resistor panel on earlier machines).
4. Start carriage by depressing the start key. Stop the carriage by depressing the carriage stop key.
5. Probe the negative shift of the emitter brush (at CE indicator panel on current machines or at pin 38 on resistor panel on earlier machines).
6. Rotate the tape drive sprocket with respect to its shaft so that emitter will make 1 millisecond \pm 1/4 millisecond after the tape stop brush.

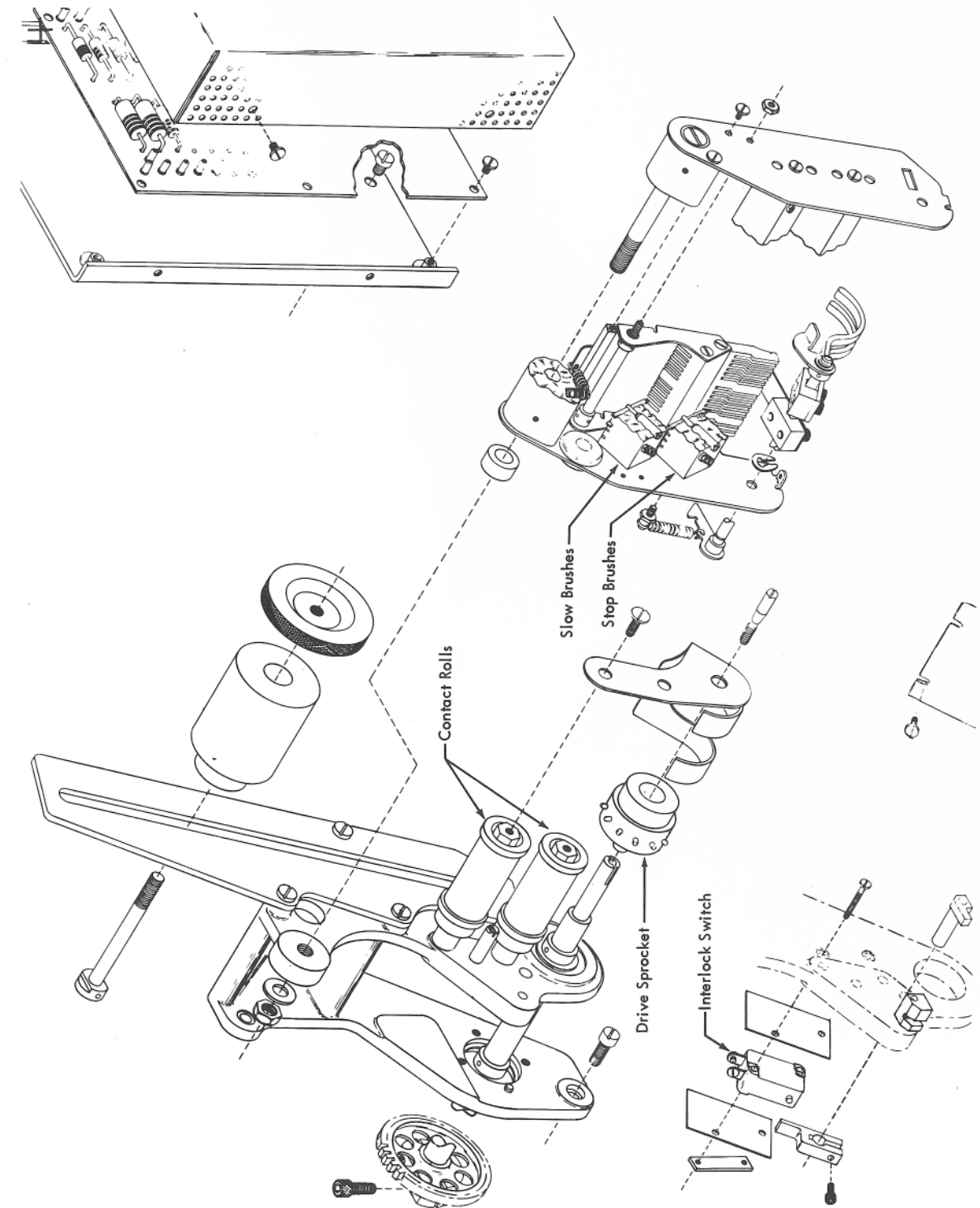


Figure 23. Carriage Tape Brushes

Locations and Voltage Specifications

Voltage

The carriage motor, the type array drive motor, and the hammer blower motor are 208-230 volts ac 3-phase motors. WARNING: Be careful of this voltage.

Voltage Variation

When connected to the system, the printer must continue to perform all specified functions within the following voltage ranges:

Line Voltage $\pm 10\%$.

-60 volts dc	$\pm 4\%$ at component using voltage
- 6 volts dc	$\pm 4\%$ at component using voltage
+ 6 volts dc	$\pm 4\%$ at component using voltage
-12 volts dc	$\pm 4\%$ at component using voltage
+12 volts dc	$\pm 4\%$ at component using voltage
-20 volts dc	$\pm 4\%$ at component using voltage

Serial Plate

This is mounted on the top surface of the right cover frame.

Ground

The ground connections are made at the left front corner of the cover frame.

Connectors

The two-signal and one-power connector enter the printer at the left.

Resistors

These are located at the rear of the printer at the upper right above the hydraulic unit. The carriage resistors are mounted on a heat sink behind the hydraulic unit.

Main-Line Switch (AC Power)

This is located at the left rear corner of the cover frame.

CAUTION: This switch is to be used to condition the printer. Operate it only when the system power is off. It does not remove all dc voltages.

Convenience Outlet

This is available from underneath at the rear of the printer.

Terminal Blocks

- TB-1, 10-position terminal; rear cover frame
- TB-2, 8-position terminal; in hydraulic reservoir
- TB-3, 3-position terminal; on printer casting at upper left
- TB-4, for hammer magnet; (when installed, blower)
- TB-5, 2-position terminal; on ribbon drive unit
- TB-6, 4-position terminal; on ribbon drive unit
- TB-7, 6-position terminal; on T-casting at left rear
- TB-8, 2-position terminal; on T-casting at left rear

Thermistors

These are in series with the hammer magnets and are located at the rear of the printer on the left.