

**IBM**

**OPD CUSTOMER ENGINEERING  
I/O Reference Manual  
Section 1**

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## GENERAL PROCEDURE

Power clean the printer with the covers removed. Clean the feed rolls, platen, and deflector. Unless otherwise stated, all parts of the printer should be inspected and lubricated once every four months.

Note: Lubrication must be applied judiciously to eliminate excessive quantities and prevent migration or spin-off into electrical contacts.

## LUBRICATION

Figures 1 through 8 show the points that require lubrication. The number references require IBM #10. The letter references require IBM #23. Points that do not require lubrication every four months are identified with the required frequency in the reference list. A rule of thumb should be "All bearing areas having a sliding motion use IBM #23 and all bearing areas having rotational motion use IBM #10 unless otherwise specified."

Machines with power on 24 hours daily require more frequent lubrication than machines used for single-shift operation. The following areas are primarily affected by idling time, since only the operational shaft is driven:

1. Motor and motor pulley
2. Cycle-clutch spring and arbor
3. Driven-pulley hub and bearing
4. Operational cam bearings
5. Right-hand operational shaft and shift cam bearing
6. Shift-clutch spring and arbor

Since these machines are hot 24 hours daily, some lubricant evaporation can be expected in areas not driven during idling; however, they are not nearly so affected as items 1 through 6. Where power is on 24 hours daily, we recommend lubricating these items every six weeks.

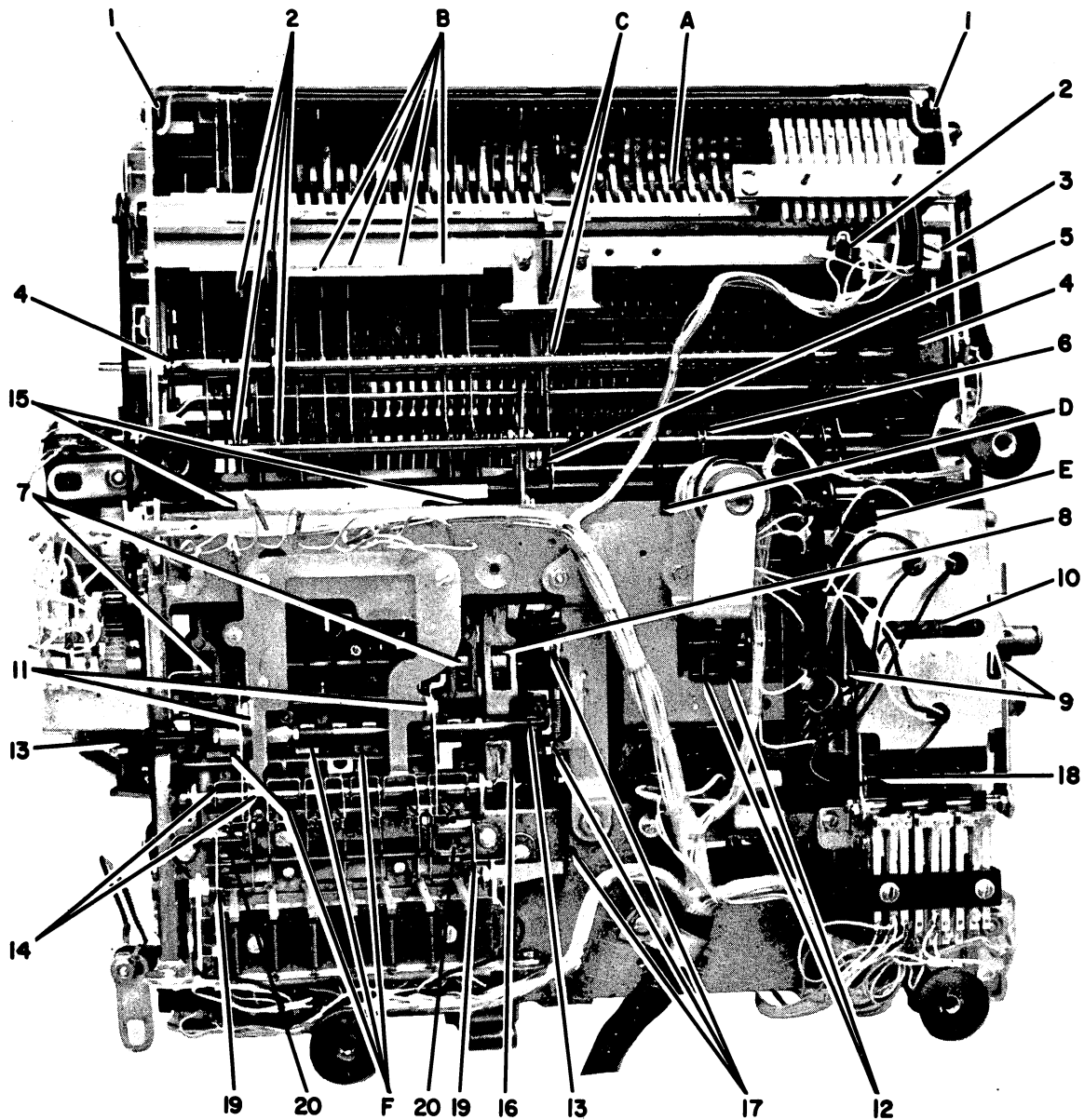


Figure 1. Bottom View Of The Printer

IBM #10

1. Power-tab key-lever bail pivots
2. Clevis and link pivots
3. Keyboard-lockout bellcrank pivot
4. Keyboard-lockout bail pivots
5. Cycle-clutch pawl and link pivots
6. Keyboard-lockout bail roller and lever pivot
7. Selector bail roller pivots
8. Negative-five bail roller pivot
9. Actuating-arm pivots
10. Operational pull links
11. Pusher bail-arm pivots
12. Carrier-return actuating-arm pivot
13. Rotate-link pivots
14. Pusher-arm pivots
15. Selector-latch bail pivots

16. Negative-five link bearing

17. Cycle-clutch trip pivots
18. Contact-latch pivots
19. Cycle-clutch trip-bail pivot points
20. Pusher bail pivots

IBM #23

- A. Keyboard-lockout-comb sliding surface
- B. Interposer sliding surfaces
- C. Cycle-clutch latch surfaces
- D. Filter-shaft surface
- E. Operational-arm pivots
- F. Selector-latch surfaces

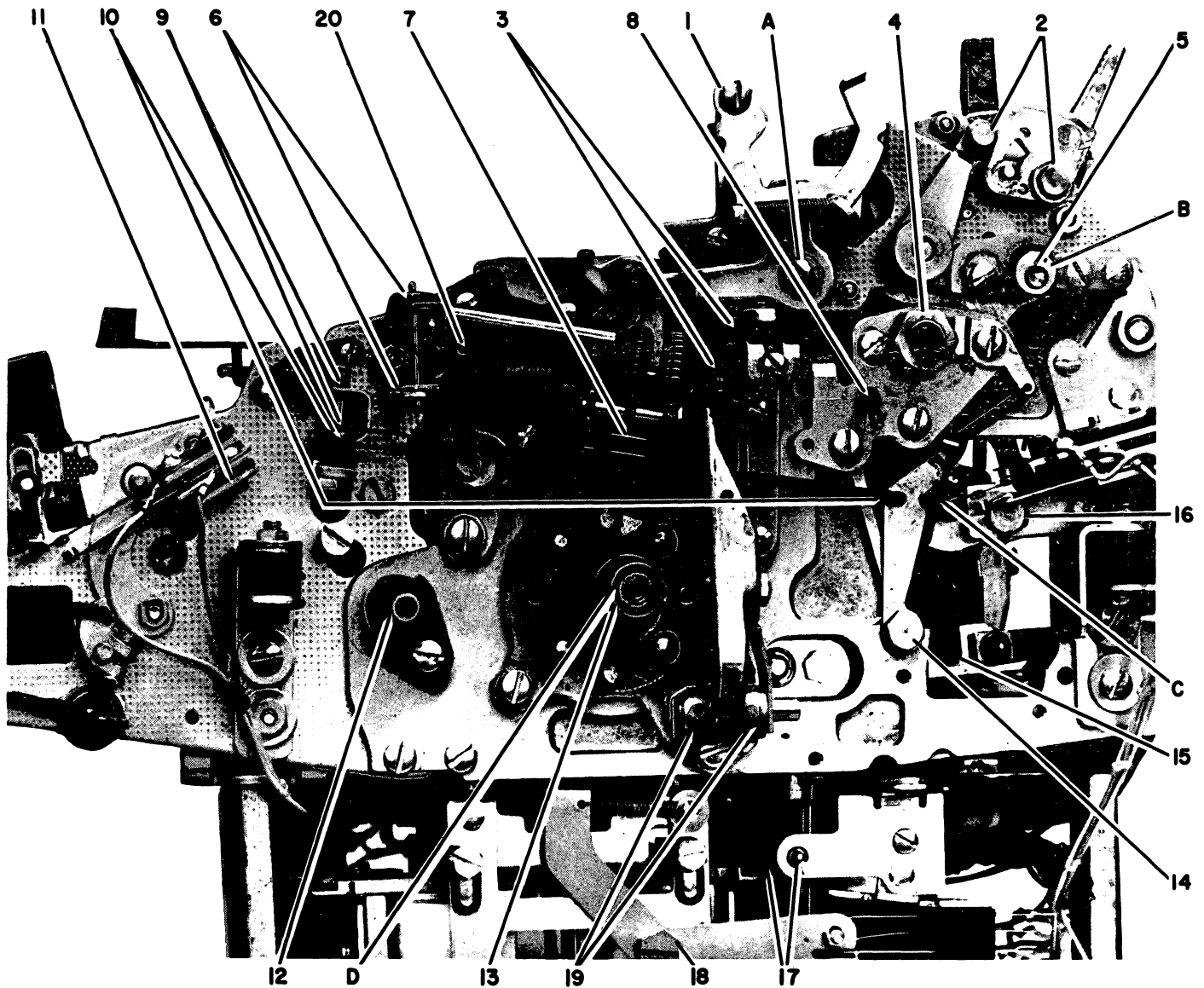


Figure 2. Right Side Of The Printer

IBM #10

- 1. Platen-release pivot
- 2. Paper-release-lever pivots
- 3. Rotate and tilt pulley bearings
- 4. Tab-rack support bearing
- 5. Copy-control eccentric pivot
- 6. Pulley-assembly pivots
- 7. Right-hand cord-pulley bearing
- 8. Escapement torque-bar pivot
- 9. Carrier-return unlatching-bellcrank pivot
- 10. Carrier-return unlatching-link pivot
- 11. Bellringer bail pivot
- 12. Filter-shaft bearing
- 13. Operational-shaft bearing
- 14. Carrier-return latch-keeper pivot
- 15. Index-link pivot
- 16. Carrier-return-link pivots

- 17. Operational-contact link-rod pivots
- 18. Contact-bail pivots
- 19. Shift arm pivot
- 20. Print shaft bearing

IBM #23

- A. Guide-bracket sliding surface
- B. Copy-control eccentric surface
- C. Carrier-return latch keeper
- D. Shift clutch spring and arbor

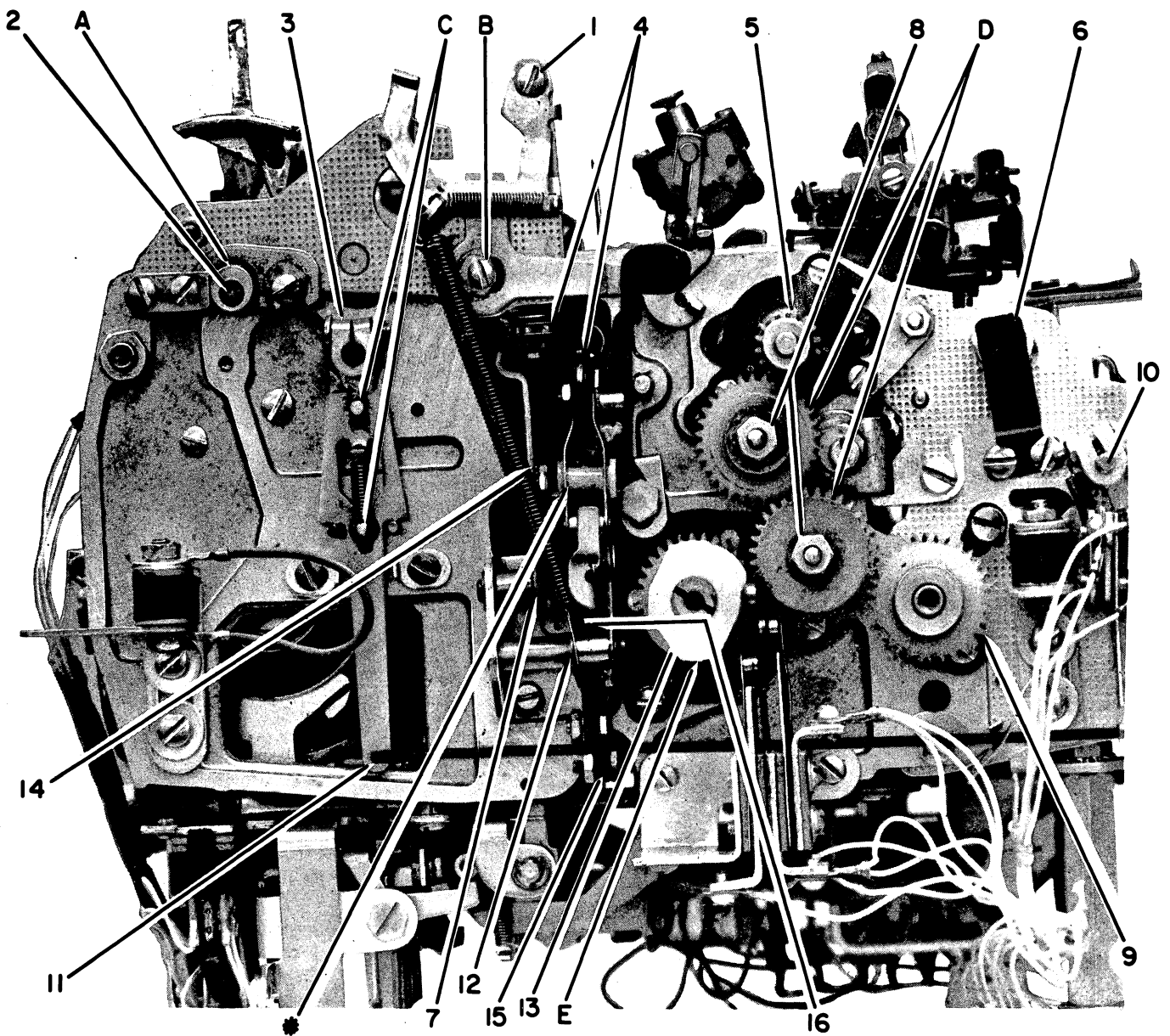


Figure 3. Left Side Of The Printer

IBM #10

- 1. Platen-release pivot
- 2. Copy-control eccentric pivot
- 3. Tab-rack support bushing
- 4. Rotate and tilt pulley bearings
- 5. Print-shaft bearing
- 6. Left-hand margin-rack bushing
- 7. Tilt-arm pivot
- 8. Idler-gear bearings (lightly)
- 9. Filter-shaft bearing
- 10. End-of-line bail
- 11. Tab set/clear link pivots
- 12. Wear-compensator pivots
- 13. Cycle-shaft bearing

- 14. Tilt link pivot
- 15. Rotate link
- 16. Rotate arm paddle eccentric

IBM #23

- A. Copy-control eccentric surface
- B. Guide-bracket sliding surface
- C. Tab set/clear bellcrank
- D. Idler gear teeth
- E. C1 and C2 can surfaces

\* Keep free of any lubricants

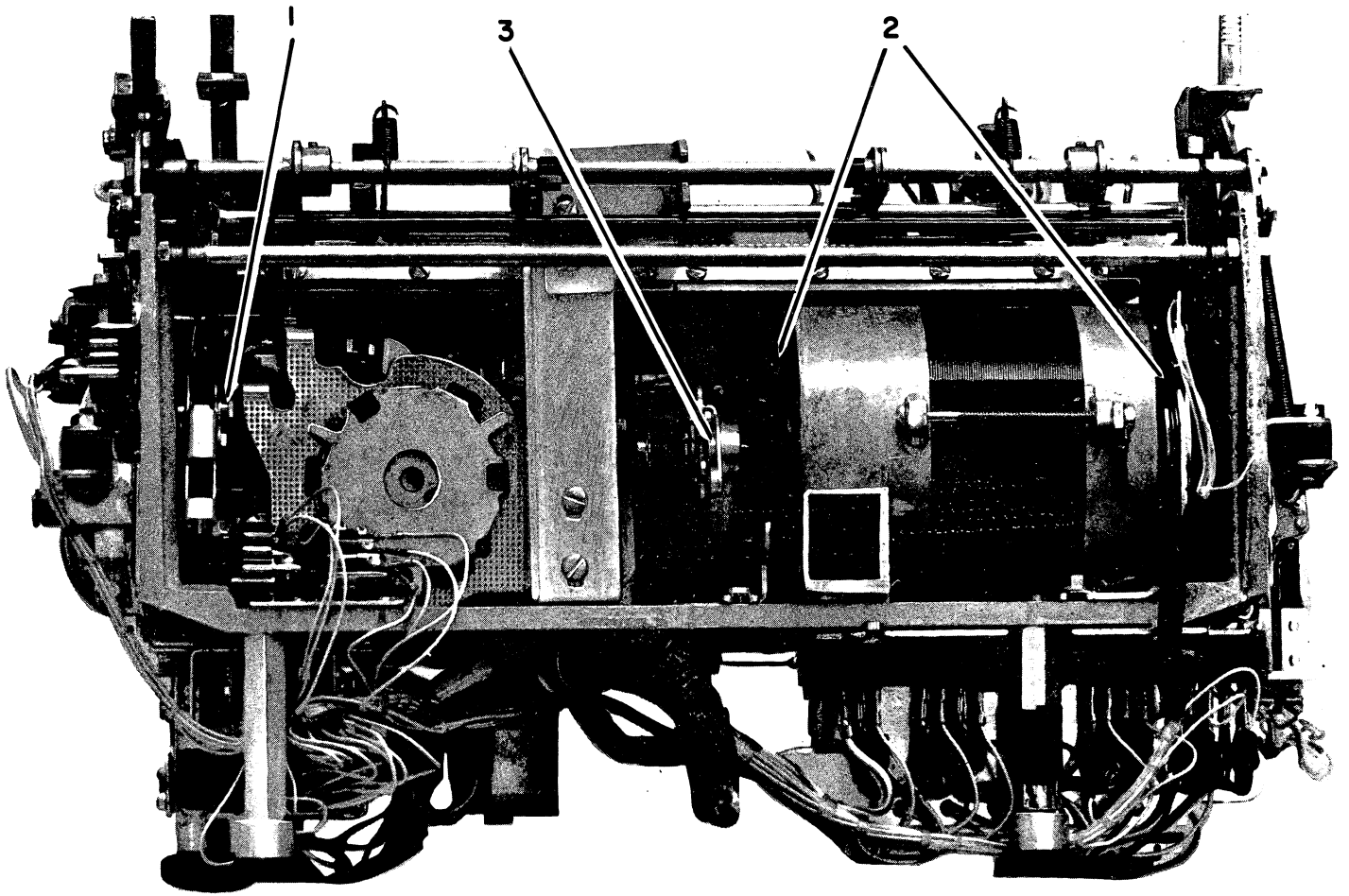


Figure 4. Back Of The Printer

IBM #10

1. Index-control lever (old style)
2. Motor bearings  
All pivots and bearings in operational unit.
3. Motor pulley and clutch assembly.

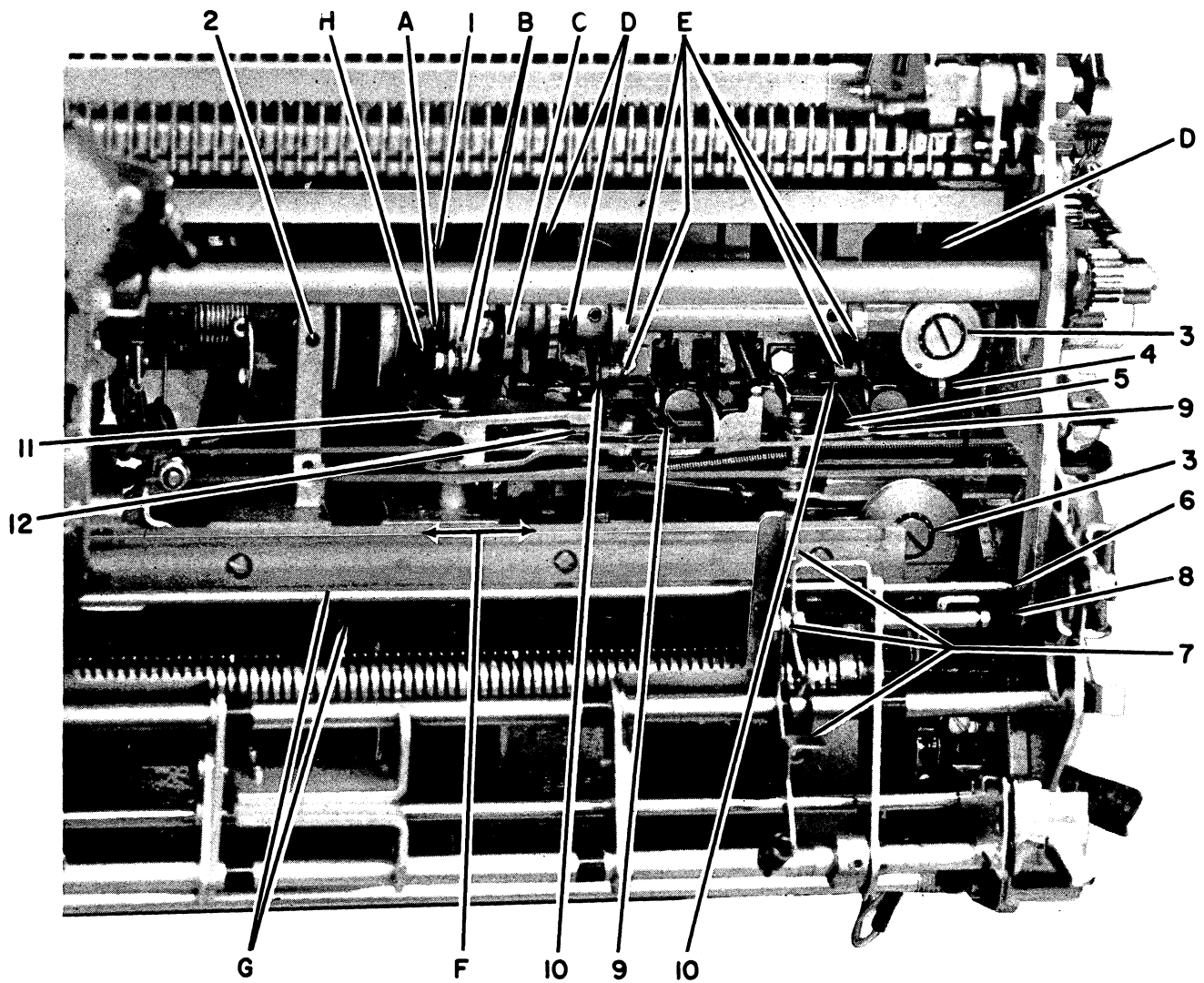


Figure 5. Differential Mechanism

IBM #10

1. Cycle-clutch latch pivot
2. Center bearing
3. Carrier-return pulleys
4. Cycle-clutch check-latch pivot
5. Check-selector latch pivot
6. Tab-torque-bar pivot
7. Feed-roll bearings
8. Escapement-torque-bar pivot
9. All selector latch and differential mechanism pivots
10. Latch pusher roller and pivot studs
11. Rotate bellcrank
12. Balance arm

IBM #23

- A. Cycle-clutch sleeve surface
- B. Cycle-clutch restoring cam and roller
- C. Negative-five cam surface
- D. Selector-cam surface and roller
- E. Pusher-bail cam surface and arm rollers
- F. Surface of the escapement rack
- G. Torque bars (light film)
- H. Cycle-clutch (inside)

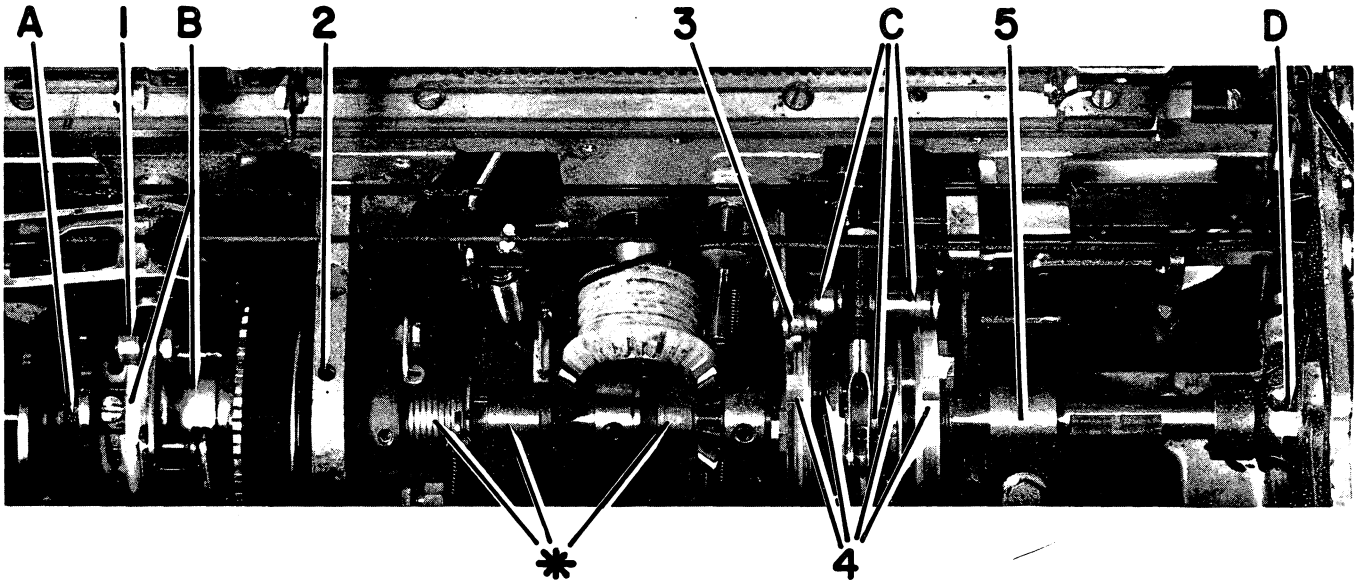


Figure 6. Improved Lubrication Machines

IBM #10

1. Latch restore roller pivot.
2. Center Bearing.
3. C-5 cam follower roller.
4. Operational cam wicks and pawl pivots.
5. Operational shaft stabilizer (sintered iron).

IBM #23

- A. Cycle clutch (inside) (with grease gun).
- B. Cycle clutch sleeve and restoring cam surfaces.
- C. Operational cam surfaces, rollers, and drive ratchets.
- D. R.H. bearing and shift clutch (inside) (with grease gun).

\* Do not lubricate - oil impregnated or self lubricating

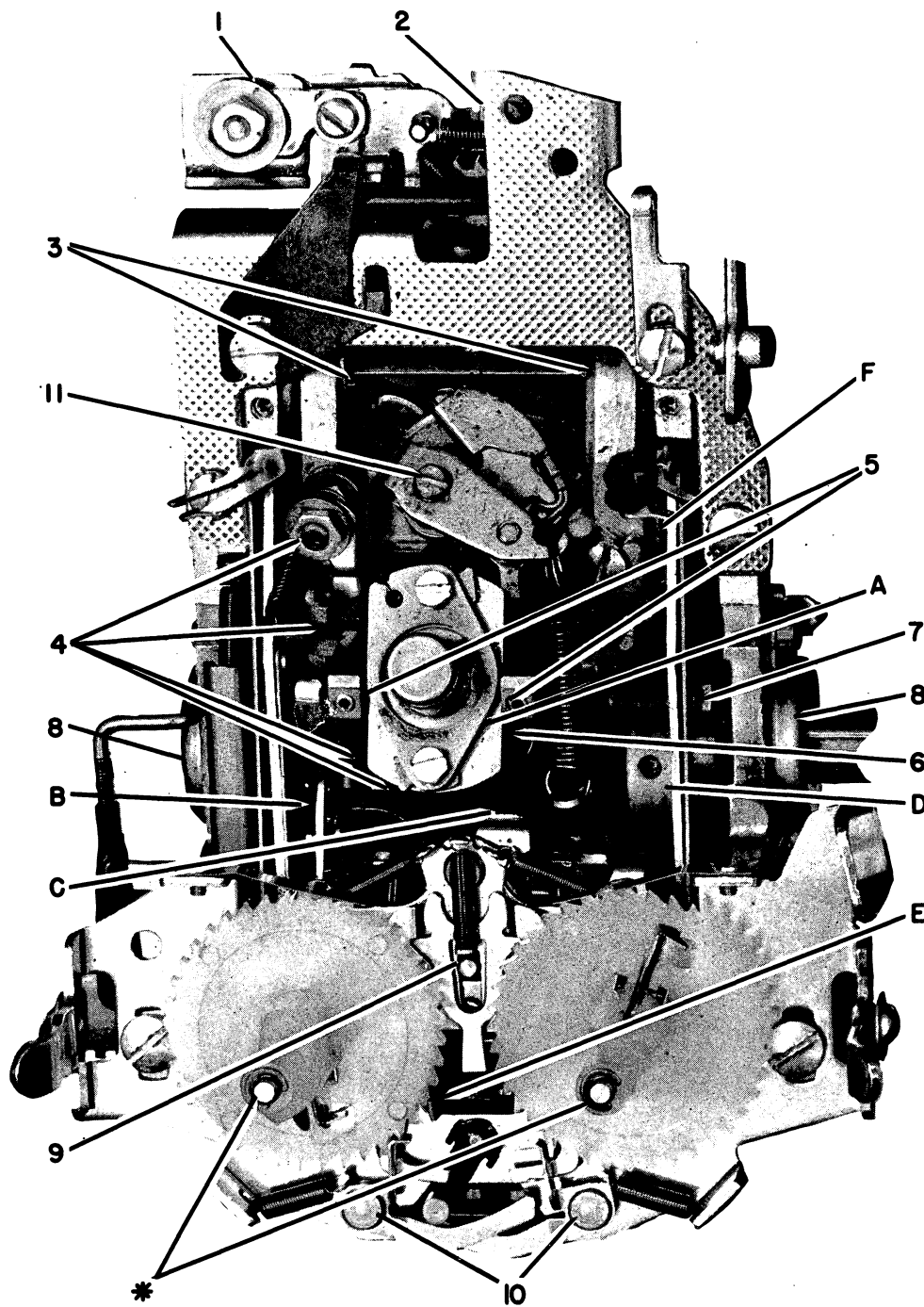


Figure 7. Carrier Mechanism

\* Keep cartridge and spindles free of all lubricants

IBM #10

- 1. Tab-lever pivot
- 2. Tab-lever latch pivot
- 3. Rocker pivots
- 4. Detent pivots
- 5. Tilt-ring pivots
- 6. Lower ball socket
- 7. Print-cam roller bearing
- 8. Print-shaft wipers
- 9. Interposer-lever sliding surface

- 10. Detent-lever bearings
- 11. Tilt bellcrank pivot

IBM #23

- A. Tilt ring and ball joint
- B. Ribbon-lift cam surface
- C. Ribbon-feed and detent cam surface
- D. Print-cam surface
- E. Ribbon-feed pawl
- F. Velocity control plate pin

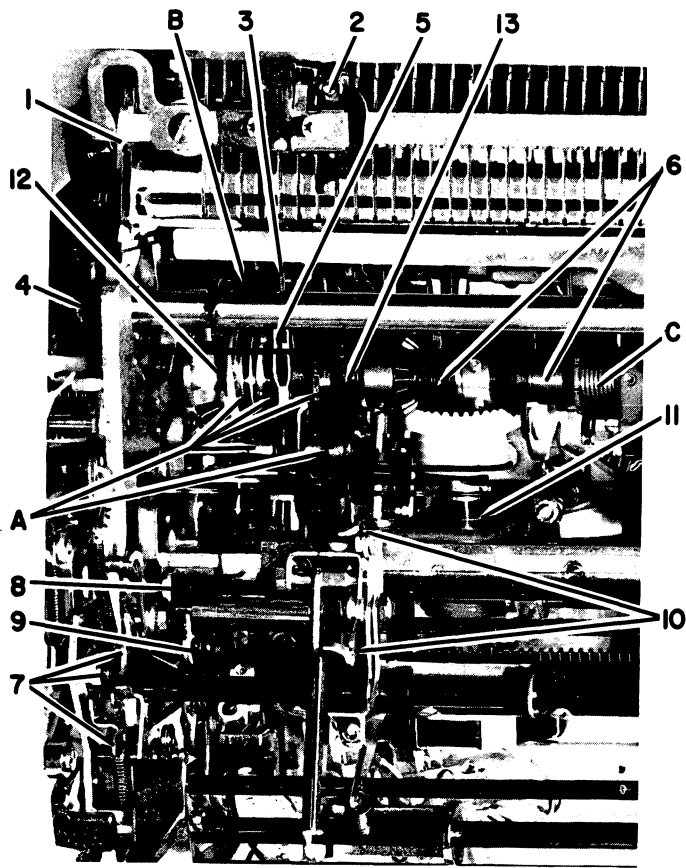


Figure 8. Operational Mechanism

IBM #10

1. Right-hand margin-rack bushing
2. End-of-line contact-actuating pivots
3. Escapement-cam-follower roller
4. Print-shaft bearing
5. Escapement clevis
6. Spring-clutch arbor. Oil carriage return spring clutch only when reassembly is necessary
7. Index pawls
8. Tab-torque-bar pivot
9. Power-tab bellcrank-link ends and pivots
10. Feed-roll bearings
11. Escapement-shaft bearing
12. Operational cam and RH bearing
13. Operational cam pivot

IBM #23

- A. Operational-cam surfaces, rollers, and drive ratchets
- B. Actuating arm and check-pawl contact surface
- C. Torque-limiter spring clutch

PRINTER CONTACT LOCATIONS

Figures 9 to 13 show the locations of the printer contacts.

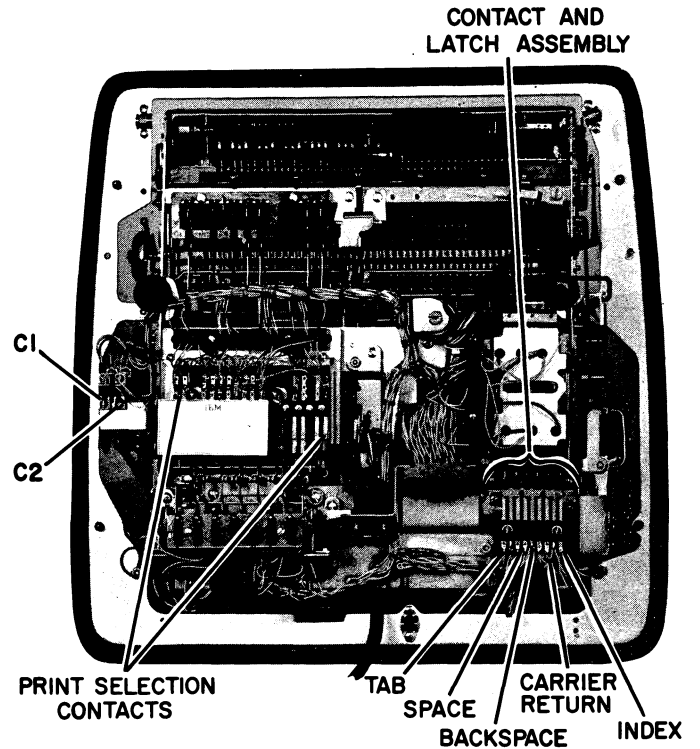


Figure 9. Bottom View Showing Contact Location

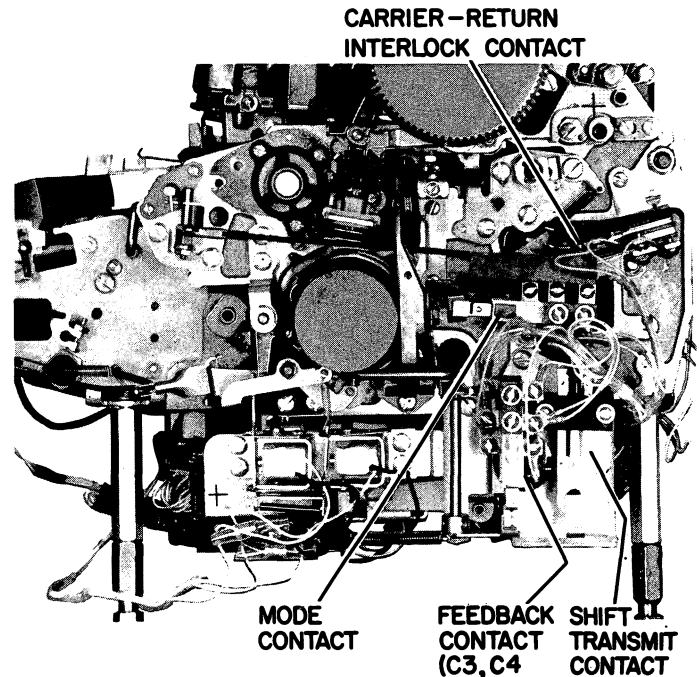


Figure 10. Right View Showing Contact Location

PRINT FEEDBACK CONTACTS (C1,C2)      LAST COLUMN CONTACT

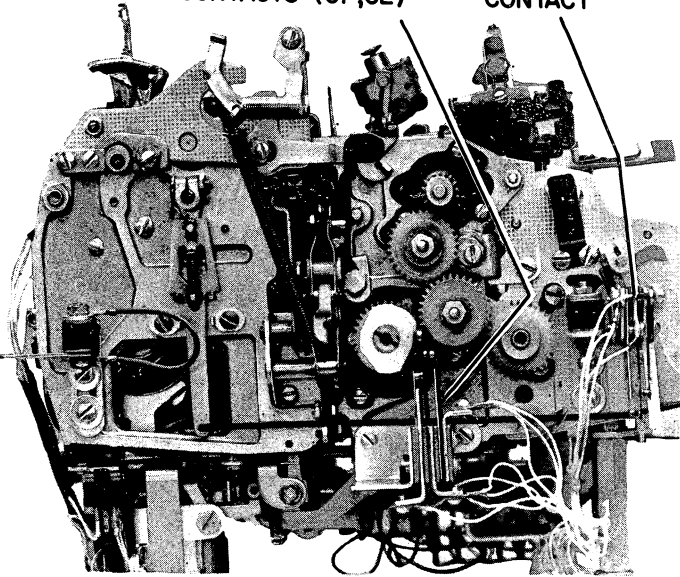
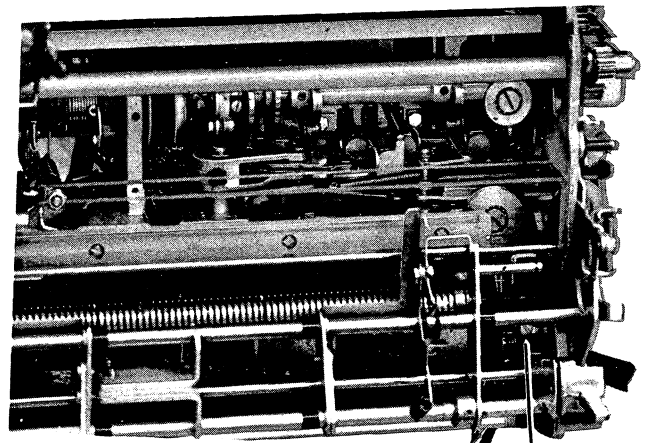


Figure 11. Left View Showing Contact Location



TAB INTERLOCK CONTACT

Figure 13. Upper Left Rear Corner Showing Contact Location

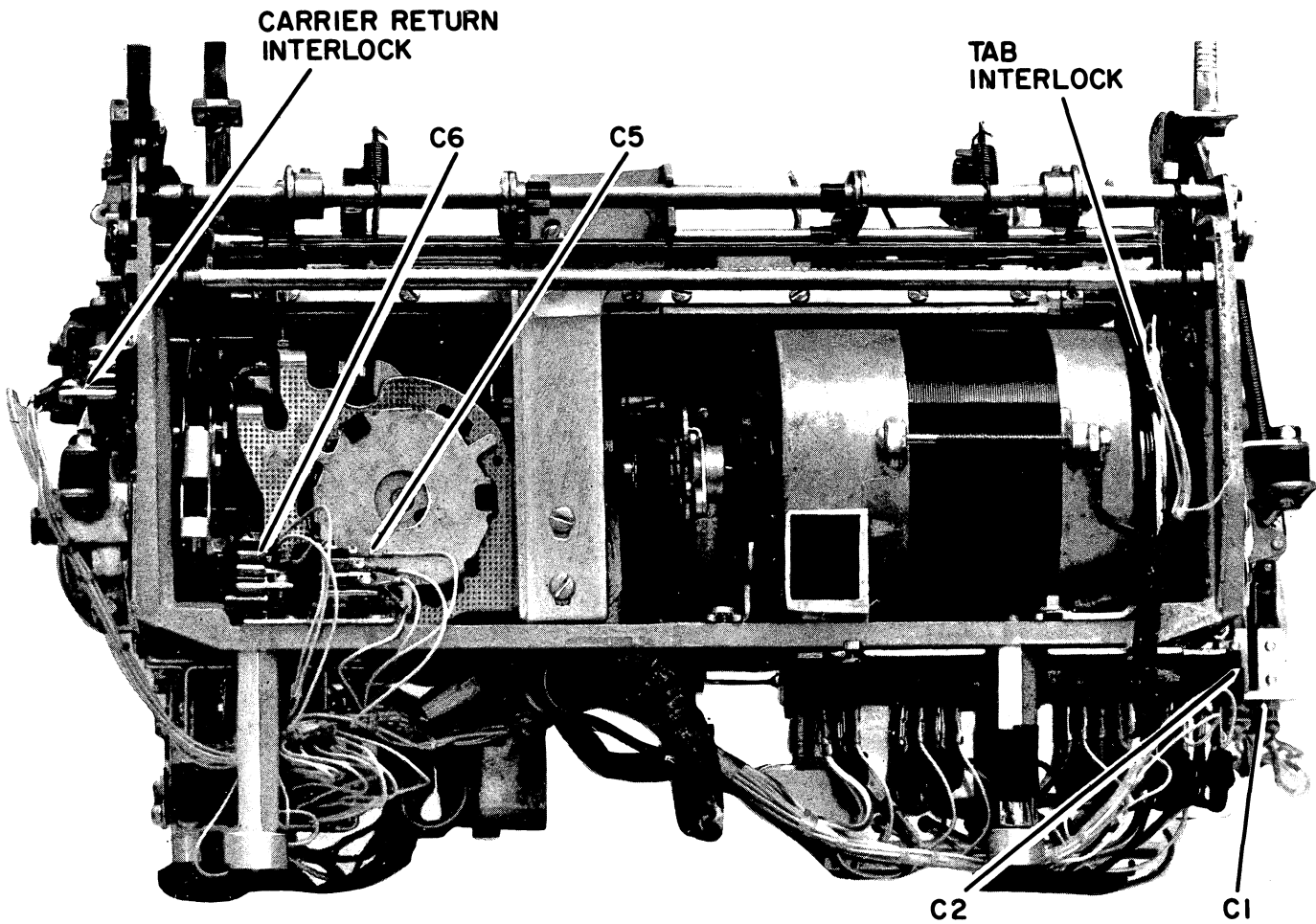


Figure 12. Rear View Showing Contact Location

## INSPECTION PROCEDURE

Inspection Period	Inspection Area
1	Impression and Alignment Tilt Mechanism Rotate Mechanism Detenting Keyboard Area
2	Selection Magnet Units Operational Magnet Units Pusher Unit Cycle Clutch Unlatching Cycle Clutch
3	Contacts Contact Cleaning Ribbon Feed Mechanism Escapement Motor Drive and Carrier Return Indexing and Paper Feed Shift (Enter Mechanism)

### FIRST INSPECTION PERIOD

#### IMPRESSION AND ALIGNMENT

1. The rotate and tilt tapes must be free from kinks and nicks.
2. Check for binds or excessive play in the tilt and rotate detents with respect to their guides. Check the tilt ring in relation to its pivots, and the upper ball socket with respect to the tilt-ring spacer.
3. Check for smooth compensator action.  
Static check:
  - a. Half-cycle a -5 selection with the typehead removed.
  - b. Pull the rotate arm out until it is completely removed from the compensator leaf spring.
  - c. Release the rotate arm. This should cause the leaf spring to collapse against the power frame.

#### DYNAMIC CHECK

1.
  - a. Move the roller to the top of the compensator.
  - b. Repetitively type minus-five selections. The roller should return to the compensated position. If wear has caused the compensator roller to drop almost to the bottom of the slot, half-cycle a -5 character. Tilt the machine up on its back. Raise the nylon wedge manually, and tighten the rotate link until there is 1/16" travel left in the nylon wedge. Tighten the nuts on the rotate link. NOTE: The compensator nylon wedge must be clean and free of oil. If it does not drop easily, or appears to be oily or dirty, flush the wedge with cleaning fluid and wipe dry.
2. The general condition of all selection and output-motion adjustments can be checked by making a complete strike-up of the keyboard. Type back over it several times, watching for signs of misalignment with the previously typed characters. If alignment is not satisfactory, the need for closer inspection can be met by observing the dynamic detenting action of the typehead.

#### TILT MECHANISM

1. Check the tilt motion: Use T0 and T3.
2. Check the tilt detenting: Use a T3 character and half-cycle the machine. Place a slight pressure on the rear of the tilt ring. Remove the detent, and allow it to return slowly. The ring should move no more than .005".

#### ROTATE MECHANISM

1. Half-cycle a 0-rotate, 3-tilt character and observe the detenting. Follow the same procedure for a +5 rotate, 3-tilt character, a -3 rotate, 3-tilt character, and a -5 rotate, 3-tilt character.

The variance in bandwidth of these characters should not exceed .030".

NOTE: Check as follows: Half-cycle the character and remove detent from the head. Take the play out of the head in a clockwise direction. Allow the detent to return slowly, and observe the point the detent strikes or enters the skirt. Bandwidth equals the difference between the best and worst character.

#### DETENTING

1. Print-shaft timing: The detent must enter and leave the head without hitting the skirt. Check by manually half-cycling. Use a -5, home, and a +5 character.
2. The skirt clearance should be .025" - .035" in a 2-tilt position. When both detents are engaged fully in their respective notches, there should be .001" minimum motion of the detent-cam follower with respect to the detent lever.

#### KEYBOARD AREA

1. All key levers operate freely. No binds.
2. All key levers have enough travel to fully latch an interposer and restore positively.
3. With any interposer latched down, the cycle-clutch-release pawl should clear its keeper by .002" - .008" (unlatching adjustment).
4. The cycle-clutch-latch-pawl bite on the keeper must be one-half the thickness of the keeper. Adjust the bail up-stop.
5. The cycle-clutch-latch pawl overthrows the keeper by .020" - .025" (under manual operation) when restoring.
6. Operational key levers should allow for positive single operation.

Latch Selection. The latch links should allow the latches to overhang the bail flush to .010" overlap.

Manually half-cycle the following selections one at a time, and observe the latches:

0-rotate, 1-tilt character  
-5 rotate, 1-tilt character  
+ 1 rotate, 0-tilt character  
+ 2 rotate, 0-tilt character  
+ 3 rotate, 0-tilt character

These characters allow each latch to be checked individually. Observe that the selected latches clear the bail fully, and do not snap off. Observe that the nonselected, or operated, latch seats fully on the bail, does not jump off, and makes the correct selection.

## SELECTION MAGNET UNITS

1. Check the pick times of all magnets by observing (on an oscilloscope) the voltage rise across a 10-ohm, 1/2-watt resistor (part 321271) in series with the individual magnet coils, when a 48-volt pulse is applied to the coil. All pick times must be ten milliseconds or less, with the exception of U.C. shift magnet, red ribbon shift magnet and the keyboard-lock solenoid. The U.C. magnet and red ribbon shift magnet armatures must seal within 12 milliseconds maximum and the keyboard lock solenoid must pick in a maximum of 55 milliseconds. See Figure 14 for wave form of magnet pick time.

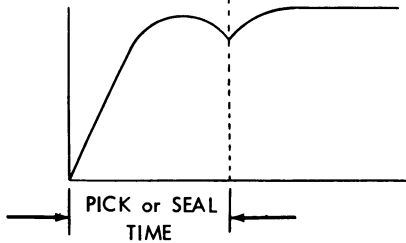


Figure 14. Waveform of Magnet Pick Time

Pick-time readings are the best indicator of magnet performance. High pick times foretell adjustment discrepancies, wear, or sluggishness. They are often evidenced by noticeable machine slowness when repeat operations are performed. Note the following items when high picktimes are encountered:

- a. With the armature manually attracted, an armature-to-yoke clearance of .001" - .006" is necessary to prevent an armature from rocking on the yoke. Carefully check the pivot points for wear (pivot plate adjustment).
- b. Except in the case of the operational magnets, the armature stops are to be adjusted for a .004" - .008" armature-to-yoke clearance. This clearance must be maintained to prevent permanent residual effects in the armature.
- c. In no case should an armature rock on the core.

## OPERATIONAL MAGNET UNITS

1. When an armature is operated, the armature pull-link adjustment should allow for positive interposer tripping with .002" - .010" overthrow clearance between the interposer and the pawl guide plate at the point of unlatching.

## PUSHER UNIT

1. Both latch-pusher cam-follower rollers must contact the cams on the selector cam shaft throughout a cycle.
2. Check the individual pusher-to-latch extension clearances. Clean all operational circuit-breaker contacts, and check for pitting.

## CYCLE CLUTCH UNLATCHING

1. Positive unlatching of the cycle clutch must occur when each armature is operated by hand, with the latch overthrow .002" - .007" (old style trip mechanism). On the spring-loaded (new style) trip mechanism, overthrow (with an armature operated) should measure .005" - .020" between the trip lever and the latch lever. Check to insure that the K.O. eccentrics do not choke off the armature travel (K.O. eccentrics should clear trip bail extensions by .003" to .008" with armatures manually attracted).
2. Check for .005" - .010" vertical clearance between the selection-armature latching surface and the pushers, and for .001" - .010" horizontal between the tip of the pushers and the armatures.
3. The trip bail pivot eccentrics must allow equal motion to be transmitted from the T2 and R5 armatures to the trip link. The eccentrics must be in the upper sphere of their adjustment to prevent binding.

## CYCLE CLUTCH

1. Latch height: Measure with #3 scribe line on Hoover-ometer.
2. Cycle shaft collar: The cycle clutch should begin to slip approximately 15° before the check pawl detents. Hand cycle the machine, using a -5 rotate, 0-tilt character.
3. Nylon stop: Adjust for four degrees rotation or overthrow when the cycle shaft is latched home.
4. Shaft end play: .001" - .003".
5. All gears: Minimum play, no binds, screws tight.
6. Print-shaft timing: The keyway should be toward the dowel pin on the carrier.
7. Filter-shaft timing: With an interposer latched down, there should be .005" - .010" between the interposer and the filter shaft.

## THIRD INSPECTION PERIOD

## CONTACTS

1. The operational transmitting contact latches should be flush with the end of the contact-strap stop (interposers latched), and should have .005" - .015" clearance between the contact-strap stop and the latch (interposers unlatched).
2. There should be .002" - .010" clearance between the print-feedback O/P's and the low point of the feedback cams.
3. The tab interlock microswitch should move at least .031" after the switch has transferred when the tab torque bar is moving toward its rest position. The switch must remain transferred during tabulation and must transfer before the backspace cam reaches its high point.
4. The carrier-return-interlock (normally-open) strap should rise a minimum of .010" off its support terminal with the carrier-return-clutch latch latched.
5. Check the timing and air-gap adjustments on all contacts. All transmitting and checking contacts should have:
  - a. .020" air gap except the shift which is .040".
  - b. All circuit-breaker contacts and interlocks should have a .040" air gap.

## CONTACT CLEANING

Caution: Under no condition should contact files, burnishing blades or similar tools be used to clean gold contacts in this machine.

To clean the gold contacts, use IBM Contact Cleaner and clean bond paper.

## RIBBON FEED MECHANISM

1. A -5 rotate, 1-tilt character should strike the ribbon 1/16" from the bottom in the high lift position.
2. Check for enough tension of the ribbon-feed mechanism-ratchet-brake springs to hold the ribbon ratchets in a rotated position, to overcome positively the action of the centering spring.
3. The ribbon-feed pawl should hold the reversing interposer within .005" - .010" of its total travel with the ribbon-feed cam on its high point and the ribbon mechanism set for a reversing operation. Positive two-tooth feed plus .010" overthrow should result.

## ESCAPEMENT

1. The carrier should escape smoothly and positively throughout the full length of the writing line and through the right-hand margin under spacebar operation and tabulation.
2. Check for frayed or loose transport cords.
3. Tension should be maintained on the right-hand transport pulley to maintain its mounting parallel to the power frame. Its outside flanges should be 1-7/32" from the right-hand outside surface of the power frame.
4. The line-gage holder must clear the platen at all points, and not impede carrier motion.
5. A minimum of .015" clearance should exist between the carrier-return shoe and the spring-clutch. Note, however, that excessive clearance can result in erratic carrier-return motion.
6. Check for 1/2-3/4 pounds of mainspring tension measured at the carrier as it escapes through the linelock load at the extreme right-hand margin.
7. Check for .002" - .004" backlash of the tab governor and carrier-return pinion gears with the escapement gear.
8. Letter escapement should occur as soon after print as possible.
9. The trigger guide should disengage the trigger from the escapement-torque-bar arm when the escapement pawl has cleared the rack by .010" - .015". Both the letter-escapement and the spacebar operation should allow .005" - .010" excess motion after the trigger has disengaged the trigger from the torque-bar arm.
10. When operated, the tab lever should overthrow the tab-lever latch by .005" - .010" without being choked off by the tab torque-bar lockout lug or backup eccentric, and without overthrowing into the tab rack. Observe the operation at both ends and the middle of the torque bar. Dynamically check for tab failures using five irregularly set tab stops for at least five columns.
11. Check to make sure that the carrier-return operation unlatches the tab when both operations occur simultaneously.
12. With the backspace operated manually, the escapement pawl should just fail to get a new tooth on the escapement rack.
13. There should be a clearance of .005" - .015" between the front of the backspace pawl and a tooth of the backspace rack (with the carrier at rest).
14. Overthrow clearance of .010" - .020" is required between the interposer pawls and the operational-latch bracket when the operational cams are on their high point.

## MOTOR DRIVE AND CARRIER RETURN

1. Check for adequate tension of the motor-pulley belt, or for a frayed or noisy belt.
2. The selector and operational cam shafts, and the print and filter shafts, must have .002" end play.
3. There must be freedom from binds in the idler gear train with minimum backlash.
4. With the carrier-return cam on its high point, the carrier-return arm should overthrow its keeper by .020" - .030".
5. The carrier-return brake shoe should cause the carrier-return spring clutch to drive the carrier no later than when the escapement pawl clears the last one-third of the escapement rack tooth. The clutch shoe should overlap the last three coils of the spring clutch.
6. The carrier-return unlatching link must positively unlatch the carrier-return latch at the left-hand margin with .005" - .010" overtravel when the margin-rack overbank is set.
7. The escapement pawl must not drag the escapement rack during carrier-return operations.
8. Measure one-half to one pound tension of the shock unloader at the left-hand margin while unlatching the carrier-return keeper-latch arm.

## INDEXING AND PAPER FEED

1. Check for .015" - .030" clearance between the platen ratchet and the index pawl, at rest.
2. Index operation should result in one full-tooth motion of the index pawl with respect to the platen ratchet (in single-linespace position) and two full-teeth motion with no evidence of hesitation or drag (in the double-linespace position).

## SHIFT

Check the cam and spring for rust. Check for the positive release of the ratchet when the key lever is two thirds down. Turn power on, and hold the shift ratchet (grey section). Release the ratchet by pressing the key. Allow the ratchet to rotate slowly while holding down on the key. The shift cam should stop at a fully detented position for each 180° operation. The white nylon roller should seat fully in cam notch.