

Fig. 7-1 Rear Bearing Retainer—Sectional View

TRANSMISSION AND GEARSHIFT CONTROL

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GENERAL DESCRIPTION

TRANSMISSION

Features of the Pontiac transmission include the use of helical gears, ball and roller type bearings on the main shaft, needle roller bearings on the counter-shaft, and a synchronizing unit.

The front universal joint yoke is supported on two bushings in the transmission rear bearing retainer (Fig. 7-1). The rear oil seal consists of a spring loaded leather seal and a felt seal. The rear bearing splash shield is of one piece construction.

A plunger type Back-up lamp switch is mounted on the transmission (Fig. 7-2) so that the Low and Reverse shaft actuates the switch when transmission is placed in Reverse.

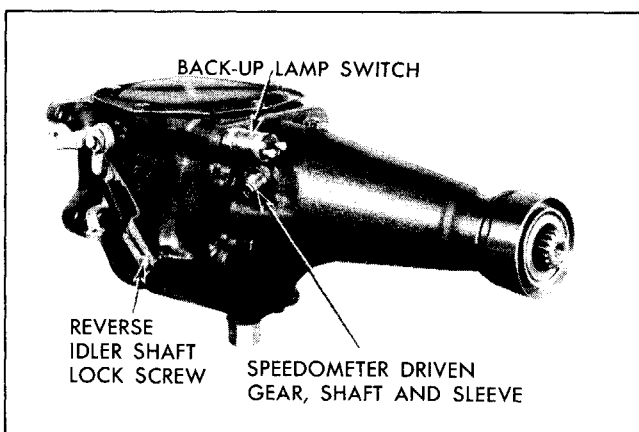


Fig. 7-2 Back-Up Lamp Switch Location

The synchronizing mechanism consists primarily of two cone-type friction clutches, one for second speed gear and one for third speed gear. The synchronizing drum of each clutch is loosely retained to the gear by a spring wire retainer (Fig. 7-3). The drum is a steel stamping having a bronze insert machined to match the conical surface on the gear, and has two fingers with beveled cam surfaces. Synchronization is obtained when the beveled cam surfaces of the two slots in the sliding sleeve contact the beveled cam surface of the synchronizing drum fingers so as to press the drum against the gear. This brings the gear to the same speed as the sliding sleeve and synchronizing drum which, together with the slight angular motion imparted, permits the teeth of the sliding sleeve and of the gear to mesh easily without clashing.

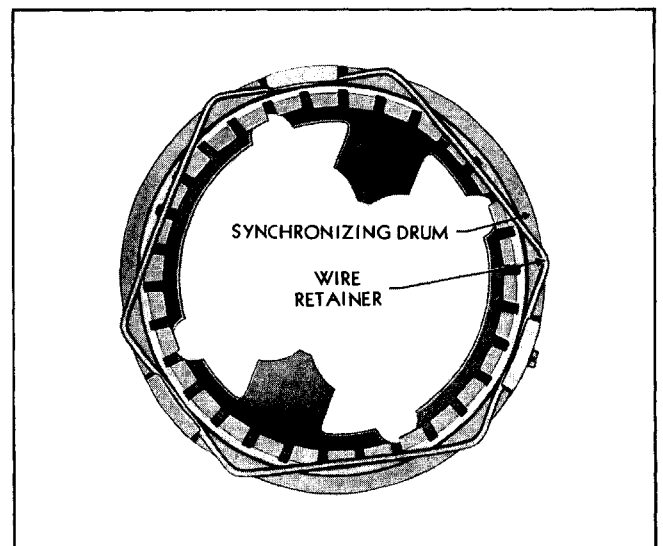
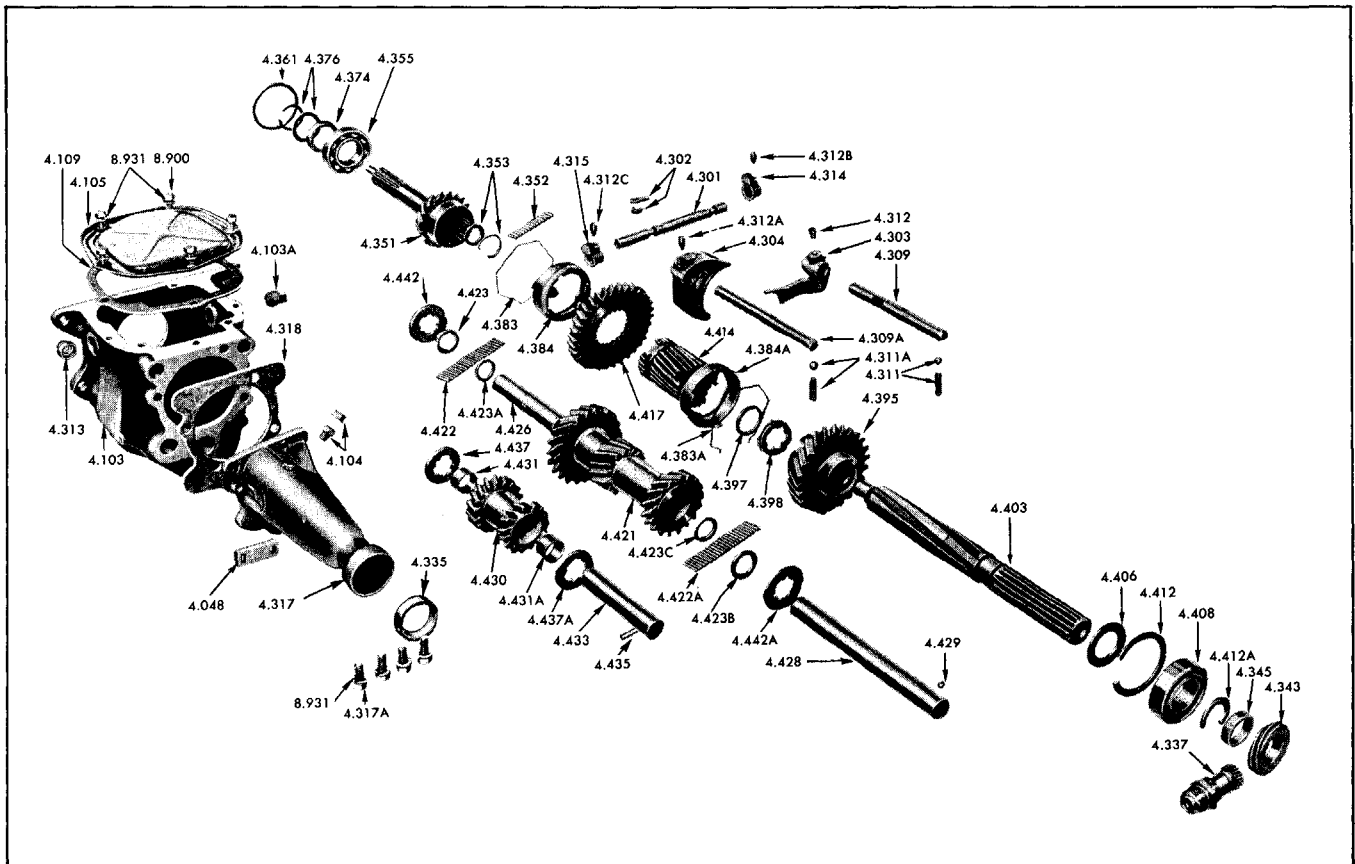


Fig. 7-3 Synchronizing Drum and Retainer



- | | | | | | |
|--------|---|--------|--|--------|--|
| 4.048 | Shift Lever Spring Yoke Support | 4.317 | Rear Bearing Retainer | 4.412 | Front Rear Bearing Snap Ring |
| 4.103 | Case | 4.317A | Rear Bearing Retainer Bolt and Washer | 4.412A | Rear Rear Bearing Snap Ring |
| 4.103A | Case Filler Plug | 4.318 | Rear Bearing Retainer Gasket | 4.414 | Second and High Sliding Sleeve |
| 4.104 | Cover Breather Screw and Cap | 4.335 | Rear Bearing Retainer Oil Seal | 4.417 | Low and Reverse Sliding Gear |
| 4.105 | Case Cover | 4.337 | Speedometer Driven Gear Shaft and Sleeve Assembly | 4.421 | Countershaft Gear |
| 4.109 | Cover Gasket | 4.343 | Speedometer Drive Gear | 4.422 | Front Countershaft Roller Bearings |
| 4.301 | Selector Shift Shaft | 4.345 | Speedometer Drive Gear Spacer | 4.422A | Rear Countershaft Roller Bearing |
| 4.302 | Shift Selector Inner Lever | 4.351 | Main Drive Gear | 4.423 | Front Outer Counter Gear Bearing Retainer Washer |
| 4.303 | Gearshift Second and High Shift Fork | 4.352 | Main Shaft Pilot Bearing | 4.423A | Front Inner Counter Gear Bearing Retainer Washer |
| 4.304 | Gearshift Low and Reverse Shift Fork | 4.353 | Pilot Bearing Snap Ring and Retainer Washer | 4.423B | Rear Outer Counter Gear Bearing Retainer Washer |
| 4.309 | Second and High Shift Shaft | 4.355 | Front Bearing | 4.423C | Rear Inner Counter Gear Bearing Retainer Washer |
| 4.309A | Low and Reverse Shift Shaft | 4.361 | Front Bearing Snap Ring | 4.426 | Countershaft Gear Spacer (Inside) |
| 4.311 | Second and High Shift Fork Poppet Ball and Spring | 4.374 | Front Bearing Oil Slinger | 4.428 | Countershaft |
| 4.311A | Low and Reverse Shift Fork Poppet Ball and Spring | 4.376 | Front Bearing Washer Retainer and Retainer Spring Washer | 4.429 | Countershaft Lock Ball (Steel) |
| 4.312 | Second and High Shift Fork Set Screw | 4.383 | Third Speed Synchronizer Drum Retainer | 4.430 | Reverse Idler Gear |
| 4.312A | Low and Reverse Shift Fork Set Screw | 4.383A | Second Speed Synchronizer Drum Retainer | 4.431 | Reverse Idler Gear Front Bushing |
| 4.312B | Second and High Selector Shaft Set Screw | 4.384 | Third Speed Synchronizer Drum | 4.431A | Reverse Idler Gear Rear Bushing |
| 4.312C | Low and Reverse Selector Shaft Set Screw | 4.384A | Second Speed Synchronizer Drum | 4.433 | Reverse Idler Gear Shaft |
| 4.313 | Selector Shaft Seal | 4.395 | Main Shaft Second Speed Gear | 4.435 | Reverse Idler Shaft Lock Pin |
| 4.314 | Second and High Selector Shaft Shift Lever | 4.397 | Main Shaft Second Speed Sleeve Snap Ring | 4.437 | Reverse Idler Gear Front Thrust Washer |
| 4.315 | Low and Reverse Selector Shaft Shift Lever | 4.398 | Second Speed Gear Thrust Washer | 4.437A | Reverse Idler Gear Rear Thrust Washer |
| | | 4.403 | Main Shaft | 4.442 | Countershaft Front Thrust Washer |
| | | 4.406 | Main Shaft Thrust Washer | 4.442A | Countershaft Rear Thrust Washer |
| | | 4.408 | Main Shaft Rear Bearing | 8.900 | Cover to Case Attaching Bolt |
| | | | | 8.931 | Cover to Case Attaching Bolt Washer |

Fig. 7-4 Synchro-Mesh Transmission—Exploded View

POWER FLOW

All power being delivered to the transmission must enter through the main drive gear. All power leaving the transmission must be delivered through the second and high sliding sleeve, which drives the output shaft.

In neutral, with the clutch engaged, engine power is transmitted to the main drive gear, countergear to reverse idler gear and to the second speed gear. Engine power is not being transmitted to the output shaft because the second and high sliding sleeve, which is splined to the output shaft, is positioned midway between main drive gear and second speed gear; the first and reverse sliding gear, which is splined to the second and high sliding sleeve, is not driving the sliding sleeve because it is not in mesh with either the countergear or reverse idler gear.

In 1st speed, power is transmitted to the main drive gear, countergear, 1st and reverse sliding gear, sliding sleeve and to the output shaft.

In 2nd speed, power is transmitted to the main drive gear, countergear, 2nd speed gear, sliding sleeve and to the output shaft.

In 3rd speed, power is transmitted to the main drive gear and directly to the sliding sleeve and output shaft without gear reduction.

In reverse, power is transmitted to the main drive gear, countergear, reverse idler gear, 1st and reverse sliding gear, sliding sleeve and to the output shaft. The reverse idler gear changes the direction of rotation of the sliding sleeve and output shaft.

TRANSMISSION SHIFT CONTROL (FIG. 7-5)

The steering column shift linkage is known as the concentric tube type. The gearshift lever engages a concentric tube inside the steering column. Movement of the gearshift lever rotates the tube or slides it up and down inside the steering column. A gearshift lever, bolted to the lower end of the tube, moves the transmission gearshift control rod when the upper gearshift lever is moved parallel with the steering wheel. The selector lever at the lower end of the steering column is actuated by a pin which rides in the selector collar near the lower end of the concentric tube. By this means, movement of the shift lever in a direction perpendicular to the steering wheel is transmitted to the transmission gearshift selector rod.

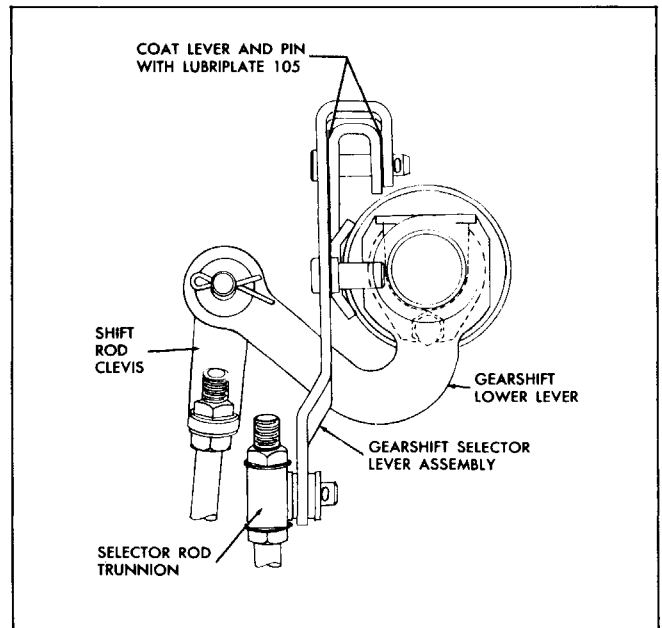


Fig. 7-5 Lower Steering Column Details

A return spring below the gearshift tube selector collar provides force to return the tube to the upward position. Thus the shift lever will always return to the high speed side as soon as it is moved to the neutral position.

Felt insulator pads inside the steering column prevent the transmission of engine and gear noise up the steering column.

The shift linkage for Hydra-Matic is essentially the same in appearance and operation except selector parts are omitted.

PERIODIC SERVICE

TRANSMISSION

No periodic service of the transmission is required except checking for leaks and proper lubricant level at each 2000 mile chassis lubrication (for details see General Lubrication Section).

TRANSMISSION SHIFT CONTROL

No periodic service of the shift control is required. Certain parts are lubricated on assembly as outlined under "Installation of Steering Column Shift Linkage".

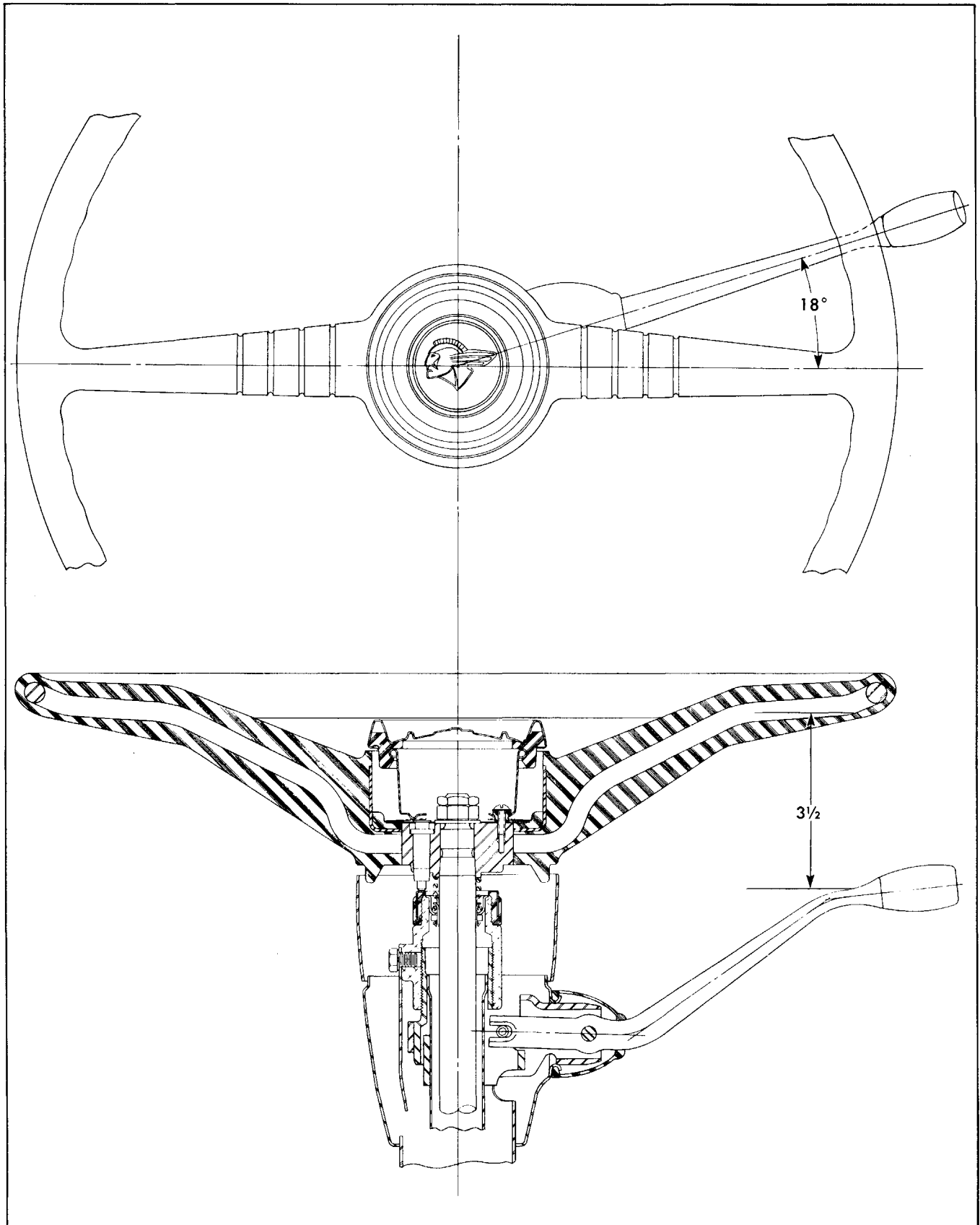


Fig. 7-6 Gearshift Lever Adjustment

GEARSHIFT LEVER—ADJUST

Proper gearshift lever position is obtained by means of the clevis and trunnion which connect the gearshift control rod and selector rod respectively to levers at lower end of steering column (Fig. 7-5). The gearshift support bearing is also adjustable, but since this adjustment requires removal of the lever and loosening bearing support, the procedure will be covered under Installation of Steering Column Shift Linkage.

1. When gearshift lever is in neutral position, clearance between lever and steering wheel should be approximately $3\frac{1}{2}$ " (Fig. 7-6). To adjust, hold transmission selector rod in its rearmost position, (normal position for 2nd and 3rd) and adjust selector rod trunnion for proper gearshift lever position. Lengthen selector rod to move lever closer to steering wheel.

2. Neutral position of gearshift lever should be approximately 18° above horizontal. To raise or lower gearshift lever, adjust length of gearshift control rod by adjusting clevis.

REAR BEARING RETAINER OIL SEAL—REPLACE

1. Disconnect rear universal joint. Use a wire or rubber band to prevent trunnion bearings from slipping off universal joint spider

2. Remove propeller shaft by sliding it to rear off transmission mainshaft spline.

3. Remove oil seal from rear bearing retainer.

4. Inspect propeller shaft yoke for nicks, burrs or scratches which would cut new seal or cause seal to leak or damage bushings in rear bearing retainer.

5. Apply sealing compound (Permatex No. 3 or equal) to outside of oil seal.

6. Install new oil seal in bearing retainer using Tool J-1354 (Fig. 7-7).

REMOVE AND REPLACE STEERING COLUMN SHIFT LINKAGE

REMOVE

1. Remove horn button and steering wheel.

2. Disconnect direction signal wiring harness, horn wire and Hydra-Matic indicator wire from connectors on steering column brace. Remove wiring clamp from steering column jacket and slip off of wires (Fig. 7-8).

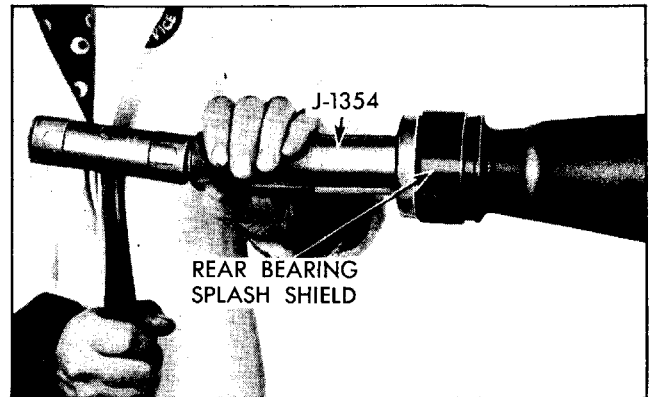


Fig. 7-7 Installing Oil Seal using Tool J-1354

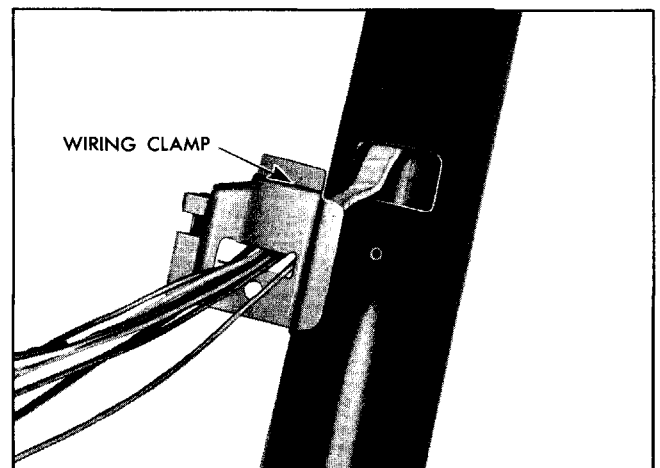


Fig. 7-8 Removing Wire Harness Clamp

3. Remove steering wheel hub cover or direction signal housing by removing two attaching screws (Fig. 7-9). When removing direction signal housing, withdraw wiring harness carefully from opening in steering column.

4. Using a $\frac{7}{16}$ " wrench remove four special screws which fasten gearshift lever bearing support to steering column (Fig. 7-10). On Hydra-Matic models friction spring and button will come off with two lower screws.

5. Remove gearshift lever rubber cover by pulling it over ridge which acts as a retainer.

6. Remove gearshift lever fulcrum pin retaining ring and fulcrum pin (Fig. 7-10) and remove gearshift lever, being careful to catch anti-rattle shims which may be between shift lever and shift lever support. Remove anti-rattle spring from end of gearshift control lever. NOTE: Retainer spring on tube yoke pin which shift lever slot engages is used to keep pin from dropping out during assembly.

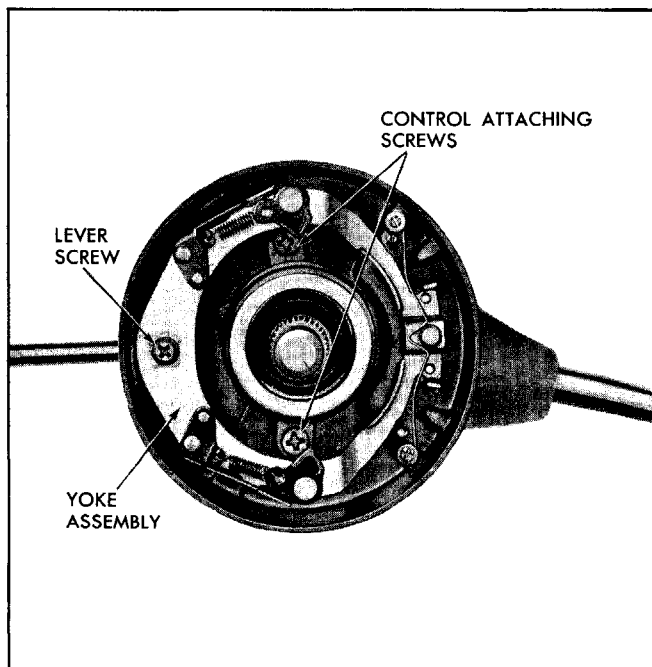


Fig. 7-9 Directional Signal Control

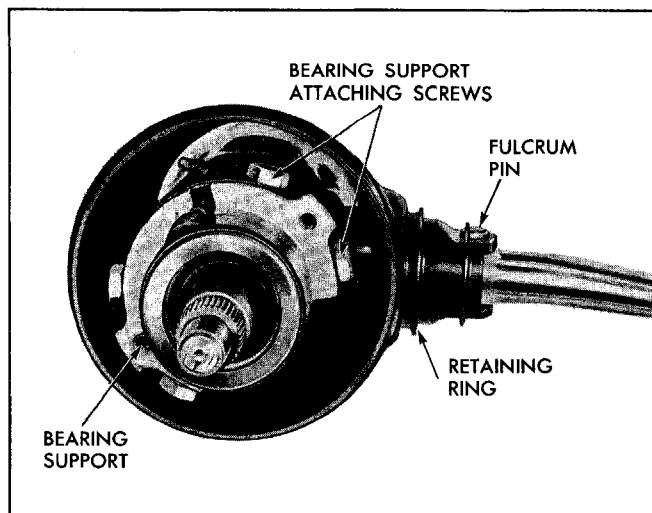


Fig. 7-10 Upper Steering Column

7. Remove gearshift lever support and bearing assembly from steering column by turning bearing support slightly to free horn contact wire and then pull assembly straight out. Horn and Hydra-Matic indicator wires must be carefully pulled through openings in steering column.

8. Remove horn contact and cable assembly from bearing support by prying gently with screwdriver.

9. Unscrew bearing support from gearshift lever support.

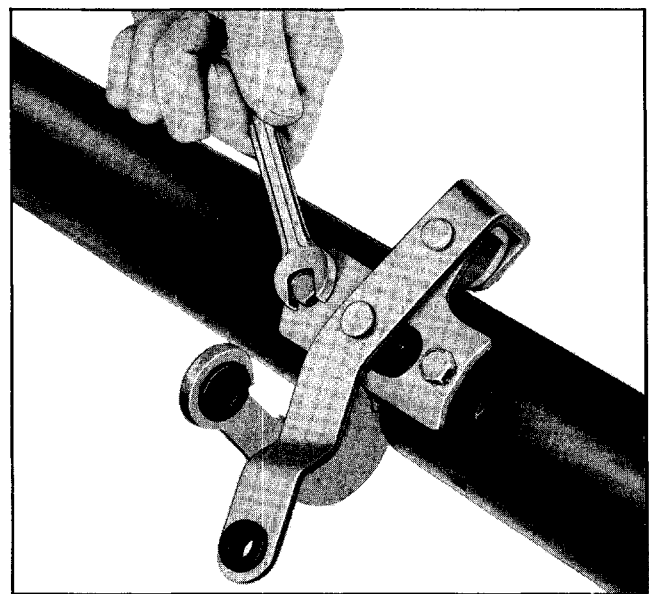


Fig. 7-11 Lower Gearshift Lever

10. If steering shaft upper bearing is to be replaced, remove it from bearing support by pushing it out with screwdriver handle or other tool which can be inserted up through bearing support.

11. If disassembly is being made with steering column assembly in car, it will be necessary to remove left engine splash apron so that lower end of steering column jacket can be reached from beneath car.

12. Remove transmission control rods from levers. Hydra-Matic cars have only shift lever.

13. On Synchro-Mesh cars remove gearshift selector lever and bracket by removing two retaining screws (Fig. 7-11). When selector lever and bracket assembly have been removed, pivot pin can be pulled out to disassemble lever from bracket.

14. Remove shift lever from tube yoke by loosening screw about $\frac{1}{8}$ " with an open end wrench and moving lever down and out. Gearshift tube can be held downward by means of screwdriver inserted through selector lever opening (Fig. 7-12). Attaching screw need not be completely removed from bracket since re-installation is greatly simplified if screw is left in.

15. Gearshift tube can now be withdrawn from top of steering column jacket. Insulating pads will come out with shift tube when it is removed.

16. Remove gearshift tube return spring, lower seal retainer and lower seal if they are to be replaced.

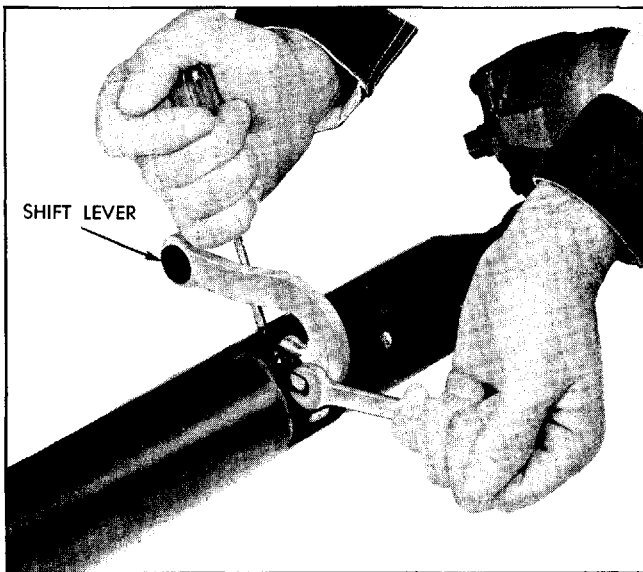


Fig. 7-12 Removing Lower Shift Lever

REPLACE

1. Slide lower felt seal and retainer down inside steering column jacket against shift tube lower bearing plate. Coat both ends of shift tube return spring with Lubriplate 105 and drop it down steering column jacket into place against lower seal retainer with large end down.

2. Apply a thin coat of Lubriplate 105 to bearing surfaces at both ends of gearshift concentric tube including upper tube yoke pin and selector collar groove in which selector lever pin rides. Position insulating pads around shift tube beneath retainer plate and install shift tube in steering column with gearshift lever yoke facing opening in upper end of steering column.

3. With screw started in gearshift lower lever, position lever against bottom of lower lever drive plate engaging driving lugs and extrusion at screw boss and tighten cap screw securely. Shift tube can be held down by means of screwdriver inserted through selector lever opening (Fig. 7-12).

4. On Synchro-Mesh models coat selector lever pivot pin with Lubriplate 105 and assemble selector lever to bracket. Install pivot pin so cotter pin is on side which will be against steering column jacket (Fig. 7-13).

5. Place Synchro-Mesh selector lever and bracket assembly on steering column jacket making sure selector lever pin engages collar on gearshift tube. Install attaching screws securely.

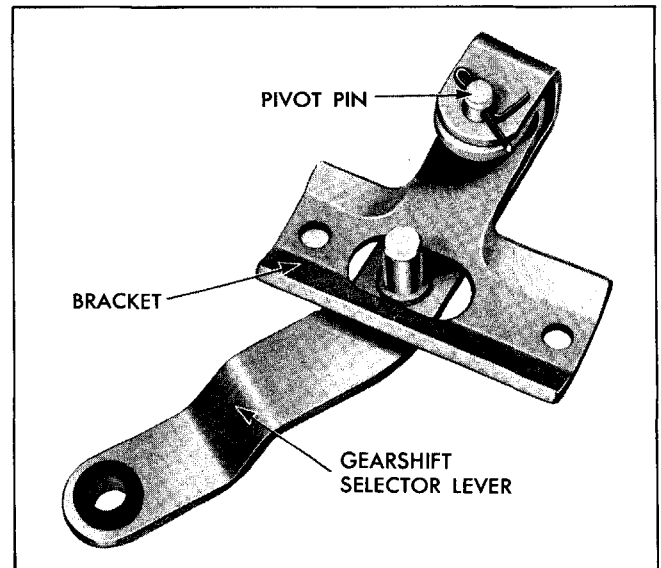


Fig. 7-13 Selector Lever and Bracket Assembly

6. Connect transmission selector rod trunnion and shift rod clevis to their respective levers. Use flat washer on each side of selector rod insulator.

7. Replace left engine splash apron if unit is being assembled on car.

8. If standard steering shaft upper bearing was removed from bearing support, lubricate and press new bearing into support until flush (Fig. 7-14). If power steering, do not lubricate, just press plain bearing flush with counterbore.

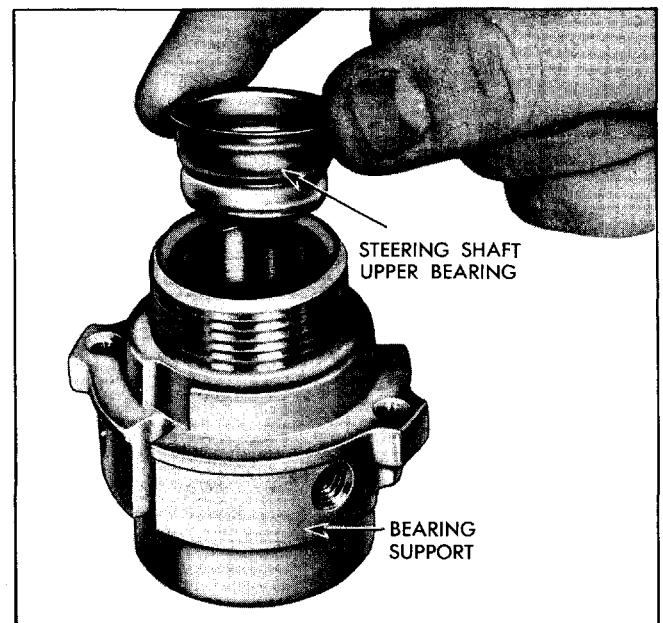


Fig. 7-14 Steering Shaft Upper Bearing

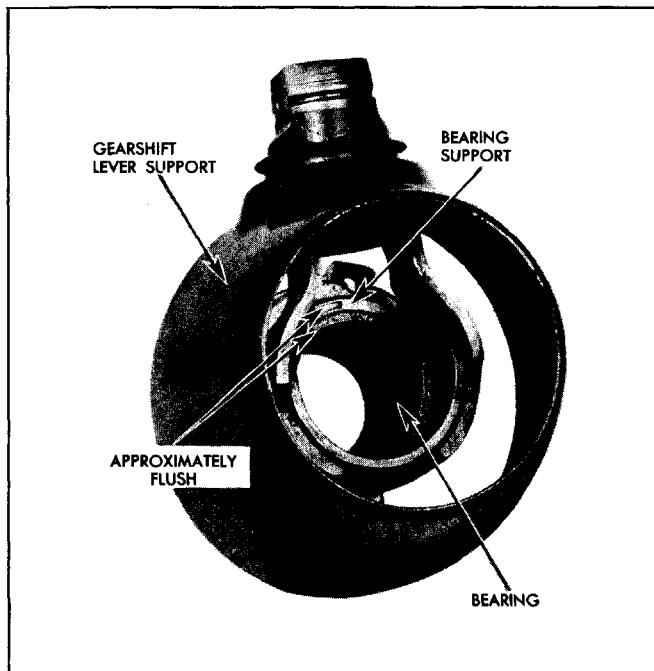


Fig. 7-15 Assembly of Bearing Support and Lever Support

9. Lubricate screw threads in bearing support with Lubriplate 105 and screw bearing support (die casting) on bearing in gearshift lever support until bearing and support are approximately flush at bottom end (Fig. 7-15) with gap in bearing support flange toward gearshift lever support. This adjustment determines clearance between gearshift lever support assembly and steering wheel hub cover or direction signal housing. Clearance should be approximately $\frac{1}{8}$ " (Fig. 7-16.) Set hub cover or direction signal housing on bearing support to check clearance before proceeding. If clearance is improper, turn bearing support (die casting) one complete turn in proper direction to correct clearance and recheck.

10. Press horn contact and cable assembly in place over annular grooves in upper end of bearing support (die casting). Cable should lay in slot in side of bearing support (Fig. 7-10).

11. Install gearshift lever support and bearing assembly indexing gearshift tube yoke with gearshift lever support and indexing bearing support with attaching screw holes in steering column. While gearshift lever support is being lowered into position, guide horn wire and Hydra-Matic indicator wire into steering column jacket through openings (Fig. 7-17), and back out of jacket through hole on top of jacket just below steering column upper bracket. Horn wire must be clamped in position shown in Fig. 7-10.

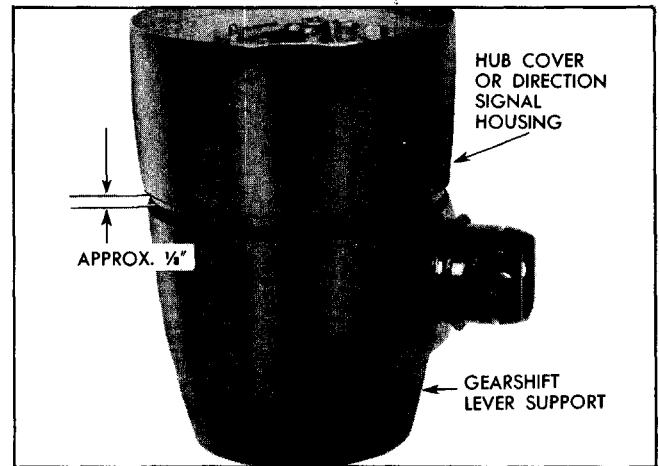


Fig. 7-16 Clearance Between Lever Support and Directional Signal Housing

12. In Hydra-Matic assemblies install plastic button in tension spring and slide tension spring and button assembly into place on underside of mast jacket so that button contacts inside of bearing support cover. Bolt holes in tension spring should index with bottom bearing support attaching screw holes. **NOTE:** This tension spring is not required on synchro-mesh cars.

13. Install four bearing support attaching screws and tighten.

14. Position gearshift lever anti-rattle spring (coil spring) in bore in lever and position lever in its support. Replace anti-rattle shims between lever and support and install gearshift lever fulcrum pin and retaining ring.

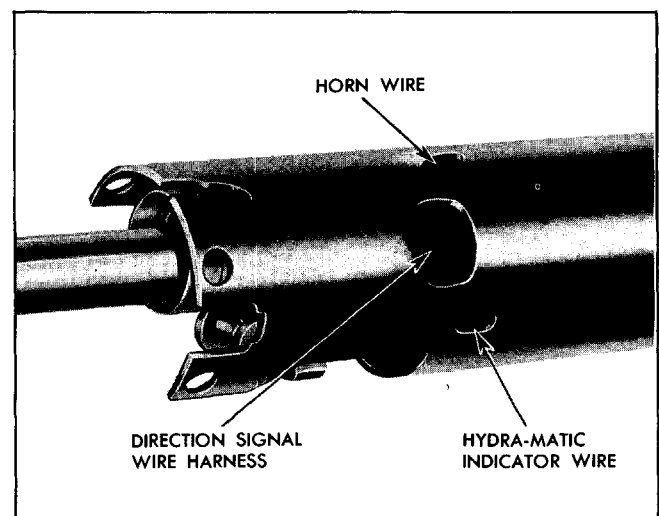


Fig. 7-17 Openings for Wiring in Steering Column Jacket

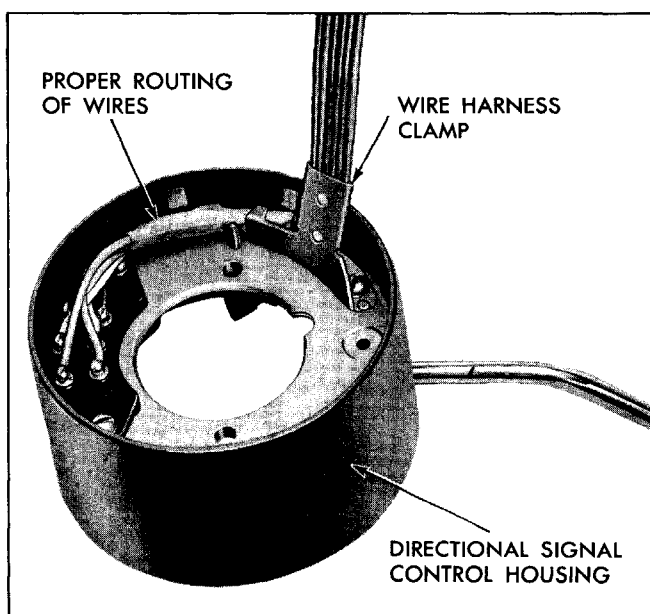


Fig. 7-18 Routing of Direction Signal Wires

15. Install gearshift control lever rubber cover making certain it is properly seated in retainer groove.

16. Install hub cover or direction signal housing with two attaching screws. To simplify installation of direction signal wiring, tape loose ends with scotch tape so that they can be easily guided through openings in steering column jacket. Direction signal wires in housing should be routed as shown in Fig. 7-18 to prevent clamping them between housing and bearing support. Direction signal wire loom should be directed into mast jacket through upper opening (under control lever support cover) and out of mast jacket through opening just below steering column upper bracket.

17. Slip wiring clamp over wires and into place on steering column (Fig. 7-8) and attach with screw. Connect all wiring.

18. Install steering wheel and horn button.

REMOVAL OF TRANSMISSION

1. Disconnect speedometer cable, gearshift selector rod, control rod and back-up lamp switch wires from transmission.

2. Disconnect rear universal joint. Use a wire or rubber band to prevent trunnions from slipping off universal joint spider.

3. Remove propeller shaft by sliding it to rear off transmission mainshaft splines.

4. To give clearance for removing upper cap screw holding transmission to clutch housing, remove transmission shift lever spring yoke and extension. Remove shift lever screw while holding shift lever in neutral (center position) to avoid damage to shift levers on shaft inside transmission. Remove shift lever.

5. To give clearance for removing lower cap screw holding transmission to clutch housing, remove transmission outer selector lever.

6. Remove transmission upper cap screws and install two transmission guide pins (pins can be made by cutting the heads off two transmission cap screws and sawing a screwdriver slot in the ends.) CAUTION: Guide pins must be used, since they support transmission and prevent distortion of clutch driven plate hub when lower transmission cap screws are removed.

7. Remove lower cap screws and move transmission to rear, bringing rear bearing extension into intersection of frame "X" members until main drive gear is free, then lower to floor. CAUTION: Use care to avoid getting dirt into front bearing when pulling transmission away from clutch housing.

DISASSEMBLY OF TRANSMISSION

1. Thoroughly clean all dirt from exterior of transmission to avoid getting dirt into bearings when transmission is opened.

2. Remove transmission cover and gasket.

3. Remove speedometer driven gear, sleeve and shaft assembly.

4. Lock transmission in high gear position to prevent sliding sleeve, and first and reverse gear from dropping into bottom of case, and remove rear bearing retainer, mainshaft and second speed gear assembly (Fig. 7-19).

5. Use tool J-2895, transmission shift fork lock screw remover, to take out shift lever and shift fork lock screws as outlined in Steps a and b below; this tool completely fills screw slot and facilitates removal, whereas an ordinary screwdriver with taper bit will spread screw, making removal difficult.

a. With gears set in high position, remove shift fork lock screw (Fig. 7-20).

b. Shift selector shaft to neutral position and remove shift lever lock screws.

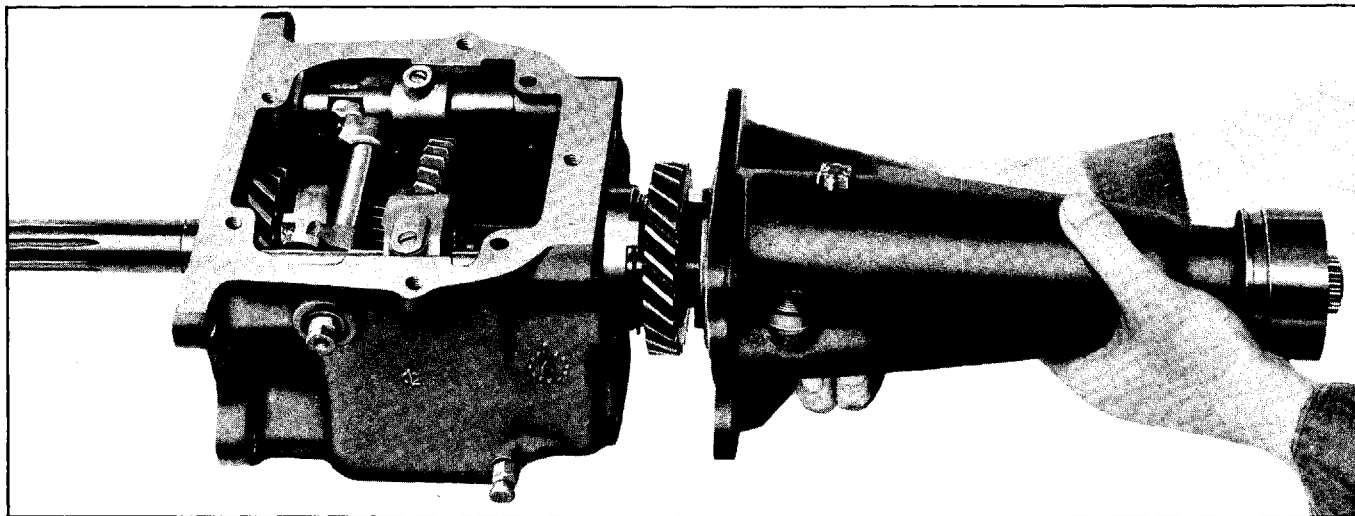


Fig. 7-19 Removing Rear Bearing Retainer

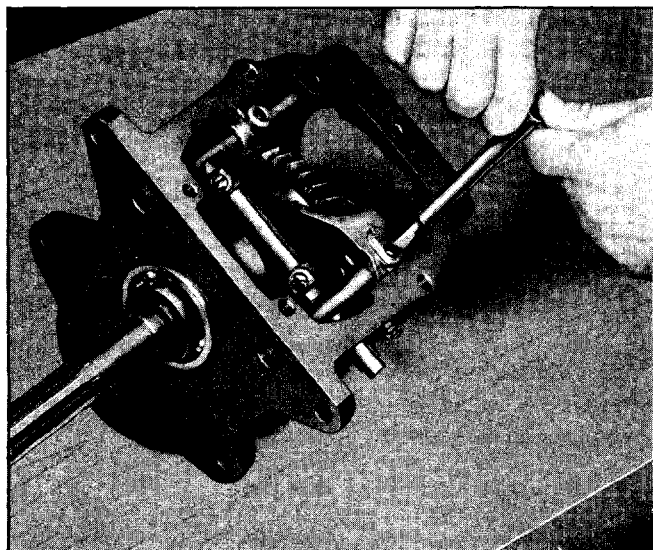


Fig. 7-20 Removing Shift Fork Lock Screws with Tool J-2895

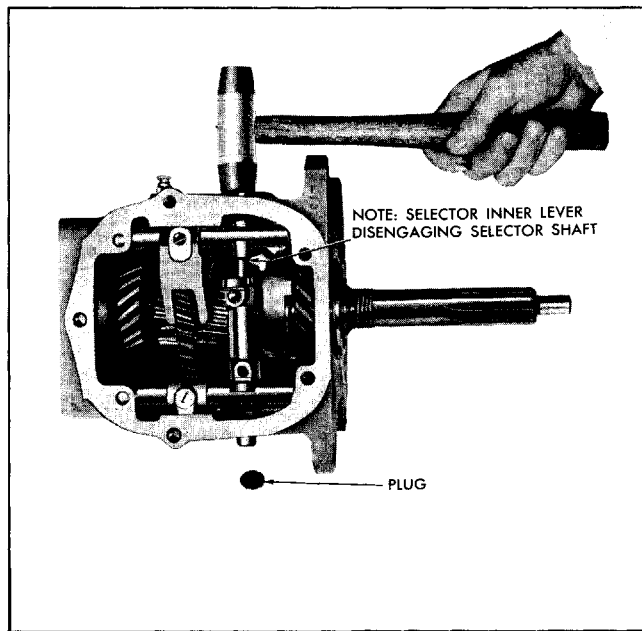


Fig. 7-21 Removing Selector Shaft

6. With soft hammer, drive selector shaft from left side of case toward right. This will knock out expansion plug on right side of case and permit removal of shaft (Fig. 7-21). **CAUTION:** A selector shaft leather oil seal is pressed into left side of transmission case with its lip toward inside of case. Selector shaft must be removed from right side of case to prevent its recessed portion from damaging seal.

7. Slide shift shafts through rear of transmission case, taking care not to lose poppet balls and springs when ends of shafts clear these parts (Fig. 7-22).

8. Remove sliding sleeve and first and reverse sliding gear.

9. Drive countergear shaft to rear so it clears hole in front of transmission case. Insert transmission needle bearing loader, J-1334, in hole in front of transmission and use it to push countergear shaft out of rear of case (Fig. 7-23), allowing countergear and tool J-1334 to rest on bottom of case.

10. Remove snap ring from front bearing outer race and tap main drive gear with bearing toward rear and remove entire assembly from case (Fig. 7-24).

11. Remove countergear, thrust washers, and tool J-1334 from transmission case.

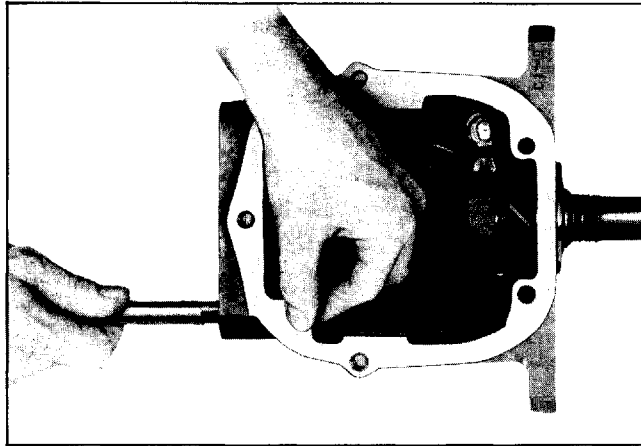


Fig. 7-22 Removing Shift Shaft

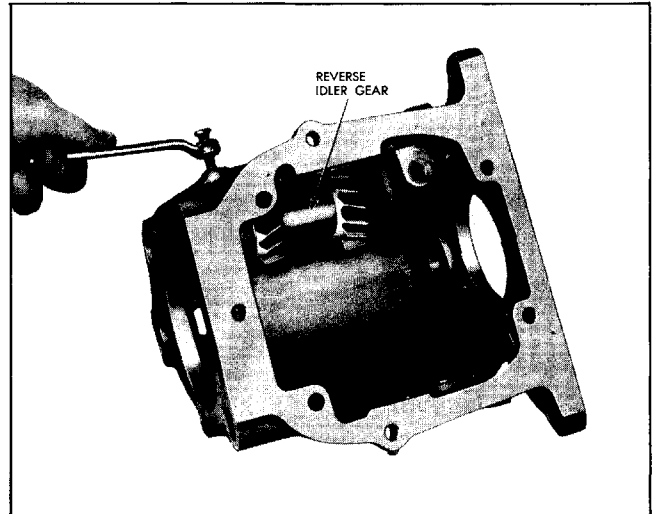


Fig. 7-25 Removing or Replacing Reverse Idler Shaft Lock Screw

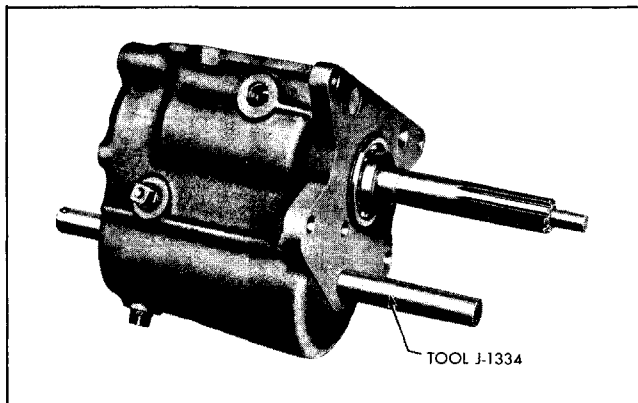


Fig. 7-23 Removing Countershaft with Tool J-1334

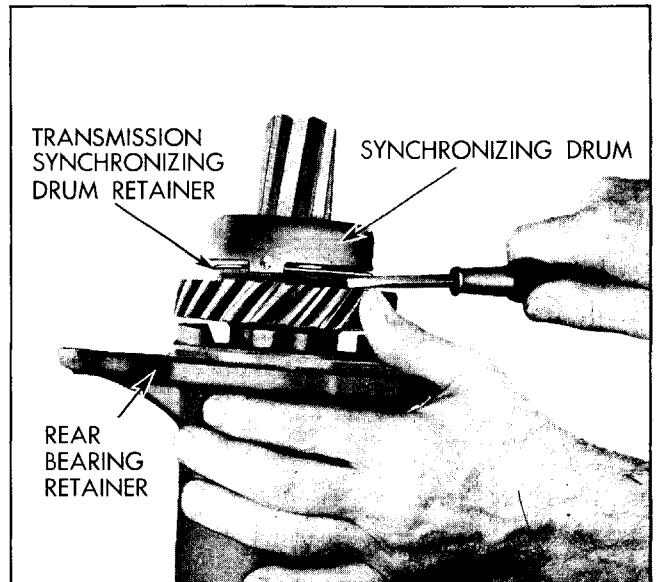


Fig. 7-26 Removing Synchronizing Drum

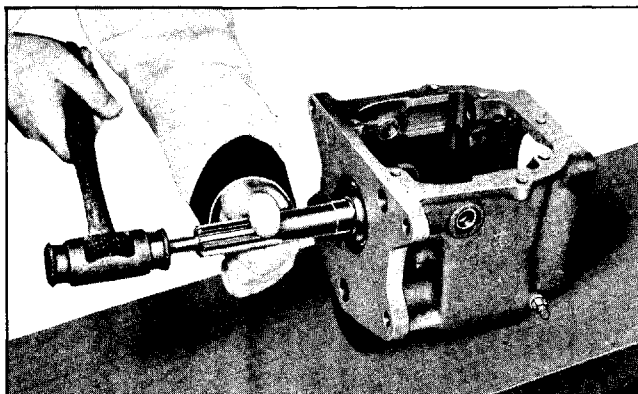


Fig. 7-24 Removing Main Drive Gear and Bearing Snap Ring

12. Remove reverse idler gear shaft lock screw (Fig. 7-25), then remove idler gear shaft toward rear of case, and lift reverse idler gear and thrust washers from case.

13. Remove second speed gear from mainshaft as follows:

a. Expand wire retainer and slide synchronizing drum off gear and end of mainshaft, leaving retainer in drum (Fig. 7-26).

b. Remove mainshaft snap ring, using snap ring remover, J-1130, or KMO-630 (Fig. 7-27) and then remove thrust washer and gear.

14. Turn transmission rear bearing front snap ring so snap ring ends are down at groove in retainer. Pry out one end of snap ring with a screwdriver and continue on around until snap ring is entirely free.

15. Remove mainshaft and bearing from bearing retainer by tapping rear end of shaft with soft hammer.

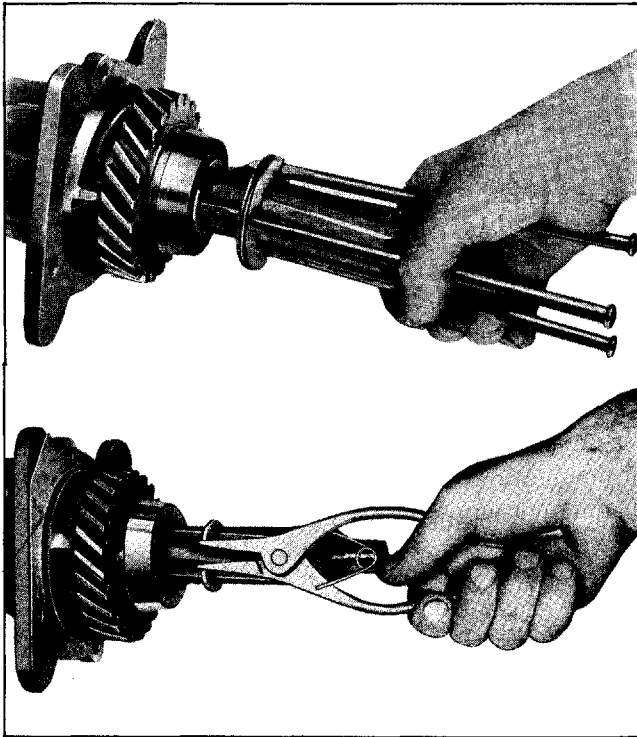


Fig. 7-27 Removing or Installing Snap Ring Using Tool J-1130 or KMO-630

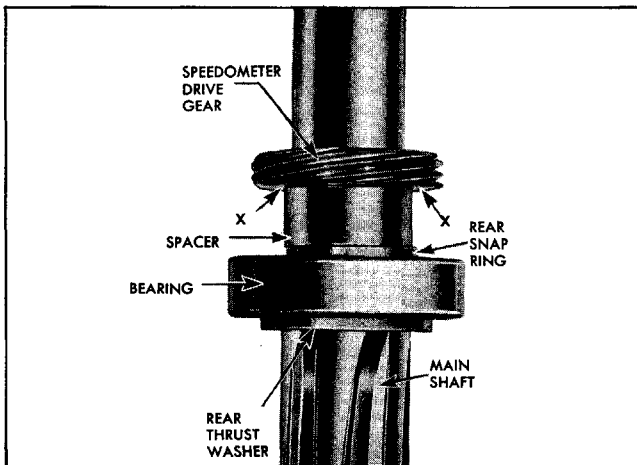


Fig. 7-28 Main Shaft Assembly Construction

16. If necessary to replace speedometer drive gear or mainshaft rear bearing:

a. Remove speedometer drive gear from shaft by supporting gear at "X" (Fig. 7-28) and pressing out shaft.

b. Remove speedometer gear spacer from mainshaft and then remove rear bearing rear snap ring, using transmission mainshaft U retainer remover, J-1041 (Fig. 7-29).



Fig. 7-29 Removing Rear Bearing Rear Snap Ring with Tool J-1041

c. Remove bearing by bumping shaft on wood block (Fig. 7-30).

17. To disassemble main drive gear assembly:

a. Expand synchronizing drum wire retainer with screwdriver as was done on second speed gear and remove drum from drive gear.

b. Remove front bearing retainer snap ring, spring washer, and oil slinger.

c. Remove bearing by bumping shaft on block of wood.

d. If necessary to replace any of mainshaft pilot bearing needle rollers, remove snap ring and washer from inside main drive gear and remove rollers (Fig. 7-31).

INSPECTION OF TRANSMISSION

After disassembly, all transmission parts should be cleaned in cleaning solvent and inspected as follows:

1. Transmission Case—Inspect case for cracks and stripped threads; inspect selector shaft oil seal in case to see that it is not damaged and shows no evidence of leakage. If damaged, replace with new seal coating outer surface of new seal with Permatex No. 3 or similar sealing compound and installing with lip of seal toward inside of case.



Fig. 7-30 Removing Rear Bearing

2. **Ball Bearings**—Clean bearings in cleaning solvent to wash out any old lubricant, dirt, or metal particles. When blowing off solvent with compressed air be sure to hold bearing from turning. Examine bearings for cracks, deformed balls, chipped races, etc., any of which would require bearing replacement. Coat bearing with oil and rotate slowly while placing a light load on bearing by hand. If bearing feels smooth or only very slightly rough, it is satisfactory for re-use. Small indentations in race caused by steel chips will seldom affect life of bearings if no extreme roughness is felt when testing bearing by rotation as outlined above.

3. **Roller Bearings**—Examine rollers for crushing, deformation, indentations, burrs or surface cracks. Any of these require replacement of defective rollers.

4. **Gears and Shafts**—Inspect teeth and ground surfaces of gears for wear, scoring, chipping, nicks and burrs. Use care not to confuse tool marks from manufacturing for scores or nicks. Check especially gear conical surfaces which contact synchronizing drum to see that they are smooth and free of burrs (burrs in either steel cones or drums will prevent proper

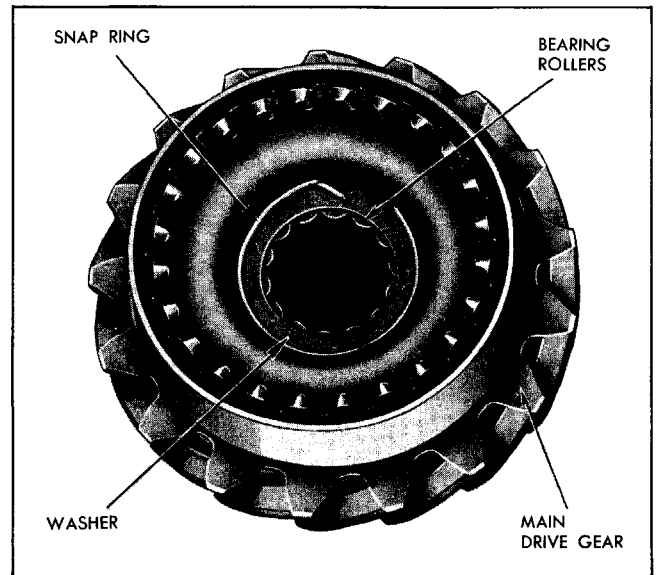


Fig. 7-31 Rollers, Washer and Retainer in Main Drive Gear

synchronization). See that teeth on sliding sleeve are free from chipping, scores, and cracks. Check to see that sliding sleeve slides freely on mainshaft and first and reverse gear slides freely on sliding sleeve. See that second speed gear revolves freely on main shaft. Check condition of counter gear shaft to see that it has not been pitted on surface contacted by rollers of bearings. Check synchronizing drums to see that wire retainers are in good condition, that conical surfaces are not scored and burred and oil grooves clean. Drums should show heaviest contact on their large diameter to give best results when synchronizing. Never polish synchronizing surfaces or change their angle. Inspect surface of propeller shaft splined yoke contacting oil seal in rear bearing retainer to see that it is not nicked or burred so as to damage oil seal. Roughness or burrs may be removed by careful use of a stone. See that wire ring which acts as stop for propeller shaft front universal joint is in place in groove in mainshaft spline.

5. **Selector Shaft and Shift Shafts**—Check selector shaft and shift shafts by rolling on a flat surface to see if they are bent. A bent shaft can cause hard shifting and should be replaced.

6. **Snap Rings**—Examine all snap rings carefully to see that they are not distorted or damaged in any way so as to prevent their securely retaining parts in position. Unless a snap ring is in perfect condition, it should be replaced.

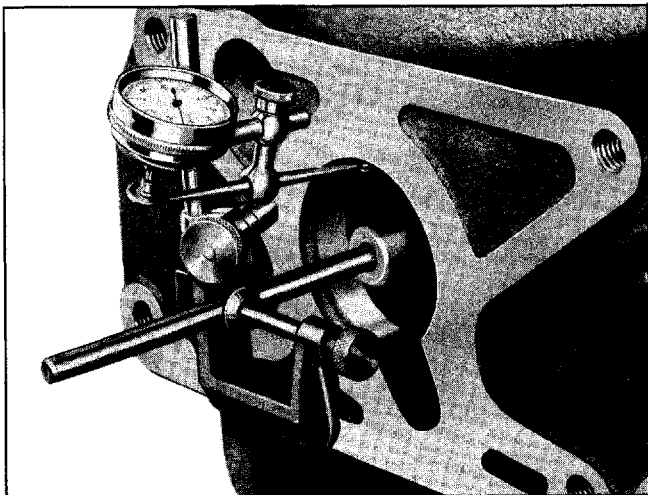


Fig. 7-32 Dial Indicator in Place to Check Housing Hole

REPAIRS

FLYWHEEL HOUSING ALIGNMENT

CHECKING ALIGNMENT — When a new flywheel housing is installed, or when a very noisy transmission or transmission jumping out of high gear indicates possible housing misalignment, the following procedure should be followed to check flywheel housing alignment.

1. Remove transmission (page 7-9) and clutch (see page 6C-1).

2. Install alignment checking tool J-5128 and install dial indicator on stem of checking tool. Arrange hole attachment of dial indicator so its forward tip contacts inside diameter of pilot hole in flywheel housing (which front transmission bearing enters when transmission is in place) as shown in Fig. 7-32.

3. Check location of hole in flywheel housing as follows:

a. Check horizontally: Rotate crankshaft to place dial indicator tip at point A, Fig. 7-33. Set dial at 0. Rotate crankshaft until indicator spindle is at B directly opposite point A. Indicator reading at B must not be more than .005" on either side of initial reading indicating that center of housing hole is within .0025" on either side of center of flywheel.

b. Check vertically: Rotate crankshaft to place dial indicator tip at point C, Fig. 7-33. Set dial at .014". Rotate crankshaft until indicator spindle is at D directly under C. Indicator reading must be between .010" and .000" indicating center of hole in housing is .002" to .007" below center of flywheel.

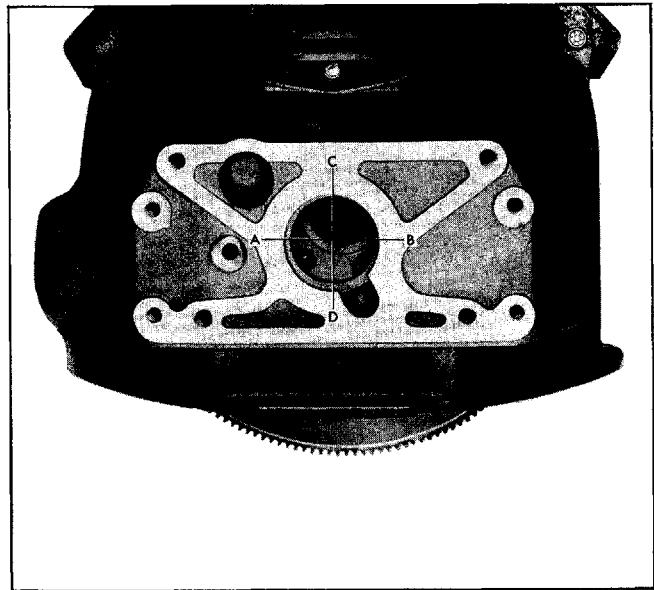


Fig. 7-33 Indicator Positions for Checking Housing Hole

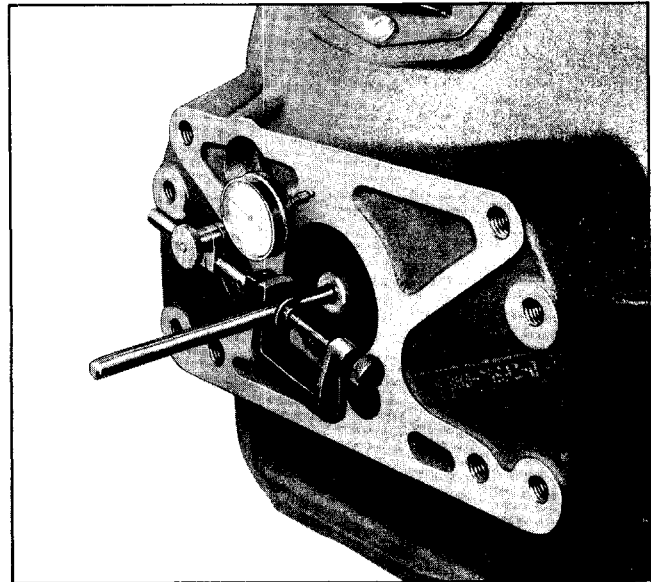


Fig. 7-34 Dial Indicator in Place to Check Face

4. Check squareness of face of housing as follows:

a. Change indicator location so stem of indicator contacts rear face of flywheel housing $\frac{3}{4}$ " from edge of hole (or $\frac{23}{8}$ " radius from center of hole) as shown in Fig. 7-34.

b. Rotate crankshaft and check total indicator reading which should not exceed .004".

If any of the above checks show flywheel housing to be misaligned, replace with new housing.

ASSEMBLY OF TRANSMISSION

1. Coat reverse idler gear shaft with transmission lubricant, and holding reverse idler gear in position with bronze thrust washer in place at each end, insert idler gear shaft from rear of case so hole in shaft will index with lock screw hole in transmission case. Petrolatum on thrust washers will hold them in place while inserting shaft. **CAUTION:** Check to see that hole in shaft lines up with hole in case for shaft lock screw.

2. Install reverse idler shaft lock screw into hole in case and tighten.

3. Assemble countergear as follows:

a. Coat countergear bearing spacer with transmission lubricant and slip it over needle bearing loader, J-1334.

b. Slip countergear over spacer.

c. Coat inner bearing retainers with transmission lubricant and install one in each end of countergear against spacer.

d. Install 25 bearing rollers in each end of countergear (Fig. 7-35).

e. Coat outer bearing retainers with transmission lubricant and install against needle rollers at each end of countergear.

f. Coat thrust washers with petrolatum and install one against each end of countergear.

4. Place countergear with tool J-1334 in bottom of transmission case.

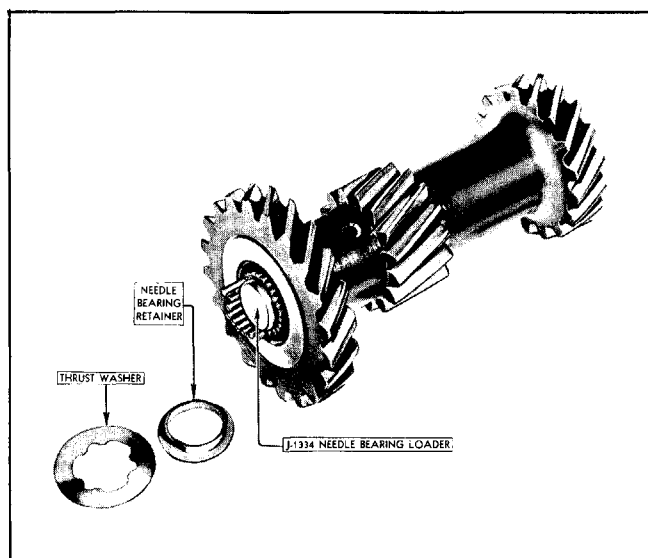


Fig. 7-35 Installing Bearings in Countergear

5. If main drive gear was disassembled, assemble as follows:

a. Install ball bearing on main drive gear by positioning it on gear shaft with shielded side of bearing toward gear and press bearing into place using a tube or pipe placed over gear shaft and pressing on **INNER** bearing race.

b. Install oil slinger, spring washer and snap ring on main drive gear shaft against ball bearing as shown in Fig. 7-36. Spring washer should be installed with concave side toward oil slinger and bearing. Felt oil seal on main drive gear shaft will be installed at time transmission is installed in car.

c. If mainshaft pilot bearing in main drive gear required disassembling to replace bearing rollers, install 14 bearing rollers after coating with petrolatum to hold them in place and then install mainshaft pilot bearing washer and wire retainer.

d. Install synchronizing drum on main drive gear making sure wire retainer snaps into groove on gear.

6. Install main drive gear and ball bearing assembly in case after oiling ball bearing. When drive gear bearing is in place in case, install snap ring in groove in outer bearing race and then tap main drive gear and ball bearing lightly to insure that snap ring is bearing fully against front of transmission case.

7. Coat countergear shaft with transmission lubricant and insert in hole in rear of transmission case. Coat locking ball with petrolatum and install in hole in end of countergear shaft.

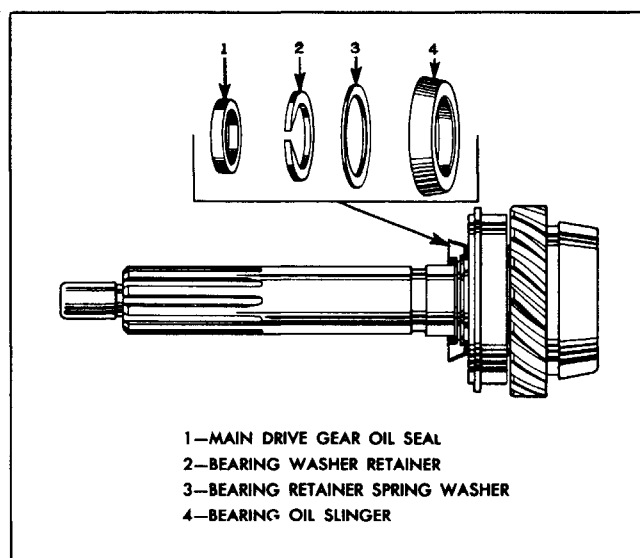


Fig. 7-36 Oil Seal and Oil Slinger on Main Drive Gear

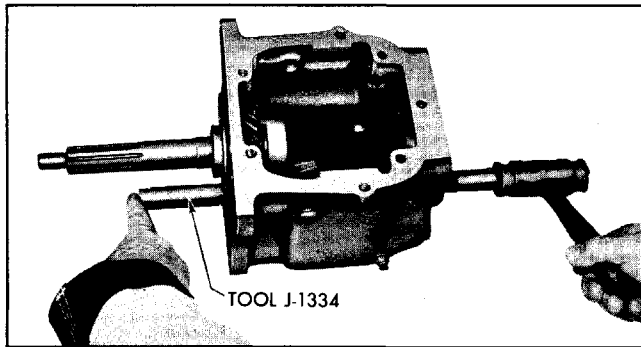


Fig. 7-37 Installing Countershaft

8. Holding countergear in place in case, force tool J-1334 out of countergear by tapping countergear shaft inward from rear of case. See that tool J-1334 and shaft are in contact at all times so roller bearings do not drop out of position (Fig. 7-37).

9. Coat shaft and washers of inner selector lever (Fig. 7-38) with Lubriplate 105, arrange oil seal, plain washer, and spring washer on shaft of lever, and install inner selector lever in case.

10. Place first and reverse gear on sliding sleeve and after oiling mainshaft pilot bearing in main drive gear, place them in transmission so sliding sleeve meshes with main drive gear (high gear position); this will hold sleeve in position when installing rear bearing retainer and mainshaft.

11. Position second and high fork in grooves of sliding sleeve.

12. Position low and reverse fork on low and reverse gear.

13. Insert right hand end (without flats for lever) of transmission selector shaft in hole in left side of transmission case and push it inward slipping first the long shifter lever then the short lever on the shaft as shown in Fig. 7-39 so long lever will be on left side of transmission case. **CAUTION:** The selector shaft oil seal has a feather edge pointing inward so shaft must be installed from left to prevent damage to seal. Be sure inner selector lever is in notch in selector shaft and selector shaft passes on top of lever.

14. Install shift fork poppet springs and balls in transmission case holes.

15. Depress poppet spring and ball and slide second and high shift shaft (short shaft) into case from rear slipping shift fork on shaft. Check to see that expansion plug is over end of second and high shift shaft hole at front of transmission case.

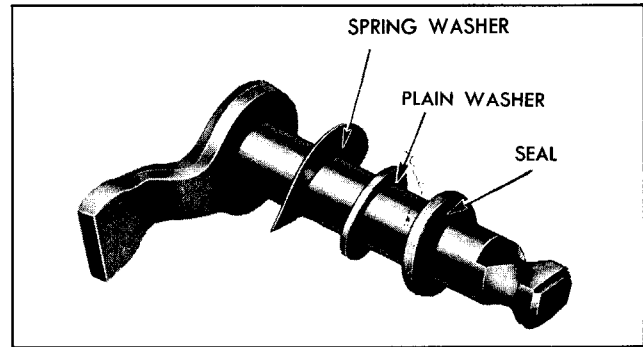


Fig. 7-38 Selector Shaft Inner Lever and Seal

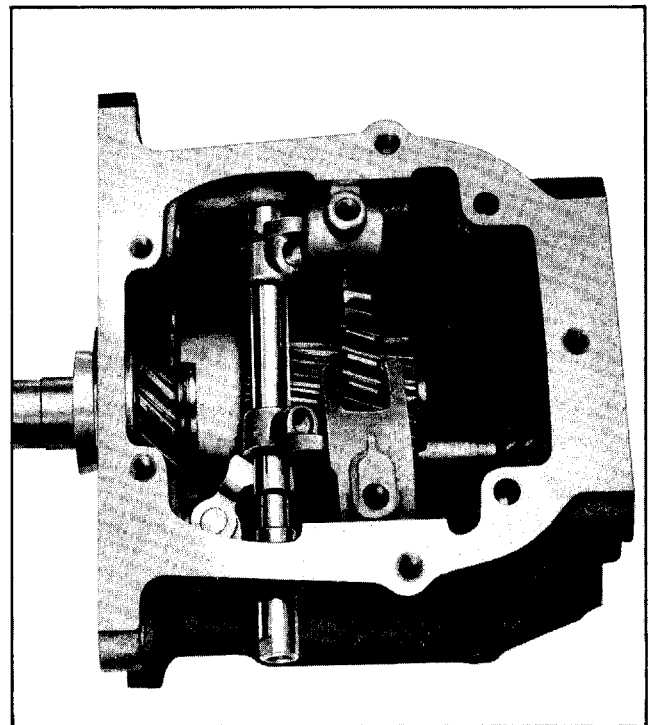


Fig. 7-39 Installing Selector Shaft

16. Depress poppet spring and ball and slide low and reverse shift shaft into case from rear slipping low and reverse shift fork on shaft.

17. Temporarily place transmission selector lever on selector shaft outside case and hold shaft in neutral position while tightening selector shaft shift levers in place using transmission shift fork lock screw remover, tool J-2895. **CAUTION:** Be sure levers are correctly positioned so lock screws enter holes in shift shafts.

18. Tighten low and reverse, and second and high shift fork lock screws on shift shafts using tool J-2895 (Fig. 7-20).

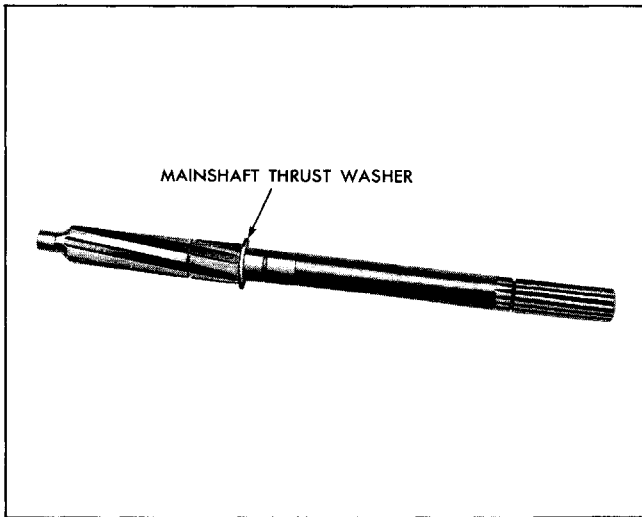


Fig. 7-40 Main Shaft

19. If mainshaft rear ball bearing and/or speedometer gear were removed on disassembly:

a. Install mainshaft thrust washer on mainshaft (Fig. 7-40) and press bearing on mainshaft with shielded side of bearing toward engine end of mainshaft. Use a tube or pipe to press on bearing exerting pressure on inner bearing race only and see that bearing race is firmly against mainshaft thrust washer.

b. Install rear bearing rear snap ring.

c. Place speedometer drive gear spacer against bearing rear snap ring.

d. Press speedometer driven gear onto mainshaft until it touches spacer.

20. Oil rear ball bearing and portion of mainshaft which runs in rear bearing retainer bushing and insert mainshaft in rear bearing retainer so ball bearing outer race seats firmly in bearing retainer. Install bearing front snap ring.

21. Oil inside of second speed gear and install gear and thrust washer on mainshaft. Install snap ring against thrust washer using tool J-1130 or KMO-630 (Fig. 7-27).

22. Install synchronizing drum on second speed gear seeing that wire retainer is well seated in groove on gear.

23. Install rear bearing retainer and main shaft on transmission case. Use new retainer to case gasket and hold gasket in place with petrolatum while making installation. Tighten bearing retainer to case mounting bolts securely.

24. Apply sealer (Permatex No. 3 or equal) to inside of rear bearing retainer. Oil felt of new rear bearing retainer oil seal. Apply sealer to outside of oil seal and install seal using installer J-1354 (Fig. 7-7).

25. Check operation of transmission by working shift lever and selector lever and observing for correct meshing of gears.

26. Using a new gasket install transmission cover on case.

27. Install new expansion plug over selector shaft hole in right side of transmission.

28. Apply sealing compound (Permatex No. 3 or equal) to end of countergear shaft at outside front face of transmission case, and to selector shaft expansion plug on right side of case. This will seal possible points of oil leakage.

TRANSMISSION INSTALLATION

If transmission was reported as being very noisy or jumping out of gear, misalignment between transmission and flywheel housing may be present. Check as indicated in "Repairs" page 7-14 before installing transmission.

1. Install two transmission guide pins in upper cap screw holes in flywheel housing as was done when transmission was removed from car.

2. Place new transmission main drive gear felt oil seal over end of main drive gear. Apply oil to seal and position seal against shoulder ahead of oil slinger snap ring (Fig. 7-36).

3. Place new transmission to flywheel housing gasket over two guide pins and then install transmission entering guide pins in two upper cap screw holes to guide transmission into place and also support it so as to prevent distortion of clutch driven plate. Install two lower transmission to flywheel housing cap screws; remove guide pins and then install two upper cap screws. **CAUTION:** When installing transmission do not try to force transmission main drive gear into clutch driven plate hub as damage will result. Release clutch by applying force to throw out fork and realign driven plate with a spare transmission main drive gear.

4. Install transmission shift lever spring, yoke, and extension and then install shift lever, lockwasher and screw. Apply Lubriplate 105 to spring extension ends and hole in shift lever; coat yoke end on all sides (where it enters yoke support at rear bearing retainer) and yoke spring hole with Lubriplate 105.

5. Install outside selector lever, lockwasher and cap screw on selector lever shaft.

6. Install selector and control rods on shift and selector levers at transmission. Coat holes in levers with Lubriplate 105 before inserting rods.

7. Apply light coating of engine oil to spline on transmission main shaft and slide propeller shaft on spline.

8. Fill case with $1\frac{3}{4}$ pts. grease and $\frac{3}{4}$ pts. in rear bearing retainer through speedometer sleeve hole. (Extreme Pressure Lubricant or Multi-Purpose Gear Lubricant S.A.E. 80 or 90.)

9. Install speedometer driven gear, sleeve, and shaft assembly on rear bearing retainer.

10. Install speedometer cable.

11. Install and connect stop lamp switch.

12. Connect rear universal joint to companion flange tightening bolts to 28-33 lb. ft. torque. Use new lock plates under bolts and see that tabs are bent up against bolt heads to lock them.

TROUBLE DIAGNOSIS AND TESTING

TROUBLE

1. Hard shifting or blocking out.
2. Low and reverse gear clash.
3. Noise in neutral with engine running and car standing.
4. Noisy gears.
5. Noisy shifting out of first or reverse.

REMEDY

Check for free clutch release and observe driver habits to insure that driver gets full release of clutch. A clutch that drags will cause blocking out of second and high gear. May be caused by either shift control linkage on steering column or in transmission. Disconnect control and selector rods to isolate. Check for binding at rod rubber grommets. If in transmission, disassemble and check for bind in shift shafts, selector shaft, seals, etc. On blocking out, check synchronizing drums and cones on gears for burrs and scores and replace defective parts.

Shifting into low or reverse too rapidly; depress clutch pedal and allow time for clutch disc to stop spinning. Check for improper clutch pedal free travel and adjust to 1".

Engage and disengage clutch to see if noise is actually in transmission or elsewhere. If in transmission, noise can come from main drive gear and bearings, reverse idler gear, main shaft pilot bearing in main drive gear, or second speed gear. A regular clicking noise usually indicates a nicked bearing or gear. Replace defective parts.

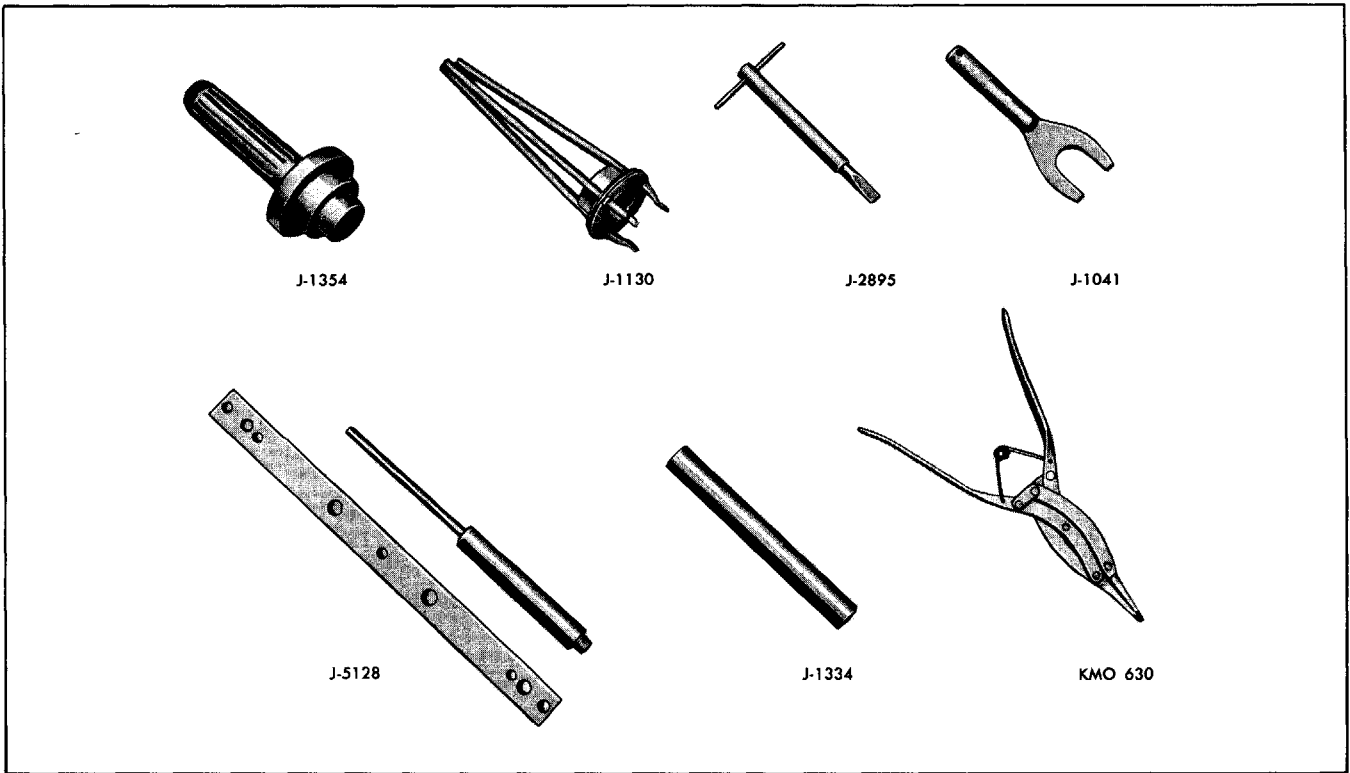
Some gear noise is normal in all but high gear. Compare car to others to see if noise is average or excessive. If excessive, drive in different speeds to determine which gears are noisy and replace. Misaligned flywheel housing; correct as indicated on page 7-14.

Some noise is normal, if shift is made slowly. Abnormal noise usually due to improper clutch pedal free travel. Check and adjust to 1".

CAUSE	REMEDY
6. Car jumps out of gear.	High gear jump out is usually due to misalignment of flywheel housing. Second gear jump out is usually due to incompleting shift, worn jaw clutch teeth, or loose fit of sliding sleeve on main shaft. See that shift lever is moved through full travel; replace worn parts.
7. Gearshift lever too close to steering wheel causing interference with hand, or too far away.	Adjust (page 7-5).
8. Gearshift lever not properly positioned in neutral.	Adjust (page 7-5).
9. Rattle or clicking noise in gearshift lever.	Remove excess clearance at pivot points by shims and see that control shaft anti-rattle spring (upper) is in place.
10. Gearshift lever does not return to high speed side when placed in neutral position.	Check to see that control shaft spring is in place at lower end of control shaft. When car is new, the selector shaft seal sometimes drags on shaft so lever will not return promptly; with use, seal will smooth up.
11. Gearshift lever shakes when driving.	Models equipped with Hydra-Matic transmission, check upper friction button spring.
12. Squeak at transmission end of control rod as gears are shifted.	Apply Lubriplate 105 on portion of selector shaft contacting over-center spring yoke. Lubricate transmission ends of control rod and selector rod.
13. Squeak at steering gear end of control and selector rods in cold weather.	Lubricate rubber grommets at steering gear end of rods with rubber lubricant. Apply coating of Lubriplate 105 to selector contact on selector collar.

SPECIFICATIONS

Type					Synchro-Mesh	
Gear Material					Chromium Steel	
Gear Reduction						
Low	2.39:1	Second	1.49:1	High	Direct Reverse	2.71:1
Countershaft Bearings—Front and Rear					Roller	
Main Shaft Pilot Bearing					Roller	
Transmission Bearings—Front and Rear					Ball (Shielded Type)	
Idler Gear Bearing—2848 x .9868 x 3/4" Bronze	
Lubricant Level					Bottom of Filler Plug Hole	
Lubricant Capacity to Refill					13/4 pints	
Lubricant, Rear Bearing Retainer					3/4 pints	
Diameter of Main Shaft Pilot Bearing Needle Roller2180—.2182	
Universal Joint Front Yoke in Rear Bearing Retainer002—.004	
Main Shaft Rear Bearing in Retainer—Clearance0011 tight—.0004 loose	
Second Speed Gear and Main Shaft—Clearance0015—.0030	
Second Speed Gear End Play0061—.0261	
Second and Third Speed Sliding Sleeve and Main Shaft Clearance at Bottom of Splines001—.003	
Countergear End Play0176—.0306	
Reverse Idler Gear Bushing to Shaft—Clearance0027—.0042	
Speedometer Drive Gear					7 Teeth	
Speedometer Driven Gear						
39-10 Ratio					19 Teeth	
43-10 Ratio					20 Teeth	



SPECIAL TOOLS—TRANSMISSION

- J-1354 Rear Bearing Retainer Oil Seal Installer
- J-1130 Transmission Spline Shaft Snap Ring Remover
- J-2895 Transmission Shifter Fork Lock Screw Remover
- J-1041 Transmission Main Shaft Bearing Retainer Remover
- J-5128 Flywheel Housing Align Tool (Use With Dial Indicator)
- J-1334 Transmission Countershaft Needle Bearing Loader
- KMO 630 Snap Ring Pliers

SERVICE CRAFTSMAN NEWS REFERENCE

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