REMOVING THE SPINDLE CHAIN IDLER PULLEYS

It is suggested that the idler pulleys be removed as a unit with the spindle chain adjusting mechanism. To remove the pulleys refer to Figure 2-1 and proceed as follows:

1. Remove the base guard and base opening cover.
2. Loosen the idler sprocket arm shaft nut (22) about halfway on the threads and tap the nut towards the casting with a soft face hammer.
3. Back the idler adjusting rod screws (30 and 37) completely out.
4. Reach thru the base opening and remove the idler sprocket arm washer (9). Note: when reassembling the washer be sure to face the counterbore away from the idler sprocket arm.

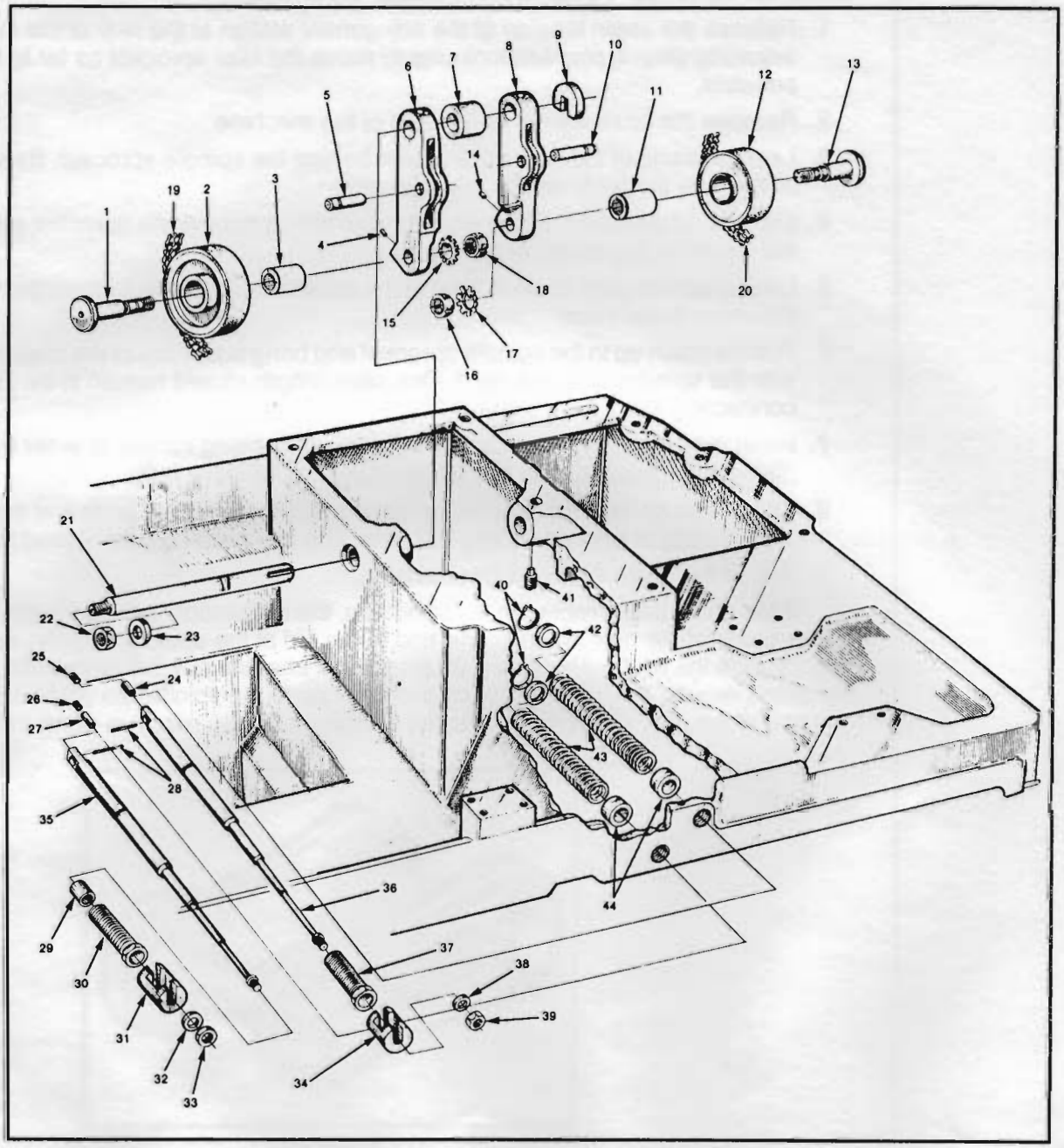

Figure 2-1

5. Slowly remove the idler sprocket arm shaft (21) from the machine. Be careful not to drop the spacer (7).
6. Move the sprocket arms (6 and 8) and the adjusting rods (35 and 36) past the spindle chain, drop them down, and withdraw them thru the opening in the base.
7. Remove the idler pulleys (2 and 12) from the idler sprocket arms (6 and 8).

The installation is the reverse of the disassembly. Before installing the chains, the alignment of the speed case with the spindle sprockets and idler sprocket should be checked using a straight edge or, if the machine is level, a plumb line.

REPLACING THE SPINDLE CHAIN

1. Release the chain tension at the adjustment station at the rear of the machine. Turn the adjusting sleeve counterclockwise to move the idler sprocket as far to the rear as possible.
2. Remove the base covers at the rear of the machine.
3. Lead one end of the new chain down behind the spindle sprocket. Be sure to mesh the chain over the teeth on the idler sprocket.
4. Drop the chain until only the end remains above the spindle sprocket and wire this end to the machine to prevent dropping.
5. Lead a wire or cord down in front of the spindle sprocket and attach the wire to the end of the chain in the base.
6. Pull the chain up to the spindle sprocket and bring both ends of the chain into engagement with the spindle sprocket teeth. One pitch length should remain to be completed by the connecting link.
7. Insert the connecting link pins through the rolls being careful to enter the loose middle plates and the side plate as the link is inserted (Figure 2-2).
8. Check that all links are properly engaged with the sprocket teeth and snap the spring clip on the ends of the connecting link pins. The clip must be fully seated in the groove.
9. Adjust the chain for the correct tension.

If the chain being replaced is not broken, the installation can be simplified by connecting one end of the new chain to one end of the old at the spindle. Slip the open connecting link through the two chain ends and use the old chain to pull the new chain past the idler sprocket, around the base sprocket, and back up to the spindle sprocket. Be sure the trailing end of the new chain is wired to the machine so it will not drop down into the base.

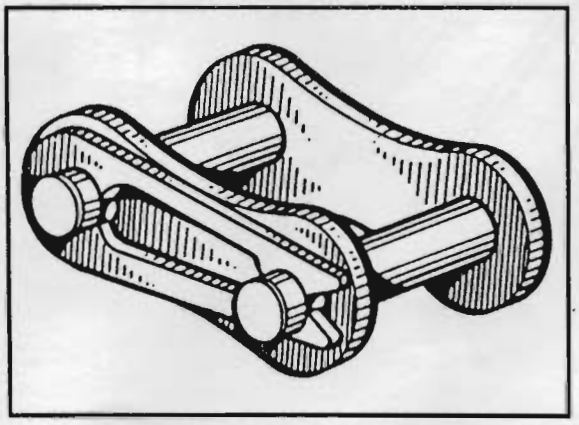

Figure 2-2

NOTE: The ¾" spindle uses a double strand chain. The driving sprocket in the base has three rows of teeth. Care must be taken to engage the double chain with the two rows of teeth at the right hand edge of the sprocket (as viewed from the front of the machine). This is extremely important as serious misalignment can result.

Chains will fail quickly from a lack of oil. Examine the oil slinger in the base without fail if a chain breaks. The chains and the transmission will not be lubricated properly if the slinger is not functioning correctly.

REMOVING THE SPINDLE DRIVE MOTOR ON #00, 2, AND 3 ULTRAMATICS.

To remove the spindle drive motor refer to Figures 2-3, 2-4, 2-5, and 2-6 and proceed as follows:

1. Turn the main disconnect switch of "off", tag and lock.
2. Remove the base guard - #00 machine (Figure 2-3 Item 17) #2 and 3 machines (Figure 2-4 Item 10).
3. Remove the base opening plate - #00 machine (Figure 2-5 Item 20) #2 and 3 machines (Figure 2-4 Item 11).
4. Remove the motor drive chain (Figure 2-5 Item 16) and (Figure 2-6 Item 16) by removing the connector link and lifting the chain off. An alternate method is to loosen the chain by backing off the motor bracket adjusting screw (Figure 2-5 Item 21) and (Figure 2-6 Item 18).
   This will permit the chain to be slipped off the motor sprocket.
5. Loosen the motor sprocket set screw (Figure 2-6 Item 14).
6. Remove the four spindle motor clamp bolts (Figure 2-5 Item 5) and (Figure 2-6 Item 30).
7. Slide the motor to the left. Be careful to slide the sprocket and sprocket key off the motor shaft as the motor is moved. The key must stay with the sprocket or it will damage the labyrinth seal.

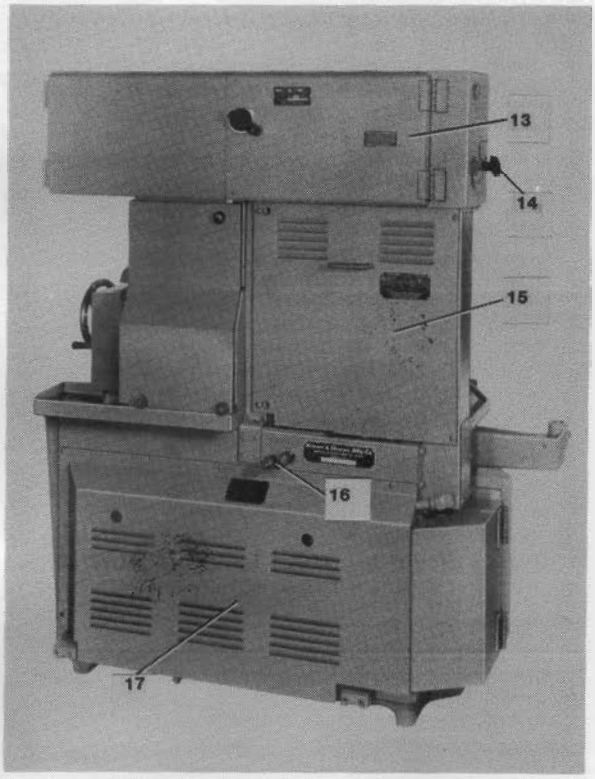

Figure 2-3

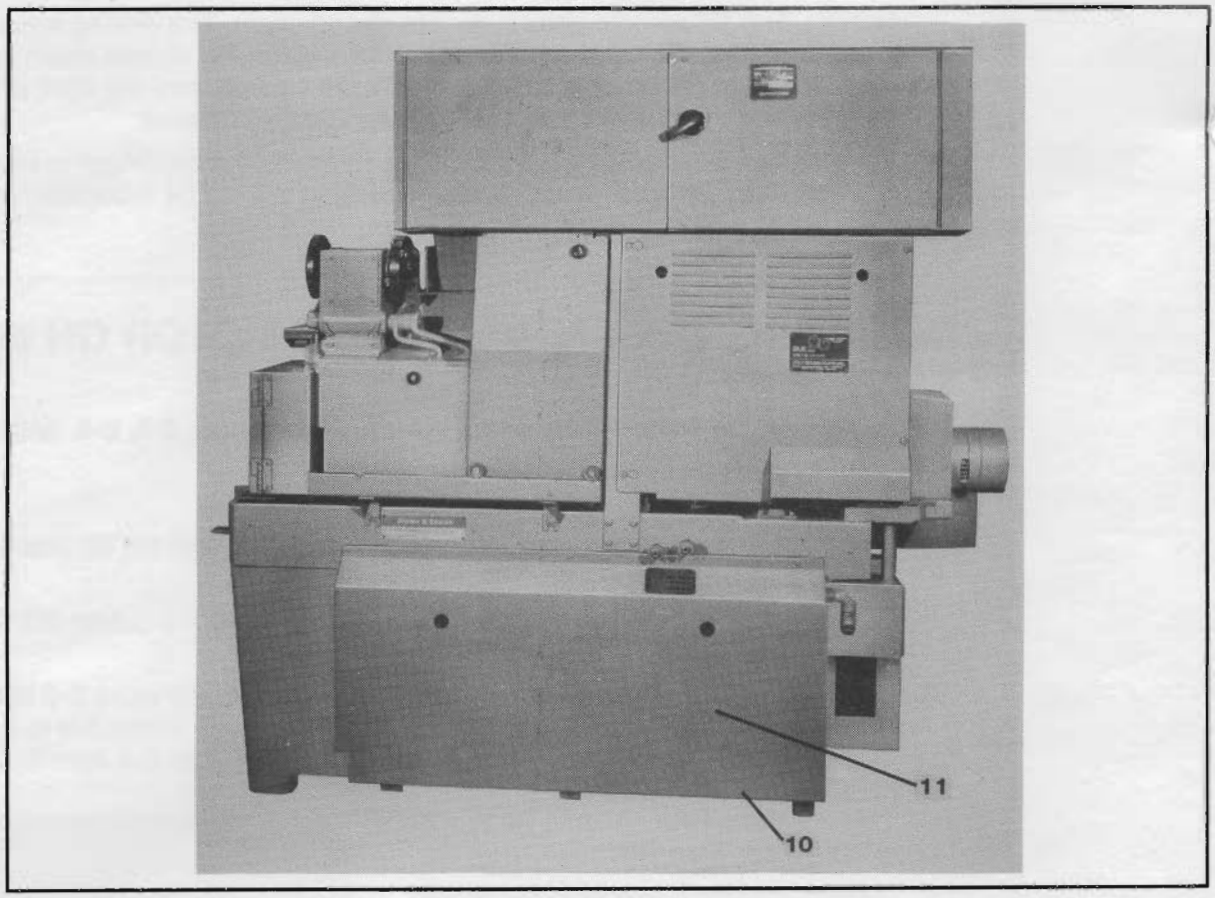

Figure 2-4

8. Break the electrical connections at the motor, tagging each connection as it is removed.
9. Remove the motor from the base.

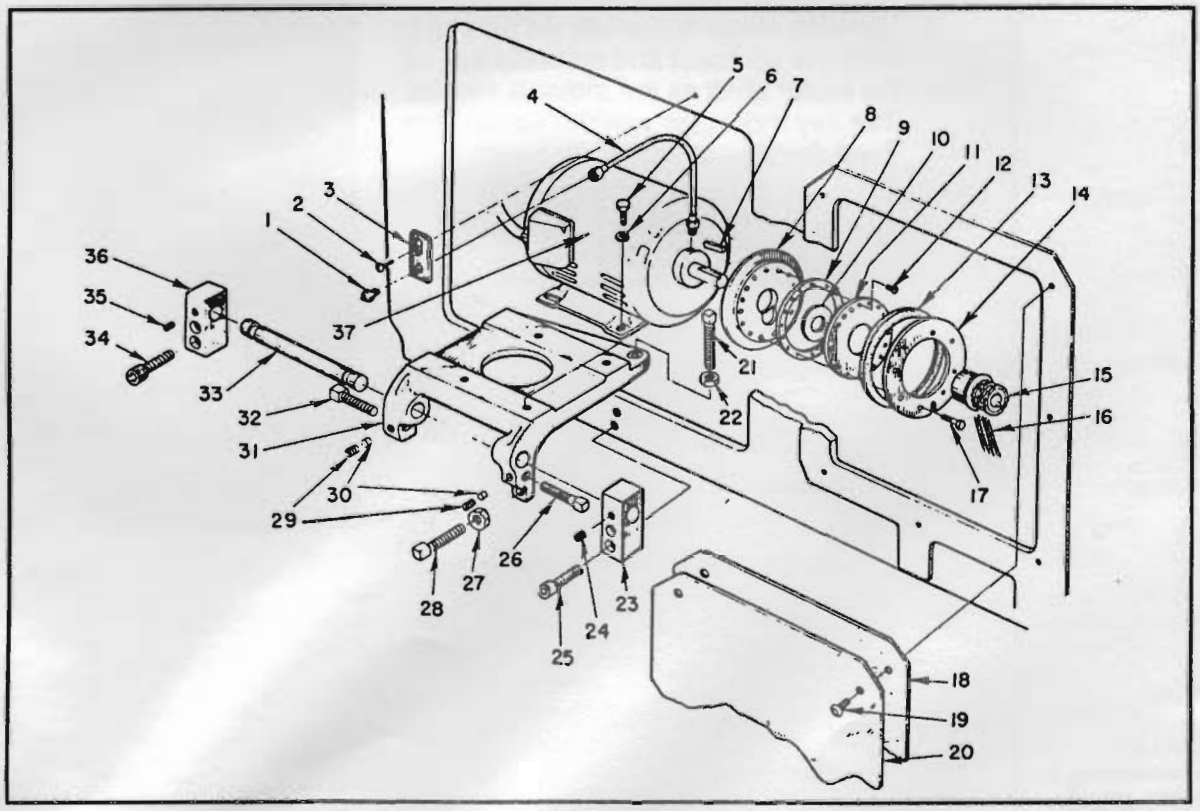

Figure 2-5

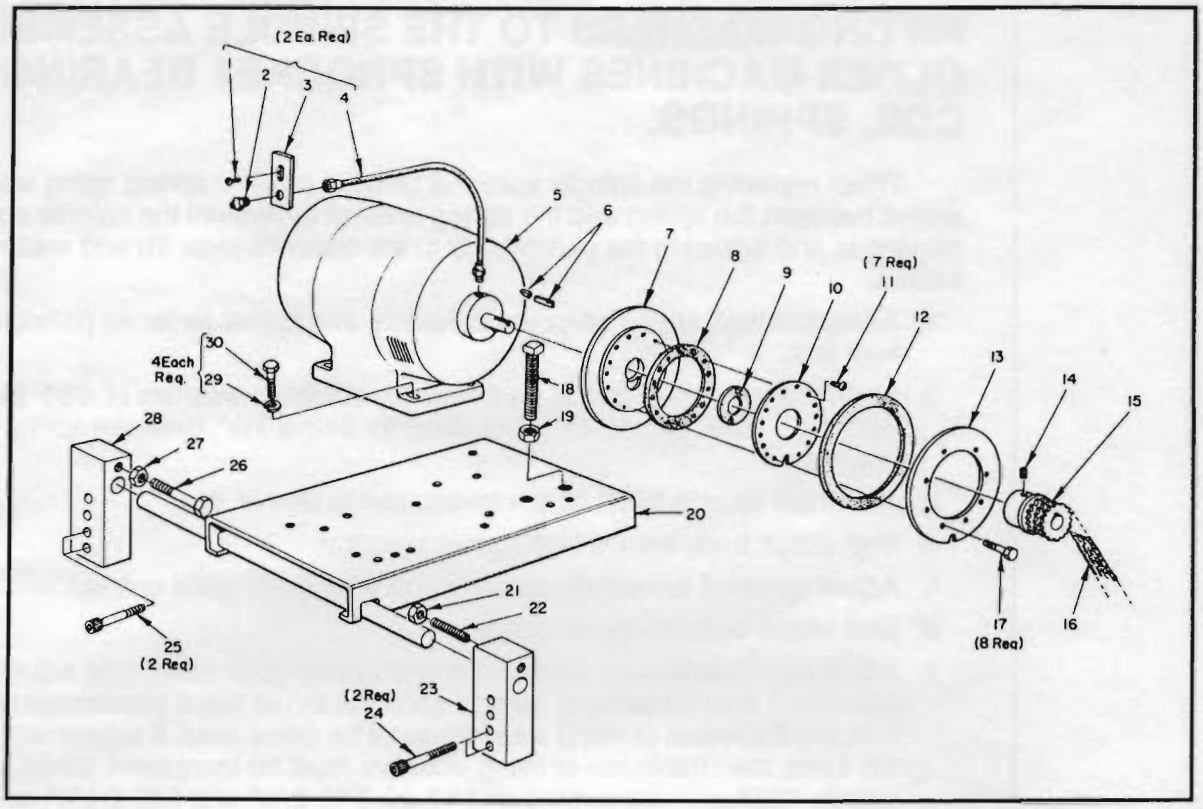

Figure 2-6

When installing a Spindle Drive Motor, follow the reverse of the above procedure. Be sure to *Align* the Motor Sprocket with the Intermediate Driving Shaft Sprocket before locking it solid. (Place a straight edge along the side of both sprockets.) Install the chain by slipping it over the Motor Sprocket and the Intermediate Driving Shaft Sprocket.

Adjust the chain as follows:

1. Turn the adjusting screws 00 machine (Figure 2-5 Items 21 and 28) 2 and 3 machine (Figure 2-6 Item 18). Chain must be taut.
2. To check adjustment, place thumb on top of chain and have fingers straddle it. Try squeezing the chain together. A *slight* movement is acceptable.
3. Check to be sure the motor bracket adjusting screws, long, 00 machine (Figure 2-5 Item 21); 2 and 3 machine (Figure 2-6 Item 18), and adjusting screws, short, 00 machine (Figure 2-5 Items 26 and 32); 2 and 3 machine (Figure 2-6 Items 22 and 26) are tight and locked with set screws or nuts, 00 machine (Figure 2-5 Item 25) 2 and 3 machine (Figure 2-6 Items 21 and 27).

FITTING WASHERS TO THE SPINDLE ASSEMBLY ON OLDER MACHINES WITH SPROCKET BEARING RETAINER COIL SPRINGS.

When replacing the spindle sprocket bearing retainer spring, fitting washers should be added between the spring and the spring retainer to prevent the spindle sprocket from sticking to and following the clutch body to the opposite side. To add washers proceed as follows:

1. Assemble high speed sprocket to spindle and adjust as far as possible toward spindle front box.
2. At initial assembly of spring, try a thickness of fitting washers of .080″ for 542-00, .150″ for 542-2 ¾″, .160″ for 542-2 1¼″ or .050″ for 542-2 1½″, between spring and spring retainer.
3. Assemble spindle keys, clutch levers, clutch sleeve, etc.
4. Shift clutch body toward high speed sprocket.
5. Adjust sprocket toward clutch body until they make solid contact.
6. Shift clutch body to opposite side.
7. Adjust sprocket toward clutch body until spring goes solid. This adjustment must fall between 1 and 1½ turns of spindle sprocket thrust nut. If adjustment is less than one turn, the thickness of fitting washers must be decreased. If adjustment is greater than 1½ turns, then thickness of fitting washers must be increased. Since one turn of nut equals .055″ axial movement for 542-00, 542-2 ¾″ and 542-2 1¼″; or .062″ axial movement for 542-2 1½″; new thickness of washers can be calculated.
8. If necessary to alter thickness of fitting washers, disassemble clutch body, spring keys and spring. Insert new fitting washers. Repeat steps 3 thru 7.
9. After high speed side is fitted correctly, proceed in like manner for low speed side.

SETTING SPINDLE CLUTCHES

To set the spindle clutches refer to Figures 2-7, 2-8, 2-9, 2-10 and 2-11 and proceed as follows:

With the spindle stopped, lift the spindle covers at the front of the machine. On older machines, loosen the two slotted Guard Clamp Screws (recessed) in the casting in front of the spindle clutch, (Figure 2-7). A Cotter pin through each screw prevents it from being backed out too far. Remove the block sheet metal guard from in front of the spindle clutch. On newer machines, this guard is held from above by two button head screws as shown in Figure 2-8.

If the machine is equipped with a Brake-In-Neutral Attachment, the spring pressure must be released. To do this on a 00, 2 or 3 Ultramatic Screw Machine, back-off the Brake Hold Out Screw (92-5041-1240) behind the rear spindle box (Figure 2-9). The spindle clutch will now operate the same as on a machine without the attachment.

Adjust one clutch at a time. First, loosen the clamp screw in the adjacent Spindle Sprocket Thrust Nut.* These are split ring nuts with three holes, 90° apart, drilled around the outside. Insert one of the pin levers (or pin wrench) supplied into the Sprocket Thrust Nut* and one into the Chuck Adjusting Nut (Figure 2-7). To tighten the clutches, turn the low speed nut toward you and the high speed nut away from you.

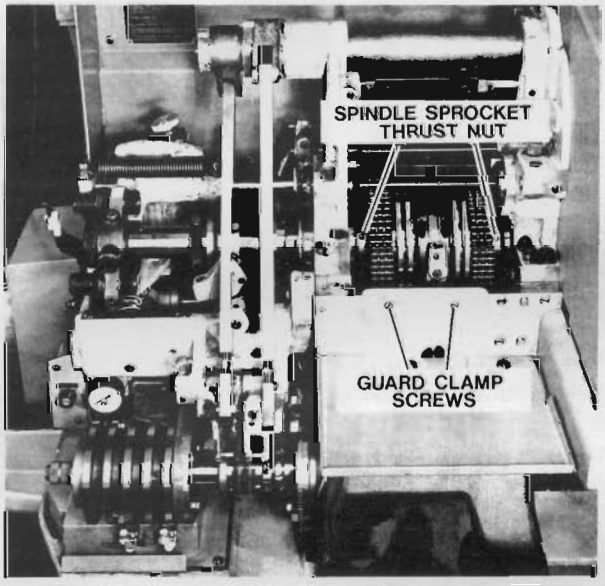

Figure 2-7

Figure 2-8

*The part numbers for the Spindle Sprocket Thrust Nuts are:

Machine	Size	Right	Left
#00	½"	42-16605	42-16605
#00	¾"	42-19643	42-19643
#2	¾"	42-20393	42-20394
#2	1¼"	42-20386	42-20388
#2	1⅝"	42-20379	42-20380
#3	2" & 2⅜"	42-20276	42-20378

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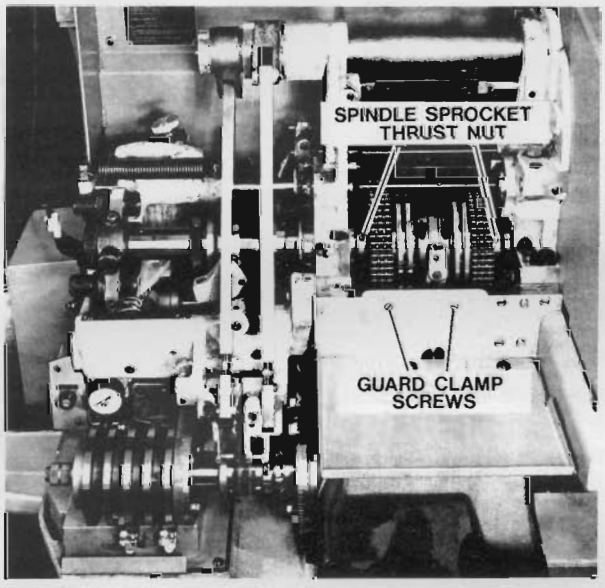

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#2	1⅝"	42-20379	42-20380
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1. Trip the Spindle Reversing Trip Lever manually.
2. Slowly crank the handwheel until the Reversing Lever Cam Roll (#00-91-215-246-1) (#2 and #3 — 91-215-18) is in the center of the Reversing Cam (#00 — 42-16290) (#2 and #3 — 42-20006) path half way between the two pockets in the cam (Figure 2-10). In this position the cam roll is centered and cannot move from side to side. See Figure 2-11 for Reversing Cam and Roll removed from machine.
3. With a 2″ long scale, measure the distance from the center of the Clutch Sleeve Ring to the inside edge of both sprockets. The distance *must* be the same to either side within .032″.
4. If the distance is correct, lock the Reversing Lever Link Connector with the two lock nuts.

If the machine is equipped with Brake-In-Neutral, it can now be reset.

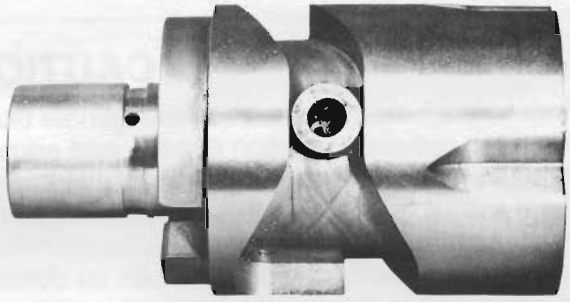

Figure 2-11

CAUTION:

Never leave the Clutch Body in the extreme high or low speed side. *Always relieve either manually or mechanically.* This holds true when oiling the Spindle Clutch Body, etc. If left in full engagement and the spindle is running, the Clutch Body Ring can be overheated.

PREVENTIVE MAINTENANCE OF BASE AND SPINDLE CLUTCHES

1. Base Clutch

One of the advantages of a 4-speed ULTRAMATIC is that it can be used as a conventional 2-speed simply by not switching the base clutches. Usually this is done by keeping the high speed clutch energized continuously and obtaining two speeds in the cycle by shifting the spindle clutch only just as is done on a 2-speed machine. This allows the use of cams designed for 2-speed machines to be used on both types without alteration.

When this is done, however, there is a tendency for the high speed clutch plates to deform or indent the splines on the sleeve on which it is mounted. This sleeve is made from non-magnetic stainless steel which is not hardenable. After an extended operation with the high speed clutch energized continuously this deformation may result in some sluggishness in the operation of the high speed clutch when four speeds are later needed.

This effect may be minimized during a 2-speed setup by periodically shifting the base speed clutches. It is suggested that this be done at the beginning or end of a shift by tripping the base clutch switch manually about a dozen times at the rate of twice every fifteen seconds with the spindle running but with the cam-shaft stopped. It is important of course to leave the high speed clutch energized at the end of this sequence.

2. Spindle Clutch

When running for long intervals on one sprocket, adjust the tension on the driving side tighter than when using both sprockets.

When readjusting the spindle clutches, refer to page 2-7 Setting of Spindle Clutches and paragraph beginning "Before checking the tension,..."

When reengaging the spindle clutch by hand, *NEVER* leave the clutch body in the extreme high or low speed side. *ALWAYS RELIEVE MANUALLY OR MECHANICALLY.*

CAUTION:

Proper tension must be reset on the spindle clutch when any new setup is being made. This reduces vibration of parts and adds to the wear life of spindle inserts, clutch levers, and shoes when only one speed is used. Run the idle sprocket at the highest available speed in the same direction. Once every day, disengage the clutch from the driving sprocket and rotate the spindle. This allows the sprocket ball bearings to change their position. This can be done easily when oiling the sprocket bearings according to the spindle lubrication placard attached to the spindle cover on the front of the machine.

ASSEMBLY OF ULTRAMATIC SPINDLE BALL BEARINGS

Serial #542-00-3300, 542-2-3100 (¾ only), 542-2-7574, and 542-3-51

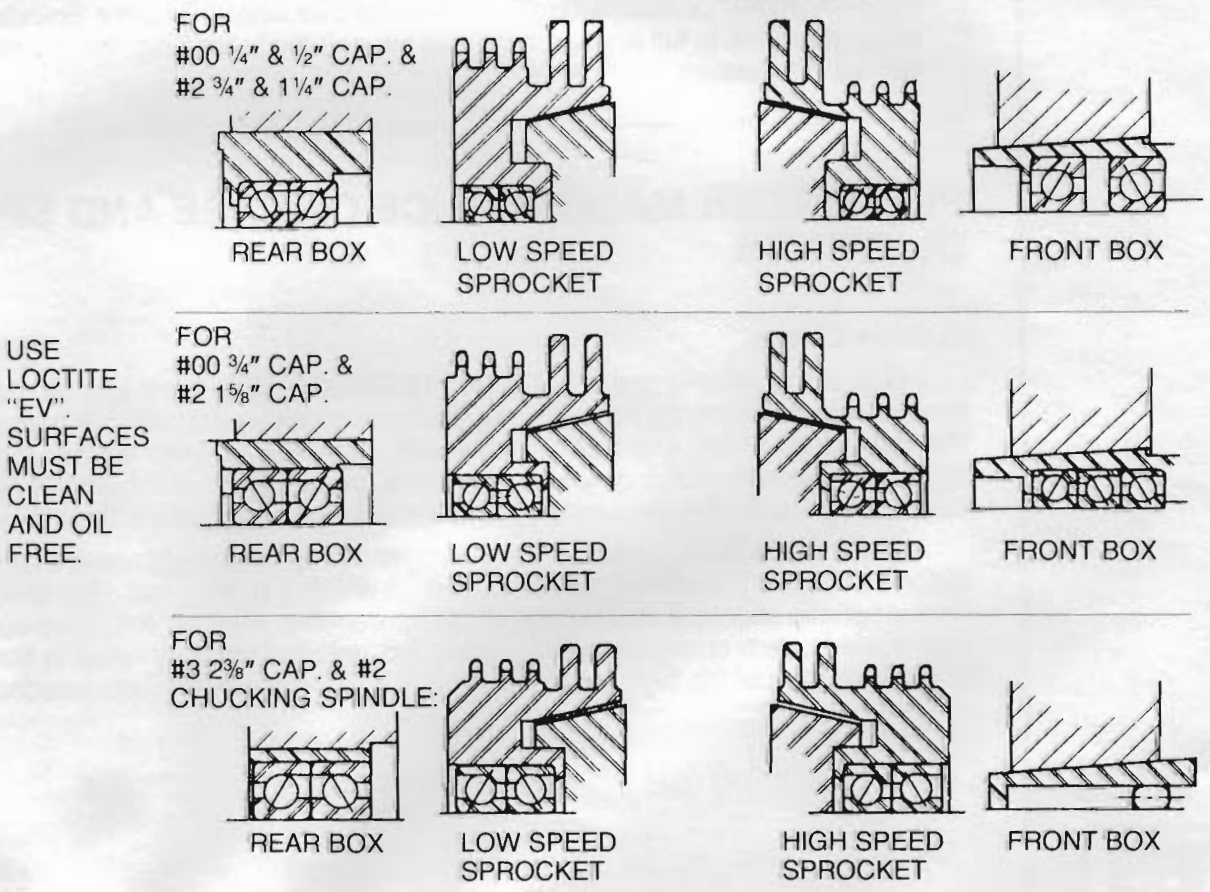

Figure 2-12

SETTING SPINDLE LIFT ON 2" AND 2⅜" MACHINES

To set the spindle lift on 2" and 2⅜" machines refer to Figures 2-13, 2-14, and 2-15 and proceed as follows:

1. Loosen the spindle driving chains.
2. In Figure 2-13, loosen the nut (22), and remove the chuck nut (68), the sleeve (67), the guard (65), the washer (64) and the labyrinth washer (63).
3. Loosen nut (54) a couple of turns. Using a brass drift and hammer tap the nut lightly to the right. This will release the liner for easy removal.
4. If a new liner (57) is to be used, grind both sides to a final thickness of .093" - .094".

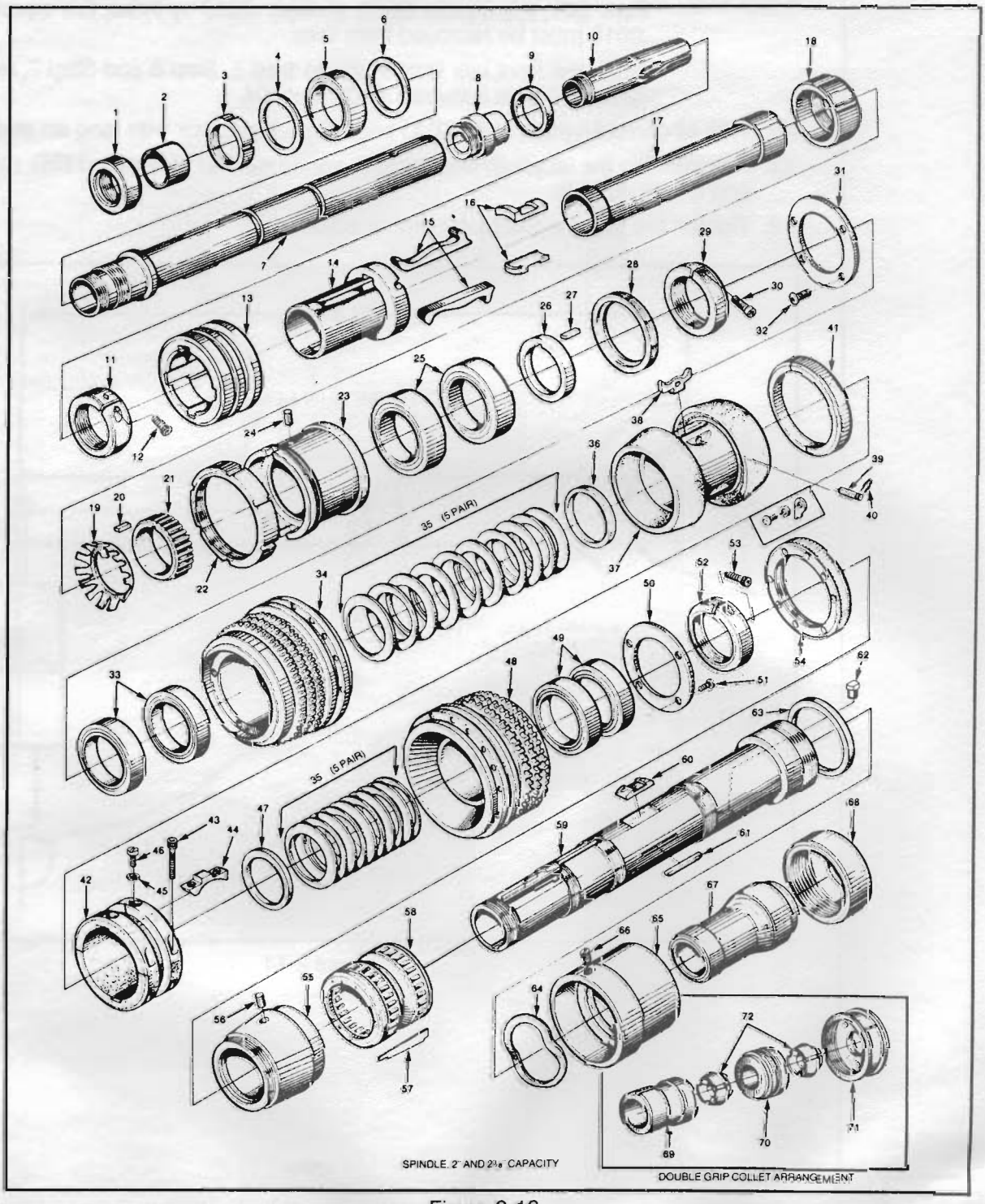

Figure 2-13

5. Always deburr the liner before installing in front box.
6. Assemble liner to front box and tighten Nut (54). Use the special wrench (Figure 2-14) to provide proper torque for seating front box. This is a must for obtaining correct lift.
7. Check Spindle Lift (Figure 2-15). The $4^{9}/_{16}$" dimension is obtained when cross slide is in back position. When pulling on scale make sure it is a 90° pull. A tenth indicator must be used, take reading, release pull, push spindle down, rotate ¼ turn, take another reading, do this at least three times.
8. With spindle cold the tolerance is .0002" to .0004", when hot it is .0000 to .0002", anything in excess must be removed.
9. Example: With a cold spindle we have a lift of .001. Subtract the high tolerance of .0004 from .001, this equals .0006. Multiply .0006 by three, this equals .0018. .0018 must be removed from liner.

   Grind the front box liner. Refer to Step 5, Step 6 and Step 7, repeat this process until lift is between .0002 to .0004.
10. With lift correct tighten Nut (22) to original position, lock with tang on star washer.
11. Reassemble the labyrinth washer (63), spring washer (64), guard (65), chuck sleeve (67) and chuck nut (68).
12. Tighten the spindle chains for proper adjustment.

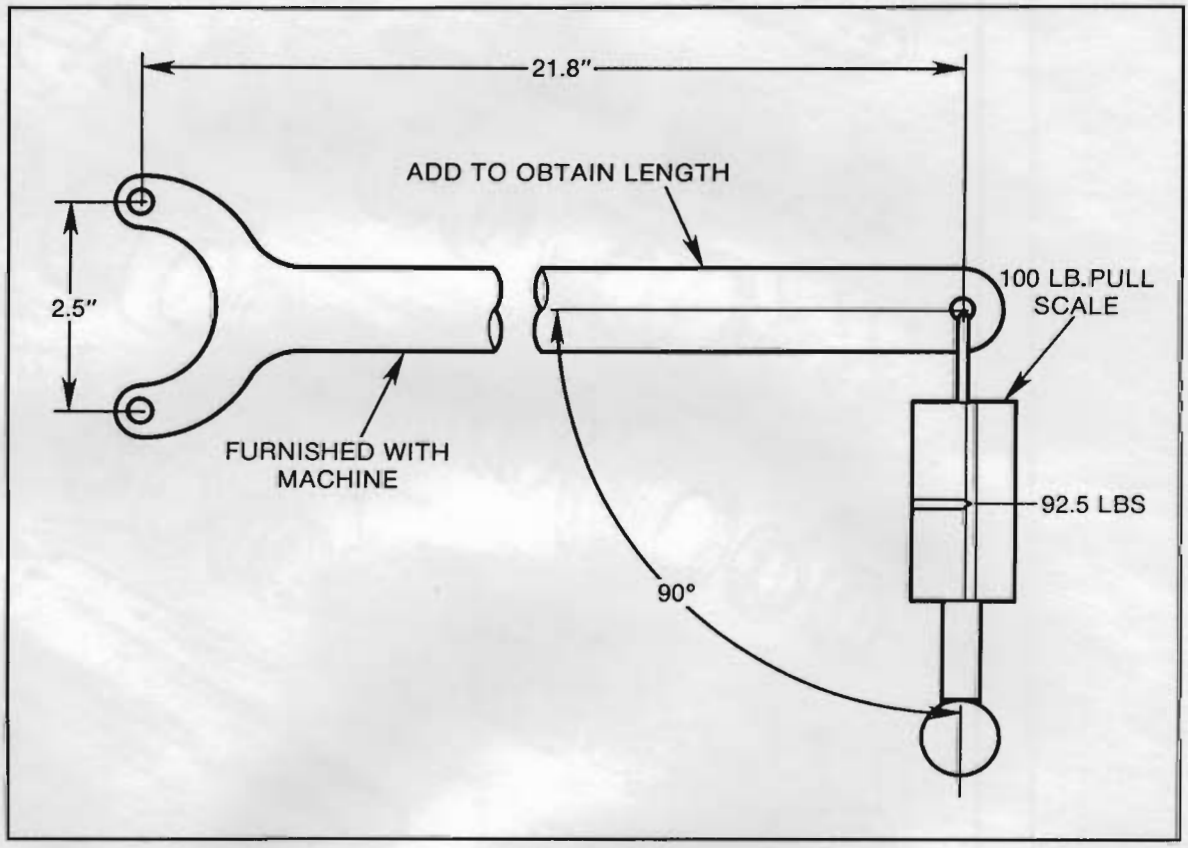

Figure 2-14

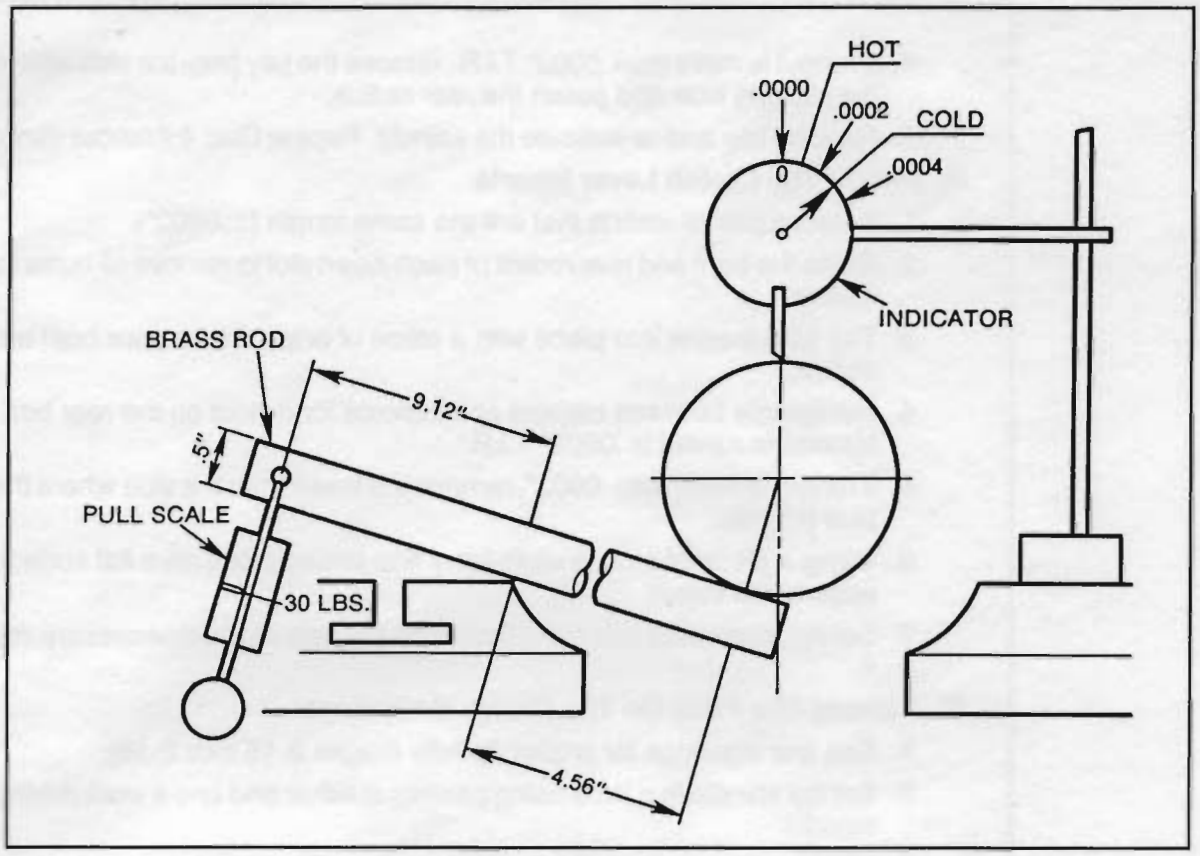

Figure 2-15

INSTALLING CLUTCH BODY KEYS AND CLUTCH LEVER INSERTS

For reference purpose the end of the spindle where the collet is inserted will be known as the front end of the spindle.

A. Fitting The Clutch Body Keys

1. The radius on the keys must be fitted to the front radius of the key slot. The final fitting of the rear radius will be accomplished at Step 4.
2. Press keys into the spindle body. They *must* be snug.
3. Put spindle between centers and indicate the spindle at the rear box bearing journal. Maximum runout in spindle is .0002" T.I.R.

4. If runout is more than .0002″ T.I.R., remove the key from the side where the runout is on the plus (+) side and polish the rear radius.
5. Refit the key and re-indicate the spindle. Repeat Step 4 if runout exceeds .0002″ T.I.R.

B. Fitting The Clutch Lever Inserts

1. Select a pair of inserts that are the same length (±.0002″).
2. Stone the front and rear radius of each insert slot to remove all burrs for proper fitting of inserts.
3. Tap both inserts into place with a piece of brass. Make sure both are seated and central.
4. Put spindle between centers and indicate for runout on the rear box bearing journal. Maximum runout is .0002″ T.I.R.
5. If runout is more than .0002″, remove the insert from the side where the runout is on the plus (+) side.
6. Using a piece of crocus cloth (very fine emery cloth) on a flat surface, polish the rear edge of the insert.
7. Set the insert back into the spindle and indicate again. If necessary, repeat Steps 5 and 6.

C. Turning The Flats On The Clutch Body Keys

1. See line drawings for proper spindle (pages 2-15 thru 2-18).
2. Set the spindle in a lathe using centers at either end and a work driving dog to drive the spindle.
3. Turn two flats on each key (one on each end) to dimensions indicated in line drawings.
4. After keys have been turned to the proper dimension, indicate the spindle as done in A, steps 3 and 4.
5. Keys must be prick punched so as to identify one from the other.
6. Keys are to be prick punched on rear turned diameter.
7. Looking from the rear of the spindle forward, the key directly in line with the long narrow keyway will be marked #1 (one prick punch mark) on #00G spindles.
8. On #0G and #2G, the key marked #1 should be directly in front of the aligning pin for the rear boss bearing sleeve.
9. Other keys on spindles will be marked #2 (two prick punch marks).
10. Spindle is now ready for assembly.