

SERVICE MANUAL

SECTION VI TRANSMISSION AND OVERDRIVE



Packard Motor Car Company
Detroit 32, Michigan

INDEX

	PAGE
OPERATION	
CLEANING AND INSPECTION	9
OVERDRIVE ASSEMBLY	14
Engaging Mechanism	14
Transmission and Overdrive Installation	17
OVERDRIVE DISASSEMBLY	5
SERVICING THE GEARSHIFT LINKAGE	18
Assembly	18
Disassembly of the Gearshift	18
Installation	19
Removal of the Gearshift Linkage	18
SERVICING THE OVERDRIVE AND TRANSMISSION	4
Transmission and Overdrive Removal	4
THE OVERDRIVE	2
Engaging Mechanism	3
Lockout	3
Over-running Clutch	3
Planetary System	3
THE TRANSMISSION	1
Gearshift Mechanism	1
TRANSMISSION ASSEMBLY	10
Clutch Shaft and Gear	13
Countershaft	13
Countershaft Gear Cluster	11
Cover	10
Main Driving Shaft	12
Reversing Pinion	11
Synchronizing Unit	11
TRANSMISSION DISASSEMBLY	7
Clutch Shaft Gear	7
Countershaft	7
Countershaft Gear Cluster	9
Cover	9
Main Driving Shaft	8
Reversing Pinion	9
Synchronizing Unit	8
TROUBLE SHOOTING AND CORRECTIVE MEASURES	20

SECTION VI

TRANSMISSION AND OVERDRIVE

THE TRANSMISSION

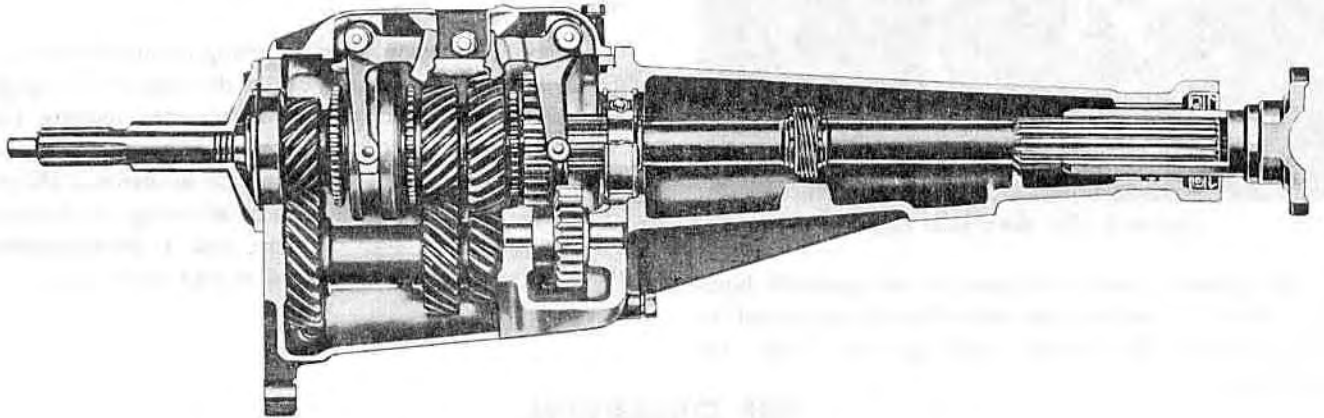


Figure 1—Cross Section of the "Uni-Mesh" Transmission

Description

The function of the Packard selective three-speed type transmission is to transmit engine torque through the propeller shaft and differential to the rear wheels at the desired ratio and rotation. This is accomplished by the use of a helical and straight tooth spur gear train in the transmission.

The transmission case and cover support the transmission internal parts, protects them from dirt and foreign matter, and acts as a reservoir for the lubricant.

The die cast transmission cover supports two short shafts to which the external operating levers are attached. The levers are connected by link rods and relay levers to the steering column gearshift. The shifting forks are mounted on the inner ends of the shafts.

The engine torque is transmitted through a hardened steel clutch shaft and helical gear which meshes with the forward gear of the countershaft gear cluster. The helical forward center gear of the gear cluster meshes with the second speed gear. The helical rear center gear meshes with the low speed gear, while the straight tooth rear gear meshes with the reversing pinion.

The countershaft gear cluster is supported by the countershaft and two roller bearings. The main driving shaft is supported at the rear end by a ball bearing, while the forward end is supported by a roller bearing in the clutch shaft gear. The main driving shaft carries the second speed gear and low speed gear, which are

in constant mesh with the countershaft gears. The reverse sliding gear has a sliding fit on the main driving shaft and is in mesh only during reverse operation.

Direct and second speed engagement is accomplished by the use of a synchronizing clutch assembly splined on the main driving shaft and located between the clutch gear and second speed gear. Low gear engagement is accomplished by engaging the forward internal splines of the reverse sliding gear and the rear splines of the low speed gear. Reverse mesh is accomplished by sliding the reverse sliding gear rearward into mesh with the reversing pinion.

Engine torque is transmitted to the propeller shaft through the splined universal joint flange attached with a sliding fit to the transmission main driving shaft. A babbit bearing in the rear end of the rear bearing retainer supports the flange. An oil seal at the extreme rear end of the rear bearing retainer keeps the lubricant in and the dirt out. The transmission is lubricated by the splash system.

Gearshift Mechanism

The gearshift mechanism located at the right side of the steering column shroud, consists of the following parts: The gearshift lever, the gearshift housing shaft, selector rod, selector, shaft levers, idler levers, and the operating rods.

TRANSMISSION AND OVERDRIVE

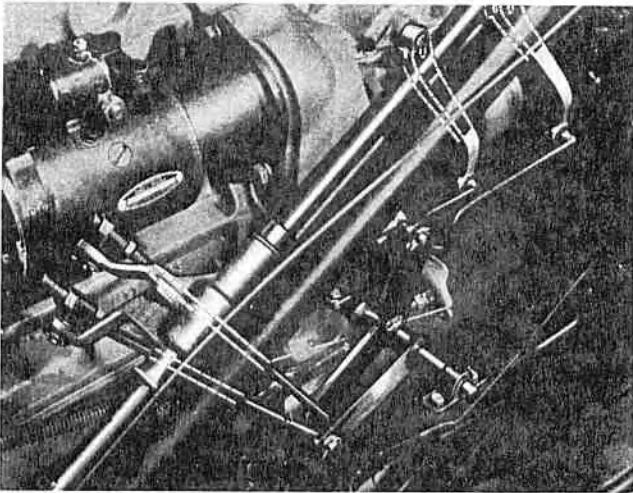


Figure 2—The Gearshift Linkage

The gearshift lever is pivoted in the gearshift housing, which is a hollow tube splined at the lower end for the selector. The selector rod operates inside the housing.

The shaft levers are free to turn on the housing. The levers are recessed to engage the selector, depending on the position of the selector and the gear desired.

Moving the gearshift lever rotates the gearshift housing shaft, which in turn rotates the shaft lever. The shaft lever moves the relay link and operates the relay lever, which in turn moves the relay to transmission rod and operates the transmission shift lever to the position desired.

Selection is accomplished by lifting up on the steering gearshift lever; this in turn causes the selector to engage in the low and reverse shaft lever; then moving the steering column lever forward or back causes the transmission to shift into low or reverse as desired. Direct or second speed can be selected by allowing the steering column gearshift lever to drop, and a spring pushes the selector into the direct and second shaft lever.

THE OVERDRIVE

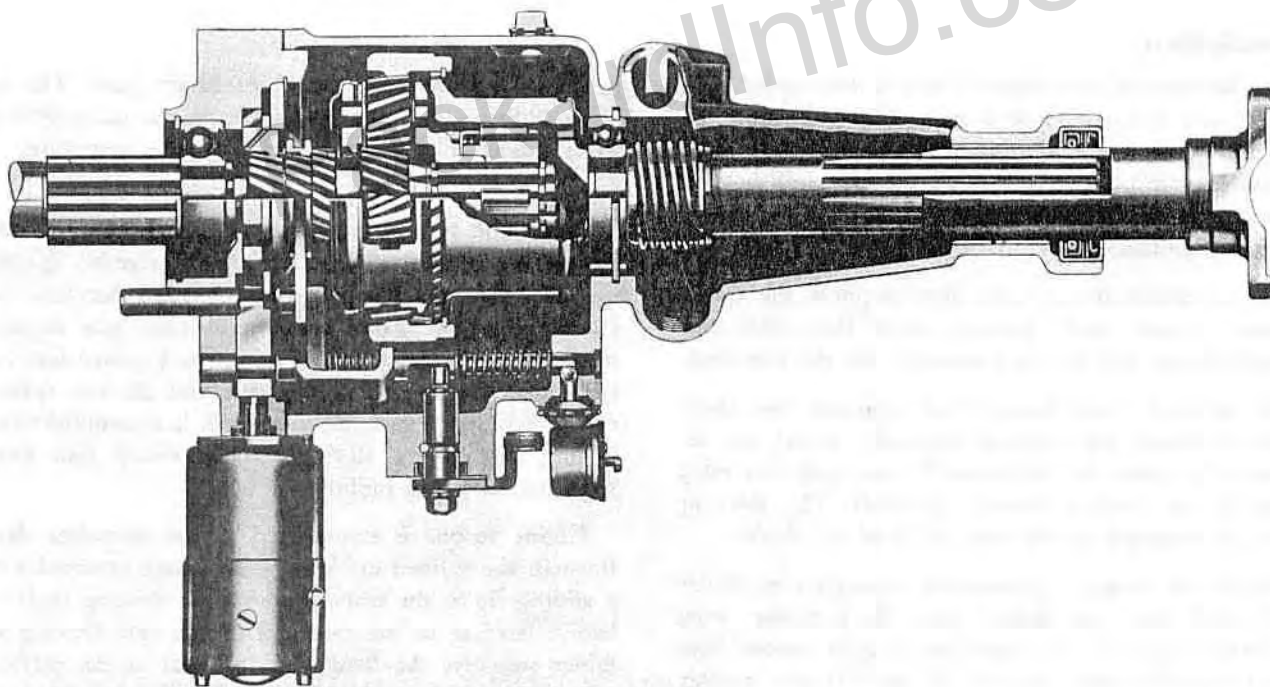


Figure 3—Cross Section of the Overdrive Unit

Description

The Packard overdrive is a device attached to the rear of the transmission which steps up the propeller shaft speed 38.5% in relation to engine speed. This in effect

permits maintaining the same car speed, with the engine speed reduced 27.8%. The overdrive is driven by the transmission main driving shaft and provides two propeller shaft ratios:

TRANSMISSION AND OVERDRIVE

- (a) The overdrive ratio, 28.5% faster than engine speed.
- (b) The direct drive ratio or conventional high.

Three main mechanisms are employed in the overdrive:

(1) The increase of propeller shaft speed over engine speed is obtained by driving the propeller shaft through a train of planetary gears. The ratio of the gear train is such that it steps up the propeller shaft speed.

(2) An over-running clutch (or free wheeling unit) is a two speed driving connection. It is used to enable the propeller shaft to be rotated faster than engine speed at one time, and at engine speed at another.

(3) The engaging mechanism, which consists of a solenoid operating a sliding pawl, holds or releases the sun gear to engage or disengage the overdrive. Overdrive ratio is obtained by holding the sun gear.

Planetary System

The planetary gear train consists of the following parts:

- (a) The sun gear, which is held by the engaging pawl.
- (b) The planetary pinion cage consisting of three pinions carried on roller bearings in the cage.
- (c) The planetary ring gear.

In overdrive, the planetary cage, rotated by the transmission main driving shaft, causes the pinions to revolve around the sun gear, which is held by the engaging pawl. The pinions, being meshed with the ring gear, drive the ring gear 38.5% faster in the same direction as the cage rotation.

In direct drive, the planetary cage is rotated by the transmission main driving shaft; however, the sun gear is not held, and there is no power transmitted through the gear train. The power is transmitted through the over-running clutch. There is no step-up of speed, since all parts are rotating at the same speed.

Over-running Clutch

The over-running clutch is a simple one-way clutch, using a ratchet principle. It contains two essential members, the *driving* and the *driven* members. The driving member is the over-running clutch cam, and the driven member is the overdrive main shaft.

The over-running clutch is made up of the following parts:

- (a) A cam with 12 ramps which is splined to the transmission driving shaft.
- (b) Twelve rollers which operate on the ramps.

- (c) A cage that holds the rollers in place on the cam.
- (d) A race, formed by the inner bore of the overdrive main shaft.

When the cam is rotated forward, the rollers are forced up and wedged against the race, making a solid drive unit through the tail shaft. When the tail shaft rotates faster than the cam, as it does in overdrive, the rollers move down the ramps and the unit slips or free wheels.

Lockout

Overdrive lockout is accomplished by moving the sun gear rearward and locking the pinions and the ring gear and main shaft assembly into a single unit.

When the lockout knob is pulled out, a cam on the end of the lockout control shaft moves the lockout shift rail and the shift fork rearward. The shift fork in turn moves the sun gear rearward and the external clutch teeth of the gear engage with the internal clutch teeth of the pinion cage assembly.

Since the sun gear meshes with the pinions and has now engaged the clutch teeth of the pinion cage, the pinions cannot turn in the cage. Thus the assembly turns as a unit, driving the ring gear and main shaft as a unit by means of the teeth of the locked pinions. Power is then transmitted through the transmission main shaft to the sun gear, to the pinion and cage assembly, and through the pinions to the ring gear and main shaft assembly. The sun gear also is moved into engagement with the pinion cage by action of the reverse plunger when the transmission is shifted into reverse gear.

Engaging Mechanism

The engagement of the overdrive is accomplished by the use of a pusher-type solenoid operating a sliding pawl. When energized, the solenoid pushes the pawl into the slots of the sun gear plate (*stationary gear plate*) holding the sun gear.

To disengage the overdrive, a compression coil spring in the solenoid moves the pawl out of the plate, releasing the sun gear and permitting it to rotate.

A balk ring is used to control the engagement of the pawl by preventing its engagement until the accelerator is released. This arrangement prevents sudden engagement of the pawl, while power is being transmitted to the propeller shaft.

The operation of the solenoid is controlled by the governor switch, kickdown switch, and the lockout switch. These switches are in series with each other so that the overdrive will engage only when all three are closed.

TRANSMISSION AND OVERDRIVE

SERVICING THE OVERDRIVE AND TRANSMISSION

Transmission and Overdrive Removal

For cleanliness and accuracy, it is preferred and recommended that the transmission and overdrive be removed as a unit and serviced on the bench.



Figure 4—Removing the Propeller Shaft

Drain the lubricant from the overdrive and transmission. Disconnect the propeller shaft at the rear universal and remove the propeller shaft completely by slipping the front universal flange off the main shaft.

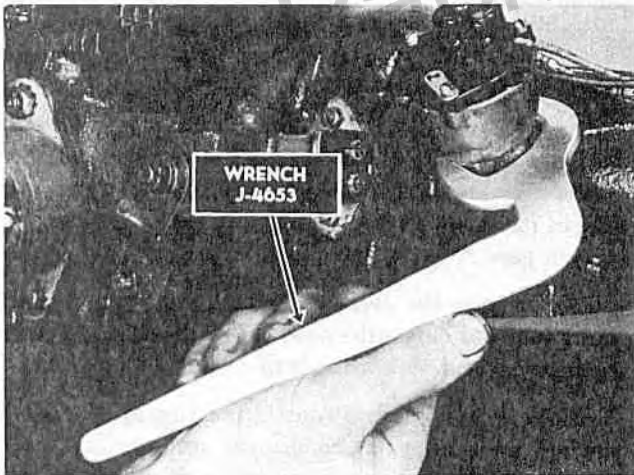


Figure 5—Removing the Governor

Disconnect the speedometer cable. Disconnect the overdrive control cable from the lever on the side of the case. Disconnect the shifter rods from the levers on the transmission case. Disconnect the leads at the governor, lockout switch, and the solenoid assembly. Identify the leads with tags to be sure to connect them at their proper location on reassembly.

Remove the governor, using tool J-4653. Remove the solenoid attaching screws. Rotate the solenoid $\frac{1}{4}$ turn clockwise, and withdraw the solenoid from the adapter.

Use a jack or some other method to support the engine when lifting the transmission and overdrive off.

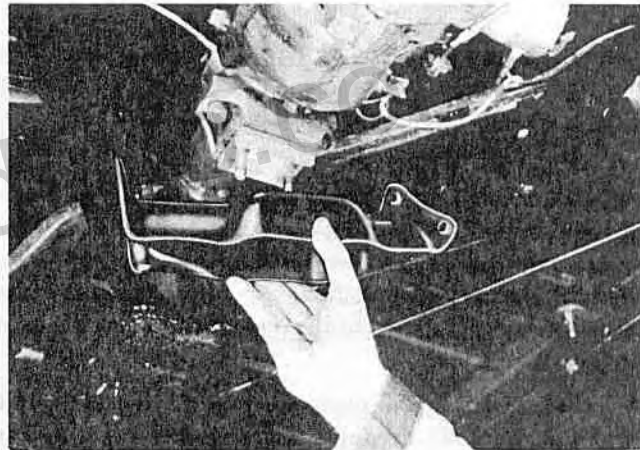


Figure 6—Removing the Engine Rear Support Mounting Cross Member

Remove the rear engine support mounting from the transmission. Remove the five cap screws attaching the transmission to the clutch housing. Remove the transmission and overdrive assembly from the clutch housing.

Support the transmission and overdrive assembly in a work stand or a vise by gripping the bosses on the transmission case in the vise jaws.

TRANSMISSION AND OVERDRIVE

OVERDRIVE DISASSEMBLY

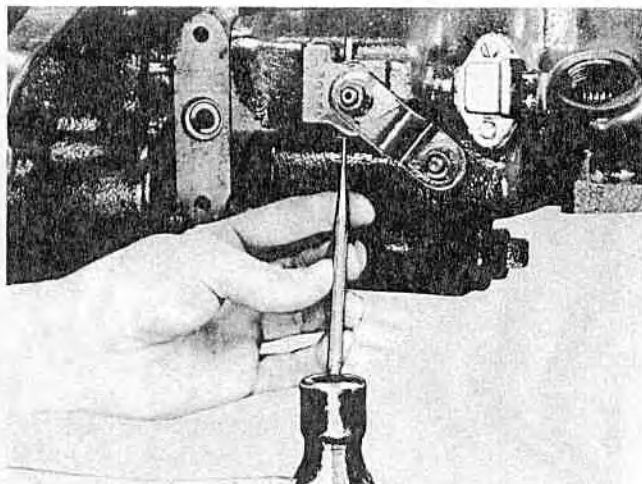


Figure 7—Driving Out the Control Shaft Retaining Pin

Drive out the lockout control shaft tapered retaining pin from the bottom as shown in figure 7. Work the lever and shaft outward as far as possible to disengage the cam on the end of the shaft from the shifter rail. See figure 8.



Figure 8—Moving the Control Shaft Out to Disengage the Rail

Remove the overdrive case to adapter retaining screws and pull the case and main shaft to the rear and away from the adapter. Do not remove the two screws which hold the adapter to the transmission case. When the overdrive case is pulled rearward, the shift rail retractor spring may drop into the case. Some of the free wheel rollers will drop into the case, while some will remain in the cam and roller retainer assembly on the end of the transmission driving shaft. Care should be exercised to prevent losing the retractor spring or any of the 12 rollers.

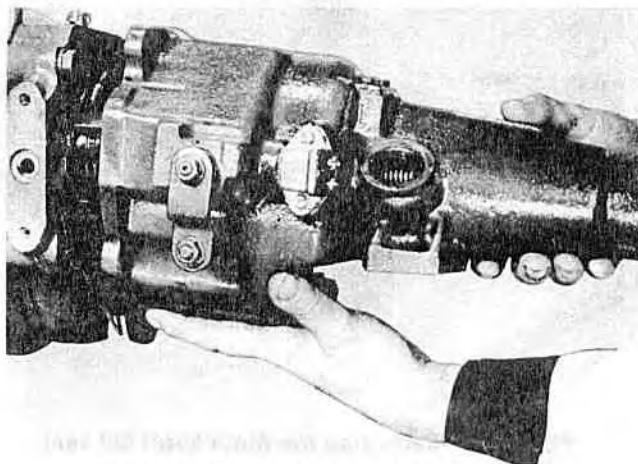


Figure 9—Removing the Overdrive Case

Remove the inspection plate on top of the overdrive case. (This is the small plate attached with two cap screws.) Using snap ring pliers KMO-630 through the opening, spread the mainshaft bearing snap ring, and tap the end of the mainshaft with a soft hammer to remove the mainshaft assembly from the case.

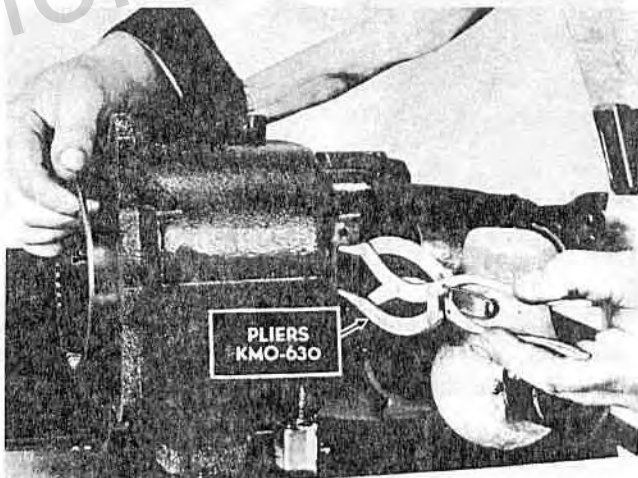


Figure 10—Spreading the Overdrive Mainshaft Bearing Snap Ring

Remove the speedometer driving gear snap ring using tool KMO-630. Remove the speedometer driving gear and Woodruff key. Press the ball bearing from the overdrive main shaft.

Pull the main shaft oil seal. The axle shaft oil seal remover J-943-B may be used for this operation. It may be necessary to grind down the legs of the tool to engage the seal retainer. This seal seldom can be removed without mutilation, and a new seal should be installed when the unit is assembled. Remove the rear bearing rear snap ring and tap the rear bearing out of the case.

TRANSMISSION AND OVERDRIVE

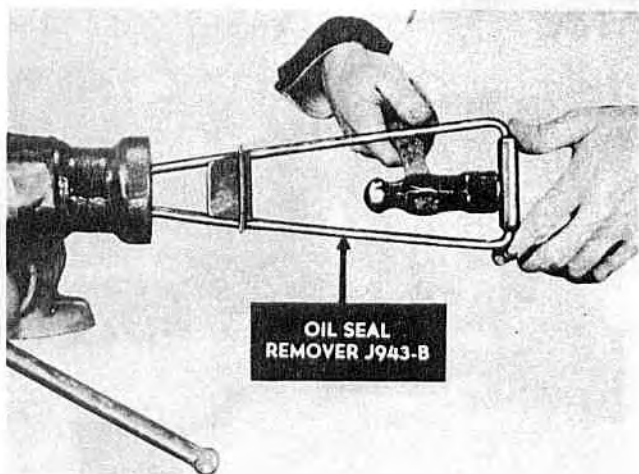


Figure 11—Removing the Main Shaft Oil Seal

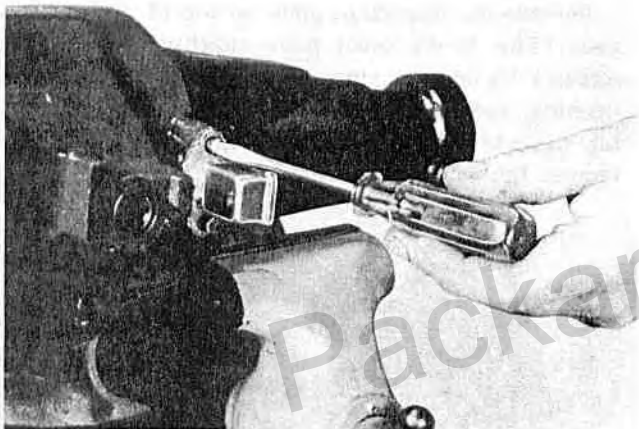


Figure 12—Removing the Overdrive Lockout Safety Switch

Remove the lockout control lever retaining nut and the lever, and work the lever shaft out from inside the case. Remove the overdrive lockout safety switch.

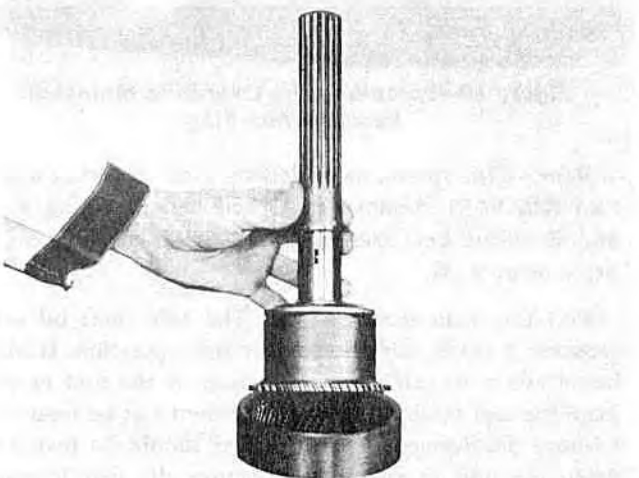


Figure 13—Separating the Main Shaft From the Ring Gear

Remove the large snap ring from the ring gear, and separate the ring gear from the main shaft.

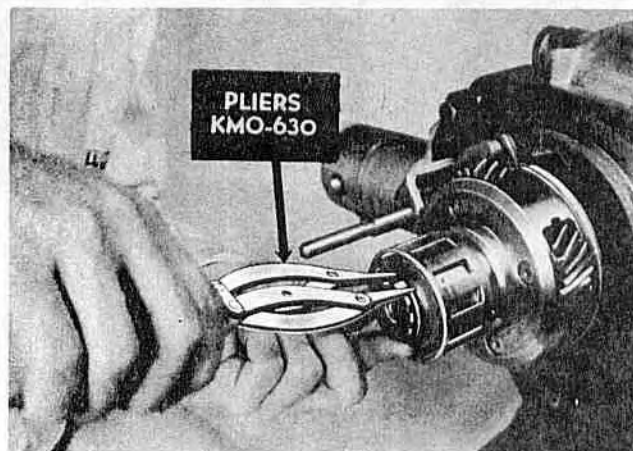


Figure 14—Removing the Over-Running Clutch Cam Retaining Snap Ring

Remove the over-running clutch cam retaining snap ring using the snap ring pliers KMO-630 as shown in figure 14. Slide the roller retainer and cam assembly and the pinion and cage assembly off the transmission driving shaft. Remove the pinion cage assembly.

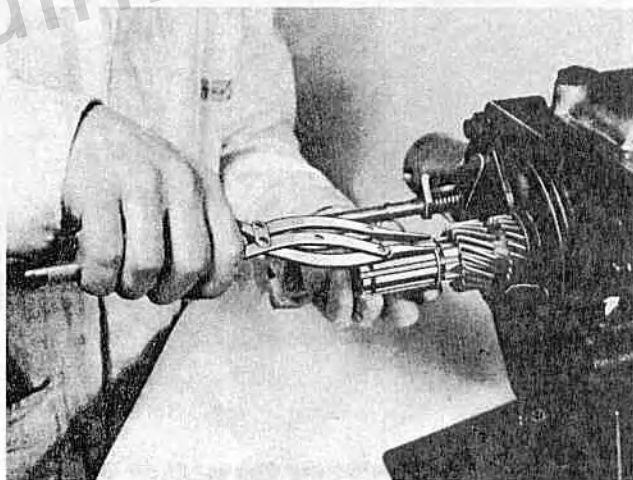


Figure 15—Removing the Pinion Cage Forward Snap Ring

Remove the pinion cage assembly front snap ring from the driving shaft and mark or tag the ring so that it may be distinguished from the over-running clutch cam retaining ring when the unit is assembled. In some cases, the two rings may be of the same thickness. In other cases, however, the over-running clutch cam retaining ring is the thicker of the two, since it is available in various thicknesses in order to eliminate any end play of the over-running clutch cam assembly and the pinion cage assembly on the transmission driving shaft.

TRANSMISSION AND OVERDRIVE

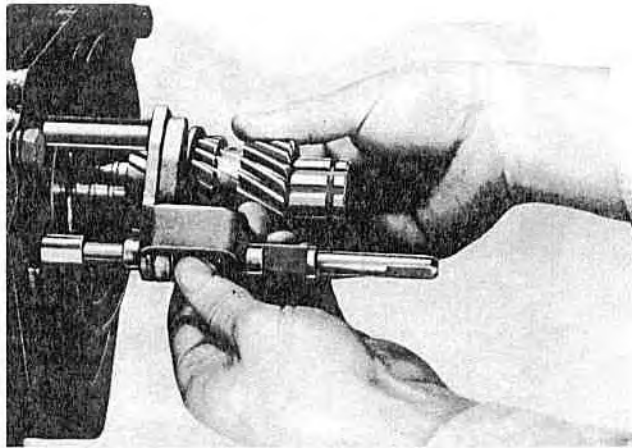


Figure 16—Removing the Reverse Plunger, Shift Rail, and Fork

Pull the reverse plunger, shift rail, and shift fork assembly out of the adapter while sliding the stationary gear rearward and off the driving shaft. These parts are removed together in one operation, as shown in figure 16.

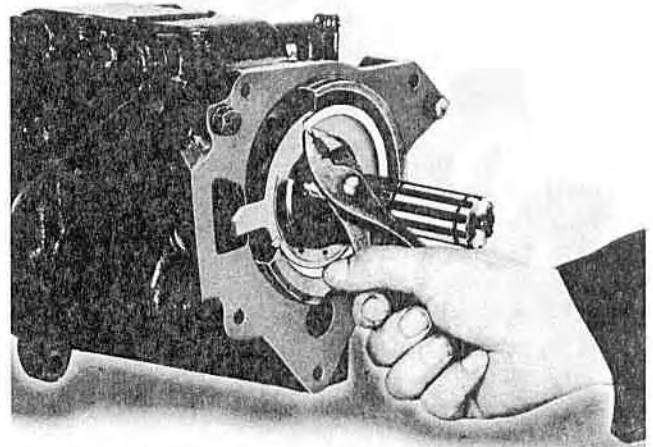


Figure 17—Removing the Stationary Gear Plate Retaining Snap Ring

Remove the stationary gear plate cover retaining snap ring and remove the cover, the gear plate, and the sliding pawl.

TRANSMISSION DISASSEMBLY

Countershaft

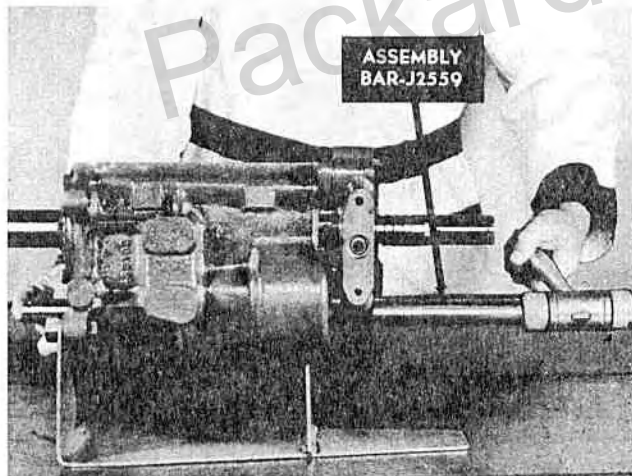


Figure 18—Driving Out the Countershaft

Remove the transmission cover and shifting fork assembly. Drive out the countershaft from the rear of the transmission case using the countershaft assembly bar J-2559 and a soft hammer. See figure 18. The assembly bar in place will permit the countershaft gear cluster to drop to the bottom of the transmission case.

Note: The clutch shaft cannot be removed until the countershaft is removed and the countershaft gear is dropped to the bottom of the transmission case.

Clutch Shaft Gear

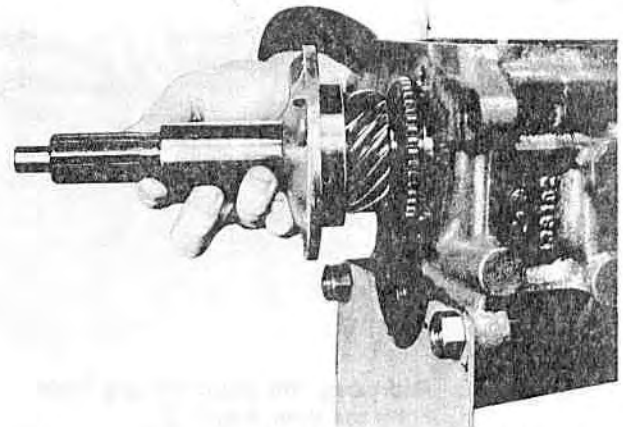


Figure 19—Removing the Clutch Shaft and Bearing

Remove the clutch shaft rear bearing retainer. Remove the clutch shaft and bearing. Remove the main driving shaft front pilot bearing from the bore of the clutch shaft gear. Remove the spacer from the forward end of the main driving shaft.

Remove the clutch shaft bearing snap ring using snap ring pliers KMO-630. Support the bearing in an arbor press and press the clutch shaft from the bearing.

TRANSMISSION AND OVERDRIVE

Main Driving Shaft

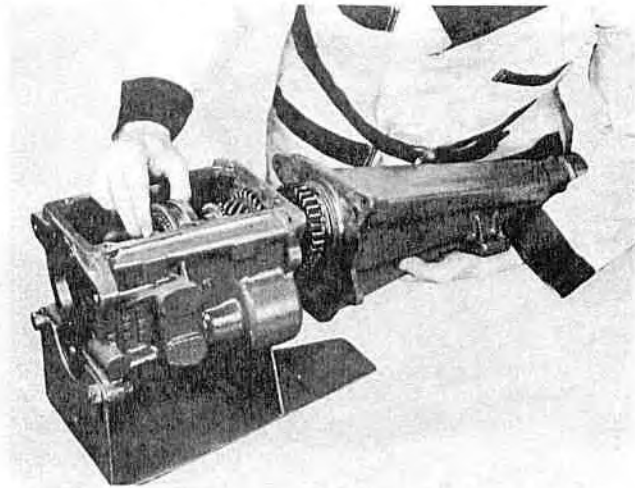


Figure 20—Removing the Transmission Rear Housing

On transmissions without overdrive, remove the transmission rear housing attaching cap screws. Remove the rear housing and driving shaft assembly from the transmission case. Remove the synchronizing unit and main driving shaft front bearing spacer from the forward end of the main driving shaft while it is being removed from the transmission case.

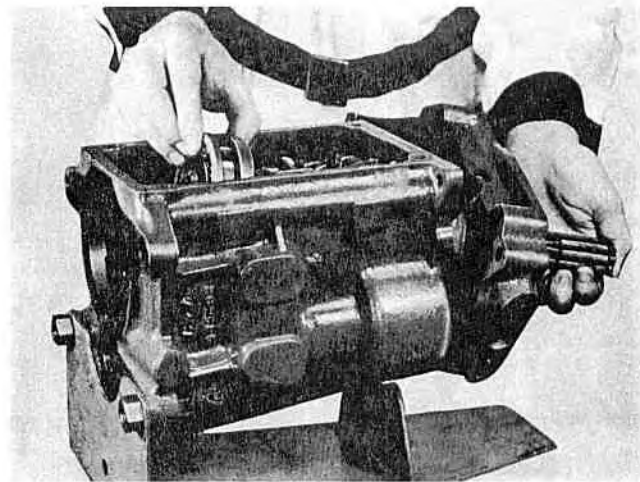


Figure 22—Removing the Adapter Plate and Main Driving Shaft

Remove the large snap ring from the forward side of the adapter plate. Press the driving shaft and rear bearing from the adapter plate. Remove the driving shaft rear bearing snap ring from the driving shaft. Press the bearing from the driving shaft.

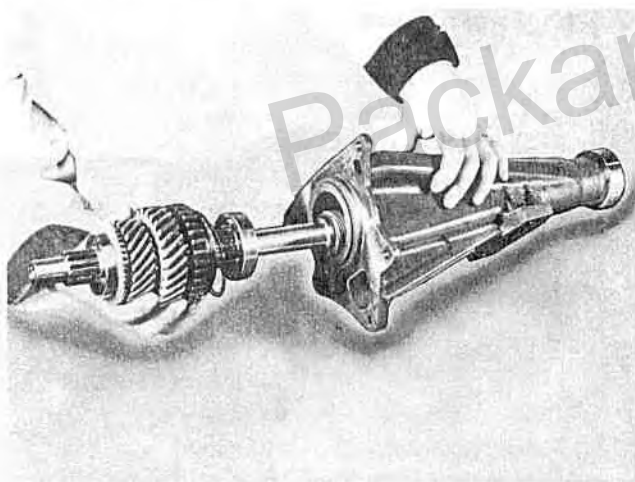


Figure 21—Removing the Main Driving Shaft From the Rear Housing

Remove the large snap ring from the bearing bore of the front end of the rear housing. Press the main driving shaft and rear bearing from the rear housing. Remove the speedometer driving gear snap ring and press off the speedometer gear. Remove the driving shaft rear bearing snap ring, and press off the rear bearing.

On transmissions with overdrive, remove the two cap screws attaching the adapter plate to the transmission case. Remove the adapter plate and driving shaft assembly from the transmission case. Remove the synchronizing unit and main driving shaft front bearing spacer from the forward end of the main driving shaft.



Figure 23—Removing the Large Snap Ring From the Adapter Plate

Slip the reverse sliding gear from the rear end of the main driving shaft. Remove the synchronizing unit from the forward end of the main driving shaft.

Synchronizing Unit

Separate the synchronizer sliding sleeve from the synchronizer clutch gear.

Caution: When separating these parts, be careful that the synchronizing clutch springs and plungers are not lost. Remove the plungers and springs.

TRANSMISSION AND OVERDRIVE

Countershaft Gear Cluster

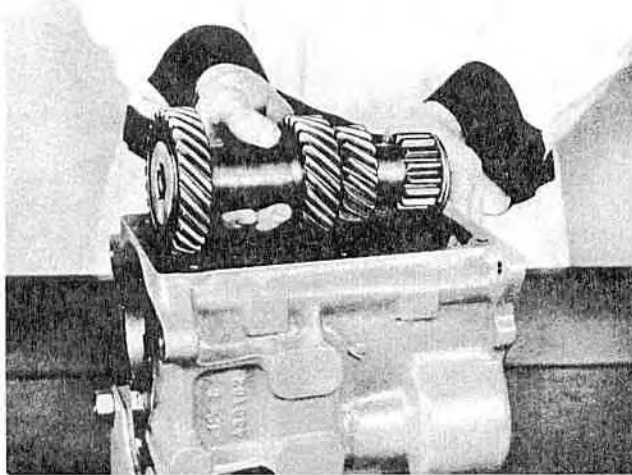


Figure 24—Removing the Countershaft Gear Cluster

Remove the countershaft gear cluster, end plates, and thrust washers from the transmission case. Remove the assembly bar, roller bearings, bearing spacer rings, and the long bearing spacer from the countershaft gear cluster.

Reversing Pinion

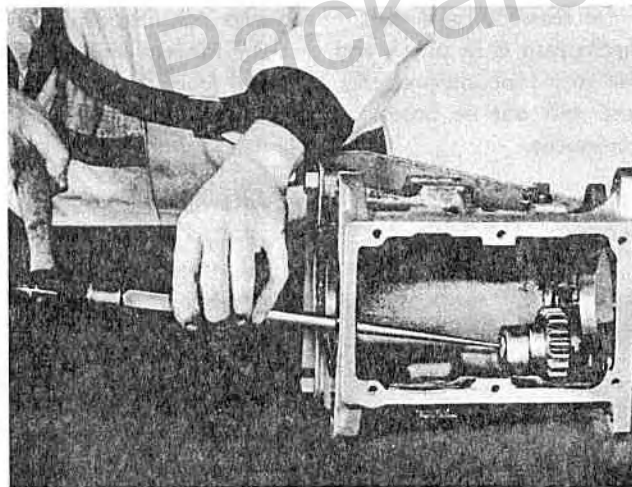


Figure 25—Driving Out the Reversing Pinion Shaft

Clean all the transmission and overdrive parts, except ball bearings, in a solvent cleaning compound. Make sure that all gum deposits are removed.

Inspect the shifter forks for wear, brinelling, and scores. Inspect the shifter fork shafts for scores and wear. Replace all faulty parts with new parts.

Drive the reversing pinion shaft from the transmission case by using a long drift through the bearing opening at the forward end of the transmission case. Lift out the reversing pinion. Remove the two countershaft thrust springs from the inside of the transmission case. Drive the thrust spring plugs from the case using a small drift.

Cover

Drive out the low and reverse, and the direct and second speed shifter fork retaining pins, using a pin punch and hammer. Remove the low and reverse shifter lever and shifter fork shaft. Remove the direct and second speed shifter lever and shifter fork shaft.

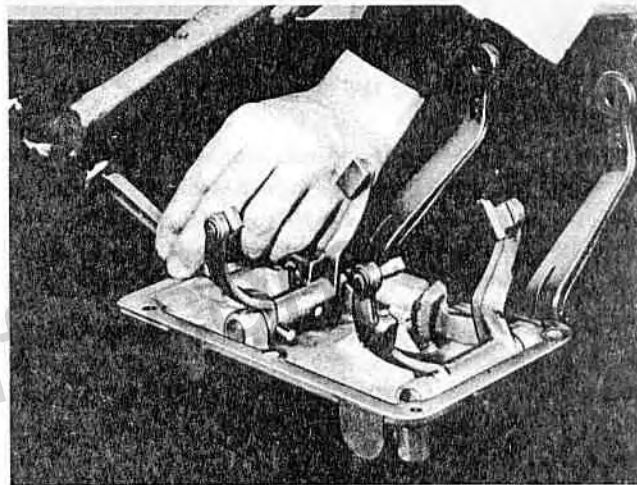


Figure 26—Driving Out the Direct and Second Shifter Fork Retaining Pin

Caution: Be careful that the detent and interlock balls are not lost when the forks are free in the cover. Mark the position of the shifter levers in relation to the shifter fork shafts so that they may be reinstalled in the same position. Remove the levers from the shifter fork shafts.

Remove the interlock ball spacer and the detent ball spring from inside the interlock bracket. Remove the interlock bracket. Remove the shifter fork shaft seals and retainers from the transmission cover.

After the transmission and overdrive are completely disassembled, clean and inspect the parts.

CLEANING AND INSPECTION

Inspect the shifter fork shaft bores in the transmission cover for wear. If the wear is excessive, it will be necessary to install a new complete cover assembly, since the cover alone is not available.

Inspect all gears for wear, chipped teeth, scores, and pits. Inspect the countershaft and the reverse idler shaft

TRANSMISSION AND OVERDRIVE

for wear and scores. Replace all faulty parts with new parts.

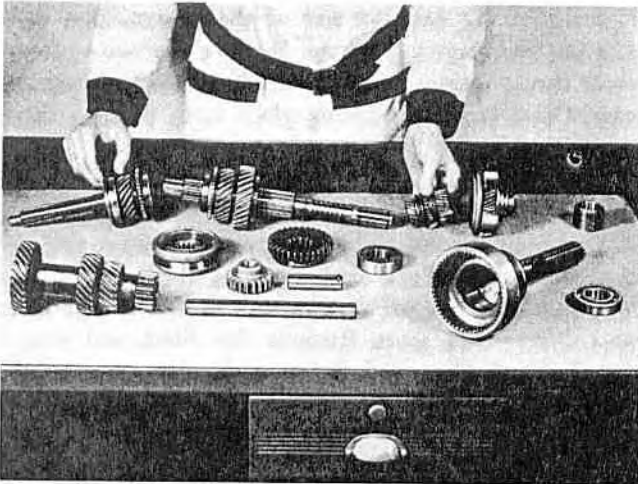


Figure 27—Inspecting the Gears, Shafts, and Bearings

Inspect all bearings for scores, roughness, flat spots or looseness due to wear. Install new bearings when necessary. If the ball bearings are in good condition and are to be reused, do *not* wash them nor soak them in cleaning solvent. Wipe them clean with a clean, lintless cloth.

Inspect the second speed and low gear ball bearings for roughness, looseness, and pre-load. Install complete new main driving shaft and gears assembly if the bearings or gears are fault, since these parts are furnished only as an assembly.

Inspect the overdrive stationary gear, plate, the planetary pinions, and the overdrive ring gear for burrs, wear, scoring, and pitting. Inspect the over-running

clutch cam, rollers, and the race of the inner bore of the overdrive main shaft for wear, pits, indentations, and flat spots. Replace all faulty parts with new parts.

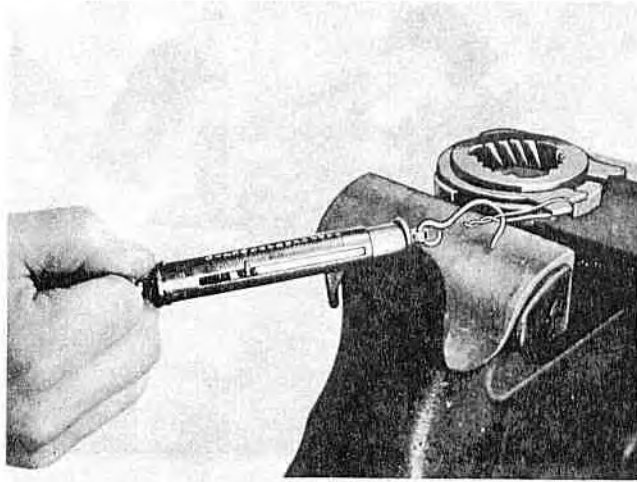


Figure 28—Checking the Balk Ring Tension

With a pull scale hooked over the shoulder of the balk ring, measure the balk ring drag. The pull required to rotate the balk ring when lubricated with overdrive lubricant should not be less than $3\frac{1}{2}$ - $5\frac{1}{2}$ pounds. Replace all parts that do not come up to inspection specifications. *Always* install new snap rings, gaskets, and oil seals.

On reassembly, make sure the interlock on the shifter mechanism is in place, and that the lockout shifter rail and fork function properly. Removal from the overdrive case will not be necessary unless these parts need replacement.

TRANSMISSION ASSEMBLY

Cover

Install new shifter fork shaft seals and retainers in the transmission cover. Start the shifter fork shafts through the bores in the transmission cover.

Position the direct and second speed shifter fork in the forward end of the cover. Line up the retaining pin hole in the fork with the hole in the shifter fork shaft. Push the shaft into place. Rotate the shaft until the retaining pin hole in the shaft aligns with the hole in the fork. Drive a new retaining pin into the hole and peen it over on both ends.

Install the low and reverse shifter fork in the rear end of the cover. Line up the retaining pin hole in the fork with the hole in the shifter shaft. Push the shaft into place. Rotate the shaft until the retaining pin hole in the shaft aligns with the hole in the fork. Drive a new retaining pin into place and peen it over at both ends.

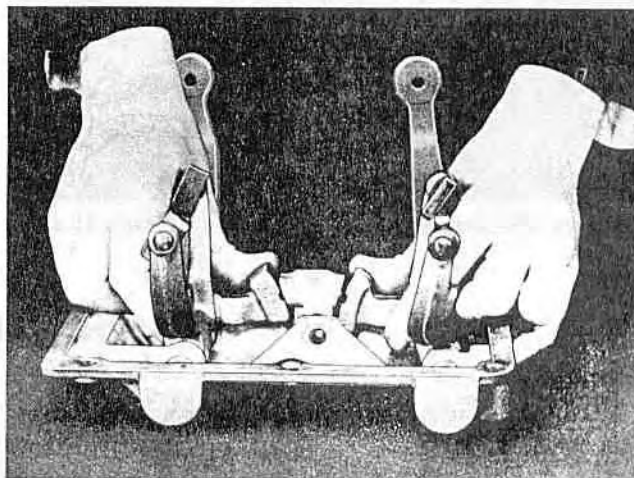


Figure 29—Pushing the Shifter Forks and Interlock Bracket Into Position

TRANSMISSION AND OVERDRIVE

Place the cover on the bench with the top side down. Position the forks so that the upper grooves of the forks (those deepest in the cover) are opposite each other.

Assemble the detent balls, springs, and interlock ball into the interlock bracket. While holding the detent and interlock ball in place, set the interlock balls in place, set the interlock bracket into the cover so that the interlock balls rest in the center grooves of the forks.

Pull the forks toward each other and at the same time push the interlock bracket into position. Install the bracket retaining bolt, flat washers, nut, and cotter pin. Place the smaller flat washer under the head of the bolt and the larger one under the nut.

Move the direct and second speed shifter fork to the direct gear position. Check the clearance between the stop finger on the shifter fork and the stop pad on the transmission cover. Clearance should be .002 to .005 inch when the detent ball is properly seated in the detent groove. If the clearance is less than .002", the additional clearance may be obtained by filing the stop pad in the cover. If the clearance exceeds .005", it can be reduced without disassembling the fork from the cover by holding the fork in the second gear position and striking the finger a sharp blow with a hammer.

Install the direct and second shifting lever on the shifter fork shaft. Install the low and reverse shifting lever on the shifter fork shaft.

Caution: Be sure the levers are so installed that when the cover is held in the upright position and the shifter forks are in neutral, the shifting levers will point downward. Lock the outer levers in place with the lock screws.

Reversing Pinion

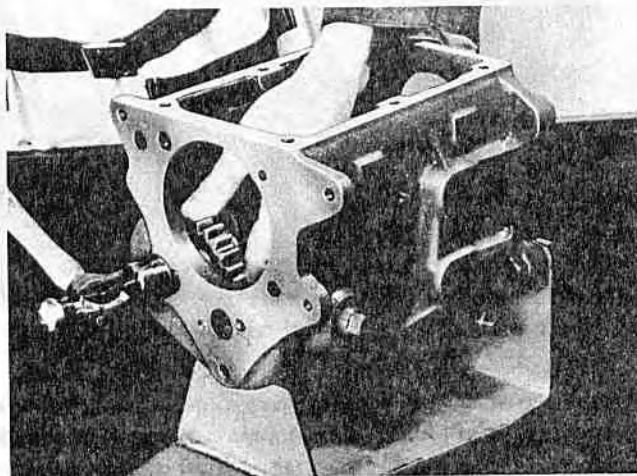


Figure 30—Driving in the Reversing Pinion Shaft

Place the reversing pinion in position in the trans-

mission case with the chamfered side of the teeth forward. Position the reversing pinion shaft so that the Woodruff key is in line with the recess in the case. Drive the reversing pinion shaft into the case until the Woodruff key is seated in the recess.

Countershaft Gear Cluster

Place the countershaft assembly bar J-2559 inside the countershaft gear cluster and slip the long bearing spacer over the assembly bar to the approximate center of the countershaft gear cluster.

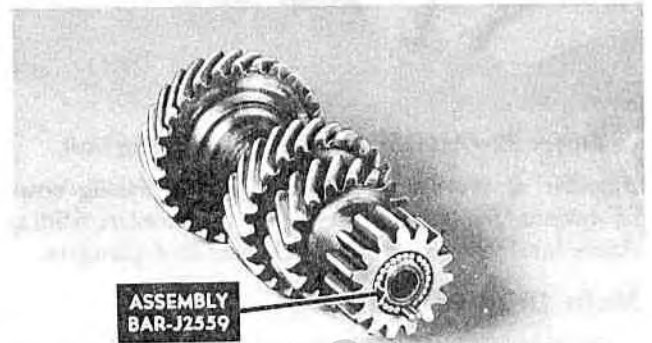


Figure 31—Countershaft Assembly Bar and Rollers in Place

Install one countershaft bearing spacer ring over each end of the assembly bar. Install 25 rollers into each end of the countershaft gear cluster, using heavy cup grease to hold them in place.

Install a steel end plate coated with cup grease at each end of the countershaft gear cluster. Install a bronze thrust washer at each end plate, holding them in place with a film of heavy cup grease. Be sure the locating lips are up and away from the countershaft gear.

Place the entire countershaft gear assembly into the bottom of the transmission case. Do not install the countershaft at this time.

Synchronizing Unit

Install the synchronizer clutch friction ring into each end of the synchronizer clutch gear. Install the three retainer springs.

Place the synchronizer clutch assembly on the bench with the extended hub of the clutch gear up and a block under the opposite end. Install the synchronizer plunger springs and plungers. Hold them in place with the clutch gear clamp J-2563.

Line up the splines of the synchronizer sliding sleeve with the splines of the clutch gear. Then, with the wide

TRANSMISSION AND OVERDRIVE



Figure 32—Assembling the Synchronizing Unit

shoulder of the external shifting groove facing down or toward the bench, press the synchronizer sliding sleeve into place over the clutch gear and plungers.

Main Driving Shaft

On transmissions without overdrive, install the reverse sliding gear on the rear end of the main driving shaft with the shifting groove of the gear toward the rear. Make sure the gear slides freely on the main driving shaft.

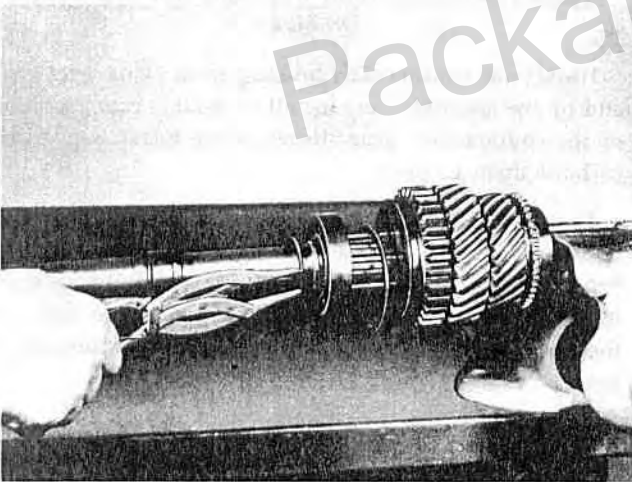


Figure 33—Installing the Transmission Main Driving Shaft Rear Bearing Snap Ring

Install the rear housing snap ring over the main driving shaft. Install the rear bearing and snap ring of the correct thickness. Install the speedometer drive gear Woodruff key, gear, and snap ring. Install the main driving shaft into the rear housing. Insert the bearing snap ring in place.

With a new rear housing gasket in place, install the rear housing, complete with the main driving shaft and gears, into the transmission case. Install the synchronizing unit with the wide shoulder toward the second speed gear. Install the driving shaft front bearing

spacer. Install the rear housing attaching cap screws and torque tighten.

On transmissions with overdrive, install the adapter plate bearing snap ring over the main driving shaft. Install the rear bearing. Install a new rear bearing snap ring of the proper thickness. These snap rings are available in several thicknesses and should be selected to eliminate shaft end play in the bearing.

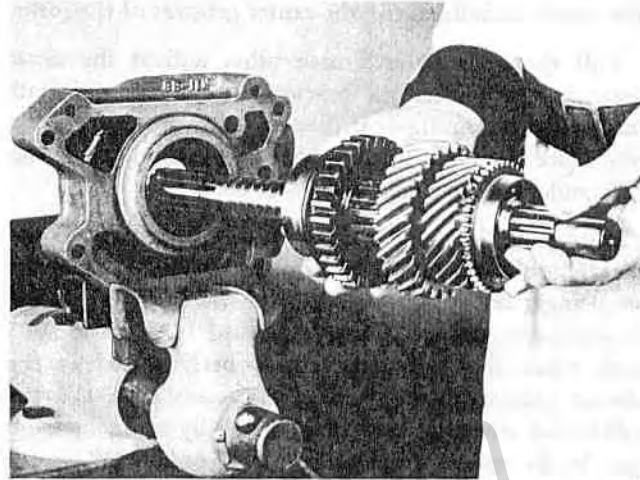


Figure 34—Installing the Main Driving Shaft Into the Overdrive Adapter Plate

Install the main driving shaft bearing oil slinger in the bearing bore of the adapter plate. Install the main driving shaft assembly into the adapter plate. Be sure that the main driving shaft rear bearing, seats in the bore of the adapter plate. Insert the adapter plate bearing snap ring in place.

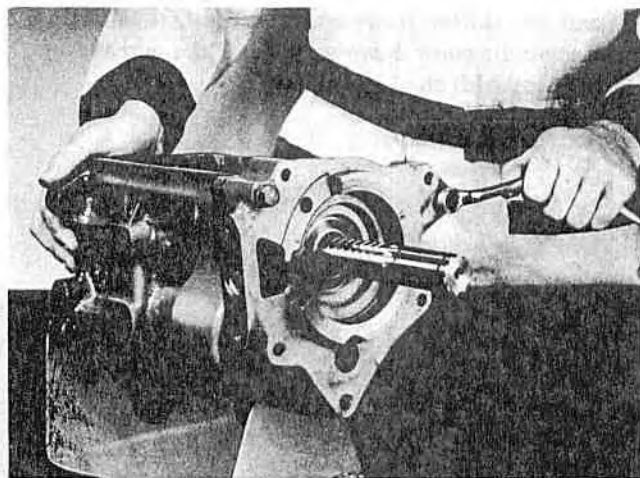


Figure 35—Tightening the Adapter Plate to Transmission Case Cap Screws

With a new adapter plate gasket in place, install the adapter plate complete with the main driving shaft and gears into the transmission case. Install the synchronizing unit and main driving shaft front bearing spacer. Install the two cap screws attaching the adapter plate to the transmission case and tighten.

TRANSMISSION AND OVERDRIVE

Clutch Shaft and Gear

Press the clutch shaft rear bearing into place on the clutch shaft. Install the clutch shaft rear bearing snap ring. Install the main driving shaft front pilot bearing into the bore of the clutch shaft gear.

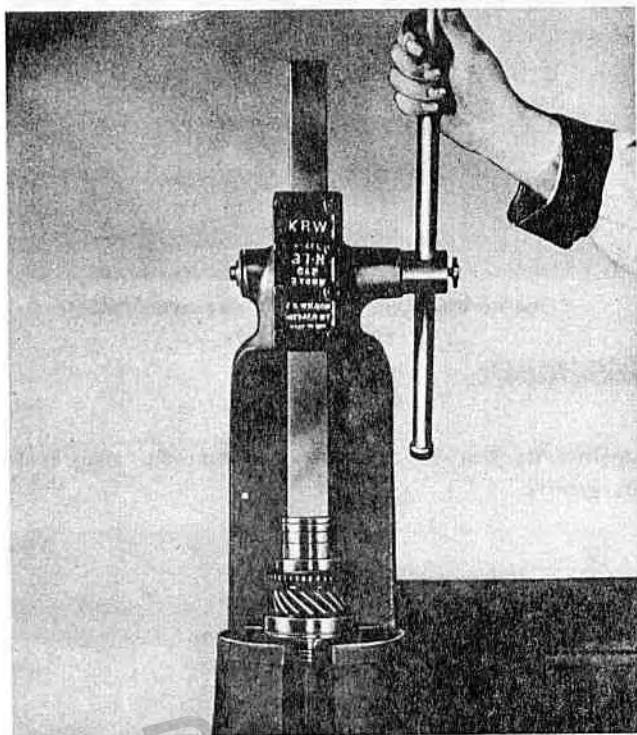


Figure 36—Pressing on the Clutch Shaft Rear Bearing

Install the clutch shaft assembly while supporting and guiding the pilot of the main driving shaft into the bearing in the bore of the clutch shaft gear.

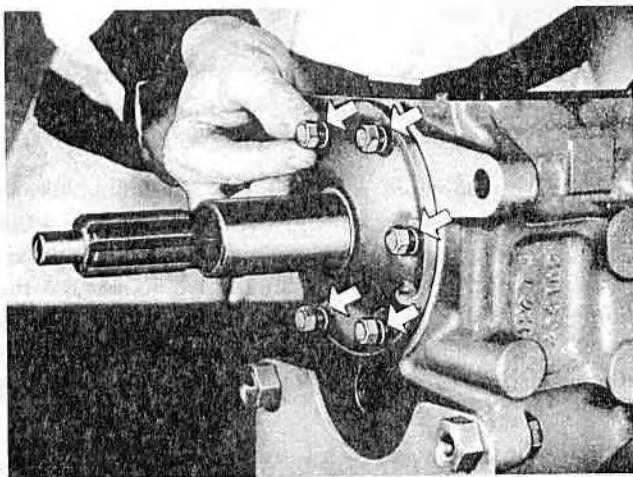


Figure 37—Installing the Clutch Shaft Bearing Retainer Cap Screws and Gaskets

Install the clutch shaft rear bearing retainer using a new gasket. Be sure that the drain passage in the retainer aligns with the passage in the transmission case. Install the retainer cap screws, using new gaskets.

Countershaft

Raise the countershaft gear cluster into position by inserting drifts or screwdrivers through the hole at each end of the case and into each end of the aligning bar.

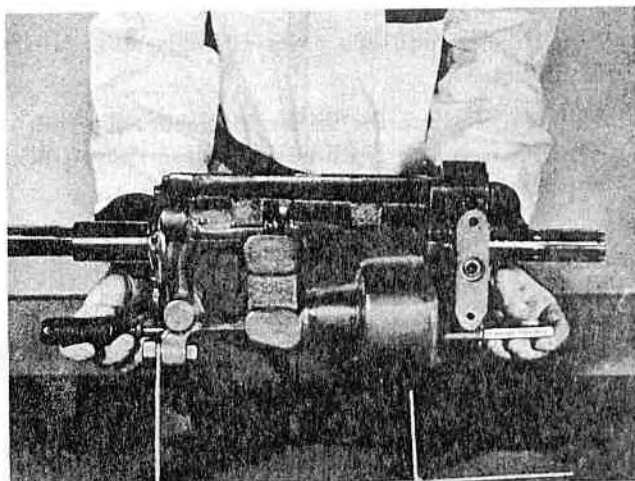


Figure 38—Raising the Countershaft Gear Cluster Into Position

An alternate method of moving the countershaft gear cluster into position is to invert the transmission case with the top side toward the bench. The countershaft gear cluster will then fall into position.

Note: When raising the countershaft gear cluster into position, it may be necessary to turn the thrust washers to either side so that the lips of the washers will line up with the grooves in the transmission case.

While supporting the countershaft gear cluster in position, start the countershaft through the front end of the case. Insert the Woodruff key and align it with the recess in the case.

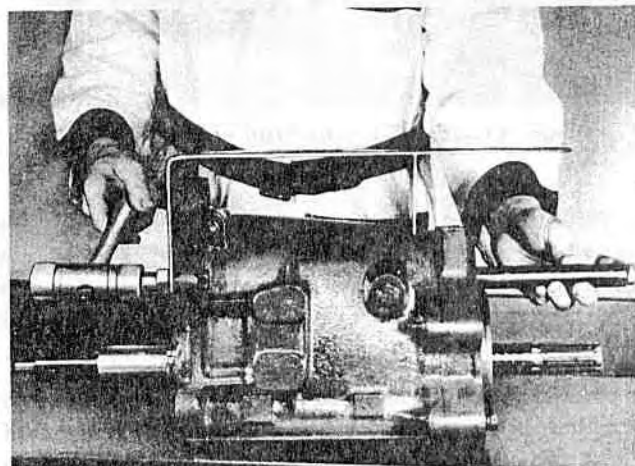


Figure 39—Driving In the Countershaft

TRANSMISSION AND OVERDRIVE

Drive the countershaft into position in the case while holding and guiding the aligning bar out through the hole in the rear of the case. Install the countershaft thrust springs and drive in the thrust spring plugs deep enough so they will not protrude. It may be necessary to rotate the adapter plate to install the thrust springs and plugs.

Install the transmission cover assembly, using a new cover gasket.

Caution: Be sure the shifter fork shoes slip into the groove of the synchronizer sliding sleeve and the reverse sliding gear.

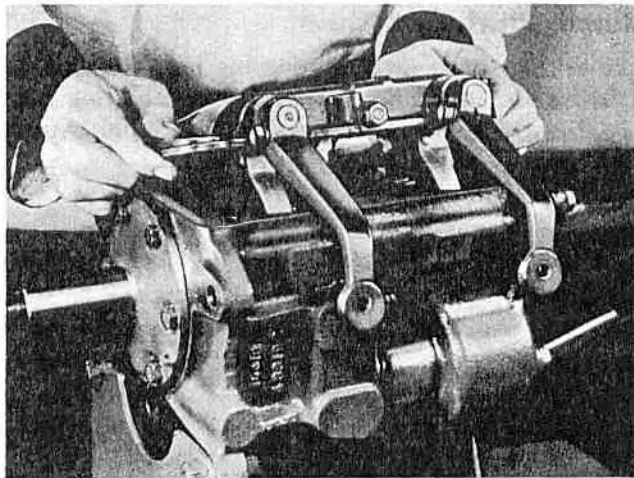


Figure 40—Installing the Cover and Shifter Fork Assembly

OVERDRIVE ASSEMBLY

Prior to installing gears, bearings, or other moving parts, it is advisable to lubricate all surfaces which are subject to friction with transmission oil. This will provide sufficient lubrication until such time as the lubricating oil reaches these parts after the unit is placed in service.

Engaging Mechanism

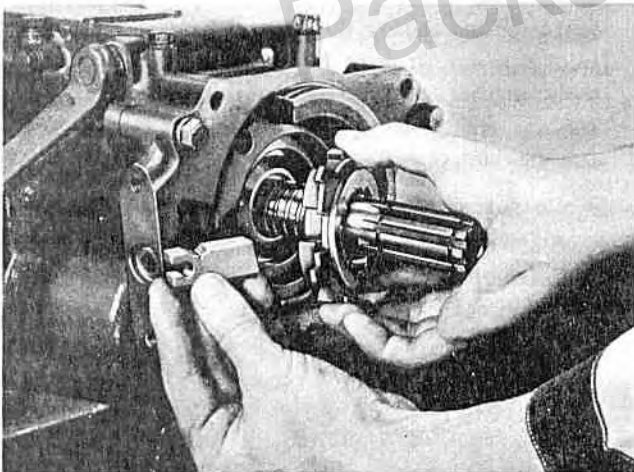


Figure 41—Installing the Stationary Gear Plate and Sliding Pawl

Place the balk ring on the stationary gear plate with the chamfered side of the ring toward the slotted hub of the plate. Place the gear plate in the adapter, and then install the sliding pawl, groove upward, in the adapter.

Install the stationary gear plate cover and the cover retaining ring. Rings are available in thicknesses of .062", .066", and .070". The cover should be held tightly

against its seat in the adapter when the ring is in its groove.

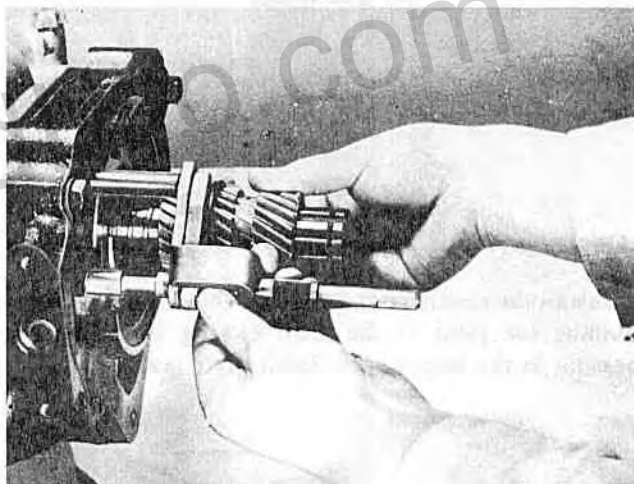


Figure 42—Installing the Shift Rail, Shift Fork, and Stationary Gear

Install the solenoid so that the two terminal screws are toward the rear or toward the overdrive case when it is installed. To install the solenoid, turn it approximately $\frac{1}{4}$ turn clockwise, push inward to engage the plunger with the pawl. Rotate the solenoid $\frac{1}{4}$ turn to the left (counterclockwise) to lock the plunger into the pawl. Install and tighten the solenoid attaching screws.

Install the reverse plunger, shift rail, and shift fork assembly and the stationary gear together, in one operation, as shown in figure 42.

Install the pinion cage assembly front snap ring which was tagged or marked during disassembly. If a new ring is to be installed, the thickness of the new

TRANSMISSION AND OVERDRIVE

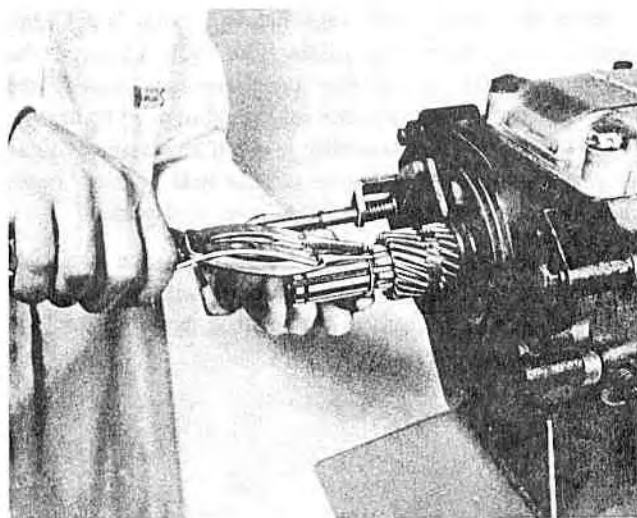


Figure 43—Installing the Pinion Cage Front Snap Ring

ring should be checked to insure installing one of the proper thickness. The ring thickness should be .062", plus or minus .002".

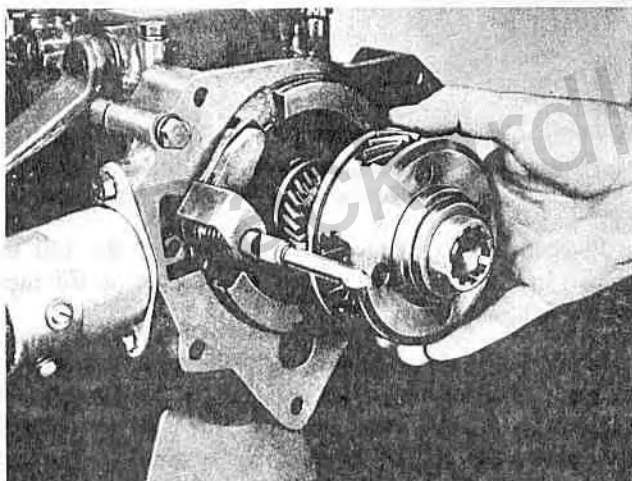


Figure 44—Installing the Pinion and Cage Assembly

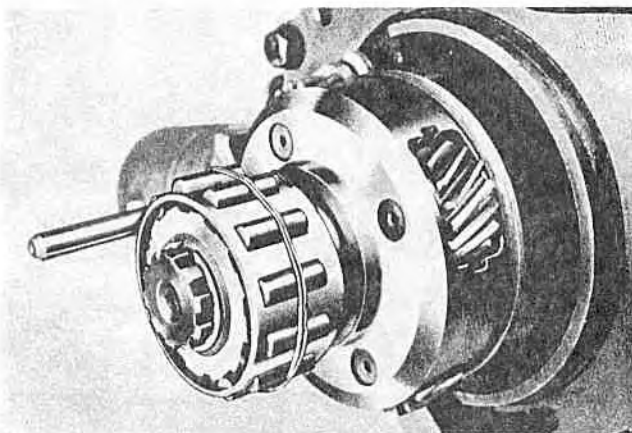


Figure 45—Using a Rubber Band to Hold the Over-Running Clutch Rollers

Slide the pinion and cage assembly and the over-running clutch cam assembly onto the transmission driving shaft and install the over-running clutch cam retaining snap ring. This snap ring is available in thicknesses of .062", .068", and .074". Select and install a ring which will not permit any end play of the pinion and cage assembly and the over-running clutch cam assembly on the transmission driving shaft.

Place the over-running clutch rollers in the roller retainer using a rubber band to hold them in the retainer. Rotate the retainer to the left (counterclockwise) to position and hold the rollers at the bottom of their ramps on the cam.

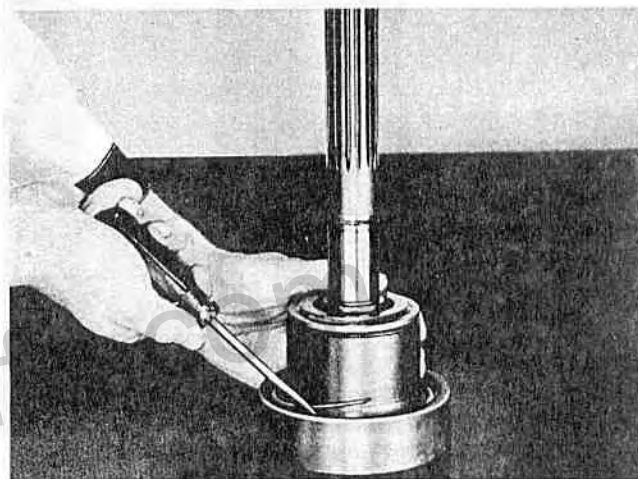


Figure 46—Installing the Ring Gear Retaining Ring

Assemble the ring gear to the main shaft and install the ring gear retaining ring. Rings are available in thicknesses of .055", .057", and .059". Select and install a ring which will not permit end movement of the ring gear on the main shaft.

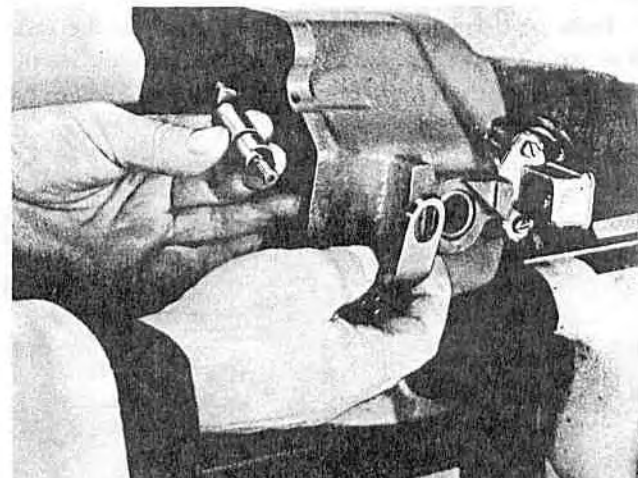


Figure 47—Installing the Overdrive Lockout Lever and Shaft

Insert the lockout lever shaft into its opening from inside the case. Position the shaft so that the cam on

TRANSMISSION AND OVERDRIVE

the inner end is toward the top of the case. With the shaft in this position, install the lockout lever so it is in the overdrive position or nearly against the bottom of the stop on the case. Install the lockout safety switch.



Figure 48—Pressing On the Overdrive Main Shaft Rear Bearing

Press the overdrive main shaft ball bearing on the main shaft tightly against the shoulder, with the outer snap ring groove *away* from the ring gear. Install the speedometer driving gear Woodruff key and install the speedometer driving gear. Install the speedometer driving gear snap ring, using the thickest ring that will go in.

Press or drive the main shaft oil seal into the case. The seal is properly located when the shoulder of the seal retainer is flush with the end of the case.

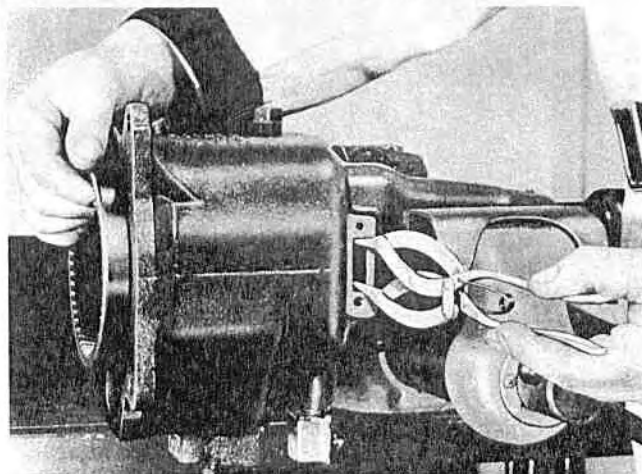


Figure 49—Installing the Overdrive Main Shaft

With the main shaft rear bearing outer snap ring spread, using snap ring pliers KMO-630, through the opening in the top of the overdrive case, install the main shaft assembly into the case, as shown in figure 49. Press the main shaft assembly in until the bearing outer snap ring enters the groove of the ball bearing outer race. Install the inspection hole cover and gasket.

Work the lockout lever and shaft outward as far as possible so the inner end of the shaft will not interfere with the shift rail when the case is being assembled to the adapter.

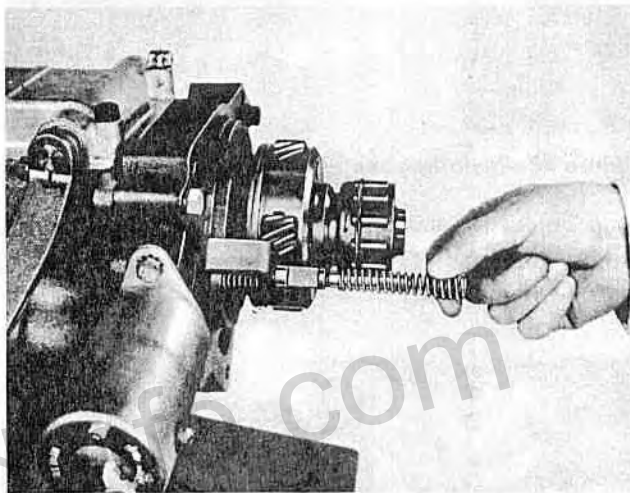


Figure 50—Installing the Shift Rail Retracting Spring On the Rail

Place the shift rail retractor spring on the rail as shown in figure 50, and place a new gasket on the face of the adapter.

Support the case assembly and move it toward the adapter while turning the main shaft to line up the pinions so they can enter the ring gear. Do not attempt to remove the rubber band which is holding the free wheel rollers in the roller retainer. The roller race inside the main shaft will push the rubber band off the

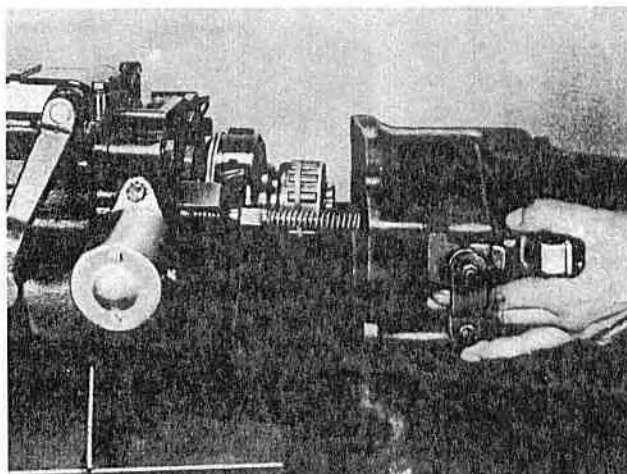


Figure 51—Installing the Overdrive Case

TRANSMISSION AND OVERDRIVE

rollers and the lubricant will dissolve it. When the shift rail retractor spring is in its free position, it extends beyond the end of the rail. It is necessary to compress the spring while pushing the case toward the adapter. It also may be necessary to rotate the case slightly to the right or left or to tilt it upward or downward to permit the end of the shift rail to enter the pilot hole in the case.

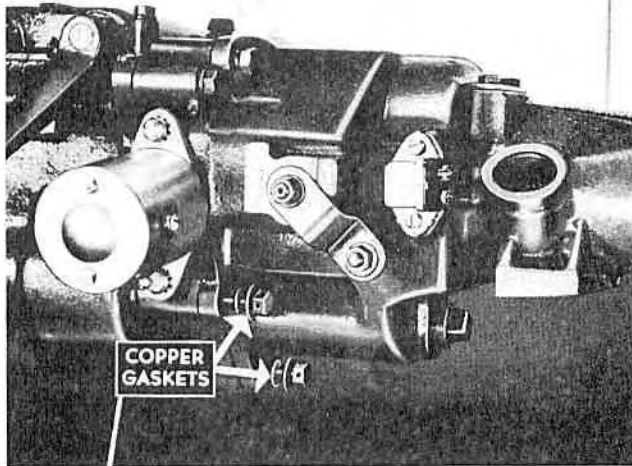


Figure 52—Be Sure Copper Gaskets Are Installed Where Indicated by Arrows

Install the case to adapter retaining screws, using a copper gasket between the case and washer of the screws having drilled heads for lock-wiring, shown in figure 52. Tighten all screws evenly. Install the lockwire.

Transmission and Overdrive Installation

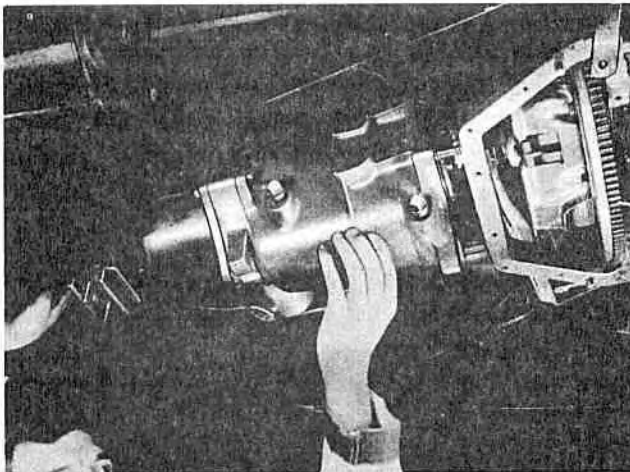


Figure 53—Installing the Transmission

Install the transmission and overdrive assembly and attach it with five cap screws to the clutch housing. Make sure the clutch release bearing retracting spring is connected.

Install the engine rear support mounting. Do not tighten the insulator attaching bolts to the frame cross member. Lower the engine and rock it back and forth to

stabilize the engine supports. Tighten the engine support mounting attaching bolts.

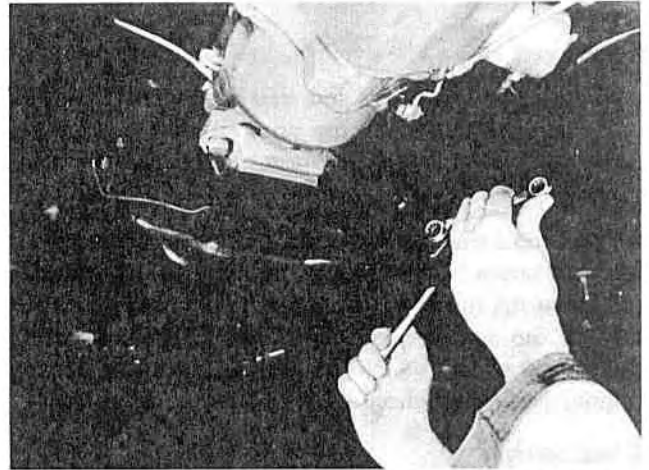


Figure 54—Tightening the Engine Rear Support Mounting Cross Member

Remove the jack or support beam from under the engine. Connect the shifter link rods to their respective levers. Install the governor and tighten, using an overdrive governor wrench J-4653.

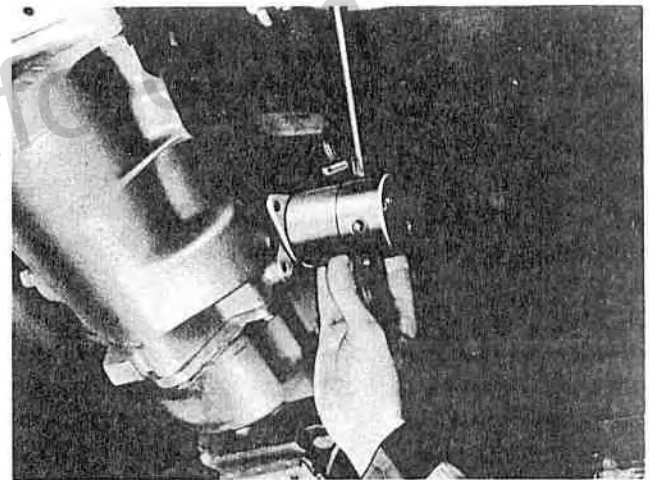


Figure 55—Installing the Solenoid

Install the solenoid so the two terminal screws are toward the rear. Turn the solenoid $\frac{1}{4}$ turn clockwise and push the solenoid in to engage the plunger with the pawl. Turn the solenoid $\frac{1}{4}$ turn counterclockwise to lock the plunger in the pawl. Install and tighten the solenoid attaching screws.

Connect the governor and solenoid leads to their correct terminals.

Connect the speedometer cable. Connect the overdrive lockout cable to the lockout lever on the side of the case.

Install the propeller shaft and connect the universal joint.

Fill the transmission and overdrive case to level with the proper lubricant. Lower the car to the floor and road test it.

TRANSMISSION AND OVERDRIVE

SERVICING THE GEARSHIFT LINKAGE

Removal

Remove the horn ring and steering wheel. Raise the front floor mat to clear the area around the steering column. Remove the steering gear and brake pedal floor opening cover.

Disconnect the shifting rods from the gearshift shaft levers. Loosen the "U" clamp around the steering column at the steering gear. Remove the steering column bracket cap at the instrument panel. Disconnect the directional signal switch cables. Remove the steering column jacket and shroud assembly.

Disassembly

Remove the gearshift shaft lower pivot "U" clamp. Screw the lower pivot counterclockwise and remove it from the gearshift shaft. Remove the lower shaft lever.

Drive out the selector pin. Remove the selector and selector rod spring. Remove the upper gearshift shaft lever.

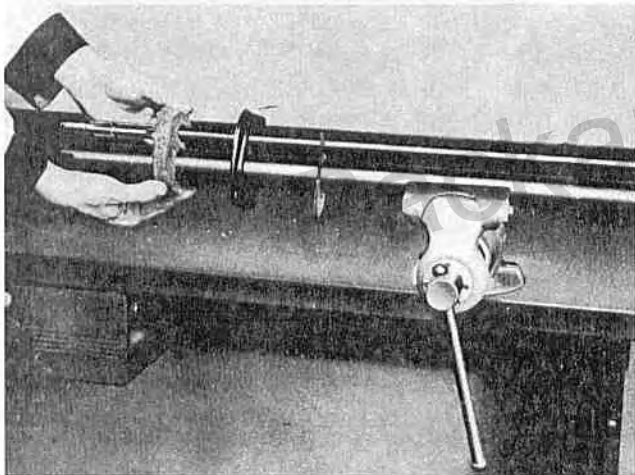


Figure 56—Removing the Steering Column Draft Pad

Remove the directional signal switch and the windshield wiper control from the shroud. Remove the gearshift lever. Remove the steering column draft pads. Remove the gearshift shaft upper spring lock in the upper end of the shroud. Remove the shroud to jacket attaching screws.

Remove the shroud and gearshift shaft from the column jacket. Remove the gearshift shaft from the shroud. Remove the selector rod from inside the gearshift shaft.

Cleaning and Inspection

Wash and dry all parts. Inspect all parts for wear and damage. Carefully inspect the shaft levers and selector

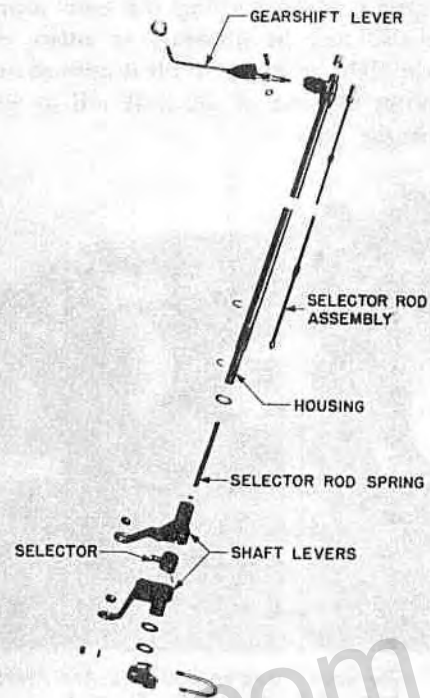


Figure 57—A Disassembled Steering Column Gearshift Linkage

for wear. Replace all parts that do not meet inspection standards.

Assembly

Lubricate all moving parts with "Lubriplate." Install the selector rod inside the gearshift shaft. Locate the gearshift shaft in the shroud and install the shroud over the steering column jacket. Be sure the gearshift shaft enters the bearing in the jacket. Install the attaching screws.

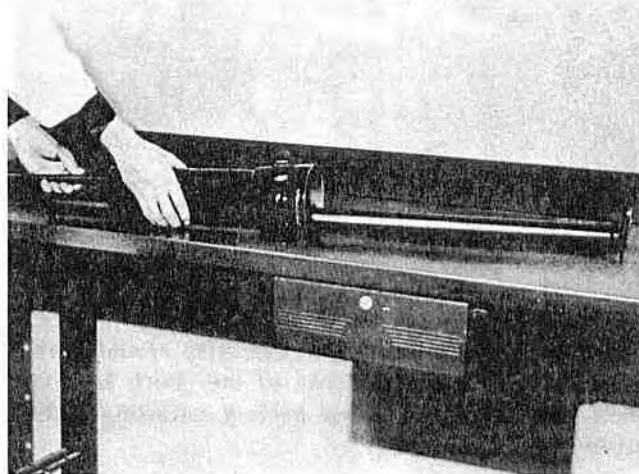


Figure 58—Installing the Shroud Over the Steering Column Jacket

TRANSMISSION AND OVERDRIVE

Install the gearshift shaft upper spring lock in the upper end of the shroud. Install the steering column draft pads. Install the gearshift lever. Install the directional signal switch and windshield wiper control.

Install the gearshift shaft upper lever. Install the selector rod spring, spacer, and selector. While holding the spring compressed, drive in the selector pin. Lubricate the selector and shaft levers with "Lubriplate."

Install the gearshift shaft lower lever and washer. Lubricate the threads of the lower pivot and install it on the gearshift shaft by turning it on "clockwise." Adjust the lower pivot so there is .025" clearance at the lower shaft lever. Locate the pivot dowel in the locating hole in the column jacket. Install the "U" clamp and tighten the nuts.

Installation

Install the steering column jacket and shroud assembly. Install the bracket cap, but do not tighten at this time. Connect the directional signal cable connector. Connect the windshield wiper control.

Install the steering wheel and horn ring. Adjust the position of the jacket and shroud so there is approximately $\frac{1}{16}$ " clearance between the steering wheel and the shroud. Tighten the "U" clamp around the steering column jacket at the steering gear. Tighten the steering column jacket bracket cap.

Connect the gearshift rods to the shaft levers. Adjust the rods in neutral, so that a $\frac{1}{8}$ " drill rod may be inserted through the hole in both shaft levers, when the gearshift lever is slightly above a horizontal position.

Connect the horn wire. Install the steering gear and brake pedal floor opening cover. Install the front floor mat in place. Road test the car. Readjust the gearshift rods if necessary.

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TRANSMISSION AND OVERDRIVE

TROUBLE SHOOTING AND CORRECTIVE MEASURES

CONDITION	POSSIBLE CAUSE	CORRECTION
1. Transmission buzz or rattle.	This condition is caused by a natural engine period that causes the transmission and overdrive gears to rattle in their clearances. It is more noticeable on overdrive-equipped cars because there are more gears and shafts to rattle in their clearances. On overdrive-equipped cars it comes in a slightly lower speed because of the slower rear axle ratio.	
	There are three causes that may exaggerate and aggravate this condition.	
	(a) Transmission and overdrive oil too light.	(a) Change transmission and overdrive oil to the correct grade.
	(b) Clutch driven plate grease soaked.	(b) Check the clutch driven plate and replace it with a new one if it is found to be grease soaked.
	(c) Low friction lag clutch driven plate on an overdrive-equipped car.	(c) If the rattle is still objectionable, install a new "high friction lag" clutch disc, which will help to minimize the rattle. It must be remembered that in some cases the rattle cannot entirely be eliminated.
2. Failure of overdrive to engage. (Electrical causes.)	(a) Burned out fuse in overdrive main feed circuit.	(a) Remove the fuse and examine. Install a new fuse of the correct capacity if necessary.
	(b) Faulty governor.	(b) Test the governor. Install a new governor if necessary.
	(c) Faulty overdrive relay. May be indicated by no operation in the overdrive electrical circuit, after the fuse and governor check O.K.	(c) Install a new overdrive relay.
	(d) A faulty solenoid.	(d) Test the solenoid circuits with a test lamp. Install a new solenoid if necessary.
3. Failure of overdrive to engage. (Mechanical causes.)	(a) Failure to engage.	(a) Remove the solenoid and check the pawl for free movement. If the pawl is sticking, the overdrive must be disassembled and the pawl freed up.
	(b) Solenoid plunger sticking. This condition may be caused by the solenoid spacer being installed in the wrong position, which would cause a bind on the solenoid plunger.	(b) Remove the solenoid and check the position of the spacer. Note that the plunger hole is not in line with the bolt holes. Install spacer in the correct position.

TRANSMISSION AND OVERDRIVE

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CONDITION	POSSIBLE CAUSE	CORRECTION
3. Failure of overdrive to engage. (Mechanical causes.) (Continued)	(c) Faulty balk ring on the stationary gear plate. This is generally indicated by spasmodic engagement of the overdrive and very harsh engagement at times.	(c) Disassemble the overdrive. Check drag of balk ring on the stationary gear plate. Install a new balk ring if drag is too slight.
4. Failure to disengage.	(a) Faulty governor.	(a) Test the governor. Install a new governor if necessary.
	(b) Sticking engaging pawl.	(b) Remove the solenoid. Check for free movement of the pawl. Disassemble the overdrive if necessary to free up the pawl.
	(c) Failure to disengage on the "kick-down" is generally caused by a faulty kickdown switch.	(c) Test the kickdown switch with a test lamp. Install a new kickdown switch if necessary.
	(d) "Ground-out" lead disconnected at the distributor or coil.	(d) Connect the "ground-out" lead at the distributor or coil primary terminal.
	(e) Overdrive relay faulty. Ground-out unit not operating.	(e) Check operation of the relay with test lamp. Install a new relay if necessary.
5. Failure to lock out the overdrive.	(a) Lock-out cable disconnected or out of adjustment.	(a) Connect overdrive lock-out cable and adjust properly.
	(b) Failure to lock out the electrical units after the overdrive is mechanically locked out is generally caused by a shorted lock-out switch.	(b) Install a new lock-out switch.
6. Failure to lock out overdrive when shifting lever is placed in reverse gear position.	(a) Sun gear sticking, which may be caused by congealed lubricant in cold weather.	(a) Drain transmission and overdrive. Refill with new lubricant of the correct grade.
	(b) Burred or worn splines on the sun gear or the internal splines on the planetary cage.	(b) To check for this condition, pull out the control knob of the instrument panel. Usually this will shift to the lockout position. To make a further check, the control cable can be disconnected at the lock-out lever on the overdrive case. Then by operating the lever by hand it is possible to feel whether the sun gear is sliding freely and traveling the full distance. If the sun gear cannot be shifted easily, disassemble the overdrive and replace any worn or burred parts.

TRANSMISSION AND OVERDRIVE

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CONDITION	POSSIBLE CAUSE	CORRECTION
7. "Lock-up" in reverse gear. This condition in the overdrive unit, after the transmission has been shifted into reverse gear and the power applied, is usually caused by a faulty condition in the overdrive electrical system. However, this condition also may be caused by faulty operation of the mechanical parts or in the units of the overdrive.	(a) Contact points of the governor closed or sticking.	(a) Test the governor. Install a new governor if necessary.
	(b) Lock-out switch grounded.	(b) Test for grounds with a test lamp. Install a new switch if necessary.
	(c) Kickdown switch grounded.	(c) Test the kickdown switch for being grounded. Install a new switch if necessary.
	(d) Overdrive relay contacts closed or sticking. Relay terminals grounded.	(d) Test the relay. Inspect the relay terminals for being grounded. Install a new relay if necessary.
	(e) Overdrive electrical wiring grounded.	(e) Test the wiring for grounds with a test lamp. Repair or replace the faulty wiring.
	If the overdrive electrical system is in normal operating condition, the lock-up may be caused by any of the following mechanical conditions:	
	(f) Stationary gear plate engaging pawl sticking.	(f) Remove the solenoid attaching bolts. Check the engaging pawl for free movement. If the pawl is sticking, disassemble the overdrive and correct the sticking condition.
	(g) If the overdrive solenoid has been removed, it may be possible that the solenoid spacer was installed in the wrong position causing a bind on the solenoid plunger.	(g) Remove the solenoid. Check the position of the spacer. Note: The plunger hole is out of line with the bolt holes. Install the spacer in the correct position. Install the solenoid.
	(h) Broken engaging pawl.	(h) Remove the solenoid and check the engaging pawl. If the pawl is broken, disassemble the overdrive and install a new pawl.
(i) Engaging pawl disconnected from the solenoid plunger.	(i) Remove the solenoid. Check for pawl being disconnected from the plunger. Install the solenoid making sure the knob on the end of the plunger is engaged in the slot of the pawl.	

TRANSMISSION AND OVERDRIVE

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CONDITION	POSSIBLE CAUSE	CORRECTION
8. Transmission and overdrive oil leaks.	(a) Worn or faulty overdrive tail shaft oil seal.	(a) Install new tail shaft oil seal. Procedure is the same as replacing tail shaft bearings.
	(b) Worn or faulty transmission main driving shaft extension oil seal.	(b) Install new extension oil seal.
	(c) Oil leaks around the clutch shaft rear bearing retainer cap screws.	(c) Remove the transmission and install new copper gaskets under the heads of the clutch shaft rear bearing retainer cap screws.
9. Locking or sticking in gear.	(a) Transmission lubricant that is too heavy gets so congealed in cold weather that a great pressure is required to shift into gear or into neutral. In this case, even with a small amount of stretch and lost motion in the linkage the movement of the gear may be held back enough that the selector lever may drop back into neutral before the gears are out of mesh.	(a) Drain transmission. Refill with lubricant of the proper grade for winter driving.
	(b) Burred or battered teeth on the low and reverse sliding gear will make shifting difficult, due to the drag of the battered teeth. The effect will be similar to that of congealed transmission lubricant.	(b) To check for this condition leave the steering column shifting lever in the neutral position. Then, underneath the car, disconnect the low and reverse shifting rod. Move the low and reverse shifting lever on the transmission cover in and out of gear. If an excessive drag is noticed with the proper lubricant, the transmission should be removed, disassembled, and the gears inspected. Replace any worn or damaged parts.
	(c) Worn gear shifting linkage is most likely the cause of locking or sticking in gear. Although it may seem very slight at any one point, a little wear or looseness at each connection throughout the linkage will add up to the point where the total lost motion will permit the selector to drop back into neutral while the gears are still meshed.	(c) Recondition the linkage in the following procedure: Check the movement of the levers at the transmission cover. If the holes in the levers are worn, install new levers. Be sure to tighten the pinch bolts on the levers. If the shifting rod ends are worn install new shifting rods. Check the idler levers for wear in the bushings and in the pin holes in the ends of the levers. Install new levers, pins and clevises if necessary. Inspect the steering column selector levers for wear. Install new selector levers if necessary. Accurately align the shifting levers and adjust the linkage.

TRANSMISSION AND OVERDRIVE

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CONDITION	POSSIBLE CAUSE	CORRECTION
10. Gearshift lever rattle.	(a) Worn gearshift linkage.	(a) Recondition the gearshift linkage. Replace any worn or faulty parts.
	(b) Pivots of the idler levers lubricated. Friction washers are used on the pivot bearings to provide a dampening effect. Lubrication will reduce the dampening effect and permit free movement of the shifting lever and a possible rattle.	(b) Wash off the idler lever pivots with clean unleaded gasoline. Install new friction washers.
	(c) Worn or faulty selector rod bumpers will permit the selector rod to rattle.	(c) Disassemble steering column gearshift shaft and housing. Install new selector rod bumpers.
11. Locking or sticking in gear. Transmission may be forced into two gears at the same time.	(a) A transmission that will lock or stick in gear, due to worn gearshift linkage and levers, and permit the driver to "force" his way into two gears at the same time, is usually accompanied by a loose or worn interlock block on the transmission cover.	(a) Remove the transmission cover. Inspect the detent and interlock grooves on the shifter forks. Inspect the interlock block for wear or looseness. Install all necessary new parts. On complaints where the transmission is subject to hard usage or abuse, it is recommended that a complete new transmission cover assembly be installed if the shifter forks and interlock block are worn.