PART 6-5 WARNER GEAR FOUR-SPEED TRANSMISSION

1 DESCRIPTION AND OPERATION

DESCRIPTION

The Warner 4-speed transmission (Fig. 1) is of the fully synchronized type with all gears except the reverse sliding gear being in constant mesh. All forward-speed changes are accomplished with synchronizer sleeves (Fig. 2) instead of sliding gears. The synchronizers will enable quicker shifts, greatly reduce gear clash, and permit down-shifting into any forward speed gear while the car is moving.

The shift linkage is mounted directly on the transmission extension housing (Fig. 1) and enters the drivers compartment through an opening in the floor pan. A flexible rubber boot is provided to seal the drivers compartment (Fig. 3) from the exterior.

The shift pattern is shown on the top of the gear shift lever knob. A finger-operated release lever is provided on the shift lever to prevent the transmission from being accidentally shifted into reverse gear. All forward speed gears in the transmission are helical-type, however, the reverse sliding gear and the reverse rear idler gears located in the extension housing are spur-type gears.

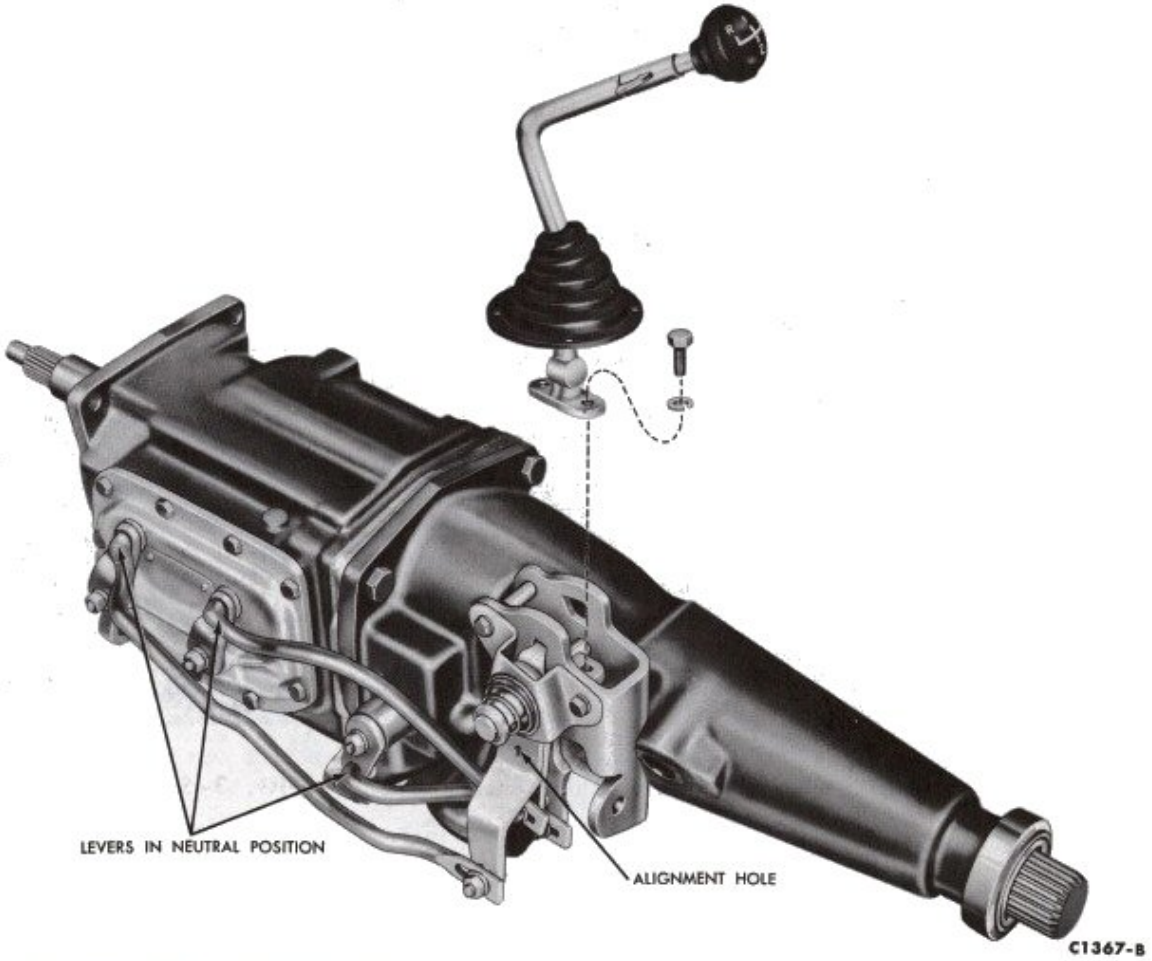

FIG. 1—4-Speed Floor Shift Transmission

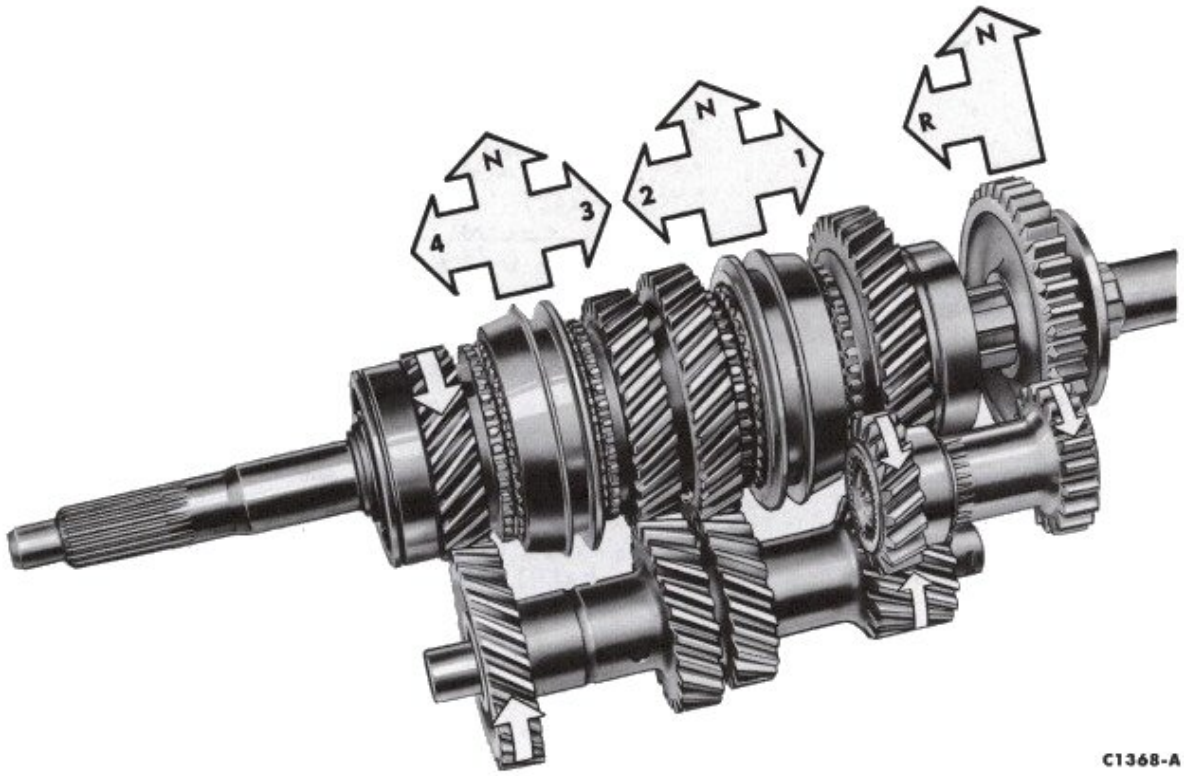

FIG. 2—Power Flow—4-Speed Transmission

OPERATION

In first speed, the first and second speed synchronizer sleeve is moved rearward by the shift fork. The sleeve engages the first speed blocking ring, which acts as a cone clutch applied to the free-wheeling first speed gear. This action speeds up or slows down the first-speed gear to match the speed of the output shaft. Further movement of the sleeve locks the first-and-second speed synchronizer hub to the first-speed gear by means of internal splines. On engagement of the clutch, power flows through the input shaft and gear to the meshed countershaft gear and thence to the first-speed gear. This gear transmits the power through the locked synchronizer hub to the transmission output shaft. All the other forward speed gears are in idler motion, as they are all driven by the countershaft (cluster) gear, but they do not transmit power because they are not locked to the output shaft. All the forward-speed shifts are made in the same manner as the first-speed shift, due to the constant-mesh features.

Reverse gear is engaged by moving the reverse sliding gear forward on the output shaft until it meshes with the reverse rear idler gear. Movement of the sliding gear is accomplished by a separate shift fork mounted in the extension housing. With all forward speed synchonizer sleeves in neutral, power flow in reverse is through the input shaft to the constant-mesh countershaft (cluster) gear, thence to the constant mesh reverse gear front idler. Splines then carry the power through the adapter plate to the reverse gear rear idler in the extension housing. As the sliding reverse gear is meshed with the reverse gear rear idler, power is transmitted to the output shaft, rotating it in a reverse direction.

FIG. 3—Shift Lever Installation

2 IN-CAR ADJUSTMENT AND REPAIRS

GEAR SHIFT LINKAGE ADJUSTMENT

To adjust the gear shift linkage, place the shift lever in neutral position and raise the car on a hoist. Insert a ¼-inch drill or drill rod into the alignment hole as shown in Fig. 4. If the rod will not enter, check for bellied or bent shift rods. If the shift rods are the correct shape, check for loose lever lock nuts at the rod ends. Reset the linkage by loosening the three rod-retaining lock nuts (Fig. 5) and moving the levers until the ¼-inch gauge rod or drill will enter the alignment holes. Make sure the transmission shift levers are in neutral and the reverse shift lever is in the neutral detent. If there is any doubt about location of the neutral position, disconnect the shift rods at the retaining lock nuts and rotate each forward-speed shift lever through its three positions until the center (neutral) detent is positively located. Move the reverse shift lever forward until positive engagement of the detent is felt. Install the shift rods and tighten the lock nuts to specifications. Remove the ¼-inch gauge rod. Operate the shift levers to make sure that the detents are engaging. Lower the car and check for smooth cross-over operation.

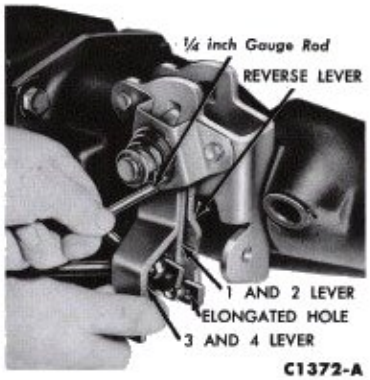

FIG. 4—Shift Linkage Adjustment

3 REMOVAL AND INSTALLATION

REMOVAL

1. Before raising the car, remove the transmission gear shift selector lever boot retainer (Fig. 5). Working under the boot, **remove the shift selector lever retaining bolts** and remove the selector lever from the shift assembly. The remaining shift linkage may be left on the transmission during removal.

2. Disconnect the drive shaft from the rear U-joint flange. Slide the drive shaft off the transmission output shaft and install the tool shown in Fig. 2, Part 6-1, to prevent lubricant leakage.

3. Disconnect the speedometer cable from the extension housing.

4. Disconnect the parking brake at the equalizer bar and support the engine with a transmission jack.

5. Remove the extension housing-to-engine rear support spring attaching bolts.

6. Raise the rear of the engine with the transmission jack. Disconnect the frame crossmember at the frame and remove the crossmember and engine rear support as a unit.

7. Support the transmission on a jack and remove the bolts that attach the transmission to the flywheel housing.

8. Move the transmission and jack rearward until the transmission input shaft clears the flywheel housing. If necessary, lower the engine enough to obtain clearance for transmission removal.

Do not depress the clutch pedal while the transmission is removed.

INSTALLATION

1. Make sure that the mounting surfaces of the transmission and the flywheel housing are free of dirt, paint, and burrs. Install two guide pins in the flywheel housing lower mounting bolt holes. Move the transmission forward on the guide pins until the input shaft splines enter the clutch hub splines and the case is positioned against the flywheel housing.

2. Install the two upper mounting bolts snug and then remove the two guide pins. Install the two lower mounting bolts. Torque all mounting bolts to specifications.

3. Raise the rear of the engine, and install the engine rear support and spring mount as a unit. Then lower the engine. Torque the rear support-to-frame attaching bolts to specifications.

4. With the transmission extension housing resting on the spring mount, install the transmission extension housing attaching bolts. Torque to specifications.

5. Connect the speedometer cable to the extension housing, and connect the parking brake cable to the equalizer.

6. Remove the tool shown in Fig. 2, Part 6-1, and slide the forward end of the drive shaft assembly over the transmission output shaft. Connect the drive shaft to the rear U-joint flange.

7. Place the shift cover levers and the reverse shift lever in neutral position and insert a ¼-inch rod in the shift linkage alignment hole. Adjust the linkage as necessary and tighten the linkage lever lock nuts to specifications. Remove the ¼-inch rod.

8. Fill the transmission to the proper level with the specified lubricant.

9. Lower the car and install the shift selector lever and boot.

10. Check the shift and cross-over motion for full shift engagement and smooth cross-over operation.

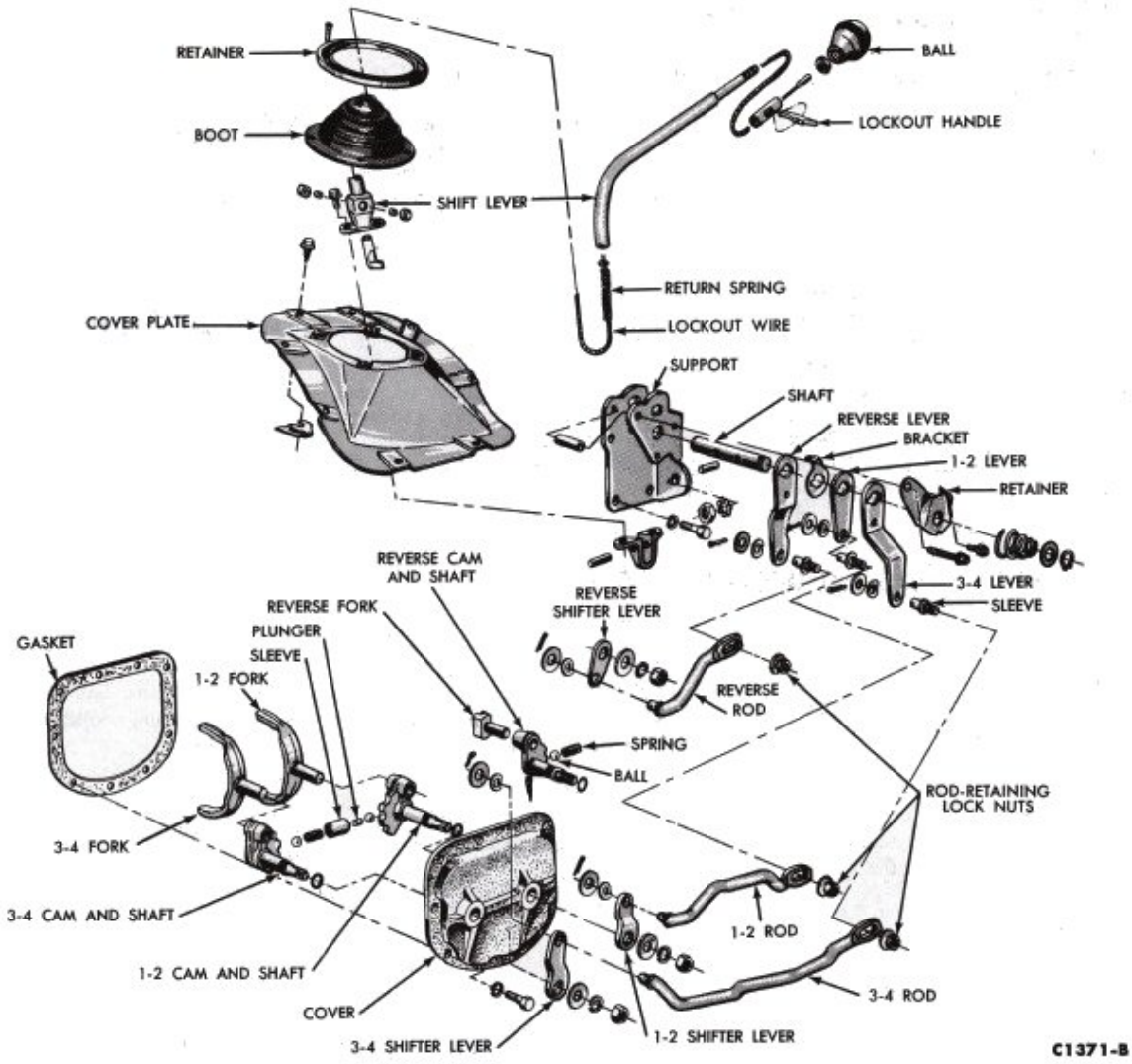

FIG. 5—Shift Linkage and Cover Disassembled

4 MAJOR REPAIR OPERATIONS

DISASSEMBLY

1. Mount the transmission in a holding fixture and drain the lubricant.

2. Disconnect the shift linkage rods at the shift levers. Remove the shift linkage from the extension housing as a unit.

3. Remove the transmission shift cover, gasket and shift forks as an assembly.

4. Drive the reverse shift shaft pin (Fig. 6) out of the extension housing. Move the reverse shift shaft out of the extension housing about ⅛-inch. This operation frees the reverse shift fork from the reverse sliding gear located in the extension housing.

5. Remove the extension-to-case attaching bolts (Fig. 7). Tap the extension housing with a soft hammer to free it from the case. Slide the extension housing rearward until the reverse idler shaft (Fig. 8) is clear of the reverse rear idler gear. Rotate the extension housing to the left to clear the reverse shift fork and remove the extension housing.

6. Lift the reverse gear rear idler (Fig. 9) from the case.

7. Remove the self-locking bolt that attaches the adapter plate to the transmission case. Remove the transmission output shaft assembly along with the adapter plate (Fig. 10). Catch any of the input shaft pilot rollers that may stick to the output shaft. Remove the remaining rollers from the input shaft bore.

8. Remove the fourth-speed gear synchronizer blocking ring which will be stuck on the input shaft gear or will have fallen into the case.

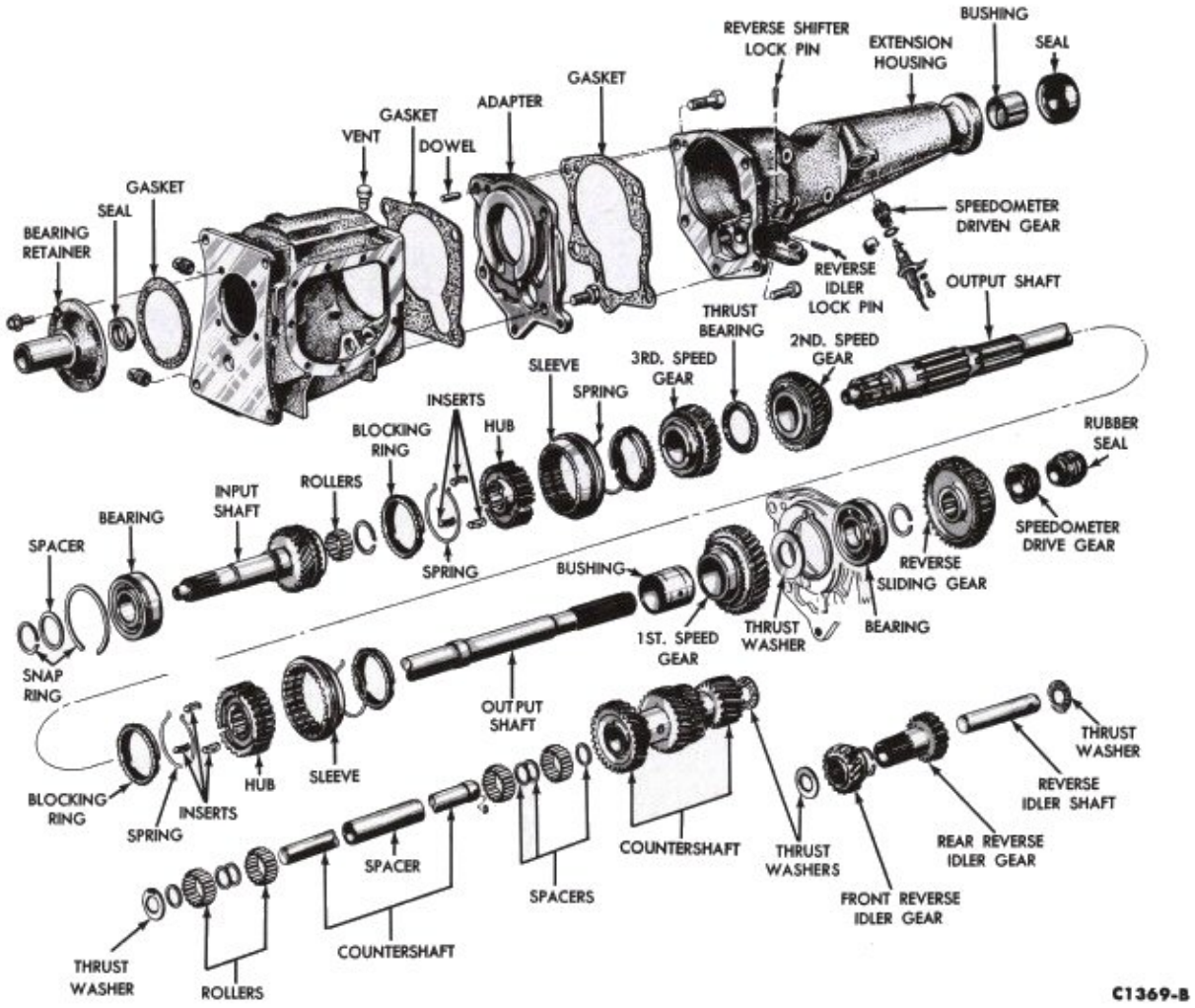

FIG. 7—4-Speed Transmission Disassembled

9. Remove the reverse gear front idler and thrust washer from the case (Fig. 11).

10. Working from the front of the case, use a drift to start the countershaft rearward. Insert the tool (dummy shaft) shown in Fig. 12 and push out the countershaft, allowing the countershaft (cluster) gear to settle to the bottom of the case. Remove the Woodruff key from the rear of the countershaft.

11. Remove the input shaft bearing retainer and discard the gasket. Remove the input shaft bearing retaining snap ring and push the input shaft and bearing assembly inward and out of the bearing bore. Remove the input shaft assembly from inside the case.

12. Remove the countershaft (cluster) gear from the case (including dummy shaft and thrust washers). Note the arrangement of the spacers.

13. Remove the input shaft bearing retainer oil seal as shown in Fig. 13.

14. Install the input shaft bearing retainer oil seal using the tool shown in Fig. 14.

15. To disassemble the output shaft, remove the small snap ring at the front of the shaft and slide the third and fourth-speed gear synchronizer assembly (Fig. 15), third-speed gear synchronizer blocking ring, third-speed gear (Fig. 16), thrust washer, second-speed gear, and second-speed synchronizer blocking ring (Fig. 17) off the shaft.

16. Remove the output shaft rear oil seal from the shaft. Position the output shaft in a press and remove the speedometer drive gear (Fig. 18). Slide the reverse sliding gear off the output shaft.

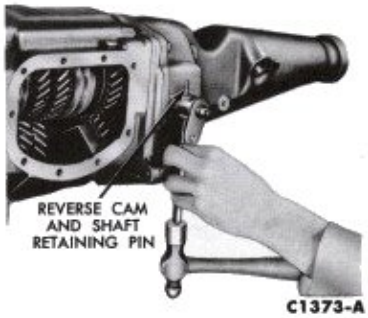

FIG. 6—Removing Reverse Cam and Shaft Retaining Pin

17. Spread the retaining snap ring (Fig. 19) and press or tap the

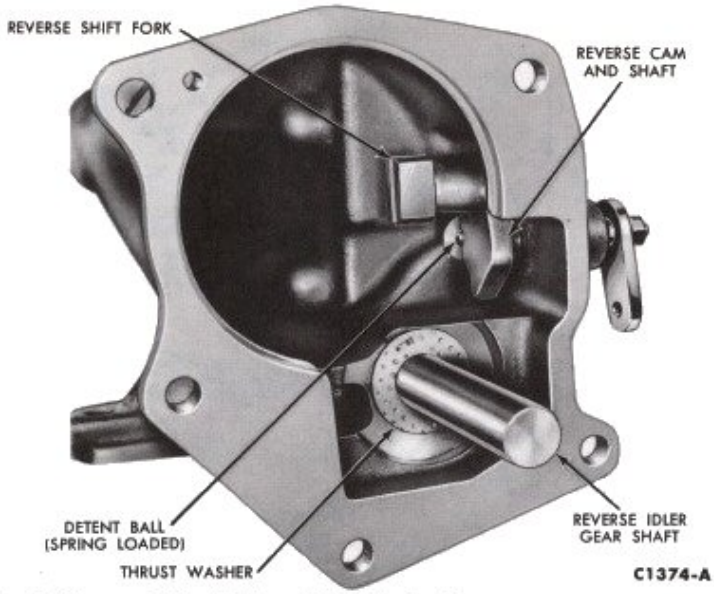

FIG. 8—Reverse Idler Shaft and Shift Mechanism

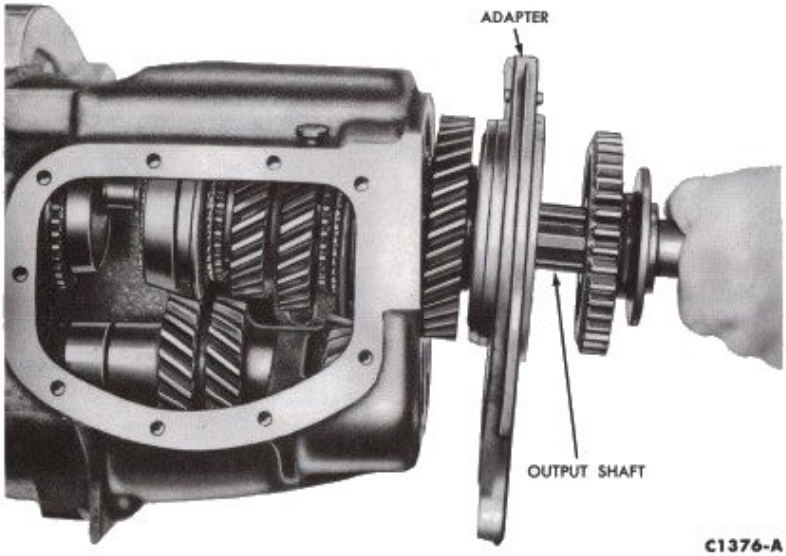

FIG. 10—Output Shaft Removal

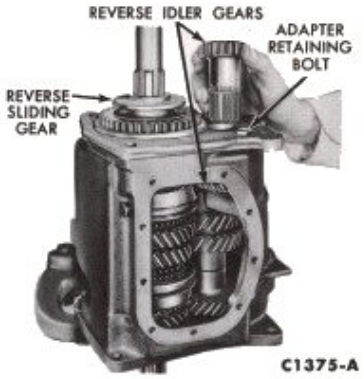

FIG. 9—Reverse Gear Rear Idler Removal

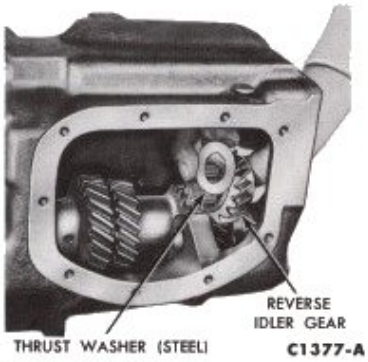

FIG. 11—Reverse Gear Front Idler Removal

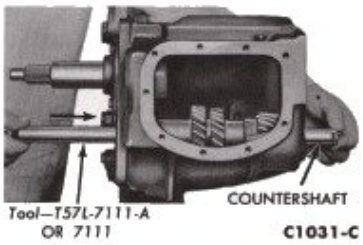

FIG. 12—Countershaft Removal

adapter plate off the output shaft rear bearing. Remove the snap ring retaining the output shaft bearing to the output shaft and press the bearing off the shaft (Fig. 20).

18. Complete the disassembly of the output shaft by sliding off the first-speed gear thrust washer (plain), first-speed gear, first-speed gear bushing, first-speed synchronizer blocking ring and first and second-speed synchronizer assembly (Fig. 20).

19. To disassemble the extension housing, first remove the oil seal as shown in Fig. 1, Part 6-1. If necessary to replace the extension housing bushing, do so after reinstalling the extension housing, so that the tool shown in Fig. 2, Part 6-1, will be supported by the output shaft.

20. Pull the reverse shift fork from the reverse shift shaft and cam. Remove the reverse shift lever and carefully tap the shaft and cam into the housing, allowing the detent ball and spring to drop out of the detent bore. Remove the "O"-ring seal from the shift shaft.

21. Remove the reverse idler shaft by driving the retaining pin inward until it bottoms. Pull the shaft from the extension housing. Tap the shaft with a soft-faced hammer to loosen it if necessary.

PARTS REPAIR OR REPLACEMENT

SYNCHRONIZERS

1. Scribe an index mark across the sleeve and the hub so that they may be installed in their original

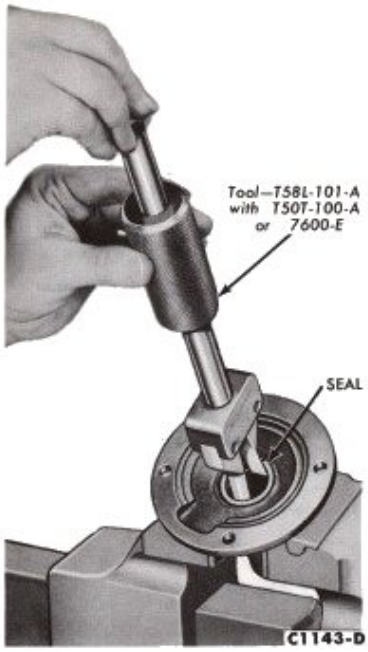

FIG. 13—Input Shaft Oil Seal Removal

FIG. 14—Input Shaft Oil Seal Installation

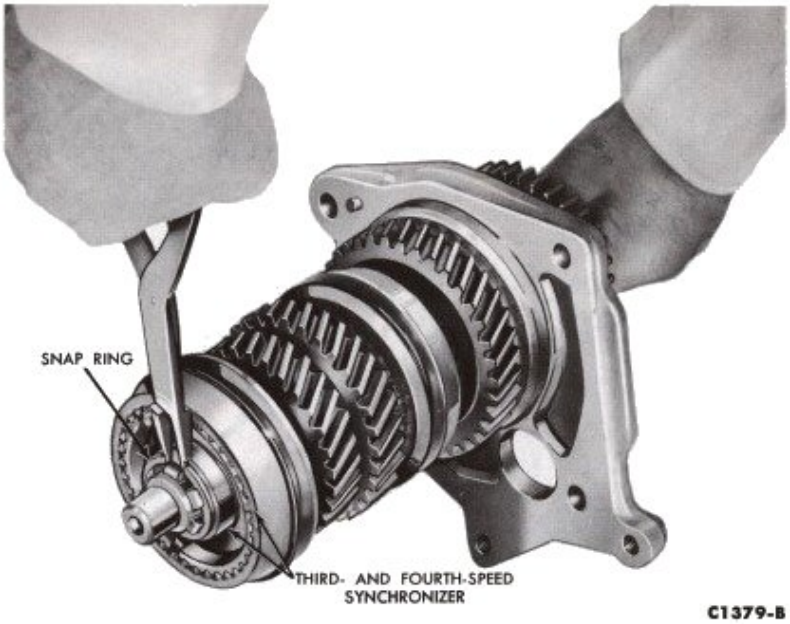

FIG. 15—Third and Fourth-Speed Synchronizer Removal

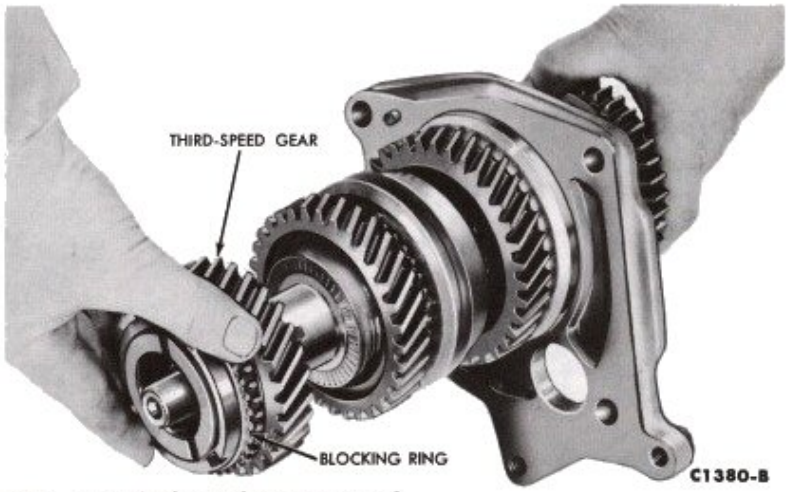

FIG. 16—Third-Speed Gear Removal

position when assembling them.

2. Disassemble the first and second speed and third and fourth-speed synchronizers (Fig. 7) by sliding the clutch sleeves off the hubs and removing the three inserts and two insert springs from each assembly.

3. In both units, the synchronizer is assembled by installing two insert springs and three inserts on the synchronizer hub.

4. The springs should be assembled with one tang of each spring in the same insert, but the springs turned in opposite directions so that the openings do not line up.

5. Line up the etched marks on the sleeves and hub and slide the sleeve onto the hub.

SHIFT COVER

1. Remove the shift levers (Fig. 5) from the cam and shaft assemblies.

2. Pull the shift forks and shafts out of the gear shift cover. With the shafts removed, the detent balls, retainer, and spring will fall out of the gear shift cover.

3. Pull the shifter forks out of the cams.

4. Remove the seal rings from the cam shafts.

5. Install new seal rings on the shift lever cam shafts. Lubricate the seal rings and shaft bores in the cover.

6. Position one cam and shaft in the cover and place it in the neutral position.

7. Install the interlock spring, sleeve, pin, and one detent ball in the shift cover detent bore (Fig. 5).

8. Position the remaining detent

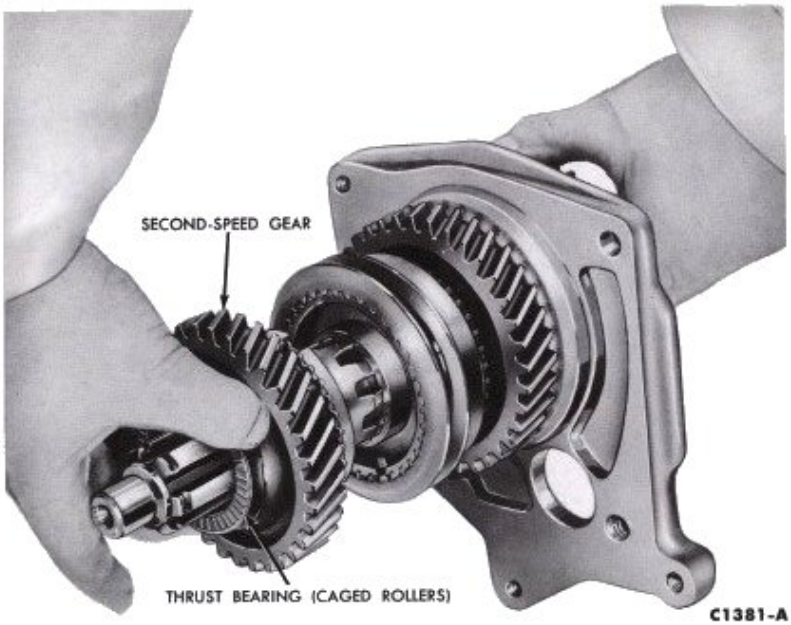

FIG. 17—Second-Speed Gear Removal

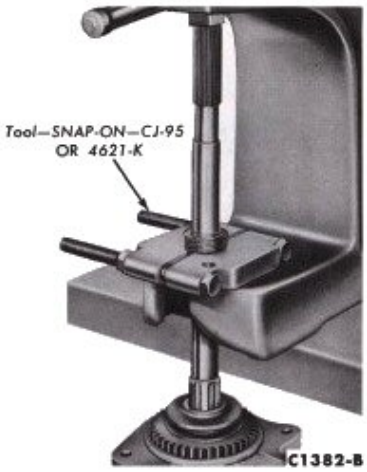

FIG. 18—Speedometer Drive Gear Removal

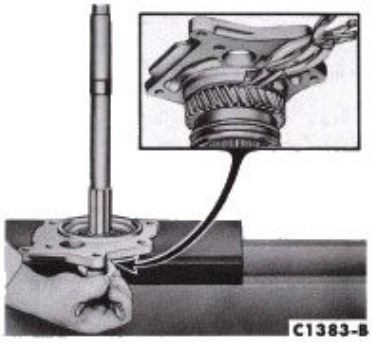

FIG. 19—Adapter Plate Removal

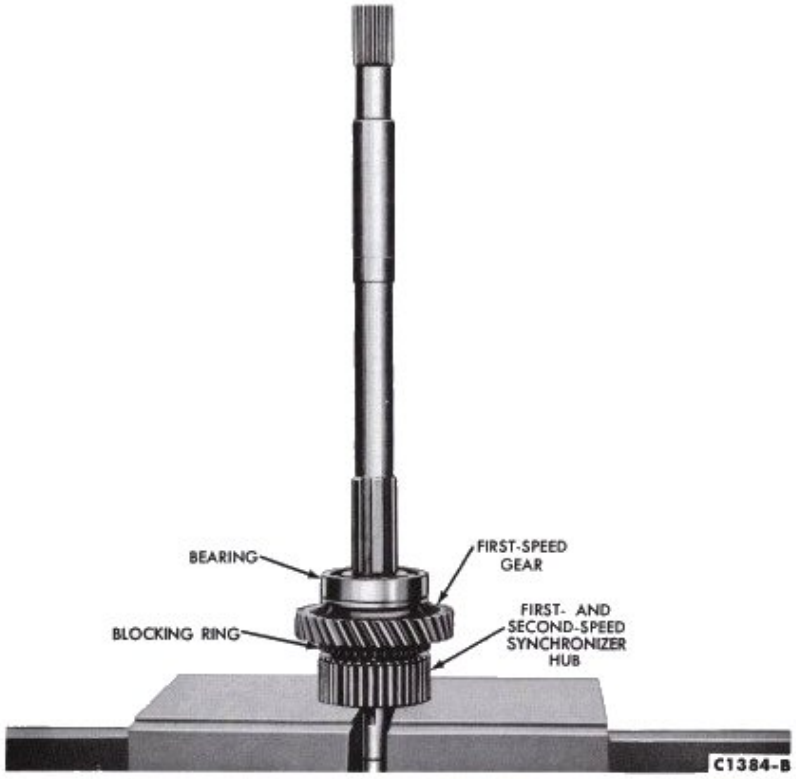

FIG. 20—Output Shaft Bearing Removal

ball and second cam and shaft in the cover. Install the gear shift levers and forks on the shafts. Check operation of the assembly.

COUNTERSHAFT GEAR BEARINGS

1. Disassemble the countershaft gear as shown in Fig. 21. The six steel spacer washers are interchangeable.

2. Position the long countershaft roller spacer on the remover tool (dummy shaft) and install it in the countershaft (cluster) gear.

3. Install 20 roller bearings, two spacer washers, 20 more roller bearings, one spacer, and one thrust washer in each end of the countershaft gear (Fig. 21).

4. Install the thrust washers with the flat bronze sides toward the countershaft gear faces.

INPUT SHAFT BEARING

1. To disassemble the input shaft on a Falcon transmission, remove the bearing retainer snap ring, and spacer washer. Reinstall the bearing

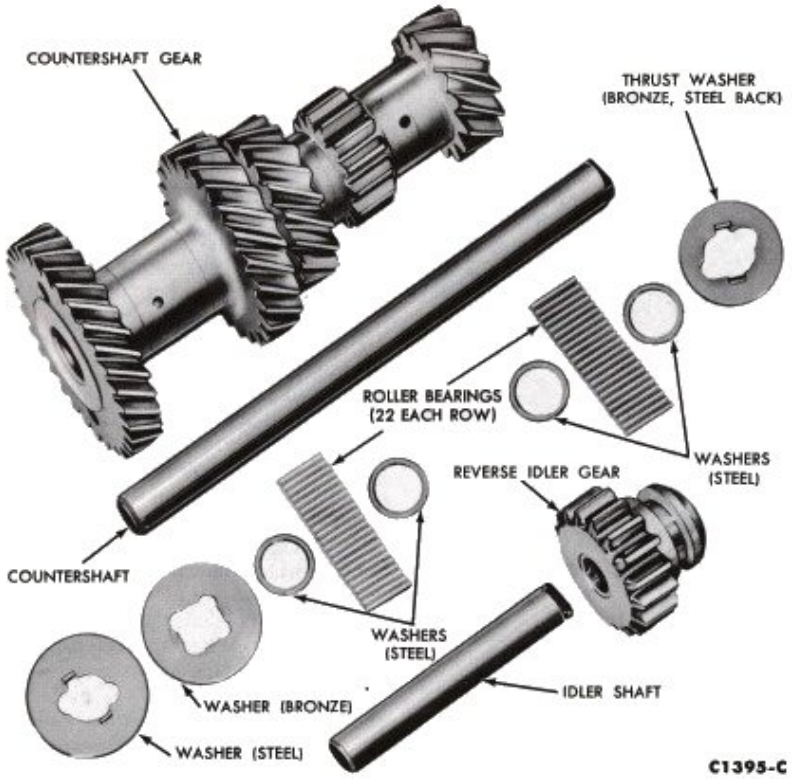

FIG. 21—Countershaft and Idler Gear Disassembled

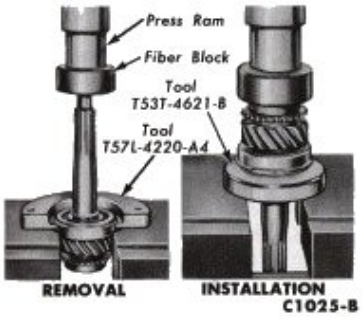

FIG. 22—Input Shaft Bearing Replacement

outer snap ring that was removed previously, then, press the bearing off the shaft as shown in Fig. 22, using the tool indicated. To disassemble the input shaft on a Comet transmission, remove the bearing retainer snap ring, and spacer washer. Insert the lip of the tool in the bearing snap ring groove and press the shaft out of the bearing.

2. Assemble the input shaft bearing on the input shaft as shown in Fig. 22. Retain the bearing on the shaft with a spacer and snap ring.

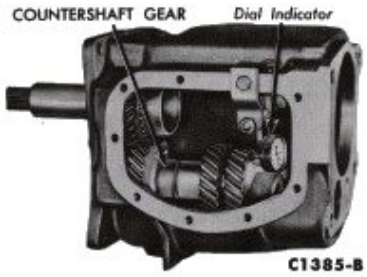

FIG. 23—Checking Countershaft Gear End Play

3. Position the input shaft pilot rollers in the input shaft bore using a light film of heavy grease.

ASSEMBLY

1. Place the countershaft gear in the case, aligning the thrust washer tangs with the slots in the case. Install the countershaft and check the countershaft gear end play (Fig. 23). Replace the thrust washers as required so that end play does not exceed 0.025-inch. Insert the remover tool in place of the countershaft and allow the countershaft gear to rest on the bottom of the case.

2. Install the input shaft assembly in the case, working through the shift cover opening. Install the input shaft assembly retaining snap ring in the front bearing groove.

3. Raise the countershaft gear into mesh with the input shaft gear and install the countershaft. Line up the countershaft Woodruff key slot with the counterbore provided in the case and install the Woodruff key. Tap the countershaft into position flush with the rear face of the case.

4. Position the fourth-speed synchronizer blocking ring on the input shaft gear taper with heavy grease.

5. Working from the rear of the output shaft, slide the first and second-speed synchronizer onto the shaft. The sliding clutch sleeve long taper should face the rear (Fig. 19).

6. Slide the first-speed gear bushing onto the output shaft. Position the first-speed gear synchronizer blocking ring on the first and second-speed gear synchronizer, aligning the notches in the blocking ring with the inserts in the synchronizer. Install the first-speed gear on the first-speed gear bushing, tapered hub facing forward. Install the first-speed gear thrust washer, with the grooved side to the gear (Fig. 7).

7. Position the output shaft rear bearing on the output shaft with the snap ring groove in the bearing race facing forward. Press the bearing on the shaft. Seat the bearing firmly against the shaft shoulder and install the retaining snap ring.

8. Install the adapter plate on the output shaft rear bearing by spreading the snap ring in the adapter plate and tapping or pressing the plate over the bearing (Fig. 19). Release the snap ring.

9. Position the reverse sliding gear on the output shaft, with the shift collar toward the rear. Press the speedometer drive gear on the output shaft until the measurement from the rear end of the output shaft to the rear face of the speedometer gear is $8^{11}/_{16}$ inches.

10. Working from the front of the output shaft (Fig. 17), position the second-speed gear synchronizer blocking ring on the previously installed first and second-speed synchronizer. Line up the notches in the blocking ring with the inserts in the synchronizer.

11. Slide the second-speed gear onto the output shaft, with the tap-

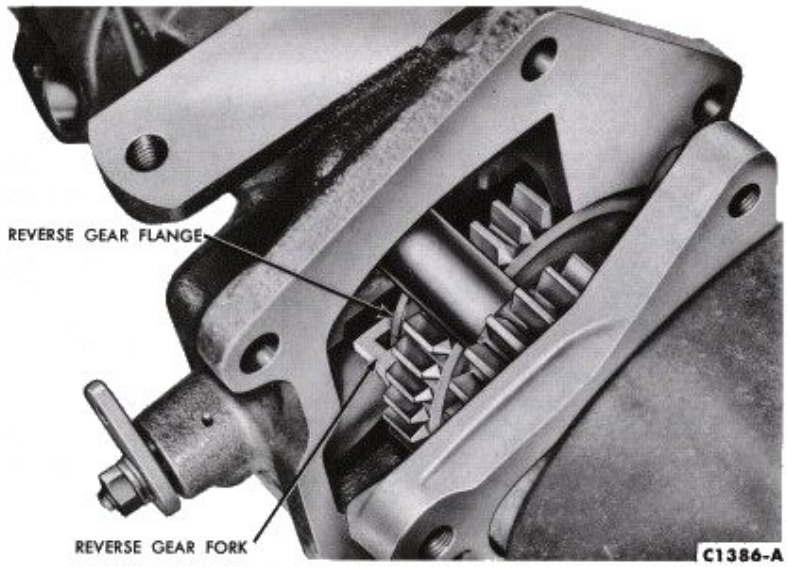

FIG. 24—Extension Housing Installation

ered hub facing toward the rear. Position the radial roller thrust bearing against the front hub face of the second-speed gear (Fig. 17).

12. Install the third-speed gear on the output shaft, with the tapered hub facing forward. Position the third-speed gear synchronizer blocking ring on the taper of the third-speed gear, with the notches in the blocking ring facing forward (Fig. 16).

13. Position the third and fourth-speed gear synchronizer assembly on the output shaft, lining up the synchronizer insert with the notches in the third-speed gear blocking ring. Install the output shaft front snap ring (Fig. 15).

14. Position the output shaft seal on the output shaft.

15. Working through the output shaft opening, install the reverse gear front idler and thrust washer in the case as shown in Fig. 11.

16. Make sure that the fourth-speed synchronizer blocking ring is in place on the input shaft gear and that the input shaft pilot rollers are installed. Apply a gasket to the rear of the case. Position the output shaft in the transmission case and move it forward, lining up the notches in the fourth-speed blocking ring with the inserts in the third and fourth-speed synchronizer. Line up the dowel pin in the adapter with the locating hole in the main case and push or tap the output shaft and adapter into position. Install the self-locking bolt retaining the adapter plate to the transmission case and torque it to specifications.

17. Install the reverse gear rear idler gear (Fig. 9).

18. Line up the retaining pin holes in the idler shaft and housing and tap the reverse idler shaft into the extension housing with a soft hammer. Coat the retaining pin with oil resistant sealer and install the pin flush with the outside of the housing.

19. Position the "O"-ring seal on the reverse shifter shaft. Install the detent ball and spring in the detent bore. Working from inside the extension housing, hold the detent ball down with a suitable tool and insert the shift shaft and cam from the inside. Install the reverse shift lever. Position the reverse shift fork on the reverse shift shaft (Fig. 8).

20. Install the reverse idler gear tanged thrust washer on the idler shaft with the tang gear facing rearward (Fig. 8). Apply heavy grease to retain the washer against the extension housing.

21. Position a new gasket on the adapter, using sealer to hold the gasket in place.

22. Move the reverse shift lever to bring the shift fork to the extreme forward position (Fig. 8). Pull the lever outward so that the reverse fork will clear the reverse gear on assembly. Slide the reverse gear forward on the output shaft until it engages the reverse idler gear.

23. Position the extension housing over the output shaft and carefully push the housing forward. Insert the reverse idler shaft into the reverse idler gears. When the reverse shift fork seats in the reverse gear shift collar groove (Fig. 24), push the reverse shift shaft into position. Move the reverse gear rearward with the shift lever, and seat the extension housing against the adapter plate.

24. Place the 1-2 and the 3-4 synchronizer in neutral and the reverse idler gear in reverse (forward) position. Set the reverse shift lever in the reverse position. Install a new shift cover gasket on the case, using sealer. Install the shift cover. Use sealer on the bolts and torque them to specifications.

25. Check the operation of the reverse shift lever. If satisfactory, install the extension housing to the adapter plate and transmission case. Apply sealer to the lower right bolt to prevent lubricant leaks. Torque to specifications.

26. Install the reverse shifter cam and shaft locking pin (Fig. 6).

27. Install the extension housing bushing and oil seal as shown in Figs. 4 and 2, Part 6-1.

WARNER FOUR-SPEED TRANSMISSION

TORQUE LIMITS

Description	Ft-Lbs.
Adapter Plate to Extension Housing Bolts	20-30
Engine Rear Support to Extension Housing Bolts	35-40
Gear Shift Control Levers to Cam and Shaft Assembly	12-15
Gear Shift Housing to Transmission Case Bolts	15-20
Gear Shift Linkage to Transmission Extension Housing Bolts	12-15
Input Shaft Bearing Retainer Bolt	15-20
Third Crossmember to Support Bracket Bolts	45-50
Transmission to Extension Housing Bolts	35-45

CLEARANCES

Description	Inches
Countershaft Gear End Play	0.025

LUBRICANT

Type Lubricant	Mild EP Gear Oil M-568-D
Capacity (Dry)	3½ pints