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PART 5
TRANSMISSION SYSTEMS

Chapter 1
9 x 3 GEAR TRANSMISSION — MODEL 1320-1520

A. DESCRIPTION AND OPERATION

The standard 9 x 3 gear transmission is a three range gearbox with each range having three forward and one reverse speed, for a total of nine forward and three reverse speeds, Figure 1.

Two gearshift levers control the operation of the transmission, Figure 2.

The range selector lever (1), Figure 2, controls operation of the range transmission.

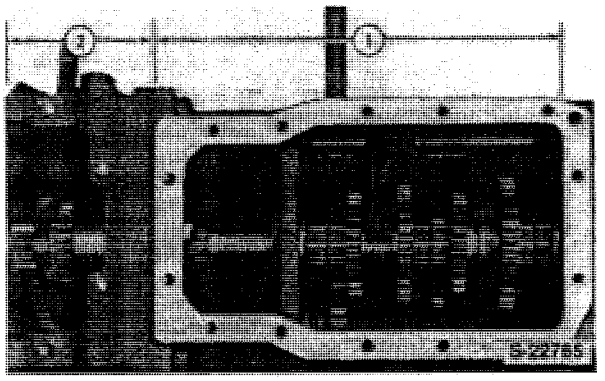

Figure 1
9 x 3 Gear Transmission — Model 1320-1520
1. Main Transmission Gearbox
2. Range Gearbox

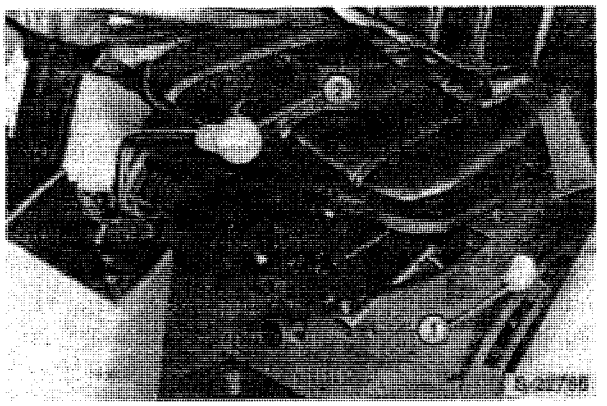

Figure 2
Shift Levers
1. Range Shift Lever
2. Main Shift Lever

The main shift lever (2), Figure 2, controls the three forward and one reverse speeds of the main transmission.

The transmission housing is a part of a common oil reservoir which provides gear lubricant for the differential and transmission and hydraulic system. The oil used is Ford 134B or equivalent.

The oil fill plug (1), Figure 3, is located on the rear of the hydraulic lift cover. The oil level check dipstick (2) is located on the transmission cover.

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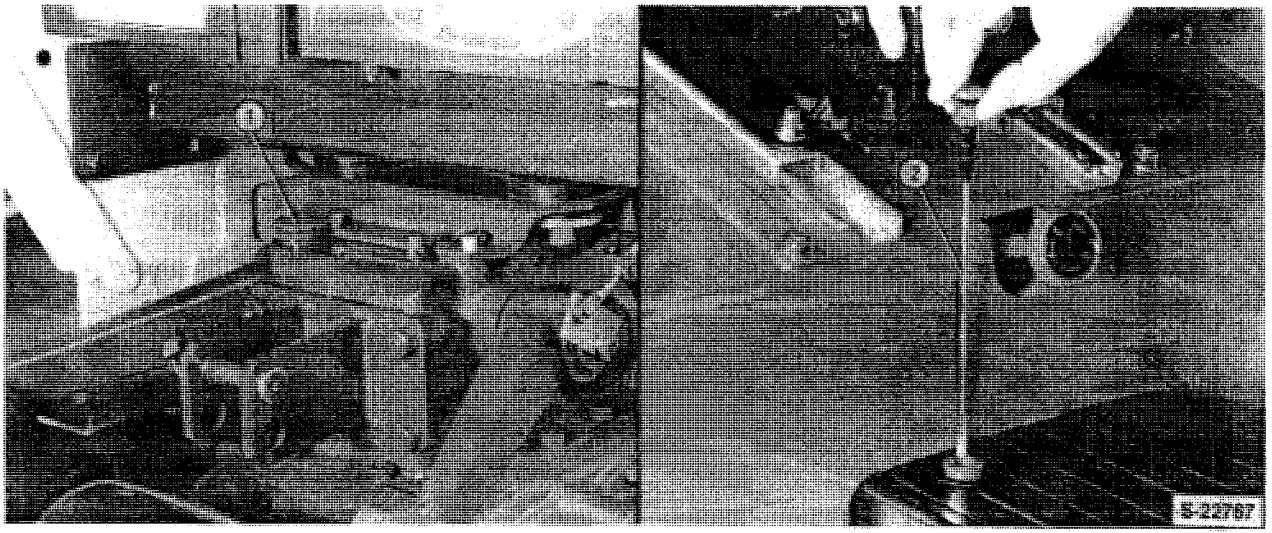

Figure 3
Transmission Hydraulic Rear Axle
Oil Fill and Level Check Location
1. Oil Filler Plug
2. Dipstick

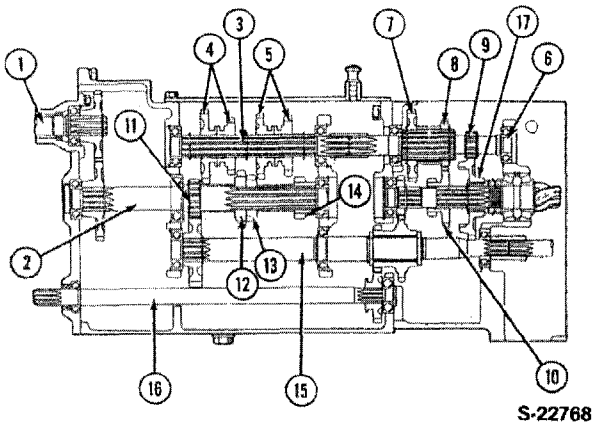

Figure 4
9 x 3 Gear Transmission — Cross-Sectional View and Identification

1. Input Shaft
2. Countershaft
3. Front Main Shaft
4. Sliding Gear (1-3)
5. Sliding Gear (2-R)
6. Rear Main Shaft
7. High Range Gear — Fixed
8. Mid-Range Gear — Fixed
9. Low Range Gear — Fixed
10. Sliding Gear (High, Middle, Low)
11. 1st Gear — Fixed
12. 3rd Gear — Fixed
13. 2nd Gear — Fixed
14. Reverse Gear — Fixed
15. PTO Countershaft
16. 4WD Drive Shaft
17. Low Range Gear — Fixed

A transmission cross-section view with gear identification is shown in Figure 4.

Power flows through the transmission are shown in Figures 5 through 16.

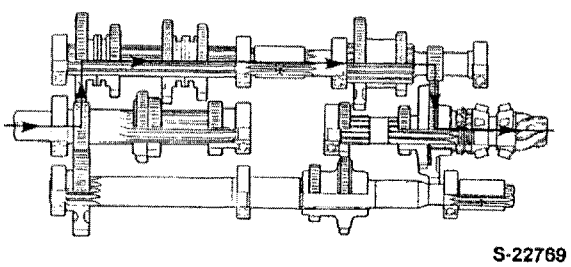

Figure 5
Power Flow — 1st Gear — Low Range

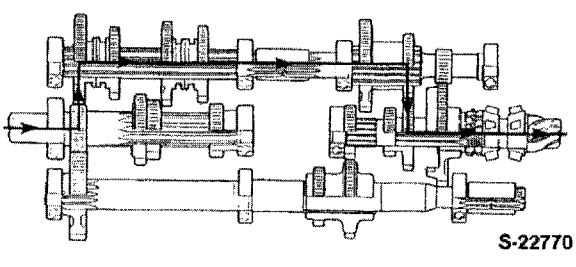

Figure 6
Power Flow — 1st Gear — Mid-Range

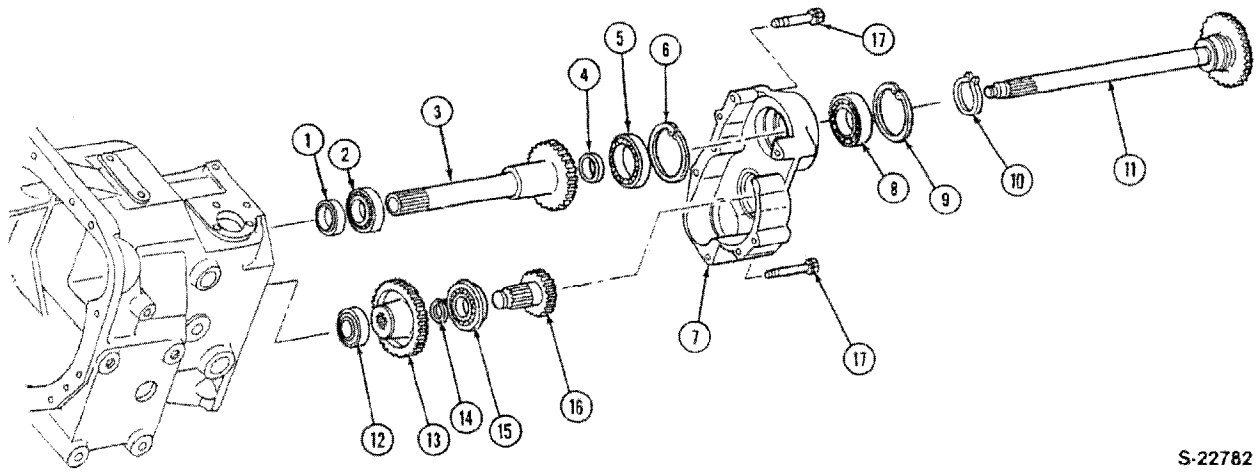

Figure 18
Input Shaft Removal (Double Clutch)

1. Seal
2. Bearing
3. Input Shaft (PTO)
4. Seal
5. Bearing
6. Snap Ring
7. Case
8. Bearing
9. Snap Ring
10. Snap Ring
11. Input Shaft (Trans.)
12. Bearing
13. Gear
14. Snap Ring
15. Bearing
16. Gear and Shaft Assy.
17. Bolts

2. Remove the snap ring (10) and remove the input shaft (11) from the case.

3. Withdraw the PTO input shaft (3) from the clutch housing.

4. Remove the bearing (12) and gear (13).

5. Remove the snap ring (14) and remove the shaft and gear asembly (16).

   NOTE: *On assembly, replace the seals (1) and (4) with new.*

MAIN GEAR SHIFTER ROD – REMOVAL
Reference – Figure 19

1. Remove the upper detent spring (6). Using a small pencil type magnet, remove the detent ball (7), Figure 19.

2. Drive the roll pin (5) out of the shift fork (3), Figure 19.

3. Remove the top shift rod (1), sliding it forward out of the housing. Remove the fork (3) and interlock (balk) pin (8).

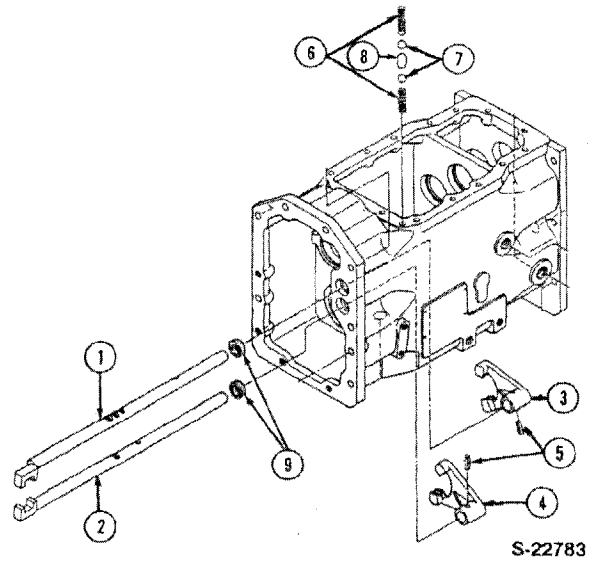

Figure 19
Main Gear Shift Rod Removal

1. Shifter Rod (2-R)
2. Shifter Rod (1-3)
3. Shifter Fork (2-R)
4. Shifter Fork (1-3)
5. Roll Pin
6. Detent Spring
7. Detent Ball
8. Balk Pin
9. Oil Seals

NOTE: *The lower shift rod must be in neutral position before the upper shift rod can be removed.*

4. Drive the roll pin out of the second shift rod (4) and slide the shift rod forward out of the housing.

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

5. Remove the lower detent ball (7) and spring (6), Figure 19.

MAIN SHAFT — REMOVAL
Reference — Figure 20

1. Remove the front snap ring (8), Figure 20.
2. Remove the snap rings (3) and (6) from the shaft grooves and place them toward the rear on the shaft.
3. Gently drive the main shaft forward while supporting the gears and snap rings and remove from the case.

REVERSE IDLER — REMOVAL
Reference — Figure 21

1. Remove the front snap ring (1), Figure 21.
2. Gently drive the idler shaft forward while supporting the counter gear and remove from the case.

COUNTERSHAFT — REMOVAL

1. Remove the bearing (1) and gear (2), Figure 22.
2. Remove the bearing retaining snap ring (4), Figure 23.
3. Gently drive the countershaft and front bearing forward and remove the rear bearing (11), fixed gears and spacer (7, 8, 9 and 10), Figure 23, from the shaft.
4. Remove the shaft and front bearing as an assembly from the case.

PTO COUNTERSHAFT — REMOVAL
Reference — Figure 24

1. If equipped with FWD, remove the snap ring (13) and remove the thrust washers, gear set, needle bearings and spacer (9-10-11 and 12), Figure 24.
2. Remove the snap ring (7) from the rear side of the center bearing bore, Figure 24.
3. Gently drive the PTO countershaft rearward.

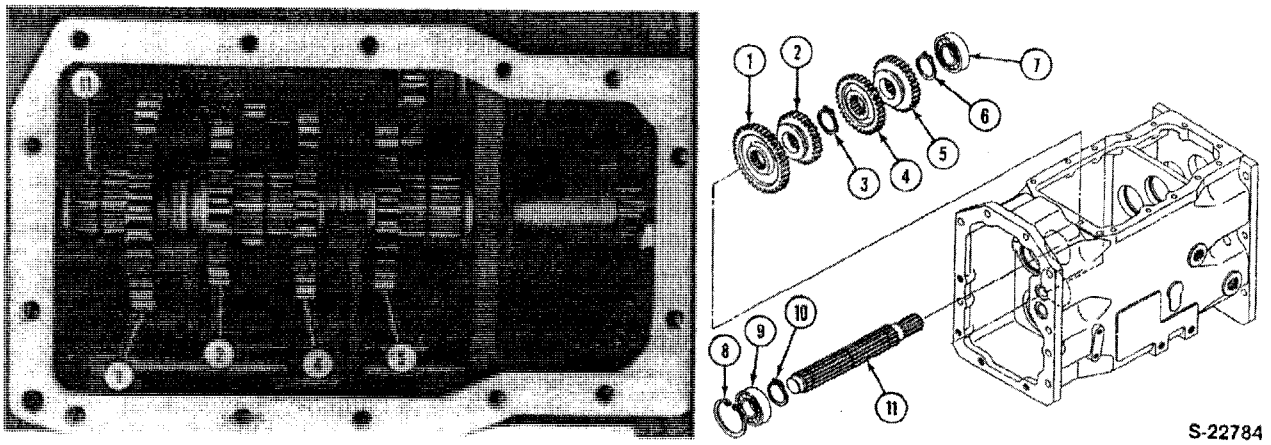

Figure 20
Main Shaft Removal

1. Sliding Gear (1st)
2. Sliding Gear (3rd)
3. Snap Ring
4. Sliding Gear (2nd)
5. Sliding Gear (Rev)
6. Snap Ring
7. Ball Bearing
8. Snap Ring
9. Ball Bearing
10. Snap Ring
11. Main Shaft

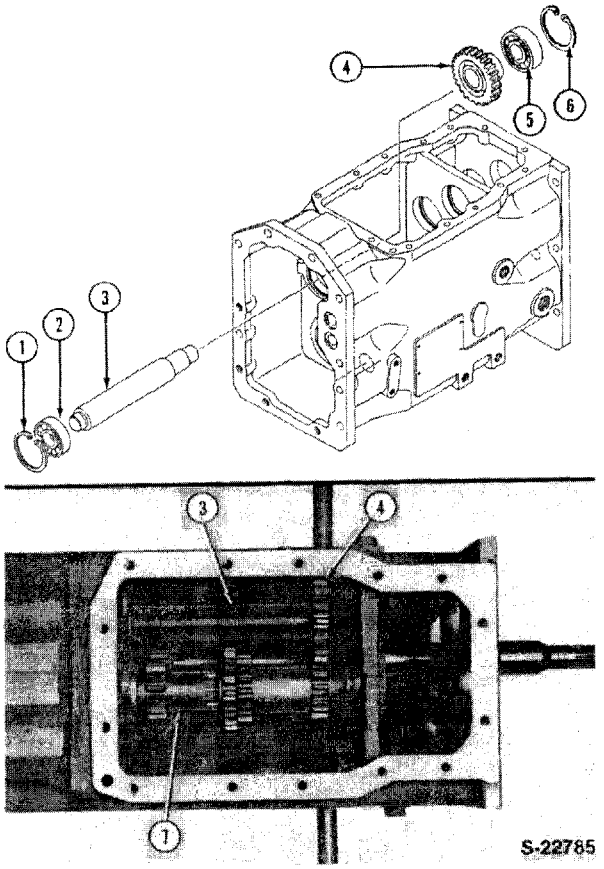

Figure 21
Reverse Idler Removal

1. Snap Ring
2. Ball Bearing
3. Reverse Idler Shaft
4. Counter Gear
5. Ball Bearing
6. Snap Ring
7. Countershaft

4. Remove the bearing (2) and gear (3) from the shaft, Figure 24.

4WD SHIFT ROD — REMOVAL
Reference — Figure 25

1. Drive the roll pin (11), Figure 25, out of the lever (7) and remove the lever.

2. Remove the shift rod (5) from the rear.

   NOTE: *Use care not to lose the detent ball and spring when separating the rod from the fork.*

3. Remove the shift fork (1) and arm (2) from the case.

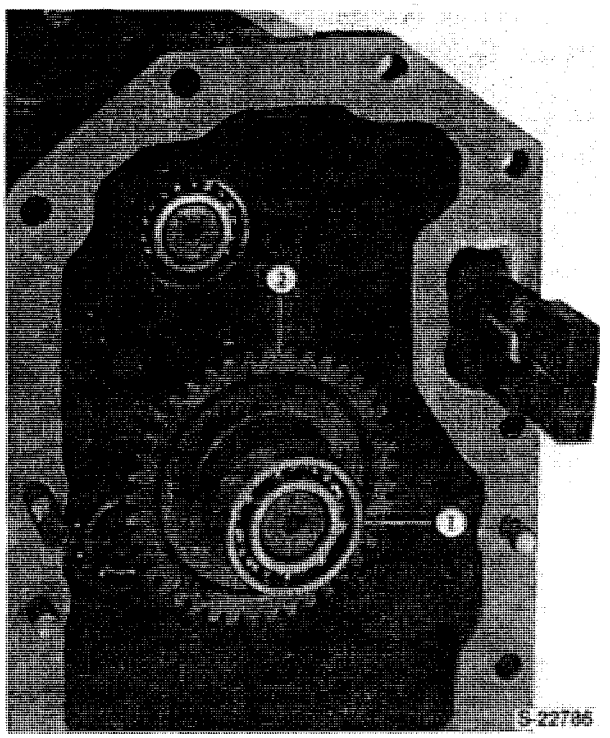

Figure 22
Countershaft Gear Removal

1. Bearing
2. Gear

4WD DRIVE SHAFT — REMOVAL
Reference — Figure 26

1. Gently drive the shaft (3), Figure 26, toward the front while supporting the sliding gear (4) and remove from the case.

2. Remove the seal (1) and bearing (2) from the case.

REAR MAIN SHAFT — REMOVAL
Reference — Figure 27

1. Release the snap ring (3) from the shaft groove and slide it to the rear on the shaft.

2. While sliding the gears (4 and 6) rearward on the shaft, gently drive the main shaft forward removing it from the case. Remove the bearings from the shaft as required.

3. Remove the snap ring (3), gears (4 and 6) and spacer collar (5).

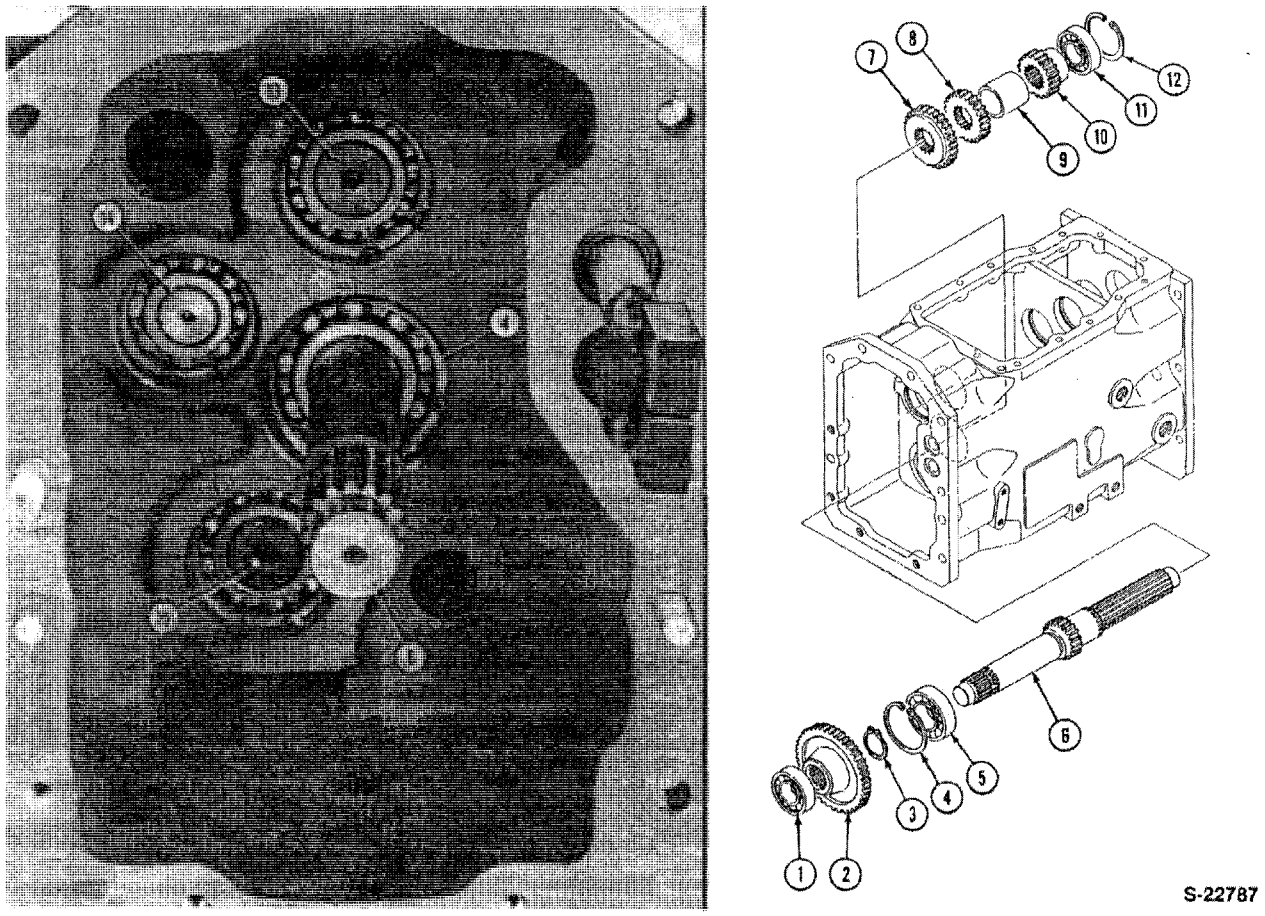

Figure 23
Countershaft Removal

1. Ball Bearing
2. Gear
3. Snap Ring
4. Snap Ring
5. Ball Bearing
6. Countershaft
7. 3rd Gear — Fixed
8. 2nd Gear — Fixed
9. Collar
10. Reverse Gear — Fixed
11. Ball Bearing
12. Snap Ring
13. Main Shaft
14. Reverse Idler Shaft
15. PTO Countershaft

RANGE GEAR SHIFTER ROD — REMOVAL

Reference — Figure 28

1. Drive the roll pin (10) out of the lever (11) and remove the lever, Figure 28.

2. Pull the shift rod (7) forward and remove it from the front of the case.

   NOTE: *Use care to not loose the detent ball and spring when the rod is separated from the fork.*

3. Remove the shift fork (3).

4. Remove the retaining plate (8) and remove the shifter arm (1).

DRIVE PINION — REMOVAL

Reference — Figure 29

- Remove the differential assembly from the rear axle center housing.

  See "Differential — Rear Axle and Brakes," Part 7 and 12.

1. Straighten the lock washer tabs (15) and loosen the two locknuts (14).

2. Release the snap ring (8) from the shaft groove and slide it forward on the shaft.

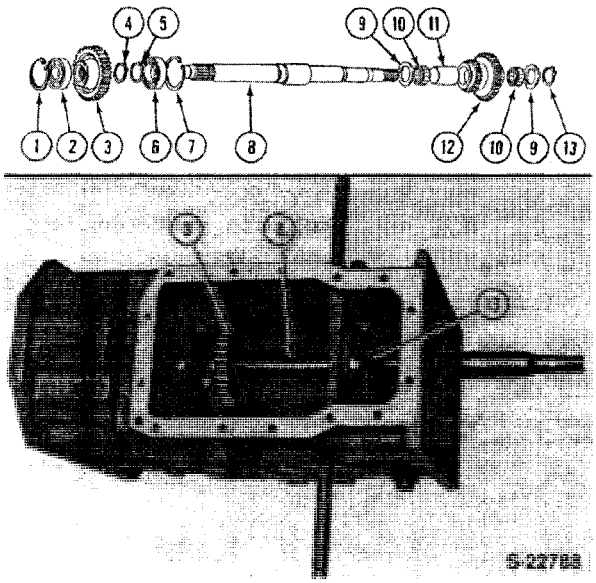

Figure 24
PTO Countershaft Removal

1. Snap Ring
2. Ball Bearing
3. Fixed Gear
4. Snap Ring
5. Snap Ring
6. Bearing
7. Snap Ring
8. Countershaft
9. Thrust Washer (2)
10. Needle Bearings (2)
11. Spacer
12. Gear
13. Snap Ring

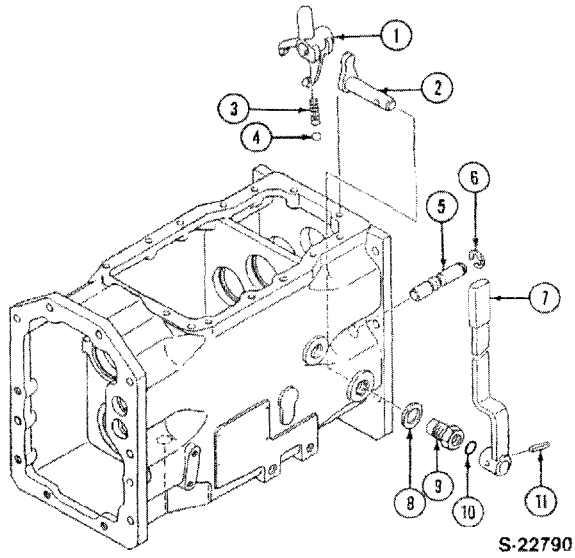

Figure 25
4WD Shift Linkage Removal

1. Shifter Fork
2. Shifter Arm
3. Detent Spring
4. Detent Ball
5. Shifter Rod
6. Snap Ring
7. Change Lever
8. Seal Washer
9. Shift Guide
10. O-Ring
11. Roll Pin

3. While moving the pinion gear rearward, remove the bearing (6), gear (7), snap ring (8), sliding gear (9), second snap ring (8), thrust washer (10) and gear and bushing assembly (11), Figure 29.

4. Remove the drive pinion assembly from the rear.

5. Remove the coupling, locknuts, lock washer and bearing (13-16), Figure 29.

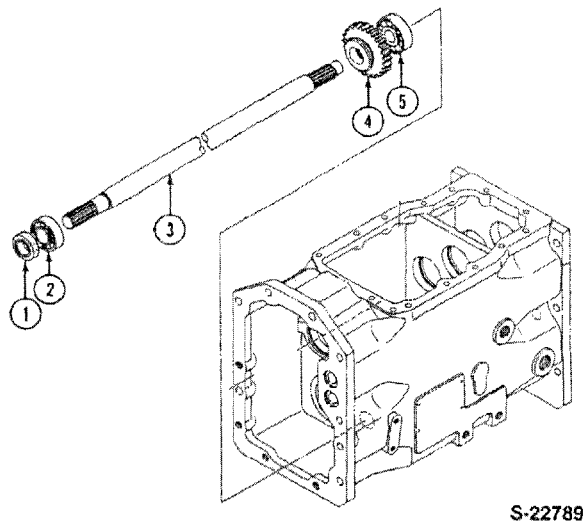

Figure 26
4WD Drive Shaft Removal

1. Oil Seal
2. Ball Bearing
3. 4WD Drive Shaft
4. Slide Gear A
5. Ball Bearing

INSPECTION

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

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.

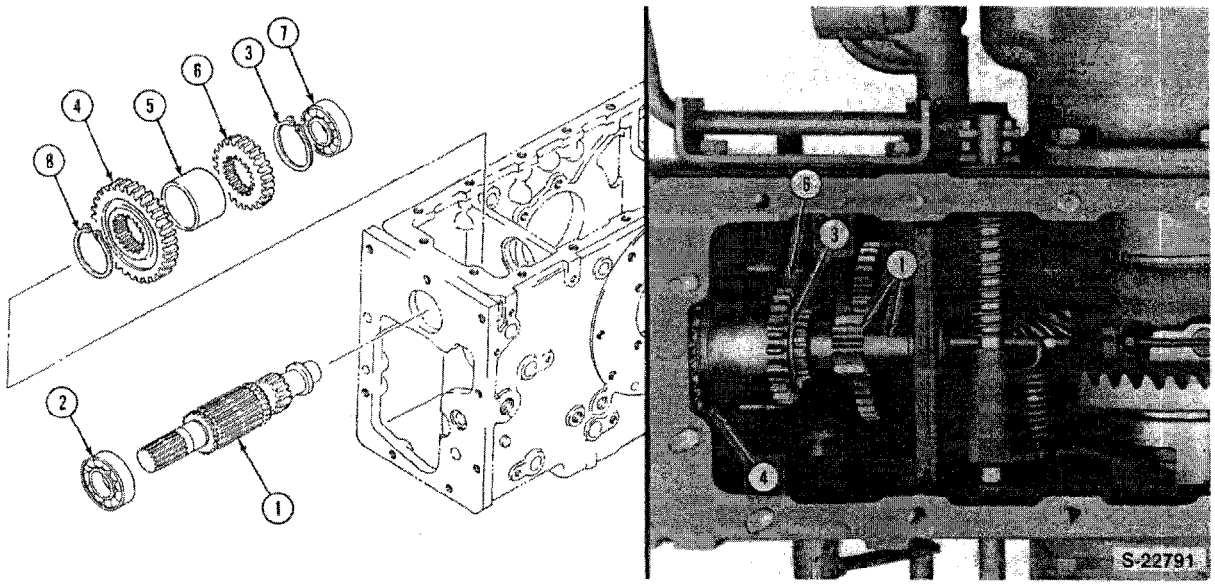

Figure 27
Rear Main Shaft Removal

1. Main Shaft
2. Ball Bearing
3. Snap Ring
4. Fixed Gear (High Range)
5. Collar
6. Fixed Gear (Mid-Range)
7. Ball Bearing
8. Snap Ring

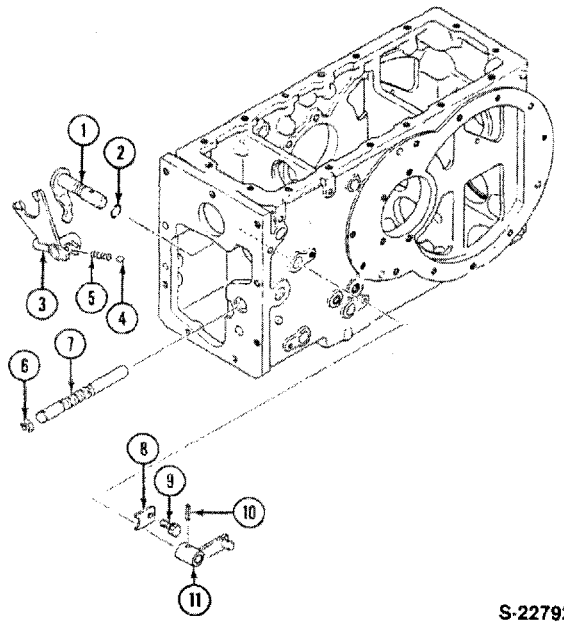

Figure 28
Range Gear Shift Rod Removal

1. Shift Arm
2. O-Ring
3. Shifter Fork
4. Detent Ball
5. Detent Spring
6. Snap Ring
7. Shifter Rod
8. Retaining Plate
9. Bolt
10. Roll Pin
11. Change Lever

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 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

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

2. Install new gaskets and seals during assembly.

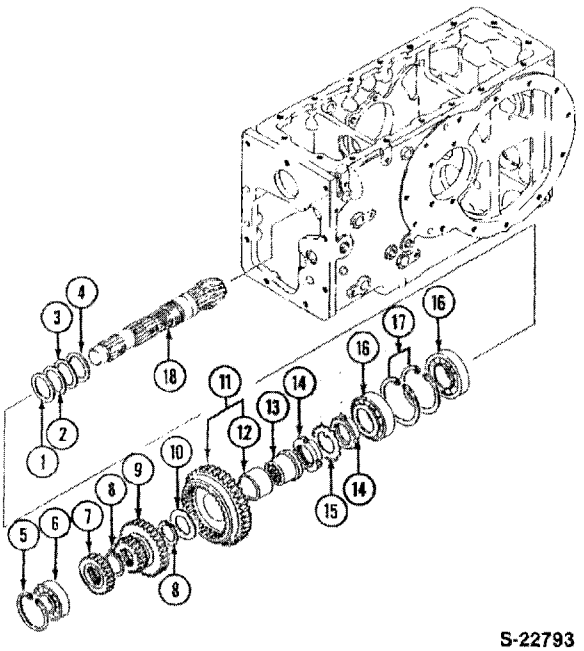

Figure 29
Drive Pinion Removal

1. Shim 0.1T
2. Shim 0.2T
3. Shim 0.5T
4. Thrust Washer
5. Snap Ring
6. Ball Bearing
7. Fixed Gear (4WD)
8. Snap Ring
9. Range Slide Gear
10. Thrust Washer
11. Gear Assy.
12. Bushing
13. Coupling
14. Locknut
15. Lock Washer
16. Ball Bearing
17. Snap Ring
18. Drive Pinion

DRIVE PINION – ASSEMBLY

Install the drive pinion components, Figure 29.

See Part 7, Chapter 1, Section B.

RANGE GEAR SHIFTER ROD – ASSEMBLY
Reference – Figure 28

1. Using a new o-ring, install the shift arm and retaining plate.

2. Install the shift rod and fork with detent ball and spring in place.

3. Position the lever on the shift arm and install the roll pin.

REAR MAIN SHAFT – ASSEMBLY
Reference – Figure 27

1. Install the rear main shaft with the fixed gears, snap rings, spacer and bearings as shown, Figure 27.

4WD DRIVE SHAFT – ASSEMBLY
Reference – Figure 26

1. Install the drive shaft from the front end with the sliding gear and bearings as shown, Figure 26.

2. Using a suitable driver, install the oil seal.

4WD SHIFTER ROD – ASSEMBLY
Reference – Figure 25

1. Install the shifter arm in the transmission.

2. Using a new sealing washer and o-ring install the shift arm guide.

3. Install the shift rod and fork with detent spring and ball as shown, Figure 25.

4. Position the lever on the shifter arm and install the roll pin.

PTO COUNTERSHAFT – ASSEMBLY
Reference – Figure 24

1. Position the PTO countershaft in the case from the rear while positioning the snap rings, thrust washer, gears and bearing on the shaft as shown, Figure 24.

   NOTE: *Counter gear (12) and related components is used with 4WD only.*

COUNTERSHAFT – ASSEMBLY
Reference – Figure 23

1. Install the countershaft from the front end while positioning gears, collar, snap rings, and bearings as shown, Figure 23.

REVERSE IDLER — ASSEMBLY
Reference — Figure 21

1. Install the reverse idler shaft from the front while positioning the gear, bearings and snap ring as shown, Figure 21.

MAIN SHAFT — ASSEMBLY
Reference — Figure 20

1. Install the main shaft from the front while positioning the sliding gears, snap rings and bearings as shown, Figure 20.

MAIN GEAR SHIFTER ROD — ASSEMBLY
Reference — Figure 19

1. Using a suitable driver, install new oil seals (9) in the shift rod case bores.
2. Install the shift rods, forks and detent springs, balls and balk pin as shown, Figure 19.
3. Install the roll pins securing the shift forks to the rods.

C. SHIFT LEVERS

The transmission utilizes two shift levers.

The main transmission shift lever is mounted on the steering column and controls the three forward and one reverse main gear speeds, Figure 30.

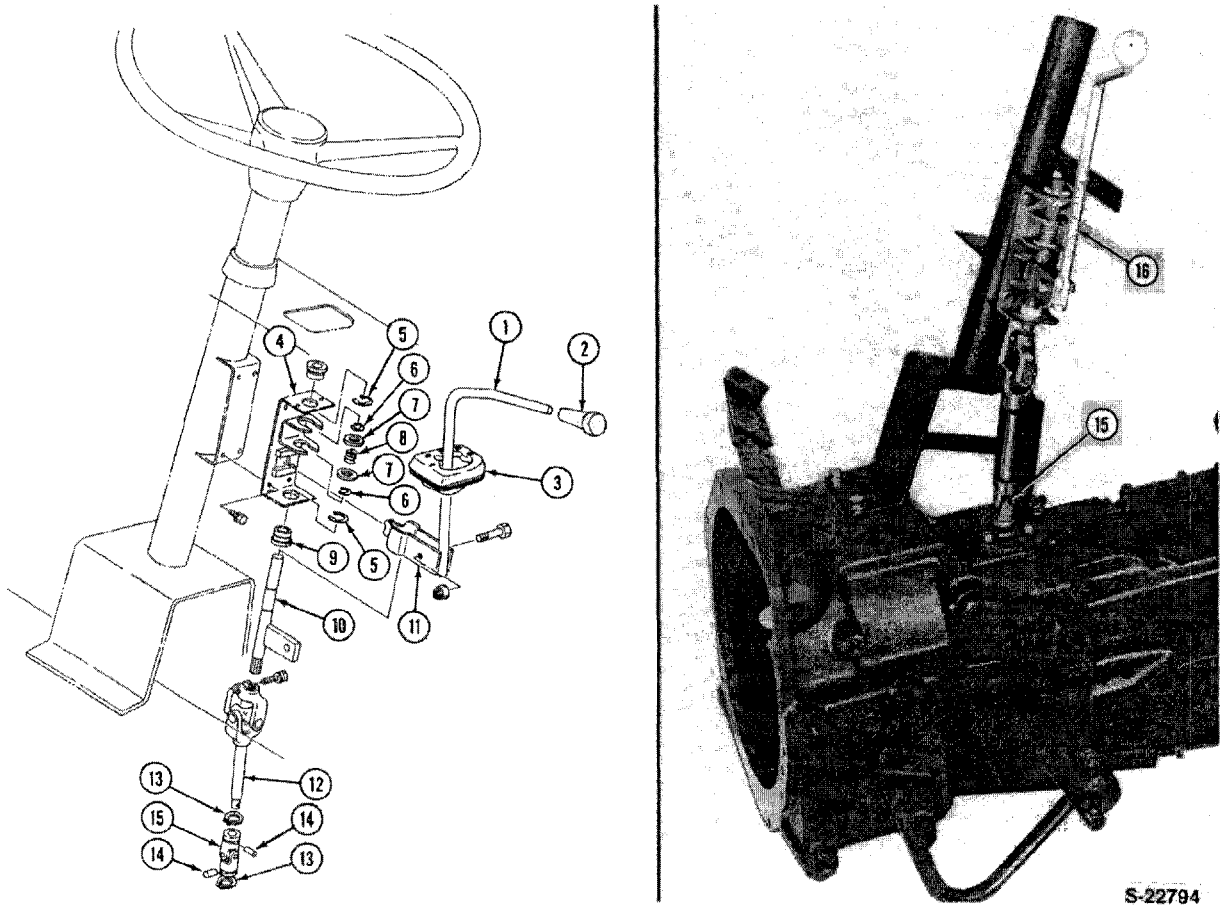

Figure 30
Main Gear Shift Lever Linkage

1. Lever
2. Grip
3. Rubber
4. Holder
5. Snap Ring
6. Snap Ring
7. Washer
8. Spring
9. Bushing
10. Shaft
11. Link Assy.
12. Universal and Shaft Assy.
13. Snap Ring (2)
14. Pin (2)
15. Universal Joint
16. Main Gear Shift Linkage Assy.