

**SERVICE REPAIR**

**MANUAL**

Hyster A222 (R45-27IH, RS45-30CH, RS46-30IH,  
RS46-33CH, RS46-33IH, RS46-36CH) Forklift

***HYSTER***

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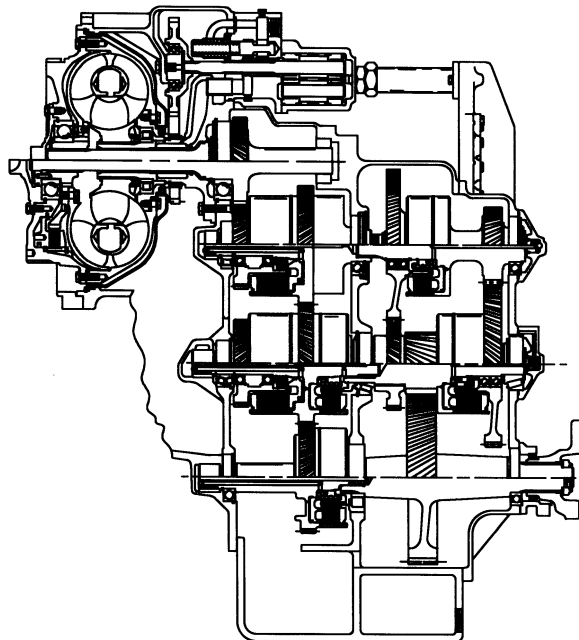
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# **FOUR-SPEED POWERSHIFT TRANSMISSION**

## **REPAIR (HR 36000)**

**H36.00-48.00E (H800-1050E) [D117];  
RS45-30CH, RS46-35CH, RS45-25IH, RS46-30IH,  
RS45-46TP, RS45-46TBP [A222];  
HR45-25, HR45-27, HR45-31, HR45-40S, HR45-36L, HR45-40LS,  
HR45-45LSX, HR45H [A227, B227]**



HM240421

# ***HYSTER***

# SAFETY PRECAUTIONS

## MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- **DISCONNECT THE BATTERY CONNECTOR** before doing any maintenance or repair on electric lift trucks.
- Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See **HOW TO PUT THE LIFT TRUCK ON BLOCKS** in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a **DO NOT OPERATE** tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

**NOTE:** The following symbols and words indicate safety information in this manual:



### **WARNING**

**Indicates a condition that can cause immediate death or injury!**



### **CAUTION**

**Indicates a condition that can cause property damage!**

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This section is for the following models:

H36.00-48.00E (H800-1050E) [D117];  
 RS45-30CH, RS46-35CH, RS45-25IH, RS46-30IH,  
 RS45-46TP, RS45-46TBP [A222];  
 HR45-25, HR45-27, HR45-31, HR45-40S, HR45-36L, HR45-40LS,  
 HR45-45LSX, HR45H [A227, B227]

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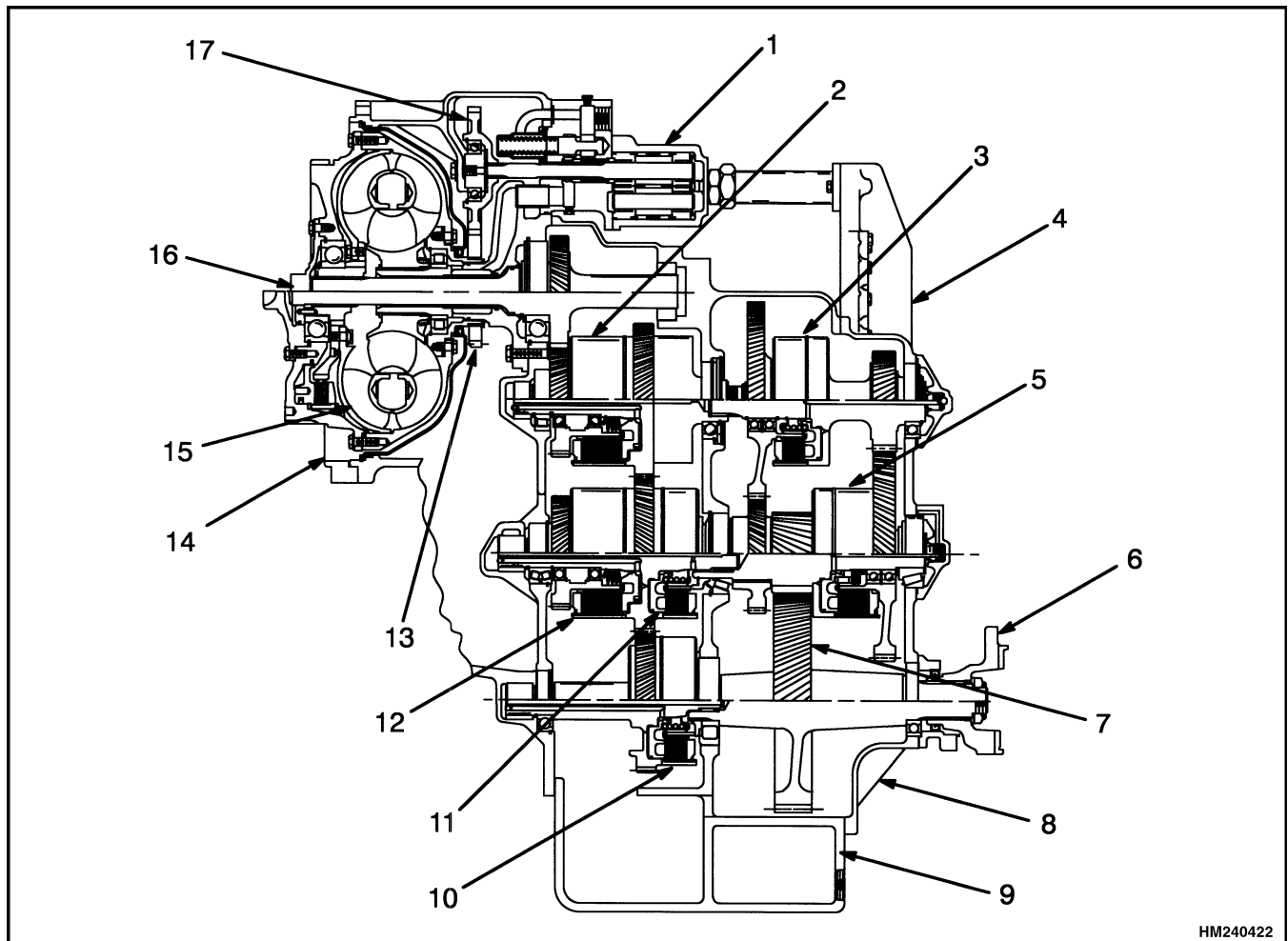
## General

This four-speed powershift transmission is an HR-36000 series transmission manufactured by Spicer-Clark.

This section has the repair procedures for the torque converter, transmission, control valve, and the oil pump for the transmission. See the section **Four-Speed Powershift Transmission Description and Operation 1300 SRM 634** for information on the operation of this transmission. The transmission assembly is shown in Figure 1.

ALWAYS replace all seals, O-rings, metal seal rings, gaskets, and snap rings with new ones. Lubricate all seals with clean transmission oil before installation. Lubricate metal seal rings with multipurpose grease #2 before installation. Use care with seals especially during installation to prevent damage.

If possible, use magnaflux to check all gears and shafts. Check gear teeth for wear, pitting, chipping, nicks, cracks, or scoring. If gears show spots where hardened surface has worn through, replace gear. Make sure shafts are not bent or the splines twisted.



- |                          |                         |                                 |
|--------------------------|-------------------------|---------------------------------|
| 1. TRANSMISSION OIL PUMP | 8. TRANSMISSION HOUSING | 14. TORQUE CONVERTER HOUSING    |
| 2. FORWARD CLUTCH        | 9. OIL SUMP AND PAN     | 15. TURBINE OF TORQUE CONVERTER |
| 3. THIRD CLUTCH          | 10. FOURTH CLUTCH       | 16. INPUT SHAFT AND GEAR        |
| 4. REAR COVER            | 11. SECOND CLUTCH       | 17. PUMP DRIVE GEAR             |
| 5. FIRST CLUTCH          | 12. REVERSE CLUTCH      |                                 |
| 6. OUTPUT YOKE           | 13. IMPELLER HUB GEAR   |                                 |
| 7. OUTPUT GEAR           |                         |                                 |

*Figure 1. Transmission (HR-36000)*

## Torque Converter Repair

### TORQUE CONVERTER, REMOVE

The torque converter is removed during removal of the transmission. See Remove, Transmission Only procedures for the transmission.

### TORQUE CONVERTER, DISASSEMBLE

If it is necessary to disassemble the torque converter, do so as follows and as shown in Figure 2:

1. Remove capscrews and lockwashers that fasten drive plates and bearing cover to impeller cover. Remove backing ring, drive plates, bearing cover, and O-ring.
2. Remove two rings and washer spacer that fastens the turbine hub. One ring is thicker than the hub locating ring.

**NOTE:** Use a drain pan for the oil in the converter section that did not drain during initial drain of oil.

3. Remove screws and washers that fasten impeller cover. Use a screwdriver at the slots to remove impeller cover, turbine, and turbine hub. Remove large O-ring for the cover.
4. Remove locating snap ring from under turbine hub. This ring is thinner than the retainer ring of Step 2. Remove snap ring that fastens stator to stator support. The stator support is fastened to the stator with a dowel. Do not remove spacer if stator or spacer will not be replaced.
5. Remove retainer for oil baffle (Figure 3). Use a special removal tool to remove impeller and oil baffle. The special removal tool is very similar to a gear puller, but is for larger diameter parts.
6. Remove screws and washers that fasten stator support to converter housing. Rotate stator support so there is clearance between stator support and pump drive gear. The "cutout" in the stator support allows this clearance.
7. Remove snap ring for the impeller hub gear (Figure 3). Remove hub gear from impeller hub. Remove oil baffle, oil seal, and baffle seal ring.

8. Remove screws and washers that fasten hub to impeller. Remove backing ring. Remove impeller from hub. Remove O-ring between hub and impeller.
9. Straighten locking tabs for hub bolts. Remove turbine-to-hub bolts and washers. Remove turbine hub.

If necessary, disassemble turbine and impeller cover. Install blocks under the edges of the impeller cover to suspend the turbine and hub. Remove bearing snap ring and spacer. Use a drift and hammer to remove turbine and hub from impeller cover bearing.

### CLEAN AND INSPECT



#### WARNING

**Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.**

Clean the parts of the torque converter in solvent. Dry parts with compressed air. Inspect splines and gear teeth for damage. Inspect shafts, bearings, and bearing surfaces for scratches, wear, or damage. Clean holes that have threads and capscrews where a thread-locking compound is used.

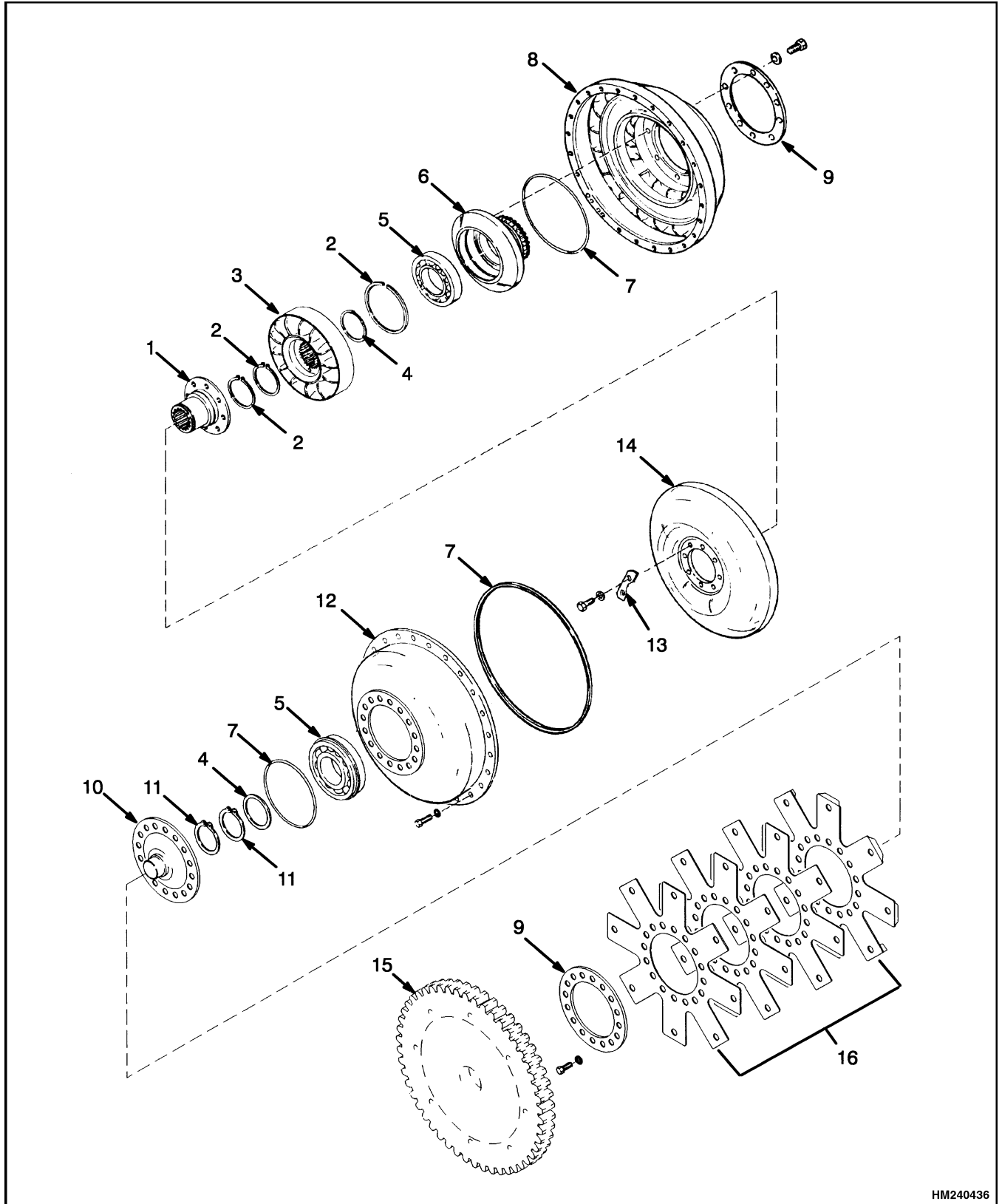
### TORQUE CONVERTER, ASSEMBLE

If the turbine and impeller cover were not disassembled, go to Step 3.

If disassembled, assemble turbine and impeller cover as follows (see Figure 2):

1. Align holes in turbine and turbine hub and install lock tabs, hub bolts, and washers. Tighten hub bolts to 122 to 134 N•m (90 to 99 lbf ft). Bend a corner of lock tab over bolt heads.
2. Align impeller cover over turbine and hub. Install bearing for impeller cover in cover and over turbine hub. Install new O-ring. Install spacer on turbine hub. Install bearing rings.



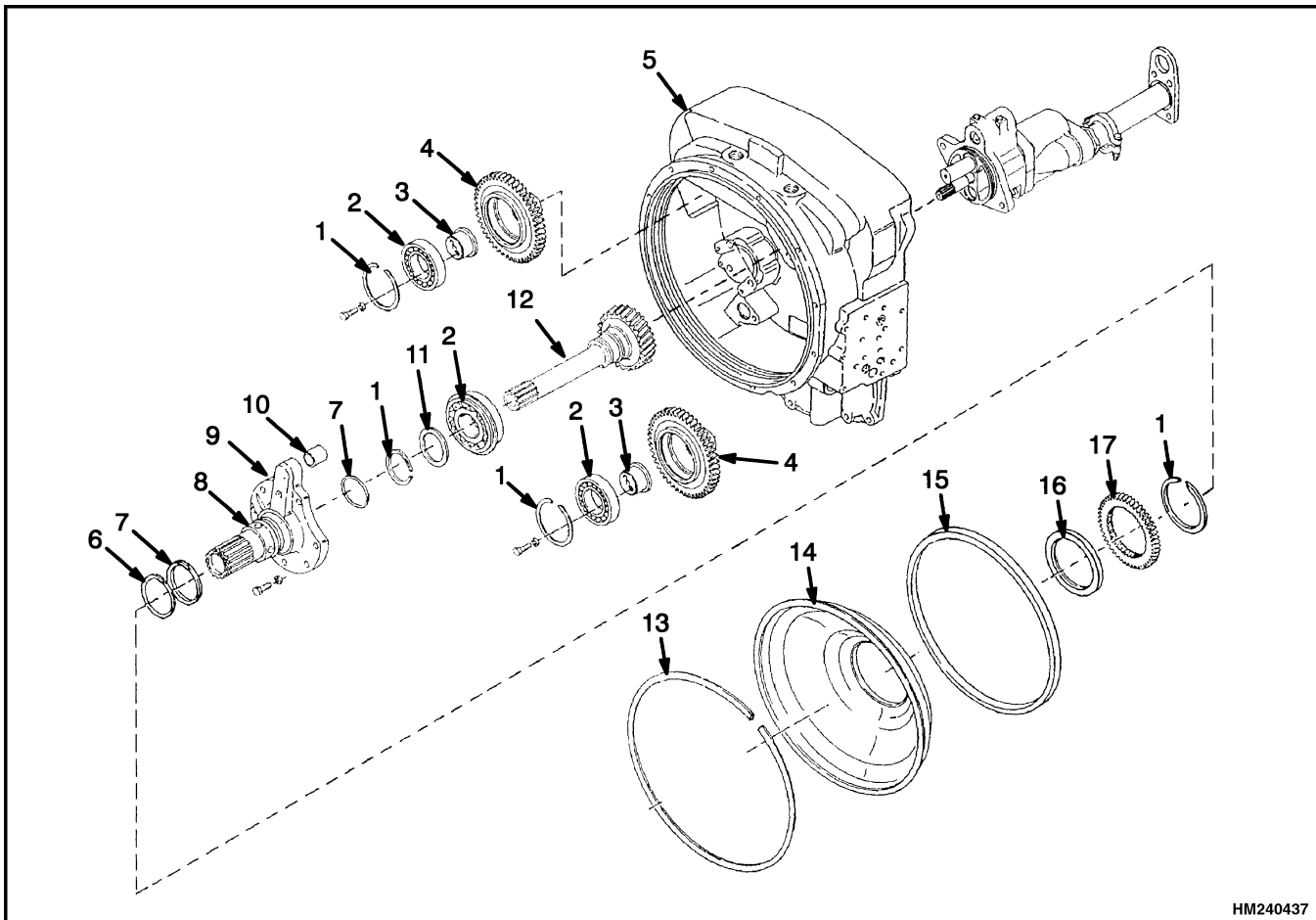


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Figure 2. Torque Converter and Flywheel

*Legend for Figure 2*

- |                    |                    |
|--------------------|--------------------|
| 1. TURBINE HUB     | 9. BACKING RING    |
| 2. SNAP RING       | 10. BEARING COVER  |
| 3. REACTION MEMBER | 11. RING           |
| 4. SPACER          | 12. IMPELLER COVER |
| 5. BEARING         | 13. LOCK TAB       |
| 6. IMPELLER HUB    | 14. TURBINE        |
| 7. O-RING          | 15. FLYWHEEL       |
| 8. IMPELLER        | 16. DRIVE PLATES   |



- |                        |                   |
|------------------------|-------------------|
| 1. SNAP RING           | 10. TUBE          |
| 2. BEARING             | 11. WASHER        |
| 3. BEARING SUPPORT     | 12. INPUT SHAFT   |
| 4. HYDRAULIC PUMP GEAR | 13. RETAINER      |
| 5. TURBINE HOUSING     | 14. BAFFLE        |
| 6. SPRING              | 15. SEAL RING     |
| 7. PISTON RING         | 16. OIL SEAL      |
| 8. SLEEVE              | 17. IMPELLER GEAR |
| 9. STATOR SUPPORT      |                   |

*Figure 3. Input Shaft and Pump Drive Gears*

3. Make sure the surface of impeller hub and holes for screws are clean and dry. Put new O-ring on impeller hub. If removed, use a drift or press the same size as the bearing and install hub bearing and snap ring in hub.
4. Align holes in impeller with hub holes. Do NOT damage O-ring. The two dimples that are 180 degrees apart on backing ring must be installed toward engine flywheel. Install backing ring and install new special self-locking screws and washers. Tighten screws to 79 to 87 N•m (58 to 64 lbf ft).



### CAUTION

Make sure the total time to install and tighten the special screws is less than 15 minutes. If any screw is removed for any reason, it must be replaced. The epoxy left in the hub hole must be removed with a tap and cleaned with solvent. Make sure the hole is dry before installing a new screw.

5. Put a thin coat of Loctite® 638 on the outer diameter of the oil seal of the oil baffle (Figure 3). Press oil seal in oil baffle with lip of seal down.
6. Carefully install oil baffle on impeller without damaging oil seal. Install a new sealing ring for oil baffle. Install hub gear on impeller hub and install snap ring.

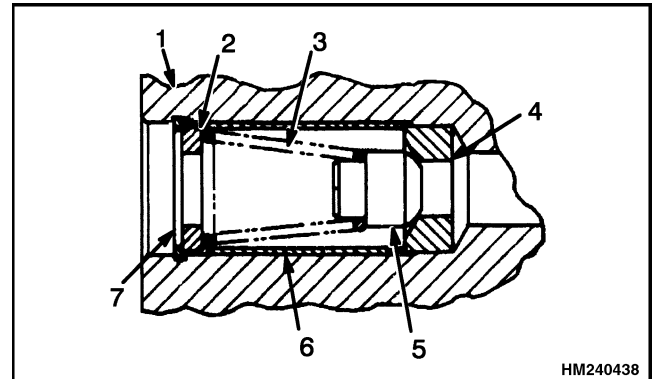
## TORQUE CONVERTER (TURBINE) HOUSING, DISASSEMBLE

If necessary, disassemble converter housing assembly as follows:

1. Remove snap ring for front bearing of input shaft. Use a hammer with a soft face to lightly hit input shaft to remove it and bearing from housing.
2. Put a mark on each pump gear for correct location during installation. Remove bearing support screws and lockwashers for the drive (center) gear. Remove drive gear and bearing assembly. Remove other two pump gear and bearing assemblies using the same procedure.

## RELIEF VALVE FOR LUBE PRESSURE, DISASSEMBLE AND ASSEMBLE

If the unit has this relief valve, disassemble, clean, or replace and assemble the valve as shown in Figure 4.



- |            |                           |
|------------|---------------------------|
| 1. HOUSING | 5. PLUNGER                |
| 2. WASHER  | 6. VALVE SEAT<br>RETAINER |
| 3. SPRING  | 7. RETAINING RING         |
| 4. SEAT    |                           |

*Figure 4. Relief Valve Assembly*

## OIL SEALING RINGS SLEEVE, REPLACE

There is a sleeve at the front end of the forward, reverse, and fourth-gear clutch shafts. Remove the sleeves ONLY if they are to be replaced.

1. Remove locating ring for front bearing of clutch shaft.
2. Remove retainer plate screw, washer, and plate.
3. Remove sleeve using a puller.
4. Use a press or a driver to prevent damage to the sleeve during installation. Make sure the notch in the new sleeve is aligned with the sleeve lock notch.
5. Put sleeve lock in position. Install capscrew and washer. Tighten capscrew.
6. Install locating ring for front bearing of clutch shaft in ring groove.

## TORQUE CONVERTER HOUSING, ASSEMBLE

Assemble converter housing assembly as follows and as shown in Figure 3:

1. Install two pump drive gears as marked during disassembly. Install transmission pump gear at center location. Tighten all mount capscrews.
2. Install input shaft and gear. Use a hammer with a soft face to tap shaft so bearing snap ring can be installed. Install snap ring and continue to tap shaft so snap ring is against shoulder in housing.
3. Open locating ring for the front bearing of the reverse clutch. See Figure 15. Use a hammer

with a soft face to tap shaft of the reverse and second clutch until locating ring is completely in groove of converter housing.

4. Open locating ring for the front bearing of the fourth-speed clutch. See Figure 7. Use a hammer with a soft face to tap shaft of the fourth-speed clutch until locating ring is completely in groove of converter housing.
5. Install the front bearing of the forward clutch.

## TORQUE CONVERTER, INSTALL

The torque converter is assembled in the torque converter housing and is installed with the transmission. See Install, Transmission .

# Transmission Repair

## REMOVE, TRANSMISSION ONLY

**NOTE:** The transmission can be removed from under the lift truck or as a complete assembly with the engine. If an inspection pit is not available, the truck must be raised 500 mm (19.7 in.) from the ground to provide easier access and removal.

1. Place truck on level surface.
2. Shut down engine.
3. Apply parking brake.
4. Operate all hydraulics to release pressure in the system.

**NOTE:** When removing battery cables, remove ground cable first.

5. Disconnect the cables at the battery.
6. Remove floor plates and covers to provide access to the hydraulic pump and transmission.
7. Close shut-off valves on hydraulic tank.
8. Disconnect the drive shaft at the differential.
9. Remove the drive shaft between the transmission and the differential.
10. Disconnect the wiring harness on top of the transmission.
11. Disconnect the wires at the solenoids on the transmission control valve.

12. Disconnect the wires at the pressure and temperature sending unit on the transmission.

13. Place tags on lines for identification.

14. Remove the drain plug from the transmission sump.

15. Drain the oil.

16. Put plugs and caps on open fittings.

17. Disconnect the hoses at the hydraulic pumps.

18. Put plugs and caps on open fittings.

**NOTE:** The hydraulic pumps are fastened to the transmission with 4 capscrew each.

The drive shaft of the hydraulic pump is engaged in splines in the drive gear.

The drive shaft of the hydraulic pump will slide from the drive gear when the hydraulic pump is removed.

19. Remove the hydraulic pumps.

20. Disconnect and remove the dipstick assembly.

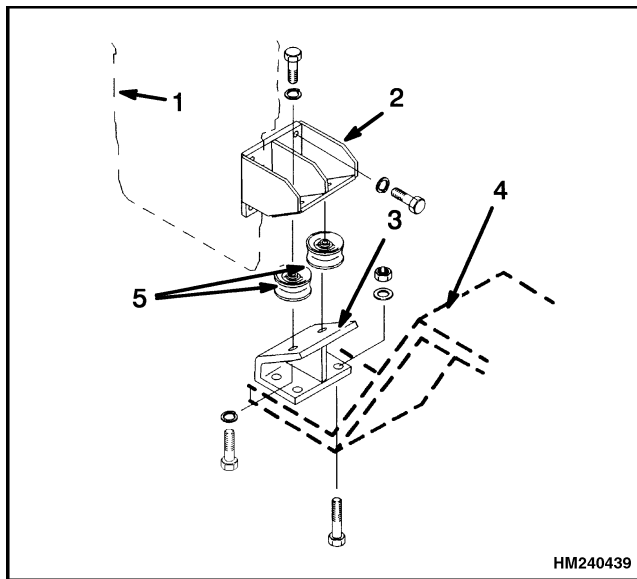
21. Install blocks and a jack under the flywheel end of the engine as a support.

22. Disconnect exhaust system to avoid possible damage.

**WARNING**

Verify the lifting device has the minimum capacity of 725 kg (1600 lb).

23. Connect a lifting device to the transmission.
24. Remove the transmission mounts to the frame. See Figure 5.



**NOTE:** RS45-30CH, RS46-35CH, RS45-25IH, RS46-30IH (A222) SHOWN.

- |                         |                   |
|-------------------------|-------------------|
| 1. TRANSMISSION HOUSING | 3. FRAME MOUNT    |
| 2. TRANSMISSION MOUNT   | 4. FRAME BRACKET  |
|                         | 5. ISOLATOR MOUNT |

**Figure 5. Transmission Mount**

25. Remove the 8 bolts securing the drive plates to the torque converter.
26. Remove all fasteners between engine flywheel housing and torque converter housing.
27. Verify all the connections have been removed.
28. Carefully slide back the transmission from the frame approximately 40 mm (1.60 in.) to permit the transmission to be lowered.

**WARNING**

The transmission is heavy, verify that the lifting devices are securely positioned.

29. Carefully, to avoid damage to the flex plate, lower the transmission assembly past the cross member support.

**REMOVE, TRANSMISSION AND ENGINE ASSEMBLY**

**NOTE:** The transmission can be removed from under the lift truck or as a complete assembly with the engine. If an inspection pit is not available, the truck must be raised 500 mm (19.7 in.) from the ground to provide easier access and removal.

1. Place truck on level surface.
2. Shut down engine.
3. Apply parking brake.
4. Operate all hydraulics to release pressure in the system.

**NOTE:** When removing battery cables, remove ground cable first.

5. Disconnect the cables at the battery.
6. Remove floor plates and covers to provide access to the hydraulic pump and transmission.
7. Close shut-off valves on hydraulic tank.
8. Disconnect the drive shaft at the differential.
9. Remove the drive shaft between the transmission and the differential.
10. Disconnect the wiring harness on top of the transmission.
11. Disconnect the wires at the solenoids on the transmission control valve.
12. Disconnect the wires at the pressure and temperature sending unit on the transmission.
13. Place tags on lines for identification.
14. Remove the drain plug from the transmission sump.
15. Drain the oil.
16. Put plugs and caps on open fittings.
17. Disconnect the hoses at the hydraulic pumps.
18. Put plugs and caps on open fittings.

**NOTE:** The hydraulic pumps are fastened to the transmission with 4 capscrew each.

The drive shaft of the hydraulic pump is engaged in splines in the drive gear.

The drive shaft of the hydraulic pump will slide from the drive gear when the hydraulic pump is removed.

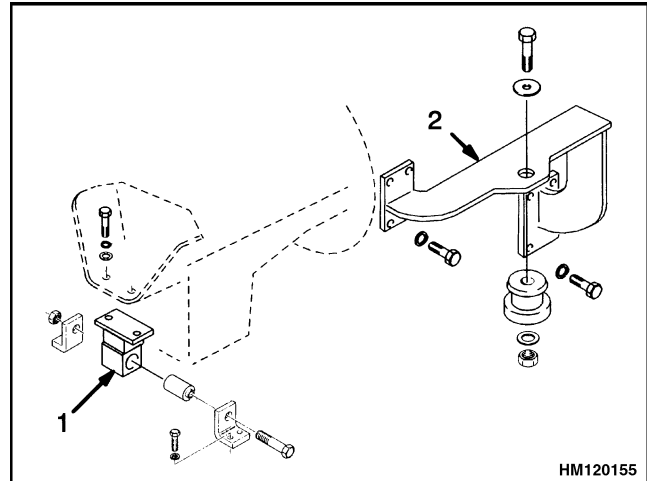
19. Remove the hydraulic pumps.
20. Disconnect and remove the dipstick assembly.
21. Install blocks and a jack under the flywheel end of the engine as a support.
22. Disconnect exhaust system to avoid possible damage.
23. Remove engine hood and ballast cover.
24. Disconnect the air cleaner intake elbow.
25. Drain coolant from the cooling system.
26. Disconnect cooling lines.
27. Remove the radiator and transmission oil cooler.
28. Remove the tubing between the engine and air cleaner.
29. Disconnect fuel lines at the fuel filter.
30. Disconnect the throttle linkage.
31. Disconnect wires and wiring harnesses at the engine.
32. Disconnect the heater hoses at the engine.

**NOTE:** Verify that the lifting device has a capacity of at least 1360 kg (3000 lb).

33. Connect a lifting device to the engine.
34. Remove the capscrews that hold the engine mount at the fan end of the engine. See Figure 6.
35. Remove the capscrews that hold the two rear engine mount brackets to the frame.

**NOTE:** Verify all the connections to the engine or transmission have been removed.

36. Carefully lift the engine and transmission assembly from the frame.



1. REAR MOUNT (FAN END OF ENGINE)
2. FRONT MOUNT

**Figure 6. Engine Mounts**

## TRANSMISSION, DISASSEMBLE

Make sure to keep the parts for each clutch together during disassembly. Make a note of the order of the friction discs and separator plates of each clutch. Also make a note of which way each bearing seal is facing for correct installation. Disassemble the transmission as follows:

1. Remove torque converter assembly from transmission. If necessary, disassemble torque converter as described in Torque Converter, Disassemble.
2. Remove solenoid dust cover from transmission control valve. Remove screws and lockwashers that fasten control valve cover. Remove cover assembly of control valve, seal plate, and inner and outer gaskets. Remove control valve housing and gasket.
3. Remove screws that fasten stator support. Rotate stator support so curved "cutout" section is aligned with pump drive gear to allow removal. See Figure 3. Remove stator support.
4. Use a crane and sling to support torque converter housing. Remove capscrews that fasten torque converter housing to transmission case. Remove torque converter housing with the reverse/second- and fourth-speed clutch assemblies attached.
5. Remove snap ring that fastens front bearing for the fourth clutch to the torque converter housing.

It can be necessary to use a prybar to remove the fourth-speed clutch assembly from housing.

6. Remove snap ring that fastens the front bearing for the second and reverse clutch to the torque converter housing. See Figure 15. It can be necessary to use a prybar to remove the second and reverse clutch assembly from housing.
7. Remove output shaft nut, washers, yoke, seal, and yoke from output shaft. Remove seal and spacer. Remove bearing cap nuts and lockwashers for rear bearing of output shaft. Remove bearing cap and O-ring. See Figure 7.
8. Remove bearing cap nuts and lockwashers for bearing of the third-speed shaft. Remove bearing cap, O-ring, rings, and washer. See Figure 10.
9. Remove bearing cap nuts and lockwashers for the bearing of the first-speed (low) shaft. Remove bearing cap, shims, O-ring, and ring. See Figure 17. Keep cap and shims together. If cap, clutch, front or rear bearings, transmission case, or rear cover are not replaced, the same shims will be used during assembly.
10. Remove clutch pressure and lube tubes and O-rings at the holes under bearing cap for the first-speed shaft bearing.
11. Remove locating rings for the rear bearings of the third-speed and output shafts.
12. Remove nuts, screws, and lockwashers that fasten the rear cover of the transmission. Remove oil screen plug and oil screen. Tap on the end of the output shaft and clutch shafts while prying cover off to remove cover. Using aligning studs can help in the removal. Remove cover gasket.
13. Remove retaining ring for the fourth-speed hub. Remove hub. Remove three retaining rings for the second-speed hub. Remove hub.
14. Use a bearing puller to remove the rear bearing of the output shaft. Remove first-speed clutch and output shaft simultaneously. Remove front bearing for output shaft.
15. Remove clutch assembly of the third-speed clutch.
16. Remove oil baffle screws, lockwashers, and oil baffle from cover. Remove bolts and lockwashers

of the suction tube. Remove suction tube and O-ring.

17. Have another person release the bearing snap ring for the rear bearing of the forward shaft. Use a hammer that has a soft face to tap the end of the shaft for removal.
18. Remove forward clutch assembly. See Figure 12. Remove outer race of the rear bearing of the input shaft. Remove bearing cup and oil baffle spacer of the first-speed shaft.

### Output Shaft, Disassemble and Assemble

**NOTE:** The following procedures describe the disassembly of each of the shaft assemblies and clutches. These assemblies have been removed from the transmission as assemblies in the previous procedures. Disassemble only the shaft or clutch assembly necessary to make repairs.



#### CAUTION

**Inspect all bearings for damage and wear. Bearings are normally replaced during a major disassembly and assembly such as this.**

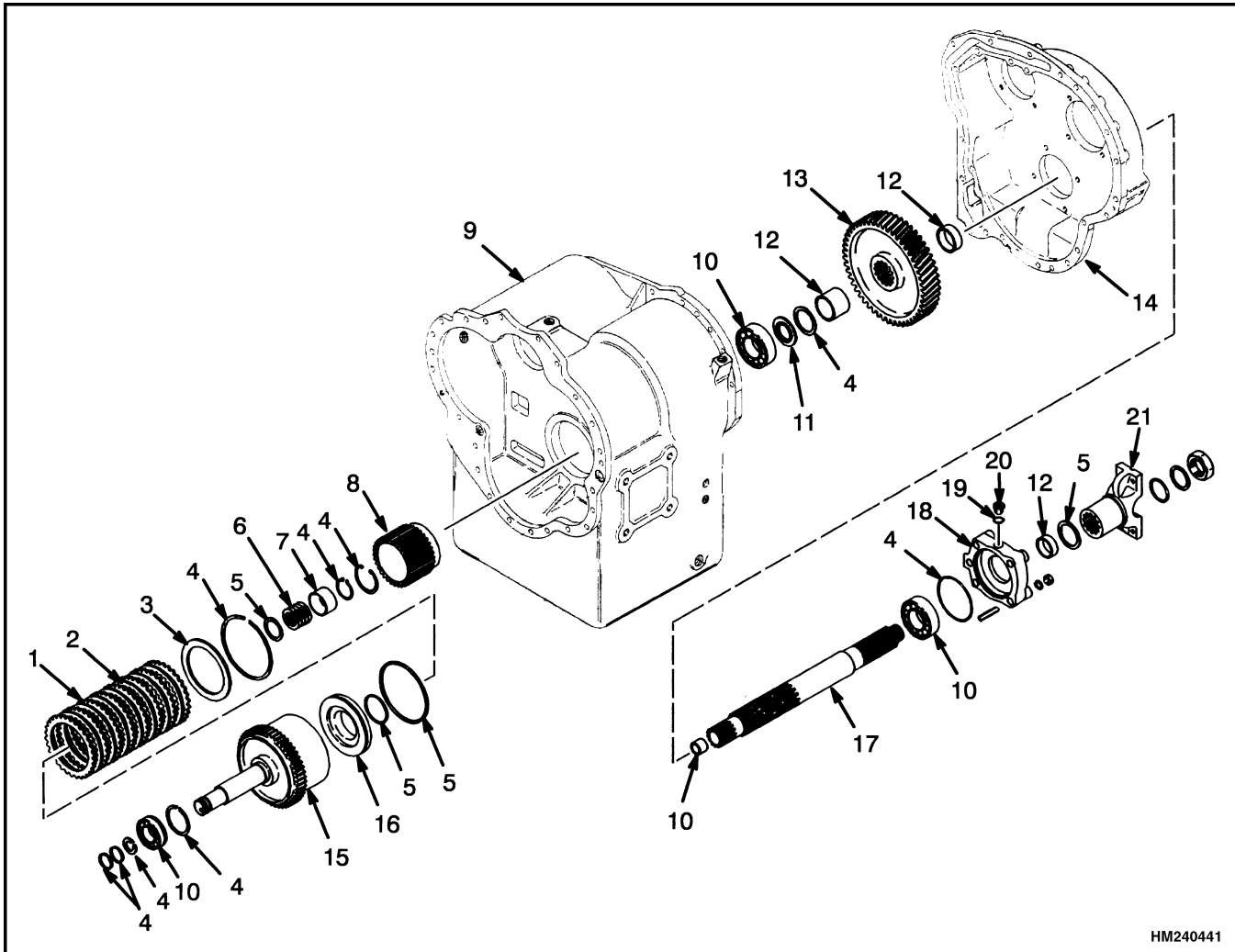
**Inspect clutch plates for wear of friction material and damage to the separator plates.**

**Make sure to keep all parts of each clutch assembly together. Some of these parts look the same, but are not. Using the wrong part can cause incorrect operation or damage.**

**Always use new seals, seal rings, and snap rings during assembly. Apply a thin coat of multipurpose grease #2 to all seals before installation. Fill all seal grooves with this same grease.**

The following procedure describes the disassembly and assembly of the output shaft. See Figure 7:

1. Remove inner race of the front bearing of the output shaft.
2. Remove front retaining ring for the output gear. Remove spacers and gear from shaft. If necessary, remove rear retaining ring.



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- |                                   |                         |   |
|-----------------------------------|-------------------------|---|
| 1. SEPARATOR DISC (TEETH OUTSIDE) | 7. SPRING RETAINER      | 15. CLUTCH DRUM AND GEAR FOR FOURTH SPEED |
| 2. FRICTION DISC (TEETH INSIDE)   | 8. HUB                  | 16. PISTON                                |
| 3. BACKING PLATE                  | 9. TRANSMISSION HOUSING | 17. OUTPUT SHAFT                          |
| 4. RING                           | 10. BEARING             | 18. BEARING CAP                           |
| 5. SEAL                           | 11. RETAINER            | 19. O-RING                                |
| 6. SPRING                         | 12. SPACER              | 20. PLUG                                  |
|                                   | 13. OUTPUT GEAR         | 21. YOKE                                  |
|                                   | 14. REAR COVER          |   |

**Figure 7. Fourth-Speed Shaft and Output Shaft**

3. If removed, install rear retaining ring on output shaft. Install spacers and gear with long hub toward rear. Install front retaining ring.
4. Install retainer and press front bearing on output shaft with race shoulder facing gear. Install bearing and outer race on inner race.
5. Install clutch hub on shaft using retaining rings.

### Fourth-Speed Shaft, Disassemble and Assemble

The following procedure describes the disassembly and assembly of the fourth-speed shaft: See Figure 7 and Figure 8.

1. Remove oil sealing rings from the fourth-clutch shaft. Remove snap ring for front bearing and remove bearing using a bearing puller. Remove other ring.

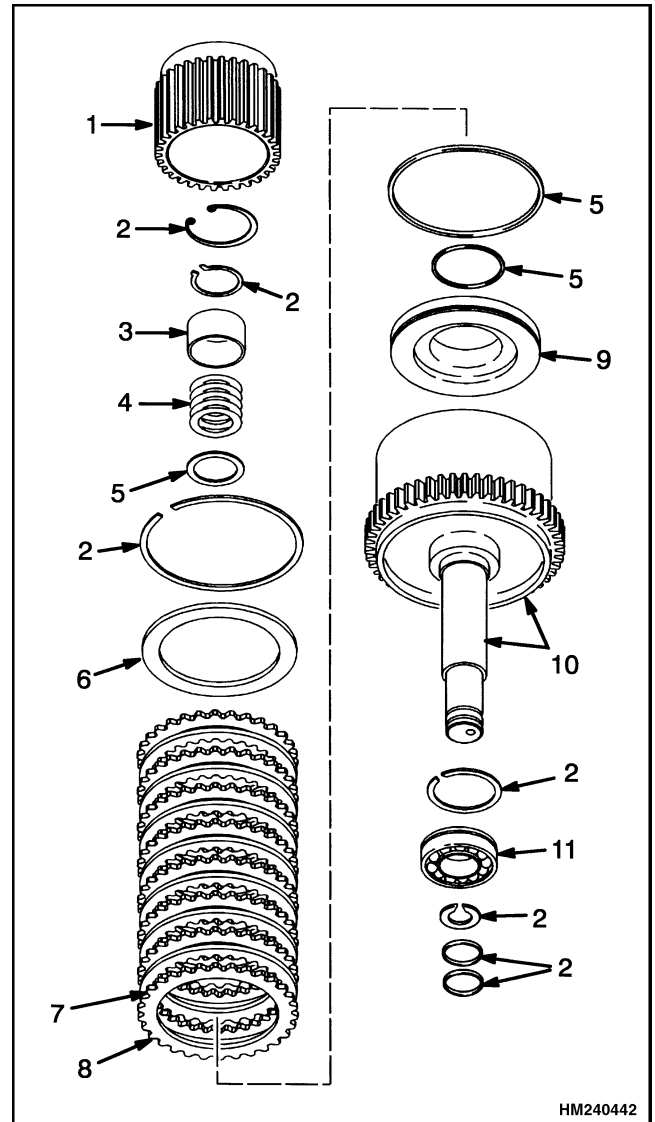


2. Remove snap ring for the backing plate of the clutch disc and remove backing plate. Remove all friction and separator discs.
3. Remove seal. Compress wave spring and remove retaining ring from its groove. Release wave spring and remove snap ring and retainer for the spring. Remove wave spring and thrust washer. Turn assembly over and tap shaft on a block of wood to remove seals and piston.
4. Make sure the bleed valve is clean in the piston removed in Step 3. Install inner and outer seal rings on piston. Lock ring joint and apply grease to stabilize it in the ring groove. Carefully position piston in drum without damaging seal rings.
5. Install seal, thrust washer, wave spring, spring retainer, and retainer snap ring on shaft. Compress wave spring and install retainer snap ring in shaft groove. Install a separator disc (teeth on outside) in clutch drum.
6. Alternately install six friction discs and the other five separator discs in drum. The last disc must be a friction disc.
7. Install backing plate and snap ring in drum.
8. Press front bearing against shoulder on shaft with snap ring groove toward drum. Install snap ring. Install grease in groove for seal rings and install seals in grooves.

### Third-Speed Shaft, Disassemble and Assemble

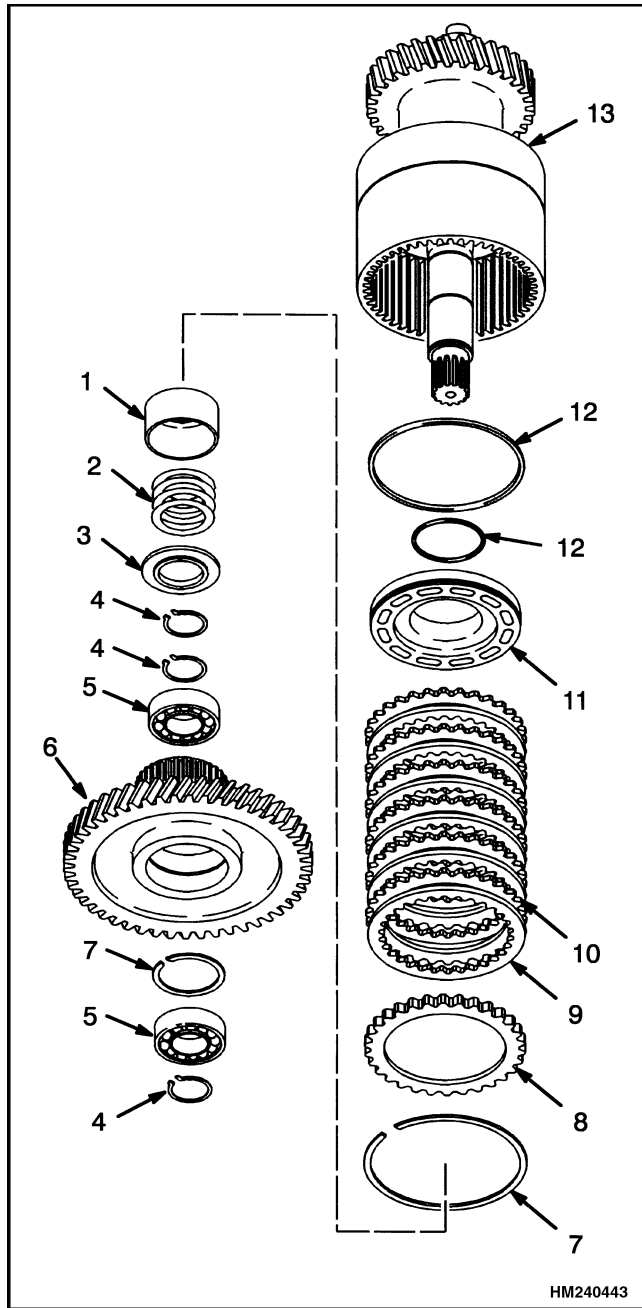
The following procedure describes the disassembly and assembly of the third-speed shaft (see Figure 9 and Figure 10):

1. Remove sealing ring from shaft. Remove snap ring for rear bearing. Use a bearing puller to remove rear bearing.
2. Remove retaining ring for outer bearing of the third gear. Use a hammer that has a soft face to tap the third gear with the outer bearing from clutch drum.
3. Remove snap ring for clutch backing plate. Remove backing plate.



- |                                 |   |
|---------------------------------|---|
| 1. HUB                          | 8. SEPARATOR DISC (TEETH OUTSIDE)                 |
| 2. RING                         | 9. PISTON   |
| 3. SPRING RETAINER              | 10. CLUTCH SHAFT, DRUM, AND GEAR FOR FOURTH SPEED |
| 4. SPRING                       | 11. BEARING                                       |
| 5. SEAL                         |   |
| 6. BACKING PLATE                |   |
| 7. FRICTION DISC (TEETH INSIDE) |   |

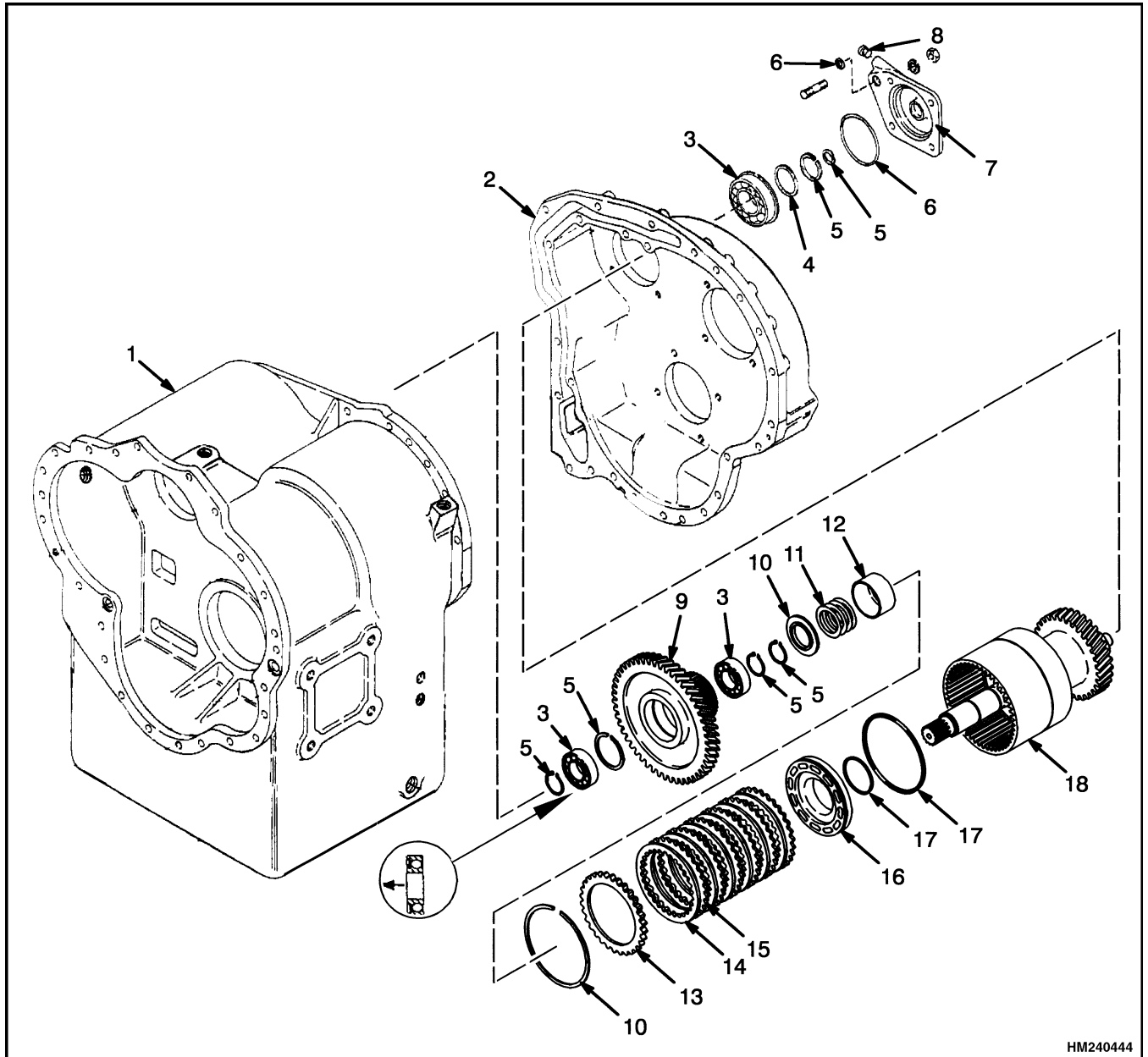
**Figure 8. Fourth-Speed Clutch**



- |                    |  |
|--------------------|--|
| 1. SPRING RETAINER | 9. FRICTION DISC (TEETH INSIDE)                  |
| 2. SPRING          | 10. SEPARATOR DISC (TEETH OUTSIDE)               |
| 3. RETAINING RING  | 11. PISTON                                       |
| 4. RING            | 12. SEAL   |
| 5. BEARING         | 13. CLUTCH SHAFT, DRUM, AND GEAR FOR THIRD SPEED |
| 6. GEAR AND HUB    |  |
| 7. SNAP RING       |  |
| 8. BACKING PLATE   |  |

4. Use a bearing puller to remove inner bearing for the third-speed gear. Remove snap ring for inner bearing.
5. Remove all friction and separator discs. Compress wave spring and remove retaining ring from its groove. Release wave spring and remove snap ring and retainer for the spring. Remove wave spring.
6. Remove clutch piston and seals.
7. Make sure the bleed valve is clean in the piston removed in Step 6. Install inner and outer seal rings on piston. Lock ring joint and apply grease to stabilize it in ring groove. Carefully position piston in drum without damaging seal rings.
8. Put retainer for wave spring, wave spring, wave spring retainer, and snap ring for retainer on shaft. Compress wave spring and install retainer ring for spring into groove of shaft. Make sure retainer ring is completely in groove.
9. Install snap ring for inner bearing on shaft. Install a separator disc (teeth on outside) in clutch drum.
10. Alternately install 12 friction discs and the other 11 separator discs in drum. The last disc must be a friction disc.
11. Install backing plate and snap ring in drum.
12. Install inner bearing for the third-speed gear. This bearing does not have an oil shield. Carefully install the third gear and hub. Make sure the hub splines engage the splines of all friction discs. To avoid damage, do not force the hub through the discs.
13. Install outer bearing of the third gear. This bearing has an oil shield. The oil shield must face away from the gear. Install retaining ring for bearing.
14. Install rear bearing on shaft. The groove in the bearing must be toward the end of the shaft. Install snap ring for bearing. Install oil seal ring in the groove near the end of the shaft. Use grease to hold the oil seal ring in place.

Figure 9. Third-Speed Clutch Assembly



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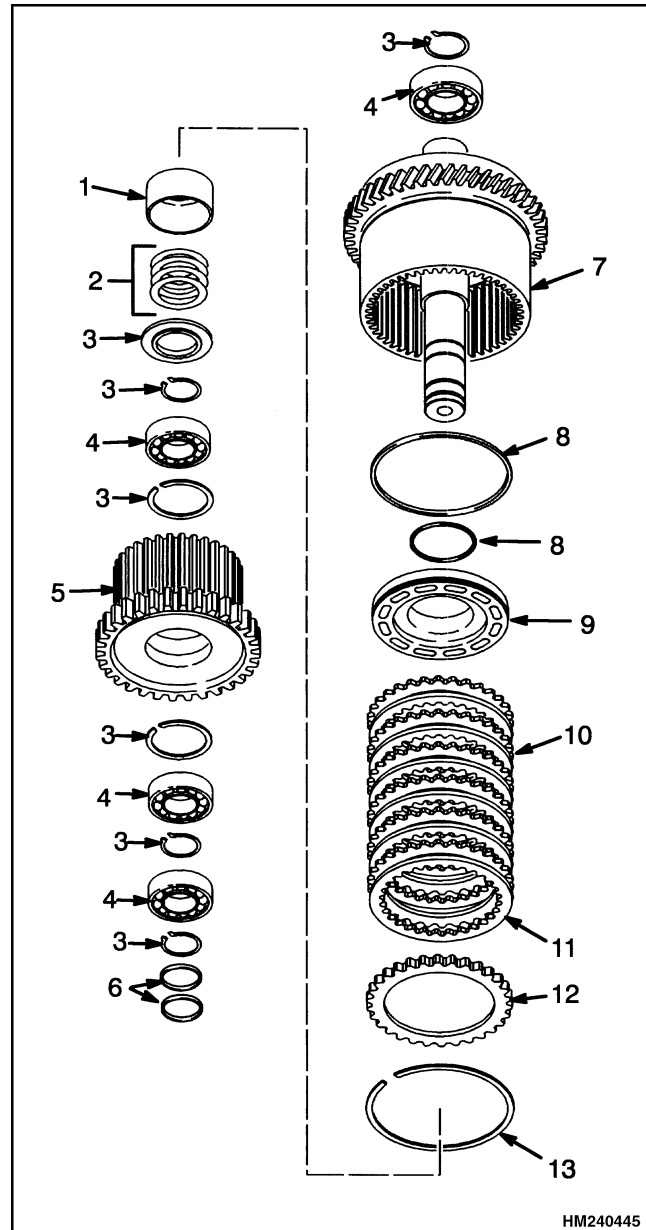
- |                         |                                    |
|-------------------------|------------------------------------|
| 1. TRANSMISSION HOUSING | 10. RETAINING RING                 |
| 2. REAR COVER           | 11. SPRING                         |
| 3. BEARING              | 12. SPRING RETAINER                |
| 4. WASHER               | 13. BACKING PLATE                  |
| 5. RING                 | 14. FRICTION DISC (TEETH INSIDE)   |
| 6. O-RING               | 15. SEPARATOR DISC (TEETH OUTSIDE) |
| 7. BEARING CAP          | 16. PISTON                         |
| 8. PLUG                 | 17. SEAL                           |
| 9. HUB AND GEAR         | 18. CLUTCH DRUM, SHAFT, AND GEAR   |

**Figure 10. Third-Speed Shaft**

## Forward Shaft and Clutch, Disassemble and Assemble

The following procedure describes the disassembly and assembly of the forward shaft and clutch (see Figure 11 and Figure 12):

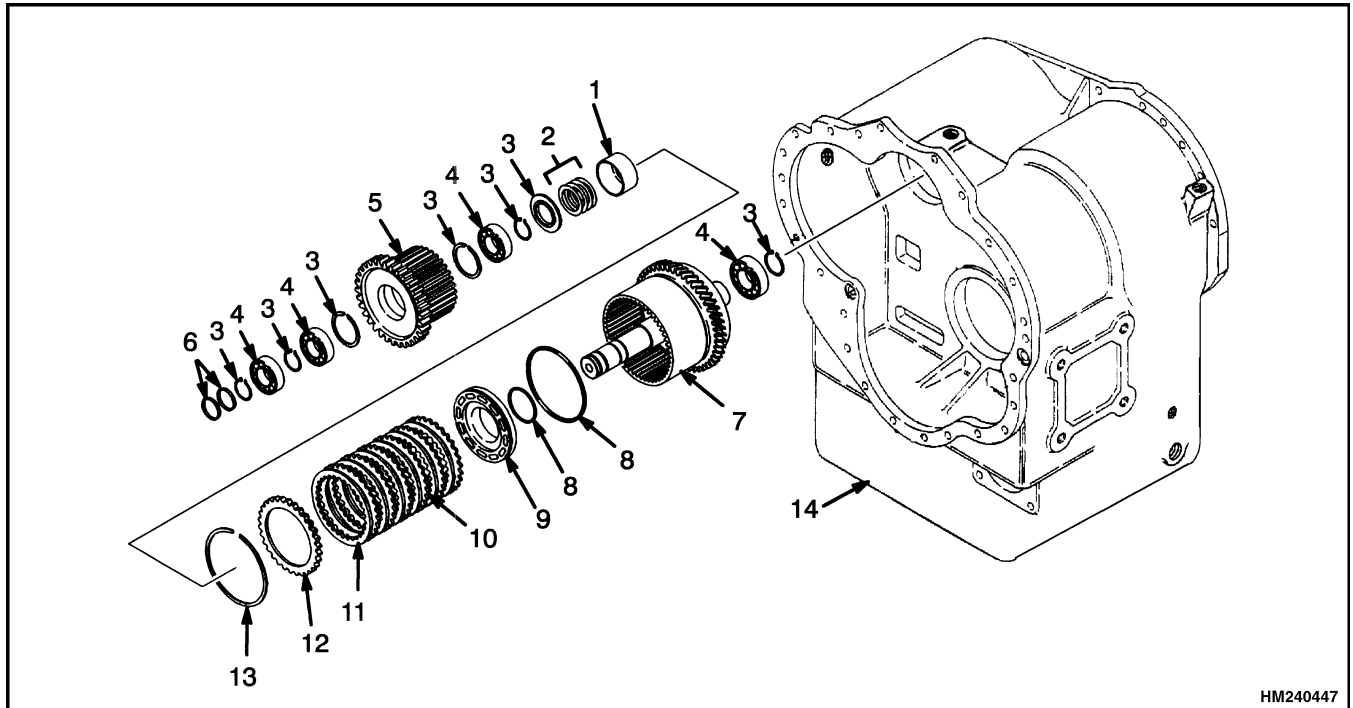
1. Remove piston rings from forward clutch shaft. Remove retainer ring for inner race of front bearing. Use prybars to remove bearing inner race. Remove retainer ring for outer bearing.
2. Use prybars to remove clutch gear/hub and outer bearing together.
3. Use a bearing puller to remove inner bearing for hub.
4. Remove retainer ring for clutch backing plate. Remove backing plate. **DO NOT LOSE THE BALL AND SPRING OF THE BACKING PLATE.** Remove all friction and separator discs.
5. Compress disc springs and remove retaining rings from grooves. Release disc springs and remove snap ring and retainer for spring. Remove disc springs. Make sure to keep these disc springs together and with the other clutch parts. Remove clutch piston and seals.
6. Remove retainer ring and thrust washer for rear bearing. Not all units have the thrust washer. Use a bearing puller to remove rear bearing.
7. Get a section of pipe that has approximately the same outer diameter as the bearing outer race. Use the pipe and a hammer or a press to install rear bearing. The groove in the bearing must be toward the end of the shaft. If installed, put thrust washer on shaft. Install retaining ring for rear bearing.
8. Install inner and outer seal rings on piston. Lock ring joint and apply grease to stabilize it in ring groove. Carefully position piston in drum without damaging seal rings.
9. Install one friction disc (teeth on inner diameter). Install one separator disc, then alternately install the other 10 friction discs and the other nine separator plates. The first and last clutch disc must be a friction disc. This is the sequence of installation when the clutch has an iron piston.



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|----------------------------|---------------------------------------|
| 1. RETAINER                | 8. SEAL                               |
| 2. SPRING                  | 9. PISTON                             |
| 3. RING                    | 10. SEPARATOR DISC<br>(TEETH OUTSIDE) |
| 4. BEARING                 | 11. FRICTION DISC<br>(TEETH INSIDE)   |
| 5. CLUTCH HUB AND<br>GEAR  | 12. BACKING PLATE                     |
| 6. PISTON RING             | 13. SNAP RING                         |
| 7. CLUTCH DRUM<br>AND GEAR |                                       |

*Figure 11. Forward Clutch Assembly*

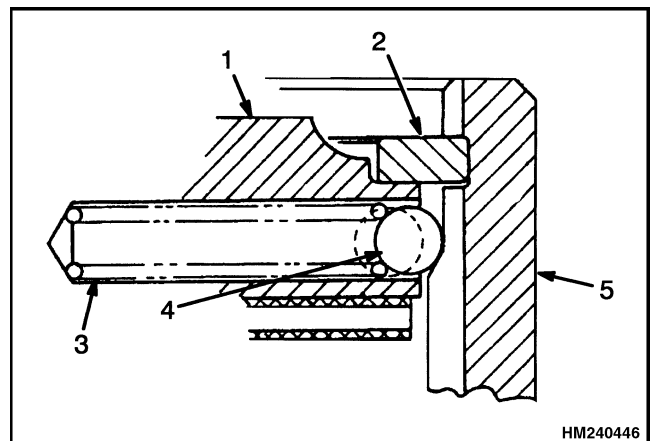


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- |                         |                                    |
|-------------------------|------------------------------------|
| 1. RETAINER             | 8. SEAL                            |
| 2. SPRING               | 9. PISTON                          |
| 3. RING                 | 10. SEPARATOR DISC (TEETH OUTSIDE) |
| 4. BEARING              | 11. FRICTION DISC (TEETH INSIDE)   |
| 5. CLUTCH HUB AND GEAR  | 12. BACKING PLATE                  |
| 6. PISTON RING          | 13. SNAP RING                      |
| 7. CLUTCH DRUM AND GEAR | 14. TRANSMISSION HOUSING           |

**Figure 12. Forward Clutch and Shaft Assembly**

10. Install detent spring and ball in backing plate. See Figure 13. Install backing plate in clutch drum making sure not to lose the spring or ball. Compress clutch discs and disc springs and install retainer ring for backing plate.
11. Install disc springs and retainer for piston. Make sure the disc spring with the large diameter is toward the piston.
12. Compress disc springs and install rings fully in grooves. Install inner bearing and ring. This bearing does not have a shield in it. Carefully install hub and gear in drum. Make sure hub splines engage splines of all friction discs. To avoid damage, do not force hub through the discs.



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|------------------|----------------|
| 1. CLUTCH PLATE  | 4. DETENT BALL |
| 2. RETAINER RING | 5. CLUTCH DRUM |
| 3. DETENT SPRING |                |

**Figure 13. Detent**