THREE-SPEED MANUAL TRANSMISSION

X & A SERIES

CONTENTS

DESCRIPTION

3-SPEED MANUAL TRANSMISSION

The "X" & "A" Series cars have a three-speed manually operated transmission with all forward gears synchronized. All forward speed changes are accomplished with synchronizer sleeves. See Figure 7B-1. The synchronizers permit quicker shifts, greatly reduce gear clash, and permit down shifting from third to second between 40-20 MPH and from second to first below 20 MPH.

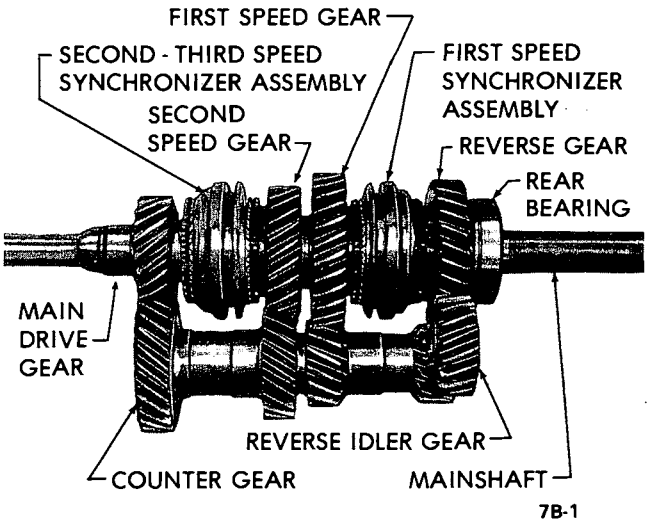


Figure 7B-1-Gear Synchronizers

DIAGNOSIS

TROUBLE DIAGNOSIS

Complaint	Probable Cause
Noisy in Forward Speeds	1. Low lubricant level. 2. Incorrect lubricant. 3. Transmission misaligned or loose. 4. Main drive gear bearing worn or damaged. 5. Counter gear or needle roller bearings worn or damaged. 6. Main drive gear worn or damaged. 7. Blocking rings worn or damaged.

Complaint	Probable Cause
Noisy in "Reverse"	1. Reverse idler gear or shaft, worn or damaged. 2. Reverse gear worn or broken.
Hard Shifting	1. Clutch improperly adjusted. 2. Shift linkage out of adjustment. 3. Bent, damaged or loose shift linkage. 4. Shift levers, shafts or forks worn. 5. Incorrect lubricant. 6. Blocking rings worn or broken.
Jumping Out of Gear	1. Shaft linkage out of adjustment, worn or loose. 2. Partial engagement of gear. 3. Transmission misaligned or loose. 4. Bent or worn shift fork, lever and/or shaft. 5. Worn pilot bearing. 6. End play in main drive gear rear bearing retainer loose or broken, loose or worn bearings on main drive gear and output shafts). 7. Detent cam spring weak. 8. Detent cam notches worn. 9. Worn clutch teeth on main drive gear and/or worn clutch teeth on synchronizer sleeve. 10. Worn or broken blocking ring. 11. Bent output shaft.
Sticking in Gear	1. Clutch not releasing fully. 2. Low lubricant level. 3. Incorrect lubrication. 4. Corroded transmission levers (shaft). 5. Tight main drive gear pilot bearing. 6. Frozen synchronizing blocking ring on main drive gear cone. 7. Burred or battered teeth on synchronizer sleeve and/or main drive gear.
Forward Gears Clash	1. Clutch not releasing fully. 2. Weak or broken springs in the synchronizer assembly. 3. Worn blocking rings and/or cone surfaces. 4. Broken blocking rings. 5. Excessive rock of synchronizer assembly on mainshaft.
Gears Spinning When Shifting Into Gear From "Neutral"	1. Clutch not fully releasing. 2. Binding main drive gear pilot bearing. 3. Synchronizers not functioning.
Reverse Gear Clash	1. Allow approximately 3/4 seconds after the clutch pedal has been depressed before shifting into reverse gear. 2. If gear clash continues after allowing proper time for the clutch plate to stop, check the clutch adjustment to make sure that it is within specifications. 3. Make sure that the engine idle speed is set to specifications.

Complaint	Probable Cause
	4. Gear clash can also be caused by the following: Dragging clutch driven plate. Distorted clutch driven plate. Tight or frozen main drive gear bearing.
Scored or Broken Gear Teeth	1. Insufficient lubricant. 2. Failure of the car operator to fully engage the gears on every shift before engaging the clutch and applying engine power.

MAJOR REPAIR

REMOVAL AND INSTALLATION OF TRANSMISSION

Removal

1. Disconnect speedometer cable and remove driven gear and sleeve assembly.

2. Disconnect shift controls from transmission.

3. Remove propeller shaft.

4. Support rear of engine and remove transmission support.

5. Remove the two (2) top transmission to flywheel housing bolts and insert guide pins.

6. Remove the two (2) lower transmission to flywheel housing attaching bolts.

7. Slide transmission straight back on guide pins until the main drive gear is free of splines in the clutch driven plate. If guide pins are not used, damage to the clutch driven plate can result.

8. Remove transmission.

Installation

1. Install guide pin in upper and lower right transmission to flywheel housing bolt holes for alignment and place transmission on guide pins. Place transmission in third gear and rotate transmission mainshaft as necessary to start main drive gear into clutch driven plate. Slide transmission forward. If guide pins are not used, damage to the clutch driven plate can result.

2. Install two (2) lower transmission mounting bolts. Remove guide pin and install two upper bolts. Torque bolts to 45-60 lb. ft.

3. Install transmission support.

4. Install propeller shaft.

5. Install speedometer driven gear and connect speedometer cable.

6. Connect linkage and adjust as described in Linkage section.

DISASSEMBLY OF TRANSMISSION

1. Drain lubricant.

2. Remove side cover attaching bolts. Remove side cover assembly and gasket.

3. Remove front main bearing retainer and gasket.

4. Remove front main bearing to main drive gear snap ring.

5. Remove front main bearing by pulling main drive gear out of case as far as possible. See Figure 7B-2.

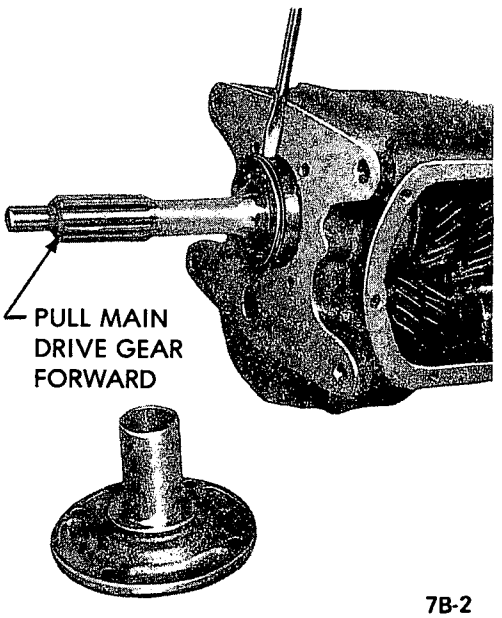


Figure 7B-2 Removing Front Main Bearing

The front bearing is a slip fit on main drive gear. It may be necessary to aid removal with a screwdriver.

6. Remove reverse idler shaft to gear "E" ring. See Figure 7B-3.

7. Remove rear bearing retainer to case attaching bolts.

8. From rear of case, remove rear bearing retainer and mainshaft assembly. See Figure 7B-4.

9. Remove main drive gear, 14 needle bearings, and third speed blocking ring from mainshaft assembly.

10. Using snap ring pliers, expand snap ring at rear of bearing retainer which retains the rear bearing to the retainer. See Figure 7B-5. Remove rear bearing retainer.

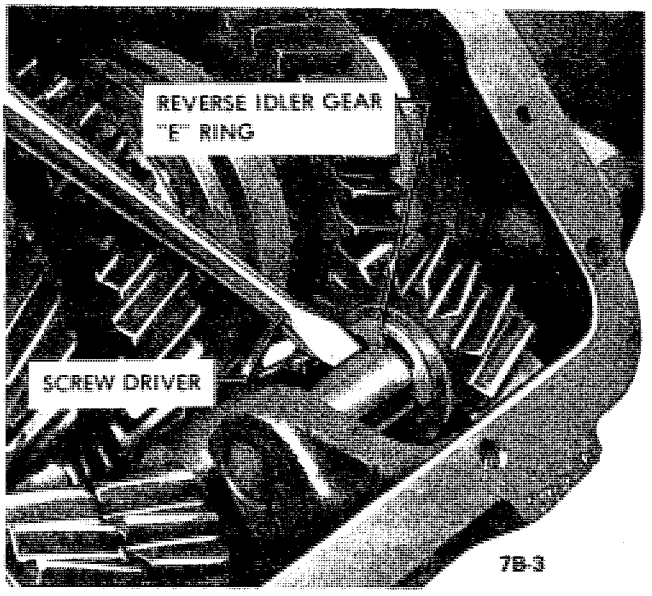


Figure 7B-3 Removing Reverse Idler "E" Ring

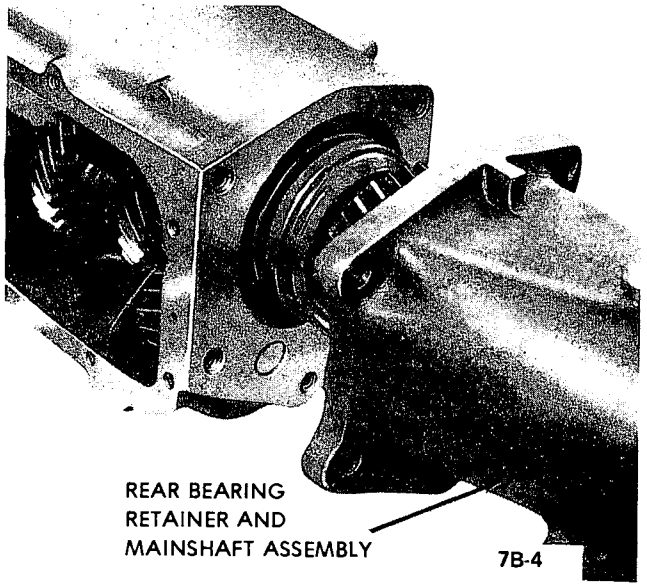


Figure 7B-4 Removing Mainshaft Assembly

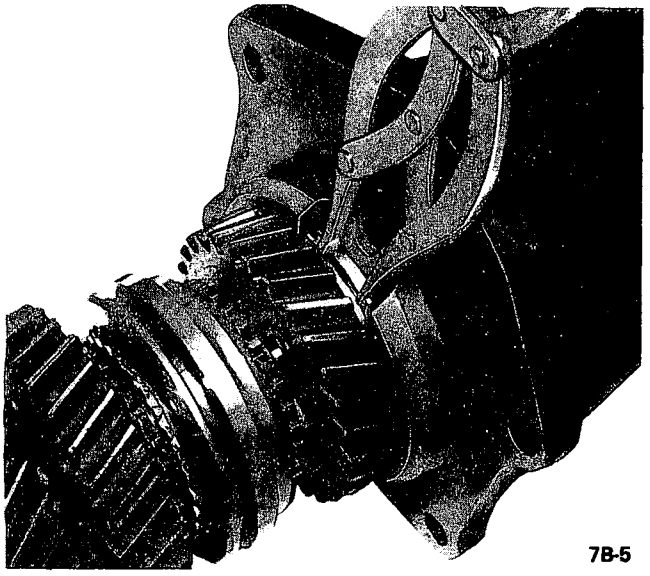


Figure 7B-5 Removing Rear Bearing Retainer.

11. Using Countershaft Alignment Tool J-22246, remove counter gear shaft and its woodruff key through rear of case. See Figure 7B-6. Remove two (2) tanged bronze thrust washers.

12. Use a long brass drift and drive reverse idler shaft and woodruff key through rear of case. See Figure 7B-7.

13. Remove reverse idler gear tanged steel thrust washer.

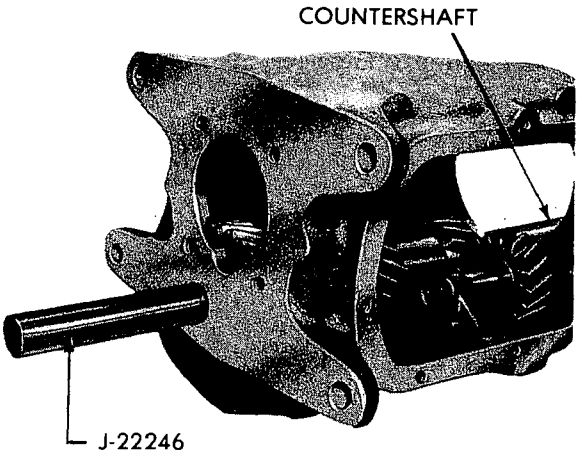


Figure 7B-6 Removing Countergear

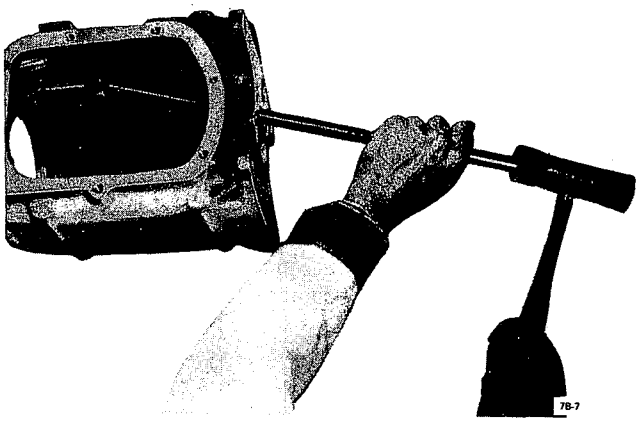


Figure 7B-7 - Removing Reverse Idler Shaft

MAINSHAFT ASSEMBLY

Disassembly

1. Depress retaining clip and slide speedometer drive gear from mainshaft.

2. Remove second-third synchronizer sleeve. See Figure 7B-8.

3. Remove rear bearing snap ring. See Figure 7B-9.

4. Using ram press or arbor press, remove rear bearing spring washer, thrust washer, and reverse gear. See Figure 7B-10.

5. Remove first speed synchronizer snap ring. See Figure 7B-12.

6. Support first speed gear on press plate using two (2) pieces of stock 6x1 7/8x1/4. See Figure 7B-13. Remove first speed synchronizer assembly and first speed gear.

7. Remove second-third speed snychronizer assembly snap ring. See Figure 7B-14.

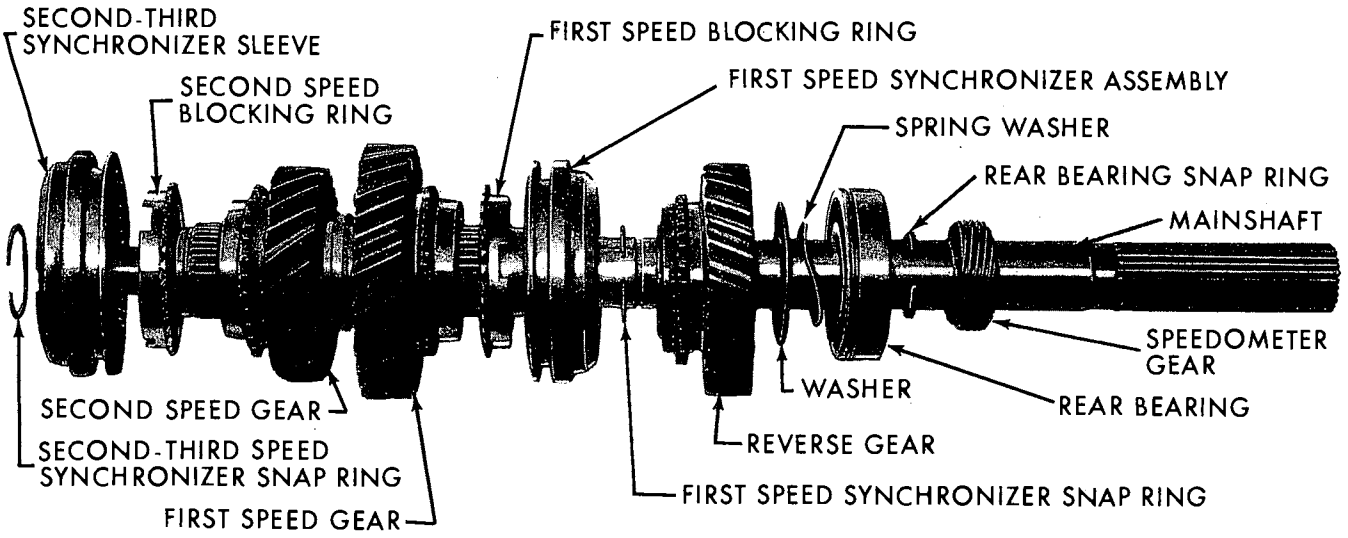


Figure 7B-8 - Exploded View of Mainshaft

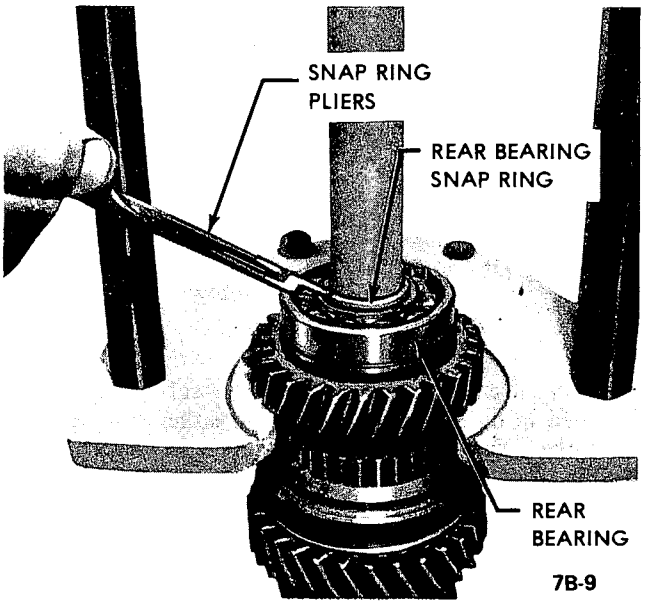


Figure 7B-9 - Removing Rear Bearing Snap Ring

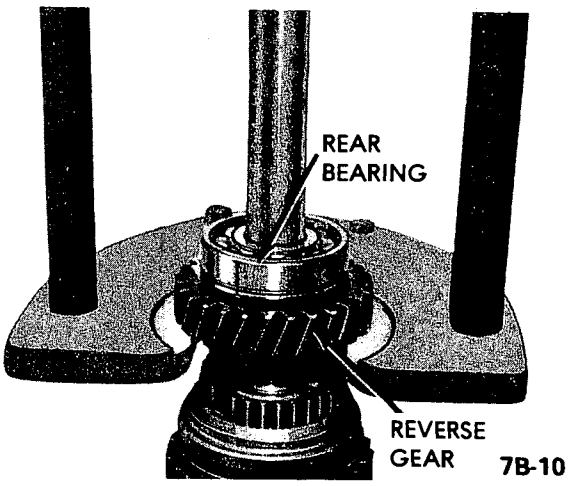


Figure 7B-10 - Removing Rear Bearing and reverse gear

8. Support second speed gear on press plate using two (2) pieces of stock 6x1 7/8x1/4. See Figure 7B-15. Remove second-third speed synchronizer assembly and second speed gear.

Inspection

1. Check synchronizer hubs, sliding keys and springs and, if necessary, replace as follows:

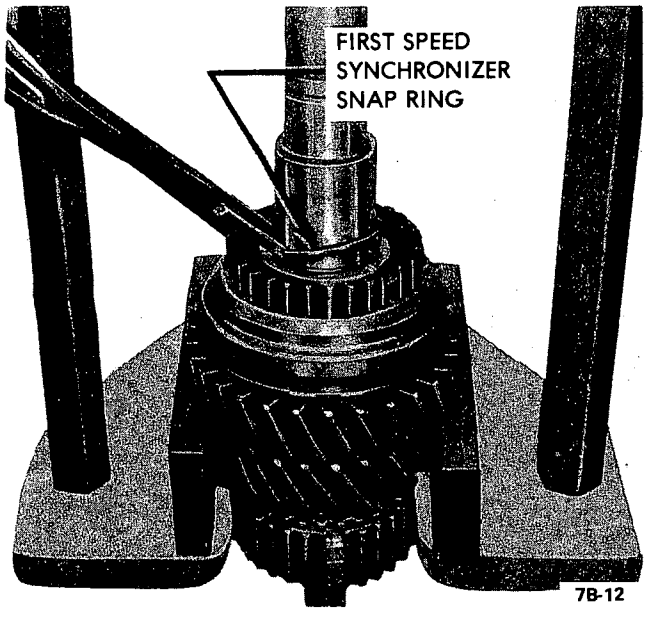


Figure 7B-12 - Removing First Speed Synchronizer Snap Ring

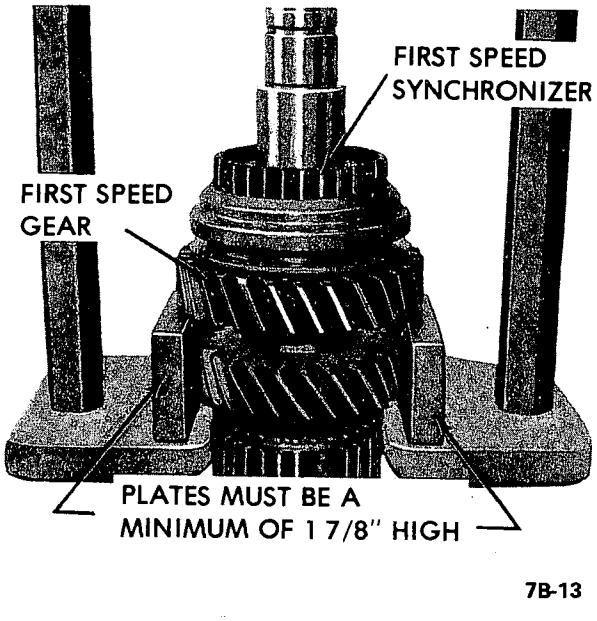


Figure 7B-13 - Removing First Speed Synchronizer Assembly

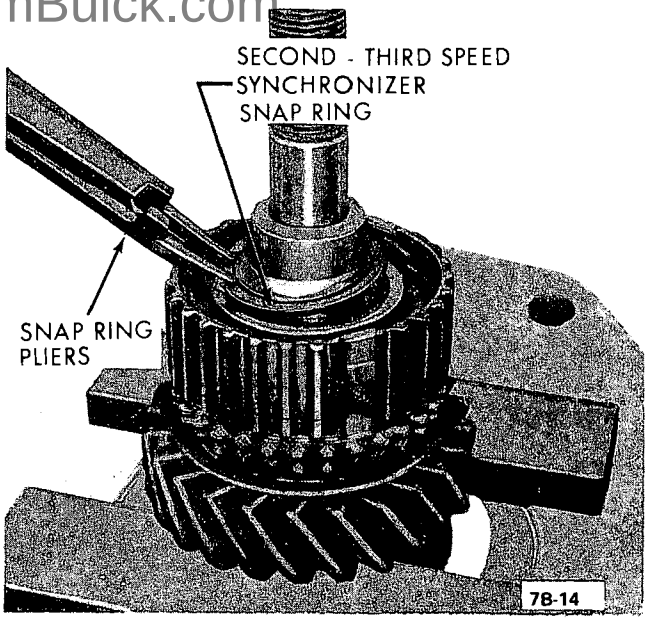


Figure 7B-14 - Removing Second-Third Speed Synchronizer Snap Ring

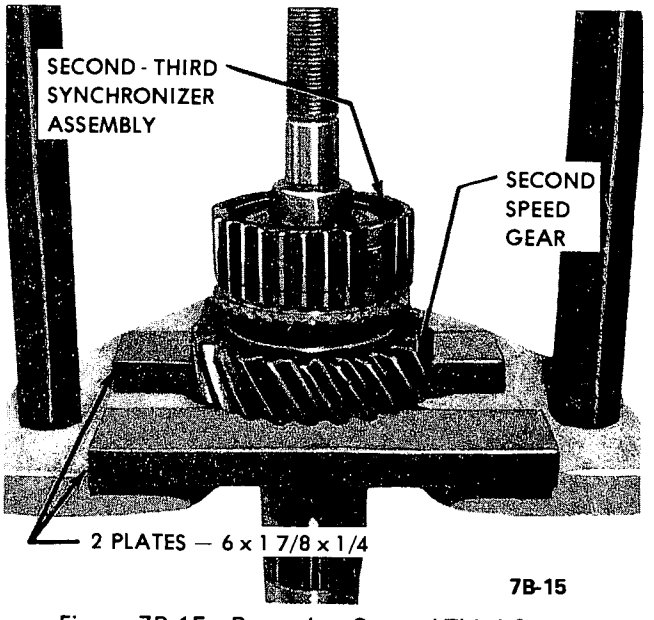


Figure 7B-15 - Removing Second-Third Speed Synchronizer Assembly

The synchronizer hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled. The keys and springs must be replaced if worn or broken.

a. Mark hub and sleeve with paint so they can be reassembled in the same position.

b. Remove sliding sleeve from synchronizer hub. Remove keys and springs from the hub. See Figure 7B- 16.

c. Place the three (3) keys and two springs in position (one on each side of hub) so all three (3) keys are engaged by both springs. See Figure 7B-16.

The tanged end of each synchronizer spring should be installed in different key cavities on either side of hub. Slide the sleeve onto the hub aligning the marks made before disassembly. An identification ring around the outside of the synchronizer hub splines identifies the end that must be opposite fork slot in sleeve. See Figure 7B-17.

2. Wash front and rear bearing thoroughly in a cleaning solvent. Blow out bearing with compressed air. Do not allow the bearings to spin; turn them slowly by hand. Spinning bearings will damage the race and balls.

Make certain bearings are clean, then lubricate with light engine oil and check them for roughness by slowly turning the race by hand.

3. Check for cracks in blocking rings.

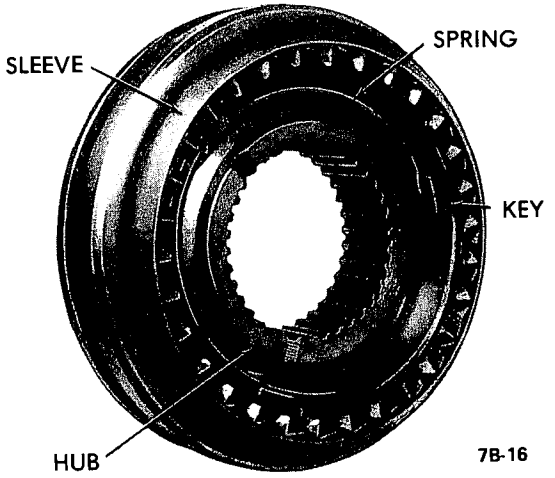


Figure 7B-16 - Synchronizer Assembly

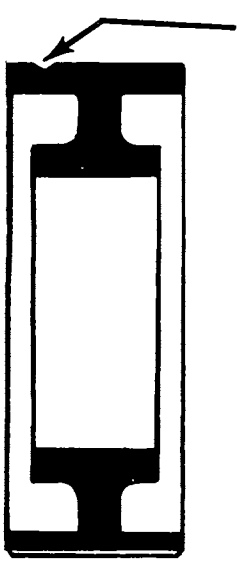


Figure 7B-17 - Identification Ring

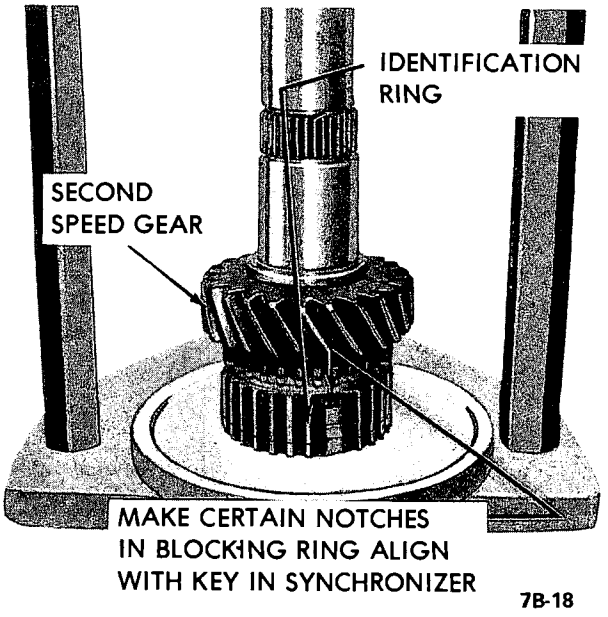


Figure 7B-18 - Installing Second Speed Gear

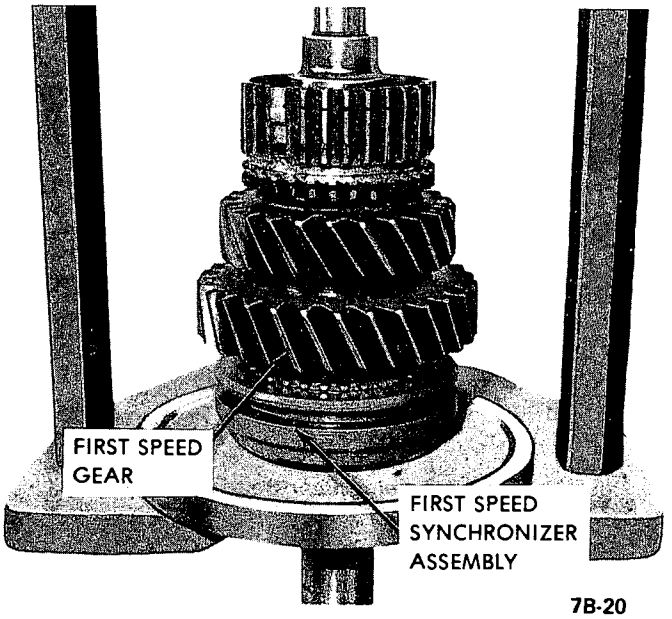


Figure 7B-20 - Installing First Speed Gear and Synchronizer

Assembly

1. Install second speed gear blocking ring on mainshaft. Using ram press or arbor press and Press Plate J-8609, press second-third speed synchronizer assembly (with identification ring toward front of transmission) onto mainshaft. See Figure 7B-18. Install retaining snap ring.

Make certain notches in blocking ring align with keys in synchronizer assembly.

2. Install first speed gear and synchronizer on mainshaft. See Figure 7B-20. Using ram press and Press Plate J-8609, press first speed synchronizer assembly (with identification ring toward rear of transmission) onto mainshaft. Install retaining snap ring. Make certain notches in blocking ring align with keys in first speed synchronizer assembly.

3. Install reverse gear, thrust washer, spring washer, and rear bearing.

Groove on bearing must be toward reverse gear. Using ram press or arbor press, press rear bearing into position. See Figure 7B-21. Install retaining snap ring.

4. Install speedometer drive gear and retaining clip.

5. Install second-third synchronizer sleeve.

REAR BEARING RETAINER SEAL AND BUSHING

Removal

1. Using J-2619 Slide Hammer and J-4830-02 Puller, remove rear bearing retainer oil seal. See Figure 7B-23.

Figure 7B-21 - Installing Rear Bearing

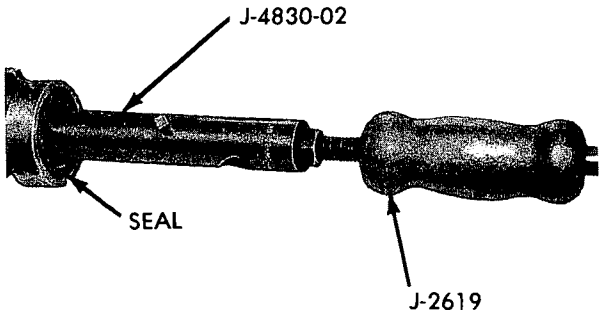


Figure 7B-23 - Removing Rear Bearing Retainer Oil Seal

2. Using J-2619 Slide Hammer and J-4830-02 Puller, remove rear bearing retainer bushing. See Figure 7B-24.

Installation

1. Install rear bearing retainer bushing, using Tool J-6403-1. See Figure 7B-25.

2. Install rear bearing retainer oil seal as follows:

a. Install J-6403-2 onto J-6403-1. Flat side of J- 6403-2 must be toward rear of J-6403-1. See Figure 7B- 26.

COUNTERGEAR ASSEMBLY

Disassembly

1. Remove Countershaft Alignment Tool J-22246.

2. From each end of countershaft, remove spacer and 27 needle bearings. See Figure 7B-27.

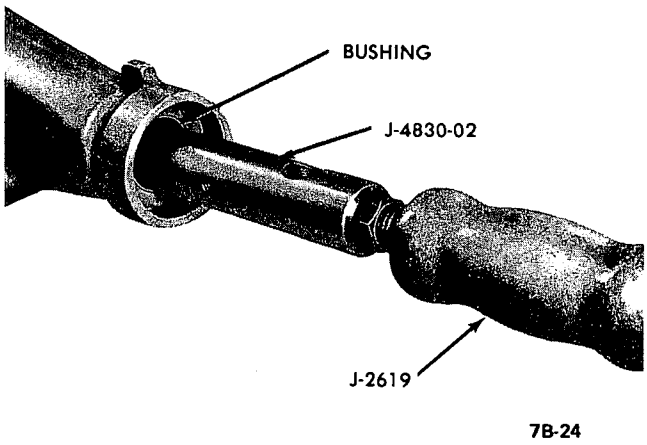


Figure 7B-24 - Removing Rear Bearing Retainer Bushing

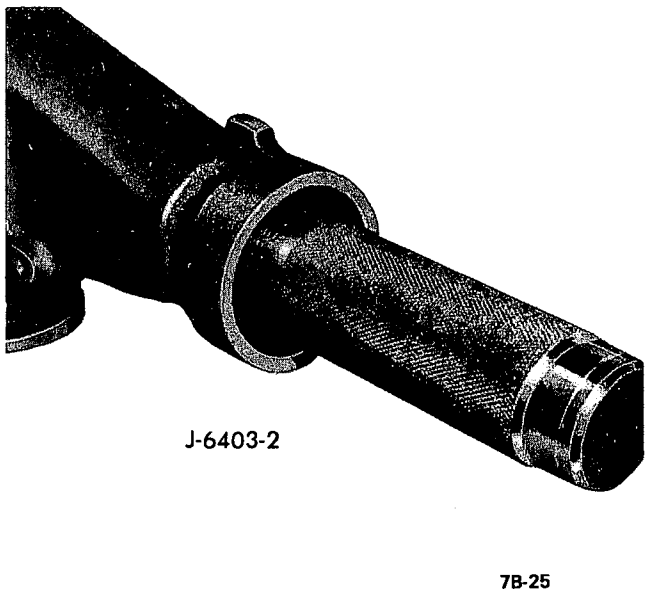


Figure 7B-25 - Installing Rear Bearing Retainer Bushing

Inspection

1. Check for broken needle bearings.

2. Check for broken anti-rattle gear springs. The anti-rattle gear is riveted to the countergear and is not serviced separately. See Figure 7B-28.

Assembly

1. Install Countershaft Alignment Tool J-22246.

2. From each end of countergear, install 27 needle bearings and spacer. Use heavy grease to retain needle rollers. See Figure 7B-27.

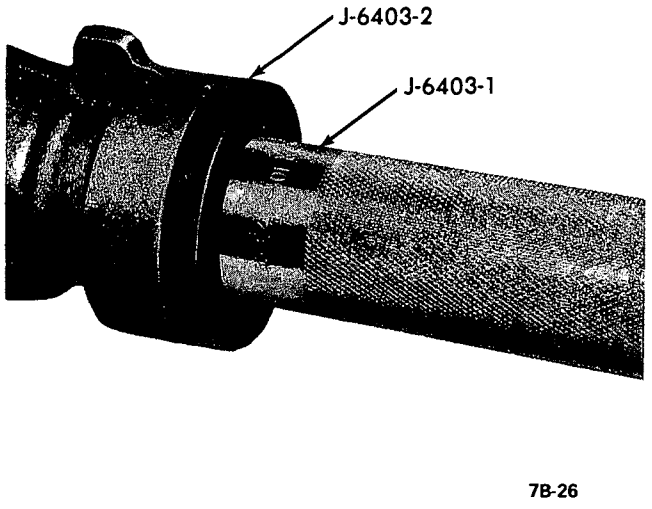


Figure 7B-26 - Installing Rear Bearing Retainer Oil Seal

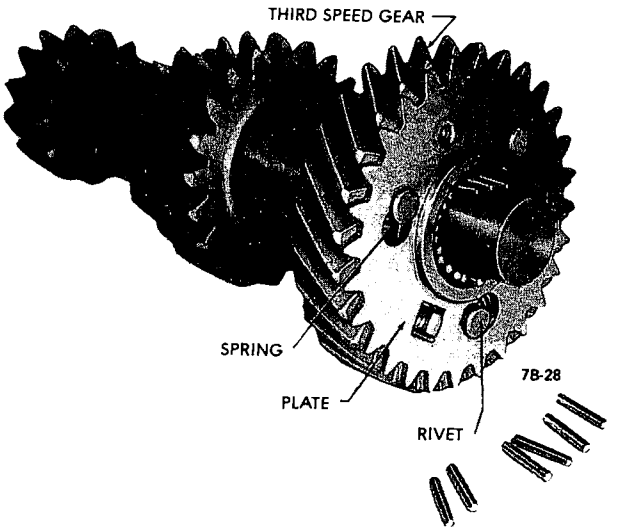


Figure 7B-28 - Anti-Rattle Gear Springs

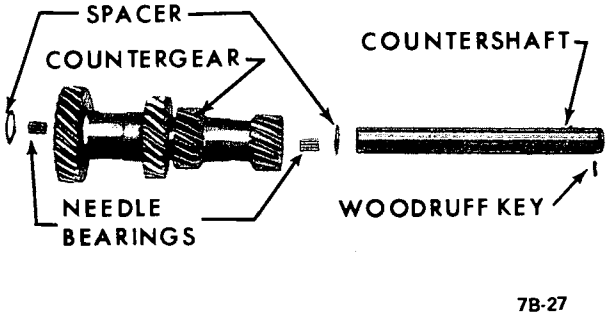


Figure 7B-27 - Exploded View of Countergear

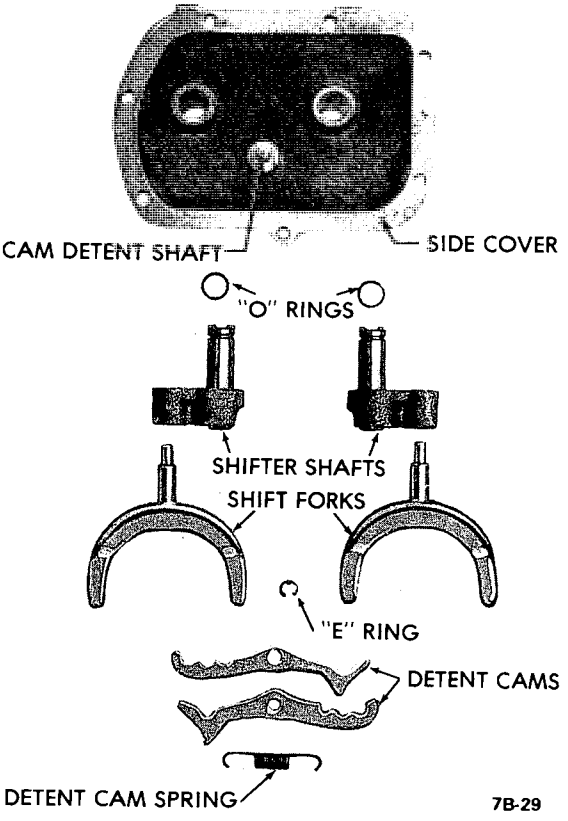


Figure 7B-29 - Exploded View of Side Cover

SIDE COVER ASSEMBLY FIGURE 7B-29

Disassembly

1. Remove detent cam spring.
2. Remove shifter forks.
3. Remove shifter shafts.
4. Remove detent cam retainer.
5. Remove detent cams.
6. Inspect shifter shaft "O" rings and replace if necessary.

Assembly

1. Install shifter shaft "O" rings, if removed.
2. Install detent cams.
3. Install detent cam retainer.
4. Install shifter shafts.
5. Install shifter forks.
6. Install detent cam spring.

Detent cams, shifter shafts and forks are interchangeable.

CLEANING AND INSPECTION OF TRANSMISSION PARTS

Transmission Case

1. Wash the transmission case thoroughly inside and outside with a suitable cleaning solvent; then inspect case for cracks.

2. Check front and rear faces for burrs, and if present, remove with a fine mill file.

3. Check and clean magnet in bottom of transmission case.

Needle Bearings

All main drive gear and countergear needle bearings should be inspected closely and replaced if they show wear.

Transmission Gears

1. Inspect all gears for excessive wear, chips or cracks.

2. Inspect reverse gear bushing and if worn or damaged, replace the entire gear. Reverse gear bushing is not serviced separately.

3. Inspect reverse idler gear bushing and if worn or damaged, replace the entire gear.

FRONT MAIN BEARING RETAINER OIL SEAL

Removal

1. Using screwdriver remove seal. See Figure 7B-30.

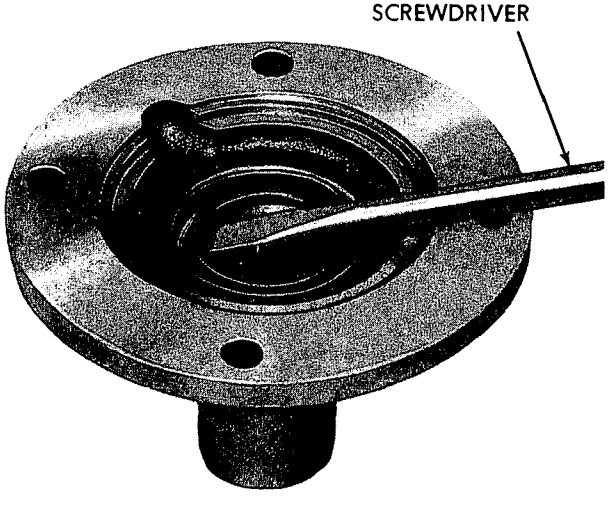


Figure 7B-30 - Removing Front Bearing Retainer Seal

Installation

1. Using a suitable tool, drive new seal into position. Lip of seal must face rear of bearing retainer. See Figure 7B-31.

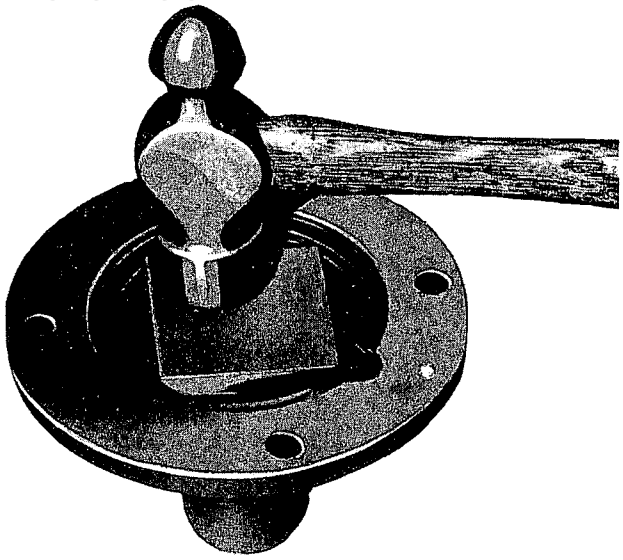


Figure 7B-31 - Installing Front Bearing Retainer Seal

TRANSMISSION REASSEMBLY

1. Install countergear to case bronze thrust washers.

2. Install countergear into case. Install countergear shaft from rear of case. Make certain woodruff key is in position. See Figure 7B-32.

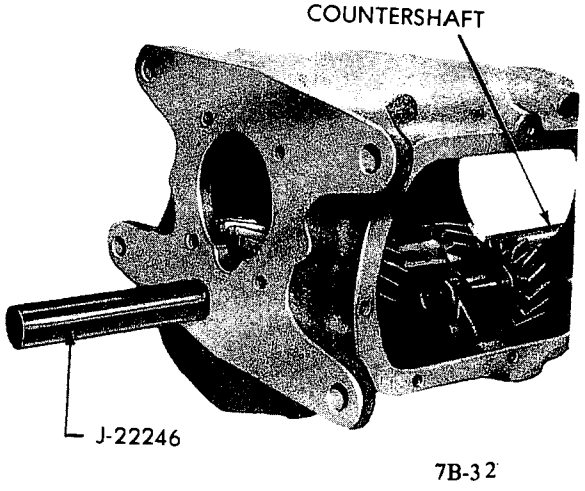


Figure 7B-32 - Installing Countergear Shaft

3. Install reverse idler gear tanged steel thrust washer. Install reverse idler gear, shaft and woodruff key. Reverse idler gear snap ring will be installed after installation of mainshaft.

4. Install the rear bearing retainer snap ring. Spread snap ring in the retainer to allow the snap ring to drop around rear bearing. See Figure 7B-33. Press on end of mainshaft until the snap ring engages groove in rear bearing.

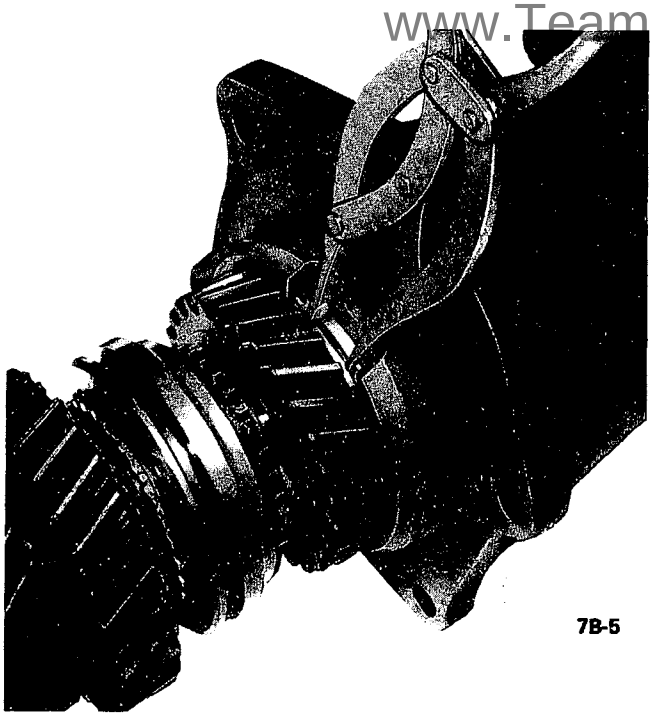


Figure 7B-33 - Installing Rear Bearing Retainer Snap Ring

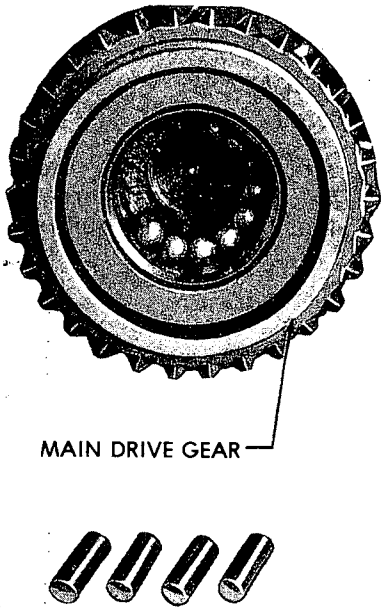


Figure 7B-34 - Installing Needle Roller Bearings

5. Install fourteen (14) needle bearings in main drive gear, using heavy grease to hold the bearings in place. See Figure 7B-34.

6. Assemble third speed blocking ring on main drive gear.

7. Pilot main drive gear and third speed blocking ring over front of mainshaft. Make certain notches in blocking ring align with keys in second-third synchronizer assembly.

8. Using heavy grease, install rear bearing retainer to case gasket.

9. Install rear bearing retainer and mainshaft assembly into case. Install bearing retainer to case bolts. Torque 35-55 lb. ft.

10. Install front main bearing onto main drive gear. Outer snap ring groove must be toward front of gear.

11. Install retaining snap ring.

12. Install front main bearing retainer, gasket and four (4) attaching bolts, torque 8-12 lb. ft. The retainer oil return hole must be positioned toward bottom of case.

13. Install reverse idler gear "E" ring.

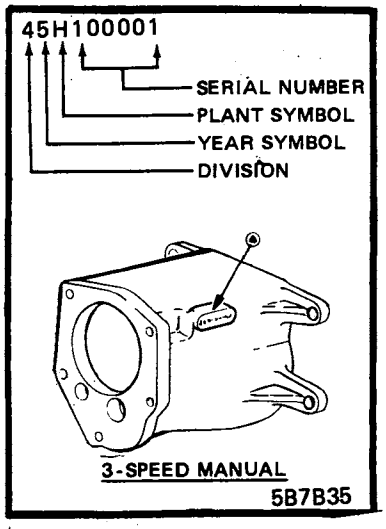
14. Install new side cover gasket. Place transmission in neutral and install side cover. Install attaching bolts and tighten evenly to avoid side cover distortion. Torque 8-12 lb. ft.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Transmission Identification

A production code number and Transmission Serial Number are stamped on "X" & "A" Series three-speed manual transmissions. See Figure 7B-35 for location of these numbers.



SERIAL NUMBER LOCATION

Figure 7B-35

These numbers should always be furnished on all product reports, Warranty Document forms, and all correspondence with the factory concerning a particular transmission.

B. General Specifications

Type	All Forward Gears Synchronized
Mounting	Unit With Engine
Lubricant	
Type	SAE 80W or 80W-90 GL-5
Capacity	Approx. 3 1/2 Pints
Synchronization	1st, 2nd and 3rd
Gear Ratios	
1st	3.11 to 1
2nd	1.84 to 1
3rd	1.00 to 1
Reverse	3.22 to 1
Gear Shifting	On Steering Column
Speedometer Drive Gear	Nylon

Bolt Tightening Specifications

Use a reliable wrench to tighten the parts listed to insure proper tightness without straining or distorting parts. These specifications are for clean and lightly-lubricated threads only; dry or dirty threads produce increased friction which prevents accurate measurement of tightness.

Location	Torque Lbs. Ft.
Front Main Bearing Retainer	14
Side Cover to Case	14
Rear Main Bearing Retainer	45
Shift Lever to Shifter Shaft Bolts	25
Lubrication Filler Plug	13
Transmission Case to Flywheel Housing	53

FOUR-SPEED MANUAL TRANSMISSION "H" SERIES

CONTENTS

DESCRIPTION

4-SPEED MANUAL TRANSMISSION

The four speed manual transmission used by the H Series is of a constant-mesh design. It is fully synchronized in all forward speeds except reverse. The synchronizer assemblies permit gears to be selected without clashing, by synchronizing the speeds of mating parts before they engage. Helical gears are incorporated throughout except reverse gear which is a spur gear.

DIAGNOSIS

TROUBLE DIAGNOSIS

CONDITION	PROBABLE CAUSE	CORRECTION
Slips out of High Gear	1. Transmission loose on clutch housing.	1. Tighten mounting bolts.
	2. Shift rods interfere with engine mounts or clutch throw-out lever.	2. Replace or bend levers and rods to eliminate interference.
	3. Shift linkage does not work freely; binds.	3. Adjust and free up shift linkage.
	4. Damaged mainshaft pilot bearing.	4. Replace pilot bearing.
	5. Main drive gear retainer broken or loose.	5. Tighten or replace main drive gear.
	6. Dirt between transmission case and clutch housing.	6. Clean mating surfaces.
	7. Misalignment of transmission.	7. Align.
	8.Stiff shift lever seal.	8. Replace seal.
	9. Pilot bearing loose in crankshaft.	9. Replace bearing.
	10. Worn or improperly adjusted linkage.	10. Adjust or replace linkage as required.

CONDITION	PROBABLE CAUSE	CORRECTION
Noisy in All Gears	1. Insufficient lubricant. 2. Worn countergear bearings. 3. Worn or damaged main drive gear and countergear. 4. Damaged main drive gear or main shaft 5. Worn or damaged countergear anti-lash plate.	1. Fill to correct level. 2. Replace countergear bearings and shaft. 3. Replace worn or damaged gears. 4. Replace damaged bearings or main drive gear. 5. Replace countergear.
Noisy in High Gear	1. Damaged main drive gear bearing. 2. Damaged mainshaft bearing. 3. Damaged high speed gear synchronizer.	1. Replace damaged bearing. 2. Replace damaged bearing. 3. Replace synchronizer.
Noisy in Neutral with Engine Running	1. Damaged main drive gear bearing. 2. Damaged or loose main-shaft pilot bearing. 3. Worn or damaged countergear anti-lash plate. 4. Worn countergear bearings.	1. Replace damaged bearing. 2. Replace pilot bearings. 3. Replace countergear. 4. Replace countergear bearings and shaft.
Noisy in all Reduction Gears	1. Insufficient lubricant. 2. Worn or damaged main drive gear or countergear.	1. Fill to correct level. 2. Replace faulty or damaged gears.
Noisy in Second Only	1. Damaged or worn second-speed constant mesh gears. 2. Worn or damaged countergear rear bearings. 3. Damaged or worn second-speed synchronizer.	1. Replace damaged gears. 2. Replace countergear bearings and shaft. 3. Replace synchronizer.
Noisy in Third Only	1. Damaged or worn third-speed constant mesh gears. 2. Worn or damaged countergear bearings.	1. Replace damaged gears 2. Replace damaged countergear bearings and shaft
Noisy in Reverse Only	1. Worn or damaged reverse idler gear or idler bushing. 2. Worn or damaged reverse gear on mainshaft. 3. Damaged or worn reverse countergear. 4. Damaged shift mechanism.	1. Replace reverse idler gear assembly. 2. Replace reverse gear. 3. Replace countergear assembly. 4. Inspect linkage and adjust or replace damaged parts.
Excessive Backlash in Reduction Gears	1. Worn countergear bearings. 2. Excessive end play in countergear.	1. Replace bearings. 2. Replace countergear thrust washers.

CONDITION	PROBABLE CAUSE	CORRECTION
Main Drive Gear Bearing Retainer Burned or Scored by Input Shaft	1. Loose or damaged main-shaft pilot bearing.	1. Replace bearing.
	2. Misalignment of transmission.	2. Align Transmission.
Leaks Lubricant	1. Excessive amount of lubricant in transmission.	1. Drain to correct level.
	2. Loose or broken main drive gear bearing retainer.	2. Tighten or replace retainer.
	3. Main drive gear bearing retainer gasket damaged.	3. Replace gasket.
	4. Side cover loose or gasket damaged.	4. Tighten cover or replace gasket.
	5. Rear bearing retainer oil seal leaks.	5. Replace seal.
	6. Countershaft loose in case.	6. Replace case.
	7. Shift lever seals leak.	7. Replace seal.

REMOVAL AND INSTALLATION OF TRANSMISSION

Removal

1. Raise vehicle on hoist and drain lubricant from transmission.

2. Remove propeller shaft assembly as described in Section 4 of this manual.

3. Disconnect the speedometer cable, and back-up lamp switch. Remove damper assembly.

4. Disconnect transmission control rod and lever assemblies from the shifter shafts. Tie rods up out of work area.

5. Remove crossmember-to-transmission mount bolts.

6. Support engine with an appropriate jack stand and remove crossmember-to-frame bolts. Remove crossmember from vehicle.

7. Remove transmission to clutch housing upper retaining bolts and install guide pins to holes.

8. Remove lower bolts, then slide transmission rearward and remove from vehicle.

Installation

1. Position transmission to clutch housing and slide forward, piloting clutch gear in to pilot bearing.

(NOTE: Make certain main drive gear splines are clean and dry.)

2. Install transmission-to-clutch housing retaining bolts and lock washers. Torque to specifications.

3. Position Crossmember to frame and loosely install retaining bolts. Install crossmember-to-transmission mount bolts. Tighten all retaining bolts to specifications. Remove engine support.

CAUTION: *Check position of engine in front mounts and realign as required.*

4. Position control rod and levers to shifter shafts and install retaining bolts. Torque to specifications.

REMOVAL AND INSTALLATION OF SIDE COVER FIGURE 7B-66

Removal

1. Shift transmission into neutral position.

2. Raise vehicle on hoist.

3. Remove shift levers at cover.

4. Remove cover assembly from transmission, allowing oil to drain into a waste container.

5. Remove (pull) both shift forks from shifter shafts, then remove shifter shafts from cover. Pry out 2nd-3rd or 3rd-4th shifter shaft lip seal from housing bore and remove "O" ring seal from 1st-Rev. or 1st-2nd shaft. Remove reverse shifter shaft, detent ball and spring.

6. Remove detent cam spring and pivot retainer "C" ring. Remove both detent cams.

7. Replace damage parts.

Installation

1. With detent spring tang projecting up over the 2nd-3rd or 3rd-4th shifter shaft cover opening, install the 1st-Reverse or 1st-2nd detent cam onto the cam pivot pin. With the detent spring tang projecting up over the 1st-Reverse 1st-2nd shifter shaft cover hole, install the detent cam.

2. Install detent cam retaining "C" ring to pivot shaft and hook spring into detent cam notches.

3. Install both shifter shaft assemblies in cover using care not to damage seals. Install both shift fork to the shifter assemblies, lifting up on the detent cam to allow forks to fully seat into position.

4. Install reverse detent ball, spring and shaft in cover.

5. Position shifter levers into neutral position. Align shift forks with respective sliding sleeves and install cover assembly to transmission. Torque attaching bolts to specifications.

6. Remove filler plug and add lubricant to level of filler plug hole.

7. Install shift levers to shifter shafts. Lower and remove vehicle from hoist. Check transmission operation and adjust linkage as required.

DISASSEMBLY OF TRANSMISSION

1. Remove side cover attaching bolts and remove side cover assembly.

2. Remove clutch gear bearing retainer bolts, retainer and gasket.

3. Remove clutch gear bearing to gear stem snap ring, then remove clutch gear bearing by pulling outward on clutch gear until a screwdriver or other suitable tool can be inserted between bearing, large snap ring and case to complete removal. The clutch gear bearing is a slip fit on the gear and into the case bore. This provides clearance for removal of clutch gear and mainshaft assembly. See Figure 7B-45.

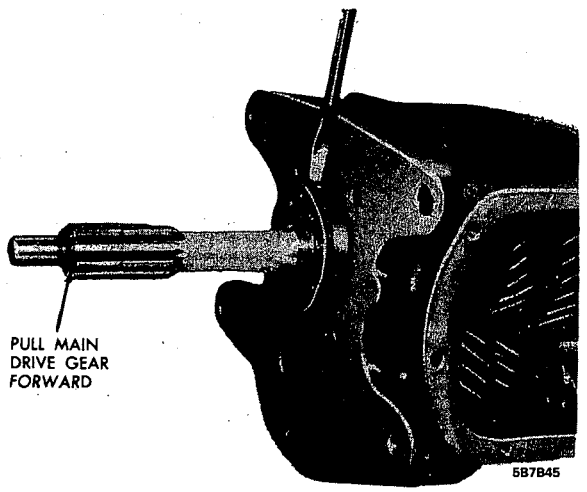


Figure 7B-45 - Removing Clutch Gear Bearing

4. Remove extension to case attaching bolts.

5. Remove clutch gear, mainshaft and extension assembly together through the rear case opening. See Figure 7B-46.

6. Using snap ring pliers, expand the snap ring in the extension which retains the mainshaft rear bearing and remove the extension. See Figure 7B-47.

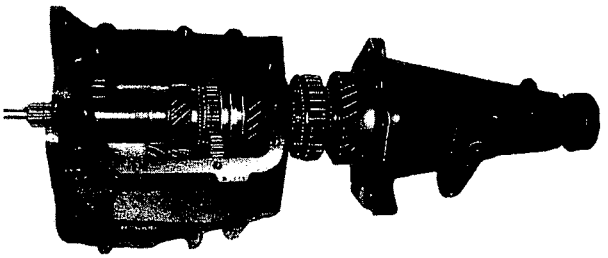


Figure 7B-46 - Removing Clutch Gear and Mainshaft

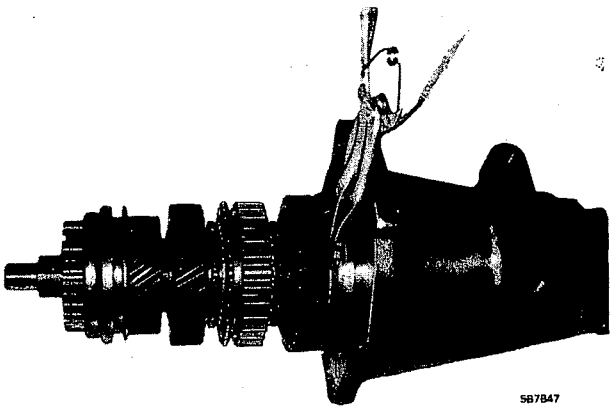


Figure 7B-47 - Removing Extension from Mainshaft Rear Bearing

7. Using J-22246 at the front of the countershaft, drive the shaft and its woodruff key out the rear of the case.

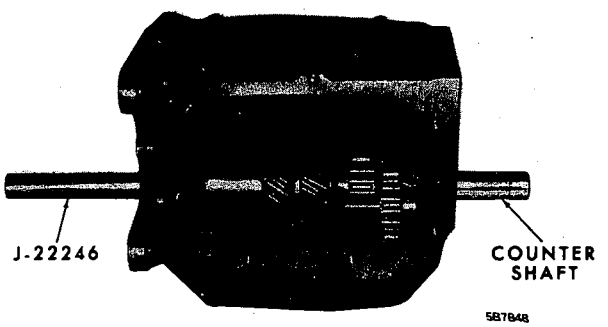


Figure 7B-48 - Removing Shaft and Countergear

Tool J-22246 will now hold the roller bearings in position within the countergear bore. Remove the gear and bearings. See Figure 7B-48.

8. Remove reverse idler gear stop ring. Use a long drift or punch through the front bearing case bore and drive the reverse idler shaft and woodruff key through the rear of the case. See Figure 7B-49.

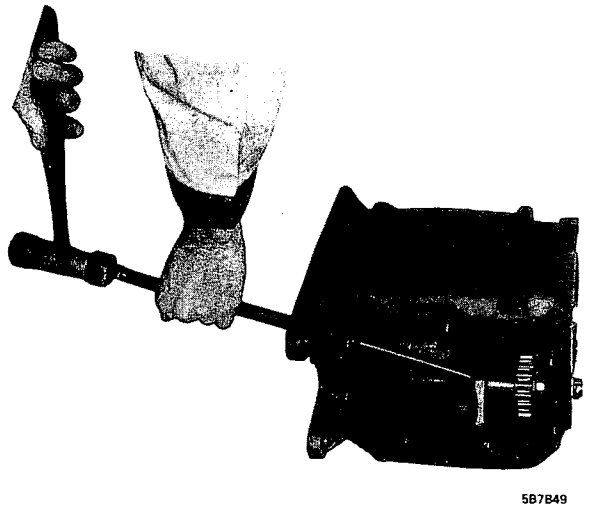


Figure 7B-49 - Removing Reverse Idler Gear

DISASSEMBLY OF MAINSHAFT

1. Using snap ring pliers, remove the 3rd and 4th speed synchronizer snap ring from mainshaft and remove clutch assembly, third gear blocker ring and third speed gear from front of mainshaft. See Figure 7B-50.

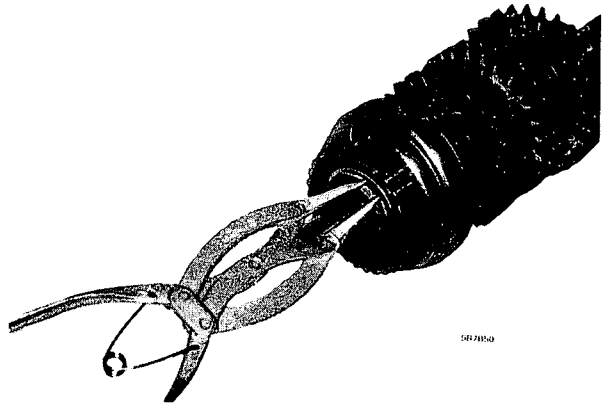


Figure 7B-50 - Removing 3rd and 4th Synchronizer snap ring

2. Depress speedometer retaining clip and slide gear from mainshaft.

3. Remove rear bearing snap ring from mainshaft groove. See Figure 7B-52.

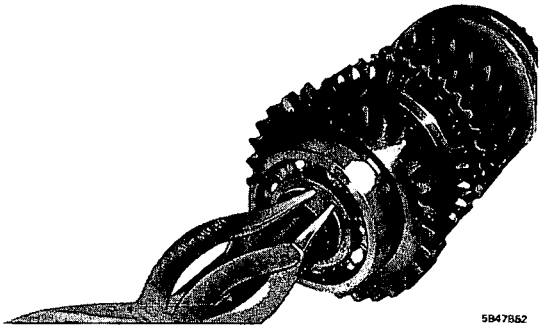


Figure 7B-52 - Removing Rear Bearing Snap Ring

4. Support first gear with press plates and press on rear of mainshaft to remove first gear, thrust washer, spring washer and rear bearing from rear of mainshaft. See Figure 7B-53.

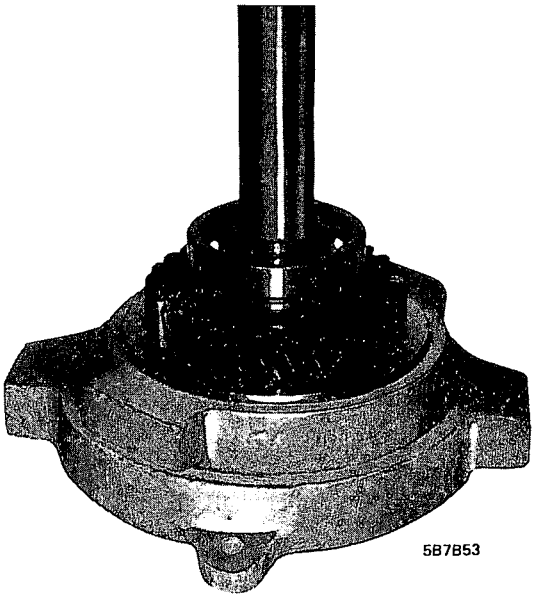


Figure 7B-53 - Removing Rear Bearing and 1st Speed Gear

5. Remove the first and second synchronizer snap ring from the mainshaft and remove the clutch assembly, 2nd speed blocker ring and second speed gear from the rear of the mainshaft. See Figure 7B-54.

Transmission Case

1. Wash the transmission thoroughly inside and outside with cleaning solvent, then inspect the case for cracks.

2. Check the front and rear faces for burrs, and if present, dress them off with a fine mill file.

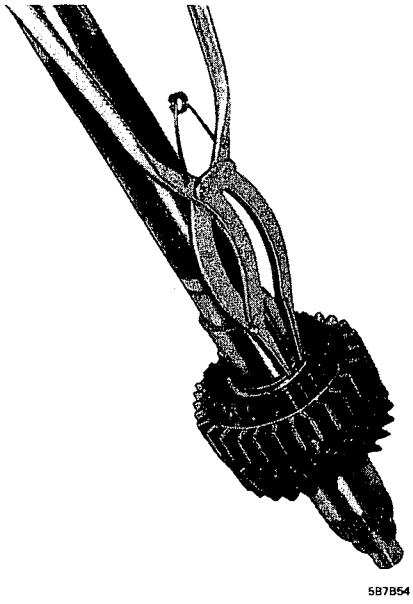


Figure 7B-54 - Removing 1st and 2nd Synchronizer Snap Ring

Front and Rear Bearings

1. Wash the front and rear ball bearings 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 bearings are clean, then lubricate with light engine oil and check them for roughness by slowly turning the race by hand.

Bearing Rollers

All clutch gear and countergear bearing rollers should be inspected closely and replaced if they show wear. Inspect countershaft and reverse idler shaft at the same time, replace if necessary. Replace all worn washers.

Gears

1. Inspect all gears for excessive wear, chips, or cracks and replace any that are worn or damaged.

2. Check both clutch sleeves to see that they slide freely on their hubs.

Reverse Idler Gear Bushings

The bushing used in the idler gear is pressed into the gear and finish bored in place. This insures the positive alignment of the bushing and shaft as well as proper meshing of the gears. Because of the high degree of accuracy to which these parts are machined, the bushing is not serviced separately.

Clutch Keys and Springs

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

1. Mark hub and sleeve so they can be matched upon reassembly.

2. Push the hub from the sliding sleeve, the keys and the springs may be easily removed.

3. Place the three keys and two springs in position (one on each side of hub), so all three keys are engaged by both springs. The tanged end of each synchronizer spring should be installed into different key cavities on either side. Slide the sleeve onto the hub aligning the marks made before disassembly. See Figure 7B-55.

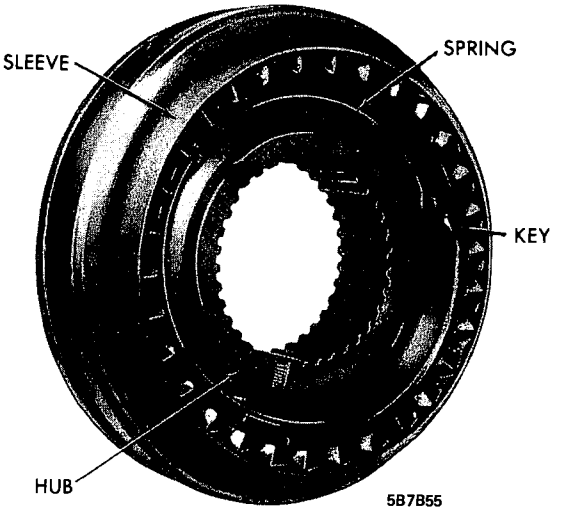


Figure 7B-55 - 3rd and 4th Synchronizer Assembly

(NOTE: A groove around the outside of the synchronizer hub identifies the end that must be opposite the fork slot in the sleeve when assembled. This groove indicates the end of the hub with a greater recess depth.)

Extension Oil Seal or Bushing

If bushing in rear of extension requires replacement, remove seal and use Tool J-5778 to drive bushing into extension housing. See Figure 7B-56. Using the same tool, drive new bushing in from the rear. Coat I.D. of bushing and seal with transmission lubricant, then install new oil seal using Tool J-5154. See Figure 7B-57.

Clutch Gear Bearing Retainer Oil Seal

If the lip seal in the retainer needs replacement; pry the oil seal out and replace with a new seal using Tool J-23096 until seal seats in its bore. See Figures 7B-58 and 7B-59.

(NOTE: Lip of seal must face rear of bearing retainer.)

ASSEMBLY OF MAINSHAFT FIGURE 7B-60

Turn the front of the mainshaft upward. Install the following components on the mainshaft:

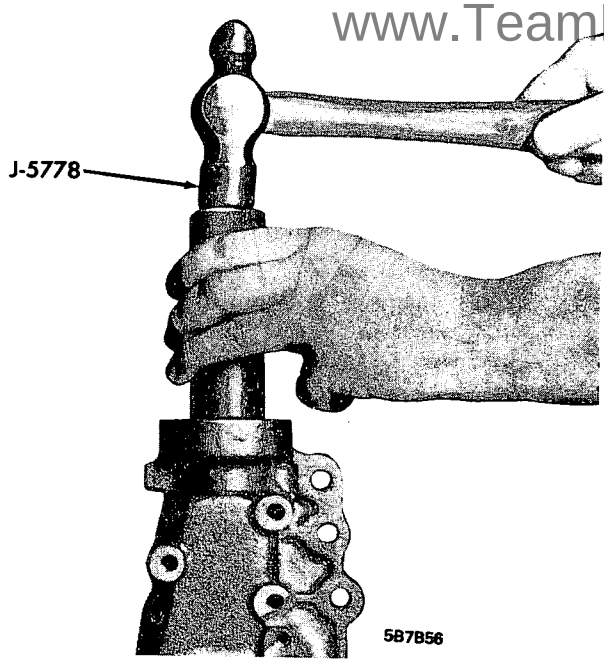


Figure 7B-56 - Extension Bushing Replacement

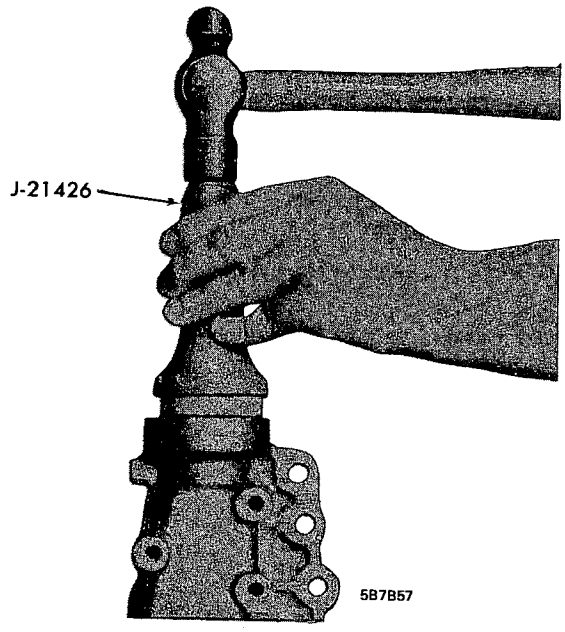


Figure 7B-57 - Installing Extension Oil Seal

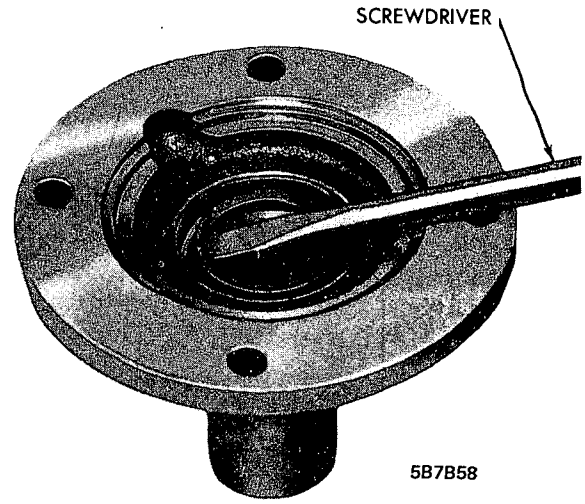


Figure 7B-58 - Removing Bearing Retainer Oil Seal

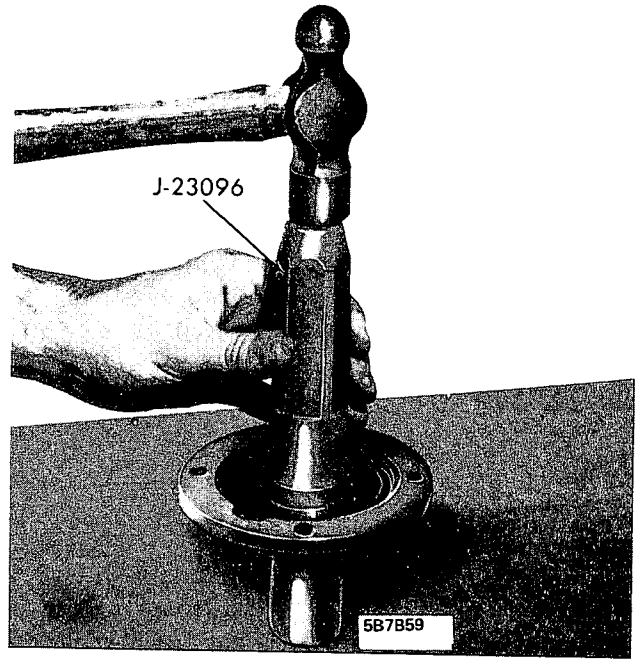


Figure 7B-59 - Installing Bearing Retainer Oil Seal

1. Install the third speed gear with clutching teeth upward; the rear face of the gear will butt against the flange on the mainshaft.

2. Install a blocking ring with clutching teeth downward over the synchronizing surface of the third speed gear. All four blocker rings used in this transmission are identical.

3. Install the 3rd and 4th synchronizer assembly with the fork slot downward on the mainshaft until it bottoms out against flange.

CAUTION: *Be sure the notches of the blocker ring align with the keys of the synchronizer assembly.*

4. Install synchronizer hub to mainshaft snap ring. Both synchronizer snap rings are identical.

Turn the rear of the mainshaft upward. Install the following components on the mainshaft:

5. Install the second speed gear with clutching teeth upward; the front face of the gear will butt against the flange on the mainshaft.

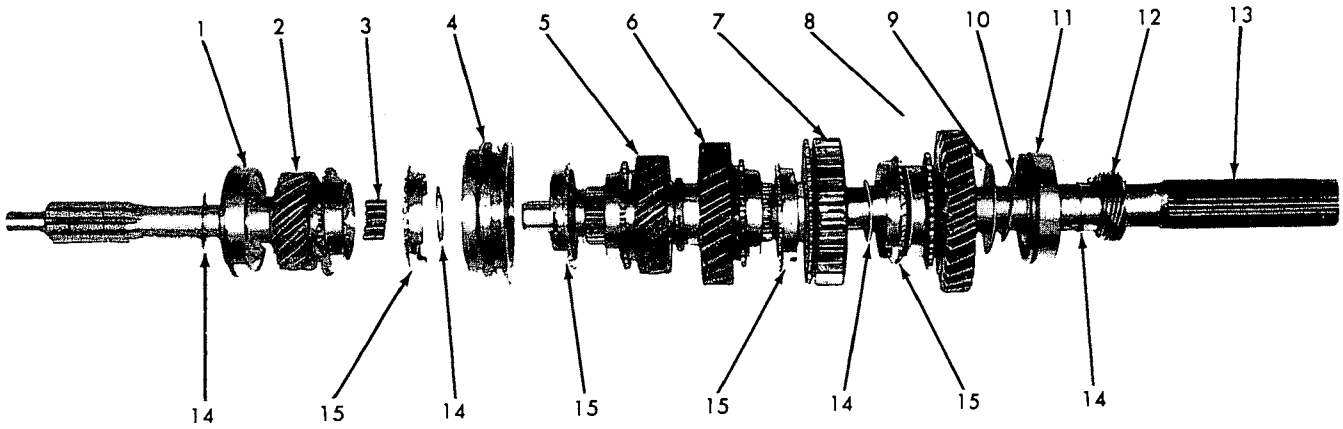
6. Install a blocker ring with clutching teeth downward over synchronizing surface of the second speed gear.

7. Install the first and second synchronizer assembly with fork slot downwards.

8. Install synchronizer hub to mainshaft snap ring.

9. Install a blocker ring with notches downward so they align with the keys of the 1-2 synchronizer assembly.

10. Install first gear with clutching teeth downward.



1. Drive Gear Bearing
2. Drive Gear
3. Mainshaft Pilot Bearings
4. 3-4 Synchronizer Assembly
5. Third Speed Gear
6. Second Speed Gear
7. 1-2 Synchronizer and Reverse Gear Assembly
8. First Speed Gear
9. Thrust Washer
10. Spring Washer
11. Rear Bearing
12. Speedo Drive Gear
13. Mainshaft
14. Snap Ring
15. Synchronizing "Blocker" Ring

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Figure 7B-60 - Clutch Gear and Mainshaft

11. Install first gear thrust washer (steel).

CAUTION: *Be sure the notches of the blocker ring align with the keys of the synchronizer assembly.*

12. Install first gear spring washer.

13. Install rear ball bearing with snap ring slot downward; press onto mainshaft. Figure 7B-63.

14. Install rear bearing to mainshaft snap ring.

15. Install speedometer drive gear and retaining clip.

This completes the assembly of the mainshaft.

ASSEMBLY OF TRANSMISSION (Figure 7B-66)

1. Using Tool J-22246 load a row of roller bearings (27) and a bearing thrust washer at each end of the countergear. Use heavy grease to hold them in place. See Figure 7B-64.

2. Place countergear assembly through case rear opening along with a tanged thrust washer (tang away from gear) at each end and install countergear shaft and woodruff key from rear of case.

CAUTION: *Be sure countersfaft picks up both thrust washers and that the tangs are aligned with their notches in the case.*

3. Install reverse idler gear and shaft with its woodruff key from the rear of case.

4. Using snap ring pliers, expand the snap ring in the extension and assemble extension over rear of mainshaft and onto rear bearing. Seat snap ring in rear bearing groove.

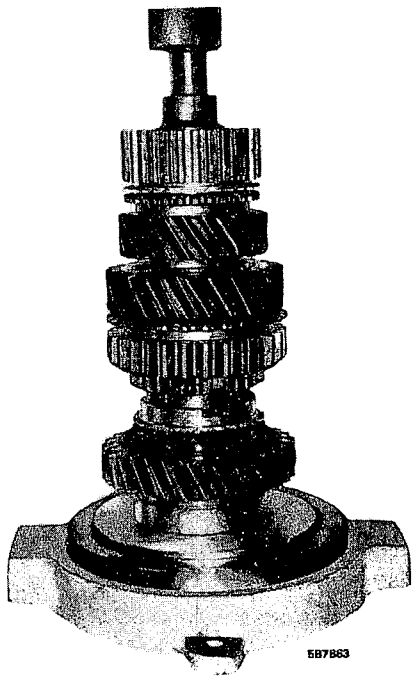


Figure 7B-63 - Installing Rear Bearing

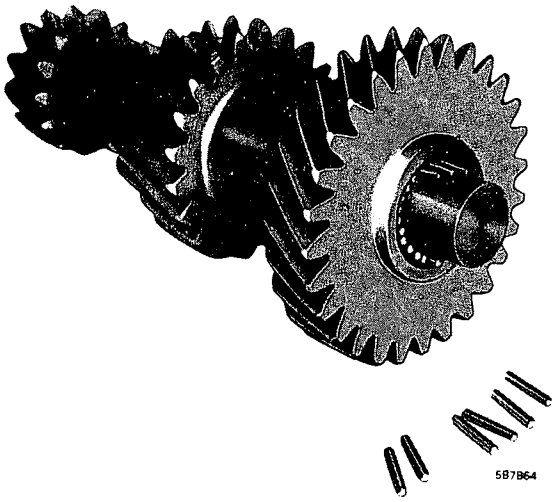


Figure 7B-64 - Loading Countergear Bearing

5. Load the mainshaft pilot bearings (14) into the clutch gear cavity and assemble the 4th speed blocker ring onto the clutch gear clutching surface with its clutching teeth toward the gear. See Figure 7B-65.

6. Place the clutch gear, pilot bearings and 4th speed blocker ring assembly over the front of the mainshaft assembly. Do not assemble bearing to gear yet.

CAUTION: *Be sure the notches in the blocker ring align with the keys in the 3-4 synchronizer assembly.*

7. Place extension to case gasket at rear of case holding in place with grease and, from the rear of the case, assemble the clutch gear, mainshaft and extension to case as an assembly.

8. Install extension to case retaining bolts. Using seal cement on bottom bolt only.

9. Install bearing over stem of drive gear and into front case bore.

10. Install snap ring to drive gear stem, and drive gear bearing retainer and gasket to case.

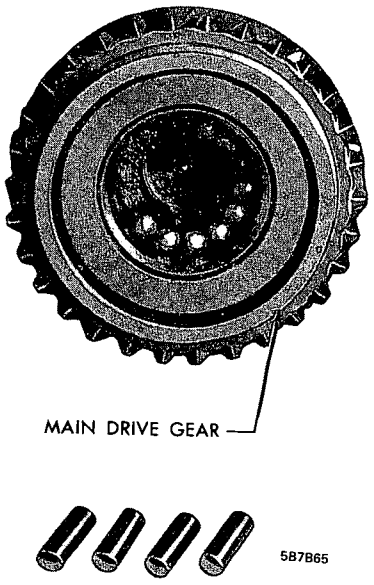


Figure 7B-65 - Loading Mainshaft Bearings

(NOTE: The retainer oil return hole should be at the bottom.)

11. Shift synchronizer sleeves to neutral positions and install cover, gasket and fork assembly to case. Be sure forks align with their synchronizer sleeve grooves.

12. Tighten all bolts to specified torque.

SPECIFICATIONS

Transmission Identification

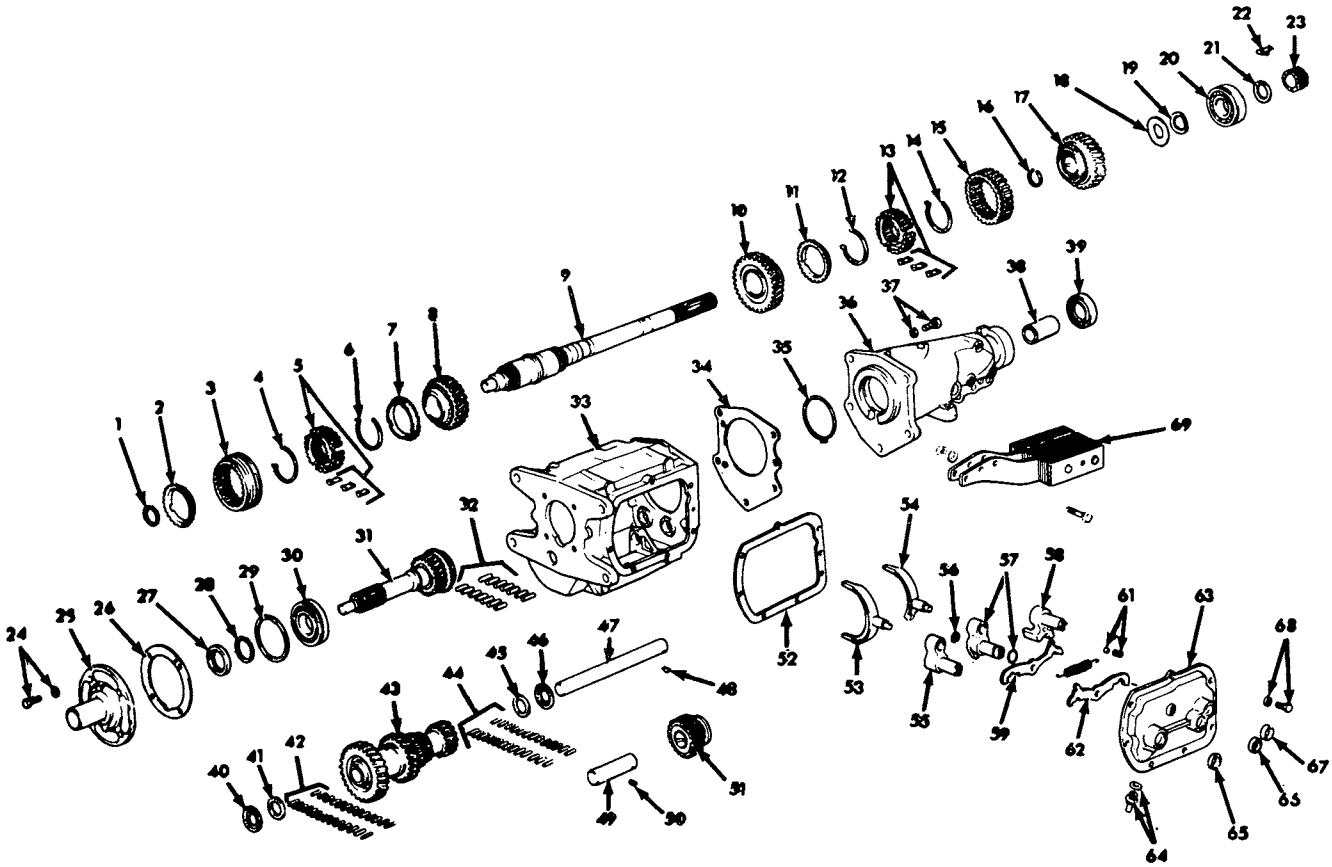
A production code and transmission serial number are stamped on the right side of the transmission case on H Series four speed manual transmissions. These numbers should always be furnished on all product reports, warranty document forms, and all correspondence with the factory concerning a particular transmission.

General Specifications

Transmission Fluid	
Type	SAE 80W or SAE 80W-90 GL-5
Capacity	Approx. 3 1/2 Pints
Gear Shifting	Floor Mounted
Gear Ratios	
1st	3.11 to 1
2nd	2.20 to 1
3rd	1.47 to 1
4th	1.00 to 1
Reverse	3.11 to 1

Bolt Tightening Specifications

	Torque Lbs. Ft.
Transmission to Clutch Housing	55
Transmission Filler Plug	18
Speedo Driven Gear Retainer	4
Transmission Control Lever	3
Transmission Control Rod To Swivel Lock Nut	10
Shift Control Levers	10



1. Snap ring, Hub to Shaft
2. Synchronizer Ring
3. 3-4 Synchronizer Sleeve
4. Synchronizer Key Spring
5. Synchronizer Hub and Keys
6. Synchronizer Key Spring
7. Synchronizer Ring
8. Third Gear
9. Main Shaft
10. Second Gear
11. Synchronizer Ring
12. Synchronizer Key Spring
13. Synchronizer Hub and Keys
14. Synchronizer Key Spring
15. 1-2 Synchronizer Sleeve & Rev. Gear
16. Snap Ring, Hub to Shaft
17. First Gear
18. Thrust Washer
19. Waved Washer
20. Ring Bearing
21. Snap Ring, Bearing to Shaft
22. Speedometer Gear Clip
23. Speedometer Drive Gear
24. Bearing Retainer Bolts and Washers (4)
25. Front Bearing Retainer
26. Bearing Retainer Gasket
27. Bearing Retainer Oil Seal
28. Snap Ring
29. Bearing Snap Ring
30. Front Bearing
31. Drive Gear
32. Pilot Bearings
33. Case
34. Extension to Case Gasket
35. Rear Bearing to Extension Retaining Ring
36. Rear Extension
37. Extension to Case Retaining Bolts and Washers
38. Rear Extension Bushing
39. Rear Seal
40. Thrust Washer
41. Spacer
42. Countergear Shaft Roller Bearings
43. Countergear
44. Countergear Shaft Roller Bearings
45. Spacer
46. Thrust Washer
47. Countergear Shaft
48. Countergear Shaft Key
49. Reverse Idler Shaft
50. Idler Shaft Key
51. Reverse Idler Gear
52. Side Cover Gasket
53. 3-4 Shift Fork
54. 1-2 Shift Fork
55. 3-4 Shifter Shaft
56. Retaining "E" Ring
57. 1-2 Shifter Shaft with "O" Rings
58. Reverse Shifter Shaft
59. 3-4 Detent Cam
60. Detent Cam Spring
61. Reverse Detent Ball & Spring
62. 1-2 Detent Cam
63. Shift Cover
64. TCS Switch and Gasket
65. Shifter Shaft Seal
66. Shifter Shaft Seal
67. Shift Cover Bolts and Washers
68. Shift Cover Attaching Bolts and Lock Washers
69. Damper Assembly

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Figure 7B-66 - Four Speed Transmission — Exploded View