

Figure 120

Transmission Input Shaft and Fixed Gear Removal (Double Clutch)

- | | |
|----------------|--------------------|
| 1. Input Shaft | 8. Gear (Rev) |
| 2. Bearing | 9. Bearing |
| 3. Gear (3rd) | 10. Retainer |
| 4. Collar | 11. Retainer Bolts |
| 5. Gear (1st) | 12. Sealing Washer |
| 6. Gear (2nd) | 13. Snap Rings |
| 7. Spacer | |

NOTE: The bottom shift rail must be in neutral position before the top rail can be removed.

4. Using a small pencil type magnet, remove the interlock pin (9) from the detent bore.
5. Drive the roll pin out of the lower shift fork and rail.
6. Drive the roll pin out of the shift boss (10) and rail, Figure 121.
7. Rotate the rail 90° and slide the rail forward out of the case.

NOTE: Use care to not lose the detent ball and spring as they will be expelled with considerable force when released by the rail.

8. Remove the plug (5), Figure 122.
9. Remove the roll pin retaining wire (6).
10. Drive the roll pins (4) out of the shift arm (3) and shaft (1), Figure 122, and remove the arm and shaft from the case.

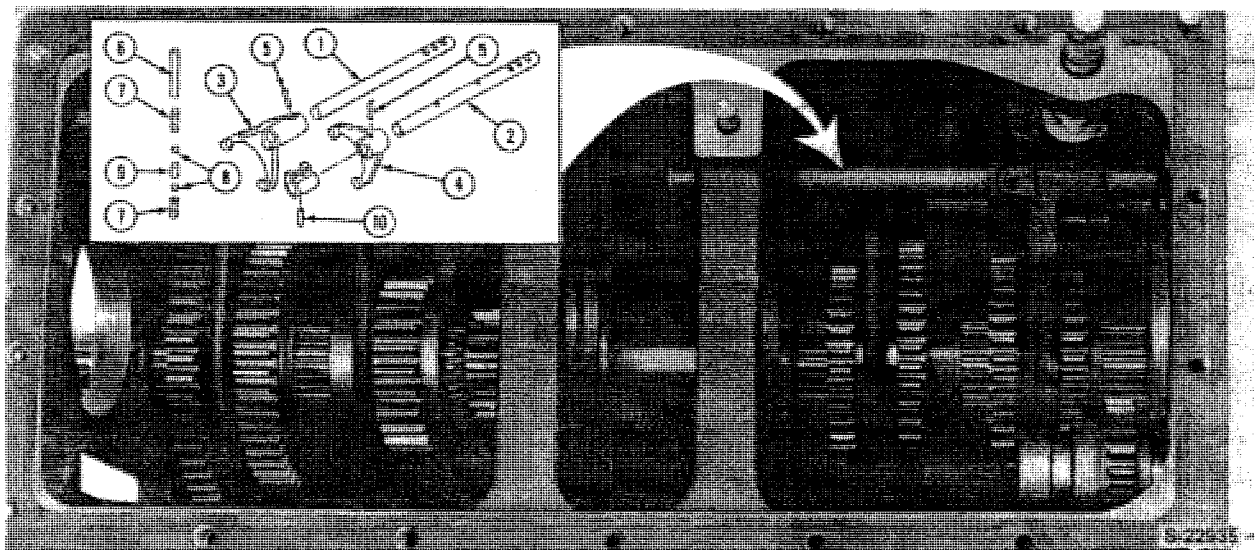


Figure 121

Main Gearshift Rails and Forks Removal

- | | | | |
|-------------------------|-------------------|-------------------------|----------|
| 1. Shift Rail (R-2nd) | 4. Fork (1st-3rd) | 7. Spring (2) | 10. Boss |
| 2. Shift Rail (1st-3rd) | 5. Roll Pin (2) | 8. Ball (2) | |
| 3. Fork (R-2nd) | 6. Detent Pin | 9. Interlock (Balk) Pin | |

RANGE GEAR SHIFT RAIL AND FORK — REMOVAL

Reference — Figure 123

1. Remove the rail retaining bolt (1), Figure 123.
2. Rotate the rail 1/2 turn and slide the rail rearward out of the case.

NOTE: Use care to not lose the detent springs and balls as they will be expelled with considerable force when released by the rail. Cover the shift forks with a shop towel to contain the loose parts.

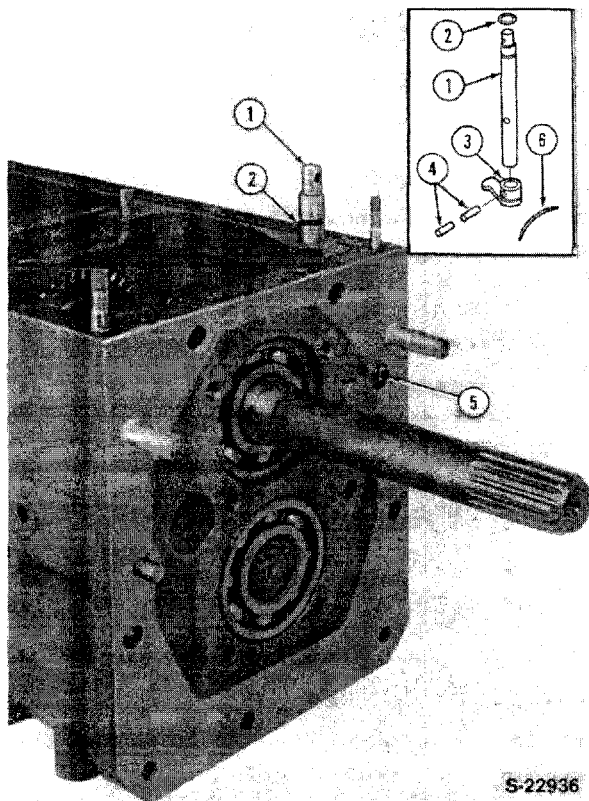


Figure 122
Shift Arm and Shaft Removal

- | | |
|--------------|----------------|
| 1. Shaft | 4. Roll Pins |
| 2. O-Ring | 5. Plug |
| 3. Shift Arm | 6. Safety Wire |

3. Remove the shift forks, detent balls and springs, Figure 123.

4. Remove the retaining plate (8) and remove the shift arms (7) from the case.

REAR MAIN SHAFT — REMOVAL

Reference — Figure 124

1. While supporting the range sliding gears, gently drive the rear main shaft and bearing rearward out of the case.
2. Remove the needle bearing (6) from the rear of the front main shaft.

FRONT MAIN SHAFT — REMOVAL

Reference — Figure 125

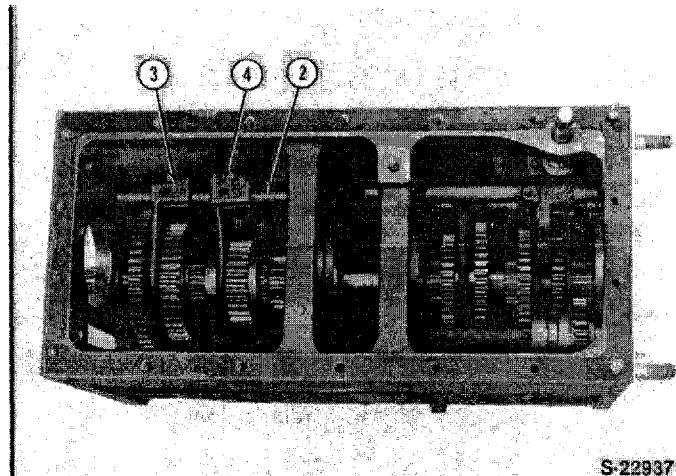
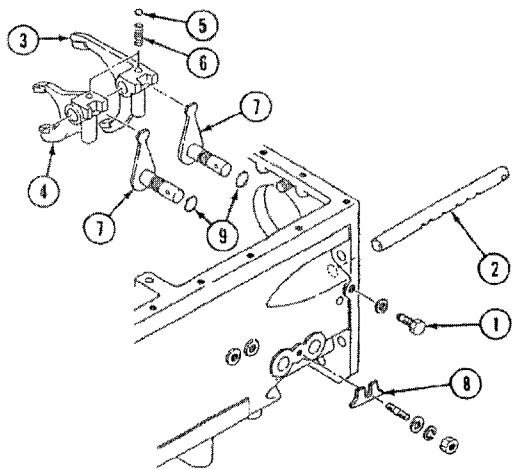
NOTE: The front main shaft may be removed without removing the shift rails and forks.

1. Remove the rear bearing snap ring (10), Figure 125, from the case.
2. Gently drive the main shaft rearward while supporting the sliding gears and shift forks. Remove the sliding gears and spacer from the main shaft.
3. Remove the reverse idler shaft retaining bolts and slide the reverse idler gear and shaft assembly (11), rearward, as shown, Figure 125.
4. Slide the front main shaft and bearing assembly forward and remove from the case.

REVERSE IDLER SHAFT — REMOVAL

Reference — Figure 126

1. Remove the reverse idler shaft retaining bolt (1) from the case.
2. Drive the roll pin (7) out of the reverse idler shaft.
3. Slide the shaft forward out of the case.
4. Remove the thrust washers, idler gear and needle bearings, Figure 126.



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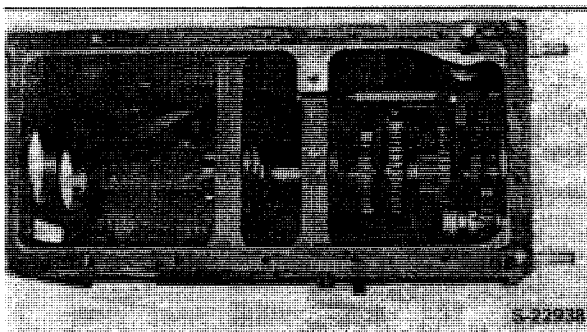
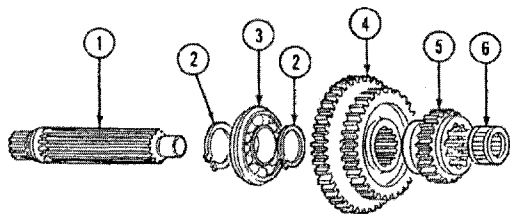
Figure 123

Range Gear Rail and Fork Removal

- | | | |
|---------------------------------|---------------------------------|--------------------|
| 1. Retaining Bolt | 4. Shifter Fork (3rd-4th Range) | 7. Shift Arm |
| 2. Rail | 5. Detent Ball (2) | 8. Retaining Plate |
| 3. Shifter Fork (1st-2nd Range) | 6. Detent Spring (2) | 9. O-Ring |

INSPECTION

1. Wash all components using a suitable cleaning solvent and air dry.

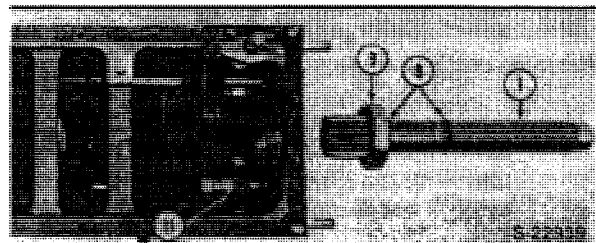
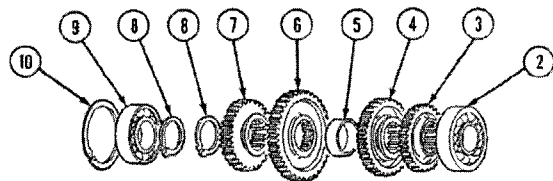


S-22938

Figure 124

Rear Main Shaft Removal

- | | |
|---------------------------------|---------------------------------|
| 1. Rear Main Shaft | 5. Sliding Gear (3rd-4th Range) |
| 2. Snap Ring | 6. Needle Bearing |
| 3. Bearing | |
| 4. Sliding Gear (1st-2nd Range) | |

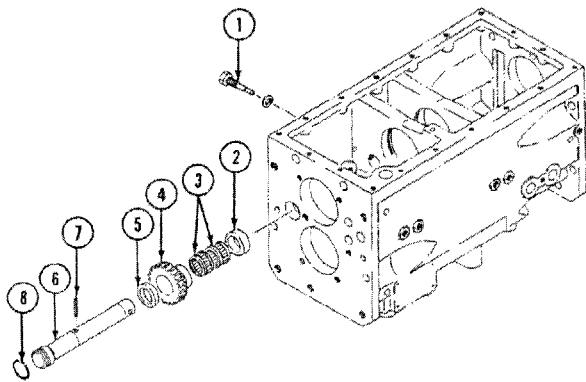


S-22939

Figure 125

Front Main Shaft Removal

- | | |
|---------------------|-------------------|
| 1. Front Main Shaft | 7. Sliding Gear |
| 2. Bearing | 8. Snap Ring (2) |
| 3. Sliding Gear | 9. Bearing |
| 4. Sliding Gear | 10. Snap Ring |
| 5. Spacer | 11. Reverse Idler |
| 6. Sliding Gear | |



S-22940

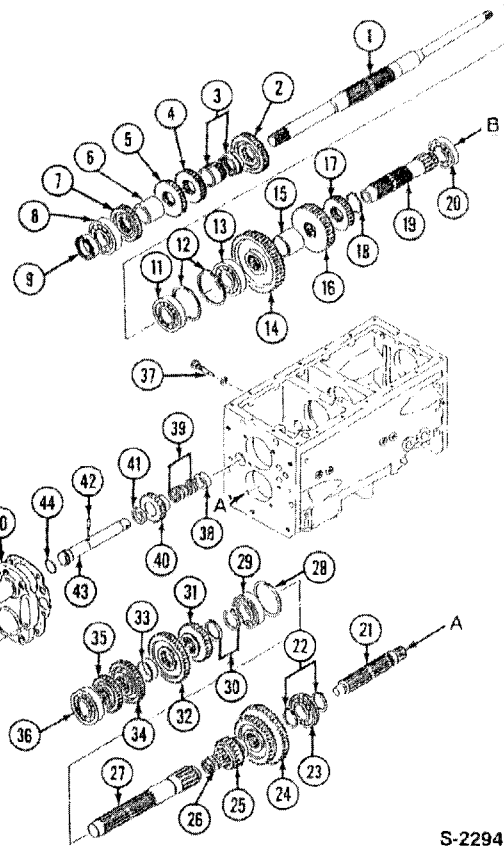
Figure 126
Reverse Idler Shaft Removal

- | | |
|-------------------|------------------|
| 1. Retaining Bolt | 5. Thrust Washer |
| 2. Thrust Washer | 6. Idler Shaft |
| 3. Needle Bearing | 7. Roll Pin |
| 4. Idler Gear | 8. O-Ring |
2. Inspect all bearings for excess wear, score marks, discoloration from overheating, or other damage. Rotate the bearings by hand and check for roughness while slowly rotating the inner and outer races.
 3. Lubricate all bearings with a clean lubricant before installation.
 4. Inspect the transmission case for cracks, worn bearing bores or other damage.
 5. Check the detent springs for wear, chipped teeth or weak spring tension.
 6. Inspect the detent balls for excess wear or damage.
 7. Inspect the shift rail detent grooves for excess wear.
 8. Inspect all gears for excess wear, chipped teeth, or other damage.
 9. Inspect the shift forks for excess wear, bending or other damage. See "Wear Specifications," Chapter 3.

ASSEMBLY

Reference — Figure 127

1. Lubricate all parts with clean transmission oil prior to assembly into the case.



S-22941

Figure 127
Non-Synchronesh Transmission Components
(Single Clutch Model Shown)

- | | |
|----------------------------|----------------------------------|
| 1. Input Shaft | 24. Sliding Gear (2nd-1st Range) |
| 2. Fixed Gear (3rd) | 25. Sliding Gear (4th-3rd Range) |
| 3. Collar (Adjustable) | 26. Needle Bearing |
| 4. Fixed Gear (1st) | 27. Front Main Shaft |
| 5. Fixed Gear (2nd) | 28. Snap Ring |
| 6. Collar | 29. Bearing |
| 7. Fixed Gear (Rev) | 30. Snap Ring |
| 8. Bearing | 31. Sliding Gear (3rd) |
| 9. Oil Seal | 32. Sliding Gear (1st) |
| 10. Retainer | 33. Collar |
| 11. Bearing | 34. Sliding Gear (2nd) |
| 12. Snap Ring | 35. Sliding Gear (Rev) |
| 13. Bearing | 36. Bearing |
| 14. Fixed Gear (4th Range) | 37. Retaining Bolt |
| 15. Collar | 38. Thrust Washer |
| 16. Fixed Gear (3rd Range) | 39. Needle Bearing |
| 17. Fixed Gear (2nd Range) | 40. Reverse Idler Gear |
| 18. Snap Ring | 41. Thrust Washer |
| 19. Countershaft | 42. Roll Pin |
| 20. Bearing | 43. Reverse Idler Gear |
| 21. Rear Main Shaft | 44. O-Ring |
| 22. Snap Ring | |
| 23. Bearing | |

2. Install new gaskets and seals during assembly.

REVERSE IDLER SHAFT — ASSEMBLY

Reference — Figure 126

1. Install the reverse idler shaft through the front of the case, inserting the thrust washers, needle bearing, gear and o-ring.
2. Install the roll pin in the shaft.
3. Align the idler shaft lock bolt counterbore and install the locking bolt using a new sealing washer.

FRONT MAIN SHAFT — ASSEMBLY

Reference — Figure 125

1. Install the rear bearing (9), and two snap rings (8), on the main shaft as shown, Figure 125.
2. Guide the main shaft into the case from the front. Position the rear bearing beyond the case web and then position the sliding gears and spacer on the shaft in the order as shown, Figure 125.
3. Slide the assembled main shaft forward and install the rear bearing retaining ring (10).
4. Install the front bearing (2) in the case.
5. Reinstall the reverse idler gear assembly and install the locking bolt.

REAR MAIN SHAFT — ASSEMBLY

Reference — Figure 124

1. If removed, install the main shaft rear bearing (3) and snap rings (2) onto the main shaft.
2. Install the needle bearing (6) in the front main shaft counterbore.
3. Position the two sliding gears in the bottom of the housing in the order as shown, Figure 124.
4. Install the main shaft from the rear through the gears into the front main shaft.

RANGE GEAR SHIFT RAIL AND FORKS — ASSEMBLY

Reference — Figure 123

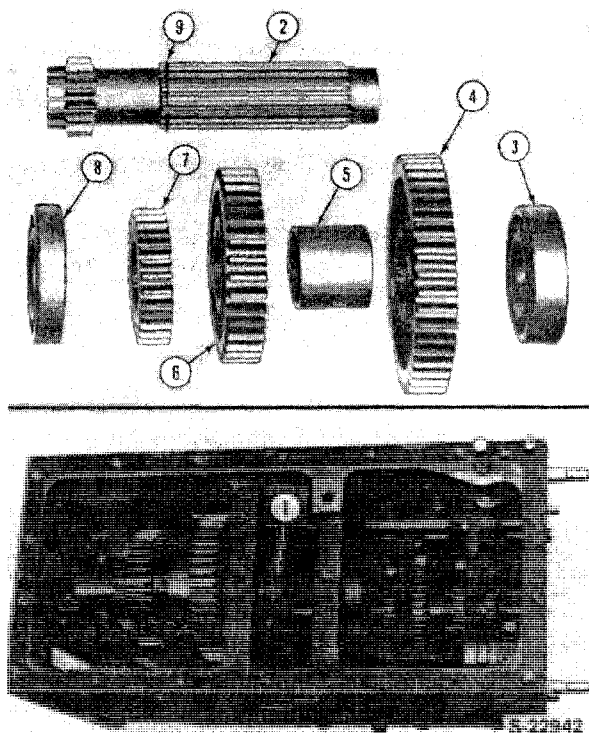
1. Install the shift arms from inside of the case using new o-rings.
2. Assemble the shift fork and detent mechanism prior to installing in the housing as follows:
 - Place the fork in a vise with the detent bore facing upward.
 - Place the detent spring and ball in the fork.
 - Position a 3/8 in. straight wall socket in the rod bore and using a suitable size punch compress the detent spring and ball while maintaining hand pressure on the socket. Slide the socket inward to hold the compressed spring and ball in place.
 - Position the assembled fork in the housing and onto the end of the shift rail.
 - While holding the shift fork from moving, strike the end of the shift rail with a light sharp blow with a brass hammer. This will displace the socket while containing the detent mechanism with the shift rail. Assemble the second fork and detent in the same manner.
3. Align the rail lock bolt counterbore with the housing bore and install the locking bolt using a new sealing washer.
4. Install the shift arms locking plate and tighten the nut.

MAIN GEAR SHIFT RAILS AND FORKS

Reference — Figures 121 and 122

1. Install the lower detent spring and ball in the case, Figure 121.
2. Position the 1st-3rd shift fork (4) and boss (10) inside the housing.
3. Install the 1st-3rd shift rail from the front through the fork and boss, Figure 121.
4. Install the roll pins in the fork and boss.

5. Install the shifter shaft (1) in the housing from the top and through the shift arm (3), Figure 122.
6. Install the double roll pin and wire together with a new safety wire.
7. Install the plug (5) in the case.
8. Install the interlock (balk) pin (9), Figure 121.
9. Position the 2nd-Rev fork in the case.
10. Install the 2nd-Rev shift rail in the housing through the fork and install the roll pin.
11. Install the upper detent ball, spring and pin as shown, Figure 121.



COUNTERSHAFT — ASSEMBLY — SINGLE TRANSMISSION

Reference — Figure 128

1. Install the countershaft, gears and bearings as shown, Figure 128.

NOTE: When equipped with the double clutch, first install the input shaft in reverse order as described in steps 1 through 7, "Countershaft Removal," Figure 119.

INPUT SHAFT — ASSEMBLY

Reference — Figures 117 and 118

1. If removed, install the rear snap ring (11) and rear bearing (10), Figure 118.
2. Position the fixed gears and collars in place.

NOTE: If new input shaft components parts are used, or if the collar (8) has been upset install a new collar assembly at time of assembly.

When a new collar is used, assemble the collar to provide free play on the shaft during assembly. Make final adjustment only after installation of the front retainer assembly.

3. Install the input shaft from the front through the gears and collars.
4. Install the front bearings (3), Figure 118.
5. Install a new seal (2) in the retainer, Figure 117.

**Figure 128
Countershaft Assembly**

- | | |
|---------------------------|---------------------------|
| 1. Snap Ring | 6. Fixed Gear (3rd Range) |
| 2. Countershaft | 7. Fixed Gear (2nd Range) |
| 3. Bearing | 8. Bearing |
| 4. Fixed Gear (4th Range) | 9. Snap Ring |
| 5. Spacer | |

6. Using a new gasket, install the retainer and tighten the bolts to the specified torque.

NOTE: Use new sealing washers on the retainer mounting bolts.

COLLAR ADJUSTMENT

Reference — Figure 129

1. Adjust the length of the collar by hand to zero free play of the gears on the shaft. The collar should not be binding nor should it have free play. With proper adjustment, the collar should rotate with medium hand pressure.
2. After adjustment, stake the nut flange into the groove to lock the assembly.

Never reuse a collar assembly if the staking has been upset.

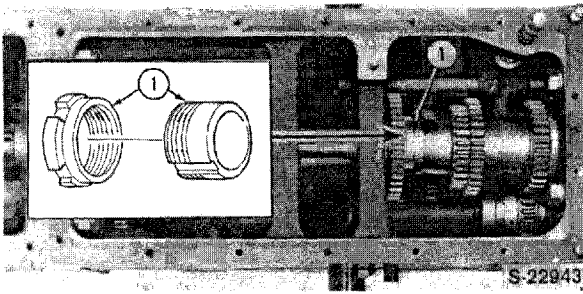


Figure 129
Collar Adjustment

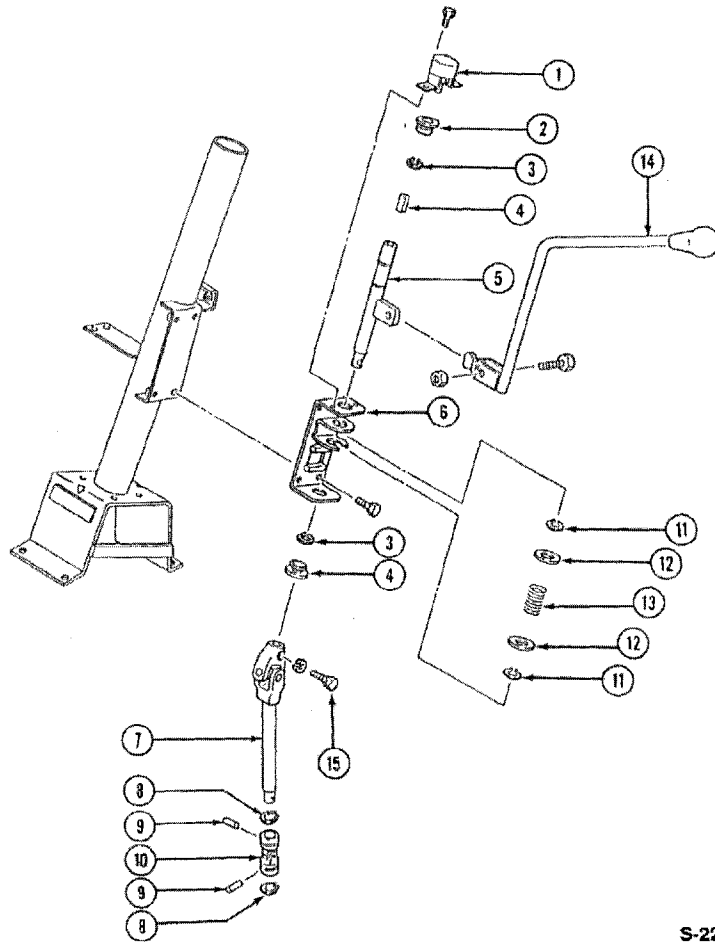
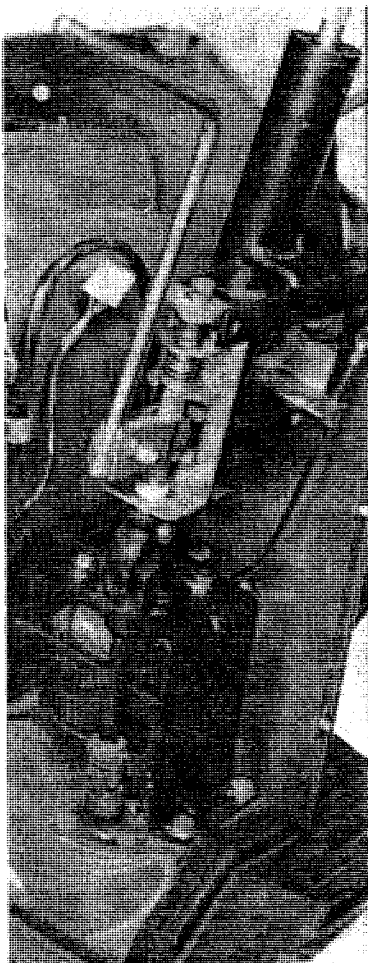
- 1. Collar

C. SHIFT LEVERS

The non-synchromesh transmission utilizes two control levers.

The main transmission gear shift lever is column mounted, Figure 130. The range gear shift lever is located on the left hand side of the operator seat, Figure 131.

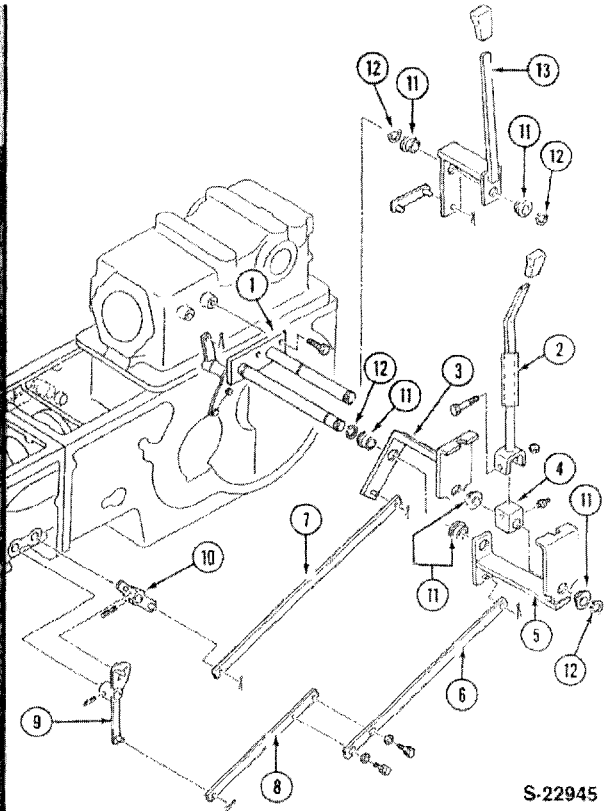
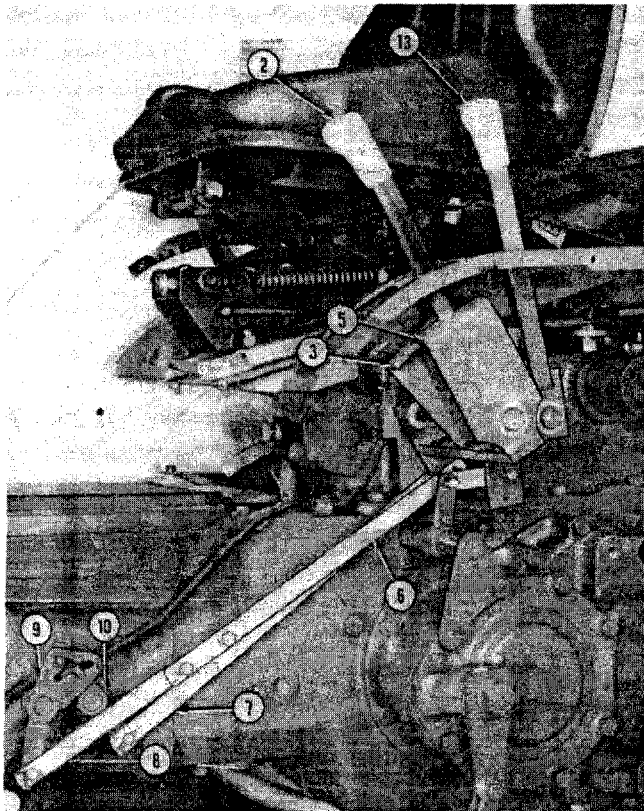
The main shift lever controls the 1st-3rd and Rev-2nd gear shifts. The range shift lever controls the four speeds.



S-22944

Figure 130
Main Transmission Gearshift Linkage Overhaul

- | | | | |
|------------------|------------------|---------------|------------------|
| 1. Safety Switch | 5. Shift Arm | 9. Pin | 13. Spring |
| 2. Bushing | 6. Bracket | 10. Joint | 14. Change Lever |
| 3. Snap Ring | 7. Link Assembly | 11. Snap Ring | 15. Clamp Bolt |
| 4. Roll Pin | 8. Snap Ring | 12. Washer | |



S-22945

Figure 131
Range Gear Shift Linkage Overhaul

- | | | | |
|-----------------------------|----------------|------------------|------------------------|
| 1. Shift Guide | 4. Boss | 8. Shift Plate | 12. Snap Ring |
| 2. Change Lever
(Trans.) | 5. Shift Arm | 9. Change Lever | 13. Change Lever (PTO) |
| 3. Shift Arm | 6. Shift Plate | 10. Change Lever | |
| | 7. Shift Plate | 11. Bushing | |

Overhaul of the gear shift levers and linkage requires normal repair practices.

On assembly, observe the following requirements:

- With the transmission gears in neutral, assemble the gear shift arm (5) to align the change lever (14) in the neutral position with the guide on the instrument panel.

Tighten the clamp bolt (15) securely.

- Install the switch (1), Figure 130, being certain to have the small pin on the switch shaft located in the roll pin groove.
- Center the switch assembly in the slotted holes and tighten the mounting screws finger tight. Test the switch operation making sure the switch has continuity when the change lever is in neutral position only. Adjust the switch as required and tighten the mounting screws.



PART 5 TRANSMISSION SYSTEMS

Chapter 6 SYNCHROMESH 12 x 12 SHUTTLE TRANSMISSION — MODEL 1720

Section	Page
A. DESCRIPTION AND OPERATION	61
B. OVERHAUL	62
C. SHIFT LINKAGE	76

A. DESCRIPTION AND OPERATION

The optional synchromesh shuttle transmission assembly, Figure 132, available on the Model 1720 tractor provides 12 forward and 12 reverse speeds which are manually controlled by three shift levers.

The transmission is driven by a double clutch and provides a live power take-off system.

The transmission case contains three compartments, Figure 132. The forward compartment contains the shuttle transmission gears consisting of a forward and reverse synchronizer and are controlled by a column mounted shift lever (1), located on the left hand side of the steering column, Figure 133.

The center compartment contains the main transmission gears consisting of four speed ratios with the two synchronizer gear sets, Figure 132.

These gears are controlled by a column mounted shift lever (2), mounted on the right hand side of the steering column, Figure 133.

The rear compartment contains the range gears, which provides for three range speed ratios for each of the main transmission gear speeds for a total of 12 forward and 12 reverse speeds.

The range gears are not synchronized and are controlled by a lever located at the left hand side of transmission case, Figure 134.

All the shuttle and main transmission gears are in constant mesh, Figure 132, and shifting is accomplished by engaging and disengaging three synchronized assemblies located in the transmission forward and center compartments.

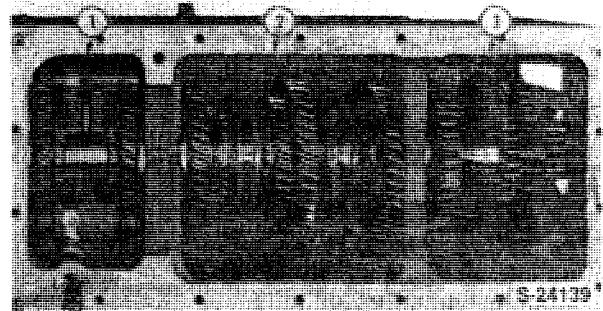


Figure 132
**Synchromesh 12 x 12 Shuttle Gear
Transmission**

- | | |
|-------------------------------|-----------------------------|
| 1. Shuttle Transmission Gears | 3. Range Transmission Gears |
| 2. Main Transmission Gears | |

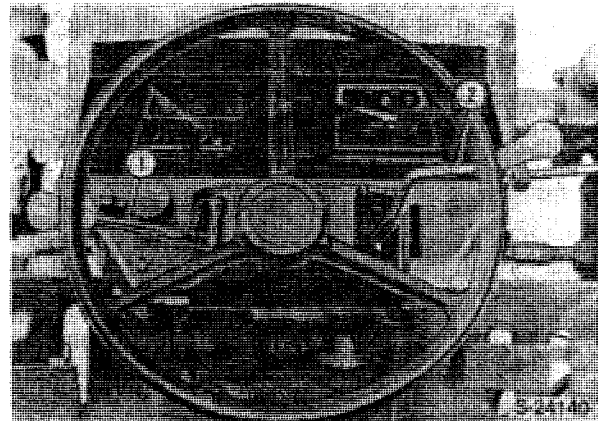


Figure 133
**Shuttle Transmission — Main and Shuttle
Control Levers**

- | | |
|------------------------|---------------------|
| 1. Shuttle Shift Lever | 2. Main Shift Lever |
|------------------------|---------------------|



Figure 134

Shuttle Transmission Range Gear Lever

1. Range Shift Lever

The range gears are not synchronized and shifting is accomplished by engaging sliding gears located in the transmission rear compartment.

The transmission housing serves as a common oil reservoir for the final drive assembly, transmission and hydraulic system.

The oil used is Ford 134B or equivalent.

The oil level dipstick is located on the transmission top cover.

B. OVERHAUL

REMOVAL

1. Drain the transmission and differential oil into a clean container. See Operator's Manual.
2. Remove the transmission from the tractor. See "Separating the Tractor," Part 12.
3. Drive the roll pins (6 and 7) out of the upper shift rail shift fork and boss (4 and 5), Figure 135. Remove the detent spring (1) and ball (2), Figure 135.
4. Slide the upper rail rearward out of the case and remove the fork and boss from the case.
5. Remove the interlock (balk) pin (11), Figure 135.

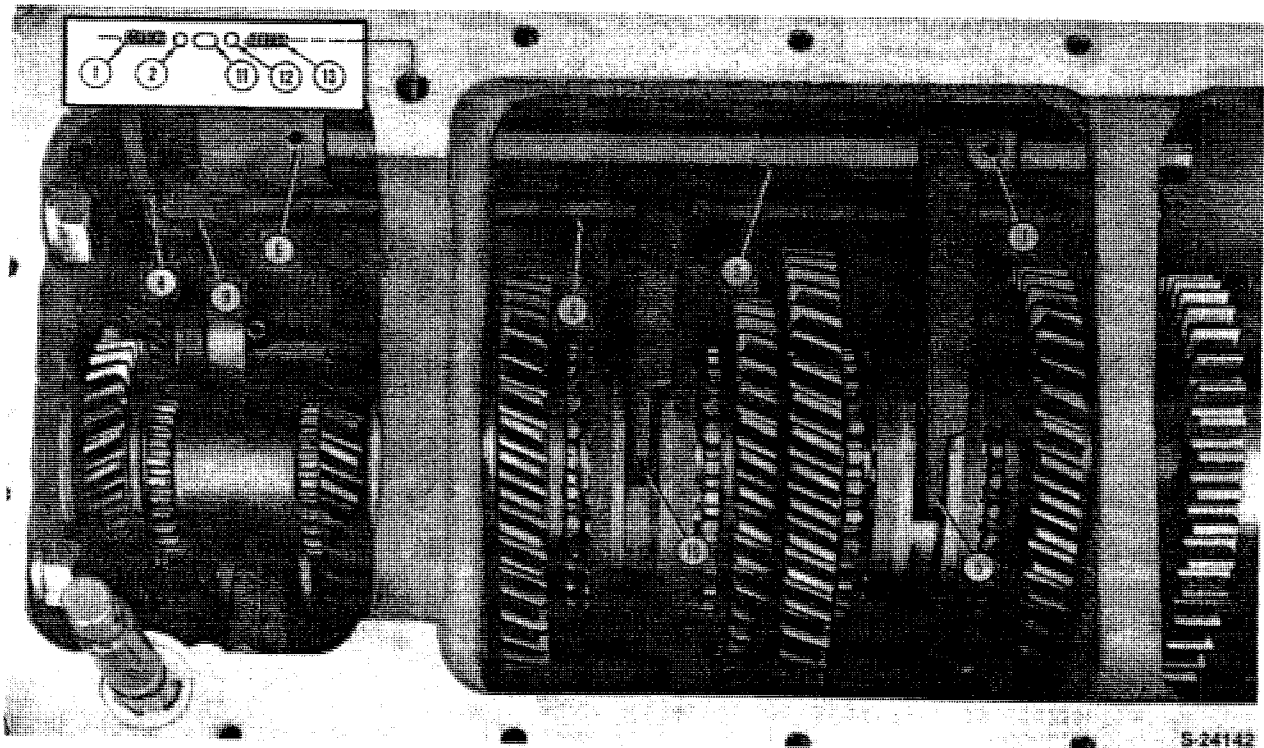


Figure 135

Main Shift Rails and Forks Removal

- | | | | |
|-------------------------|--------------------------------|---------------------------------|-------------------|
| 1. Detent Spring | 5. Shifter Fork (1st-2nd-Main) | 8. Shift Rail (3rd-4th) | 11. Balk Pin |
| 2. Detent Ball | 6. Roll Pin | 9. Shifter Boss | 12. Detent Ball |
| 3. Shift Rail (1st-2nd) | 7. Roll Pin | 10. Shifter Fork (3rd-4th-Main) | 13. Detent Spring |

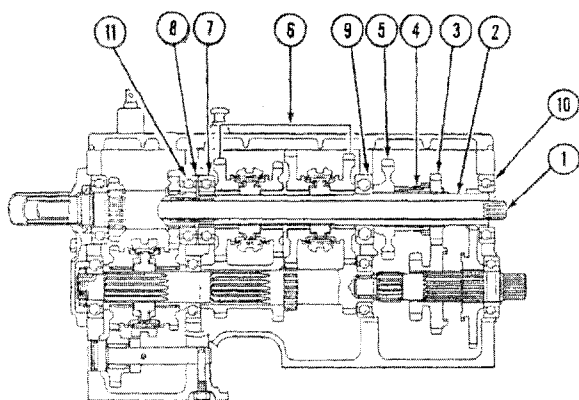
6. Drive the roll pins out of the lower shaft boss and shift fork (9 and 10), Figure 135.
7. Slide the lower shaft rearward out of the case and remove the fork and boss.

NOTE: Use care not to lose the detent ball and spring (12 and 13) when removing the lower shaft as they will be expelled with considerable force when released by the shaft. Place a shop towel over the detent bore to contain the spring and ball while removing the shaft.

MAIN SHAFT REMOVAL

1. Slide the PTO drive shaft (1) out the rear of the case, Figure 136.
2. Drive the rear bearing (10) out the rear of the case, Figure 136.
3. Drive the main shaft assembly (1) and center bearing (2) rearward, Figure 137.

NOTE: The center bearing (2) must be all the way out of the case web as shown in Figure 137. It may be necessary to remove the snap ring (3) from the shaft groove to provide clearance with the large gear on the lower shaft.



S-24143

Figure 136
Main Shaft Removal

- | | |
|------------------------------|--------------------------|
| 1. Drive Shaft — PTO | 6. Synchronizer Assembly |
| 2. Main Shaft | 7. Bearing |
| 3. Fixed Gear (Middle-Range) | 8. Snap Ring |
| 4. Collar | 9. Bearing |
| 5. Fixed Gear (High-Range) | 10. Bearing |

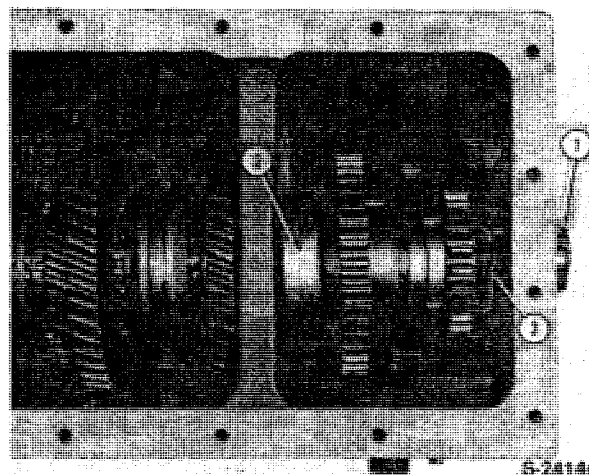


Figure 137
Main Shaft Removal

- | | |
|------------------------|--------------|
| 1. Main Shaft Assembly | 2. Bearing |
| | 3. Snap Ring |
4. While supporting the main synchronizer gears and fixed range gears, withdraw the main shaft (1), from the case, Figure 138.
 5. Remove the fixed range gears (3), spacer (4) and bearing (5), Figure 138.
 6. Remove the two synchronizer assemblies (6 and 7), collars (8 and 9) and front bearing (10), Figure 138.
 7. Remove the snap ring (8), Figure 136.

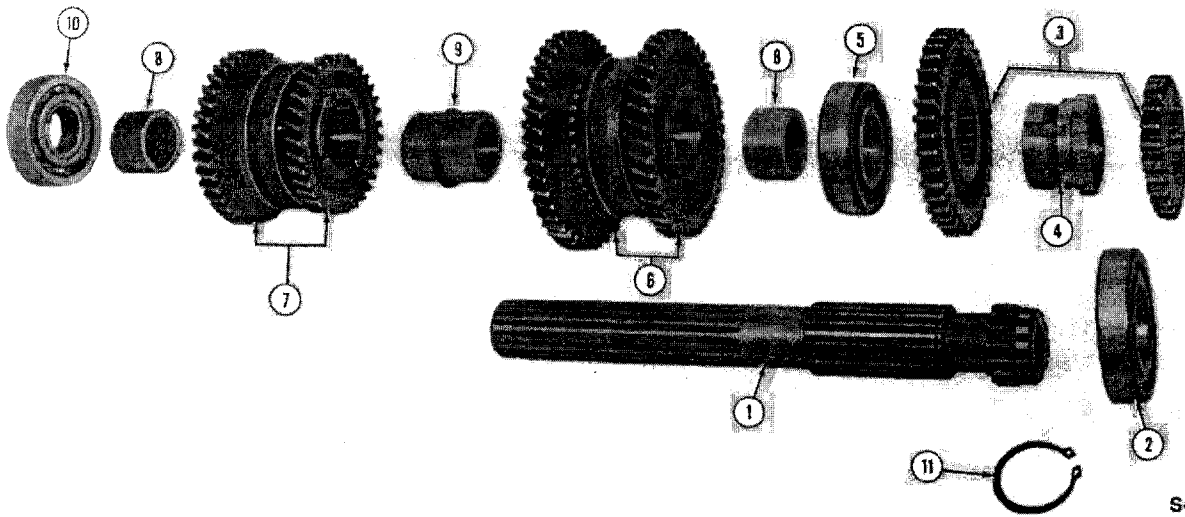
NOTE: The snap ring (8) is used as a floating spacer between the bearings .

RANGE SHIFT RAIL AND FORK REMOVAL

1. Remove the retaining bolt (8), Figure 139.
2. Rotate the shift rail 90° and slide the rail rearward.

NOTE: The detent spring and ball are located in the fork on the underside of the rail, Figure 140. Use care when removing the rail as the spring and ball will be expelled with considerable force when released. Cover the shift fork with a shop towel to contain the spring and ball while removing the shaft.

3. Remove the rail and shift fork from the case.



S-24145

Figure 138

Main Shaft Removal

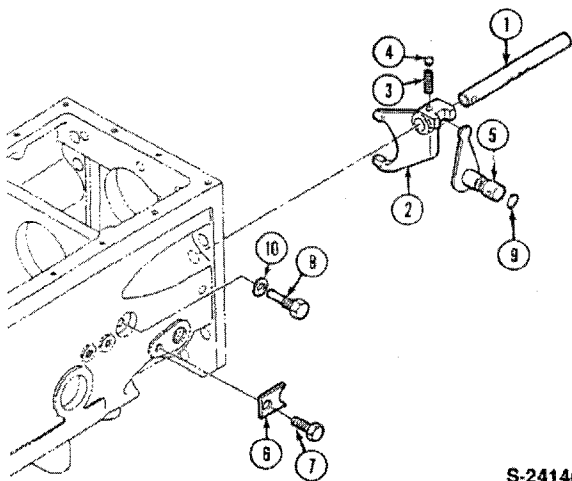
- | | | |
|----------------------|------------------------------------|-------------------|
| 1. Main Shaft | 5. Bearing (Center) | 8. Collar |
| 2. Rear Bearing | 6. Synchronizer Assembly (1st-2nd) | 9. Collar |
| 3. Fixed Range Gears | 7. Synchronizer Assembly (3rd-4th) | 10. Bearing Front |
| 4. Adjustable Spacer | | 11. Snap Ring |

4. If required, remove the bolt (7), and plate (6), Figure 139.
5. Remove the shift arm (5) from the inside of the case.

RANGE GEAR COUNTERSHAFT REMOVAL

NOTE: *The range gear countershaft may be removed without removing the shift rail and fork from the case.*

1. Slide the snap ring (4) forward on the countershaft, Figure 140.
2. Remove the shift rail retaining bolt (8), Figure 139, to permit sliding the shift fork, rail and sliding gear back and forth easily to prevent binding.
3. Withdraw the countershaft (5), Figure 140, rearward out of the case.
4. Remove the sliding gear (2), countershaft gear (3), snap rings (4 and 5) and rear bearing (6), Figure 141.
5. Remove the needle bearing (7) from inside of the main gear countershaft, Figure 141.



S-24146

Figure 139

Range Gear Shift Rail and Fork Removal

- | | |
|------------------|--------------------|
| 1. Shift Rail | 6. Plate |
| 2. Fork | 7. Bolt |
| 3. Detent Spring | 8. Retaining Bolt |
| 4. Detent Ball | 9. O-Ring |
| 5. Shift Arm | 10. Sealing Washer |

INPUT SHAFT REMOVAL

1. Remove the input shaft retainer (1), Figure 142.

NOTE: *Use care to not lose any shims (if used) on the lower shaft for bearing pre-load.*