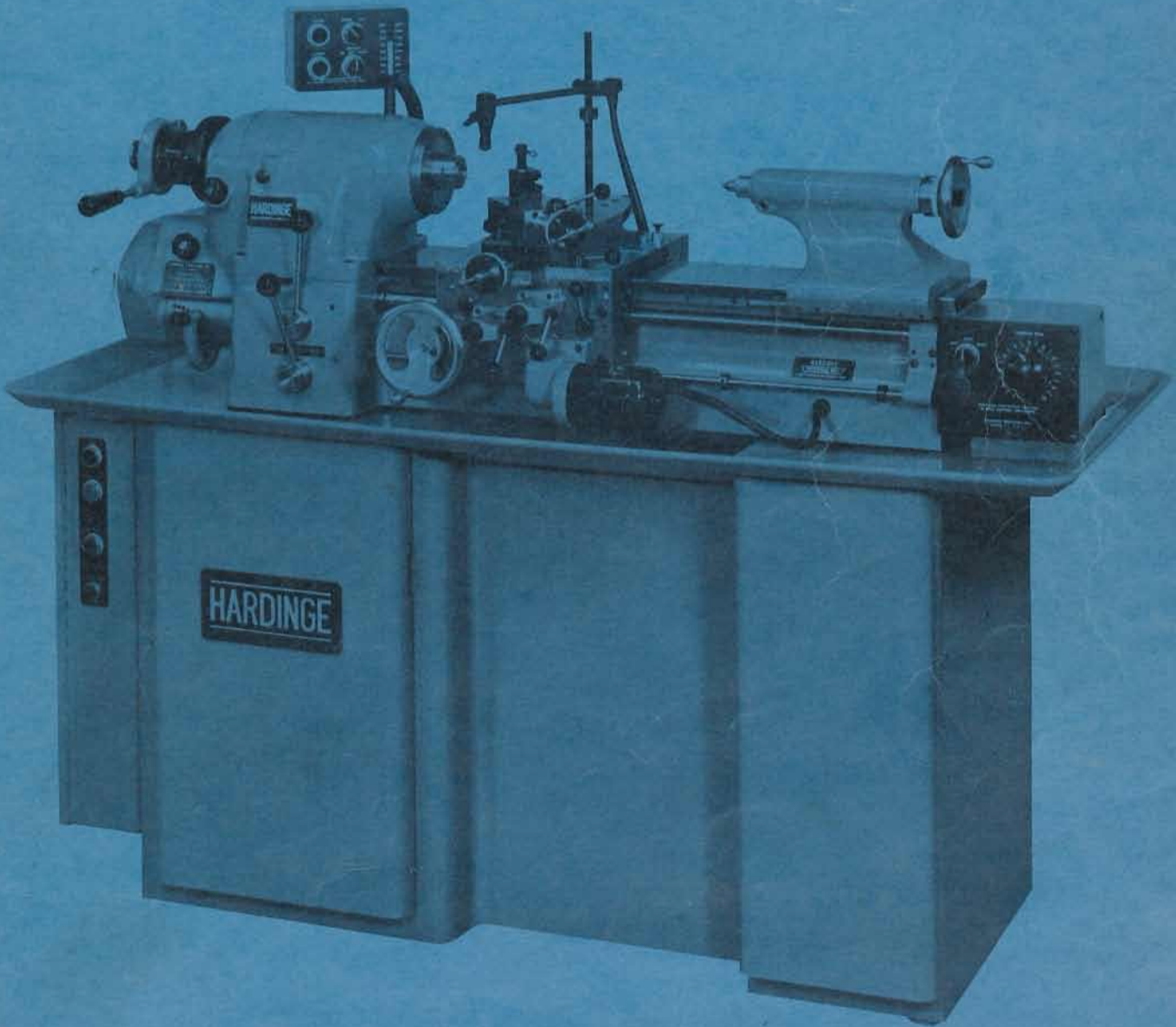


HARDINGE

MAINTENANCE MANUAL



**Model HLV-H
TOOL ROOM LATHE**

**READ MANUAL CAREFULLY BEFORE STARTING
MAINTENANCE OR REPAIR ON HLV-H TOOL ROOM LATHE**

When this manual was printed the information given was current. However, since we are constantly improving the design of our machine tools, it is possible that the illustrations and descriptions may vary from the machine you received. This means that the machine you received is the latest improved model to better fulfill your requirements.

It is assumed those who use this manual will have a general knowledge of machine maintenance and repair. This general knowledge coupled with the following manual will greatly reduce or eliminate machine down time to allow you to receive maximum production from your Hardinge HLV-H Tool Room Lathe.

**HARDINGE BROTHERS, INC.
ELMIRA, NEW YORK**

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PREVENTIVE MAINTENANCE

DAILY

	PAGE
Oil brake insert	21
Run drive through complete speed range	22
Operate carriage pressure oiler	31
Lubricate threading change gear bracket	9

WEEKLY

	PAGE
Clean and lubricate carriage gear rack and lead screw	31
Remove, clean and lubricate collet closer	4

MONTHLY

	PAGE
Check drive belt tension	5
Lubricate drive	22
Clean and lubricate tool post slide	44
Clean and lubricate carriage cross slide	44
Operate gear box shifting knobs and handle	9

BI-MONTHLY

	PAGE
Change oil in apron	31

QUARTERLY

	PAGE
Lubricate gear box	9
Lubricate drive countershaft	22

DEPENDING ON USE

	PAGE
Keep carriage oil reservoir full	31
Keep oil in sight window of apron	31
Clean coolant sump	51

See Page 51 for Lubricant and Sealer Vendors

INSTALLATION INSTRUCTIONS

Remove crating but do not remove machine from skid. Move machine to the location in your plant where it is to be used before removing from skid. Remove the four bolts which hold machine to skid. There are two bolts at the extreme left-hand end of the pedestal and two at the right-hand end.

LIFTING MACHINE: The machine may be removed from the skid by either a crane or fork lift truck. When lifting with a crane, the rope or cable sling should be arranged as shown, Figure 1. **NEVER LIFT MACHINE WITH ROPE OR CABLE AROUND SPINDLE, BED OR ATTACHMENTS.**

The rope or cable must be capable of withstanding a weight of 2000 pounds. When using a lift truck, adjust forks to go in between top planks of skid and bottom of pedestal base. Lift machine slowly, checking to see that correct balance is maintained. **USE CAUTION** as machine is heavier at the front and is more easily tipped using the lift truck method than the crane and sling method.

After skid has been removed, place machine directly on location where it is to be used.

MACHINE FOUNDATION: The Hardinge HLV-H Precision Lathe is designed to operate without a special foundation. A substantial wood or concrete floor is satisfactory. However, it must be fairly flat and have sufficient strength to support machine properly.

Do not locate machine near other equipment that causes vibration which will transmit to this machine as poor work finish may result.

LEVELING MACHINE: The Hardinge HLV-H Tool Room Lathe is designed with a three point bearing arrangement between bed and pedestal base. This makes accurate leveling unnecessary. Leveling should be such as to be reasonable and so that coolant will properly drain back into sump from ends of pan.

There is an adjustable foot at the right rear corner of the pedestal base to compensate for uneven floor conditions. To adjust, loosen the socket set screw and raise or lower the foot with a pin wrench so that all four feet rest firmly on the floor. Tighten socket set screw to retain setting. Should floor conditions be such that adjustable foot does not take care of leveling, use shims under feet of pedestal.

CLEANING MACHINE: Use a cloth or brush to clean this precision machine. **DO NOT CLEAN MACHINE WITH COMPRESSED AIR.** The use of compressed air for cleaning reduces the precision life of the machine. Small particles of dirt and foreign matter can be forced past seals and wipers into the precision slides and bearings.

After machine has been properly located, leveled and bolted to floor, clean off all anti-rust shipping grease and dirt accumulated in transit with a good grade of grease solvent.

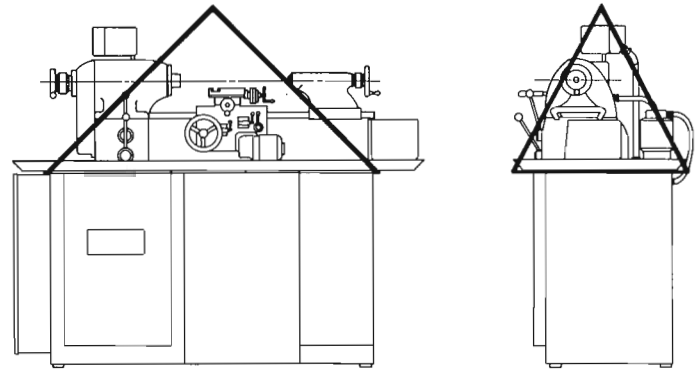


Figure 1 — Cable Sling for Lifting Machine

Remove wood shipping retainer block and wire binding from variable speed countershaft pulley assembly. Using a $\frac{3}{4}$ " socket wrench, remove and discard shipping hold down clamps located up inside motor compartment over the top of the pulley assembly.

Remove all shipping grease from variable speed vertical screw "A", Figure 2, pulleys and brake drum with cloth dampened with solvent. Rotate pulleys by hand to see that all grease is removed and wipe dry. **DO NOT REMOVE LUBRICANT FROM COUNTER-SHAFT.** Lubricate vertical screw at "B", Figure 2, with Houghton Cosmolube #2 before starting machine. Add a few drops of light oil to brake drum. Clean motor compartment and tool storage compartment. Put bottom tool shelf in place.

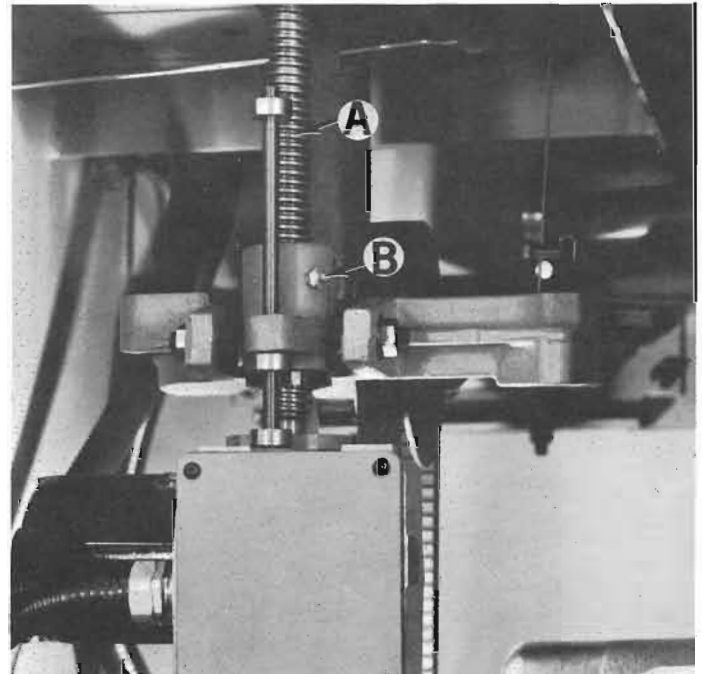


Figure 2 — Drive Lubrication Fitting

ELECTRICAL CONNECTIONS

The Hardinge HLV-H Lathe is shipped completely wired and assembled. Access for the electric power line is gained at any convenient place. Remove fibre board cover on disconnect switch "D", Figure 3, and

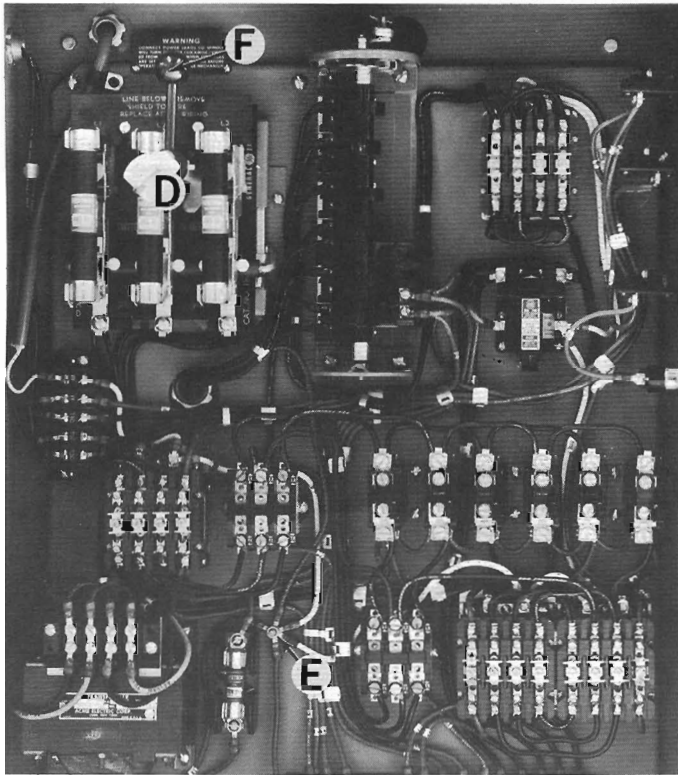


Figure 3 — Main Switch Case

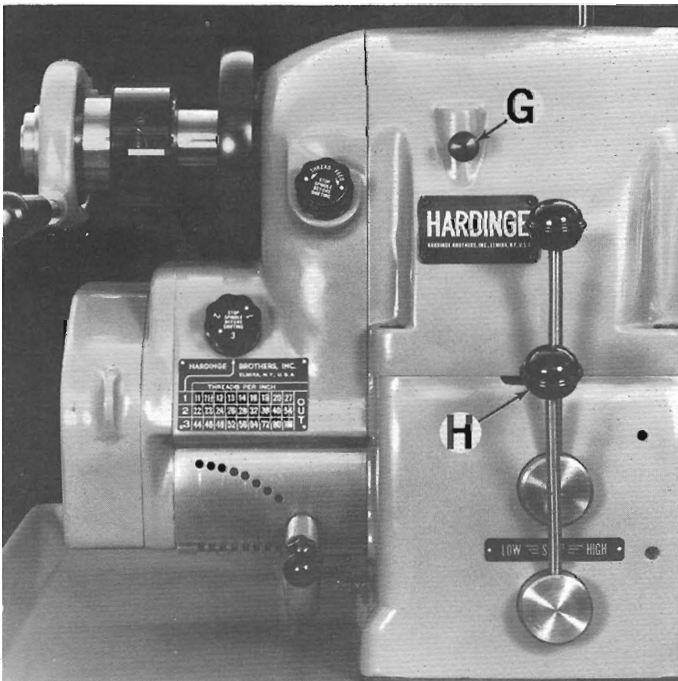


Figure 4 — Spindle Lock Pin and Bed Levers

make electrical connections on line side of disconnect switch. Ground connection is made at ground post "E".

DO NOT OPERATE SPEED CHANGE MECHANISM UNTIL SPINDLE ROTATION HAS BEEN CHECKED.

To check rotation of spindle, apply a collet to the machine spindle to anchor collet closer. Exercising extreme care, make power connection and turn switch to "On" using lever "F".

Pull out lock pin "G" Figure 4. Place lever "H" in

"Low" position and selector switch "J", Figure 5, in "Forward" position. Push "Start" button "K". Spindle should rotate counterclockwise when viewed from tail-stock end of machine.

If spindle does not turn in correct direction, **DISCONNECT POWER SOURCE** and interchange any two leads at line side of disconnect switch. Replace fibre board cover on disconnect switch. When spindle is rotating correctly, turn disconnect switch to "Off" with lever "F", Figure 3. Close and secure switch case door.

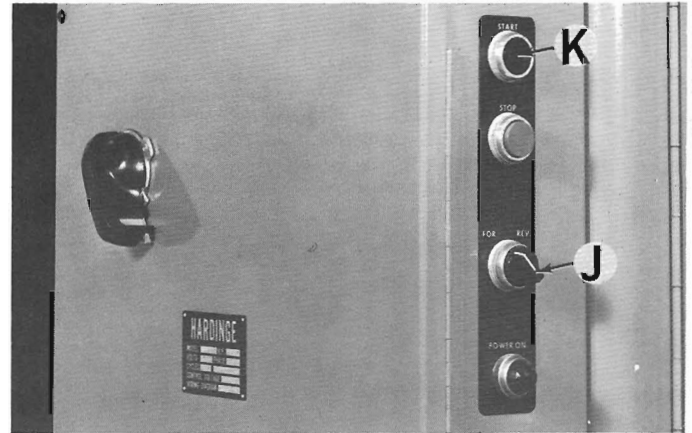


Figure 5 — Main Switch Case Controls

— MAINTENANCE INSTRUCTIONS — COLLET CLOSER REMOVAL

The collet closer should be removed weekly and between set ups for cleaning to prevent loading of chips between collet closer tube and inside of spindle at rear end and collet threads.

1. Remove link pin "A", Figure 6, only. This pin is easily removed by pulling up and out with fingers.
2. Remove collet closer as shown, Figure 7. To remove adjusting nut "B", pull straight off end of spindle. **DO NOT TURN ADJUSTING NUT — IT IS NOT THREADED TO SPINDLE.**

COLLET CLOSER REPLACEMENT

1. Clean the inside of the headstock spindle before applying collet closer. Also clean outside diameter at rear of spindle where adjusting nut locates. Clean collet closer tube inside and out.
2. Apply a film of light oil on rear of headstock spindle and replace adjusting nut "B", Figure 7. **DO NOT FORCE ADJUSTING NUT ON SPINDLE.** if adjusting nut goes on tight, remove and examine for burrs or scratches. Apply a film of light oil on bearing section "C" of collet closer tube, replace closer and insert link pin "A", Figure 6.

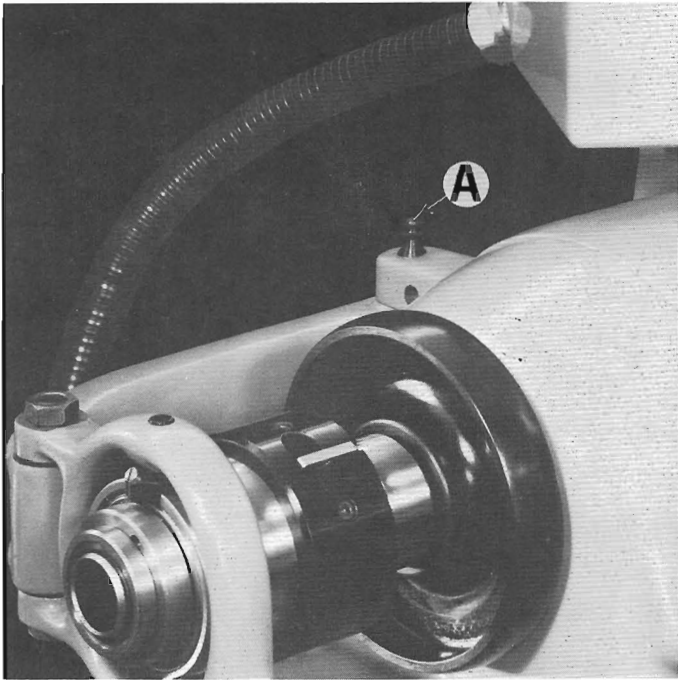


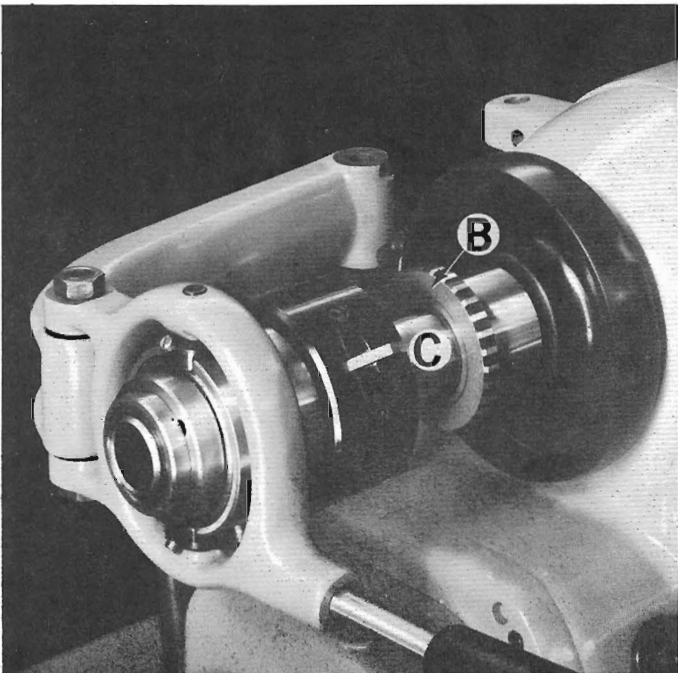
Figure 6 — Collet Closer Link Pin

DRIVE BELT ADJUSTMENT

To check belts for proper tension, place brake selector switch in "Off" position. Run machine spindle at 1100 R.P.M. and allow it to coast to a stop. There should be no "looseness" in the belts and yet they should not be "drum tight". If belts slip when properly adjusted, machine is being overloaded.

TO ADJUST BELTS, loosen lock nut "A", Figure 8. Turn adjusting screw "B" clockwise to lower motor plate and tighten belts. Each time after adjusting, start machine spindle and allow it to coast to a stop with brake selector switch in "Off" position to allow belts to equalize their tension.

Figure 7 — Collet Closer Removal



DRIVE BELT REPLACEMENT

1. Run pulley carrier to down position (low spindle speed, 125 R.P.M.).
2. Push stop button to **SHUT OFF MACHINE**.

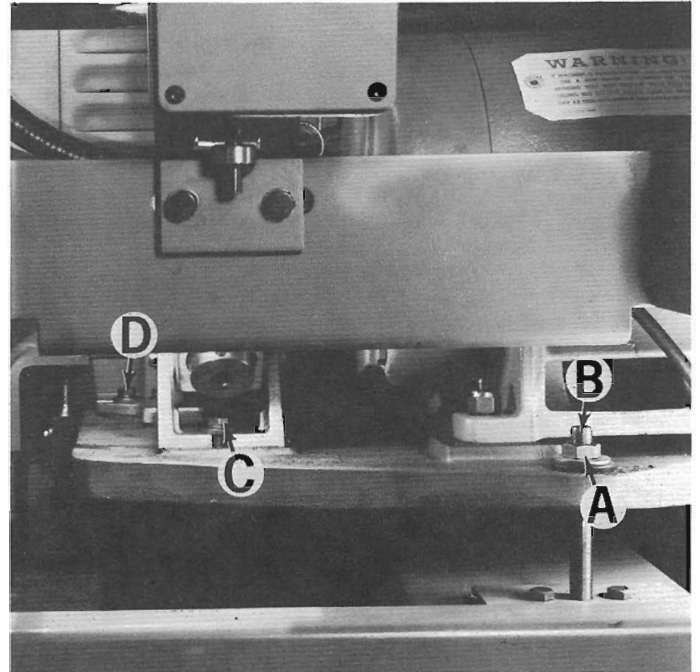


Figure 8 — Brake Mounting Bolts and Drive Belt Adjusting Screw

3. Remove pedestal rear cover to prevent damage when motor mounting plate is raised.
4. Remove lock nut "A", Figure 8.
5. Raise front of motor mounting plate approximately 2" and block, Figure 9.
6. Roll motor belt to right off countershaft pulley onto pulley hub, Figure 10.
7. **TO REMOVE MOTOR BELT** from motor pulley, remove bolt "C", Figure 8, loosen bolt "D" and swing brake assembly to left, Figure 11.

8. Run pulley carrier to top position (high spindle speed, 3000 R.P.M.) with "Faster" push button on control head.
9. Push stop button to **SHUT OFF MACHINE.**

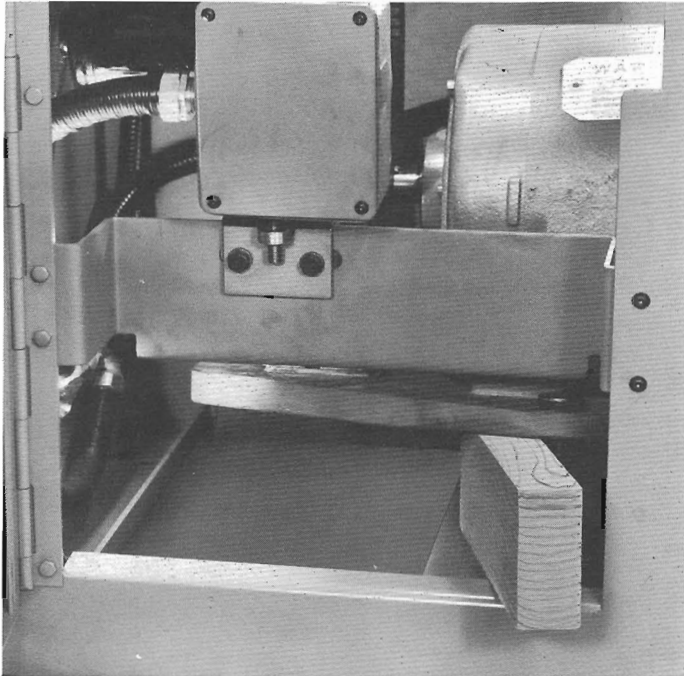


Figure 9 — Motor Mounting Plate Raised and Blocked

10. Slide countershaft assembly to extreme right and remove belts over left end of countershaft, Figure 12.

Figure 10 — Motor Belt rolled from Countershaft Pulley onto Pulley Hub

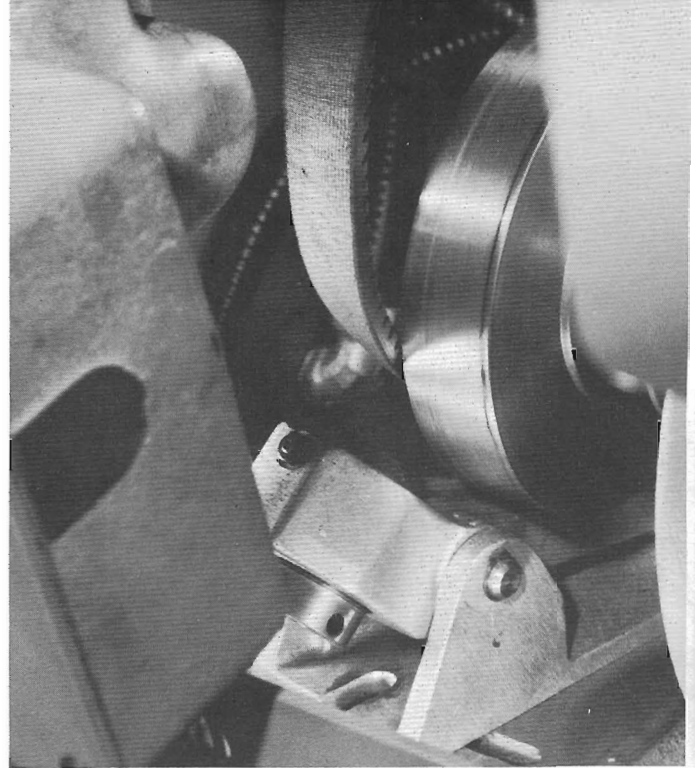
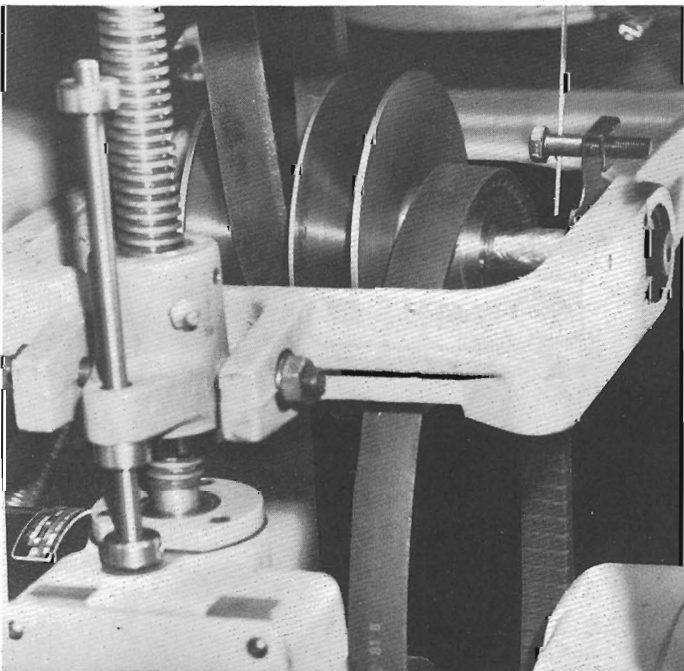
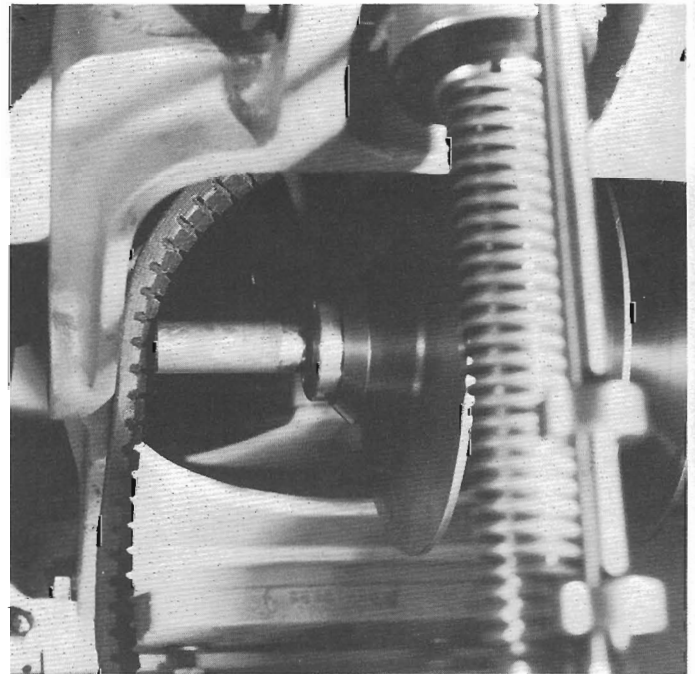


Figure 11 — Motor Belt Removal from Motor Pulley

Figure 12 — Belt Removal over Countershaft



11. TO REMOVE HEADSTOCK BELT:

- (A). Remove cotter pins from both ends of pull rod "E", Figure 13, which passes through headstock belt. (Pull rod can be used to hook belt over spindle pulley.)
- (B). Remove collet closer and adjusting nut per Page 4.
- (C). Remove snap ring "F", Figure 14, and remove handwheel "G".

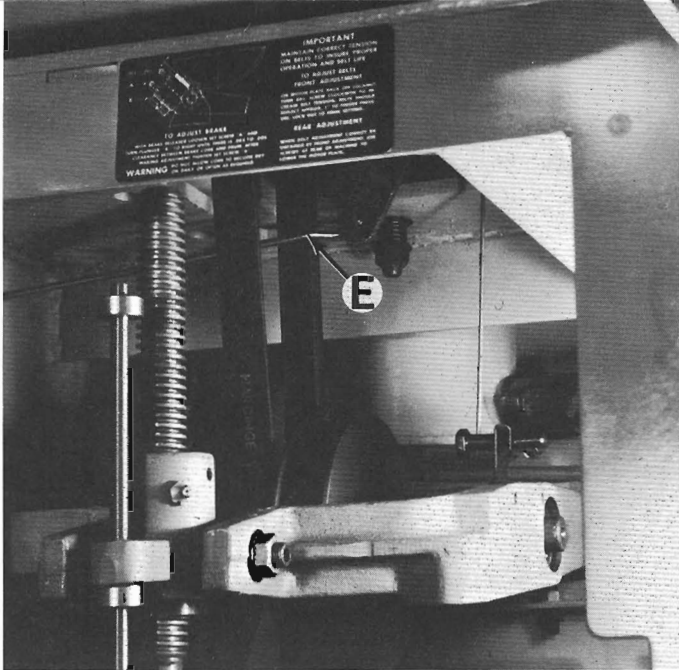


Figure 13 — Speed Change Pullrod

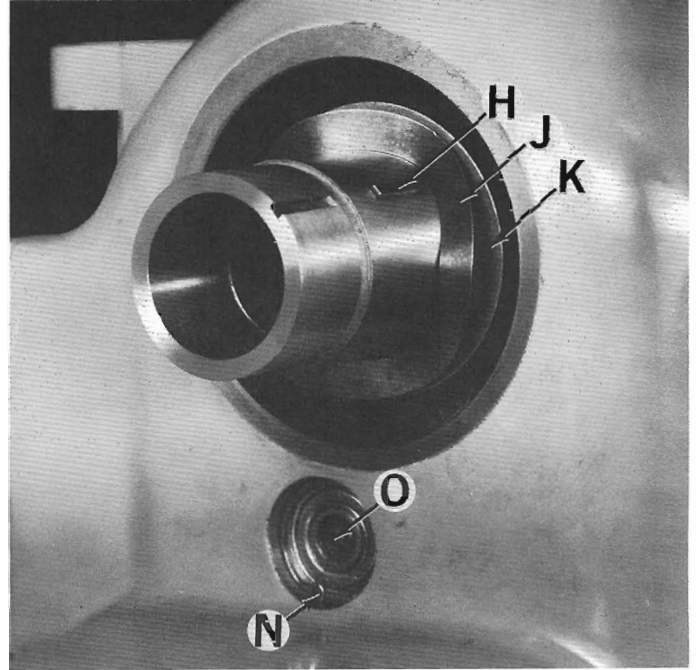


Figure 15 — Handwheel Washers and Key

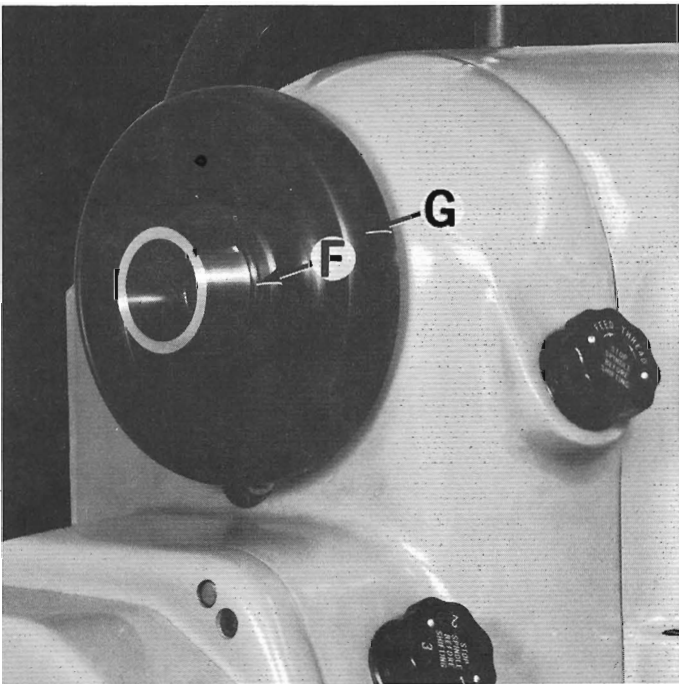


Figure 14 — Spindle Handwheel

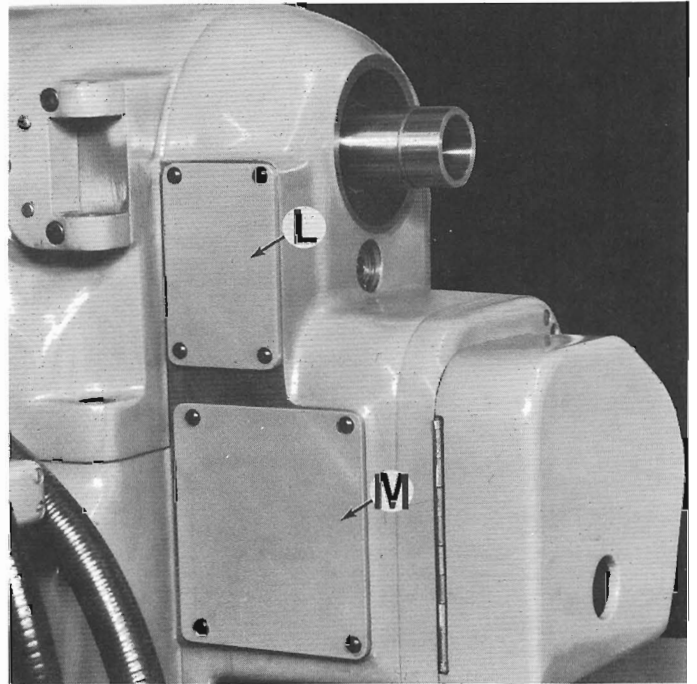
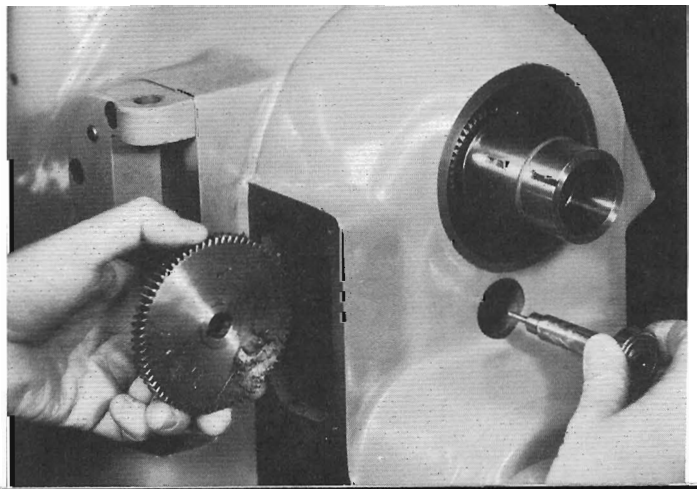


Figure 16 — Gearbox Covers

- (D). Remove key "H", Figure 15, and washers "J" and "K".
- (E). Remove covers "L" and "M", Figure 16.
- (F). Remove snap ring "N", Figure 15.
- (G). Turn push screw "O" clockwise to remove gear, shaft and bearing, Figure 17.

Figure 17 — Idler Gear and Shaft Removal



- (H). Remove lock screws "P" and "Q", Figure 18.
- (I). Unscrew shaft "R", Figure 19, with hex pin wrench. Pull shaft "R" out approximately 5".
- (J). Use switch pull rod as hook to lift spindle belt out of pulley and out through opening in headstock, Figure 19. (Pull belt part way out of top opening in rear of gear box to aid in passing narrow width of belt past underside of pulley and over boss of gear box housing.)

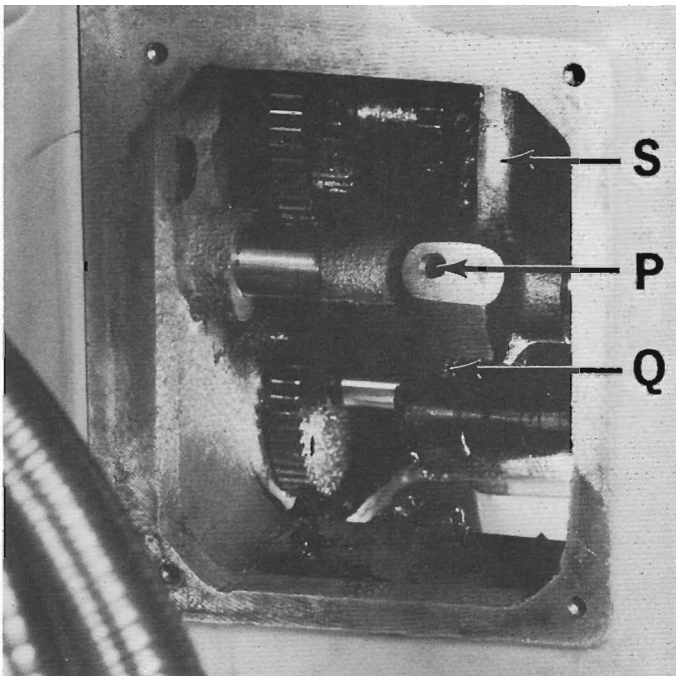


Figure 18 — Gearbox Shifter Fork

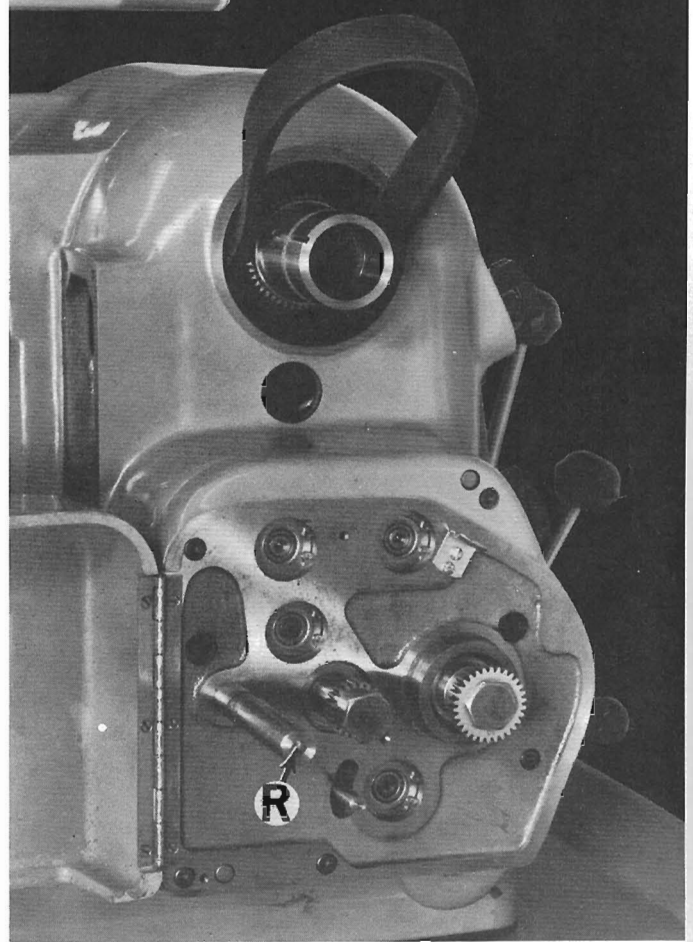
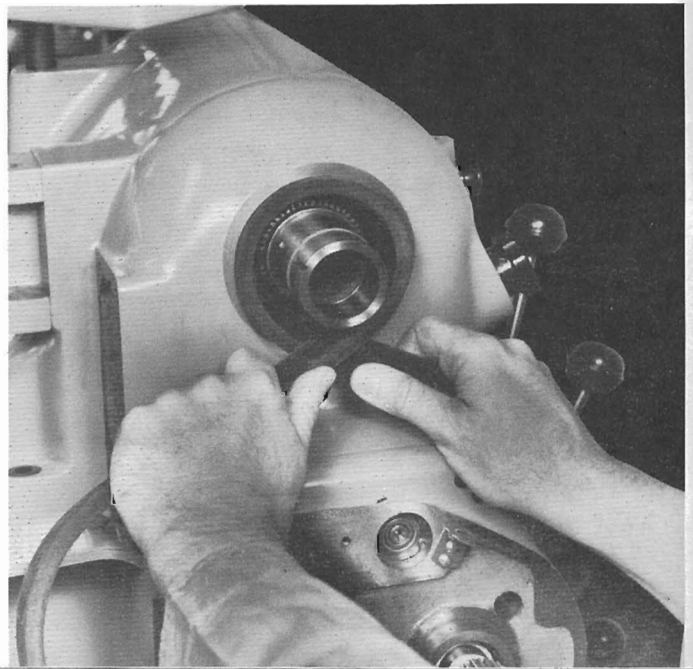


Figure 19 — Spindle Belt Removal

- 16. Assemble other components. Adjust for proper belt tension per Page 5. See instructions for brake adjustment, Page 21.
- 17. Make checks as outlined in steps 8, 9 and 10 under "Speed Change Mechanism Replacement", Page 26.

Figure 20 — Spindle Belt Replacement

- 12. Cross new spindle belt, Figure 20, and feed through gear box, headstock and down into pedestal. Use pull rod to lift belt over spindle pulley.
- 13. Assemble belts on countershaft.
- 14. Replace shaft "R", Figure 19, and screws "P" and "Q", Figure 18 (locate shifter yoke on shaft by lining up screw holes).
- 15. Back off push screw "O", Figure 15. Replace idler gear shaft and bearing, Figure 17. (Match timing marks on gear and worm, Figure 21.) Replace snap ring "N", Figure 15.



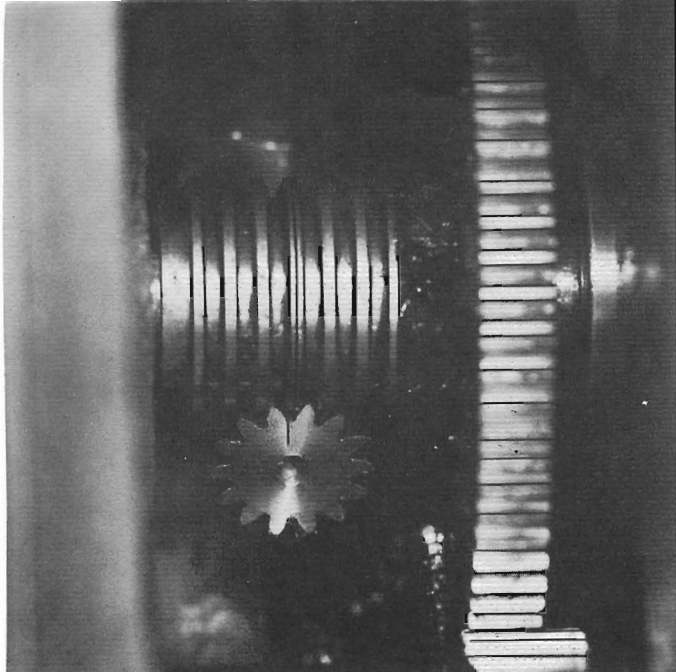


Figure 21 — Timing Marks for Pinion and Worm

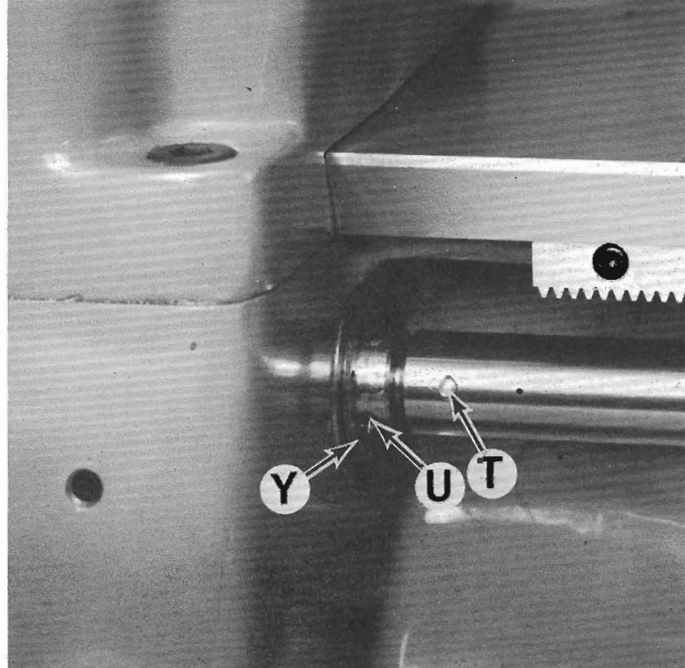


Figure 22 — Lock Nut and Taper Pin for Lead Screw

GEAR BOX LUBRICATION

Lubricate gears in gear box every three months, or more often if necessary, with Houghton Cosmolube #2. If long periods exist when threading unit is not shifted, operate monthly thread-feed knob, three change knob and nine change handle from one extreme to the other several times.

Lubricate bushings and shafts on change gear bracket with spindle oil. If long run threading is involved, lubricate daily.

GEAR BOX REMOVAL

1. Remove collet closer and adjusting nut per Page 4.
2. Remove snap ring "F", Figure 14, and remove handwheel "G".
3. Remove key "H", Figure 15, and washers "J" and "K".
4. Remove cover "M", Figure 16.
5. Remove lock screws "P" and "Q", Figure 18.
6. Unscrew shaft "R", Figure 19, with hex pin wrench. Remove shaft "R" and shifter fork "S", Figure 18.
7. Remove taper pin "T", Figure 22.
8. Engage carriage lead screw nut with lead screw and move carriage with handwheel approximately $\frac{1}{2}$ " to right.
9. Remove lock nut "U", Figure 22.
10. Turn nut "V", Figure 23, clockwise to remove dowel pin "W".
11. Remove four screws "X", Figure 23, and Figure 24. **NOTE:** Screw removal shown in Figure 24 requires length of hex stock.

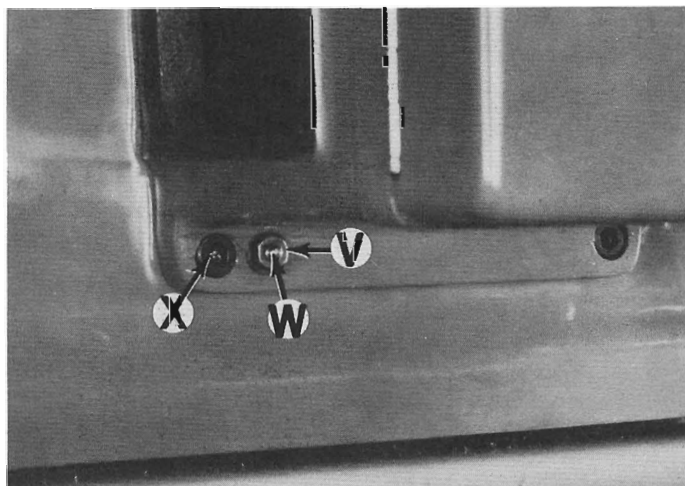


Figure 23 — Locating Pin and Mounting Bolts for Gearbox

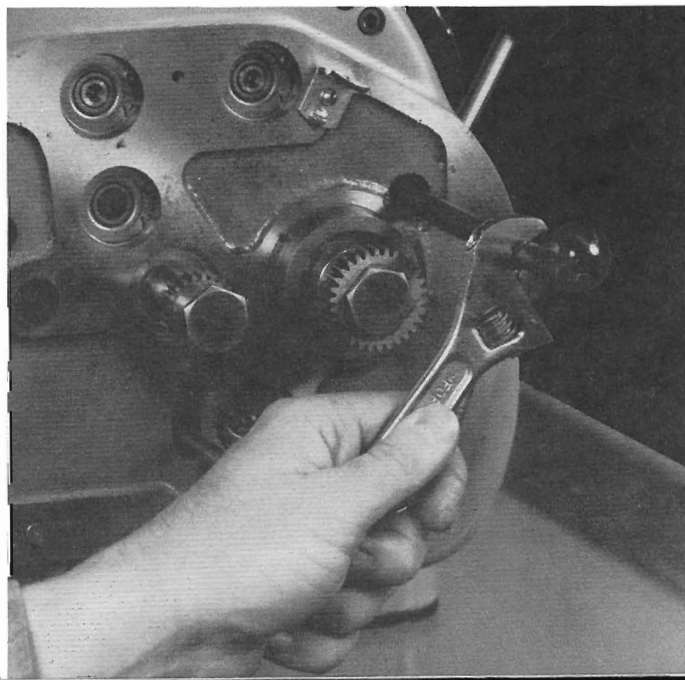


Figure 24 — Gearbox Mounting Bolt Removal

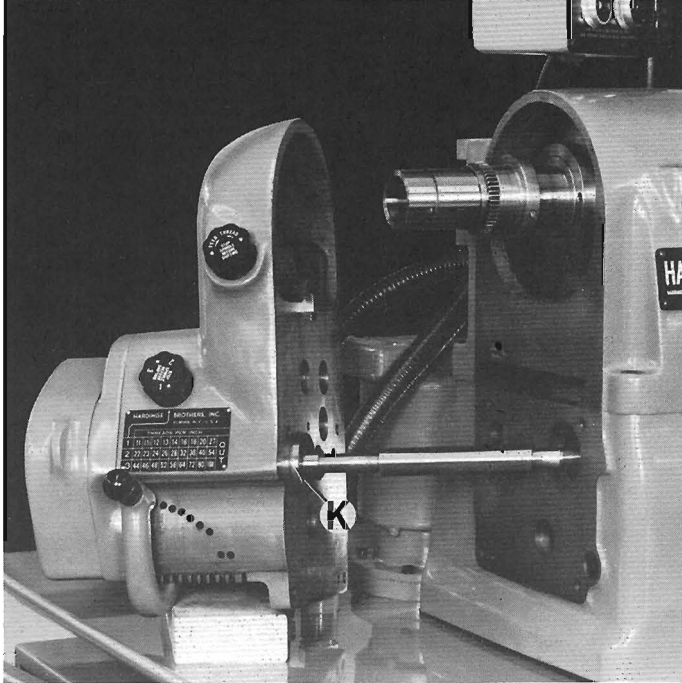


Figure 25 — Gearbox Removal

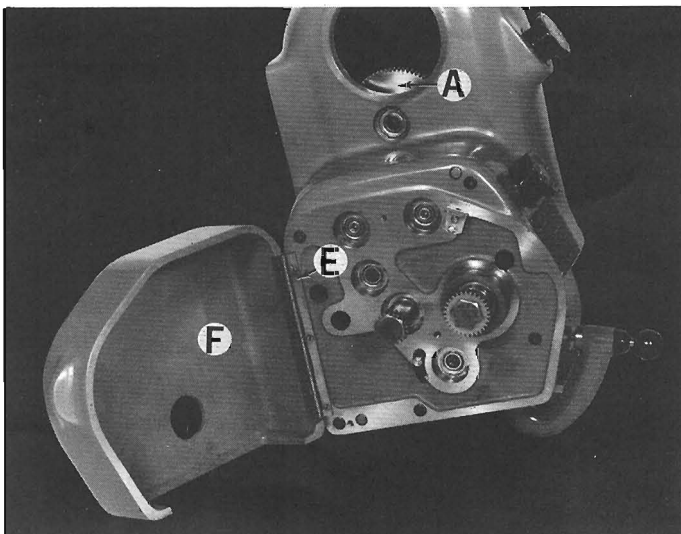
12. Pull gear box straight off to remove, Figure 25.
13. If necessary, remove nut "Y", Figure 22, to remove two bearings for cluster shaft.

GEAR BOX DISASSEMBLY

NOTE: Should it be necessary to remove idler gear assembly "A", Figure 26, this is accomplished without removal of gear box by following steps 11B, 11C, 11E, 11F and 11G under "Drive Belt Replacement", Page 5. Follow step 15 in same section for replacement.

1. Follow steps 1 through 12 under "Gear Box Removal", Page 9.
2. To remove bearing "B", Figure 27, remove stop block "C".
3. If necessary to remove "Feed-Thread" pinion assembly, remove lock screw "D", Figure 27, and set screw under lock screw "D".
4. Remove three screws "E", Figure 26, and remove gear guard "F". Remove studs "A", Figure 28, and gears "B" if clearance is insufficient for gears to pass through cover openings.

Figure 26 — Gearbox Assembly



5. Remove five snap rings "G", Figure 28, and spacers. Lay out spacers "H" as shown, Figure 29, or identify with shaft to maintain spacing when reassembling.

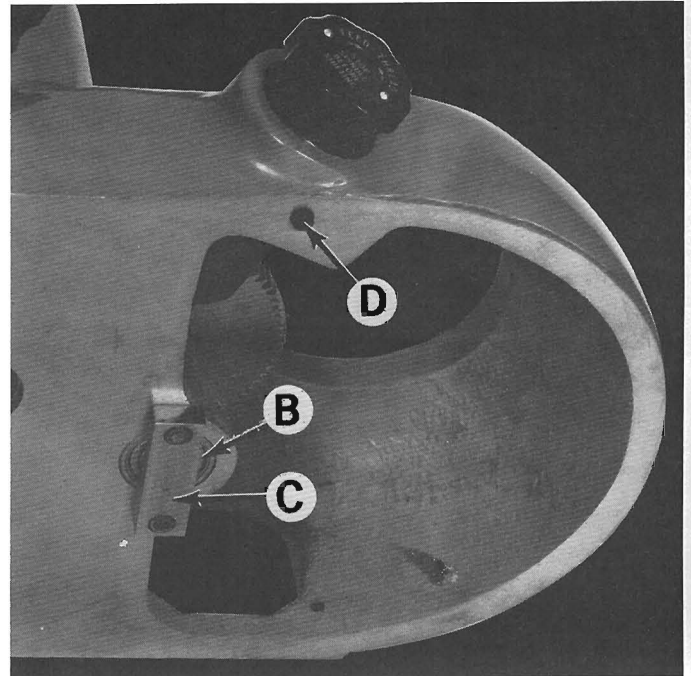
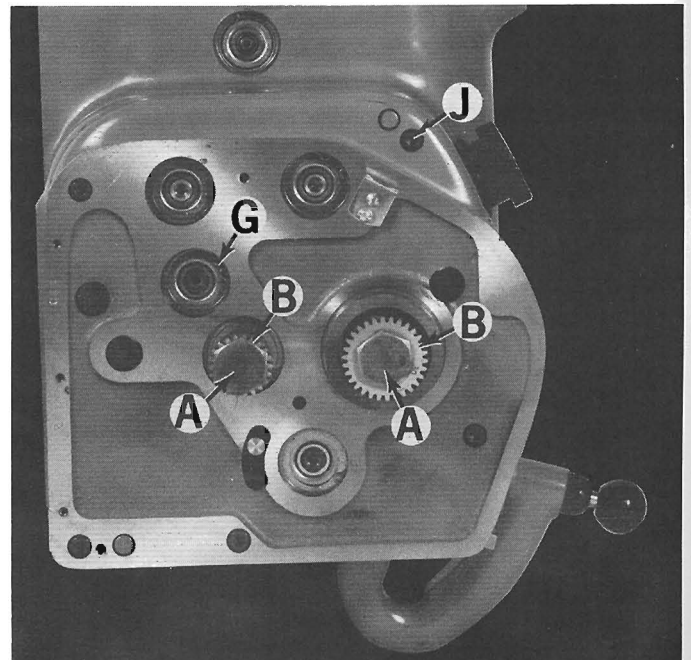


Figure 27 — Idler Shaft Rear Bearing

6. Remove five screws "J", Figure 28.
7. With shifter shaft "K", Figure 30, out of mesh, tap cluster shaft with plastic mallet until free from cover "L".

Figure 28 — Gearbox Assembly



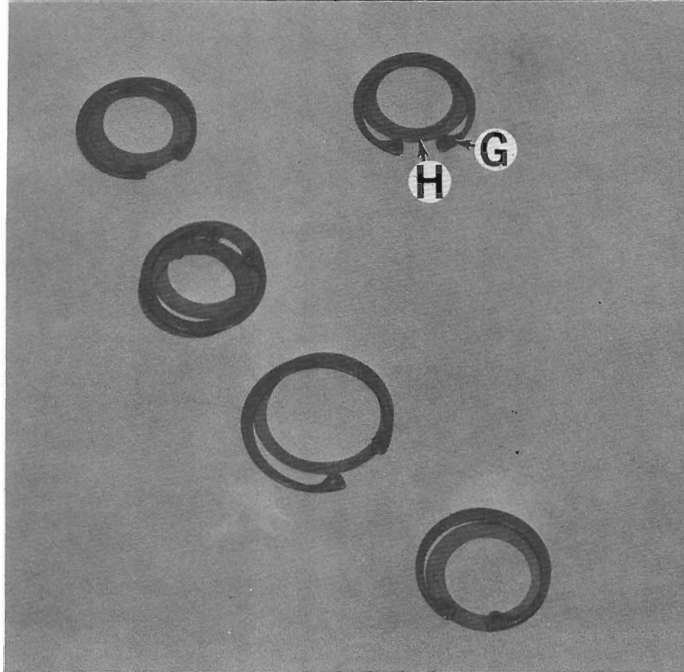


Figure 29 — Shim and Snap Ring Layout

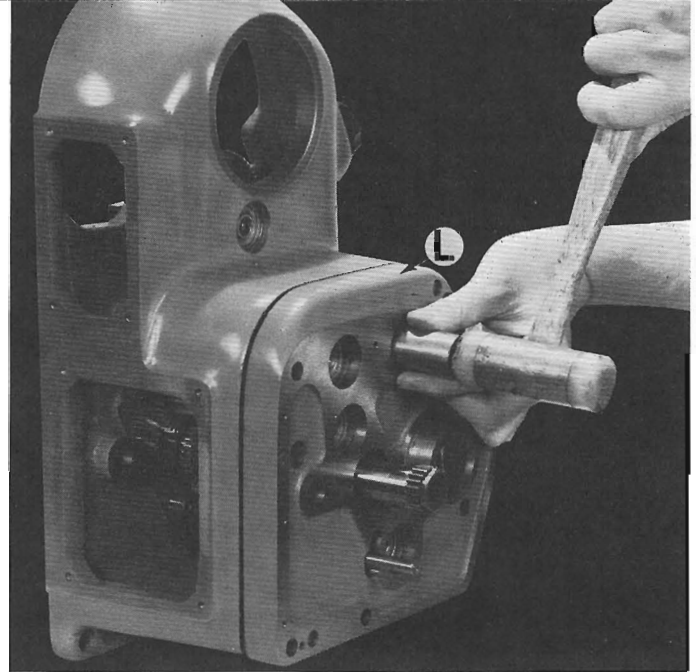


Figure 31 — Tapping Shafts In Place During Cover Removal

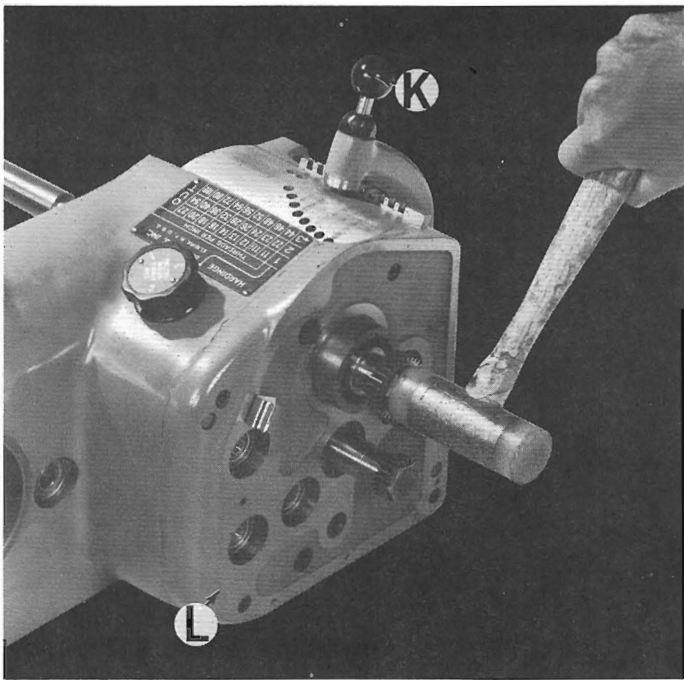


Figure 30 — Cluster Shaft Removal from Cover

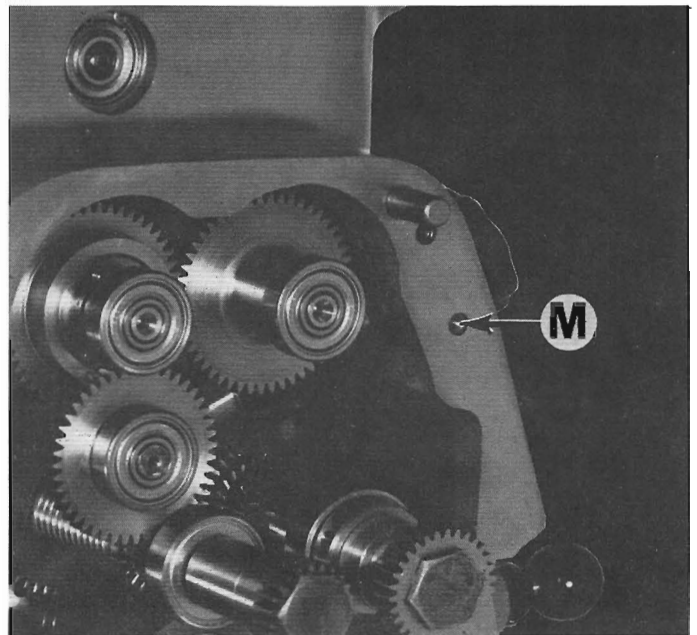


Figure 32 — Lock Screw for "Three Change" Pinion Assembly

Figure 33 — Tumbler and Shaft Assembly Removal



8. Remove cover "L" with plastic mallet. **DO NOT ALLOW** remaining shafts to lift up with cover. Tap shafts down in place while cover is being removed, Figure 31.
9. If necessary to remove "Three Change" pinion assembly, remove lock screw "M", Figure 32, and set screw under lock screw "M".
10. Remove gear box tumbler and shaft assembly, Figure 33.

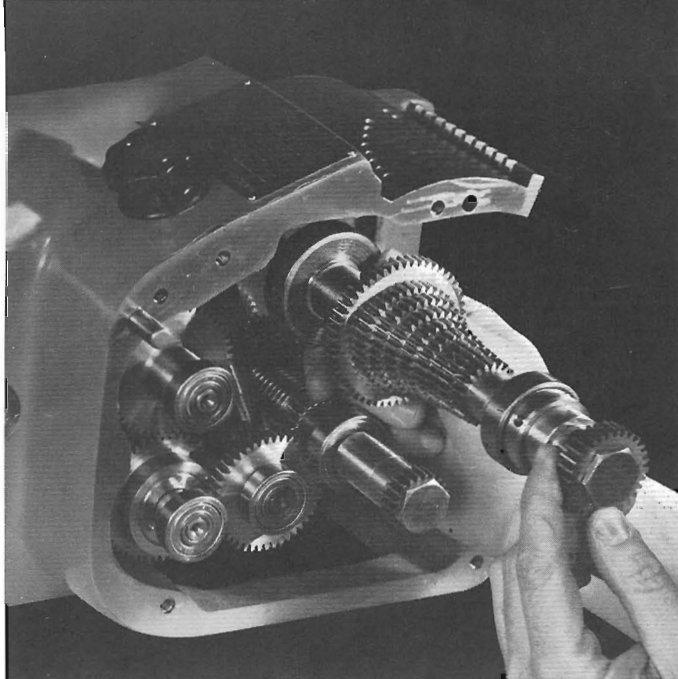


Figure 34 — Cluster Shaft Assembly Removal

11. Remove cluster shaft assembly, Figure 34.
12. Remove clutch shaft, intermediate shaft and change shaft assemblies simultaneously, Figure 35.
13. Remove reverse shaft, Figure 36. **USE CARE** to keep spacers in mounting side of gear box with gear shafts as removed.
14. To disassemble "Feed-Thread" or "Three Change" pinion assemblies:
 - (A). Remove set screw "A", Figure 37, to remove pinion shaft "B" and handle "C" from bushing "D".

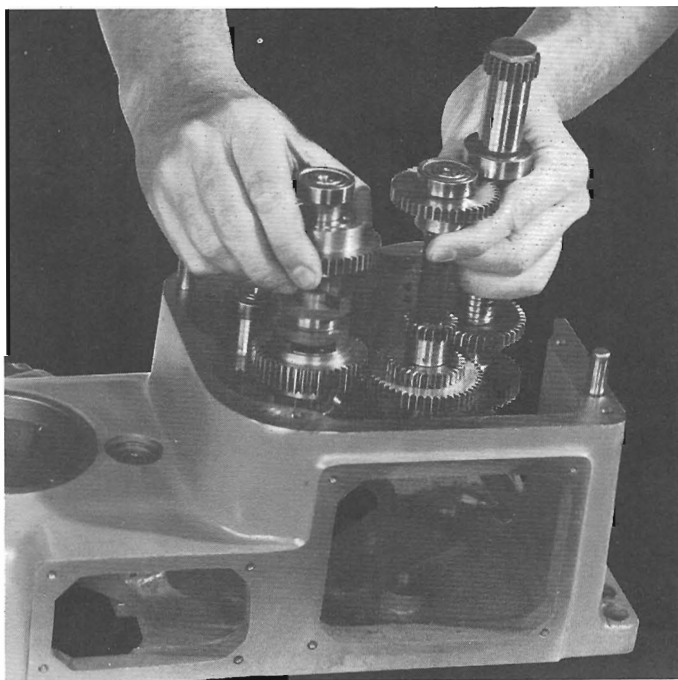


Figure 35 — Clutch Shaft, Intermediate Shaft and Change Shaft Removal

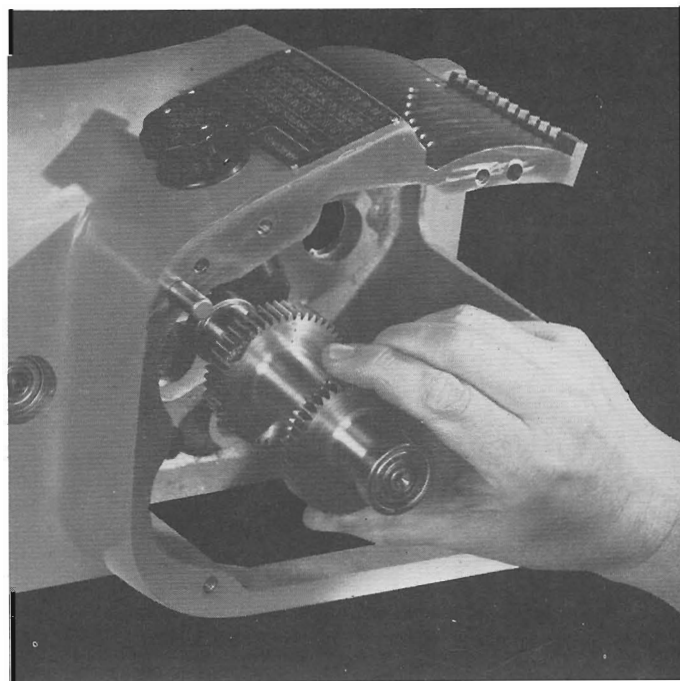


Figure 36 — Reverse Gear Removal

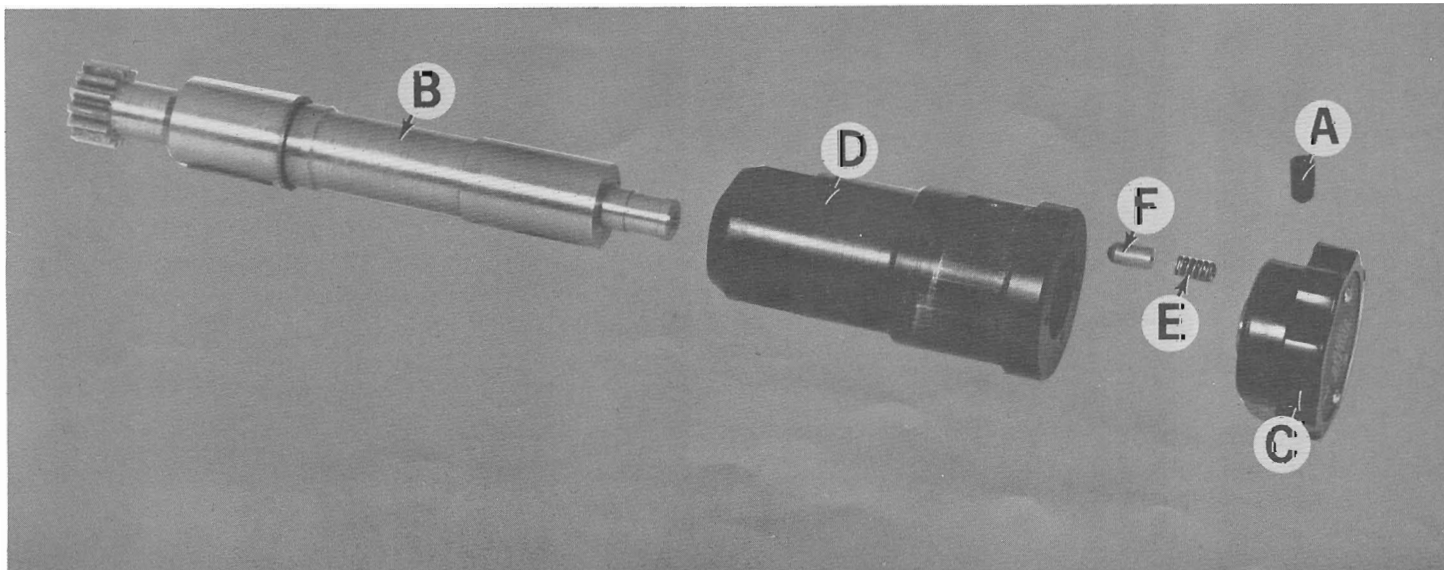


Figure 37 — Pinion Assembly Components

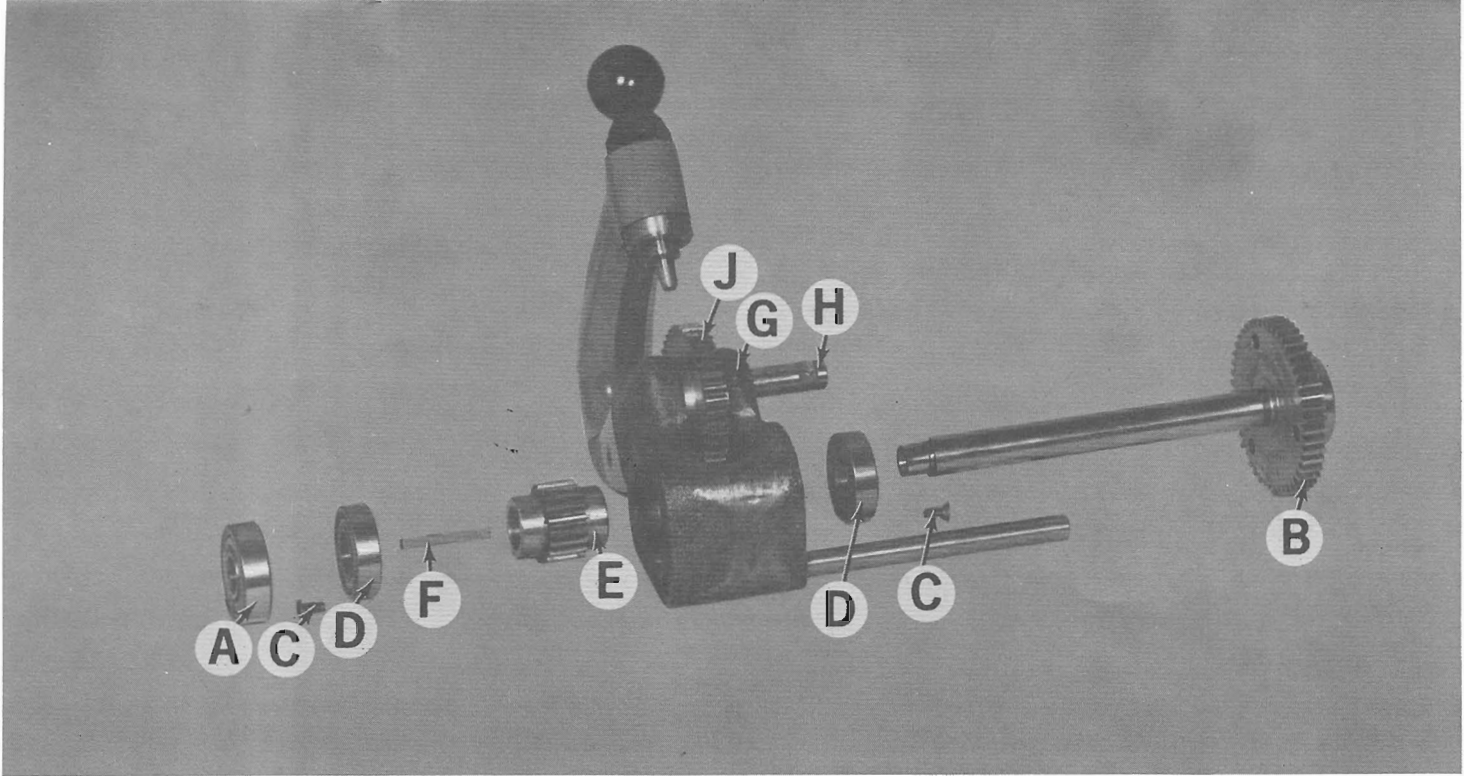


Figure 38 — Tumbler and Shaft Assembly

- (B). Remove spring "E" and plunger "F" from handle.
15. To disassemble gear box tumbler and shaft assembly:
- (A). Press bearing "A", Figure 38, off tumbler shaft "B" and remove shaft.
- (B). Remove two screws "C".
- (C). Remove bearings "D", gear "E" and key "F".
- (D). Loosen set screw "G", remove shaft "H" to remove gear and bearing "J".
- (E). Remove ball handle "A", Figure 39, nut "B", spring "C", plunger "D" and bushing "E".

- (D). Remove bearing "G" and remove 22, 23, 24, 26, 28, 32, 36, 40 and 54 tooth gears.
- (E). Remove key "H" and spacer "J".
- (F). Press off bearing "K".

16. To disassemble cluster shaft assembly:
- (A). Remove stud "A", Figure 40, gear "B" and spacer "C".
- (B). Remove key "D" and collar "E".
- (C). Remove nut "F".

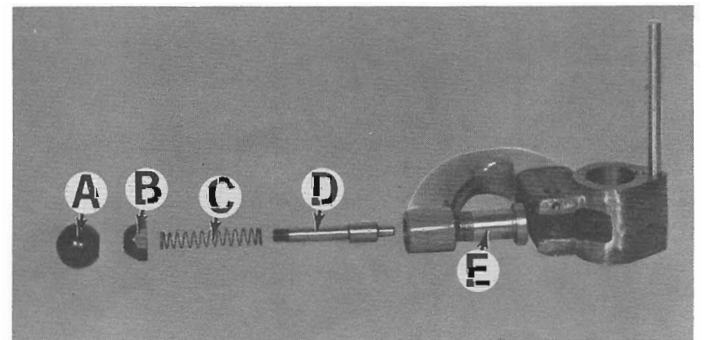
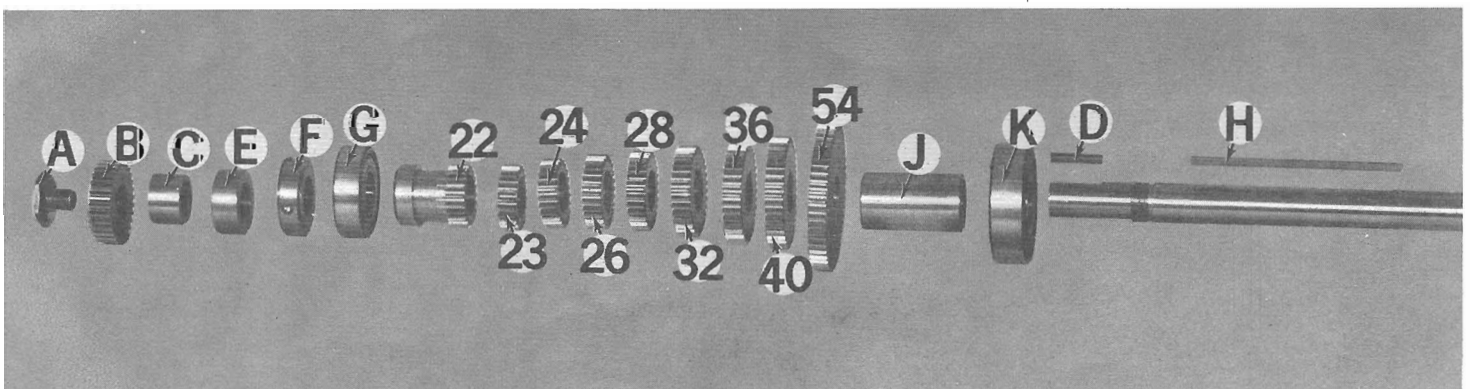


Figure 39 — Plunger Assembly Components

Figure 40 — Cluster Shaft Assembly



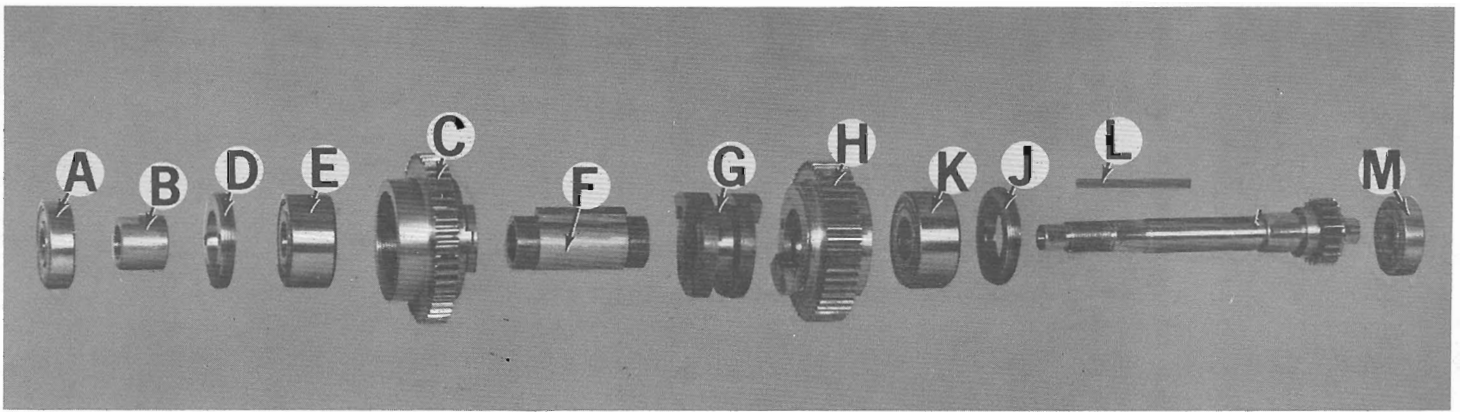


Figure 41 — Clutch Shaft Assembly

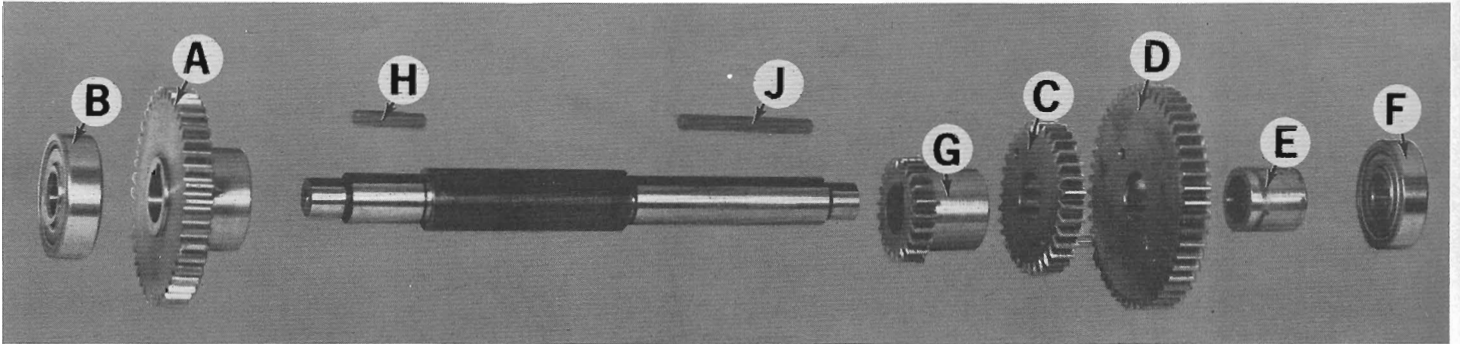


Figure 42 — Intermediate Shaft Assembly

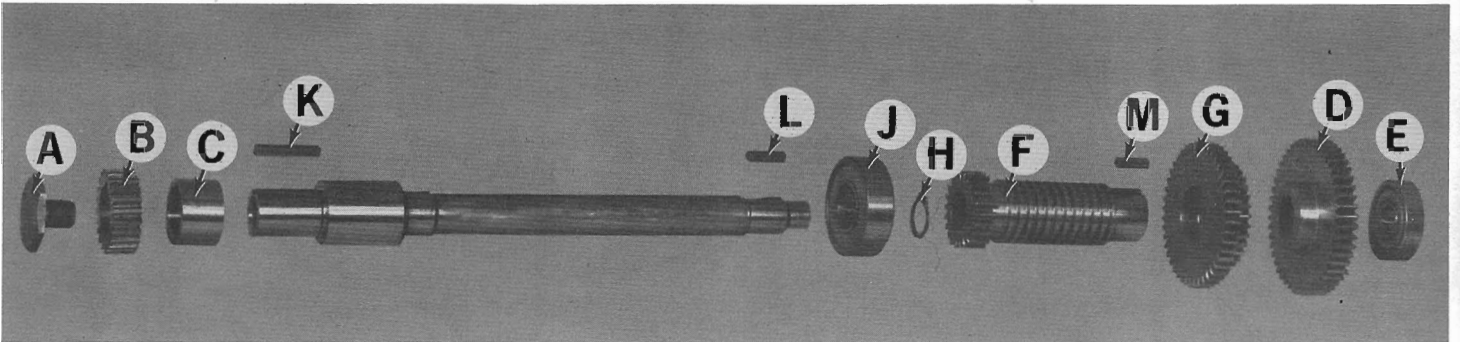


Figure 43 — Change Shaft Assembly

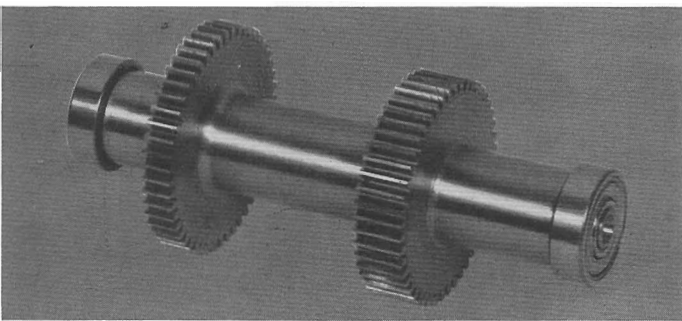


Figure 44 — Reverse Shaft

17. To disassemble clutch shaft:

- (A). Press off bearing "A", Figure 41.
- (B). Remove nut "B" and remove reverse gear assembly "C".
- (C). Remove nut "D" to remove bearing "E" from gear assembly "C".

(D). Remove clutch bushing "F", clutch "G", remove key "L" and forward gear assembly "H".

(E). Remove nut "J" to remove bearing "K" from gear assembly "H".

(F). If necessary, press off bearing "M".

18. To disassemble intermediate shaft:

(A). Press off gear "A", Figure 42, and bearing "B".

(B). Press off gears "C" and "D", bushing "E" and bearing "F". Gears "C" and "D" are pinned together.

(C). Press off gear "G".

(D). Remove keys "H" and "J" if necessary.

19. To disassemble change shaft:
 - (A). Remove stud "A", Figure 43, gear "B" and spacer "C".
 - (B). Press off gear "D" and bearing "E".
 - (C). Remove worm "F" and two gears "G". Gears "G" are pinned together.
 - (D). Remove snap ring "H" and press off bearing "J".
 - (E). If necessary, remove keys "K", "L", "M" and key located in inside diameter of worm "F".
20. Reverse shaft, Figure 44, is of one piece construction with the exception of bearings which are pressed on each end.

GEAR BOX ASSEMBLY

1. Reverse steps 14, 15, 16, 17, 18 and 19 under "Gear Box Disassembly", Page 10.
2. Replace spacers (if removed) in mounting side of gear box housing as identified per gear shaft.
3. Replace reverse shaft, Figure 36. Tap into place against spacers and snap ring.
4. Replace clutch shaft, intermediate shaft and change shaft assemblies simultaneously, Figure 35. Tap into place.
5. Replace cluster shaft assembly, Figure 34. Position bearing "K" midway in casting as shown, Figure 25.
6. Replace gear box tumbler and shaft assembly, Figure 33.
7. Replace "Three Change" pinion assembly, set screw and lock screw "M", Figure 32.
8. Replace cover "L", Figure 30. Use care that all components are properly aligned with cover and tap slowly into place with plastic mallet.
9. Replace five screws "J", Figure 28.
10. Replace spacers "H", Figure 29, and snap rings "G", Figure 28, as identified with shafts in disassembly.
11. Replace gear guard "F", Figure 26.

12. Replace "Feed-Thread" Pinion assembly, set screw and lock screw "D", Figure 27. Line up timing marks on pinion and worm, Figure 21.
13. Replace bearing "B", Figure 27, and stop plate "C", if removed.
14. For proper operation gears "A" and "B", Figure 45, must be in mesh when "Three Change" handle is in No. 3 position. If this is not the case, loosen set screw "A", Figure 37, position gears "A" and "B", Figure 45, as shown. With plunger "F", Figure 37, in notched position hold against pinion and knob and tighten set screw "A", Figure 37.

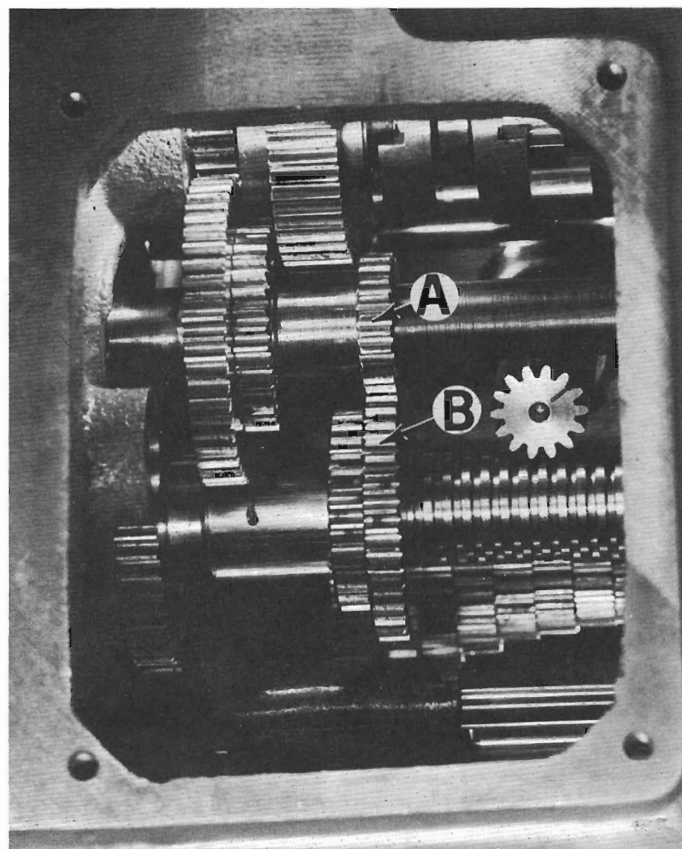


Figure 45 — Gear Position When "Three Change" Handle Is In No. 3 Position

GEAR BOX REPLACEMENT

1. Replace two bearings and nut "Y", Figure 22. Start gear box into position, Figure 25. Use care not to damage spindle gear and idler gear. Place lock nut "U", Figure 22, on cluster shaft and push gear box into place. If resistance is met, bearing "K", Figure 25, may not be positioning properly.
2. Replace four screws "X", Figure 23, and Figure 24. **NOTE:** Screw replacement shown in Figure 24 requires length of hex stock.

3. Back off nut "V", Figure 23, and replace dowel pin "W".
4. Tighten lock nut "U", Figure 22.
5. Engage carriage lead screw nut with lead screw and move carriage with handwheel to left to line up holes for taper pin "T". Replace taper pin "T".
6. Replace shaft "R", Figure 19, and shifter yoke "S", Figure 18. Place shifter fork in groove of clutch "G", Figure 41.
7. Locate shifter yoke on shaft by lining up screw holes and replace lock screws "P" and "Q", Figure 18. ("P" is the dog point screw and must locate in hole in shaft "R".)
8. Replace cover "M", Figure 16.
9. Replace washers "J" and "K", Figure 15, and key "H".
10. Replace handwheel "G", Figure 14, and snap ring "F".
11. Replace collet closer per instruction on Page 4.

HEADSTOCK BEARING LUBRICATION

The headstock spindle is mounted on precision pre-loaded ball bearings. The preloading and resulting load-carrying capacity is engineered to take radial thrust or end thrust or a combination of both.

THE PRECISION PRELOADED BALL BEARINGS ARE GREASE PACKED FOR LIFE and require no further lubrication. The entire bearing assembly is housed as a unit and is properly sealed to exclude dirt and foreign matter. The spindle bearing seals are designed to operate at high speed without wear or friction.

SPINDLE LOCK PIN

The electrical interlock between lock pin "A", Figure 46, and the main drive motor is controlled by limit switch "B", Figure 47, located under Hardinge name plate "C", Figure 46. The limit switch "B" is actuated by a plunger moved by lock pin "A".

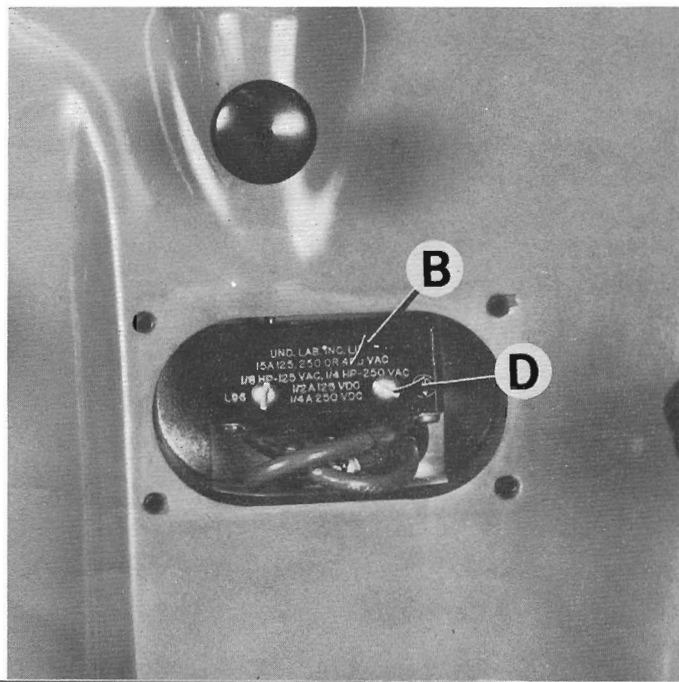
SPINDLE LOCK PIN LIMIT SWITCH REPLACEMENT

1. Turn disconnect switch to "Off" position.
2. Remove cover "C", Figure 46.
3. Remove screws "D", Figure 47, and limit switch "B" and disconnect wires.
4. When replacing limit switch, connect wires to normally closed and common terminals. Clearance in mounting holes will allow limit switch to be located in proper position for tripping.



Figure 46 — Spindle Lock Pin

Figure 47 — Spindle Limit Switch



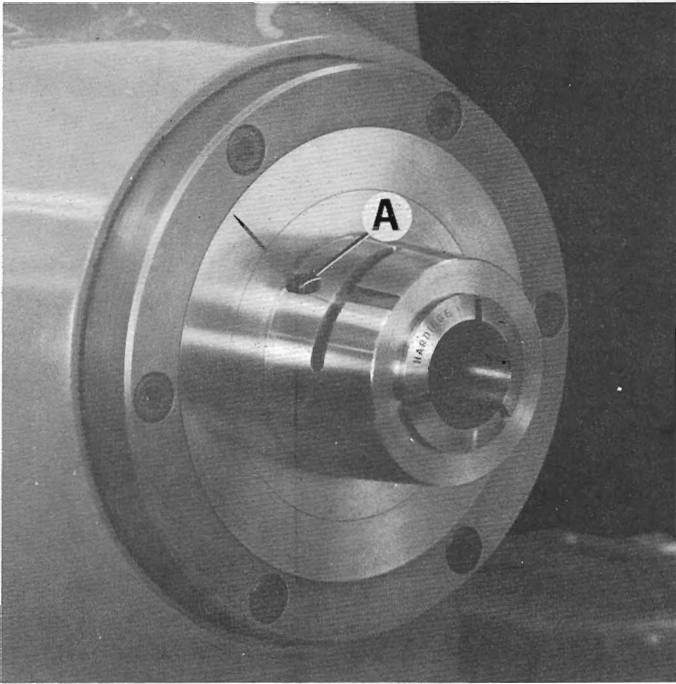


Figure 48 — Spindle Collet Key

SPINDLE COLLET KEY

The spindle collet key located under lock screw "A", Figure 48, can be replaced in the event of wear or damage. Use a 3/32" hex pin wrench to remove lock screw and collet key screw.

HEADSTOCK REMOVAL

For repairs to headstock spindle or bearings, return headstock to Hardinge. Unit should be properly greased to prevent rust.

1. Follow steps 1 through 12 under "Gear Box Removal", Page 9.
2. Follow steps 1 through 6, 8 through 10, 11A and 11J under "Drive Belt Replacement", Page 5.
3. Remove lock screw "A", Figure 49, and loosen set screw under lock screw "A". Lift control head "B" straight off. **NOTE:** It may be necessary to remove cable nut "C" to remove control head.
4. Loosen set screw "D", Figure 50, in motor compartment and remove indicator rod up through headstock.
5. Remove cover "C", Figure 46.
6. Remove screws "D", Figure 47, and limit switch "B" and disconnect wires.
7. Remove cable nut "E", Figure 49, and pull wires out of rear of headstock.
8. Remove four screws "F", Figure 51.

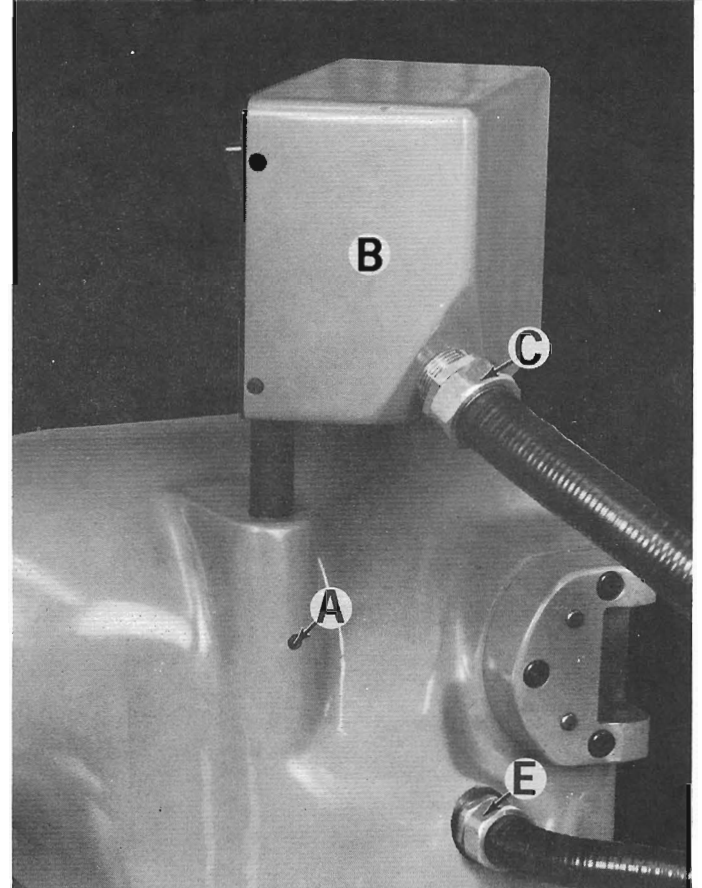


Figure 49 — Control Head from Machine Rear

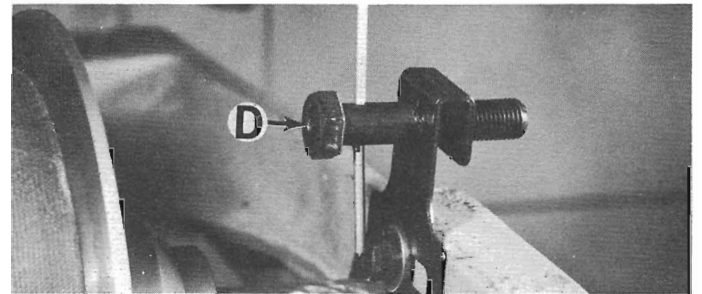
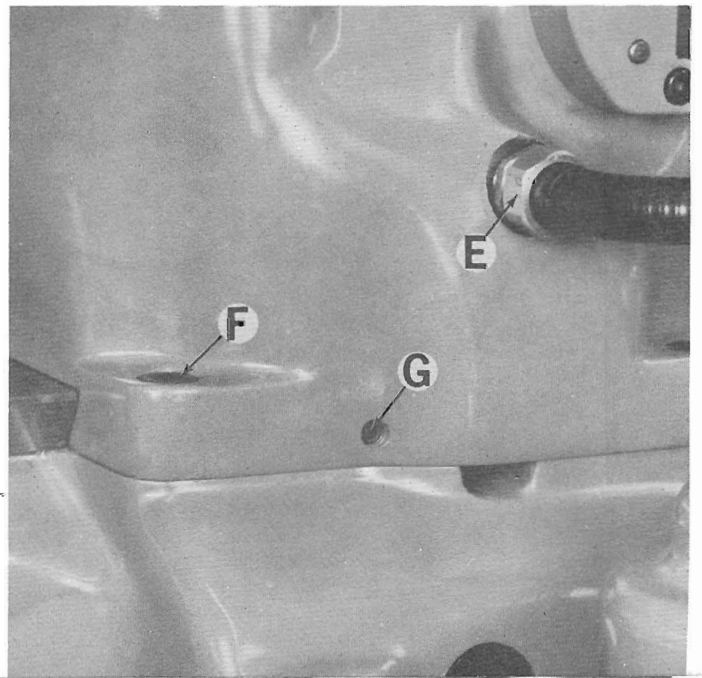


Figure 50 — Indicator Rod Bracket

Figure 51 — Headstock Rear



9. Remove lock screw "G" and remove set screw under lock screw "G". Remove locking plug "H", Figure 52.
10. Using hoist and sling for support, Figure 53, slide headstock off dovetail bed. **CAUTION:** If sling is placed around headstock spindle, handle head with smooth motion to prevent damage to super-precision spindle. Do not misplace seal under headstock.

HEADSTOCK REPLACEMENT

1. Replace headstock, Figure 53.
2. Locate machined surface "A", Figure 54, of headstock .008" forward (toward tailstock end) of machined surface "B" of bed casting.

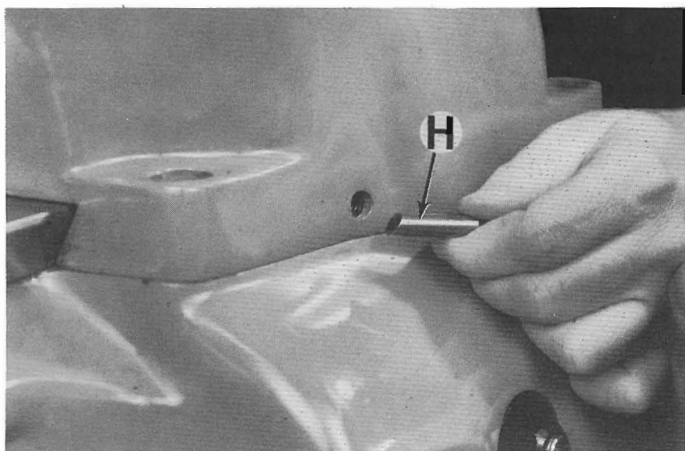
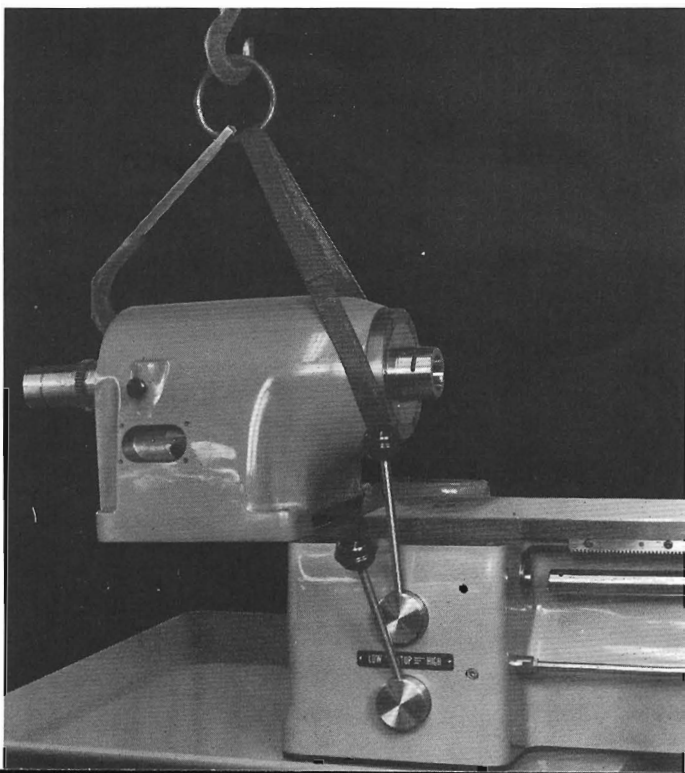


Figure 52 — Headstock Locking Plug

Figure 53 — Headstock Removal

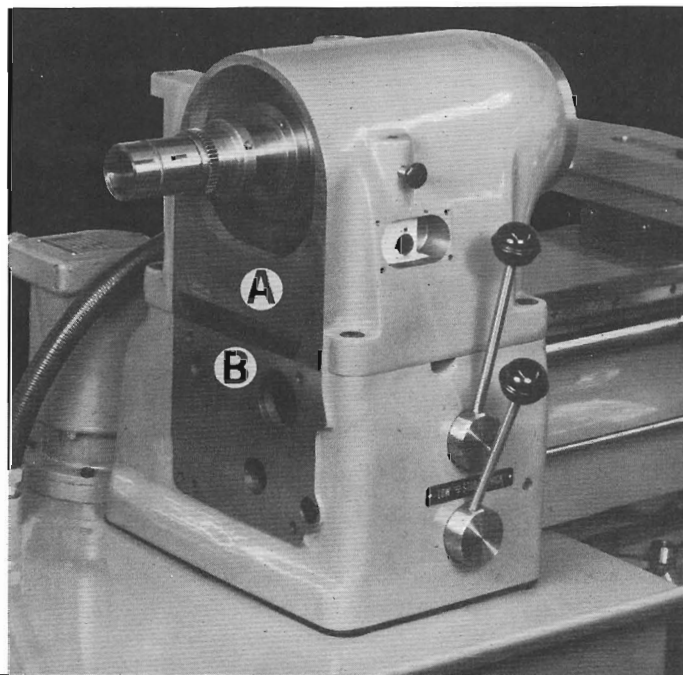


3. Replace locking plug "H", Figure 52. Use care that locking plug angle matches dovetail. Replace and tighten set screw until snug. Replace lock screw "G", Figure 51.
4. Replace four screws "F", Figure 51. (65 foot pounds torque)
5. Replace micro switch wires and cable nut "E", Figure 49.
6. Connect wires to normally closed and common terminals and replace limit switch "B", Figure 47. Clearance in mounting holes will allow limit switch to be located in proper position for tripping. Replace cover "C", Figure 46.
7. Replace indicator rod (flat side toward front of machine).
8. Replace control head "B", Figure 49. Replace set screw and lock screw "A".
9. Replace spindle belt through headstock opening and down into pedestal.
10. Assemble belts on countershaft and lower motor mounting plate into position. Replace lock nut on adjusting screw. Replace pedestal rear cover. Replace cotter pins at both ends of speed change pull rod.
11. Follow steps 1 through 11 under "Gear Box Replacement" Page 15.
12. Run pulley carrier to down position. Push stop button. Hold indicating rod at 125 R.P.M. and tighten set screw "D", Figure 50.

BED LEVER REMOVAL

1. Follow steps 1 through 9 under "Headstock Removal", Page 17.
2. Slide headstock towards tailstock to reveal opening in bed, Figure 55.

Figure 54 — Headstock Positioning



3. Loosen lock nut "A", Figure 55, on stop rod shaft and remove taper pin "B", Figure 56, from positive stop. Unscrew stop rod "C", Figure 55, from stop rod extension "D".
4. Loosen nut "E", Figure 57, which is accessible through bed opening. Remove screw "F" and block "G".
5. Remove lock screw "H", Figure 58, set screw "J", spring "K" and plunger "L".
6. Remove stop rod extension "M", Figure 59.

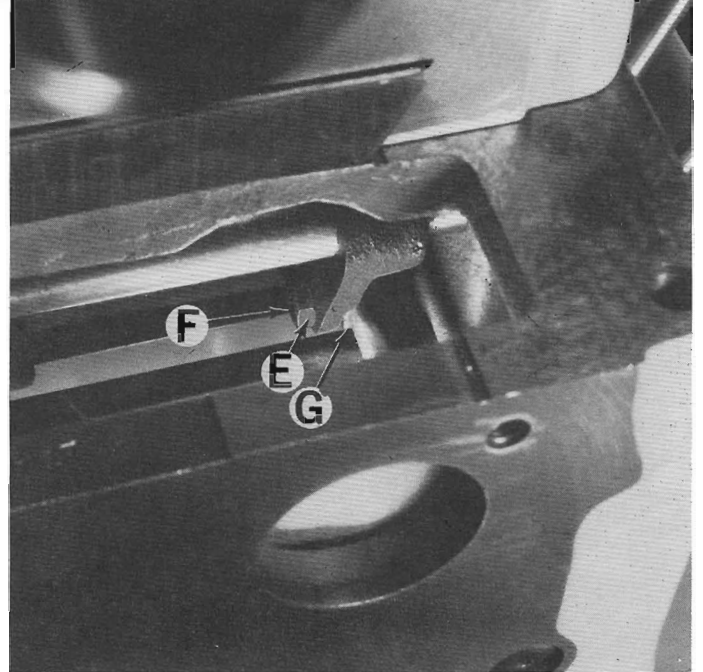


Figure 57 — Reverse Lever Shaft

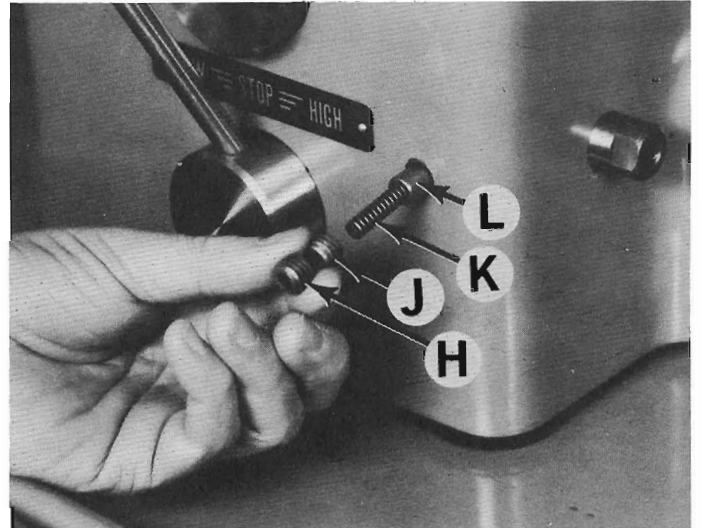


Figure 58 — Stop Rod Plunger Assembly

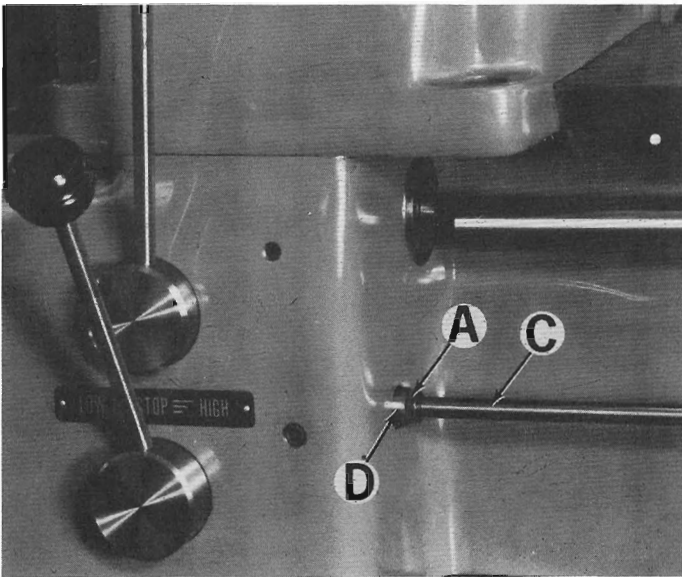


Figure 55 — Stop Rod

Figure 56 — Stop Rod Positive Stop

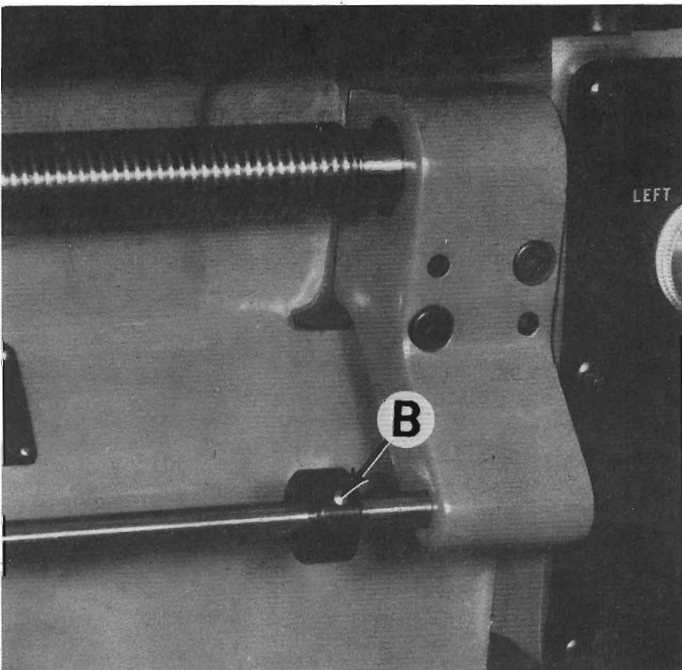
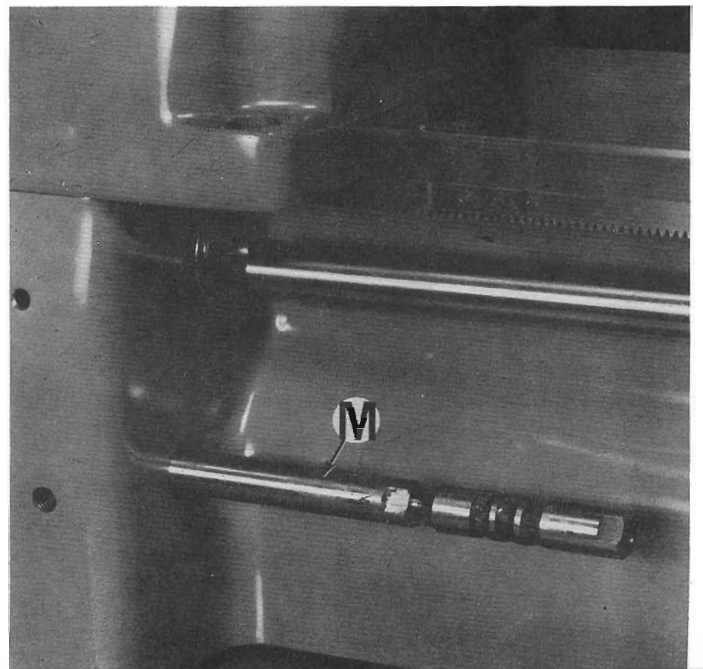


Figure 59 — Stop Rod Extension Removal



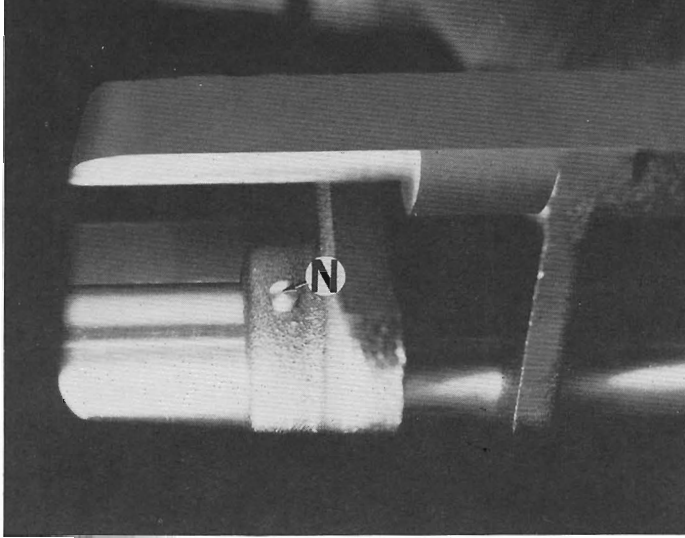


Figure 60 — Speed Lever Shaft

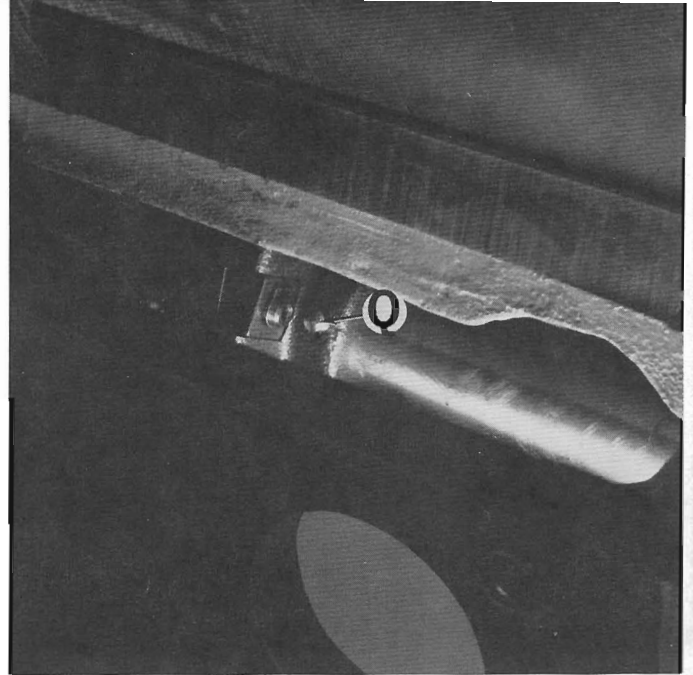


Figure 63 — Reverse Lever Shaft

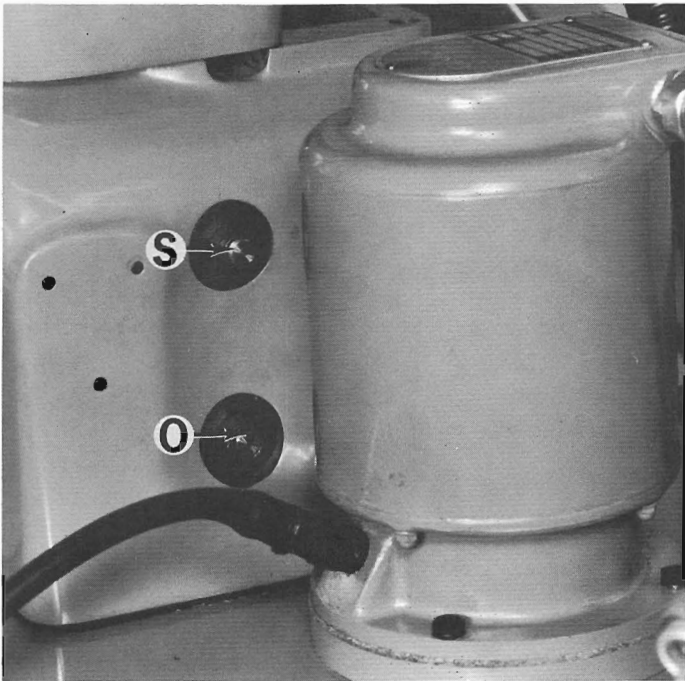


Figure 61 — Rear View of Bed Lever Shafts

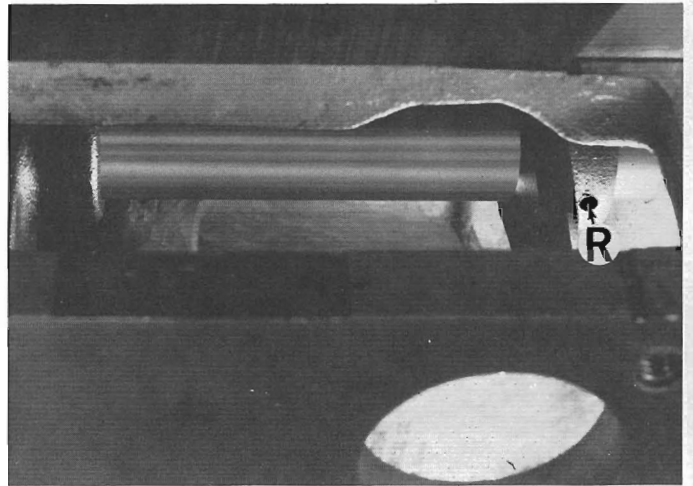


Figure 64 — Reverse Lever Shaft

Figure 62 — Speed Lever Removal

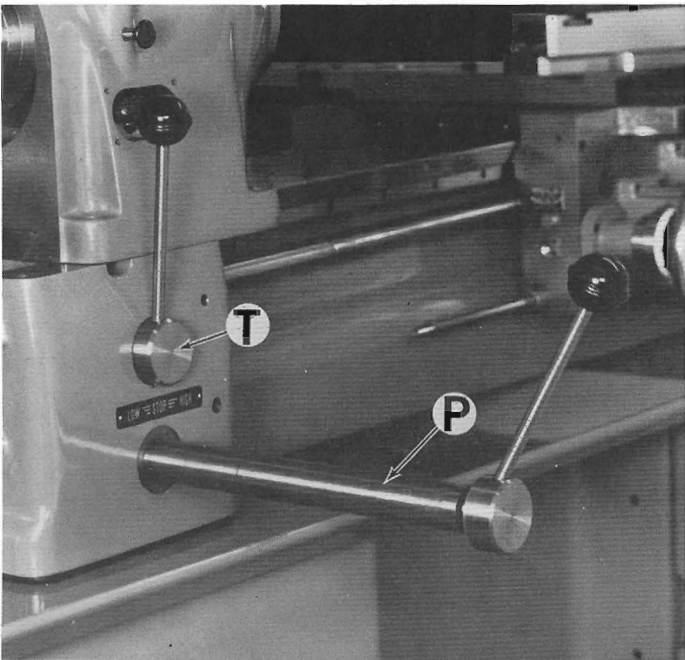
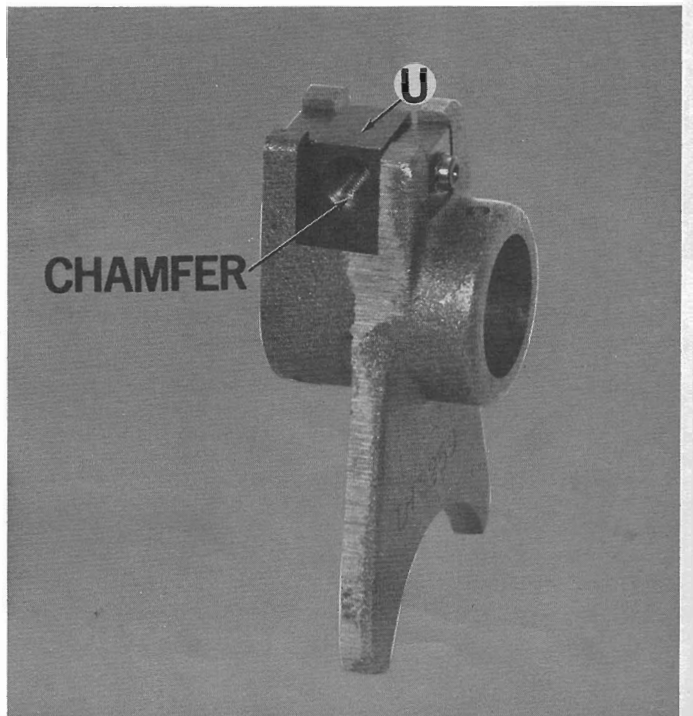


Figure 65 — Reverse Lever



7. Remove taper pin "N", Figure 60, from lower shaft to free speed lever. This is accomplished through motor compartment with punch and hammer.
8. Remove nut "O", Figure 61, washer and spring washer. Hold speed lever and remove shaft assembly "P", Figure 62.
9. Remove taper pin "Q", Figure 63. This also is accomplished from motor compartment.
10. Rotate reverse lever shaft to bring small end of taper pin "R", Figure 64, up so it can be removed through bed opening with punch and hammer.
11. Remove nut "S", Figure 61, washer and wave washer.
12. Hold reverse lever and stop rod lever and remove shaft assembly at machine front.

BED LEVER REPLACEMENT

1. Position block "U", Figure 65, with chamfered end of hole as shown.
2. Hold reverse lever and stop rod lever in position and replace shaft assembly "T", Figure 62. Replace taper pins.
3. Hold speed lever in position and replace shaft assembly "P", Figure 62. Replace taper pin.
4. Replace spring washers, washers and nuts "O" and "S", Figure 61.
5. Replace stop rod extension "M", Figure 59.
6. Replace block "G", Figure 57, screw "F" and nut "E".
7. Thread stop rod "C", Figure 55, into stop rod extension "D". Do not tighten. Position positive stop and replace taper pin "B", Figure 56. Tighten stop rod into stop rod extension and tighten lock nut "A", Figure 55.
8. Replace plunger "L", Figure 58, spring "K" and set screw "J". Adjust screw "J" to obtain proper "feel" when operating lever "T", Figure 62. Replace lock screw "H", Figure 58.
9. Follow steps 2 through 12 under "Headstock Replacement", Page 18.

SPINDLE BRAKE

The spindle brake is built for rapid but gradual stopping of the precision headstock spindle at all speeds. The brake drum "D", Figure 66, is located directly on the main drive motor shaft. The brake is actuated when the brake insert "C" is forced against the brake drum by spring action and is released by a solenoid. **OIL BRAKE INSERT DAILY** with spindle oil or as often as necessary. Allowing insert to become dry will reduce belt and brake life excessively.

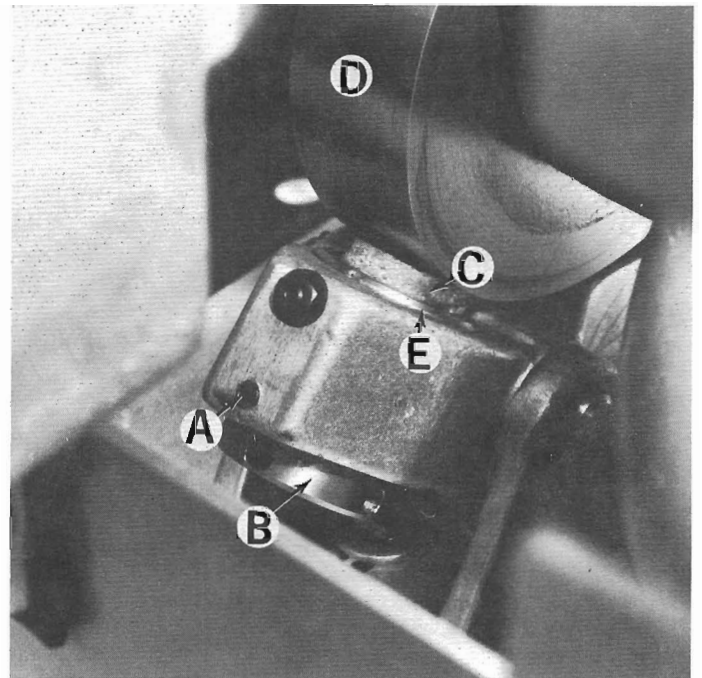


Figure 66 — Spindle Brake

BRAKE ADJUSTMENT

After considerable use it may be necessary to adjust the spindle brake. With power on and brake selector in "Off" position, loosen set screw "A", Figure 66, and turn adjusting collar "B" to the right with a pin wrench until there is .005" clearance between the insert "C" and drum "D". Relock set screw "A". Do not permit brake insert to become worn enough to allow insert housing to score brake drum.

TO REPLACE BRAKE INSERT

Loosen set screw "A", Figure 66, and unscrew collar "B". Remove housing "E" and knock out old insert. Place new insert on flat surface and, using a rawhide mallet, drive housing "E" over insert until 3/16" to 1/4" of insert projects from housing.

When reassembling, line up keyway of housing "E" with key before starting adjusting collar "B". Set clearance as when adjusting brake and relock set screw "A". Oil brake insert with spindle oil and operate 25 times. Readjust brake.

BRAKE SOLENOID REPLACEMENT

1. Remove cover "F", Figure 67. Disconnect solenoid wires under cover. Remove conduit connector "G", Figure 68, from brake housing.
2. Remove two screws "H", Figure 67, and brake housing "J", Figure 68.
3. Remove four screws "K", Figure 69, and nut and screw "L" to remove solenoid "M".
4. Remove screws "N" to remove supports "O" from solenoid "M".

BRAKE SPRING REPLACEMENT

1. Follow steps 1 and 2 above under "Solenoid Replacement".
2. Remove spring "P", Figure 69.

DRIVE LUBRICATION

Grease at fitting "A", Figure 70, with Houghton Cosmolube No. 2. Grease is sufficient when forced out of slot in fitting "A". Lubricate once a month or more often if necessary. **FOR PROPER LUBRICATION OF DRIVE, RUN THROUGH COMPLETE SPEED RANGE DAILY.** Lubricate bearing surfaces of counter-shaft with anti-seize Molyube every three months. The main drive motor and the speed change motor bearings are grease packed for life and require no further lubrication.

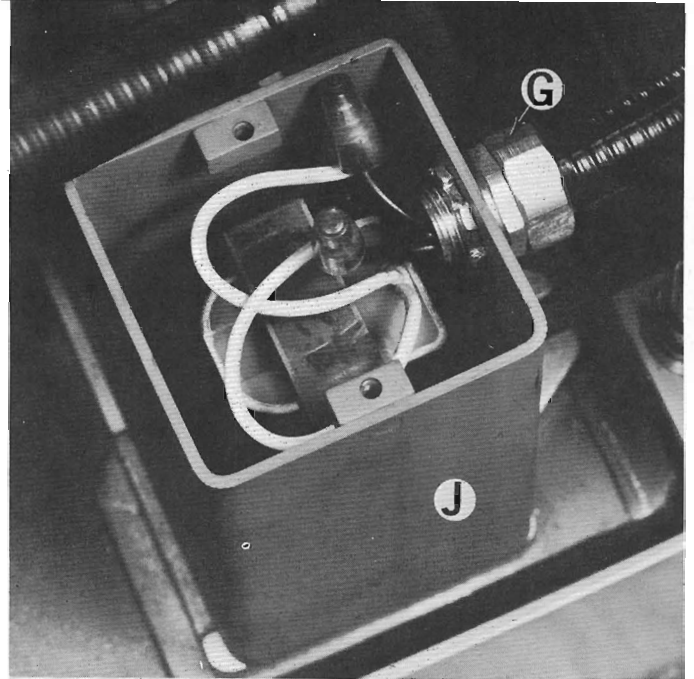


Figure 68 — Brake Housing with Cover Removed

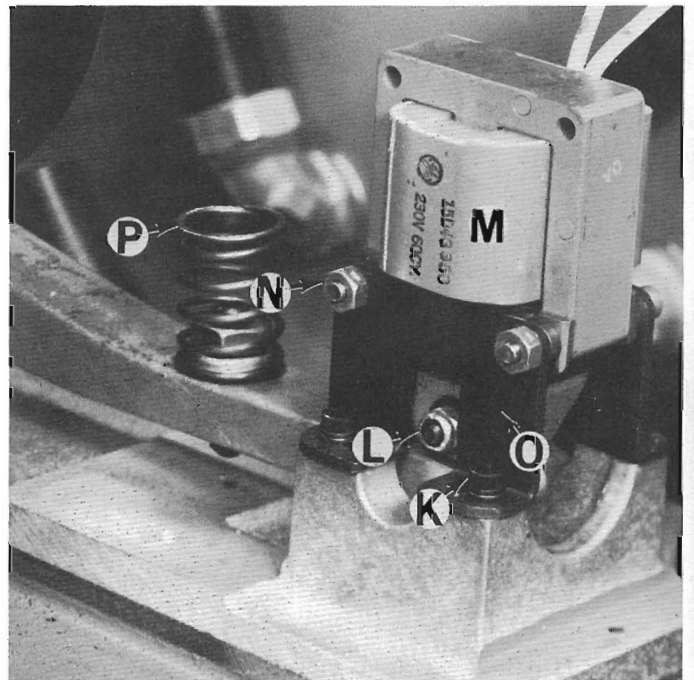


Figure 69 — Brake Solenoid and Spring

Figure 67 — Brake Housing

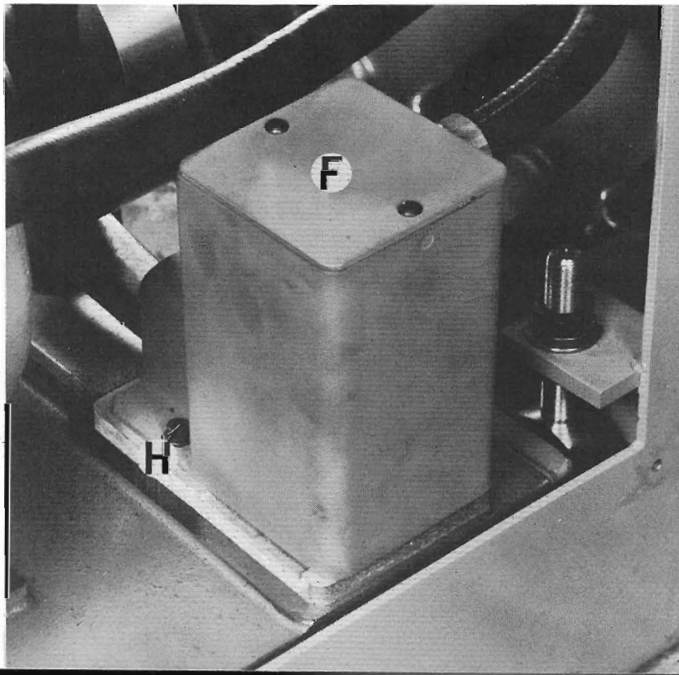
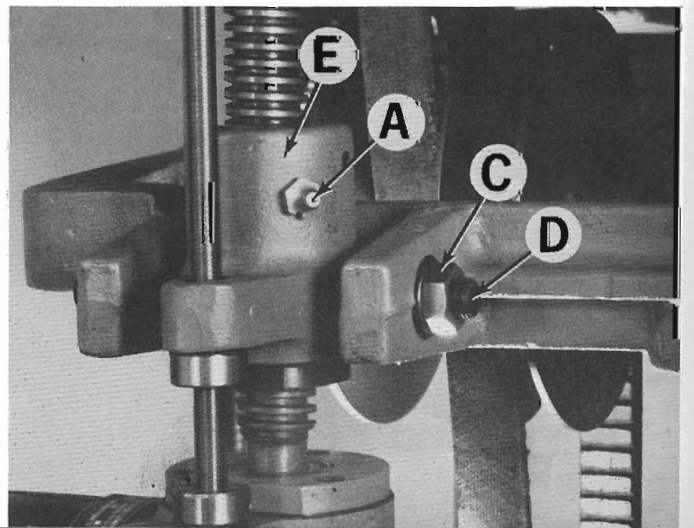


Figure 70 — Feed Screw Nut for Drive



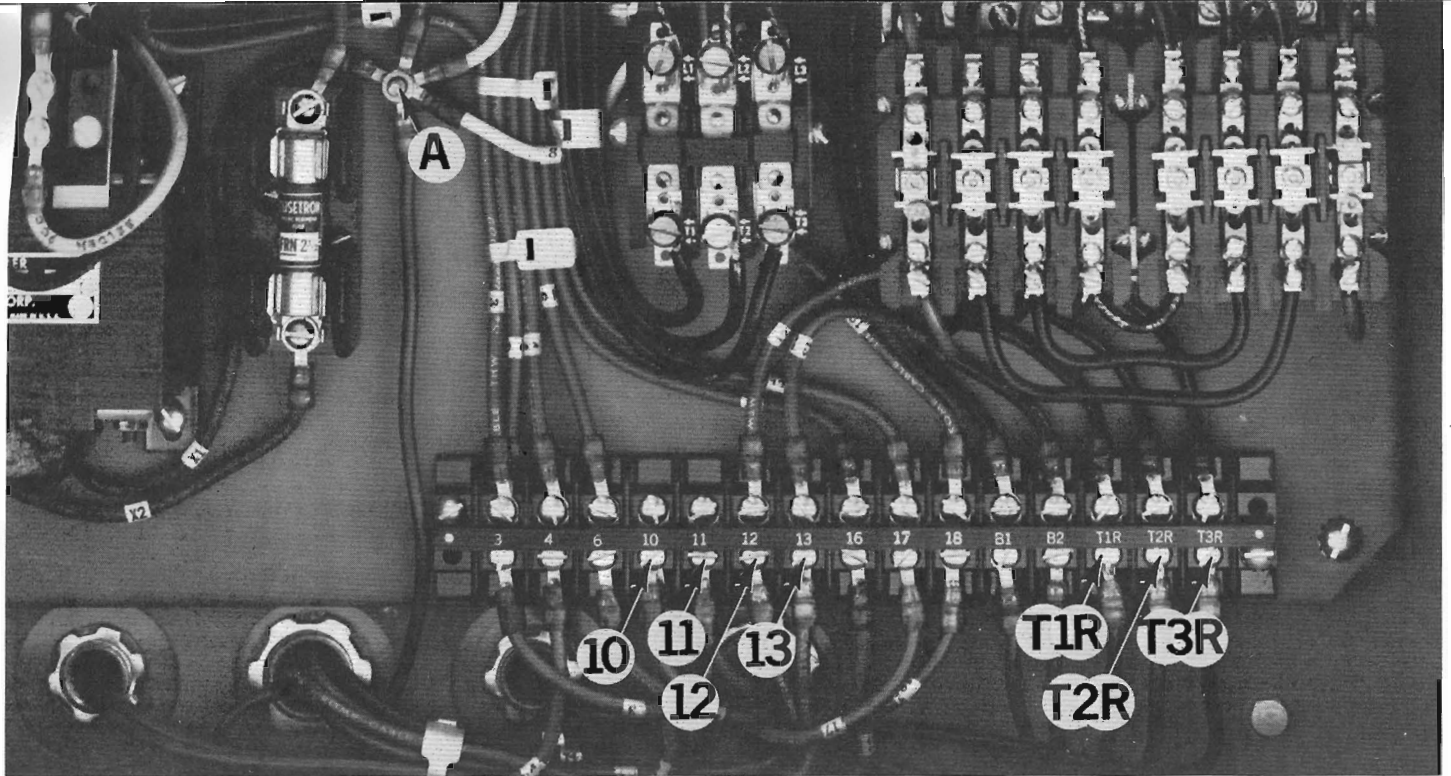


Figure 71 — Main Switch Case

SPEED CHANGE MECHANISM REMOVAL

1. Run pulley carrier to down position (125 R.P.M.).
2. Disconnect electric power source.
3. In main switch case remove wires T1R, T2R, T3R, 10, 11, 12, 13, Figure 71. Remove wire band.
4. Remove green ground wire, which enters switch case from same conduit, from ground post "A".
5. Remove conduit nut "B", Figure 72, and pull wires into pedestal.
6. Loosen two nuts "C", Figure 70, and loosen pivot screws "D" to clear feed screw nut "E".

7. Loosen set screw "F", Figure 73.

8. Support control housing and remove pin "G" with brass punch. Remove from pedestal. Do not disturb mounting bracket "H" which is factory adjusted for alignment.

SPEED CHANGE MECHANISM DISASSEMBLY

1. Follow steps 1 through 8 above under "Speed Change Mechanism Removal".

Figure 72 — Speed Change Conduit Nut

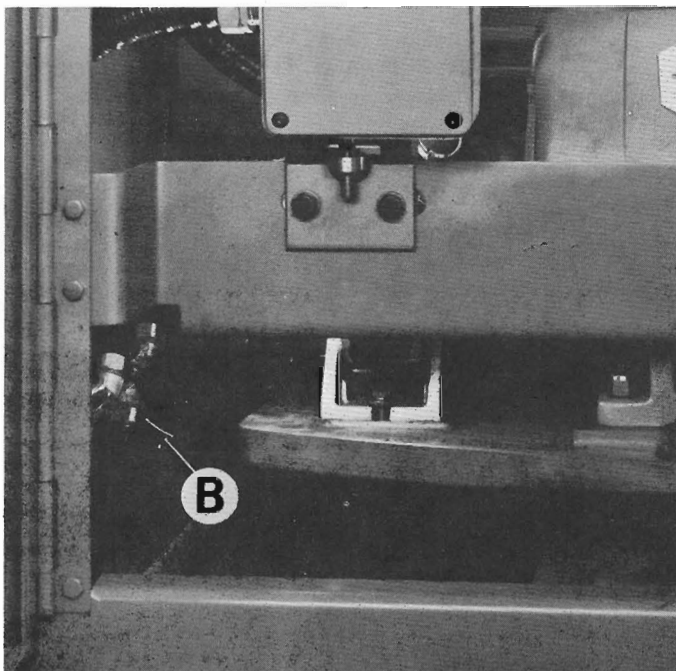
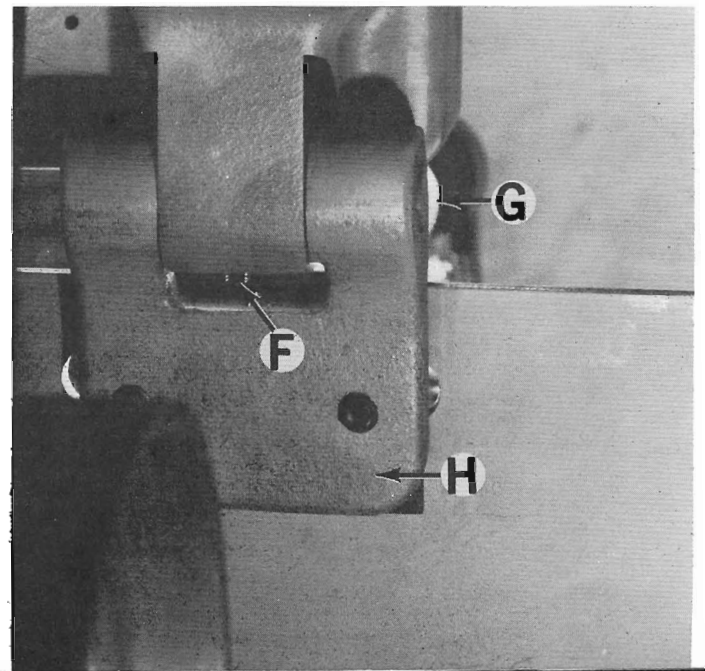


Figure 73 — Speed Change Mounting Bracket



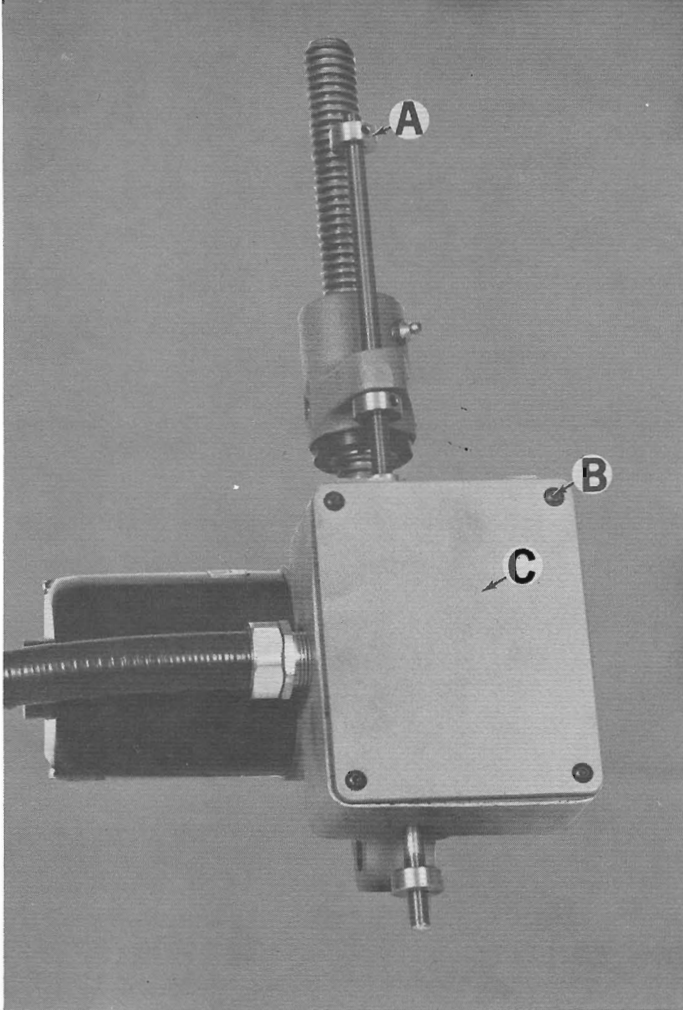


Figure 74 — Speed Change Mechanism

2. Loosen set screw and remove stop collar "A", Figure 74. Turn vertical screw by hand to remove feed screw nut.
3. Remove four screws "B" and cover "C".
4. Disconnect three (black) motor leads.
5. Remove two screws "D", Figure 75, and remove motor.

Figure 75 — Speed Change Motor

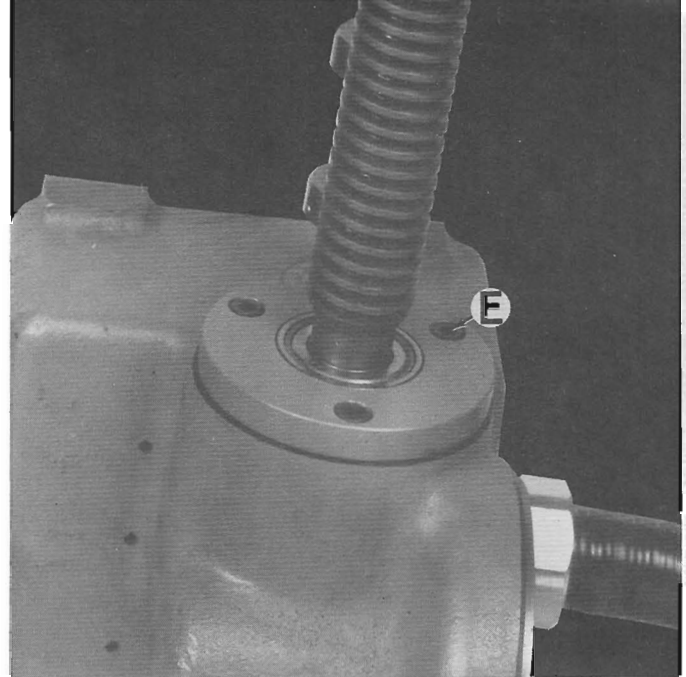
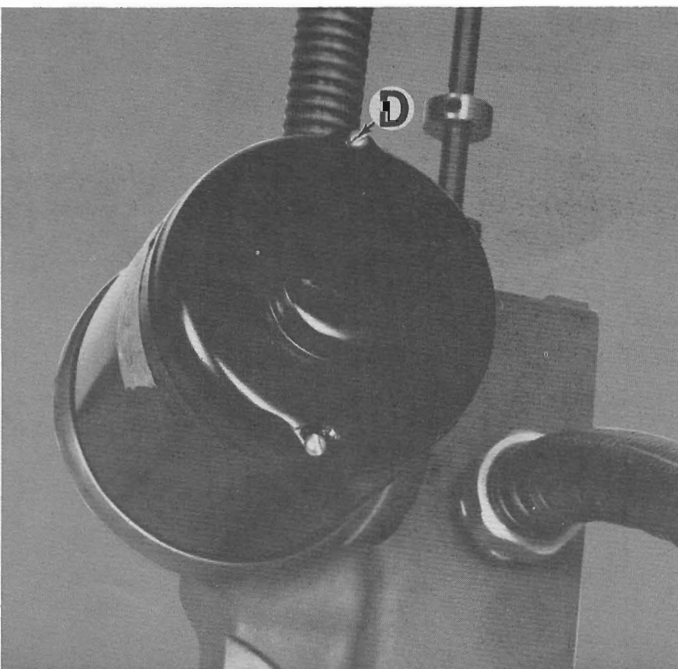


Figure 76 — Feed Screw Housing

6. Remove three screws "E", Figure 76, and remove vertical screw assembly, Figure 77.
7. Loosen set screw "F", Figure 78, and remove nut "G" using face spanner wrench. Do not misplace nylon plug under screw "F".
8. Remove worm wheel "H".
9. Remove key "J".
10. Remove vertical screw "K" from housing "L".
11. Remove bearing "M", spacer "N" and shim "O".
12. Press bearing "P" from vertical shaft, if necessary.
13. Disconnect wires 10, 11, 12, 13. Figure 79.
14. Remove four screws "Q" to remove micro switches and (green) ground wire.
15. Loosen set screw "R" and remove stop collar "S".
16. Remove two roll pins "T" and remove stop rod "U" to free cams "V" and springs "W".
17. Remove motor armature, Figure 80.
18. Remove nut "A" to remove worm "B".
19. Bearings "C" and "D" are pressed on armature shaft.

TO REASSEMBLE SPEED CHANGE MECHANISM

1. Replace worm "B", Figure 80, nut "A" and replace armature. Note position of wave washer "E", Figure 80, which is located in motor cap.
2. Replace motor and screws "D", Figure 75.

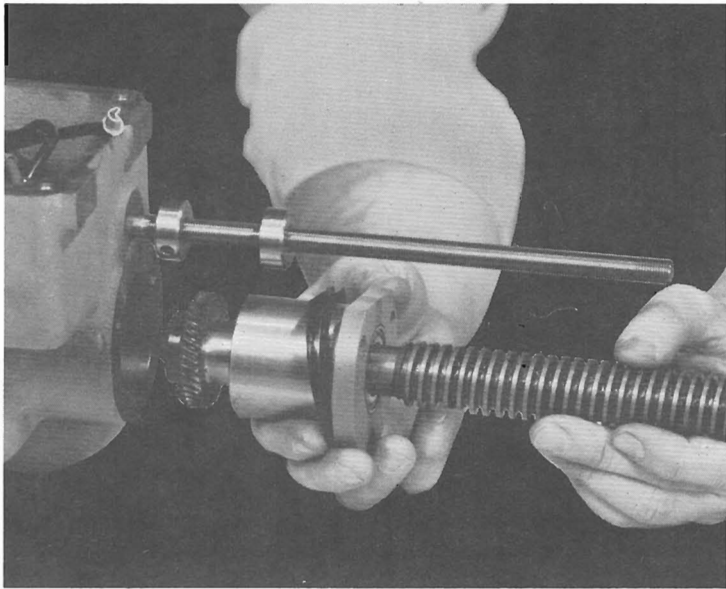


Figure 77 — Feed Screw Removal

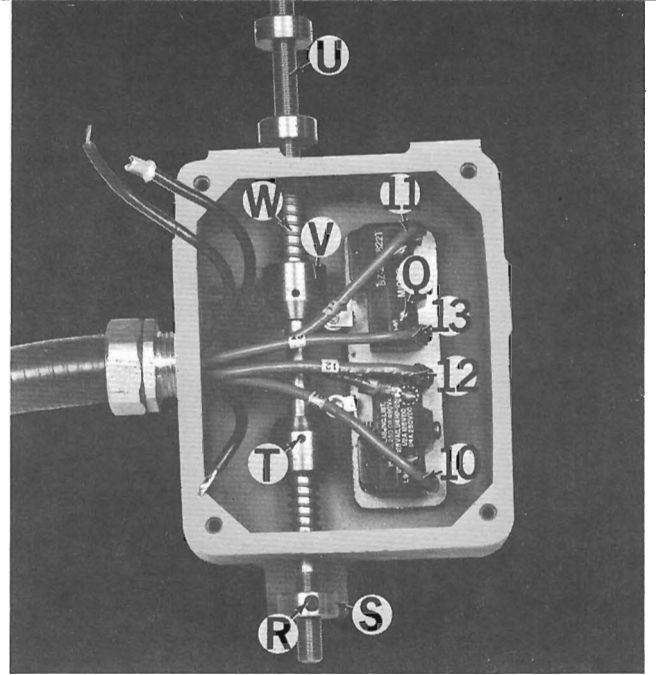


Figure 79 — Drive Switches and Cams

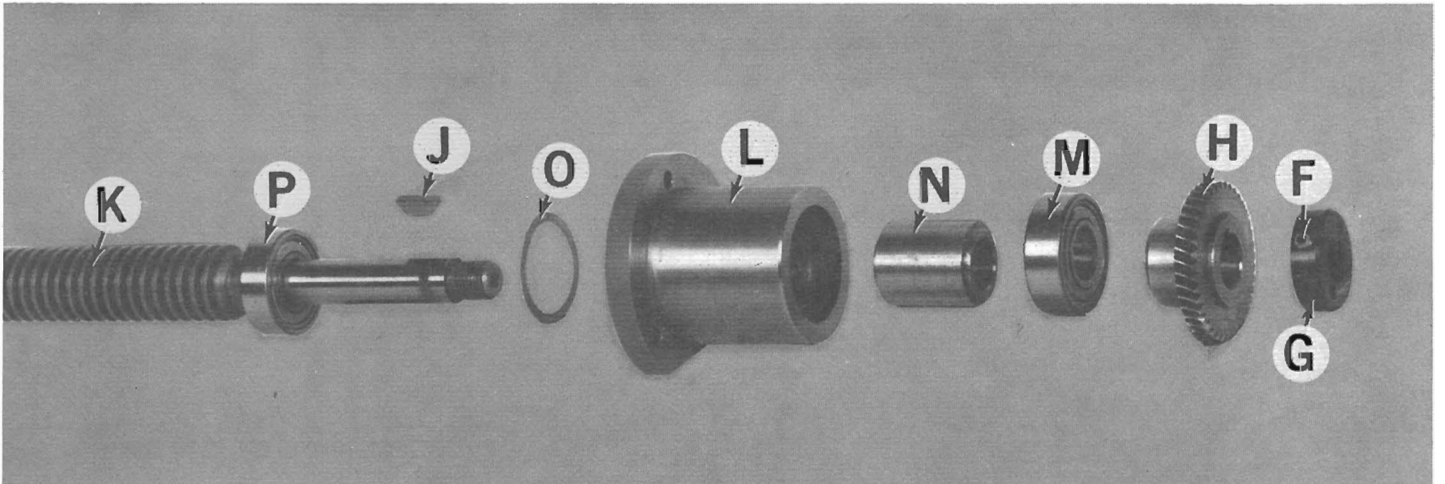


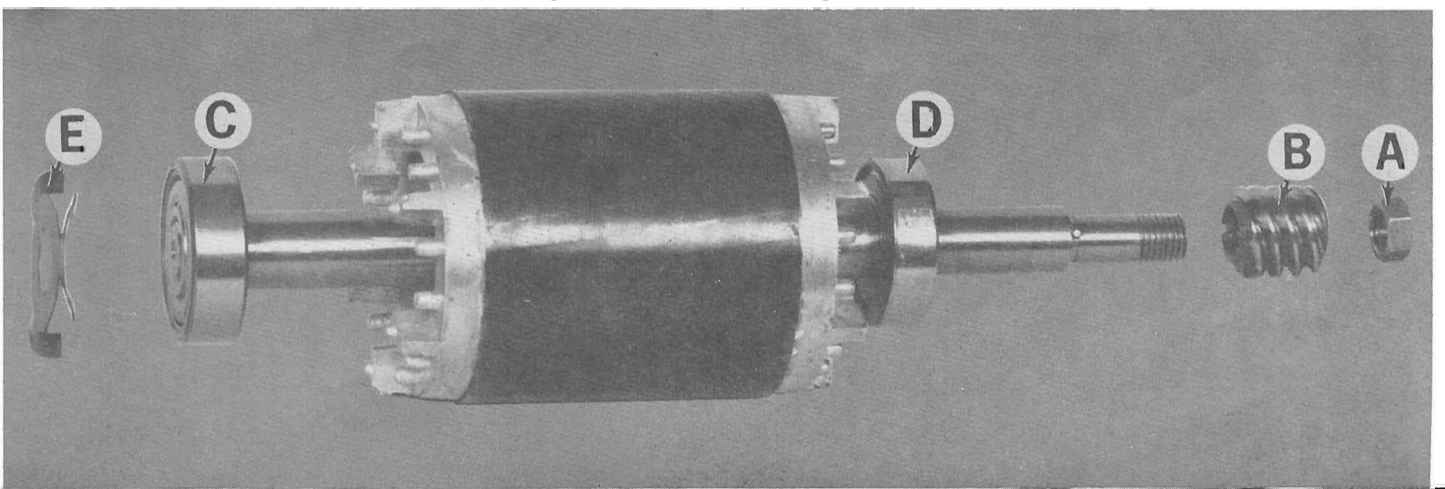
Figure 78 — Drive Feed Screw Components

3. Replace micro switches and wires 10, 11, 12, 13 and ground wire, Figure 79.
4. Replace springs "W", cams "V", stop rod "U" and roll pins "T", Figure 79.
5. Rewire three (black) motor leads.
6. Press bearing "P", Figure 78, on vertical screw "K".

7. Assemble shim "O", vertical screw "K", housing "L", spacer "N" and bearing "M".
8. Replace key "J", worm wheel "H" and nut "G". Tighten set screw "F".

NOTE: On later model machines worm wheel "H" has been replaced with a straight tooth wheel and shims shown in Figure 77 are no longer necessary.

Figure 80 — Drive Motor Components



9. Replace vertical screw assembly in drive housing, Figure 77, and replace three screws "E", Figure 76. (Grease worm and wheel with Andox "B" grease.)
10. Replace cover "C" and four screws "B", Figure 74.
11. Replace feed screw nut. Hold top half of feed screw nut within 1/16" of flush with nut housing until feed screw threads engage.
12. Start only, stop collars "A", Figure 74, and "S", Figure 79. (Do not tighten lock screws.)

SPEED CHANGE MECHANISM REPLACEMENT

1. Place drive in pedestal and secure with pin "G", Figure 73. Tighten set screw "F".
2. Feed wires through conduit elbow into switch case and replace conduit nut "B", Figure 72.
3. Replace wires in switch case, Figure 71.
4. Line up pivot screws "D", Figure 70, with feed screw nut. (Pulley carrier can be manually positioned up or down when spindle is running.)
5. Turn screws into pivot holes in feed screw nut to align drive. Lock nuts on pivot screws. Vertical screw should turn freely by hand.
6. To check drive rotation, push start button, pull lock pin and place speed lever in "Low" position. Jog "Raise" button — pulley carrier assembly should move up. (When "Lower" button is jogged, pulley carrier assembly should move down.) Use caution as drive may jam up on stop collars if speed change motor rotation is not correct.
7. If drive does not operate as outlined, disconnect power source, interchange wires T1R and T2R, Figure 71, in main switch case.
8. Turn stop collar "A", Figure 81, down on trip rod 1" from top of rod. Adjust stop collar gradually upward, running speed change mechanism between settings, until spindle belt is flush to 1/16" out of countershaft pulley when micro switch stops upward motion. Lock set screw in stop collar "A" to maintain setting.
9. If stop collar "B" has been disturbed, turn collar "B" to a point 2-1/4 inches from drive housing casting. Adjust stop collar "B" down on trip rod

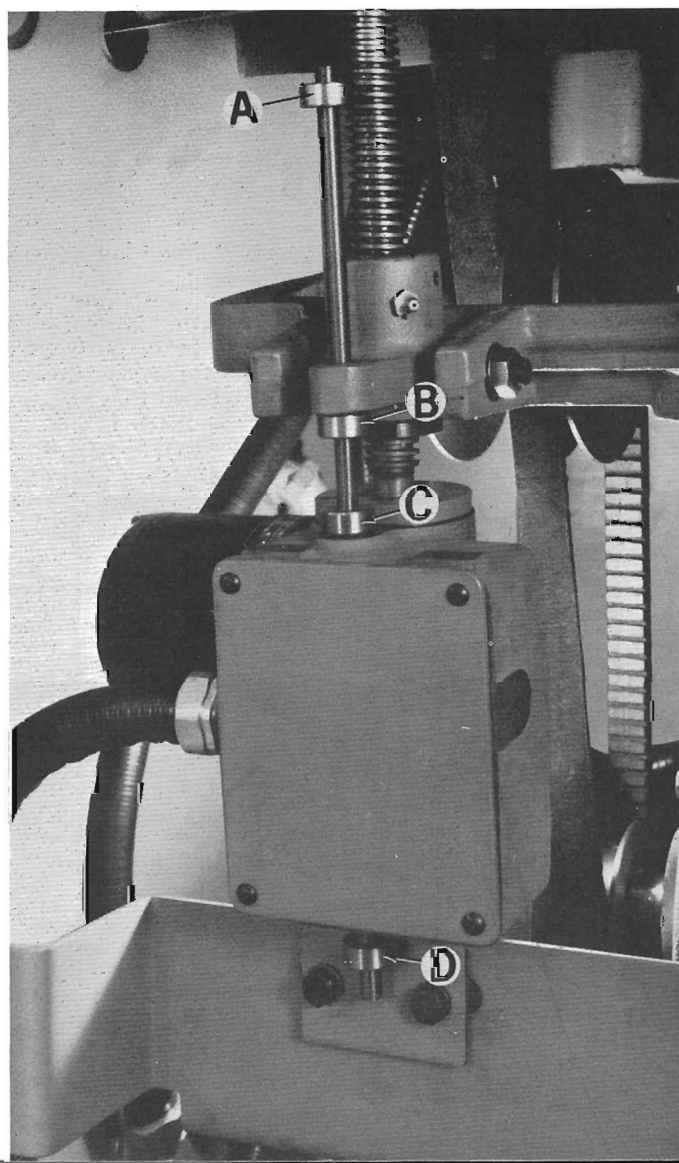
gradually, running speed change mechanism between settings, until motor belt is flush to 1/16" out of countershaft pulley when micro switch stops downward motion. Lock set screw in stop collar "B" to maintain setting.

10. Stop collars "C" and "D", Figures 81, 82 and 83, are set to allow 1/16" clearance after micro switches are tripped and drive drifts to a stop.

DRIVE FEED SCREW NUT REMOVAL

1. Loosen two nuts "C", Figure 70, and loosen pivot screws "D" to clear feed screw nut "E".
2. Loosen set screw and remove stop collar "A", Figure 81.
3. Place pulley carrier in down position and lean drive toward machine rear.
4. Turn vertical screw by hand to remove feed screw nut "E", Figure 70.

Figure 81 — Stop Collars for Drive



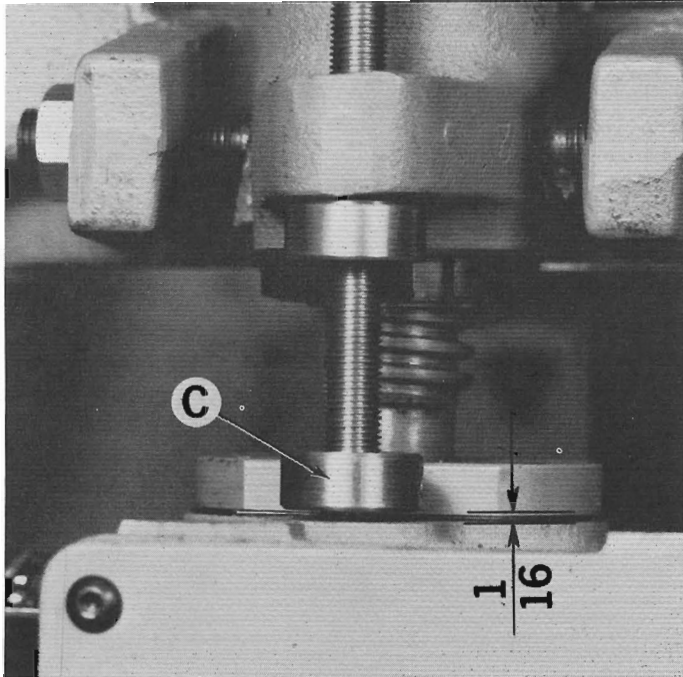


Figure 82 — Stop Collar Adjustment

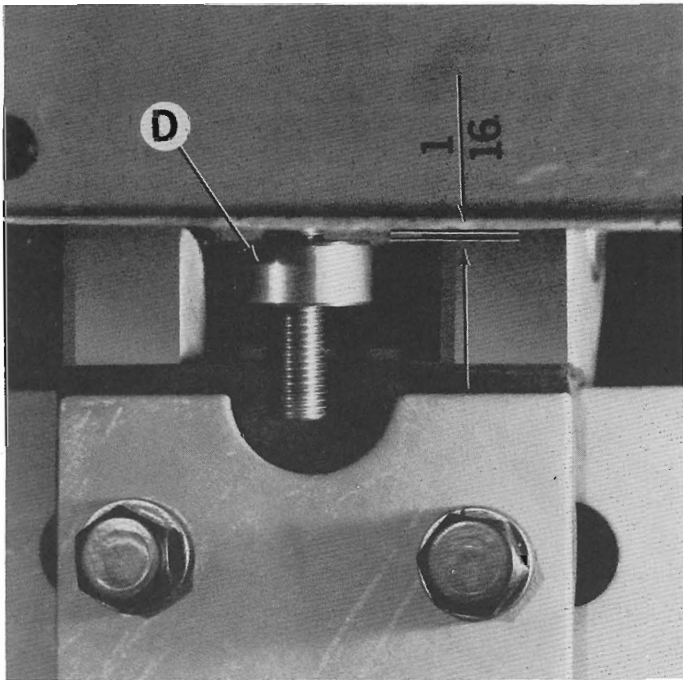
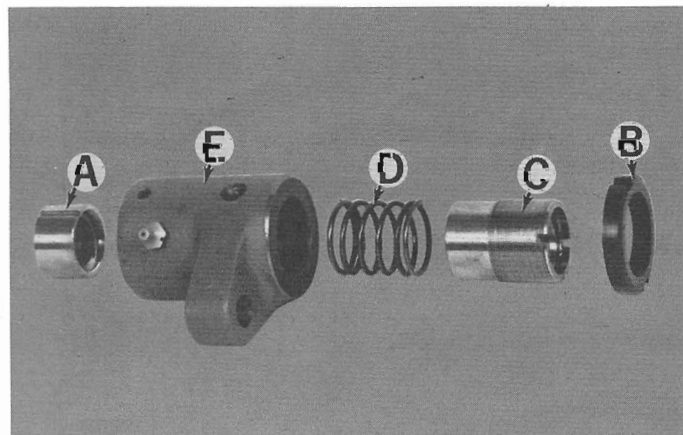


Figure 83 — Stop Collar Adjustment

Figure 84 — Feed Screw Nut Components



5. Remove half nut "A", Figure 84.
6. Remove nut "B" to remove half nut "C" and spring "D" from housing "E".

DRIVE FEED SCREW NUT REPLACEMENT

1. Replace spring "D", Figure 84, half nut "C" and nut "B" in housing "E". Do not tighten nut "B".
2. Replace feed screw nut. Position half nut "A" with key and keyway in line. Hand feed vertical screw while holding half nut "A" within 1/16" of flush with housing "E" until feed screw threads engage. It may be necessary to turn half nut "C" slightly to line up threads in both sections of feed screw nut. Tighten nut "B".
3. Follow steps 4, 5, 8 under "Speed Change Mechanism Replacement", Page 26.

VARIABLE SPEED PULLEY AND SHAFT ASSEMBLY REMOVAL

1. Follow steps 1 through 6 and 8 through 10 under "Drive Belt Replacement", Page 5.
2. Remove snap ring, Figure 85, from right side of pulley carrier.
3. Remove bearing and spacer, Figure 86. (A small piece of sheet metal wrapped around shaft can be used to remove bearing and spacer.)

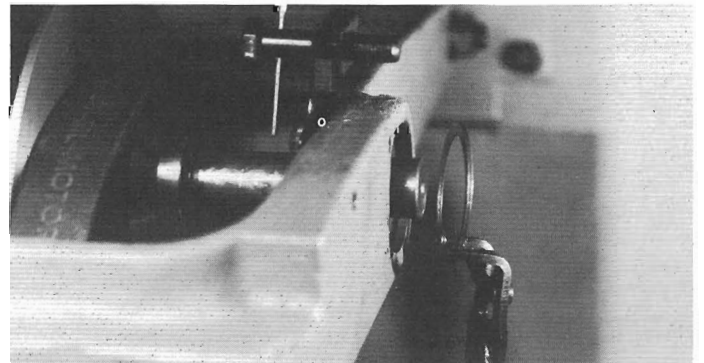
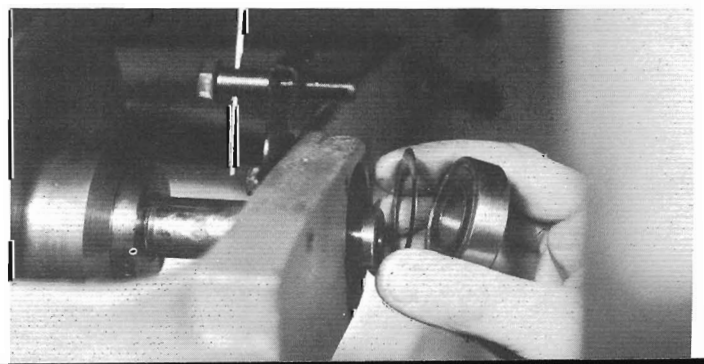


Figure 85 — Countershaft Snap Ring Removal

Figure 86 — Countershaft Bearing and Spacer Removal



4. Move pulley shaft to the right out of remaining bearing and remove pulley and shaft assembly, Figure 87.
5. Remove snap ring to remove remaining bearing and spacer.
6. Coat bearing surfaces of shaft with anti-seize Molylube and reassemble. Adjust for proper belt tension per Page 5.
7. If replacement of pulley and shaft assembly was necessary, make checks as outlined in steps 8 and 9 under "Speed Change Mechanism Replacement", Page 26.



Figure 87 — Countershaft Removal

POWER FEED DRIVE REMOVAL

1. Remove eight screws "A", Figure 88, and set power feed panel out of control box.
2. Remove four wires F1, F2, A1 and A2, Figure 89.
3. Remove three bolts "B", Figure 88.
4. Pull control box away from end of bed and remove nut "C", Figure 90, from cable grip.
5. Pull grommet "D", Figure 91, and cable out through bed. Do not pull against cable end attached to power feed motor.
6. Remove magnetic drain plug "E", Figure 92, to drain transmission fluid from apron. Replace drain plug.
7. Remove three screws "F", Figure 91, and remove power feed assembly from apron.

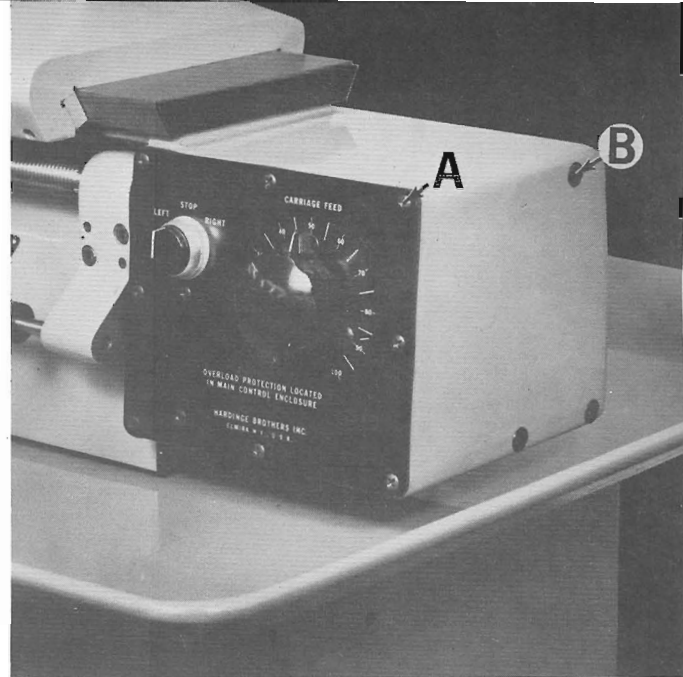


Figure 88 — Power Feed Control Panel

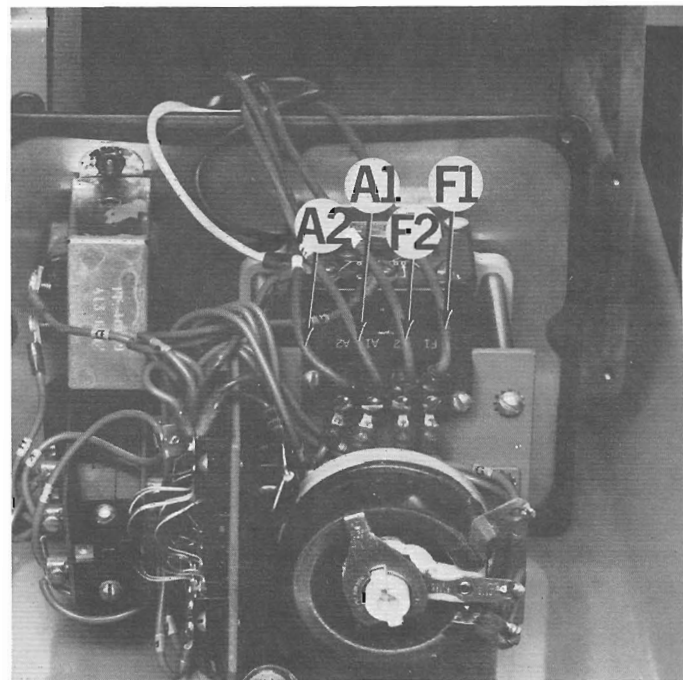


Figure 89 — Power Feed Control Panel

POWER FEED DRIVE DISASSEMBLY

1. Remove motor brushes under two caps "H", Figure 93.
2. Remove two screws "G" and remove power feed motor.
3. If necessary, remove screw "J", Figure 94, to remove motor cap.
4. Remove rotor shaft, Figure 95, from power feed housing.
5. Remove spring pin "K", Figure 95, to remove worm gear "L".
6. Bearings "M" and "O" and spacer "N" are pressed onto rotor shaft.

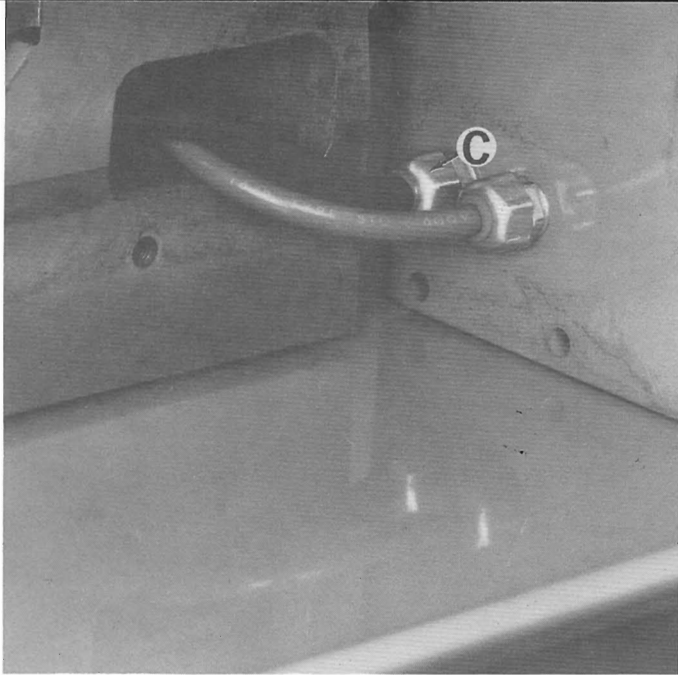


Figure 90 — Control Panel Removal

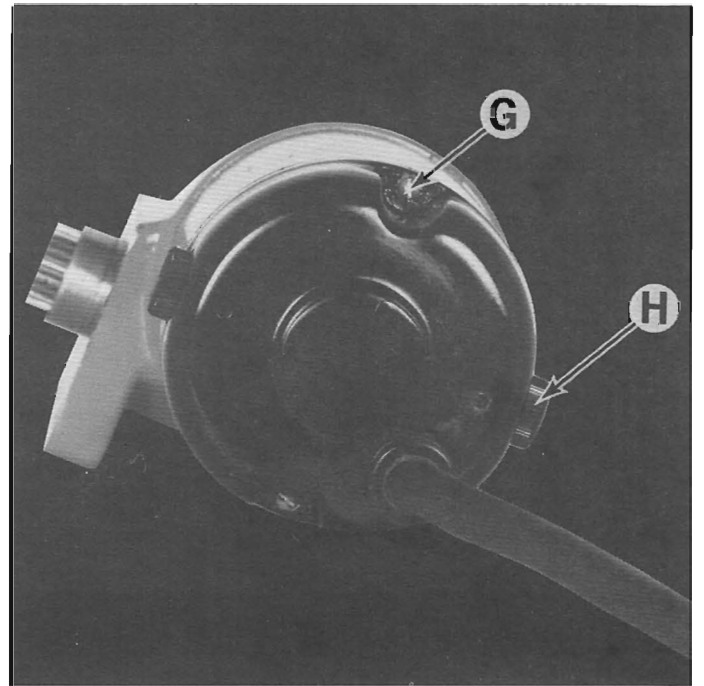


Figure 93 — Power Feed Drive

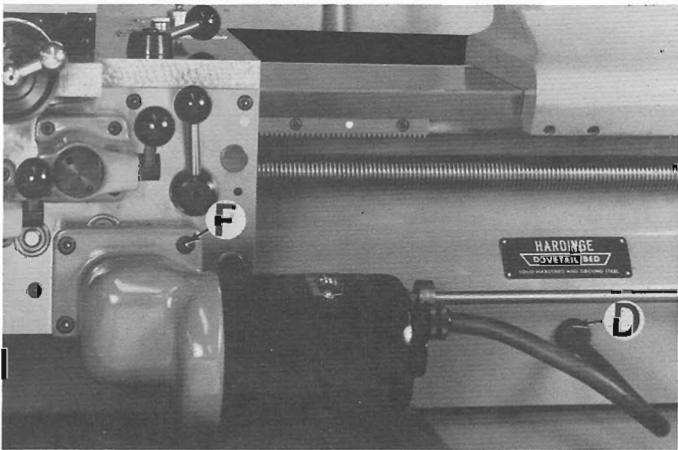


Figure 91 — Power Feed Drive

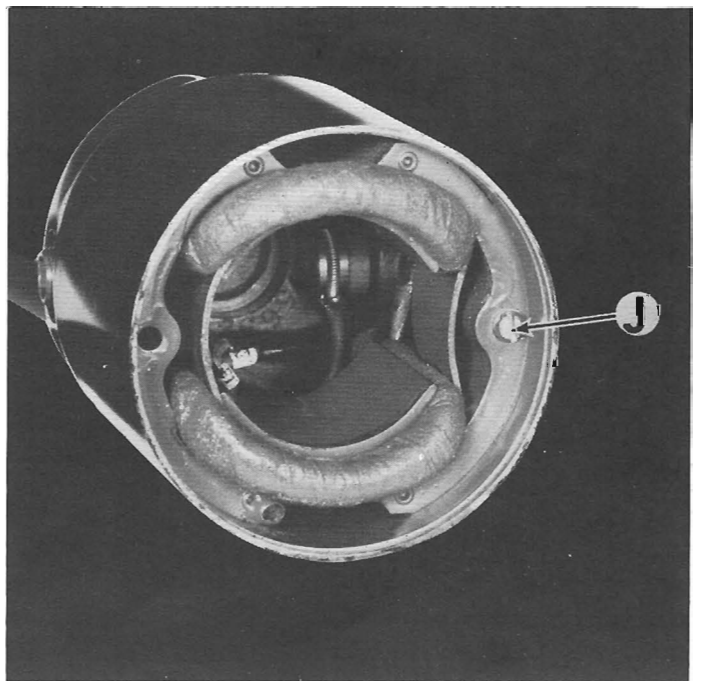


Figure 94 — Power Feed Motor

Figure 92 — Lubricant Drain Plug

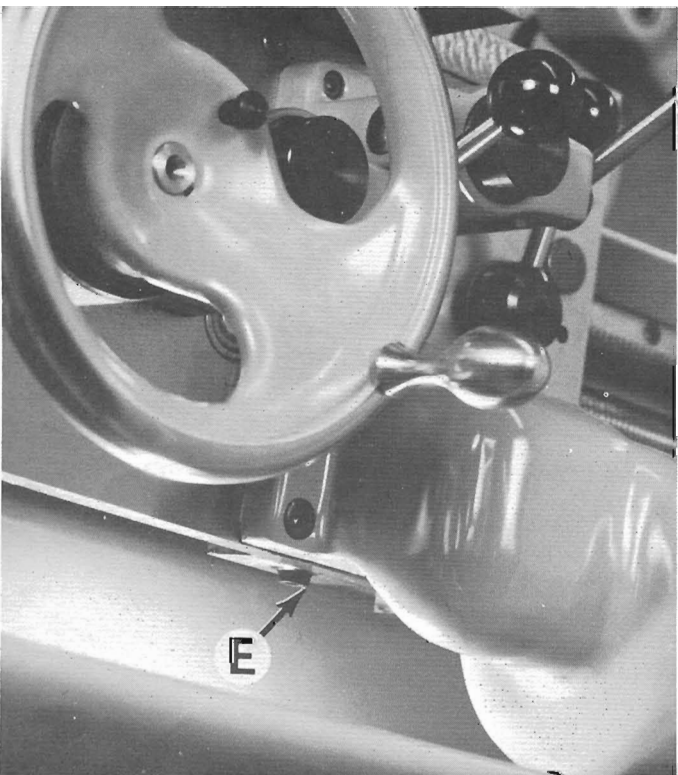
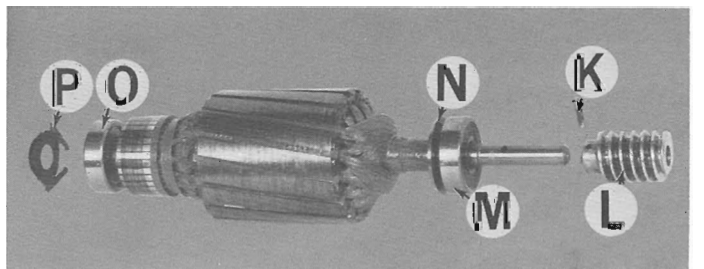


Figure 95 — Rotor Shaft and Components



7. Remove screw "Q", Figure 96, and remove worm wheel and housing, Figure 97.
8. Remove nut "R", Figure 97, and worm wheel "S".
9. Remove key "T", Figure 98, and remove 21 tooth gear and shaft "U".
10. Remove bearings "V", Figure 99, snap rings "W" and seals "X" from housing "Y".
11. **When reassembling:** If motor cap has been removed, tuck wires in cap away from armature to prevent wires from rubbing on armature and shorting out. Grease worm wheel "S", Figure 97, with Houghton Cosmolube #2. Note position of wave washer "P", Figure 95. Permatex seal power feed housing to apron cover. Assemble motor brushes last and fill apron with oil as described under apron lubrication, Page 31.



Figure 96 — Retaining Screw for Worm Wheel Housing

Figure 97 — Worm Wheel and Housing

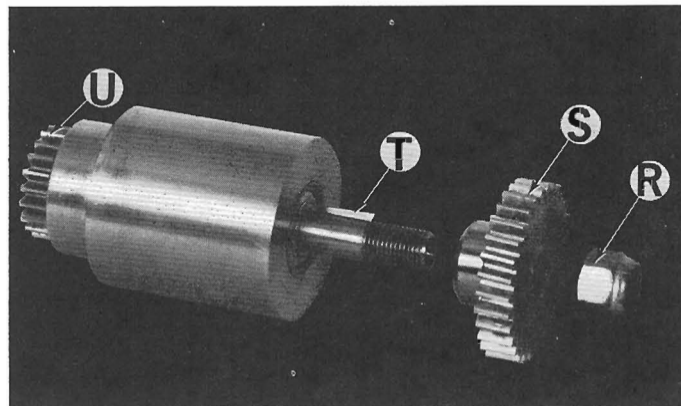
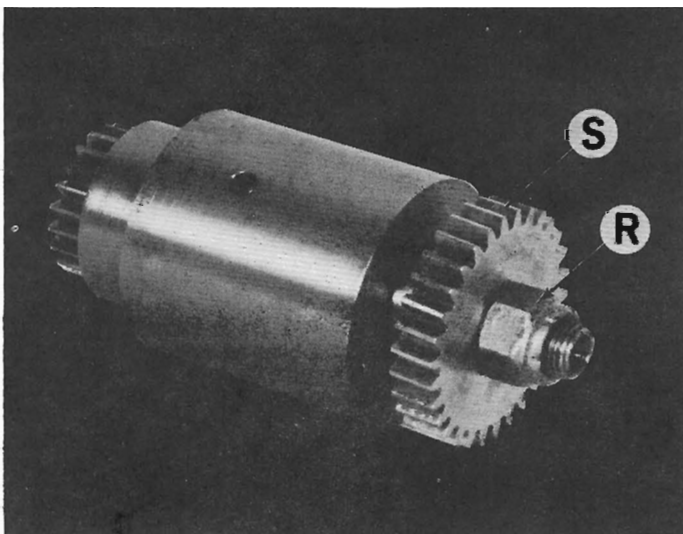


Figure 98 — Worm Wheel Housing and Components

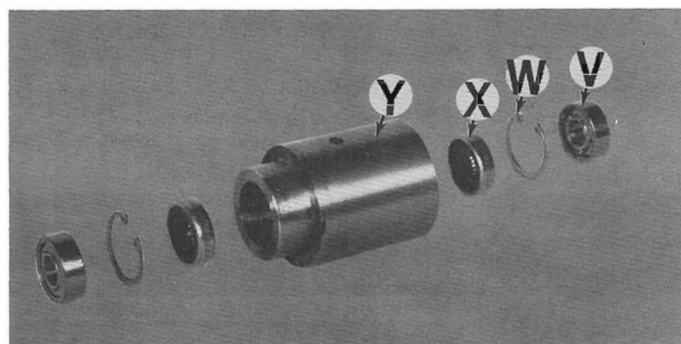


Figure 99 — Worm Wheel Housing and Components

POWER FEED CONTROL PANEL

The carriage feed is powered by a direct current, totally enclosed, ball bearing motor. 110 volt alternating current is fed from the main electric control panel at the left end of the pedestal to the power feed control panel at the right end of the machine. Here it is converted by silicon rectifiers to direct current for the power feed motor.

Access to the power feed control box is gained by removing eight screws "A", Figure 88.

Autotransformer "A", Figure 100, provides voltage control for armature.

Field Control Rheostat "B" varies voltage on field inversely to armature circuit.

Resistor "C" is switched across armature circuit when switch "F", Figure 101, is in the stop position.

Capacitor and resistor "D" provide transient suppression.

Rectifier assembly "E", Figure 101, with silicon rectifiers provides change to DC voltage. **NOTE:** When replacing rectifiers, bleeder resistor "H" must be properly reconnected.

Switch "F" controls power feed direction — left, right and stop.

Reactor "G" filters DC power supply to armature.

NOTE: When power feed unit fails to function properly, first check fuse "R", Figure 184. If fuse is blown check motor, motor leads and motor field connections.

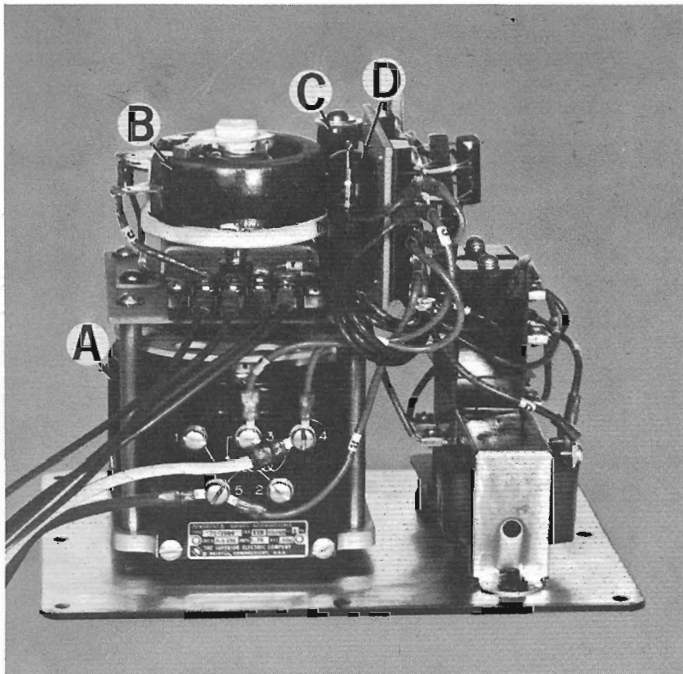
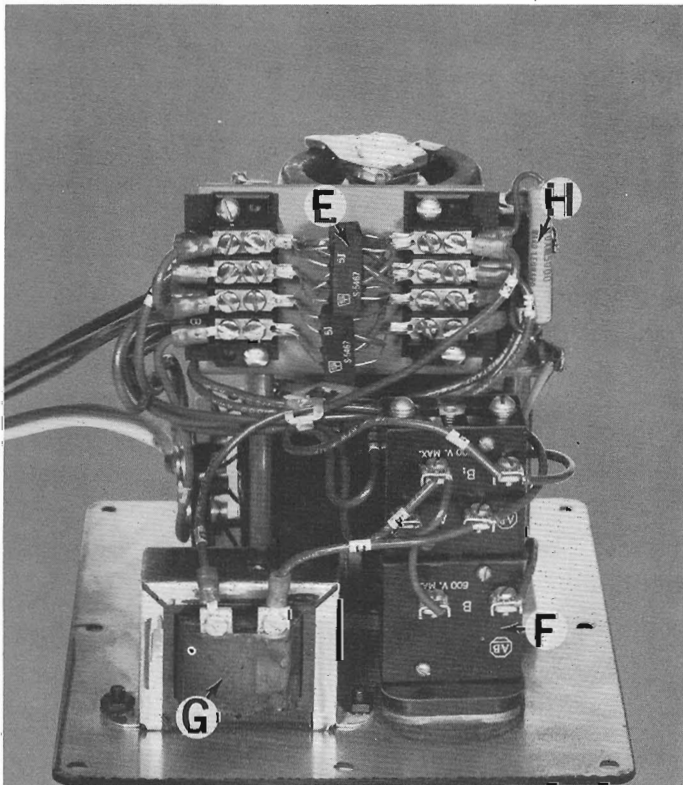


Figure 100 — Power Feed Control Panel

Figure 101 — Power Feed Control Panel



CARRIAGE LUBRICATION

Keep oil reservoir "A", Figure 102, full with Mobil Vactra Oil #2 or equivalent. Maintain oil level in sight window "B". To lubricate carriage and bed ways, lift plunger "C", **HOLD BRIEFLY AND RELEASE, ALLOWING PLUNGER TO RETURN OF ITS OWN ACCORD.**

Operate pressure oiler as often as required to keep bed ways wet or a minimum of once daily.

Clean and use pressure oil can to **LUBRICATE CARRIAGE GEAR RACK, LEAD SCREW AND LEAD SCREW NUT** with light oil weekly.

APRON AND CLUTCHES LUBRICATION

Keep oil in apron assembly in sight window "E", Figure 103. Add oil by removing cap "F". Use automatic transmission fluid Type A Mobilfluid 200 or equivalent. **CHANGE OIL EVERY 60 DAYS.** To drain oil remove magnetic drain plug "E", Figure 92.

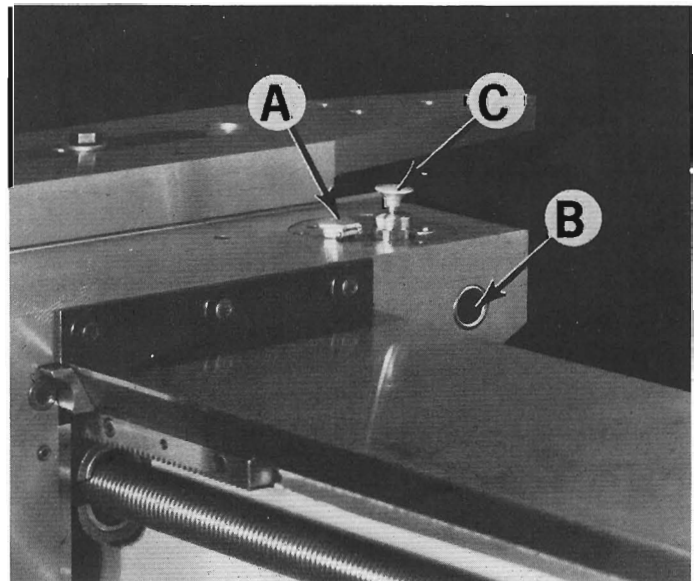
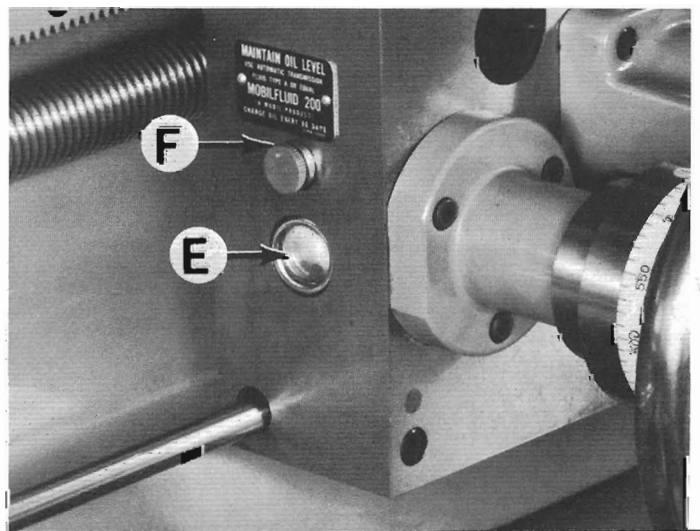


Figure 102 — Carriage Lubrication

Figure 103 — Apron Lubrication



CARRIAGE LUBRICATION SYSTEM

Lubricating oil for the carriage is channeled from the lubricator "C", Figure 102, to a junction block at the rear of the carriage. From the junction block the oil is fed in four tubes to channels in the top and bottom of the carriage. Two of these channels can be seen with the cross slide removed. On the bottom of the carriage is a large almost "X" shaped channel for lubricating the bed ways.

1. **TO GAIN ACCESS TO THE JUNCTION BLOCK,** remove four screws "A", Figure 104, and cover "B".
2. Remove four screws "C", Figure 105, and junction block "D".
3. Remove lubricator assemblies "E", "F", "G" and "H", Figure 106. Lubricator assemblies "E" and "H" are for the channel in carriage bottom and "F" and "G" are for channels in the top of carriage. **DO NOT INTERCHANGE LUBRICATOR ASSEMBLIES.**

CARRIAGE APRON DISASSEMBLY

1. Remove magnetic drain plug "E", Figure 92, to drain transmission fluid from apron.
2. Remove three screws "A", Figure 107, and remove power feed assembly from apron.
3. Remove three screws "B" and remove longitudinal handwheel assembly "C".
4. Remove eight screws "D", Figure 108, and clutch housings "E" and "F".
5. Remove two screws "G", Figure 109, and cover "H". **DO NOT MISPLACE SEAL UNDER COVER "H".**
6. Remove taper pin "J", Figure 110, and remove lead screw nut handle "K" and fibre washer. Remove lock screw "L".
7. Remove seven screws "M", Figure 110.
8. The apron cover is Permatex sealed. To remove cover, pull with left hand while striking cover with plastic mallet as shown, Figure 111. When crack in sealer appears, rap cover back in place. Repeat procedure, working cover back and forth, until seal is broken and cover can be removed.
9. Remove rack pinion and 70 tooth gear "N", Figure 112.

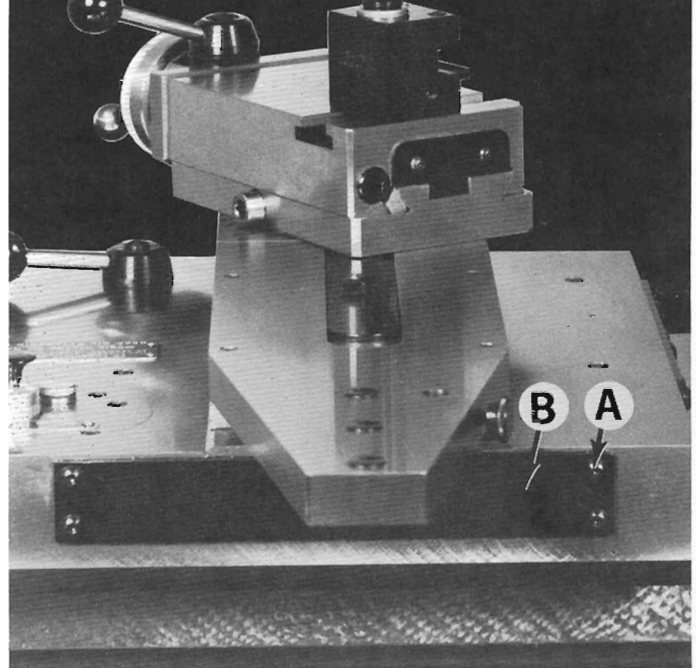


Figure 104 — Junction Block Cover

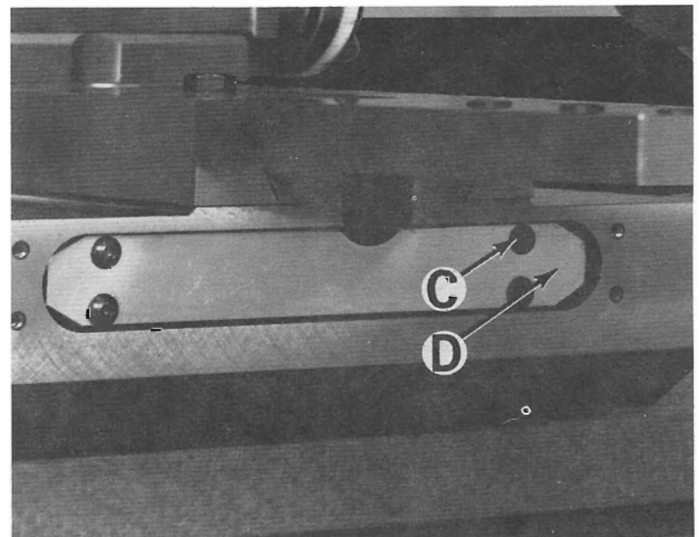


Figure 105 — Lubricator Junction Block

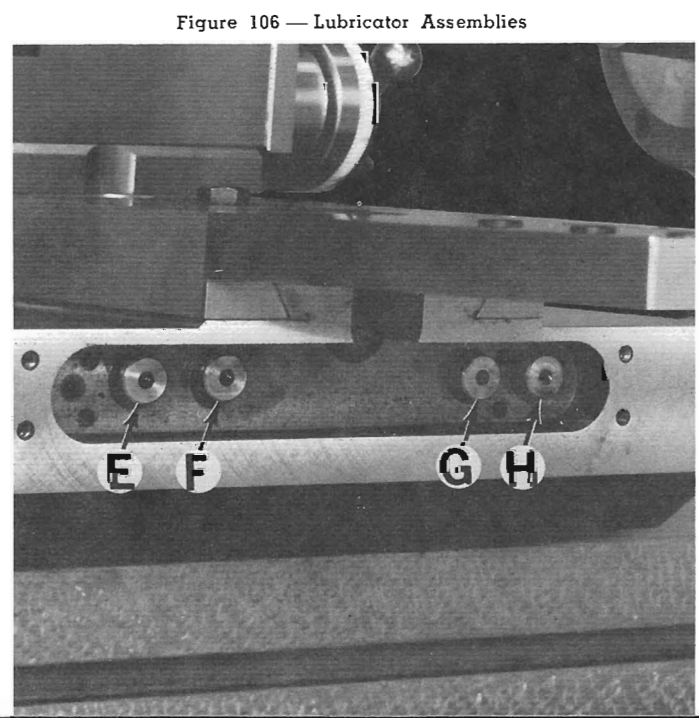


Figure 106 — Lubricator Assemblies

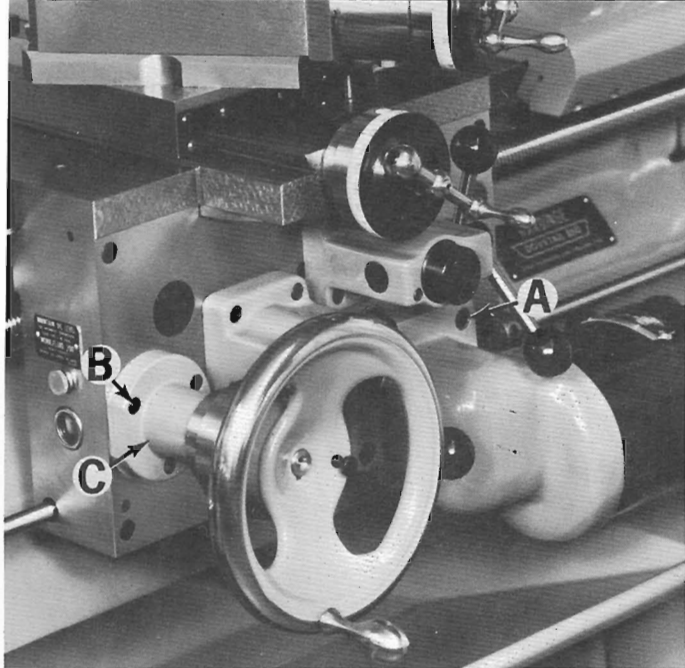


Figure 107 — Carriage Handwheel

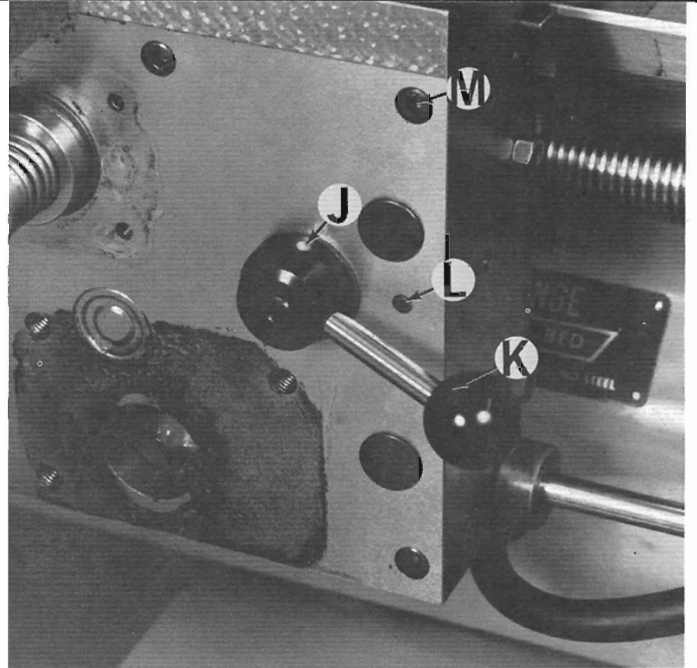


Figure 110 — Lead Screw Nut Handle

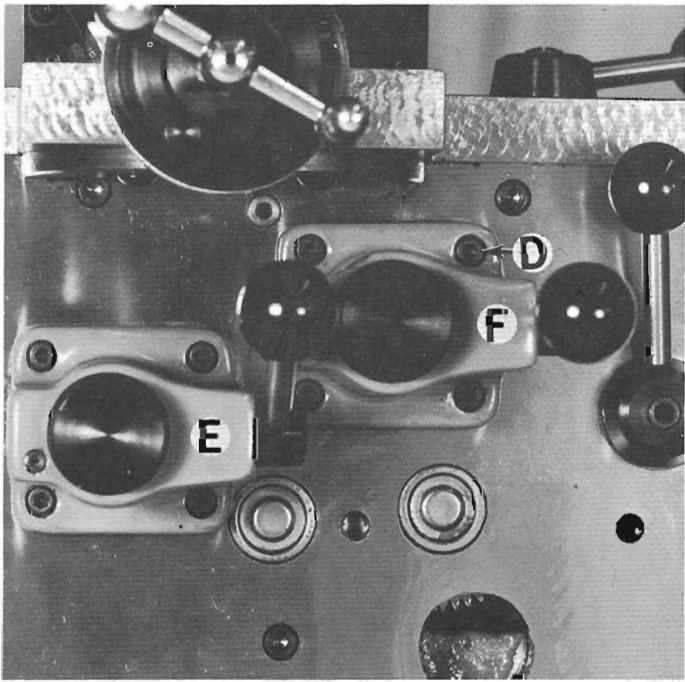


Figure 108 — Carriage Clutches

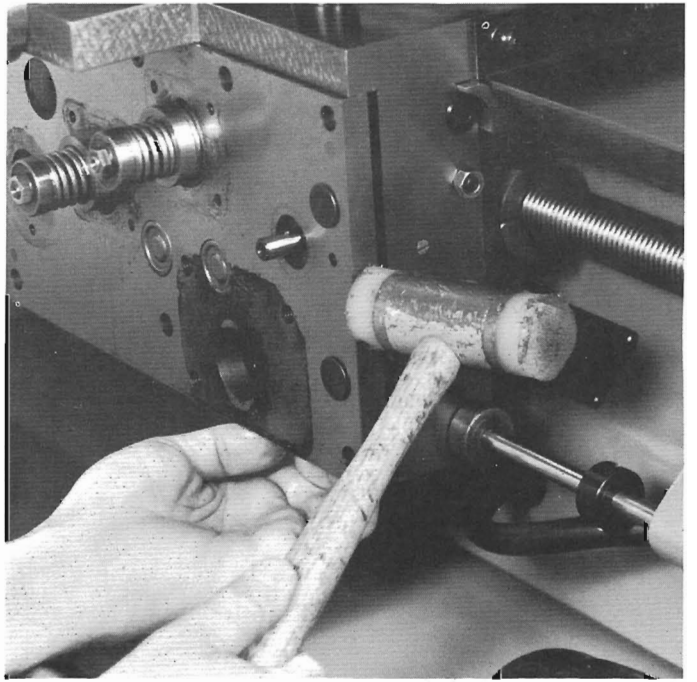


Figure 111 — Apron Cover Removal

Figure 109 — Carriage Cover

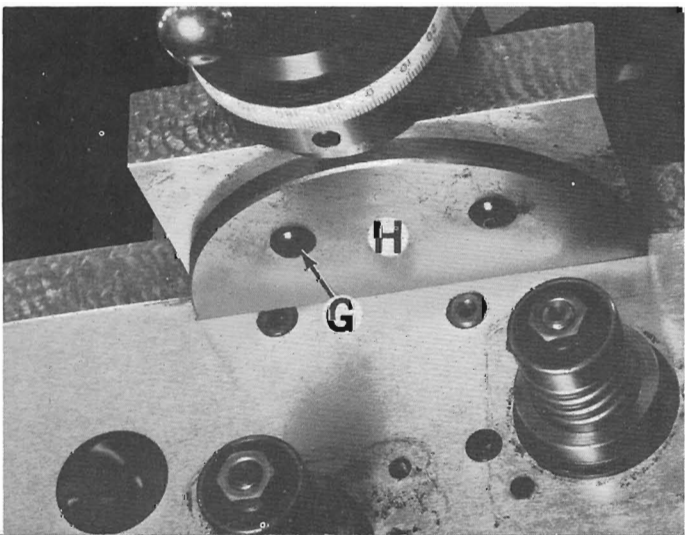
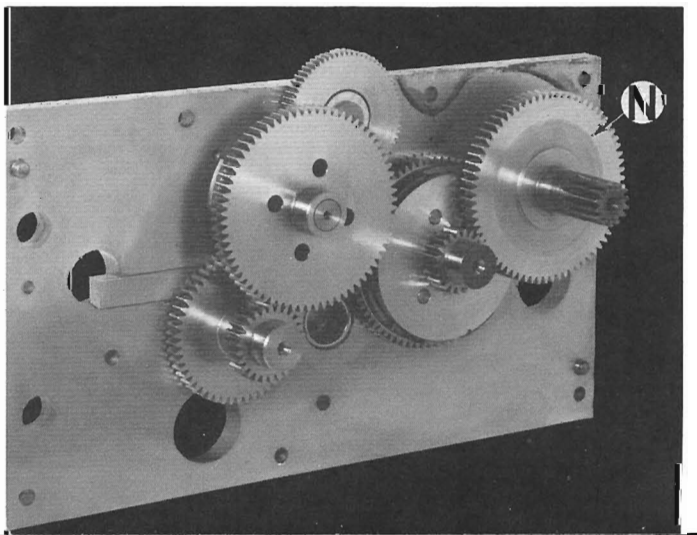


Figure 112 — Apron Cover Assembly



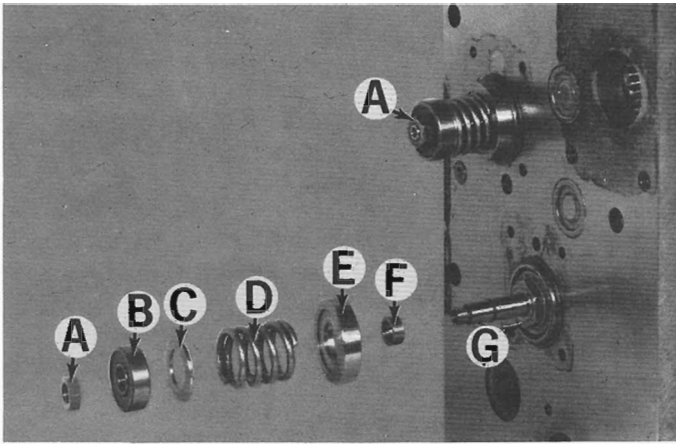


Figure 113 — Power Feed Clutch Components

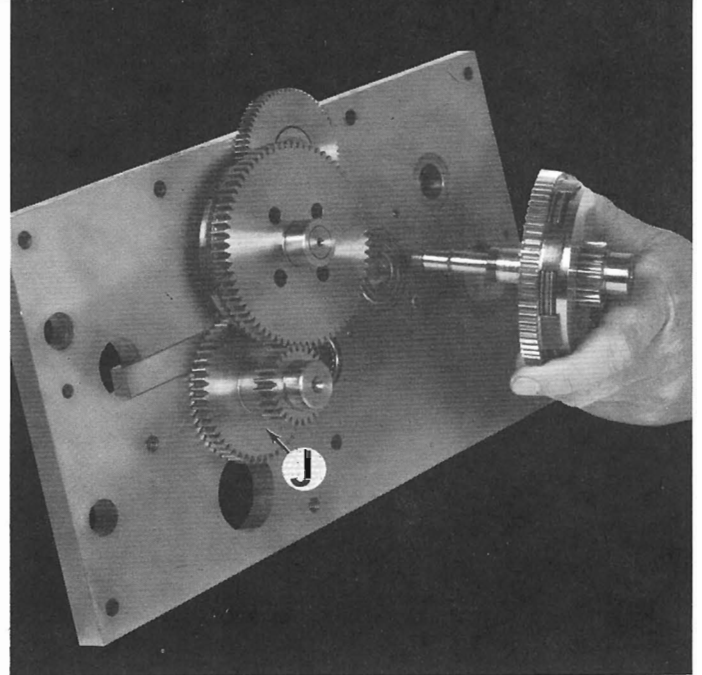


Figure 114 — Power Feed Clutch Removal

10. TO REMOVE CLUTCHES:

- (A). Remove nut "A", Figure 113. **CAUTION:** spring is under tension. **NOTE:** Clutch parts are identical on front side of cover.
- (B). Remove bearing "B", washer "C", spring "D", spring seat "E", and spacer "F".
- (C). Remove nut "G" to remove clutch assembly, Figure 114.

- 11. Clutch bearing "H", Figure 115, is removed from face of cover. **IT IS NOT NECESSARY TO REMOVE SNAP RING** on bearing for clutch disassembly.

- 12. Remove intermediate gears "J", Figure 114, and "K", Figure 116.

- 13. If necessary, remove 70 tooth gear "L", Figure 115, by driving with punch at stud "M".

- 14. Remove screw "N", Figure 115, to remove interlock plate "O", Figure 117.

- 15. Remove longitudinal feed interlock bar "P", spring "Q", Figure 118, and plunger "R".

16. TO DISASSEMBLE LONGITUDINAL CLUTCH:

- (A). Remove snap ring "A", Figure 119.
- (B). Remove 70 tooth gear "B", Figure 120 and clutch plate "C".
- (C). Remove snap rings "D", Figure 121, clutch disc "E", clutch plate "F" and wave washer "G".

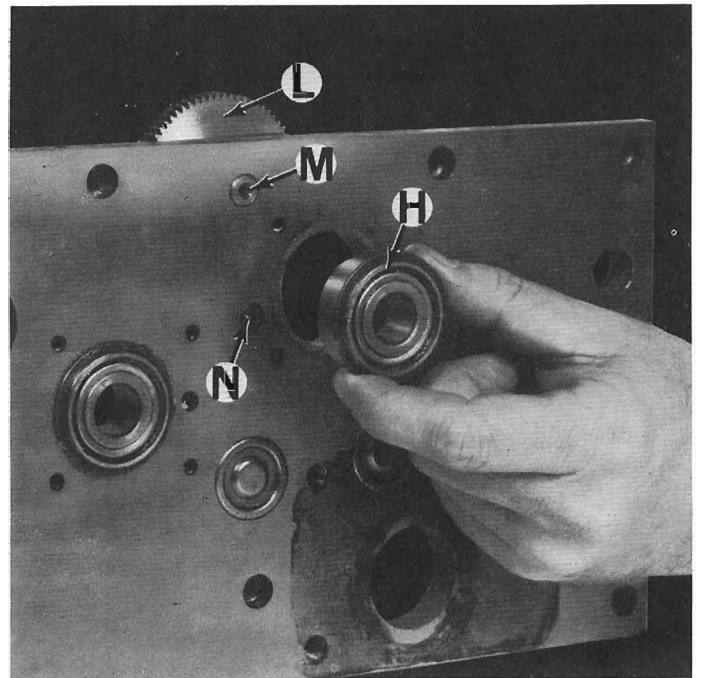
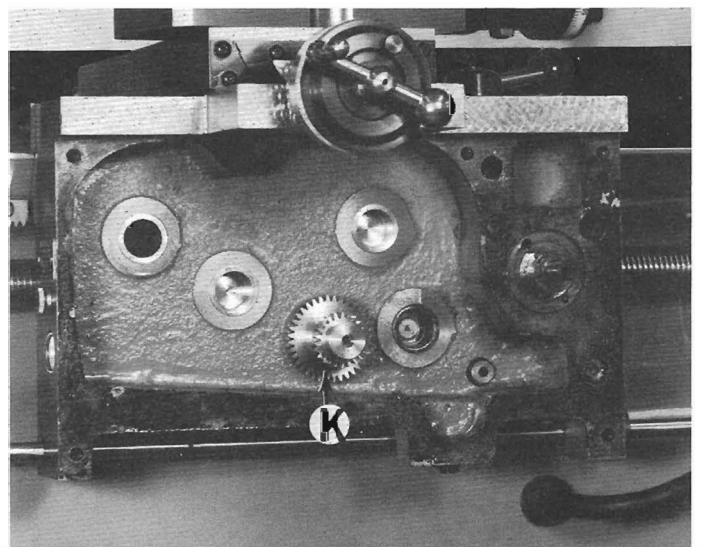


Figure 115 — Clutch Bearing Removal

Figure 116 — Carriage Apron with Cover Removed



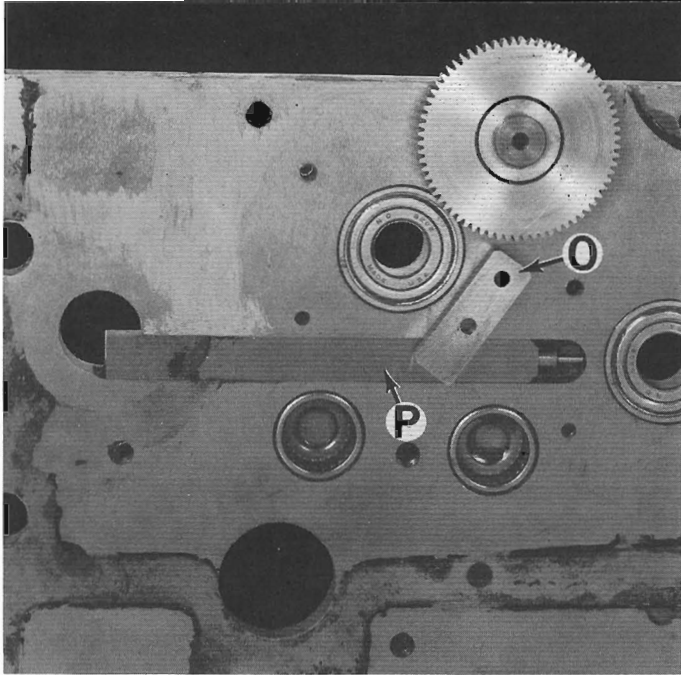


Figure 117 — Longitudinal Feed Interlock

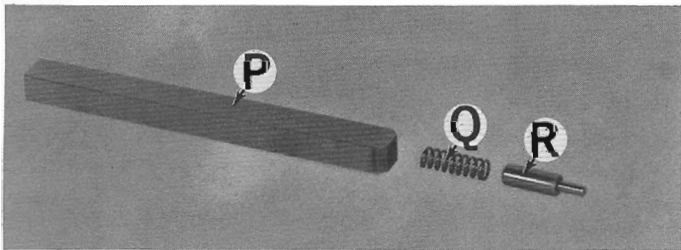


Figure 118 — Interlock Components

17. TO DISASSEMBLE CROSS FEED CLUTCH:

- (A). Remove snap ring "A", Figure 122.
- (B). Remove shaft and 70 tooth gear "B", Figure 123. Remove clutch plate "C".

Figure 119 — Longitudinal Clutch

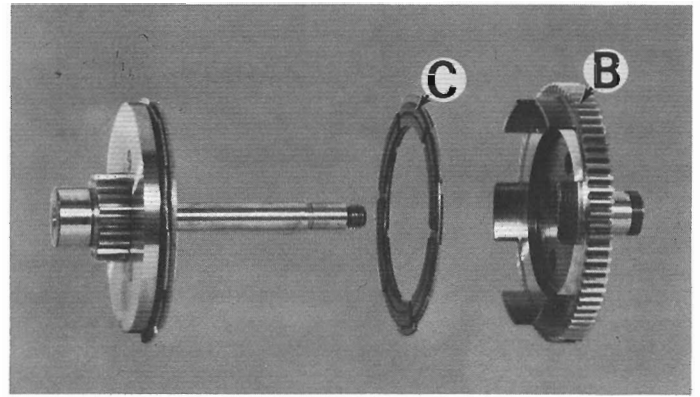
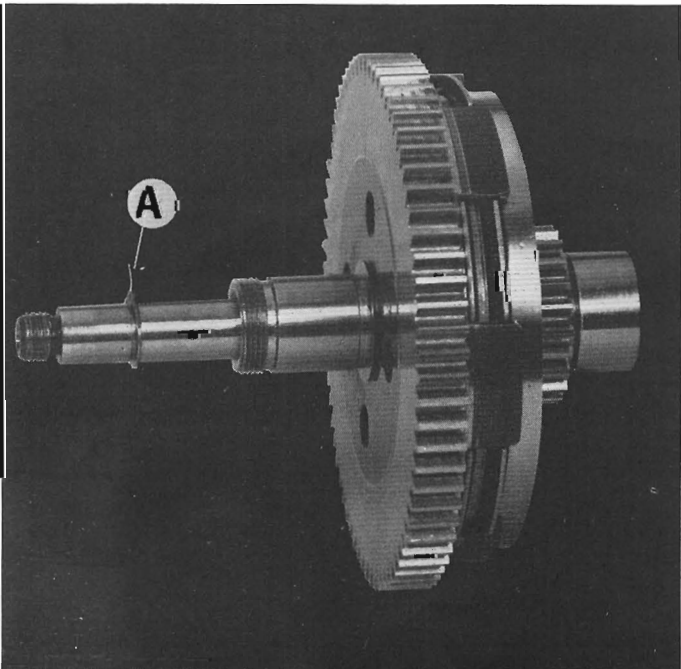


Figure 120 — Longitudinal Clutch Components

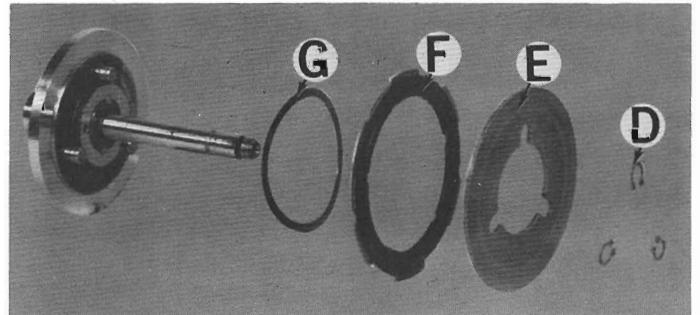


Figure 121 — Longitudinal Clutch Components

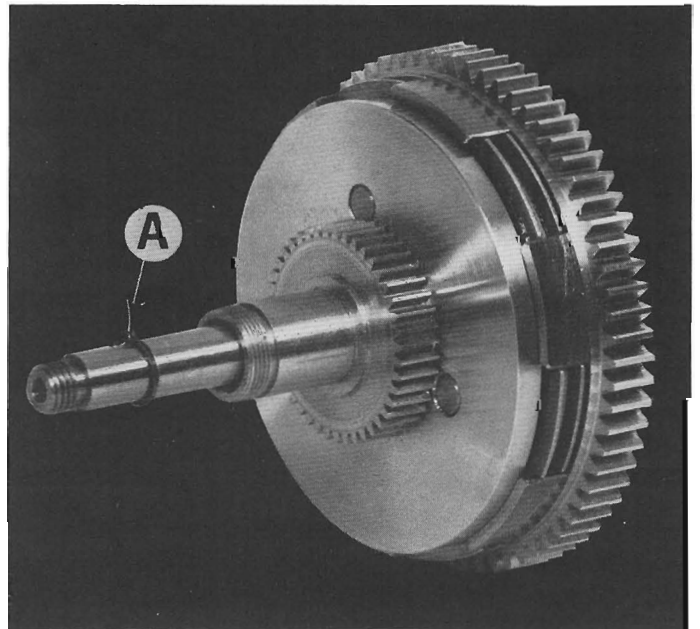


Figure 122 — Cross Feed Clutch

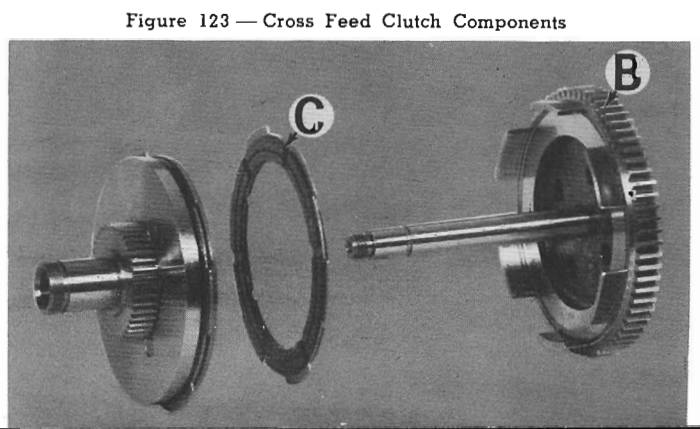


Figure 123 — Cross Feed Clutch Components

(C). Remove snap rings "D", Figure 124, clutch disc "E", clutch plate "F" and wave washer "G".

18. TO DISASSEMBLE CLUTCH HOUSINGS:

(A). Remove spring "A", Figure 125 and 126. Remove interlock plunger "B", Figure 125 and plunger "C", Figure 126.

(B). Remove cap "C", Figure 127, and nut "D".

(C). Loosen set screw "E" and remove camshaft "F".

(D) Remove sleeve "G" and bolt "H".

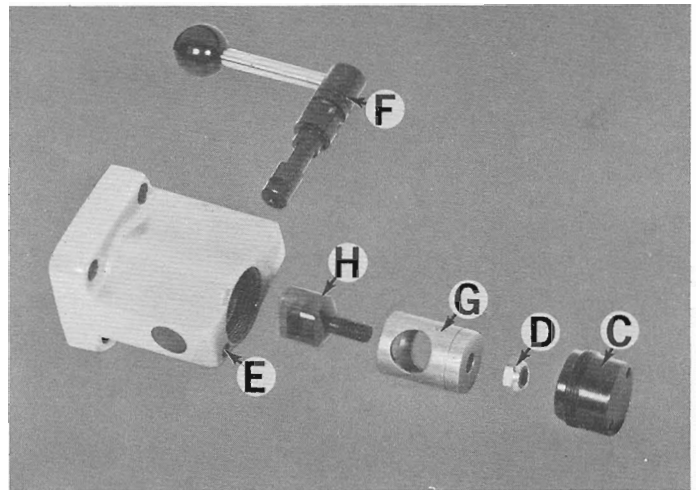


Figure 127 — Clutch Housing and Components

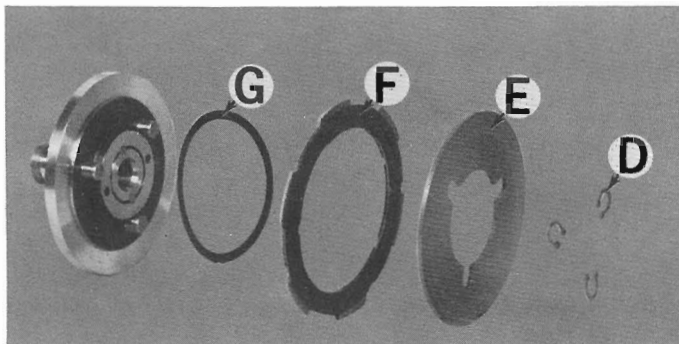


Figure 124 — Cross Feed Clutch Components

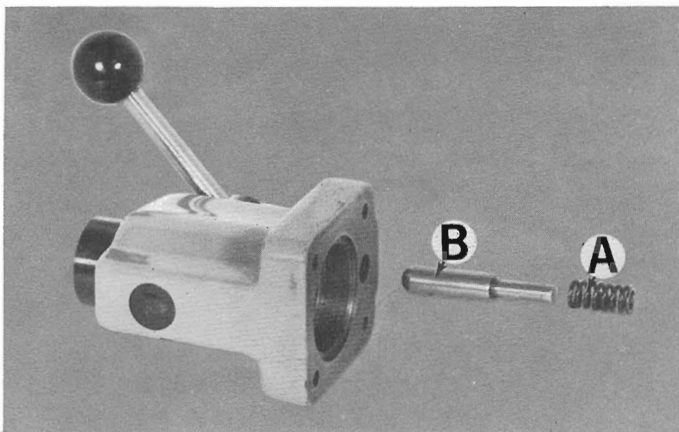
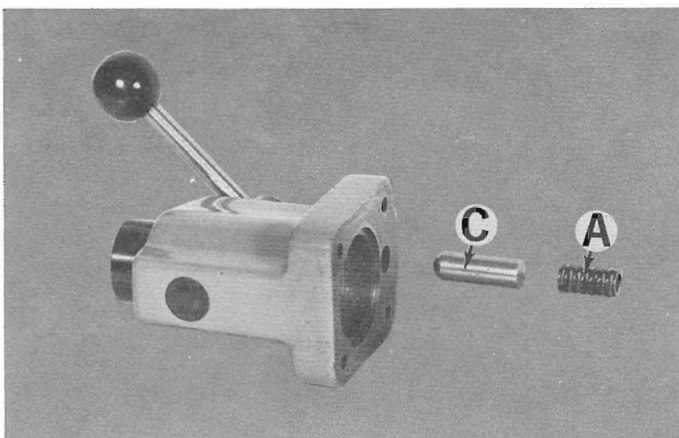


Figure 125 — Longitudinal Clutch Plunger and Spring

Figure 126 — Cross Feed Clutch Plunger and Spring



CARRIAGE APRON REASSEMBLY

1. Reassemble clutches and clutch housings. Reverse steps 16, 17 and 18 under "Carriage Apron Disassembly", Page 32.
2. Replace spring "Q", Figure 118, plunger "R" and interlock bar "P", Figure 117. Clearance chamfers on bar must be positioned as shown, Figure 117.
3. Replace screw "N", Figure 115 and interlock plate "O", Figure 117.
4. Replace 70 tooth gear "L", Figure 115 and bearings "H".
5. Replace intermediate gears "J", Figure 114 and "K", Figure 116.
6. Replace clutch assemblies and nuts "G", Figure 113.
7. Replace spacers "F", Figure 113, spring seats "E", springs "D", washers "C" and bearings "B".
8. Assemble nut "A", Figure 113. Some method of compressing spring until nut can be threaded on flush with post is necessary. Note bracket used in Figure 128.
9. Replace rack pinion and 70 tooth gear "N", Figure 112.
10. Permatex apron cover and replace. **USE CARE NOT TO DAMAGE PRECISION GEARS.** Assemble seven screws "M", Figure 110.
11. Permatex cover "H", Figure 109. Assemble seal, cover "H" and two screws "G".
12. Permatex seal clutch housings. Pack spring "A", Figures 125 and 126 with Shell Alvania #3 grease. Replace clutch housings and eight screws "D", Figure 108.
13. Permatex seal handwheel housing. Assemble handwheel assembly and three screws "B", Figure 107.
14. Permatex seal power feed housing and assemble power feed and three screws "A", Figure 107.

15. Replace lock screw "L", Figure 110, Fibre washer, handle "K" and taper pin "J".
16. Replace plug "E", Figure 92, and fill apron with transmission fluid per instructions, Page 31.
17. With clutch handle in notched position, tighten screw "E", Figure 129.
18. Adjust clutches per following instructions.

CARRIAGE CLUTCH ADJUSTMENT

1. Using face spanner wrench remove threaded covers "C", Figure 127.
2. Adjust clutches at nut "D", Figure 129. When properly adjusted, clutches will engage and dis-engage when ball lever is between 10° and 20°

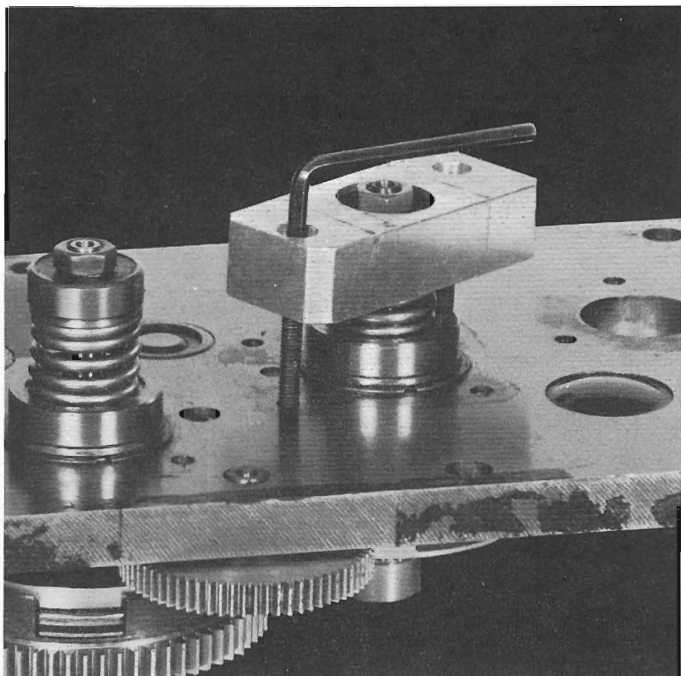


Figure 128 — Clutch Spring Replacement

Figure 129 — Power Feed Clutch Adjustment

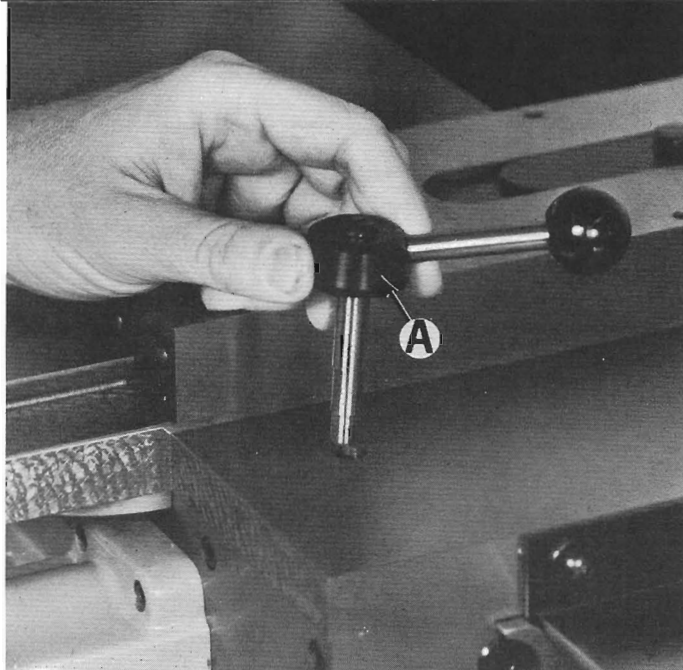
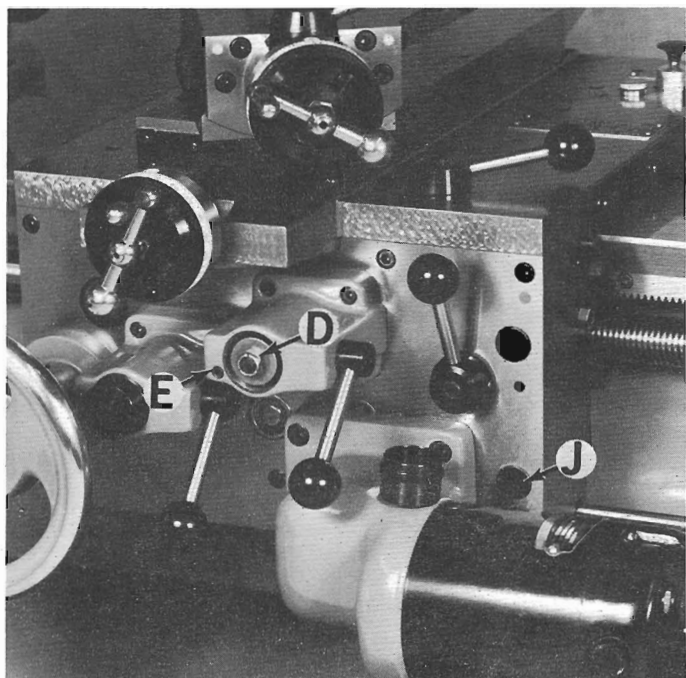


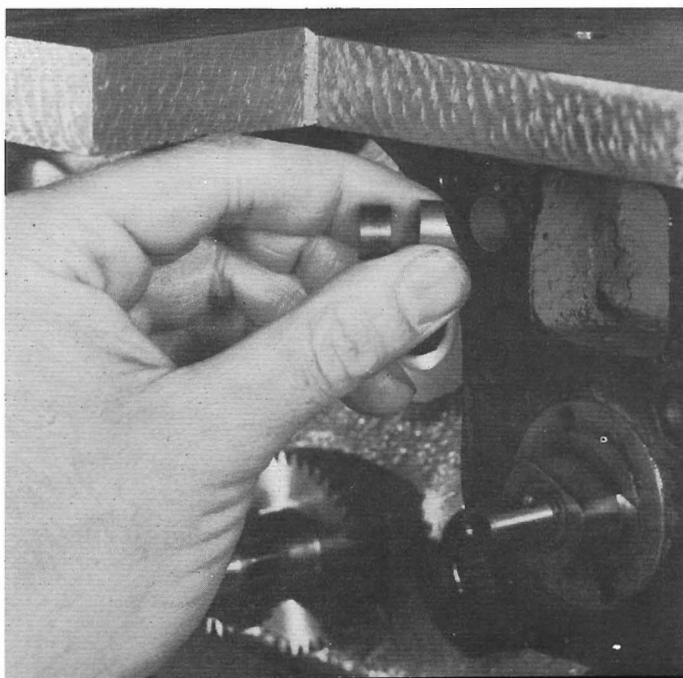
Figure 130 — Carriage Lock Removal

above horizontal. **CLUTCHES** are spring loaded and **CANNOT BE ADJUSTED FOR MORE PULLING POWER.**

CARRIAGE LOCK REMOVAL

1. To remove the carriage lock handle "A", Figure 130, place handle in unlocked position and lift up.
2. If necessary to remove two piece carriage lock bolt, Figure 131, follow steps 1 through 8 under "Carriage Apron Disassembly", Page 32.
3. To reassemble insert two piece lock bolt as shown, Figure 131. Both sections must bottom in hole against carriage gib.
4. Replace lock handle "A", Figure 130. Check lock handle for proper operation and follow steps 10 through 16 under "Carriage Apron Reassembly", Page 36.

Figure 131 — Carriage Lock Bolt



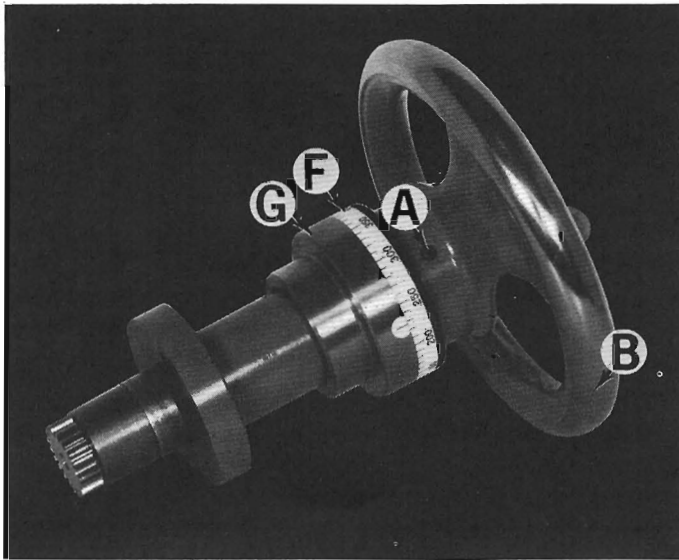


Figure 132 — Carriage Handwheel Assembly

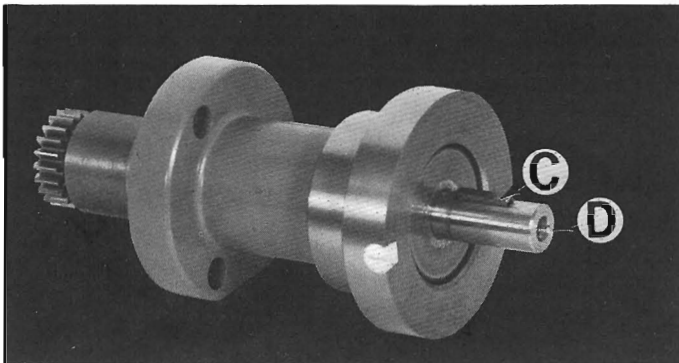


Figure 133 — Carriage Handwheel Components

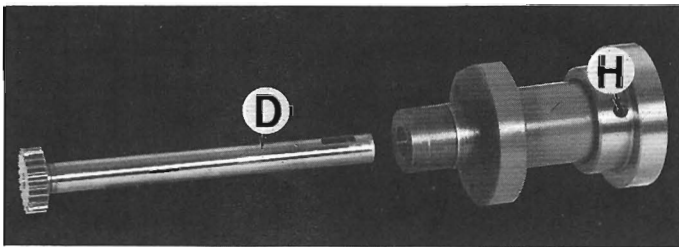
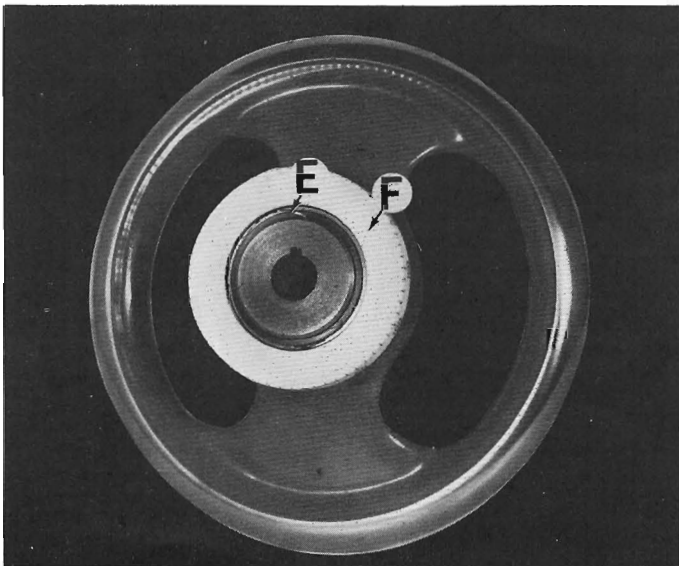


Figure 134 — Carriage Handwheel Components

Figure 135 — Carriage Handwheel and Dial



CARRIAGE HANDWHEEL DISASSEMBLY

1. Remove magnetic drain plug "E", Figure 92, to drain transmission fluid from apron. Replace drain plug.
2. Remove three screws "B", Figure 107, and remove carriage handwheel assembly "C".
3. Remove lock screw "A", Figure 132, and loosen set screw under lock screw "A". Remove handwheel "B".
4. Remove key "C", Figure 133.
5. Remove shaft and 21 tooth gear "D", Figure 134.
6. Remove snap ring "E", Figure 135, to remove dial "F" from handwheel. Do not misplace plug between lock screw and dial.
7. Reassemble. Permatex seal handwheel housing and replace handwheel assembly on carriage apron. Fill apron with transmission fluid per instructions Page 31.
8. Clearance between dial "F", Figure 132, and zero ring "G" should be set at .002" to .004". To change clearance loosen set screw "H", Figure 134.

LEAD SCREW REMOVAL

1. Remove taper pin "T", Figure 22. Engage carriage lead screw nut with lead screw and move carriage with handwheel approximately 1/2" to right.
2. Remove three bolts "B", Figure 88, and set power feed control box to machine rear.
3. Disengage lead screw nut and move carriage with handwheel to extreme left.
4. Remove two screws "A", Figure 136, and remove lead screw bracket "B" and shims. Remove bracket straight out until dowel pins clear and then to the right to clear lead screw and stop rod.
5. Support lead screw "C" by hand to remove through lead screw nut to prevent damage to precision threads.
6. Locating dowel pins "D", Figure 137, and needle bearing "E" are press fit in lead screw bracket.
7. Reverse above steps to reassemble.

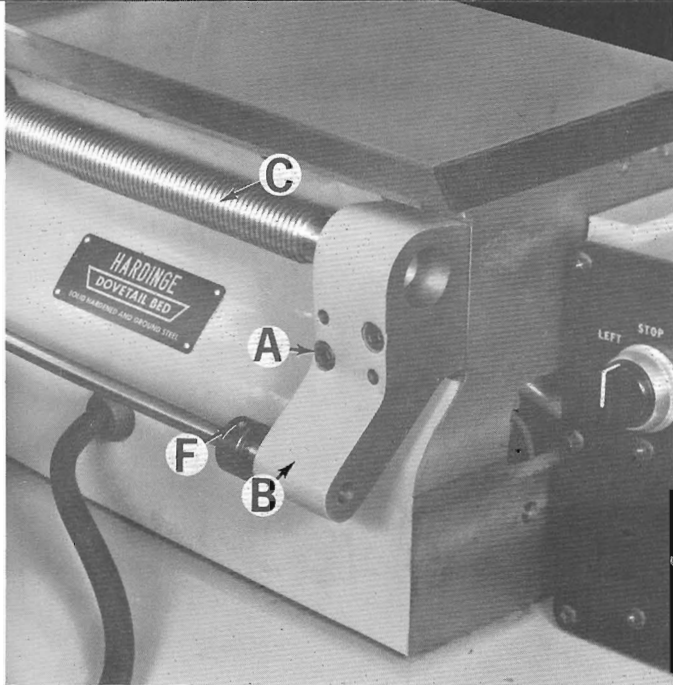


Figure 136 — Lead Screw and Bracket

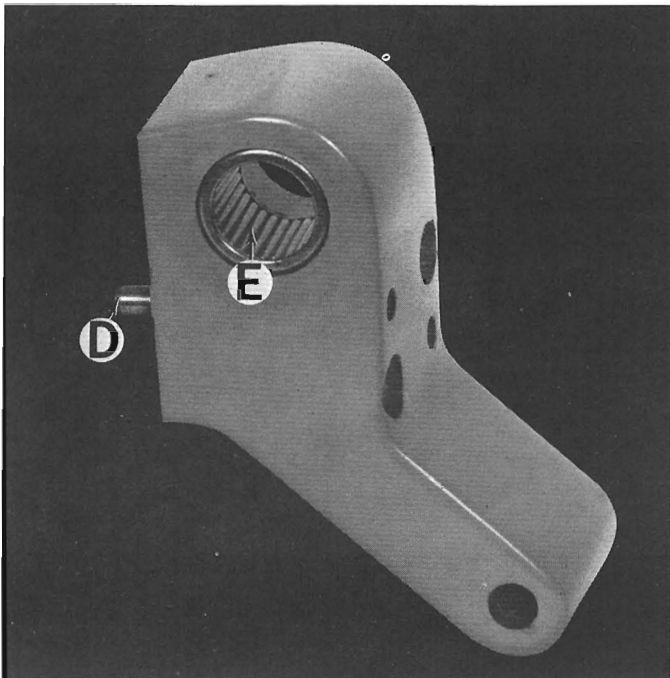


Figure 137 — Lead Screw Bracket

LEAD SCREW NUT REMOVAL

1. Remove tailstock assembly. Remove taper pin from positive stop "F", Figure 136.
2. Follow steps 1 through 5 under "Lead Screw Removal", Page 38.
3. Remove positive stop, "F", Figure 136.
4. Hand feed carriage to right until travel stops. Pull carriage by hand past end of bed until lead screw nut "A", Figure 138, clears.
5. Loosen two lock nuts "B" and loosen two screws "C".
6. Remove two dot plug covers "J", Figure 129. Remove two screws under covers "J". **HOLD GIB "D", FIGURE 138,** to prevent it from dropping from position.

7. Remove gib "D" and remove lead screw nut, Figure 139.
8. If necessary, to remove gib "E", Figure 139, or cam "F":
 - (A). Follow steps 1 through 8 under "Carriage Apron Disassembly", Page 32.
 - (B). Remove two screws "G", Figure 140, and remove gib "E", Figure 139.
 - (C). Loosen screw "J", Figure 140, and remove cam "F".

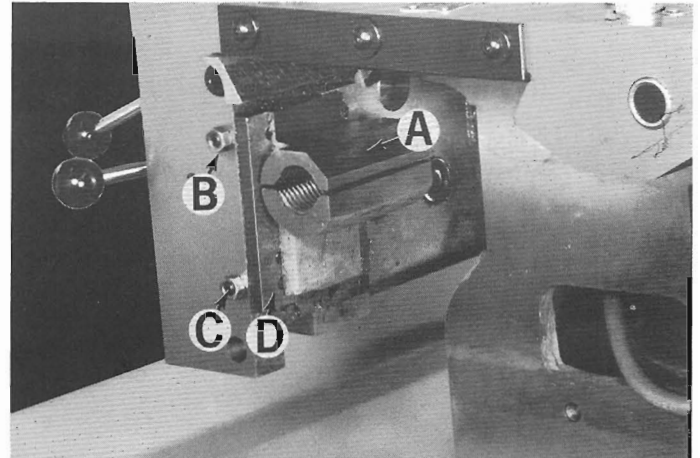


Figure 138 — Lead Screw Nut

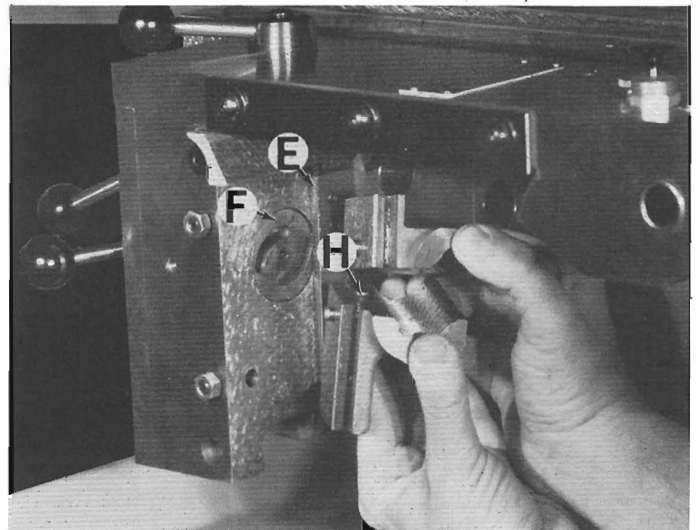
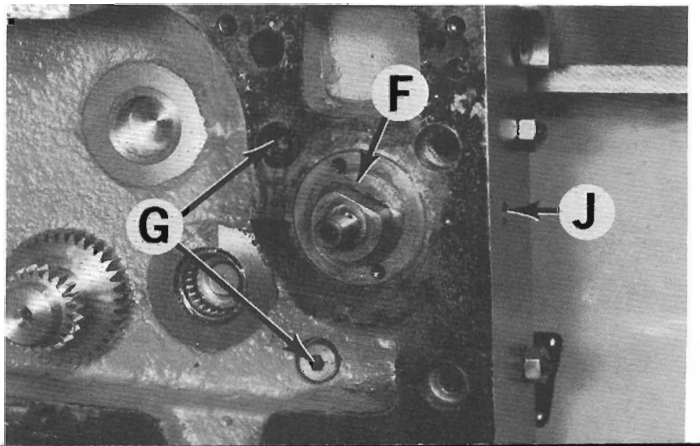


Figure 139 — Lead Screw Nut Removal

Figure 140 — Lead Screw Nut Cam and Gib Screws



LEAD SCREW NUT REPLACEMENT

1. Replace cam "F", Figure 140, with cam slots "G", Figure 141, in line with screw "J", Figure 140.
2. Replace gib "E", Figure 139, and two screws "G", Figure 140.
3. Follow steps 10 through 16 under "Carriage Apron Reassembly", Page 36.
4. Replace both halves of lead screw nut, Figure 139, placing lead screw nut pins in cam slots "H", Figure 141. Replace gib "D", Figure 138. Replace and tighten securely two screws. Replace covers "I", Figure 129.
5. With lock screw "L", Figure 110, loose, tighten screw "J", Figure 140, gradually inward until handle "K", Figure 110, has approximately 5° overtravel after lead screw nut pin "H", Figure 139, contacts upper half of nut. Tighten lock screw "L", Figure 110.
6. Alternately tighten two screws "C", Figure 138, until pressure is required to close half nut. Tighten securely two lock nuts "B".
7. **LIFT BED WIPER**, which is spring loaded, and push carriage back on bed slowly using care that rack pinion and rack engage properly.
8. Replace tailstock assembly. Replace positive stop "F", Figure 136.
9. Reverse steps 1 through 5 under "Lead Screw Removal", Page 38.
10. Replace taper pin in positive stop "F", Figure 136.

CARRIAGE GEAR RACK REMOVAL

1. Remove tailstock assembly. Remove taper pin from positive stop "F", Figure 136.
2. Follow steps 1 through 5 under "Lead Screw Removal", Page 38.
3. Remove positive stop "F", Figure 136.
4. Hand feed carriage to right until travel stops. Pull carriage by hand past end of bed until gear rack "B", Figure 142, is completely exposed.
5. Remove eight screws "A", Figure 142.
6. Remove rack "B" by prying alternately at both ends with small sharp screwdriver to free dowel pins "C" from bed.
7. Note step 7 above under "Lead Screw Nut Replacement" when reassembling.

CARRIAGE, CROSS SLIDE AND TOOL POST SLIDE GIB ADJUSTMENT

After considerable use it may be necessary to adjust the carriage, cross slide or tool slide gibs. The gibs are the tapered type and adjustment is as follows:

NOTE: Adjusting screw "A" locations are carriage,

Figure 143, cross slide, Figure 144, and tool post slide, Figure 145.

1. Insert 1/4" hexagon wrench in adjusting screw "A", Figure 146.
2. Loosen one full turn.
3. Push wrench on through into adjusting screw "B".
4. Advance adjusting screw "B" a fraction of a turn.
5. Pull wrench out of "B" and tighten "A".
6. Test for "feel"—the slide or carriage should have a slight drag, but should not bind.

NOTE: Excessive gib pressure or drag does not improve machine performance.

TOOL POST SLIDE DISASSEMBLY

1. Remove tooling and tool post.
2. Loosen eccentric lock "B", Figure 145, and remove eccentric lock.
3. Lift tool post slide from cross slide.
4. Remove four screws "C", Figure 147.
5. Turn handwheel counterclockwise to remove end cap and dial assembly from slides, Figure 148.

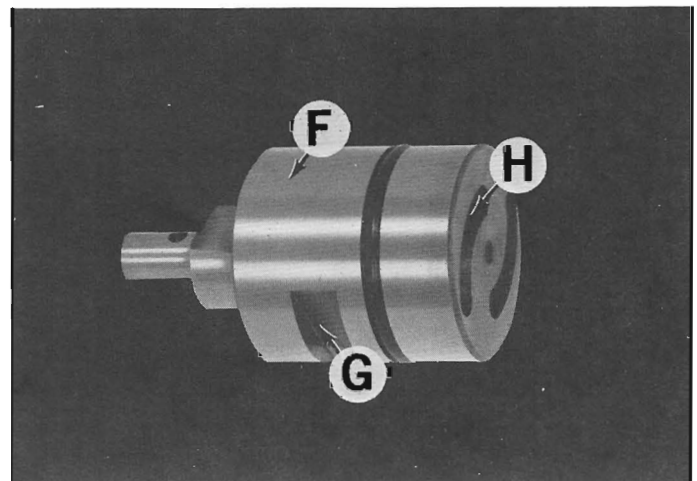
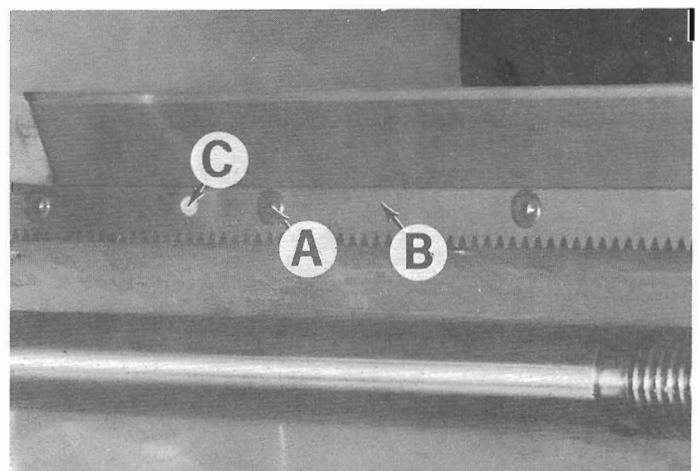


Figure 141 — Cam for Lead Screw Nut

Figure 142 — Carriage Rack



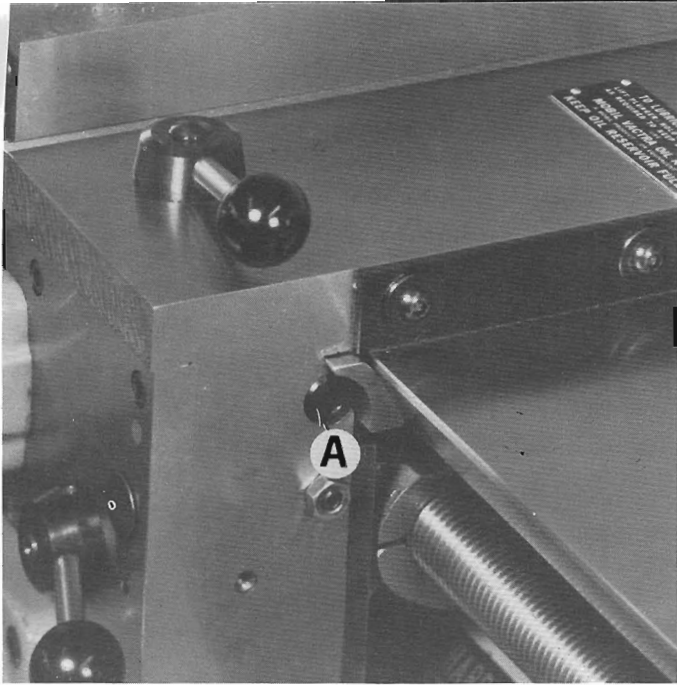


Figure 143 — Carriage Gib Adjustment

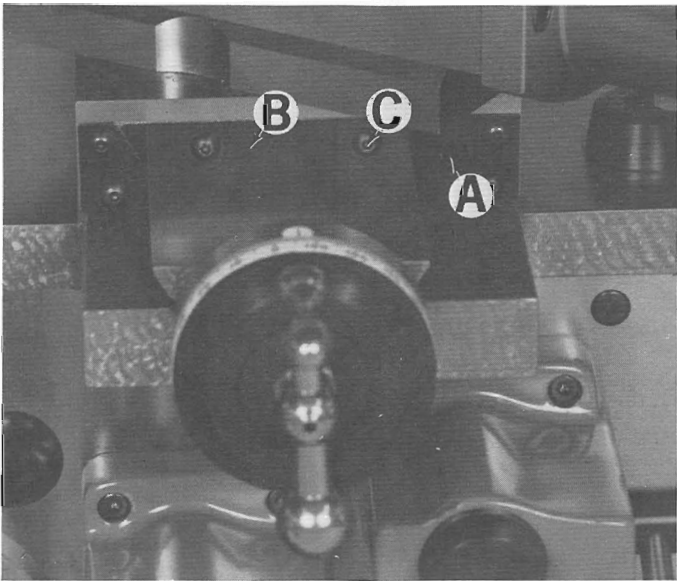


Figure 144 — Cross Slide Gib Adjustment

Figure 145 — Tool Post Slide Gib Adjustment

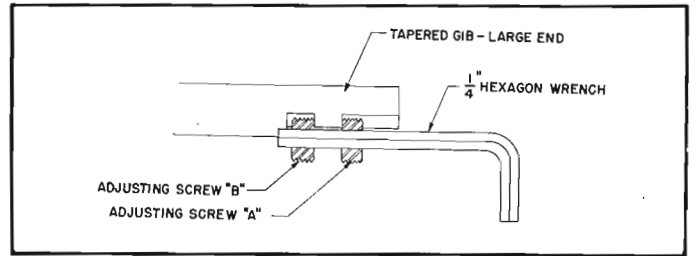
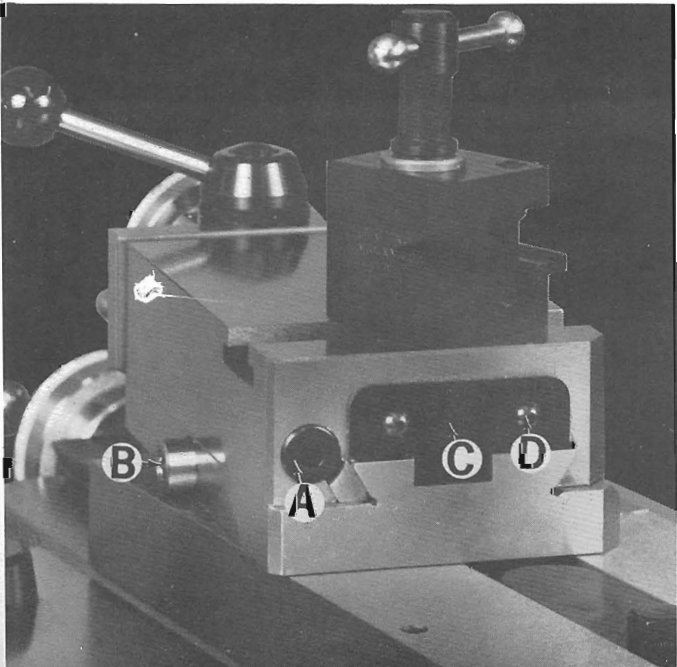


Figure 146 — Taper Gib Adjustment

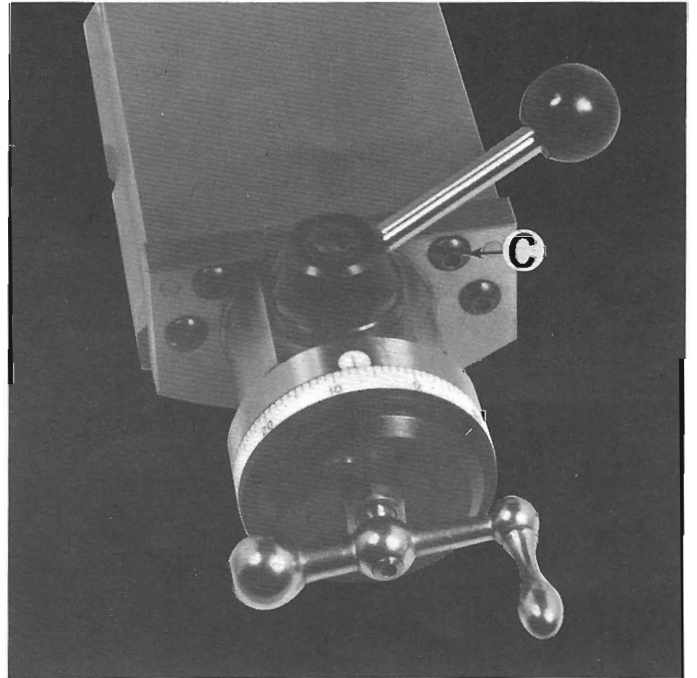


Figure 147 — Tool Post Slide

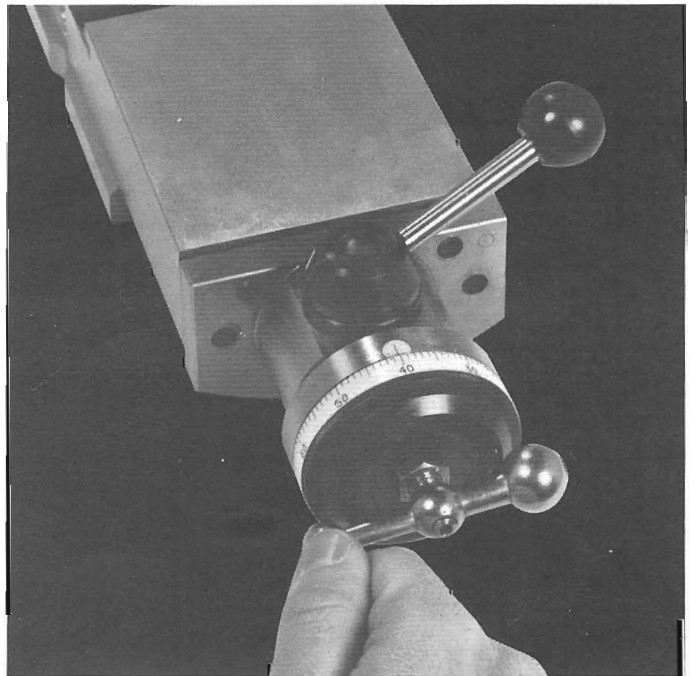


Figure 148 — End Cap and Dial Assembly Removal

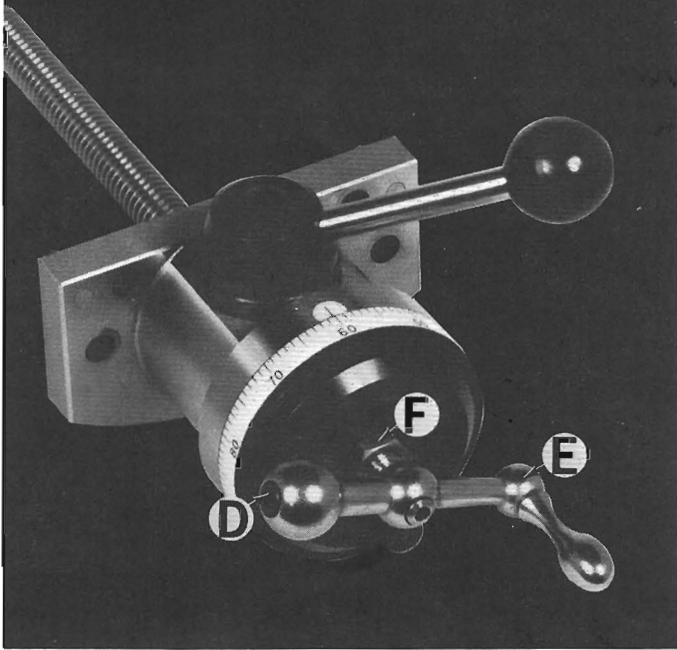


Figure 149 — End Cap and Dial Assembly

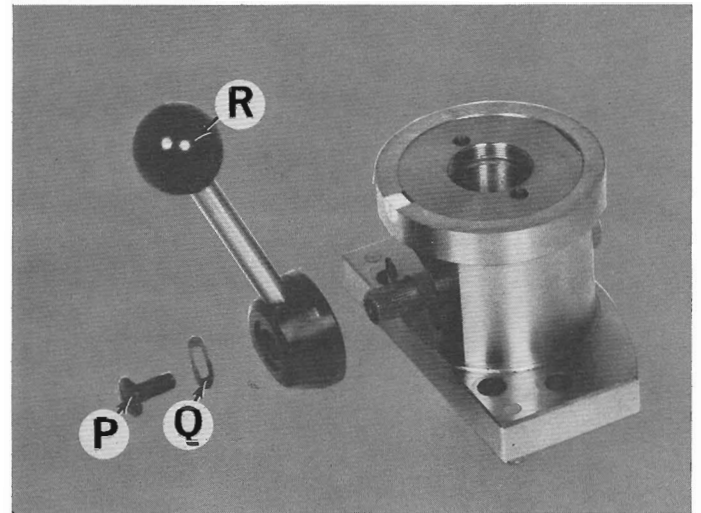


Figure 152 — Quick Acting Handle Removal

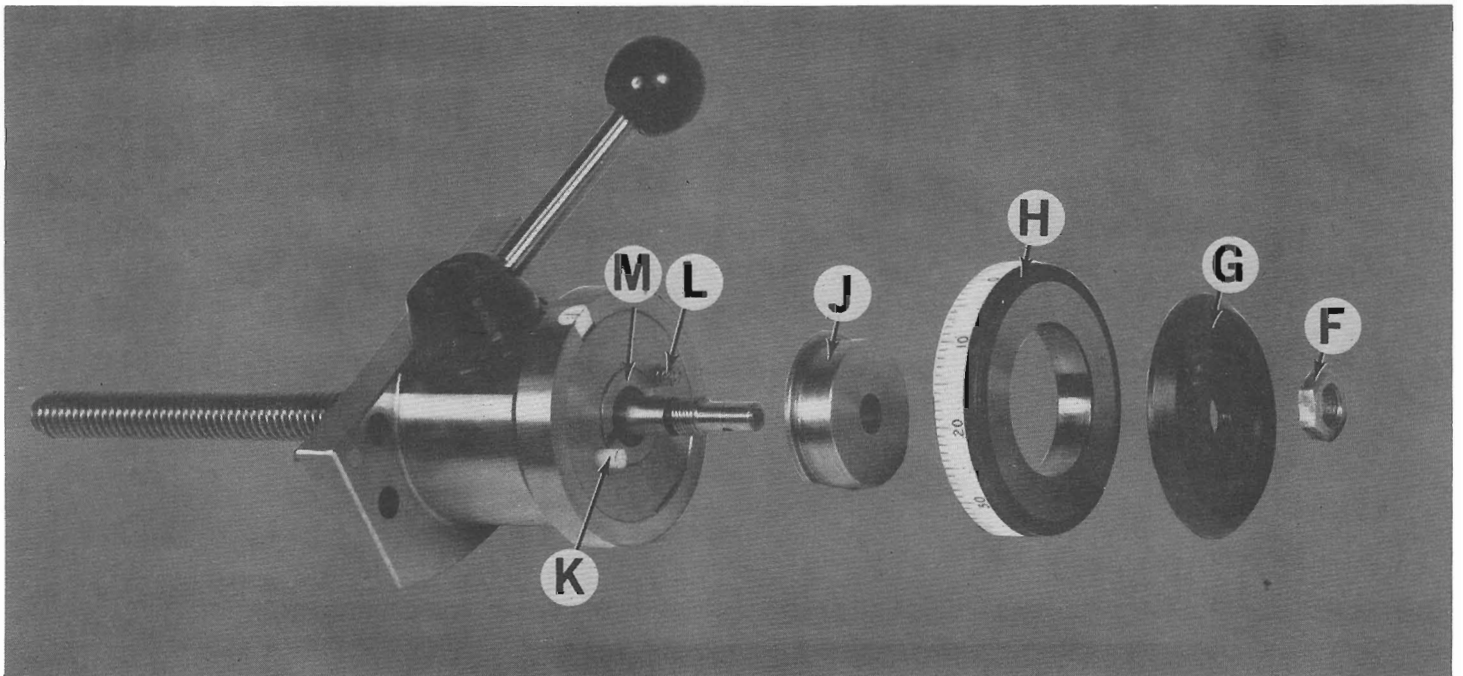
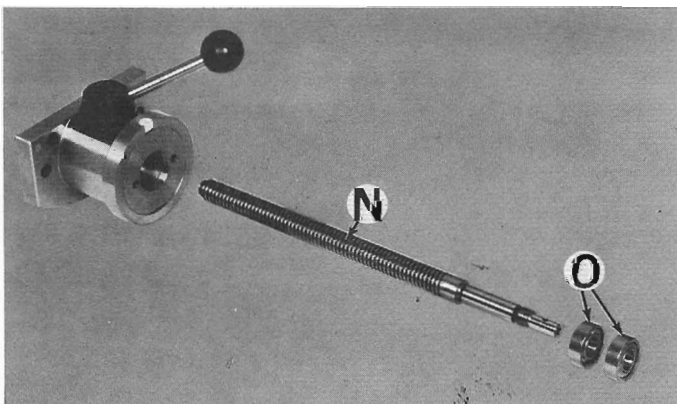


Figure 150 — End Cap and Dial Components

Figure 151 — End Cap and Feed Screw



6. To disassemble end cap and dial assembly:

- (A). Remove lock screw "D", Figure 149, loosen screw under lock screw "D" and remove crank "E".
- (B). Remove nut "F", Figure 149, washer "G", Figure 150, dial "H" and bushing "J". **DO NOT MISPLACE NYLON PLUG** under lock screw in washer "G".
- (C). Remove two plugs "K" and springs "L".
- (D). Remove nut "M". Remove feed screw "N", Figure 151, and two bearings "O".
- (E). Remove screw "P", Figure 152, wave washer "Q" and handle "R".
- (F). Remove two screws "S", Figure 153, eccentric support "T" and eccentric shaft "U".
- (G). Loosen nut "V", Figure 154, and remove eccentric stop screw "W".

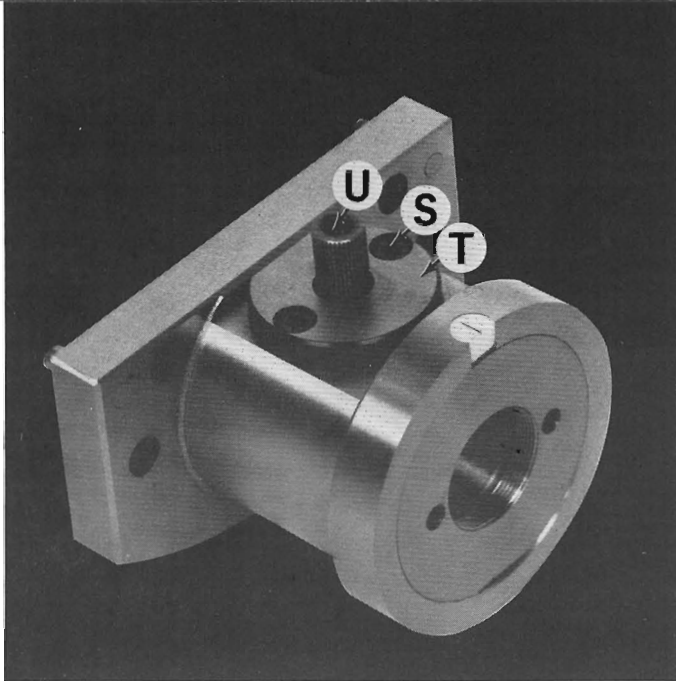


Figure 153 — Eccentric for Handle

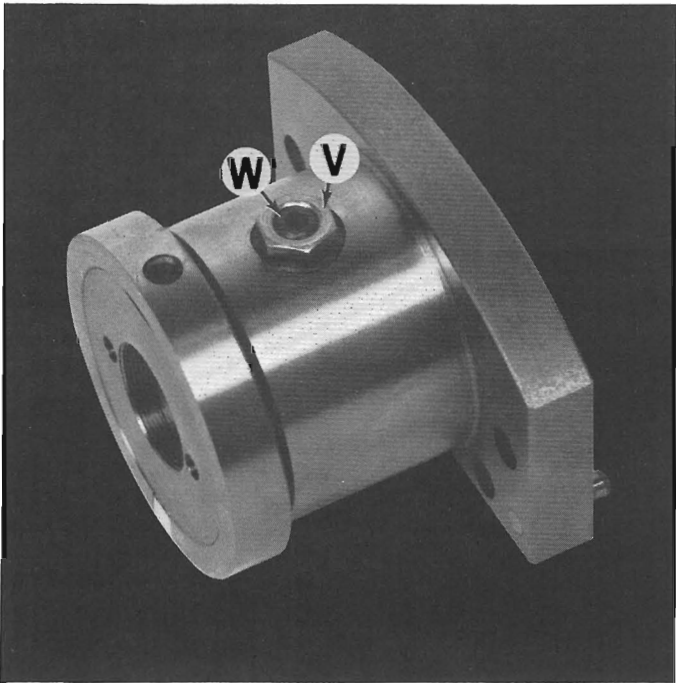
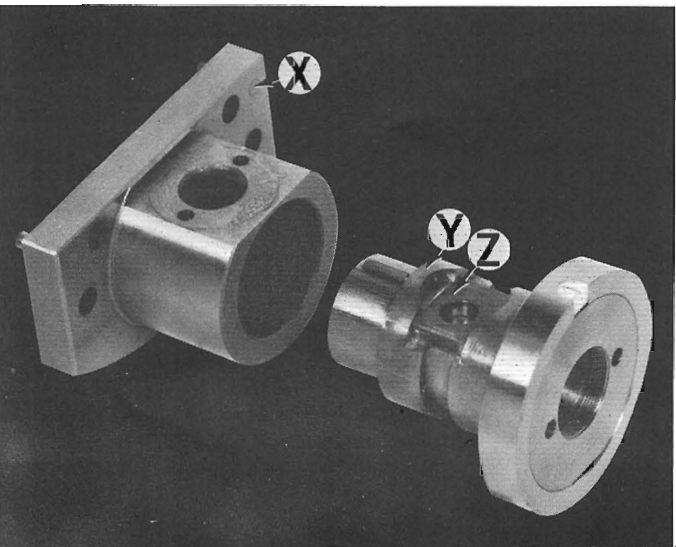


Figure 154 — Stop Screw for Handle

Figure 155 — End Cap and Bearing Housing



(H). Remove end cap "X", Figure 155, from bearing housing "Y". Remove block "Z".

7. To disassemble slides and feed screw nut:

(A). Separate slides by moving top slide to rear.

(B). Loosen lock nut "A", Figure 156, and unscrew half nut "B", Figure 156.

(C). Loosen set screw "C", Figure 157, to remove half nut "D", Figure 156.

NOTE: Screws "E", Figure 158, and "F", Figure 157, are stop screws. **IT IS NOT NECESSARY TO DISTURB THESE SCREWS** for disassembly.

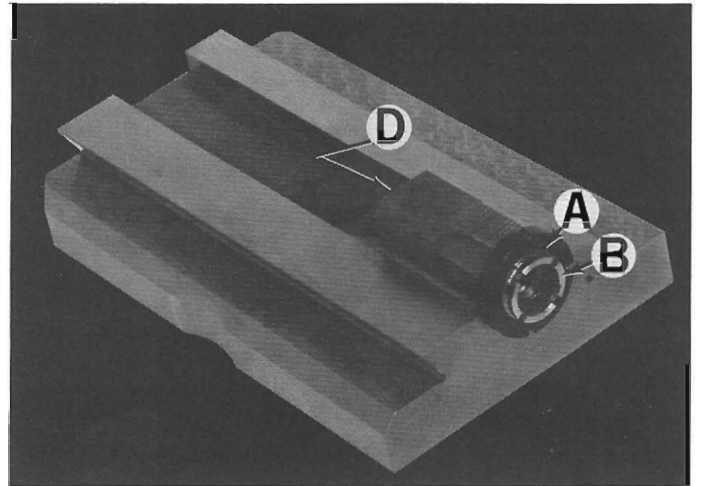


Figure 156 — Adjustable Feed Screw Nut

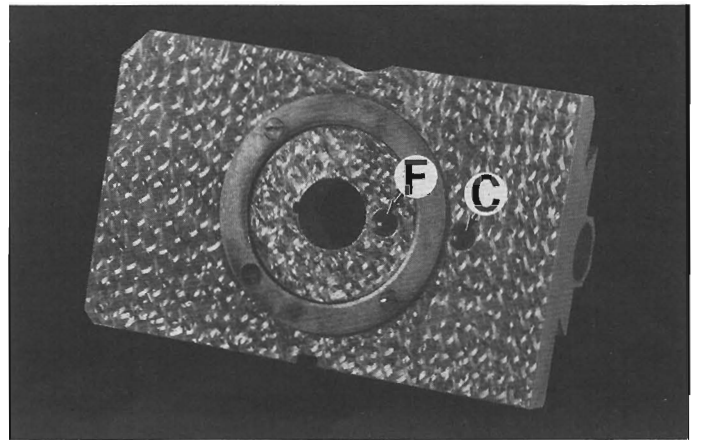
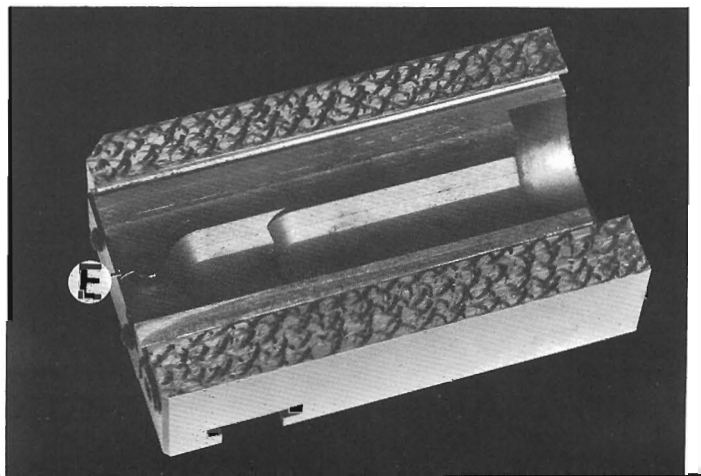


Figure 157 — Stop Screw and Half Nut Retaining Screw

Figure 158 — Stop Screw for Top Slide



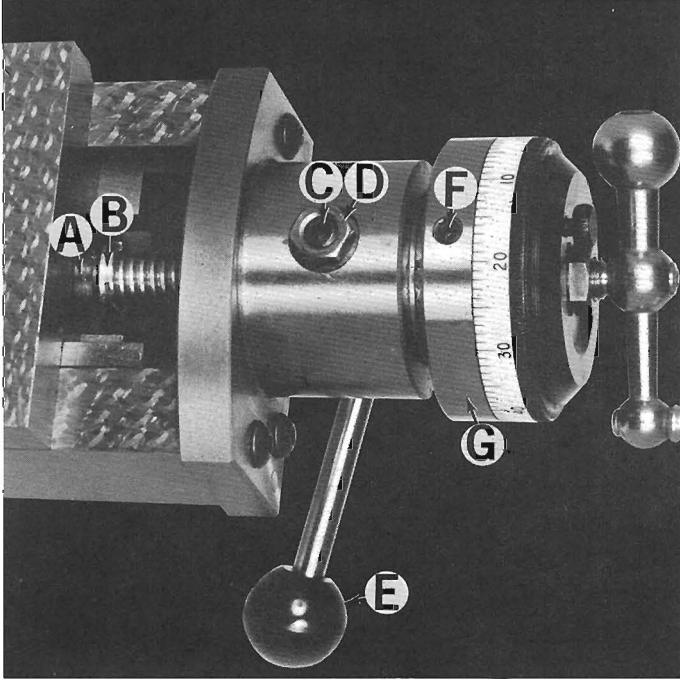


Figure 159 — Stop Screw Adjustment for Quick Acting Lever

TOOL POST SLIDE REASSEMBLY

1. Replace feed screw half nut "D", Figure 156, and tighten set screw "C", Figure 157.
2. Thread half nut "B", Figure 156, into casting leaving approximately $11/32$ " projection. Replace lock nut "A" but do not tighten.
3. Coat inside of feed screw nut with Die Makers Grease and assemble top and bottom slides.
4. Coat block "Z" with Die Makers Grease and replace as shown, Figure 155. Assemble end cap "X" and bearing housing "Y".
5. Replace eccentric stop screw "W", Figure 154, and lock nut "V", but do not tighten.
6. Coat eccentric end of shaft "U", Figure 153, with Die Makers Grease and replace. Replace eccentric support "T" and two screws "S".
7. Replace handle "R", Figure 152, wave washer "Q" and screw "P".
8. Replace bearings "O", Figure 151, feed screw "N" and nut "M", Figure 150.
9. Replace two springs "L", Figure 150, and two plugs "K".
10. Replace bushing "J", dial "H", washer "G" and nut "F". **NOTE:** When replacing washer "G", nylon plug must be in position under lock screw.
11. Replace crank "E", Figure 149, tighten set screw and replace lock screw "D".
12. Coat feed screw with Mobil Vactra Oil No. 2. Replace end cap and dial assembly and four screws "C", Figure 147. Do not force feed screw into feed screw nut. Turn half nut "B", Figure 159, gradually until half nuts line up to permit assembly of feed screw.
13. If zero ring "G", Figure 159, has been disturbed, loosen set screw "F" and set gap between dial and zero ring at $.002$ " to $.004$ ".
14. If wiper "C", Figure 145, has been disturbed, loosen two screws "D" and set clearance between wiper and bottom slide at $.0015$ ".
15. Follow steps 2, 4 and 5 under "Tool Post Slide Feed Screw Nut Adjustment" on this page.

16. Replace tool post slide on cross slide and replace eccentric lock "B", Figure 145.
17. Turn eccentric stop screw "C", Figure 159, until it bottoms and back off two turns. To get positive holding and repeatability, adjust eccentric stop screw "C" to obtain equal throw of lever "E" in both directions from the point perpendicular to the feed screw. Fine adjustments from this point may be necessary to obtain the desired solid stop. Hold screw "C" with hex pin wrench and tighten lock nut "D".

TOOL POST SLIDE FEED SCREW NUT ADJUSTMENT

Following considerable use or after disassembly of the tool post slide, it may be necessary to adjust the feed screw nut for proper backlash.

1. Follow Steps 1, 2 and 3 under "Tool Post Slide Disassembly", Page 40.
2. With bottom slide up, turn feed screw handle to separate slides and to expose adjustable feed screw nut "B", Figure 159.
3. Loosen Lock Nut "A", Figure 159.
4. Adjust half nut "B" in for minimum backlash (maximum of two graduations on feed screw dial).
5. Hold half nut "B" and tighten lock nut "A".

TOOL POST SLIDE LUBRICATION

The tool post slide should be removed monthly to lubricate the feed screw and nut, and to clean and lubricate slide ways. Lubricate with Mobil Vactra Oil No. 2.

Follow Steps 1, 2 and 3 under "Tool Post Slide Disassembly", Page 40. Clean and lubricate tool post slide ways, feed screw and nut.

CROSS SLIDE REMOVAL AND LUBRICATION

The cross slide should be removed monthly to clean and lubricate the cross feed screw and nut and to clean the slide ways. Lubricate feed screw and nut with Mobil Vactra Oil No. 2. To remove cross slide:

1. Follow Steps 1 through 3 under "Tool Post Slide Disassembly", Page 40.
2. With handwheel, feed cross slide towards machine rear until travel stops. Remove cross slide by hand, Figure 160, from rear of machine.
3. Use care when reassembling not to bump cross slide screw and nut.
4. If three cross slide wipers "B", Figure 144, have been disturbed, loosen button head screws, "C" and set clearance at $.001$ " between wipers and dovetail surfaces.

CROSS FEED SCREW NUT ADJUSTMENT

1. Remove bolt "A", Figure 161, and remove cover "B".
2. Loosen cap screw "C", Figure 162.
3. Turn adjusting screw "D" gradually clockwise to reduce backlash to a maximum of four graduations on cross feed dial.
4. Tighten cap screw "C", Figure 162, replace cover "B", Figure 161, in center of slot with long end towards machine rear and replace bolt "A".

CROSS FEED SCREW DISASSEMBLY

1. Remove screw "A", Figure 163, and loosen set screw under lock screw "A". Remove crank "B".
2. Remove nut "C" and washer and screw assembly "D". **DO NOT MISPLACE NYLON PLUG UNDER LOCK SCREW.** Remove dial "E" and bushing "F", Figure 164.

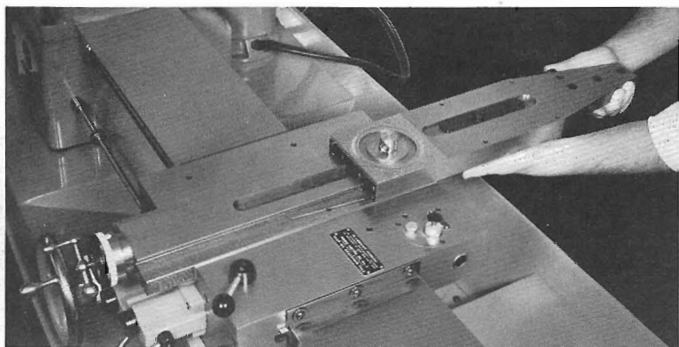


Figure 160 — Cross Slide Removal

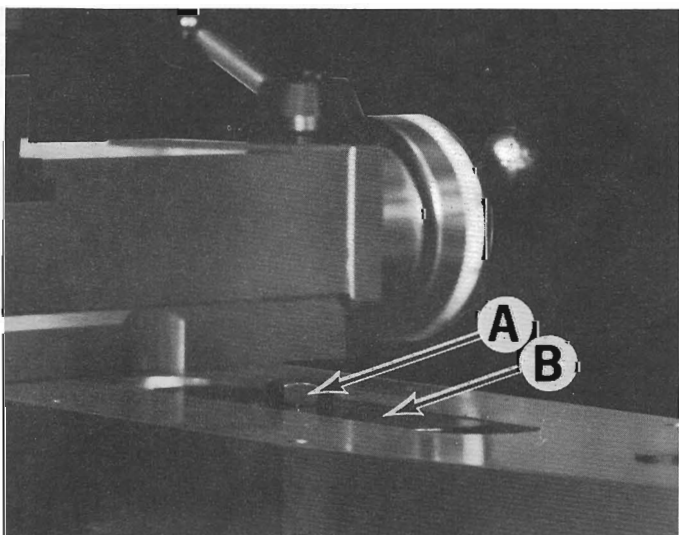


Figure 161 — Cover for Cross Feed Screw Nut

Figure 162 — Nut for Cross Feed Screw

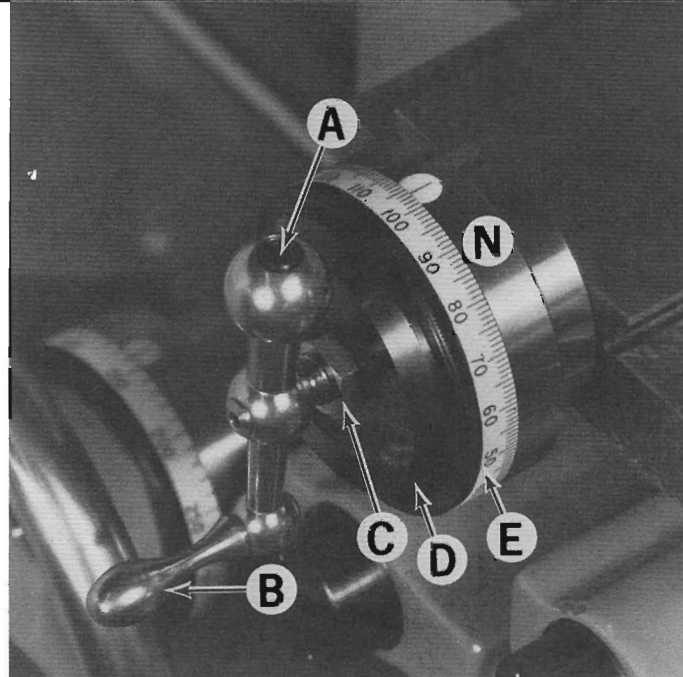
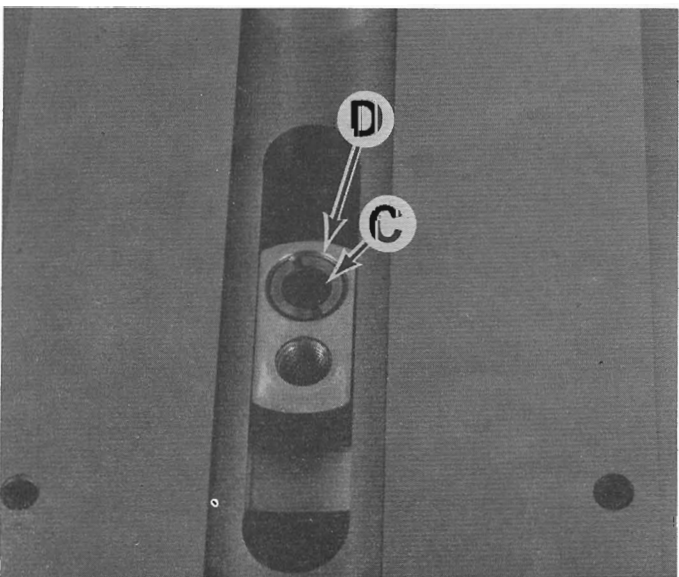


Figure 163 — Handle and Dial for Cross Feed Screw

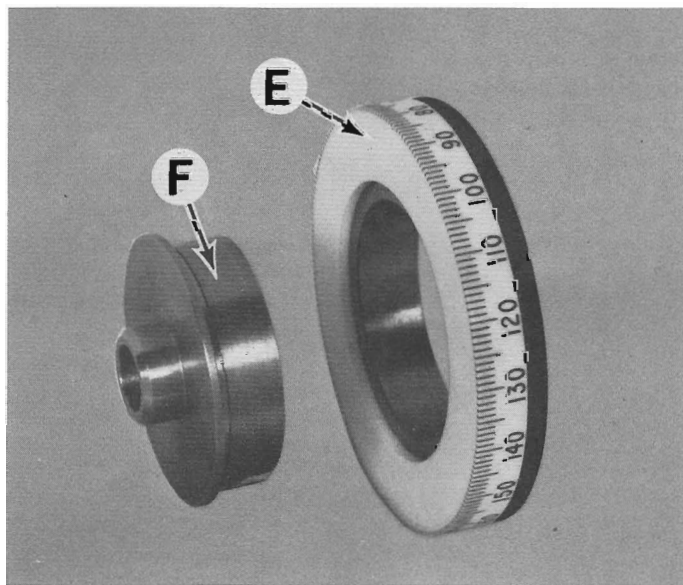


Figure 164 — Dial and Bushing for Cross Feed Screw

Figure 165 — End Cap and Zero Ring for Cross Feed Screw

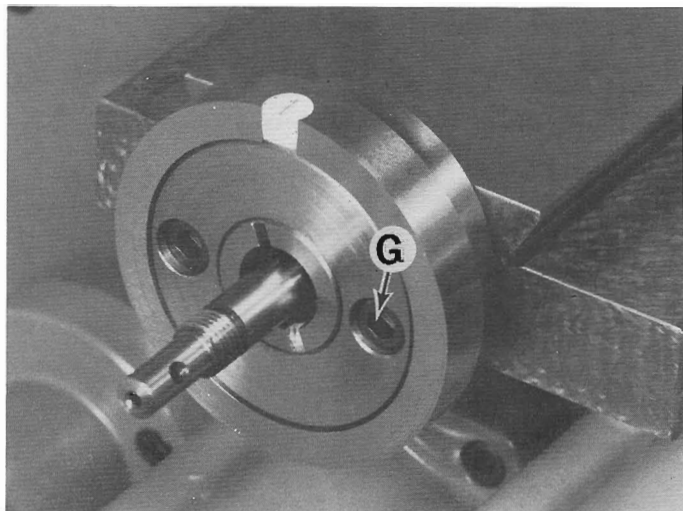




Figure 166 — Cross Feed Screw Removal

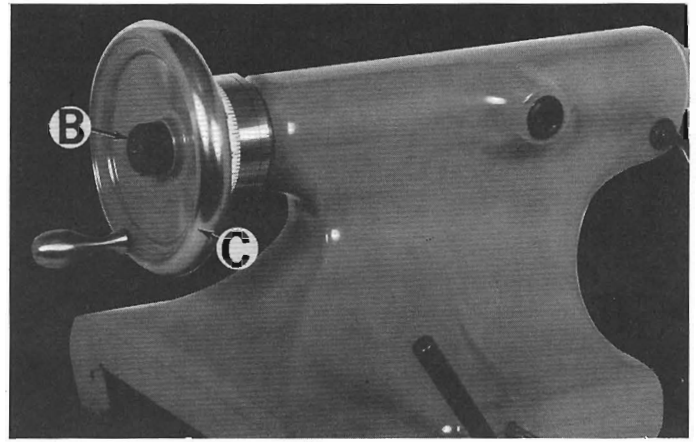


Figure 170 — Handwheel Locknut

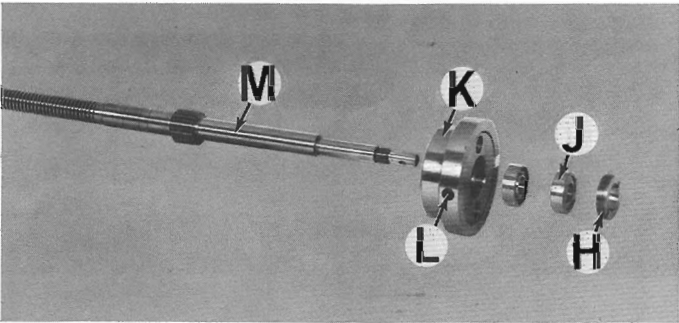


Figure 167 — Cross Feed Screw and Components

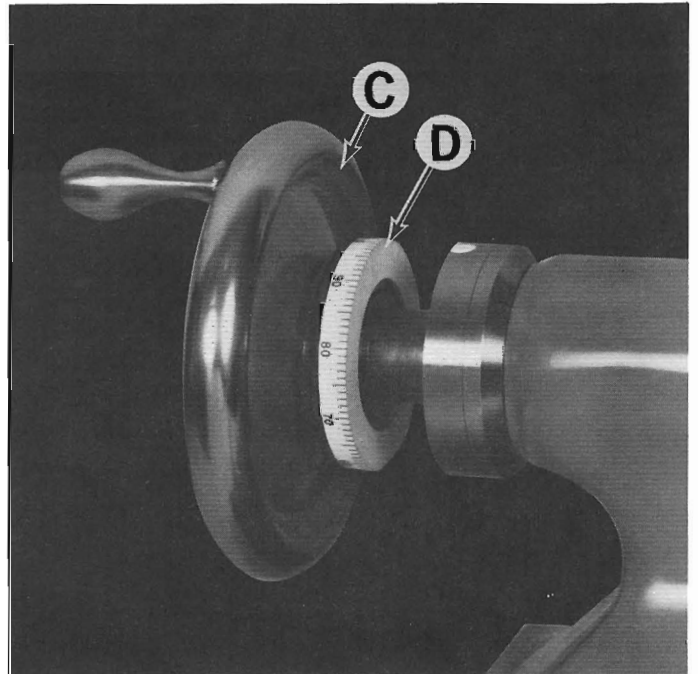


Figure 171 — Tailstock Handwheel Removal

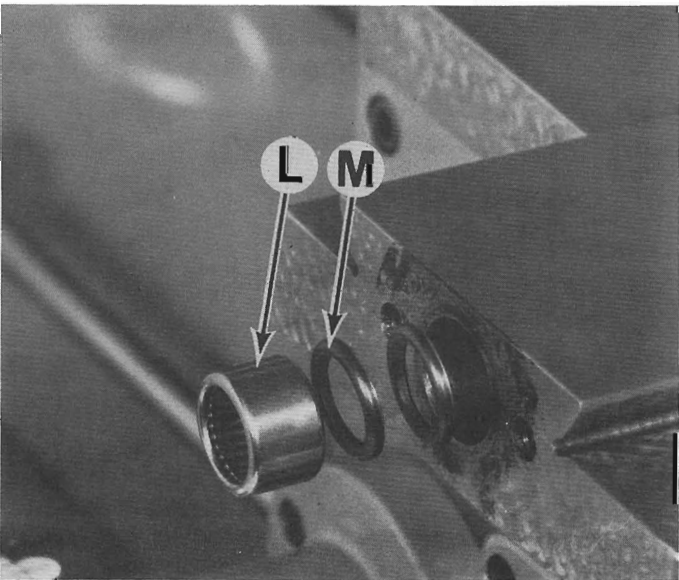


Figure 168 — Bearing and Seals for Feed Screw

Figure 172 — Plug and Spring for Dial

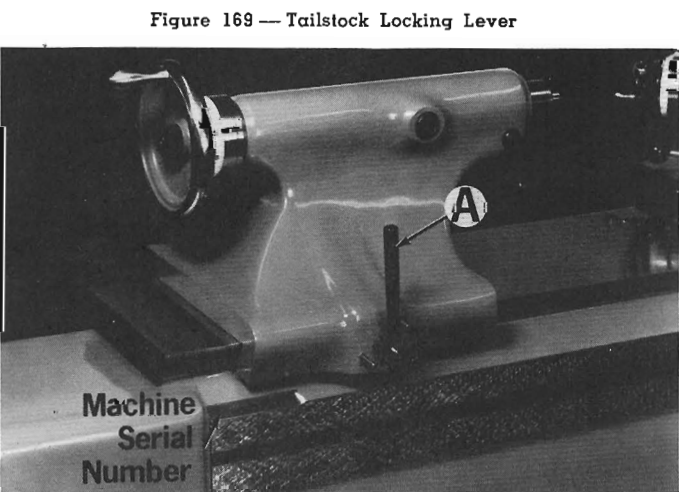


Figure 169 — Tailstock Locking Lever

Machine
Serial
Number

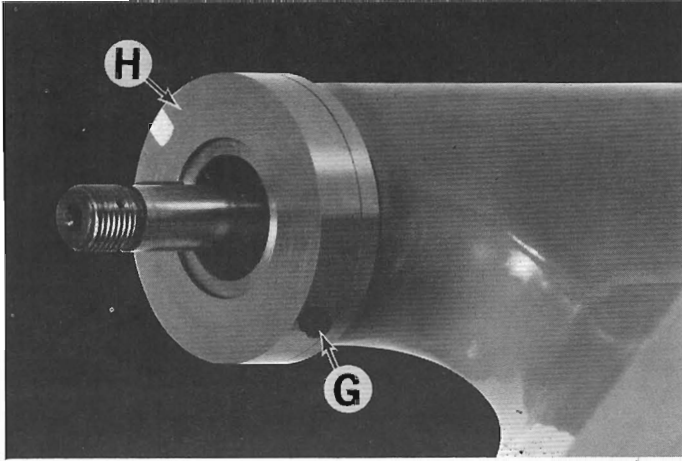


Figure 173 — Zero Ring for Tailstock

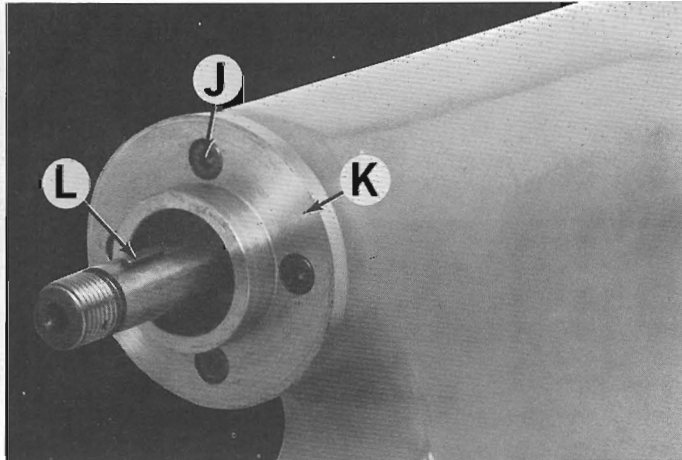


Figure 174 — End Cap for Tailstock

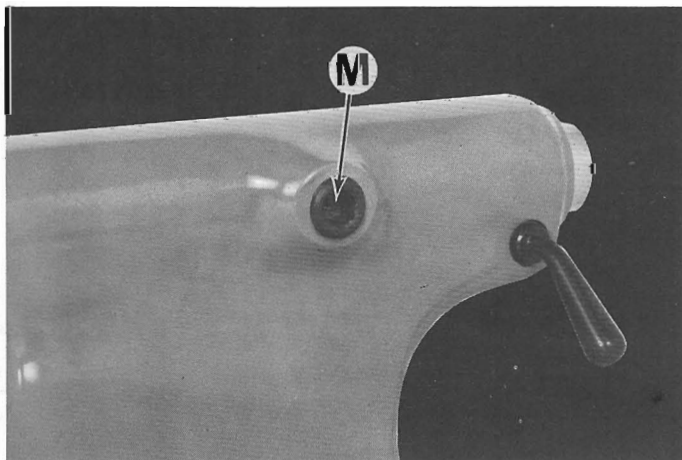
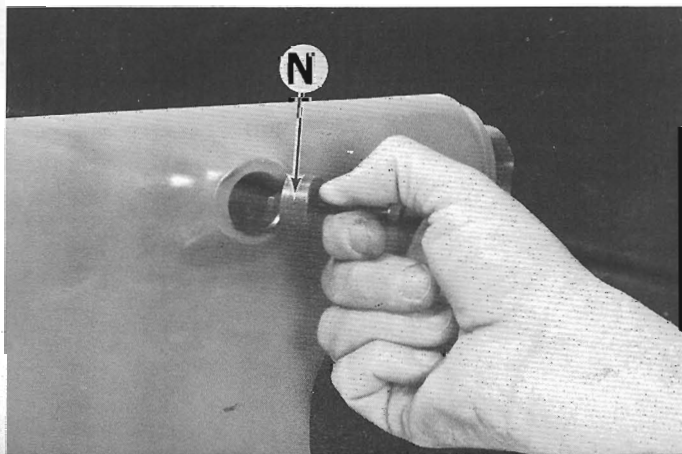


Figure 175 — Lockscrew for Spindle Key

Figure 176 — Tailstock Spindle Key Removal



3. Remove two screws "G", Figure 165, and remove cross feed screw and end cap assembly, Figure 166.
4. Remove nut "H", Figure 167, two bearings "J" and feed screw "M" from end cap "K".
5. If necessary, remove needle bearing "L", Figure 168, and two seals "M" which are pressed in carriage bore.

CROSS FEED SCREW ASSEMBLY

1. Press bearing "L", Figure 168, into carriage bore to a depth of 3-3/4 inches from front face of carriage.
2. Press two seals "M" into carriage bore from back end of carriage to depths of 11-1/4 inches and 10-7/8 inches from rear face of carriage.
3. Assemble feed screw "M", Figure 167, two bearings "J" and nut "H" with end cap "K".
4. Lubricate cross feed screw with Mobil Vactra Oil No. 2. Replace cross feed screw and end cap assembly and two screws "G", Figure 165.
5. Replace bushing "F", Figure 164, and dial "E", Figure 163.
6. Replace washer and screw assembly "D", Figure 163. **NOTE:** When replacing washer "D", nylon plug must be in position under lock screw.
7. Replace nut "C", Figure 163, and crank "B". Tighten set screw and replace lock screw "A".
8. If zero ring "N", Figure 163, has been disturbed, loosen set screw "L", Figure 167, and set clearance between dial and zero ring at .002" to .004".

MACHINE SERIAL NUMBER

The serial number for the HLV-H tool room lathe is located at the rear of the bed at the tailstock end, Figure 169. The machine serial number should be included in all correspondence regarding this machine.

TAILSTOCK DISASSEMBLY

NOTE: For repairs involving tailstock body, spindle or gib, tailstock should be returned to Hardinge. Unit should be properly greased to prevent rust.

1. Loosen tailstock locking lever "A", Figure 169, and remove tailstock over end of bed. (Lever "A" is shown in locked position.)
2. To disassemble spindle and feed screw:
 - (A). Remove nut "B", Figure 170, and washer.
 - (B). Remove handwheel "C", Figure 171, and dial "D".
 - (C). Remove dial from handwheel and remove plug "E", Figure 172, and spring "F".
 - (D). Loosen screw "G", Figure 173, and remove zero ring "H". Do not misplace plug under screw "G".
 - (E). Remove four screws "J", Figure 174, and remove end cap "K". Remove key "L".
 - (F). Remove screw "M", Figure 175, and using one screw "J" remove spindle key "N", Figure 176.

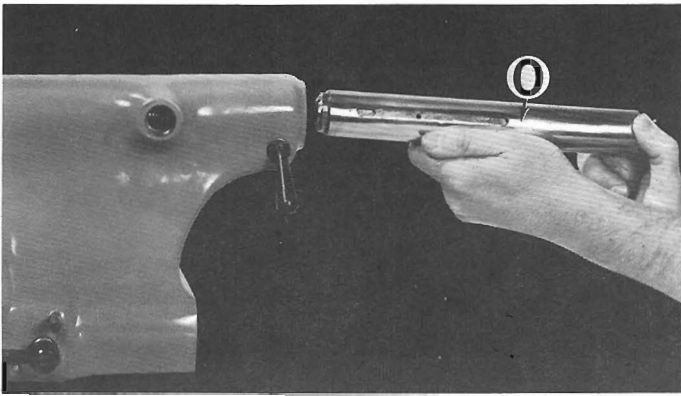


Figure 177 — Tailstock Spindle Removal

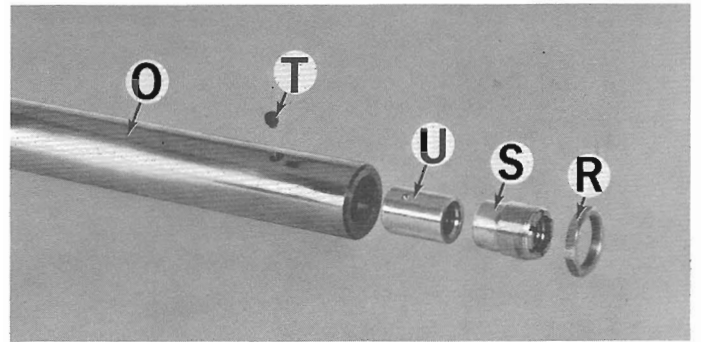


Figure 180 — Adjustable Feed Screw Nut

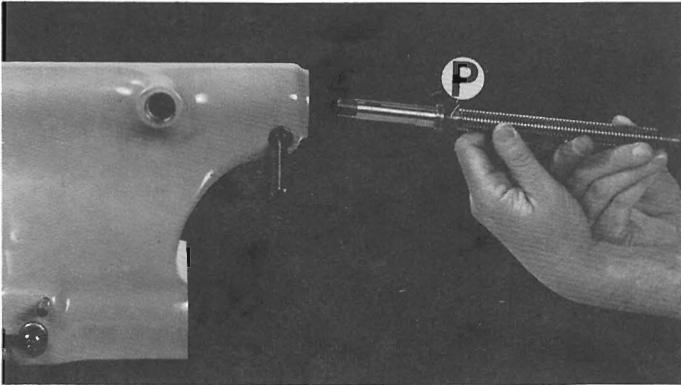


Figure 178 — Feed Screw Removal

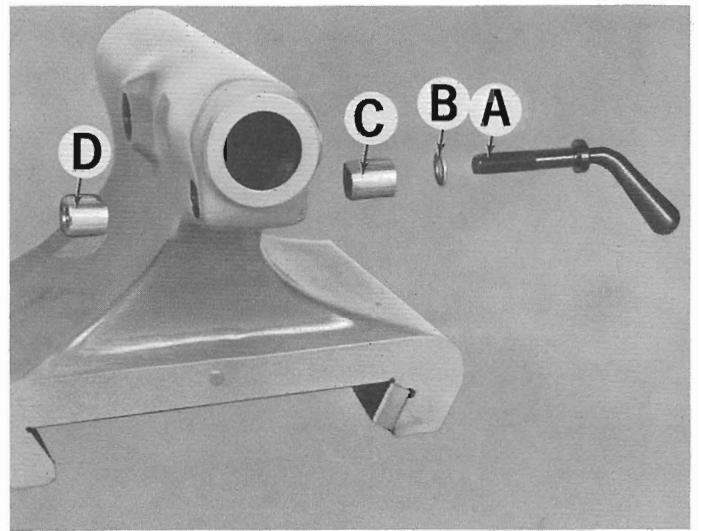


Figure 181 — Spindle Lock and Components

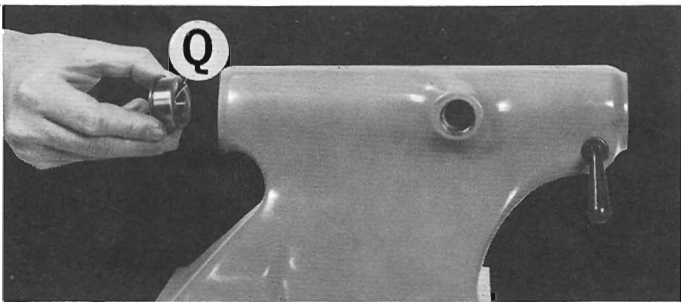
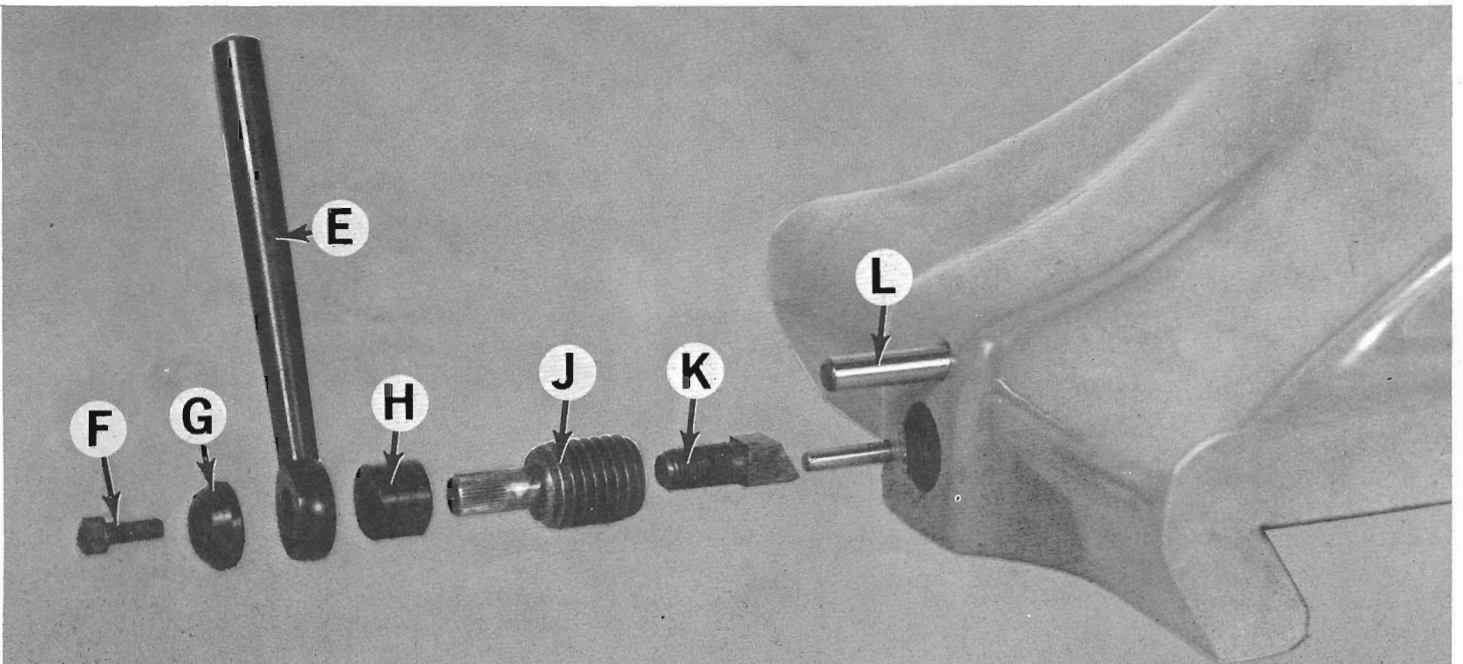


Figure 179 — Feed Screw Bearing Removal

Figure 182 — Bed Locking Lever and Components



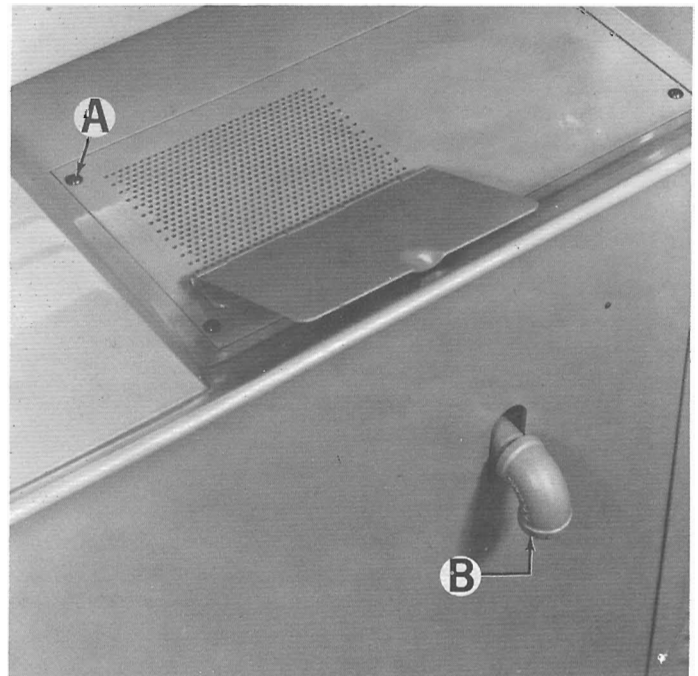
- (G). Remove tailstock spindle "O", Figure 177, feed screw "P", Figure 178, and bearing "Q", Figure 179. **EXTREME CARE SHOULD BE EXERCISED TO PREVENT DAMAGE TO PRECISION SURFACES OF SPINDLE DIAMETERS AND TAILSTOCK BODY BORE.**
- (H). Remove nut "R", Figure 180, half nut "S", screw "T" and half nut "U" from tailstock spindle "O".
3. To remove locking lever "A", Figure 181, and components:
- (A). Turn lever "A", Figure 181, counterclockwise to remove shim "B" and binding nut sections "C" and "D".
4. To remove locking lever "E", Figure 182, and components:
- (A). Remove screw "F", Figure 182, washer "G", lever "E" and spacer "H".
- (B). Unscrew clamp bolt "J". Unscrew locking plug "K".

TAILSTOCK REASSEMBLY

1. To replace spindle, feed screw and components:
NOTE: EXTREME CARE SHOULD BE EXERCISED TO PREVENT DAMAGE TO PRECISION SURFACES OF SPINDLE DIAMETERS AND TAILSTOCK BODY BORE.
- (A). Replace half nut "U", Figure 180, and screw "T". Assemble half nut "S" leaving sufficient projection for lock nut "R". Assemble lock nut "R" but do not tighten.
- (B). Thread feed screw "P", Figure 178, into feed screw nut and spindle slowly while turning half nut "S", Figure 180, gradually until half nut threads line up permitting feed screw to pass through half nut "U".
- (C). Turn half nut "S" inward until a slight backlash is encountered when feed screw is turned. Hold half nut "S" and lock nut "R". Remove feed screw. When tailstock is reassembled there should be a maximum backlash of three graduations on dial handwheel.
- (D). Replace bearing "Q", Figure 179. Lubricate feed screw "P", Figure 178, with Cosmolube #2 and spindle "O", Figure 177, with spindle oil. Replace feed screw and spindle.
- (E). Line up keyway in spindle and using one screw "J" replace spindle key "N", Figure 176. Replace screw "M", Figure 175.
- (F). Replace key "L", Figure 174, and replace end cap "K". Replace four screws "J", tightening alternately and evenly to prevent any bind on bearing.
- (G). With nylon plug under screw "G", Figure 173, replace zero ring "H". Do not tighten screw "G".
- (H). Replace spring "F", Figure 172, and plug "E". Replace dial "D", Figure 171, on handwheel.
- (I). Replace handwheel "C", Figure 171. Replace washer and nut "B", Figure 170.

- (J). Set clearance between dial "D", Figure 171, and zero ring "H", Figure 173, at .002" to .004" and tighten screw "G".
2. To replace spindle locking lever "A", Figure 181, and components:
- (A). Replace binding nut sections "C", Figure 181, and "D". **ANGLED FLATS ON NUT SECTIONS MUST BE PLACED AGAINST TAILSTOCK SPINDLE OR SERIOUS SCORING OF SPINDLE WILL RESULT.** Nut sections should be flush with casting when properly positioned.
- (B). Replace shim "B" on lever "A" and insert lever through nut section "C" and thread into nut section "D".
3. To replace locking lever "E", Figure 182, and components:
- (A). Replace tailstock on bedway.
- (B). Thread locking plug "K", Figure 182, into clamp bolt "J" to approximately 13/32" from square shoulder of plug "K" to clamp bolt "J".
- (C). Thread bolt "J" into casting and replace spacer "H".
- (D). Replace lever "E" and turn clockwise until plug "K" contacts bed plate — just tight enough to hold in position. Remove lever "E" and reposition lever on splined shaft approximately 3/8" from stop pin "L". Replace washer "G" and screw "F".

Figure 183—Coolant Sump and Drain



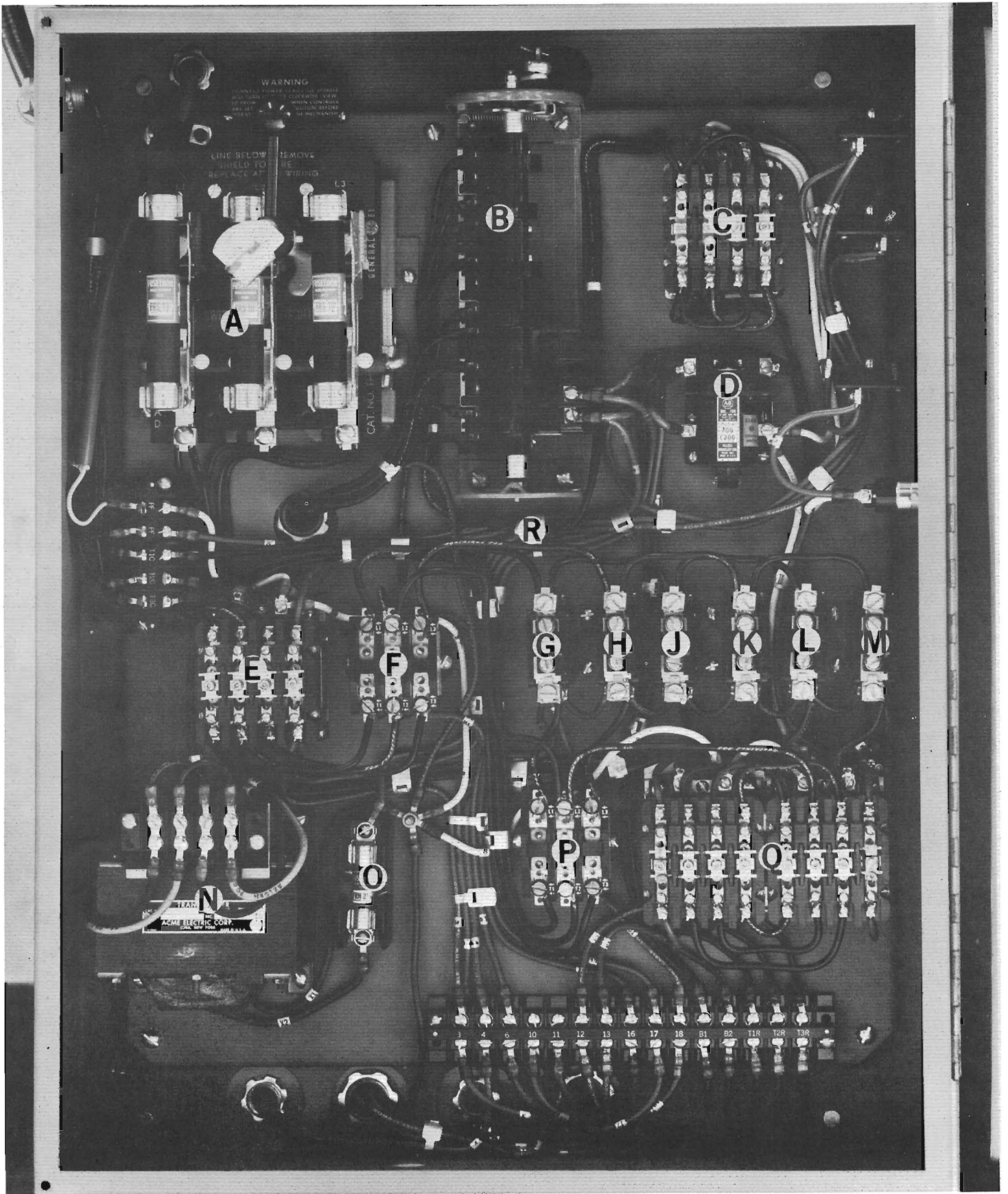


Figure 184 — Main Switch Case

TAILSTOCK ALIGNMENT

If tailstock misalignment is suspected, first check should be made of taper shank of tooling being used. Burrs on tooling shank will cause tool to seat unevenly. Second check spindle taper (#2 Morse) for burrs and if necessary **VERY LIGHTLY** hand ream.

Remove tailstock to clean out chips and to check for burrs.

COOLANT FACILITIES

OIL BASE CUTTING FLUIDS ARE RECOMMENDED FOR MAXIMUM MACHINE LIFE.

Clean sump regularly, depending upon type of material being run.

To clean sump, remove four screws "A", Figure 183, and screen cover for sump. Rinse out and drain sump by removing pipe plug "B" at rear of machine. Coolant capacity is 3 gallons.

The coolant pump motor bearings are greased packed for life and require no further attention.

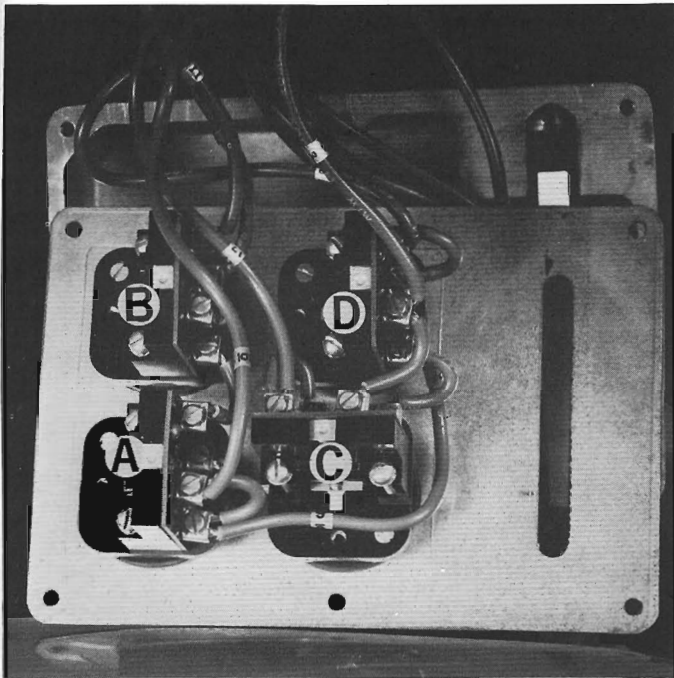


Figure 185 — Variable Speed Control Panel

ELECTRIC CONTROL FUNCTIONS

(Figures 184 and 185)

Figure 184

- A. Disconnect switch and main line fuses (220 volt FRS-10) (440 volt FRS-5).
- B. Speed selector drum switch
- C. Spindle Motor forward and reverse contactor
- D. Spindle brake relay (when energized brake is released)
- E. Main line contactor
- F. Spindle interlock contactor
- G & H. Overload relays for coolant motor (push to reset)
- J & K. Overload relays for spindle motor (push to reset)
- L & M. Overload relays for speed change motor (push to reset)
- N. Control voltage transformer (115 volt output)
- O. Control circuit fuse (FRN-2-1/2)
- P. Coolant pump contactor
- Q. Speed change contactor (raise and lower)
- R. Power feed fuse (FRN-1-8/10). Not shown in photograph, added to later machines.

Figure 185

- A. Variable speed control push button — increase speed
- B. Variable speed control push button — decrease speed
- C. Spindle brake selector switch.
- D. Coolant selector switch.

LUBRICANTS AND SEALER

(Use Recommended Product or Equivalent)

Product

Permatex (3D Sealer)
Spindle Oil (Solnus 150)
Cosmolube #2
Andox "B" Grease
Molylube (Anti-sieze)
Vactra Oil No. 2
Automatic Transmission Fluid Type A Mobilfluid 200
Alvania #3 Grease
Die Makers Grease

Vendor

Permatex Company, Inc.
Sun Oil Company
Houghton, E. F. and Company
Humble Oil and Refining Company
Bel Ray Company, Inc.
Mobil Oil Corporation
Mobil Oil Corporation
Shell Oil Company
Standard Die Set Co. (Div of Dieco)

Now ATS 220 DIRECTION

—NOTES—

HARDINGE