

**SECTION 4-C****4-SPEED SYNCHROMESH TRANSMISSION****CONTENTS OF SECTION 4-C**

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**4-13 4-SPEED TRANSMISSION SPECIFICATIONS****a. Tightening Specifications**

Part	Location	Thread Size	Torque Ft. Lbs.
Bolt	Front bearing retainer to transmission case . . . . .	5/16-18	15-20
Bolt	Side Cover Bolts . . . . .	5/16-18	15-20
Nut	Shift lever to shaft . . . . .	5/16-18	12-18
Bolt	Transmission to flywheel housing . . . . .	1/2-13	45-60
Bolt	Flywheel Housing to engine . . . . .	3/8-16	30-35

**b. 4-Speed Transmission Specifications**

Mounting . . . . .	Unit with Engine
Oil Capacity, Pints . . . . .	2 1/2
Type of Gearing . . . . .	All Helical
Transmission Ratio	
Fourth . . . . .	1.00:1
Third . . . . .	1.51:1
Second . . . . .	1.89:1
First . . . . .	2.54:1
Reverse . . . . .	2.61:1

**c. Speedometer Gear**

Speedometer Worm on Main Shaft . . . . .	Press Fit
Teeth on Worm for Axle Ratios 3.08 and 3.36 . . . . .	8
Teeth on Worm for Axle Ratios 2.78 . . . . .	9
Teeth on Worm for Axle Ratios 3.90 and 4.30 . . . . .	6

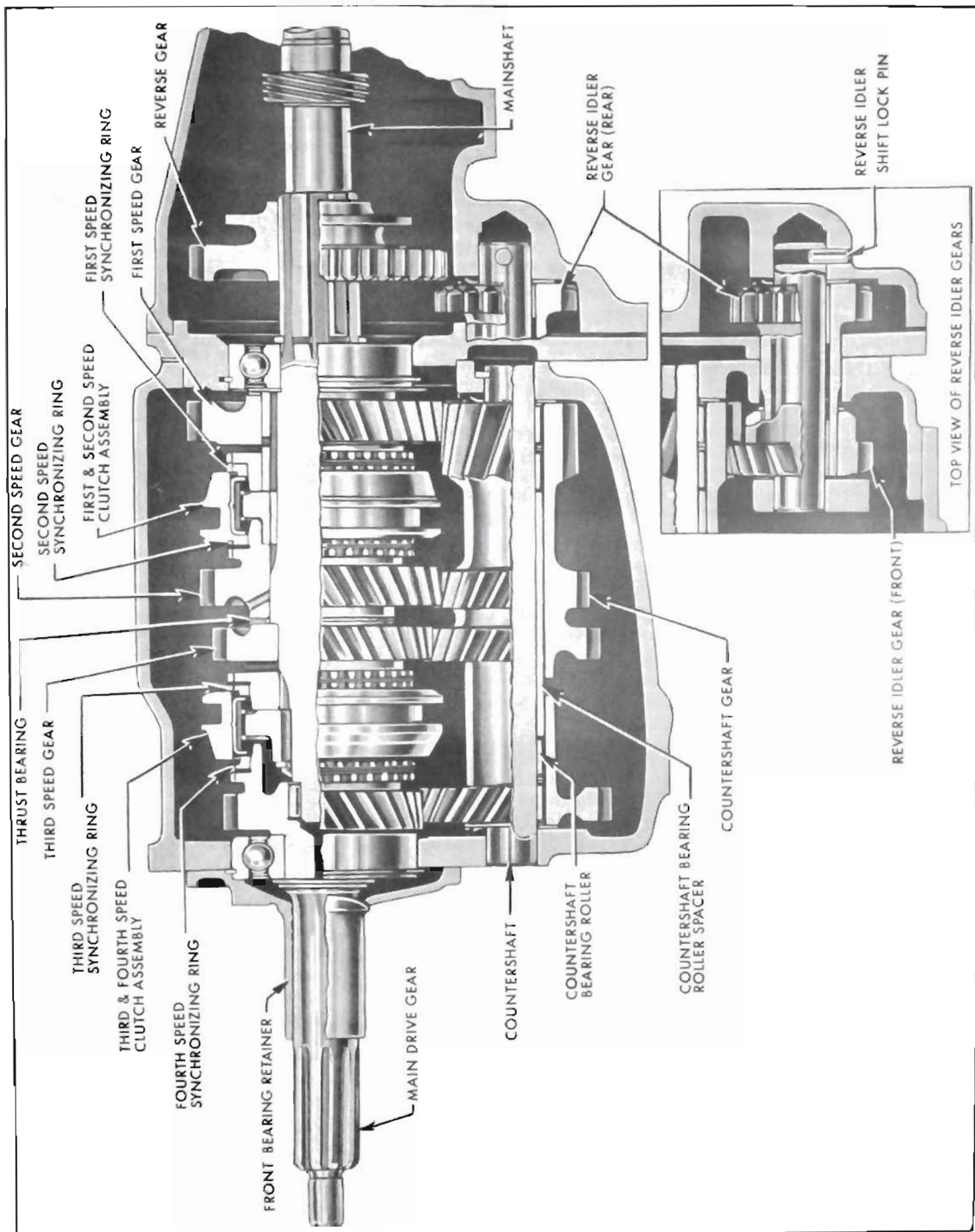


Figure 4-34—Four Speed Synchromesh Transmission

## **4-14 4-SPEED TRANSMISSION DESCRIPTION**

The 4-speed synchromesh transmission is solidly bolted to the rear face of the flywheel upper housing to form a unit assembly with the engine. The transmission main drive gear shaft extends through the clutch driven plate into a bronze bushing seated in the rear end of the engine crankshaft. The front bearing retainer projects into a bore in the flywheel housing, serving as a pilot to center the transmission with the engine crankshaft.

### **a. Transmission Gears and Shafts**

The transmission main drive gear is supported by a ball bearing which is a slip fit in the front wall of the transmission case. The inner race of the bearing is held tight against a shoulder on the drive gear. The outer race of the bearing is grooved for a snap ring which fits between the transmission case and the front bearing retainer to hold the bearing and main drive gear in place. See Figure 4-34.

The front end of the transmission main shaft is piloted in the bored rear end of the main drive gear by 14 needle rollers. The rear end of the main shaft is supported by a heavy-duty bearing identical to the one which supports the main drive gear. The inner race of the rear bearing is grooved for a snap ring which fits in the rear bearing retainer. The outer race of the bearing is retained by a snap ring in a groove in the shaft.

The transmission counter gear is carried on a double row of needle rollers on each end of the counter shaft. A tubular spacer separates the four sets of needle rollers and two washer-type spacers separates each set of needle rollers. See Figure 4-61. Two spacers

are located at the outer ends of each set to hold the rollers in position. End thrust is taken on thrust washers located between the ends of the gear and the front and rear of the case.

The two-piece reverse idler gear is carried on bronze bushings while thrust is taken on thrust washers located between the front of the gear and the back of the reverse idler thrust boss and between the rear of the gear and the reverse idler shaft boss in the case extension.

### **b. Gear Ratios**

All four forward gears are provided with synchronizing clutches which can be engaged while the car is in motion. Closely spaced gear ratios of 2.54 (first), 1.89 (second), 1.51 (third) and 1.00 (fourth) provide excellent ratio matching with minimum loss of engine speed at the shift points. Reverse gear (2.61 ratio) is not synchronized; therefore, vehicle must be brought to a complete stop before engaging reverse gear.

The transmission may be used as an aid in deceleration by downshifting in sequence without double clutching or gear clashing, due to all forward speeds being synchronized.

### **c. Speedometer Gears**

The speedometer driving worm gear is pressed on the transmission main shaft. When changing rear axle ratios it is necessary to change the driven gear, and on some axle ratios it is necessary to change the driving worm gear. The speedometer driven gear assembly consists of a sleeve, a gear and shaft, an O-ring sleeve seal, a sleeve retainer and bolt. The driven gear sleeve is a slip fit in the rear extension. The sleeve is held in place by a retainer which fits into a slot in the

sleeve and is bolted to the rear bearing retainer. The gears are lubricated by splash from the transmission. The speedometer cable is attached to the sleeve by a threaded sleeve on the cable casing.

### **d. Front Companion Flange**

The front companion flange is splined to the rear end of the transmission main shaft and is retained by a heavy steel washer and bolt. An oil seal is located in the rear end of the case extension.

### **e. Shift Linkage**

Gearshifting is manual through a floor-type gear shift lever which activates shift control rods connected to the transmission cover shifter levers for first through fourth gears, and to the reverse lever located in the case extension. The shifter lever to the rear of the transmission cover controls the first and second speed gears, while the lever to the front controls the third and fourth speed gears.

### **f. Power Flow Through Transmission**

#### **1. Operation in Neutral**

In neutral, with engine clutch engaged, the drive gear turns the countergear. The countergear then turns the third, second, first, and reverse idler gears. But, because the third and fourth and first and second speed clutch

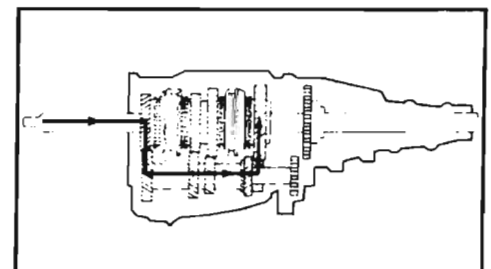


Figure 4-35—Neutral

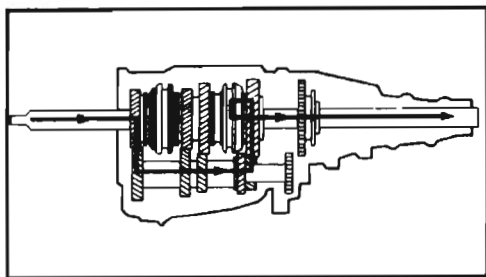


Figure 4-36—1st Gear

(sleeves) are neutrally positioned, and the reverse speed gear is positioned at the rear, away from the reverse idler gear, power will not flow through the mainshaft. See Figure 4-35.

## 2. Operation in First

In first speed, the first and second speed clutch (sleeve) is moved rearwards to engage the first speed gear, which is being turned by the countergear. Because the first and second speed clutch (hub) is splined to the mainshaft, torque is imparted to the mainshaft from the first speed gear through the clutch assembly. See Figure 4-36.

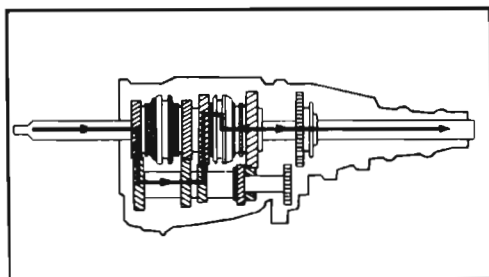


Figure 4-37—2nd Gear

## 3. Operation in Second

In second speed, the first and second speed clutch (sleeve) is moved forward to engage the second speed gear, which is being turned by the countergear. This engagement of the clutch (sleeve) with the second speed gear imparts torque to the mainshaft because the first and second speed clutch (hub) is splined to the mainshaft. See Figure 4-37.

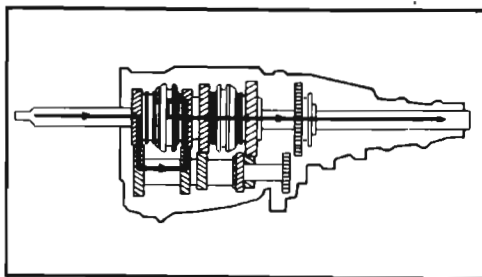


Figure 4-38—3rd Gear

## 4. Operation in Third

In third speed, the first and second speed clutch assumes a neutral position. The third and fourth speed clutch (sleeve) moves rearward to engage the third speed gear, which is being turned by the countergear. Because the third and fourth speed clutch (hub) is splined to the mainshaft, torque is imparted to the mainshaft from the third speed gear through the clutch assembly. See Figure 4-38.

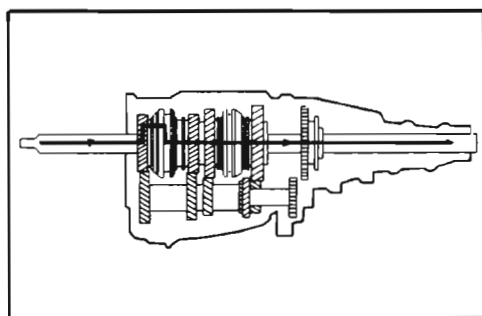


Figure 4-39—4th Gear

## 5. Operation in Fourth

In fourth speed, or direct drive, the third and fourth speed clutch (sleeve) is moved forward to engage the main drive gear and the first and second speed clutch remains in a neutral position. This engagement of the main drive gear with the third and fourth speed clutch assembly imparts torque directly to the mainshaft. See Figure 4-39.

## 6. Operation in Reverse

In reverse speed both clutch assemblies assume a neutral position. The reverse speed gear is

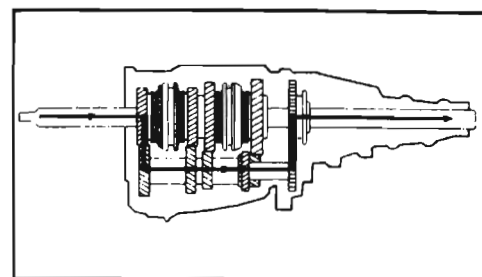


Figure 4-40—Reverse

moved forward to engage the rear reverse idler gear, which is being turned by the countergear. Because the reverse speed gear is splined to the mainshaft, this engagement causes the mainshaft to turn; however, because power flows from main drive gear to countergear and through reverse idler gear to reverse speed gear, the direction of rotation will be opposite that of the engine. See Figure 4-40.

## 4-15 TRANSMISSION SIDE COVER REMOVAL AND INSTALLATION

**NOTE:** It is not necessary to remove transmission from vehicle for inspection or replacement of parts in transmission side cover assembly, but the side cover assembly itself must be removed from the transmission case.

### a. Removal

1. Remove drain plug at the bottom of transmission and drain lubricant.
2. Disconnect first, second, third and fourth shift rods from levers. See Group 4A.
3. Remove transmission side cover assembly from transmission case.
4. Remove the outer shifter lever nuts and lockwashers and pull levers from shafts.
5. Carefully push the shifter shafts into cover, allowing the

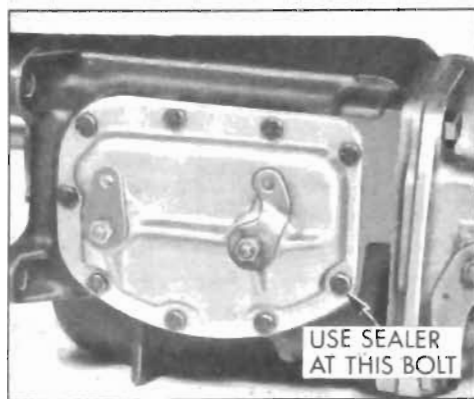


Figure 4-41—Side Cover

detent balls to fall free, then remove both shifter shafts.

6. Remove interlock sleeve, interlock pin and poppet spring.

7. Replace necessary parts.

### b. Installation

1. Install interlock sleeve and one shifter shaft. Place steel detent into sleeve followed by poppet spring and interlock pin.

2. Start second shifter shaft into position and place second detent ball on poppet spring. Compress ball and spring with screwdriver and push the shifter shaft fully in.

3. With transmission in neutral and shifter forks and levers in place, lower side cover into place. Install attaching bolts, using sealer on lower right bolt (see Figure 4-41), and tighten evenly.

## 4-16 REMOVAL AND INSTALLATION OF 4-SPEED TRANSMISSION

### a. Removal of Transmission

1. If transmission is to be disassembled, drain transmission lubricant.

2. Mark propeller shaft and front companion flange so that these parts can be reassembled in same relative position.

3. Remove the U-bolts attaching the propeller shaft to front companion flange. Slide propeller shaft rearward as far as possible for working clearance.

4. Remove trim bezel.

5. Remove rubber boot.

6. Disconnect speedometer cable from transmission.

7. Loosen all three exhaust pipe ball joints so that transmission and rear end of engine can be lowered.

8. Remove two bolts attaching transmission mounting pad to transmission support. Leave mounting pad bolted to transmission. See Figure 4-42.

9. Place a flat wood block on jack. Jack under engine pan until transmission mounting pad just clears transmission support.

10. Remove four bolts attaching transmission support to body members. Remove support, then lower jack so that transmission will clear underbody during removal.

11. Remove upper left transmission to flywheel housing bolt and install a 1/2"-13 x 4-1/2" bolt with the head removed; remove lower right bolt and install a guide pin.

12. Remove other two transmission to flywheel housing bolts. Slide transmission straight back until drive gear shaft is clear of flywheel housing, then lower transmission.

**CAUTION:** If weight of transmission is allowed to rest on main drive gear while drive gear splines are in clutch driven plate, driven plate may be damaged.

### b. Installation of Transmission

1. Lightly coat splines on end of main drive gear with Lubriplate for a distance of approximately 1 inch. Fill groove in inner surface of throw-out bearing with wheel bearing grease.

2. Make certain that front face of transmission case and rear face of flywheel housing are absolutely clean. Install 1/2"-13 x 4-1/2" bolt with the head removed guide pin in lower right hole of flywheel housing.

3. Lift transmission into place on guide pins and slide straight forward, meanwhile fully supporting transmission. Rotate companion flange as required to engage drive gear with driven plate splines. **Caution:** If weight of transmission is allowed to rest on main drive gear shaft before

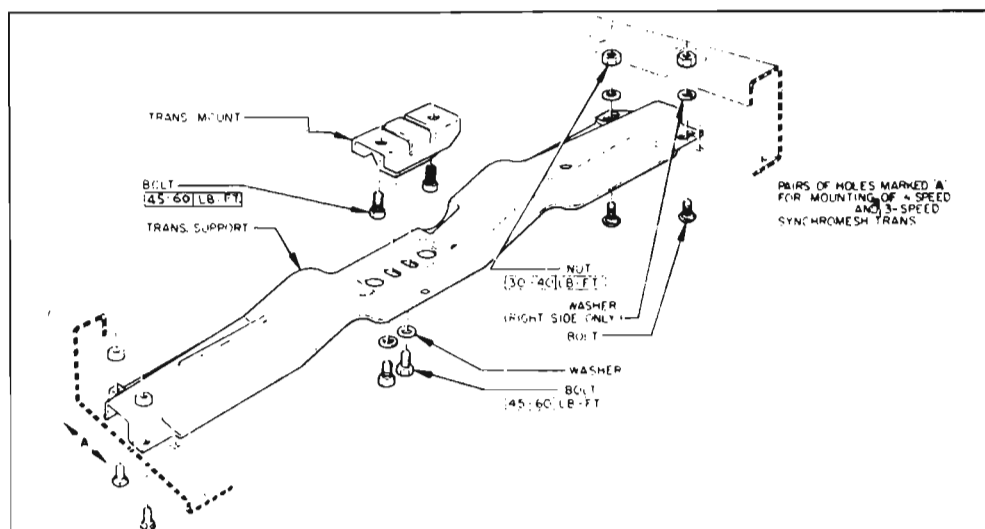


Figure 4-42—Transmission Mounting



shaft engages pilot bushing in fly-wheel, driven plate may be damaged.

4. Install two transmission to fly-wheel housing bolts; remove guide pins and install other two bolts. Tighten all four bolts securely.
5. Raise jack under engine pan so that transmission mounting pad will clear transmission support.
6. Install transmission support, leaving four nuts loose. Lower jack so that transmission rests on support.
7. Install two bolts attaching mounting pad to support, then tighten all six bolts securely.
8. Align exhaust system, if necessary, and tighten all bolts.
9. Connect speedometer cable to transmission.
10. Adjust shift linkage as described in Group 4A.
11. Reinstall rubber boot and bezel to floor pan.

## 4-17 DISASSEMBLY OF 4-SPEED TRANSMISSION

### a. Disassembly

1. Remove transmission side cover assembly from transmission case. **NOTE:** If cover assembly is to be disassembled for inspection or replacement of worn parts, follow procedures 2 through 6, Section 4-16.
2. Remove four bolts from front bearing retainer and remove retainer and gasket.
3. Drive lock pin up from reverse shifter lever boss, as shown in Figure 4-43, and pull shifter shaft out about 1/8". This disengages the reverse shift fork from reverse gear.
4. Remove five bolts attaching the case extension to the rear bearing retainer. Tap extension with soft hammer in a rearward direction

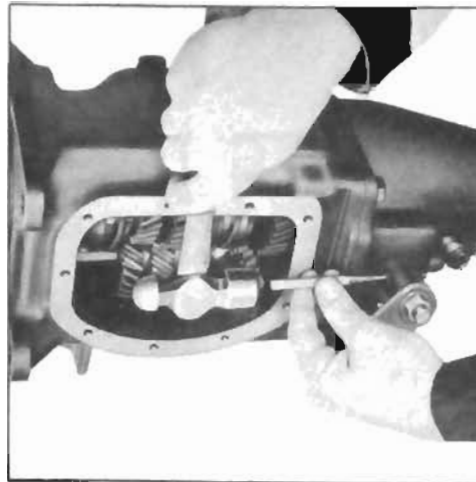


Figure 4-43—Removing Reverse Shifter Shaft Lock Pin

to start. When the reverse idler shaft is out as far as it will go, move extension to left so reverse fork clears reverse gear and remove extension and gasket.

5. Remove rear bearing snap ring on mainshaft.
6. Remove case extension oil seal. See (Figure 4-44).
7. Remove the speedometer gear with J-8760 as shown in Figure 4-45.
8. Remove the reverse gear, reverse idler gear and tapered thrust washer.



Figure 4-44—Removing Extension Oil Seal

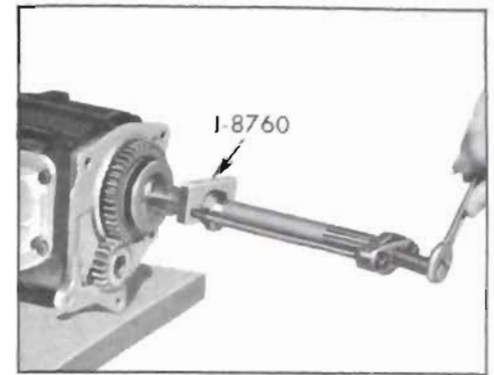


Figure 4-45—Removing Speedometer Gear

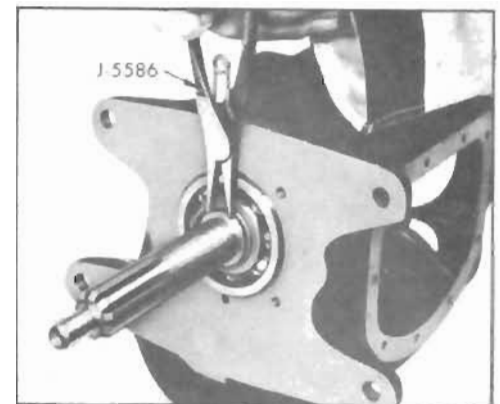


Figure 4-46—Removing Main Drive Gear Snap Ring

9. Remove the self-locking bolt attaching the rear bearing retainer to transmission case. Carefully remove the entire mainshaft assembly.
10. Unload bearing rollers from main drive gear and remove fourth speed synchronizer blocking ring.

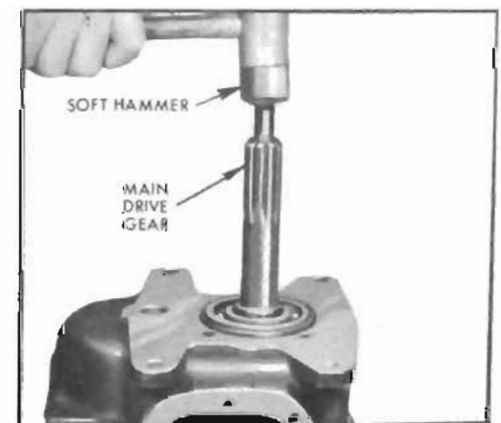


Figure 4-47—Removing Main Drive Gear

11. Lift the front half of reverse idler gear and its thrust washer from case.

12. Remove the main drive gear snap ring (see Figure 4-46), and remove spacer washer.

13. With soft hammer, tap main drive gear down from front bearing as shown in Figure 4-47.

14. From inside case, tap out front bearing and snap ring.

15. From the front of the case, remove countershaft with J-9573; then remove the countergear and both tanged washers.

16. Remove the 80 rollers, six .050" spacers and roller spacer from countergear.

17. Remove mainshaft front snap ring (see Figure 4-49), and slide third and fourth speed clutch assembly, third speed gear and synchronizing ring, second and third speed gear thrust washer (needle roller bearing), second speed gear and second speed synchronizing ring from front of mainshaft.

18. Spread rear bearing retainer snap ring and press mainshaft out of retainer. See Figure 4-50.

19. Remove the mainshaft rear

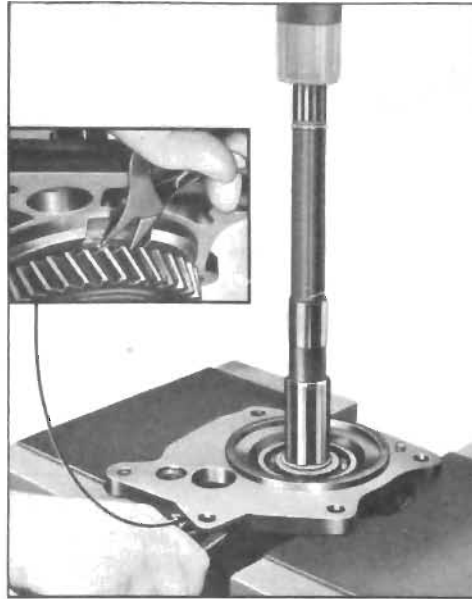


Figure 4-50—Removing Rear Bearing Retainer

snap ring. Support first and second speed clutch assembly as shown in Figure 4-50, and press on rear of mainshaft to remove shaft from rear bearing, first speed gear, and synchronizing ring first and second speed clutch sliding sleeve and first speed gear bushing.

#### **b. Reverse Idler Shaft Replacement**

1. With case extension removed from the transmission, drive the reverse idler shaft lock pin into the boss until it falls into the clearance hole in the shaft. See Figure 4-53.

2. Pry out the welch plug at the end of the shaft and press the shaft from the extension.

3. Line up the lock pin hole in the shaft with the hole in the boss. Install idler shaft and taper pin in place to lock.

#### **c. Reverse Shift and Seal Replacement**

1. With case extension removed from transmission, the reverse shifter shaft lock pin will already be removed.

2. Remove shift fork.

3. Carefully drive shifter shaft into case extension, allowing ball detent to drop into case. Remove shaft and ball detent spring.

4. Place ball detent spring into detent spring hole and start reverse shifter shaft into hole in boss.

5. Place detent ball on spring and, holding ball down with a suitable tool (see Figure 4-54), push the shifter shaft into place and turn; the ball drops into place in detent on shaft detent plate.

6. Install shift fork.

**NOTE:** Do not drive the shifter shaft lock pin into place until the extension has been installed on the transmission.

#### **d. Clutch Keys and Springs Replacement**

**NOTE:** The clutch hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled, but the three keys and two springs may be replaced if worn or broken.

1. Push the hub from the sliding sleeve. The keys will fall free and the springs may be easily removed.

2. Place the two springs in position (one on each side of hub), so a tanged end of each spring falls into the same keyway in the hub. Place the keys in position and, holding them in place, slide the hub into the sleeve.

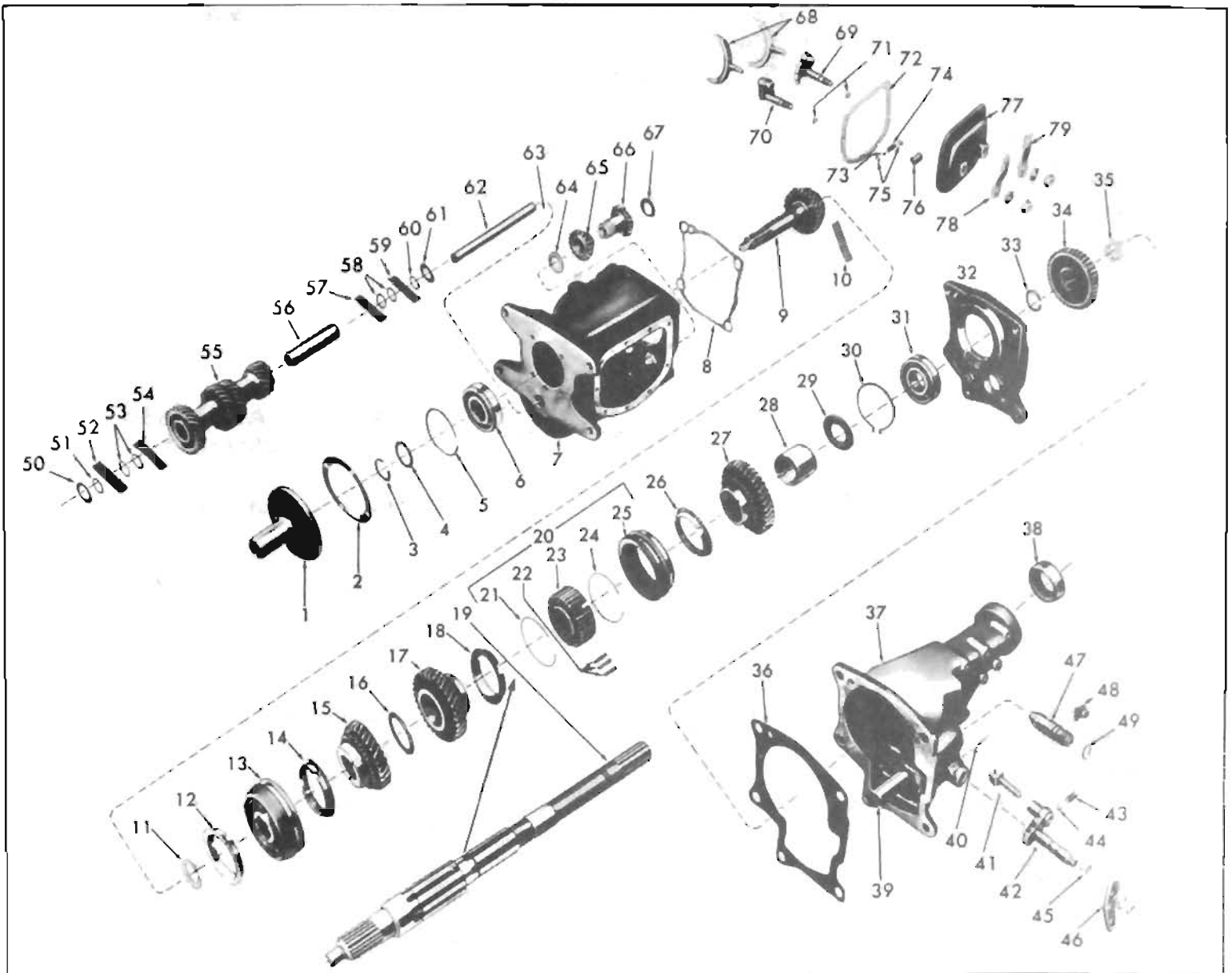
### **4-18 CLEANING AND INSPECTION**

#### **a. Transmission Case**

Wash the transmission case inside and out with a cleaning solvent and inspect for cracks.



Figure 4-49—Removing Mainshaft Front Snap Ring



- |   |  |  |  |
|---|--|--|--|
| 1. Bearing Retainer   | 21. Clutch Key Spring                              | 41. Reverse Shift Fork                       | 61. Tanged Washer  |
| 2. Gasket   | 22. Clutch Keys                                    | 42. Reverse Shifter Shaft and Detent Plate   | 62. Countershaft   |
| 3. Selective Fit Snap Ring  | 23. Clutch Hub                                     | 43. Reverse Shifter Shaft Ball Detent Spring | 63. Countershaft Woodruff Key                                  |
| 4. Spacer Washer  | 24. Clutch Key Spring                              | 44. Reverse Shifter Shaft Detent Ball        | 64. Reverse Idler Front Thrust Washer (Flat)                   |
| 5. Bearing Snap Ring  | 25. First and Second Speed Clutch Sliding Sleeve   | 45. Reverse Shifter Shaft "O" Ring Seal      | 65. Reverse Idler Gear (Front)                                 |
| 6. Main Drive Gear Bearing  | 26. First Speed Gear Synchronizing Ring            | 46. Reverse Shifter Lever                    | 66. Reverse Idler Gear (Rear)                                  |
| 7. Transmission Case  | 27. First Speed Gear                               | 47. Speedometer Driven Gear and Fitting      | 67. Tanged Thrust Washer                                       |
| 8. Rear Bearing Retainer Gasket                                       | 28. First Speed Gear Bushing                       | 48. Retainer and Bolt                        | 68. Forward Speed Shift Forks                                  |
| 9. Main Drive Gear  | 29. First Speed Gear Thrust Washer                 | 49. "O" Ring Seal                            | 69. First and Second Speed Gear Shifter Shaft and Detent Plate |
| 10. Bearing Rollers (14)  | 30. Rear Bearing Snap Ring                         | 50. Tanged Washer                            | 70. Third and Fourth Speed Gear Shifter Shaft and Detent Plate |
| 11. Snap Ring (.086" to .088")  | 31. Rear Bearing                                   | 51. Spacer (.050")                           | 71. "O" Ring Seals   |
| 12. Fourth Speed Gear Synchronizing Ring                              | 32. Rear Bearing Retainer                          | 52. Bearing Rollers (20)                     | 72. Gasket   |
| 13. Third and Fourth Speed Clutch Sliding Sleeve                      | 33. Selective Fit Snap Ring                        | 53. Spacer (2—, .050")                       | 73. Interlock Pin  |
| 14. Third Speed Synchronizing Ring                                    | 34. Reverse Gear                                   | 54. Bearing Rollers (20)                     | 74. Poppet Spring  |
| 15. Third Speed Gear  | 35. Speedometer Drive Gear                         | 55. Countergear                              | 75. Detent Balls   |
| 16. Second and Third Speed Gear Thrust Washer (Needle Roller Bearing) | 35A. Special Snap Ring                             | 56. Countergear Roller Spacer                | 76. Interlock Sleeve   |
| 17. Second Speed Gear   | 36. Rear Bearing Retainer to Case Extension Gasket | 57. Bearing Rollers (20)                     | 77. Transmission Side Cover                                    |
| 18. Second Speed Gear Synchronizing Ring                              | 37. Case Extension                                 | 58. Spacers (2—, .050")                      | 78. Third and Fourth Speed Shifter Lever                       |
| 19. Mainshaft   | 38. Rear Oil Seal                                  | 59. Bearing Rollers (20)                     | 79. First and Second Speed Shifter Lever                       |
| 20. First and Second Speed Clutch Assembly                            | 39. Reverse Idler Shaft                            | 60. Spacer (.050")                           |  |
|   | 40. Reverse Shifter Shaft Lock Pin                 |  |  |

Figure 4-51





Figure 4-52—Removing Mainshaft  
From Clutch Assembly

Inspect the front face which fits against the clutch housing for burrs and if any are present, dress them off with a fine cut mill file.

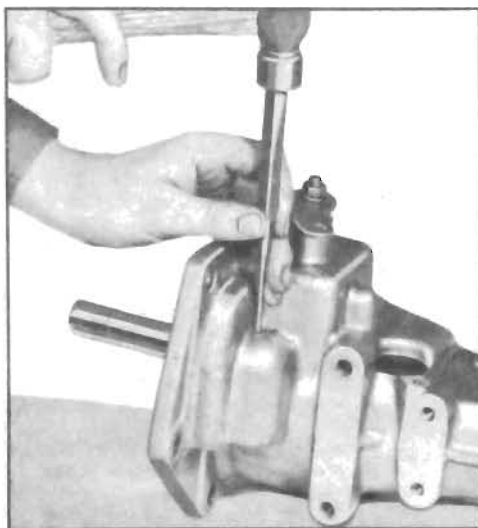


Figure 4-53—Removing Reverse Idler  
Shaft Lock Pin

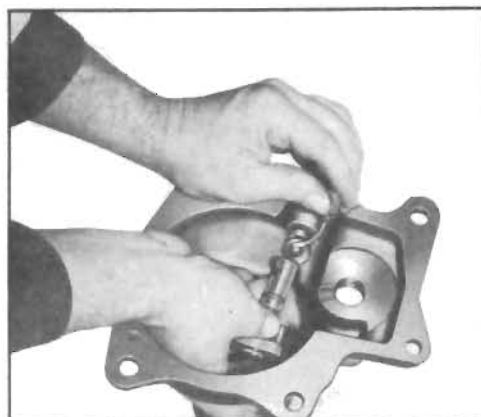


Figure 4-54—Installing Reverse  
Shifter Shaft

### **b. Front and Rear Bearings**

1. Wash the front and rear thoroughly in a cleaning solvent.
2. Blow out bearing with compressed air.

**NOTE:** Do not allow the bearings to spin but turn them slowly by hand. Spinning bearings will damage the race and balls.

3. Make sure the bearings are clean; then lubricate them with light engine oil and check them for roughness. Roughness may be determined by slowly turning the outer race by hand.

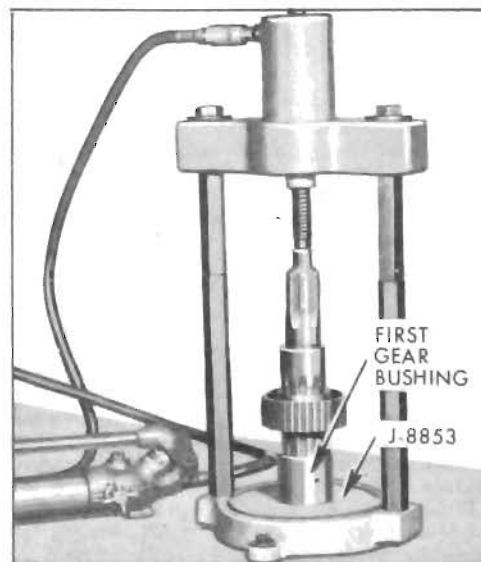


Figure 4-55—Installing First Speed  
Gear

### **c. Bearing Rollers and Spacers**

All main drive gear and counter-gear bearing rollers should be inspected closely and replaced if they show wear. Inspect countershaft at the same time and replace if necessary. Replace all worn parts.

### **d. Gears**

Inspect all gears and replace all that are worn or damaged.

## **4-19 TRANSMISSION ASSEMBLY**

### **a. Mainshaft Assembly**

1. From rear of mainshaft, assemble first and second speed clutch assembly to mainshaft (sliding clutch sleeve taper toward the rear, hub to the front) and, using J-8853, press the first gear bushing on shaft. See Figure 4-55.
2. Install the first speed gear synchronizing ring so the notches in the ring correspond to the keys in the hub. See Figure 4-56.
3. Install first speed gear (with hub toward the front) and the first speed gear thrust washer. **Make** certain that the grooves in the washer are facing the first speed gear.
4. Using J-8853, press on the rear bearing with the snap ring groove toward the front of the transmission (see Figure 4-57).

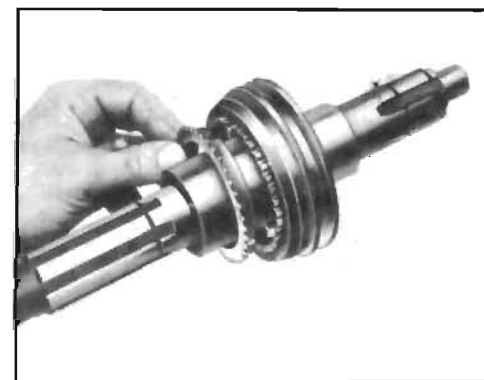


Figure 4-56—Installing Synchronizing  
Ring

Firmly seat bearing against the shoulder on the mainshaft.

5. Install snap ring in the groove in the mainshaft behind the rear bearing.

**NOTE:** Always use new snap ring when reassembling transmission and do not expand the snap ring further than is necessary for assembly.

6. From the front of the mainshaft, install the second speed gear synchronizing ring so notches in the ring correspond to the keys in the hub.

7. Install the second speed gear (with the hub of the gear toward the back of the transmission) and install the second and third speed gear thrust washer (needle roller bearing).

8. Install the third speed gear (hub to front of transmission) and the third speed gear synchronizing ring (notches to front of transmission).

9. Install the third speed and fourth speed gear clutch assembly (hub and sliding sleeve) with taper toward the front, making sure that the keys in the hub correspond to the notches in the third speed gear synchronizing ring.

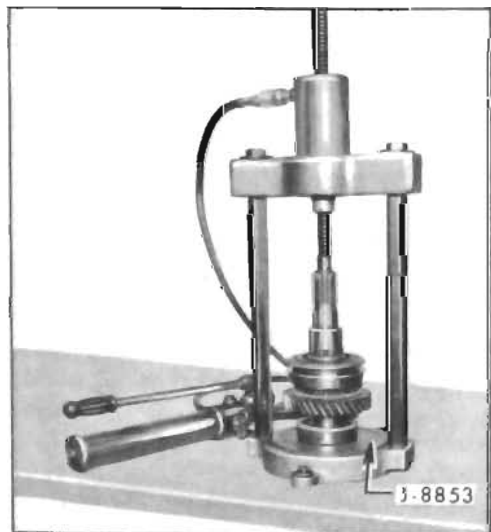


Figure 4-57—Installing Rear Bearing

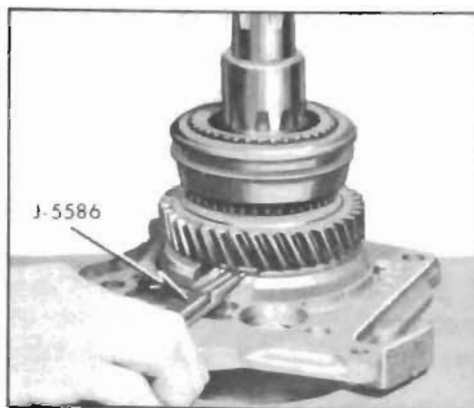


Figure 4-58—Installing Rear Bearing Retainer

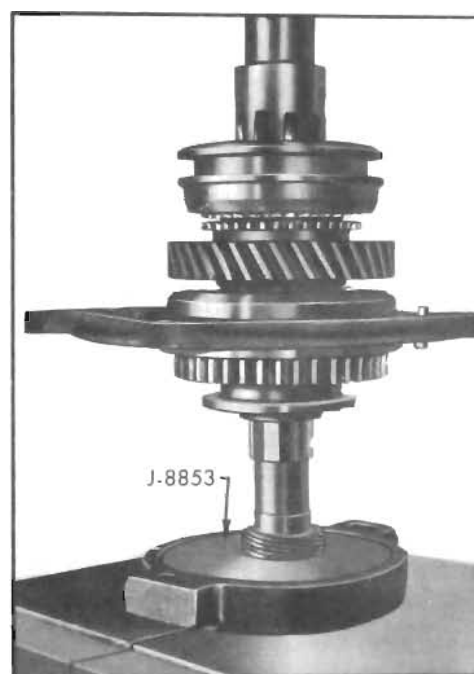


Figure 4-59—Installing Speedometer Drive Gear

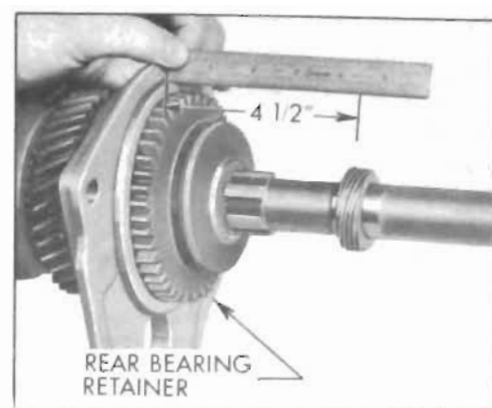


Figure 4-60—Speedometer Gear Location

10. Install snap ring in the groove in mainshaft in front of the third and fourth speed clutch assembly.

**NOTE:** If there is no end play, check the thickness of the snap ring just installed; it should be .087" thick. While the snap ring used at this location is NOT selective, it is identical to the selective washers used at the clutch gear and rear bearing locations.

11. Install the rear bearing retainer (see Figure 4-58). Spread the snap ring in the plate to allow the snap ring to drop around the rear bearing and press on the end of the mainshaft until the snap ring engages the groove in the rear bearing.

12. Install the reverse gear (shift collar to rear).

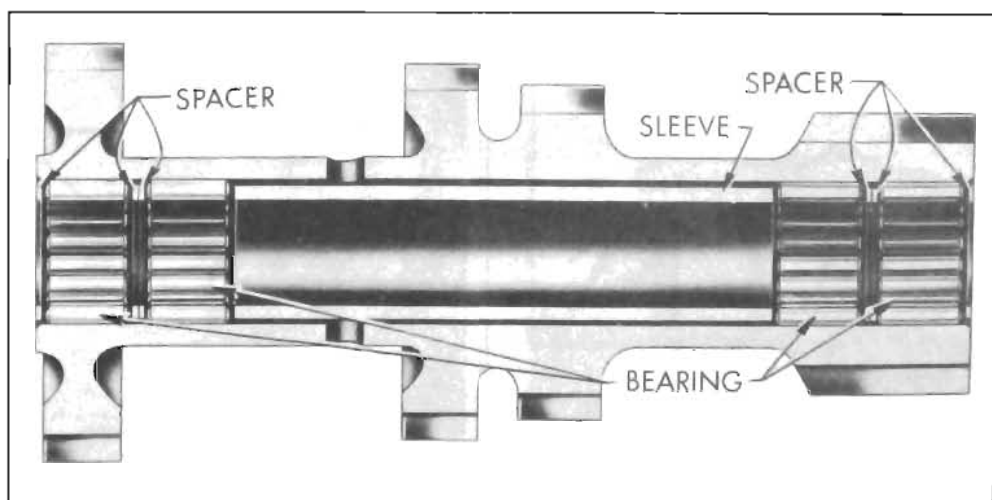


Figure 4-61—Counter Gear Assembly

13. Press speedometer drive gear onto the mainshaft, using a J-8853, press plate. (See Figure 4-59). Position the speedometer gear to get a measurement of 4-1/2" from the center of the gear to the flat surface of the rear bearing retainer. (See Figure 4-60).

14. Replace rear bearing snap ring on mainshaft.

### **b. Counter Gear Assembly**

1. Install roller spacer in countergear.

2. Using heavy grease to retain the rollers, install 20 rollers in either end of the countergear, two .050" spacers, 20 more rollers, then one .050" spacer. Install in the other end of the countergear, 20 rollers, two .050" spacers, 20 more rollers, and another .050" spacer. (See Figure 4-62).

### **c. Transmission Assembly**

1. Rest the transmission case on its side with the side cover opening toward the assembler. Reinstall retainer thrust washers on end of countergear with grease.

2. Set countergear in place in bottom of transmission case,

making sure that tanged thrust washers are correctly positioned.

3. Press bearing onto main drive gear (snap ring groove to front), using J-5746 (Figure 4-62). Be sure bearing fully seats against shoulder on gear.

4. Install spacer washer and selective fit snap ring in groove on gear stem.

NOTE: The snap ring is available in three thicknesses: .087", .093", and .099". Use the ring that will produce from zero to .005" clearance between the rear face of the snap ring and the front face of the spacer washer.

5. Install the main drive gear and bearing assembly through the side cover opening and into position in transmission front bore. Tap lightly into place, if necessary, with a plastic hammer. Place snap ring and spacer in groove in front bearing.

6. With the transmission case resting on its front face, move countergear into mesh with main drive gear. Be sure thrust washers remain in place. Install woodruff key into end of countershaft

and press shaft (Figure 4-63) until end of shaft is flush with rear face of transmission case.

7. Attach a dial indicator as shown in Figure 4-64, and check the end play of the countergear. End play must not be more than .025".

8. Install the fourteen roller bearings into the main drive gear, using heavy grease to hold the bearing in place.

9. Using heavy grease, place gasket in position on front face of rear bearing retainer.

10. Install fourth speed synchronizing ring on main drive gear with the notches toward the rear of the transmission.

11. Position the reverse idler gear thrust washer (untanged) on the machined face of the ear cast for the reverse idler shaft. Position the front reverse idler gear on top of the thrust washer, with the hub facing forward rear of the case.

12. Lower the mainshaft assembly into the case, making certain that the notches on the fourth speed synchronizing ring correspond to the keys in the clutch assembly. See Figure 4-65.

13. Install the self-locking bolt attaching rear bearing retainer

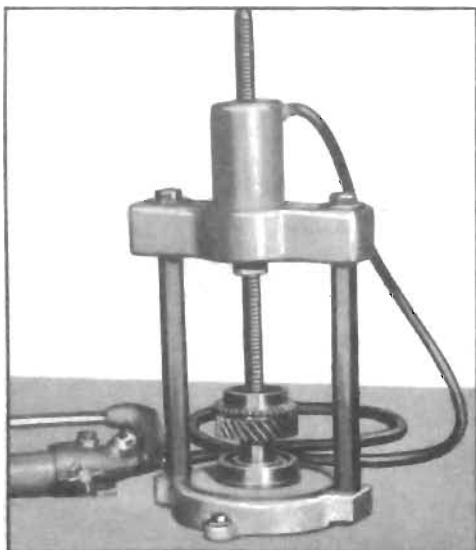


Figure 4-62—Installing Main Drive Gear Bearing

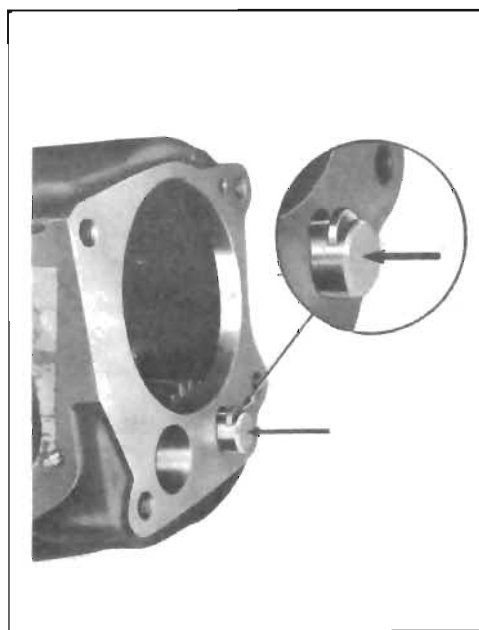


Figure 4-63—Installing Countershaft

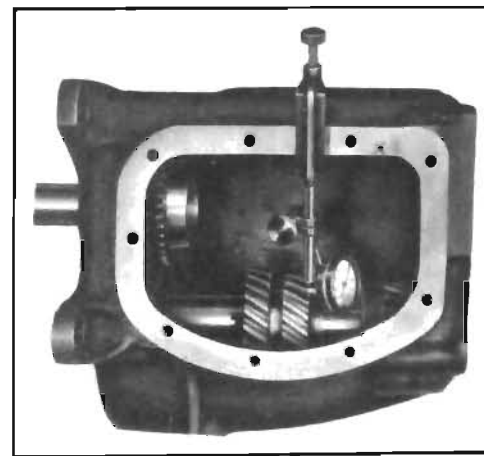


Figure 4-64—Checking Countergear End Play



Figure 4-65—Installing Mainshaft

to transmission case. Torque to 20 to 30 ft. lbs.

14. From the rear of the case, insert the rear reverse idler gear, engaging the splines with the portion of the gear, within the case.

15. Using heavy grease, place gasket into position on rear face of rear bearing retainer.

16. Using heavy grease, install the remaining thrust washer into place on the reverse idler shaft, making sure tang on the thrust washer is in the notch in the idler thrust face of the extension.

17. Place the two clutches in neutral position. Pull reverse shifter shaft to left side of extension and rotate shaft to bring reverse shift fork as far forward in extension as possible. Start the extension



Figure 4-66—Bearing Retainer To Transmission Bolt

onto the transmission case (Figure 4-68) while slowly pushing in on the shifter shaft to engage the shift fork with the reverse gear shift collar. When the fork engages, rotate the shifter shaft to move the reverse gear rearward, permitting the extension to slide onto the transmission case.

18. Install new oil seal in rear bearing retainer, using Seal Installer J-8864. See Figure 4-67 Lightly coat seal with gear lubricant.



Figure 4-67—Installing Extension Oil Seal

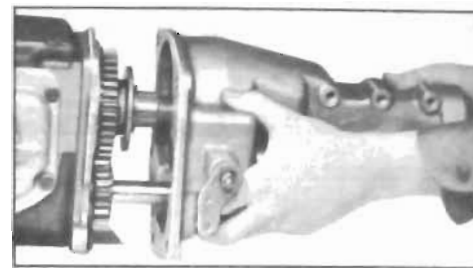


Figure 4-68—Installing Extension To Case

19. Install three extension and retainer to case attaching bolts (torque to 35 to 45 ft. lbs.) and two extension to retainer attaching bolts (torque to 20 to 30 ft.

20. Push or pull reverse shifter shaft to line up groove in the shaft with the holes in the boss and drive in the lock pin. Install shifter lever.

21. Install the main drive gear bearing retainer, gasket and four attaching bolts, using a suitable sealer on bolts. Torque to 15 to 20 ft. lbs.

22. Install a shift fork in each clutch sleeve.

23. Place both clutches in neutral, install side cover gasket and carefully lower side cover into place. Install attaching bolts and tighten evenly to avoid side cover distortion. Use suitable sealer when installing the lower right bolt.

**NOTE:** The transmission should "overshift" slightly in all ranges.

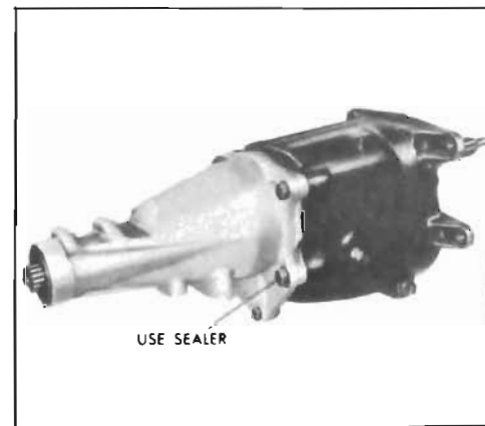


Figure 4-69—Sealing Case Extension Attaching Bolt

**4-20 4-SPEED SYNCHROMESH TRANSMISSION TROUBLE DIAGNOSIS**

SYMPTOM AND PROBABLE CAUSE	PROBABLE REMEDY
<b>SHIFTS HARD</b>	
<ul style="list-style-type: none"> <li>a. Clutch not releasing engine or slow to release.</li> <li>b. Shift linkage binding or selector not properly adjusted.</li> </ul>	<ul style="list-style-type: none"> <li>a. Adjust or repair clutch.</li> <li>b. Free up and adjust as required.</li> </ul>
<b>SHIFTS HARD ON DOWNSHIFT</b>	
<ul style="list-style-type: none"> <li>a. Downshifting at too high an engine speed.</li> </ul>	<ul style="list-style-type: none"> <li>a. Shifting into low gear above 45 MPH and second above 65 MPH causes extra work for synchronizers and will require extra time or more force on lever to complete. There is also danger of over-speeding the engine if low or second is used at high car speeds.</li> </ul>
<b>DISENGAGES FROM GEAR</b>	
<ul style="list-style-type: none"> <li>a. Dirt between transmission case and clutch housing.</li> <li>b. Does not fully engage.</li> <li>c. Clutching teeth worn or defective and/or clutch hub spline worn.</li> </ul>	<ul style="list-style-type: none"> <li>a. Clean mating surfaces.</li> <li>b. Check linkage for interference. Adjust or replace damaged shift linkage.</li> <li>c. Replace gear, clutch sleeve and clutch hub.</li> </ul>
<b>NOISY</b>	
<ul style="list-style-type: none"> <li>a. Gears worn, scored or broken.</li> <li>b. Bearing dirty, worn.</li> <li>c. Interference of clutch sleeve with counter-gear of idler gear.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace gears.</li> <li>b. Flush transmission with kerosene. If noise is still present, replace bearings and examine gears as above.</li> <li>c. Replace worn shift forks, countergear, and idler gear thrust washers to restore gears and clutch sleeve to proper location. Examine thrust faces on these gears for wear. Replace if worn excessively.</li> </ul>
<b>LEAKS LUBRICANT</b>	
<ul style="list-style-type: none"> <li>a. Excessive amount of lubricant in transmission.</li> <li>b. Loose or broken clutch gear bearing retainer.</li> </ul>	<ul style="list-style-type: none"> <li>a. Drain to correct level.</li> <li>b. Tighten or replace retainer.</li> </ul>



**4-20 4-SPEED SYNCHROMESH TRANSMISSION TROUBLE DIAGNOSIS (Cont'd)**

SYMPTOM AND PROBABLE CAUSE	PROBABLE REMEDY
<b>LEAKS LUBRICANT (Cont'd)</b>	
c. Clutch gear bearing retainer gasket damaged.	c. Replace gasket.
d. Cover loose or gasket damaged.	d. Tighten cover or replace gasket.
e. Operating shaft seal leaks.	e. Replace operating shaft seal.
f. Idler shaft expansion plugs loose.	f. Replace expansion plugs.
g. Countershaft loose in case.	g. Replace case
h. Lack of sealant on bolts.	h. Coat bolts with sealant.
i. Worn extension oil seal.	i. Replace seal.
<b>EXCESSIVE BACKLASH IN ALL REDUCTION GEARS</b>	
a. Worn countergear bearings.	a. Replace countergear bearings and shaft.
b. Excessive end play in countergear.	b. Replace countergear thrust washers.
<b>NOISY IN ALL REDUCTION GEARS</b>	
a. Insufficient lubricant.	a. Fill to correct level.
b. Worn or damaged clutch gear or countergear.	b. Replace faulty or damaged gears.
<b>NOISY IN ALL GEARS</b>	
a. Insufficient lubricant.	a. Fill to correct level.
b. Worn countergear bearings.	b. Replace countergear bearings and shaft.
c. Worn or damaged clutch gear and countershaft drive gear.	c. Replace worn or damaged gears.
d. Damaged clutch gear or mainshaft ball bearings.	d. Replace damaged bearings.
e. Damaged speedometer gears.	e. Replace damaged gears.
<b>NOISY IN HIGH GEAR</b>	
a. Damaged clutch gear bearing.	a. Replace damaged bearing.
b. Damaged mainshaft bearing.	b. Replace damaged bearing.
c. Damaged speedometer gears.	c. Replace speedometer gears.
<b>NOISY IN NEUTRAL WITH ENGINE RUNNING</b>	
a. Damaged clutch gear bearing.	a. Replace damaged bearing.
b. Damaged mainshaft pilot bearing roller.	b. Replace damaged bearing roller.