

FOUR-SPEED TRANSMISSION AND SHIFT LINKAGE

CONTENTS OF THIS SECTION

SUBJECT	PAGE	SUBJECT	PAGE
Description	7A-1	Transmission--Disassemble	7A-11
Design	7A-1	Reverse Shifter Shaft and Seal--Remove and Replace	7A-13
Operation	7A-3	Clutch Keys and Springs Remove and Replace	7A-14
Periodic Service	7A-5	Cleaning and Inspection Transmission Case	7A-14
Adjustments on Car Shift Linkage Adjustment	7A-6	Front and Rear Bearings	7A-14
Minor Repairs	7A-6	Gears and Bushing	7A-15
Speedometer Driven Gear-- Remove	7A-6	Reverse Idler	7A-15
Replace	7A-6	Transmission--Assemble	7A-17
Transmission Extension Oil Seal--Remove and Replace	7A-8	Mainshaft--Assembly	7A-15
Transmission Side Cover-- Remove and Disassemble	7A-8	Countergear--Assembly	7A-16
Transmission Side Cover-- Assemble and Replace	7A-9	Transmission Assembly	7A-17
Major Repairs Transmission--Remove and Overhaul	7A-9	Transmission--Install in Vehicle	7A-19
		Trouble Diagnosis and Testing	7A-19
		Specifications	7A-22
		Torque Specifications	7A-22
		Special Tools	7A-22

DESCRIPTION

The four-speed synchromesh transmission (Fig. 7A-1) is available only on special order and is engineered to operate on all Tempest models. It consists of two basic sections; the transmission case, or forward section, and the case extension, or rear section. The forward section contains the four forward speed gear assemblies, clutch assemblies and synchronizing mechanisms, while the rear section contains the reverse gear assembly.

Gearshifting is manual through a floor-type gearshift 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.

All four forward gears are provided with synchronizing clutches which can be engaged while the car is in motion (Fig. 7A-1). Closely spaced gear ratios of 2.56 (first), 1.91 (second), 1.48 (third) and 1.00

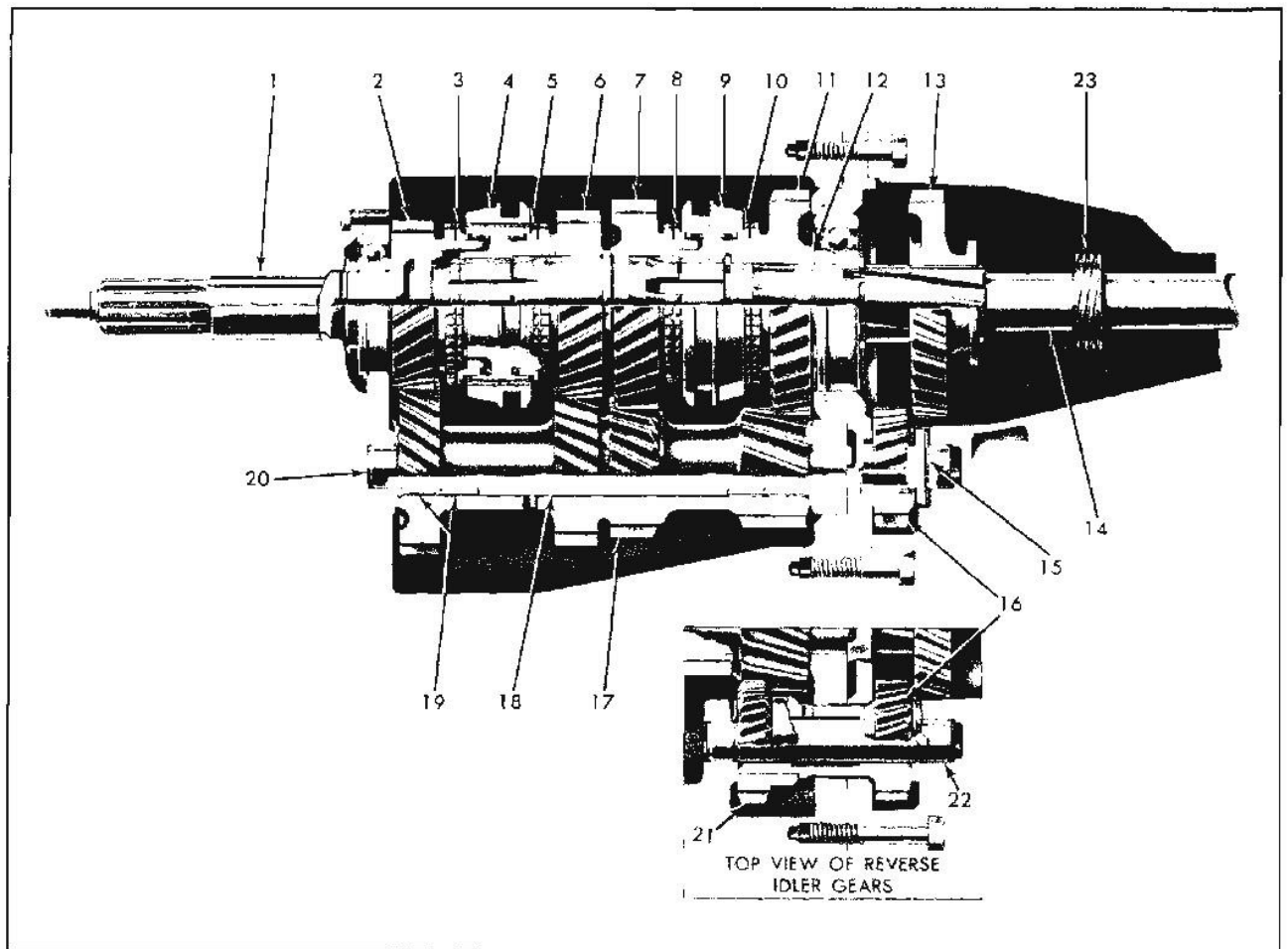
(fourth) provide excellent ratio matching with minimum loss of engine speed at the shift points. Reverse gear (2.64 ratio) is not synchronized; therefore, vehicle should be brought to a complete stop before engaging reverse gear.

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

DESIGN

The four-speed transmission incorporates helical gears specially designed to provide high torque capacity without additional weight, and gear teeth proportioned to operate at high speeds with neither excessive heat generation nor excessive frictional losses. Shafts, bearings, high capacity clutches and other precision parts are held to close limits, providing proper clearances necessary for durability during extended heavy usage.

Seven basic gears are utilized in this transmission. They are: main drive gear, third speed gear, second speed gear, first speed gear, reverse gear, countergear and reverse idler gear (front and rear). See Fig. 7A-1.



- | | | | |
|---|---|---------------------------------------|----------------------------------|
| 1. Bearing Retainer | 7. Second Speed Gear | 13. Reverse Gear | 19. Countergear Bearing |
| 2. Main Drive Gear | 8. Second Speed Synchronizing Ring | 14. Mainshaft | Roller |
| 3. Fourth Speed Synchronizing Ring | 9. First and Second Speed Clutch Assembly | 15. Reverse Idler Shaft Roll Pin | 20. Countershaft |
| 4. Third and Fourth Speed Clutch Assembly | 10. First Speed Synchronizing Ring | 16. Reverse Idler Gear (Rear) | 21. Reverse Idler (Gear) (Front) |
| 5. Third Speed Synchronizing Ring | 11. First Speed Gear | 17. Countergear | 22. Reverse Idler Shaft |
| 6. Third Speed Gear | 12. Thrust Washer | 18. Countergear Bearing Roller Spacer | 23. Speedometer Drive Gear |

Fig. 7A-1 Cross Section of Four-Speed Synchromesh Transmission

The front end of the main drive gear is piloted in a single row, prepacked and shielded ball bearing mounted in the engine crankcase, while the rear end is supported by a heavy duty ball bearing located at the front end of the transmission case.

The front end of mainshaft is piloted in a row of roller bearings set into the hollow end of the main drive gear and the rear end is carried by a heavy duty ball bearing located at the rear end of the transmission case.

The countergear is carried on a double row of roller bearings positioned at both ends of the gear, while thrust is taken on thrust washers located at front and rear of gear.

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

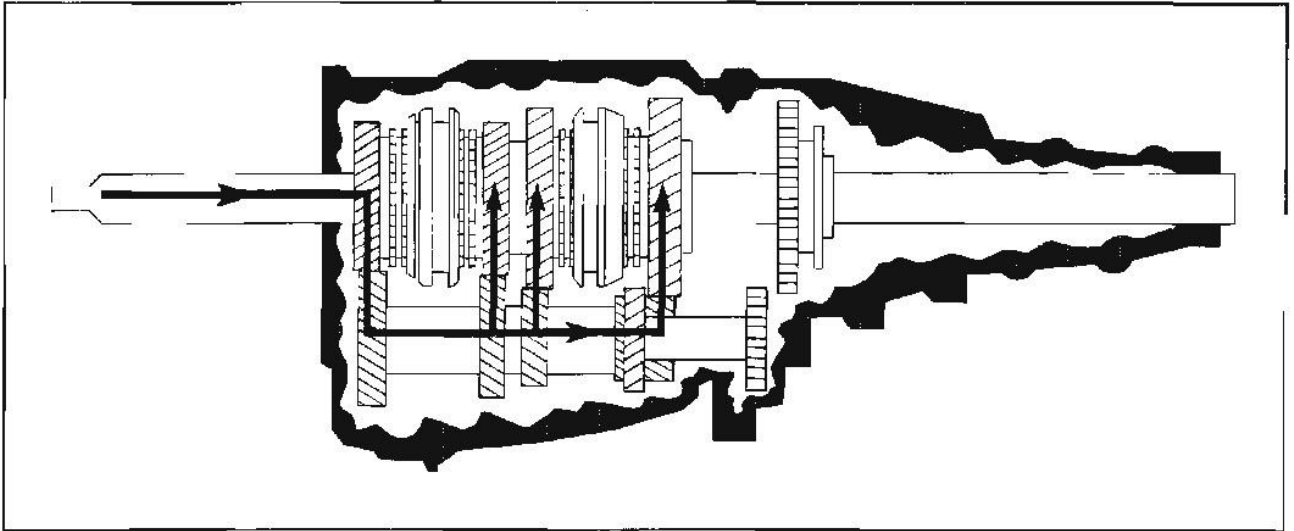


Fig. 7A-2 Four-Speed Synchromesh - Power Flow in Neutral

The first, second and third speed gears have press-fit bushings lining their inner bores which enable these gears to float freely on the mainshaft, while the reverse speed gear has splines on its inner bore to prevent the gear from rotating on the mainshaft but allow forward and rearward movement of this gear.

The two clutch assemblies are splined to the mainshaft so that they can impart torque to the mainshaft whenever they engage a rotating gear.

OPERATION

The main drive gear, third speed gear, second speed gear, first speed gear and reverse idler gears are in constant mesh with the countergear; therefore, with the engine running and the engine clutch engaged, torque is imparted to the main drive gear and through the countergear to the third, second, first, and reverse idler at all times.

OPERATION IN NEUTRAL (Fig. 7A-2)

In neutral, with engine clutch engaged, the main 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 (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.

OPERATION IN FIRST (Fig. 7A-3)

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.

OPERATION IN SECOND (Fig. 7A-4)

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.

OPERATION IN THIRD (Fig. 7A-5)

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

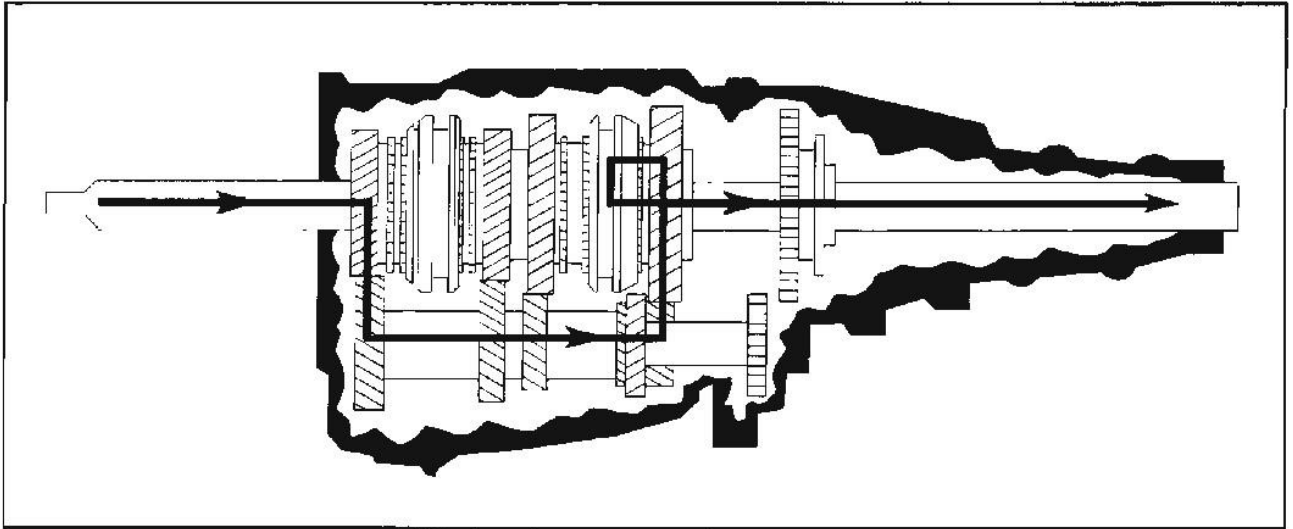


Fig. 7A-3 Four-Speed Synchromesh - Power Flow in First

imparted to the mainshaft from the third speed gear through the clutch assembly.

OPERATION IN FOURTH (Fig. 7A-6)

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.

OPERATION IN REVERSE (Fig. 7A-7)

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

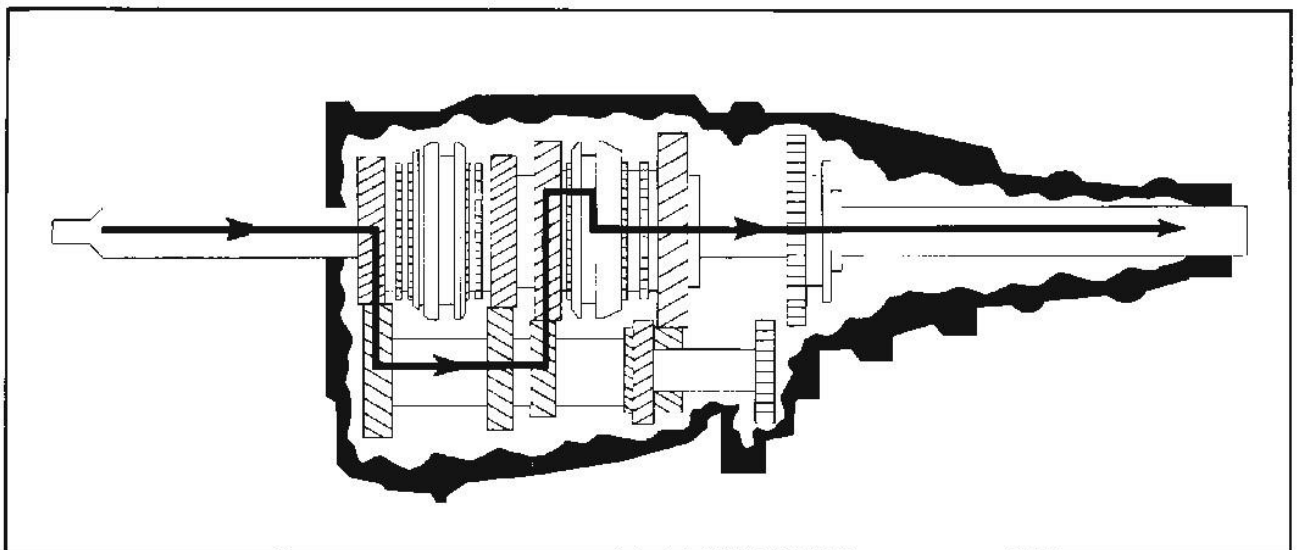


Fig. 7A-4 Four-Speed Synchromesh - Power Flow in Second Speed

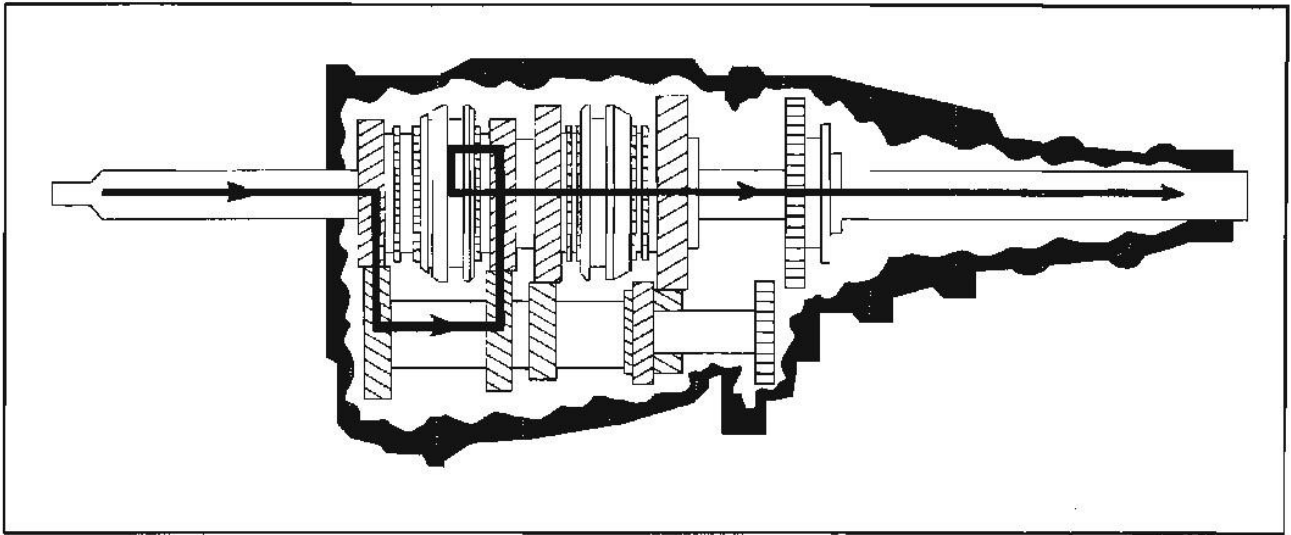


Fig. 7A-5 Four-Speed Synchromesh - Power Flow in Third Speed

PERIODIC SERVICE

TRANSMISSION

No periodic service of the transmission is required except checking for leaks and proper lubricant level every 60 days.

If there is evidence of leakage, the leak should be corrected and lubricant added, if needed. Refill capacity is 2.5 pints.

Remove filler plug at side of case and add SAE 90 "Multi-purpose Gear Lubricant". Lubricant level should be approximately level with bottom of filler plug hole. Install plug.

SHIFT CONTROL

No periodic service of the shift control is required. Certain parts are lubricated on assembly and require further lubrication only when parts become dry and sticky.

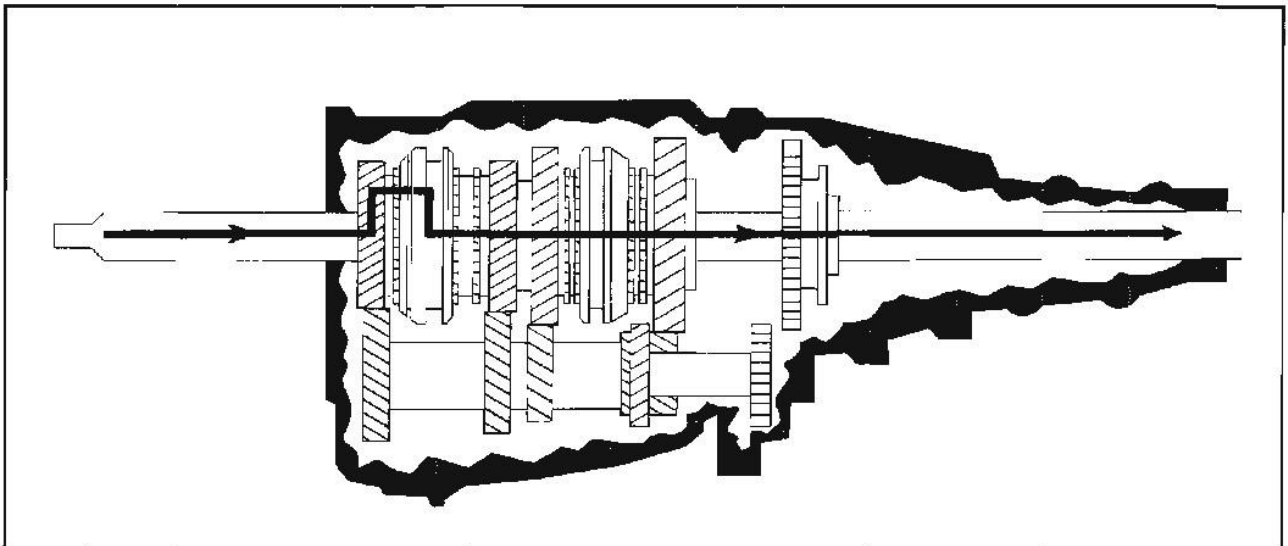


Fig. 7A-6 Four-Speed Synchromesh - Power Flow in Fourth Speed

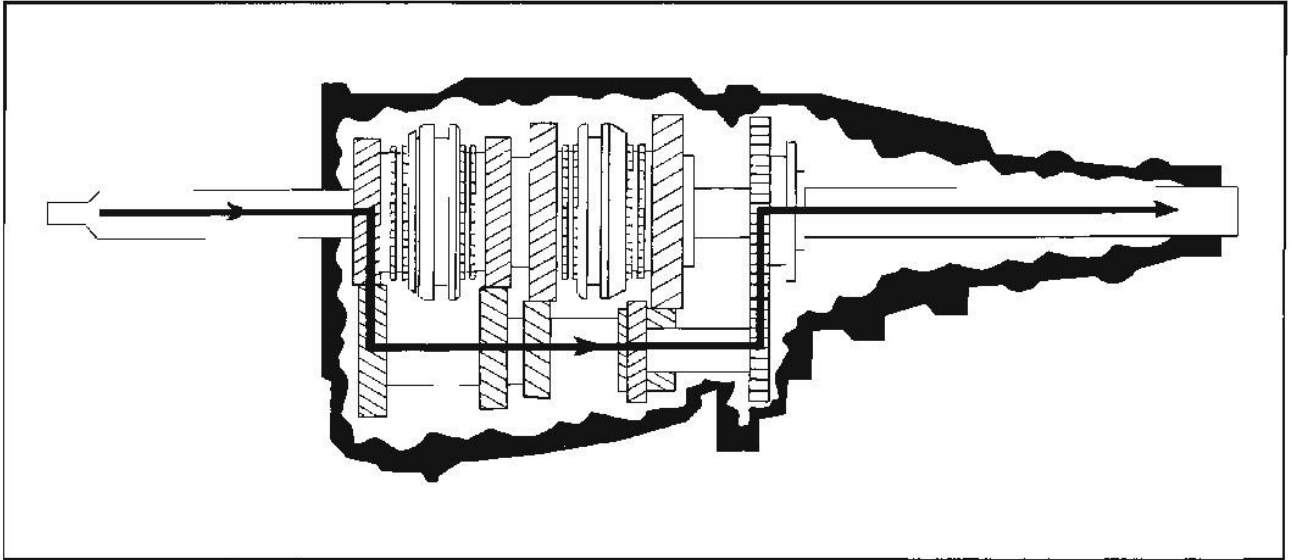


Fig. 7A-7 Four-Speed Synchromesh - Power Flow in Reverse

ADJUSTMENTS ON CAR

SHIFT LINKAGE ADJUSTMENTS (Fig. 7A-8)

NOTE: In cases where the linkage has been disconnected, lubricate linkage joints with chassis grease and assemble shift rods to transmission levers and bracket assembly control levers. Tighten swivel nuts finger tight.

1. Position selector lever in neutral position.
2. Loosen 3 swivel nut assemblies.
3. Insert 1/4 diameter gauge pin into bracket and lever assembly control levers and align them in neutral position.
4. Position levers on transmission in neutral position.
5. Tighten swivel nut assemblies to 8-12 lb. ft. torque.
6. Remove gauge pin.
7. Check complete shift pattern with engine off. Start engine and repeat complete shift pattern.

NOTE: If shift rod adjustments are made as outlined above and clutch lash is correct (see Section 6D) shifting should be smooth in and out of any

gear, with proper movement of selector lever by operator.

MINOR REPAIRS

SPEEDOMETER DRIVEN GEAR—REMOVE

1. Disconnect speedometer cable.
2. Remove retainer to housing bolt and lockwasher and remove retainer.
3. Insert screwdriver in slot in fitting and pry fitting gear and shaft from housing.
4. Pry "O" ring from groove in fitting.
5. Check gear, shaft and fitting for wear and replace, if necessary.

NOTE: Check for correct usage by referring to speedometer drive and driven gear usage chart in Section 1.

SPEEDOMETER DRIVEN GEAR—REPLACE

1. Install new "O" ring in groove of speedometer gear and sleeve assembly.

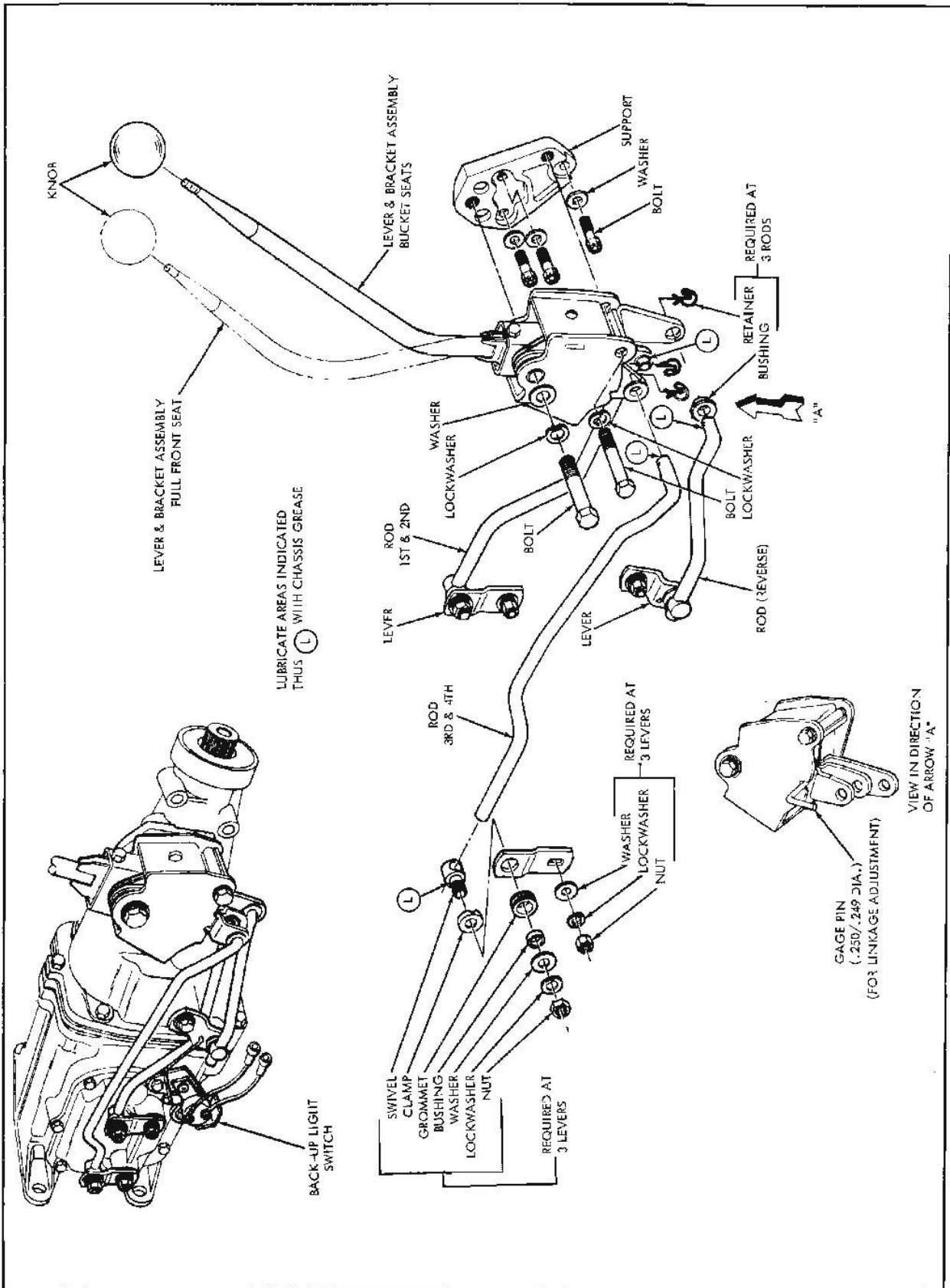


Fig. 7A-8 Gearshift Controls

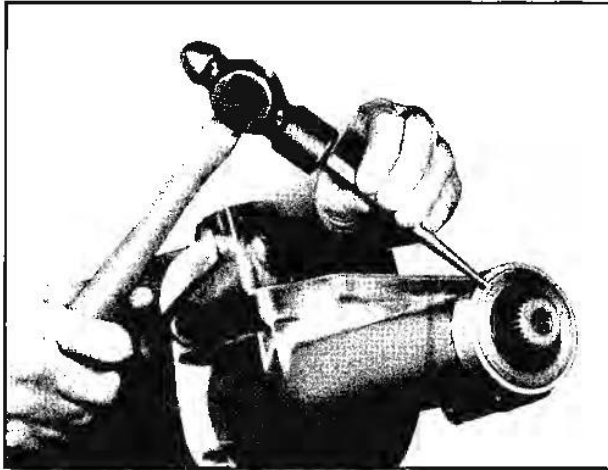


Fig. 7A-9 Removing Extension Oil Seal

2. Hold the assembly so slot is toward boss on housing and install in housing.

3. Push assembly into housing until retainer can be inserted into slot.

4. Install retainer bolt and lockwasher and tighten 35-60 lb. in. torque.

5. Connect speedometer cable to speedometer driven gear and sleeve assembly.

TRANSMISSION EXTENSION OIL SEAL— REMOVE AND REPLACE

To inspect or replace the rear extension oil seal, it is necessary to remove the propeller shaft drive line assembly from the vehicle.

1. Remove U-bolt nuts, lock plates and U-bolts from rear axle drive pinion flange.

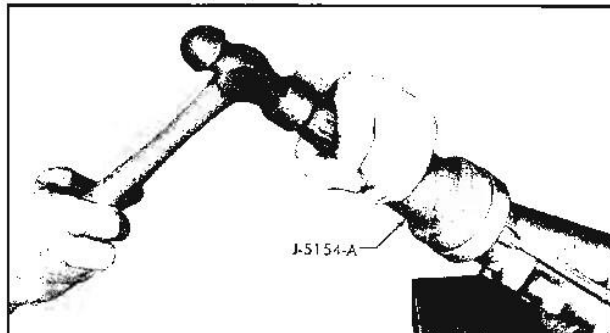


Fig. 7A-10 Installing Extension Oil Seal

2. Use suitable rubber band to hold bearings onto journals, if tie wire has been removed, to prevent loss of needle bearings when rear joint is disconnected.

3. Slide propeller shaft assembly rearward to disengage yoke from splines on transmission mainshaft.

4. Use punch or other suitable tool and loosen seal from extension and remove (Fig. 7A-9).

5. Wash counterbore with cleaning solvent and inspect for damage.

6. Inspect propeller shaft yoke for nicks, burrs or scratches which would cut new seal or cause seal to leak or damage bushing.

7. Coat new seal with sealing compound and press straight in bore of case extension with J-5154-A (Fig. 7A-10).

CAUTION: Do not excessively force the seal against the seat in the extension.

8. Install propeller shaft assembly by reversing steps 1 through 3 above. Coat outside diameter of yoke with gear lubricant before assembly.

TRANSMISSION SIDE COVER—REMOVE AND DISASSEMBLE

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 transmission case (Fig. 7A-11).

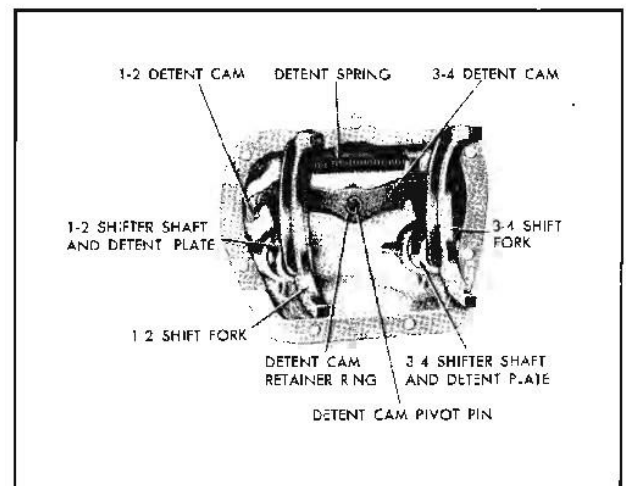


Fig. 7A-11 Transmission Side Cover Assy.

1. Remove drain plug at bottom of transmission and drain lubricant.
2. Disconnect control rods from levers (Fig. 7A-8).
3. Remove transmission side cover assembly from transmission case.
4. Remove the outer shift lever nuts and lock-washers and pull levers from shafts.
5. Carefully push the shift shafts into cover, allowing the detent balls to fall free, then remove both shifter shafts.
6. Remove interlock sleeve, interlock pin and poppet spring.
7. Inspect and replace necessary parts.

TRANSMISSION SIDE COVER—ASSEMBLE AND REPLACE

1. Install interlock sleeve and one shifter shaft, positioning shift fork retaining hole toward flat, or top side, of cover.
2. Line up center, or neutral, groove of shifter shaft with interlock sleeve.
3. Place steel detent ball into sleeve followed by poppet spring and interlock pin.
4. Start second shifter shaft into position and place second detent ball on poppet spring. Compress ball and spring with screwdriver and, with center groove lined up with detent ball, push the shifter shaft fully in.
5. Install shifter levers on outer ends of shifter shafts.
6. With transmission in neutral and shifter forks and levers in place, lower side cover into place (Fig. 7A-12). Install attaching bolts and tighten evenly to 10-20 lb. ft. torque.
7. Remove filler plug at side of transmission and add 2.5 pints of SAE 90 "Multi-Purpose Gear Lubricant". Lubricant level should be approximately level with bottom of filler plug hole. Install plug.

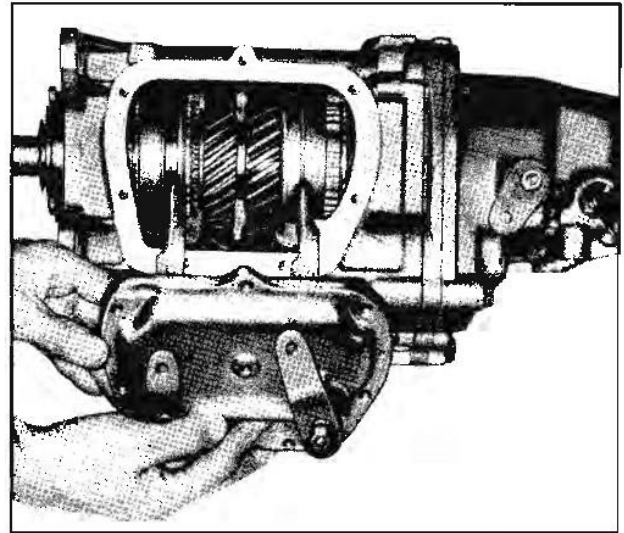
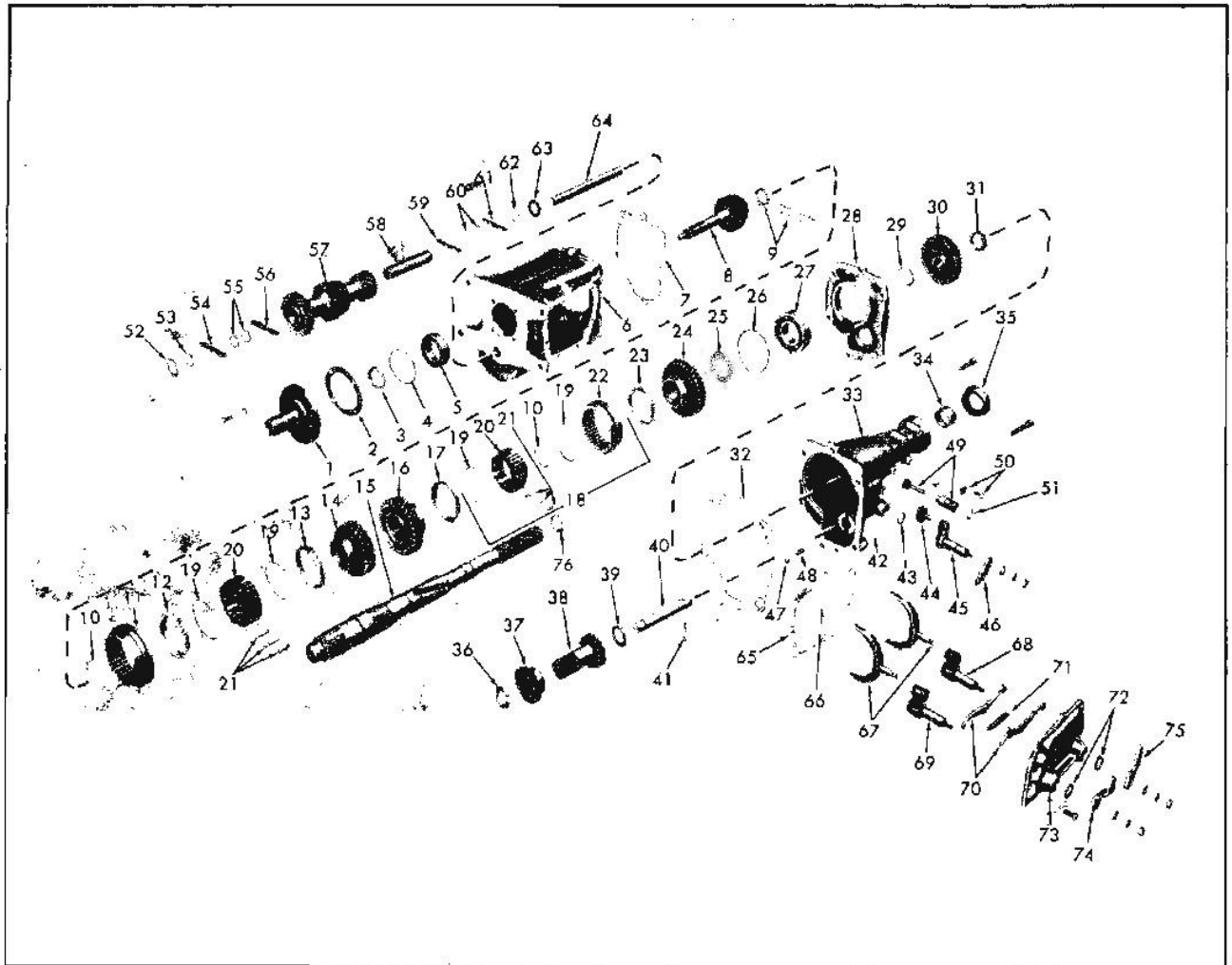


Fig. 7A-12 Installing Side Cover Assembly

MAJOR REPAIRS

TRANSMISSION—REMOVE AND OVERHAUL

1. Remove drain plug at bottom of transmission and drain lubricant.
2. Disconnect the speedometer cable from speedometer driven gear fitting and disconnect back-up light leads from back-up light switch (Fig. 7A-8).
3. Disconnect shift control rods from shifter levers. Remove two lever and bracket to extension support screws and remove manual shift lever and bracket.
4. Remove propeller shaft drive line assembly.
 - a. Remove U-bolt nuts, lock plates and U-bolts from rear axle drive pinion flange.
 - b. Use a suitable rubber band to hold bearing onto journals, if the wire has been removed, to prevent loss of needle bearings when rear joint is disconnected.
 - c. Remove complete drive line assembly by sliding rearward to disengage yoke from splines on transmission mainshaft.
5. Support rear of engine and remove two transmission extension insulator to cross member support retaining bolts. (See Fig. 6-14, 6 cyl., Fig. 6-94, 8 cyl.)



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

Fig. 7A-13. Four-Speed Synchromesh Transmission - Exploded View

6. Remove the two top transmission to clutch housing bolts and insert two transmission aligning studs in these holes, J-1126.

NOTE: The use of two aligning studs during this operation will support the transmission and prevent damage to the clutch disc through springing.

7. Remove the two lower transmission to clutch housing bolts.

8. Tilt rear of extension upward to disengage bracket studs from cross member support and withdraw transmission from clutch housing.

9. Remove the transmission.

TRANSMISSION—DISASSEMBLE

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 3 through 6 under TRANSMISSION SIDE COVER - REMOVE AND DISASSEMBLE.

2. Remove insulator assembly from transmission rear extension.

3. Remove four bolts from front bearing retainer and remove retainer and gasket.

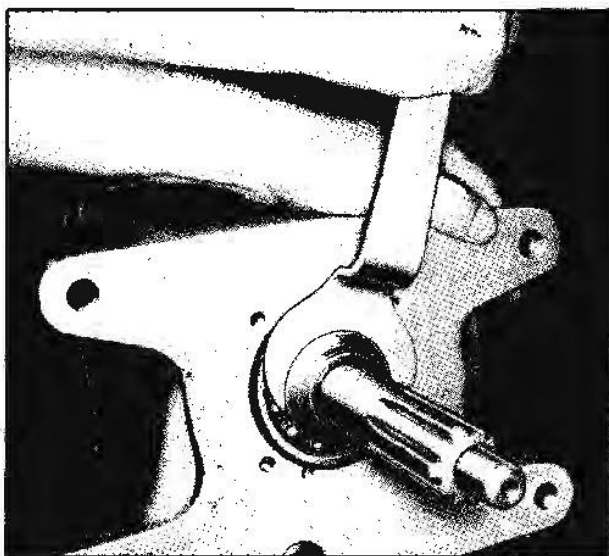


Fig. 7A-14 Removing or Replacing Main Drive Gear Retaining Nut

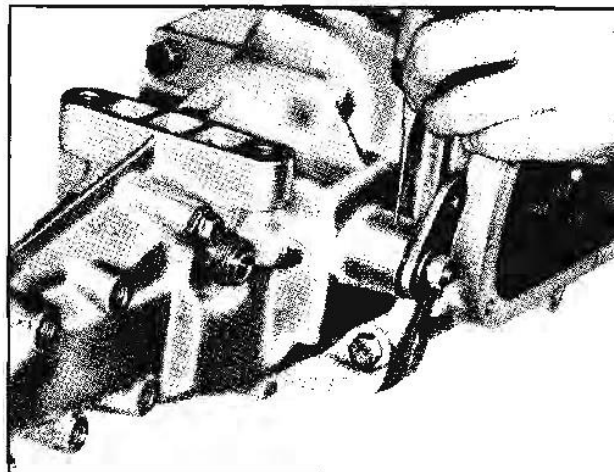


Fig. 7A-15 Removing Shifter Shaft Lock Pin

4. Remove the main drive gear retaining nut (Fig. 7A-14) using tool J-0933 after locking up transmission by shifting into two gears.

NOTE: Nut has left hand threads.

5. With transmission gears in neutral, drive lock pin from bottom side of reverse shift lever boss and pull shaft out about 1/8". This disengages the reverse shift fork from reverse gear (Fig. 7A-15).

6. Remove six bolts attaching the case extension to the rear bearing retainer. Tap extension with soft hammer in a rearward direction 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.

7. The rear section of the reverse idler gear, shaft and tang thrust washer may now be removed.

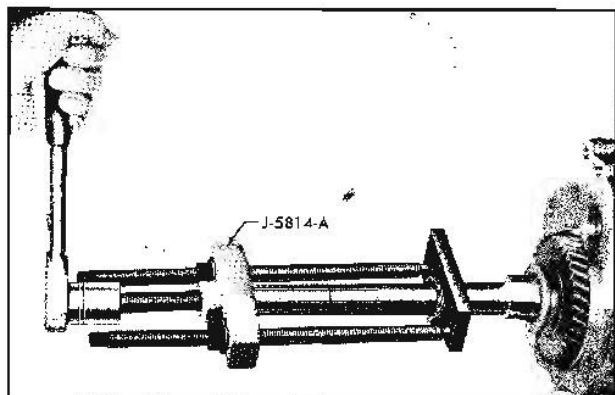


Fig. 7A-16 Removal of Speedometer Drive Gear

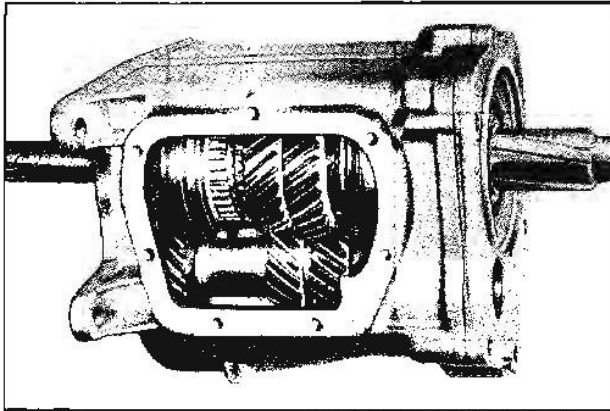


Fig. 7A-17 3-4 Speed Synchronizer Clutch Sleeve in 4th Gear

8. Remove special snap ring from rear spline of mainshaft.

9. Remove speedometer drive gear with J-5814-A as shown in Fig. 7A-16.

10. Slide 3-4 synchronizer clutch sleeve to 4th speed position (forward) (Fig. 7A-17).

11. Carefully remove the rear bearing retainer and entire mainshaft assembly from the case by tapping bearing retainer with a soft hammer.

12. Unload 17 bearing rollers and cage from main drive gear and remove fourth speed synchronizing ring.

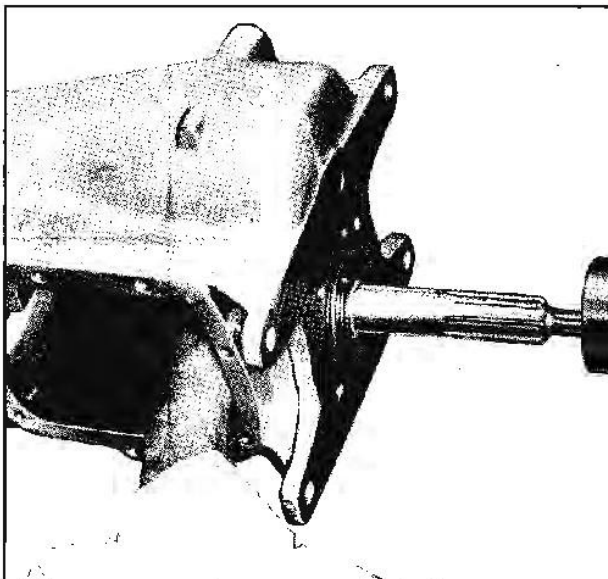


Fig. 7A-18 Removing Main Drive Gear from Front Bearing

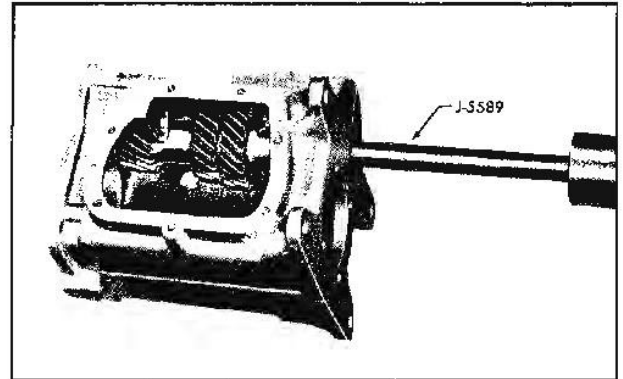


Fig. 7A-19 Removal of Countershaft

13. Lift the front reverse idler gear and thrust washer from case.

14. With soft hammer, tap main drive gear down from front bearing as shown in Fig. 7A-18.

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

16. From the front of the case, tap out the countershaft, using loader J-5589, as shown in Fig. 7A-19. Remove the countergear and both tanged washers. Remove loader J-5589 from countergear.

17. Remove the 80 rollers, six .050" spacers and roller spacer from countergear (Fig. 7A-13).

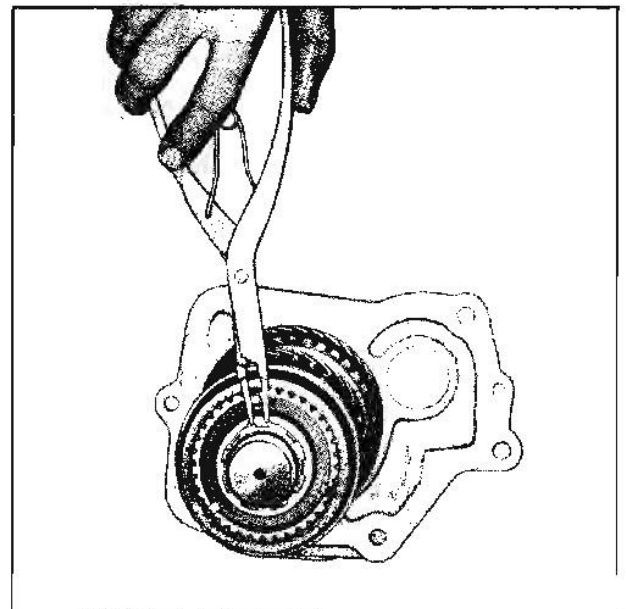


Fig. 7A-20 Removing or Replacing Mainshaft Front Snap Ring

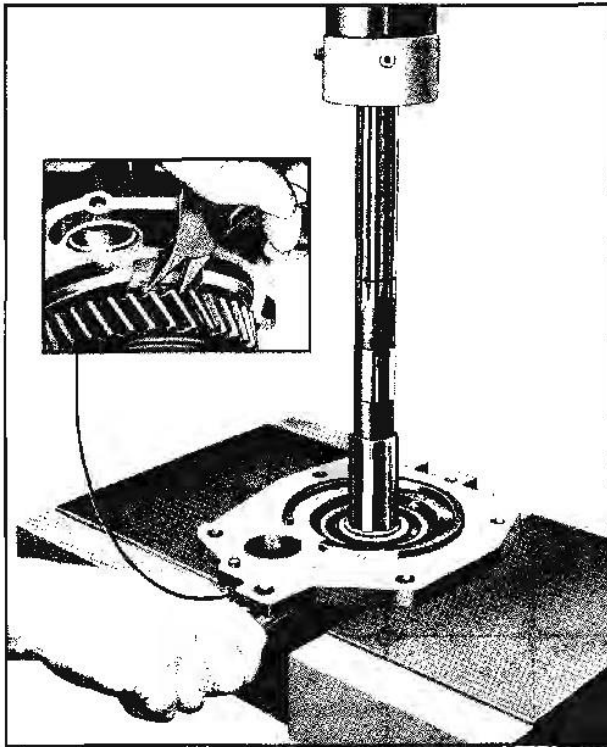


Fig. 7A-21 Removal of Mainshaft from Rear Bearing Retainer

18. Remove mainshaft front snap ring, as shown in Fig. 7A-20, and slide third and fourth speed clutch assembly, third speed gear and synchronizing ring, from front of mainshaft.

19. Spread rear bearing retainer snap ring and press mainshaft out of the retainer (Fig. 7A-21).

20. Remove the mainshaft rear snap ring. Support first and second speed clutch assembly, as shown in Fig. 7A-22, and press on rear of mainshaft to remove shaft from rear bearing, first speed gear thrust washer, first speed gear and synchronizing ring.

21. Remove 1-2 speed synchronizer clutch assembly retaining snap ring, Fig. 7A-23, and remove 1-2 synchronizer assembly, second speed synchronizer ring and second speed gear from mainshaft.

REVERSE SHIFTER SHAFT AND SEAL— REMOVE AND REPLACE

1. With case extension removed from transmission the reverse shift shaft lock pin will already be removed. (See Step 5 under Disassembly).

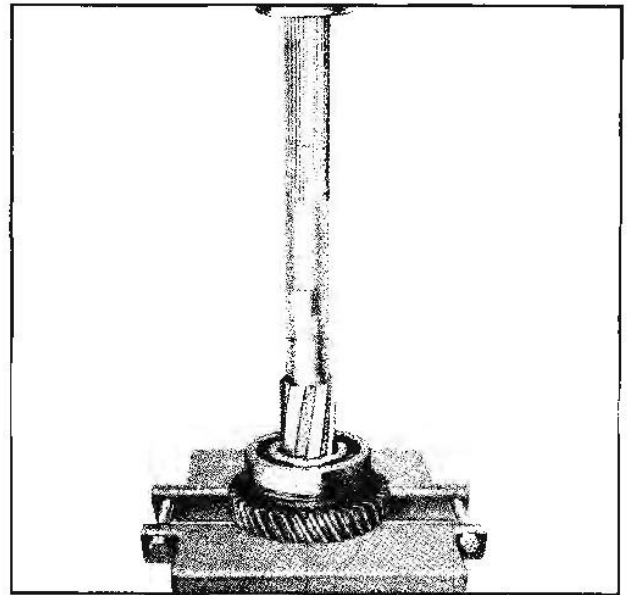


Fig. 7A-22 Removing Mainshaft From Rear Bearing and First Speed Gear

2. Remove shift fork.

3. Carefully drive shift 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 from inside of extension, install shifter shaft

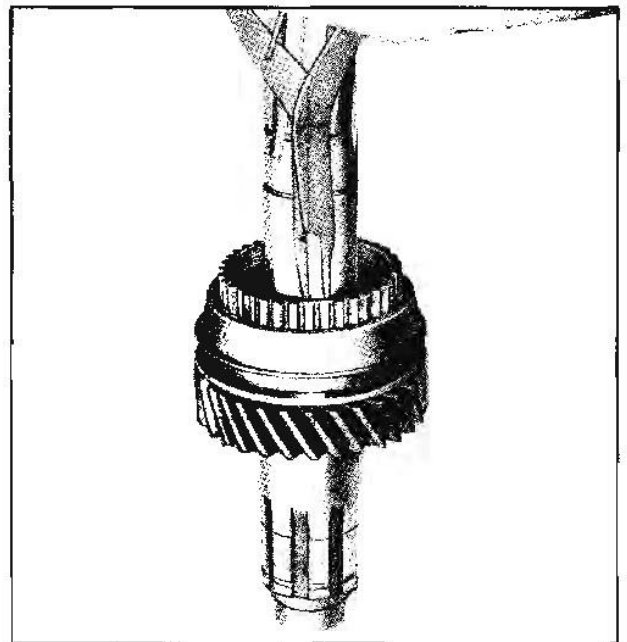


Fig. 7A-23 Removing 1-2 Speed Synchronizer Clutch Assy. Retainer Snap Ring

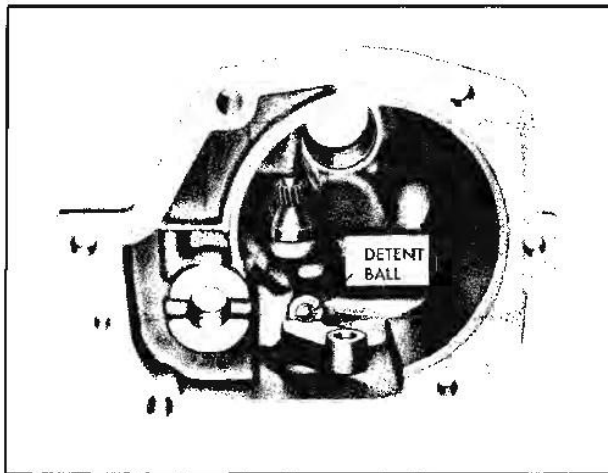


Fig. 7A-24 Installing Reverse Shifter Shaft

fully into its opening until the detent plate is butted against inside of extension housing.

5. Place detent ball on spring and, holding ball down with a suitable tool, push the shift shaft into place and turn until the ball drops into place in detent on the shaft detent plate (Fig. 7A-24).

6. Install shift fork.

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

TRANSMISSION EXTENSION CASE BUSHING AND OIL SEAL—REMOVE & REPLACE

1. Remove oil seal with punch or other suitable tool (Fig. 7A-9).

2. Using tool J-6399, drive bushing forward into case extension (Fig. 7A-25).

3. Drive new bushing in from rear of case extension with same tool (J-6399), until end of bushing is slightly below counterbore for oil seal.

4. Coat I.D. of bushing with transmission oil, and new seal with sealing compound and start straight in bore of case extension. Using installer J-5154-A tap seal into extension case (Fig. 7A-10).

CAUTION: Do not excessively force the seal against the seat in the extension.

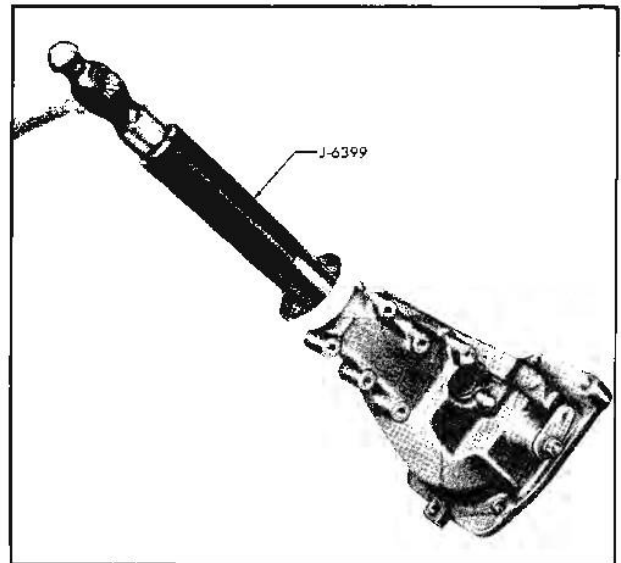


Fig. 7A-25 Removing or Installing Extension Case Bushing

CLUTCH KEYS AND SPRING—REMOVE AND REPLACE

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 the 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.

CLEANING AND INSPECTION

TRANSMISSION CASE

Wash the transmission case inside and out with a cleaning solvent and inspect for cracks. Inspect the front face which fits against clutch housing for burrs and if any are present, dress them off with a fine cut mill file.

FRONT AND REAR BEARINGS

1. Wash the front and rear bearing thoroughly in a cleaning solvent.

2. Blow out bearings with compressed air.

CAUTION: Do not allow the bearings to spin, 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.

BEARING ROLLERS AND SPACERS

All main drive gear and countergear 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 spacers.

GEARS AND BUSHING

Inspect all gears and first speed gear bushing and, if necessary, replace all that are worn or damaged.

REVERSE IDLER

1. The bushings used in the idler gear are pressed into the gear then peened into holes in the bores, and are bored in place. This insures the positive alignment of the bushings and their shafts, as well as proper meshing of the gears. Because of the high degree of accuracy to which these parts are machined, the bushings are not serviced separately.

2. Check bushings for excessive wear by using a narrow feeler gauge between the shaft and the bushing or use a micrometer. The proper clearance is from .003" to .005".

TRANSMISSION—ASSEMBLE

Mainshaft Assembly

1. From the rear of the mainshaft, assemble the second speed gear (with hub of gear toward rear of shaft).

2. Install 1-2 Synchronizer clutch assembly to mainshaft (sliding clutch sleeve taper toward the rear, hub to the front); together with a synchronizing ring on either side so their keyways line up with the clutch keys (Fig. 7A-26). Install smaller of two

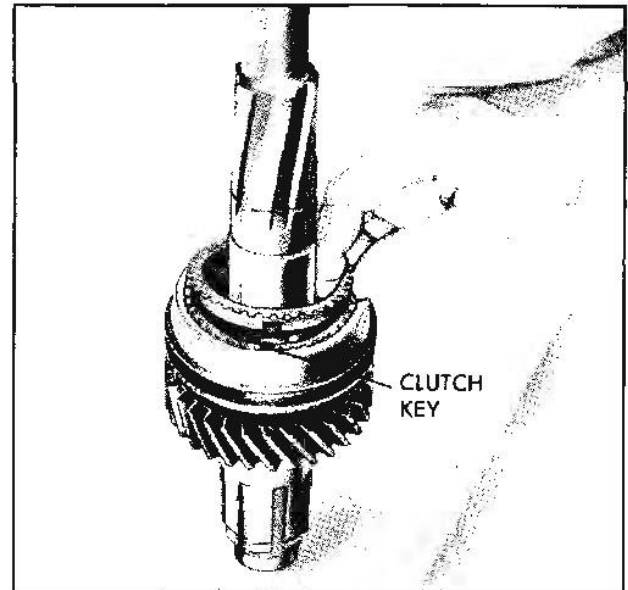


Fig. 7A-26 Installing Synchronizer Ring

synchronizer retaining snap rings to mainshaft with ends of snap ring behind spline teeth.

3. Install the first speed gear (with hub toward front) and first speed gear thrust washer.

4. Using 1-5/8" I.D. pipe cut to a suitable length, press on the rear bearing with the snap ring groove toward the front of the transmission (Fig. 7A-27).

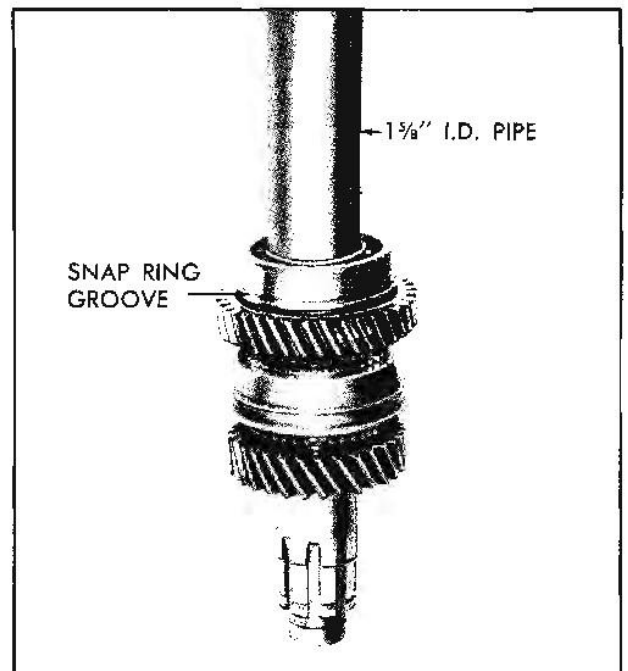


Fig. 7A-27 Installing Rear Bearing

5. Choose the correct selective fit snap ring (.084", .087", .090", .093", or .096") and install it in the groove in mainshaft behind the rear bearing. With proper ring, maximum distance between snap ring and rear face of bearing will be from zero to .005".

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

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

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

8. Install snap ring in the groove in mainshaft in front of the third and fourth speed clutch assembly, with ends of snap ring seated behind spline teeth.

9. Install the rear bearing retainer (Fig. 7A-28). Spread the snap ring in the plate to allow the snap ring to drop around the rear bearing and press on

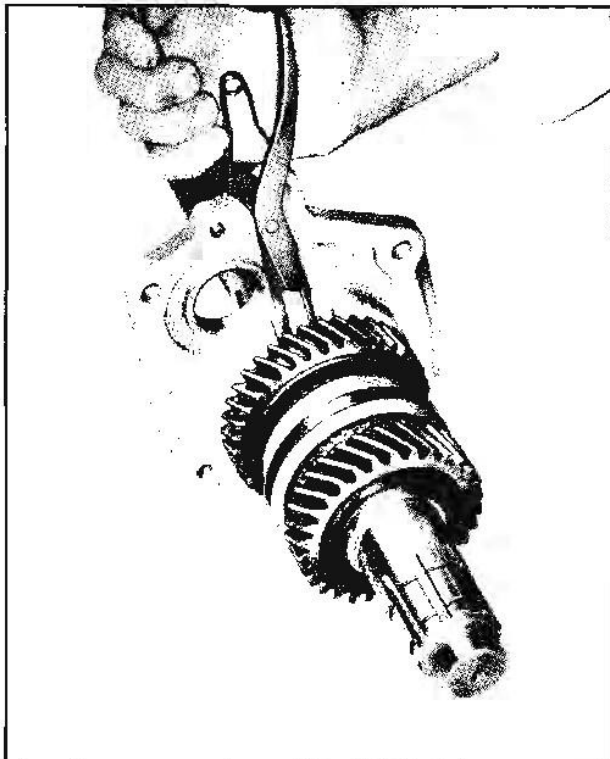


Fig. 7A-28 Installing Rear Bearing Retainer

the end of the mainshaft until the snap ring engages the groove in the rear bearing.

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

11. Press speedometer drive gear onto the mainshaft using a suitable press plate. Position the speedometer gear to get a measurement of 4-5/16" from the forward side of the gear to the flat surface of the rear bearing retainer (Fig. 7A-29) or until centered on the mainshaft speedometer drive gear boss.

CAUTION: Make certain correct speedometer drive gear is installed. Refer to Speedometer Gear Usage Chart in Section I.

12. Install special snap ring in groove at rear spline of mainshaft (Fig. 7A-13).

Countergear 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 (Fig. 7A-30).

3. Insert tool J-5589 into countergear.

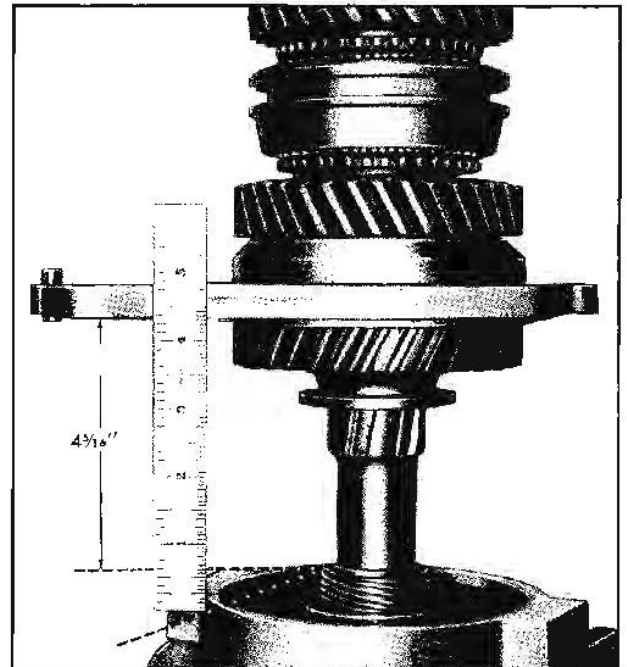


Fig. 7A-29 Installing Speedometer Drive Gear

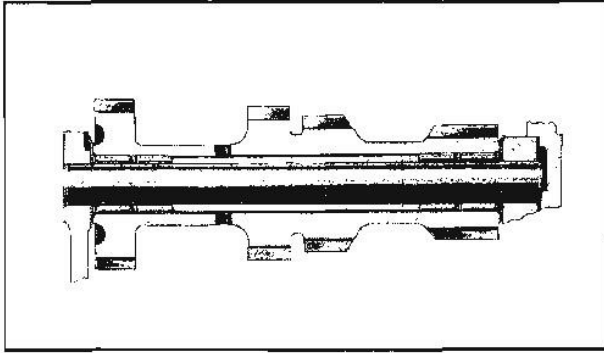


Fig. 7A-30 Cross-Section of Countergear Assembly

Transmission Assembly

1. Rest the transmission case on its side with the side cover opening toward the assembler. Put countergear tanged thrust washers in place, retaining them with heavy grease, making sure the tangs are resting in the notches of the case.

2. Set countergear in place in bottom of transmission case, making sure that tanged thrust washers are not knocked out of place.

3. Position the transmission case resting on its front face.

4. Lubricate and insert countershaft in rear of case. Turn countershaft so flat on end of shaft is horizontal and facing bottom of case.

NOTE: The flat on shaft must be horizontal and toward the bottom to mate with rear bearing retainer when installed.

5. Align countergear with shaft in rear and hole in front of case, and press countershaft into case (pushing assembly tool out front of case) until flat on shaft is flush with rear of case. Be sure thrust washers remain in place (Fig. 7A-31).

6. Attach a dial indicator as shown in Figure 7A-32 and check end play of the countergear. If end play is greater than .025" new thrust washers must be installed.

7. Install the seventeen roller bearings into main drive gear, using heavy grease to hold the bearings and cage in place.

8. Install main drive gear and pilot bearings through the side cover opening and into position in transmission front bore.

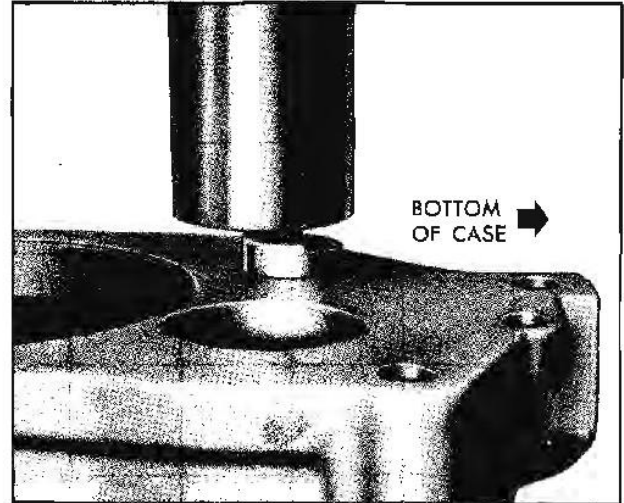


Fig. 7A-31 Installing Countershaft

9. Place gasket in position on front face of rear bearing retainer.

10. Install the 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 (tanged) on the machined face of the ear cast in the case for the reverse idler shaft and hold with heavy grease. Position the front reverse idler gear next to the thrust washer, with the hub facing toward rear of the case.

CAUTION: Before attempting to install mainshaft assembly to case, slide the 3-4 synchronizing clutch sleeve forward into fourth speed detent position (Fig. 7A-17).

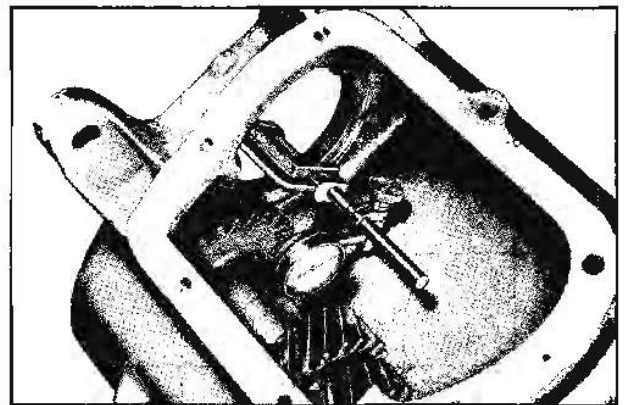


Fig. 7A-32 Checking Countergear End Play

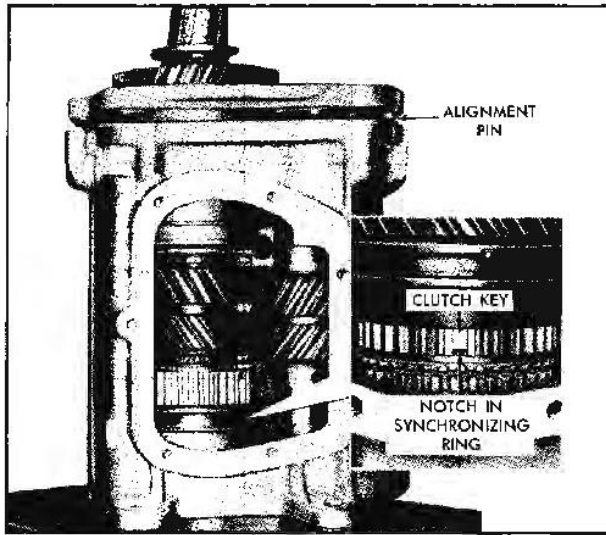


Fig. 7A-33 Installing Mainshaft Assembly

12. Lower the mainshaft assembly into the case making certain the notches on the fourth speed synchronizing ring correspond to the keys in the clutch assembly (Fig. 7A-33).

13. With the guide pin in rear bearing retainer aligned with hole in rear of case, tap rear bearing retainer into position with a soft hammer.

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

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

16. Install the remaining flat thrust washer on reverse idler shaft. If new idler shaft is being used, drive out the roll pin and press it into new shaft.

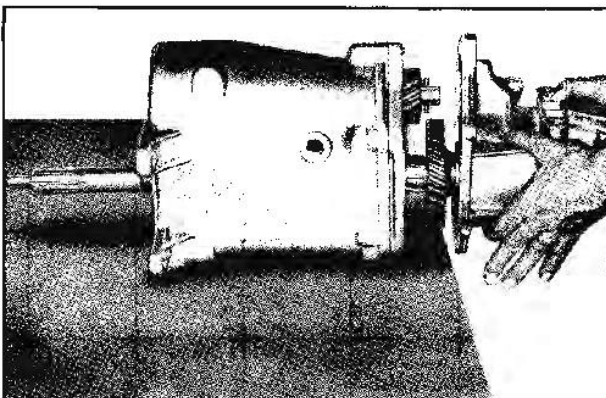


Fig. 7A-34 Installing Case Extension

17. Install reverse idler shaft, roll pin, and thrust washer into gears and front boss of case. Make sure to pickup front tanged thrust washer.

NOTE: Roll pin should be in a vertical position.

18. Position reverse gear at rear of spline, pull reverse shifter shaft to left side of extension and rotate shaft to bring reverse shift fork forward in extension (reverse detent position). Start the extension onto the transmission case (Fig. 7A-34), while slowly pushing in on the shifter shaft to engage the shift fork with the reverse gear shift collar. Then pilot the reverse idler shaft into the extension housing permitting the extension to slide onto the transmission case.

19. Install 6 extension and retainer-to-case attaching bolts. Torque upper 3 bolts to 15-25 ft. lbs.; lower 3 bolts to 25-35 ft. lbs.

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. Press bearing onto main drive gear (snap ring groove to front) and into case until several main drive gear retaining nut threads are exposed.

22. Lock transmission up by shifting into two gears. Install main drive gear retaining nut on the gear shaft and draw it up tight using tool J-0933. Be sure bearing fully seats against shoulder on gear. Torque retaining nut to 40 ft. lbs. and lock in place by staking securely into main drive gear shaft hole with a center punch. Care must be used to avoid damaging the threads on the shaft.

23. Install the main drive gear bearing retainer, gasket and four attaching bolts using a suitable sealer on bolts. Torque to 14 to 22 ft. lbs.

24. Shift mainshaft 3-4 sliding clutch sleeve into neutral position and 1-2 sliding clutch sleeve into second gear (forward) detent position. Shift side cover 3-4 shifter lever into neutral detent and 1-2 shifter lever into second gear detent position.

25. Install side cover gasket and carefully position side cover into place. There is a dowel pin in the cover to assure proper alignment with the case. Install attaching bolts and tighten evenly to avoid side cover distortion. Torque to 14-22 ft. lbs.

26. Install insulator assembly on rear extension. Torque bolts to 25-35 lb. ft.

27. If lever and bracket support to extension was removed, reinstall tightening 3 bolts 20-35 lb. ft. torque.

TRANSMISSION—INSTALL IN VEHICLE

1. Raise transmission until rear extension can be moved rearwards over center cross member support.

NOTE: If it was necessary to remove cross member support before removing transmission, install support while transmission is held in a raised position.

2. Move transmission forward until extension bracket studs engage holes in cross member support and main drive gear shaft enters clutch housing. Care should be taken to make certain clutch release bearing remains seated.

3. Install aligning stud J-1126 in lower right transmission to clutch housing bolt hole for alignment.

4. Install two upper transmission to clutch housing mounting bolts and washers and tighten securely to 45-60 lb. ft. torque. Remove aligning stud and install two lower mounting bolts and washers and tighten 45-60 lb. ft. torque.

5. Install rear extension to cross member support insulator and tighten bolts 25-35 lb. ft. torque.

6. Install propeller shaft drive line assembly by reversing steps a. through c. under TRANSMISSION
--REMOVE FROM VEHICLE.

7. Install manual shift lever and secure shift bracket to transmission rear extension support with two bracket to extension bolts. Tighten upper bolt 40-55 lb. ft. torque. Tighten lower bolt 20-35 lb. ft. torque.

8. Connect shift rods to shift bracket at rear extension. See Gearshift Linkage Adjustment Page 7A-6.

9. Connect speedometer cable to speedometer driven gear and tighten securely.

10. Connect back-up light leads to back-up light switch leads, using female connectors.

11. If rubber boot or console was removed, slide rubber boot with metal boot retainer over shift stick and secure to floor plate with six metal screws. Install console. (See Fig. 7-11, Section 7 for exploded view of console.)

12. Remove filler plug at side of transmission and add 2.5 pints of SAE 90 "Multi-purpose Gear Lubricant". Lubricant level should be approximately level with bottom of filler plug hole. Install plug.

13. Check shift pattern and adjust as required.

TROUBLE DIAGNOSIS AND TESTING

TROUBLE	REMEDY
SLIPS OUT OF HIGH GEAR	
a. Transmission loose on clutch housing.	a. Tighten mounting bolts
b. Does not fully engage.	b. Adjust threaded clevis on each shift rod until proper adjustment is attained.
c. Damaged mainshaft pilot bearing.	c. Replace pilot bearing.
d. Main drive gear bearing retainer broken or loose.	d. Tighten, or replace main drive gear bearing retainer.
e. Dirt between transmission case and clutch housing.	e. Clean mating surfaces.
f. Misalignment of transmission.	f. Shim between transmission case and clutch housing.

TROUBLE	REMEDY
SLIPS OUT OF REVERSE GEAR	
a. Reverse gear damaged from operating at part engagement.	a. Determine cause. For example: worn shift fork and control lever or rod interference. Replace worn or bent parts.
b. Improperly adjusted linkage.	b. Adjust linkage.
NOISY IN ALL GEARS	
a. Insufficient lubricant.	a. Fill to correct level.
b. Worn countergear bearings.	b. Replace countergear bearings and shaft.
c. Worn or damaged main drive gear and countergear.	c. Replace worn or damaged gears.
d. Damaged main drive gear or mainshaft ball bearings.	d. Replace damaged bearings or gear.
NOISY IN HIGH GEAR	
a. Damaged main drive gear bearing.	a. Replace damaged bearing.
b. Damaged mainshaft bearing.	b. Replace damaged bearing.
NOISY IN THIRD GEAR	
a. Damaged or worn third speed constant mesh gears.	a. Replace damaged gears.
b. Worn or damaged countergear rear bearings.	b. Replace countergear bearings and shaft.
NOISY IN SECOND GEAR	
a. Damaged or worn second speed constant mesh gears.	a. Replace damaged gears.
b. Worn or damaged countergear rear bearings.	b. Replace countergear bearings and shaft.
NOISY IN FIRST GEAR	
a. Damaged or worn first speed constant mesh gears.	a. Replace damaged gears.
b. Worn or damaged countergear rear bearings.	b. Replace countergear bearings and shaft.

TROUBLE	REMEDY
NOISY IN REVERSE ONLY	
a. Worn or damaged reverse idler gear.	a. Replace reverse idler gear assembly.
b. Worn reverse idler bushings.	b. Replace reverse idler gear assembly.
c. Damaged or worn reverse speed gear.	c. Replace reverse gear.
NOISY IN NEUTRAL WITH ENGINE RUNNING	
a. Damaged main drive bearing.	a. Replace damaged bearing.
NOISY IN ALL REDUCTION GEARS	
a. Insufficient lubricant.	a. Fill to correct level.
b. Worn or damaged main drive gear or counter-gear.	b. Replace faulty or damaged gears.
EXCESSIVE BACKLASH IN SECOND ONLY	
a. Second speed gear bearing thrust washer worn.	a. Replace bearing thrust washer.
b. Mainshaft rear bearing not properly installed in retainer.	b. Replace bearing, snap ring or retainer as necessary.
c. Worn countergear rear bearings.	c. Replace countergear bearings and shaft.
EXCESSIVE BACKLASH IN ALL REDUCTION GEARS	
a. Worn countergear bushings.	a. Replace countergear.
b. Excessive end play in countergear.	b. Replace countergear thrust washers.
LEAKS LUBRICANT	
a. Excessive amount of lubricant in transmission.	a. Drain to correct level.
b. Loose or broken main drive gear bearing retainer.	b. Tighten or replace retainer.
c. Main drive 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. Countershaft loose in case.	f. Replace case.

TRANSMISSION SPECIFICATIONS

The car serial number is located on top of the transmission at the rear bearing retainer.

The transmission face, clutch housing and block are accurately squared in production so that each unit may be interchanged as necessary. Special alignment of these assemblies is not necessary if they are installed properly.

Shift Positions	Gear Ratios
First	2.56
Second	1.91
Third	1.48
Fourth	1.00
Reverse	2.64
Lubricant Capacity	2.5 pints

TORQUE SPECIFICATIONS

	I.b. Ft.
Main Drive (Clutch) Gear Retainer Bolts . . .	14-22
Side Cover Bolts	14-22
Extension to Case Bolts (3 Upper)	15-24
Extension to Case Bolts (3 Lower)	25-35
Shift Lever to Shifter Shaft Nuts	14-22
Transmission Filler Plug	25-35
Lever and Bracket Support to Extension Bolts	20-35
Lever and Bracket Assembly to Support Bolt (Upper)	40-55
Lever and Bracket Assembly to Support Bolt (Lower)	20-35
Rear Extension to Cross Member Support Insulator Bolts	25-35
Transmission to Clutch Housing Bolts . . .	45-60
Transmission Control Rod to Transmission Lever Nuts	8-12
	Lb. In.
Speedometer Driven Gear Retainer to Transmission Screw	35-60
Speedometer Cable to Driven Gear Nut . .	40-50

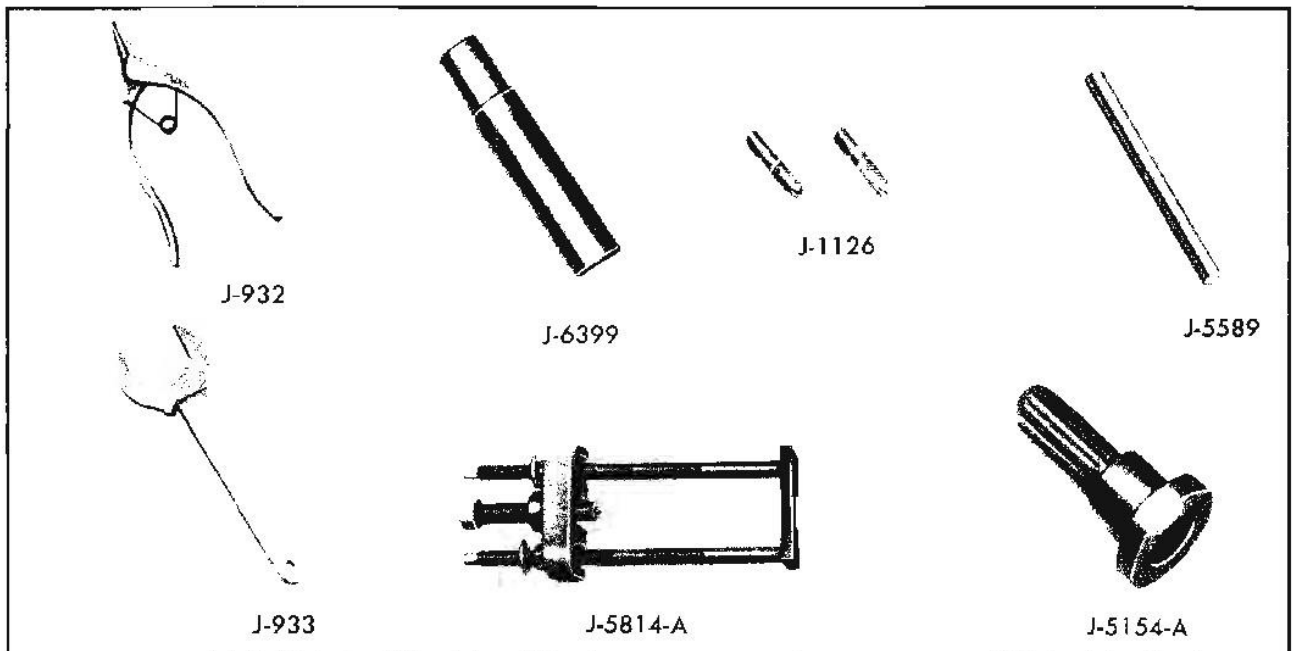


Fig. 7A-35 Four-Speed Transmission Special Tools

SPECIAL TOOLS

J-932	Snap Ring Pliers	J-5589	Countershaft Bearing Loader
J-933	Clutch Gear Retainer Nut Wrench	J-6399	Rear Bearing Extension Bushing—Remove and Replace
J-1126	Aligning Studs	J-5814-A	Speedometer Drive Gear Remover
J-5154-A	Transmission Extension Oil Seal Installer		