SECTION D

THREE SPEED (MUNCIE) MANUAL TRANSMISSION G.S. AND G.S. 455 (FLOOR SHIFT)

CONTENTS

DIVISION I SPECIFICATIONS AND ADJUSTMENTS

72-1 GENERAL SPECIFICATIONS

a. Transmission Identification

A production code number and Car Serial Number are stamped on all G.S. 400 and G.S. 350 four-speed manual transmissions. These numbers should always be furnished on all AFA 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 90 Multi-Purpose
Capacity	4 Pints
Synchronization	1st, 2nd and 3rd
Gear Ratios	
1st	3.03 to 1
2nd	1.75 to 1
3rd	1.00 to 1
Reverse	3.02 to 1
Gear Shifting	On the Floor
Speedometer Driven Gear	Nylon

c. Bolt Tightening Specifications

Locations:	Torque Lbs. Ft.
Shifter Lever-to-Shifter Shaft Bolts	20
Side Cover-to-Case Bolts	22
Filler Plug-to-Case	15
Extension Housing-to-Case Bolts	45
Transmission Case-to-Clutch Housing Bolts	55
Frame-to-Crossmember Bolts	25
Crossmember-to-Rear Mount Bolts	40
Drain Plug-to-Case	30

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.

72D-2

DIVISION II

DISCRIPTION AND OPERATION

DISCRIPTION OF THE MUNCIE THREE-SPEED MANUAL TRANSMISSION

The Muncie three-speed transmission is the heavy duty, floor shift three-speed manual transmission used on V-8 G.S. and G.S. 455.

It is fully synchronized in all forward gears and incorporates helical drive gears throughout. Reverse gear is not synchronized; however, it is a helical gear to insure quiet operation. The main drive gear (input shaft) is supported by a ball bearing at the front end in an oil impregnated bushing mounted in the engine crankshaft. The front end of the mainshaft is piloted in a row of roller bearings, set into the hollow end of the main drive gear, and is carried at the rear by a bearing mounted in the front face of the extension housing. The countergear is carried on a double row of roller bearings at both ends and thrust is taken on thrust washers located between the ends of the countergear and thrust bosses in the case. An anti-lash plate assembly at the front face of the countergear provides a constant spring tension between the countergear and the main drive gear to reduce torsional vibrations. The reverse idler gear is carried on a bushing finish, bored in place, and thrust is taken on the thrust bosses of the case.

Gear shifting is manual through a floor mounted shifter assembly from a control rod to the outer rear shifter lever of the side cover assembly for first and reverse gears and from a control rod to the outer forward shifter lever of the side cover assembly for second and third gear. All three forward gears are fully synchronized and each of these two synchronizer assemblies consists of a hub, sleeve, two key springs, and three synchronizer keys. The synchronizer hubs are spliced to the mainshaft and are retained by snap rings. The transmission may be used as an aid in slowing vehicle speed in decelleration by downshifting in sequence without double-clutching or any gear clashing.

No periodic service of the transmission is required except checking for leaks and checking for proper lubricant level every 6,000 miles. If there is evidence of leakage, leak should be corrected and lubricant added as needed. It is recommended that any additions required to bring up lubricant level should be made using the same type lubricant already in the transmission.

When checking lubricant level in transmission, it should be checked at operating temperature. When at operating temperature, lubricant should be level with bottom of filter plug hole. If unit is cold, lubricant level should be 1/2 inch below the filler plug hole. Refill capacity is four pints. Use SAE 90 "Multi-Purpose" gear lubricant. The SAE 90 viscosity grade is recommended for year around use. However, when extremely low temperatures are encountered for protracted periods during winter months only, the SAE 80 viscosity grade may be used. No special additive to these lubricants is required or recommended.

Every 6,000 miles or four months, lubricate shift linkage and floor shift control lever contacting faces with water resistant EP chassis lubricant. To lubricate the floor shifter assembly, use a needle fitting adapter on grease gun nozzle and direct grease liberally into vital areas as follows:

1. Pry dust cover off with a screwdriver blade.

2. Move gearshift control lever into third gear (second - third linkage moved forward), inject grease onto contact surfaces *behind* second-third lever, move control lever into second gear (second - third linkage moved rearward) and inject grease into contact surface *ahead* of second - third lever. Use grease liberally.

3. Repeat step 2 with first-reverse lever, and after all areas have been greased, replace dust cover.

DIVISION III

SERVICE PROCEDURES

72-3 REMOVAL AND INSTALLATION OF TRANSMISSION

a. Removal

1. Raise vehicle on hoist.

2. Replace propeller shaft as outlined in Group 40.

3. Disconnect speedometer cable from its driven gear fitting and disconnect leads from transmission switches.

4. Remove frame-to-crossmember attaching bolts and units and crossmember-to-rear mounting assembly bolts.

5. Support engine, raise slightly and slide crossmember rearward or remove.

6. Remove shifter levers at transmission shifter shafts and remove shifter assembly-to-shifter support attaching bolts. If shifter assembly removal is not required, it may be left hanging from its floor seal.

7. Remove two (2) upper transmission-to-clutch housing retaining bolts, install two (2) transmission aligning pins in their place and then remove the two (2) lower retaining bolts.

NOTE: *If guide pins are not used, damage to the clutch driven plate can result.*

8. Slide transmission rearward and remove from vehicle.

b. Installation

1. Raise transmission into position and slide forward, piloting main drive gear bearing retainer into clutch housing and index transmission with transmission aligning pins, which were installed to facilitate removal.

2. Install lower transmission-to-clutch housing bolts, remove aligning pins, and install two upper transmission-to-clutch housing bolts. Torque bolts to 55 lb. ft.

3. Position shifter assembly to extension housing shifter support and retain with its two (2) attaching bolts. Torque center bolt to 50 lb. ft.; rear bolt to 30 lb. ft.

4. Connect shifter levers to side cover shifter shafts. Torque attaching bolts to 25 lb. ft.

5. Support engine and raise slightly until crossmember may be repositioned. Then, install frame-to- crossmember attaching bolts and nuts, torque to 25 lb. ft. and remove engine support.

6. Install crossmember-to-rear mounting assembly bolts, torquue 40 lb. ft., connect speedometer cable to driven gear fitting and connect electrical leads.

7. Install propeller shaft assembly as outlined in Group 40.

8. Fill transmission with lubricant (level should be 1/2 inch below filler plug hole), install and tighten filler plug to 15 lb. ft. torque and remove vehicle from hoist.

9. Check operation of transmission.

72-4 DISASSEMBLY OF TRANSMISSION

1. With transmission shifter shafts in neutral, remove side cover attaching 1/2" bolts (7), cover assembly, shifter forks (2), and drain lubricant. See Figure 72-300.

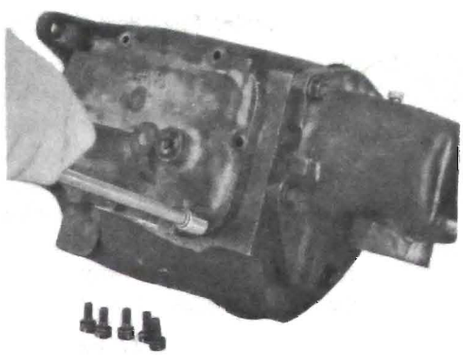


Figure 72-300 Removing Side Cover Bolts

2. Remove extension housing-to-case attaching 5/8" bolts (5). See Figure 72-301.

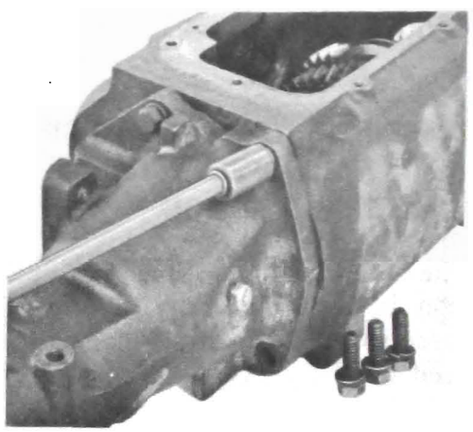


Figure 72-301 Removing Extension to Case Bolts

3. Rotate extension housing 1/4 counterclockwise, and using drift or other suitable tool, drive reverse idler shaft and its woodruff key out rear of case. See Figure 72-302.

4. Move 2-3 synchronizer sleeve forward, and from rear of case, remove extension housing and mainshaft assemblies. Remove reverse idler gear from case and third speed blocker ring from main drive gear. See Figures 72-303 and 72-304.

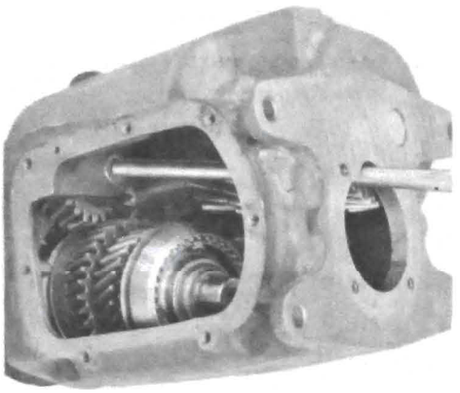


Figure 72-302 Removing
Reverse Idler Shaft

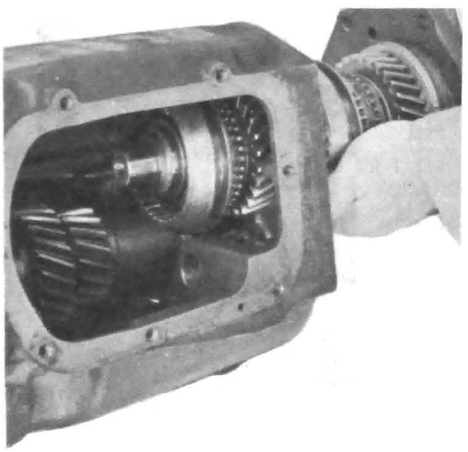


Figure 72-303 Removing
Mainshaft Assembly

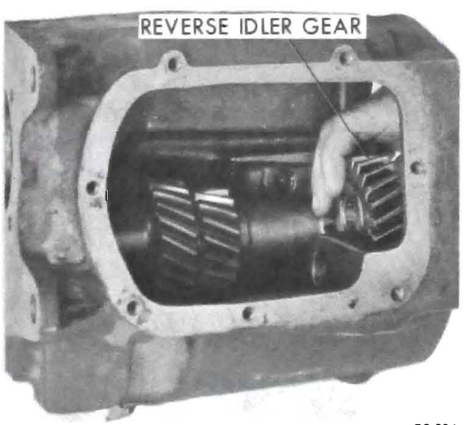


Figure 72-304 REMOVING
Reverse Idler Gear

5. Using snap ring pliers, expand snap ring at front of extension housing that retains mainshaft rear bearing and remove extension housing from mainshaft assembly. See Figure 72-305.

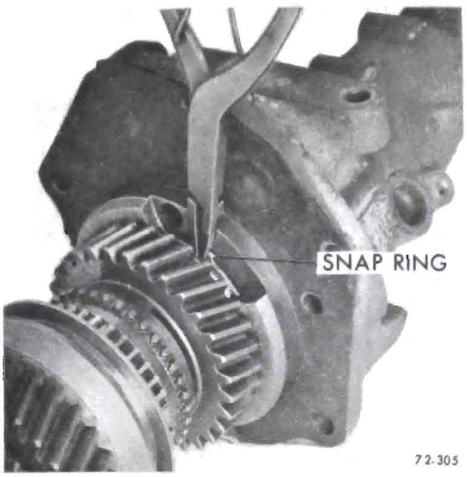


Figure 72-305 Removing
Extension Housing to Rear
Bearing Snap Ring

6. Remove main drive gear bearing retainer bolts (4) and lock washers (4), bearing retainer and gasket. See Figure 72-306.

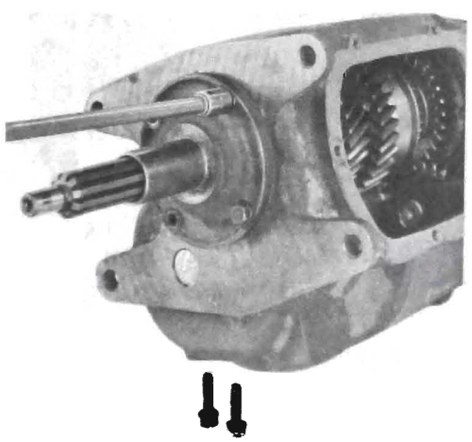


Figure 72-306 Removing
Main Drive Gear Bearing
Retainer Bolts

7. Remove bearing-to-main drive gear stem snap ring and remove main drive gear from inside of case by gently tapping on pilot end of main drive gear. See Figure 72-307.

8. Remove oil slinger from main drive gear stem and unload sixteen (16) mainshaft pilot bearings from main drive gear cavity.

9. Slip main drive gear bearing out

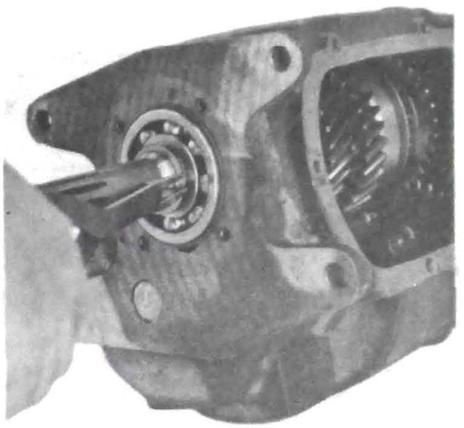


Figure 72-306 Removing
Main Drive Gear Bearing
Retainer Bolts

front of case. Since bearing is a slip fit on main drive gear stem and in case bore, it may be necessary to aid removal with a screwdriver between case and bearing outer snap ring. See Figure 72-308.

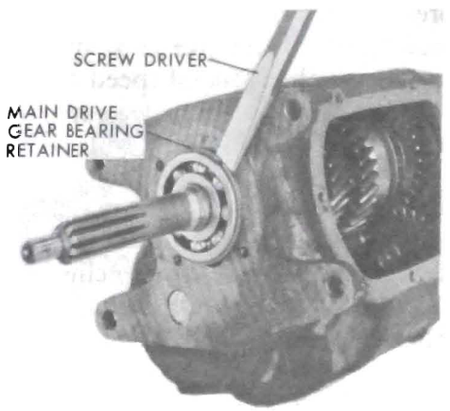


Figure 72-308 Removing
Main Drive Gear Bearing

10. Using drift or other suitable tool, drive countershaft and its woodruff key out rear of case. See Figure 72-309.

11. Remove countergear and its two (2) tanged thrust washers from each end of the countergear.

72-5 MAINSHAFT ASSEMBLY

a. Disassembly

1. With front of mainshaft upward,

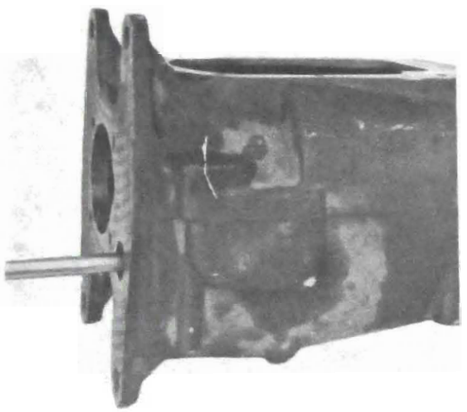


Figure 72-309 Removing Countershaft

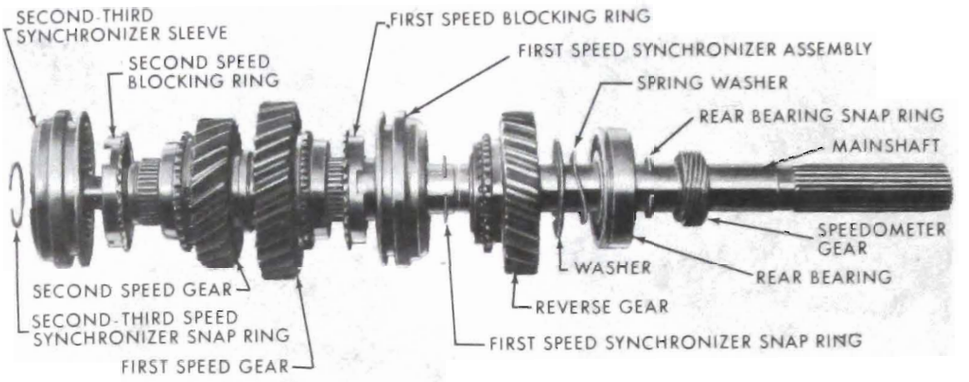


Figure 72-310 Exploded View of Mainshaft

remove third speed blocker ring, and using snap ring pliers, remove 2-3 synchronizer hub snap ring from mainshaft. See Figure 72-310 and Figure 72-311.

2. Support second speed gear with press plates and press on front of mainshaft to remove 2-3 synchronizer assembly, second speed blocker ring and second speed gear from mainshaft. See Figure 72-311.

3. From other end of mainshaft, remove speedometer drive gear by depressing its retainer clip and sliding it from mainshaft. See Figure 72-312.

4. Remove rear bearing snap ring from mainshaft groove, and supporting reverse gear with press plates, press on rear of mainshaft to remove reverse gear, thrust washer and rear bearing from mainshaft. Use care when pressing so that reverse gear, thrust washer and rear bearing are centered on mainshaft. See Figure 72-313.

5. Remove first and reverse synchronizer hub snap ring from mainshaft. See Figure 72-314.

6. Support first speed gear with press plates and press on rear of mainshaft to remove first and reverse synchronizer assembly, first speed blocker ring and first speed gear

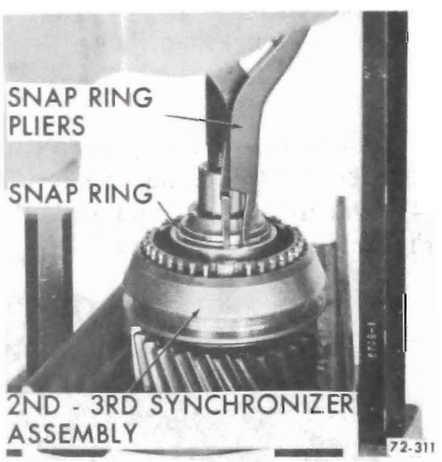
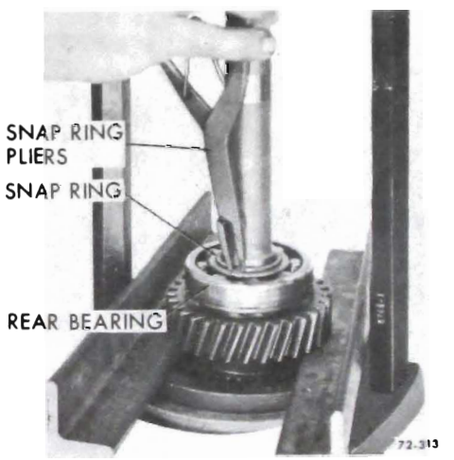


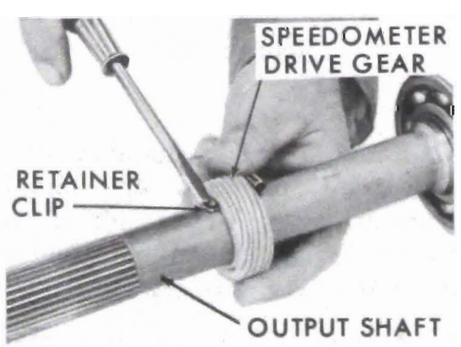
Figure 72-311 Removing Second-Third Speed Synchronizer Snap Ring



Removing Rear Bearing Snap Ring

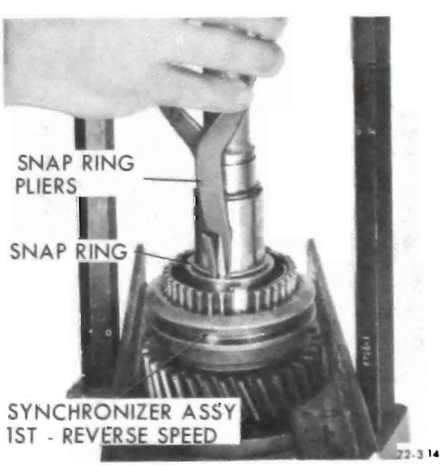
b. Reassemble

1. Turn the front of the mainshaft downward. Install the following components on the mainshaft.



NOTE: IT MAY BE NECESSARY TO TAP DRIVE GEAR WITH A PLASTIC HAMMER 72-312

Figure 72-312 Removing Speedometer Drive Gear



Removing First - Reverse Speed Synchronizer Snap Ring

2. Install the second speed gear with clutching teeth downward. The rear

face of the gear will fit against flange on the mainshaft. See Figure 72-315.

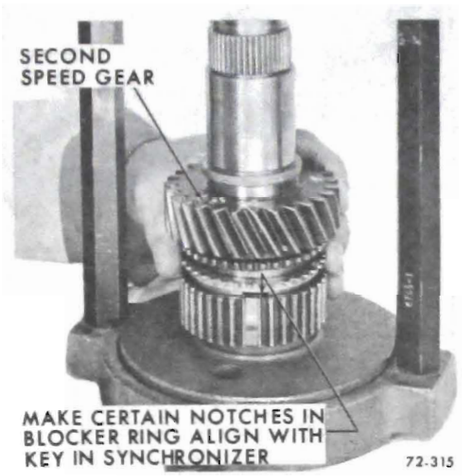


Figure 72-315 Installing Second-Speed Gear

3. Install second-speed blocker ring, with clutching teeth upward, over the synchronizing surface of the second speed gear. See Figure 72-316.

NOTE: *All three blocker rings are identical. (Note) The hub assemblies face in opposite directions while the synchronizer collars face the front of the transmission.*

4. Install second-third speed synchronizer snap ring. See Figure 72-316.

5. Install the second and third speed synchronizer assembly, (see Figure 72-317). Install synchronizer assembly with the front hub and collar assembly facing the main drive gear. Press the hub onto splines of mainshaft until it bottoms out using ram press or arbor press and Press Plate Tool J-8609.

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

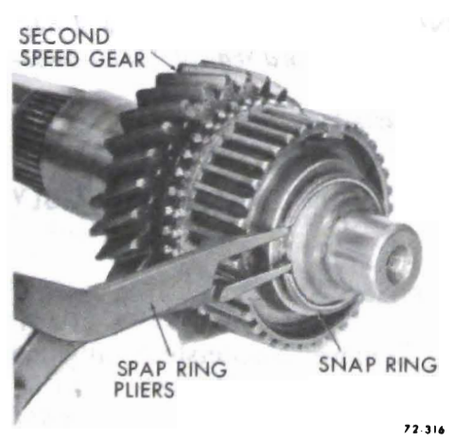


Figure 72-316 Installing Second-Third-Speed Synchronizer Snap Ring

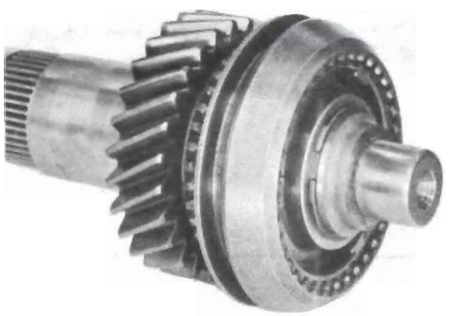


Figure 72-317 Installing Second-Third-Speed Synchronizer Assembly

6. Turn the rear of the mainshaft downward in the holding fixture and install the first-speed gear and blocker ring with clutching teeth downward. Position front face of gear against flange on mainshaft. See Figure 72-318.

7. Install first-speed synchronizer snap ring. See Figure 72-319.

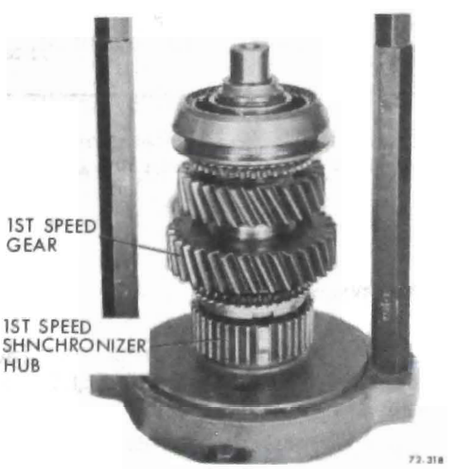


Figure 72-318 Install First-Speed Gear

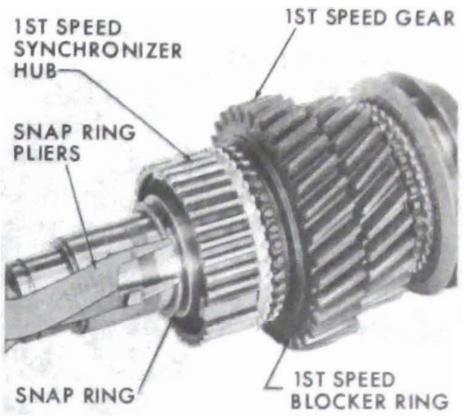


Figure 72-319 Installing First-Speed Synchronizer Snap Ring

8. Install the first and reverse synchronizer assembly, synchronizer hub to the rear and press it onto splines of the mainshaft using ram or arbor press and Press Plate Tool J-8609.

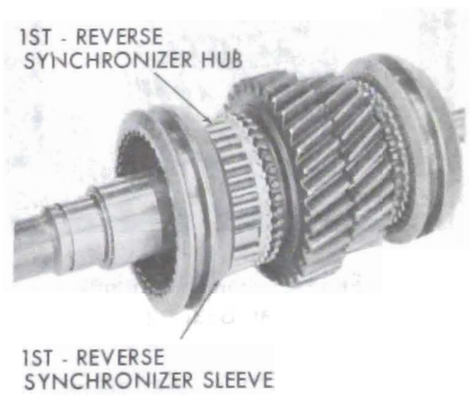


Figure 72-320 Installing First and Reverse Synchronizer Assembly

9. Install reverse gear, thrust washer, spring washer, rear bearing, and rear bearing snap ring. See Figure 72-321.

NOTE: *Groove on bearing must be toward reverse gear. Using ram or arbor press and Press Plate Tool J-8609, press rear bearing into position. See Figure 72-322.*

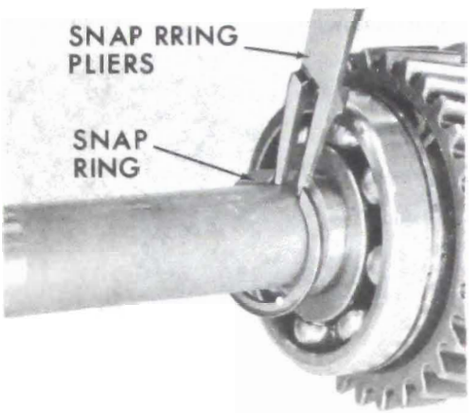


Figure 72-321 Installing Rear Bearing Snap Ring

Figure 72-322 Installing Rear Bearing

10. Install speedometer drive gear retainer clip. Align slot in speedometer drive gear with retainer clip and install. See Figure 72-323.

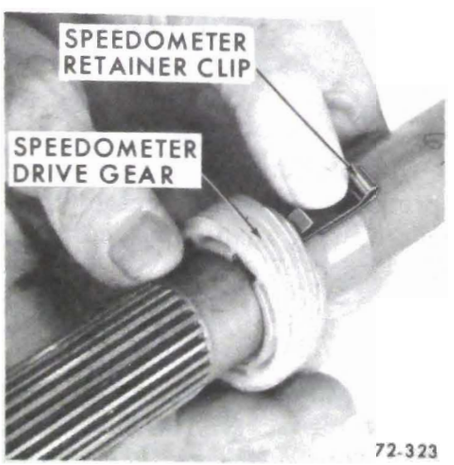


Figure 72-323 Installing Speedometer Drive Gear

72-6 REAR BEARING RETAINER SEAL AND BUSHING

a. Removal

1. Using Tool J-2619 Slide Hammer and Tool J- 4830-02 Puller, remove rear bearing retainer oil seal. See Figure 72-324.

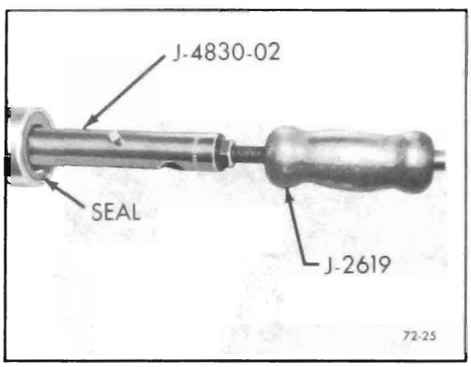


Figure 72-324 Removing Rear Bearing Retainer Oil Seal

2. Using Tool J-2619 Slide Hammer and Tool J- 4830-02 Puller, remove rear bearing retainer bushing. See Figure 72-325.

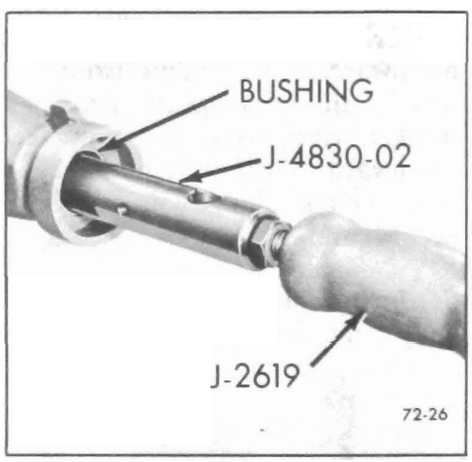


Figure 72-325 Removing Rear Bearing REtainer Bushing

b. Installation

1. Install rear bearing retainer bushing, using Tool J-6403-1. See Figure 72-326.

2. Install rear bearing retainer oil seal as follows:

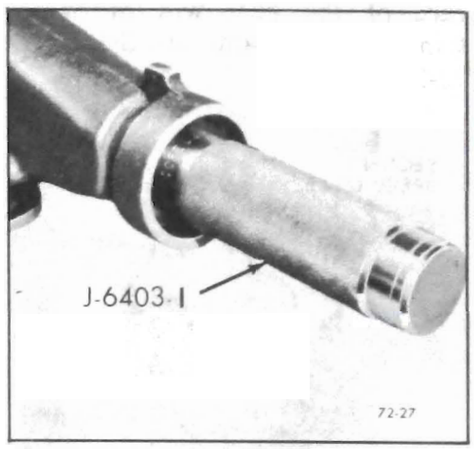


Figure 72-326 Installing Rear Bearing Retainer Bushing

a. Install Tool J-6403-2 onto Tool J-6403-1. See Figure 72-327.

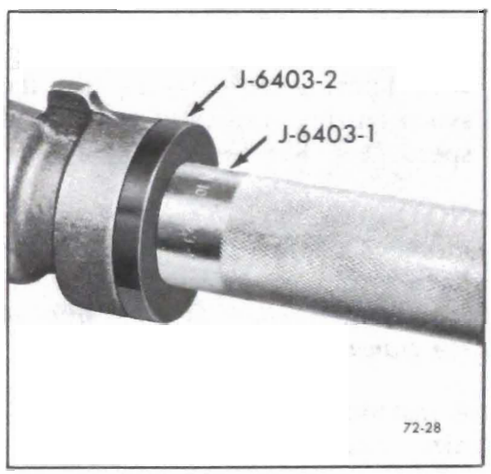


Figure 72-327 Installing Rear Bearing Retainer Oil SEAL

NOTE: *Flat side of Tool J-6403-2 must be toward rear of Tool J-6403-1.*

b. Install oil seal.

72-7 COUNTERGEAR ASSEMBLY

a. Disassembly

1. Remove countershaft alignment Tool J-22246.

2. From each end of countershaft, remove spacer and 27 needle bearings. See Figure 72-328.

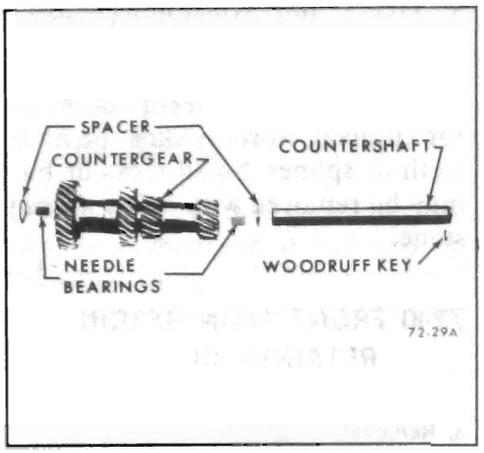


Figure 72-328 Exploded View of Countershaft

b. Inspection

1. Check for broken needle bearings.

2. Check for broken anti-rattle gear springs. See Figure 72-329.

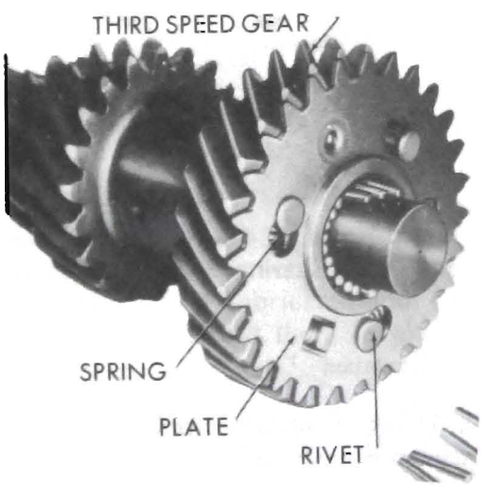


Figure 72-329 Anti-Rattle Gear

NOTE: *The anti-rattle gear is riveted to the countergear and is not serviced separately.*

c. Assembly

1. Install Countershaft Alignment Tool J-22246.

2. From each end of countergear, install 27 needle bearings and spacer. See Figure 72-328.

NOTE: *Use heavy grease to retain needle rollers.*

72-8 SIDE COVER ASSEMBLY

a. Disassembly (See Figure 72-33)

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.

b. Assembly (See Figure 72-31)

1. Install shifter shaft "O" rings, if removed.

2. Install detent cams.

3. Install detent cam retainer.

4. Install shifter shafts.

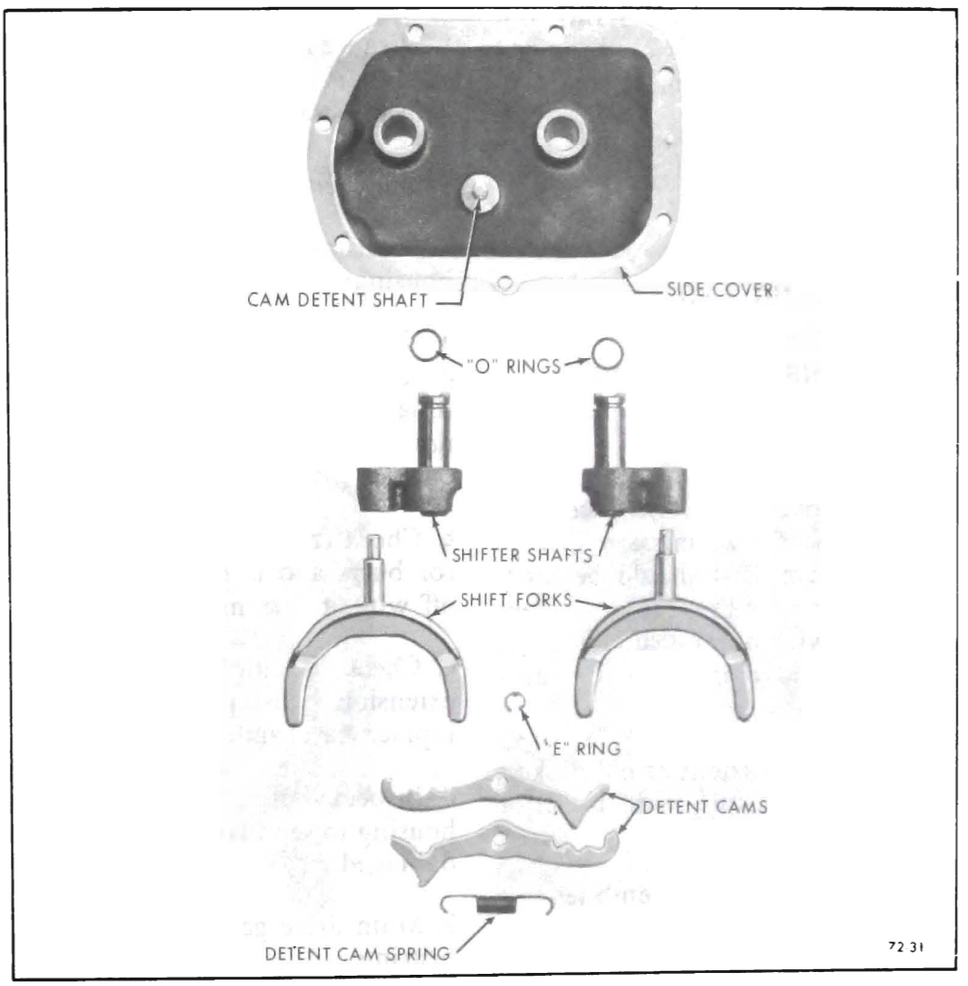


Figure 72-330 Exploded View of Side Cover

5. Install shifter forks.

6. Install detent cam spring.

NOTE: *Detent cams, shifter shafts and forks are interchangeable.*

c. Install

1. Position side cover gasket on case and carefully position side cover into place, making sure that shifter forks are aligned with their respective synchronizer sleeves.

2. Install side cover bolts, tighten to 20 lb. ft. torque and connect control rods to shifter levers.

3. Remove filler plug from case and add SAE 90 "Multi Purpose" gear lubricant so that lubricant level is approximately level with bottom of filler plug hole when unit is at operating temperature. With unit cold, lubricant level should be 1/2 inch below the filler plug hole.

4. Install and tighten filler plug to 15 lb. ft. torque, lower and remove vehicle from hoist.

72-9 CLEANING AND INSPECTION OF TRANSMISSION PARTS

a. Cleaning

1. During overhaul procedures, all components of transmission (except bearing assemblies) should be thoroughly cleaned with cleaning solvent and dried with air pressure prior to inspection and reassembly of transmission.

2. Remove all portions of old gaskets from parts by using a stiff brush or scraper.

3. Clean bearing assemblies as follows:

a. Since careful and proper cleaning of bearings is very important, they should always be cleaned separately from other parts.

b. Soak bearing assemblies in CLEAN cleaning solveent. Gasoline is not recommended. Bearings should never be cleaned in a hot solution tank.

c. Slush bearings in solvent until all lubricant is loosened. Hold bearing races so bearings will not rotate; then brush bearings with soft bristled brush until all dirt has been removed. Remove loose particles of dirt by striking bearing flat against a block of wood.

d. Rinse in clean solvent; then blow bearings dry with air pressure. DO NOT SPIN BEARINGS WHILE DRYING.

e. Rotate each bearing slowly while examining balls or rollers for roughness, excessive wear or other damage. Replace all bearings not in first class condition.

f. Wrap each bearing in clean cloth or paper until ready to reinstall in transmission.

b. Inspection

1. Transmission case and extension housing:

a. Examine case and housing for cracks or other damage. Since repairs by welding, brazing, etc., are not recommended, replace damaged parts.

b. Check front and rear faces of case for burrs and if present, dress them off with a fine mill file.

c. Check bearing bores in case and extension housing and if damaged, replace case and/or housing.

d. Inspect vent assembly in extension housing to see that it is open and not damaged.

2. Main drive gear bearing and rear bearing:

a. Slowly turning race by hand, check for roughness. Replace bearing if rough.

b. Check fit of bearings on their respective shafts and in their bores.

3. Bearing rollers, shafts and washers:

a. Examine mainshaft pilot bearings and countergear bearing rollers and replace if they show wear, pitting or galling.

b. Inspect countershaft and reverse idler shaft for wear or other damage. Check woodruff keys and keyways for condition and fit.

c. Inspect thrust washers and block or rings for wear or damage.

4. Gears and synchronizer assemblers:

a. Examine all gear teeth and splines for chipped, worn, broken, or nicked teeth or splines. Small nicks or burrs may be removed with a fine abrasive stone.

72-10 FRONT MAIN BEARING RETAINER OIL SEAL

a. Removal

1. Using screwdriver remove seal. See Figure 72-331.

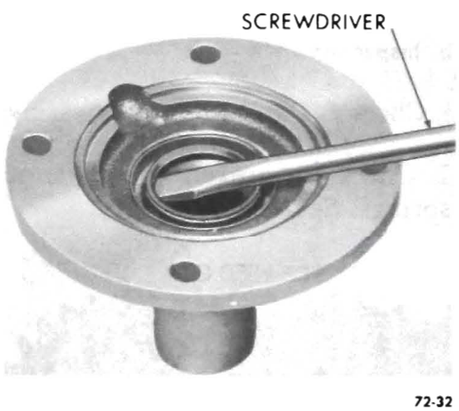
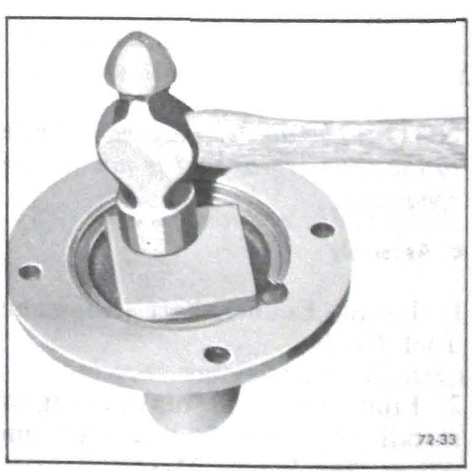


Figure 72-331 Removing Front Bearing Retainer Seal

b. Installation

1. Using a suitable tool, drive new seal into position. See Figure 72-332.



Figue 72-332 Installing Front Bearing Retainer Seal

NOTE: *Lip of seal must face rear of bearing retainer.*

72-11 TRANSMISSION REASSEMBLY

NOTE: *For ease in assembling and installing countergear, a tool may be facbricated using a l' diameter dowel stock cut to length of 9-5/8'. See Figure 72-333.*

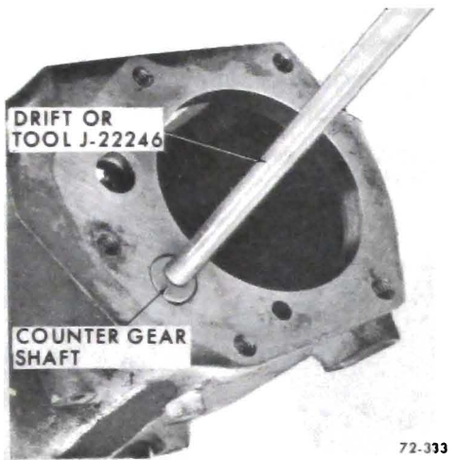


Figure 72-333 Installing Countergear Shaft

1. Load a row of roller bearings (29), a bearing washer, a second row of roller bearings (29) and a second bearing washer at each end of the countergear. Use fabricated tool or heavy grease to hold them in place. See Figure 72-334.

2. Place countergear assembly, along with a tanged thrust washer (tang away from gear) at each end, through rear opening of case and install countershaft and woodruff key from rear of case. Make sure that thrust washer tangs are aligned with their notches in case and that end flat of countershaft is flush with rear face of case. See Figure 72-335.

3. Lay reverse idler gear in case. Do not install reverse idler shaft yet.

4. Using snap ring pliers, expand snap ring in extension housing and position extension housing over rear of mainshaft and onto rear bearing. Seat snap ring into groove of rear bearing. See Figure 72-337.

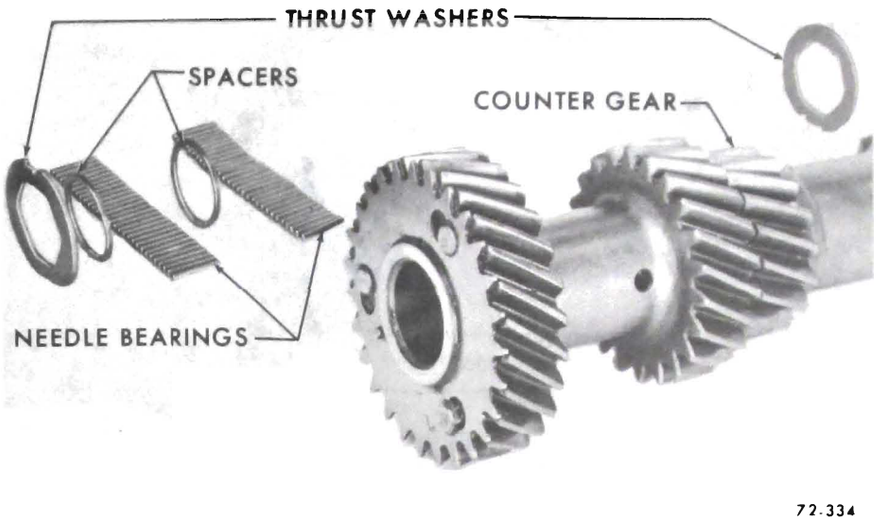


Figure 72-334 Exploded View of Countergear

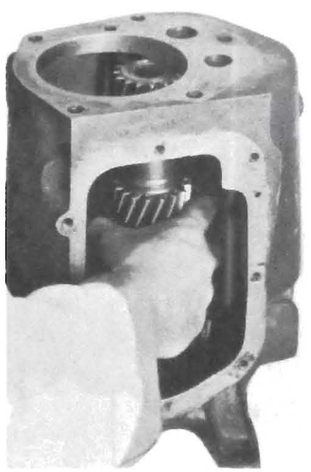


Figure 335 Installing Countergear Assembly

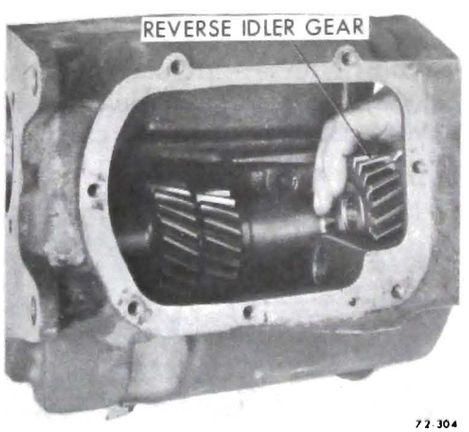


Figure 336 Installing Reverse Idler Gear

5. With heavy grease holding them in place, load mainshaft pilot bearings (16) into main drive gear cavity and install blocker ring over synchronizing surface of main drive gear with its clutching teeth toward gear.

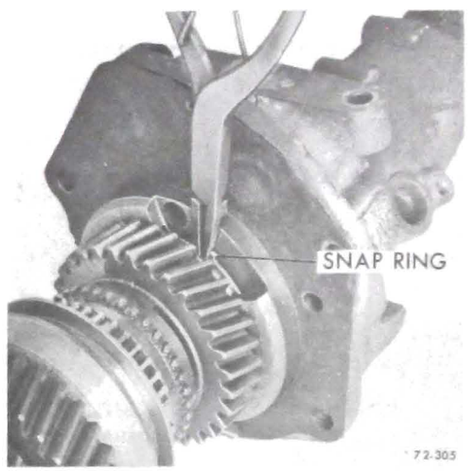


Figure 72-337 Installing Rear Bearing to Extension Housing Snap Ring

6. Pilot main drive gear assembly (minus front bearing) over front of mainshaft, making sure that notches of blocker ring align with keys in 2-3 synchronizer assembly. See Figure 72-338.

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

8. Rotate extension housing and install reverse idler shaft and its woodruff key so that end flat of shaft is flush with rear face of case. See Figure 72-340.

Figure 72-338 Installing Pilot Bearings and Third Gear Blocker Ring on Clutch Gear

make sure that main drive gear teeth engage the teeth of the countergear anti-lash plate. See Figure 72-339.

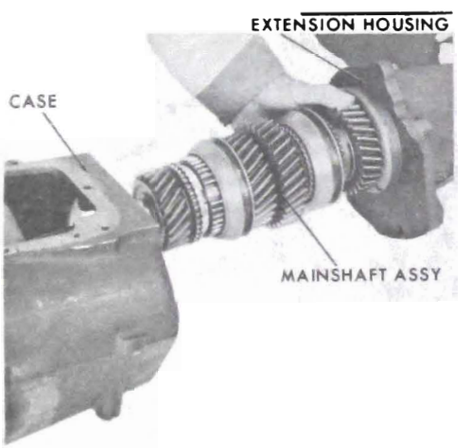


Figure 72-339 Installing Main Shaft in Case

9. Align extension housing, install housing-to-case bolts (5) and torque them to 45 lb. ft. See Figure 72-341.

10. Position oil slinger, inner lip facing forward, on main drive gear stem, install front bearing outer snap ring to bearing and slide bearing onto stem of main drive gear and

NOTE: *The retainer oil return hole should be positioned toward bottom of case.*

11. Install snap ring to main drive gear stem and install main drive gear bearing retainer and its gasket to case. Install and torque retainer bolts (4) and lock washers (4) to 20

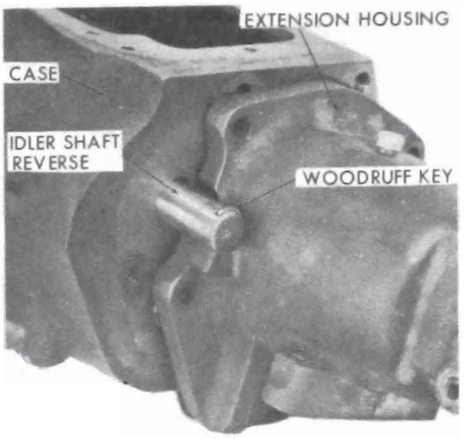


Figure 72-340 Installing Reverse Idler Shaft

into case bore. See Figure 72-342.

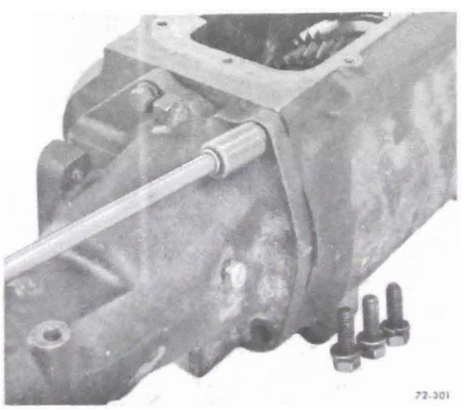


Figure 72-341 Removing Extension to Case Bolts

lb. ft.

12. Shift both synchronizer sleeves to neutral position and install side cover assembly and its gasket to

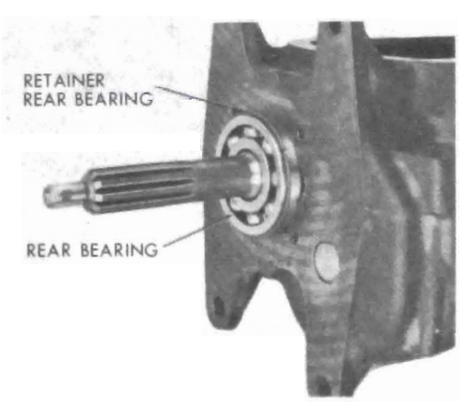


Figure 72-342 Installing Clutch Drive Gear Bearing Into Case

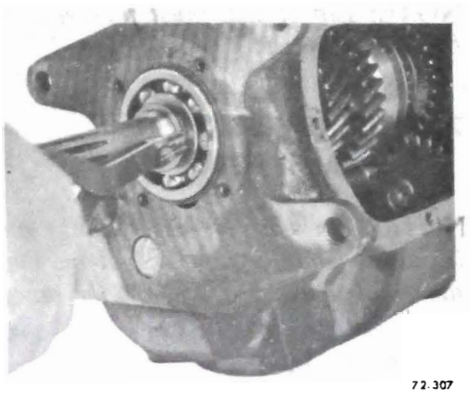


Figure 72-343 Installing Bearing to Main Drive Gear Stem Snap Ring

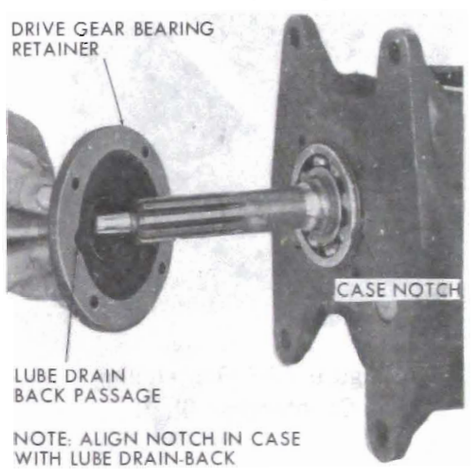


Figure 72-344 Installing Main Drive Gear Bearing Retainer

case. While installing cover, be sure that shifter forks align with their synchronizer sleeve grooves.

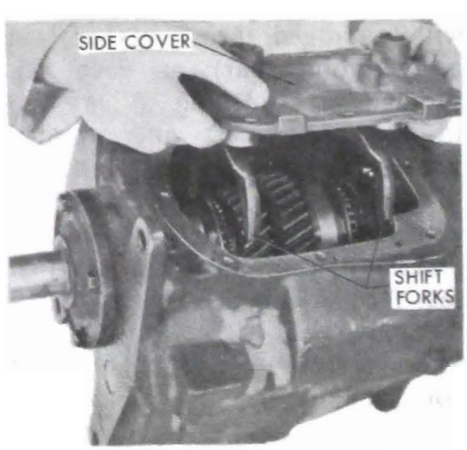


Figure 72-345 Installing Side Cover

13. Install and torque all side cover attaching bolts (7) to 20 lb. ft.

DIVISION IV TROUBLE DIAGNOSIS

72-12 TROUBLE DIAGNOSIS

Complaint	Probable Cause
NOISEY IN FOREWARD SPEEDS	Noisey speedometer drive and/or driven gears. Worn or rough mainshaft rear bearing. Excessive end play of manishaft gears. Refer to conditions listed under "Noise in Neutral."
NOISE IN NEUTRAL	Improper lubricant or lack of lubrication. Incorrect clutch linkage adjustment. Misalignment of transmission. Worn or scored main drive gear and/or countershaft bearing rollers. Worn mainshaft pilot bearings. Scuffed gear tooth contact surfaces on gears; worn or rough reverse idler gear. Excessive back lash or unmatched constant mesh gears. Sprung, worn or excessive end play in countershaft. Excessive end play in reverse idler pinion.
HARD SHIFTING	Low level or wrong lubricant. Incorrect clutch linkage adjustment. Improper adjustment of shift linkage, excessively worn or damaged. Shift assembly mounting bolts too tight. Worn, sprung shifter forks or worn shifter shafts. Damaged synchronizer assemblies.
STICKING IN GEAR	Wrong or low level of lubricant. Clutch not releasing fully. Worn chamfer on detent cam notches. Damaged blocker ring or teeth of sychronizer sleeve. Misaligned mainshaft and/or countershaft.

DIVISION IV TROUBLE DIAGNOSIS

72-12 TROUBLE DIAGNOSIS (Cont.)

Complaint	Probable Cause
WALKING OR SLIPPING OUT OF GEAR	Shift linkage out of adjustment, worn or loose, to prevent full engagement of synchronizer sleeve. Interference or resistance in side cover shift mechanism to prevent full engagement of the synchronizsleeve, such as bent or worn shift fork, lever and/or shaft, damaged detent cams, spring. If synchronizer sleeve is engaging fully, look for some other malfunction which could move sleeve out of engagement, such as worn clutch teeth on gears, synchronize sleeve, blocker ring, etc. Worn pads on shift fork or sleeve worn excessively. Worn taper on clutch gear teeth. Transmission and engine misaligned vertically or horizontally.
WALKING OR SLIPPING OUT OF GEAR (Especially on rough Roads.)	Detent cam spring in side cover broken. Detent cam notches worn. If holding gearshift lever will prevent jump-out, detent cam modification or replacement will often correct it. When a gear has been allowed to jump-out for a long period of time, the cause must be corrected plus (in most cases) the replacement of affected gears. Excessive end play in main drive gear, mainshaft or counter gear caused by worn, chipped or scored bearings and retainers. Thrust washer or faces worn excessively or missing.
ROUGH NEUTRAL CROSS-OVER	Improper adjustment of shift linkage. Bent or damaged shift control rod (1st - rev. or 2nd - 3rd rod).
LOCKS IN TWO GEARS AT SAME TIME	Improper adjustment of shift linkage. Bent or damaged shift control rod or rods.

DIVISION IV TROUBLE DIAGNOSIS

72-12 TROUBLE DIAGNOSIS (Cont.)

Complaint	Probable Cause
OIL LEAKS	Wrong lubricant or level to high. Drain plug loose. Welch plugs loose or missing from machine openings in case. Seals at side cover or extension housing omitted or defective. Extension housing bushing worn, resulting in repetitive oil seal failures. Attaching can screws loose or omitted from bearing retainers, side cover. Oil drain - back openings in bearing retainer or case plugged with varnish or dirt, or covered with gasket material. Broken gaskets, gaskets shifted or squeezed out of position, pieces still under bearing retainer or cover. Cracks or holes in castings.
CLASHING OR RAKING OF GEARS	Raking of gears during shift duration is usually caused by a defective synchronizer or improper shifting technique. a. Broken synchronizer components will sometimes prevent proper movement of synchronizer sleeve, resulting in clashing shifts. b. Worn synchronizer components, with loss of clutching action, are usually caused by poor driver technique. Failure to control engine speed drop-off during upshift, or failure to bring engine speed nearly up to output shaft speed when downshifting, causes overwork of synchronizer and failure to shift. Also, shifting without using clutch will burn or wear out synchronizer at relatively low mileage. When shift lever moves directly into gear position without resistance, raking of gears will be audible and felt through the gearshift lever. This condition does not always mean that synchronizer is worn out or broken. The following may cause this condition: a. Often, small chips may lodge temporarily in a synchronizer which would prevent proper synchronization and cause a raking shift. Continued operation may either embed the chip below the

DIVISION IV TROUBLE DIAGNOSIS

72-12 TROUBLE DIAGNOSIS (Cont.)

Complaint	Probable Cause
CLASHING OR RAKING OF GEARS (Cont.)	surface of the bronze blocker ring or reject it. and the synchronizer will return to normal functioning. CAUTION: Use of extreme pressure-type lubricants is not recommended. Glazing of synchronizer block or ring, due to breakdown of oil, is especially common because of additives found in extreme pressure lubricants. b. Use of improper lubricants often causes raking of synchronizers. Heavy oil prevents synchronizer from breaking through oil film and doing the job properly. This raking noise usually occurs with cold and heavy oil, but synchronizer begun to function properly when normal operating temperature of transmission oil is reached.