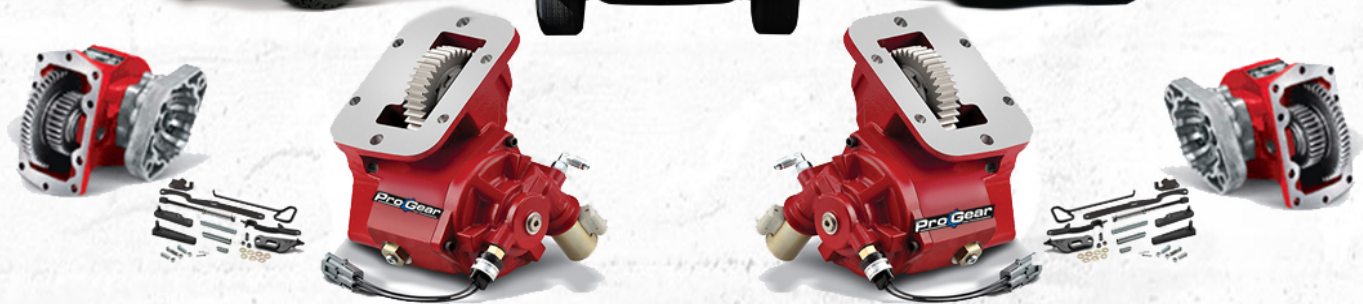




Mack Transmission T2090 Manual

Pro Gear's Mack Transmission T2090 Manual to assist in identifying the parts for your Mack Transmission unit.

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On T2090
T2090/T2100



TRANSMISSIONS

SERVICE MANUAL

FEBRUARY 1984

MACK TRUCKS, INC.

10-200(9,10)

Pro Gear and Transmission • 906 W. Gore St. Orlando, FL 32805 • 1 (877) 776-4600 / (407) 872-1901 • parts@eprogear.com

ADDENDUM

to the T2090 / T2100

Mack Transmission

Service Manual



1985

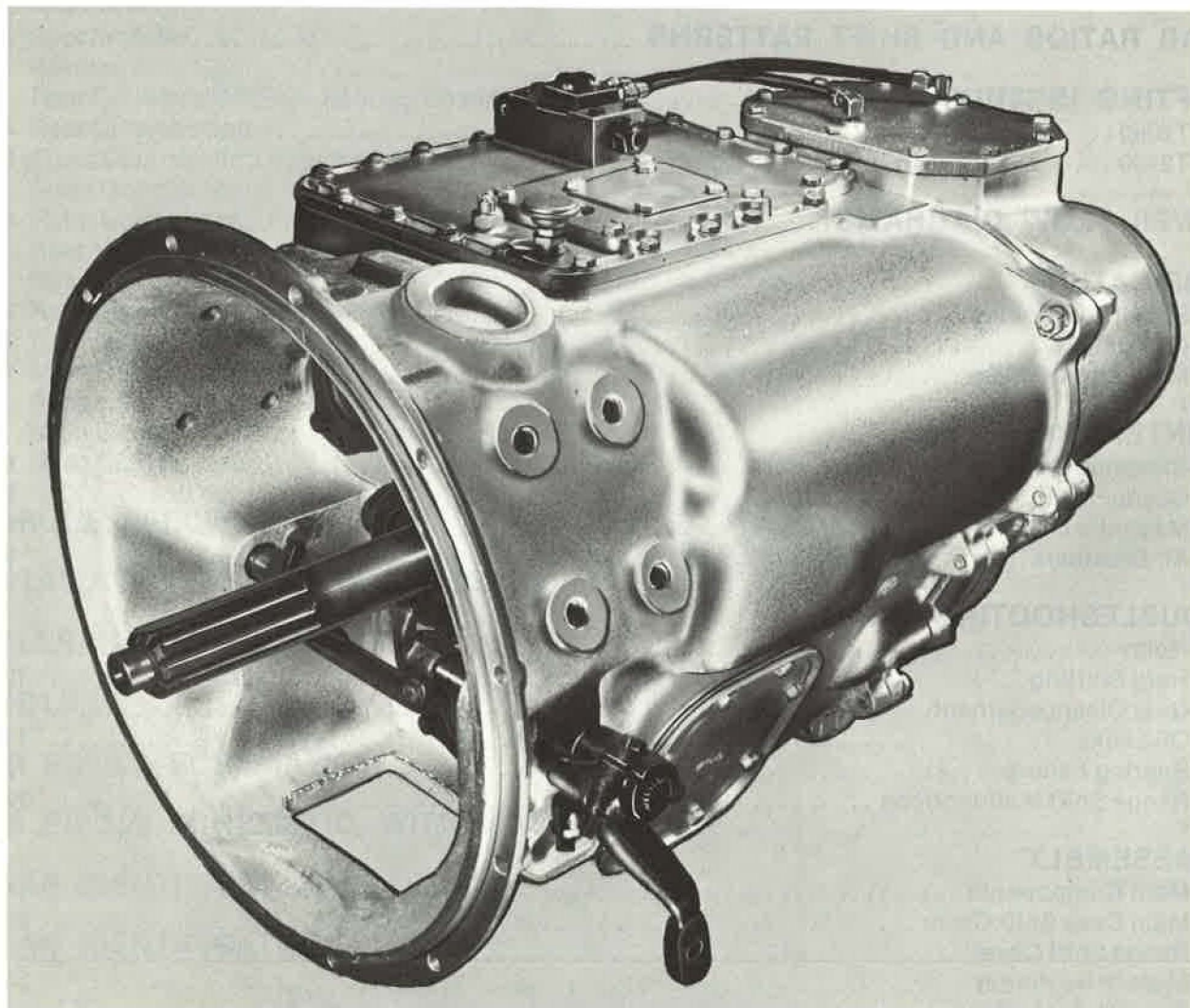
1984

The yellow pages at the end of this manual contain important information concerning improvements in the T2090/T2100 transmissions.

Be sure to familiarize yourself with this Addendum, so that you can service these transmissions using the latest information.

T2090/T2100

MACK TRANSMISSIONS



**TRIPLE COUNTERSHAFT,
MAXI-TORQUE, RANGE-TYPE
TRANSMISSIONS**

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NOTE

The illustrations contained in this publication are typical, and not necessarily exact. When working on these transmissions, the mechanic may find small differences between his unit and the illustrations.

EXPLANATION OF ADVISORY LABELS

The following labels will be used in this publication. An understanding of their use, as given below, will aid the reader.

NOTE

A procedure, condition, etc., which it is essential to emphasize.

CAUTION

Procedures, practices, etc., which if not strictly observed, will result in damage to equipment.

WARNING

Procedures, practices, etc., which will result in personal injury or loss of life if not correctly followed.

SERVICE HINT

A helpful suggestion which will make the servicing being performed a little easier and/or faster.

TRANSMISSION IDENTIFICATION

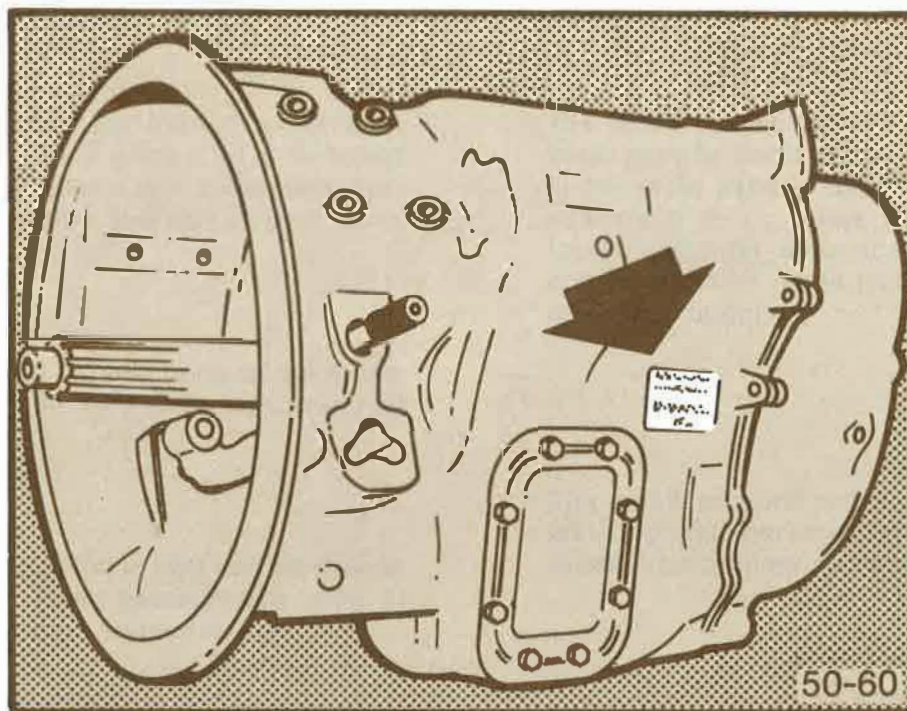


Figure 1. Location of Identification Stamping on Left Side of Main Case

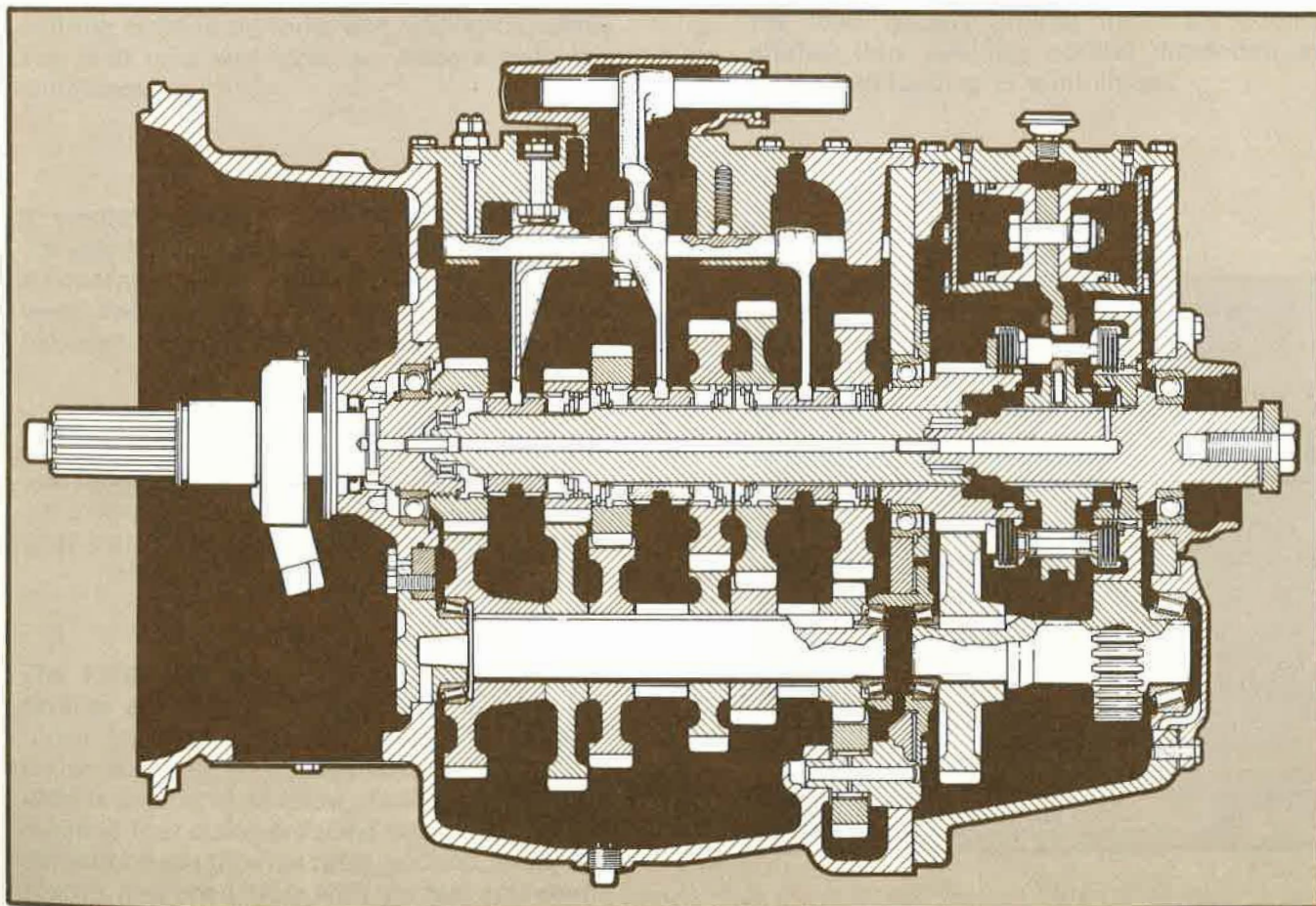


Figure 2. Cutaway View of T2090/2100 Transmission

NOTES

T2090 and T2100

MACK MAXITORQUE TRANSMISSIONS

DESCRIPTION

These transmissions are triple countershaft, range-type units. They consist of a compact main box gear set, plus a rear compound (auxiliary) which contains the range shift components.

The main case and the bell housing are a one-piece casting, made from aluminum, and heat treated for strength.

The bearings are housed in cast iron bearing retainers. Tapered roller bearings are used at both ends of the three countershafts.

All gears are of the spur type design and are in constant mesh with their mating gears. All shifting is done by forks and sliding clutches. The shift rails and forks are integral with the shift cover.

A single gear shift lever is provided, and a "double-H" shift pattern is used. In addition, an air-operated valve is mounted on the gear shift lever, and is used to shift the rear compound between Lo range and Hi range.

The range shift is preselected by the driver, and an interlock prevents range-shifting until the gear shift lever passes through neutral.

The T2090 has nine forward speeds and two reverse speeds. The main case contains five forward speeds and reverse gear. The rear case contains the range shift. One ratio in the main case is used only as a low starting ratio. The remaining four ratios are used once with the rear compound in Lo range (first, second, third, and fourth), and once more with the rear compound in Hi range (fifth, sixth, seventh, and eighth).

The T2100 has ten forward speeds and two reverse speeds. Each of the five forward speeds in the main case is used once with the rear compound in Lo range (first, second, third, fourth, and fifth), and once more with the rear compound in Hi range (sixth, seventh, eighth, ninth, and tenth).

The rear compound range shift is accomplished using plate-type synchronizer, shifted by an internal air cylinder and a shift fork.

The three countershafts are equally spaced around the mainshafts. This design distributes the load equally among the three countershafts, thus keeping normal deflection and gear tooth loading to a minimum.

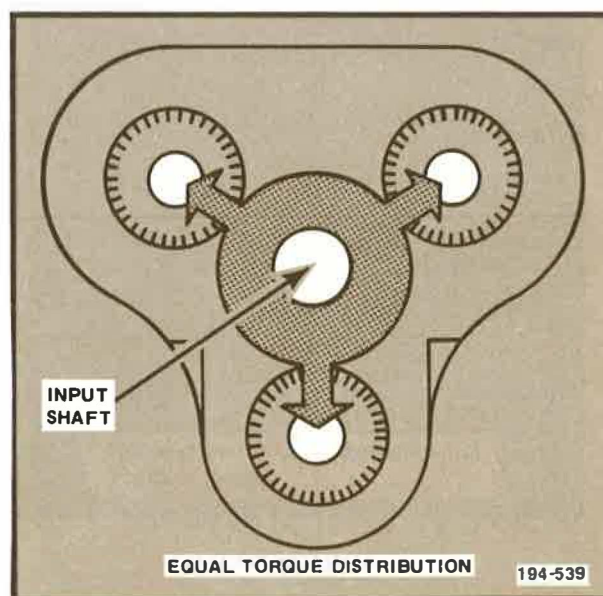


Figure 3. Equal Torque Distribution

SPECIFICATIONS

Make	Mack Trucks, Inc.
Type	Range Type, Triple Countershaft, Overdrive
Controls	Selective, One Lever Manual, with Air Shifted Rear Compound Range Shift
Range Shift Synchronizer	Plate Type, Four Friction Discs each for Hi and Lo Range
Speeds, T2090	Nine Forward, Two Reverse
Speeds, T2100	Ten Forward, Two Reverse
Bell Housing	SAE #1, Integral with Main Case
Cases	Cast Aluminum, Heat Treated
Gears	Spur Type
Shaft Splines	Fine Pitch Rolled Involute
Lubrication	Splash, plus Positive Displacement Oil Pump
Oil Filter	Integral, Magnetic
Drain Plug	Magnetic
P.T.O. Openings:	
Left side	Std. SAE 8 bolt
Right side	Std. SAE 6 bolt
Oil Capacity	Approximately 24 pints, depending on angle of installation in chassis
Oil Type	Mack GO-G Gear Oil: SAE 80W90, 80W140, 85W140 (listed in order of preference)

GEAR RATIOS AND SHIFT PATTERNS

MAIN BOX			REAR COMPOUND		
T2090			T2090		
R	$\frac{5}{1}$	$\frac{7}{3}$			
LO	$\frac{6}{2}$	$\frac{8}{4}$			
R - REVERSE N - NEUTRAL					
T2090					
GEAR (Main Box)	RANGE (REAR COMPOUND)	RATIO			
LO	LO	10.69			
1		7.45			
2		5.33			
3		3.84			
4		2.73			
R		10.92			
(LO)	HI	(2.78)			
5		1.94			
6		1.39			
7		1.00			
8		.71			
(R)		(2.84)			
Ratios shown in parentheses are not practical to use.					

MAIN BOX			REAR COMPOUND		
T2100			T2100		
R	$\frac{7}{2}$	$\frac{9}{4}$			
$\frac{6}{1}$	$\frac{8}{3}$	$\frac{10}{5}$			
R - REVERSE N - NEUTRAL					
T2100					
GEAR (Main Box)	RANGE (REAR COMPOUND)	RATIO			
1	LO	8.52			
2		6.50			
3		4.99			
4		3.84			
5		2.94			
R		11.76			
6	HI	2.22			
7		1.70			
8		1.30			
9		1.00			
10		.77			
(R)		(3.06)			
Ratios shown in parentheses are not practical to use.					

T2090 SHIFTING INSTRUCTIONS

The T2090 is a range shifted transmission with eight forward highway speeds and an extra low gear (in the Lo range). Lo and Hi ranges are controlled by an air shift control button. Under normal highway conditions, push the button down while shift lever is in neutral and shift the transmission into first gear (see shift pattern). Shift through second, third and fourth, double clutching as you go. To continue, while still in fourth gear, pull air shift control button up and then move shift lever through neutral to fifth gear (first position in Lo range). As the shift lever passes through neutral, the air shift will be completed to high range. Now continue (double clutching) through sixth, seventh and eighth.

The extra low gear in Lo range was designed for off highway use such as paving, material spreading and heavy load/steep grade conditions.

CAUTION

Do not move the air shift control button while moving in reverse. Also, when the truck is stationary, do not shift into Hi-Range and then start moving the truck. Damage to the synchronizer may result.

To down shift the T2090, shift from eighth to seventh, sixth and fifth (don't forget to double clutch between gears). While still in fifth gear, push the air control button to Lo. As you shift through neutral, the range shift to Lo will be completed. Move the shift lever to fourth, third, second and first.

CAUTION

Be careful not to overspeed the engine during downshifting. Damage to drive-line components may be the result.

T2100 SHIFTING INSTRUCTIONS

The T2100 is a range shifted transmission with ten forward highway speeds. Lo and Hi ranges are controlled by an air shift control button. The T2100 is designed for highway travel.

With shift lever in neutral, push the shift control button down and shift the transmission into first gear (see shift pattern). Shift up through second, third, fourth and fifth, double clutching between gears. When maximum rpm has been reached in fifth pull the air control button up and then shift to sixth (first gear in Lo range). Your shift lever when passing through neutral will put you in Hi range. Now follow the normal sequence (seventh, eighth, ninth and tenth) double clutching your way to high gear.

CAUTION

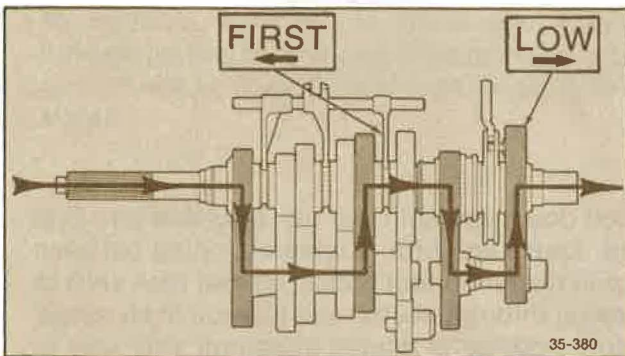
Do not move the air shift control button while moving in reverse. Also, when the truck is stationary, do not shift into Hi-Range and then start moving the truck. Damage to the synchronizer may result.

To downshift the T2100, go from tenth on down through Hi range (ninth, eighth, seventh and sixth). While still in sixth gear, push down on air shift control button and then move the shift lever through neutral to fifth (the move through neutral again activates the air shift mechanism, this time to Lo range) then fourth, third, second and first. Double clutch between all gears.

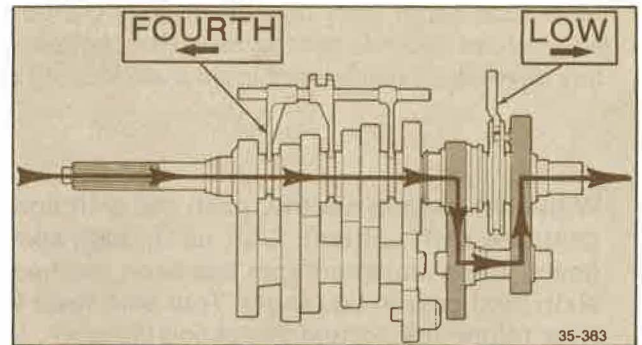
CAUTION

Be careful not to overspeed the engine during downshifting. Damage to driveline components may be the result.

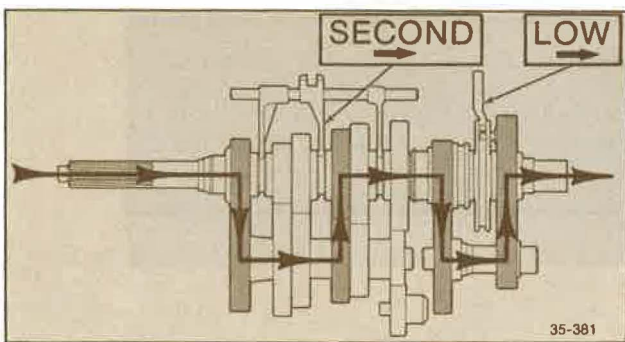
POWER FLOW DIAGRAMS



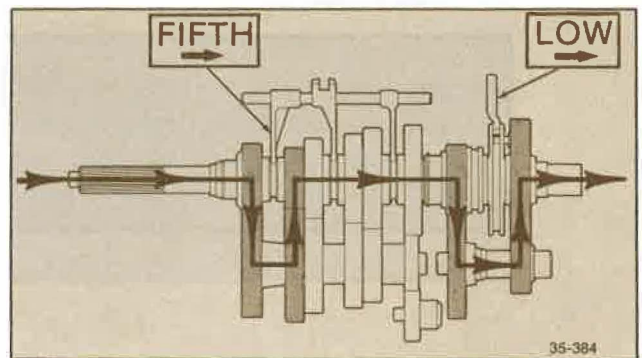
T2100: First Speed Gear
(T2090: Lo Speed Gear)



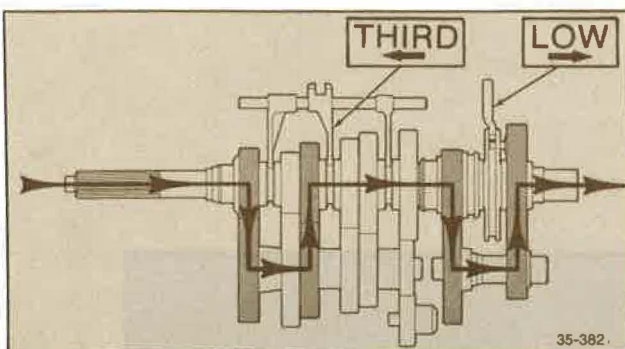
T2100: Fourth Speed Gear
(T2090: Third Speed Gear)



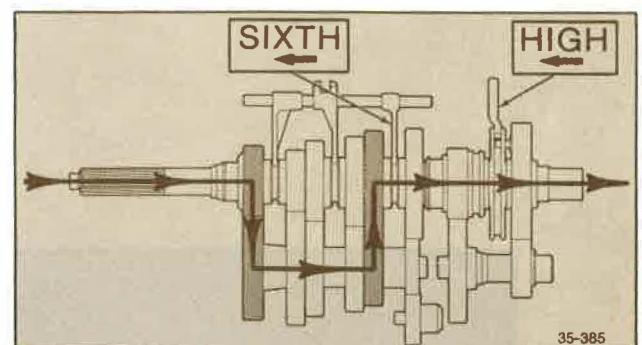
T2100: Second Speed Gear
(T2090: First Speed Gear)



T2100: Fifth Speed Gear
(T2090: Fourth Speed Gear)

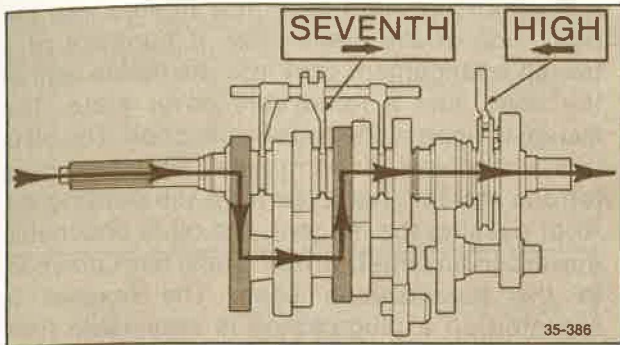


T2100: Third Speed Gear
(T2090: Second Speed Gear)

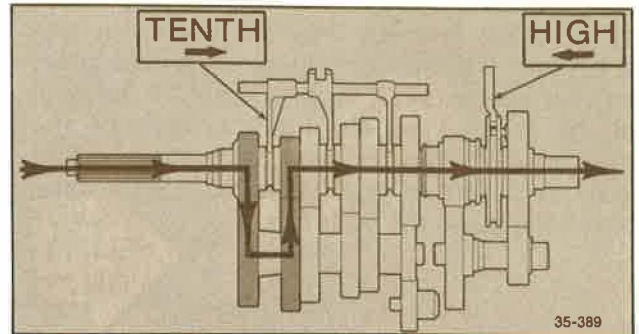


T2100: Sixth Speed Gear
(T2090: Not Used)

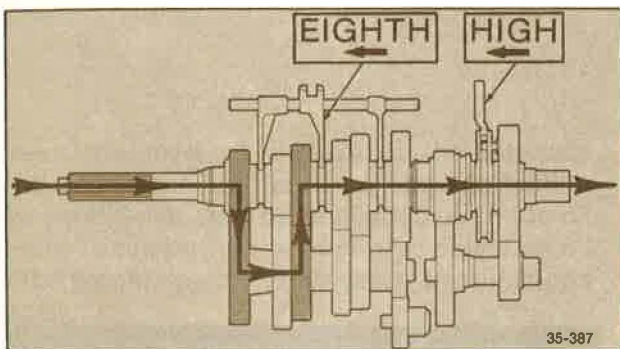
POWER FLOW DIAGRAMS



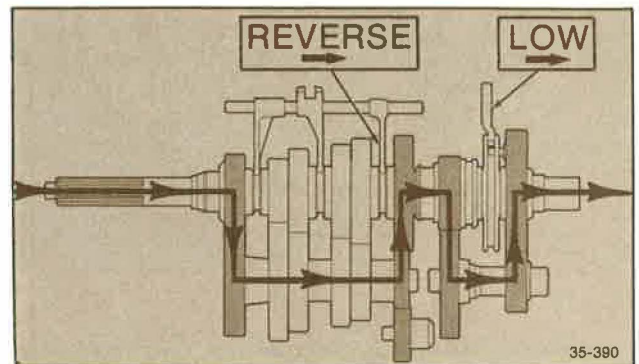
T2100: Seventh Speed Gear
(T2090: Fifth Speed Gear)



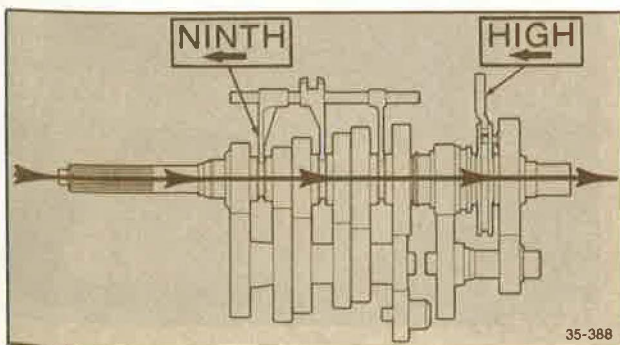
T2100: Tenth Speed Gear
(T2090: Eighth Speed Gear)



T2100: Eighth Speed Gear
(T2090: Sixth Speed Gear)



T2100: Reverse Speed Gear
(T2090: Reverse Speed Gear)



T2100: Ninth Speed Gear
(T2090: Seventh Speed Gear)

LUBRICATION

Splash Lubrication

All parts inside the transmission are lubricated by a splash system. Only the lower countershaft dips into the lubricating oil. As the gears on that countershaft spin, a constant spray of oil is directed to all internal parts of the transmission. Troughs and passages are cast into the inside of the cases, to capture and direct the oil to the bearings.

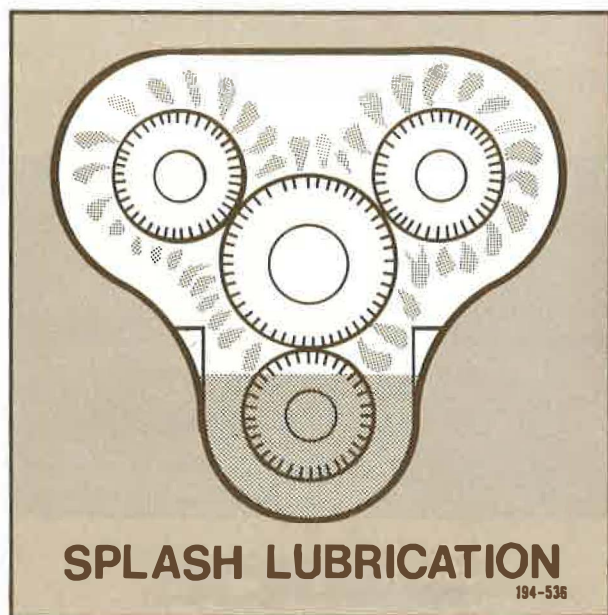


Figure 4. Splash Lubrication

Oil Pump

A small plunger pump is built into the main drive pinion. It operates in an eccentric housing which causes it to move back and forth as the main drive pinion rotates. This reciprocating action pumps oil through a center passage in the mainshafts to the Lo-Range synchronizer discs.

Magnetic Oil Filter

A magnetic oil filter assembly is built into the right side of the main case. It consists of a trough arrangement cast into the inside wall of the case, and a removable cover plate. The trough is open at the top to collect oil. The oil is then channeled past a magnet, which removes ferrous metallic particles from the passing oil. After passing the magnet, the oil is channeled upward to an outlet, where it falls back down into the transmission case. The magnet is mounted on a plug, which is removable from the outside of the transmission. The drain plug at the bottom of the case is also a magnetic plug.



Figure 5. Magnetic Oil Filter
Viewed from Inside Case

MAINTENANCE

Checking Oil

To check the oil in the transmission, remove the filler plug on the right hand side of the main case. The oil should be level with the bottom of the filler plug hole.

NOTE

The oil should be checked when it is at normal operating temperature. The vehicle should be in a level position, both front-to-rear and side-to-side.

Check the level of the oil at the intervals specified in the Maintenance and Lubrication Manual (TS494). Add oil, if needed, until the oil begins to run out of the filler plug hole. Use oil of the proper specification. (see Specifications page).

Changing Oil

To change the oil in the transmission, the oil should be at normal operating temperature. Remove the magnetic drain plug from the bottom of the transmission case, and drain the hot oil from the unit. Clean and replace the magnetic drain plug, and torque it to 25 to 30 lb. ft. torque.

Remove the filler plug and fill the transmission with oil of the proper specification to the level of the filler plug hole. (see Specifications page).

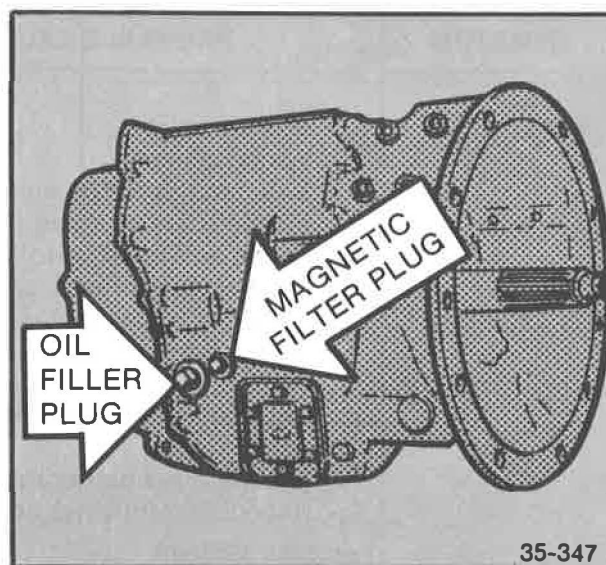


Figure 6. Plug Locations

CAUTION

Be sure to add oil to the transmission through the filler hole, NOT the magnetic filter plug hole. Severe damage due to low oil level may occur, because the baffles of the magnetic filter will prevent proper filling.

Reinstall and torque the filler plug to 70-80 lb. ft. Change the oil at the intervals specified in the Maintenance and Lubrication Manual, TS494.

Magnetic Oil Filter

The magnetic oil filter plug should be removed, and the magnet in the plug cleaned, every time the oil is changed. Also clean the trough inside, and then reinstall the magnetic plug. Torque the plug to 25 to 30 lb. ft.

Air Breathers

There are two air breathers, one located on top of the main case top cover, and the other on top of the rear case top cover. Both should be removed every time the oil is changed, and cleaned with a suitable solvent. Also check to be sure that the air flow through the breather is unobstructed.

TROUBLE SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
NOISY	a. Low oil level b. Wrong oil used c. Side mounted PTO installed too tight or too loose d. Loose bell housing to fly-wheel housing capscrews e. Incorrect clutch driven discs used f. Gears worn, chipped, rough, cracked g. Bearings worn, cracked, corroded, galled, etc. h. Mis-matched carrier ratios i. Resonating (ringing) drive shaft	a. Fill to correct level b. Drain and refill with correct oil c. Reinstall PTO correctly d. Install new capscrews using Loctite e. Install correct clutch driven discs f. Replace gears g. Replace bearings h. Install correct matched gearing i. Install suitable dampening material, then highspeed balance the driveshaft
HARD SHIFTING	a. Incorrect driving practices b. Low oil level c. Improperly adjusted clutch, clutch linkage, clutch brake, or shift linkage d. Wrong oil used e. Remote shift linkage not lubricated f. Shift lever binding or interference g. Poppet balls binding in their holes h. Loose setscrews in shifters or shift forks i. Improperly adjusted 4th/5th eccentric pin j. Worn spigot bearing k. Clutch brake ears broken l. Clutch discs worn into main drive pinion m. Mainshaft snap ring or thrust washer failure	a. Educate driver b. Fill to correct level c. Adjust properly d. Drain and refill with correct oil e. Clean and lubricate f. Relieve binding or interference g. Clean holes and balls h. Tighten to correct torque i. Adjust properly j. Replace bearing k. Replace clutch brake l. Replace clutch discs and main drive pinion m. Replace snap rings or thrust washers

TROUBLE SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
GEAR DIS-ENGAGEMENT (Jumping out of gear)	a. Excessive length and/or weight of gear shift lever and/or knob b. Shift lever interference c. Improperly adjusted remote control linkage d. Worn or loose mounting insulators e. Loose, broken or missing capscrews between clutch housing and flywheel housing f. Weak or broken shifter rail poppet springs g. Bent or worn shifter forks h. Broken snap rings i. Shift rail bent or poppet notches worn j. Improperly adjusted 4th/5th eccentric pin k. Worn taper or chipped teeth on sliding clutch teeth l. Worn or damaged spigot bearing m. Engine flywheel housing misalignment	a. Replace with standard lever and/or knob b. Remove interference c. Adjust properly d. Replace insulators e. Replace capscrews, check threads in case f. Replace springs g. Replace forks h. Replace snap rings i. Replace shift rail j. Adjust properly k. Replace sliding clutch and mating gear if its clutch teeth are damaged l. Replace bearing m. Realign properly
OIL LEAKS	a. Oil level too high b. Drain plug, fill plug, or magnetic plug loose c. Loose or missing capscrews d. Improper lubricant used e. Clogged breather f. Gaskets or O-rings broken, shifted, or squeezed out of position g. Worn oil seals h. O-rings in air shift cover leaking air pressure into transmission	a. Drain to correct level b. Tighten plugs c. Tighten or replace d. Drain and refill with correct oil e. Clean or replace f. Replace gaskets and O-rings g. Replace seals h. Replace O-rings

TROUBLE SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
BEARING FAILURE	a. Dirt in system b. Wrong grade of oil, or contaminated oil c. Excessive vibrations d. Binding or seized propeller shaft slip yoke e. Improper bearing clamping f. Improper bearing installation (pre-loads, etc.)	a. Clean and replace bearings as necessary b. Drain and refill with correct oil, replace bearings c. Eliminate vibrations, replace bearings d. Clean and replace as needed e. Reclamp using correct procedures, replace bearings f. Replace using correct procedures
RANGE SHIFT MAL-FUNCTIONS	a. Low system air pressure b. Restricted or clogged air filter in range shift valve c. Restricted air line (bent, squeezed, twisted, etc.) d. Air lines too small e. Improperly adjusted range shift inter-lock pin protrusion f. Defective synchronizer g. Defective O-rings in air shift cylinders h. Scored air shift cylinders or pistons i. Defective range shift valve and/or range selector valve j. Hi-Range synchronizer friction disc worn or burned.	a. Wait for pressure to build back up to normal b. Replace air filter c. Reroute and/or replace air lines d. Replace with correct size air lines e. Adjust properly f. Repair or replace as needed g. Replace O-rings h. Repair or replace cylinders or pistons i. Repair or replace as needed j. Replace synchronizer discs as needed.

NOTE

For the sake of simplicity, the gears referred to in this manual are of a T2100 in Lo-Range. Use the chart below to convert to the names of the gears in Hi-Range, and to T2090 gears in Lo-Range and Hi-Range.

T2100		T2090	
Lo-Range	Hi-Range	Lo-Range	Hi-Range
First	Sixth	Lo	-----
Second	Seventh	First	Fifth
Third	Eighth	Second	Sixth
Fourth	Ninth	Third	Seventh
Fifth	Tenth	Fourth	Eighth

DISASSEMBLY

Main Components Disassembly

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits (interference fits) unless replacement is necessary. In that case, use proper press setups and pullers, so that usable parts are not damaged.

1. Clean the transmission externally, and mount it in an overhaul stand. Drain the lubricant. Plug air line openings so that dirt cannot enter.
2. Remove the clutch release bearing assembly, shafts, yoke, and clutch brake.
3. Remove the main case top cover.

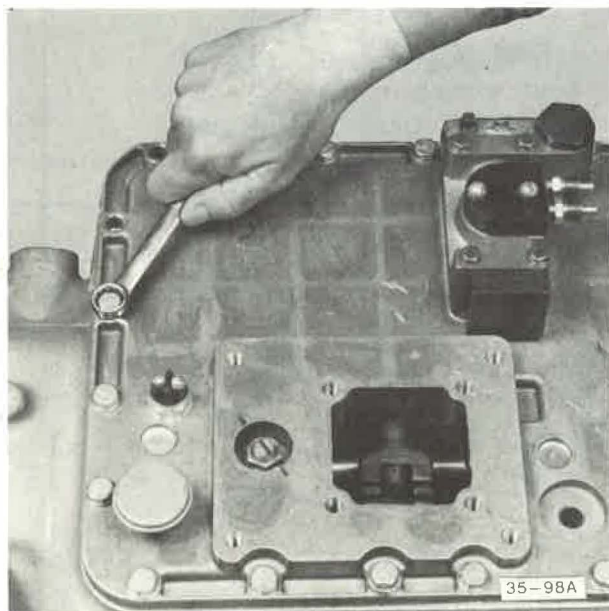


Figure 7. Removing Main Case Top Cover Capscrew

4. Remove the rear case top cover.

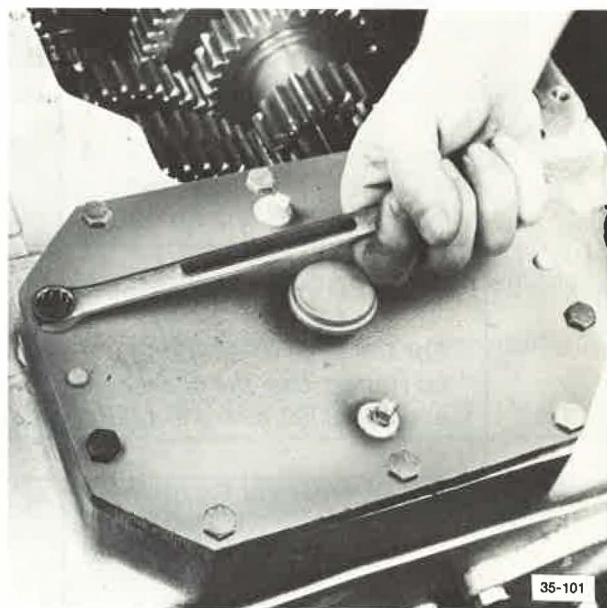


Figure 8. Removing Rear Case Top Cover Capscrew

5. Remove the drive yoke (or flange).

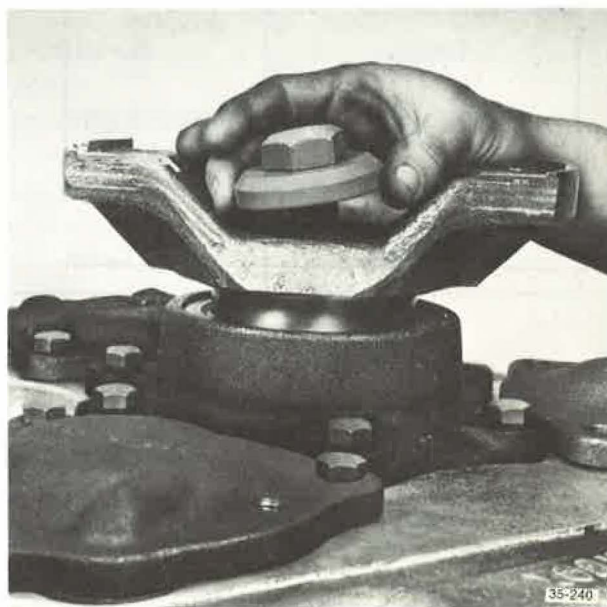


Figure 9. Removing Clamp Plate and Capscrew.

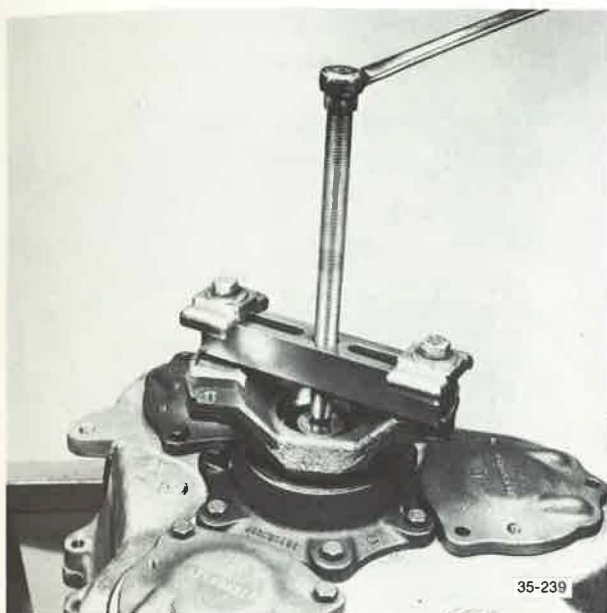


Figure 10. Removing Drive Yoke

6. Remove the rear countershaft rear bearing covers. Jackscrew holes are provided to assist the removal.

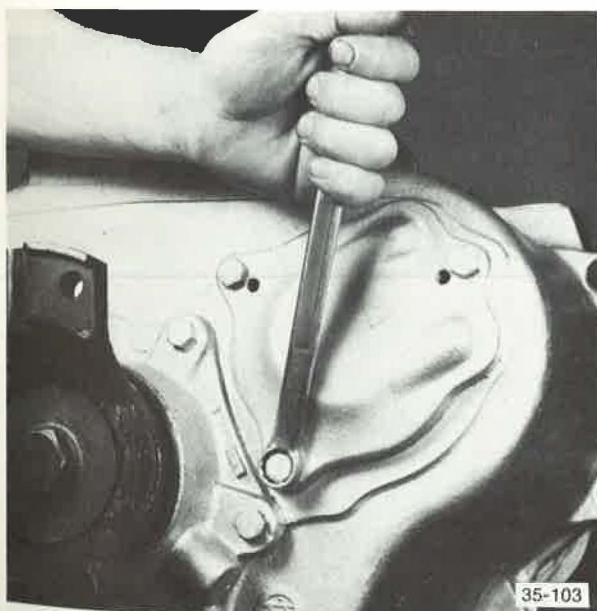


Figure 11. Removing Capscrews from Rear Countershaft Rear Bearing Cover

7. Remove the rear mainshaft rear bearing cover. Jackscrew holes are provided to assist the removal.

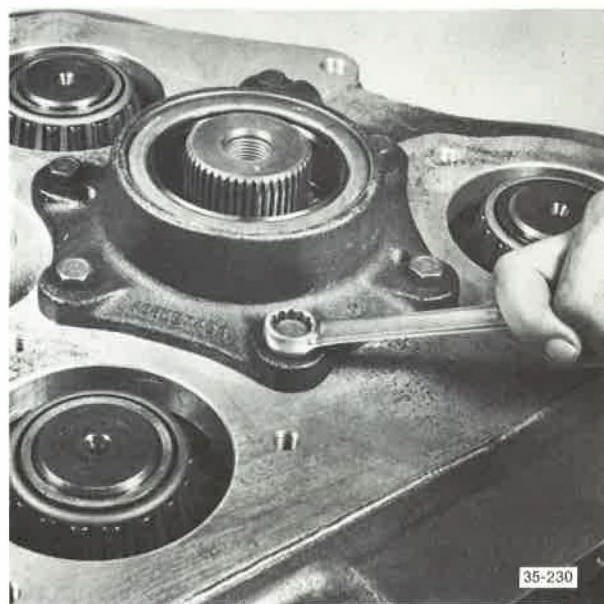


Figure 12. Removing Cover Capscrews

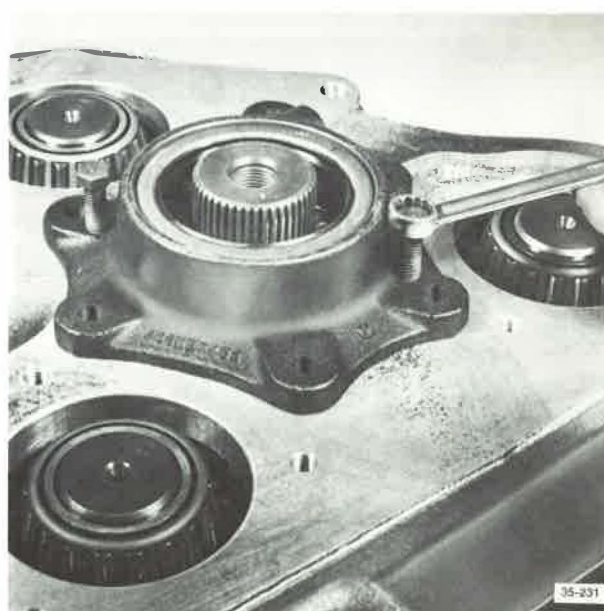


Figure 13. Tightening Jackscrews to Remove Cover



Figure 14. Cover Removed

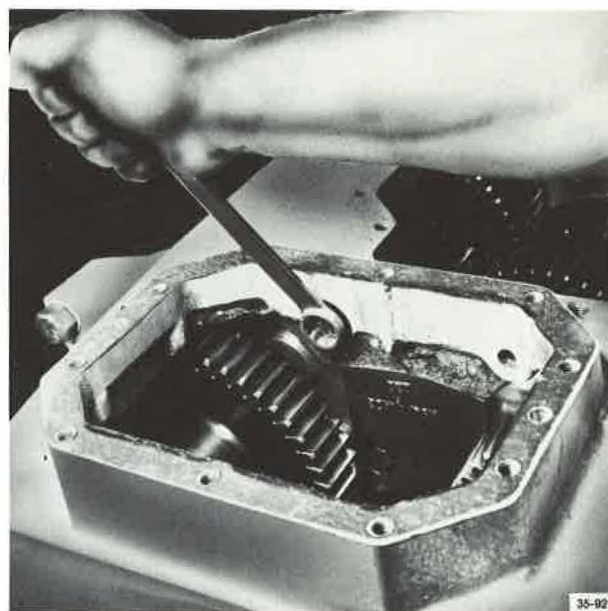


Figure 16. Removing Capscrew

8. Remove the capscrews and dowel bolts that hold the main case and rear case together. Two capscrews are located inside the rear case.

9. Lift the rear case from the front case.

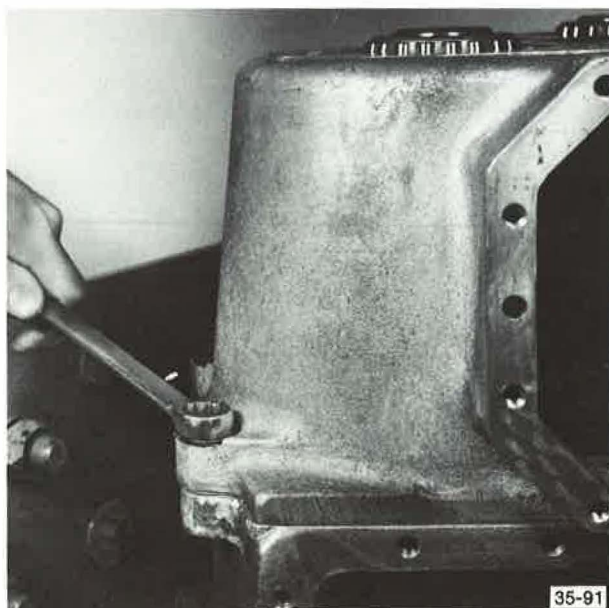


Figure 15. Removing Capscrew

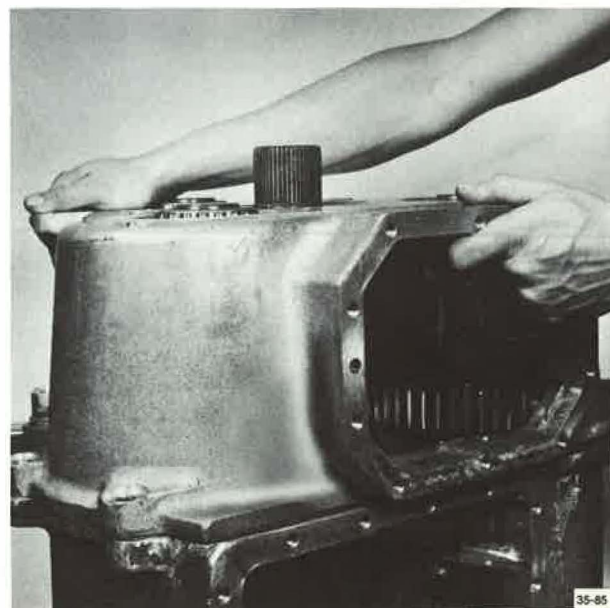


Figure 17. Removing Rear Case

10. Remove the rear mainshaft and synchronizer from the rear of the transmission.



Figure 18. Removing Rear Mainshaft

11. Remove the hi-range synchronizer plates, and the main drive gear backing plate.



Figure 19. Hi-range Synchronizer Plates

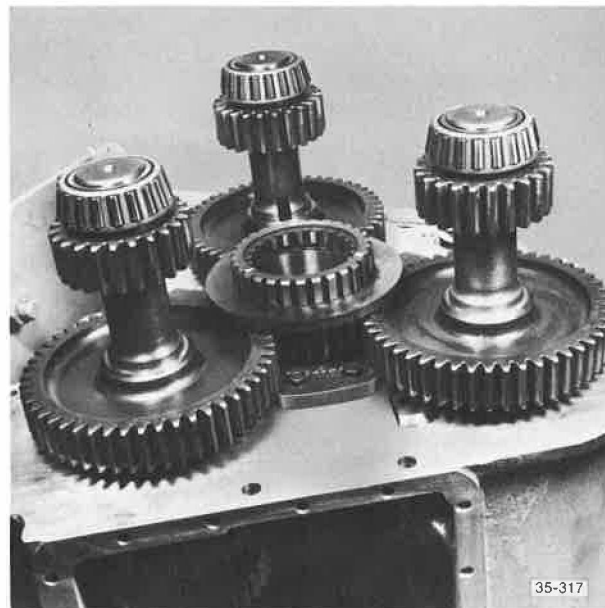


Figure 20. Main Drive Gear Backing Plate

12. Remove the three rear countershafts from the transmission.

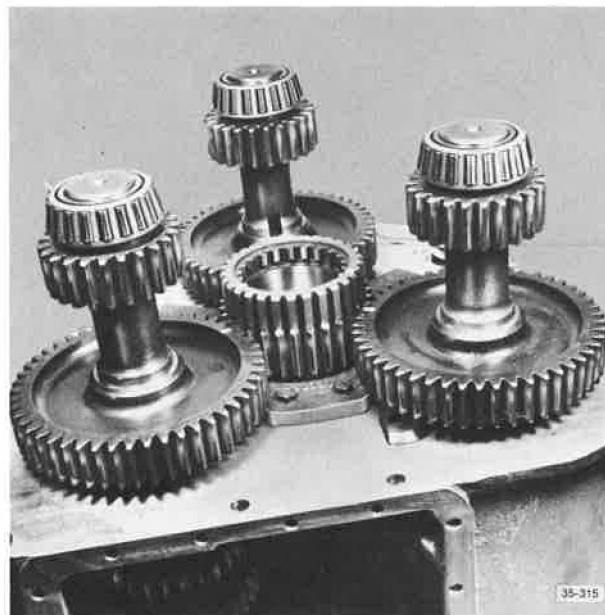


Figure 21. Three Rear Countershafts

13. Remove the capscrews from the main drive pinion bearing cover, and remove the pinion and cover assembly. Jackscrew holes are provided to assist the removal. Also remove the fourth/fifth sliding clutch.

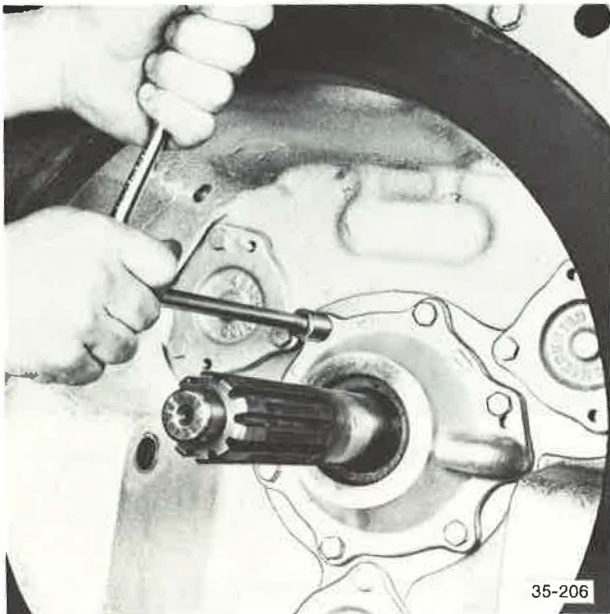


Figure 22. Removing Capscrew

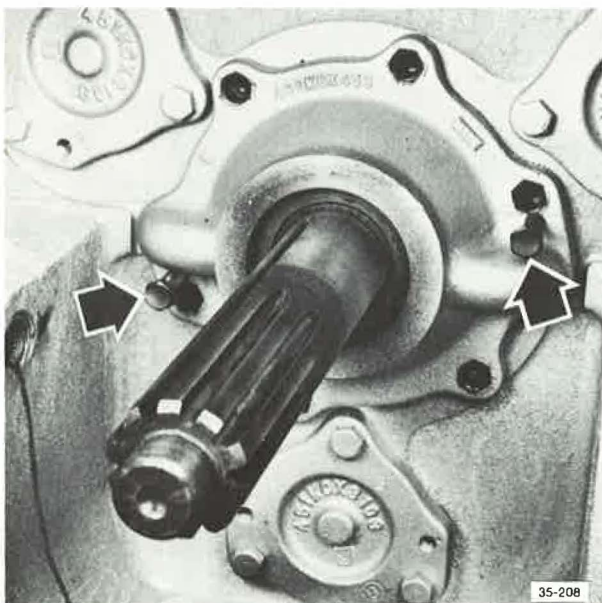


Figure 23. Using Jackscrews to Remove Cover

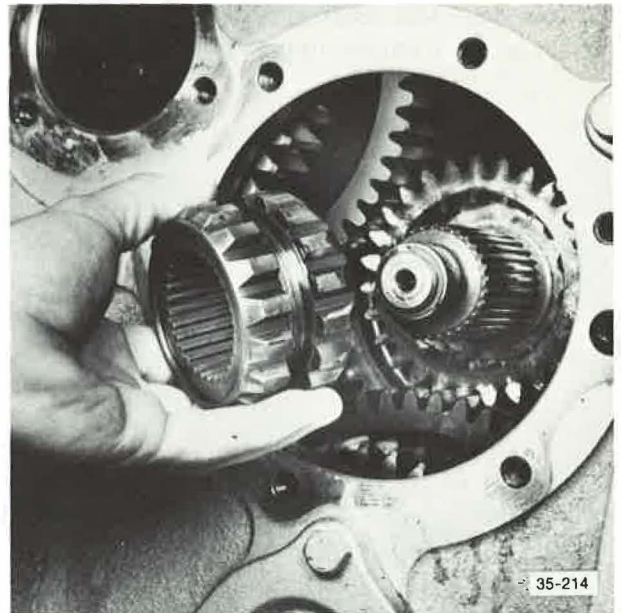


Figure 24. Removing Fourth/Fifth Sliding Clutch

14. Remove the front countershaft front bearing covers. Jackscrew holes are provided to assist the removal.

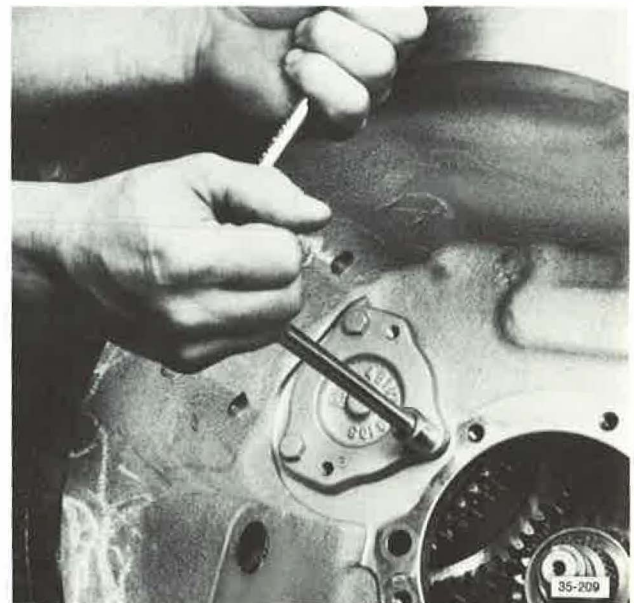


Figure 25. Removing Capscrews

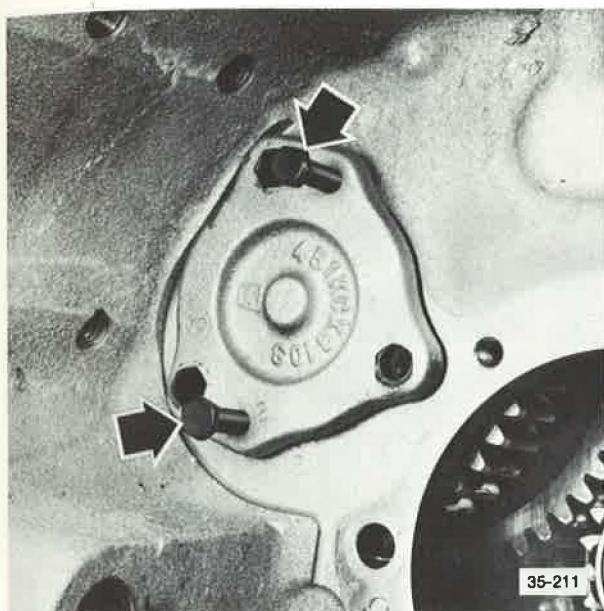


Figure 26. Using Jackscrews to Remove Cover



Figure 28. Removing Retaining Plate

15. Remove the front countershaft rear bearing covers, and the rear compound main drive gear retaining plate.

16. Remove the retaining snap ring from inside the main drive gear, and then remove the main drive gear.

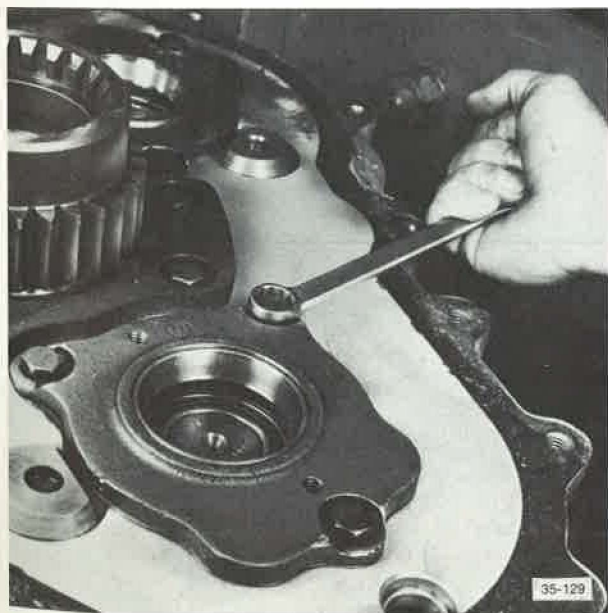


Figure 27. Removing Rear Bearing Cover

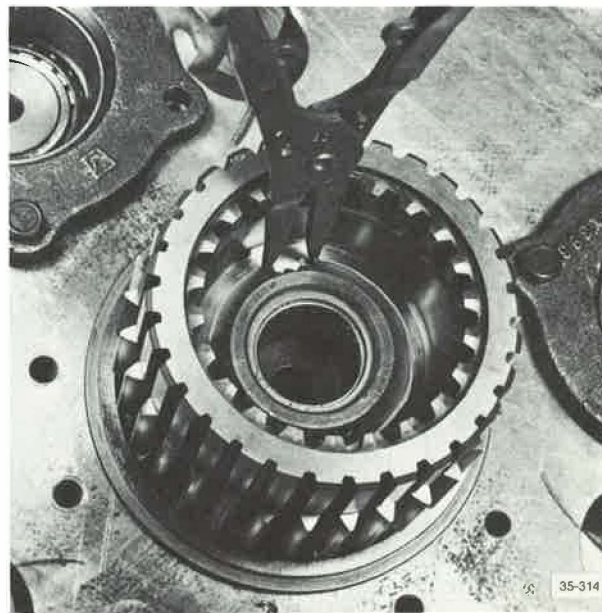


Figure 29. Removing Snap Ring

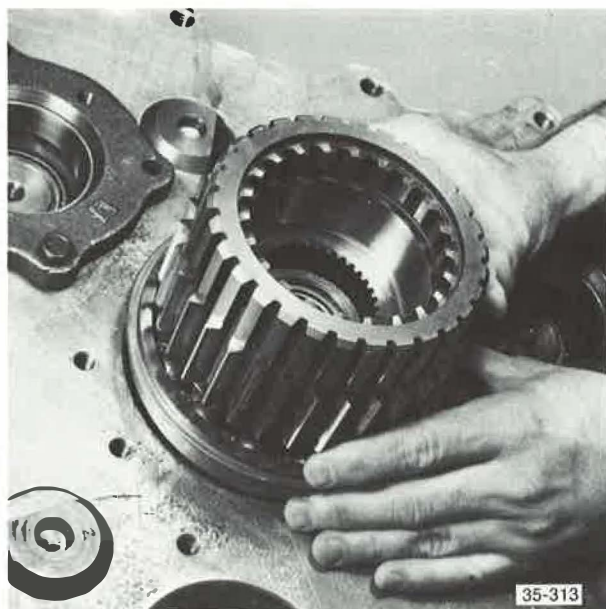


Figure 30. Removing Main Drive Gear

17. Remove the upper right reverse idler shaft and gear, using an appropriate puller.

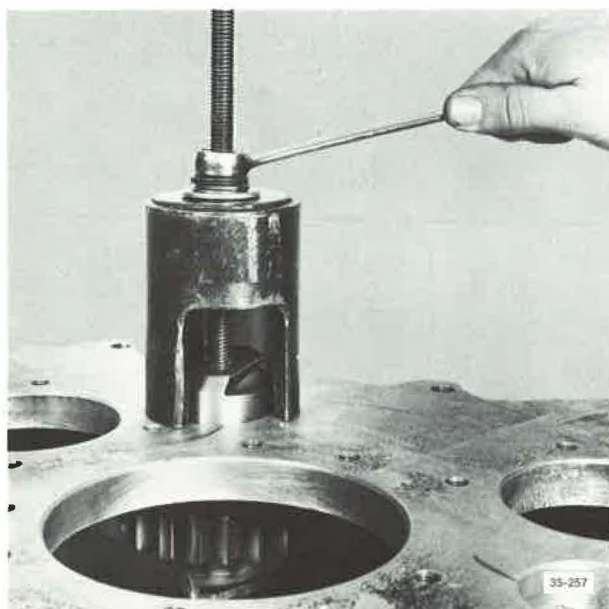


Figure 31. Removing Reverse Idler Shaft



Figure 32. Removing Reverse Idler Gear

18. Move the mainshaft reverse gear rear snap ring rearward a short distance. This will allow the reverse gear to "flop around," thus making it easier to remove the mainshaft.

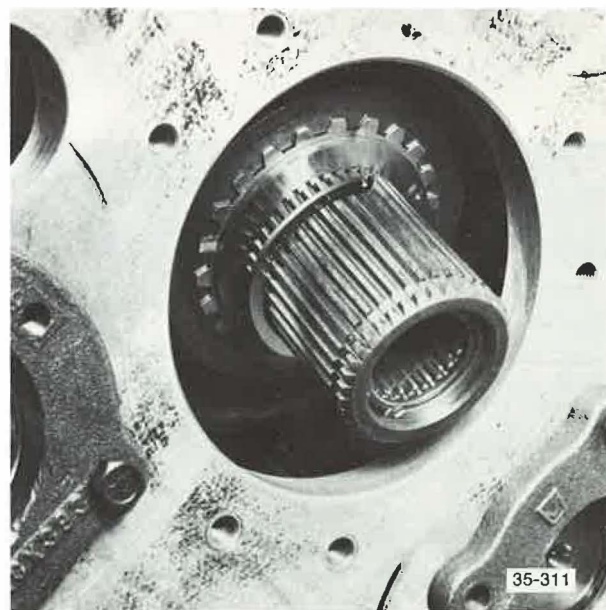


Figure 33. Snap Ring Moved Rearward

19. Remove the upper right countershaft from the main case.

SERVICE HINT

Removal is easier if the transmission is vertical, as shown, and you slide the countershaft out.

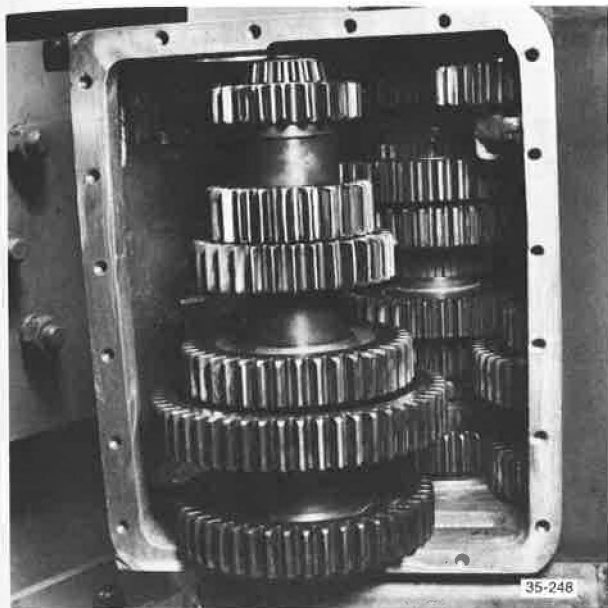


Figure 34. Removing Upper Right Countershaft

20. Remove the mainshaft from the case. Transmission should be horizontal, and the front of the mainshaft is removed first, as shown.

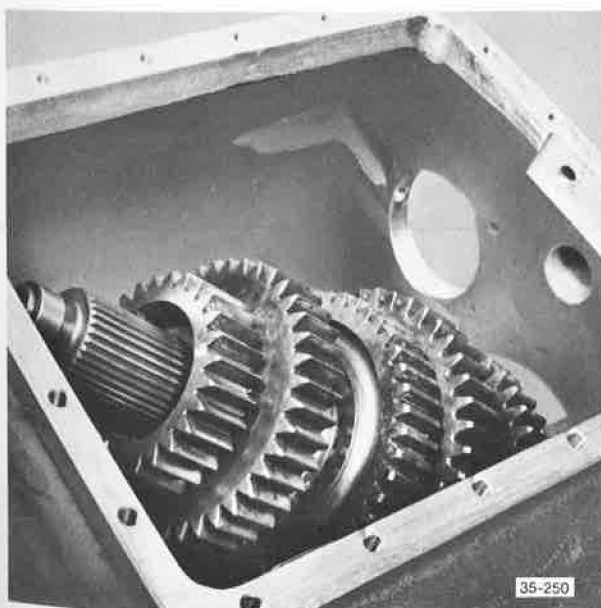


Figure 35. Starting to Remove Mainshaft

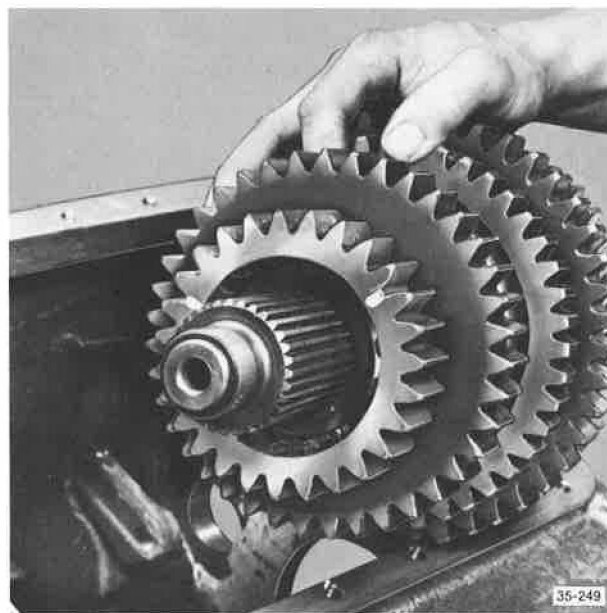


Figure 36. Mainshaft Removed

21. Remove the upper left and the lower countershafts from the case.

SERVICE HINT

Removal is easier if the transmission is vertical, as shown, and you slide the countershafts out.

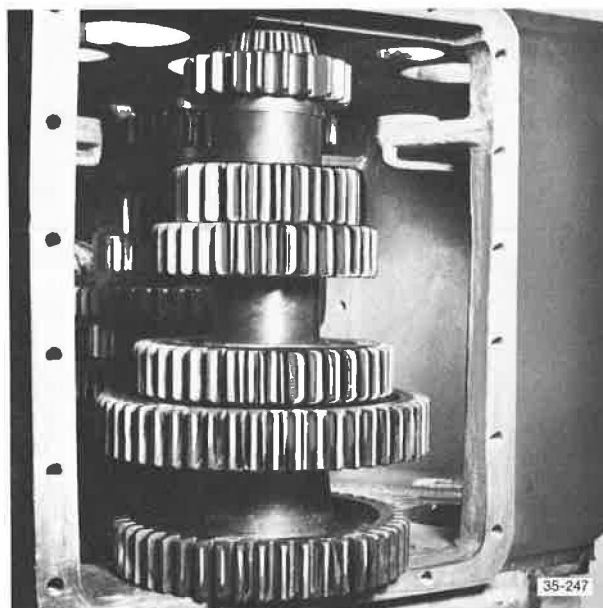


Figure 37. Removing Upper Left Countershaft

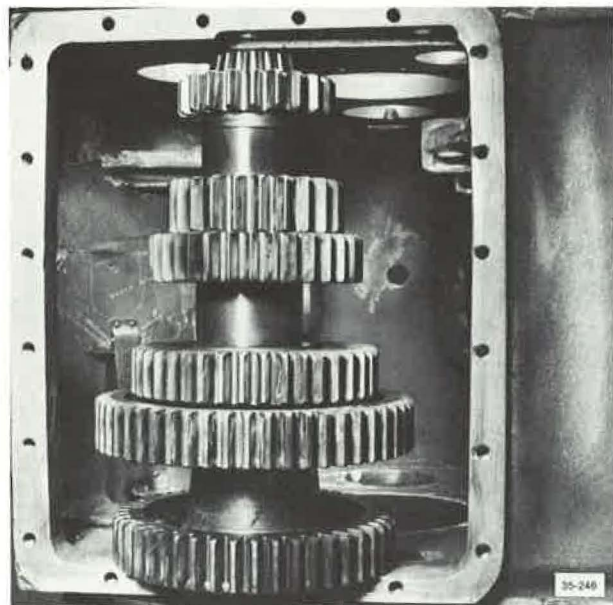
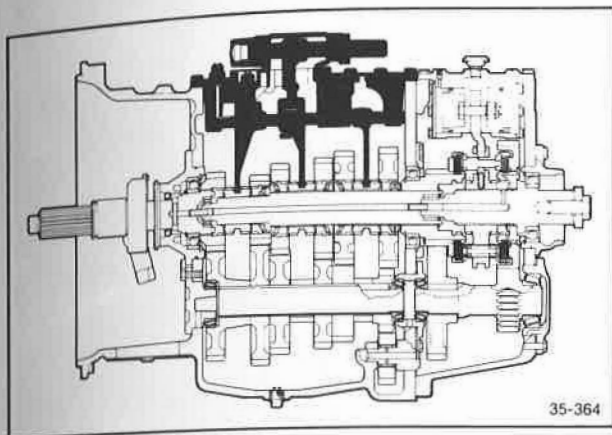


Figure 38. Removing Lower Countershaft

Main Case Shift Cover Disassembly



1. Remove the nut and washers from the interlock rocker bolt, and then remove the bolt and the rocker.

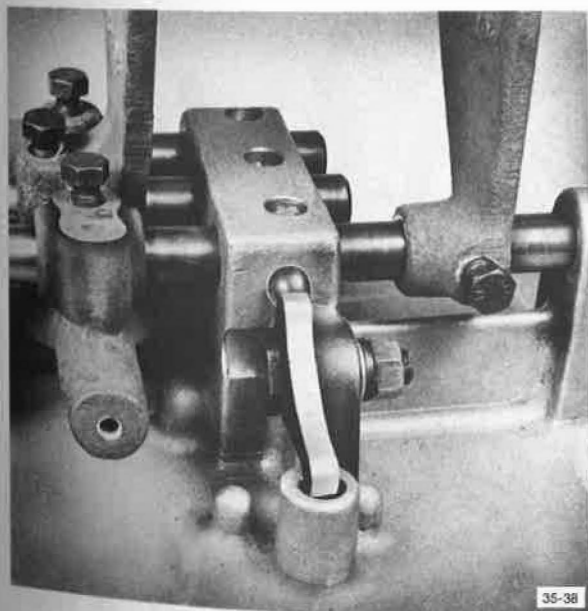


Figure 39. Interlock Rocker Assembly

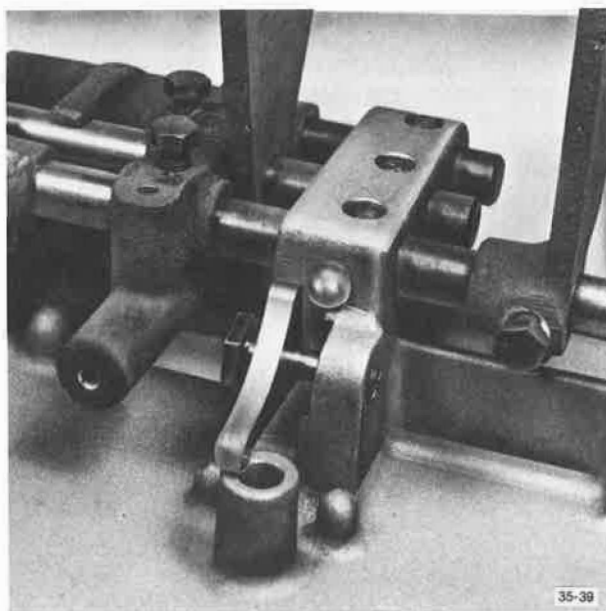
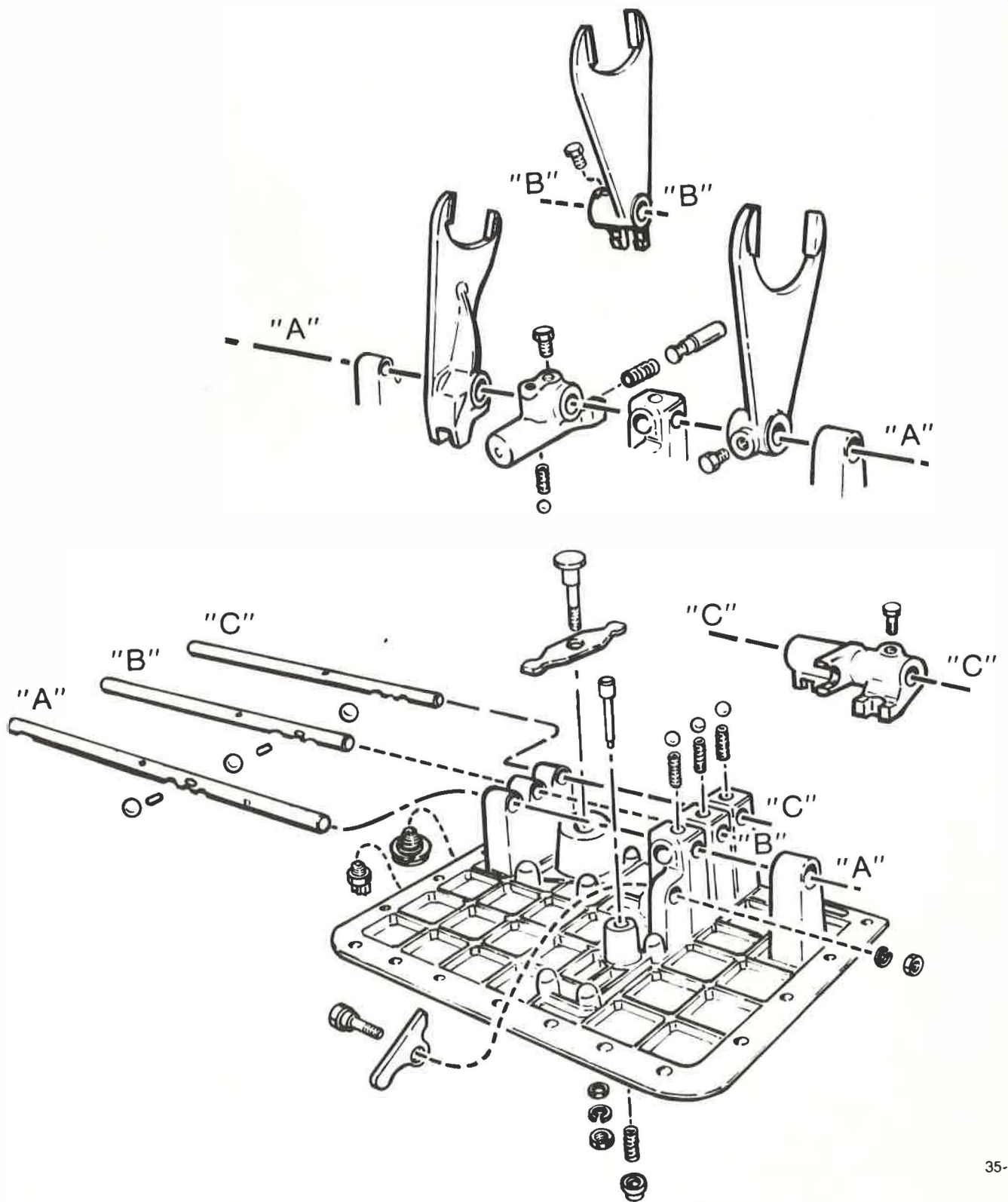


Figure 40. Removing Bolt and Rocker



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2. Remove the interlock ball from the cover.

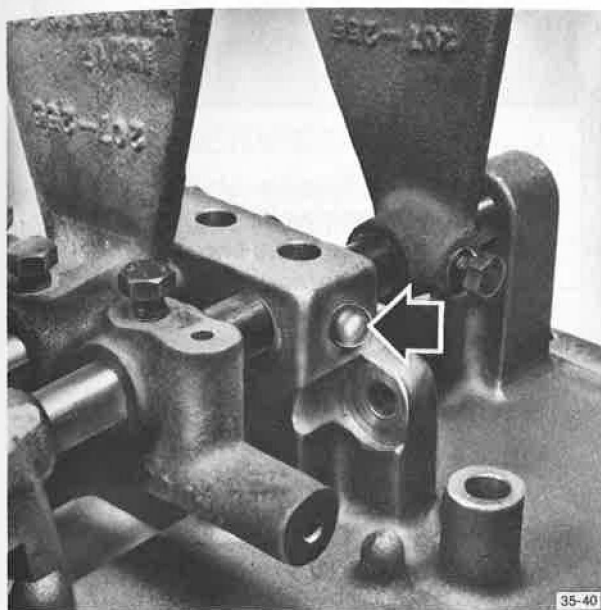


Figure 41. Removing Interlock Ball

3. Remove the setscrew from the first/reverse shift fork.

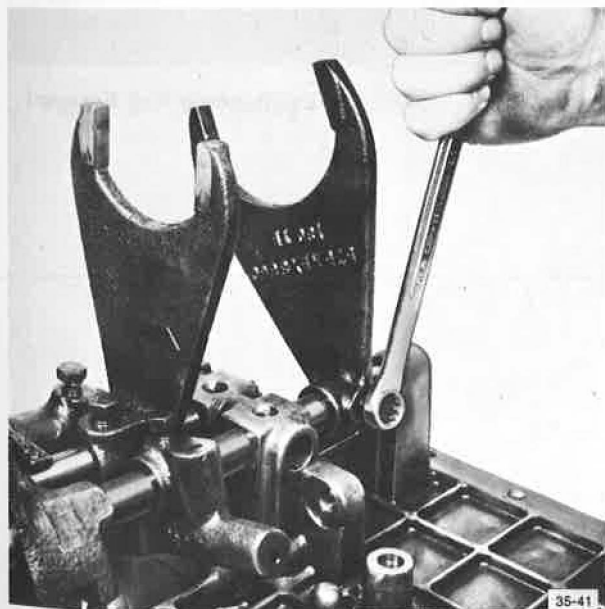


Figure 42. Removing Setscrew from First/Reverse Shift Fork

4. Remove the setscrew from the first/reverse shifter.

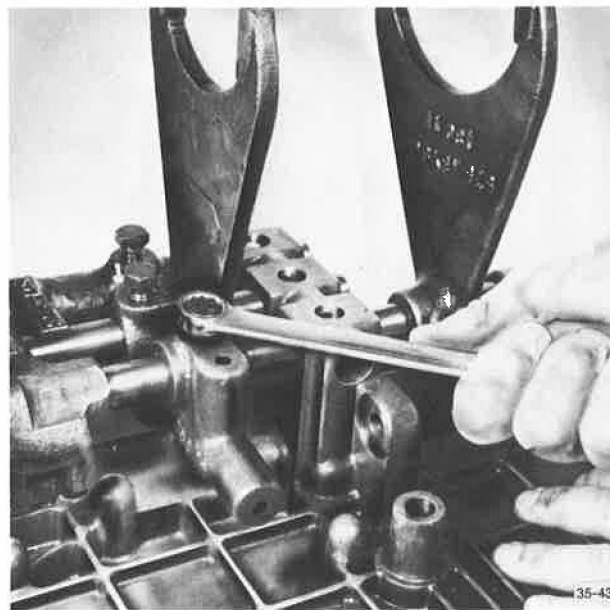


Figure 43. Removing Setscrew from First/Reverse Shifter

5. Remove the interlock pin from the first/reverse shift rail.

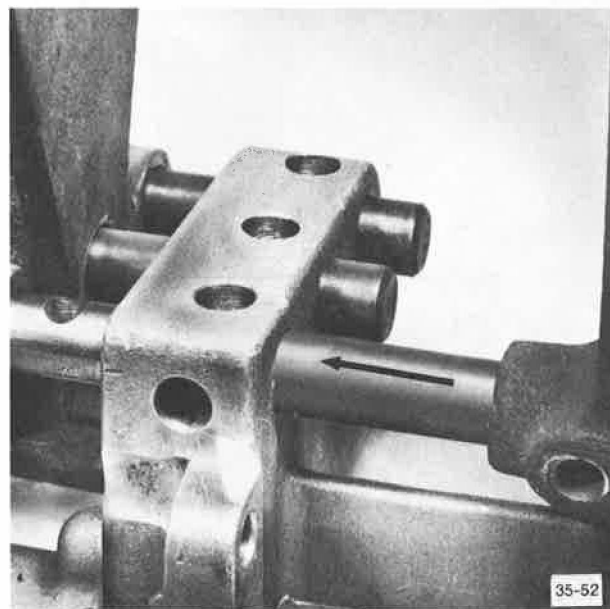


Figure 44. Removing Pin from First/Reverse Rail

6. Slide the first/reverse shift rail forward and remove the first/reverse shift fork.

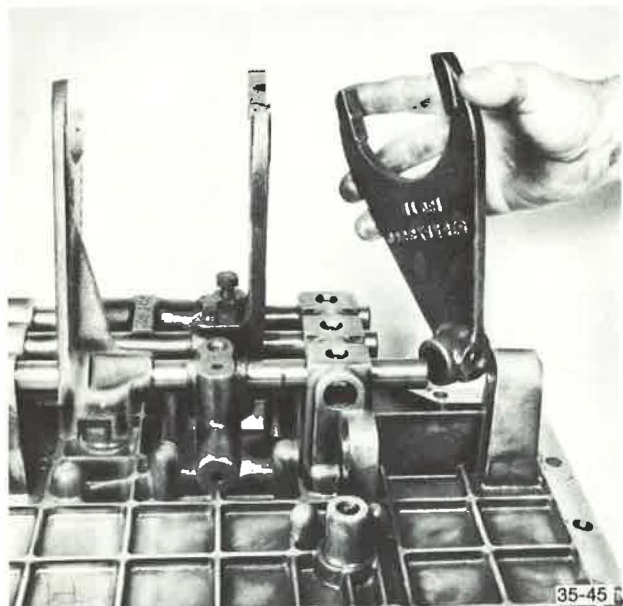


Figure 45. Removing First/Reverse Shift Fork

WARNING

Poppet balls are spring loaded, and could cause injury when they are released.

7. Push the first/reverse shift rail forward, using a metal bar, while holding a shop rag over the top opening as shown. The rag will prevent the spring and ball, that are under the rail, from popping out and becoming lost.

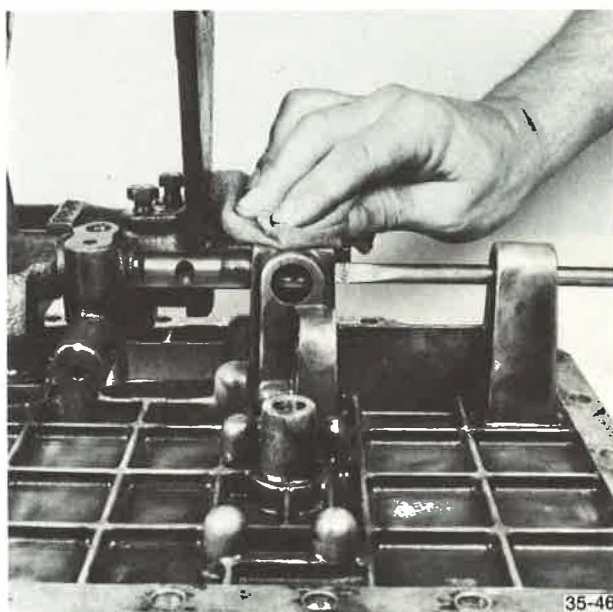


Figure 46. Pushing First/Reverse Rail Forward

8. Remove the poppet ball and spring from under the first/reverse shift rail.

SERVICE HINT

A magnet is helpful in removing the poppet ball and spring.

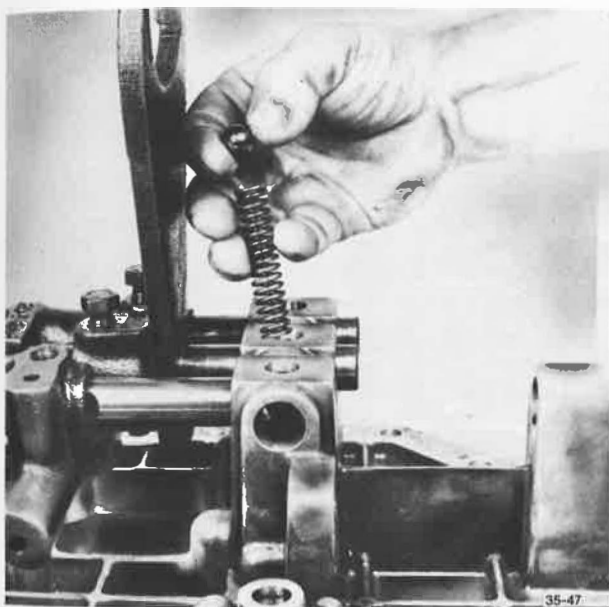


Figure 47. Removing Poppet Ball and Spring

9. Remove the interlock ball from between the first/reverse shift rail and the second/third shift rail.

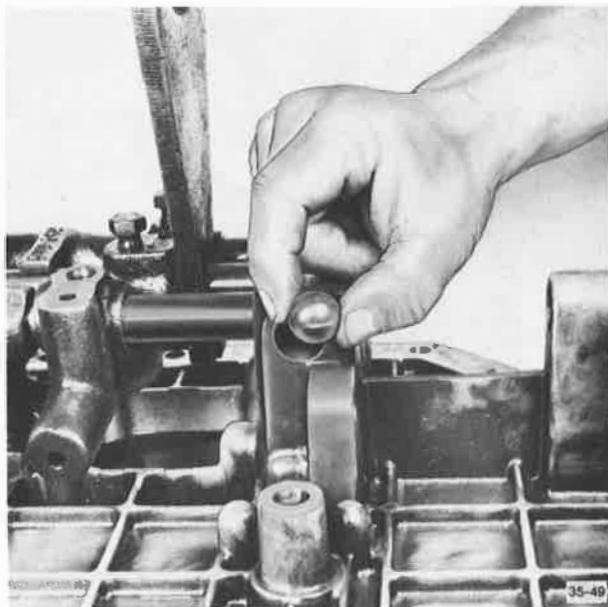


Figure 48. Removing Interlock Ball

10. Continue sliding the first/reverse shift rail forward, and remove the first/reverse shifter.



Figure 49. Removing First/Reverse Shifter

11. Slide the first/reverse shift rail the rest of the way forward, out of the shift cover, and at the same time, remove the fourth/fifth shift fork.

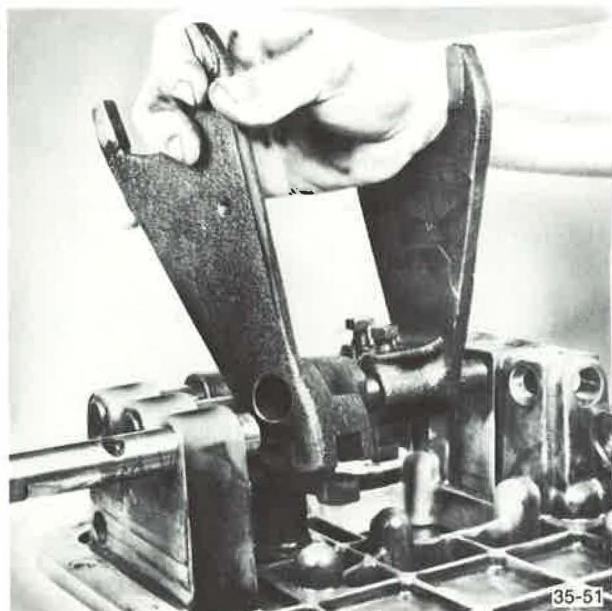


Figure 50. Removing Fourth/Fifth Shift Fork

12. Remove the setscrew from the second/third shift fork.

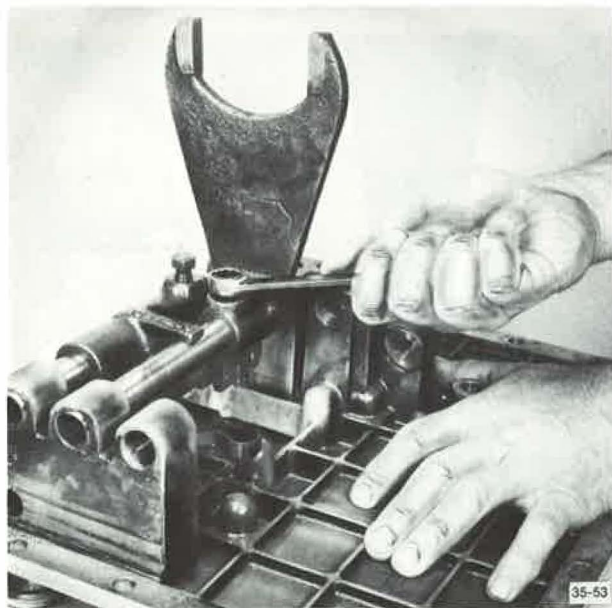


Figure 51. Removing Setscrew from Second/Third Shift Fork

WARNING

Poppet balls are spring loaded, and could cause injury when they are released.

13. Push the second/third shift rail forward, using a metal bar, while holding a shop rag over the top opening as shown. The rag will prevent the spring and ball, that are under the rail, from popping out and becoming lost.

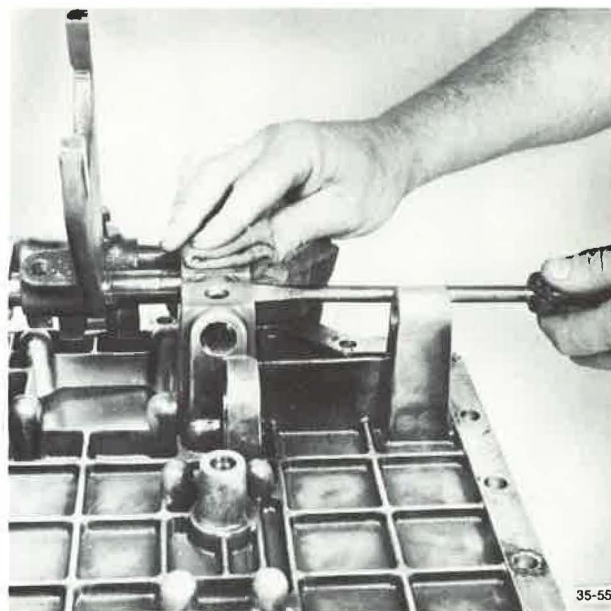


Figure 52. Pushing Second/Third Rail Forward

14. Remove the poppet ball and spring from under the second/third shift rail.

SERVICE HINT

A magnet is helpful in removing the poppet ball and spring.

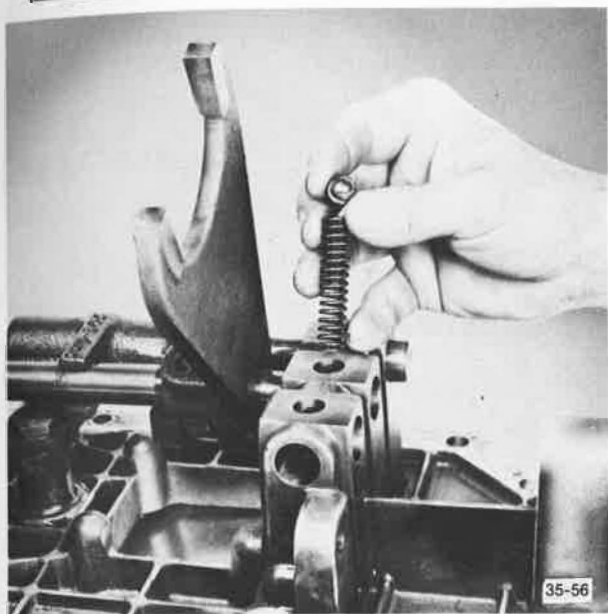


Figure 53. Removing Poppet Ball and Spring

15. Remove the interlock ball from between the second/third shift rail and the fourth/fifth shift rail.

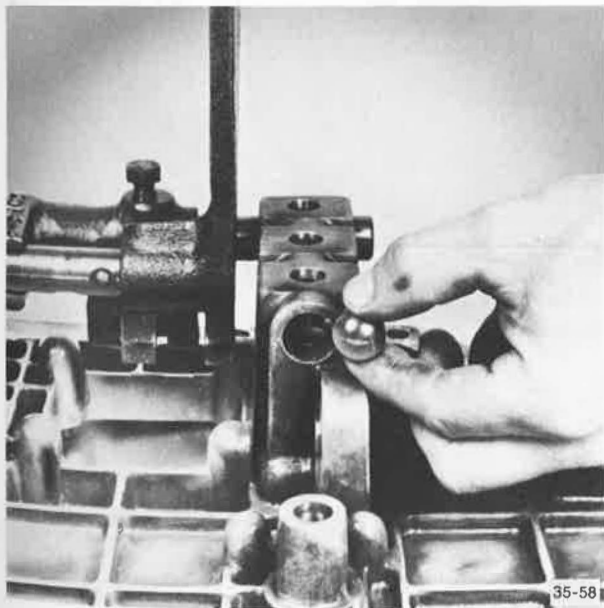


Figure 54. Removing Interlock Ball

16. Remove the interlock pin from the second/third shift rail.

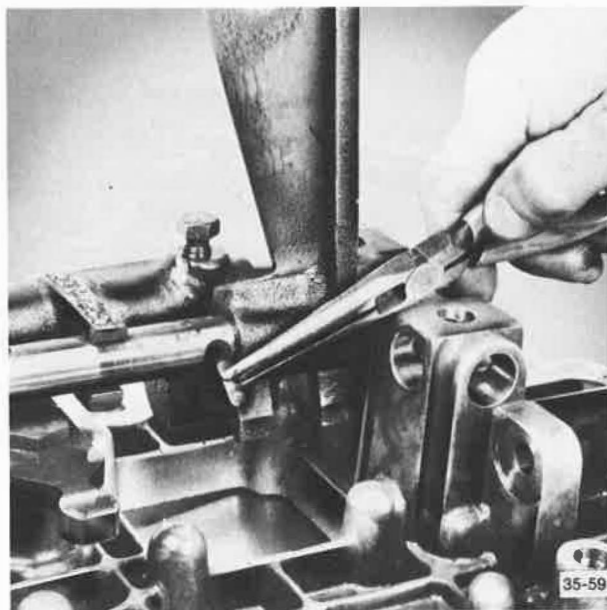


Figure 55. Removing Pin from Second/Third Rail

17. Slide the second/third shift rail further forward, and remove the second/third shift fork.

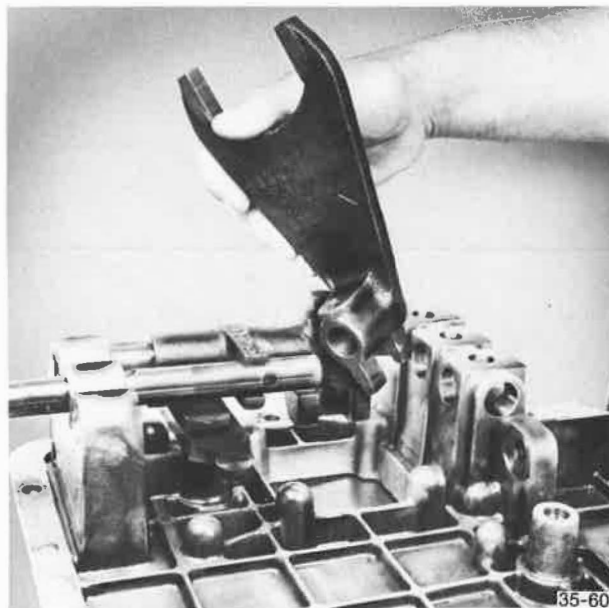


Figure 56. Removing Second/Third Shift Fork

18. Continue sliding the second/third shift rail forward, and remove it from the shift cover.

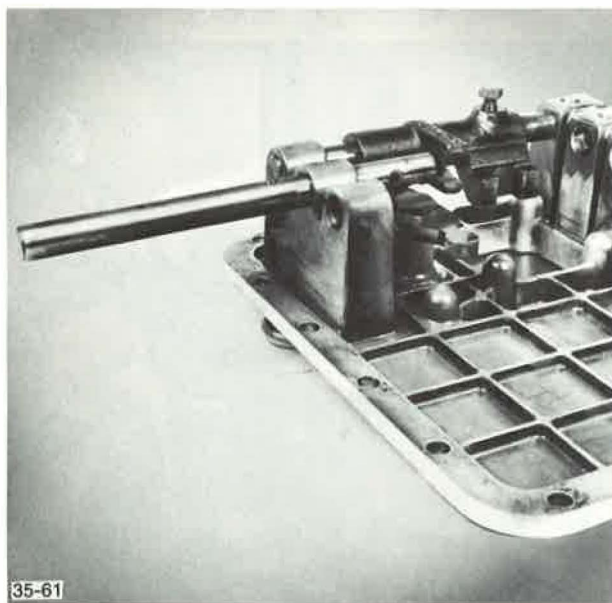


Figure 57. Removing Second/Third Shift Rail

19. Remove the setscrew from the fourth/fifth shifter.

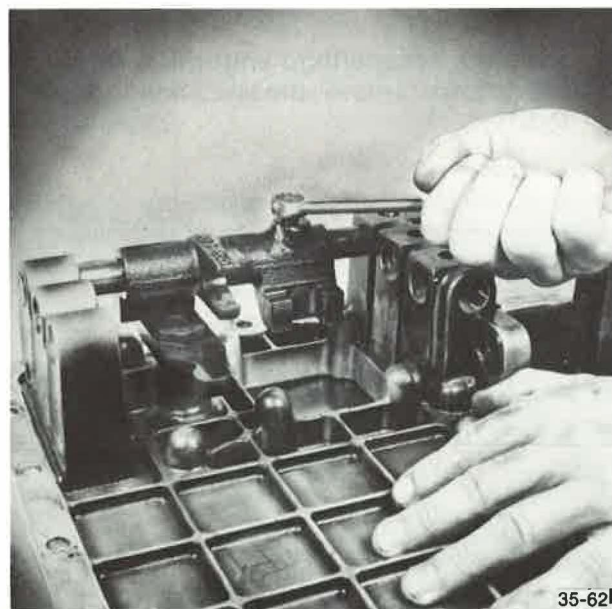


Figure 58. Removing Setscrew from Fourth/Fifth Shifter

WARNING

Poppet balls are spring loaded, and could cause injury when they are released.

20. Push the fourth/fifth shift rail forward, using a metal bar, while holding a shop rag over the top opening cover as shown. The rag will prevent the spring and ball that are under the rail from popping out and becoming lost.

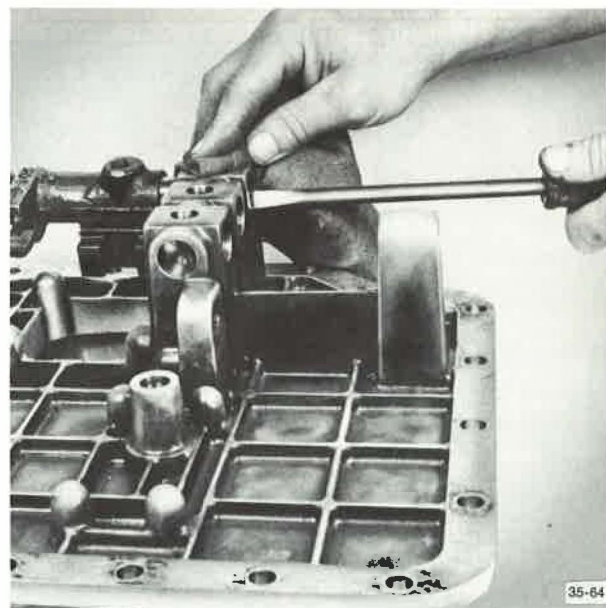


Figure 59. Pushing Fourth/Fifth Rail Forward

21. Continue sliding the fourth/fifth shift rail forward out of the shift cover. At the same time, remove the fourth/fifth shifter.

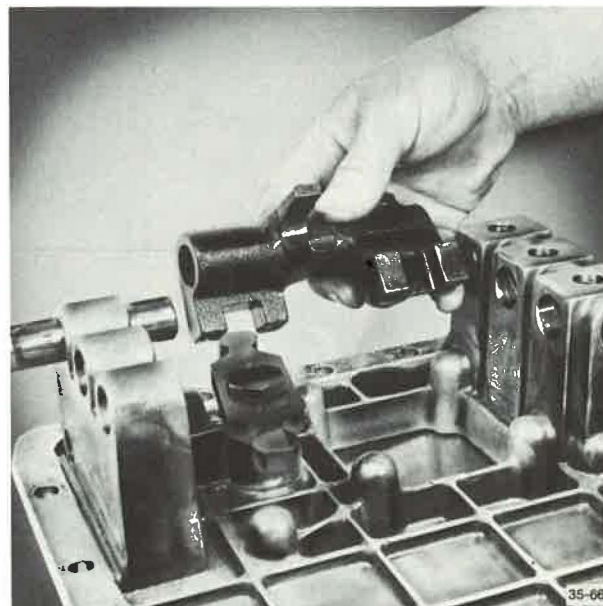


Figure 60. Removing Fourth/Fifth Shifter

22. Remove the poppet ball and spring from under the fourth/fifth shift rail.

SERVICE HINT

A magnet is helpful in removing the poppet ball and spring.

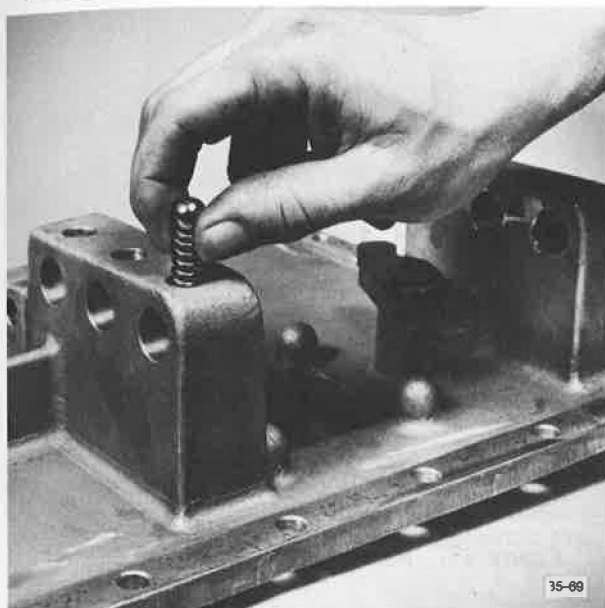


Figure 61. Removing Poppet Ball and Spring

23. Remove from the first/reverse shifter the poppet ball and spring, and the interlock plunger and spring.



Figure 62. Disassembly of First/Reverse Shifter

24. Remove the capscrews holding on the range shift valve, and then remove the valve.

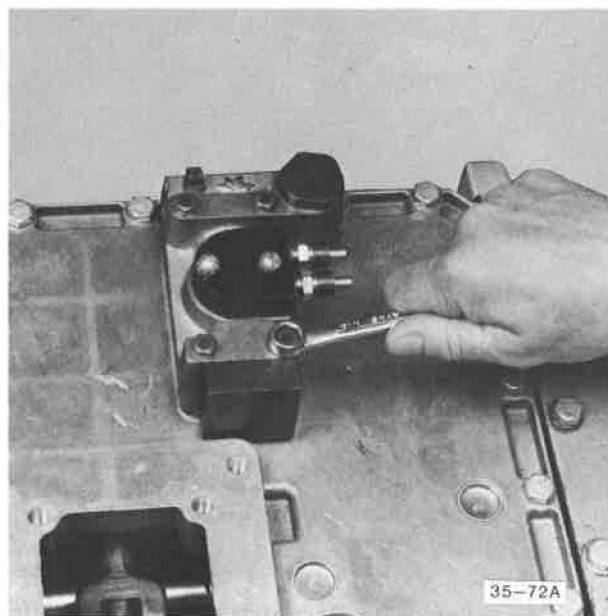


Figure 63. Removing Range Shift Valve Capscrew

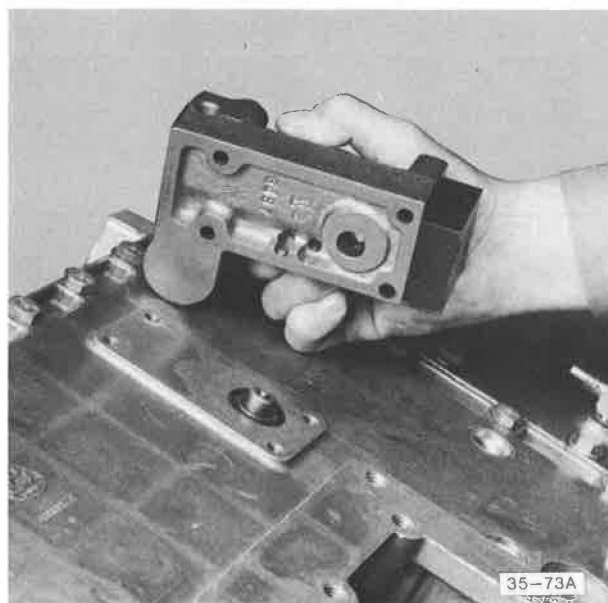


Figure 64. Removing Range Shift Valve

25. Remove the range shift valve cap, spring and plunger.



Figure 65. Removing Cap and Spring from Shift Cover

26. Remove the reverse light switch from the shift cover.

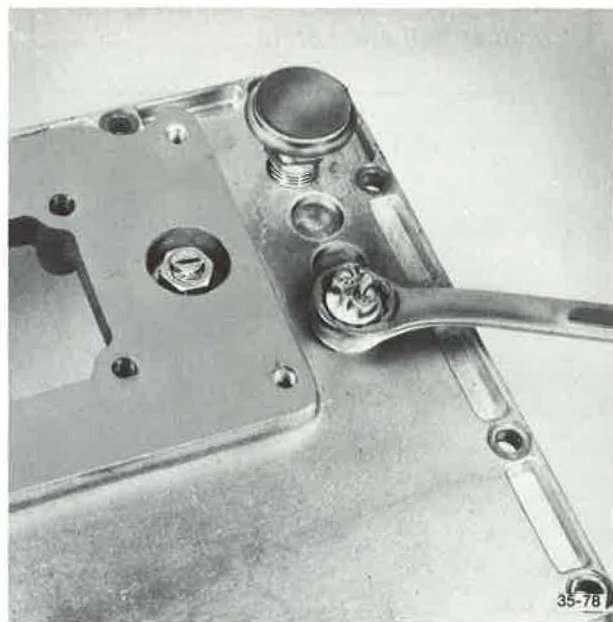


Figure 67. Removing Reverse Light Switch

27. Remove the reverse light switch rod.



Figure 66. Removing Range Shift Valve Plunger

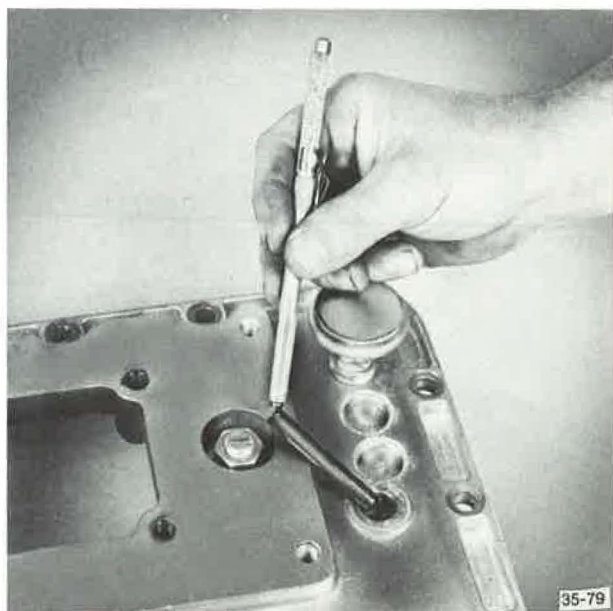


Figure 68. Removing Reverse Light Switch Rod

28. Remove the nut and washers from the fourth/fifth eccentric pin.

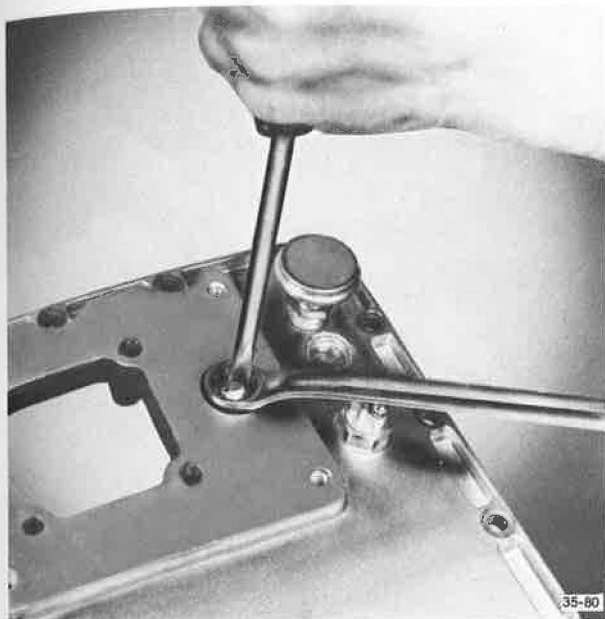


Figure 69. Loosening Fourth/Fifth Eccentric Pin Nut



Figure 70. Fourth/Fifth Eccentric Pin Nut and Washers

29. Remove the fourth/fifth eccentric pin and rocker arm.

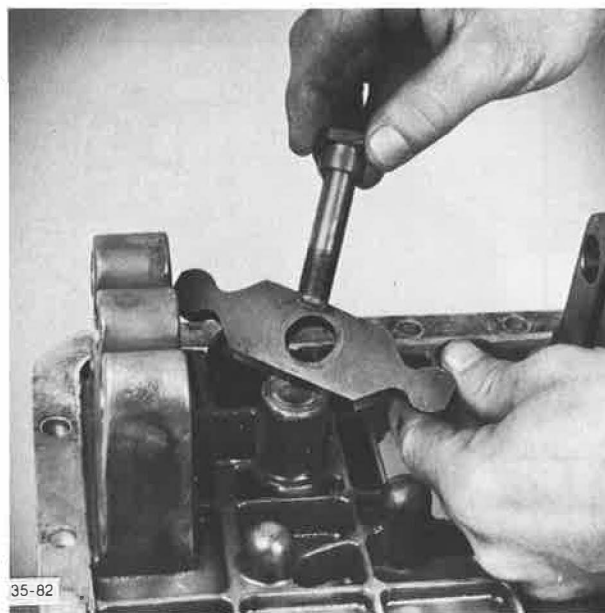


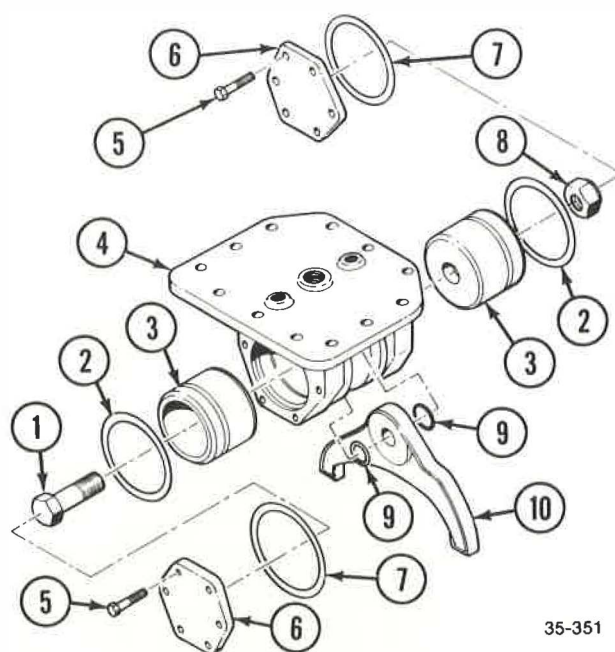
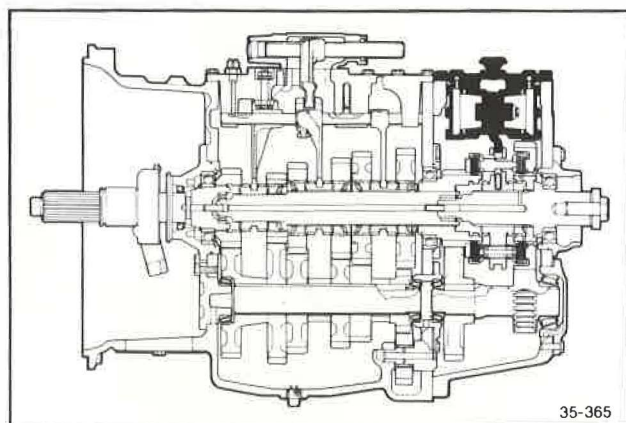
Figure 71. Removing Fourth/Fifth Eccentric Pin and Rocker

30. Remove the shift cover breather vent.



Figure 72. Removing Breather Vent

Range Shift Cover Disassembly



- | | |
|----------------------|-----------------|
| 1. Capscrew | 6. Piston Cover |
| 2. O-Ring | 7. O-Ring |
| 3. Piston | 8. Nut |
| 4. Range Shift Cover | 9. O-Ring |
| 5. Capscrew | 10. Shift Fork |

Figure 73. Exploded View of Range Shift Cover

1. Remove the capscrews and the two range shift piston covers.

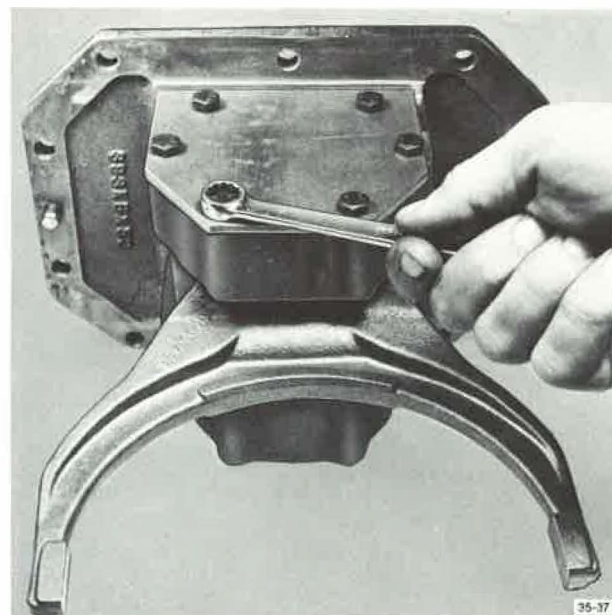


Figure 74. Removing Setscrew

2. Remove the shift piston cover O-Rings, one from each side.

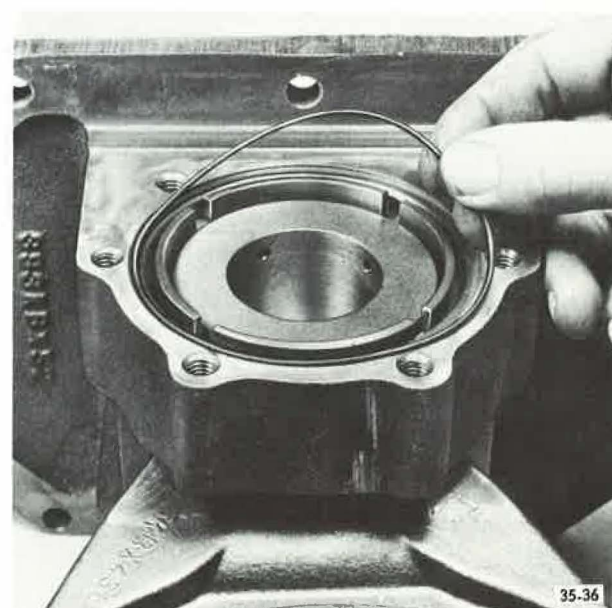


Figure 75. Removing O-Ring

3. Loosen and remove the piston retaining capscrew nut.

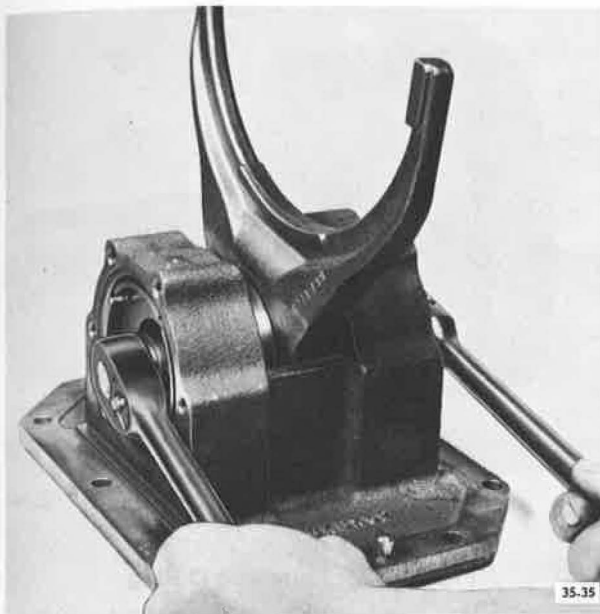


Figure 76. Loosening Nut

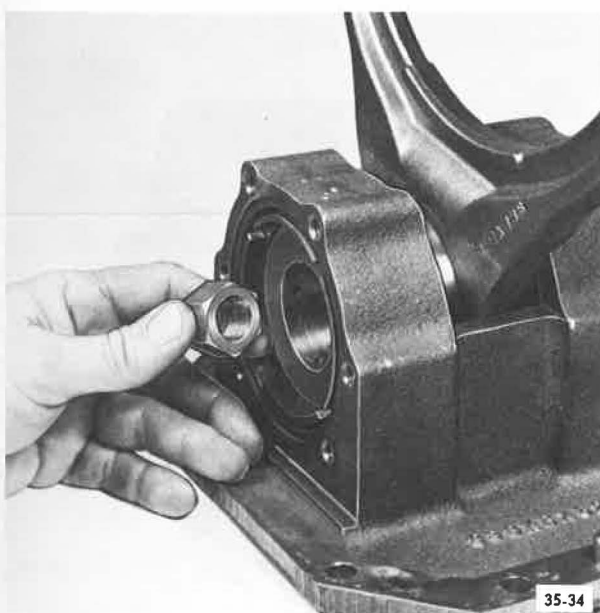


Figure 77. Removing Nut

4. On the same side where the nut was just removed, slide out and remove the shift piston.

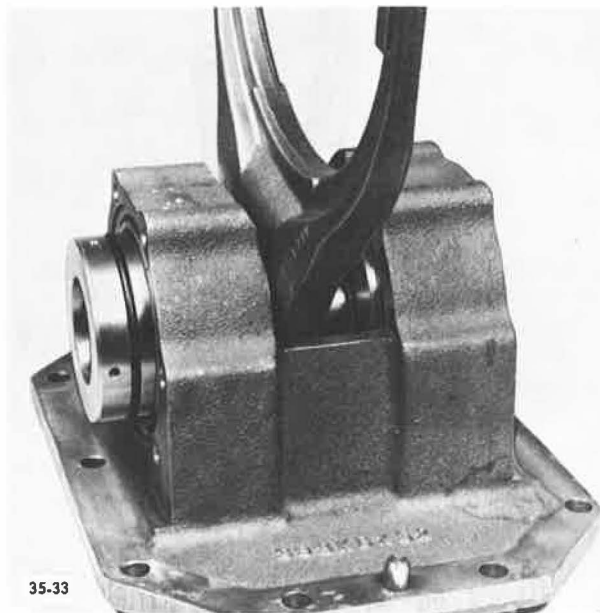


Figure 78. Removing Piston

5. Start sliding the remaining piston out of its housing, and as the capscrew slides out, remove the O-ring from the capscrew.

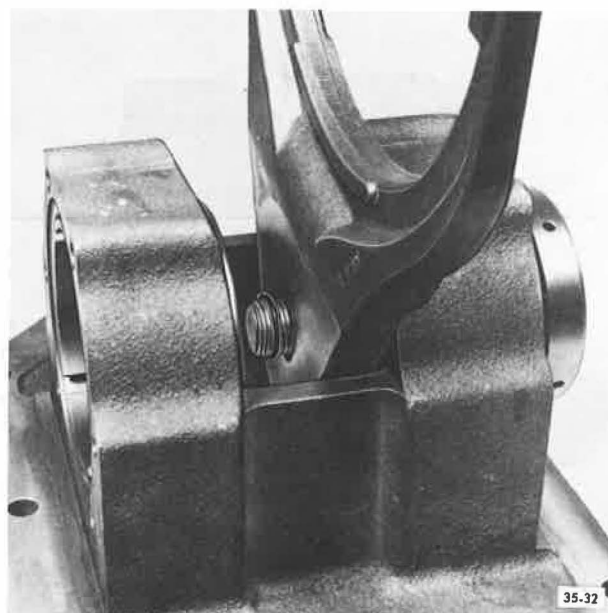
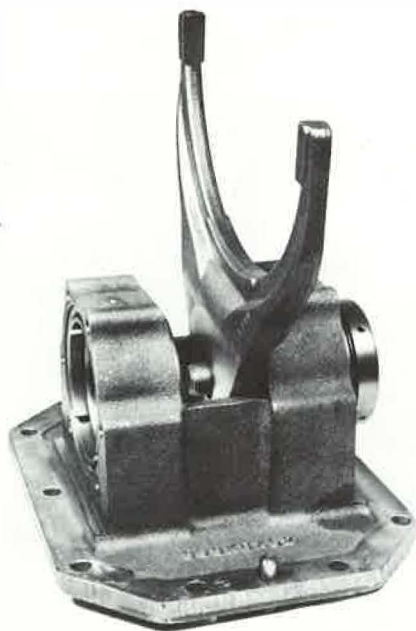


Figure 79. Removing O-Ring

6. Remove the range shift fork from the cover.



35-31

Figure 80. Removing Range Shift Fork

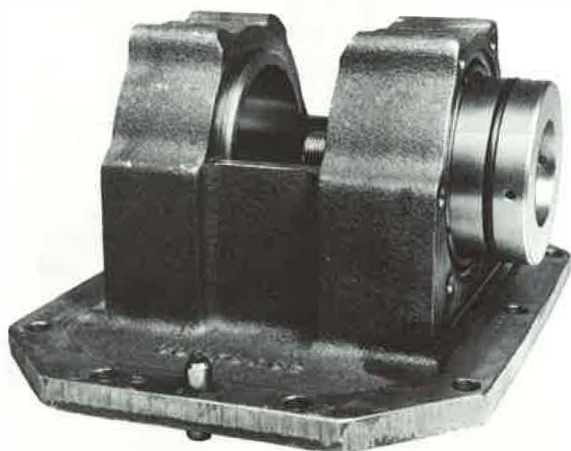
8. Remove the O-ring from the capscrew.



35-29

Figure 82. Removing O-Ring

7. Slide the shift piston and the capscrew the rest of the way out of the shift cover.



35-30

Figure 81. Removing Piston and Capscrew

9. Remove the capscrew from the piston.



35-28

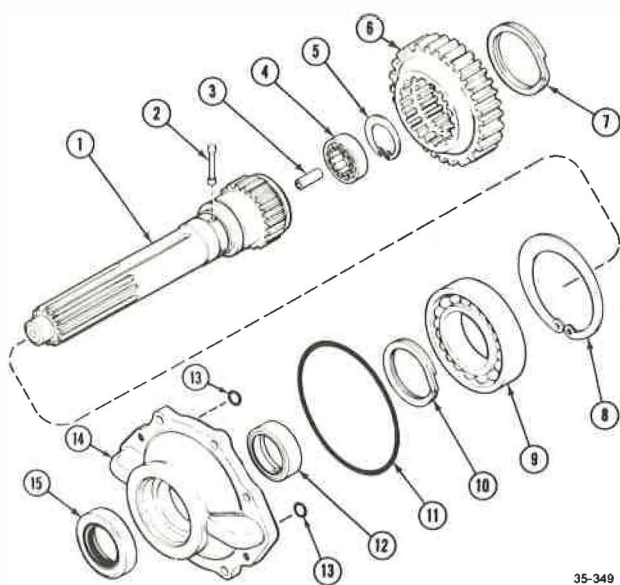
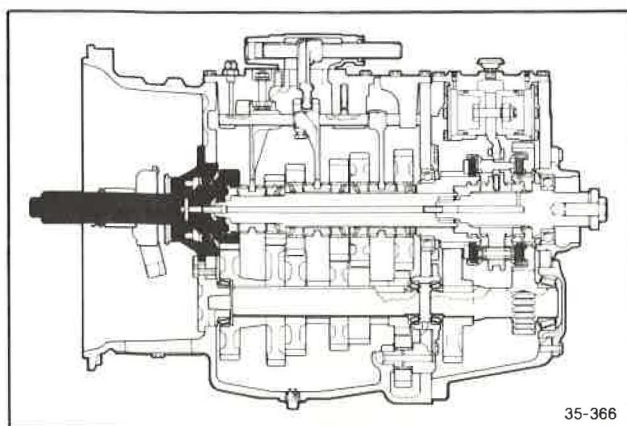
Figure 83. Removing Capscrew

10. Remove the O-ring from each shift piston.



Figure 84. Removing O-Ring

Main Drive Pinion Disassembly



- | | |
|----------------------------|-------------------------------------|
| 1. Main Drive Pinion Shaft | 9. Bearing |
| 2. Oil Pump Plunger | 10. Spiral Snap Ring |
| 3. Oil Tube | 11. O-Ring |
| 4. Spigot Bearing | 12. Oil Pump Eccentric Ring |
| 5. Snap Ring | 13. O-Ring |
| 6. Main Drive Pinion Gear | 14. Main Drive Pinion Bearing Cover |
| 7. Spiral Snap Ring | 15. Oil Seal |
| 8. Snap Ring | |

Figure 85. Exploded View of Main Drive Pinion

1. Remove the spiral snap ring, and then remove the main drive pinion gear from the shaft.

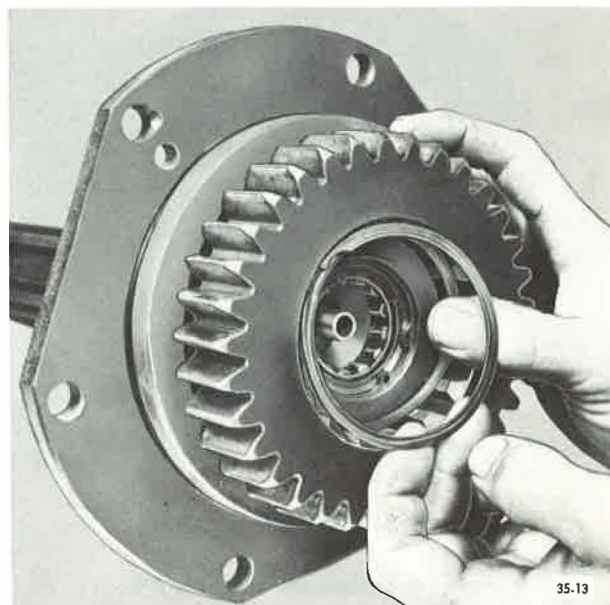


Figure 86. Removing Spiral Snap Ring

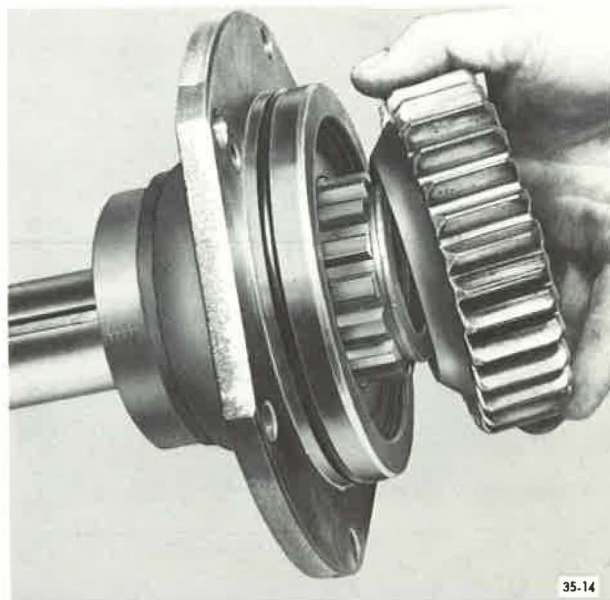


Figure 87. Removing Main Drive Gear from Shaft

2. Remove the large and the small O-rings from the main drive pinion cover.

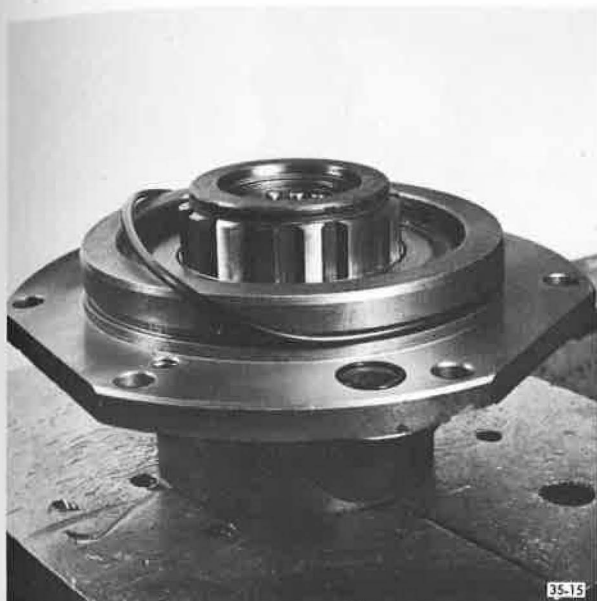


Figure 88. Removing O-Rings

3. Remove the large retaining snap ring from inside the cover.



Figure 89. Removing Snap Ring

4. Press the main drive pinion shaft and bearing out of the cover.

5. Remove the oil seal from the front of the main drive pinion cover.



Figure 90. Removing Seal

6. Remove the oil pump eccentric ring from the main drive pinion cover.

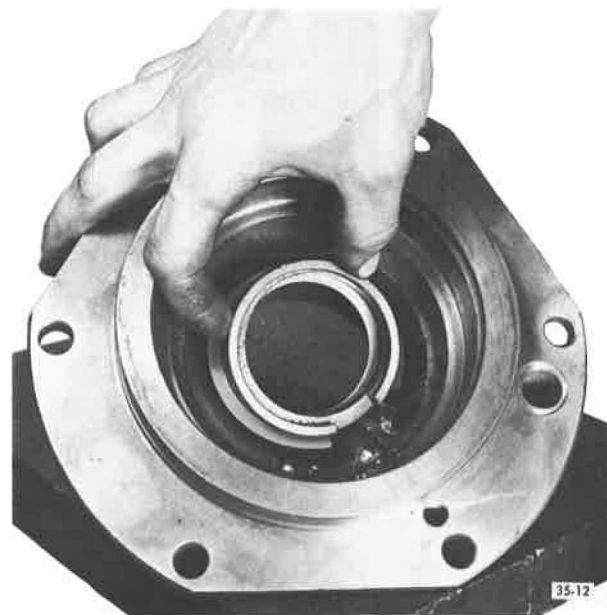


Figure 91. Removing Eccentric Ring

7. Remove the oil pump plunger from the main drive pinion shaft.

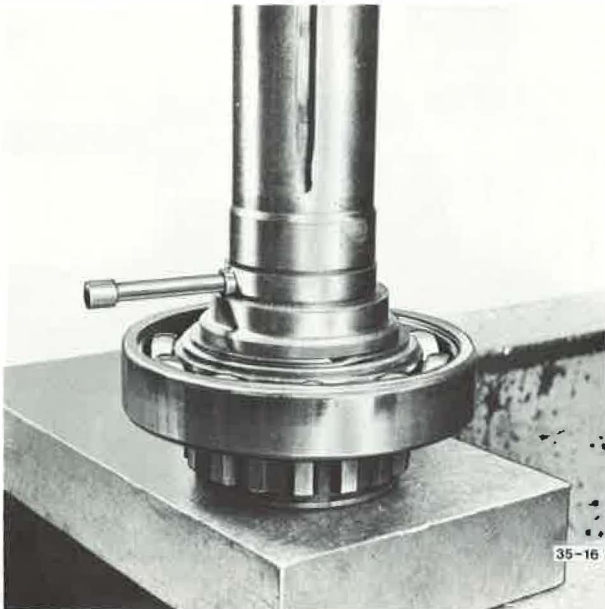


Figure 92. Removing Plunger

9. Press the main drive pinion bearing off of the shaft.

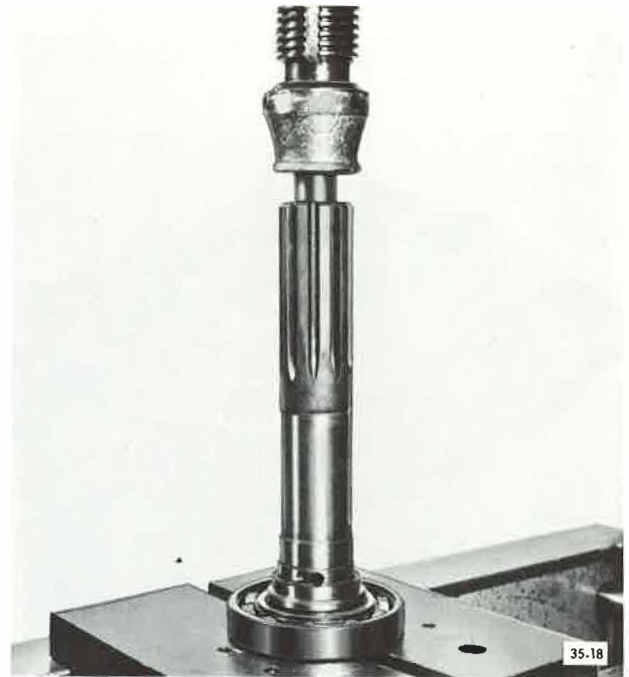


Figure 94. Pressing Bearing off of Shaft

8. Remove the spiral snap ring that holds on the main drive pinion bearing.



Figure 93. Removing Spiral Snap Ring

10. Remove the snap ring that holds in the spigot bearing.



Figure 95. Removing Snap Ring

11. Remove the spigot bearing from the main drive pinion shaft, using an appropriate puller.



35-24

Figure 96. Removing Bearing

Front Mainshaft Disassembly

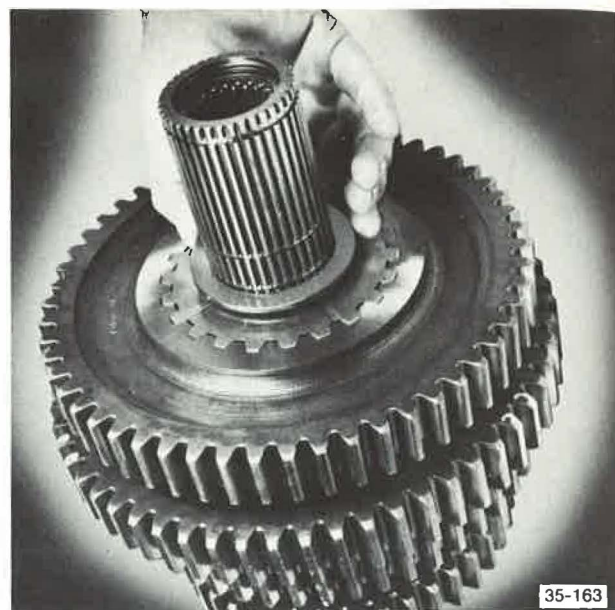
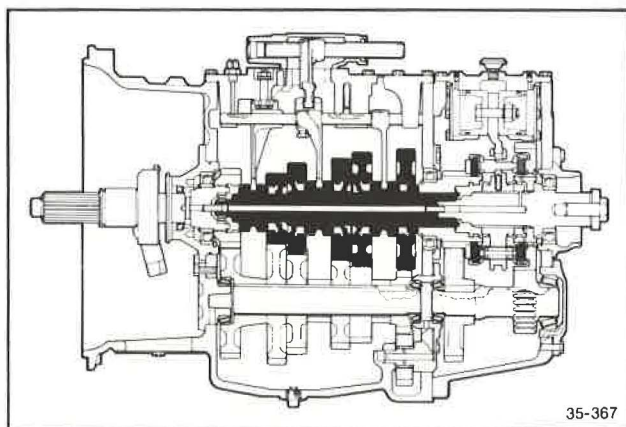
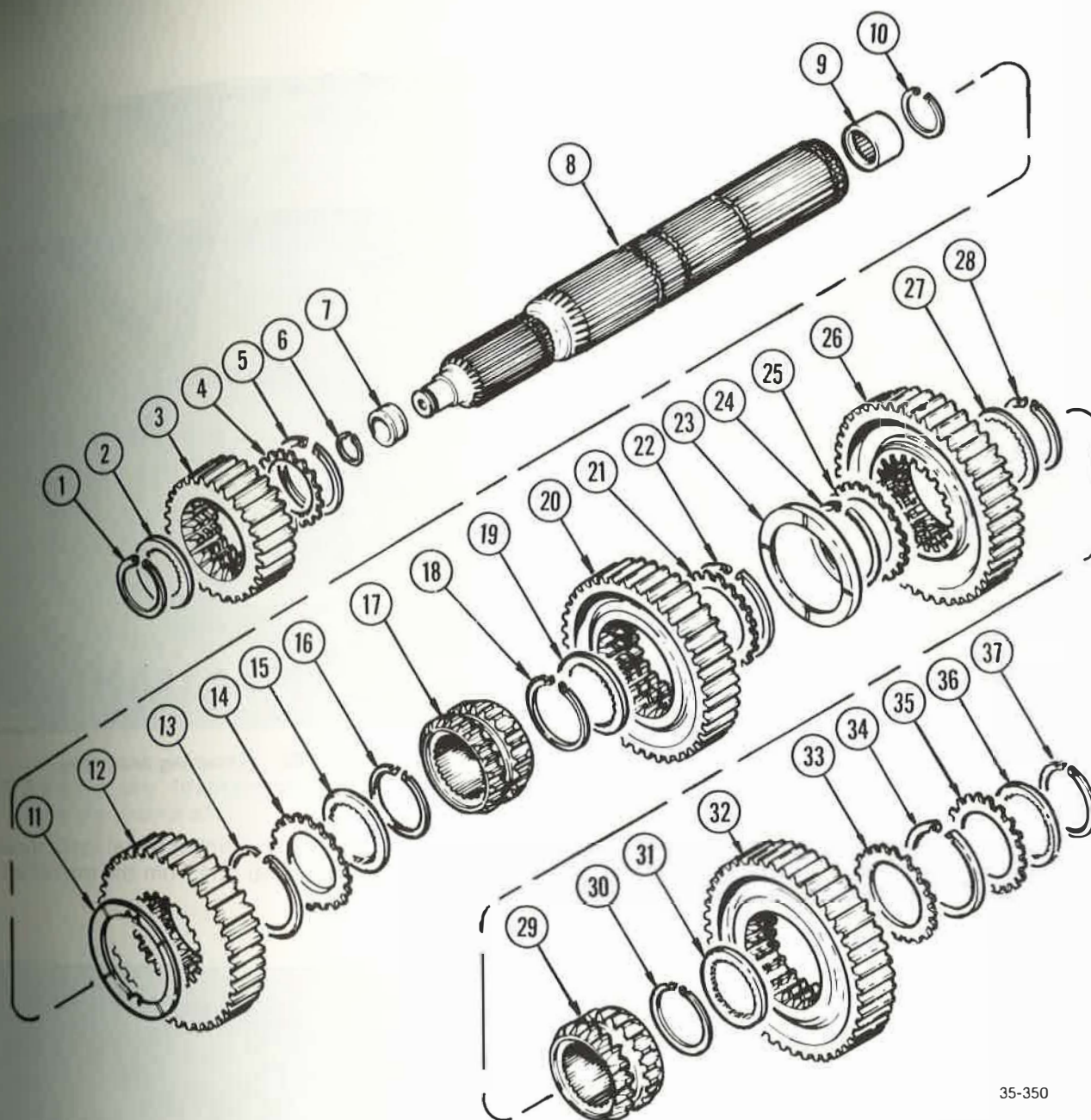


Figure 98. Removing Thrust Washer

1. Remove the snap ring and internal tooth thrust washer at the rear of the reverse gear.



Figure 97. Removing Snap Ring



35-350

1. Snap Ring
2. Thrust Washer
3. Fifth Speed Gear
4. Thrust Washer
5. Snap Ring
6. Snap Ring
7. Bearing Inner Race
8. Front Mainshaft
9. Bearing
10. Snap Ring
11. Flanged Thrust Washer
12. Third Speed Gear

13. Snap Ring
14. Thrust Washer
15. Thrust Washer
16. Snap Ring
17. Sliding Clutch
18. Snap Ring
19. Thrust Washer
20. Second Speed Gear
21. Thrust Washer
22. Snap Ring
23. Flanged Thrust Washer
24. Snap Ring

25. Thrust Washer
26. First Speed Gear
27. Thrust Washer
28. Snap Ring
29. Sliding Clutch
30. Snap Ring
31. Thrust Washer
32. Reverse Speed Gear
33. Thrust Washer
34. Snap Ring
35. Thrust Washer
36. Thrust Washer
37. Snap Ring

Figure 99. Exploded View of Front Mainshaft

2. Remove the reverse gear from the mainshaft, and then remove both external tooth thrust washers from the inside of the reverse gear.

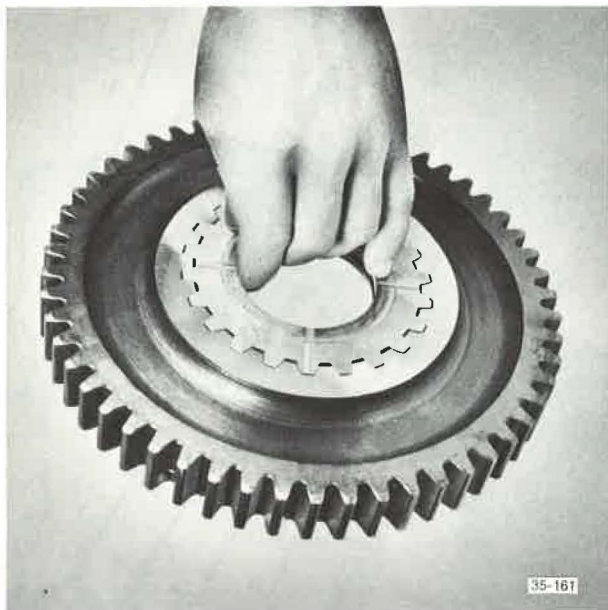


Figure 100. Removing Thrust Washer



Figure 101. Removing Thrust Washer

3. Remove the snap ring from inside the reverse gear.



Figure 102. Removing Snap Ring

4. Remove the remaining internal tooth thrust washer and snap ring from the mainshaft.

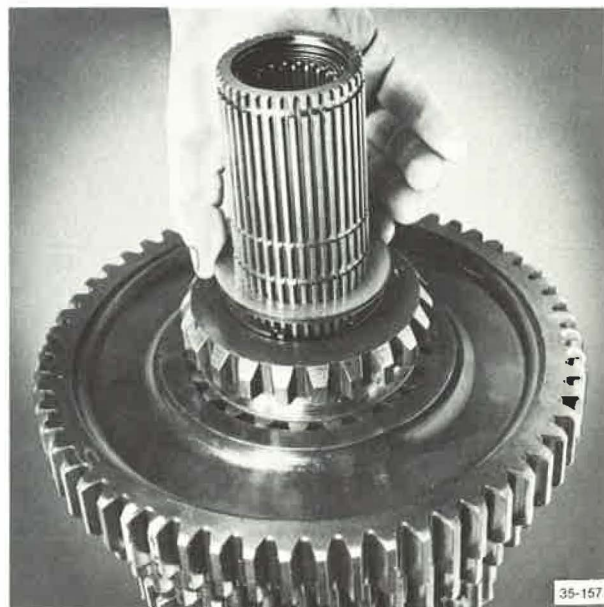


Figure 103. Removing Thrust Washer

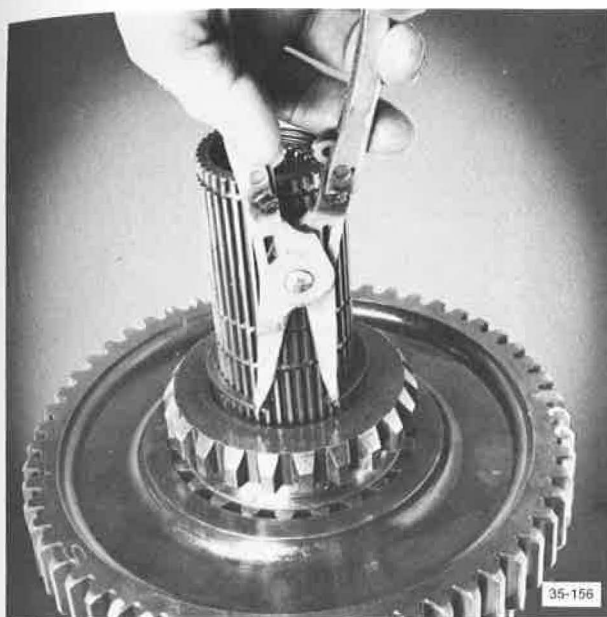


Figure 104. Removing Snap Ring

5. Remove the first/reverse sliding clutch from the mainshaft.

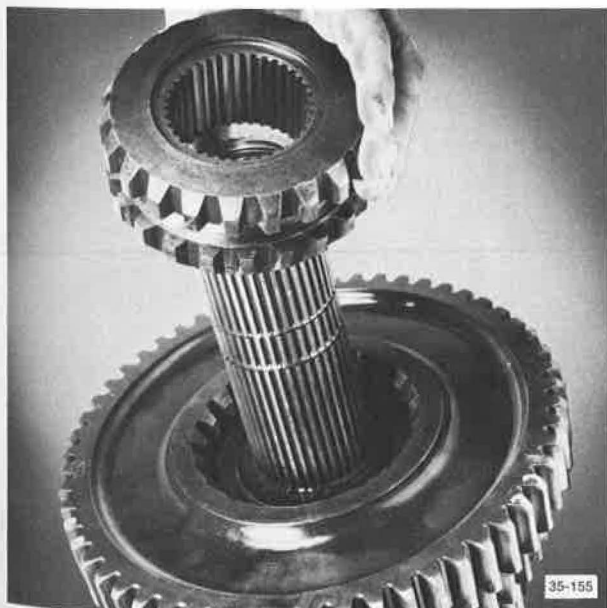


Figure 105. Removing First/Reverse Sliding Clutch

6. Remove the snap ring and the internal tooth thrust washer from inside the first speed gear.

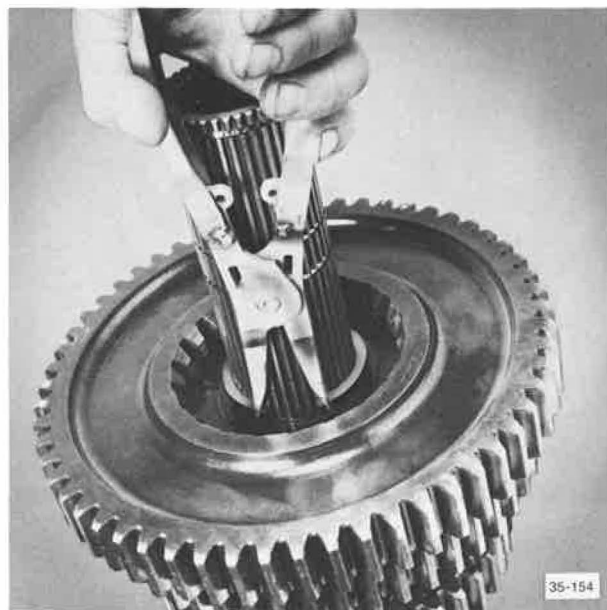


Figure 106. Removing Snap Ring

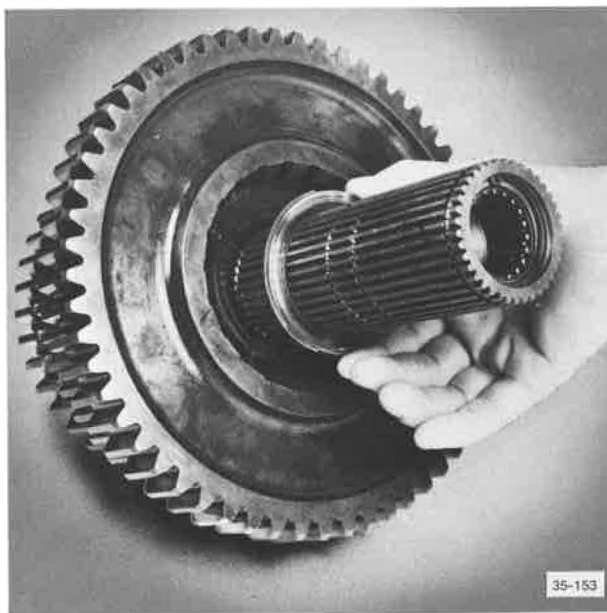


Figure 107. Removing Thrust Washer

7. Remove the first speed gear from the mainshaft.

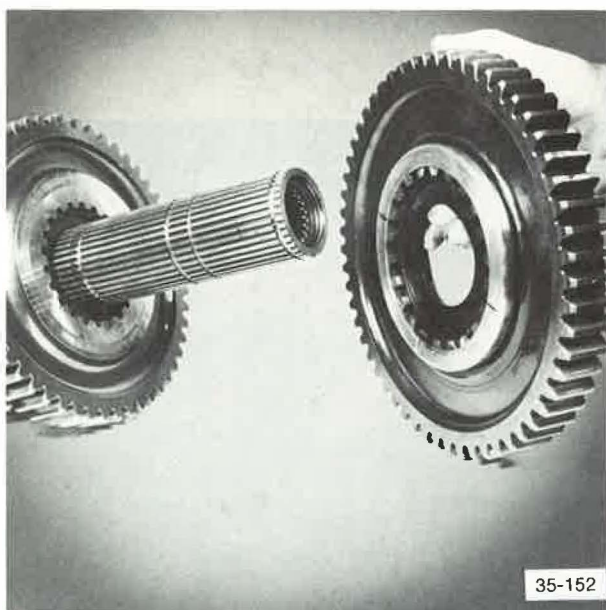


Figure 108. Removing First Speed Gear

8. Remove the external tooth thrust washer and the snap ring from inside the first speed gear.

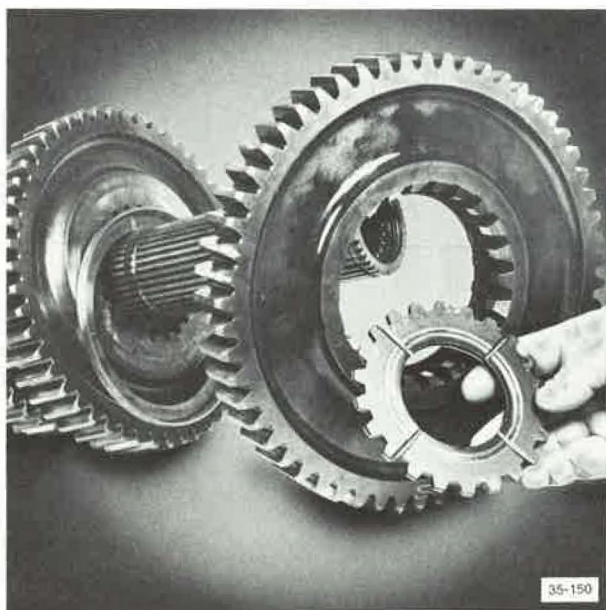


Figure 109. Removing Thrust Washer

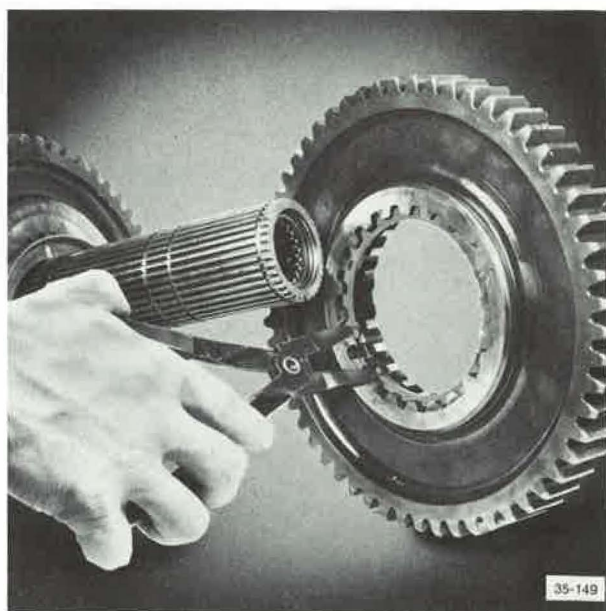


Figure 110. Removing Snap Ring

9. Remove the flanged thrust washer from between the first and second speed mainshaft gears.

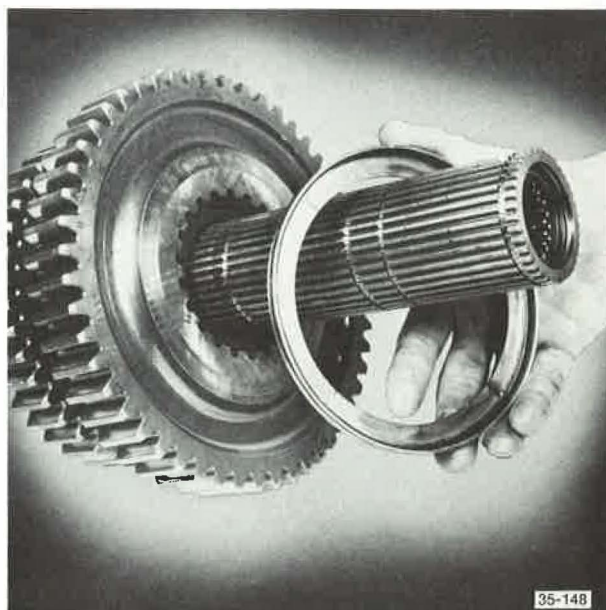


Figure 111. Removing Flanged Thrust Washer

10. Remove the second speed gear from the mainshaft.

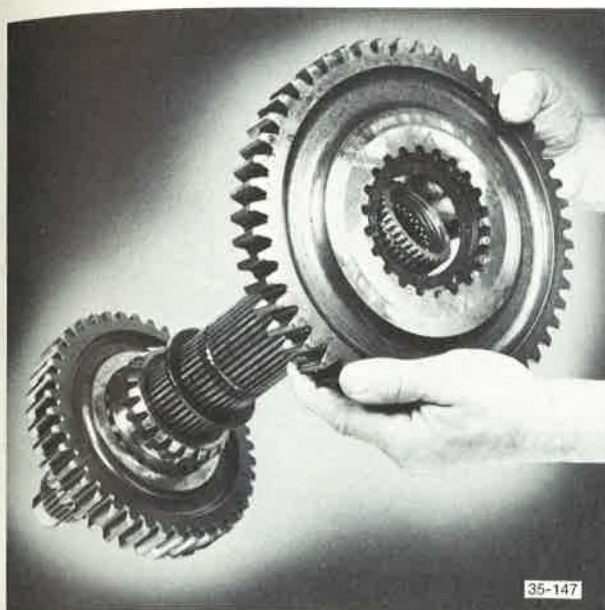


Figure 112. Removing Second Speed Gear

11. Remove the external tooth thrust washer and the snap ring from the second speed gear.

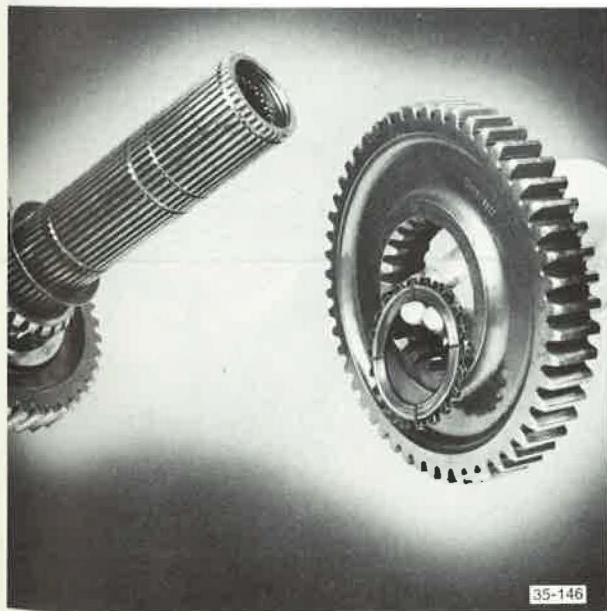


Figure 113. Removing Thrust Washer

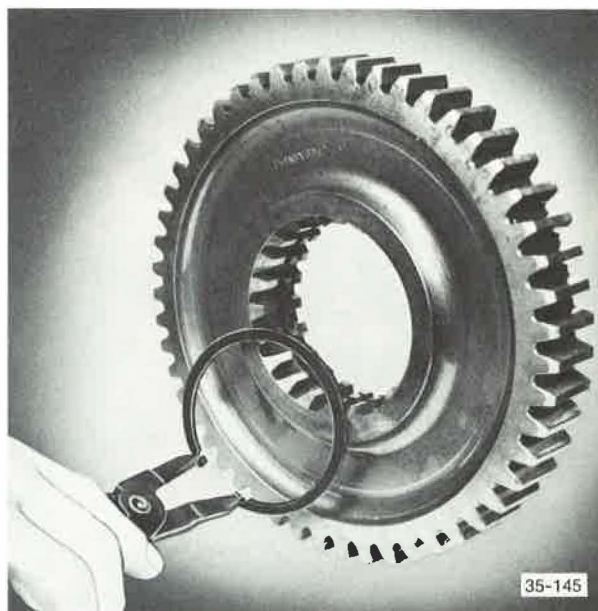


Figure 114. Removing Snap Ring

12. Remove the second speed gear internal tooth thrust washer and snap ring from the mainshaft.

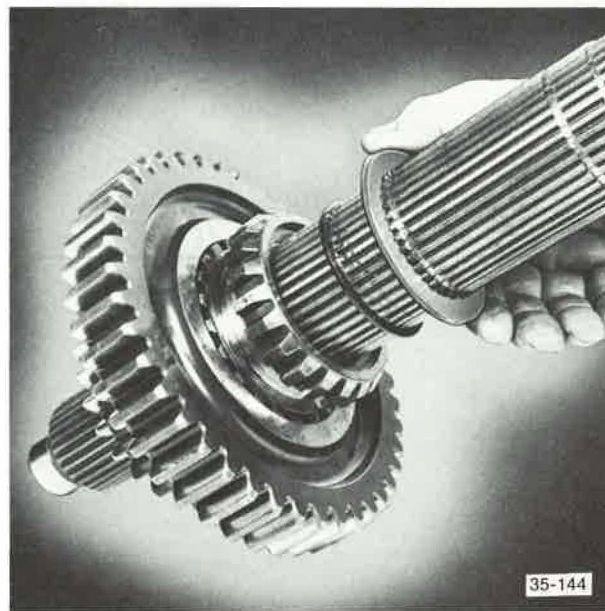


Figure 115. Removing Thrust Washer

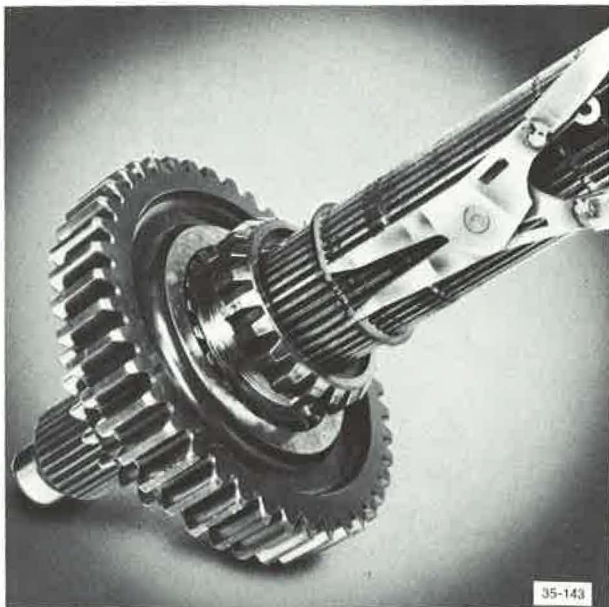


Figure 116. Removing Snap Ring

13. Remove the second/third speed sliding clutch from the mainshaft.

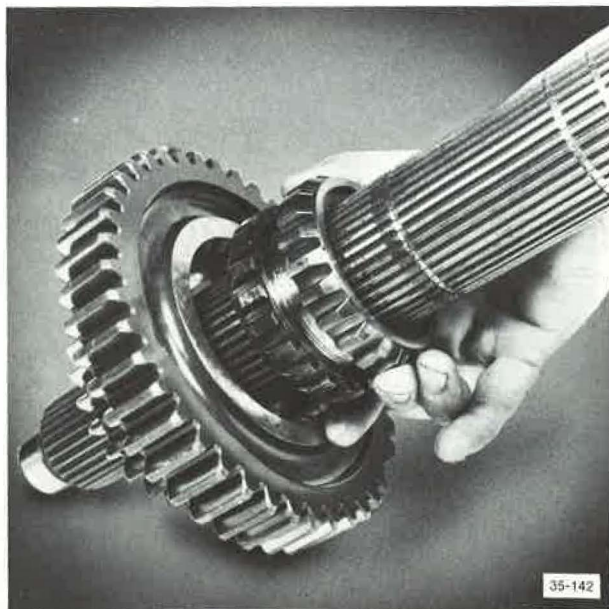


Figure 117. Removing Second/Third Speed Sliding Clutch

14. Remove the snap ring from the mainshaft inside the third speed gear.

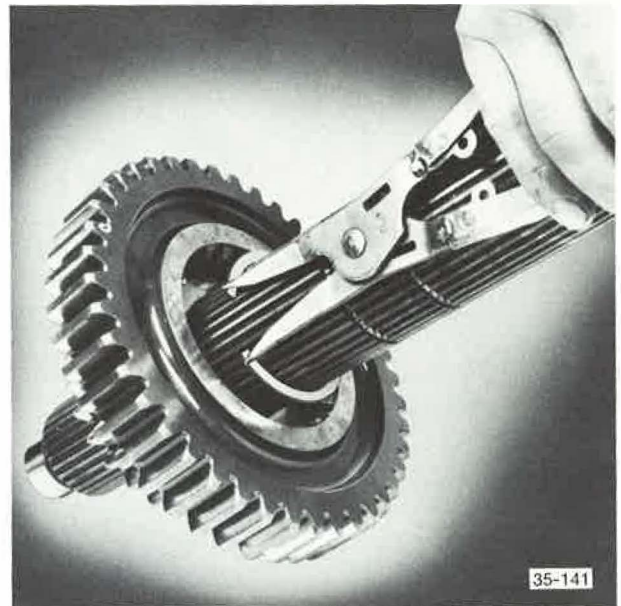


Figure 118. Removing Snap Ring

15. Remove the internal tooth thrust washer from inside the third speed gear.

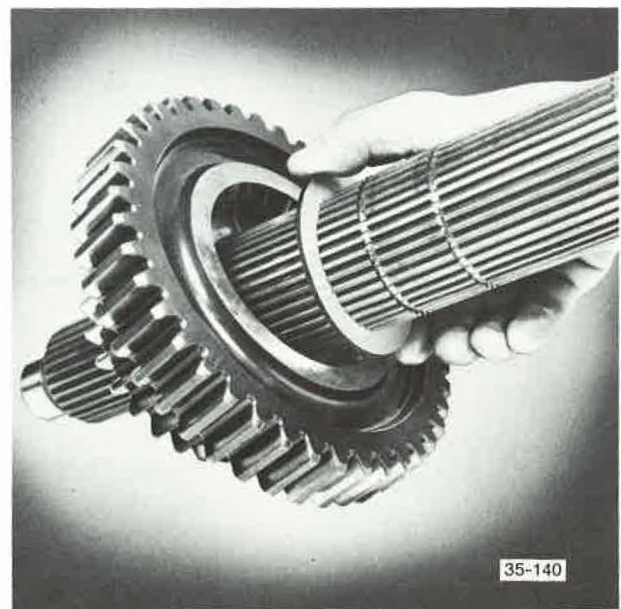


Figure 119. Removing Thrust Washer

16. Remove the third speed gear from the mainshaft, and from it remove the external tooth thrust washer, and the flanged thrust washer from the forward face of the gear.

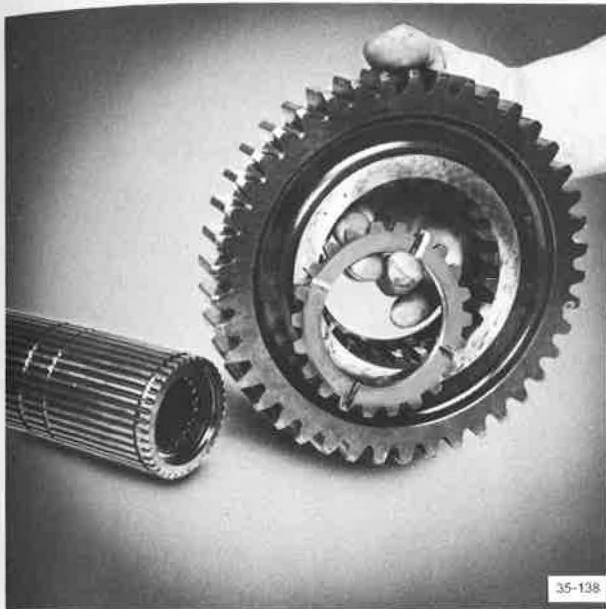


Figure 120. Removing Thrust Washer

17. Remove the snap ring from the inside of the third speed gear.

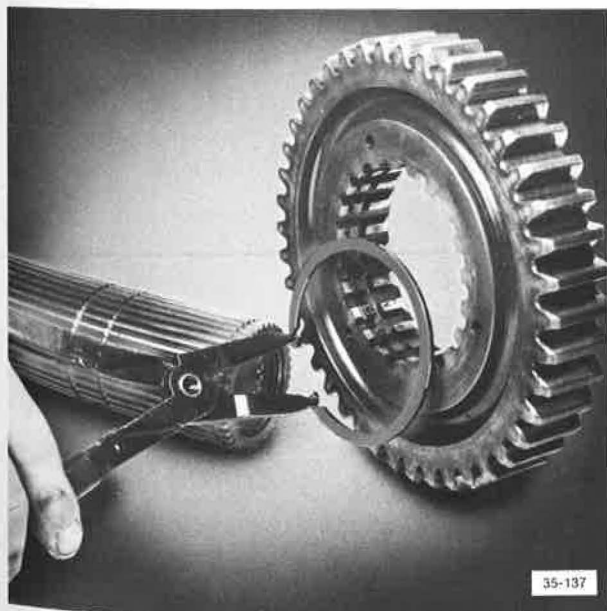


Figure 121. Removing Snap Ring

18. Remove the snap ring and the internal tooth thrust washer from the mainshaft, inside the fifth speed gear.

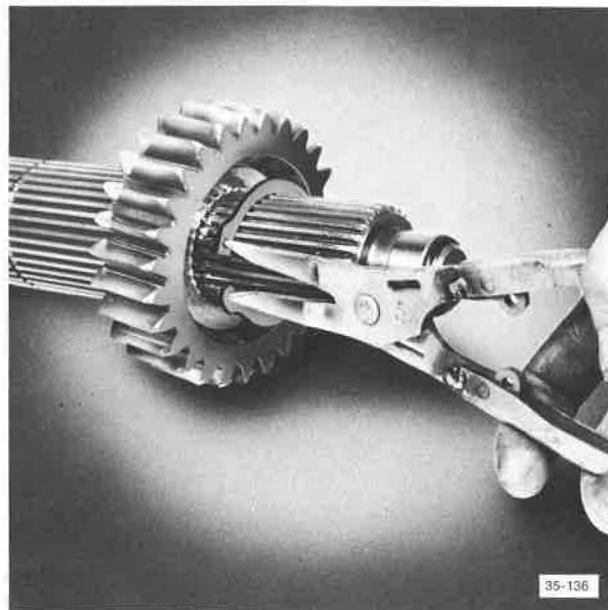


Figure 122. Removing Snap Ring

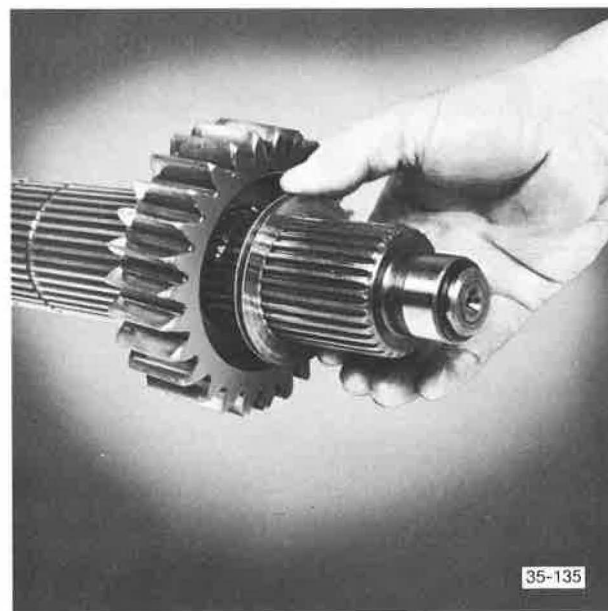


Figure 123. Removing Thrust Washer

19. Remove the external tooth thrust washer and the snap ring from inside the fifth speed gear.

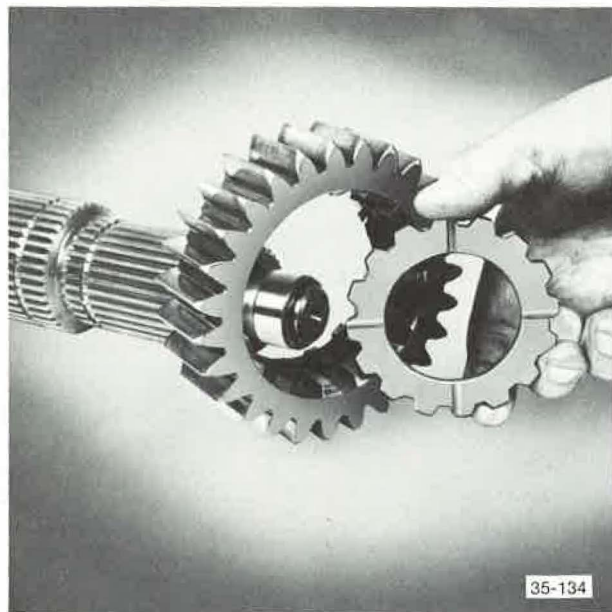


Figure 124. Removing Thrust Washer

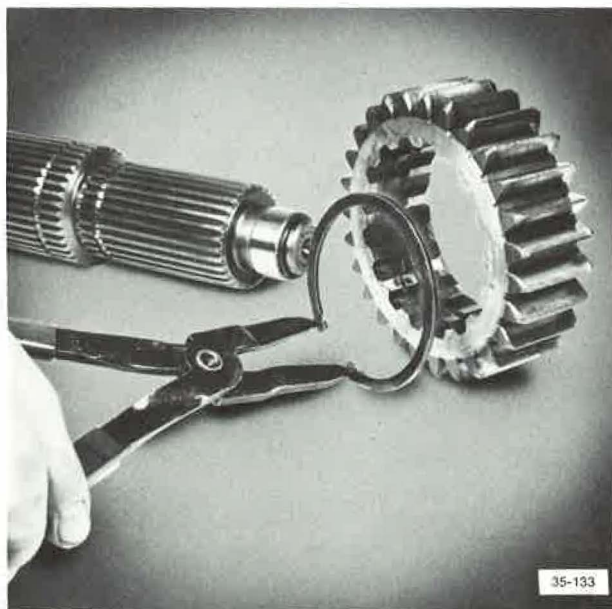


Figure 125. Removing Snap Ring

20. Remove the spigot bearing inner race retaining snap ring from the front end of the mainshaft.

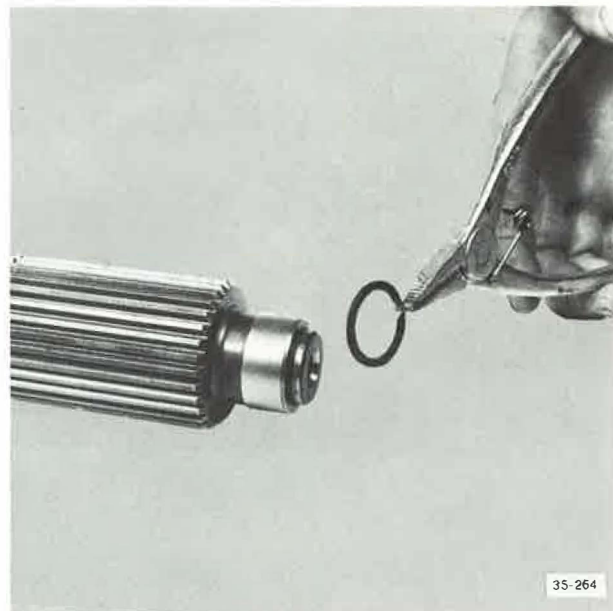


Figure 126. Removing Snap Ring

21. Press the spigot bearing inner race off of the mainshaft.

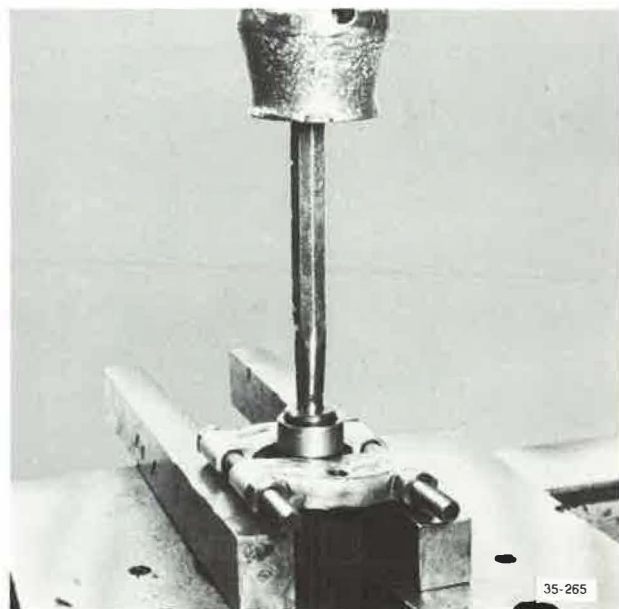


Figure 127. Pressing Off Spigot Bearing Inner Race

22. Remove the pocket bearing retaining snap ring from the rear of the mainshaft.



Figure 128. Removing Snap Ring

23. Remove the pocket bearing, using an appropriate puller.

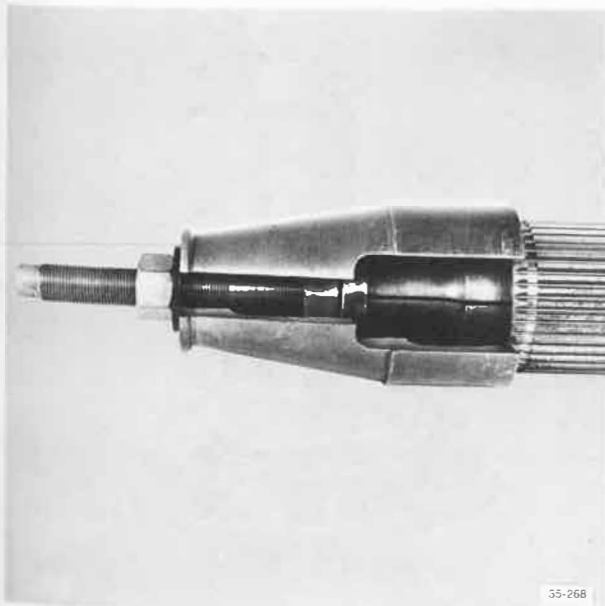
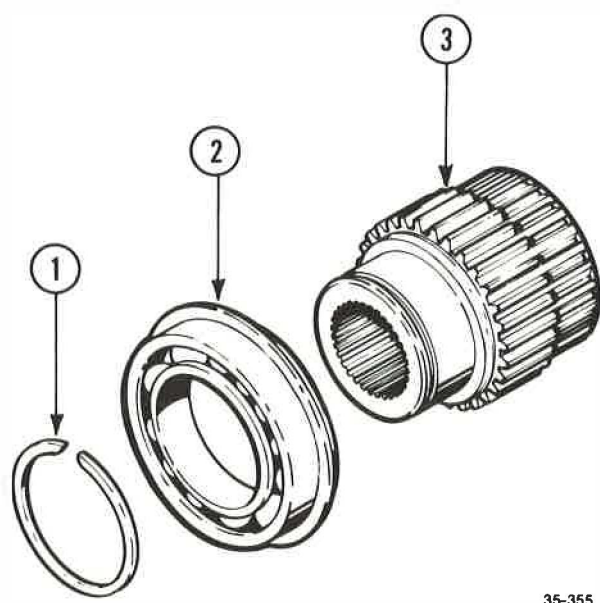
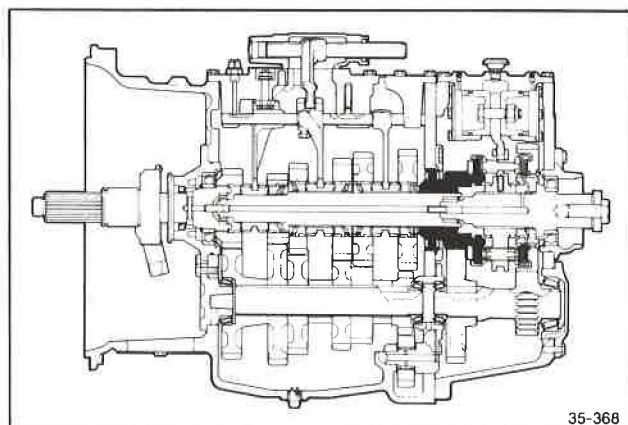


Figure 129. Removing Pocket Bearing

Rear Compound Main Drive Gear Disassembly



1. Snap Ring
2. Bearing
3. Main Drive Gear

Figure 130. Exploded View of Rear Compound Main Drive Gear

1. Remove the bearing retaining snap ring from the main drive gear.



Figure 131. Removing Snap Ring

2. Press the bearing off of the main drive gear.

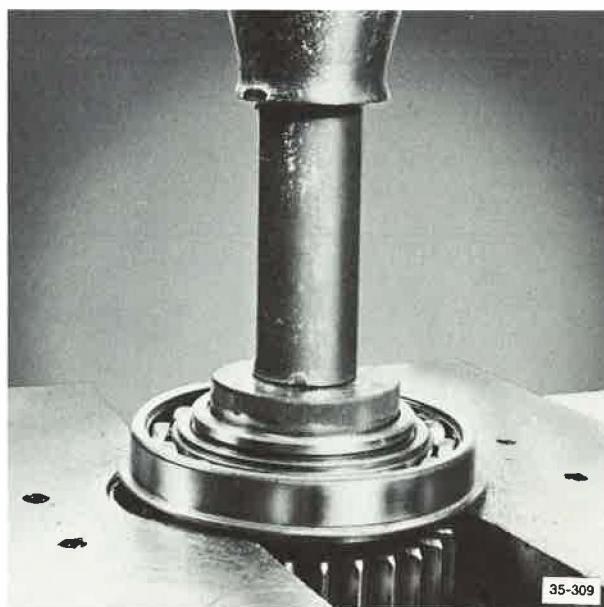
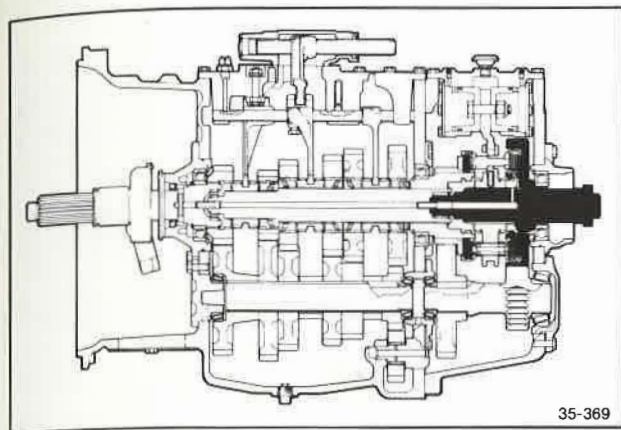
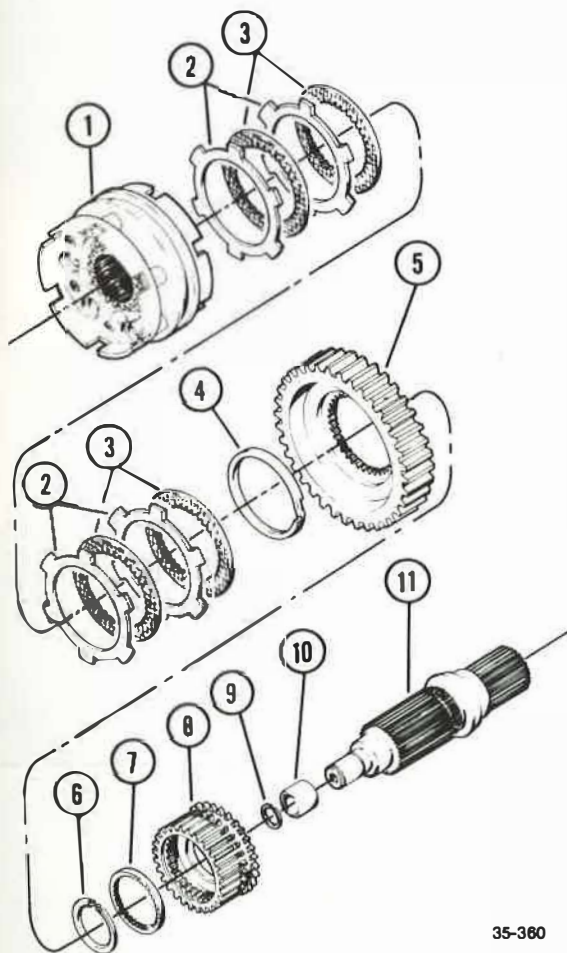


Figure 132. Pressing Off Bearing

Rear Mainshaft Disassembly



35-369

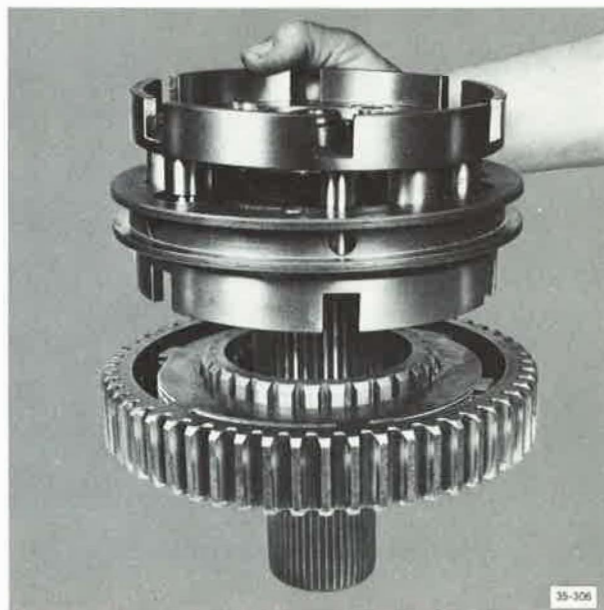


35-360

- | | |
|------------------|------------------|
| 1. Synchronizer | 7. Thrust Washer |
| 2. Reaction Disc | 8. Gear Hub |
| 3. Friction Disc | 9. Snap Ring |
| 4. Snap Ring | 10. Bearing Race |
| 5. Lo-Range Gear | 11. Mainshaft |
| 6. Snap Ring | |

Figure 133. Exploded View of Rear Mainshaft

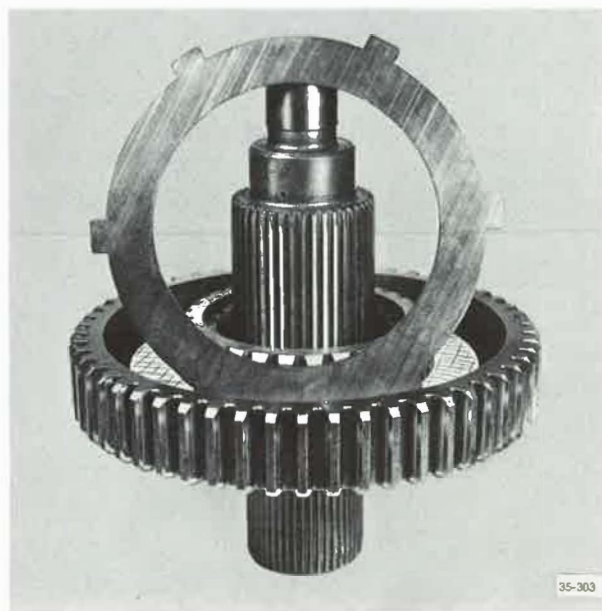
1. Remove the synchronizer assembly from the rear mainshaft.



35-306

Figure 134. Removing Synchronizer Assembly

2. Remove the reaction discs and the friction discs from inside the lo-range gear.



35-303

Figure 135. Removing Reaction Disc

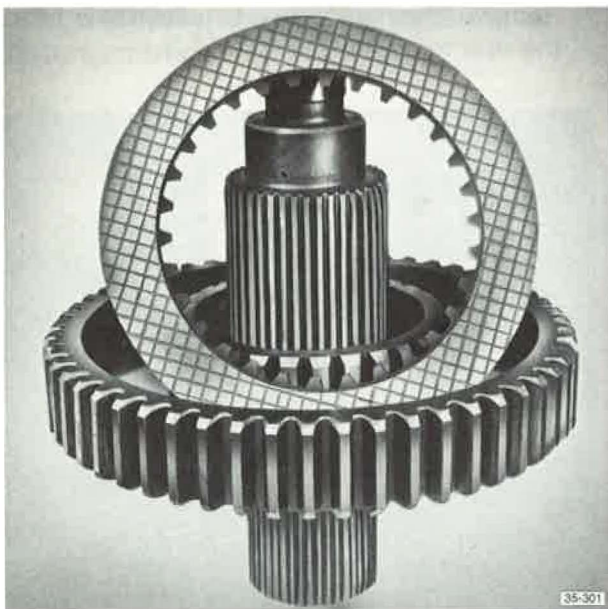


Figure 136. Removing Friction Disc

3. Remove the spiral snap ring from inside the lo-range gear, and remove the lo-range gear.

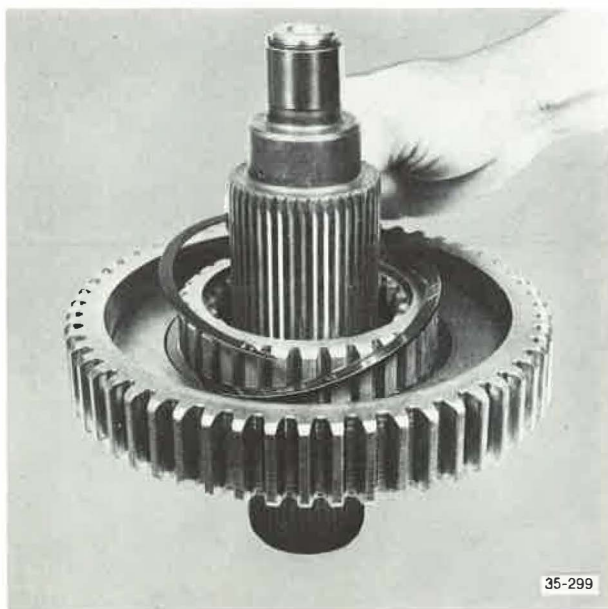


Figure 137. Removing Spiral Snap Ring

4. Remove the snap ring from inside the lo-range gear hub.

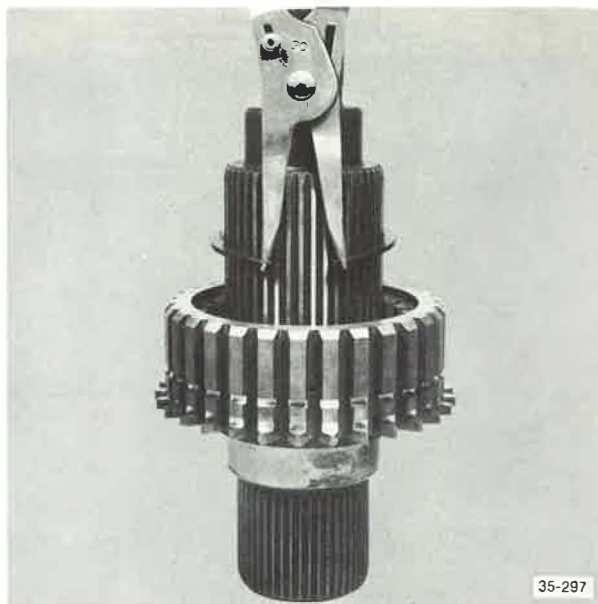


Figure 138. Removing Snap Ring

5. Remove the thrust washer from inside the lo-range gear hub, and then remove the lo-range gear hub from the rear mainshaft.

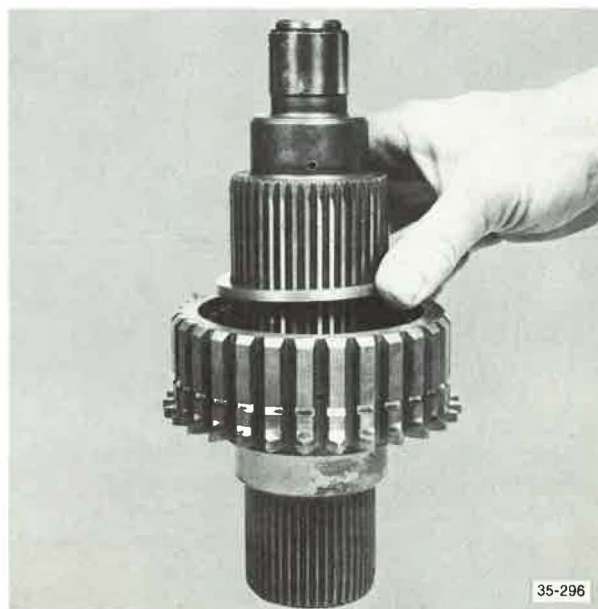


Figure 139. Removing Thrust Washer



Figure 140. Removing Lo-Range Gear Hub

6. Remove the snap ring from the front of the rear mainshaft.



Figure 142. Removing Snap Ring

7. Press off the bearing inner race from the front end of the rear mainshaft.



Figure 141. Rear Mainshaft

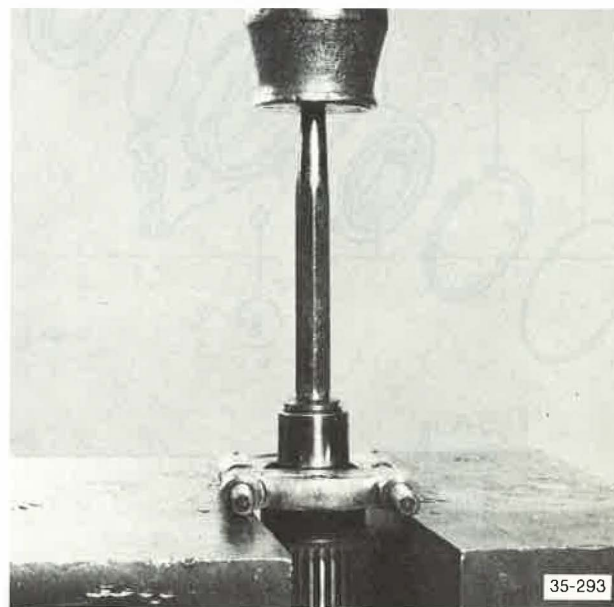
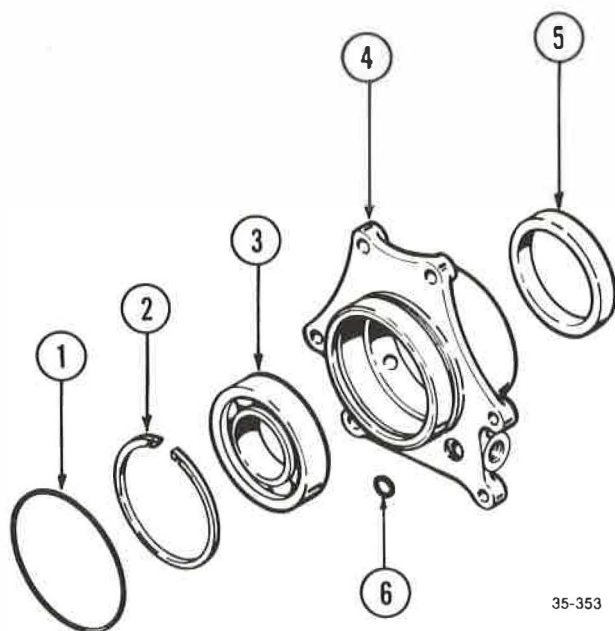
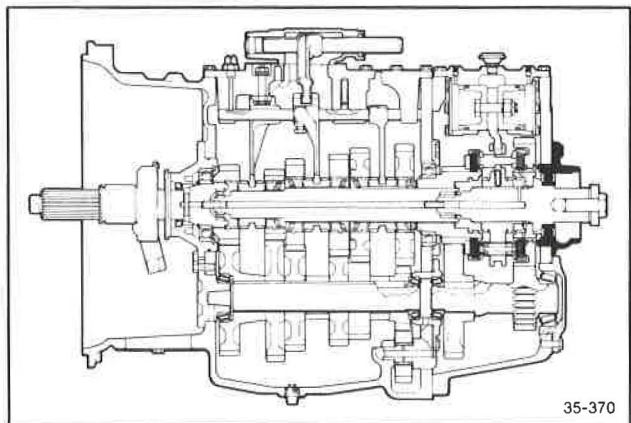


Figure 143. Pressing Off Bearing Inner Race

Rear Mainshaft Rear Bearing Cover Disassembly



1. O-Ring
2. Snap Ring
3. Bearing
4. Rear Bearing Cover
5. Oil Seal
6. O-Ring

Figure 144. Exploded View of Rear Mainshaft Rear Bearing Cover

1. Remove the small and the large O-rings from the bearing cover.

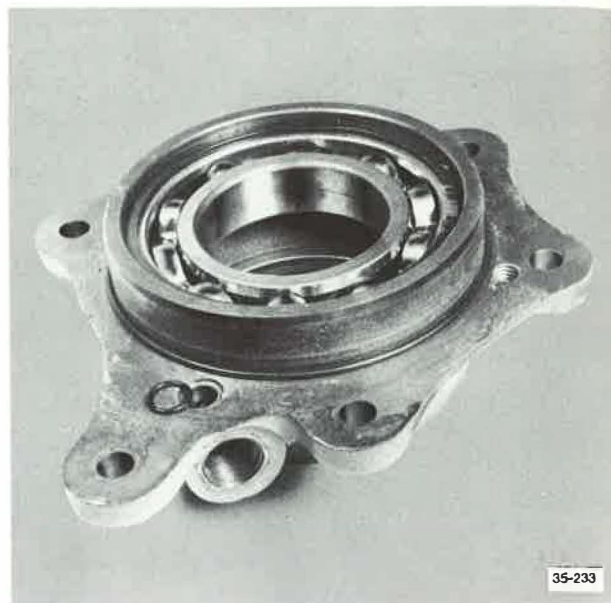


Figure 145. Removing O-Rings

2. Remove the bearing retaining snap ring from the cover.

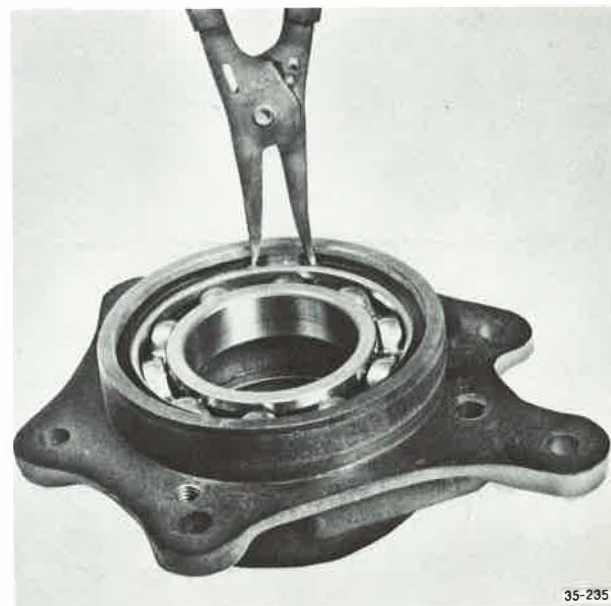


Figure 146. Removing Snap Ring

3. Remove the bearing from inside the cover.

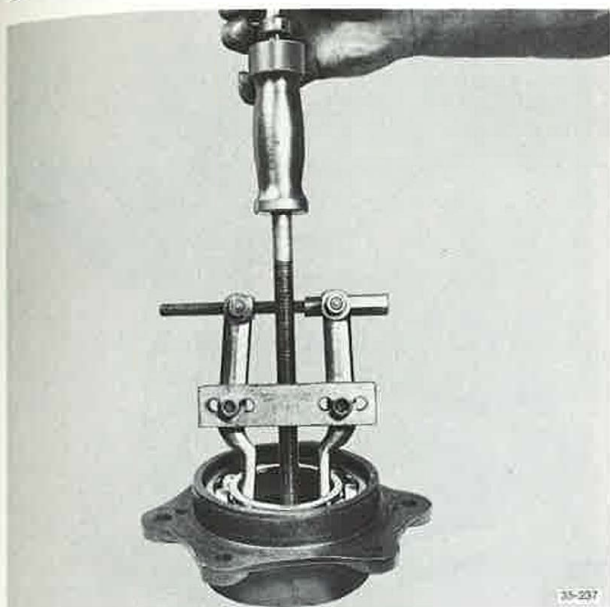
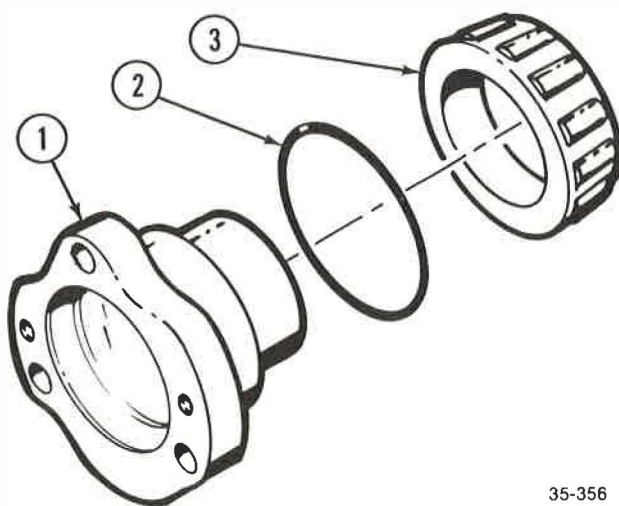
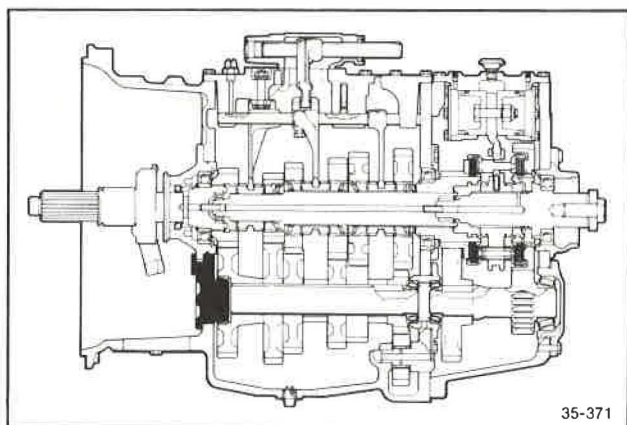


Figure 147. Removing Bearing

Front Countershaft Front Bearing Cover Disassembly



1. Front Bearing Cover
2. O-Ring
3. Bearing

Figure 148. Exploded View of Front Countershaft Front Bearing Cover

1. Remove the large O-ring from the front countershaft front bearing cover.



Figure 149. Removing O-Ring

2. Press the bearing off of the front bearing cover.

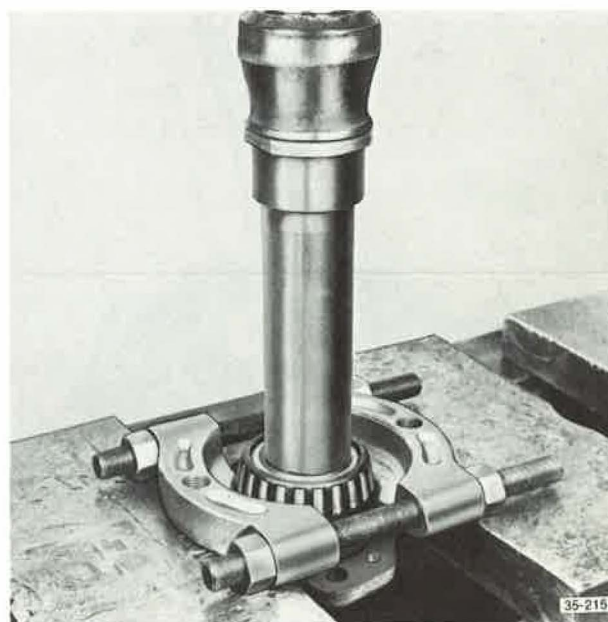
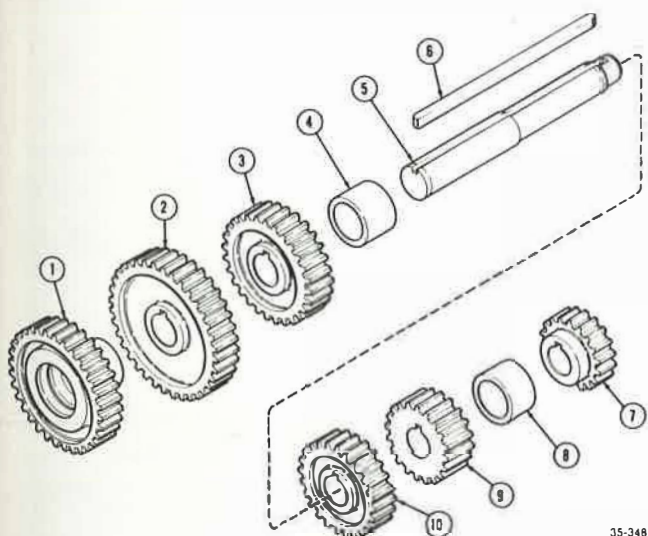
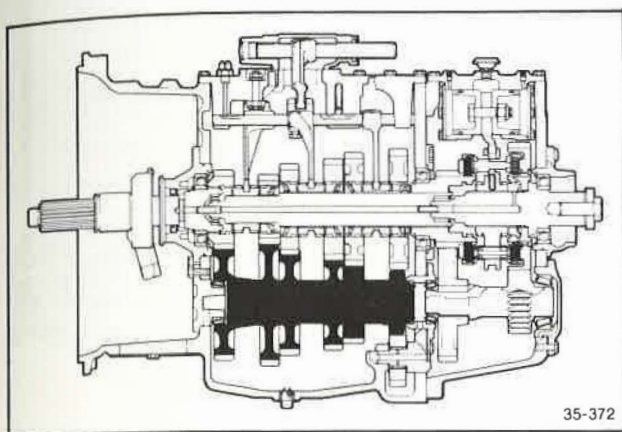


Figure 150. Removing Bearing

Front Countershaft Disassembly



- | | |
|-----------------------|-----------------------|
| 1. Main Drive Gear | 6. Key |
| 2. Fifth Speed Gear | 7. Reverse Gear |
| 3. Third Speed Gear | 8. Spacer |
| 4. Spacer | 9. First Speed Gear |
| 5. Front Countershaft | 10. Second Speed Gear |

Figure 151. Exploded View of Front Countershaft

1. Press the front countershaft main drive gear off of the shaft.

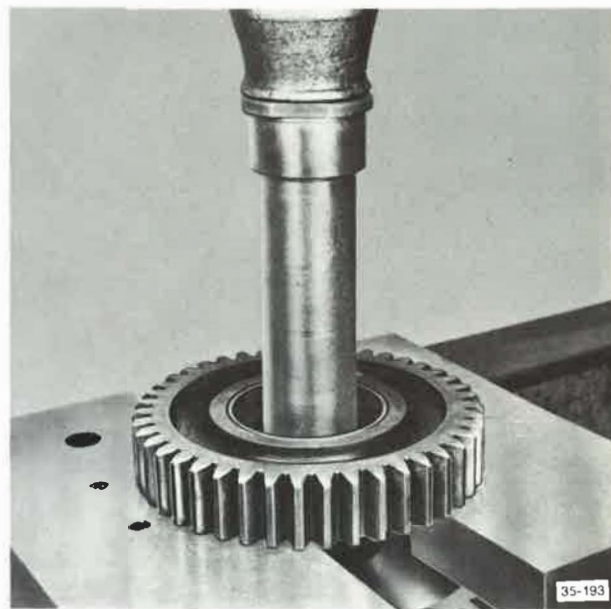


Figure 152. Pressing Main Drive Gear Off of the Shaft

2. Press the front countershaft fifth speed gear off of the shaft.

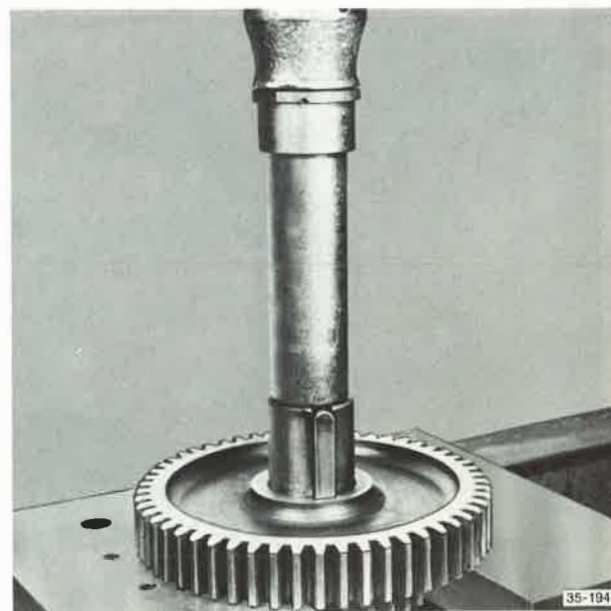


Figure 153. Pressing Fifth Speed Gear Off of Shaft

3. Press the front countershaft third speed gear off of the shaft.

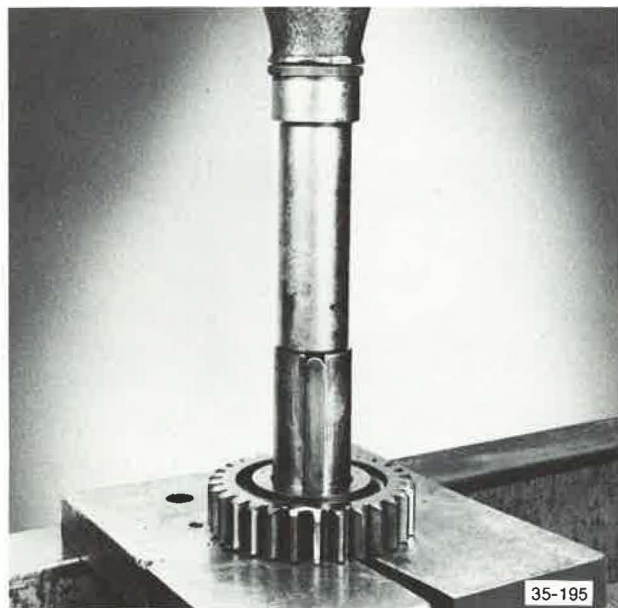


Figure 154. Pressing Third Speed Gear Off of Shaft

4. Remove the spacer between the third and second speed gears from the shaft.

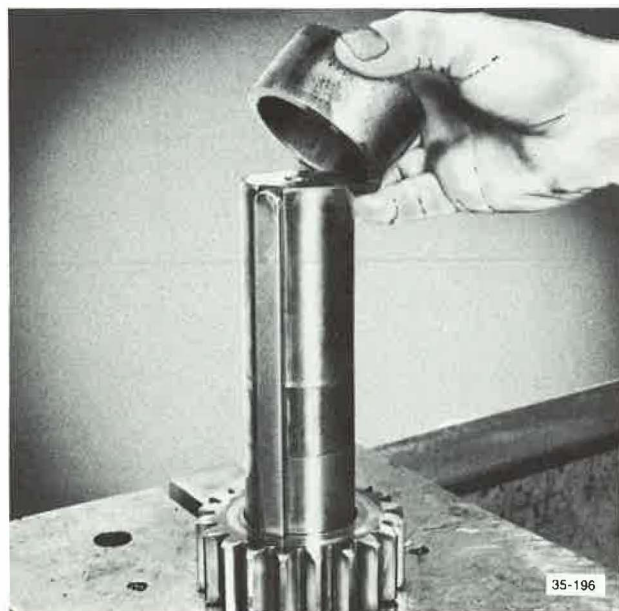


Figure 155. Removing Spacer

WARNING

The reverse, first, and second gears on the countershaft must be pressed off the REAR end of the shaft. The forward end is slightly larger in diameter than the rear. If you try to press any of these three gears on or off the forward end of the shaft, the gears will crack, and may fragment explosively, spraying metal pieces outward. These could cause severe injury or death.

5. Press the reverse gear and the rear bearing off of the countershaft. See previous WARNING about pressing only off of the rear of the shaft.



Figure 156. Pressing Off Rear Bearing and Reverse Gear

6. In a similar manner, press off the first and second gears from the shaft. See previous WARNING about pressing only off of the rear of the shaft.

7. Remove the key from the keyway of the shaft.

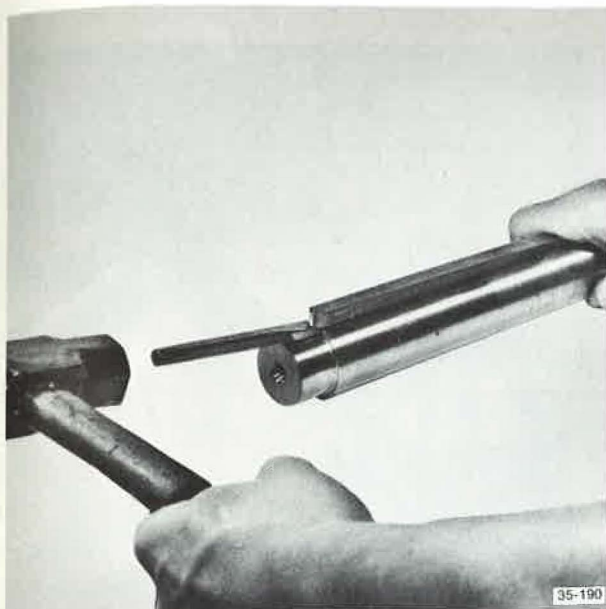


Figure 157. Removing Key

8. Remove the bearing race from inside the front countershaft main drive gear, using an appropriate puller.

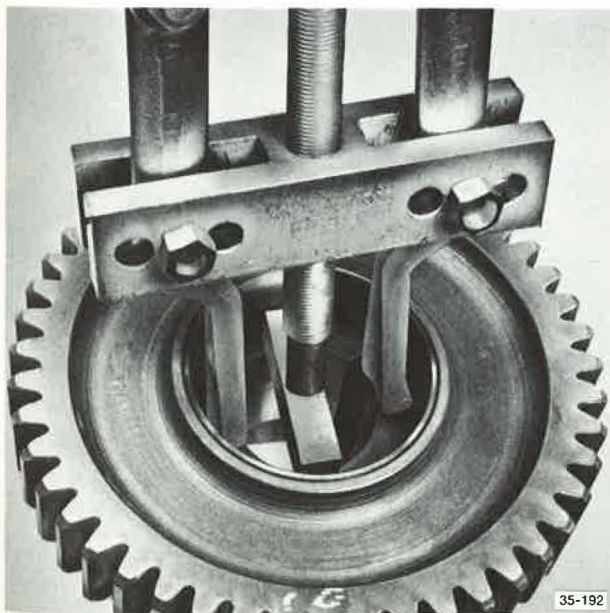
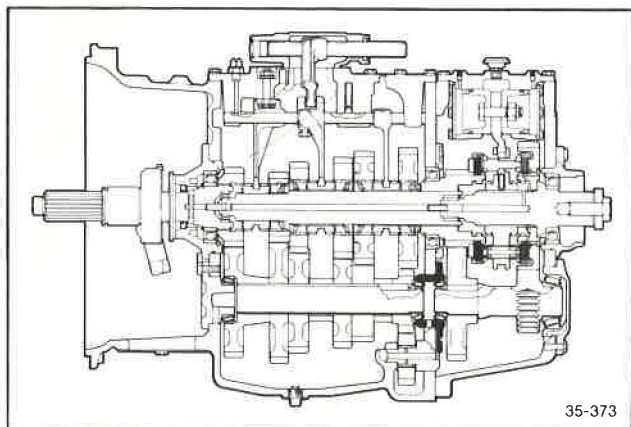


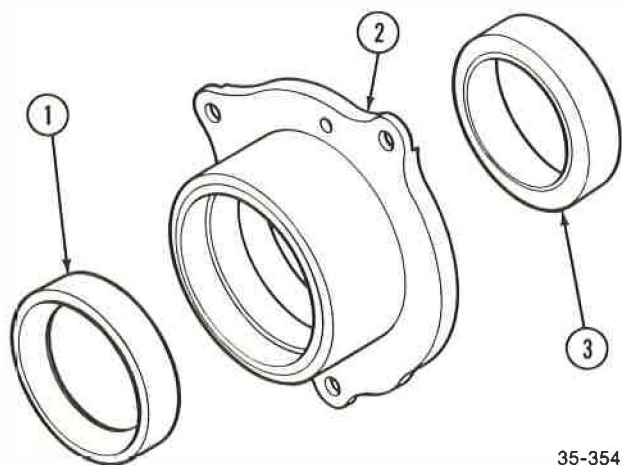
Figure 158. Removing Bearing Race

Front Countershaft Rear Bearing Cover Disassembly



WARNING

Use only soft steel or brass punches when driving against hard bearing races. A hard punch could fragmentize the race, causing injury.



1. Front Bearing Outer Race
2. Bearing Cover
3. Rear Bearing Outer Race

Figure 159. Exploded View of Front Countershaft Rear Bearing Cover

1. Remove both the front and rear bearing races from the bearing cover.

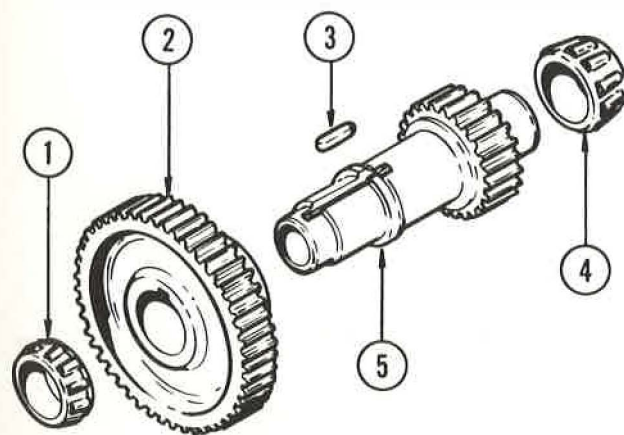
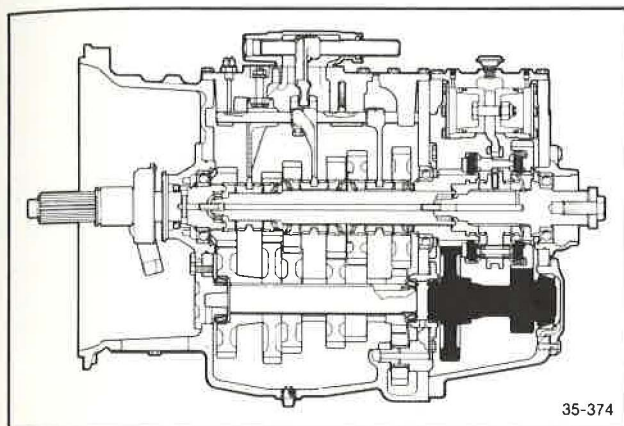


Figure 160. Removing Front Bearing Race



Figure 161. Removing Rear Bearing Race

Rear Countershaft Disassembly



1. Front Bearing
2. Main Drive Gear
3. Key
4. Rear Bearing
5. Rear Countershaft

Figure 162. Exploded View of Rear Countershaft

1. Press the rear bearing off of the rear countershaft.

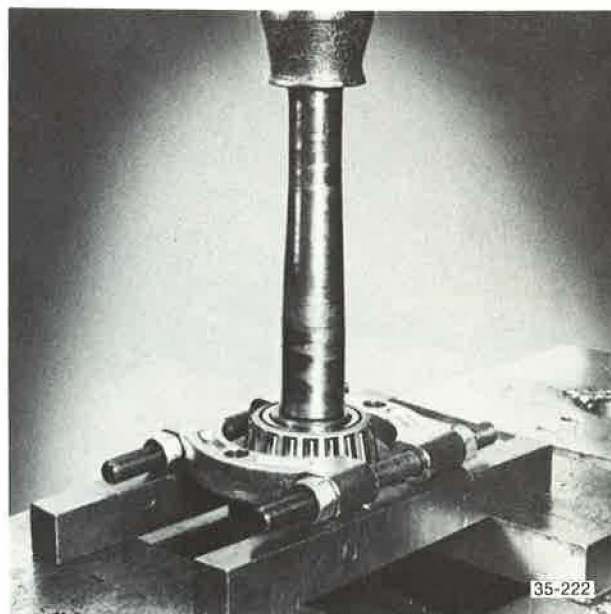


Figure 163. Pressing off Bearing

2. Press the rear countershaft main drive gear and the front bearing off of the shaft.

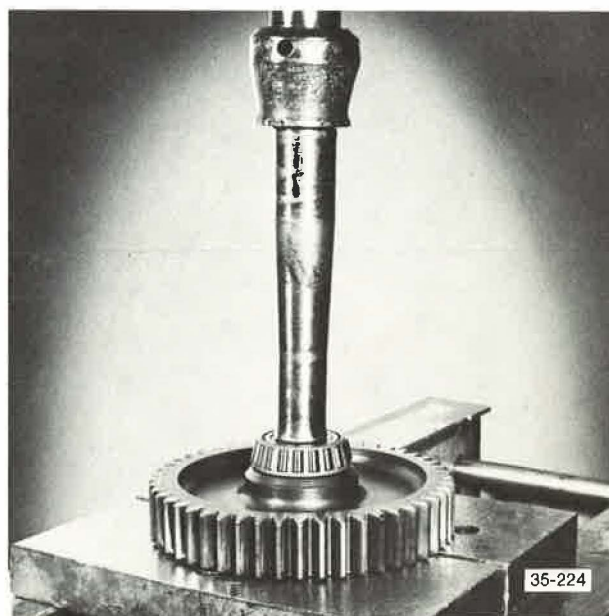


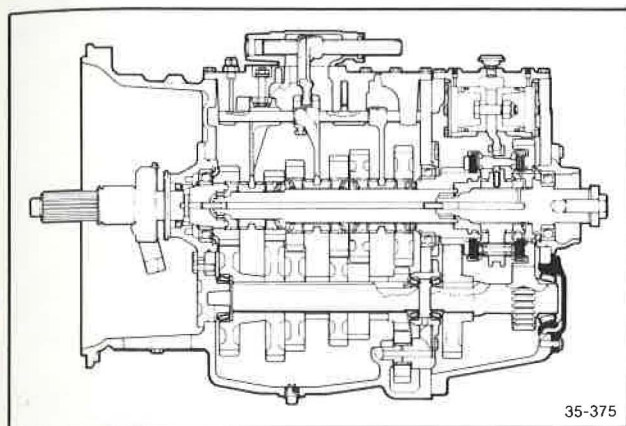
Figure 164. Pressing off Gear and Bearing

3. Remove the key from the keyway of the rear countershaft.



Figure 165. Removing Key

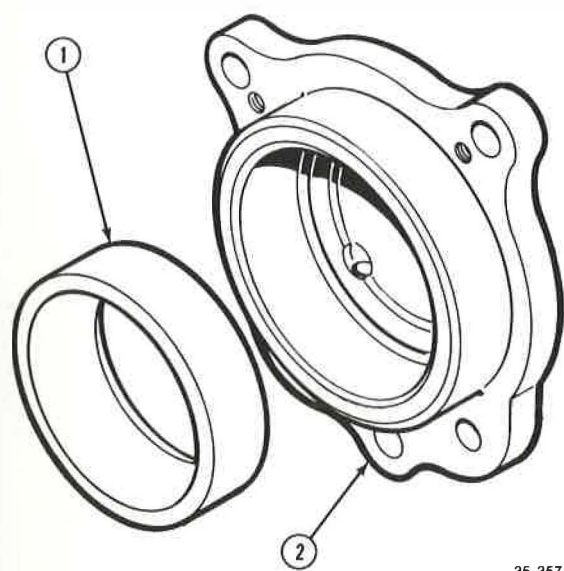
Rear Countershaft Rear Bearing Cover Disassembly



1. Using an appropriate puller, remove the bearing outer race from the cover.



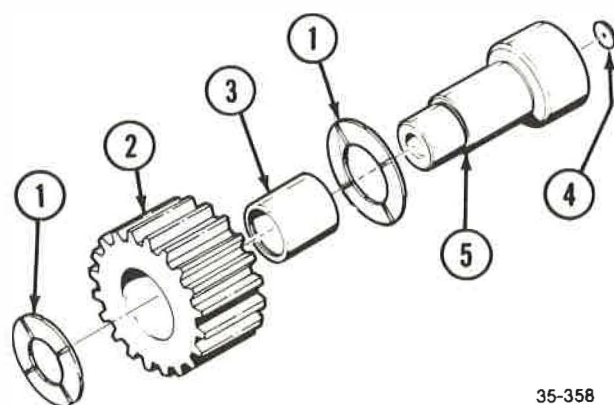
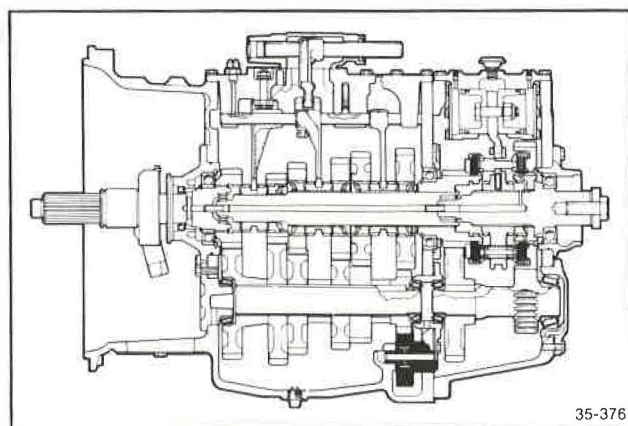
Figure 167. Removing Bearing Outer Race



1. Bearing Outer Race
2. Bearing Cover

Figure 166. Exploded View of Rear Countershaft Rear Bearing Cover

Reverse Idler Gear Disassembly



1. Thrust Washer
2. Reverse Idler Gear
3. Bearing
4. Expansion Plug
5. Reverse Idler Shaft

Figure 168. Exploded View of Reverse Idler Gear

1. Using a sharp-pointed punch, drive a hole in the expansion plug, and remove it.

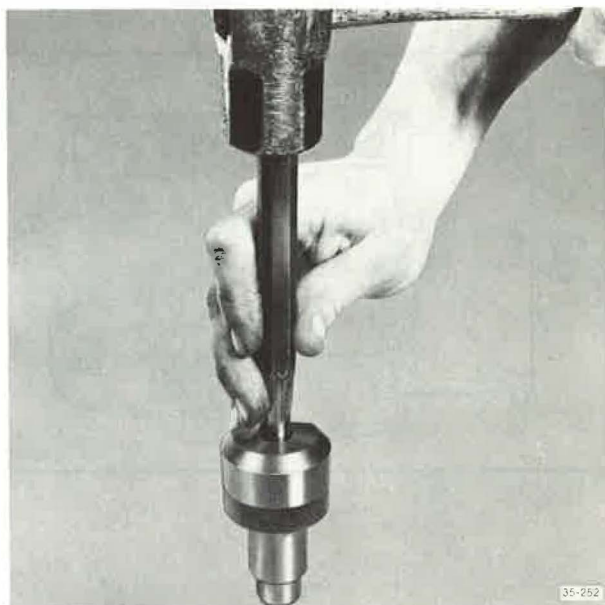


Figure 169. Removing Expansion Plug



Figure 170. Expansion Plug Removed

2. Using a driver of suitable size, press the reverse idler bearing out of the reverse idler gear.

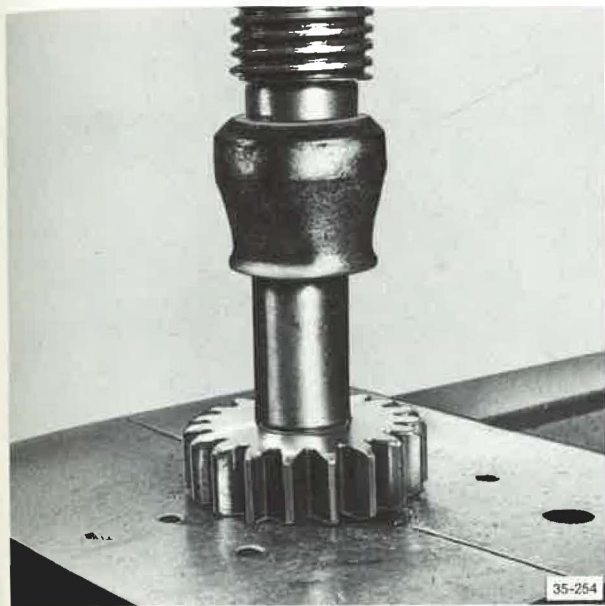
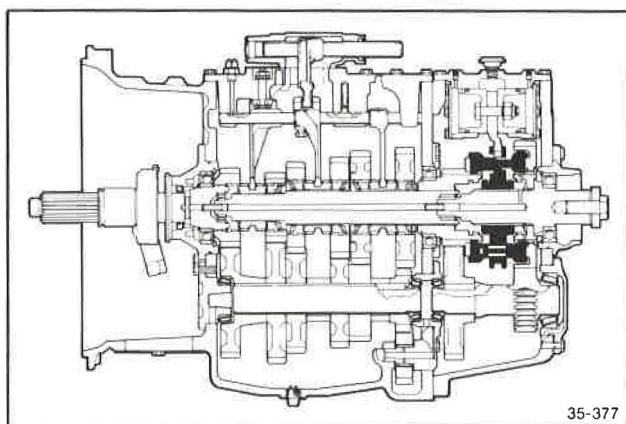
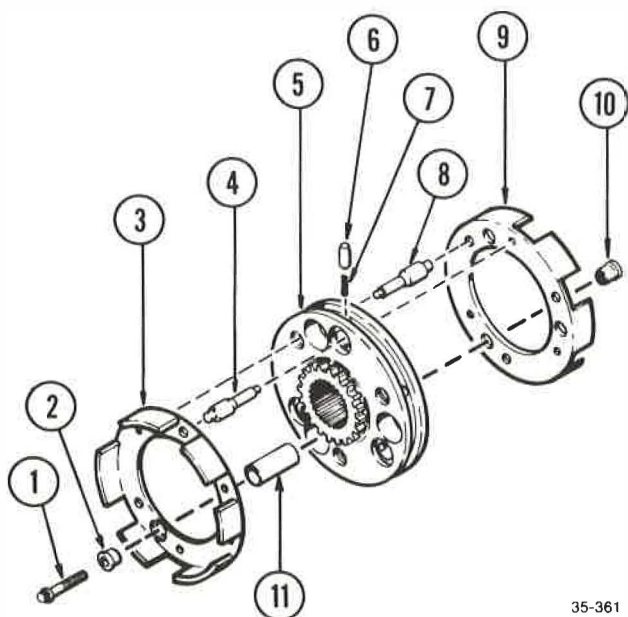


Figure 171. Pressing Out Bearing

Synchronizer Disassembly



35-377



35-361

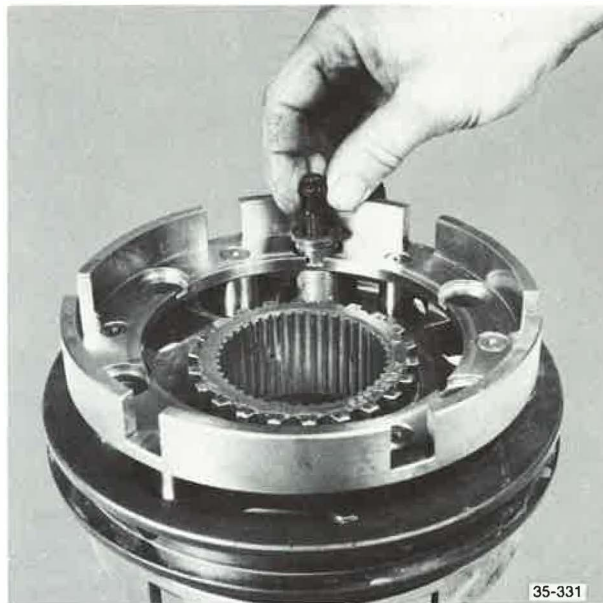
- | | |
|-----------------------|------------------|
| 1. Twelve-Point Screw | 7. Spring |
| 2. Support Cup | 8. Pin |
| 3. Housing | 9. Housing |
| 4. Pin | 10. Threaded Cup |
| 5. Sliding Clutch | 11. Support Tube |
| 6. Plunger | |

Figure 172. Exploded View of Synchronizer

NOTE

Plungers (item 6 in Figure 172) were used in early production. Round steel balls are now used, starting with serial #3Y2130 for T2090 and 3Y2136 for T2100.

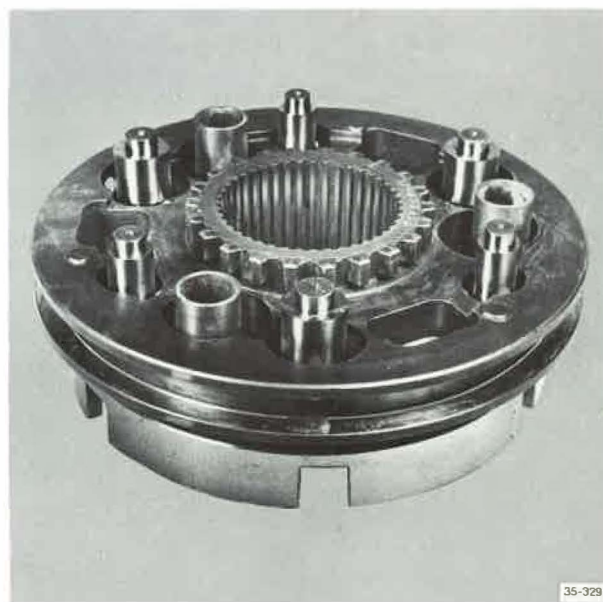
1. Loosen and remove the twelve-point screws, the support cups under the head of the screws, and the threaded cups at the other end of the screws.



35-331

Figure 173. Removing Screw

2. Remove one synchronizer housing, tapping it loose with a soft mallet if necessary.



35-329

Figure 174. One Housing Removed

3. Remove the three cylindrical support tubes, and then turn the assembly over and remove the remaining synchronizer housing.



Figure 175. Removing Second Housing

WARNING

Plungers (or balls) are spring loaded, and could fly out, causing injury.

4. Remove the six pins, and the six plungers (or balls) with springs, from the sliding clutch.

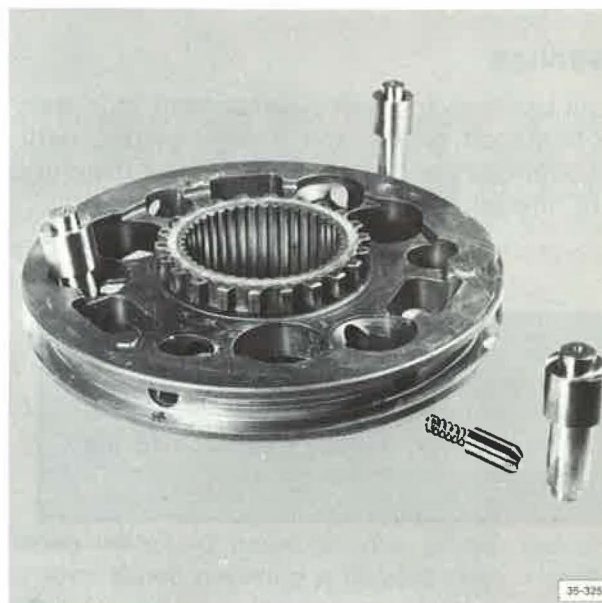


Figure 177. Removing Pins

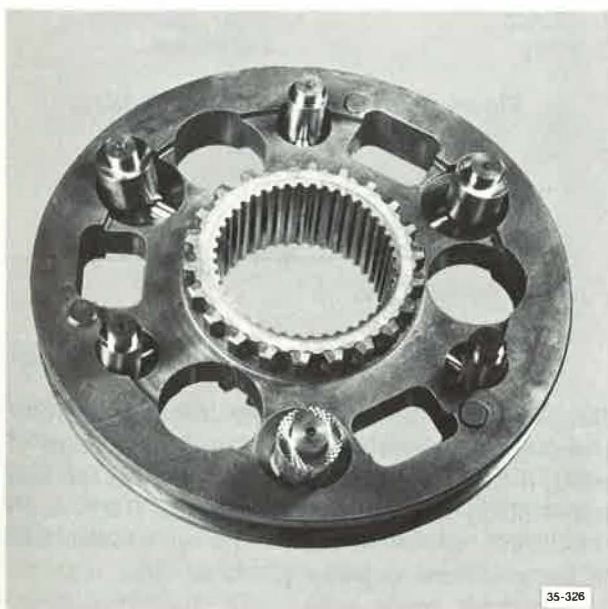


Figure 176. Sliding Clutch Assembly

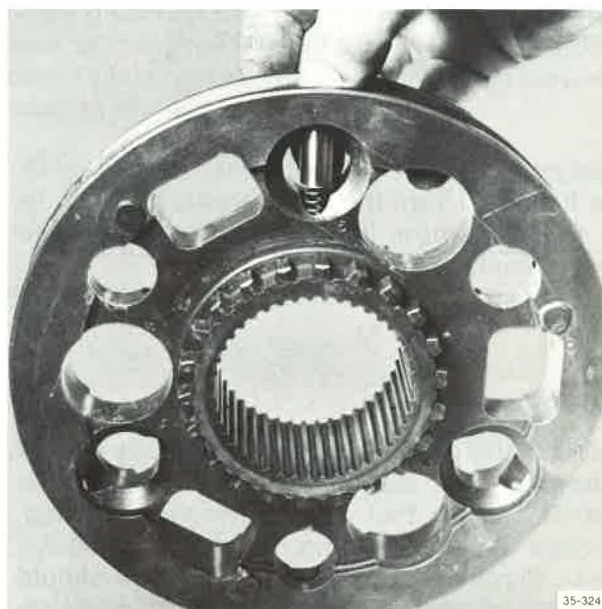


Figure 178. Removing Plungers and Springs

INSPECTION AND CLEANING

INSPECTION AND CLEANING

Clean the case, covers and all other parts of the transmission thoroughly, using a suitable safety solvent, to remove all grease, oil and foreign matter. Dry parts with moisture-free compressed air.

Bearings

Soak bearings in fresh clean solvent to loosen all hardened grease and foreign matter, until the bearings are clean, and then blow them dry with filtered, moisture-free compressed air.

CAUTION

Do not spin the bearings with compressed air, because damage to the bearings could occur.

Inspect bearings for flaking, cracks, fractures, cavities, indentations, measurable wear, brinelling, fretting, corrosion, nicking, and cage failures. If any of these conditions are present, the bearing should be replaced.

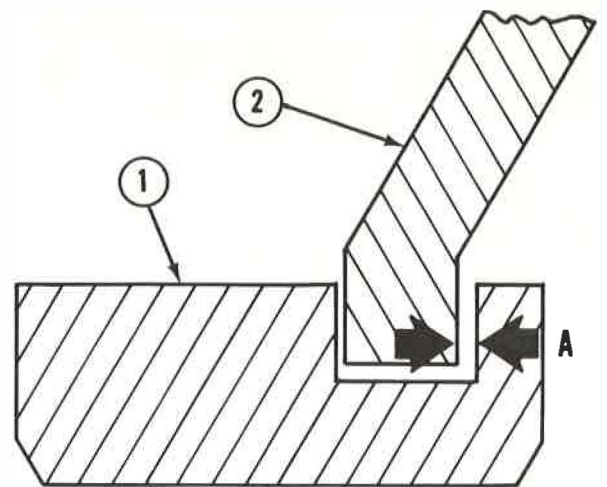
Apply a light coat of clean, fresh engine oil to the bearings. Turn the races slowly by hand, to be sure they move freely and smoothly. If they do not, replace the bearing.

Gears

Replace the gears if the teeth show any sign of abrasive wear, scratching (except for normal manufacturing tool marks), ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in, and cracking. Gears should also be inspected by Magnaflux or a similar system for cracks which would not otherwise be detected.

Shifter Forks, Sliding Clutches, and Shift Rails

Replace forks and/or clutches if side clearance between the fork and the groove in the sliding clutch is in excess of the specified limits, as shown in the Torque and Tolerance Table.



- 1. Clutch
- 2. Fork

A. Wear Tolerance Reference

Figure 179. Fork and Clutch Detail

Replace shift rails if they are cracked in either the poppet or set screw holes. In the case of wear, if the clearance between the shift rail and the mating housing bore exceeds 0.010 inch maximum, check to determine which member is worn before replacing. Shaft wear may be checked by measuring shaft diameter at an "unwearing" point as compared to the wear area.

Oil Seals

When an overhaul is required, replace all the oil seals. Care must be taken to be sure that the sealing surface of the seal is not damaged, turned back, or cut. A nick on the shaft surface may cut the seal. Remove sharp edges that could damage the seal (chamfer edges if possible). Press seals into their housings with smooth, uniform pressure, to prevent cocking the seal. Be careful when installing a shaft through a new seal (or a new seal over a shaft). The shaft should be lubricated before inserting through a seal. Splines, keyways, and holes in a shaft can damage seals unless care is taken. The sealing surfaces of seals should be manually lubricated to provide lubrication during the "start-up" period before normal lubrication occurs. Be careful that anti-seize and sealing compounds used in reassembly are kept away from the sealing surfaces.

General Inspection

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, and any part that shows mutilation. Test poppet springs and replace any that have lost their tension. Refer to Torque and Tolerance Table. Clean up any threads that show mutilation. Repair stripped threads by using Heli-Coil or equivalent repair parts.

GENERAL INSTRUCTIONS FOR REASSEMBLY

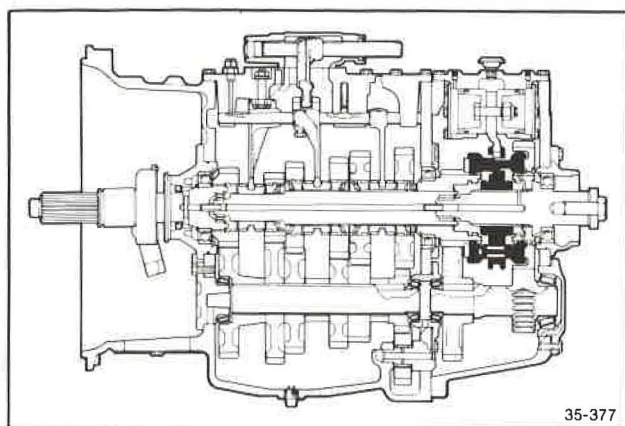
Refer to Torque and Tolerance Table for fits and limits.

All working metal parts, especially the bearings, should be coated with oil while the transmission is being reassembled. This will insure immediate lubrication when first starting and will help prevent seizing of these parts due to running without lubrication at start-up.

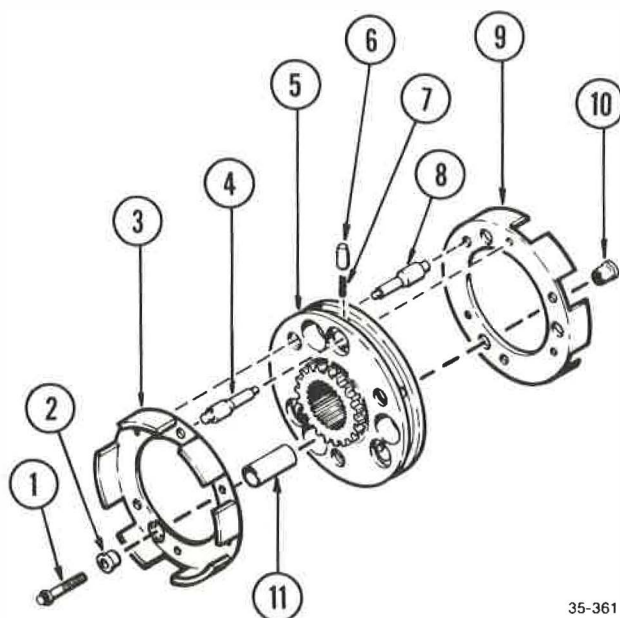
When installing bearings, use proper bearing drivers. When pressing a bearing onto a shaft, apply force only to the bearing inner race. When pressing a bearing into a housing, apply force only to the outer race. Do not apply force which is transmitted through balls or rollers, because bearing damage can result (even though not evident at the time) which will cause premature bearing failure. Apply pressure evenly to prevent cocking the bearing.

As moving parts are assembled, check frequently to see that they move freely.

Synchronizer Reassembly



35-377



35-361

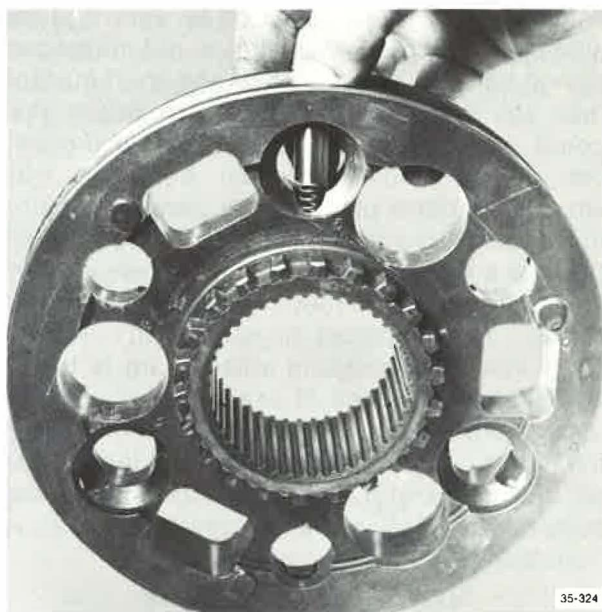
- | | |
|-----------------------|------------------|
| 1. Twelve-Point Screw | 7. Spring |
| 2. Support Cup | 8. Pin |
| 3. Housing | 9. Housing |
| 4. Pin | 10. Threaded Cap |
| 5. Sliding Clutch | 11. Support Tube |
| 6. Plunger | |

Figure 180. Exploded View of Synchronizer

NOTE

Plungers (item 6 in Figure 180) were used in early production. Round steel balls are now used, starting with serial #3Y2130 for T2090 and 3Y2136 for T2010.

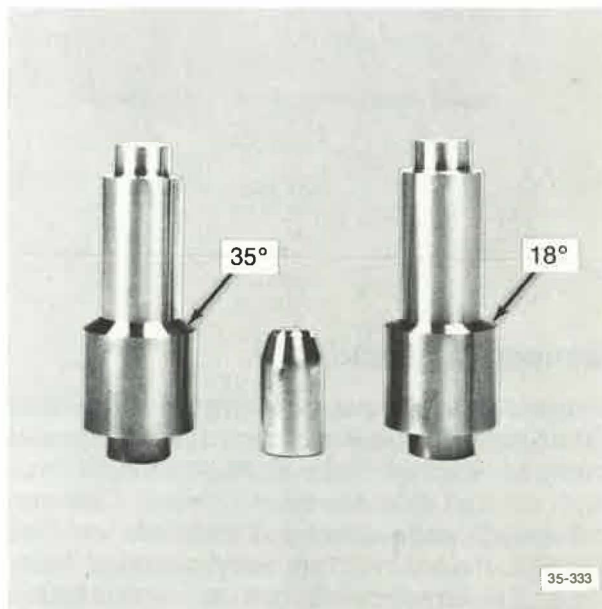
1. Install the six plungers with springs into the sliding clutch.



35-324

Figure 181. Installing Plungers with Springs

2. Notice that all the plungers with springs just installed are all the same. However, the pins are two different designs; 18 degree and 35 degree.



35-333

Figure 182. Pins and Plunger

3. Each of the pins is marked with the letter "R" on one end, and the sliding clutch is marked on one side with the letter "R." The surfaces marked in this way must face the rear of the transmission.

4. Install the pins into the sliding clutch. Three of the pins are marked on the smaller diameter end, and three on the larger diameter end. These two styles of pins must alternate position with each other, in the six holes with the plungers, and all the marked letters must be on the same side of the sliding clutch as the marked letter on the sliding clutch.

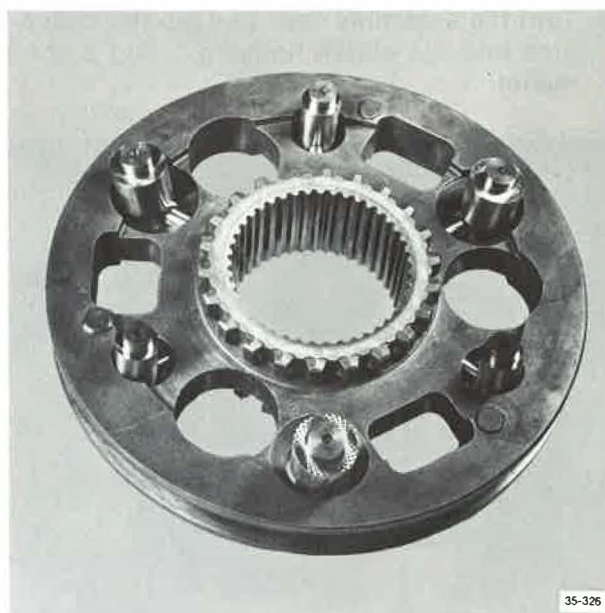


Figure 184. Pins Installed in Sliding Clutch

5. Take one of the two identical clutch housings, and place it in position on top of the clutch pins.



Figure 183. Installing Pins



Figure 185. Clutch Housing Installed Loosely on Pins

6. Turn the assembly over, and tap the clutch pins into the clutch housing, using a soft mallet.

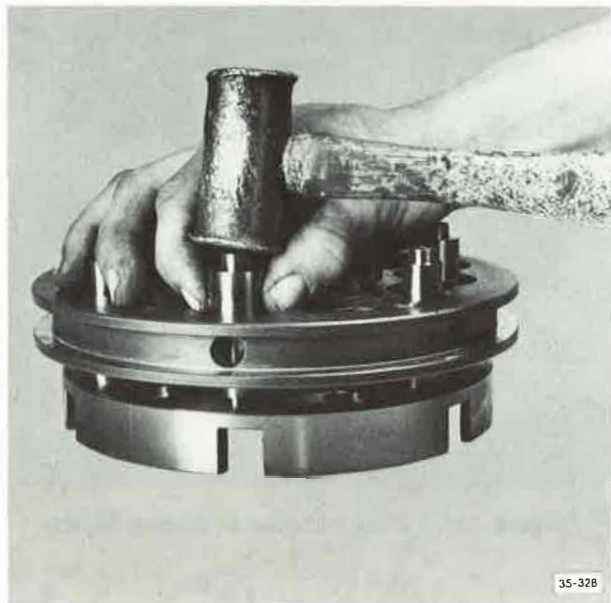


Figure 186. Tapping Pins into Clutch Housing

7. Install the three cylindrical support tubes.



Figure 187. Support Tubes Installed

8. Install the second clutch housing, and tap it into engagement with the pins, using a soft mallet.

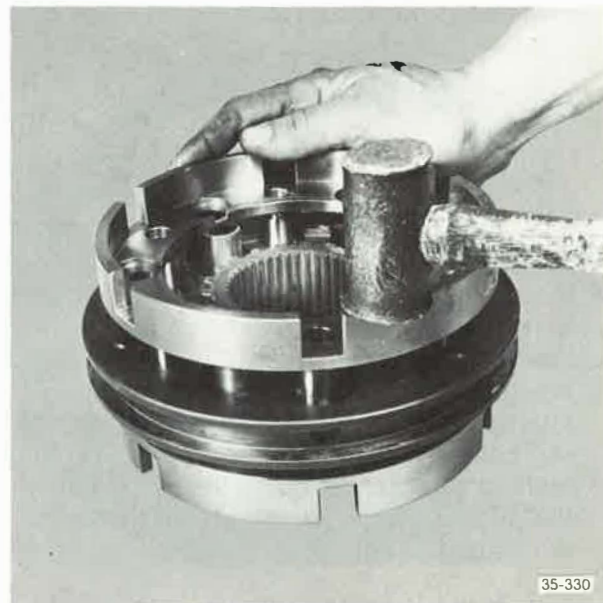


Figure 188. Installing Clutch Housing

9. Install the three special twelve-point screws, with the support cups under their heads, through the support tubes, and engage the threads of the screw with the threaded cups.

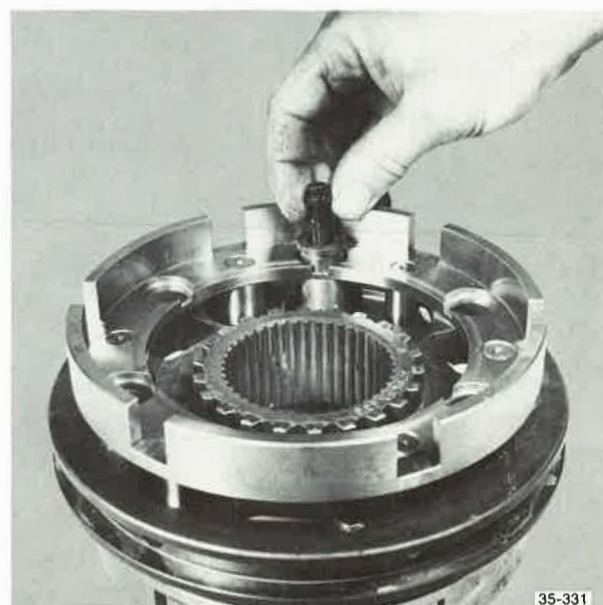


Figure 189. Installing Special Screws

10. Torque the synchronizer special screws to 24 to 28 lb. ft. torque.

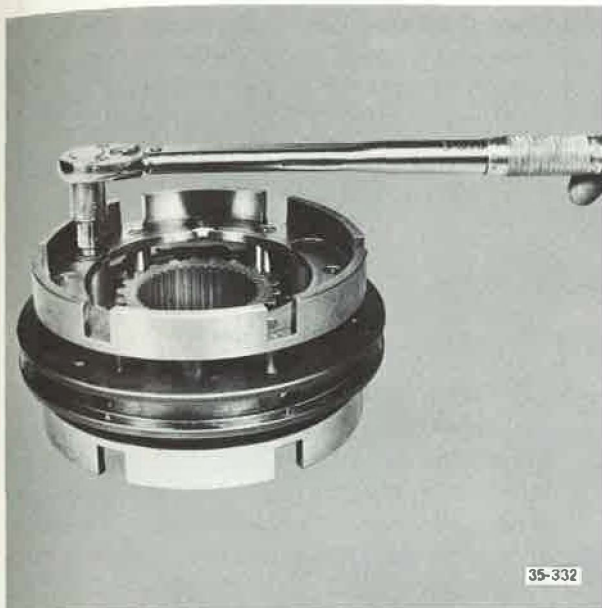
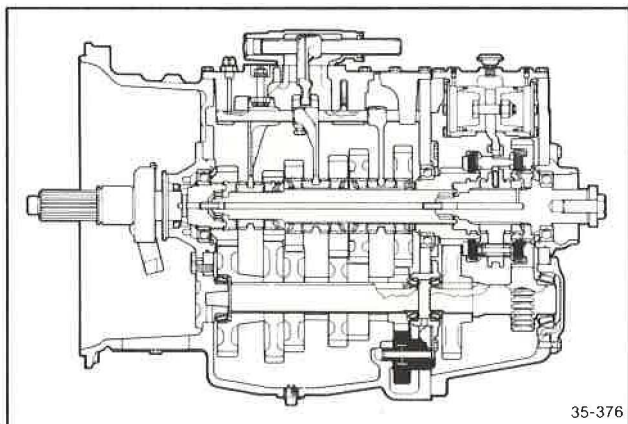


Figure 190. Torquing Screw

11. When properly assembled, the synchronizer can be shifted into Lo-Range by hand (pull sliding clutch rearward, toward the "R" markings). However, Hi-Range cannot be shifted by hand. Hi-Range can be checked by striking the sliding clutch on the Lo-Range side (rear side with "R" markings) with a soft mallet, moving the sliding clutch forward (away from the "R" markings).

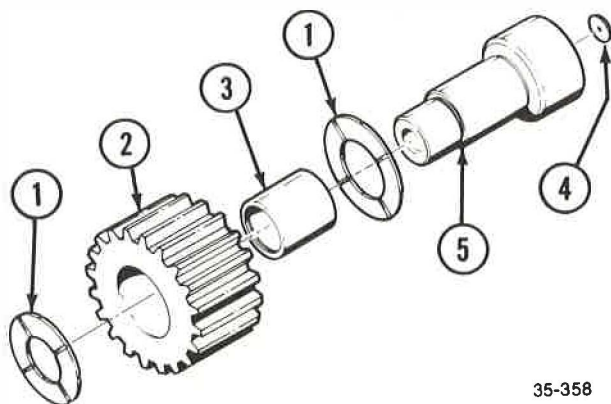
Reverse Idler Gear Reassembly



NOTE

It is recommended that the upper right reverse idler gear and shaft assembly not be installed at this time, to make it easier to install the countershaft and mainshaft later.

1. Install the expansion plug into the reverse idler shaft, rounded side up, and seat it by driving it downward with a driver. The driver should be solid (not tubular), cylindrical in shape, with an end diameter the same as the expansion plug, and a flat (not rounded) end.



1. Thrust Washer
2. Reverse Idler Gear
3. Bearing
4. Expansion Plug
5. Reverse Idler Shaft



Figure 191. Exploded View of Reverse Idler Gear

Figure 192. Seating Expansion Plug

2. Press the bearing into the reverse idler gear, until it is flush.

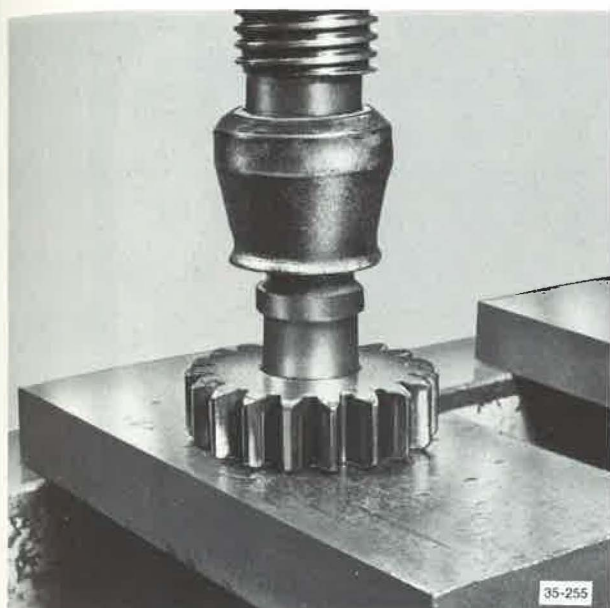


Figure 193. Pressing Bearing into Gear

3. Install the reverse idler gear and the two thrust washers into the main case.



Figure 194. Installing Gear and Thrust Washer

4. Install the reverse idler shaft, aligning the flat on the end of the shaft so that the countershaft bearing cover will hold the shaft in place. Drive the shaft in until the flat is flush with the case.



Figure 195. Reverse Idler Shaft Properly Aligned

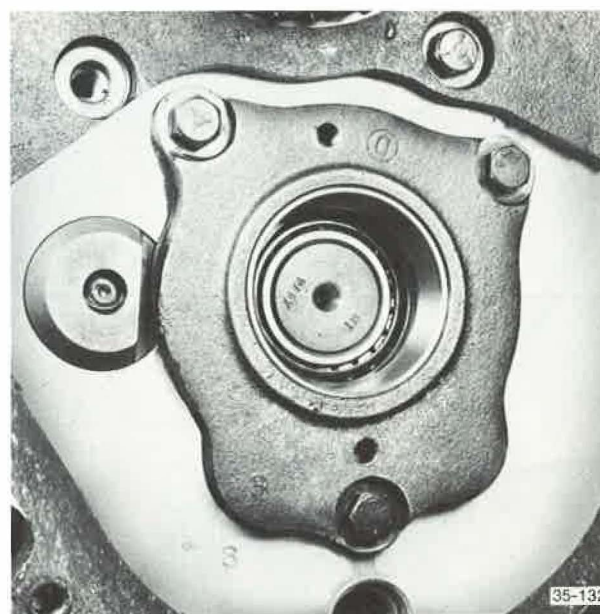
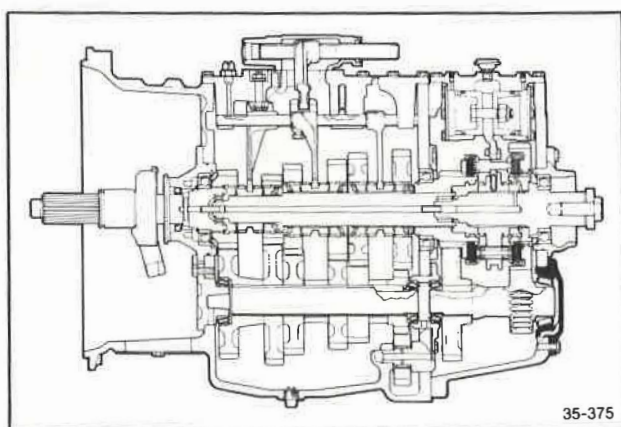


Figure 196. Reverse Idler Shaft Held in Place by Countershaft Bearing Cover

Rear Countershaft Rear Bearing Cover Reassembly



1. Using a properly sized driver, press the bearing outer race into the cover.

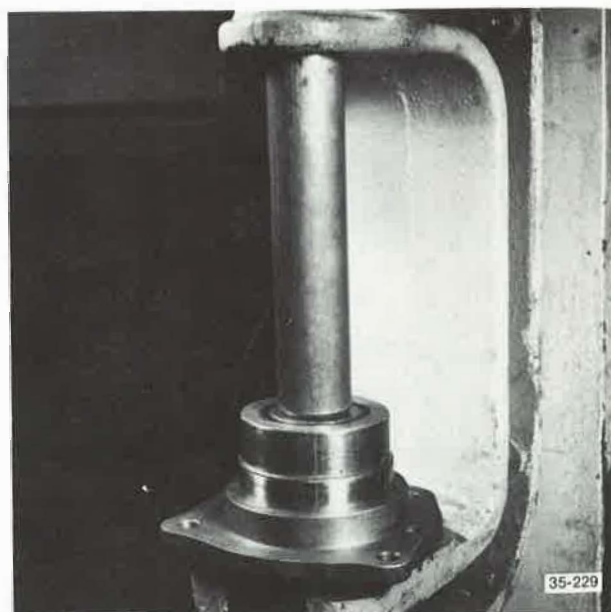
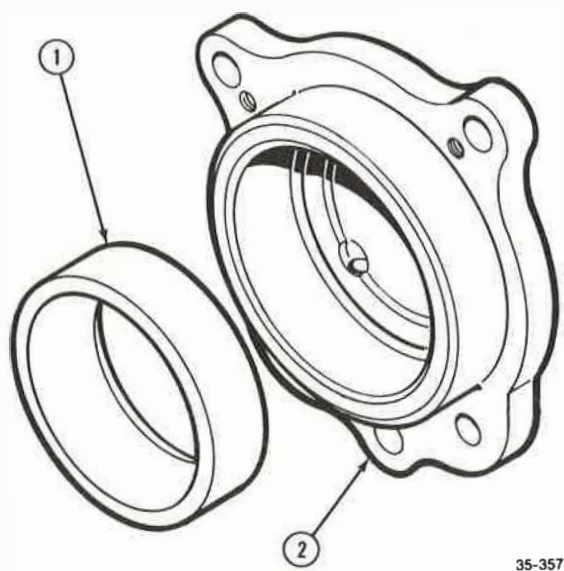


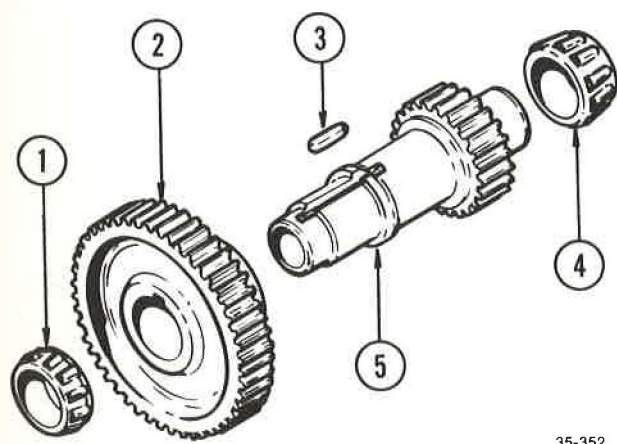
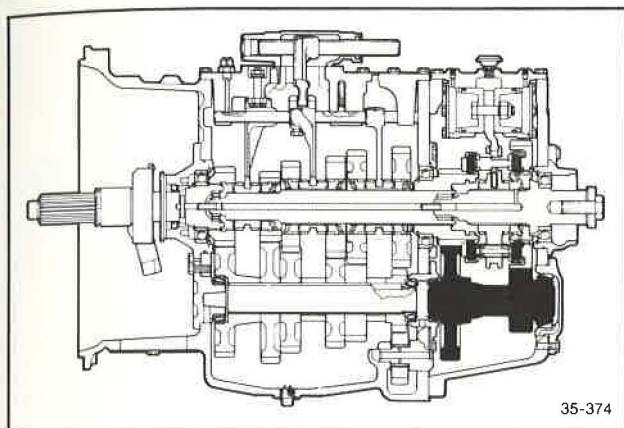
Figure 198. Pressing Outer Race into Cover



1. Bearing Outer Race
2. Bearing Cover

Figure 197. Exploded View of Rear Countershaft Rear Bearing Cover

Rear Countershaft Reassembly



1. Front Bearing
2. Main Drive Gear
3. Key
4. Rear Bearing
5. Rear Countershaft

Figure 199. Exploded View of Rear Countershaft

1. Install the key into the keyway of the rear countershaft. A soft mallet may be used.



Figure 200. Installing Key

2. Press the rear countershaft main drive gear onto the shaft. Place the side of the gear with the protruding hub toward the rear.

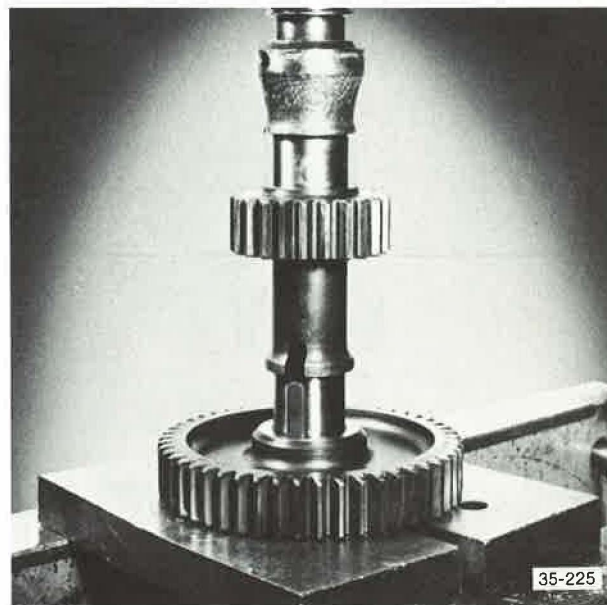


Figure 201. Pressing Gear onto Shaft

3. Press the front bearing onto the rear countershaft, using a driver that applies force to the bearing inner race only.

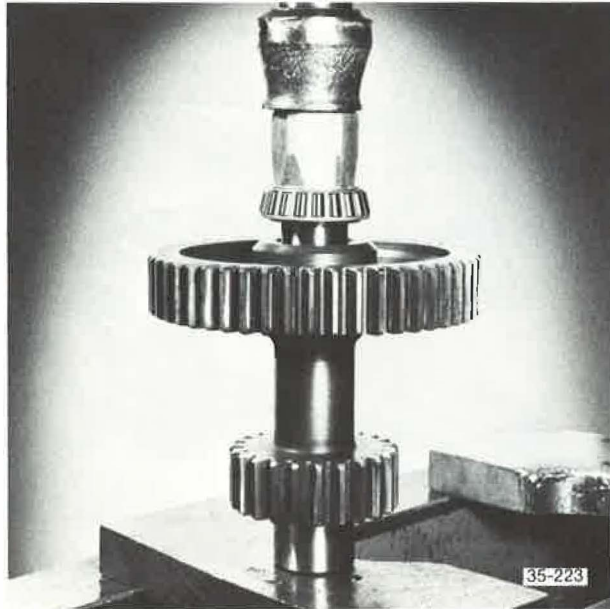


Figure 202. Pressing Front Bearing onto Shaft

4. Press the rear bearing onto the rear countershaft, using a driver that applies force to the bearing inner race only.

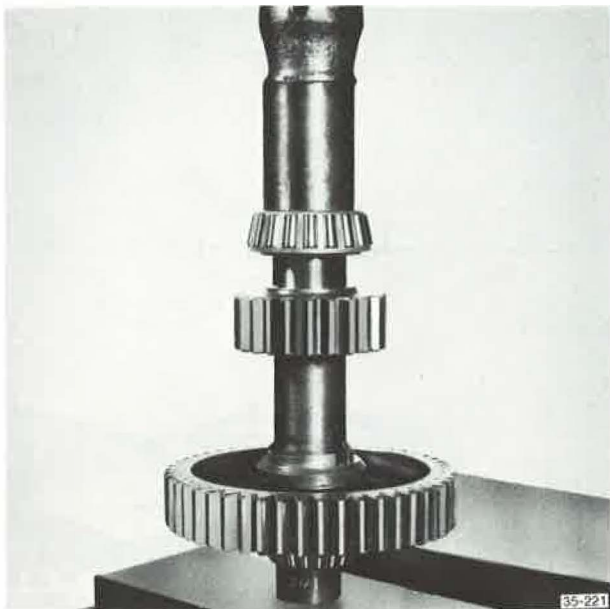
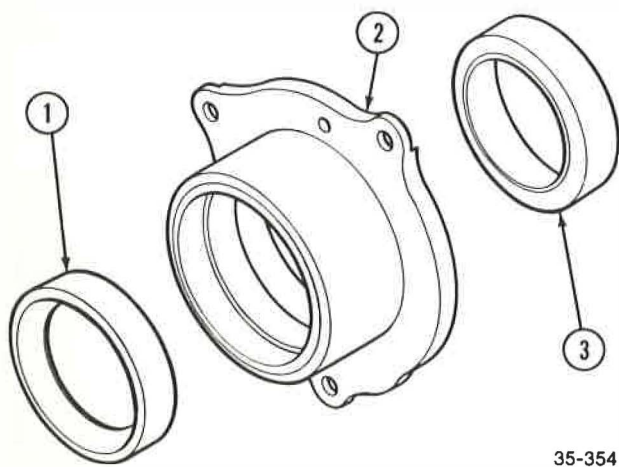
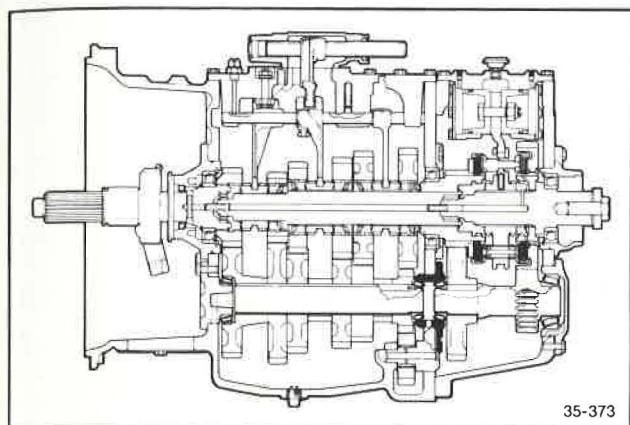


Figure 203. Pressing Rear Bearing onto Shaft

Front Countershaft Rear Bearing Cover Reassembly



1. Front Bearing Outer Race
2. Bearing Cover
3. Rear Bearing Outer Race

Figure 204. Exploded View of Front Countershaft Rear Bearing Cover

1. Press both the front and rear bearing races into the bearing cover.

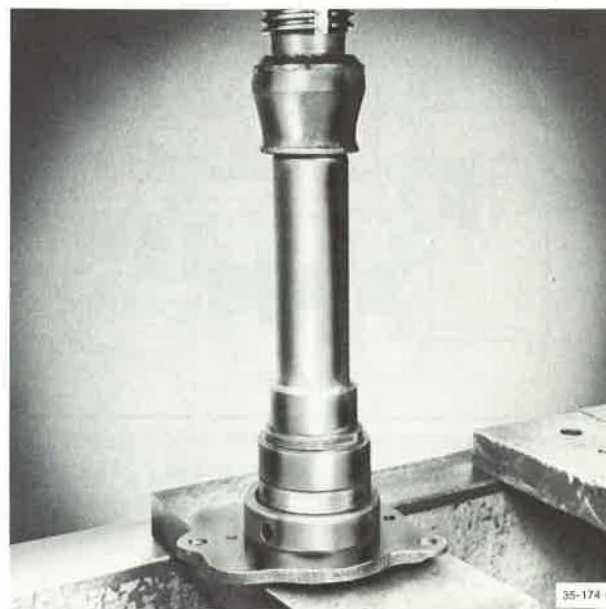


Figure 205. Pressing Front Race into Cover

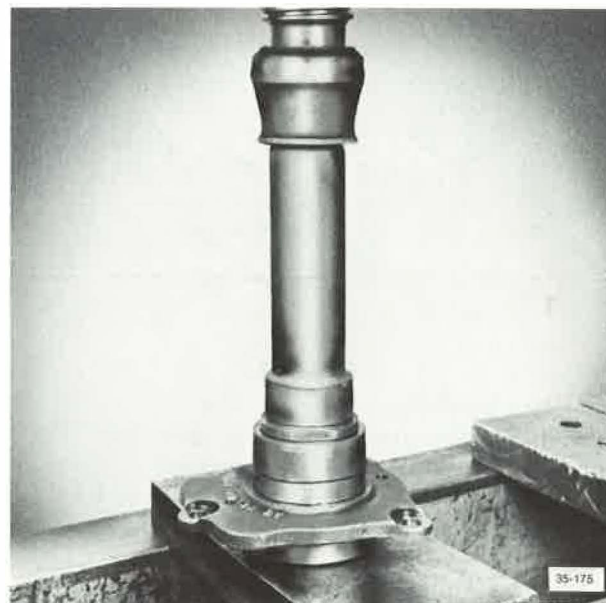
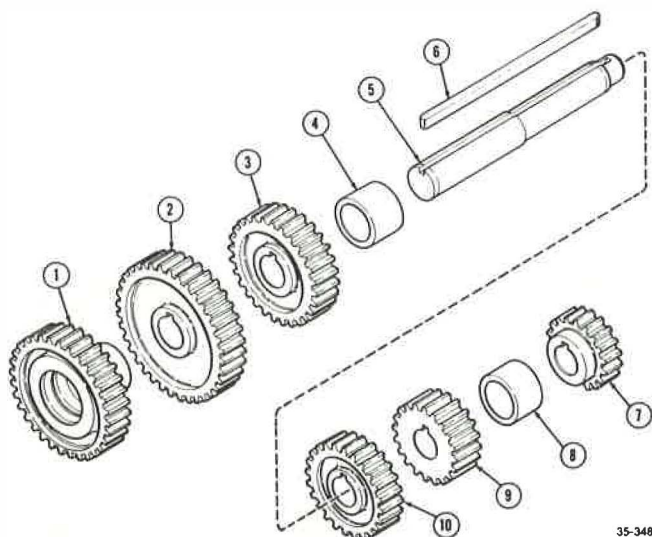
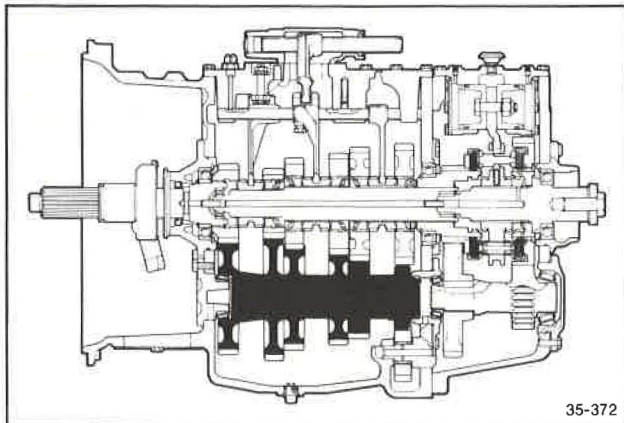


Figure 206. Pressing Rear Race into Cover

Front Countershaft Reassembly



- | | |
|-----------------------|-----------------------|
| 1. Main Drive Gear | 6. Key |
| 2. Fifth Speed Gear | 7. Reverse Gear |
| 3. Third Speed Gear | 8. Spacer |
| 4. Spacer | 9. First Speed Gear |
| 5. Front Countershaft | 10. Second Speed Gear |

Figure 207. Exploded View of Front Countershaft

1. Press the bearing outer race into the front countershaft main drive gear.

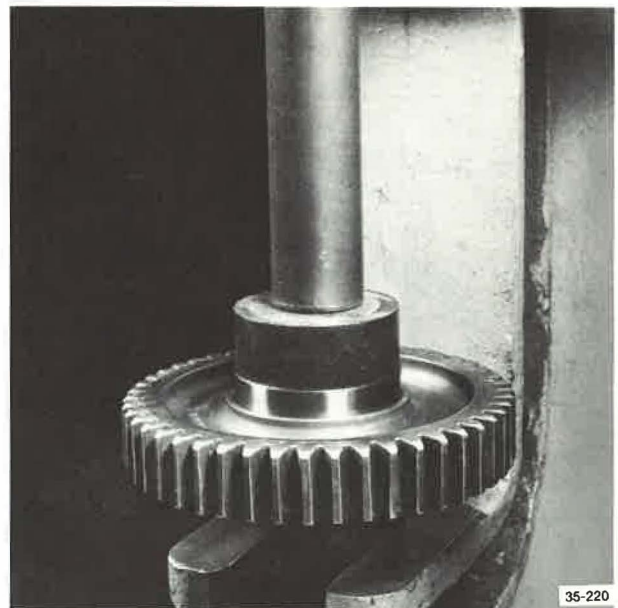


Figure 208. Pressing Race into Gear

2. Install the key into the keyway of the front countershaft. A soft mallet should be used.



Figure 209. Installing Key

WARNING

Do not attempt to press the reverse, first, or second speed gears onto the front end of the countershaft. The front end is slightly larger in diameter than the rear. If you try to press any of these three gears onto the forward end of the shaft, the gears will crack, and may fragment explosively, spraying metal pieces outward. These could cause severe injury or death.

NOTE

For all pressing operations on this countershaft assembly, use a driver that covers the end of the shaft and part of the main drive gear also. This will ensure that the end of the shaft stays flush with the main drive gear.

3. Press the main drive gear onto the front countershaft, with the hub of the gear rearward. Press until the end of the shaft is exactly flush with the gear.

4. Press the fifth speed gear onto the countershaft, until it seats against the hub of the main drive gear.



Figure 210. Pressing on Main Drive Gear

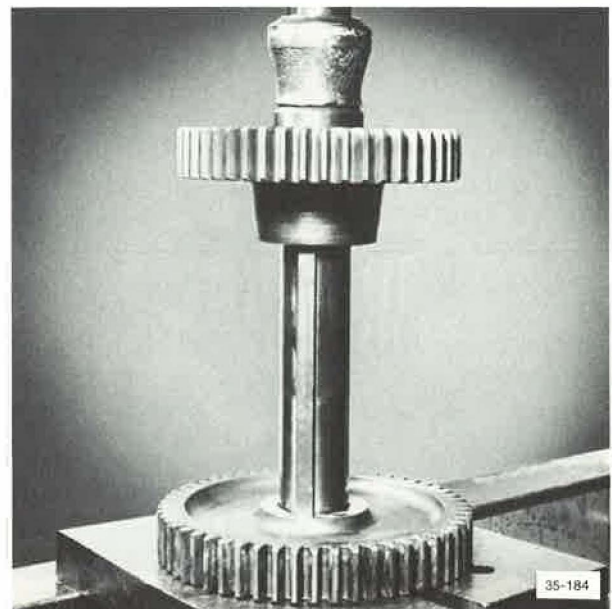


Figure 211. Pressing on Fifth Speed Gear

5. Press the third speed gear onto the countershaft, until it seats against the fifth speed gear.

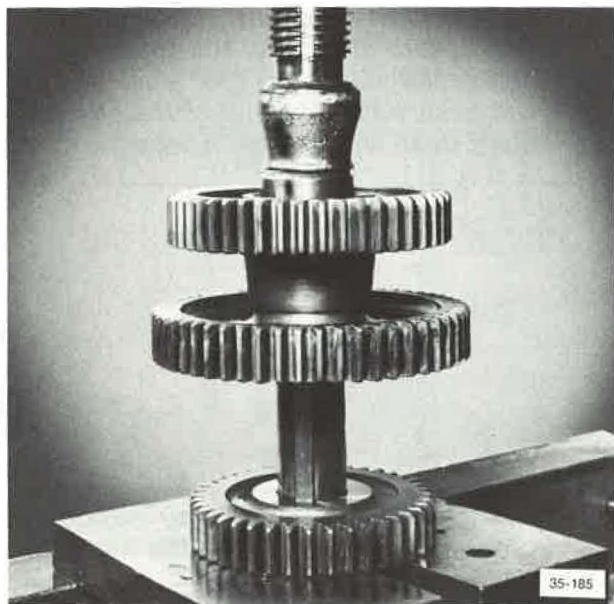


Figure 212. Pressing on Third Speed Gear

6. Install the wider spacer between third and second speed countershaft gears, and then press on the second speed gear until the gear and spacer seat against the third speed gear. See previous WARNING about pressing on second speed gear.

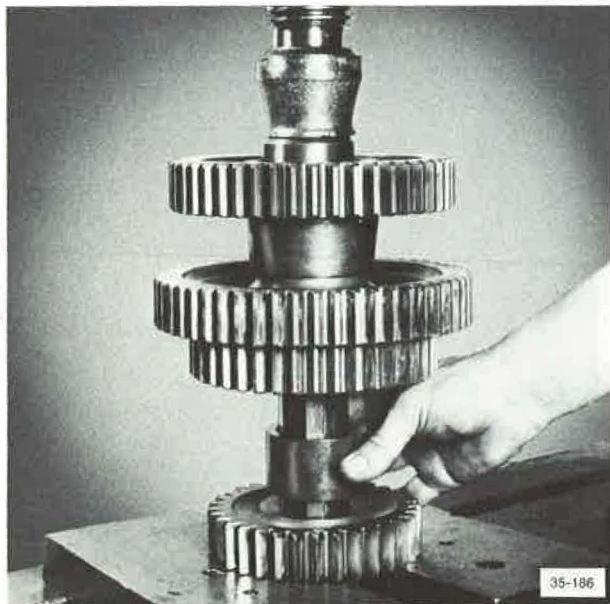


Figure 213. Installing Spacer and Second Speed Gear

7. Press the first speed gear onto the countershaft, until it seats against the second speed gear. See previous WARNING about pressing on first speed gear.

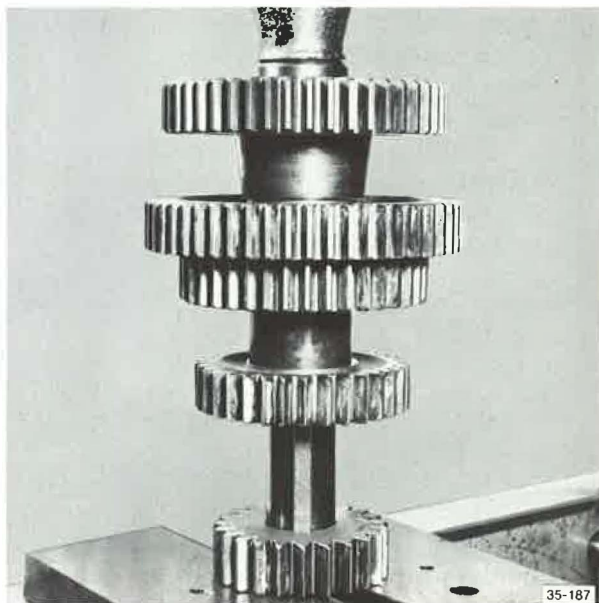


Figure 214. Pressing on First Speed Gear

8. Install the narrower spacer between the first speed gear and the reverse gear, and then press on the reverse speed gear (hub of gear facing forward) until the gear and spacer seat against the first speed gear.

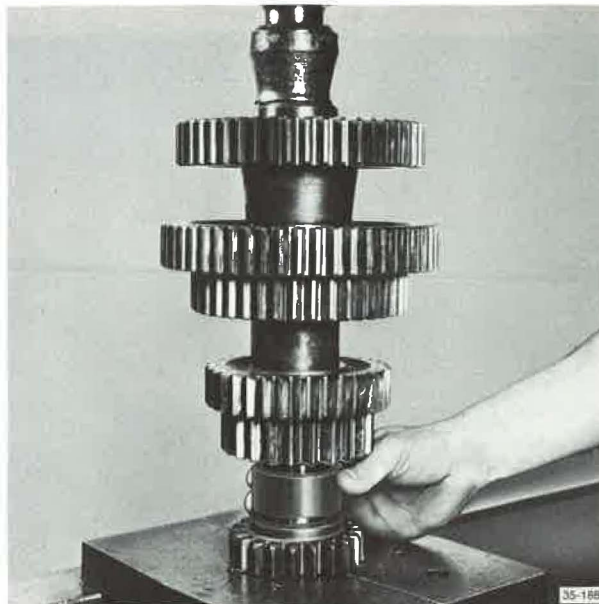


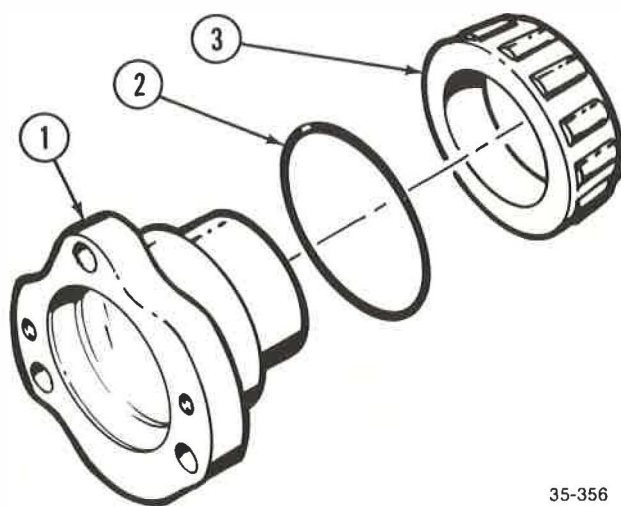
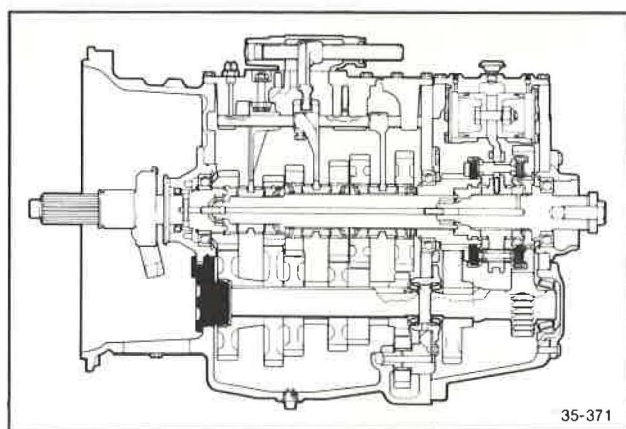
Figure 215. Installing Spacer and Reverse Speed Gear

9. Press the rear bearing onto the counter-shaft, being careful to apply force to the inner race only.



Figure 216. Pressing Rear Bearing onto Shaft

Front Countershaft Front Bearing Cover Reassembly



1. Front Bearing Cover
2. O-Ring
3. Bearing

Figure 217. Exploded View of Front Countershaft Front Bearing Cover

1. Press the bearing onto the front countershaft front bearing cover, being careful to apply force to the inner race only.



Figure 218. Pressing on Bearing

2. Install the large O-ring onto the bearing cover.

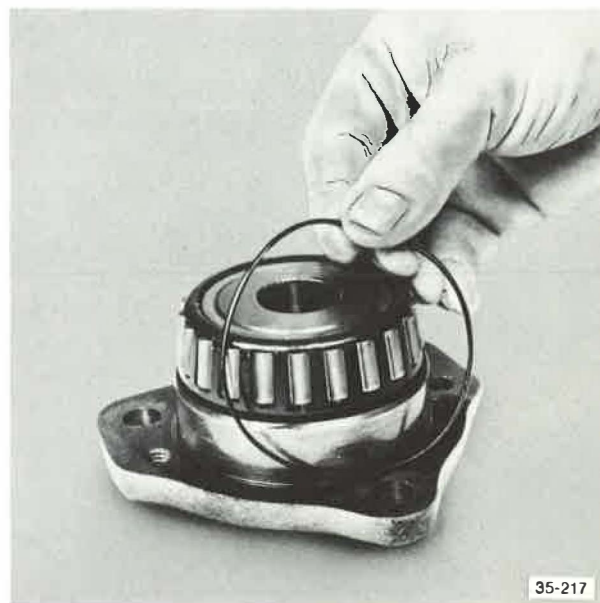
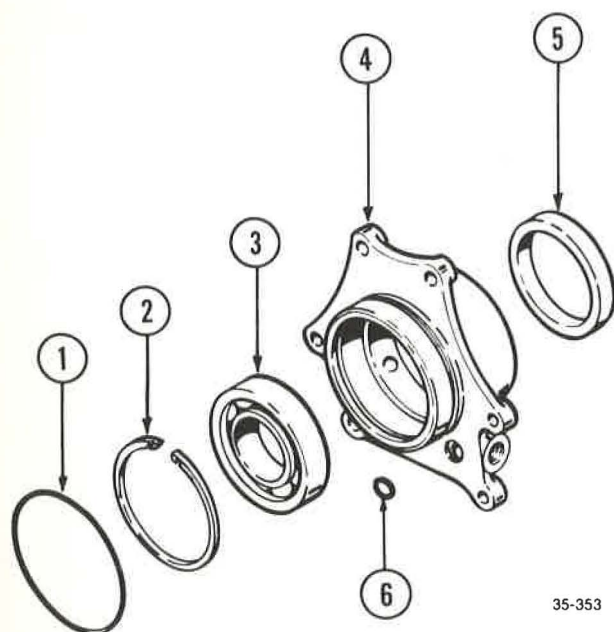
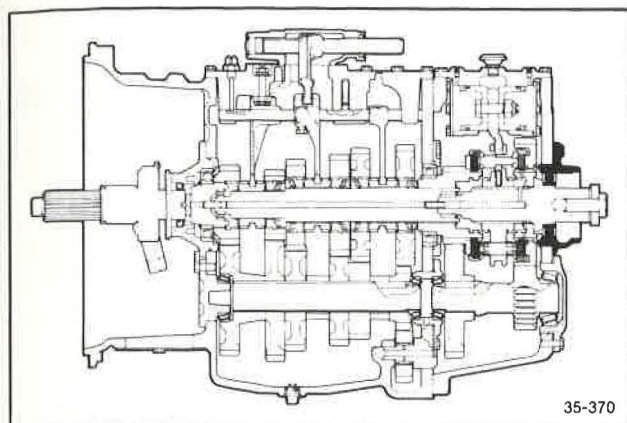


Figure 219. Installing O-Ring

Rear Mainshaft Rear Bearing Cover Reassembly



1. O-Ring
2. Snap Ring
3. Bearing
4. Rear Bearing Cover
5. Oil Seal
6. O-Ring

Figure 220. Exploded View of Rear Mainshaft Rear Bearing Cover

1. Press the seal into the rear mainshaft rear bearing cover.

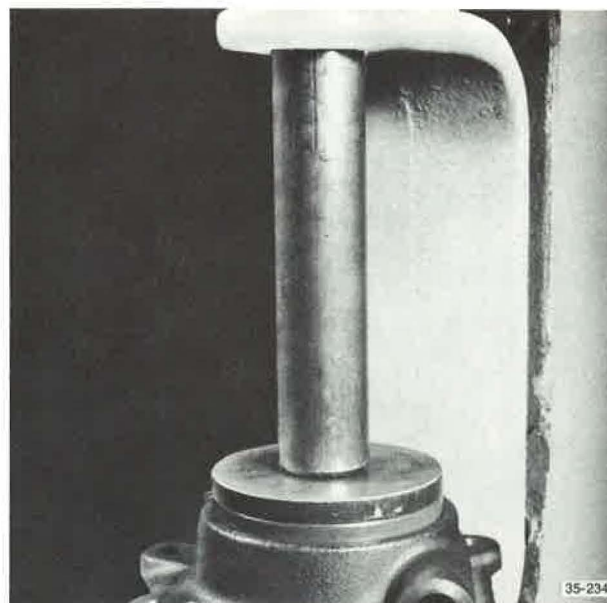


Figure 221. Pressing in Oil Seal

2. Press the bearing into the cover, using a driver that applies force on the bearing outer race.

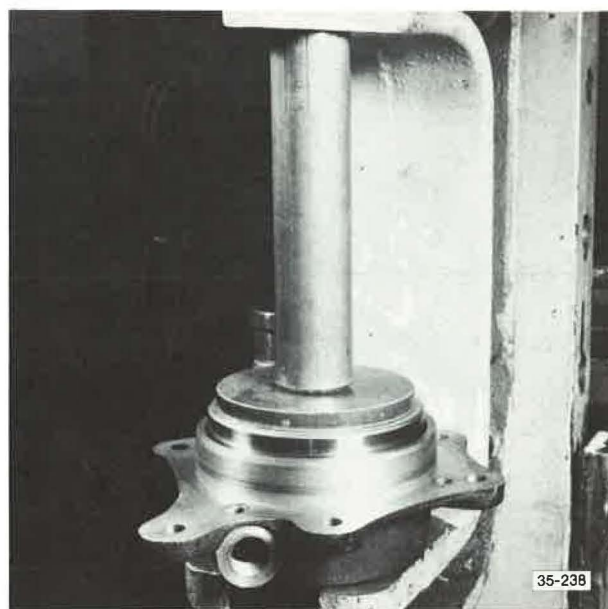


Figure 222. Pressing Bearing into Cover

3. Install the bearing retaining snap ring into the cover.



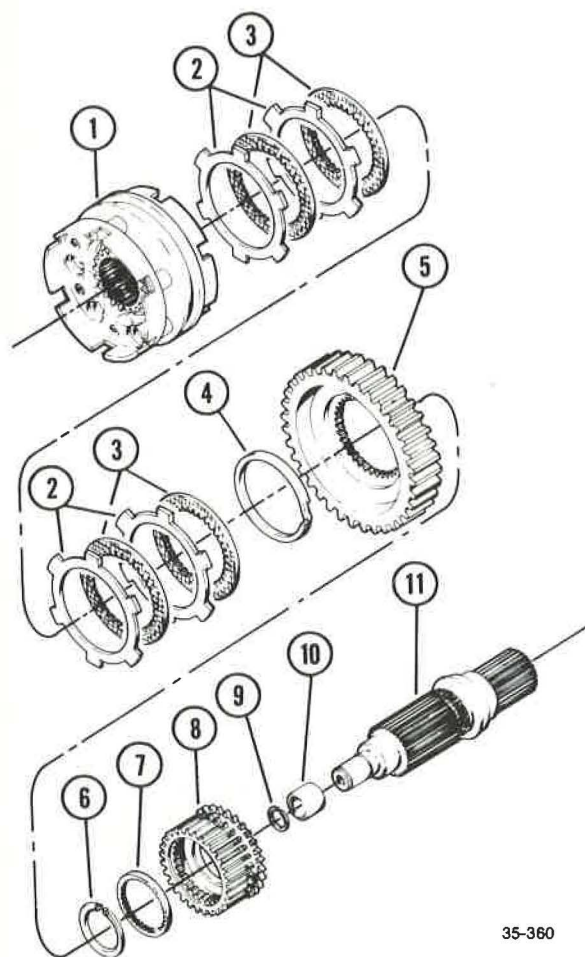
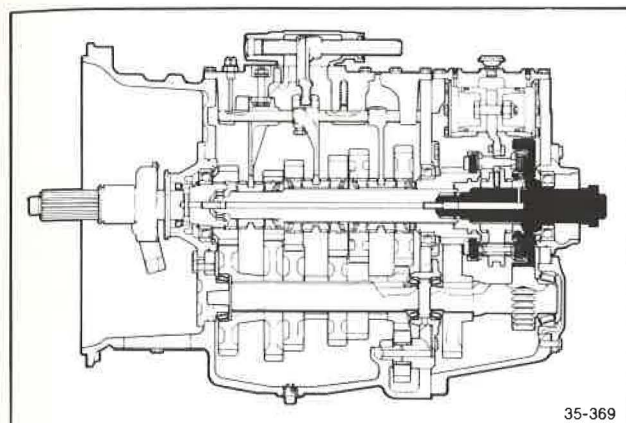
Figure 223. Installing Snap Ring

4. Install the small and the large o-rings onto the bearing cover.



Figure 224. Installing O-Rings

Rear Mainshaft Reassembly



- | | |
|------------------|------------------|
| 1. Synchronizer | 7. Thrust Washer |
| 2. Reaction Disc | 8. Gear Hub |
| 3. Friction Disc | 9. Snap Ring |
| 4. Snap Ring | 10. Bearing Race |
| 5. Lo-Range Gear | 11. Mainshaft |
| 6. Snap Ring | |

Figure 225. Exploded View of Rear Mainshaft

1. Press the bearing inner race onto the front end of the rear mainshaft, and secure it with the retaining snap ring.



Figure 226. Installing Snap Ring

2. Install the lo-range gear hub onto the rear mainshaft.



Figure 227. Lo-Range Gear Hub Installed on Shaft

3. Install the thrust washer inside the lo-range gear hub, and secure it with the snap ring.

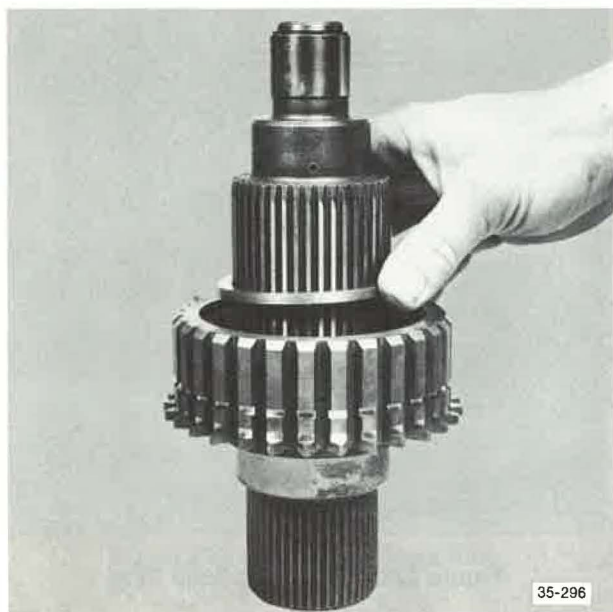


Figure 228. Installing Thrust Washer

4. Install the lo-range gear onto the lo-range gear hub, and secure it with the spiral snap ring.

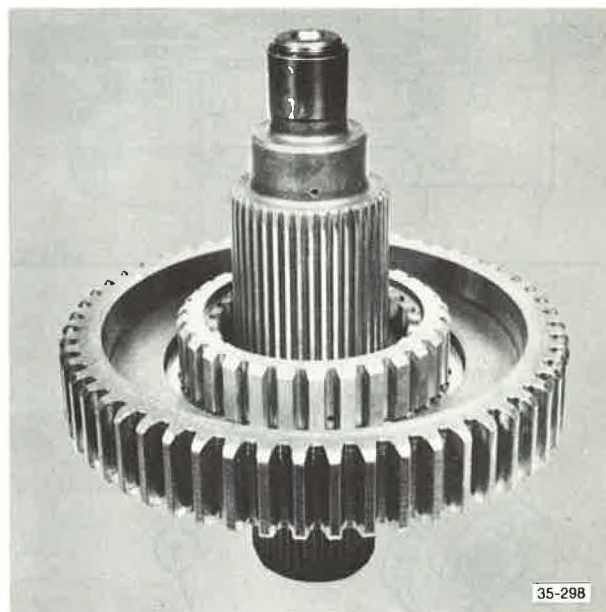


Figure 230. Lo-Range Gear Installed on Hub

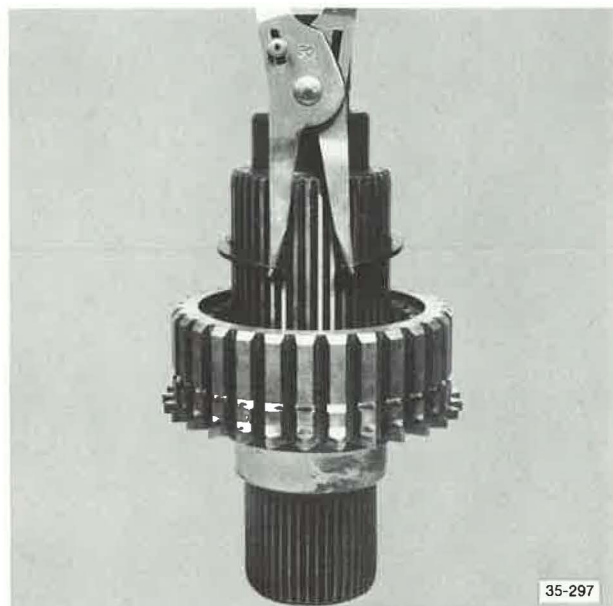


Figure 229. Installing Snap Ring

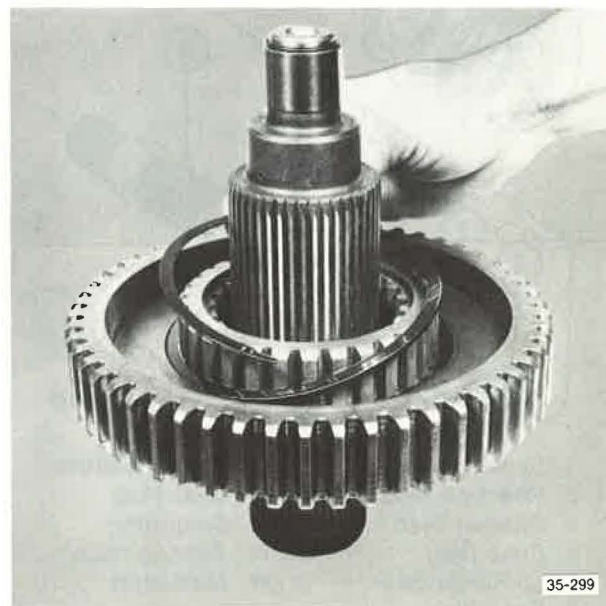


Figure 231. Installing Spiral Snap Ring

5. Install a friction disc into the lo-range gear, oiling *both sides* of each friction disc as it is installed (using a liberal amount of gear oil).

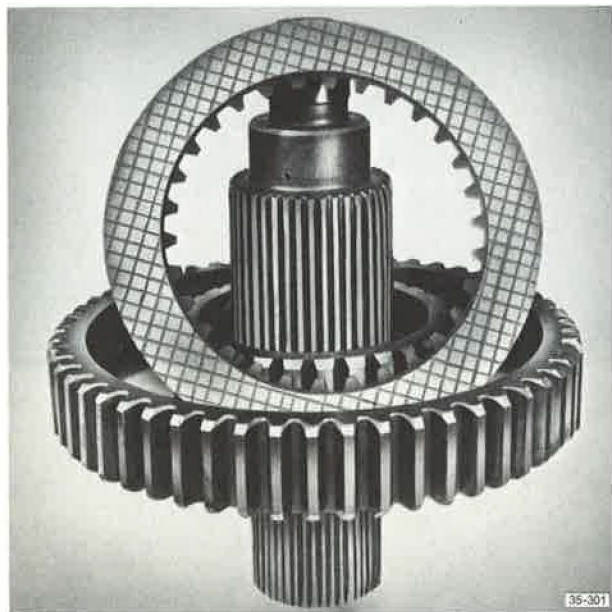


Figure 232. Installing Friction Disc

6. Install a reaction disc into the lo-range gear, and continue alternating the friction and reaction discs until four of each are installed.

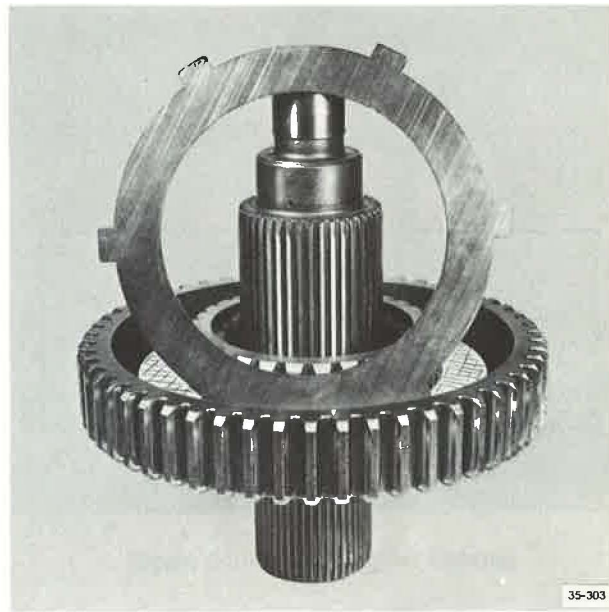


Figure 234. Installing Reaction Disc

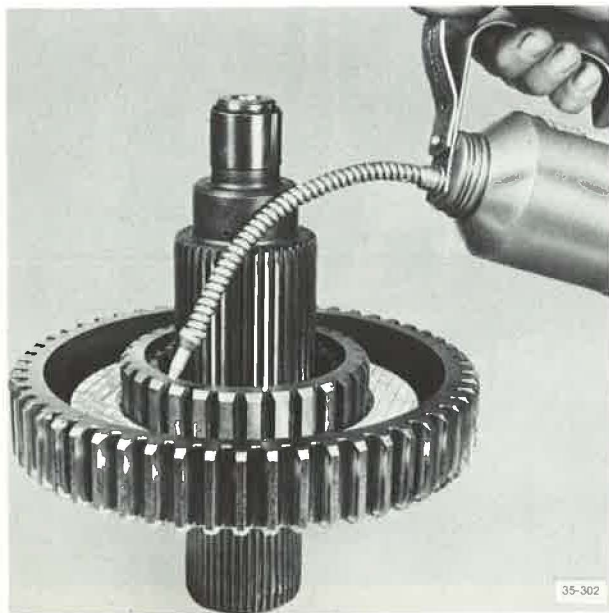


Figure 233. Oiling Friction Disc

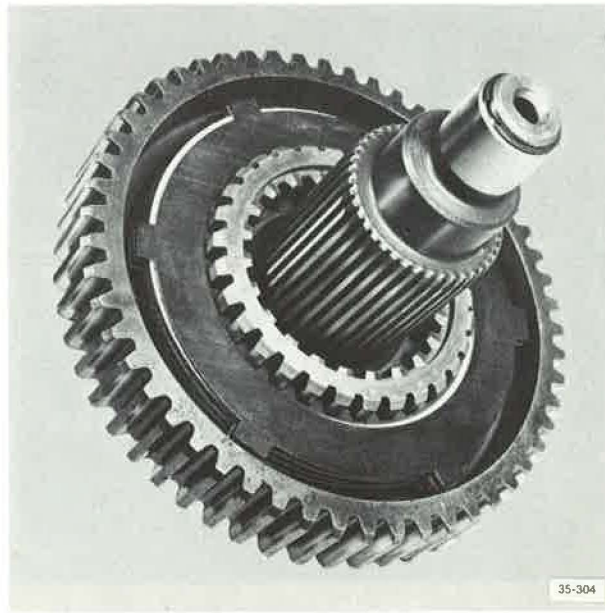


Figure 235. Lo-Range Gear with Discs Installed

7. Align the tangs of the reaction discs, install the synchronizer assembly onto the rear mainshaft assembly, and engage the tangs of the reaction discs with the slots in the synchronizer housing.

NOTE

Be sure that the synchronizer is installed with the "R" markings next to the synchronizer discs just installed.

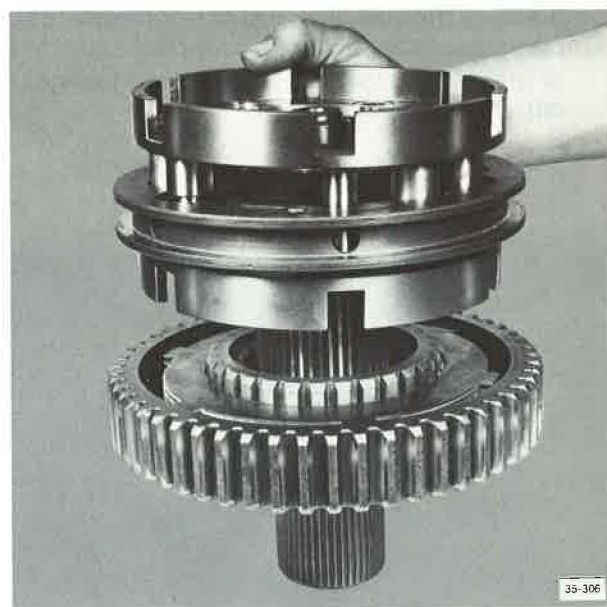


Figure 237. Installing Synchronizer

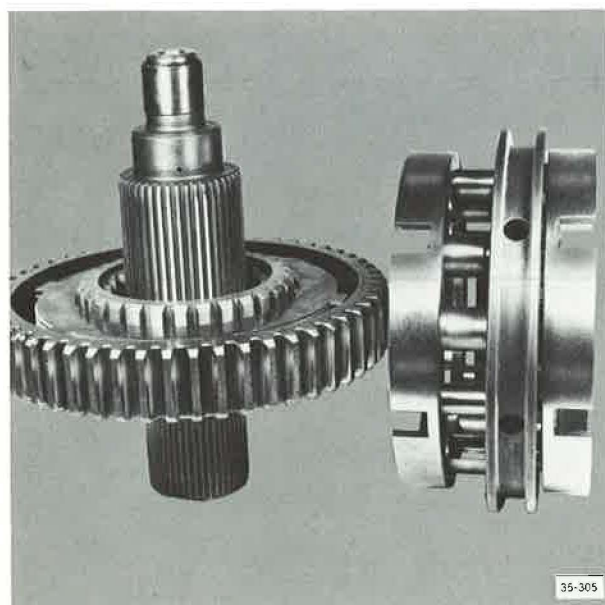


Figure 236. Synchronizer and Rear Mainshaft Assemblies

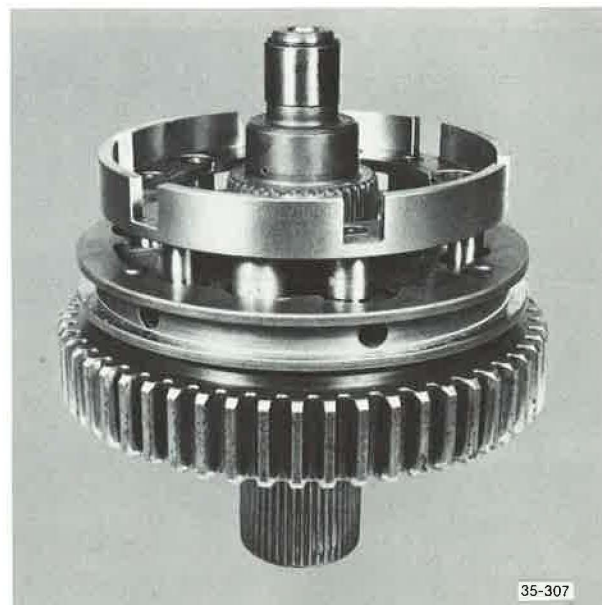
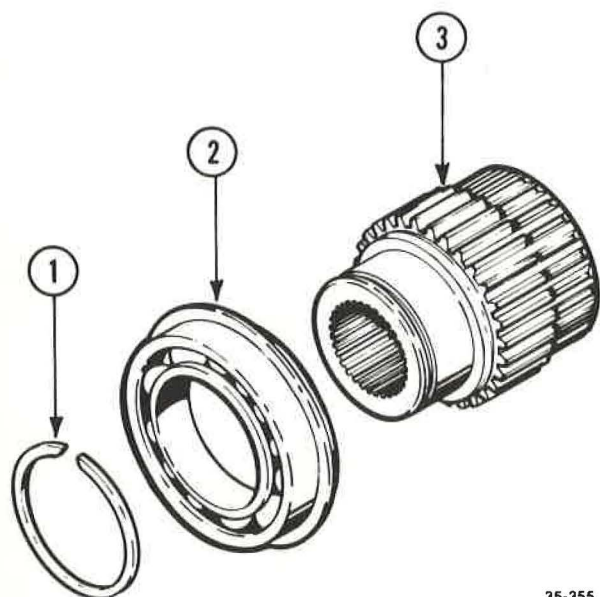
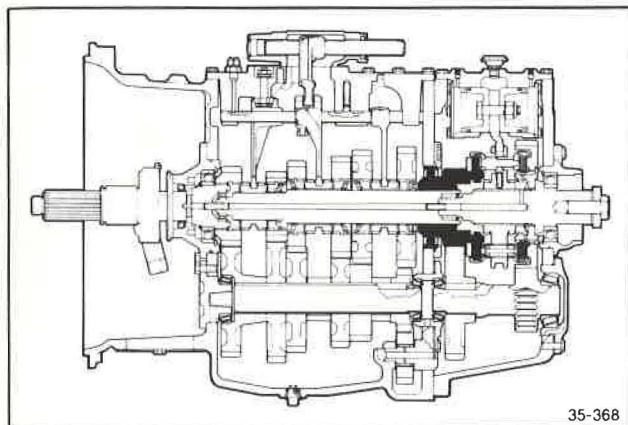


Figure 238. Synchronizer Installed on Rear Mainshaft

Rear Compound Main Drive Gear Reassembly



1. Snap Ring
2. Bearing
3. Main Drive Gear

Figure 239. Exploded View of Rear Compound Main Drive Gear

1. Press the bearing onto the rear compound main drive gear, being sure to use a driver that applies force to the inner race only.



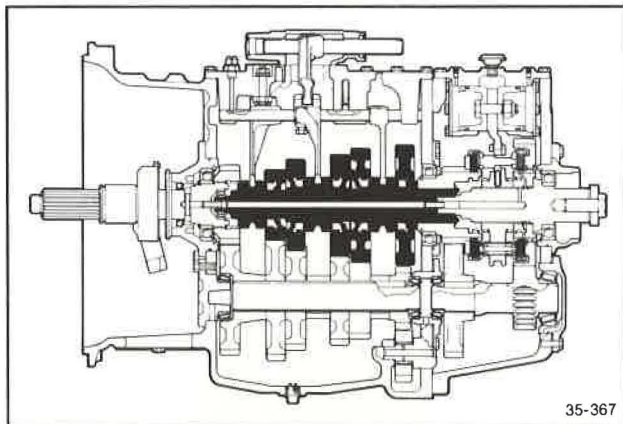
Figure 240. Pressing on Bearing

2. Install the bearing retaining snap ring.



Figure 241. Installing Snap Ring

Front Mainshaft Reassembly



CAUTION

The oil tube at the rear of the mainshaft must be in place, or the oil supply to the synchronizer Lo-Range discs will be insufficient and may result in noise, wear and early failure. Be sure it is installed.

1. Press the bearing into the rear of the mainshaft.

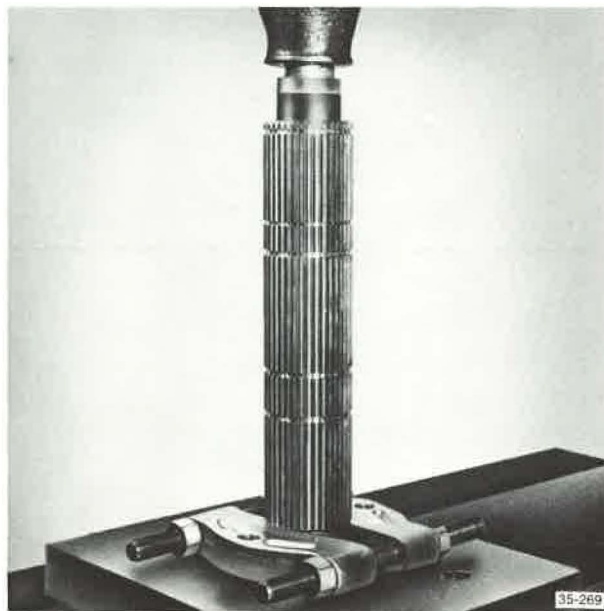


Figure 242. Pressing in Rear Bearing

2. Install the bearing retaining snap ring into the rear of the mainshaft.



Figure 243. Installing Snap Ring

3. Press the mainshaft spigot bearing inner race onto the front of the shaft.

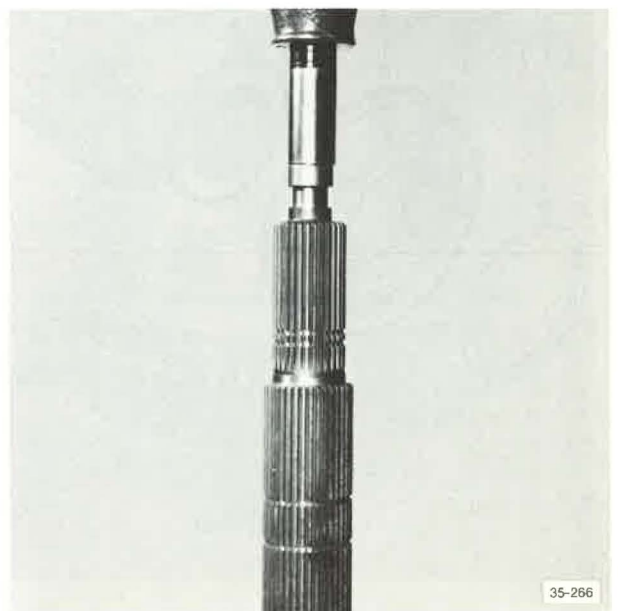
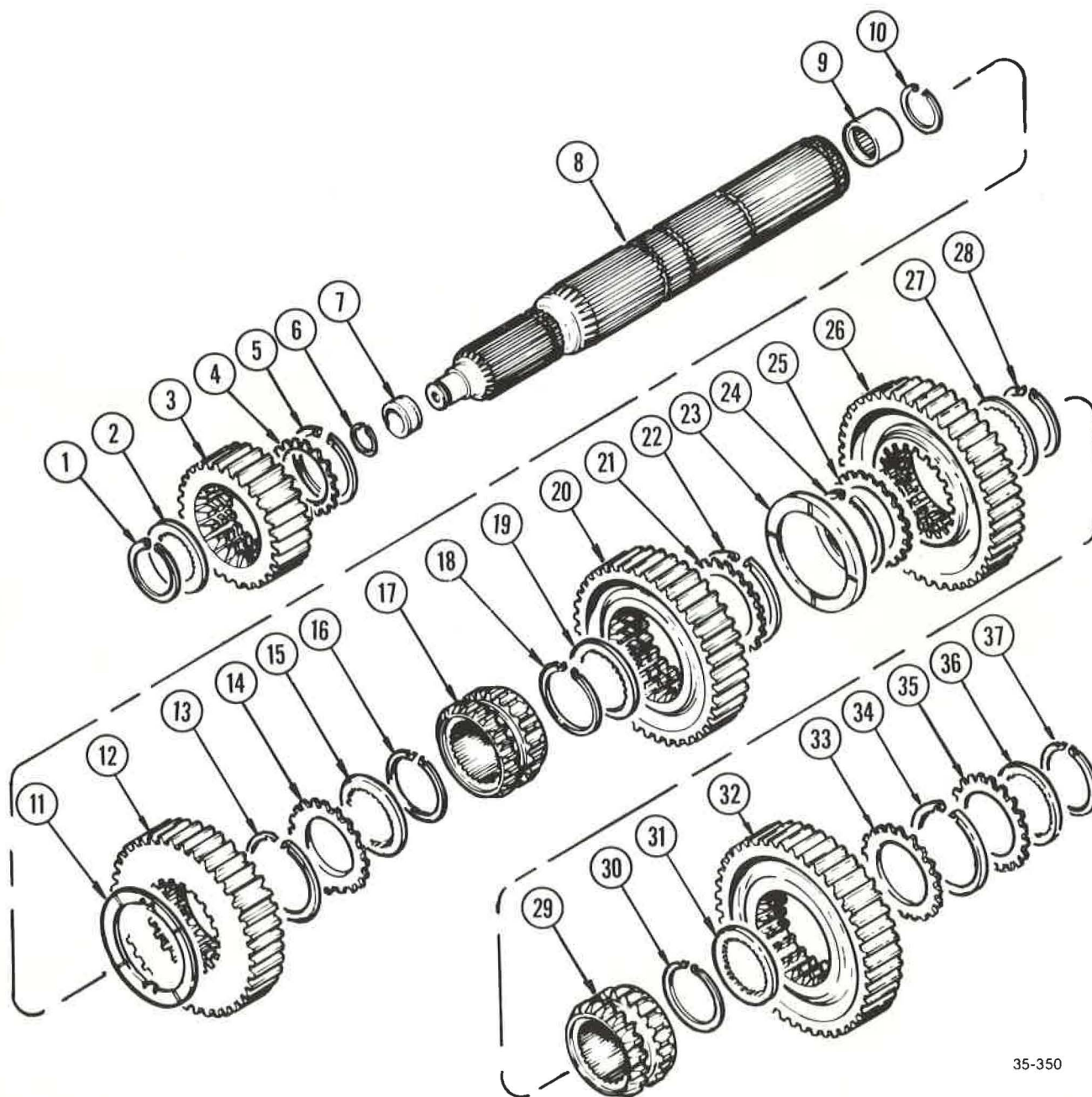


Figure 244. Pressing on Bearing Inner Race



35-350

- | | | |
|---------------------------|---------------------------|------------------------|
| 1. Snap Ring | 13. Snap Ring | 25. Thrust Washer |
| 2. Thrust Washer | 14. Thrust Washer | 26. First Speed Gear |
| 3. Fifth Speed Gear | 15. Thrust Washer | 27. Thrust Washer |
| 4. Thrust Washer | 16. Snap Ring | 28. Snap Ring |
| 5. Snap Ring | 17. Sliding Clutch | 29. Sliding Clutch |
| 6. Snap Ring | 18. Snap Ring | 30. Snap Ring |
| 7. Bearing Inner Race | 19. Thrust Washer | 31. Thrust Washer |
| 8. Front Mainshaft | 20. Second Speed Gear | 32. Reverse Speed Gear |
| 9. Bearing | 21. Thrust Washer | 33. Thrust Washer |
| 10. Snap Ring | 22. Snap Ring | 34. Snap Ring |
| 11. Flanged Thrust Washer | 23. Flanged Thrust Washer | 35. Thrust Washer |
| 12. Third Speed Gear | 24. Snap Ring | 36. Thrust Washer |
| | | 37. Snap Ring |

Figure 245. Exploded View of Front Mainshaft

4. Install the retaining snap ring onto the shaft.

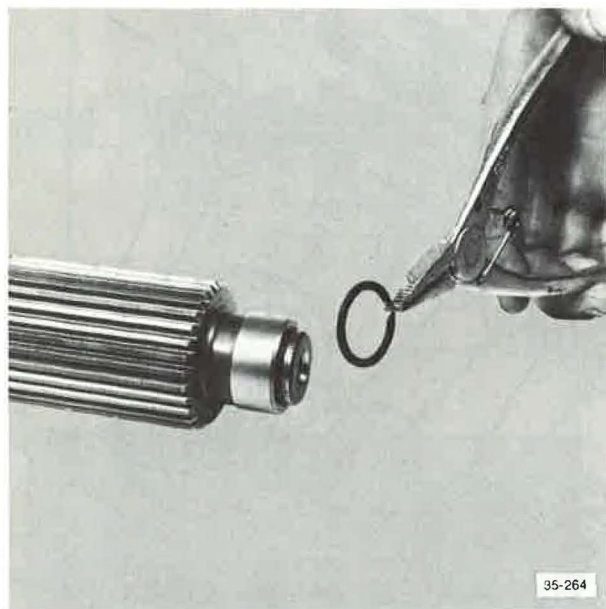


Figure 246. Installing Snap Ring

NOTE

On some mainshafts, it will not be possible to install the second/third sliding clutch from the rear end of the shaft, as shown in step 14. In those cases, install the sliding clutch now.

5. Install the snap ring into the snap ring groove inside the fifth speed gear.

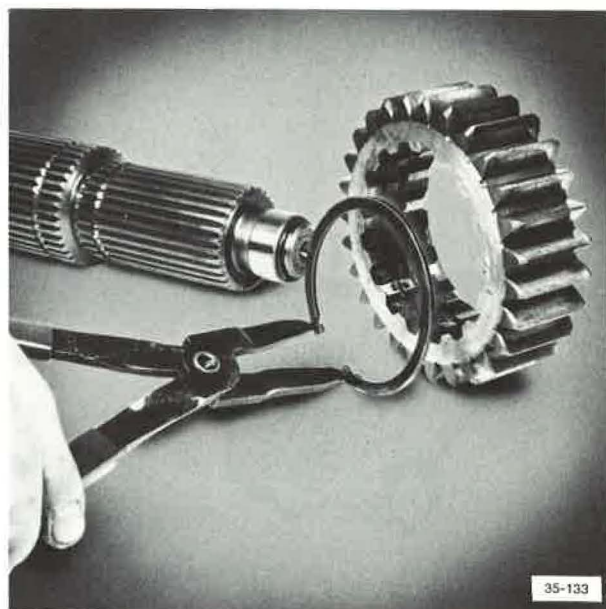


Figure 247. Installing Snap Ring

6. Install the external tooth thrust washer inside the fifth speed gear.

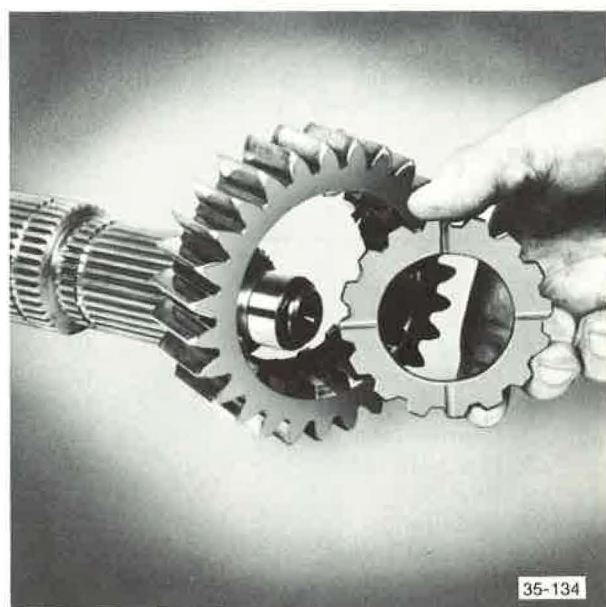


Figure 248. Installing Thrust Washer

7. Install the fifth speed gear on the mainshaft (clutch teeth forward), and then install the internal tooth thrust washer onto the shaft.

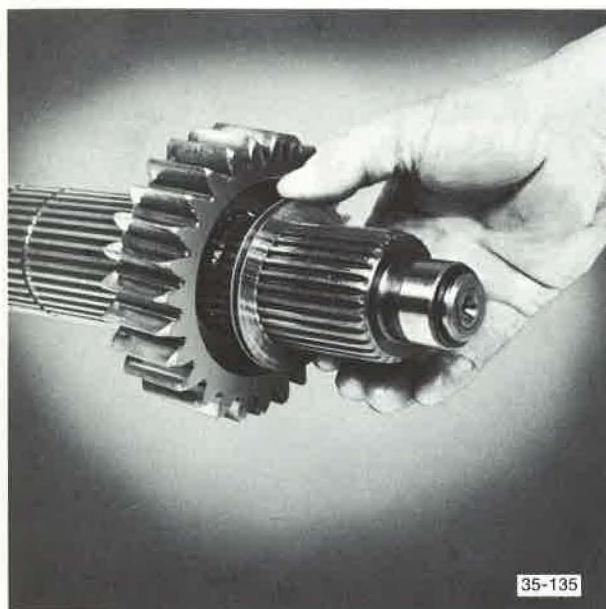


Figure 249. Installing Thrust Washer

8. Install the snap ring on the mainshaft for the fifth speed gear.

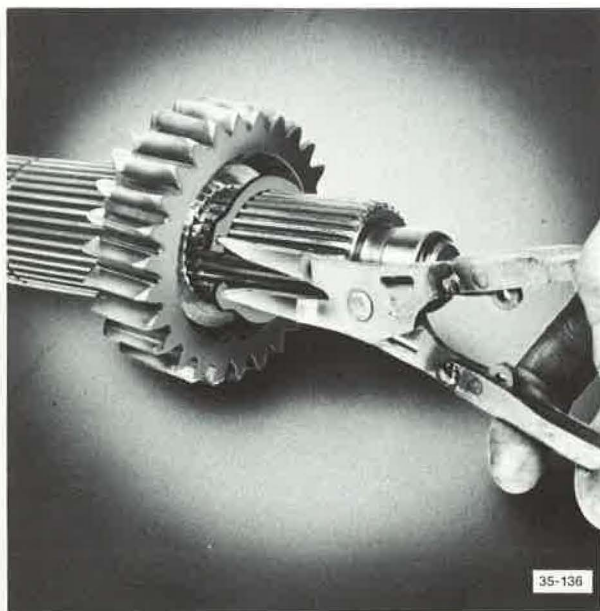


Figure 250. Installing Snap Ring

9. Install the snap ring into the snap ring groove inside the third speed gear.



Figure 251. Installing Snap Ring

10. Install the external tooth thrust washer inside the third speed gear.



Figure 252. Installing Thrust Washer

11. Place a thin layer of grease on the third/fifth flanged thrust washer (which will hold it in place on the front surface of the third speed gear during installation of that gear), and then install the third speed gear onto the mainshaft from the rear end of the shaft. The clutch teeth of the gear should face rearward, and the gear should be slid all the way forward to the fifth speed gear.

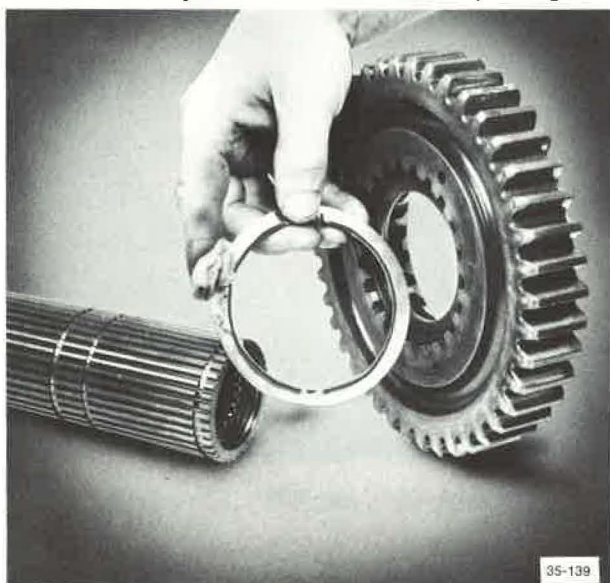


Figure 253. Placing Grease on Flanged Thrust Washer

12. Install the internal tooth thrust washer onto the shaft and slide it all the way forward inside the third speed gear.

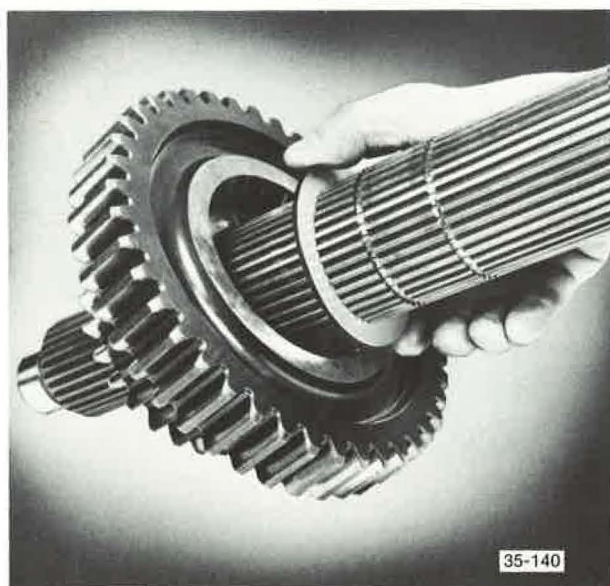


Figure 254. Installing Thrust Washer

13. Install the snap ring on the mainshaft for the third speed gear.

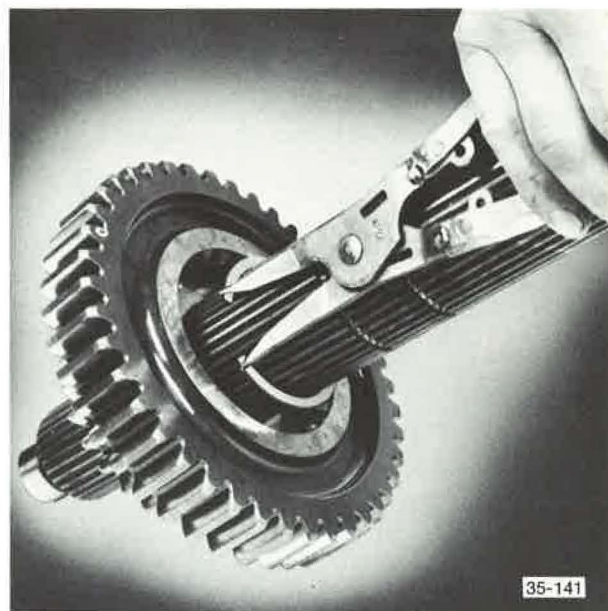


Figure 255. Installing Snap Ring

14. Install the second/third speed sliding clutch onto the mainshaft.

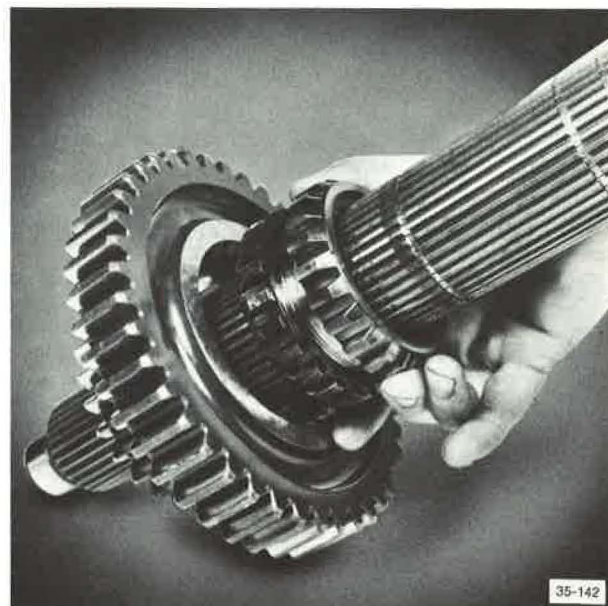


Figure 256. Installing Sliding Clutch

15. Install the snap ring onto the mainshaft for the second speed gear.

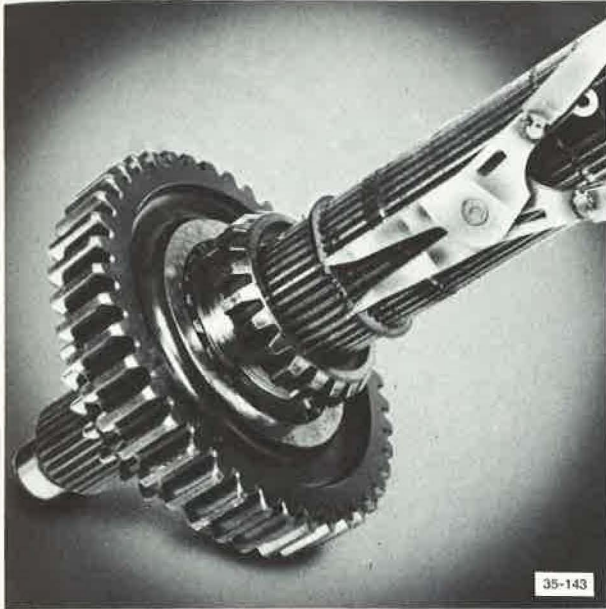


Figure 257. Installing Snap Ring

16. Install the internal tooth thrust washer, for the second speed gear, onto the mainshaft.

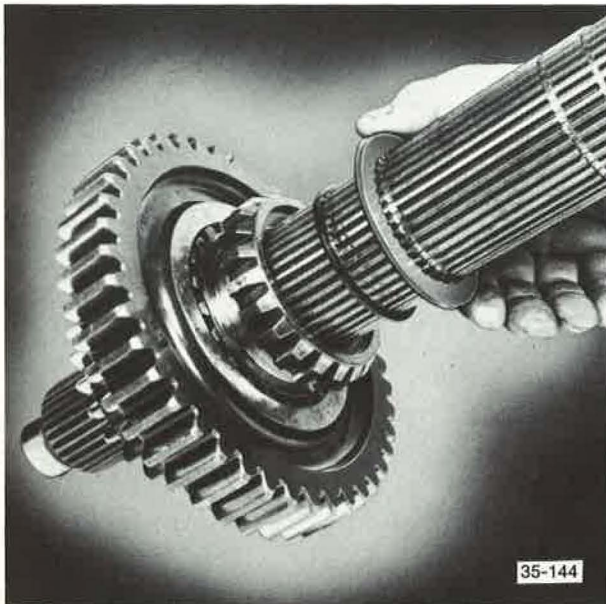


Figure 258. Installing Thrust Washer

17. Install the snap ring into the snap ring groove inside the second speed gear.

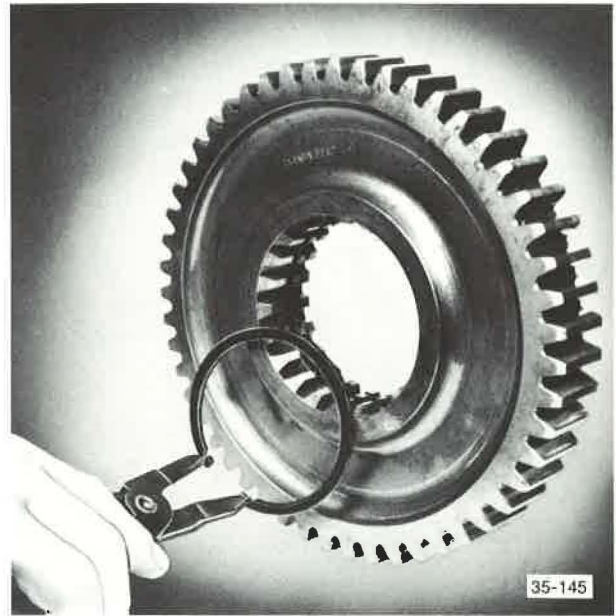


Figure 259. Installing Snap Ring

18. Install the external tooth thrust washer inside the second speed gear.

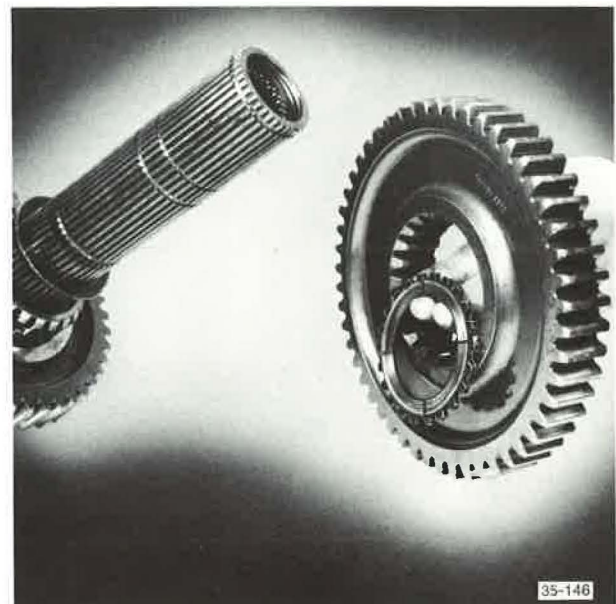


Figure 260. Installing Thrust Washer

19. Install the second speed gear onto the mainshaft (clutch teeth facing forward).

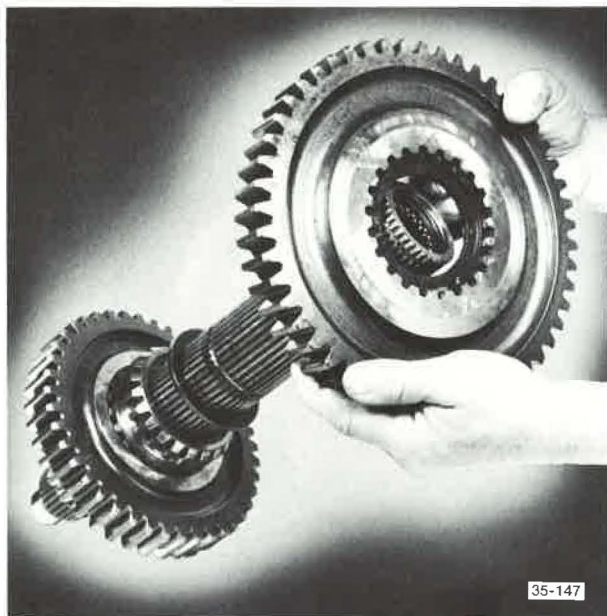


Figure 261. Installing Second Speed Gear

20. Install the snap ring into the snap ring groove inside the first speed gear.



Figure 262. Installing Snap Ring

21. Install the external tooth thrust washer inside the first speed gear.

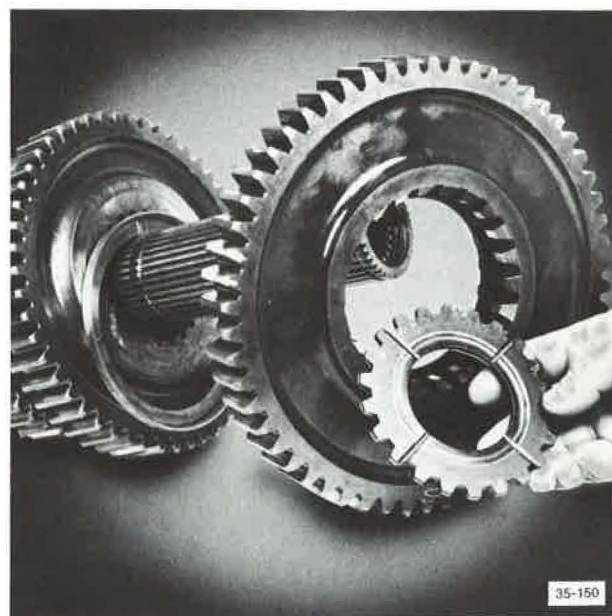


Figure 263. Installing Thrust Washer

22. Place a thin layer of grease on the first/second flanged thrust washer, to hold it in place on the front surface of the first speed gear during installation of that gear.

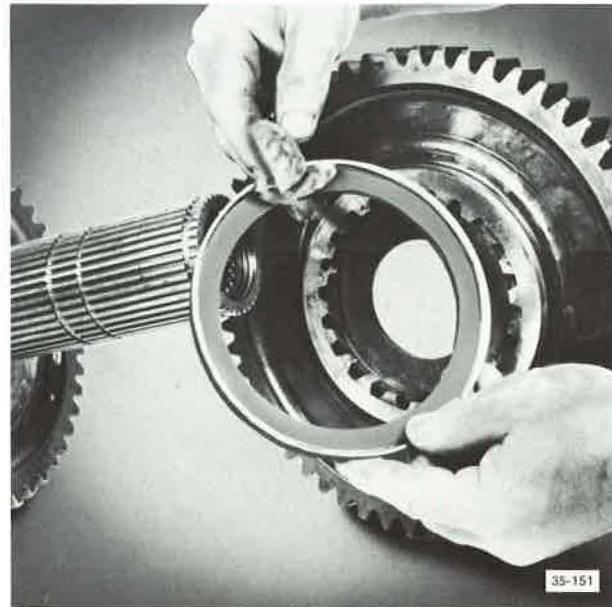


Figure 264. Applying Grease

23. Install the first speed gear onto the mainshaft, clutch teeth rearward.

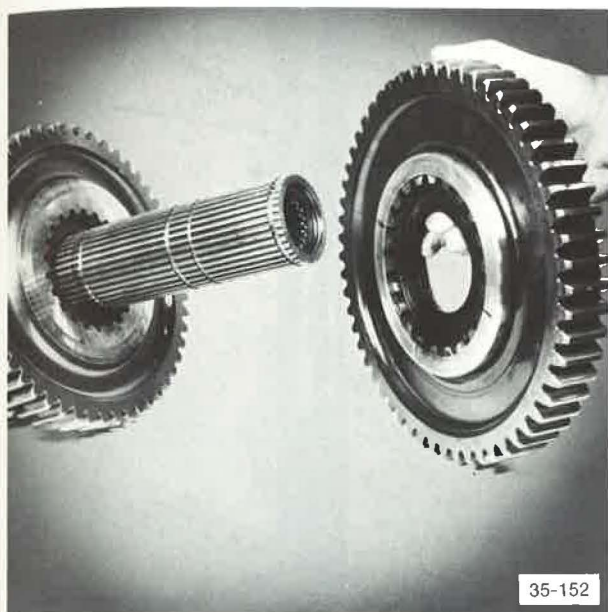


Figure 265. Installing First Speed Gear

24. Install the internal tooth thrust washer, for the first speed gear, onto the mainshaft.

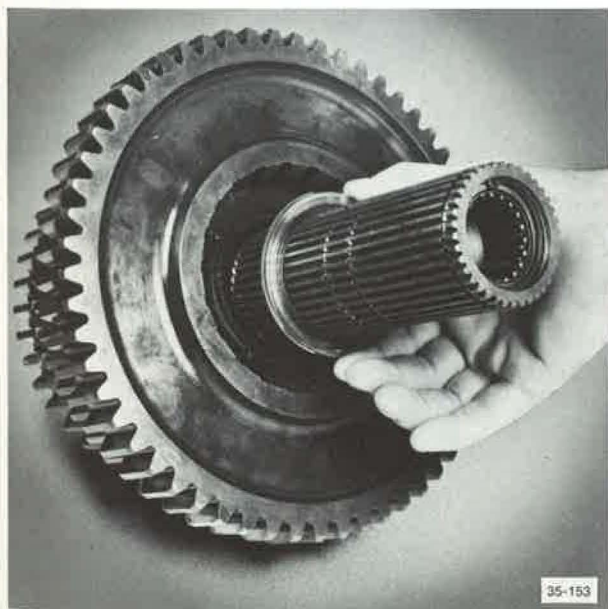


Figure 266. Installing Thrust Washer

25. Install the snap ring onto the mainshaft for the first speed gear.



Figure 267. Installing Snap Ring

26. Install the first/reverse sliding clutch, and slide it forward into engagement with the first speed gear.

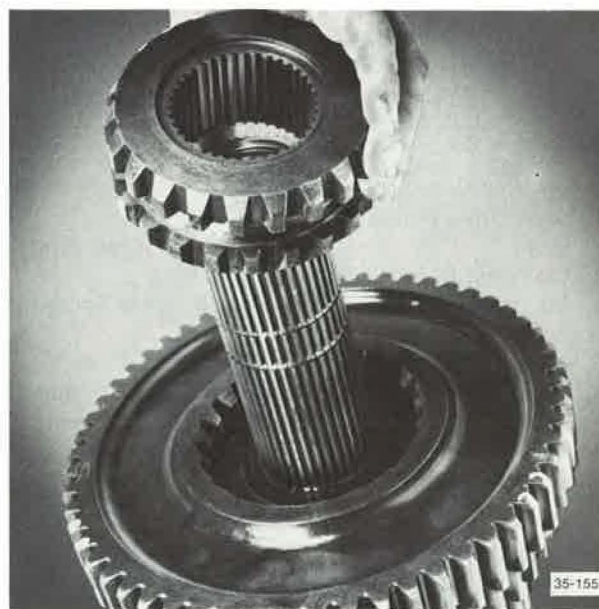
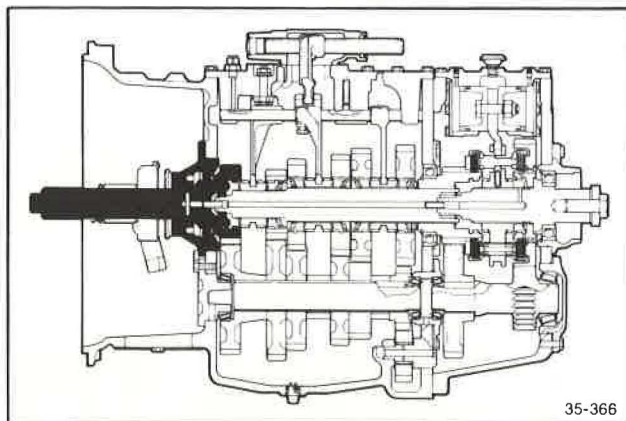


Figure 268. Installing Sliding Clutch

27. Install the reverse gear, onto the mainshaft, and slide it forward as far as possible, so that its clutch teeth mesh with the teeth of the first/reverse sliding clutch just installed.

Main Drive Pinion Reassembly



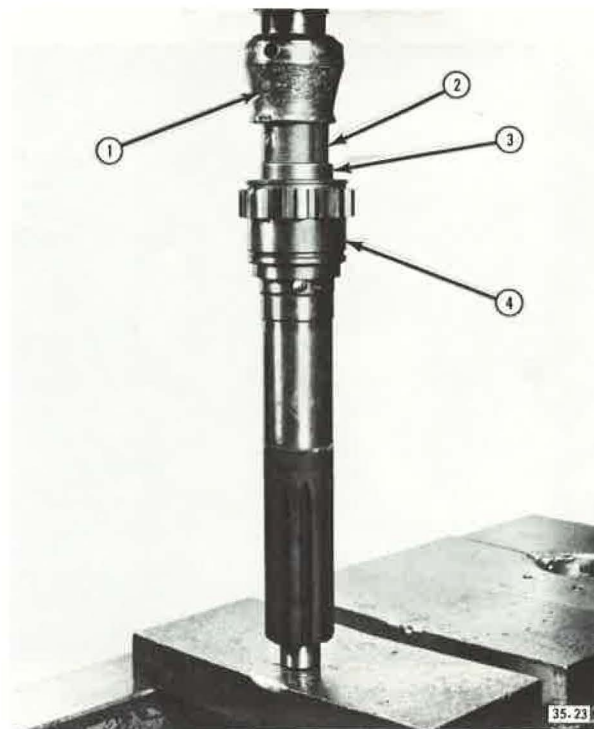
- | | |
|----------------------------|-------------------------------------|
| 1. Main Drive Pinion Shaft | 9. Bearing |
| 2. Oil Pump Plunger | 10. Spiral Snap Ring |
| 3. Oil Tube | 11. O-Ring |
| 4. Spigot Bearing | 12. Oil Pump Eccentric Ring |
| 5. Snap Ring | 13. O-Ring |
| 6. Main Drive Pinion Gear | 14. Main Drive Pinion Bearing Cover |
| 7. Spiral Snap Ring | 15. Oil Seal |
| 8. Snap Ring | |

Figure 269. Exploded View of Main Drive Pinion

CAUTION

The oil tube in the main drive pinion must be in place, or the oil supply to the synchronizer Lo-Range discs will be insufficient, and may result in noise, wear, and early failure. Be sure it is installed.

1. Press the spigot bearing into the end of the main drive pinion shaft.



- | | |
|-----------|------------|
| 1. Press | 3. Bearing |
| 2. Driver | 4. Shaft |

Figure 270. Pressing in Spigot Bearing

2. Install the bearing retaining snap ring.

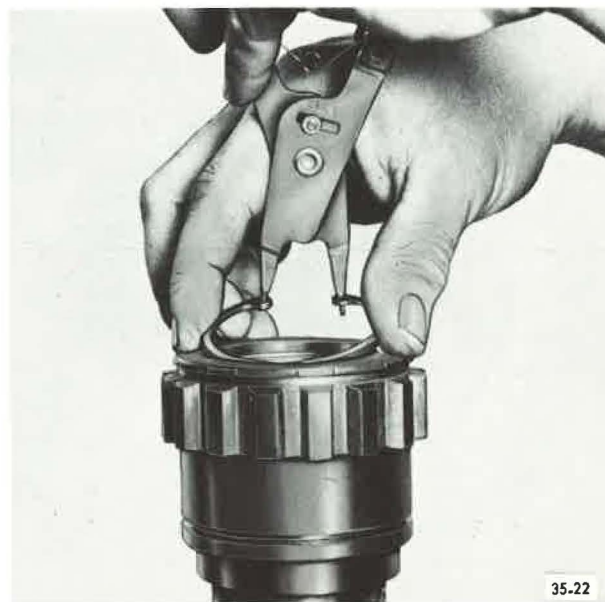
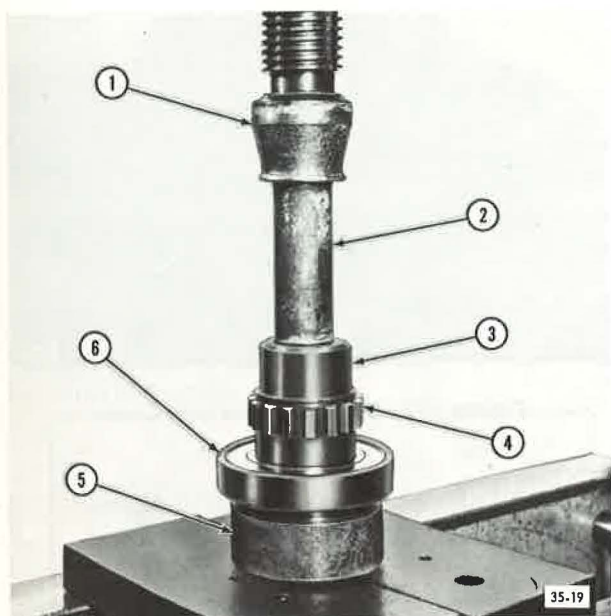


Figure 271. Installing Snap Ring

3. Press the bearing onto the main drive pinion shaft. Slide a sleeve over the shaft from the front end, so that the bearing is supported by the sleeve on the inner race only, and press the shaft into the bearing.



- | | |
|-----------------|----------------------------|
| 1. Press | 4. Main Drive Pinion Shaft |
| 2. Spacer Tuber | 5. Sleeve |
| 3. Driver | 6. Bearing |

Figure 272. Pressing Bearing onto Main Drive Pinion Shaft

4. Install the spiral snap ring that retains the bearing.



Figure 273. Installing Snap Ring

5. Install the oil pump plunger into the main drive pinion shaft.



Figure 274. Installing Oil Pump Plunger

6. Place the oil pump eccentric ring into the main drive pinion bearing cover, aligning the slot in the ring with the oil supply hole in the cover, and press the ring into the cover.



Figure 275. Installing Oil Pump Eccentric Ring

7. Place the oil seal in position in the main drive pinion bearing cover, and press the seal into the cover.



Figure 277. Placing Seal into Cover

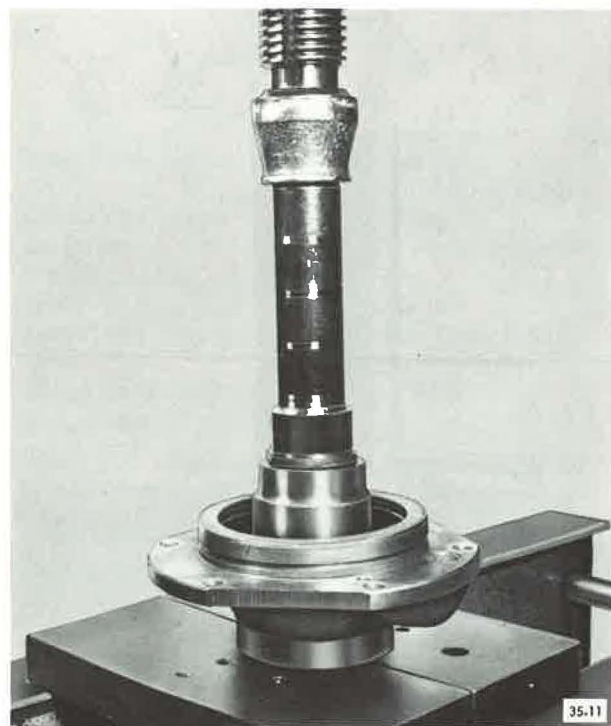


Figure 276. Pressing Ring into Cover



Figure 278. Pressing Seal into Cover

8. Press the main drive pinion shaft and bearing assembly into the cover.

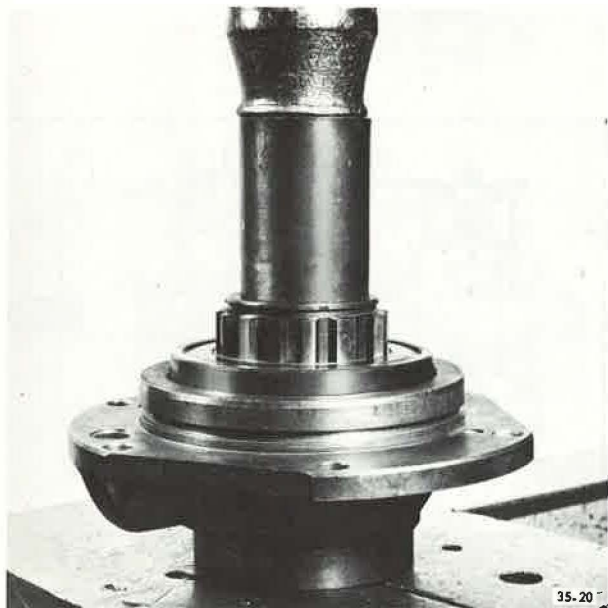


Figure 279. Pressing Shaft and Bearing into Cover

9. Install the large bearing retaining snap ring into the cover.

NOTE

Beveled side of snap ring must face rearward, which in this picture is "up."



Figure 280. Installing Snap Ring

10. Install the O-rings into the main drive pinion bearing cover.



Figure 281. Installing O-Rings

11. Install the main drive pinion gear onto the pinion shaft, and secure it with the spiral snap ring.

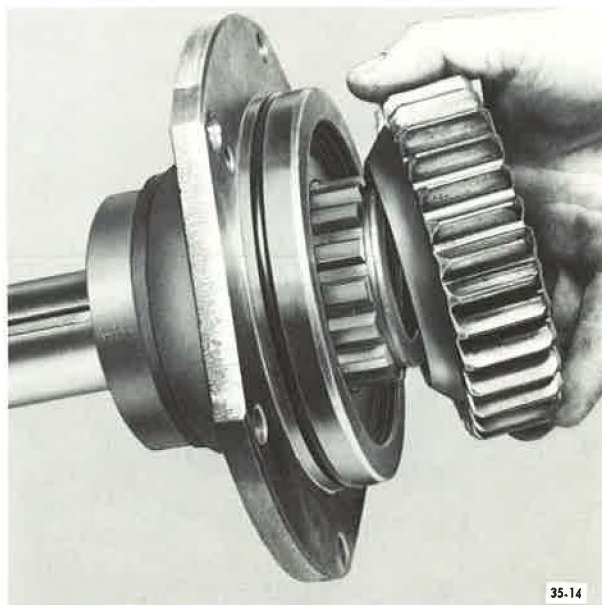


Figure 282. Installing Gear

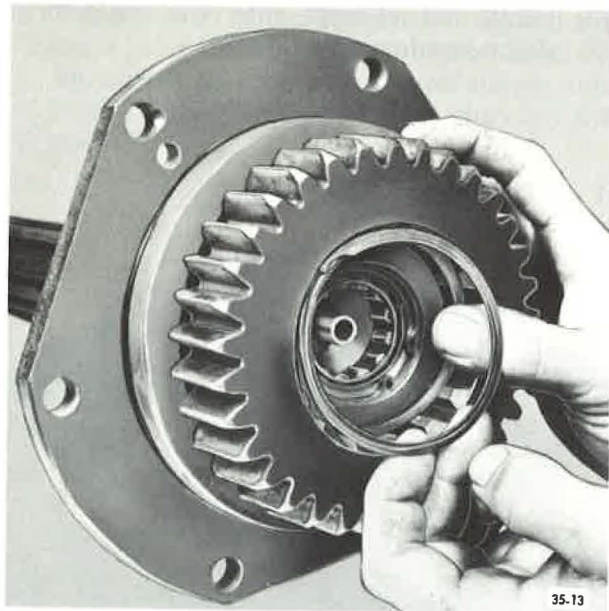
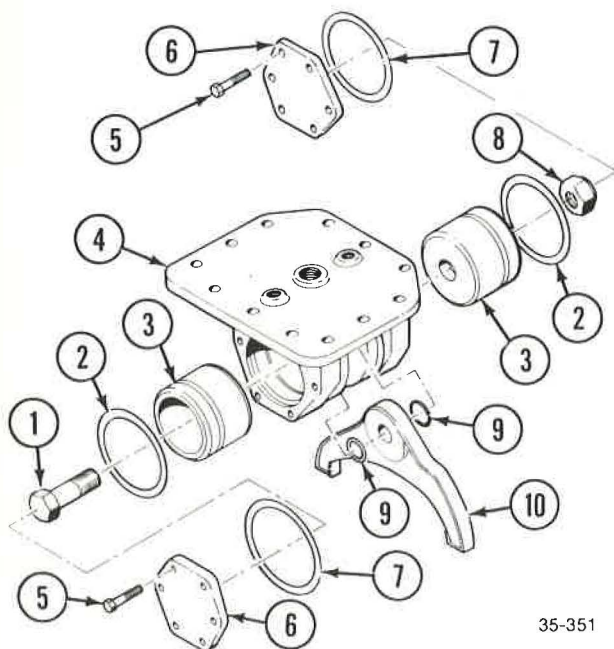
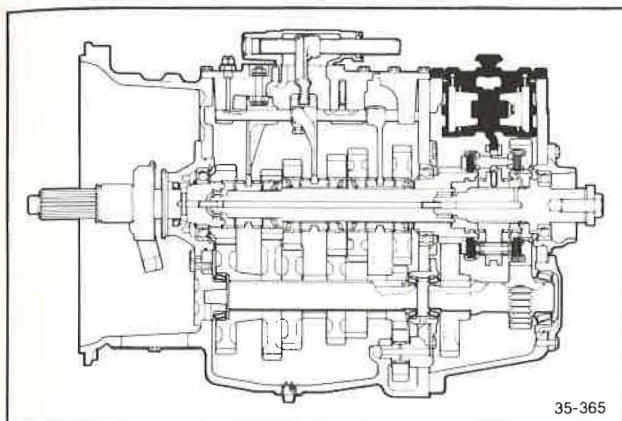


Figure 283. Installing Snap Ring

Range Shift Cover Reassembly



- | | |
|----------------------|-----------------|
| 1. Capscrew | 6. Piston Cover |
| 2. O-Ring | 7. O-Ring |
| 3. Piston | 8. Nut |
| 4. Range Shift Cover | 9. O-Ring |
| 5. Capscrew | 10. Shift Fork |

Figure 284. Exploded View of Range Shift Cover

1. Install the O-Rings onto the two air shift pistons.



Figure 285. Installing O-Ring

2. Install the capscrew into one of the shift pistons.



Figure 286. Installing Capscrew

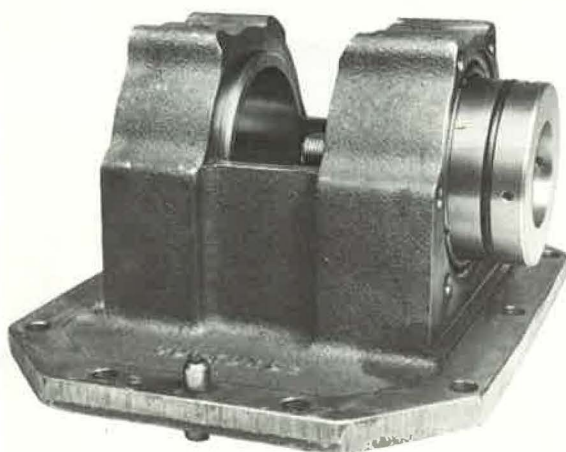
3. Install one O-ring onto the capscrew.



35-29

Figure 287. Installing O-Ring

4. Install that piston and capscrew assembly into one side of the range shift cover, and the other piston into the other side of the cover.



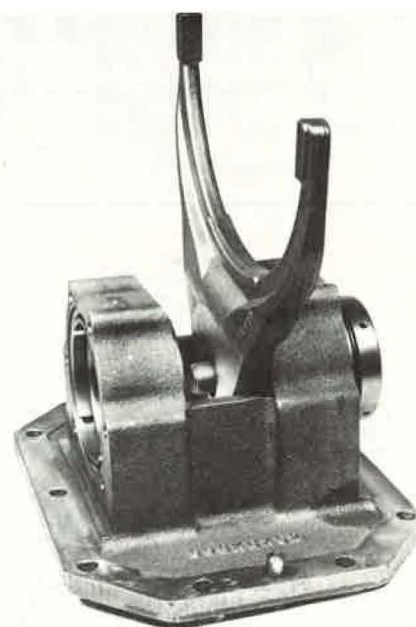
35-30

Figure 288. Pistons Installed

5. Install the shift fork onto the capscrew, between the two pistons.

NOTE

The offset of the shift fork must be closest to the rear of the transmission.



35-31

Figure 289. Shift Fork Installed

6. Install the second O-ring onto the cap-screw, on the other side of the shift fork.

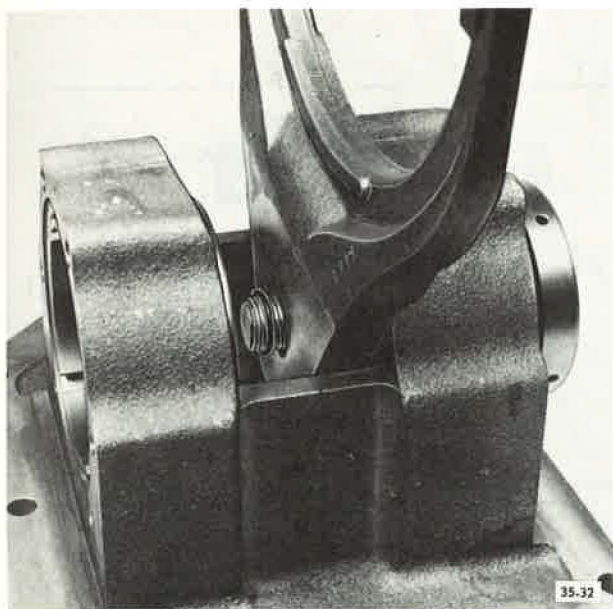


Figure 290. O-Ring Installed

7. Slide the pistons as far into the range shift cover as they will go, install the nut onto the cap screw, and tighten the nut to 173 to 211 lb. ft. torque.

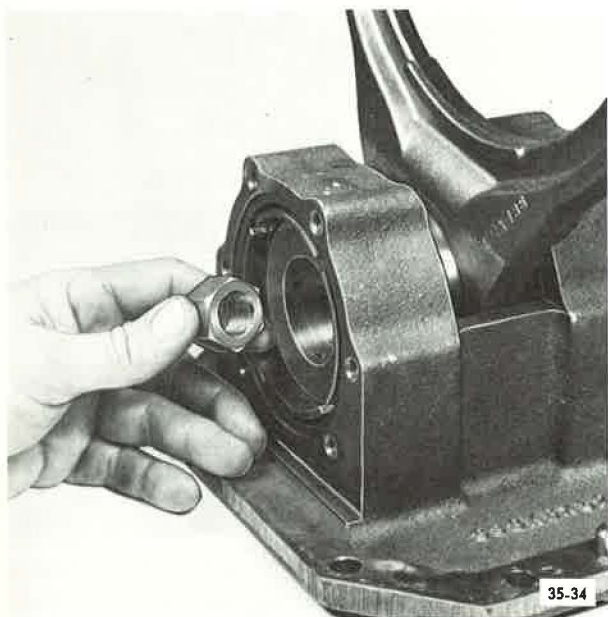


Figure 291. Installing Nut

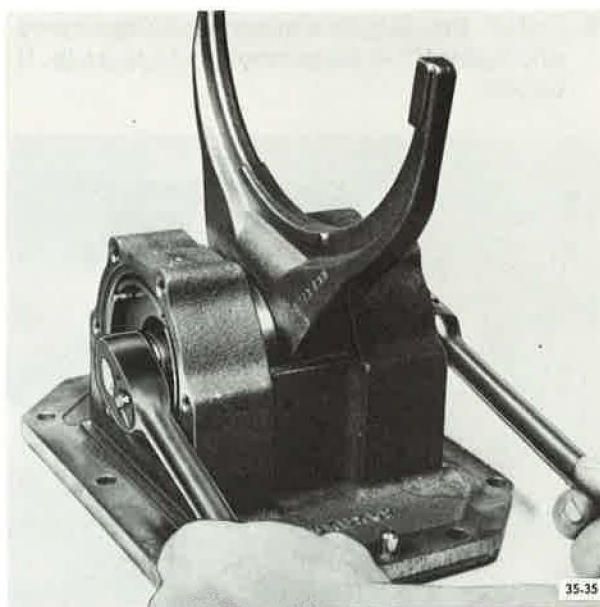


Figure 292. Tightening Nut

8. Install the piston cover O-rings, one on each side.

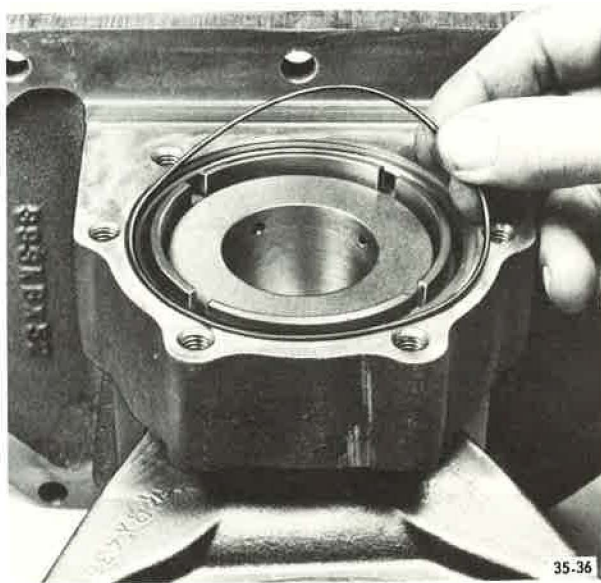


Figure 293. Installing O-Ring

9. Install the piston covers and capscrews, and tighten the capscrews to 17 to 21 lb. ft. torque.

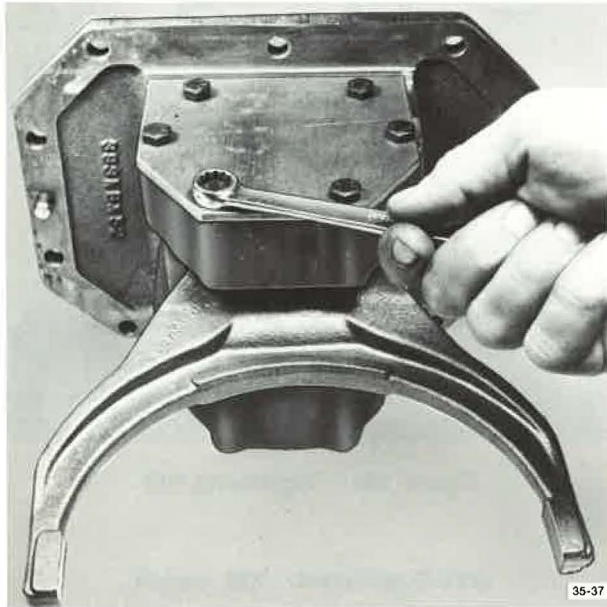
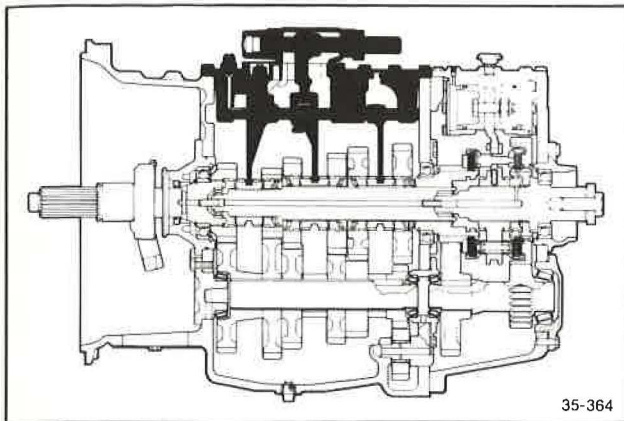


Figure 294. Tightening Capscrew

Main Case Shift Cover Reassembly



1. Install the breather vent onto the shift cover.



Figure 295. Installing Breather Vent

2. Install the fourth/fifth eccentric pin and rocker arm.

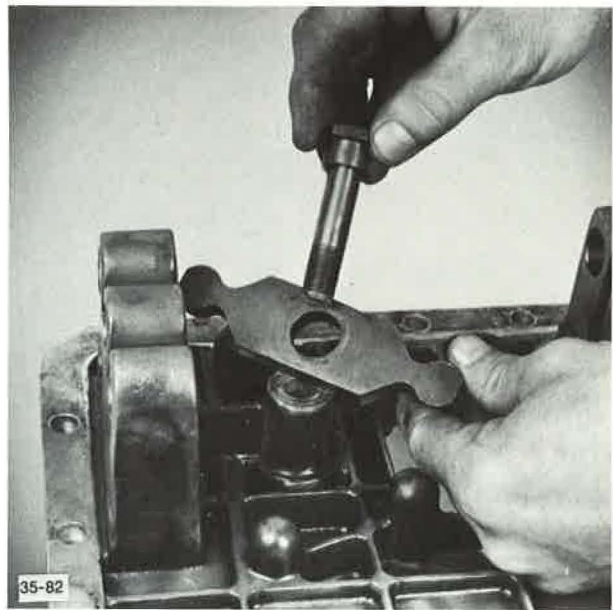
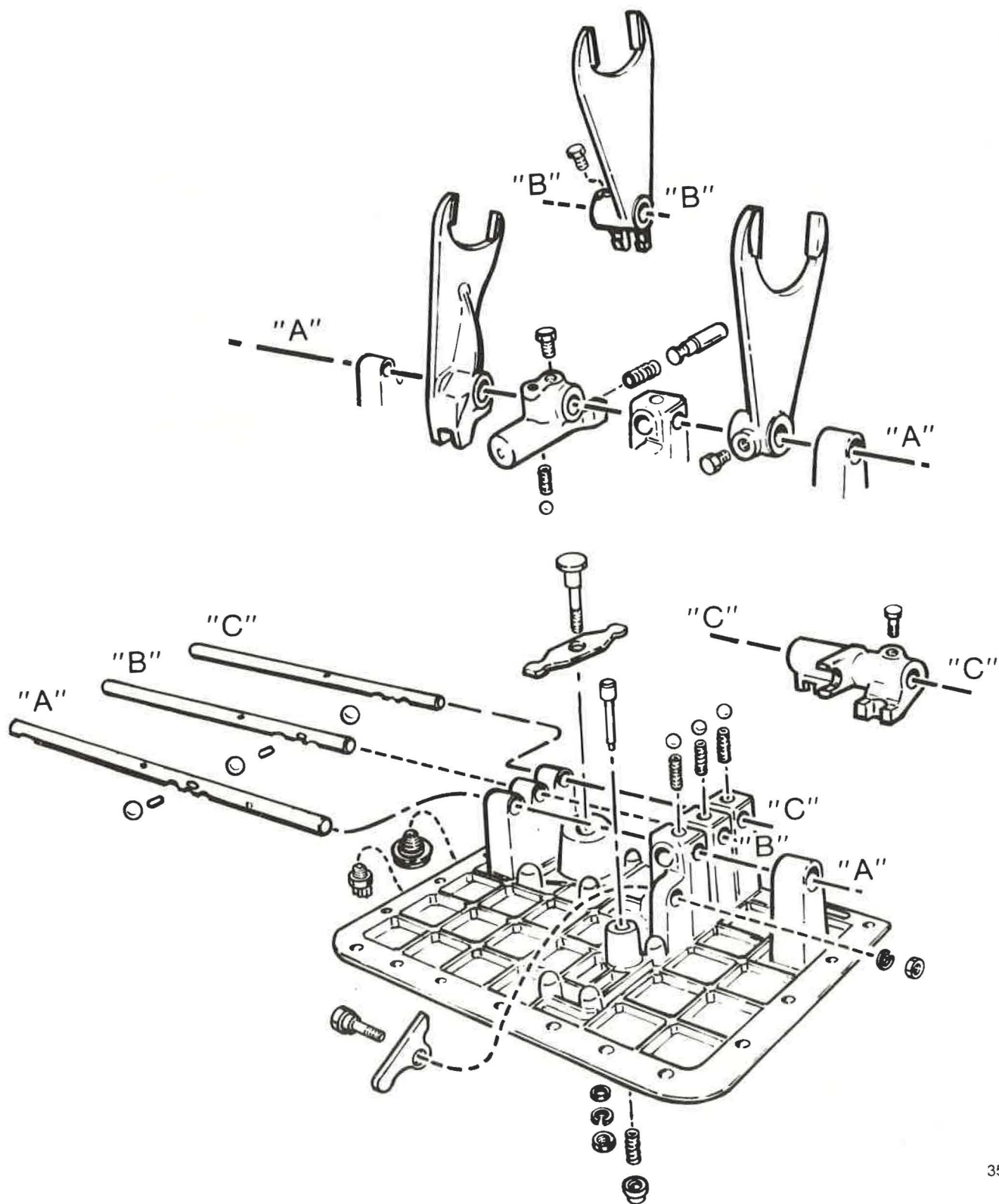


Figure 296. Installing Fourth/Fifth Eccentric Pin and Rocker



3. Install the fourth/fifth eccentric pin washers and nut, and tighten the nut to 50 to 60 lb. ft. torque.

NOTE

Temporarily position the high point of the eccentric midway between the nine and twelve o'clock position, as viewed from the rear of the transmission. Further adjustment will be made later.

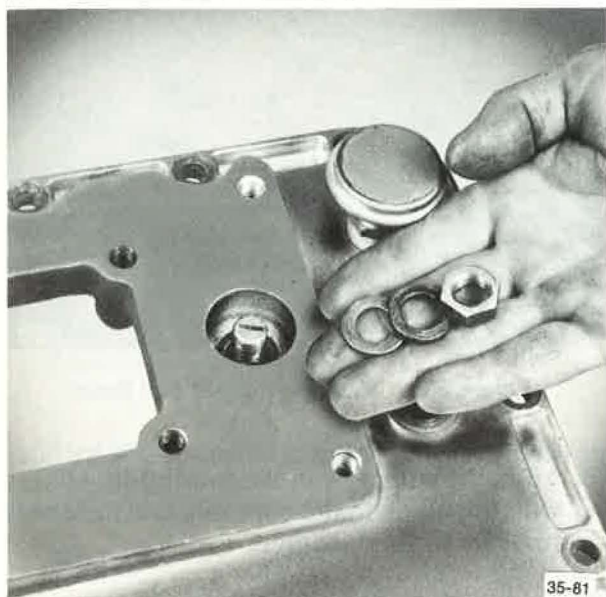


Figure 297. Installing Washers and Nut

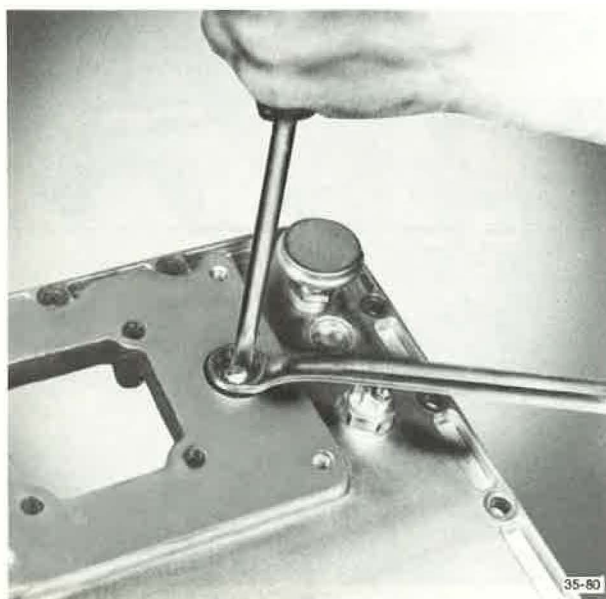


Figure 298. Tightening Nut

4. Install the reverse light switch rod, and then the reverse light switch.

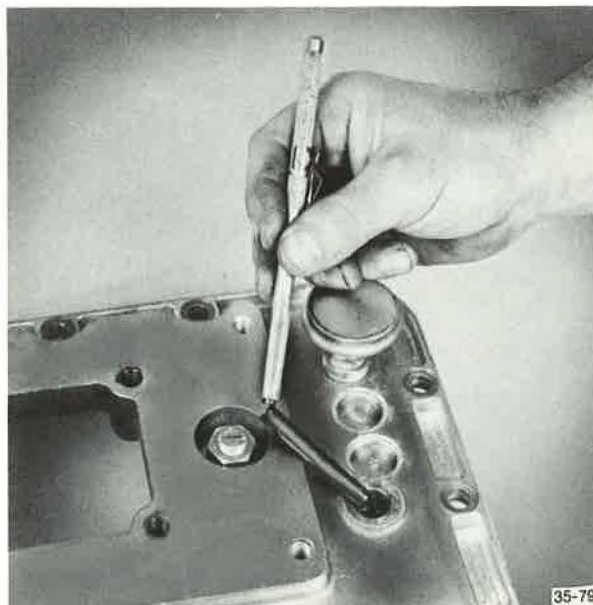


Figure 299. Installing Reverse Light Switch Rod

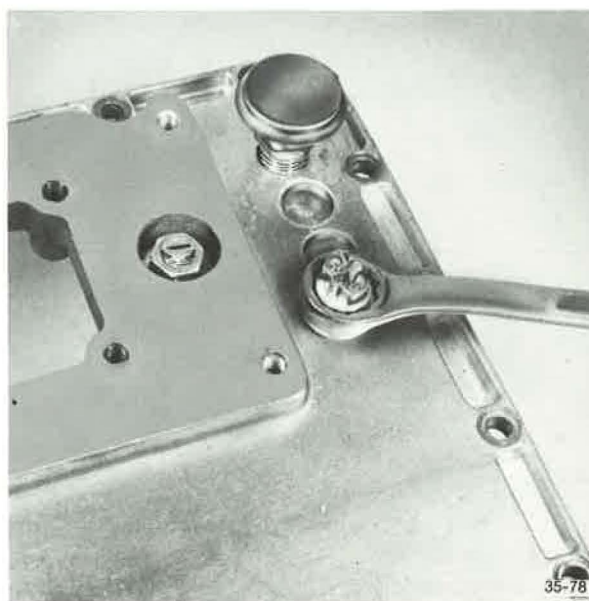


Figure 300. Installing Reverse Light Switch

5. Install the poppet ball and spring for the fourth/fifth shift rail.

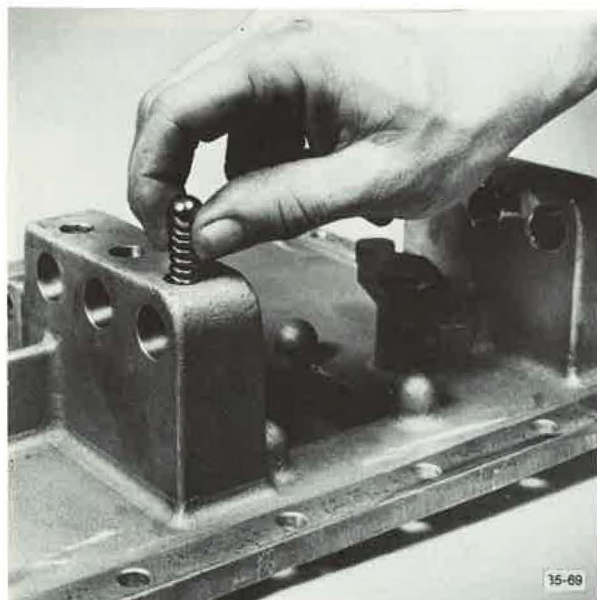


Figure 301. Installing Poppet Ball and Spring

6. Start sliding the fourth/fifth shift rail into the cover, and at the same time, install the fourth/fifth shifter.

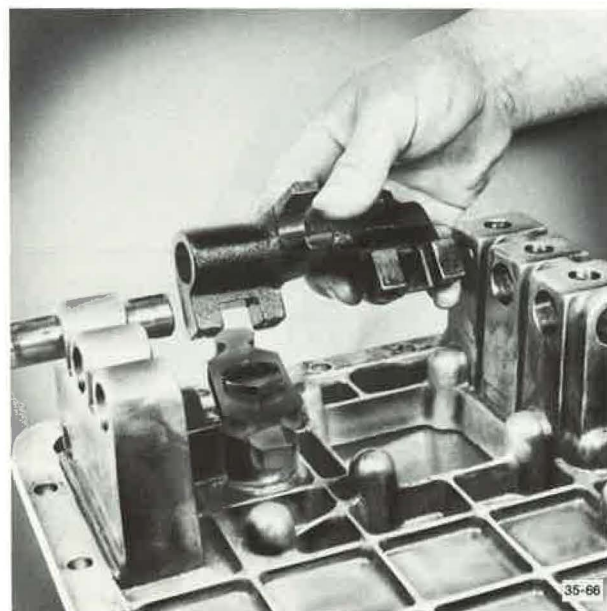


Figure 302. Installing Shift Rail and Shifter

7. Using an appropriate tool, such as the hollow tube shown below, press the poppet ball down, and slide the fourth/fifth shift rail over the ball.

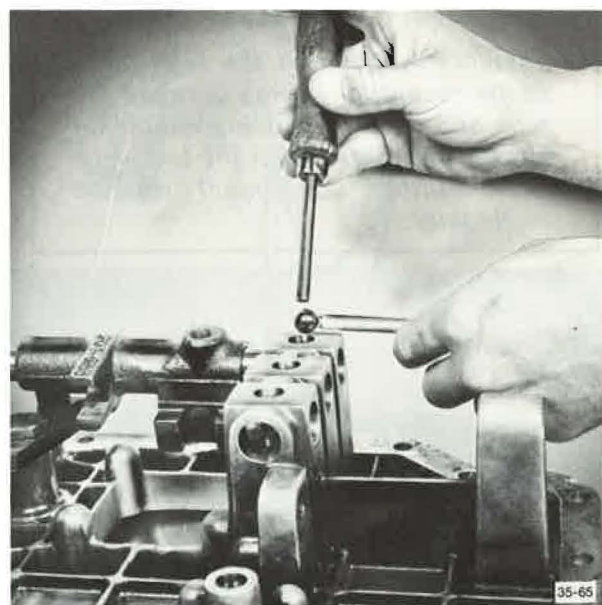


Figure 303. Pushing Poppet Ball Down

8. Align the setscrew in the fourth/fifth shifter with the notch in the shift rail, and tighten it to 35 to 45 lb. ft. torque.

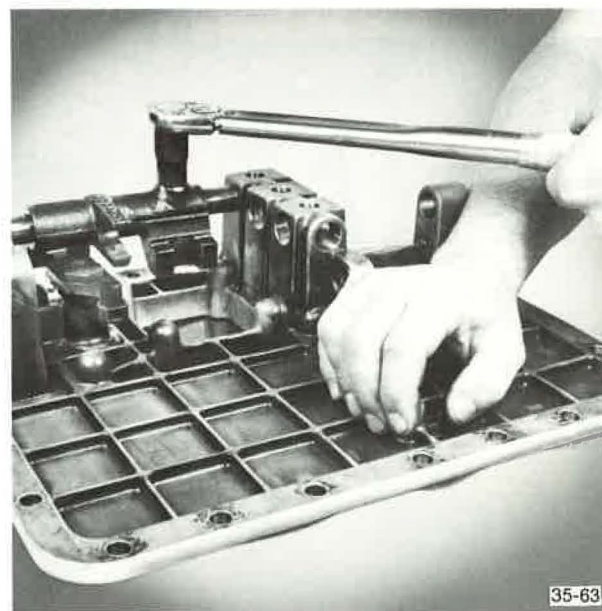


Figure 304. Torquing Setscrew

9. Start sliding the second/third shift rail into the shift cover.

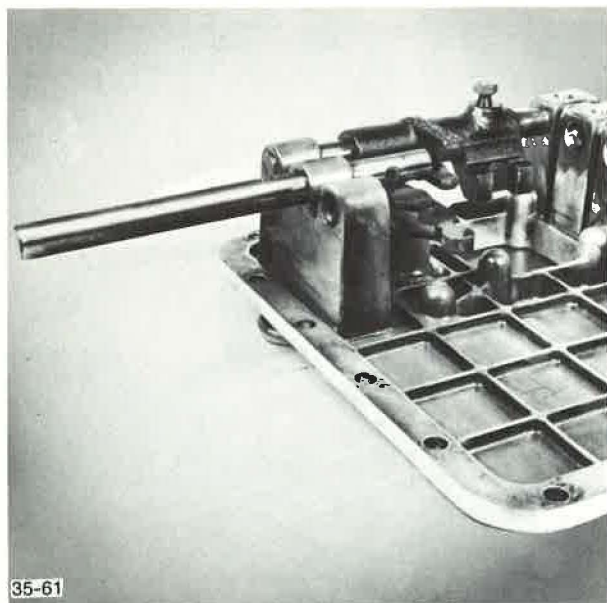


Figure 305. Installing Second/Third Shift Rail

10. Install the second/third shift fork onto the shift rail.

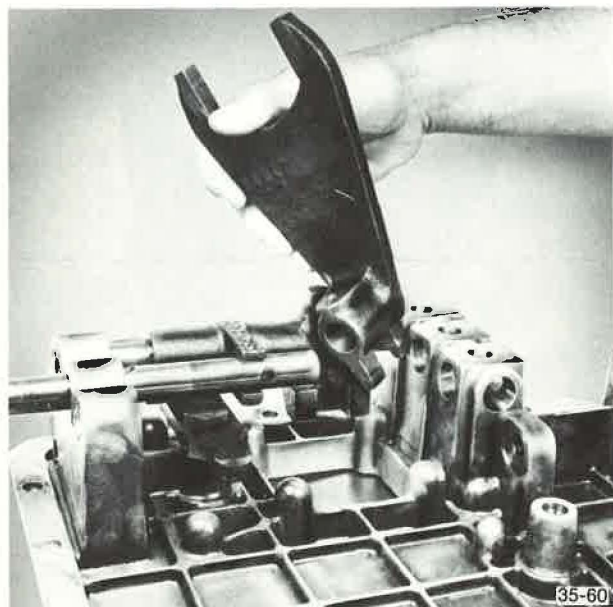


Figure 306. Installing Second/Third Shift Fork

11. Install the interlock pin into the second/third shift rail.

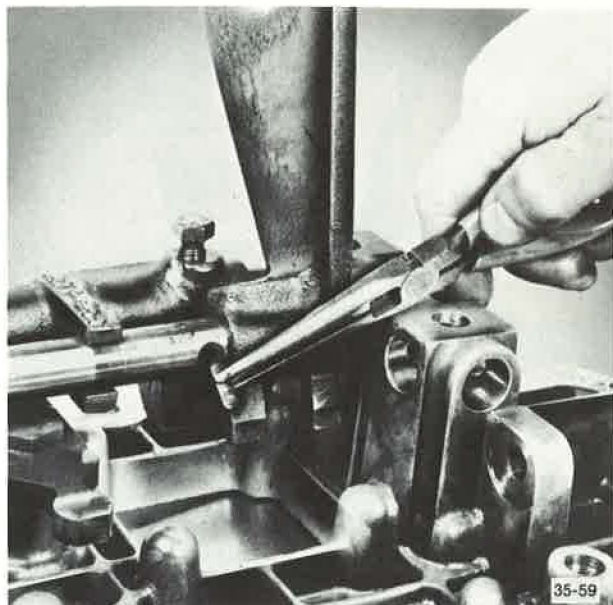


Figure 307. Installing Pin into Second/Third Rail

12. Install the interlock ball between the second/third shift rail and the fourth/fifth shift rail.

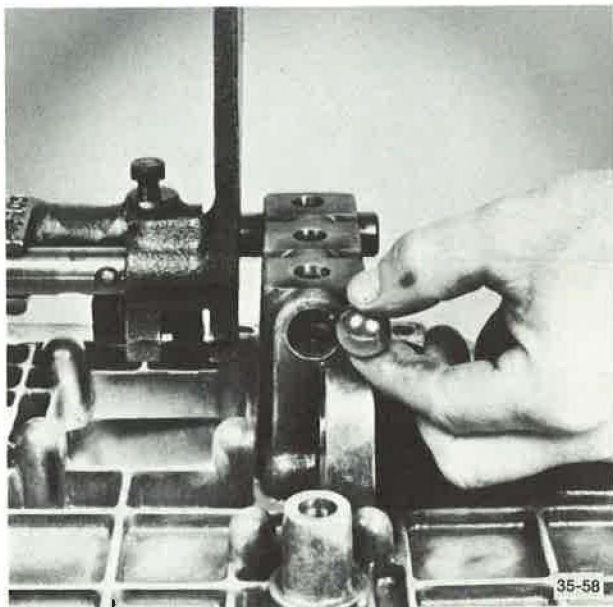


Figure 308. Installing Interlock Ball

13. Install the poppet ball and spring for the second/third shift rail.

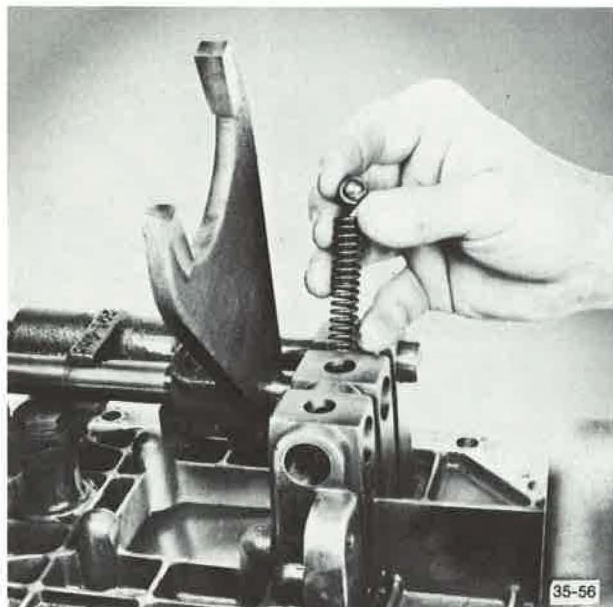


Figure 309. Installing Poppet Ball and Spring

14. Using an appropriate tool, such as the hollow tube shown below, press the poppet ball down, and slide the second/third shift rail over the ball.

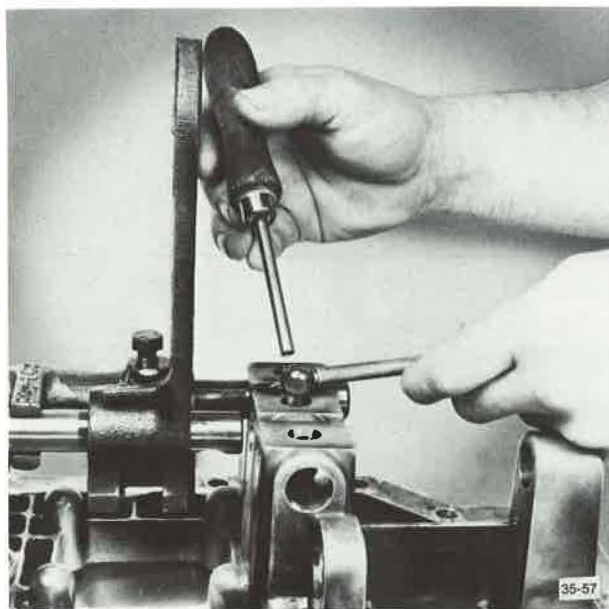


Figure 310. Pushing Poppet Ball Down

15. Align the setscrew in the second/third shift fork with the notch in the shift rail, and tighten it to 35 to 45 lb. ft. torque.

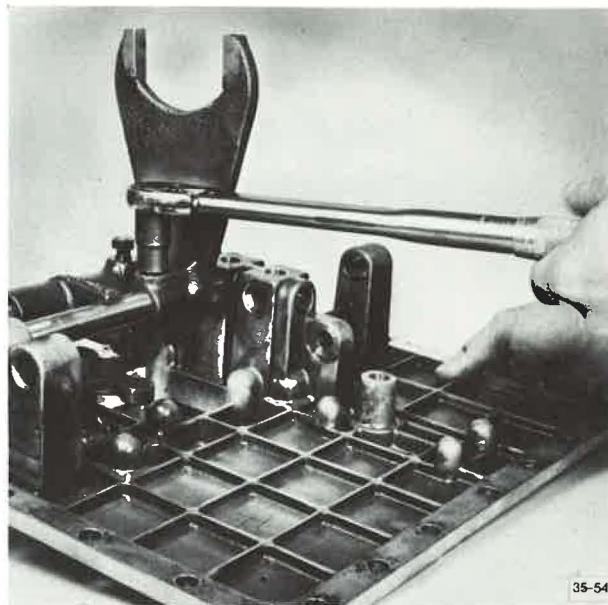


Figure 311. Torquing Setscrew

16. Start sliding the first/reverse shift rail into the shift cover, and install the fourth/fifth shift fork onto the shift rail.

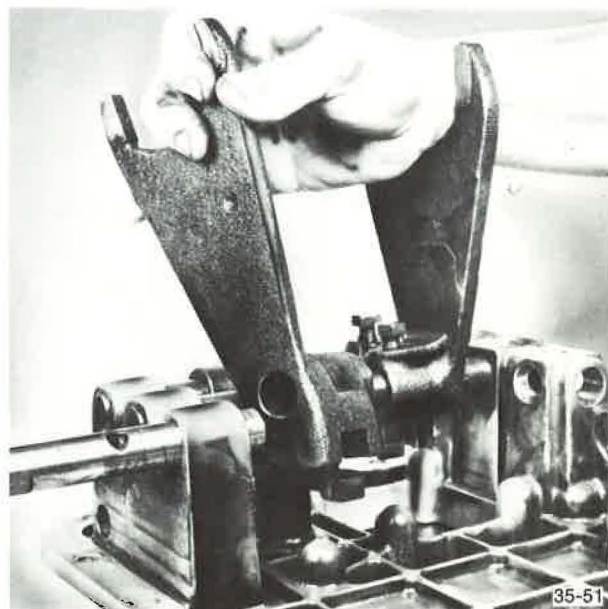


Figure 312. Installing Fourth/Fifth Shift Fork

17. Install the poppet ball and spring into the first/reverse shifter, followed by the spring and plunger. Depress the poppet ball to allow the spring and plunger to pass.



Figure 313. Exploded View of First/Reverse Shifter

18. Install the first/reverse shifter onto the shift rail.



Figure 314. Installing First/Reverse Shifter

19. Install the interlock ball between the first/reverse shift rail and the second/third shift rail.

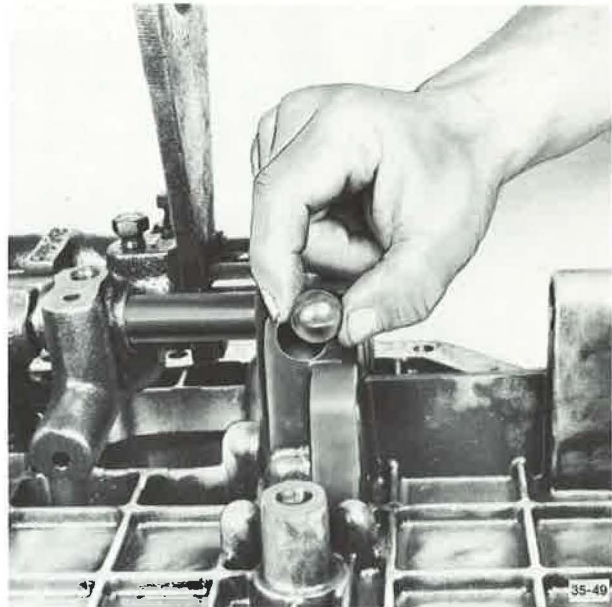


Figure 315. Installing Interlock Ball

20. Install the poppet ball and spring for the first/reverse shift rail.

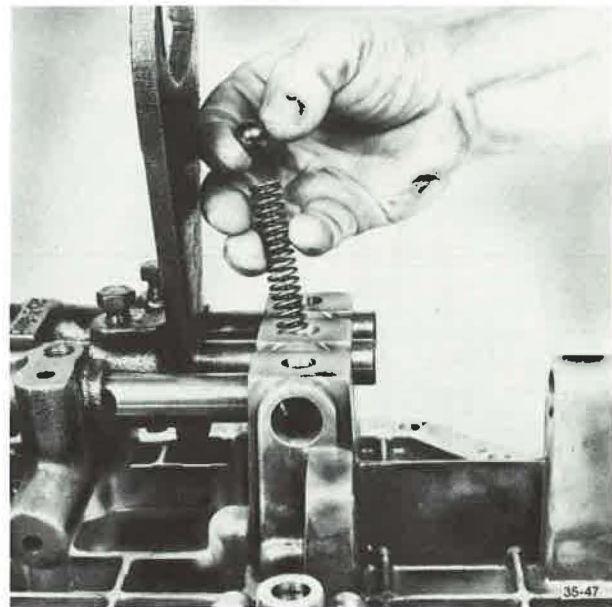


Figure 316. Installing Poppet Ball and Spring

21. Using an appropriate tool, such as the hollow tube shown below, press the poppet ball down, and slide the first/reverse shift rail over the ball.

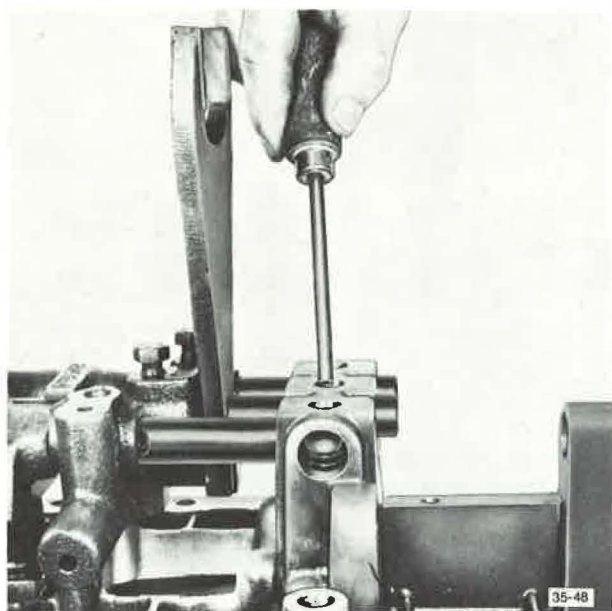


Figure 317. Pushing Poppet Ball Down

22. Install the first/reverse shift fork onto the shift rail.

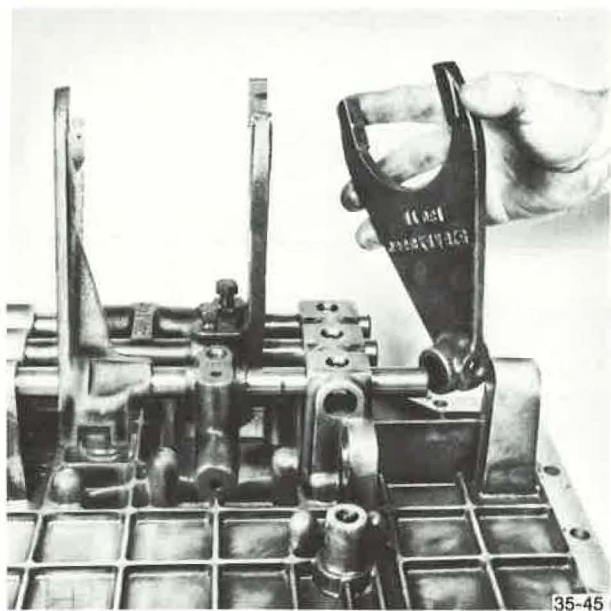


Figure 318. Installing First/Reverse Shift Fork

23. Install the interlock pin into the first/reverse shift rail.

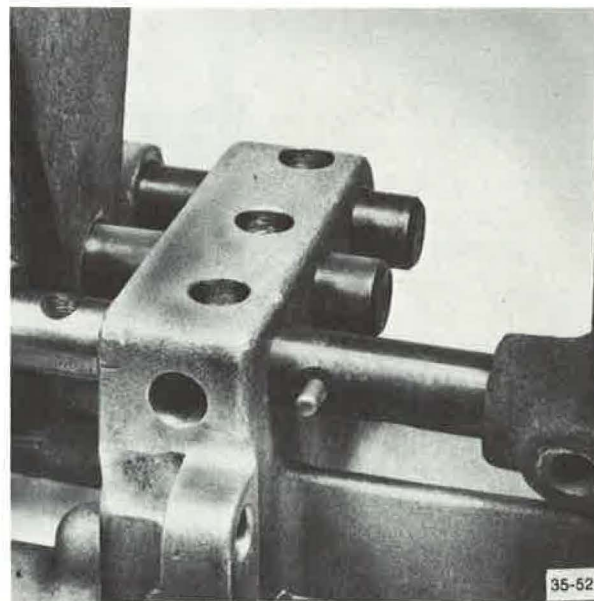


Figure 319. Installing Pin into First/Reverse Rail

24. Align the setscrew in the first/reverse shifter with the notch in the shift rail, and tighten it to 35-45 lb. ft. torque.

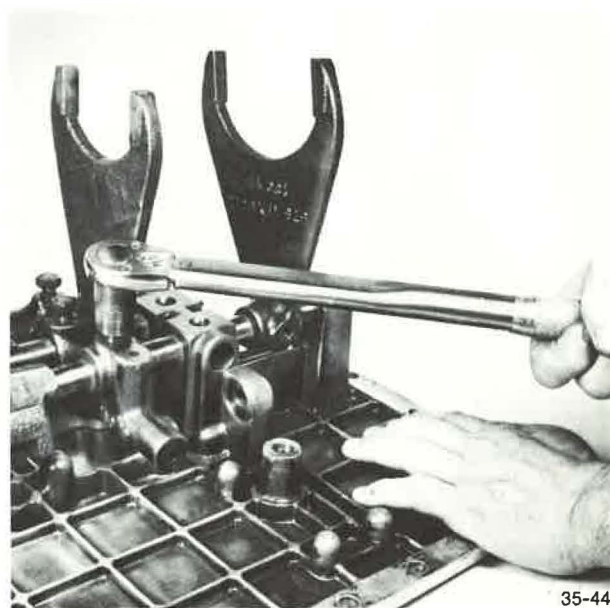


Figure 320. Torquing Setscrew

25. Align the setscrew in the first/reverse shifter with the notch in the shift rail, and tighten it to 35-45 lb. ft. torque.

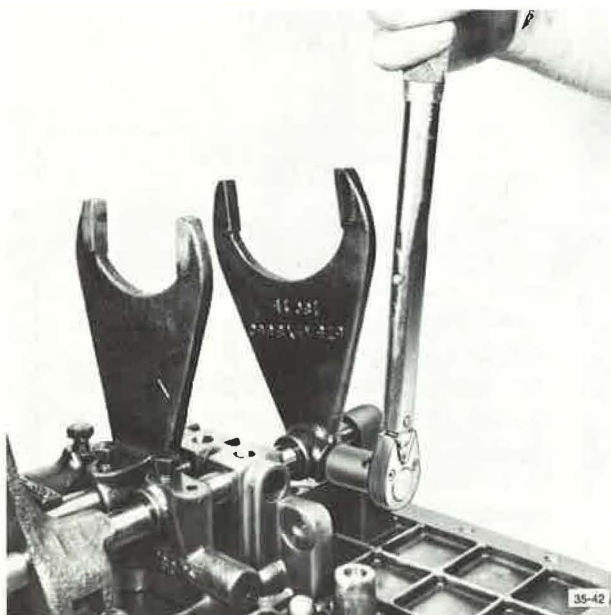


Figure 321. Torquing Setscrew

27. Install the interlock rocker and eccentric bolt.

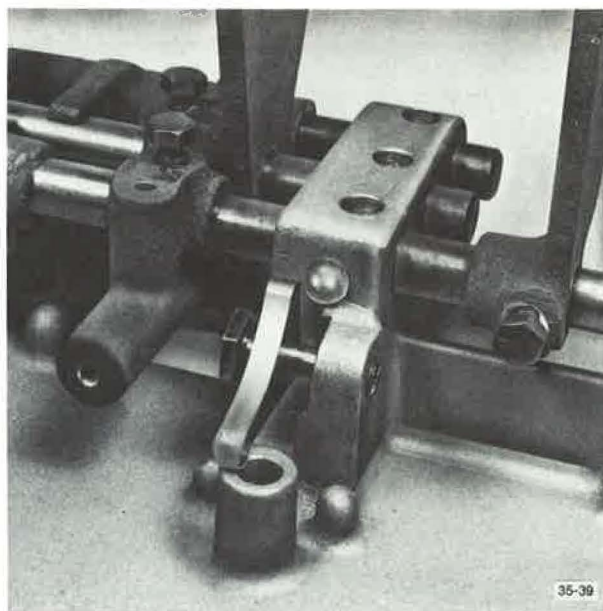


Figure 323. Installing Rocker

26. Install the interlock ball into the opening in the shift cover.

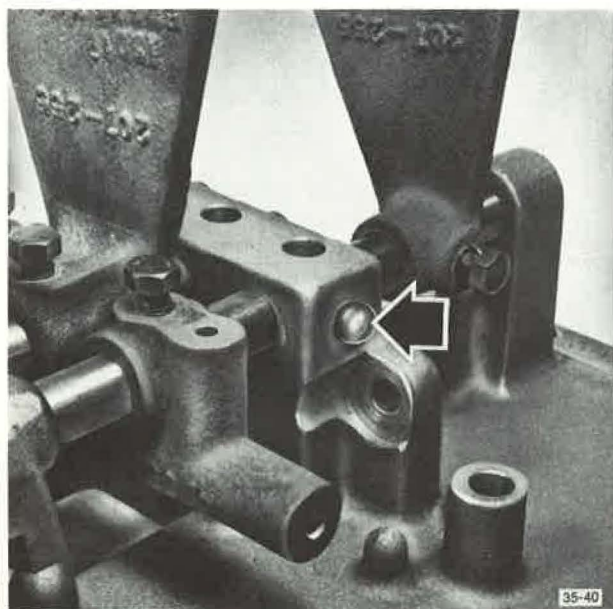


Figure 322. Interlock Ball Installed

28. Install the washers and nuts on the end of the eccentric bolt.

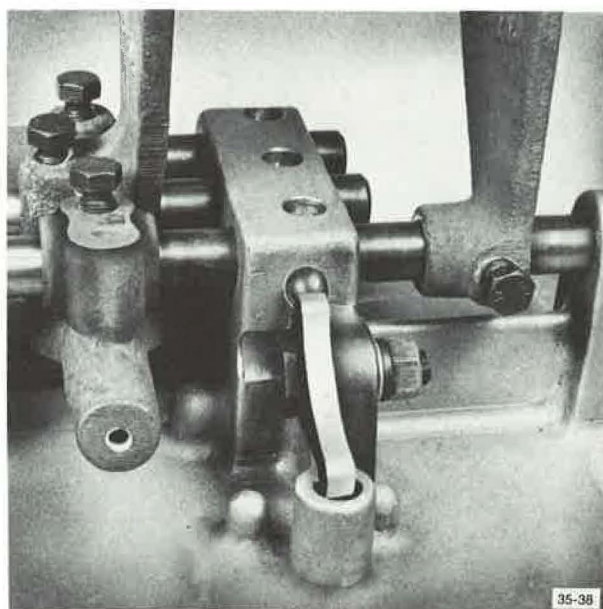


Figure 324. Washers and Nut Installed

29. Install the range shift interlock plunger, and spring and cap.



Figure 325. Interlock Plunger Installed



Figure 326. Installing Spring and Cap

30. Measure the height of the interlock plunger above the shift cover, and adjust the eccentric bolt to obtain 0.440 inch height measurement. Tighten the locknut to 20 to 25 lb. ft. torque.

NOTE

For this measurement, all shift rails must be in neutral position, and all shift forks must be in their normal operating position. Either place the shift cover onto the transmission with shift forks properly engaged and in neutral, or hold the shift cover in a horizontal position with the shift forks hanging freely in their normal operating positions.

SERVICE HINT

A more accurate plunger height measurement will be obtained if a spacer of known height is used (bearing race, key, etc.). Place the depth micrometer on this spacer so that the gauge will not wobble, and measure the distance down to the tip of the plunger. Then calculate the plunger height by subtraction.

Example:

Thickness of bearing race 0.750 in.

*Measurement down to
plunger tip 0.310 in.*

0.750 in. minus 0.310 in. equals 0.440 in. plunger height.

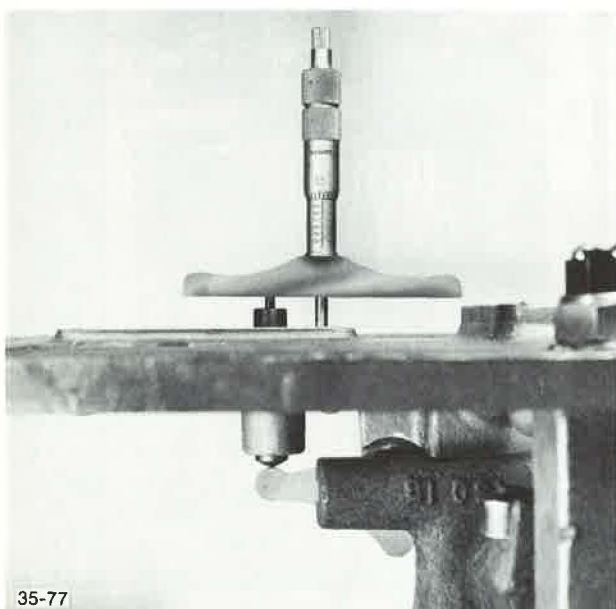


Figure 327. Measuring Plunger Height

31. Next, shift into fifth speed position, and again measure the plunger height. It should increase to approximately 0.560 inches. If it does not increase, it would indicate that an interlock pin or ball has been omitted.
32. Install the range shift interlock valve, and tighten the capscrews to 63 to 87 lb. in. torque.

CAUTION

Before installing the valve, check to be sure that the depression in the sliding metal spool inside the valve is centered. The interlock plunger fits into this depression, and the plunger may be damaged if the spool is not centered.

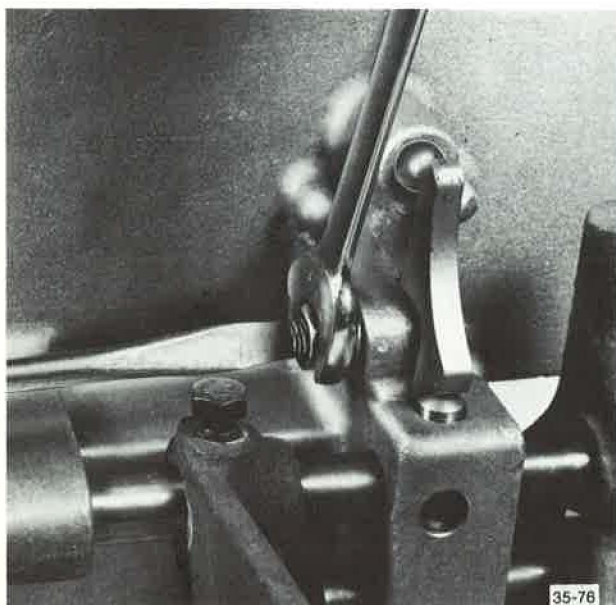


Figure 328. Adjusting Eccentric Bolt

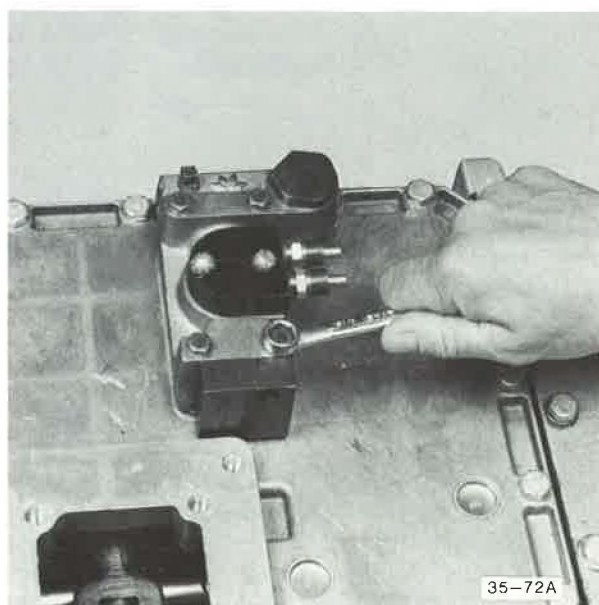


Figure 329. Installing Interlock Valve

Main Components Reassembly

1. On the front face of each countershaft fifth speed gear, locate the stamped letter "O", and paint that gear tooth on the front and top with white paint. If there is no stamped letter, mark the gear tooth that is directly in line with the key between the gear and the countershaft.
2. On the front face of the mainshaft fifth speed gear, locate the three stamped letters, and paint the gear teeth on each side of the marked tooth space. If there are no stamped letters, count the number of gear teeth (result should be divisible by three), and white paint three marks, each 120 degrees apart, located on the gear face at the tooth spaces between the teeth.

NOTE

For easier reassembly, the upper right reverse idler gear and shaft should not yet be installed.

3. With the main case in a vertical position, front end down, install the lower center and the upper left countershafts into the main case.

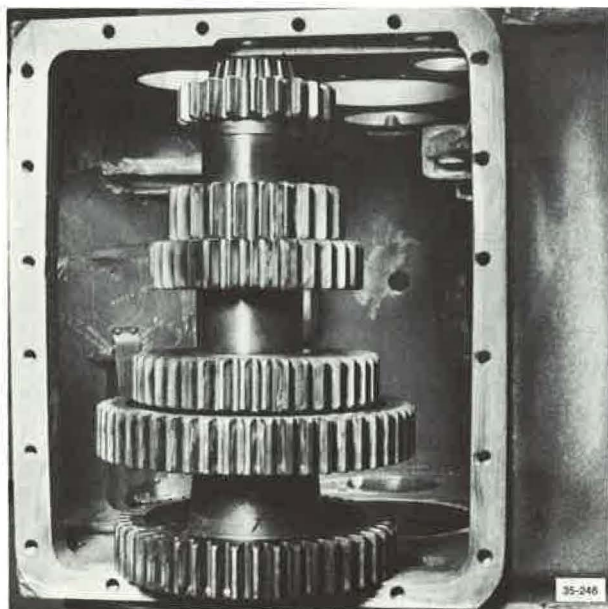


Figure 330. Installing Lower Center Countershaft

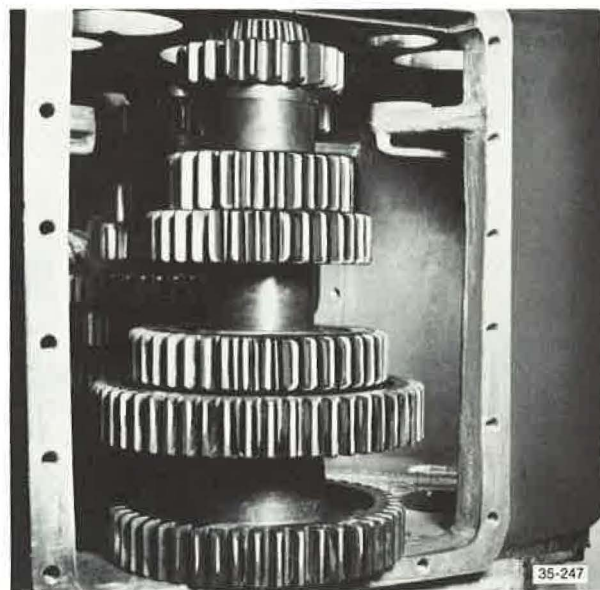


Figure 331. Installing Upper Left Countershaft

NOTE

The front and rear bearing covers for these two countershafts may be temporarily installed now. These will protect the bearings from damage, and allow the countershafts to turn freely.

4. Position the main case horizontally, and install the mainshaft assembly, lowering the rear end into the case first. Align the timing marks on the countershaft fifth speed gear teeth with the marked tooth spaces on the mainshaft fifth speed gear.

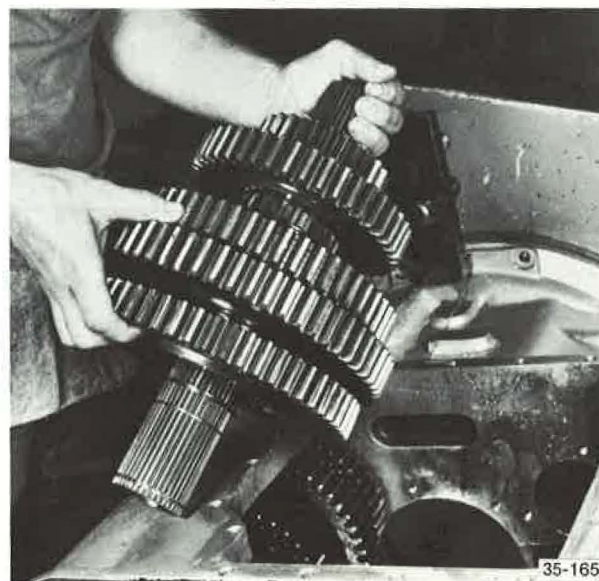


Figure 332. Installing Mainshaft

5. Install the reverse gear forward snap ring onto the mainshaft, and slide it forward to the second of the two grooves.

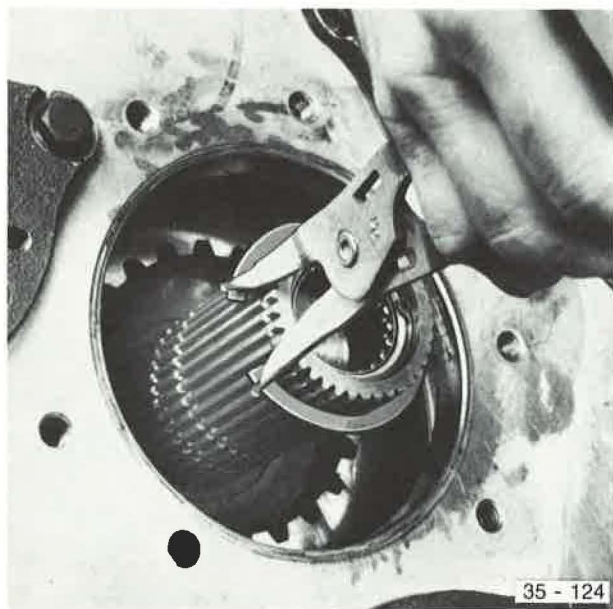


Figure 333. Installing Snap Ring

6. Install the internal tooth thrust washer onto the mainshaft, and slide it forward against the snap ring just installed.

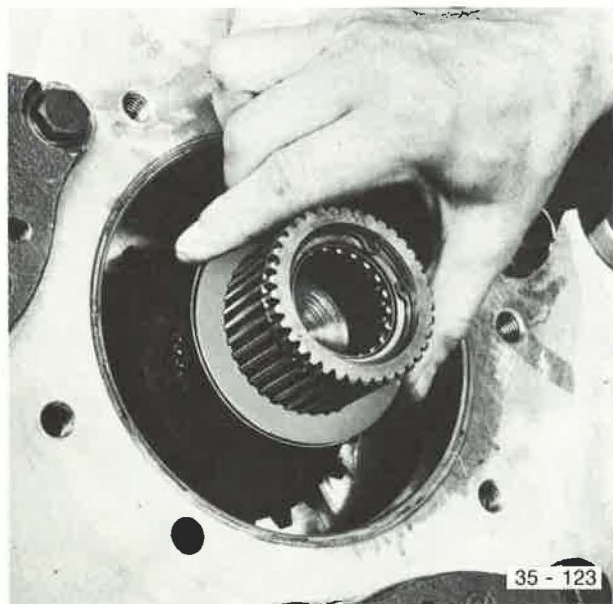


Figure 334. Installing Internal Tooth Thrust Washer

7. Install the external tooth thrust washer, sliding it forward against the thrust washer just installed, and engaging its teeth with the teeth inside the reverse gear.



Figure 335. Installing External Tooth Thrust Washer

8. Install the reverse gear snap ring into the inside of the reverse gear.

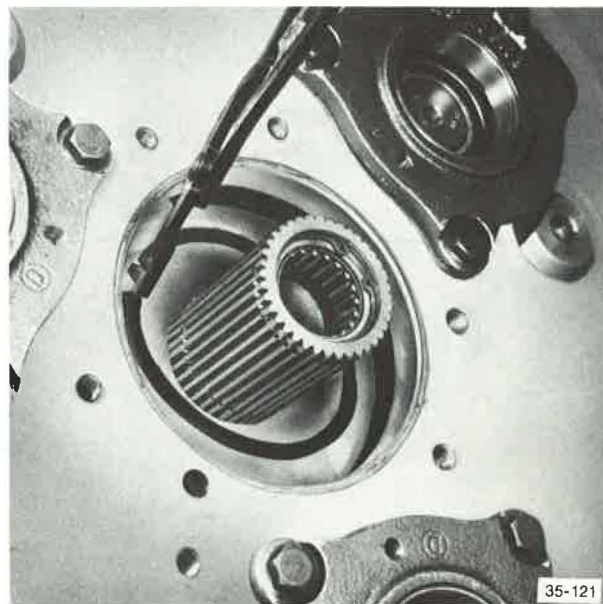


Figure 336. Installing Snap Ring

9. Install the external tooth thrust washer, sliding it forward against the snap ring just installed, and engaging its teeth with the teeth inside the reverse gear.

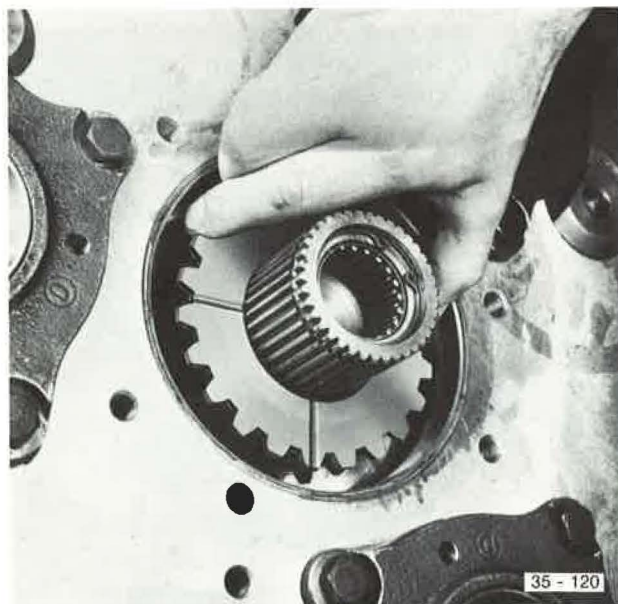


Figure 337. Installing External Tooth Thrust Washer

10. Install the internal tooth thrust washer onto the mainshaft, and slide it forward against the washer just installed.

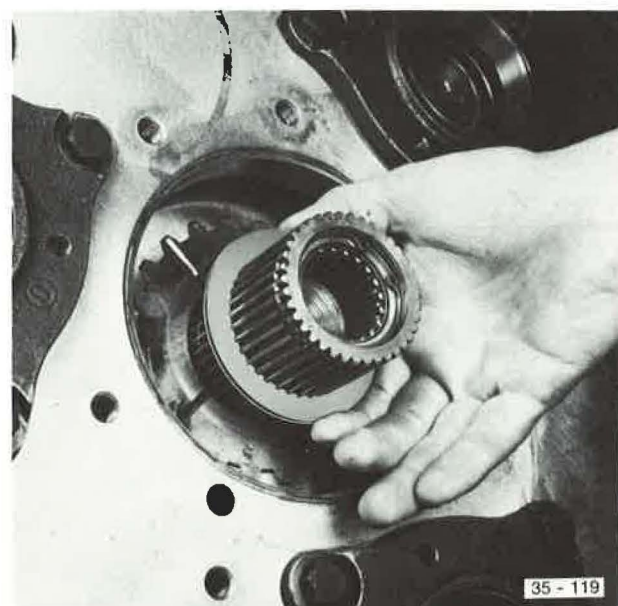


Figure 338. Installing Internal Tooth Thrust Washer

11. Install the reverse gear rearward snap ring onto the mainshaft.

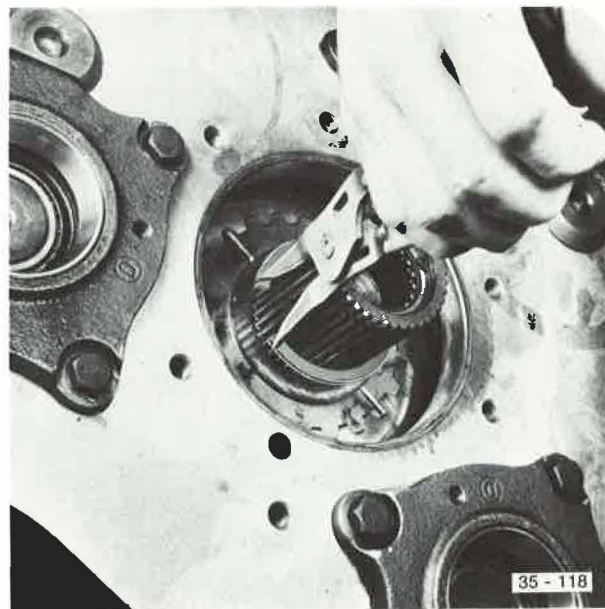


Figure 339. Installing Snap Ring

12. Install the upper right reverse idler gear and shaft, taking care to align the flat on the shaft so that the countershaft bearing cover will hold the shaft in place.



Figure 340. Reverse Idler Shaft Properly Aligned

13. Position the main case vertically, and install the upper right countershaft, aligning the timing marks properly.

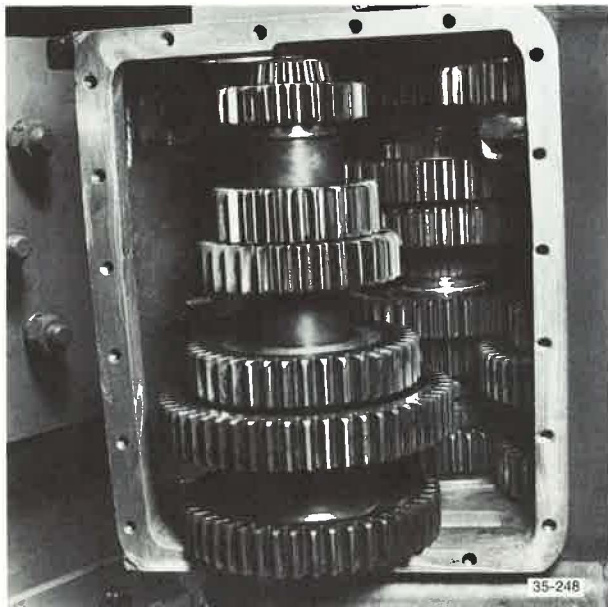


Figure 341. Installing Upper Right Countershaft

NOTE

The front and rear bearing covers for this countershaft may be temporarily installed now. They will protect the bearings from damage, and allow the countershaft to turn freely.

14. Install the main drive gear and its retaining snap ring.

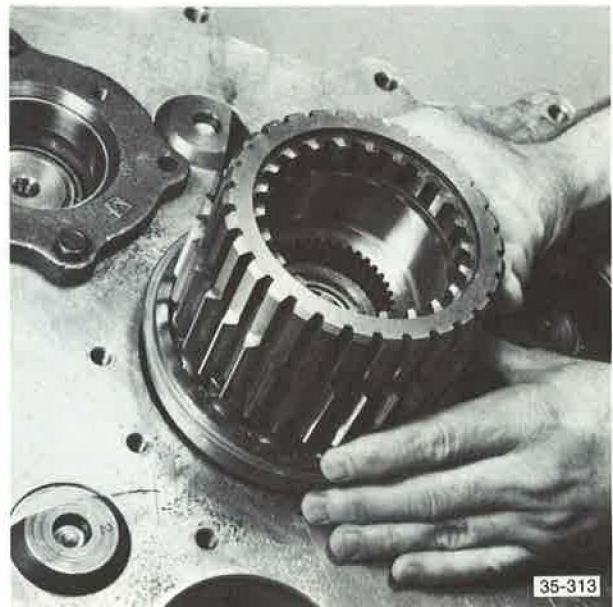


Figure 342. Installing Main Drive Gear

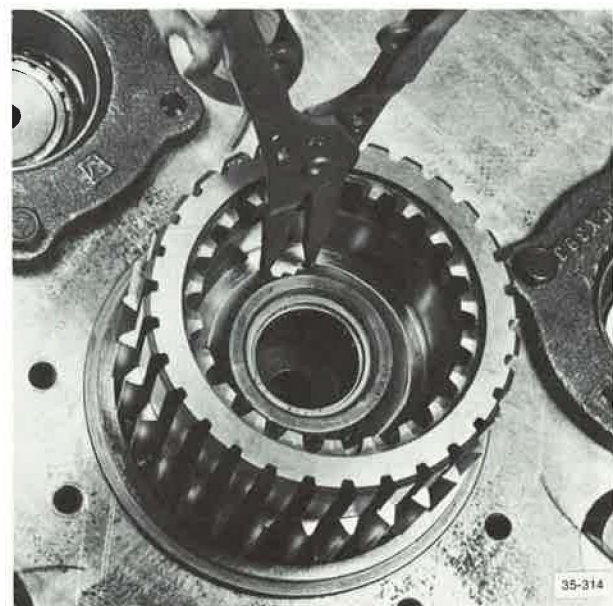


Figure 343. Installing Snap Ring

15. Install the main drive gear retaining plate, and tighten the capscrews to 40 to 50 lb. ft. torque.

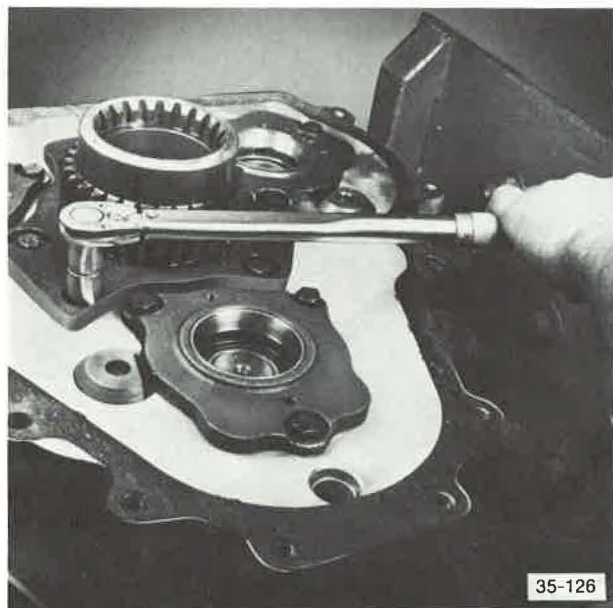


Figure 344. Torquing Capscrews

16. Install the front countershaft front bearing covers, and tighten to 40 to 50 lb. ft. torque.

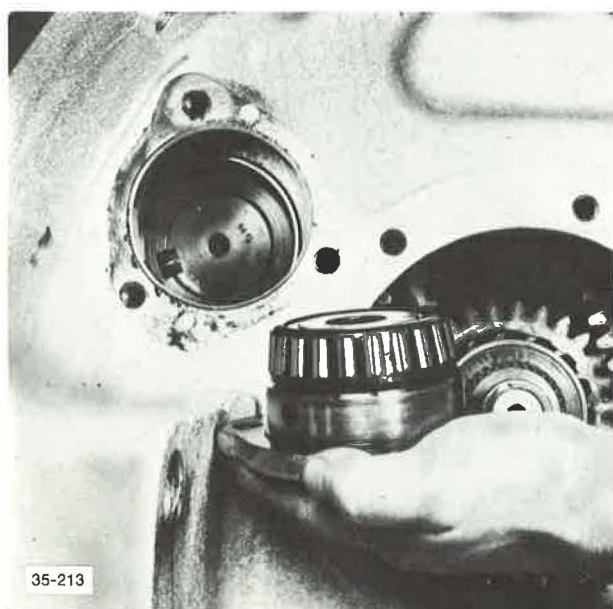


Figure 345. Installing Cover

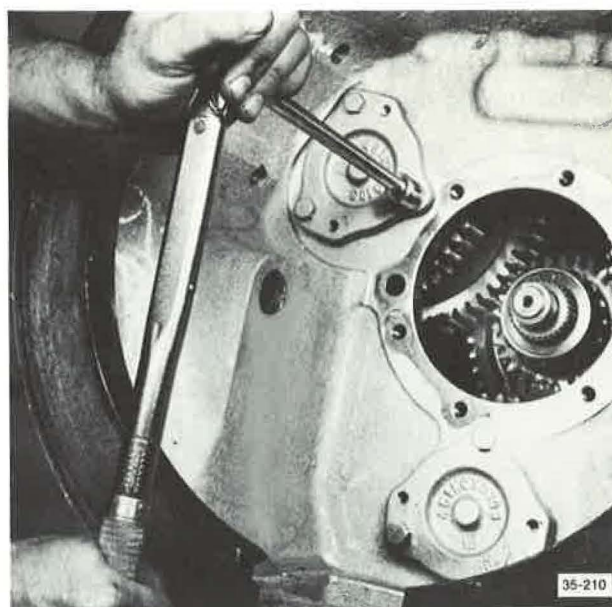


Figure 346. Torquing Capscrews

17. Install the fourth/fifth sliding clutch onto the front of the mainshaft.

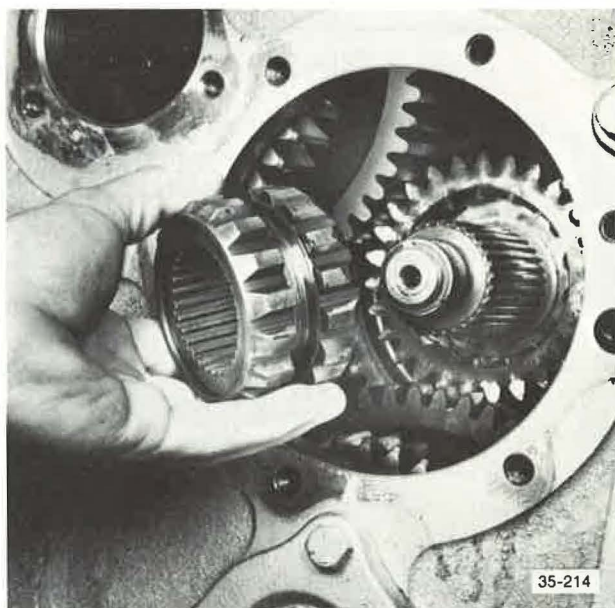


Figure 347. Installing Sliding Clutch

18. Install the main drive pinion assembly, and tighten the capscrews to 40 to 50 lb. ft. torque.

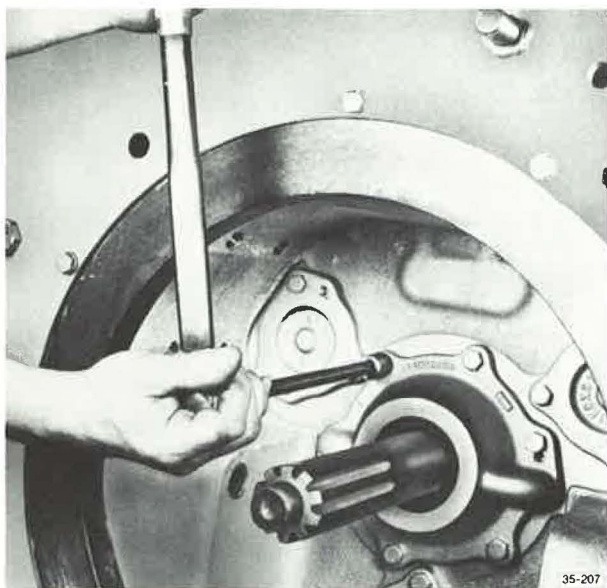


Figure 348. Torquing Capscrews

19. Install enough shims under the front countershaft rear bearing covers to be sure that the shafts have end-play, install the covers and tighten the capscrews to 40 to 50 lb. ft. torque. Measure the end-play using a dial indicator.

NOTE

A more accurate end-play reading will be obtained if the transmission is vertical, front end down, and a prybar is used to move the countershaft gears up and down.

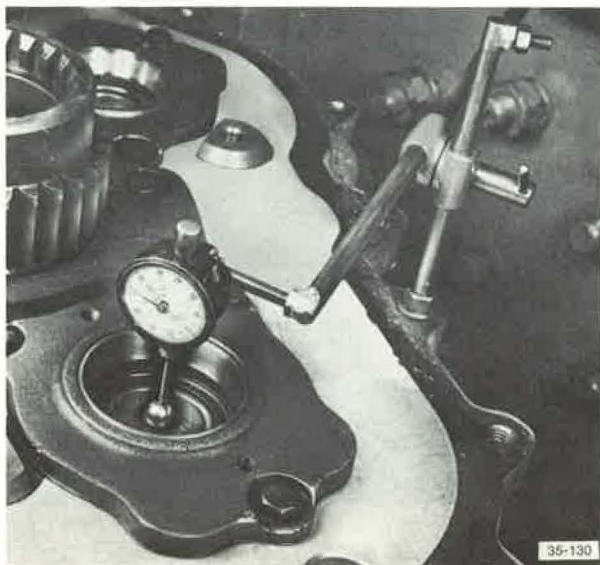


Figure 349. Measuring End-Play

20. Calculate the thickness of shims that must be removed to get zero end-play, and then enough more shims to get the required 0.003 to 0.007 inch pre-load.

Example:

Measured end-play: 0.100 inches

Shims to be removed to get 0.003 to 0.007 pre-load:

0.103 to 0.107 inches

NOTE

Because "pre-load" is "negative end-play" or "crush," it cannot be measured directly. The above measurements and calculations must be done carefully to get the correct preload.

21. Remove the bearing covers, measure the thickness of the shim packs, remove shims as needed, and reinstall the shims and covers. Tighten the capscrews to 40 to 50 lb. ft. torque.

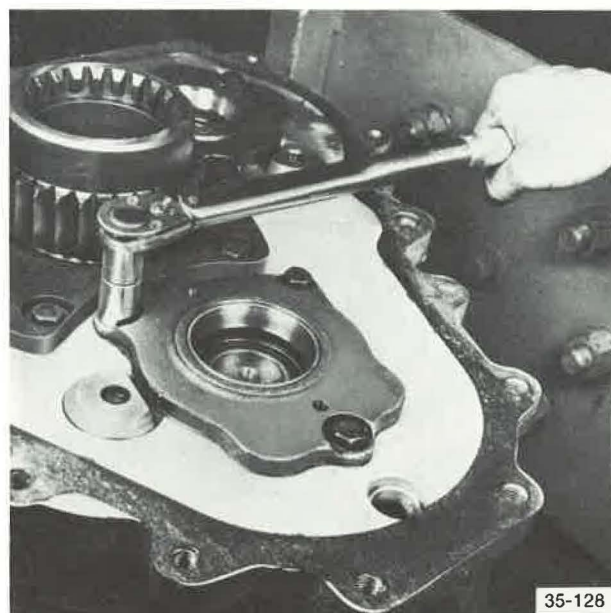


Figure 350. Torquing Capscrew

22. Locate the stamped letter "O" on the rear face of the main drive gear, at three tooth spaces 120 degrees apart. If there are no stamped letters, count the number of gear teeth (result should be divisible by three), and white paint three marks, each 120 degrees apart, located on the rear face of the gear at the tooth spaces between the teeth.

23. Locate the stamped letter "O" on the rear face of each rear countershaft main drive gear. If there is no stamped letter, mark the gear tooth that is directly in line with the key between the gear and the countershaft.

24. Install the three rear countershafts, aligning the timing marks with each other.

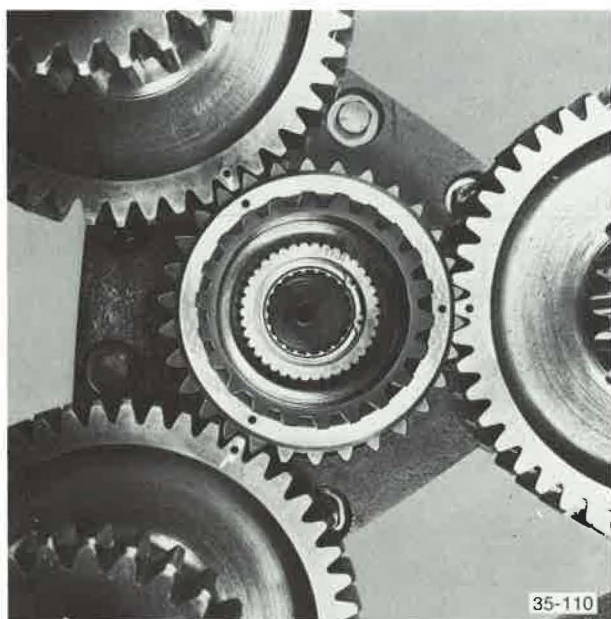


Figure 351. Timing Marks Properly Aligned

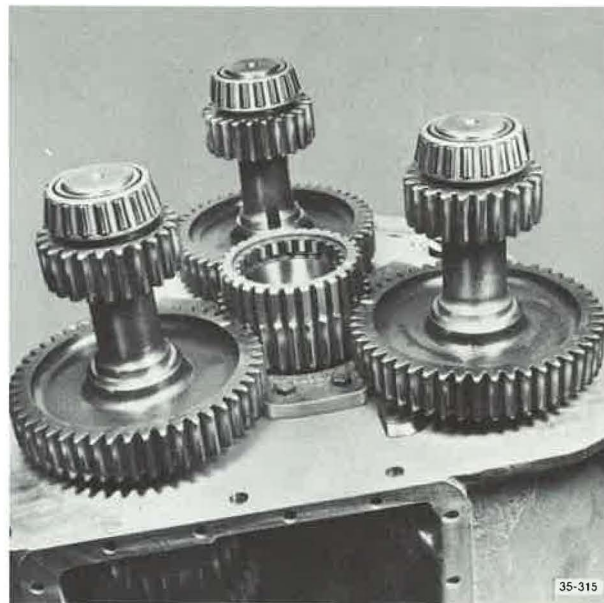


Figure 352. Rear Countershafts Installed

25. Install the main drive gear backing plate onto the main drive gear.

NOTE

If backing plate has "R" or "Rear" stamped on one face, install that face toward the rear of the transmission. If there are no markings, install the face with the sharp corner edges toward the front of the transmission.



Figure 353. Installing Main Drive Gear Drive Plate

26. Install the first synchronizer friction disc, followed by the first reaction disc. Be sure to oil both sides of each friction disc, using a liberal amount of gear oil.

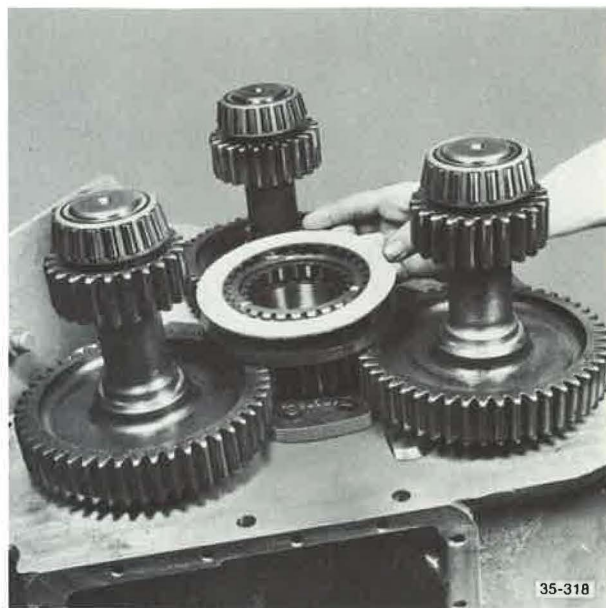


Figure 355. Installing Friction Disc

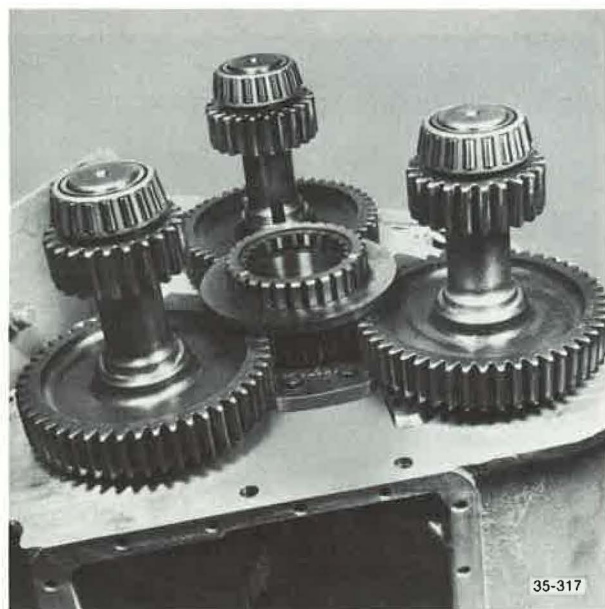


Figure 354. Main Drive Gear Backing Plate Installed



Figure 356. Installing Reaction Disc

27. Continue installing the synchronizer plates, alternating types, until *four* of each have been installed. Apply gear oil to all friction discs during installation.



Figure 357. Synchronizer Plates Installed

28. Align the tangs of the reaction discs, and then install the rear mainshaft and synchronizer assembly.

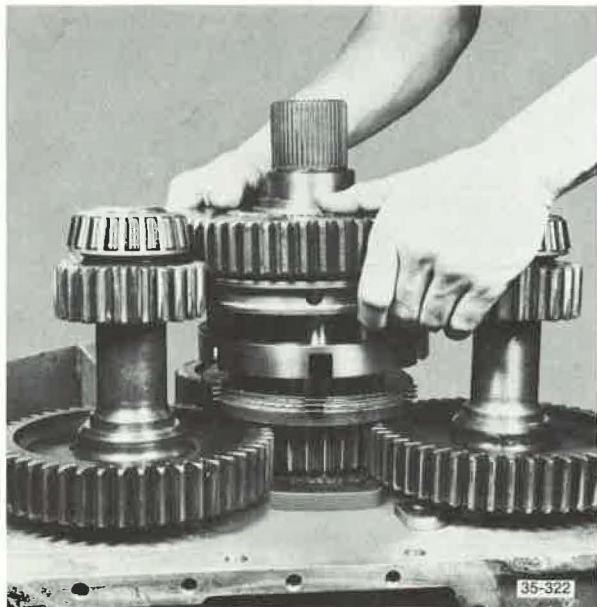


Figure 358. Installing Rear Mainshaft and Synchronizer

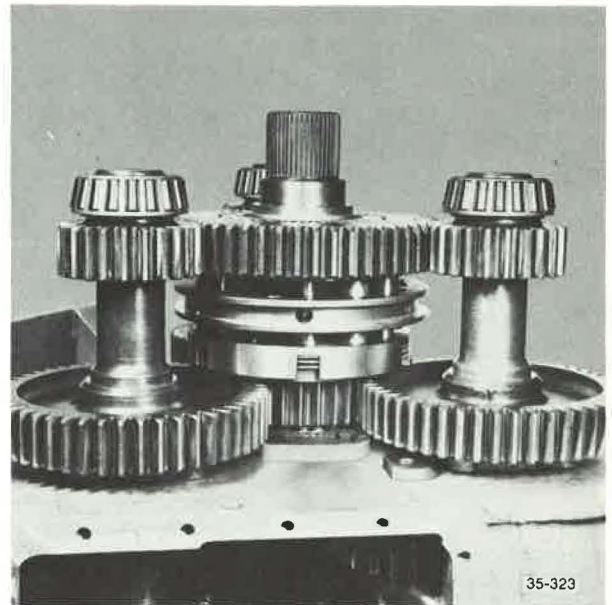


Figure 359. Rear Mainshaft and Synchronizer Installed

29. Install a new main case to rear case gasket.

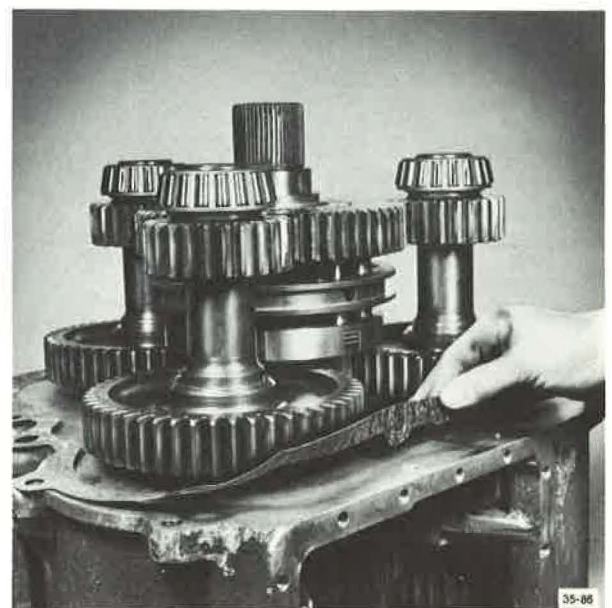


Figure 360. Installing Gasket

30. Install the rear case.

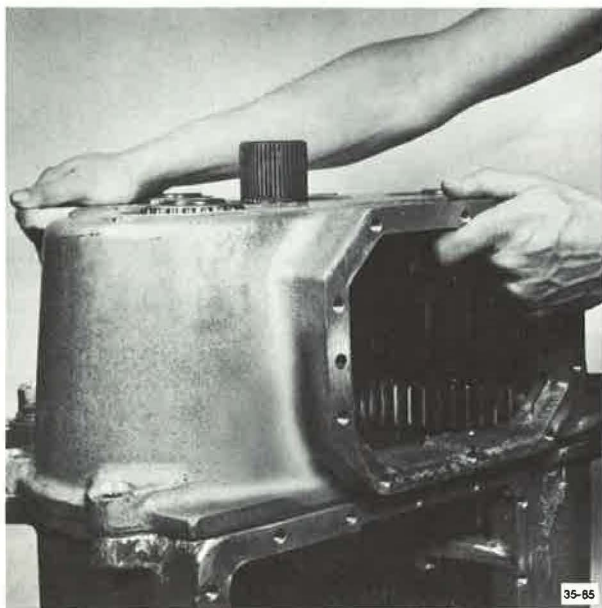


Figure 361. Installing Case

31. Install the dowel bolts and nuts, and tighten them to 66 to 80 lb. ft. torque. Install the case-to-case capscrews, and tighten them to 62 to 78 lb. ft. torque.

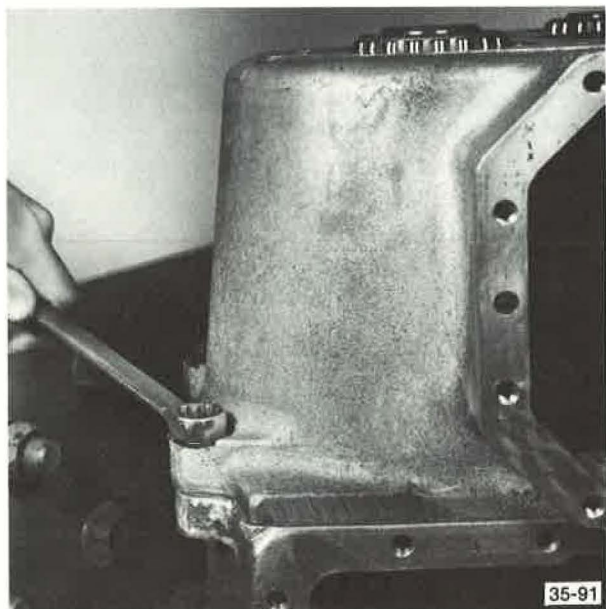


Figure 362. Tightening Case-to-Case Capscrew

32. Install the two case-to-case capscrews located inside the rear case, and tighten to 62 to 78 lb. ft. torque.



Figure 363. Torquing Capscrew

33. Install the rear mainshaft rear bearing cover, and tighten the capscrews to 40 to 50 lb. ft. torque.



Figure 364. Installing Rear Mainshaft Rear Bearing Cover

CAUTION

Premature bearing failure may occur if drive flange (or yoke) is driven on by hitting it with a hammer. Install only by pulling it onto the shaft using an appropriate puller, or the clamp plate and capscrew.

34. Install the drive flange (or yoke), and tighten the clamp plate capscrew to 494 to 600 lb. ft. torque.

NOTE

Place two of the main case sliding clutches into engagement with their gears, and also place the rear case synchronizer sliding clutch into engagement. This will lock up the mainshafts, preventing them from turning. Then the clamp plate capscrew can be torqued. After torquing, return all clutches to their neutral positions.



Figure 365. Installing Clamp Plate and Capscrew

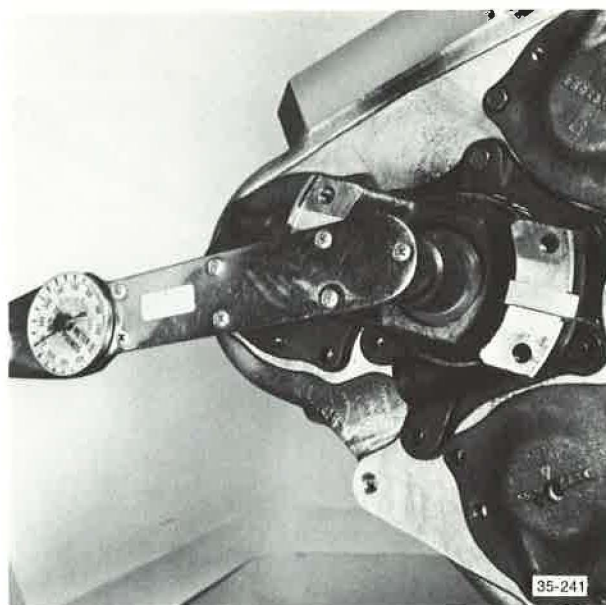


Figure 366. Torquing Clamp Plate Capscrew

35. Install the rear countershaft rear bearing covers, leaving the capscrews loose. No shims should be used.
36. Measure the space between the covers and the case. Two or more measurements for each cover should be taken, and the results averaged.

NOTE

A more accurate measurement will be obtained if the transmission is vertical, front end down, and the covers are handheld firmly against the rear countershaft bearings.



Figure 367. Measurement with Tapered Feeler Gauges

37. For each countershaft, add enough shims to bring the space under the cover down to zero, and then *subtract* enough shims to get the required 0.002 to 0.006 inch pre-load.

Example:

Measured space under cover:
0.100 inches

Shims to be added to get 0.002 to 0.006
inches pre-load:
0.094 to 0.098 inches

NOTE

Because "pre-load" is "negative end-play" or "crush", it cannot be measured directly. The above measurements and calculating must be done carefully to get the correct pre-load.

38. Reinstall the covers and shims, and tighten the capscrews to 40 to 50 lb. ft. torque.



Figure 368. Measurement with Standard Feeler Gauges



Figure 369. Torquing Capscrews

39. Install a new rear case top cover gasket.



Figure 370. Installing Gasket

41. Install a new main case top cover gasket.



Figure 372. Installing Gasket

40. Install the rear case top cover, and tighten the capscrews to 27 to 33 lb. ft. torque.

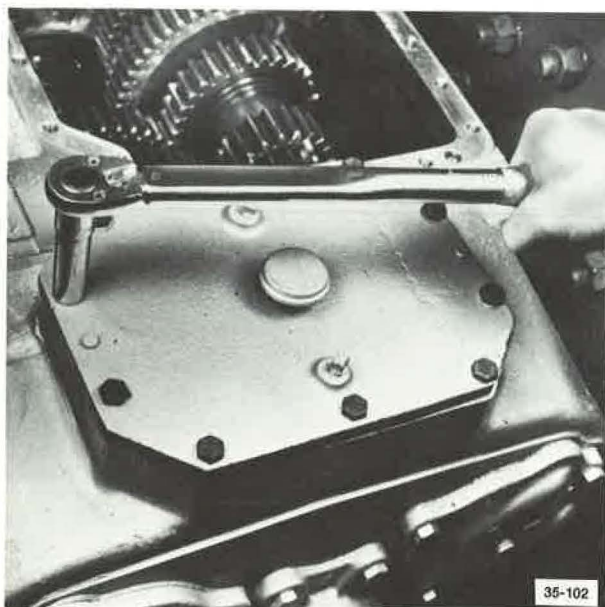


Figure 371. Torquing Capscrews

42. Install the main case top cover, and tighten the capscrews to 27 to 33 lb. ft. torque.

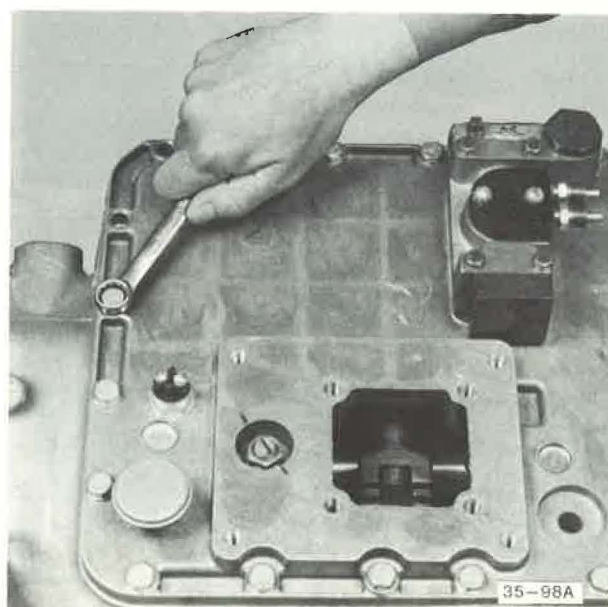


Figure 373. Tightening Capscrews

43. Loosen the locknut on the eccentric pin. While rotating the transmission input shaft by hand, adjust the eccentric pin until gear clash occurs. Note the position of the eccentric pin. Next, turn the eccentric pin in the other direction until gear clash occurs again, and note the position of the eccentric pin. Now, return the eccentric pin to a point midway between the two positions. Tighten the locknut to 50 to 60 lb. ft. torque.

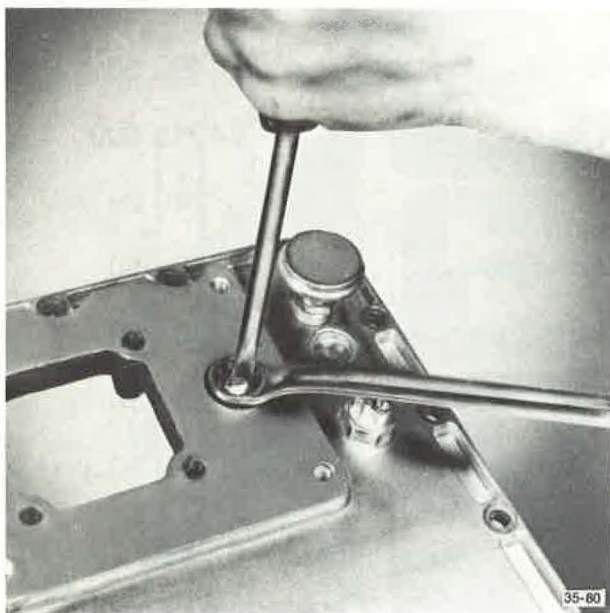


Figure 374. Adjusting Eccentric Pin

NOTE

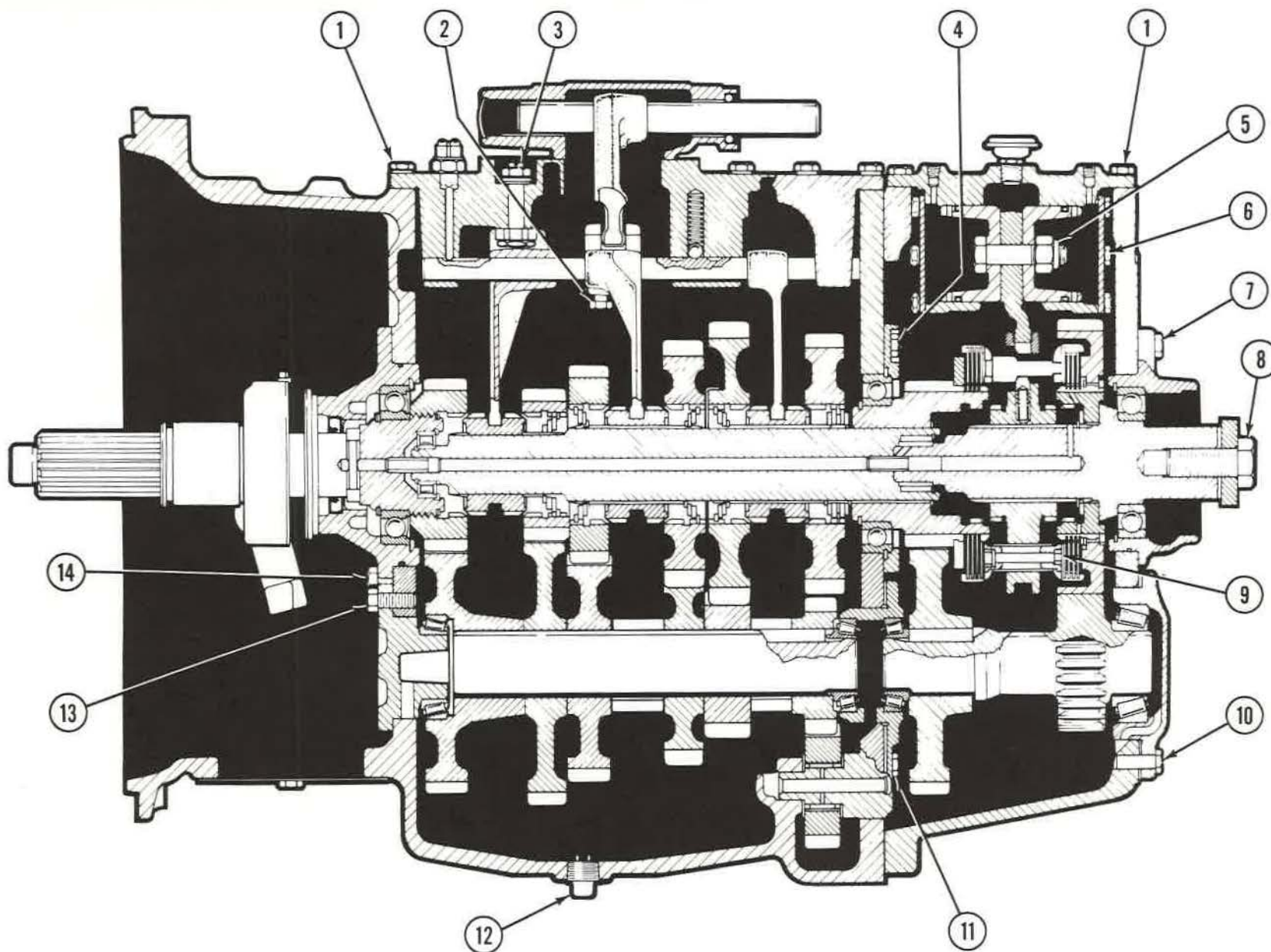
If the gear shift lever is not available, the same adjustment may be made using a prybar, and moving the fourth/fifth speed shifter forward and rearward until gear clash occurs. Then adjust as in previous step.

45. Install the drain plug and magnetic filter plug, reinstall the transmission into the chassis, and fill to proper level with approved lubricant.

44. If no gear clash occurs in any eccentric pin position, then, while rotating the transmission input shaft by hand, move the gear shift lever toward the fourth speed position, until gear clash occurs, and note the amount of shift lever travel. Then move the gear shift lever toward the fifth speed position, until gear clash occurs, and note the amount of shift lever travel. Loosen the locknut, and adjust the eccentric pin until you get, as nearly as possible, equal amounts of gear shift lever travel between gear clashes. Then tighten the locknut to 50 to 60 lb. ft. torque.

TORQUE SPECIFICATIONS

Item	Location	Torque (Lb. Ft.)
1	Top Cover Capscrews	27 - 33
2	Shifter and Shift Fork Setscrews	35 - 45
3	4th/5th Eccentric Pin Locknut	50 - 60
4	Main Drive Gear Retaining Plate Capscrew	40 - 50
5	Range Shift Piston Capscrew	173 - 211
6	Range Shift Piston Cover Capscrews	17 - 21
7	Rear Mainshaft Rear Bearing Cover Capscrews	40 - 50
8	Drive Flange (or Yoke) Clamp Plate Capscrew	494 - 600
9	Synchronizer Special 12-Point Screws	24 - 28
10	Rear Countershaft Rear Bearing Cover Capscrews	40 - 50
11	Front Countershaft Rear Bearing Cover Capscrews	40 - 50
12	Drain Plug	25 - 30
13	Front Countershaft Front Bearing Cover Capscrews	40 - 50
14	Main Drive Pinion Bearing Cover Capscrews	40 - 50
—	Range Shift Interlock Rocker Eccentric Bolt	20 - 25
—	Range Shift Interlock Valve Capscrews	63 - 87
—	Front Case to Rear Case Capscrews	62 - 78
—	Front Case to Rear Case Dowel Bolt	66 - 80
—	Filler Plug	70 - 80
—	Magnetic Filter Plug	25 - 30



35-379

TOLERANCE SPECIFICATIONS

All Forks in Sliding Clutches

	Minimum New	Maximum New	Maximum Wear
Clearance between fork pad and clutch groove	0.005 inches	0.020 inches	0.050* inches
Clearance between synchronizer shift fork pads and sliding clutch	0.073 inches	0.087 inches	0.135 inches

*If unit has experienced disengagement, clearance must not exceed 0.030 inches maximum.

Springs	Free Length	Load	Length under Load
First/Reverse Shifter Ball Spring	1.562 in.	41.8 ± 5 lbs.	0.875 in.
First/Reverse Shifter Plunger Spring	1.500 in.	22 ± 2 lbs.	0.625 in.
Shift Rail Poppet Ball Springs (3)	2.251 in.	42.4 ± 3 lbs.	1.539 in.
Synchronizer Plunger Springs (6)	1.38 in.	11.8 ± 1.2 lbs.	0.835 in.
Range Shift Interlock Valve Plunger Spring: Free length: 1.31 inches 1.12 inch length @ 18.7 lb. load 1.00 inch length @ 31.2 load			

Shift rails to mating housing bore:

0.010 inch maximum

Reverse Idler Gear Endplay:

0.003 - 0.020 inch

Range Shift Valve Plunger Height (Neutral Position):

0.440 inch

Range Shift Valve Plunger Height (Fifth Speed Position):

Approx. 0.560 inch

Front Countershaft Bearing Preload:

0.003 - 0.007 inch

Rear Countershaft Bearing Preload:

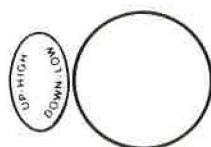
0.002 - 0.006 inch

TOOLS

J34629	Snap Ring Pliers Set
J34630	Reverse Idler Shaft Removal Tool
J29048	Tapered Feeler Gauge

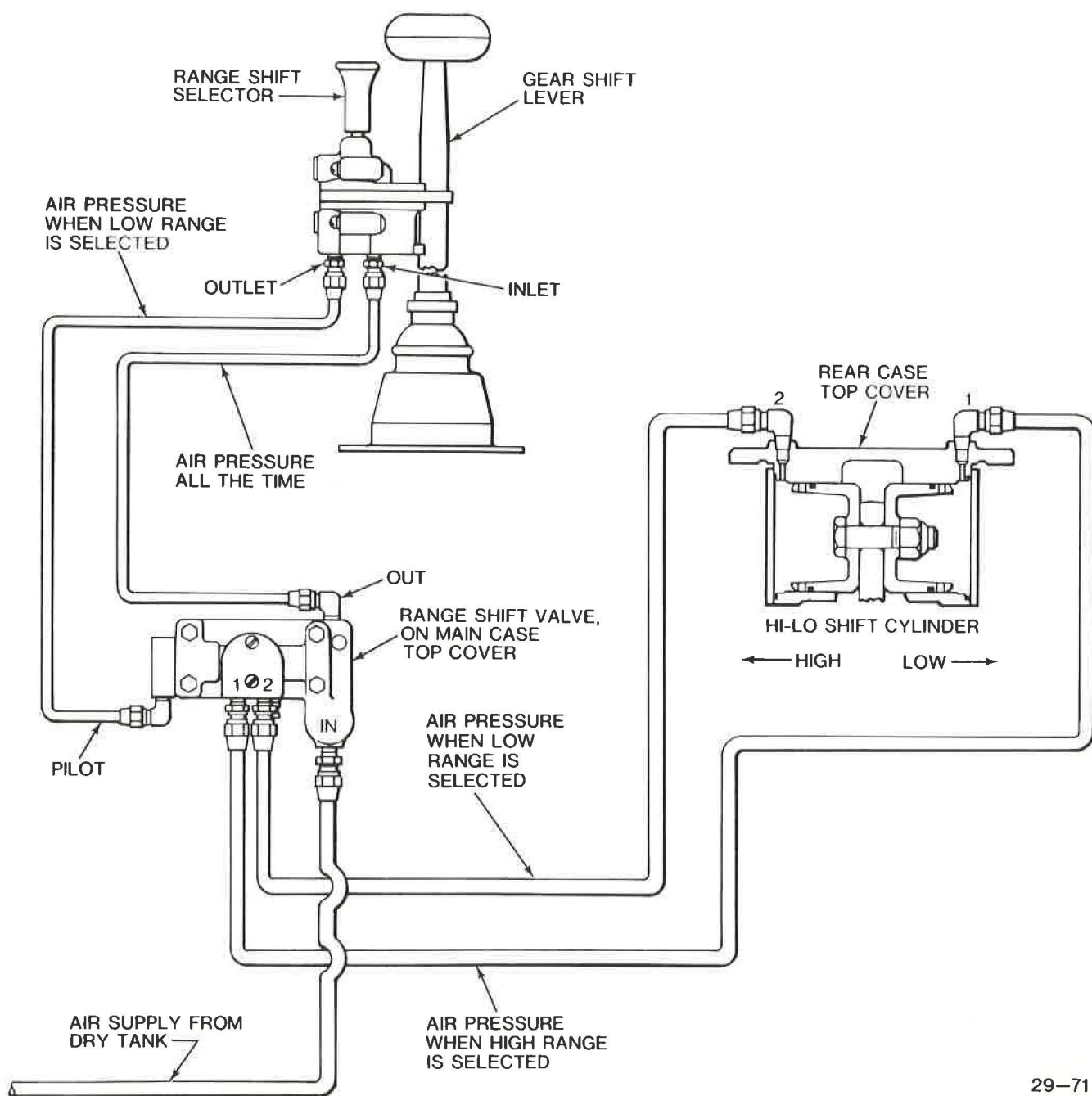
Above tools are available from:

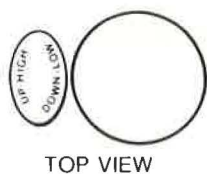
**KENT-MOORE TOOL DIVISION
29784 Little Mack Avenue
Roseville, Michigan 48066-2298
Telephone: (313) 774-9500**



TOP VIEW

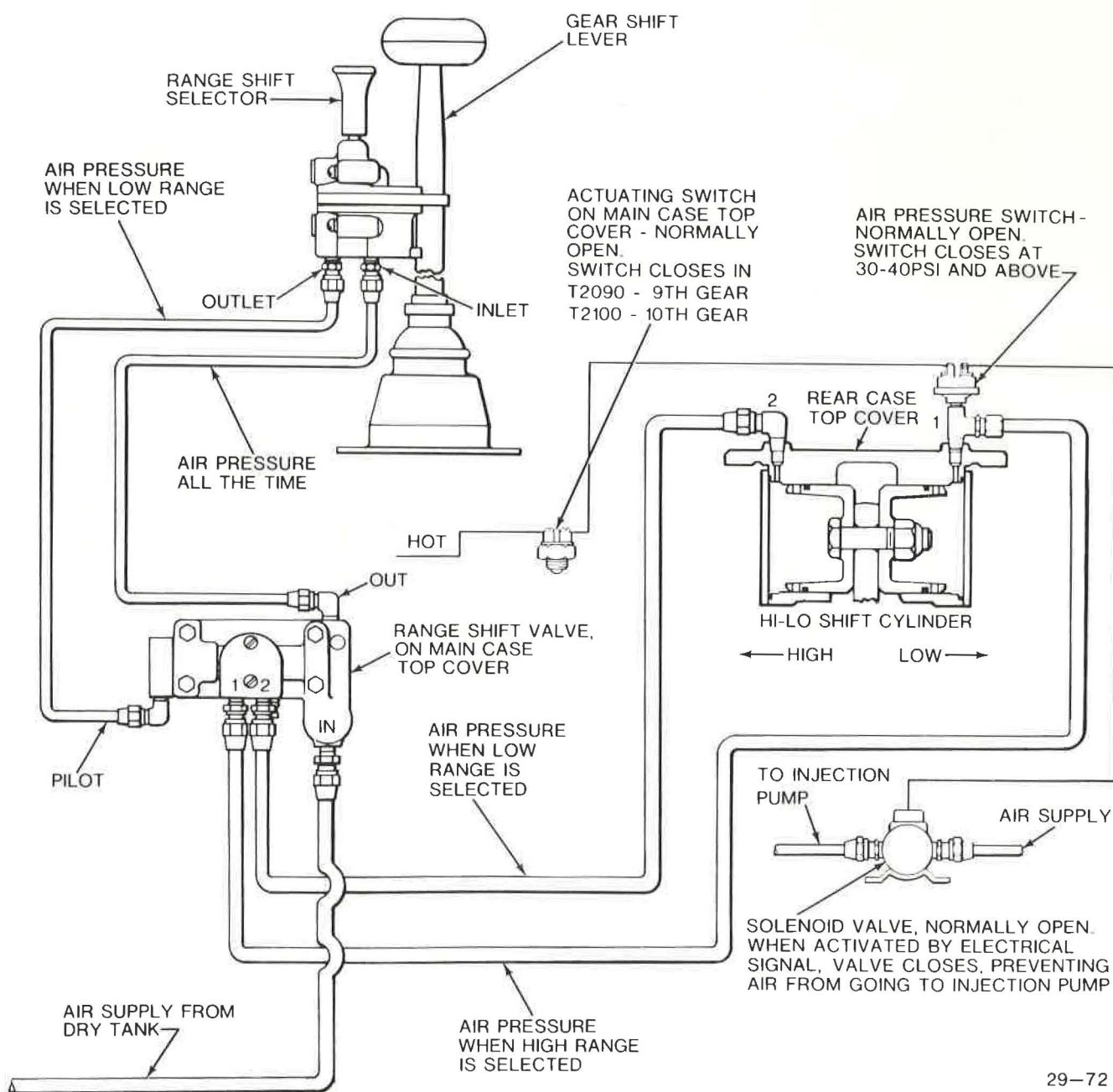
T2090/T2100 AIR PIPING SCHEMATIC





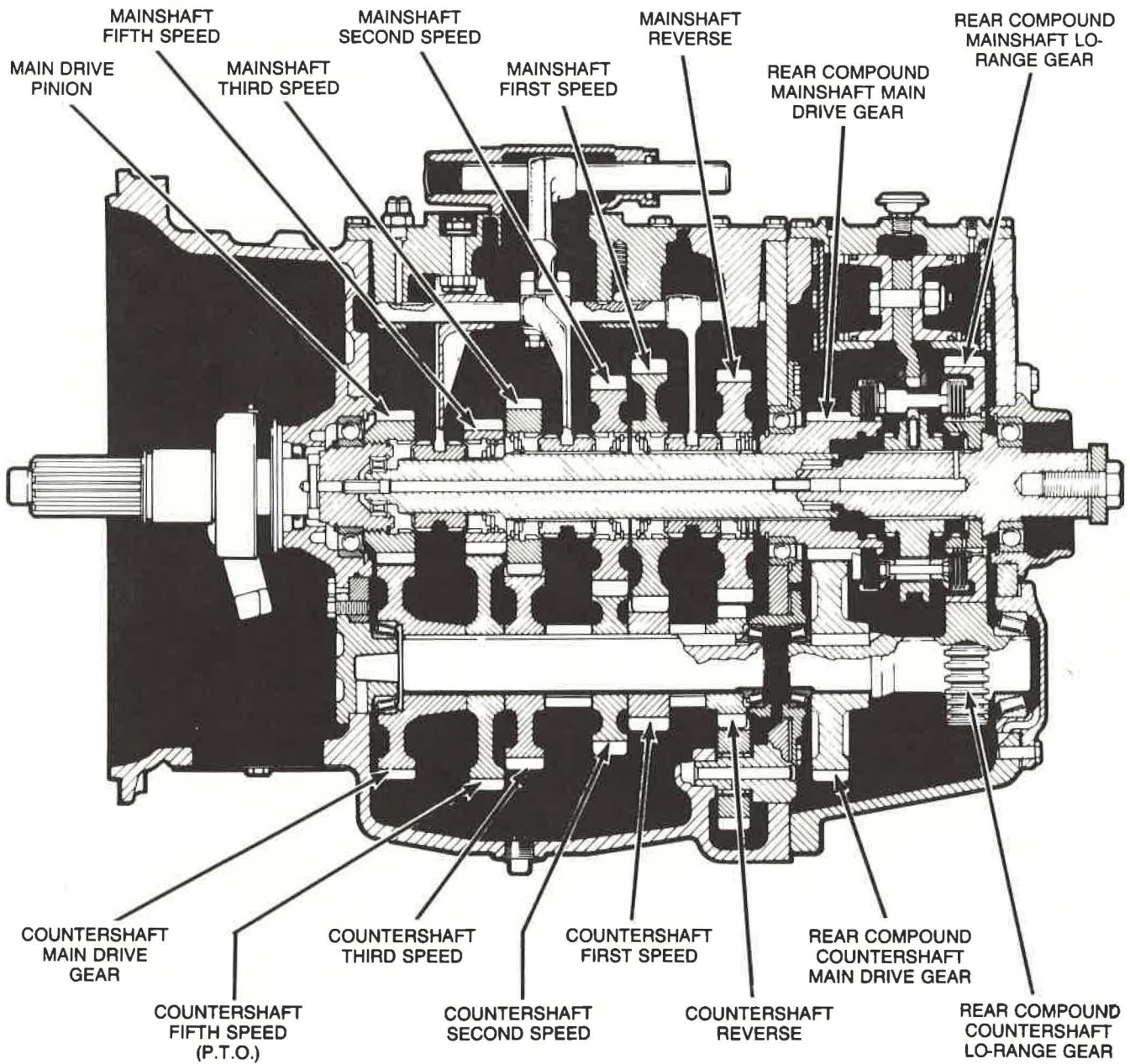
TOP VIEW

T2090/T2100 AIR PIPING SCHEMATIC WITH MAXI-MISER



29-72

T-2100 TRANSMISSION



35-393

T2100**MAINSHAFT GEARS**

	Number of Teeth	Outside Diameter
--	--------------------	---------------------

Main Box

Fourth (Main Drive Pinion)	30	5.340
Fifth	27	4.692
Third	39	6.132
Second	42	6.845
First	42	7.624
Reverse	42	8.129

Rear Compound

Main Drive Gear	30	5.204
Lo-Range Gear	54	8.996

COUNTERSHAFT GEARS**Main Box**

Main Drive Gear	46	7.831
Fifth (P.T.O. Gear)	54	8.514
Third	46	7.067
Second	38	6.372
First	29	5.484
Reverse	21	4.273

Rear Compound

Main Drive Gear	49	8.001
Lo-Range Gear (part of shaft)	23	4.205

T2090**MAINSHAFT GEARS**

	Number of Teeth	Outside Diameter
--	--------------------	---------------------

Main Box

Third (Main Drive Pinion)	33	5.633
Fourth	27	4.692
Second	39	6.603
First	45	7.539
Lo	45	8.595
Reverse	42	8.129

Rear Compound

Main Drive Gear	30	5.204
Lo-Range Gear	54	8.996

COUNTERSHAFT GEARS**Main Box**

Main Drive Gear	47	7.583
Fourth (P.T.O. Gear)	54	8.514
Second	40	6.641
First	33	5.757
Lo	23	4.779
Reverse	21	4.273

Rear Compound

Main Drive Gear	49	8.001
Lo-Range Gear (part of shaft)	23	4.205

ADDENDUM TO T2090/T2100 SERVICE MANUAL

Various improvements incorporated in current production transmissions can be applied to early production units. The following chart lists the problem and source of repair information.

COMPONENT AND CONDITION	FOR INFORMATION REFER TO SECTION—
1. Compound "hangs up" in Hi and/or Lo-range	A
2. Synchronizer Hi-range discs overheat	B
3. Synchronizer backing plate tooth damage	C
4. O-ring deterioration	D
5. Mainshaft forward thrust washer breaks	E
6. Compound drive gear snap ring dislodges	F
Lo-range gear snap ring dislodges	F
7. Mainshaft gear thrust washer damage	G
8. Shift rail carrier cover cracks	H
9. Reverse idler gear shaft backs out	I
10. Rattle in neutral-engine idling	J
11. Main transmission case porous	K
12. Main drive pinion cover O-rings dislodging	L
13. Mainshaft gear snap ring	M
14. Side mounted P.T.O.	N
15. Shift rail to case interference	O

A. Compound "hangs up" in Hi and/or Lo-range

If a range shift does not occur when air control valve is actuated, the cause may be interference between valve piston and interlock pin. In production the pin setting was changed from 0.440 in. (11.18 mm.) to 0.410 to 0.425 in. (10.41 to 10.80 mm.) to insure clearance under all conditions. See Figure 1.

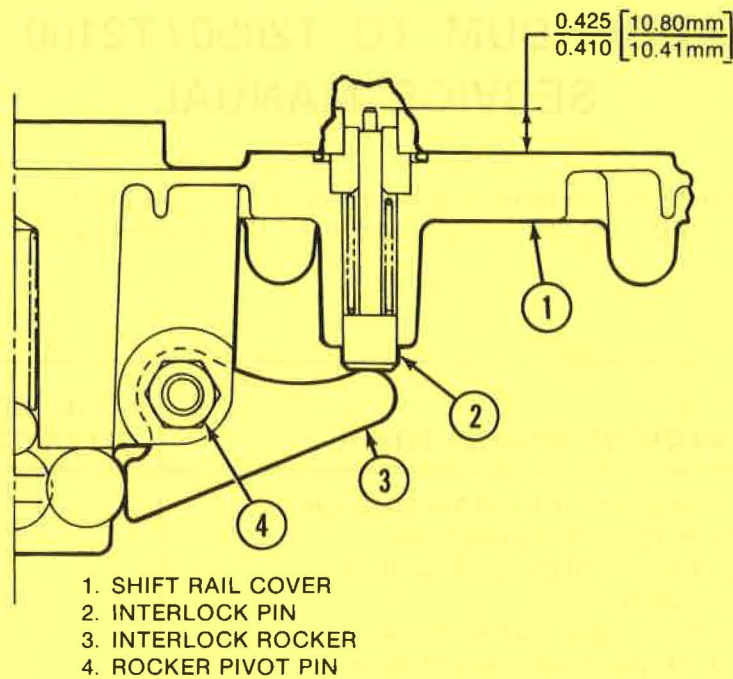


FIGURE 1
SHIFT VALVE INTERLOCK

For service the following adjusting procedure is recommended. It compensates for wear and other variables.

1. Shift main transmission into neutral.
2. Remove range control valve.
3. Slide piston to expose the largest diameter of the piston through the pin port as shown in Figure 2.

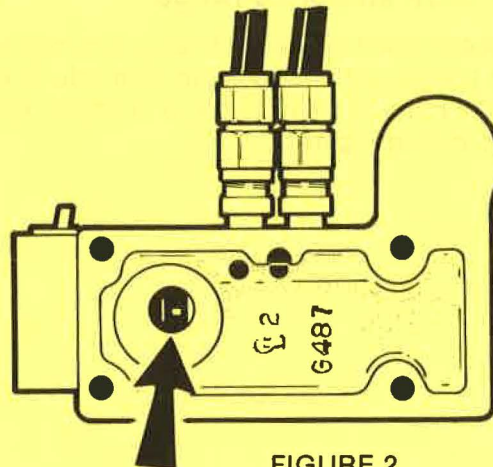


FIGURE 2
RANGE CONTROL VALVE INTERLOCK PORT

4. Using a depth gauge, measure the distance from the valve mounting surface to the piston. ("A" dimension in Figure 3).

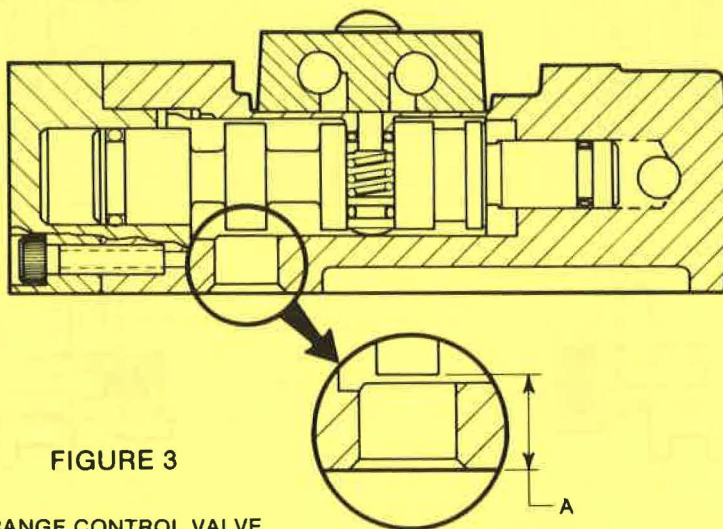


FIGURE 3

RANGE CONTROL VALVE

5. Subtract 0.010 to 0.015 in (0.25 to 0.38 mm.) from measurement in step 4 and set pin protrusion at this figure. See Figure 4.

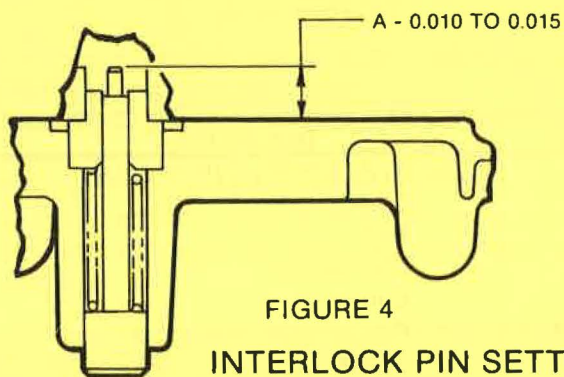


FIGURE 4

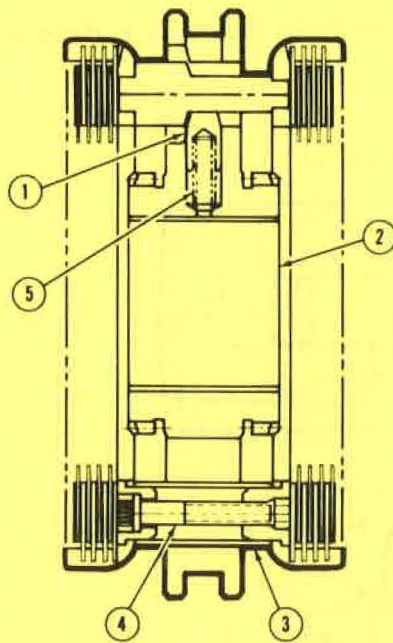
INTERLOCK PIN SETTING

Overhaul kit 28KB122 will be available to rebuild the valve.

B. Hi-range synchronizer discs overheated

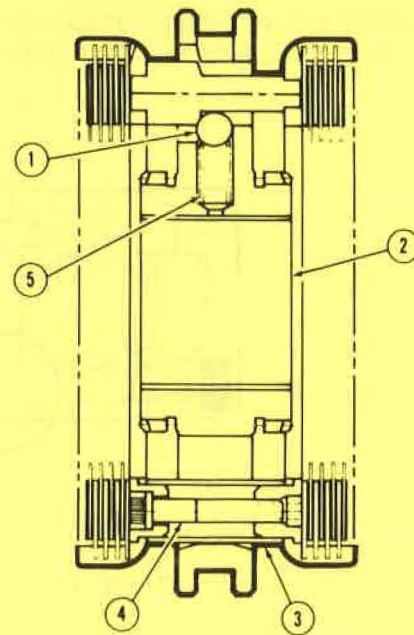
Transmissions built starting with S/N T2090 - 3Y2130, T2100 - 3Y2136 have new synchronizer material installed.

The synchronizer assembly has been changed to use steel balls in place of the steel plungers. See Figures 5 and 6.



1. PLUNGER 3. PIN 5. SPRING
2. CLUTCH 4. SCREW

FIGURE 5
NON CURRENT ASSEMBLY SYNCHRONIZER



1. BALL 3. PIN 5. SPRING
2. CLUTCH 4. SCREW

FIGURE 6
CURRENT CLUTCH ASSEMBLY SYNCHRONIZER

If hi-range friction disc wear or damage is encountered, install the latest parts.

Parts required:

Qty.	Part Number	Description	Replaces
1	320KB3135A	Clutch Assembly Synchronizer	320KB3135
1	320KB442	Clutch	320KB435B
6	48AX17	Ball	-----
6	-----	Plunger	411KC217A
6	58AX276	Spring	58AX273
3	301KC243A	Pin	301KC243
3	6AX1606X	Screw	6AX1582

NOTE

Screw, 6AX1606X, is a Nylock patch screw and is to be tightened to 21-25 lb. ft.

When replacing either the clutch, 320KB435B, or the complete synchronizer, service with the new parts. The replaced spring, 58AX273, and plunger, 411KC217A, will remain available for servicing on an individual basis when complete synchronizer is not required.

CAUTION

- 1. Make sure air pressure is at least 100 psi before making range shifts.**
- 2. Warm unit before making range shifts.**
- 3. Always start in low range per shift decal instructions, 4th or lower in T2090 and 5th or lower in T2100, including dynamometer testing.**
- 4. Do not select Hi-range and attempt to move a stationary vehicle.**

T2090 Shifting Instructions

The T2090 is a range shifted transmission with eight forward highway speeds and an extra low gear (in the Lo range). Lo and Hi ranges are controlled by an air shift control button. Under normal highway conditions, push the button down while shift lever is in neutral and shift the transmission into first gear (see shift pattern). Shift through second, third and fourth, double clutching as you do. To continue, while still in fourth gear, pull air shift control button up (preselect) and then move shift lever through neutral to fifth gear (first position in Lo range). As the shift lever passes through neutral, the air shift will be completed to high range. Now continue (double clutching) through sixth, seventh and eighth.

The extra low gear in Lo range was designed for off highway use such as paving, material spreading and heavy load/steep grade conditions.

CAUTION

Do not move the air shift control button while moving in reverse. Damage to the synchronizer may result.

To down shift the T2090, shift from eighth to seventh, sixth and fifth (don't forget to double clutch between gears). While still in fifth gear, push the air control button to Lo (preselect). As you shift through neutral, the range shift to Lo will be completed. Move the shift lever to fourth, third, second and first.

CAUTION

Be careful not to overspeed the engine during downshifting. Damage to driveline components may be the result.

T2100 Shifting Instructions

The T2100 is a range shifted transmission with ten forward highway speeds. Lo and Hi ranges are controlled by an air shift control button. The T2100 is designed for highway travel.

With shift lever in neutral, push the shift control button down and shift the transmission into first gear (see shift pattern). Shift up through second, third, fourth and fifth, double clutching between gears. When maximum rpm has been reached in fifth pull the air control button up (preselect) and then shift to sixth (first gear in Lo range). Your shift lever when passing through neutral will put you in Hi range. Now follow the normal sequence (seventh, eighth, ninth and tenth) double clutching your way to high gear.

CAUTION

Do not move the air shift control button while moving in reverse. Damage to the synchronizer may result.

To downshift the T2100, go from tenth on down through Hi range (ninth, eighth, seventh and sixth). While still in sixth gear, push down on air shift control button (preselect) and then move the shift lever through neutral to fifth (the move through neutral again activates the air shift mechanism, this time to Lo range) then fourth, third, second and first. Double clutch between all gears.

CAUTION

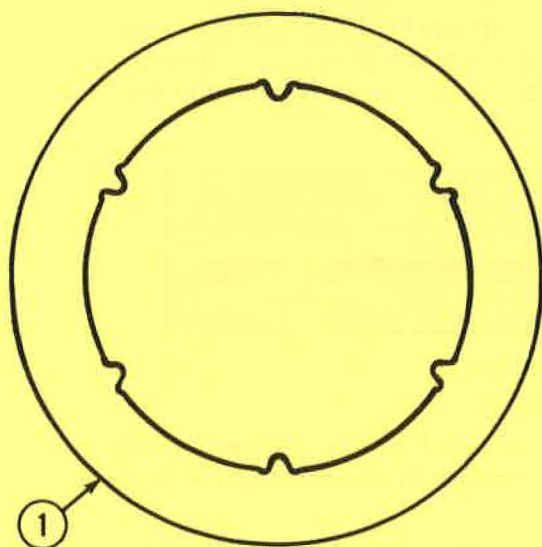
Be careful not to overspeed the engine during downshifting. Damage to driveline components may be the result.

C. Synchronizer backing plate teeth wear and break

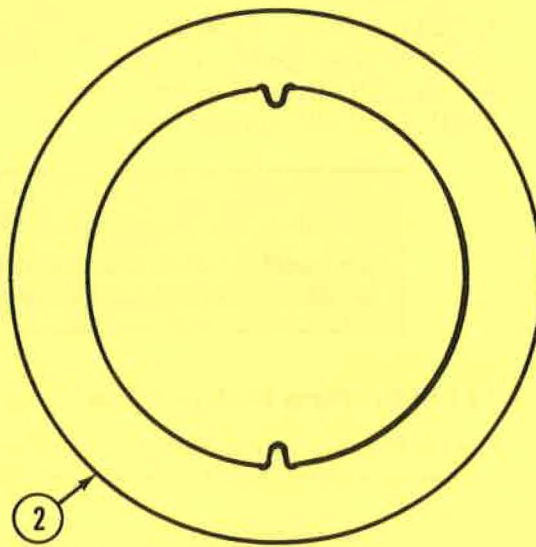
Transmissions built starting with S/N T2090 - 5G1454, T2100 - 5G1456 have new backing plates installed.

The backing plate has been improved by increasing the number of teeth from two to six. See Figure 7. This change reduces tooth wear and chipping.

Qty.	New Part	Description	Replaces
1	351KC331B	Synchronizer Clutch Backing Plate	351KC331 351KC331A



1. BACKING PLATE 351KC331B
(CURRENT PRODUCTION)



2. BACKING PLATE 351KC331
(TERMINATED)

FIGURE 7
SYNCHRONIZER CLUTCH BACKING PLATE

D. O-ring Deterioration

Units built after: T2090 - 4Y1433
T2100 - 5B0690

have incorporated
the new improved O-rings.

Improved O-rings, made of polyacrylate instead of nitrile, are now available. They reduce the potential for leaks and provide longer life.

Qty.	New O-ring	Application	Replaces
1	56AX542	Main Drive Pinion Cover	56AX399
2	56AX543	Main Drive Pinion Oil Hole	56AX497
3	56AX539	Countershaft Fr. Brg. Retainer	56AX401
1	56AX546	Range Shift Valve	56AX436
3	56AX541	Comp. Countershaft Rr. Brg. Retainer	56AX510
1	56AX545	Comp. Countershaft Rr. Brg. Ret. w/RMPTO	56AX431
1	56AX540	Comp. Mainshaft Rr. Brg. Cover Oil Hole	56AX496
2	56AX534	Shift Piston Cylinder Cover	56AX504
2	56AX533	Shift Piston Screw	56AX503

E. Mainshaft Forward Gear Thrust Washer Breakage

A two-piece thrust washer is available as a service repair to eliminate the mainshaft forward gear thrust washer breakage. This repair is to remain in effect when broken thrust washers are encountered. These parts were used in production, starting with serial number 4R9746, until eliminated by following design change.

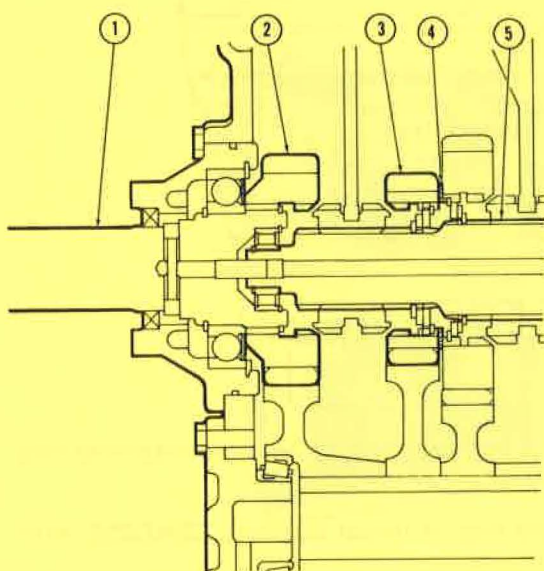
Current productions transmissions have eliminated the two-piece thrust washer and utilize wider gears to compensate for removal of thrust washer. Transmissions starting with Serial Number

T2090 - 5E1464

T2100 - 5E1473

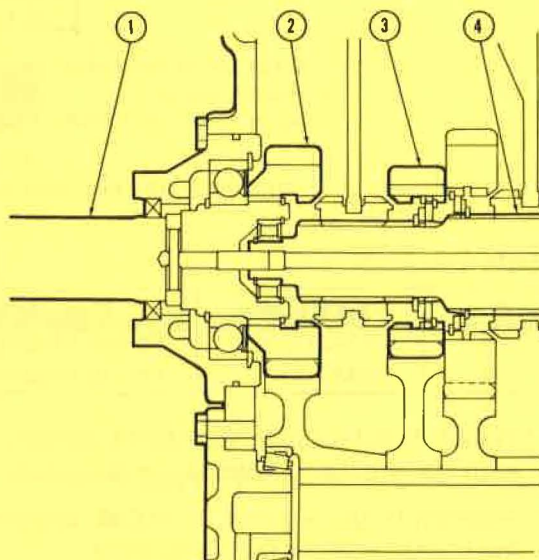
incorporate the wider gears.

Figure 8 shows non-current arrangement with thrust washer; Figure 9 shows current production arrangement with thrust washer removed.



1. MAIN DRIVE PINION
2. PINION GEAR
3. MAIN SHAFT FORWARD GEAR
4. THRUST WASHER
5. MAIN SHAFT

FIGURE 8
NON-CURRENT THRUST WASHER ARRANGEMENT



1. MAIN DRIVE PINION
2. PINION GEAR
3. MAIN SHAFT FORWARD GEAR
4. MAIN SHAFT

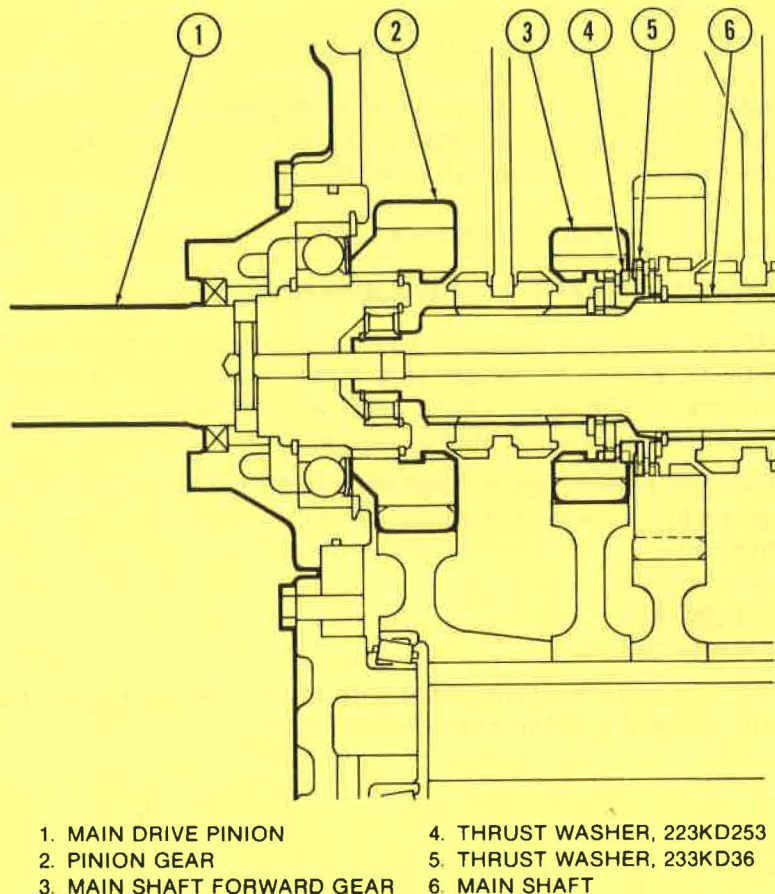
FIGURE 9
CURRENT ARRANGEMENT

If non-current units require a gear replacement, install the latest gear without the thrust washer.

Parts required:

Qty.	Part Number	Description	Replaces
1	-----	Thrust Washer	233KD316
1	751KB3450	Main Shaft Forward Gear	751KB3340

When the main shaft forward gear is not being replaced, a damaged thrust washer can be replaced with two new thrust washers. See Figure 10.



- | | |
|----------------------------|----------------------------|
| 1. MAIN DRIVE PINION | 4. THRUST WASHER, 223KD253 |
| 2. PINION GEAR | 5. THRUST WASHER, 233KD36 |
| 3. MAIN SHAFT FORWARD GEAR | 6. MAIN SHAFT |

FIGURE 10
SERVICE REPAIR THRUST WASHER ARRANGEMENT

Parts required:

Qty.	Part Number	Description	Replaces
1	223KD253	Thrust Washer*	233KD316
1	233KD36	Thrust Washer**	-----

*Install thrust washer, 223KD253, directly behind the forward gear internal retaining ring with the small shoulder facing rearward.

**Position thrust washer, 233KD36, directly to the rear of thrust washer, 223KD253, with the bronze surface facing forward.

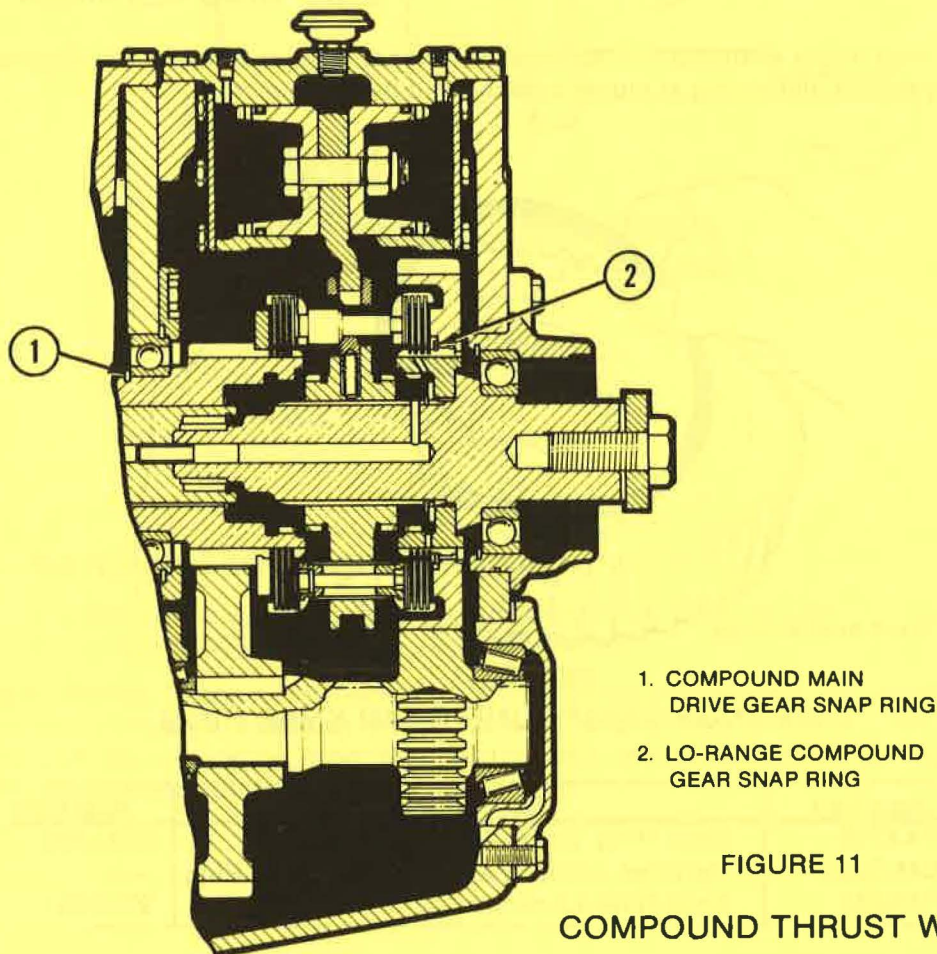
NOTE

Installation of the new washers or wider gear can be accomplished without a complete disassembly of the transmission unless other transmission damage has occurred. Removal of the shift cover assembly, main drive pinion assembly, sliding clutch gear and forward mainshaft gear will provide access to install the new washers.

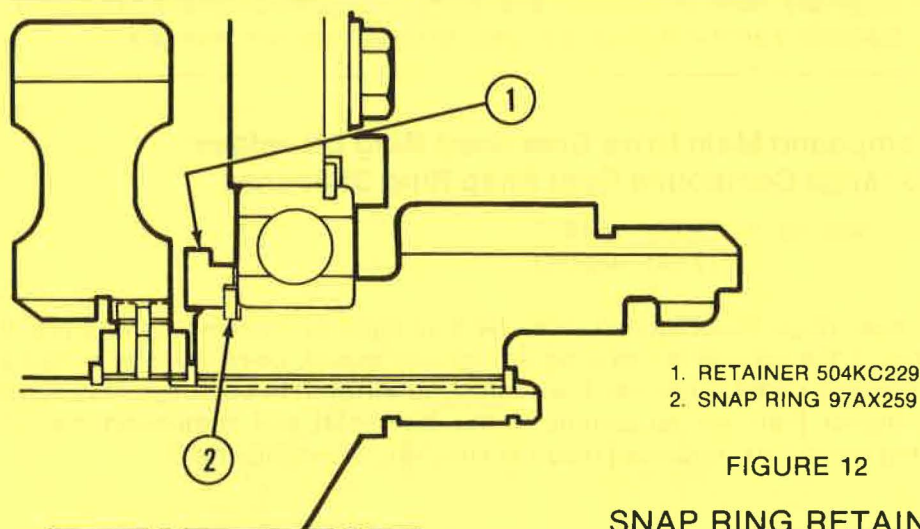
F. (1) Compound Main Drive Gear Snap Ring Dislodges (2) Lo-range Compound Gear Snap Ring Dislodges

Serial number tie-in: T2090 - 4S1915
T2100 - 4S2093

These snap rings (See Figure 11) can be dislodged by incorrect driving practices. For example, if the vehicle is traveling at highway speed, Lo-range is selected and main transmission placed in neutral, the compound will shift to Lo-range. This condition will cause higher than normal speeds in the mainshaft and compound mainshaft. The resulting centrifugal force can result in snap ring disengagement.



To insure that the main drive gear snap ring remains in place, a new snap ring and mating retainer have been released for service. The snap ring is installed first, then the retainer is pressed on the drive gear until it surrounds the ring. See Figure 12. The retainer is .0015 to 0.003 in. press fit.



An improved snap ring is available for the Lo-range compound gear location. See Figure 13. This snap ring resists dislodging at higher speeds than the original ring.

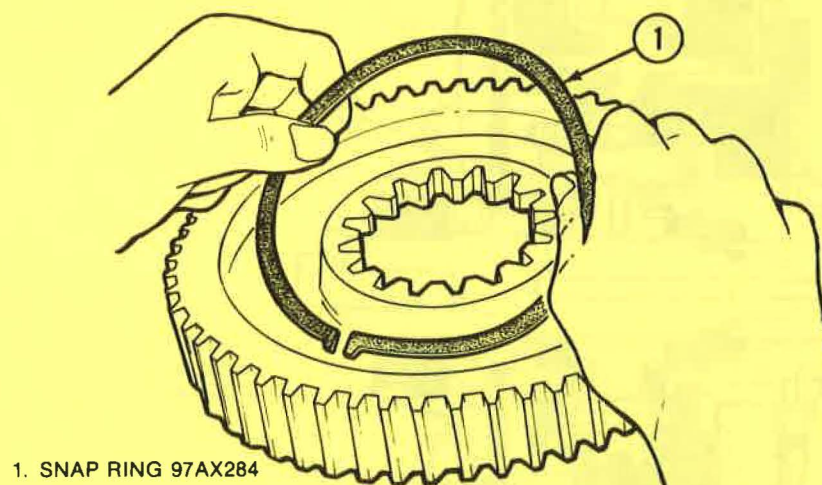


FIGURE 13
LO-RANGE COMPOUND GEAR SNAP RING

Qty.	New Part	Description	Replaces
1	97AX259	Snap Ring, Comp. Main Drive Gear	97AX269
1	504KC229	Retainer, Comp. Main Drive Gear Snap Ring	-----
1	97AX284	Snap Ring, Lo-range Comp. Gear	97AX261

NOTE (Item 1)

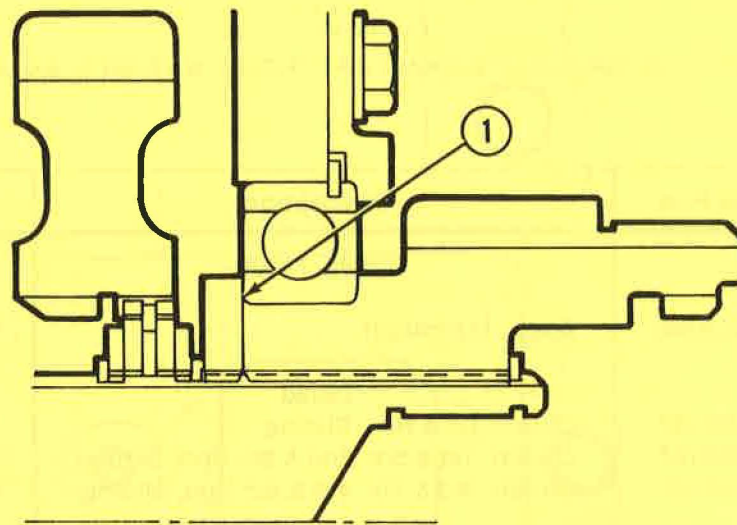
New production transmissions will not use snap ring 97AX259. Instead, a spacer will be installed between the mainshaft reverse gear thrust washer snap ring and compound main drive pinion as shown in Figure 14. The spacer serves as a clamp plate. To accommodate the spacer, the compound main drive pinion has been shortened and is flush with the ball bearing.

This change went into production starting with serial number:

T2090 - 5G1341

T2100 - 5G1365

Snap ring 97AX259 and retainer 504KC229 should be used for service unless compound main drive pinion must be replaced.



1. SPACER 31KD2132

FIGURE 14

G. Mainshaft Gear Thrust Washers

Transmissions with Serial Numbers starting with T2090 - 4Y0847, T2100 - 4Y0876 have the new M/S's and sliding clutch installed.

Bent, dished, cupped, overheated or scored thrust washers are the result of inadequate running clearance between thrust washers and sliding clutches. See Figure 15. To improve the clearance, new mainshafts with redimensioned snap ring grooves and shortened sliding clutches have been released.

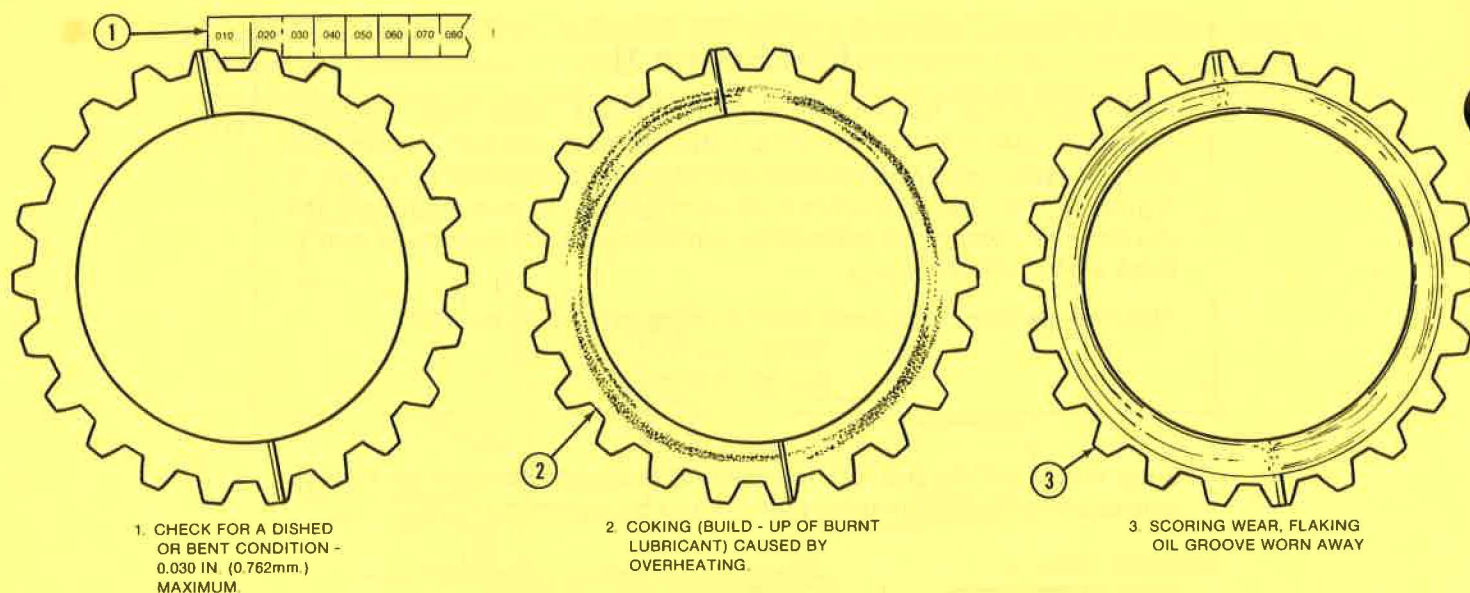


FIGURE 15

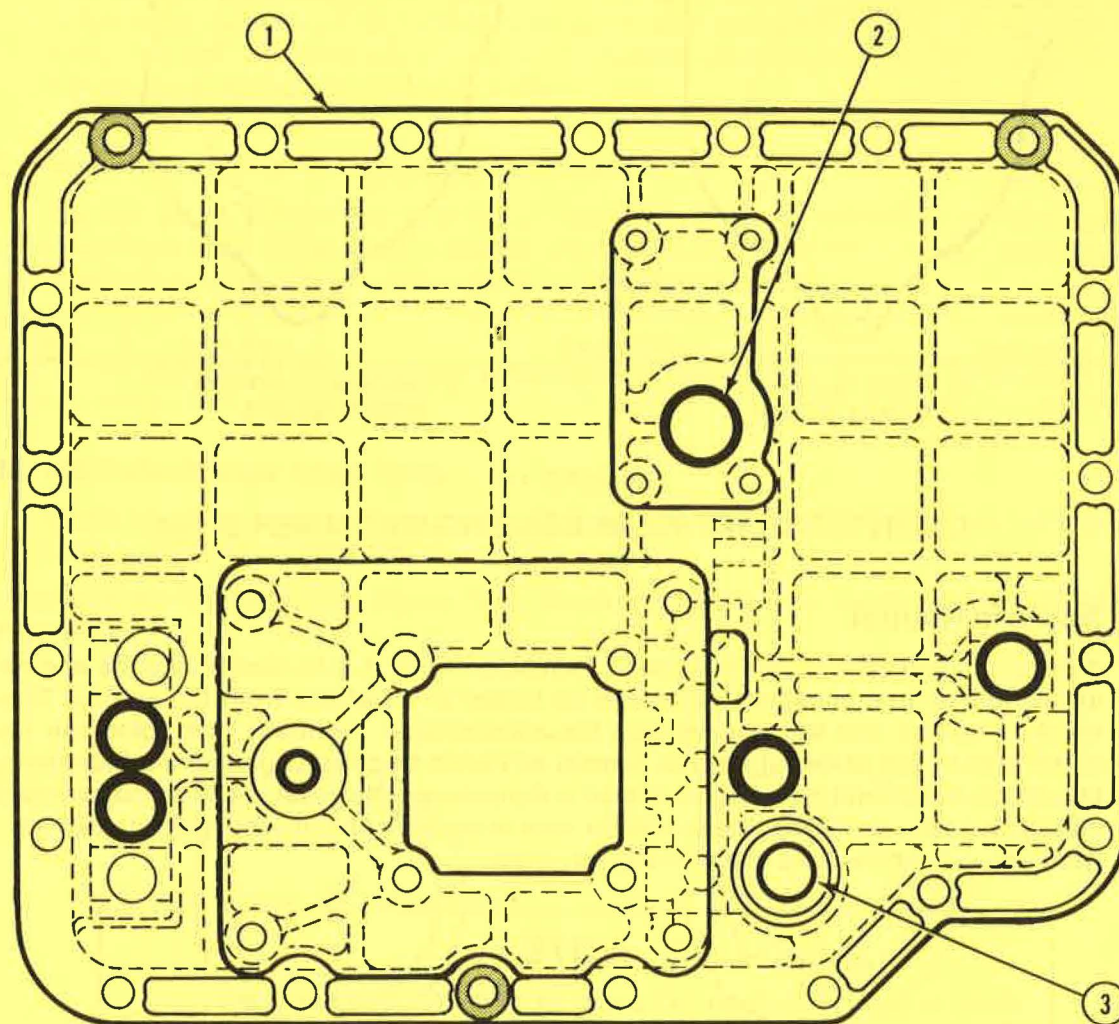
EFFECTS OF INADEQUATE MAINSHAFT THRUST WASHER CLEARANCE

Qty.	New Part	Description	Replaces
		T2090, T2100	
1	615KCA246	Assy., Mainshaft	615KCA241B
		T2090	
1	320KB3137	Clutch, Lo & Rev. Sliding	320KB3118
1	320KB3137	Clutch, 1st & 5th, 2nd & 6th Spd. Sliding	320KB3118
1	320KB3136	Clutch, 3rd & 7th, 4th & 8th Spd. Sliding	320KB3117
		T2100	
1	320KB3137	Clutch, 1st & Rev. Sliding	320KB3118
1	320KB3137	Clutch, 2nd & 7th, 3rd & 8th Spd. Sliding	320KB3118
1	320KB3136	Clutch, 4th & 9th, 5th & 10th Spd. Sliding	320KB3117

H. Shift Rail Carrier Cover Cracks

All transmissions after serial number: T2090 - 4A3759, T2100 - 4A3691 have the latest shift rail carrier installed.

A Shift Rail Carrier Cover Assembly, 405KBA461, to service all T200 series transmissions, is available. The assembly consists of a Shift Rail Carrier Cover, 405KB534B, one Plug, 366KC126, at the Maxi-Miser actuating switch hole for use on units without Maxi-Miser, and one Cup Plug, 79AX59Z, shipped loose with the cover which must be installed, for use with all T2050, T2060 and T2070 transmissions that do not require the range shift valve. See Figure 16. Non-current shift rail carrier covers may have internal bracketry and bracing that is no longer required with the current cover.



- 1. SHIFT RAIL CARRIER COVER
- 2. RANGE SHIFT VALVE PLUG

- 3. MAXI-MISER SWITCH PLUG

FIGURE 16
SHIFT RAIL CARRIER COVER ASSEMBLY

I. Reverse Idler Gear Shaft Backing Out

Occasionally, the reverse idler shaft has been found to move out against hold down shoulder of the countershaft rear bearing retainer. To eliminate this condition, the countershaft bearing retainer shim has been revised to incorporate additional material in this area and thereby retain idler shaft in position. See Item 1, Figure 17.

Current Shim	Replaced Shim
741KC321B	741KC321A

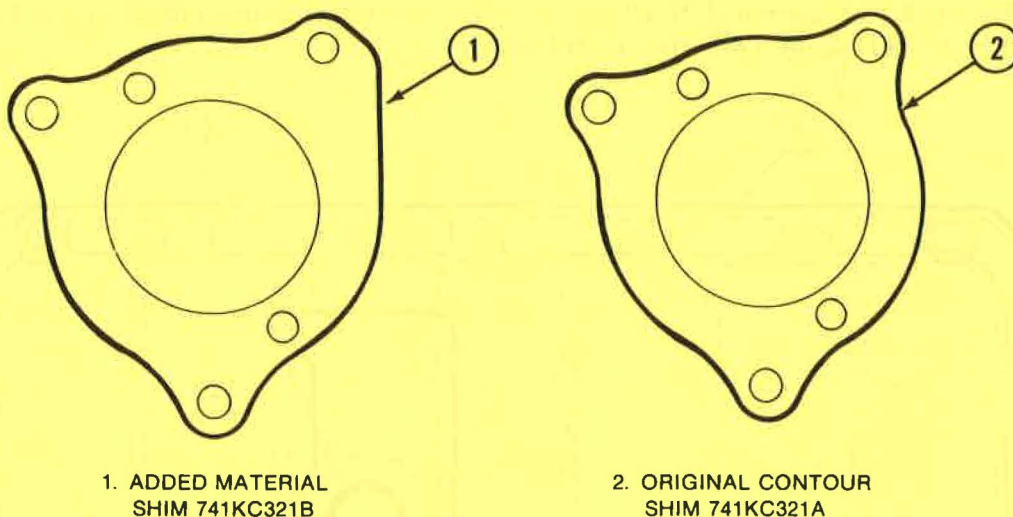


FIGURE 17
COUNTERSHAFT REAR BEARING RETAINER SHIM

J. Rattle in Neutral

A rattling noise emanating from the transmission when it is in neutral and the engine at low idle (clutch engaged), is caused by torsional vibrations from the engine. This noise is normal and will not damage the transmission. Normally, the noise can be eliminated by use of the latest type dampened clutch discs and no other modifications should be made until type of clutch disc is determined. However, if the recommended clutch discs do not correct the condition, new main drive pinions with 0.069 to 0.071 in. backlash can be installed to eliminate the noise.

NOTE

Refer to Service Bulletin L41 under CLUTCH for recommended clutch driven discs to be used with the T200 series transmissions.

Qty.	Part Number	Description	Replaces
1	764KBA288	T2090, T2100 Without Flywheel PTO Main Drive Pinion Ass'y	764KBA278B,C,D

K. Leaks in Main Case Due to Porosity

Some oil leaks in the bell housing area may be caused by porosity in the casting. This condition occurs in the front wall of the main transmission, in the main drive pinion/countershaft area. If leaks persist after replacement of sealing elements, check for porosity as follows.

Remove transmission from vehicle and steam clean inside the bell housing around the countershaft area. Stand transmission on end with main drive pinion pointed down. Either leave existing oil in transmission or fill with solvent for more positive results. Apply five psi air pressure to case and observe suspect area for leaks. Repair or replace case, as required if case is porous.

L. Main Drive Pinion O-ring Displacement

The two small O-rings that seal the oil feed/drain holes in main drive pinion bearing cover have been replaced by a gasket which is available for service use. This change eliminates the possibility of O-rings being dislodged at assembly.

Qty.	New Part	Description	Replaces
1	629KB328	Gasket, MDP Bearing Cover	(2)56AX497

M. Mainshaft Gear Snap Ring

Exact serial number tie-in is not available; however, all transmissions built after June 1, 1984 (4M-----) have the current type snap ring.

Internal Snap Ring, 97AX266, Figure 18 has been replaced by Internal Snap Ring, 97AX136, Figure 19.

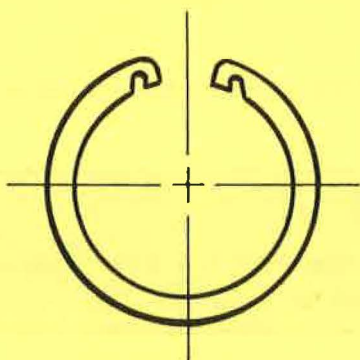


FIGURE 18
NON-CURRENT
RETAINING RING

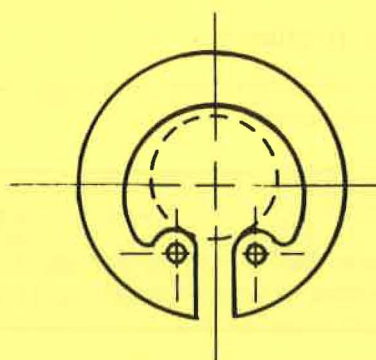


FIGURE 19
CURRENT
RETAINING RING

Snap ring location is as follows:

T2090
4th and 8th Speed Gear

T2100
5th and 10th Speed Gear

If snap ring needs replacement or when it is necessary to disassemble the transmission install the current snap ring.

NOTE

If a transmission failure occurs it is recommended to perform the modifications described in this bulletin. Mainshaft and clutch gear replacement should be done only when thrust washers are caked or scored or a dished or bent condition of 0.030 in. (0.762 mm.) is evident. When the modification is completed, stamp an "M" after the model designation on left side of the transmission, e.g. T2050M.

N. Side Mounted P.T.O.

Side Mounted Power Take-Offs (P.T.O.) from TRL107 series transmissions and T200 series transmissions are not interchangeable.

Because of a difference in the number of teeth, pressure angle and pitch, if a P.T.O. from a TRL107 series transmission were mounted on a T200 series transmission, it would result in excessive gear whine and extremely rapid wear.

Consult your local P.T.O. equipment supplier for correct component application.

O. Shift rail to case interference

Current production shift rails 591KC3127 and 591KC3143, are one half inch longer than the non-current shift rails. If these rails are to be installed in cases 284KB2303 and 5190, shifting clearance must be provided at the reverse idler boss by hand grinding. Current production cases incorporate this additional clearance feature. See Figures 1, 2 and 3.

Grinding Instructions

1. Remove transmission cover and coat the end of the appropriate shift rail with suitable marking compound.

CAUTION

Poppet ball is spring loaded. When removing shift rail, cover poppet ball bore to prevent injury from ball and spring.

2. Remove shift lug and poppet ball and spring.
3. Position cover on transmission and temporarily secure with two bolts.
4. Push shift rail against reverse idler boss to transfer marking compound to reverse idler boss.
5. Use rags to catch grindings and grind reverse idler boss to provide sufficient clearance for unobstructed shift.
6. When modification is completed, check to make sure a slight overshift past the poppet ball detent is obtainable.

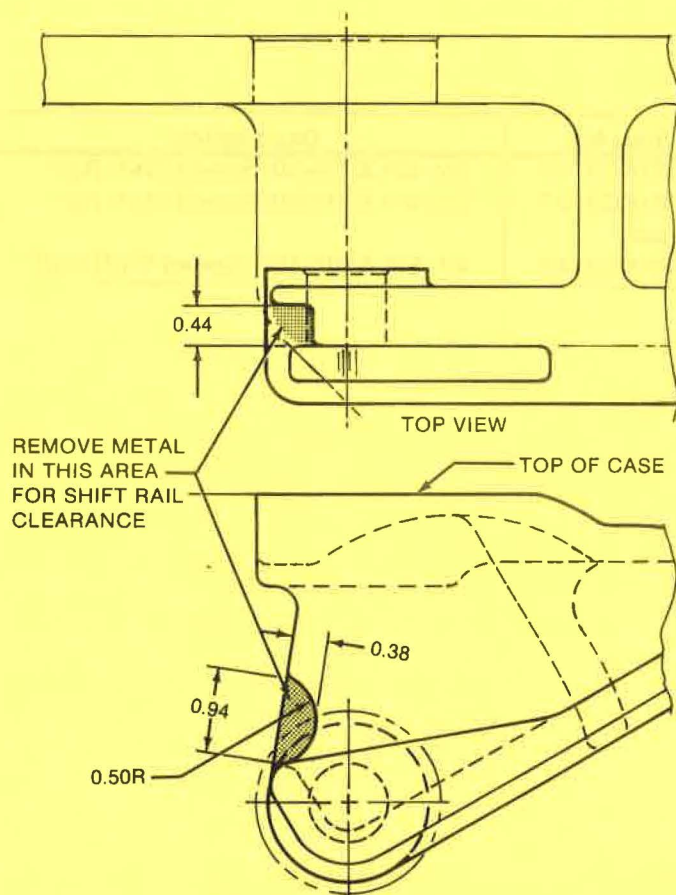
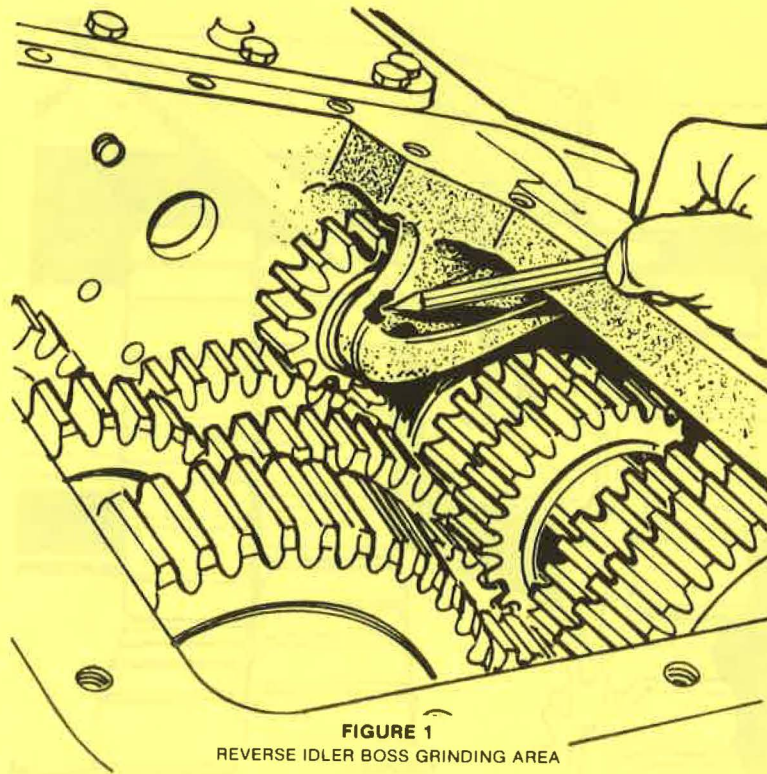


Figure 2
UPPER LEFT IDLER BOSS

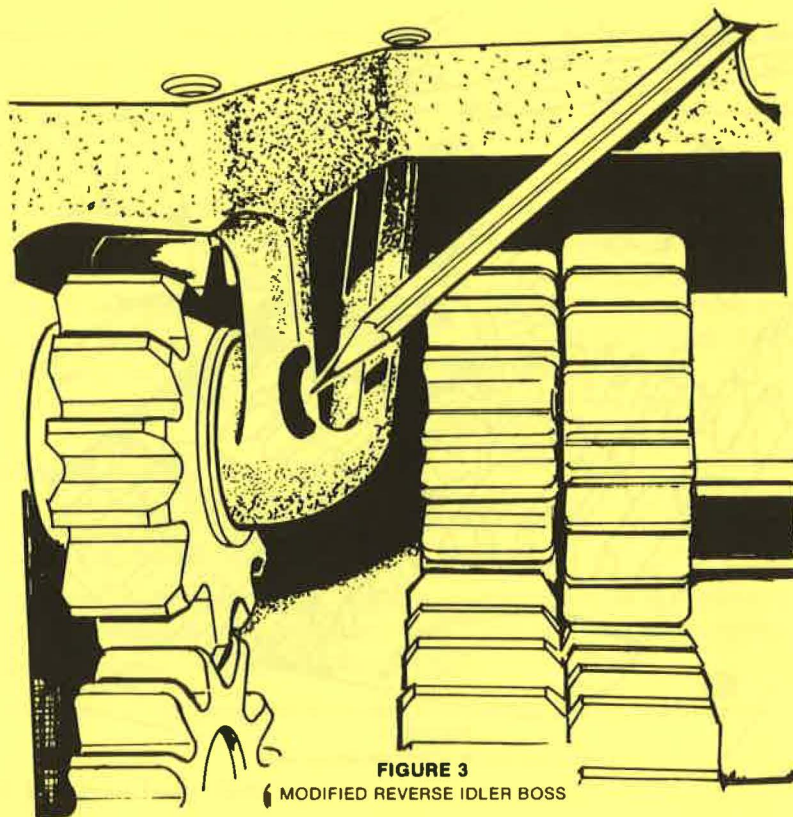


FIGURE 3
MODIFIED REVERSE IDLER BOSS

Parts required:

Qty.	Trans.	Part No.	Description	Replaces
1	T2090	591KC3143	3rd-4th & 7th-8th Speed Shift Rail	591KC3101
1	T2090	591KC3127	3rd-4th & 7th-8th Speed Shift Rail	591KC3144
	W/Maxi-Miser			
1	T2100	591KC3143	4th-5th & 9th-10th Speed Shift Rail	591KC3101



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