Date 1-1-89

MC-9 MAINTENANCE MANUAL

SECTION 13

TRANSMISSION

MC-9 MAINTENANCE MANUAL

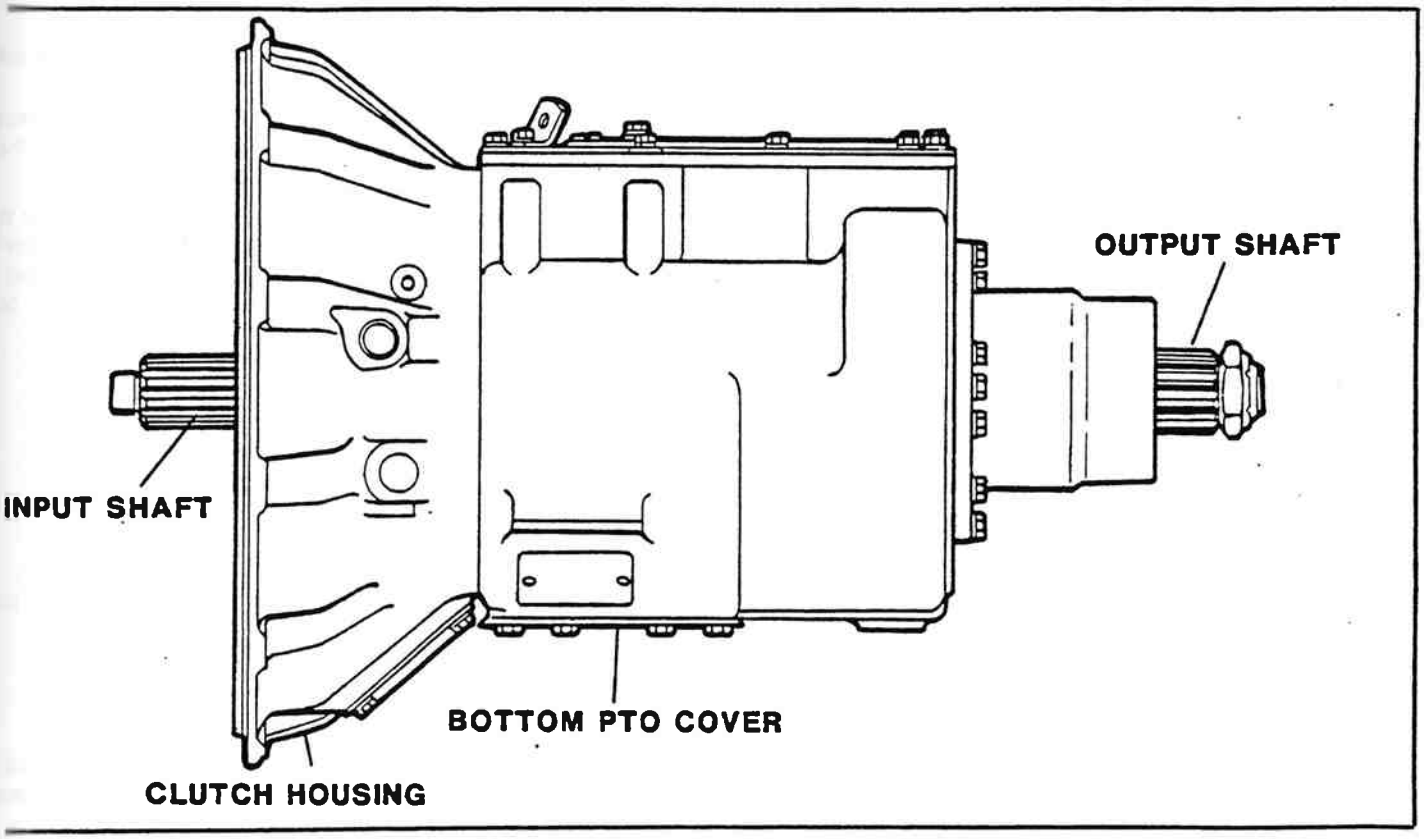

Figure 13-1. T-11605 Transmission.

5-SPEED MANUAL TRANSMISSION

The model 11605 transmission (figure 13-1) has five forward speeds and one reverse. Figure 13-2 shows the shift pattern. Twin countershafts divide the torque equally between shafts and gears. The countershafts are identical except for the PTO gears.

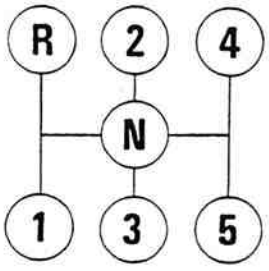

Figure 13-2. 5-Speed Shift Pattern.

The mainshaft gears are located axially by washers and held in position by the rotation of the countershaft gears. All gears have spur type teeth.

The mainshaft gears are clutched by internal splines in the hubs of gears. Sliding clutch gears with short, conical clutching teeth provide short, easy shifts.

The input shaft and drive gear are not integral and may be changed individually.

The transmission is splash lubricated by oil contained in the case. Two magnetic oil plugs are located on the bottom of the case to collect any metallic particles that are present in the oil. The filler tube and dipstick are accessible through the left side engine compartment service door.

The Model T-11605F manual transmission, which is optional, is often installed in conjunction with drive axles having 3.33 or 3.85 gear ratios. This combination is for greater fuel economy. The transmission differs from the T-11605D in the first through fourth gear ratios; see specifications at the end of this section.

MAINTENANCE

A proper lubrication schedule is essential to ensure maximum performance of the transmission.

On new coaches, the "factory fill" lubricant should be changed between the first 3,000 and 5,000 miles (4,827 to 8,045 km). During initial operation tiny metal particles are freed from the mating surfaces of moving parts. The lubricant carries these particles through the transmission causing wear on all parts. When draining the transmission, remove all metal particles that are picked up by the magnetic drain plug.

Draining the factory fill lubricant before the first 5,000 miles (8,045 km) also prevents oil contamination caused by the differences between factory fill lubricant and the lubricant used by the operator for topping up the level.

At intervals of 5,000 miles (8,045 km) check the dipstick to ensure the oil is at proper level. Inspect for leaks. At intervals of 50,000 miles (80,450 km) the transmission oil should be changed.

TRANSMISSION OIL CHANGE

While the oil is warm, remove the magnetic drain plug at the bottom of the case to drain the oil. Thoroughly clean the plug before re-installing.

When refilling the transmission, refer to the chart (figure 13-3) to determine the correct type of lubricant. Factory fill is 22 U.S. pints (10.41 liters) of SAE-50 heavy duty engine oil.

Do not overfill the transmission as this will cause fluid to be forced out of the case through the mainshaft openings. Also, types and brands of oil should not be intermixed because of possible oil component breakdown and loss of lubrication protection.

RECOMMENDED LUBRICANTS

Type	Grade (SAE)	Ambient Temperature
Heavy Duty Engine Oil	50	Above 10°F (12°C)
MIL-L-2104C or MIL-L-46152	40	Above 10°F (12°C)
or API-SF or API-CD	30	Below 10°F (12°C)
Mineral Gear Oil with rust		
and oxidation inhibitor	90	Above 10°F (12°C)
API-GL-1	80W	Below 10°F (12°C)
Mild EP Gear Oil*	90	10°F to 100°F (12°C to 38°C)
MIL-L-2105 or API-GL-4	80W	-15°F to 70°F (-26°C to 21°C)
	85W140	Above 10°F (12°C)
Multipurpose Gear Oil*	80W140	Above -15°F (-26°C)
MIL-L-2105B or MIL-L-2105C	90	10°F to 100°F (12°C to 38°C)
or API-GL-5	80W90	-15°F to 100°F (-26°C to 38°C)
	80W	-15°F to 70°F (-26°C to 21°C)
	75W	-40°F to 15°F (-40°C to 26°C)

* Mild EP gear oil or multi-purpose gear oil are not recommended when lubricant operating temperatures are above 230°F (110°C).

Figure 13-3. Lubricant Chart.

TRANSMISSION REMOVAL

1. Drain the lubricant from the transmission.

2. Disconnect the selector rod from the shift lever and from the pivot link rod by removing cotter keys and nuts. Refer to figure 13-4. Do not disconnect the linkage at the turnbuckle which connects the selector lever to the linkage; doing so will result in misadjustment of the linkage.

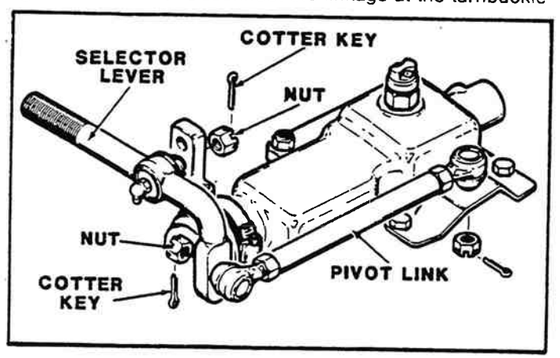

Figure 13-4. Disconnecting Shift Link.

3. Disconnect the external linkage from the clutch release arm to permit the release yoke to turn up and pull free of the bearing thrust pads.

4. A suitable sling or transmission jack should be used to properly maintain engine-transmission alignment when removing or installing the transmission. A transmission dolly is available through parts outlets or may be fabricated as shown on drawing 20-233. See Service Tools at end of this section.

CAUTION: Do not allow the rear of the transmission to drop down and hang unsupported in the splined hubs of the clutch discs. Failure to observe this caution will result in bending or distortion of the clutch friction discs.

5. Remove the mounting bolts and slide transmission on dolly away from engine while maintaining alignment.

DISASSEMBLY

Listed below are several disassembly techniques and procedures which will help the process go smoothly and help the overhaul to be successful.

1. Carefully wash and relubricate all reusable bearings as removed and protectively wrap until ready for use. Remove bearings planned to be reused with pullers designed for this purpose.

2. When disassembling the various assemblies, such as the mainshaft, countershafts, and shift bar housing, *lay all parts on a clean bench in the same sequence as removed. This procedure will simplify reassembly and reduce the possibility of losing parts.*

3. Remove snap rings with pliers designed for this purpose. Snap rings removed in this manner can be reused.

4. The input shaft can be removed from transmission without removing the countershafts, mainshaft, or drive gear. Special procedures are required. Refer to later page in this section for those procedures.

5. Provide yourself with a clean place to work. It is important that no dirt or foreign material enters the unit during repairs. Dirt is an abrasive and can damage bearings. It is always good practice to clean the outside of the unit before starting the planned disassembly.

6. Use restraint when applying force to shafts, housings, etc. Movement of some parts is restricted. Never apply force to the part being driven after it stops solidly. The use of soft hammers, bars and mauls for all disassembly work is recommended.

REMOVAL OF REMOTE CONTROL HOUSING

1. Turn out the two capscrews (13) and remove nuts (12) from the two studs (figure 13-5).

2. Lift the remote control housing from the shift bar housing

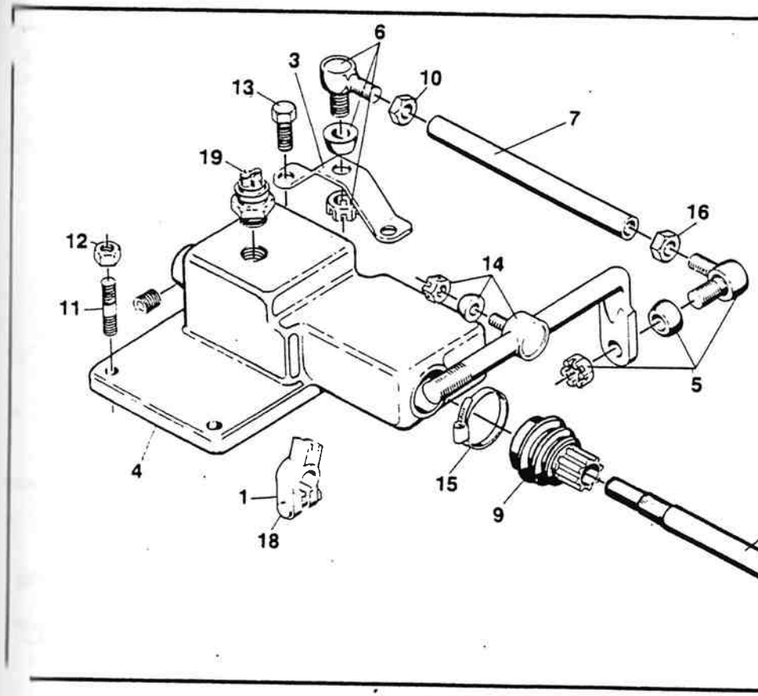

Figure 13-5. Remote Control Housing.

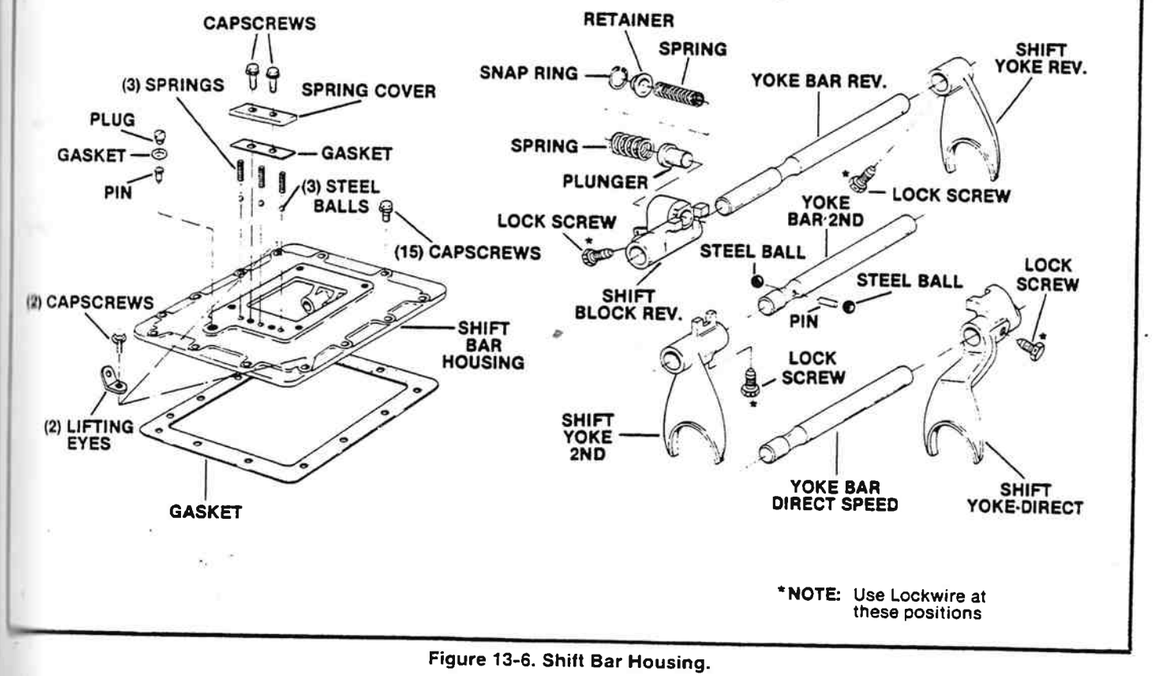

Figure 13-6. Shift Bar Housing.

SHIFT BAR HOUSING REMOVAL AND DISASSEMBLY

1. Turn out the attaching capscrews (figure 13-7). Jar to break the gasket seal and lift the shift bar housing from the transmission (figure 13-8).

NOTE: Lay all parts on a clean bench in the order in which they are removed to facilitate reassembly. Keep bars not being removed in the neutral position or interlock parts will lock bars.

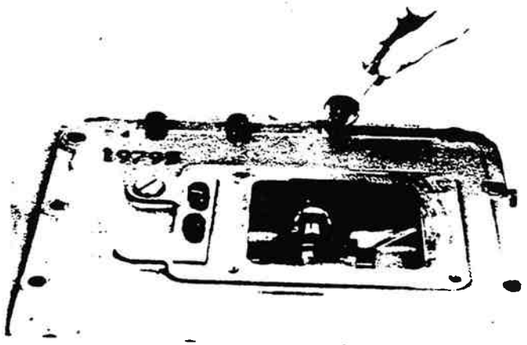

Figure 13-7. Removing Capscrews.

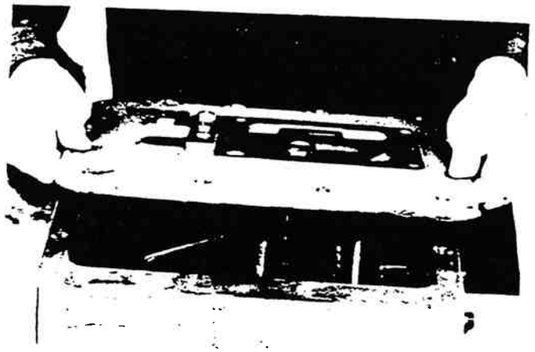

Figure 13-8. Removing Shift Bar Housing.

2. Turn out the two capscrews and remove the tension spring cover from top of housing.

3. Remove the three tension springs from bores in housing (figure 13-9) and the gasket for tension spring cover.

Figure 13-9. Tension Spring Removal.

4. Tilt housing and remove the tension balls installed under springs (figure 13-10).

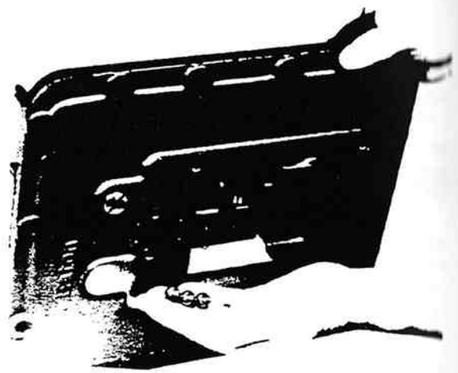

Figure 13-10. Removing Tension Balls.

5. Place the housing in a vise with the left side up; the long bar will be at the bottom (figure 13-11).

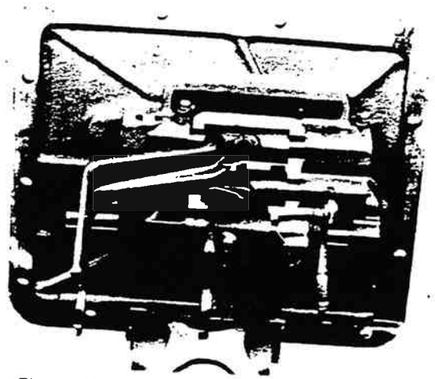

Figure 13-11. Positioning Housing In Vise.

6. Cut lockwire and remove lock screws from each bar just prior to its removal.

7. Move the top, 4th-5th speed shifting bar to the front and out of housing, removing shifting yoke from bar (figure 13-12).

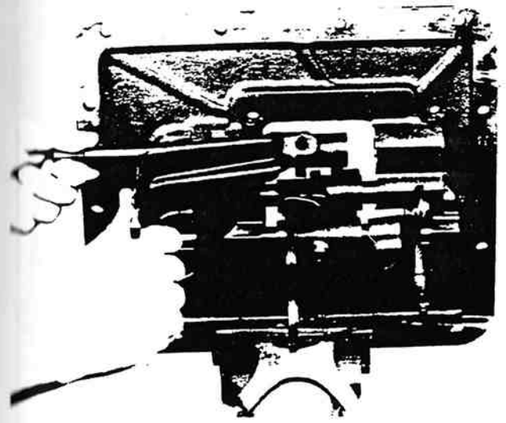

Figure 13-12. Top Shift Bar Removal.

8. Move the center, 2nd-3rd speed shifting bar to the front and out of housing, removing the shifting yoke from bar. As the neutral notch in bar clears housing boss, remove the small interlock pin from bore in neutral notch (figure 13-13).

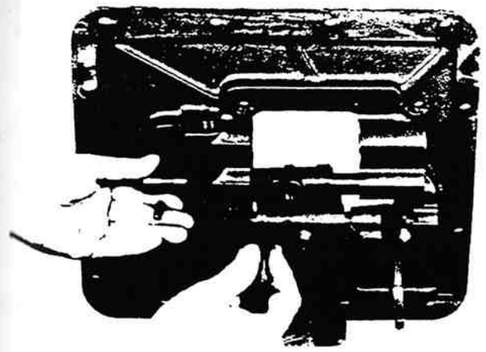

Figure 13-13. Removing Interlock Pin.

9. Move the bottom, 1st-reverse speed shifting bar to the front and out of housing, removing the shift yoke and block from the bar.

10. Two interlock balls will fall from interlock ball opening in front boss as the last bar is removed (figure 13-14).

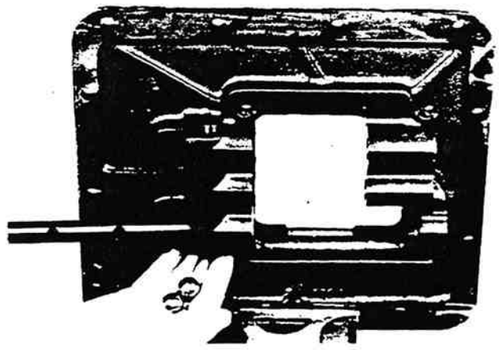

Figure 13-14. Released Interlock Balls.

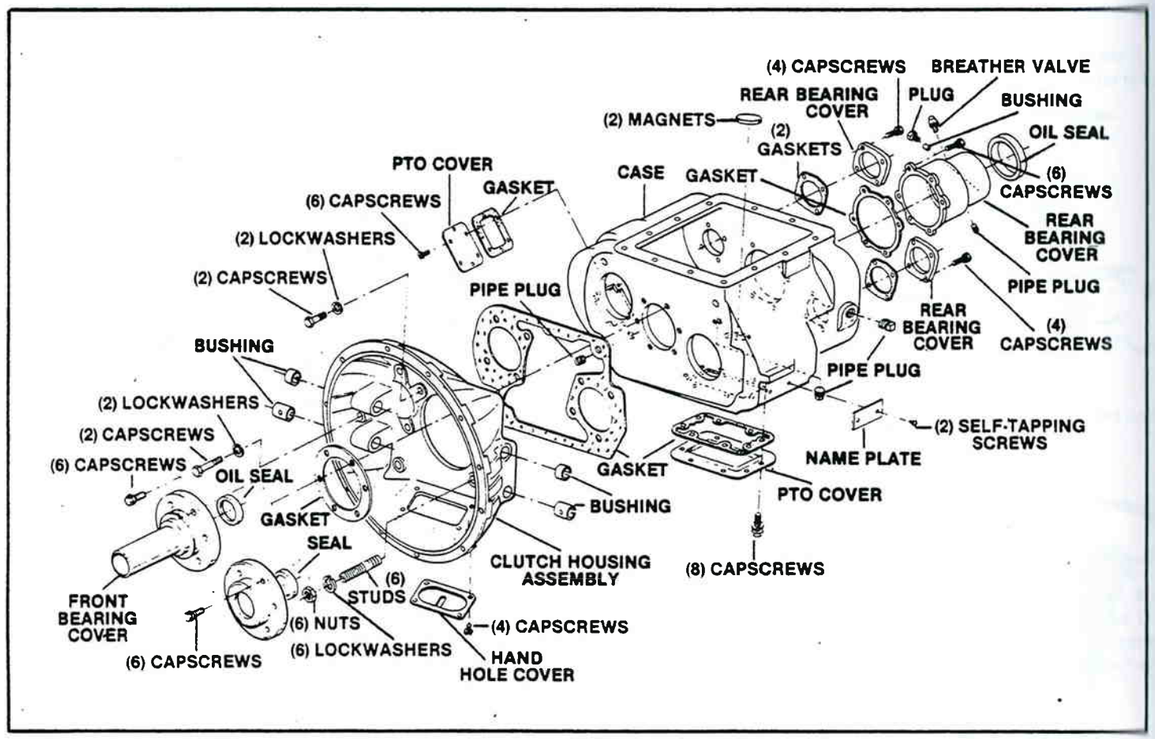

Figure 13-15. Speed Transmission Housing Assembly.

REMOVAL OF COMPANION FLANGE (OR END YOKE) AND REAR BEARING COVER

1. Lock the mainshaft by engaging two speeds with the mainshaft sliding clutch gears.
2. Remove the elastic stop nut from the output shaft (figure 13-16).

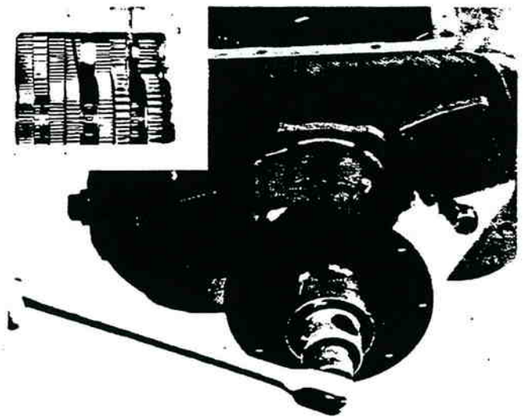

Figure 13-16. Stop Nut Removal.

3. Pull the flange or yoke from splines of the output shaft.
4. Turn out the attaching capscrews from the rear bearing cover.
5. Pry the bearing cover evenly to the rear to unseat from output shaft bearing (figure 13-17).

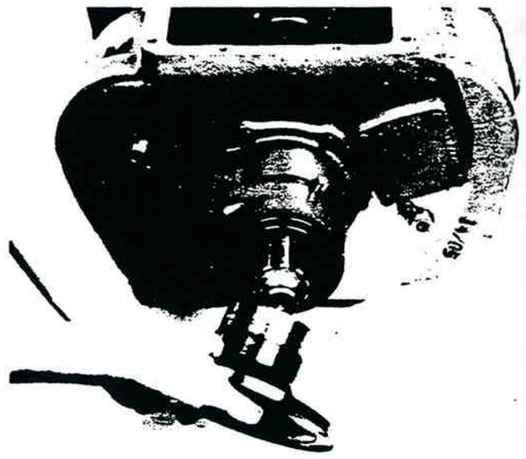

Figure 13-17. Pry Bearing Cover Evenly.

6. Remove the bearing cover from output shaft (figure 13-18).

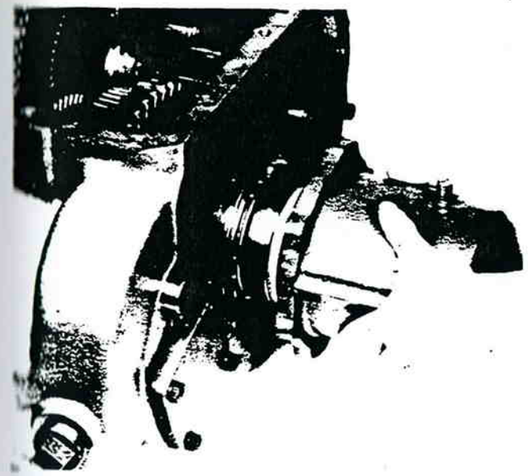

Figure 13-18. Bearing Cover Removal.

OUTPUT SHAFT REMOVAL - refer to figure 13-20

1. Remove the spacer and the bearing washer from output shaft or from bearing cover (figure 13-19).

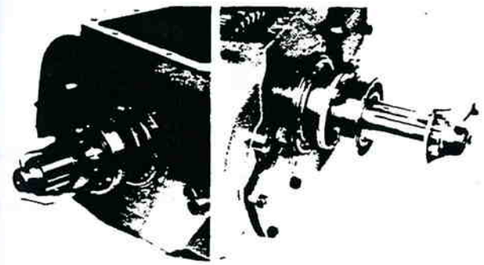

Figure 13-19. Spacer and Washer Removal.

2. Remove the oil seal from cover if necessary (figure 13-21).

NOTE: This bearing may remain in cover; in this case, move the bearing evenly forward and from cover.

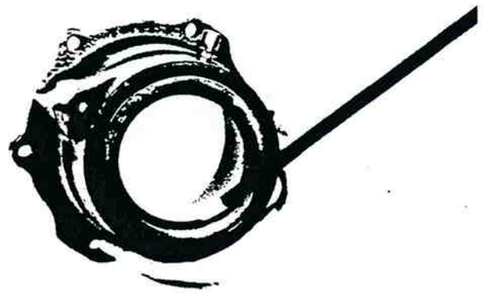

Figure 13-21. Removing Oil Seal From Cover.

3. Pull the outer bearing from output shaft (figure 13-22).

Figure 13-22. Pulling Outer Bearing.

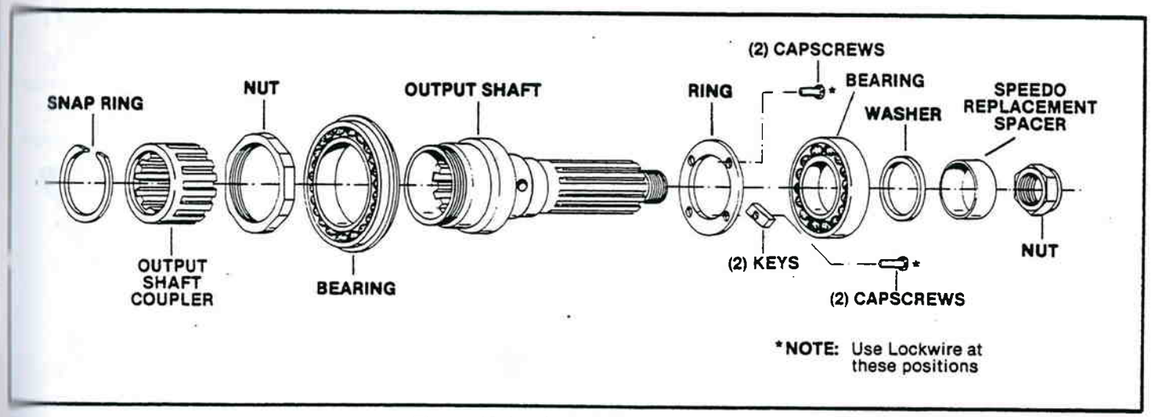

Figure 13-20. Output Shaft Assembly.

4. Cut lockwire and remove the two 5/16" capscrews from the two flat keys (figure 13-23).

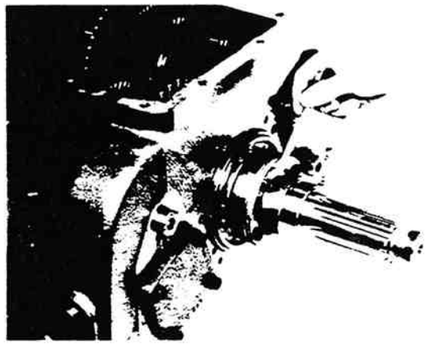

Figure 13-23. Removing Capscrews.

5. Remove the two flat keys from bores in output shaft. These keys maintain the position of the mainshaft in relation to output shaft (figure 13-24).

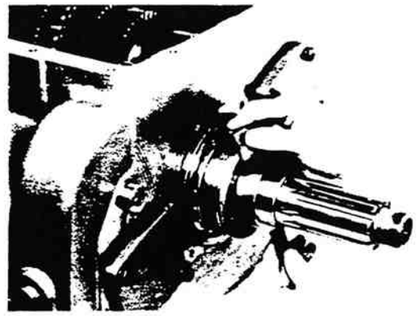

Figure 13-24. Removing Keys.

6. Move the output shaft evenly to the rear and from case bore. Moving the mainshaft assembly to the rear will start moving output shaft from bore (figure 13-25).

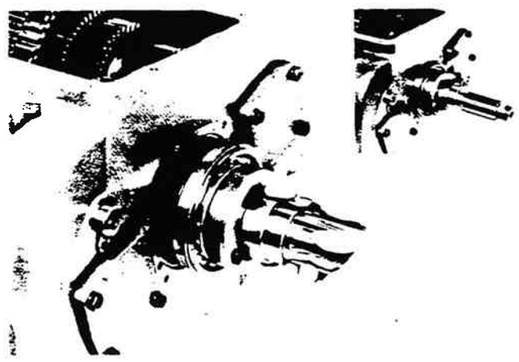

Figure 13-25. Output Shaft Removal.

7. Remove the splined coupling gear from mainshaft, or from pocket in output shaft (figure 13-26).

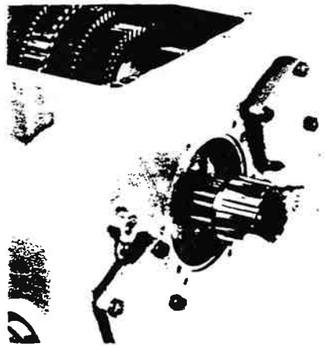

Figure 13-26. Removing Splined Coupling Gear.

8. Turn out the two 5/16" capscrews and remove the key spacer ring from output shaft (figure 13-27).

Figure 13-27. Removing Spacer Ring.

9. Remove the bearing nut from the output shaft, left hand thread (figure 13-28).

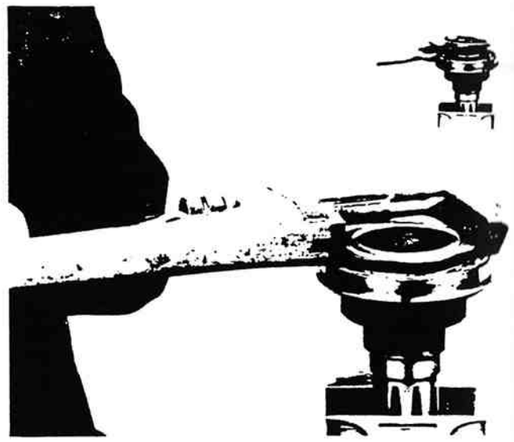

Figure 13-28. Bearing Nut Removal.

10. Press the front bearing from output shaft (figure 13-29).

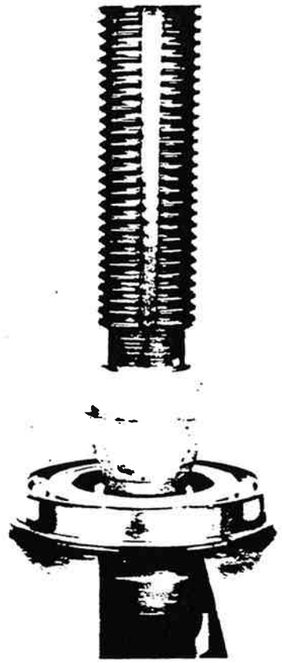

Figure 13-29. Pressing Out Bearing.

CLUTCH HOUSING REMOVAL

NOTE: The clutch housing can be removed at any time during transmission disassembly. However, it must be removed before the two countershafts can be removed.

1. Remove the clutch release mechanism.

2. Remove the four bolts and remove the six nuts and lock washers from studs at front of case (figure 13-30).

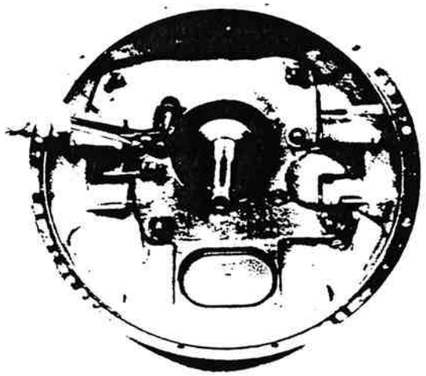

Figure 13-30. Removing Nuts from Studs.

3. Break gasket seal and pull clutch housing from case (figure 13-31).

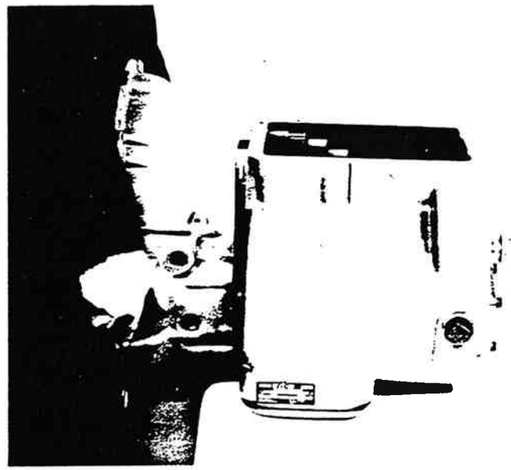

Figure 13-31. Pulling Clutch Housing from Transmission Case.

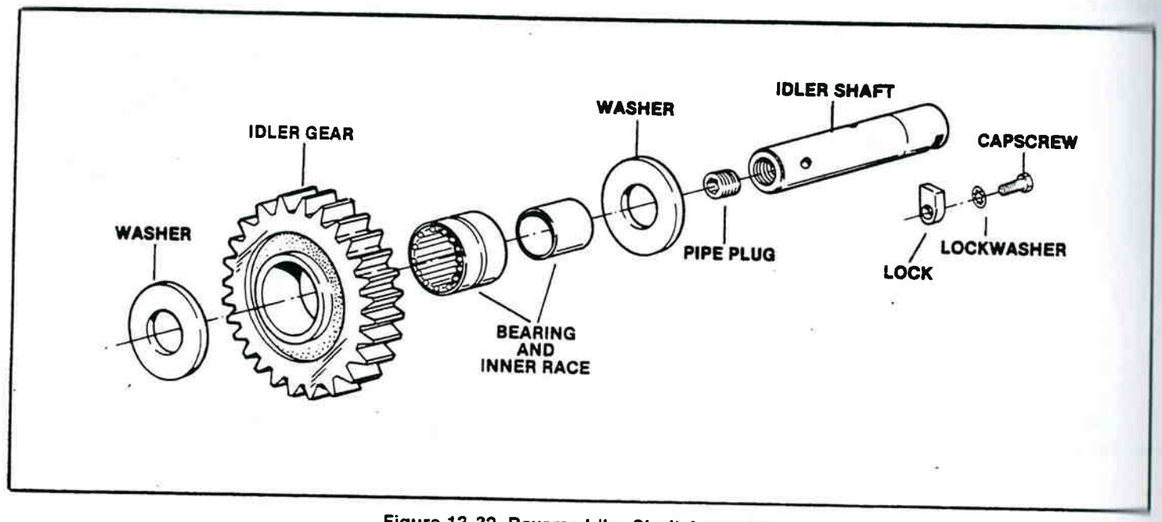

Figure 13-32. Reverse Idler Shaft Assembly.

LEFT REVERSE IDLER GEAR REMOVAL

NOTE: The left reverse idler gear must be removed in order to remove the mainshaft assembly. (See figure 13-32 for assembly drawing.)

1. Move the mainshaft assembly forward as far as possible and the mainshaft reverse gear to the rear against case (figure 13-33).

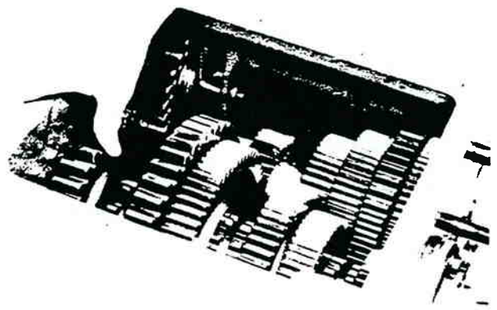

Figure 13-33. Moving Mainshaft Assembly.

2. Remove the retaining ring from I.D. of the mainshaft reverse gear (figure 13-34).

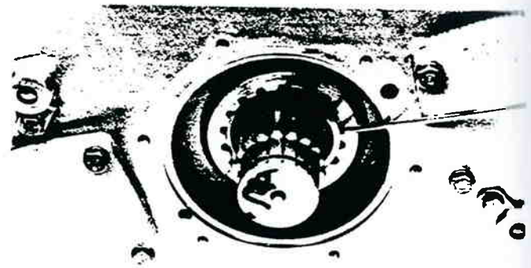

Figure 13-34. Removing Retaining Ring.

3. Engage reverse gear with the 1st-reverse sliding clutch and move the reverse gear forward against the 1st speed gear (figure 13-35).

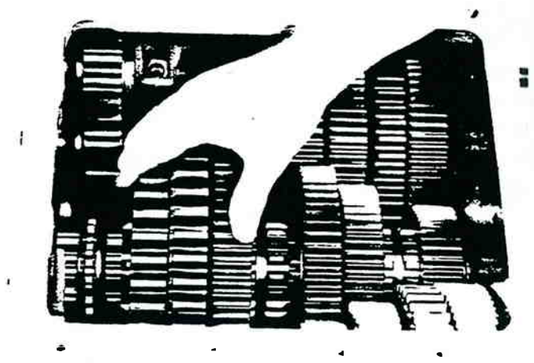

Figure 13-35. Moving Reverse Gear and Reverse Clutch.

4. Remove capscrew at rear of transmission and remove the lock plate from slot in the idler shaft (figure 13-36).

Figure 13-36. Removing Lock Plate.

5. Use impact puller to withdraw the idler shaft from case (figure 13-37).

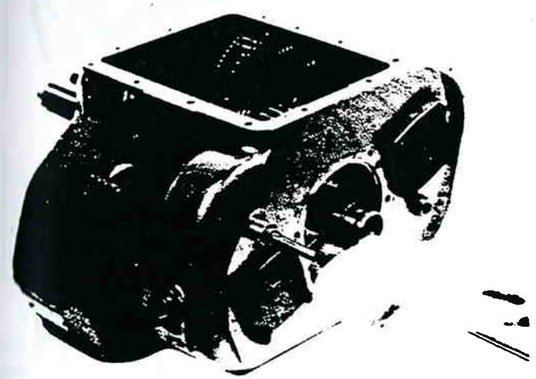

Figure 13-37. Withdrawing Idler Shaft.

6. Remove the reverse idler gear and the two thrust washers from case (figure 13-38).

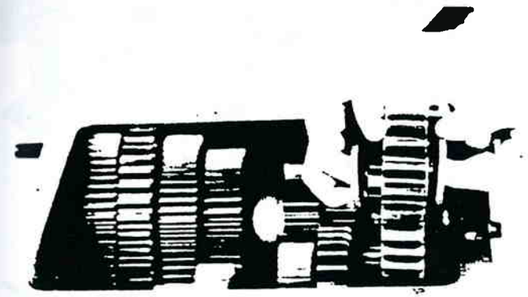

Figure 13-38. Idler Gear Removal.

7. Remove inner race of bearing from gear bore (figure 13-39).

8. Press the needle bearing from gear bore.(figure 13-39).

9. Remove plug from idler shaft if necessary (figure 13-39).

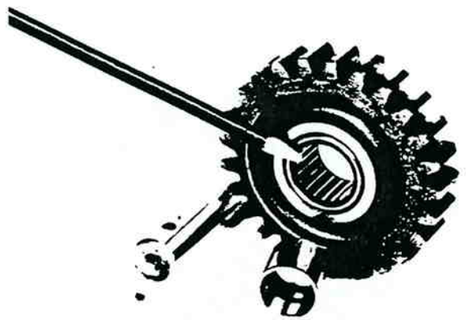

Figure 13-39. Reverse Idler Gear Disassembled.

REMOVAL OF COUNTERSHAFT BEARINGS

NOTE: Although the bearings of both countershafts are removed in the same manner, it is necessary to remove the bearings from only the right countershaft to remove the mainshaft assembly from case.

1. Remove capscrews and the rear bearing cover and gasket from each countershaft (figure 13-40).

Figure 13-40. Removing Bearing Covers.

2. Use a soft punch and maul from inside case to drive the rear countershaft bearings to the rear and from case bores (figure 13-41).

CAUTION: This removal procedure will damage the bearings and should not be attempted unless bearings are being replaced.

Figure 13-41. Driving Out Countershaft Bearings.

3. Cut lockwire and remove the two capscrews and retainer plate from the front of each countershaft. For models equipped with bearing retaining rings in groove of countershafts, remove retaining ring from groove in both countershafts (figure 13-42).

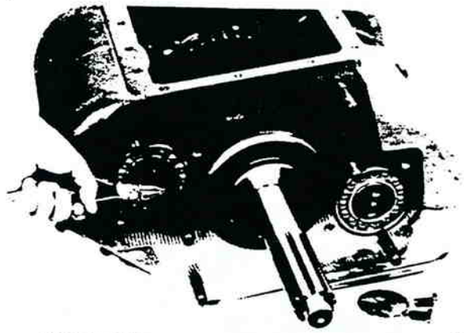

Figure 13-42. Retaining Ring Removal.

4. Use a soft bar and maul to drive each countershaft to the rear approximately ½" (figure 13-43).

Figure 13-43. Driving Countershaft Toward Rear.

5. With the same soft bar and maul on the rear of each countershaft, drive the countershafts forward to expose the front bearing retaining rings (figure 13-44). Remove the retaining rings.

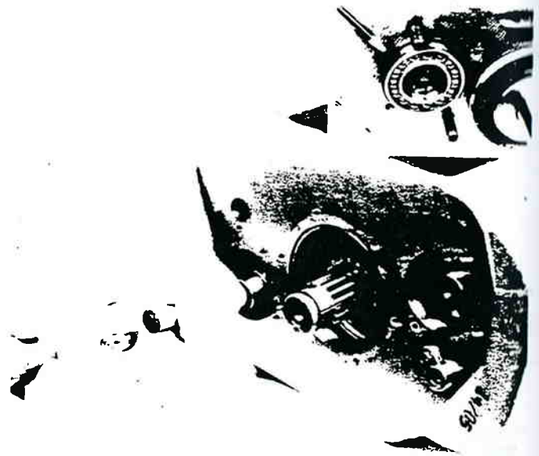

Figure 13-44. Driving Countershaft Forward.

6. Use a bearing puller to remove the front bearing from each countershaft (figure 13-45).

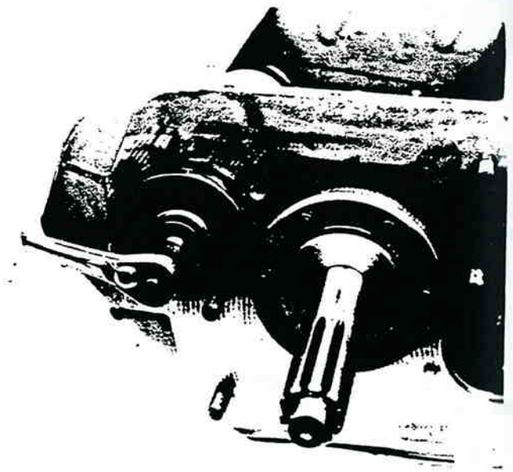

Figure 13-45. Bearing Removal.

NSHAFT REMOVAL AND DISASSEMBLY
(refer to figure 13-46)

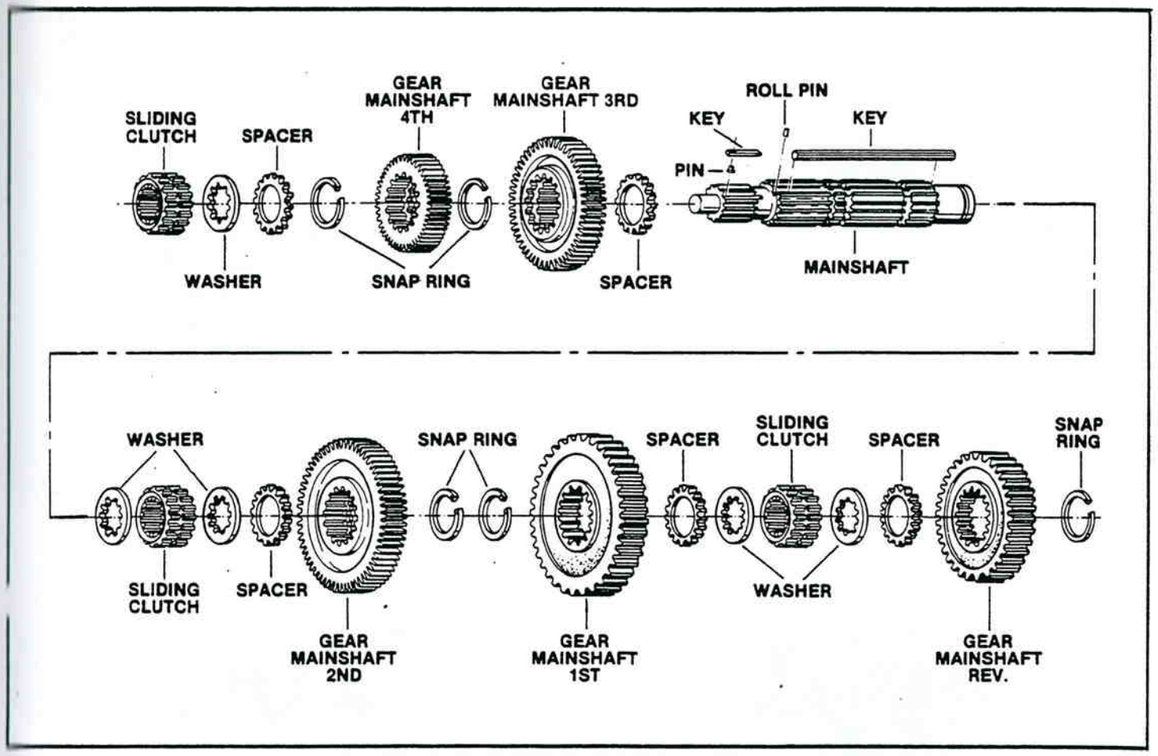

Figure 13-46. Mainshaft and Related Gears.

1. With the right countershaft moved toward wall of case, pull the mainshaft to the rear to free pilot from pocket of drive gear shaft (figure 13-47).

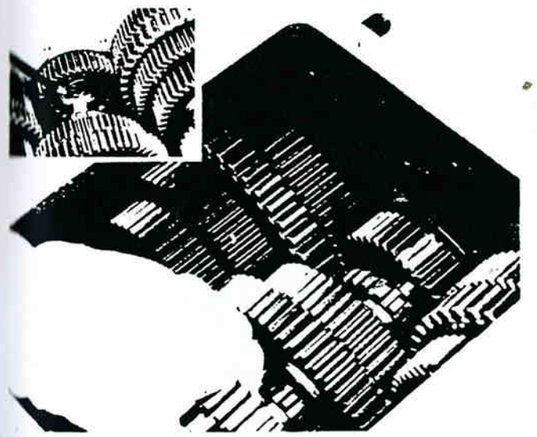

Figure 13-47. Freeing Pilot From Drive Gear Shaft Pocket.

2. While holding 3rd and 4th speed gears, tilt the front of the mainshaft up and lift assembly from case (figure 13-48).

CAUTION: The reverse gear is free at this point and may fall from shaft.

NOTE: When removing washers, spacers and gears, note their location to facilitate reassembly. Refer to figure 13-46. Keep washers and spacers with the gear from which they were removed; there is one spacer and one washer for each gear. The spacers have external splines to engage gear splines; the washers have internal splines to engage mainshaft splines.

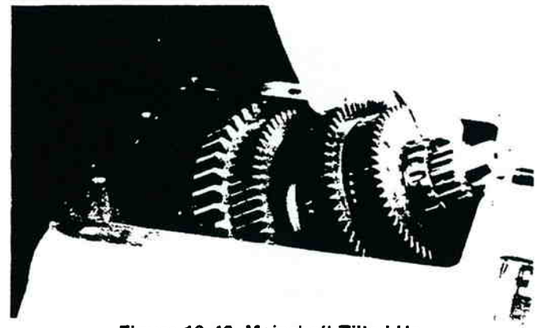

Figure 13-48. Mainshaft Tilted Up.

3. Remove the reverse gear from mainshaft (figure 13-49).

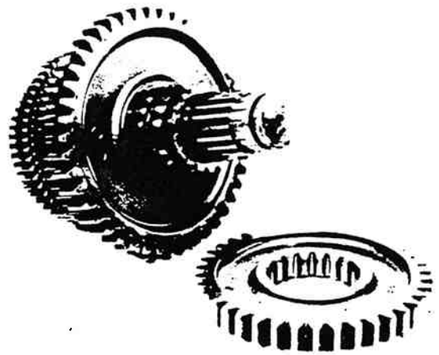

Figure 13-49. Removing Gear From Rear of Mainshaft.

4. Remove the 4th-5th speed sliding clutch from front of shaft (figure 13-50).

Figure 13-50. Removing 4th-5th Speed Clutch.

5. Remove the short key from keyway near front of shaft. This key locks the fourth speed gear limit washer in position (figure 13-51).

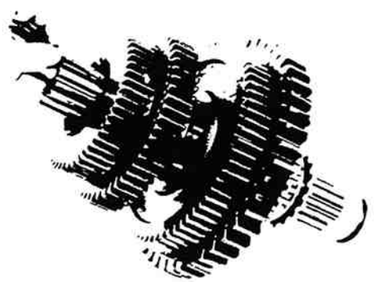

Figure 13-51. Removing Key.

6. Turn the 4th speed gear washer, located in hub of 4th-speed gear, to align with splines in mainshaft (figure 13-52).

Figure 13-52. Washer Alignment.

7. Pull 4th speed gear forward to remove the washer, spacer and gear from mainshaft (figure 13-53).

Figure 13-53. Removing 4th Speed Gear.

8. Remove the 3rd speed gear and spacer from front of mainshaft. The 3rd speed gear limit washer cannot be removed at this time as it is keyed in groove of mainshaft (figure 13-54).

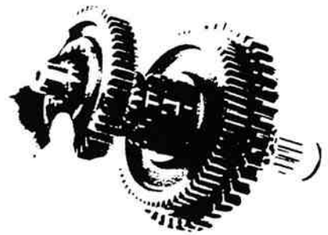

Figure 13-54. Removing 3rd Speed Gear and Spacer.

9. Remove the long key retaining snap ring from slot near rear of mainshaft (figure 13-55).

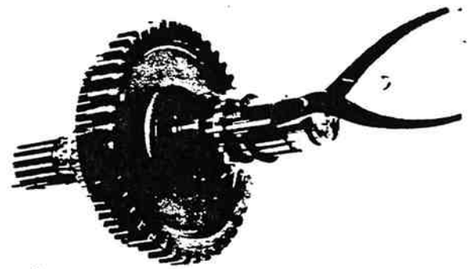

Figure 13-55. Retaining Ring Removal.

10. Remove the reverse gear spacer (figure 13-56).

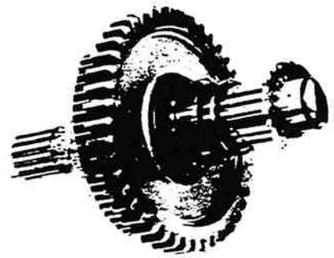

Figure 13-56. Removing Reverse Gear Spacer.

11. Pull the long key from mainshaft (figure 13-57).

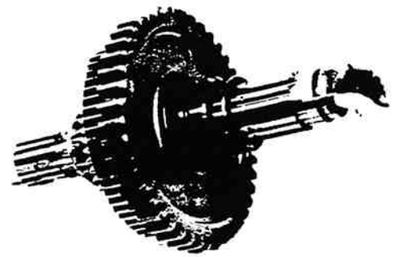

Figure 13-57. Long Key Removal.

12. Rotate reverse gear limit washer to align its splines with those of the mainshaft and remove washer (figure 13-58).

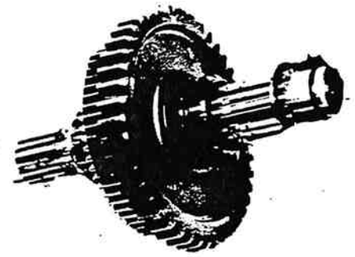

Figure 13-58. Removing Limit Washer.

13. Remove 1st-reverse sliding clutch from mainshaft (figure 13-59).

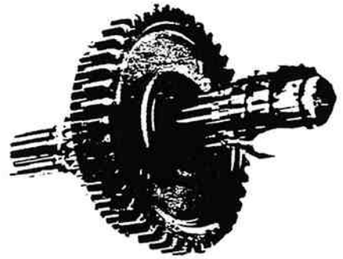

Figure 13-59. Removing 1st Reverse Sliding Clutch.

14. With a small screwdriver, rotate the 1st speed gear limit washer, recessed within the gear hub, to align its splines with those of the mainshaft (figure 13-60).

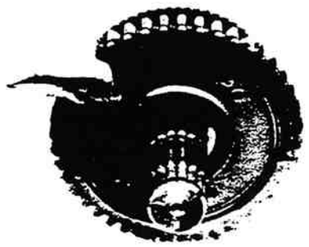

Figure 13-60. Aligning Washer Splines.

15. Pull the 1st speed gear from rear of mainshaft to remove limit washer, spacer, and gear (figure 13-61).

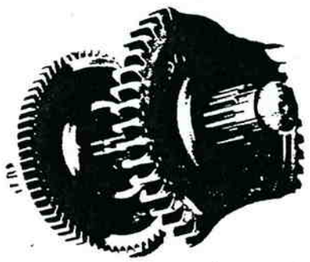

Figure 13-61. Removing 1st Speed Gear, Limit Washer and Spacer.

16. Remove 2nd speed gear and spacer from mainshaft (figure 13-62).

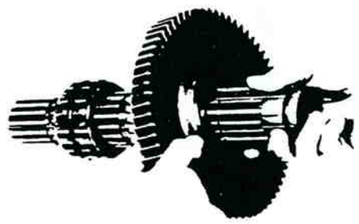

Figure 13-62. Removing 2nd Speed Gear and Spacer.

17. Rotate 2nd speed gear limit washer to align its splines with those of the mainshaft and remove washer (figure 13-63).

Figure 13-63. Removing 2nd Speed Gear Limit Washer.

18. Remove the 2nd-3rd speed sliding clutch from mainshaft (figure 13-64).

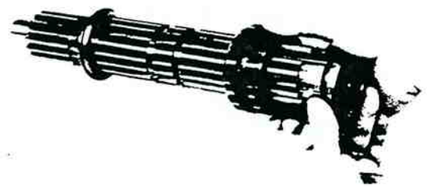

Figure 13-64. Removing 2nd-3rd Speed Sliding Clutch.

19. Rotate 3rd speed gear limit washer to align its splines with those of mainshaft and remove washer (figure 13-65).

Figure 13-65. Removing 3rd Speed Gear Limit Washer.

Mainshaft disassembly (figure 13-46) is now complete.

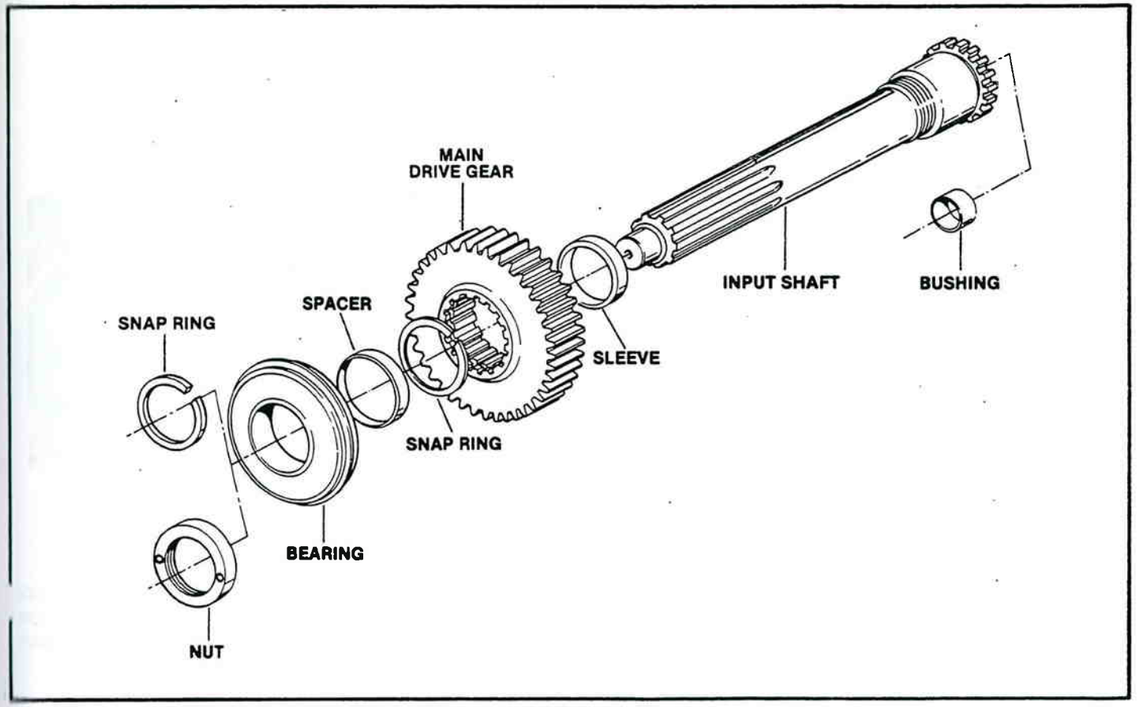

Figure 13-66. Drive Shaft (Input Shaft) and Related Parts.

DRIVE GEAR REMOVAL

1. (See figure 13-66 for assembly drawing.) Remove capscrews from the front bearing cover (figure 13-67).

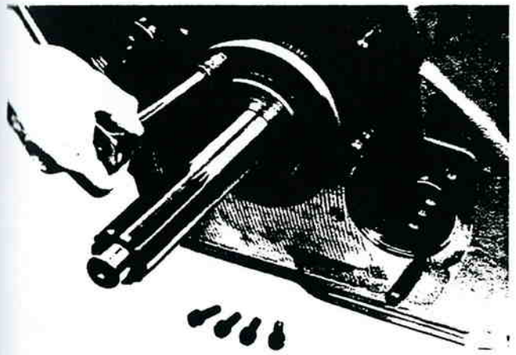

Figure 13-67. Capscrew Removal.

2. Use soft bar and maul from inside case to move the drive gear assembly forward as far as possible and remove the bearing cover (figure 13-68).

Figure 13-68. Moving Drive Gear Forward.

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CHANGING INPUT SHAFT

In some cases, it may be necessary to replace only the input shaft due to clutch wear on the splines. In these instances, the input shaft can be removed without disassembling the transmission other than removing the shifting bar housing assembly. Removal of the clutch housing is optional. Following is this procedure:

REMOVAL

1. Remove remote control and shifter housing and shift bar housing assemblies from transmission.
2. Remove the front bearing cover.
3. Engage the mainshaft sliding clutches in two gears and remove the drive gear bearing nut.
4. Move the drive gear assembly as far forward as possible and remove the drive gear bearing.
5. Remove the spacer from input shaft.
6. From the front, remove the retaining ring from I.D. of drive gear.
7. Pull the input shaft forward and from splines of drive gear.

INSTALLATION

1. Install new input shaft into splines of drive gear just far enough to expose retaining ring groove in I.D. of drive gear.
2. Install retaining ring in I.D. of drive gear.
3. Install spacer on shaft against drive gear.
4. Install drive gear bearing on shaft and into case bore.
5. Install a new drive gear bearing nut, left-hand thread. Clean threads of nut and input shaft before applying Loctite sealant to threads of both parts. Use 250-300 ft. lbs. (339-407 Nm) torque to tighten nut.
6. Peen nut into milled slots of input shaft.
7. Reinstall front bearing cover, shift bar housing and remove control and shifter housing assemblies.

NOTE: The above instructions are for changing the input shaft only. To change the drive gear, removal of the mainshaft assembly and the countershaft bearings is necessary.

REMOVAL AND DISASSEMBLY OF COUNTERSHAFT ASSEMBLIES

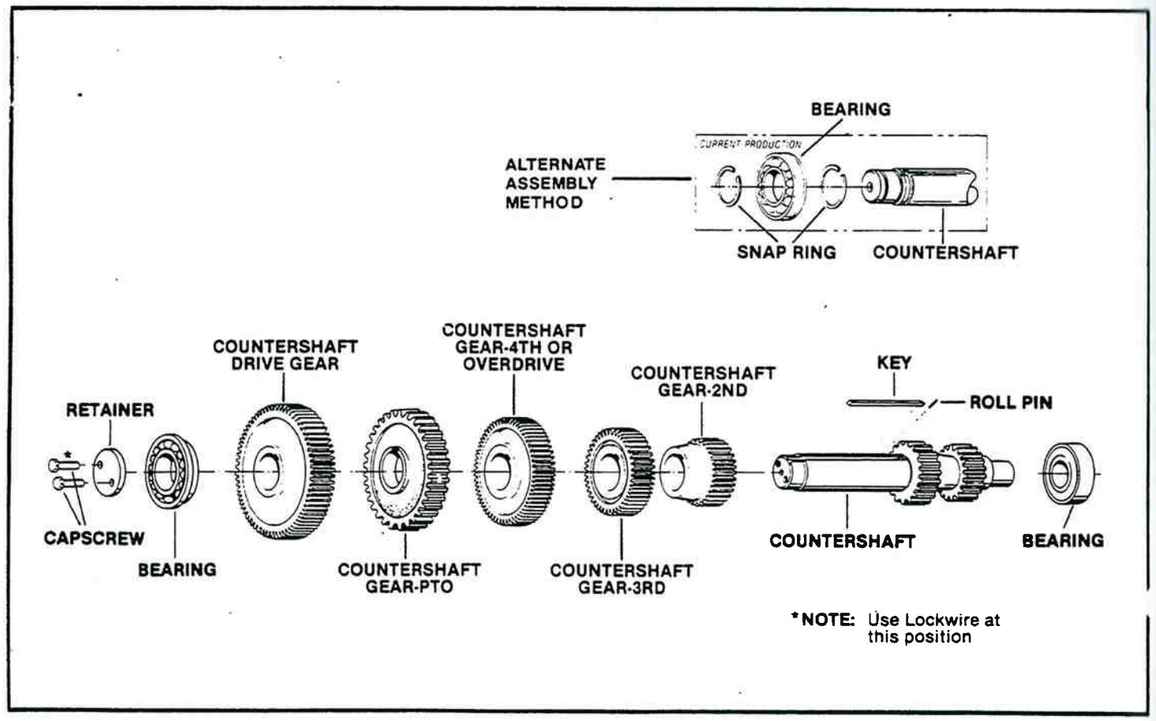

Figure 13-76. Countershaft and Related Gears.

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1. If not already done, remove front and rear bearings of left countershaft as previously described.
2. Move either countershaft assembly to the rear, lift front of shaft to the center of case by the drive and PTO gears and remove through top of case. Repeat same process for other countershaft assembly (figure 13-77).

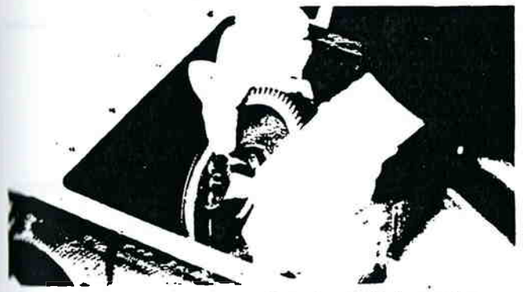

Figure 13-77. Removing Countershaft Assembly.

NOTE: Except for the PTO gears, the left and right countershaft assemblies are identical. Disassembly of each should be performed in the same manner.

3. For models equipped with a countershaft gear retaining snap ring in groove nearest to drive gear, remove snap ring from countershaft.
4. Press the drive gear, PTO gear, 4th speed gear, and 3rd speed gear from countershaft. Use caution when pressing gears as it is necessary to press these gears off in a cluster of four (figure 13-78).

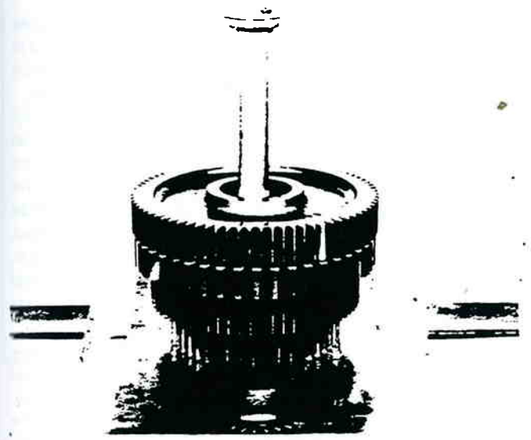

Figure 13-78. Pressing Gears Off Countershaft.

5. Press the 2nd speed gear from countershaft (figure 13-79).

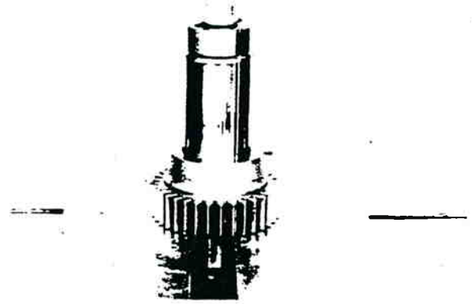

Figure 13-79. Pressing 2nd Speed Gear Off Countershaft.

6. If necessary, remove the key and roll pin from countershaft (figure 13-80).

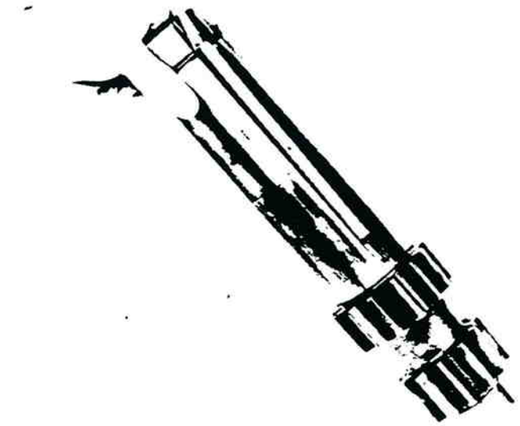

Figure 13-80. Removing Key and Roll Pin..

REMOVAL AND DISASSEMBLY OF RIGHT REVERSE IDLER GEAR ASSEMBLY

NOTE: Since the left and right reverse idler gear assemblies are identical, removal and disassembly of the Right Reverse Idler Gear Assembly should be performed in the same manner as previously described in this section.

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TRANSMISSION PARTS INSPECTION

Before reassembling the transmission, the individual parts should be carefully checked. Replace those damaged from previous service. This inspection procedure should be carefully followed to ensure the maximum wear life from the rebuilt unit.

1. Wash all bearings in clean solvent. Check balls, rollers and races for pits and spalled areas. Replace bearings which are pitted or spalled.
2. Lubricate bearings which are not spalled or pitted and check for axial and radial clearances. Replace bearings with excessive clearances.
3. Check fits of bearings in case bores. If outer races turn freely in the bores, the case should be replaced.
4. Check operating gear teeth for pitting on the tooth faces. Gears with pitted teeth should be replaced.
5. Inspect all engaging gear teeth. Gears with teeth torn, tapered or reduced in length from clashing during shifting should be replaced.
6. Check axial clearances of gears. Where excessive clearance is found, check gear retaining ring, washer, spacer and gear hub excessive wear. Maintain .005" to .012" axial clearance on mainshaft forward speed gears, .005" minimum on reverse gear.
7. Check splines on all shafts for wear. If sliding clutch gears, companion flange or clutch hub have worn into the sides of the splines, the shafts in this condition should be replaced.
8. Check surfaces of all thrust washers. Washers scored or reduced in thickness should be replaced.
9. Check bearing sleeve for wear from action of roller bearings.
10. Inspect all gray iron parts for cracks and breaks. Replace or repair parts found to be damaged. Heavy castings may be welded or brazed providing the cracks do not extend into bearing bores or bolting surfaces.
11. Check clutch release parts. Replace yokes worn at cam surfaces and bearing carrier worn at contact pads.
12. Check pedal shafts. Replace those worn at bearing surfaces.
13. Check yokes and blocks for wear at pads and lever slot. Replace worn parts.
14. Check yokes for alignment. Straighten those which are sprung.
15. Check lockscrews in yokes and blocks. Tighten and rewire those found loose.
16. If housing has been dismantled, inspect neutral notches of shifting bars for wear from interlock balls. Bars indented at points adjacent to the neutral notch should be replaced.
17. Check pivot pin and corresponding slot in lever for wear. Replace both parts if worn.
18. Check covers for wear from thrust of adjacent bearing. Replace covers worn and grooved from thrust of bearing outer race.
19. Check bores of covers for wear. Replace those worn oversize.
20. Check oil return threads in front bearing cover. If sealing action of threads has been destroyed by contact with input shaft, replace the cover.
21. Check oil seal in rear bearing cover. If sealing action of lip has been destroyed, replace seal.

REASSEMBLY

CAUTION: Make sure that interiors of case and housings are clean. It is important that dirt be kept out of transmission during reassembly. Dirt is abrasive and can damage polished surfaces of bearings and washers.

Use new gaskets throughout the transmission as it is being rebuilt. Make sure all gaskets are installed, as omission of a gasket can result in oil leakage or misalignment of bearing covers.

To prevent oil leakage, use shellac on all capscrews.

Coat all thrust washers and splines of shafts with Lubriplate during installation to provide initial lubrication, preventing scoring and galling.

Use of flanged-end bearing drivers is recommended for the installation of bearings. These drivers apply equal force to both races of bearing, preventing damage to balls and races and maintaining correct bearing alignment with shaft and bore. If tubular or sleeve type driver is used, apply force only to inner race.

Pull the companion flange tightly into place with the output shaft nut, tightening to 400-450 ft. lbs. (542-610 Nm) torque. Be sure that the spacer has been installed on the yoke. Failure to pull the yoke or flange tightly into place will permit the shaft to move axially with resultant damage to rear bearing. Figure 13-59 shows the transmission parts in an exploded view.

TIMING

Timing is mentioned at various points in subsequent pages dealing with the transmission reassembly and installation. It is recommended that the procedures pertaining to timing, which are given below, be referred to whenever timing is involved.

It is essential that proper timing procedures are carried out during reassembly and installation. Proper timing assures that the countershaft gear teeth will come into contact with the mating mainshaft gear teeth at the same time, allowing the mainshaft gears to center on the mainshaft and split the load between the countershaft gear assemblies. If improperly timed, however, the mainshaft gears would climb out of equilibrium, resulting in unequal tooth contact between meshing gears that would lead to more serious damage occurring to the transmission later.

By design, the timing of only one set of gears is necessary — the drive gear set. It is a rather simple procedure, consisting of marking the proper teeth of the main and countershaft drive gears prior to installation of the complete assemblies in the case and meshing those marked gear teeth during assembly.

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ARKING COUNTERSHAFT DRIVE GEAR TEETH

1. Prior to placing each countershaft assembly into case, clearly mark on each drive gear the gear tooth which is directly over the keyway in gear (see figure 13-81). This tooth is stamped with an "O" to aid identification.

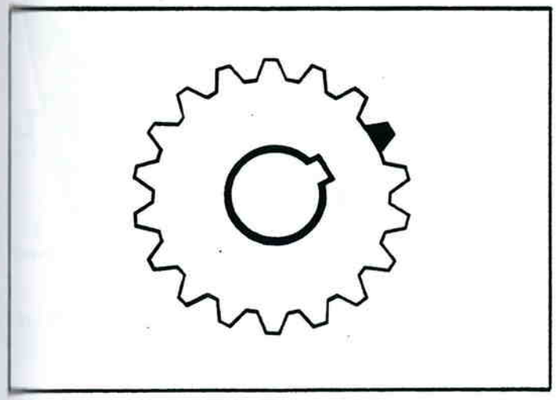

Figure 13-81. Tooth On Countershaft Drive Gear Directly Over Keyway Marked For Timing.

MARKING MAIN DRIVE GEAR TEETH

1. Mark *any* two adjacent teeth on the main drive gear.
2. Mark the two adjacent teeth on the main drive gear which are directly opposite the first set marked. There should be an equal number of teeth between the markings on each side of gear (see figure 13-82).

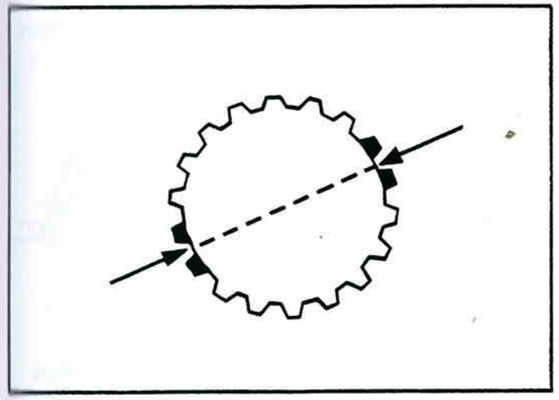

Figure 13-82. Main Drive Gear Teeth Correctly Marked For Timing.

MESHING MARKED COUNTERSHAFT DRIVE GEAR TEETH WITH MARKED MAIN DRIVE GEAR TEETH

After installing main drive gear and mainshaft assemblies, the countershaft bearings are installed to complete countershaft installation.

1. When installing bearings on the left countershaft, mesh the marked countershaft drive gear tooth between two marked teeth on the main drive gear. Repeat the procedure when installing the right countershaft bearings (see figure 13-83).

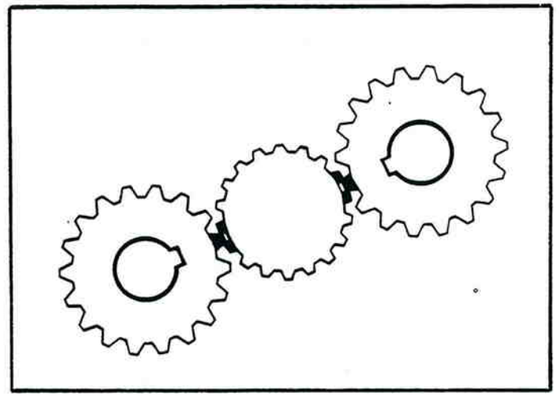

Figure 13-83. Countershaft Drive Gear Teeth Meshed With Main Drive Gear Teeth For Proper Timing.

REASSEMBLY AND INSTALLATION OF RIGHT REVERSE IDLER GEAR ASSEMBLY

1. Install plug in oil channel in idler shaft (figure 13-84).

Figure 13-84. Pipe Plug in Idler Shaft.

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2. Press needle bearing into bore of reverse idler gear (figure 13-85).

Figure 13-85. Pressed-in Needle Bearing.

3. Place inner race of bearing in gear (figure 13-86).

Figure 13-86. Inserting Inner Race.

4. With the two thrust washers in position on each side of reverse idler gear, slide the idler shaft through bore in rear of case, gear, washers and bore of idler shaft support boss inside case. To make certain the slot in rear of idler shaft is properly located to secure lock plate with capscrew in case, align oil channel hole of idler shaft with that in top of idler shaft support boss (figure 13-87).

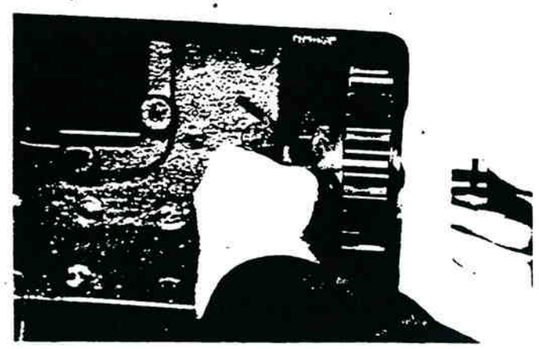

Figure 13-87. Installing Reverse Idler Gear and Shaft.

5. Install the lockplate in slot of idler shaft. Tighten capscrew securely (figure 13-88).

Figure 13-88. Installing Lockplate Capscrew.

Reassembly and installation of right reverse idler gear is now complete.

REASSEMBLY OF COUNTERSHAFTS

NOTE: Except for the power take-off gears, the countershafts are identical; reassembly is the same for each.

1. Install roll pin in bore located in keyway of countershaft.

2. Install the short key in countershaft, tapered end against roll pin.

3. Install the long key in keyway in countershaft (figure 13-89).

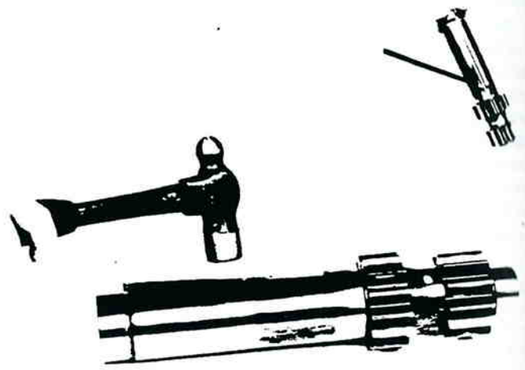

Figure 13-89. Installing Long Key.

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4. Align keyway in gear with keys in shaft and press the 2nd speed gear on shaft, long hub toward front of shaft (figure 13-90).

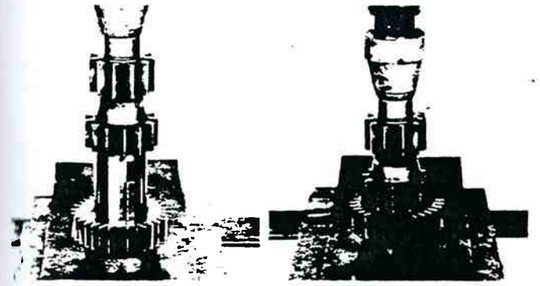

Figure 13-90. 2nd Speed Gear Installation.

5. Press the 3rd speed gear on countershaft, long hub toward 2nd speed gear (figure 13-91).

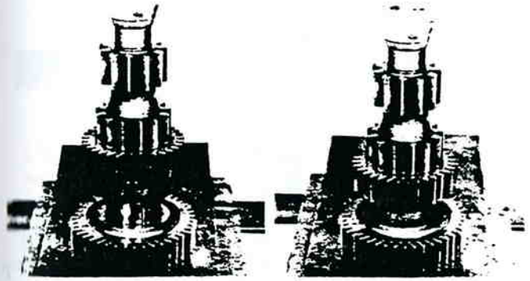

Figure 13-91. 3rd Speed Gear Installation.

6. Press the 4th speed gear on countershaft.

7. Press the power take-off gear on countershaft, bullet nose teeth toward rear of shaft (figure 13-92).

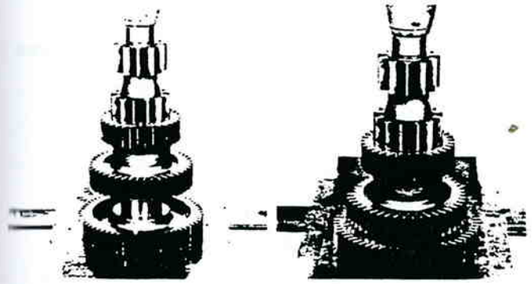

Figure 13-92. 4th Speed and PTO Gear Installation.

NOTE: The left countershaft assembly has a 47-tooth PTO gear; the right assembly has a 45-tooth gear. Mark each assembly as "right" or "left."

8. Press the drive gear on countershaft (figure 13-93).

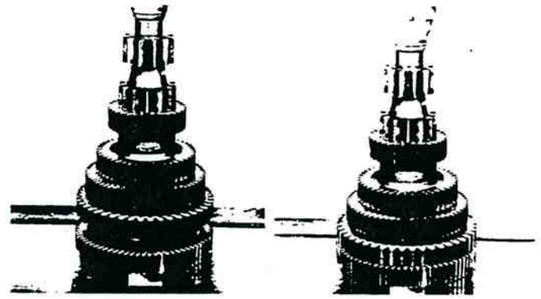

Figure 13-93. Drive Gear Installation.

9. Install countershaft gear snap ring in groove nearest to drive gear.

NOTE: Mark countershaft drive gears for timing. On the drive gear of each countershaft, mark tooth that is aligned with keyway in gear; this tooth will be stamped with an "O" (figure 13-94).

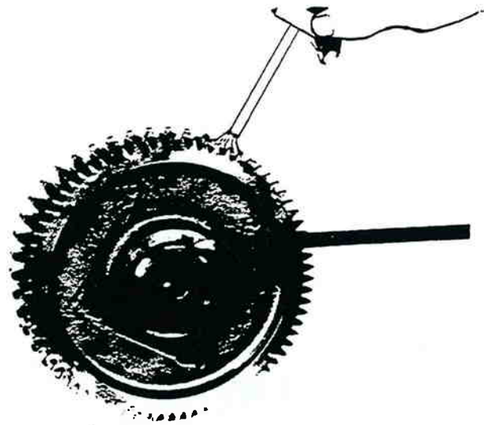

Figure 13-94. Alignment Mark.

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PARTIAL INSTALLATION OF COUNTERSHAFT ASSEMBLIES

1. Place the left countershaft assembly with the 47-tooth PTO gear into position in case, small end through the left rear countershaft bore. Do not install bearings at this time (figure 13-95).

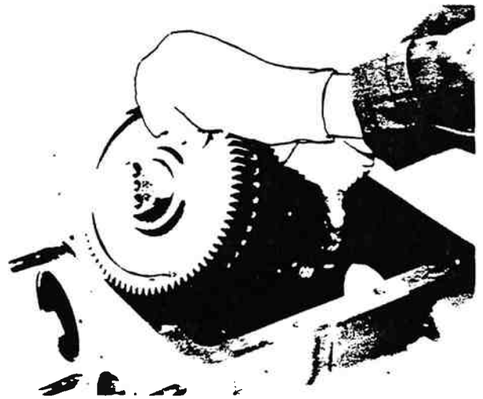

Figure 13-95. Positioning Left Countershaft.

2. Place the right countershaft assembly with the 45-tooth PTO gear into position in case, small end through right rear countershaft bore. Do not install bearings at this time (figure 13-96).

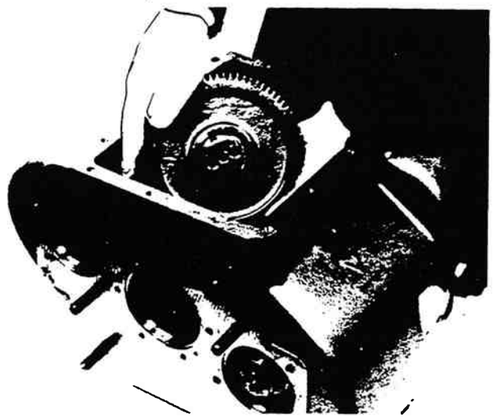

Figure 13-96. Positioning Right Countershaft.

REASSEMBLY AND INSTALLATION OF MAIN DRIVE GEAR ASSEMBLY

1. Install retaining ring in I.D. of drive gear (figure 13-97).

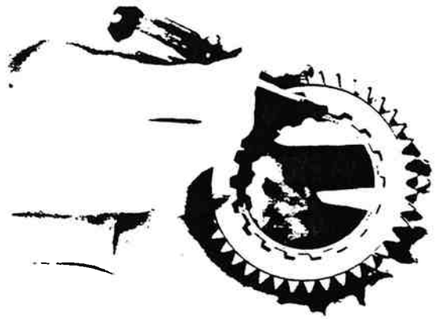

Figure 13-97. Installing Retaining Ring.

2. Install the drive gear on shaft, engaging internal splines of gear with teeth on shaft, retaining ring of gear toward the front (figure 13-98).

Figure 13-98. Drive Gear on Shaft.

3. Install the drive gear spacer on shaft and against gear (figure 13-99).

Figure 13-99. Installing Spacer.

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4. Press the drive gear bearing on shaft, shield to the front (figure 13-100).

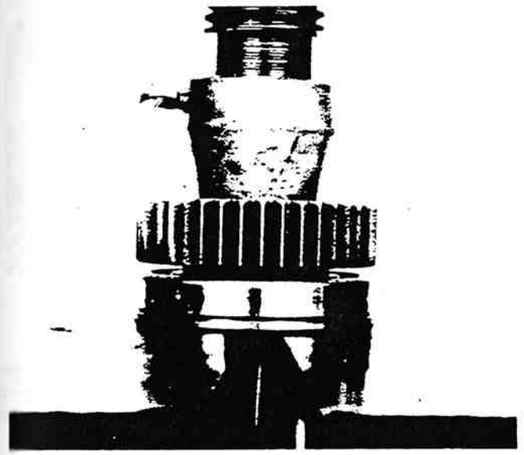

Figure 13-100. Drive Gear Bearing Installation.

5. Clean threads of input shaft and apply Loctite Threadker 277 to threads of new drive gear bearing nut. Do not use old nut.

6. Install the bearing nut on shaft, left hand threaded, tightened to 250-300 ft. lbs. (339-407 Nm) torque (figure 13-101).

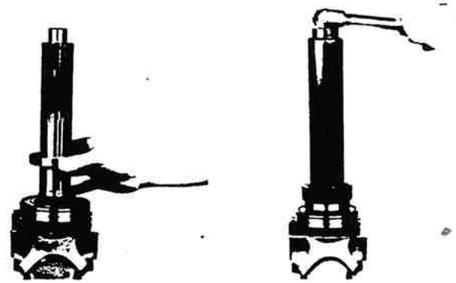

Figure 13-101. Bearing Nut Installation.

7. Peen the nut into the two milled slots (figure 13-102).

Figure 13-102. Peening Bearing Nut.

8. Match-mark the drive gear for timing. Mark any two adjacent teeth on the drive gear, then mark two adjacent teeth which are directly opposite the first set marked (figure 13-103).

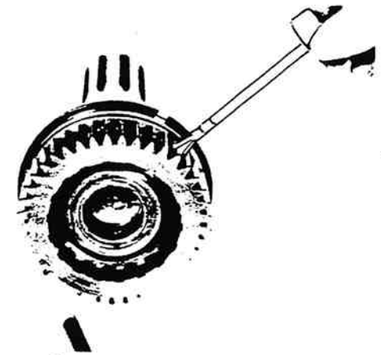

Figure 13-103. Drive Gear Timing Marks.

9. Remove the retaining ring from drive gear bearing (figure 13-104).

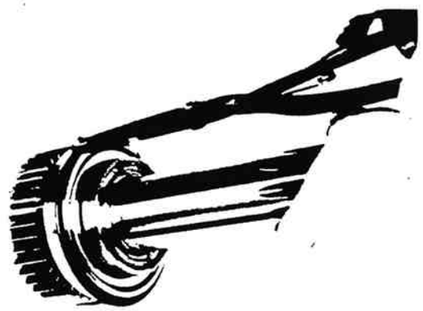

Figure 13-104. Removing Retaining Ring.

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10. Insert the drive shaft from inside case through front bore. Seat the drive gear bearing in case bore and move assembly forward until retaining ring groove in bearing is exposed (figure 13-105).

Figure 13-105. Installing Drive Gear Assembly.

11. Install retaining ring (figure 13-106).

Figure 13-106. Installing Retaining Ring.

12. Seat bearing in case bore and install the drive gear bearing cover with new gasket, aligning oil return slot in cover with oil return bore in case. Tighten capscrews securely (figure 13-107).

Figure 13-107. Installing Drive Gear Bearing Cover.

COMPLETED INSTALLATION OF LEFT COUNTERSHAFT ASSEMBLY

1. Insert countershaft support tool in rear bearing bore (figure 13-108).

Figure 13-108. Supporting Countershaft.

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2. Mesh the marked tooth of left countershaft drive gear with ...or set of two marked timing teeth of main drive gear (figure 13-109).

Figure 13-109. Meshing Marked Teeth.

3. With timing teeth still in mesh, install countershaft front bearing. Center countershaft in case bore using a small screwdriver inserted through bearing I.D. and in bell center or either threaded hole in end of shaft (figure 13-110).

Figure 13-110. Installing Countershaft.

4. Install retainer plate, secure with capscrews, and lockwire. For models equipped with groove in countershaft for front bearing retaining snap ring, install snap ring in groove (figure 13-111).

Figure 13-111. Installing Lockplate and Snapring.

5. Remove countershaft support tool from rear case bore and install countershaft rear bearing with the larger I.D. lead chamfer toward front of transmission (figure 13-112).

NOTE: If damage to original bearing resulted from punch and maul removal, replace with new rear bearing.

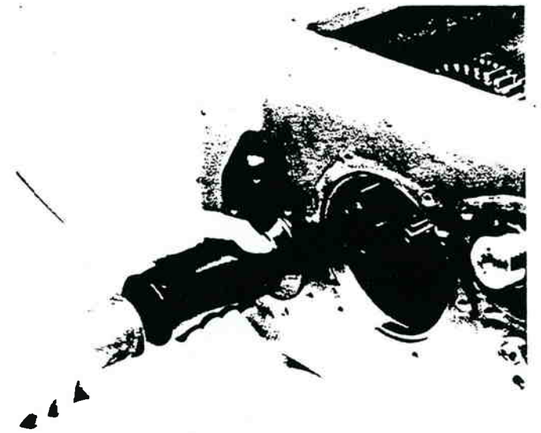

Figure 13-112. Installing Rear Bearing.

MC-9 MAINTENANCE MANUAL

PARTIAL REASSEMBLY OF OUTPUT SHAFT ASSEMBLY

1. Press the front bearing on output shaft, snap ring to the rear (figure 13-113).

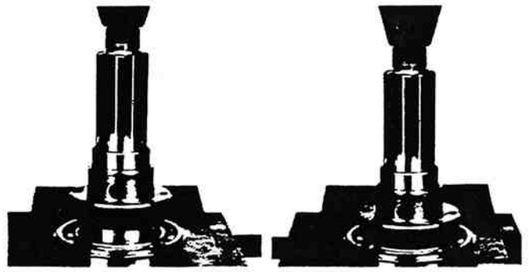

Figure 13-113. Pressing on Front Bearing.

2. Clean threads of output shaft and bearing nut. Apply loctite grade 277 sealant to threads of nut.

3. Install the bearing nut on threads of output shaft and torque to 250-300 ft. lbs. (figure 13-114).

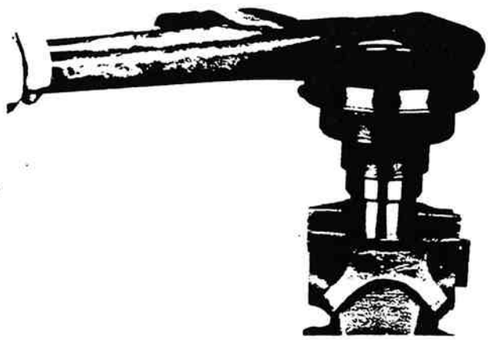

Figure 13-114. Installing Bearing Nut.

4. Position the key spacer ring on output shaft using the two $^{5}/_{16}$-24 x $^{5}/_{8}$" capscrews, but do not tighten (figure 13-115).

Figure 13-115. Attaching Key Spacer Ring.

REASSEMBLY OF MAINSHAFT

1. Place mainshaft in vise equipped with brass jaws or wood blocks, pilot end down.

NOTE: If previously removed, install all corresponding retaining rings in mainshaft gears with the exception of reverse gear.

2. Install 3rd speed washer with flat side down in the 4th groove of mainshaft. Rotate washer to align splines of washer with those of the mainshaft and install the long key in mainshaft keyway (figure 13-116).

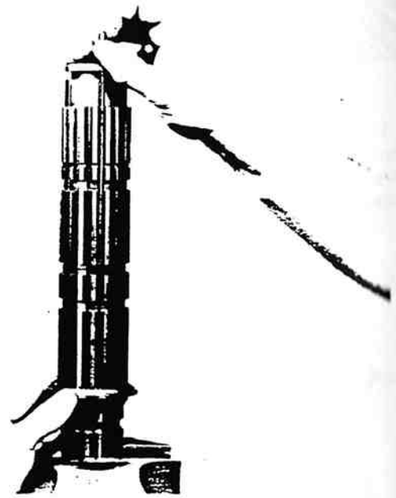

Figure 13-116. 3rd Speed Washer Installation.

3. Install 2nd-3rd speed sliding clutch, aligning missing internal spline of sliding clutch with key (figure 13-117).

Figure 13-117. Installing 2nd/3rd Sliding Clutch.

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4. Remove key and install 2nd speed gear washer, flat side up, next groove of mainshaft. Rotate washer to align splines of washer with those of mainshaft and reinsert key (figure 13-118).

NOTE: The long key is moved downward to engage washers as they are positioned on mainshaft.

Figure 13-118. 2nd Speed Washer Installation.

5. Install spacer against 2nd speed washer (figure 13-119).

NOTE: Gear washers are internally splined and locked to mainshaft by key. Gear spacers are externally splined to engage with splines in gear hubs. There is one washer and one spacer for each gear in mainshaft assembly.

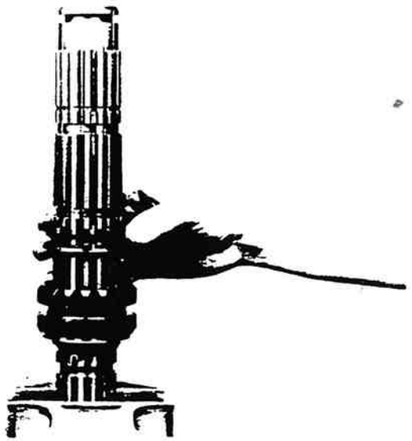

Figure 13-119. Spacer Against 2nd Speed Washer.

6. Install 2nd speed gear, clutching teeth down. Engage clutching teeth of gear with external splines of spacer (figure 13-120).

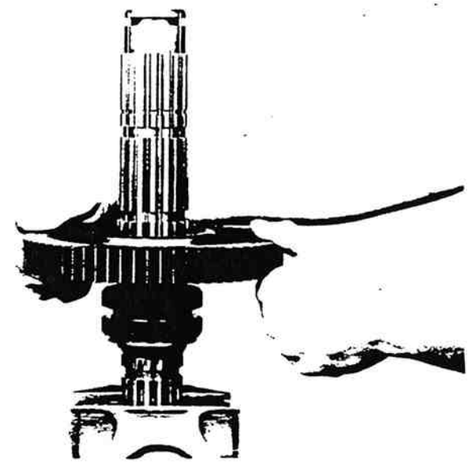

Figure 13-120. 2nd Speed Gear Installation.

7. Install 1st speed gear, clutching teeth up (figure 13-121).

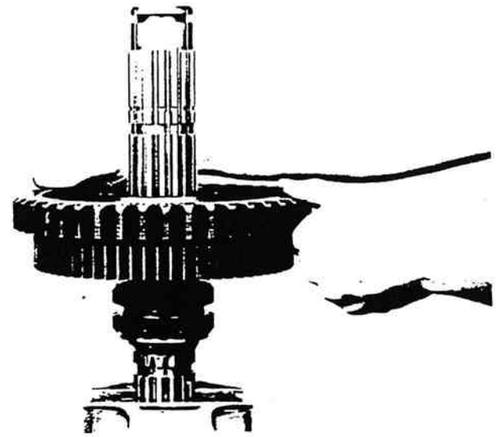

Figure 13-121. 1st Speed Gear Installation.

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8. Install spacer in 1st speed gear, engaging external splines of spacer with clutching teeth of gear (figure 13-122).

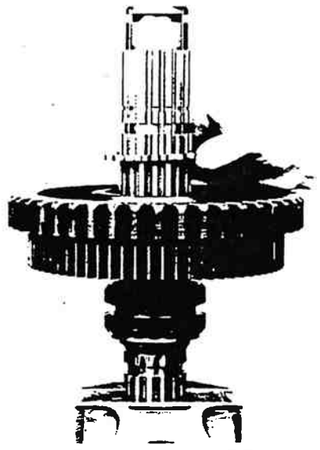

Figure 13-122. Installing Spacer.

9. Remove key and install 1st speed washer, flat side against spacer (figure 13-123).

Figure 13-123. Installing Washer.

10. Rotate washer to align splines of washer with those of mainshaft and reinsert key (figure 13-124).

Figure 13-124. Key Re-insertion.

11. Insert two large screwdrivers between 1st and 2nd speed gears. Apply slight downward pressure on screwdriver handles to spread gears evenly. Making certain gear hubs are parallel, insert feeler gauge between hubs (figure 13-125). Correct axial clearance; should be from .005" to .012" (.127-.305 mm). If the clearance is less than the minimum .005" (9.127 mm) tolerance, the washer in the 1st speed gear should be replaced by a lower limit washer. This will increase the axial clearance between the gears. If the clearance checked is greater than the maximum .012" (.305 mm) tolerance, a higher limit washer should be installed in the 1st speed gear. This would decrease the axial clearance between the gears.

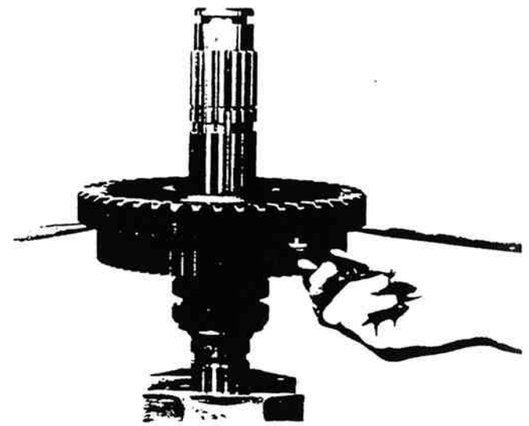

Figure 13-125. Checking Clearance Between Gears.

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NOTE: For information on axial clearance (end play) on mainshaft gears, refer to Specifications at the end of this section.

12. Install 1st-reverse speed sliding clutch, aligning missing internal spline of sliding clutch with key in mainshaft (figure 13-126).

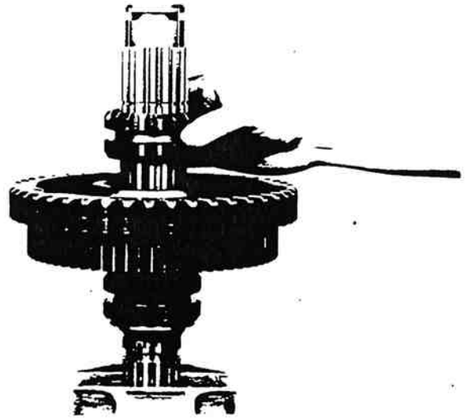

Figure 13-126. 1st-Reverse Sliding Clutch Installation.

13. Remove key and install reverse gear washer, flat side up, in rear groove of mainshaft. Rotate washer to align splines of washer with those of mainshaft and reinsert key (figure 13-127).

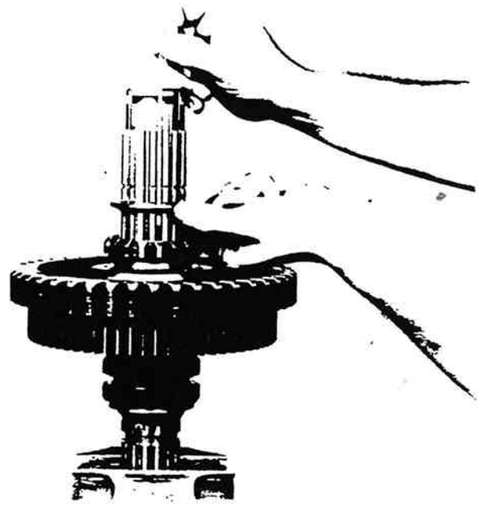

Figure 13-127. Reverse Gear Washer Installation.

14. Install spacer against reverse gear washer (figure 13-128).

Figure 13-128. Spacer Installation.

15. Install retaining ring in groove at rear of mainshaft (figure 13-129).

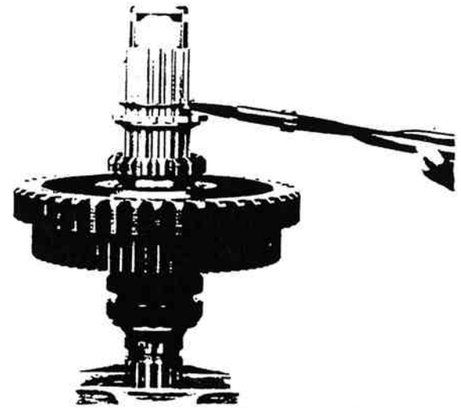

Figure 13-129. Retaining Ring Installation.

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16. Reposition mainshaft assembly in vise, pilot end up (figure 13-130).

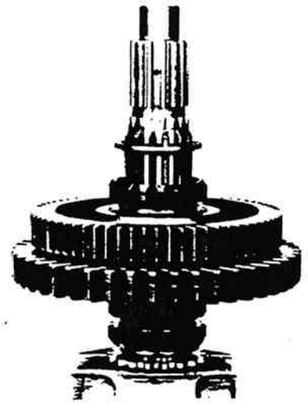

Figure 13-130. Mainshaft Repositioned in Vise.

17. Install spacer against flat side of 3rd speed gear washer (figure 13-131).

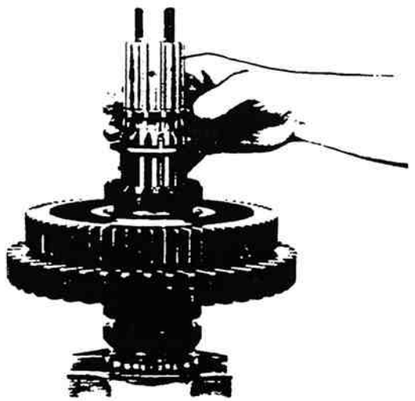

Figure 13-131. Installing Spacer.

18. Install 3rd speed gear, clutching teeth down. Engage clutching teeth of gear with external splines of spacer (figure 13-132).

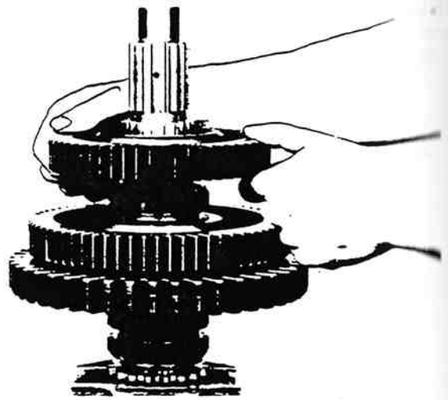

Figure 13-132. Installing 3rd Speed Gear.

19. Install 4th speed gear, clutching teeth up, against 3rd speed gear (figure 13-133).

Figure 13-133. Installing 4th Speed Gear.

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20. Install spacer in 4th speed gear engaging external splines of spacer with clutching teeth of gear (figure 13-134).

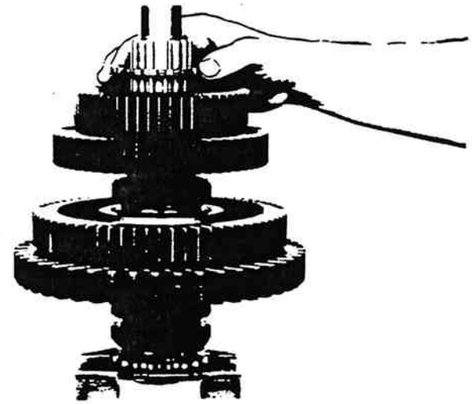

Figure 13-134. Installing Spacer in 4th Speed Gear.

21. Install 4th speed gear washer, flat side against spacer, in 4th speed gear. Rotate washer to align splines of washer with splines of mainshaft and install short key in mainshaft keyway (figure 13-135).

Figure 13-135. Short Key Installation.

22. Check axial clearances and make adjustments, if necessary, between the 3rd and 4th speed gears in the same manner as performed between the 1st and 2nd speed gears (figure 13-136).

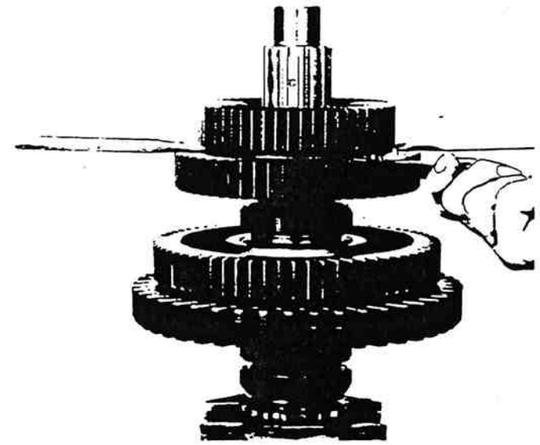

Figure 13-136. Checking Clearance.

23. Install 4th-5th speed sliding clutch, aligning missing internal spline of sliding clutch with key in mainshaft (figure 13-137).

Figure 13-137. Installing 4/5th Speed Sliding Clutch.

24. Remove mainshaft assembly from vise. Install reverse gear on mainshaft over retaining ring in rear, clutching teeth toward front, and move it against 1st speed gear, engaging clutching teeth of gear with external splines of spacer (figure 13-138).

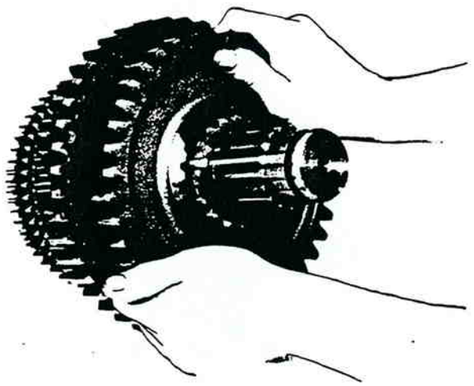

Figure 13-138. Installing 1st Speed Gear.

PARTIAL INSTALLATION OF MAINSHAFT ASSEMBLY

1. Move the right countershaft assembly as far as possible toward case wall (figure 13-139).

Figure 13-139. Positioning Countershaft Assembly.

2. With the reverse gear as far forward as possible, install the mainshaft into position in case, meshing corresponding gears on left countershaft with those on mainshaft (figure 13-140).

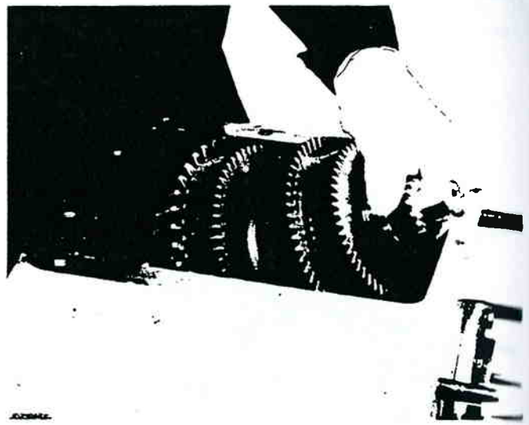

Figure 13-140. Mainshaft Assembly Installation.

3. Temporarily install the coupling gear, counterbore toward front of transmission, and partially reassembled output shaft assembly, engaging splines of output shaft with those of coupling gear, to center the rear of mainshaft assembly (figure 13-141).

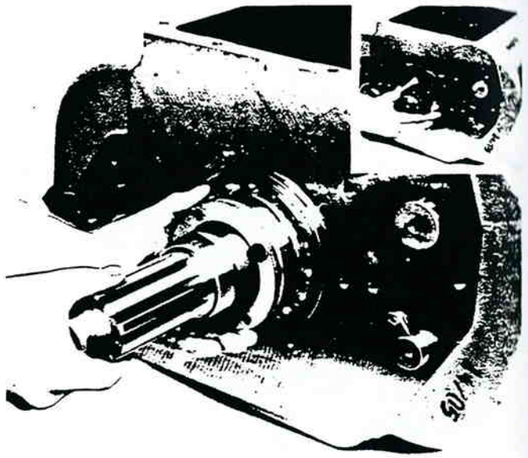

Figure 13-141. Centering Mainshaft Assembly.

MPLETION OF RIGHT
UNTERSHAFT INSTALLATION

NOTE: Left countershaft assembly must remain in time with main drive gear when timing right countershaft assembly.

1. With the right countershaft parallel with mainshaft, mesh the marked tooth of right countershaft drive gear with the remaining two marked timing teeth of main drive gear (figure 13-142).

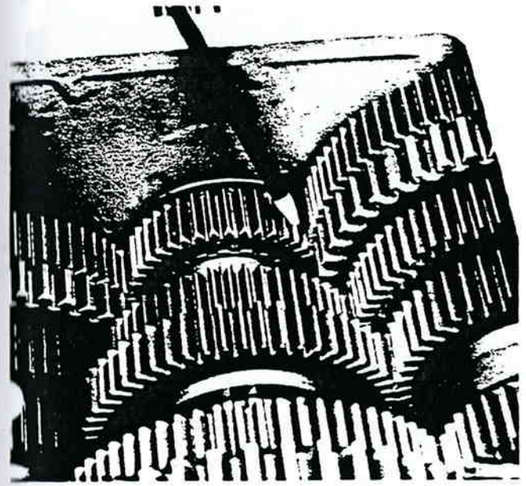

Figure 13-142. Engaging Timing Teeth.

2. Insert countershaft support tool in rear bearing bore (figure 13-143).

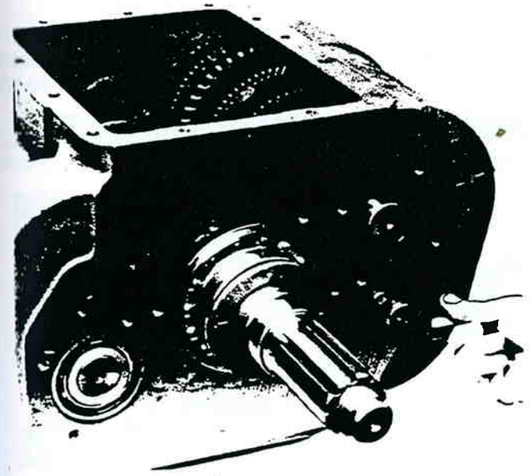

Figure 13-143. Placing Support Tool in Rear Bearing Bore.

3. With timing teeth still in mesh, install countershaft front bearing. Center countershaft in case bore using a small screwdriver inserted through bearing I.D. and in bell center or either threaded hole in end of shaft (figure 13-144).

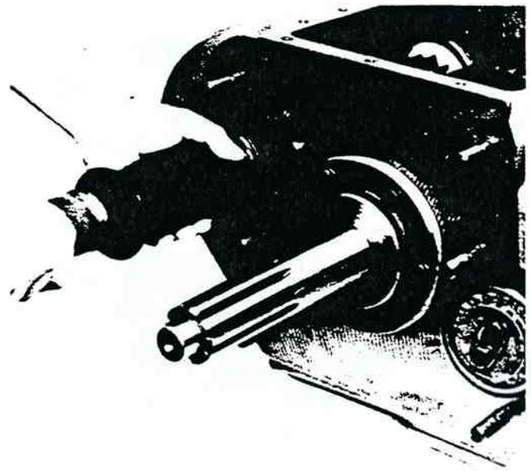

Figure 13-144. Front Bearing Installation.

4. Install retainer plate, secure with capscrews, and lockwire. For models otherwise equipped with front bearing retaining snap ring in groove of countershaft, install snap ring (figure 13-145).

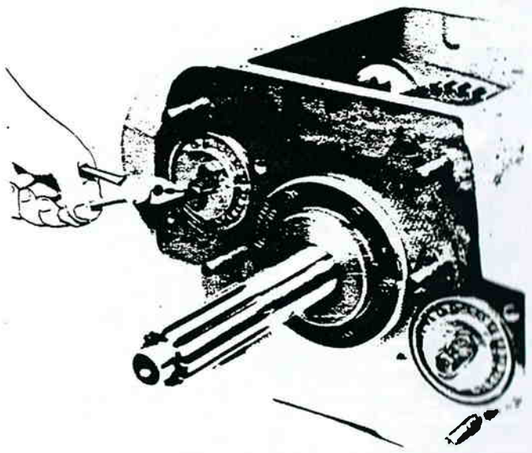

Figure 13-145. Installing Lockwires.

5. Remove countershaft support tool from rear case bore and install countershaft rear bearing with the larger I.D. lead chamfer toward front of transmission (figure 13-146).

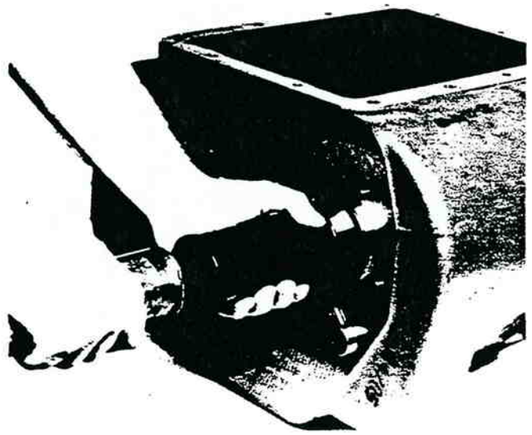

Figure 13-146. Rear Bearing Installation.

NOTE: If damage to original bearing resulted from punch and maul removal, replace with new rear bearing.

6. Shift the mainshaft sliding clutches into all gear positions with a screwdriver. A sliding clutch that cannot be shifted into gear indicates that the drive gear set is out of time. The right countershaft bearings would then need to be removed and the countershaft retimed with the mainshaft. The transmission is properly timed if the sliding clutches can be shifted into all mainshaft gears (figure 13-147).

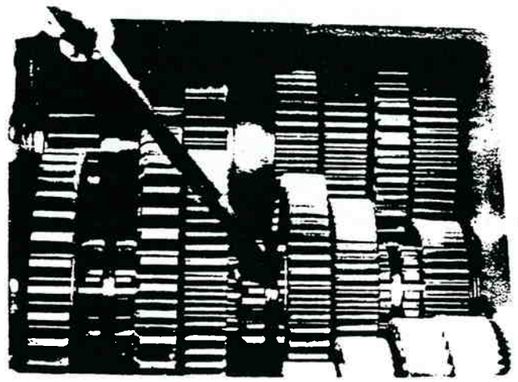

Figure 13-147. Checking Sliding Clutches.

NOTE: Do not shift the transmission into two gears at the same time. This will prevent the mainshaft and countershaft assemblies from rotating.

7. If properly timed, install both countershaft rear bearing covers with new gaskets and secure to case with capscrews (figure 13-148).

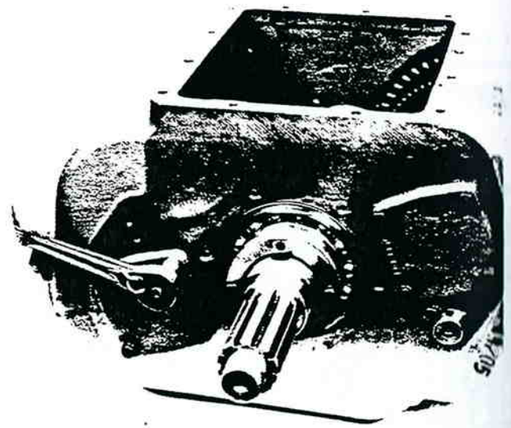

Figure 13-148. Cover Installation.

REASSEMBLY AND INSTALLATION OF LEFT REVERSE IDLER GEAR ASSEMBLY

NOTE: Since the left and right reverse idler gear assemblies are identical, reassembly and installation of the left reverse idler gear assembly should be performed in the same manner as described for right reverse idler gear in previous pages of this section.

COMPLETING INSTALLATION OF MAINSHAFT

1. Remove the temporarily installed output shaft assembly from case bore and coupling gear from rear of mainshaft (figure 13-149).

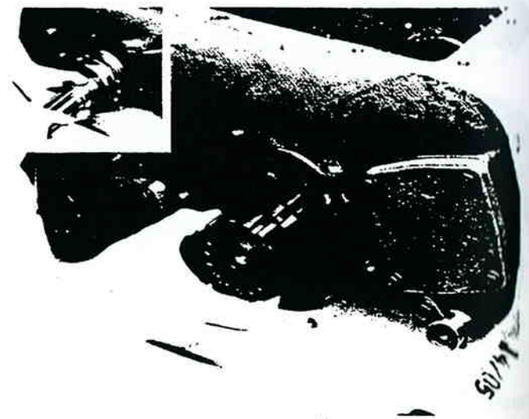

Figure 13-149. Removing Output Shaft and Coupling Gear.

2. Move the reverse gear to the rear on mainshaft as far as possible, meshing teeth of gear with teeth of the two reverse idler gears (figure 13-150).

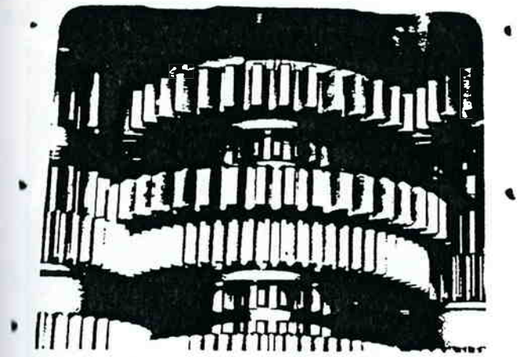

Figure 13-150. Reverse Gear Moved to Rear.

3. With mainshaft forward and reverse gear to the rear, seat the reverse gear spacer previously installed on shaft into hub of gear, and install the retaining ring in I.D. of reverse gear (figure 13-151).

Figure 13-151. Installing Retaining Ring.

COMPLETING REASSEMBLY AND INSTALLATION OF OUTPUT SHAFT ASSEMBLY

1. Install the coupling gear on splines of mainshaft with the counterbore toward the front and keyway aligned with key in shaft (figure 13-152).

Figure 13-152. Installing Coupling Gear.

2. Install the output shaft assembly over mainshaft, seating bearing in case bore (figure 13-153).

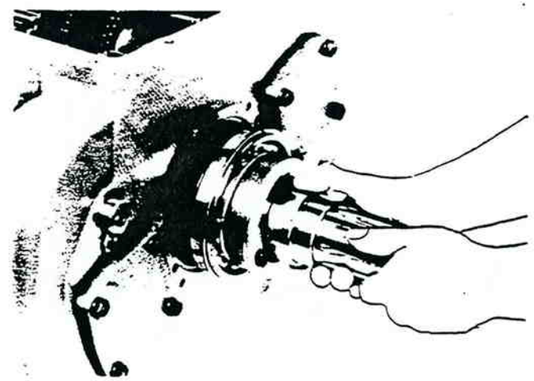

Figure 13-153. Installing Output Shaft Assembly.

CAUTION: Make sure splines in output shaft engage splines of coupling gear.

3. Install the flat keys in bores in output shaft to engage slot in mainshaft (figure 13-154).

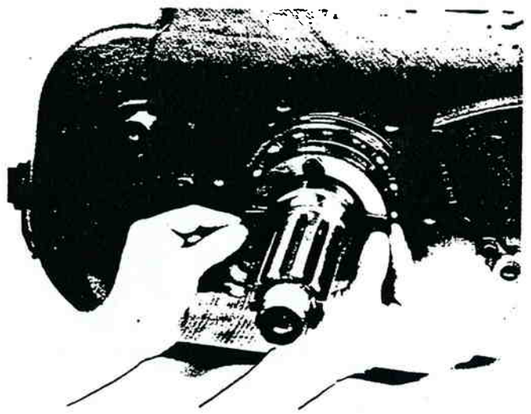

Figure 13-154. Installing Flat Keys.

MC-9 MAINTENANCE MANUAL

4. Secure flat keys with 5/16"-24 x 1" capscrews and tighten all capscrews in spacer ring evenly and securely. Install safety wire (figure 13-155).

Figure 13-155. Tightening Capscrews.

5. Install outer bearing on output shaft, seating against shaft shoulder (figure 13-156).

Figure 13-156. Installing Outer Bearing.

6. Install the output shaft bearing washer on shaft and against bearing, chamfered I.D. toward bearing (figure 13-157).

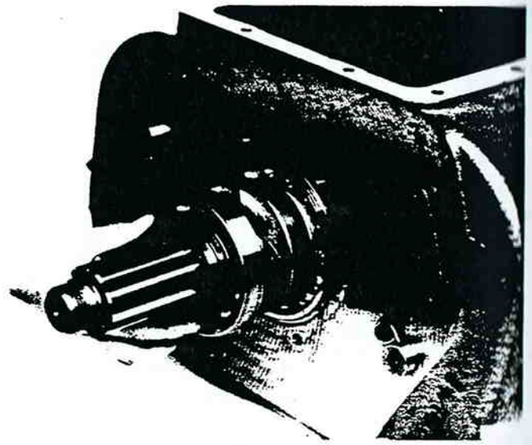

Figure 13-157. Output Bearing Washer Installation.

7. Install the spacer on shaft and against washer (figure 13-158).

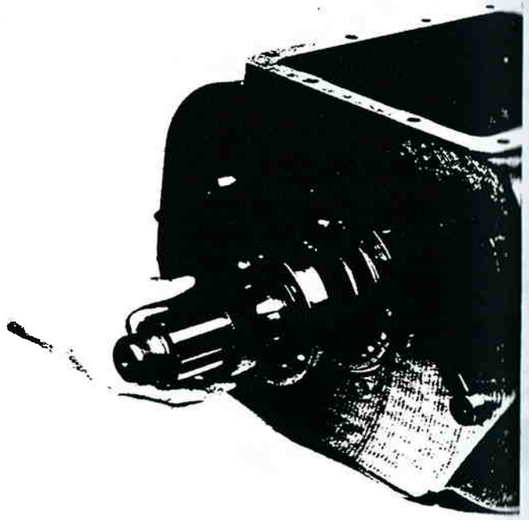

Figure 13-158. Spacer Installation.

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UTCH HOUSING INSTALLATION

1. Apply white grease to new clutch housing gasket and install in position on case (figure 13-159).

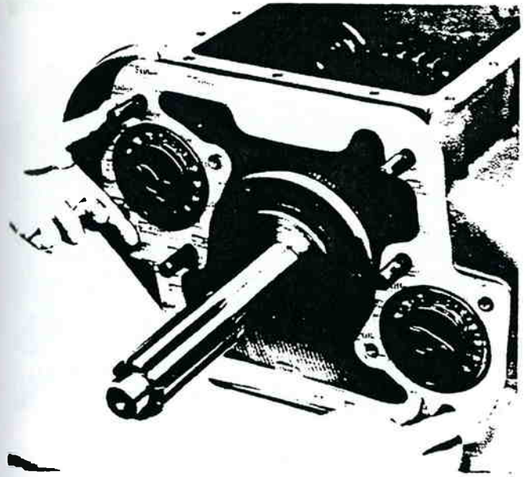

Figure 13-159. Clutch Housing Gasket.

2. Place clutch housing in position on the six studs in front of case, piloting on drive gear cover (figure 13-160).

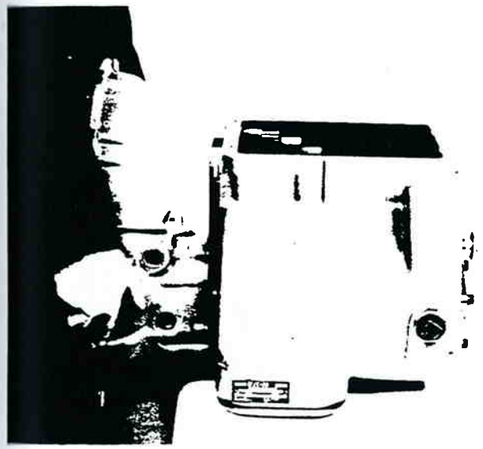

Figure 13-160. Clutch Housing Installation.

3. Install the six nuts on studs with washers or lockwashers and tighten to 180-190 ft. lbs. (244-257 Nm) torque (figure 13-161).

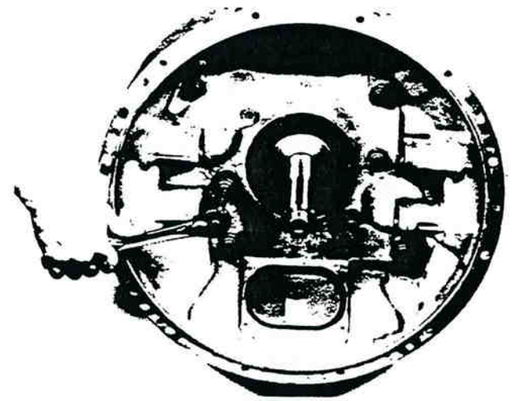

Figure 13-161. Tightening Nuts on Studs.

4. Install the four bolts in clutch housing and tighten to 90-100 ft. lbs. (122-135 Nm) torque (figure 13-162).
5. Install the clutch release mechanism.

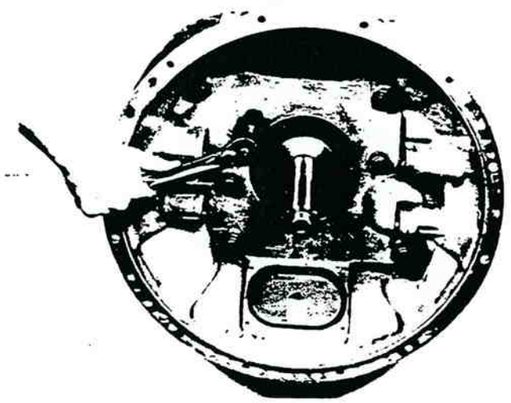

Figure 13-162. Tightening Bolts.

MC-9 MAINTENANCE MANUAL

REASSEMBLY AND INSTALLATION OF REAR BEARING COVER ASSEMBLY

1. Install new oil seal in rear bearing cover if original seal was previously removed. A spring is visible on one side of seal. Install this side with spring toward front of transmission (figure 13-163).

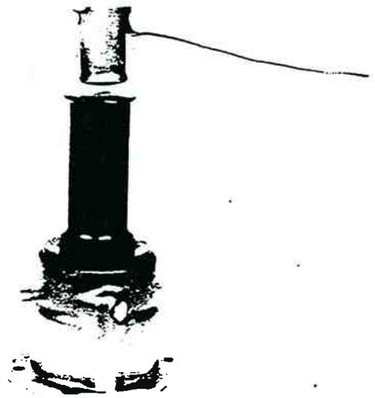

Figure 13-163. Installing Oil Seal.

2. Install rear bearing cover with new gasket evenly on output shaft to seat output shaft bearing in cover, aligning oil slot in cover and gasket with slot in case (figure 13-164).

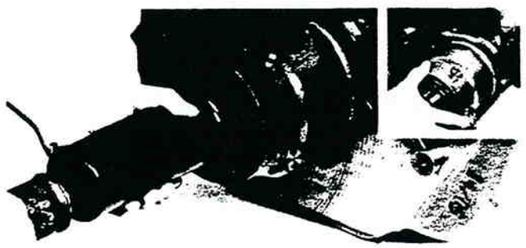

Figure 13-164. Bearing Cover on Shaft.

3. Install attaching capscrews, tighten evenly and securely (figure 13-165).

Figure 13-165. Installing Capscrews.

INSTALLING COMPANION FLANGE OR YOKE

1. Lock the mainshaft by engaging two speeds with the sliding clutch gears (figure 13-166).

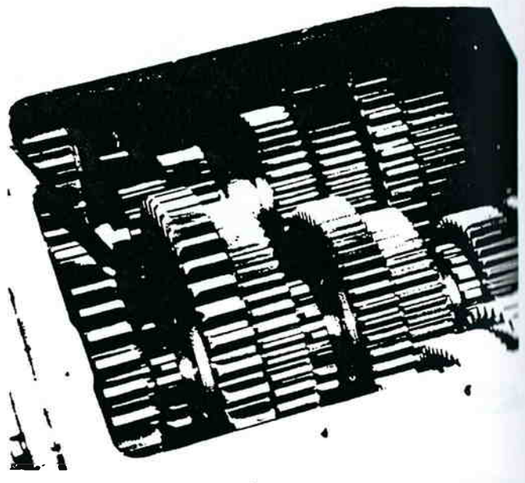

Figure 13-166. Locking Mainshaft.

2. Install flange or yoke on output shaft splines and secure with output shaft nuts, tightening to 400-500 ft. lbs. (542-678 Nm) torque (figure 13-167).

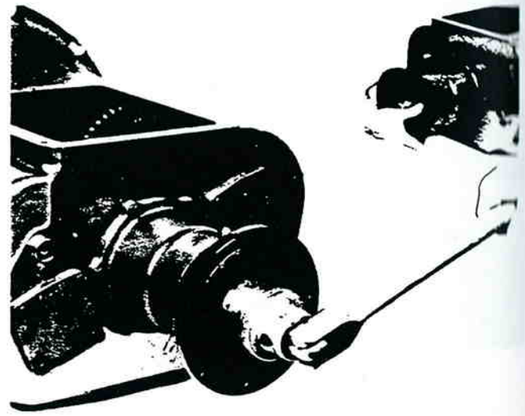

Figure 13-167. Tightening Output Shaft Nut.

MC-9 MAINTENANCE MANUAL

ASSEMBLY OF SHIFT BAR HOUSING

1. Install the housing in a vise with the left side up.

NOTE: Shift bars should be installed from the front with neutral and shift notches to the front. Keep bars in the neutral position when installed.

2. Install the long 1st-reverse shift bar in lowest bore in housing, installing the shifting yoke and block on bar, long hub of each to the front (figure 13-168).

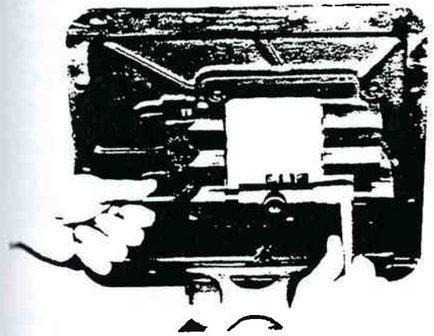

Figure 13-168. Installing 1st-Reverse Shift Bar.

3. Install lock screw in yoke and block, tighten and wire securely (figure 13-169).

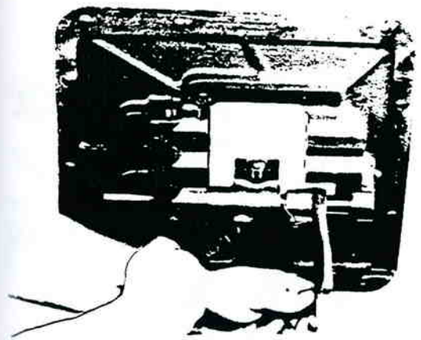

Figure 13-169. Installing Lockscrew.

4. Install ¾" interlock ball in bore in front boss (figure 13-170).

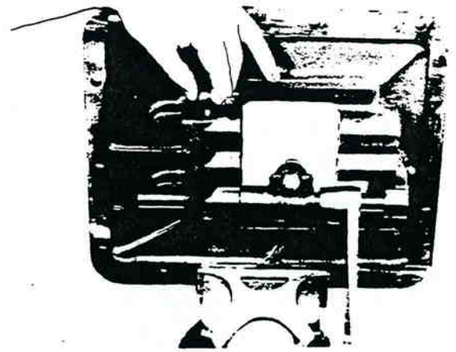

Figure 13-170. Installing Interlock Ball.

5. Install the 2nd-3rd speed shifting bar in center bore in housing and install shift yoke, long hub to the rear. At the same time install interlock pin in bore in neutral notch of bar as notch enters front boss (figure 13-171).

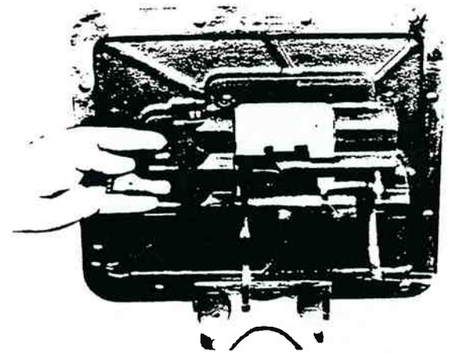

Figure 13-171. 2nd-3rd Shift Bar Installed.

6. Install yoke lock screw, tighten and wire securely (figure 13-172).

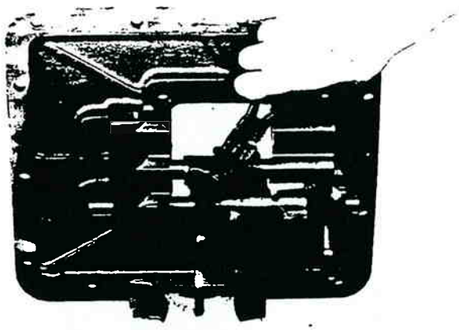

Figure 13-172. Installing Yoke Lockscrew.

7. Install ¾" interlock ball in bore in front boss (figure 13-173).

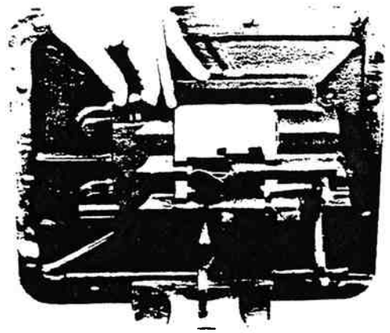

Figure 13-173. Interlock Ball Installation.

8. Install the 4th-5th speed shifting bar in upper bore in housing installing shift yoke on bar, fork to the front (figure 13-174).

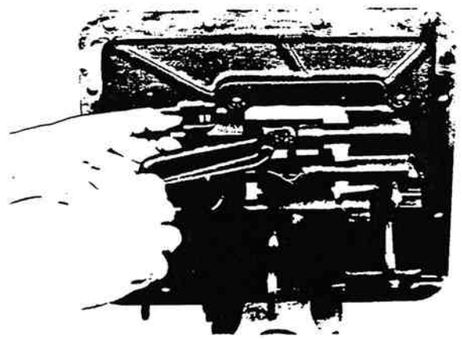

Figure 13-174. 4th-5th Shift Bar Installation.

9. Install yoke lock screw, tighten and wire securely (figure 13-175).

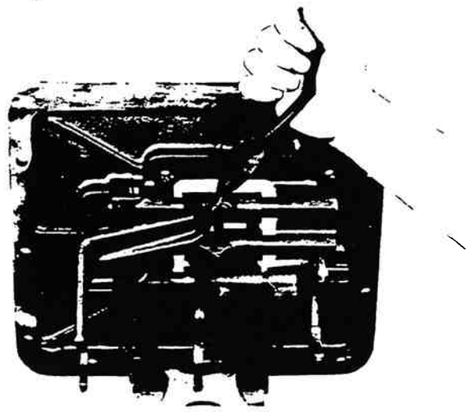

Figure 13-175. Installing Locking Wire.

10. Remove housing from vise and install the three shift bar tension balls in bores in top of housing (figure 13-176).

Figure 13-176. Replacing Tension Balls.

11. Install three tension springs in bores (figure 13-177).

Figure 13-177. Replacing Tension Springs.

12. Place a new tension spring cover gasket into position on shift bar housing and install cover. Tighten capscrews to secure (figure 13-178).

Figure 13-178. Installing Spring Cover.

INSTALLING SHIFT BAR HOUSING

1. Place all three of the sliding clutches in transmission in the neutral position (figure 13-179).

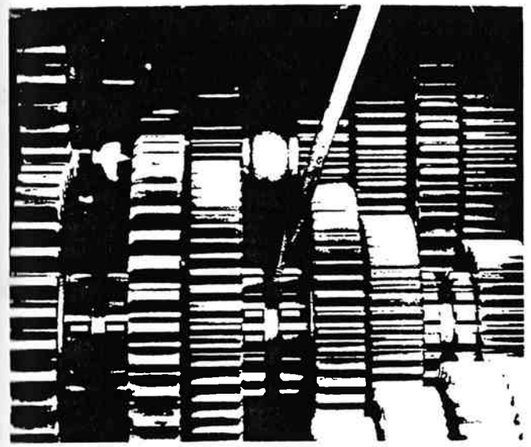

Figure 13-179. Positioning Sliding Clutches.

2. Apply white grease to new shift bar housing gasket and install in position on case (figure 13-180).

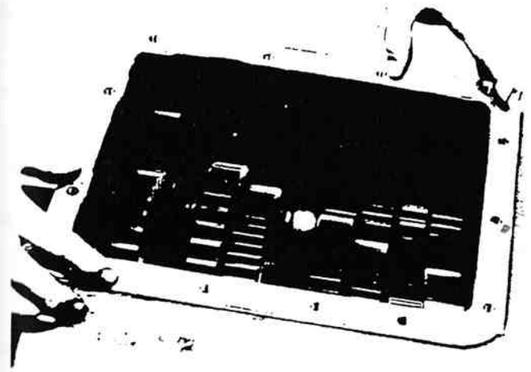

Figure 13-180. Installing Shift Bar Housing Gasket.

3. Make sure shifting bars in housing are in the neutral position (figure 13-181).

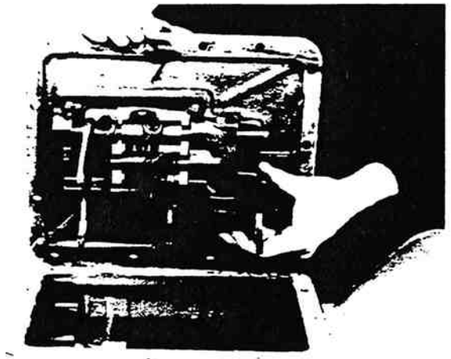

Figure 13-181. Shift Bars in Neutral.

4. Install the shift bar housing on transmission, fitting yokes into corresponding yoke slots of sliding gears, tighten capscrews securely (figure 13-182).

Figure 13-182. Installing Shift Bar Housing.

5. Install the thirteen capscrews in flange holes of housing and tighten, remembering to include the two lifting eyes in position on housing corners opposite each other (figure 13-183).

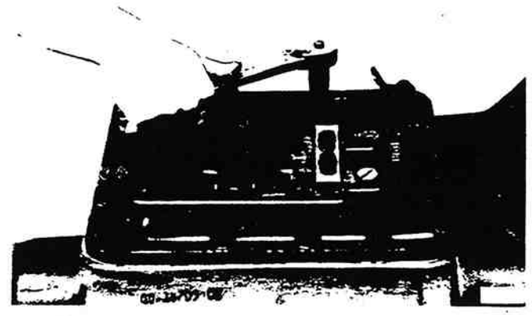

Figure 13-183. Tightening Housing Capscrews.

INSTALLING REMOTE CONTROL AND SHIFTER HOUSING

1. Make sure the shifting notches in the shift bar housing are aligned in the neutral position.
2. Install the shift lever housing, fitting lever into notches in block and yokes; tighten capscrews securely.

5 SPEED TRANSMISSION SHIFT LINKAGE ADJUSTMENT

When adjusting the shift linkage, follow the procedure outlined below to insure that the linkage is set properly for smooth and trouble-free operation.

1. Apply parking brakes.
2. Turn master switch "OFF."
3. Remove turnbuckle at rear shift linkage (figure 13-184).

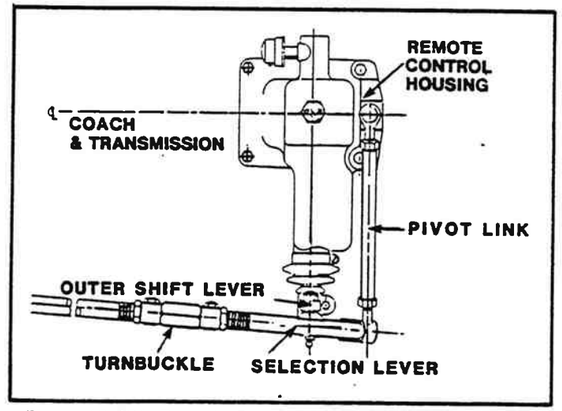

Figure 13-184. Remote Control Shift Linkage Installation.

4. With outer shift lever in vertical position (figure 13-186), find approximate center of free in-and-out movement of inner shift shaft (figure 13-185).

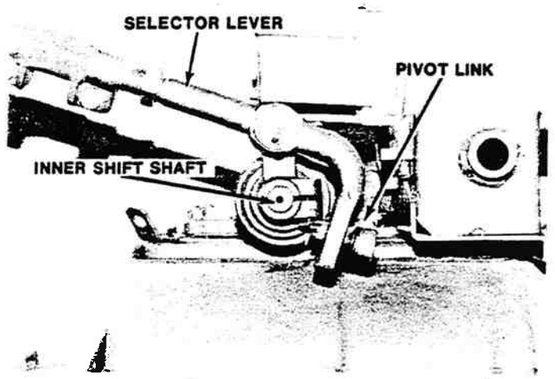

Figure 13-185. Inner Shift Shaft, Selector Lever and Pivot Link.

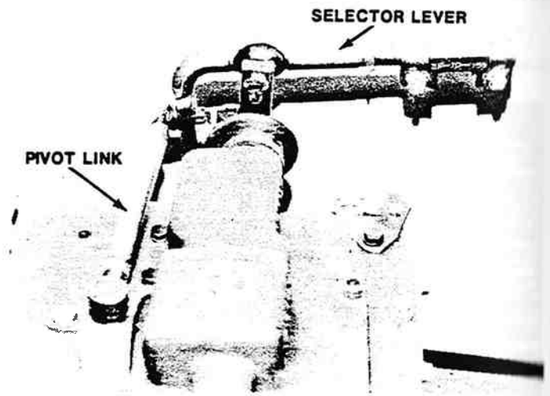

Figure 13-186. Pivot Link and Selector Lever Installation.

5. Maintaining this position, adjust pivot link until bottom end of selection lever is vertical (when viewed from the rear of the coach) and forward end aligns with control rod (figure 13-185).

6. Start turnbuckle on selection lever and rear control rod simultaneously and adjust until proper fore and aft position of gearshift lever (in neutral) is achieved (figure 13-184).

7. Rotate rear control rod to achieve proper side-to-side movement of gearshift lever and secure turnbuckle.

8. "Fine tune" adjustments by lengthening or shortening pivot link if required. Tighten jam nuts and check all shifts for proper interference-free positions (figure 13-186).

8SPEED TRANSMISSION SPECIFICATIONS: STANDARD AND OPTIONAL

Manufacturer	Fuller T-11605D, 11605F
Speeds	5-Forward 1-Reverse
Mounting	On Engine
Gear Selection	Remote Control
Oil Capacity	22 U.S. Pints (10.41 liters)

GEAR RATIOS	T-11605D (Standard)	T-11605F (Optional)
1st	5.46	7.20
2nd	3.23	3.90
3rd	2.05	2.12
4th	1.31	1.46
5th	1.00	1.00
Reverse	5.57	5.57

AXIAL CLEARANCE FOR MAINSHAFT GEARS

Axial Clearance (End Play) limits are:
Reverse speed gear - minimum of .005" (.127 mm)
Forward speed gears - .005"-.012" (.127-.305 mm)
Washers are used to obtain the correct limits and are available in the following thicknesses:

LIMITS	COLOR CODE
.248"-.250" (.630-.635 mm)	White
.253"-.255" (.642-.647 mm)	Green
.258"-.260" (.655-.660 mm)	Orange
.263"-.265" (.668-.673 mm)	Purple
.268"-.270" (.680-.685 mm)	Yellow
.273"-.275" (.693-.698 mm)	Black

Refer to Parts Manual for washer part numbers

Always use the .248"-.250" (.630-.635 mm) low limit washer (White) in the 1st and 3rd speed gear positions.

TORQUE SPECIFICATIONS

NUTS	
Clutch Housing to Case	180-190 ft. lbs. (244-257 Nm)
Drive Gear Bearing Nut	250-300 ft. lbs. (339-407 Nm)
Output Shaft Front Bearing Nut	250-300 ft. lbs. (339-407 Nm)
Companion Flange Nut	400-500 ft. lbs. (542-678 Nm)
CAPSCREWS*	
Clutch Housing to Case	90-100 ft. lbs. (131-136 Nm)
Countershaft Front Bearing Retainer	20-25 ft. lbs. (27-34 Nm)
Output Shaft Key Spacer Ring	20-25 ft. lbs. (27-34 Nm)
Output Shaft Key	20-25 ft. lbs. (27-34 Nm)
Front Bearing Cover	35-45 ft. lbs. (47-61 Nm)
Shiftbar Housing	35-45 ft. lbs. (47-61 Nm)
Mainshaft Rear Bearing Cover	35-45 ft. lbs. (47-61 Nm)
Countershaft Rear Bearing Covers	25-35 ft. lbs. (34-47 Nm)
Reverse Idler Shaft Lock	25-35 ft. lbs. (34-47 Nm)

* Do not torque capscrews dry

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AUTOMATIC TRANSMISSION

Detailed service procedures for the Allison HT700 Series automatic transmissions may be found in the applicable DDA Transmission Service Manuals.

CHANGING OIL FILTER

1. Remove filter element by rotating counterclockwise. (See figure 13-187.)

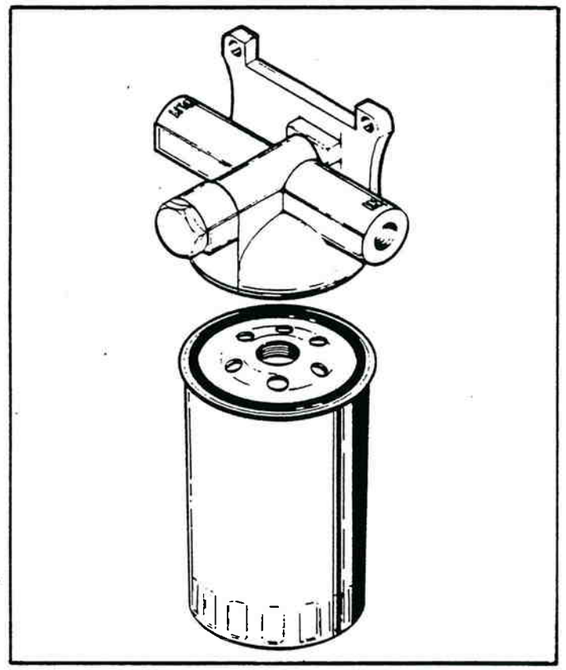

Figure 13-187. Automatic Transmission Filter.

2. Discard element.

3. Thoroughly clean any dirt or oil from the base casting.

4. Install new element. Tighten element 2/3 turn after element seal first contacts the base.

5. Run the engine and check for leaks.

6. Check the transmission oil level and add "Dexron II" fluid if required.

MODULATOR VALVE INSTALLATION (6V-92, 8V-71 & 8V-92 ENGINE AND HT740 TRANSMISSION)

1. Remove plastic plug from transmission and plastic cap from modulator valve (if so equipped). Make certain modulator valve spacer pin which is supplied with the transmission is in place. Ensure that the O-ring (11) is in place on the shaft of the valve. Refer to figure 13-189.

2. Lubricate shaft with Dexron II transmission fluid. Insert shaft of modulator valve into hole in transmission.

3. The actuator is retained by a flat spring clip and bolt which are provided with the transmission. Place retaining clip in groove on shaft of actuator and tighten bolt to 15-20 ft. lbs (20-27 Nm) torque.

4. Route cable and secure to pivot arm on governor.

5. Rotate the governor pivot lever to the full throttle position

6. Pull the cable until it is internally bottomed. Adjust trunnion on end of cable to permit a "free pin" with fuel control lever in full fuel position. Install and secure pin.

7. Check linkage for proper return to idle position. Check cable for proper travel; should be approximately 1.187" minimum (30.162 mm) to 1.56" maximum (39.62 mm).

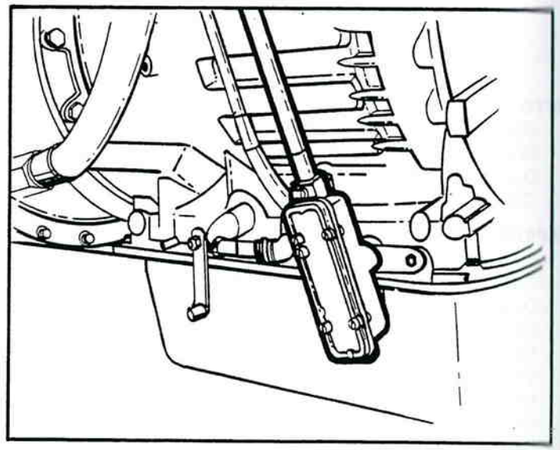

Figure 13-188. Modulator Valve Installed.

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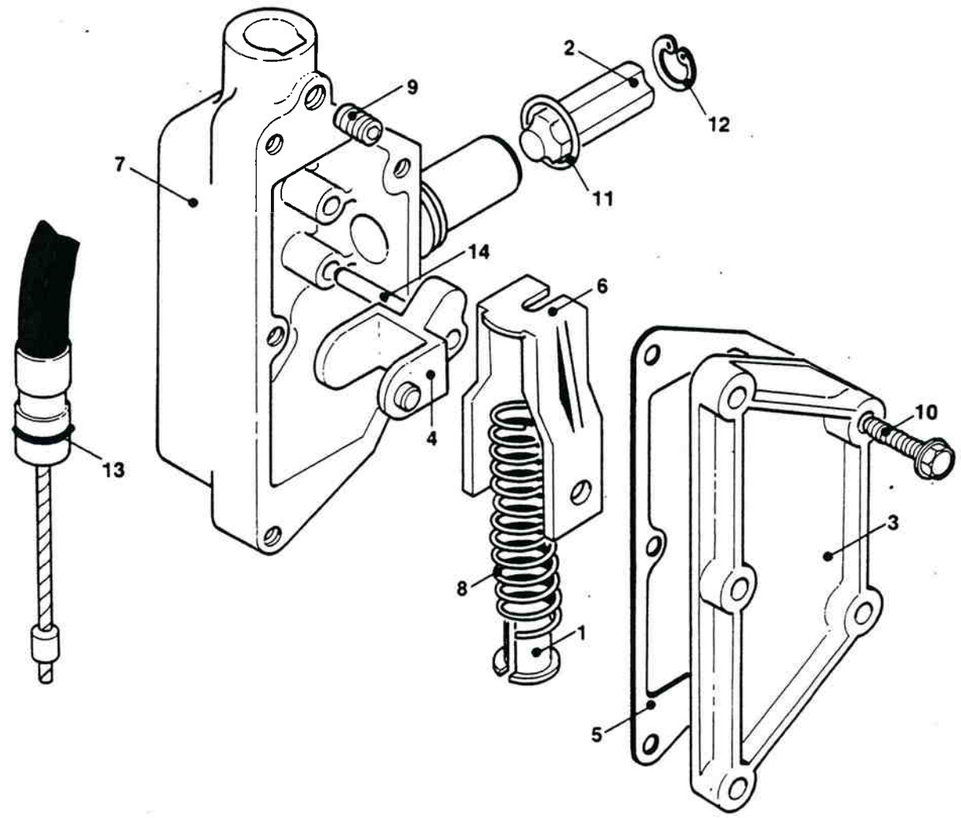

1. Thimble
2. Plunger
3. Cover
4. Lever
5. Gasket
6. Spring Retainer
7. Housing
8. Spring
9. Set Screw
10. Capscrew
11. O-ring
12. Retaining Ring
13. O-ring
14. Dowel Pin

Figure 13-189. Modulator Valve (HT-740 Transmission With 6V-92 or 8V-71 Engine).

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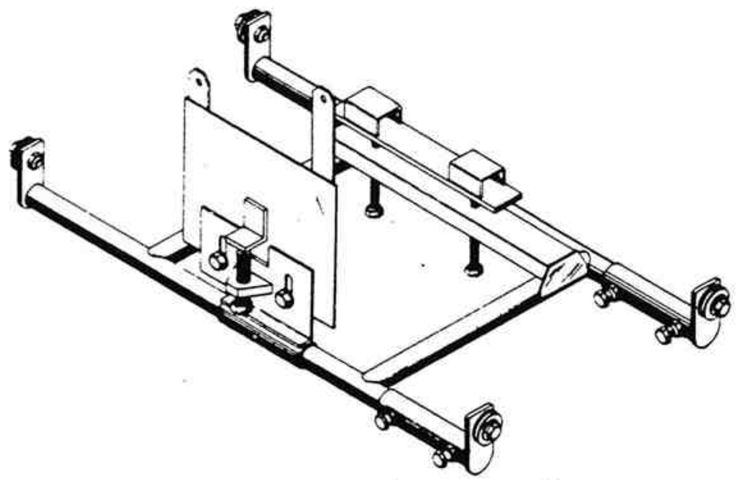
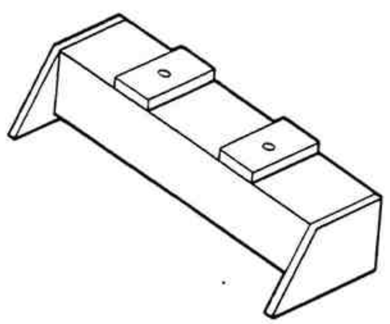
SERVICE TOOLS

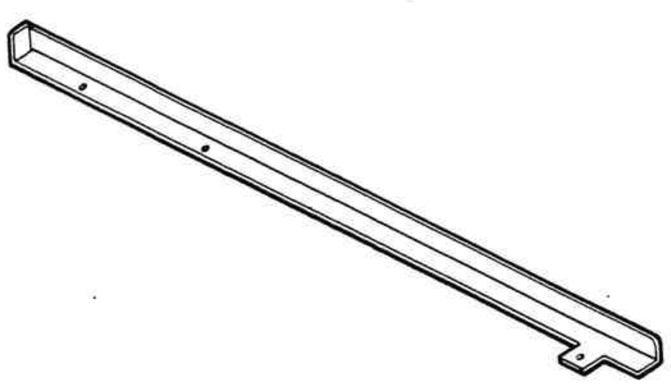
SOME OF THE TOOLS USED FOR THE MAINTENANCE PROCEDURES OUTLINED IN THIS SECTION ARE NONSTANDARD. THEY ARE, HOWEVER, AVAILABLE FOR PURCHASE FROM MOTOR COACH INDUSTRIES, TRANSPORTATION MANUFACTURING CORPORATION AND UNIVERSAL COACH PARTS. WHERE PRACTICAL, THEY MAY BE FABRICATED BY THE SERVICE FACILITY.



20-233 Transmission Dolly

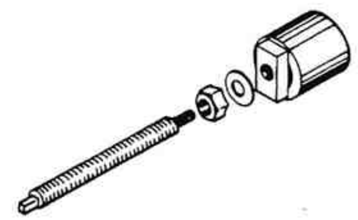


20-234 Transmission Adjusting Channel

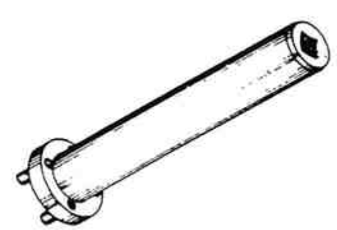


20-235 Support Rail - L.H. - Transmission Dolly

20-236 Support Rail - R.H. - Transmission Dolly



20-42 Puller — Removing Transmission Reverse Idler Gear Shaft



20-43 Wrench — Assembling Bearing Retaining Nut on Transmission Main Drive Gear (use with 20-79)

20-79 Adapter — Transmission Drive Gear, Lock Nut Installation Tool

MC-9 MAINTENANCE MANUAL

SERVICE BULLETINS

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of bulletins pertaining to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject