

Section M

TRANSMISSION (All Models)

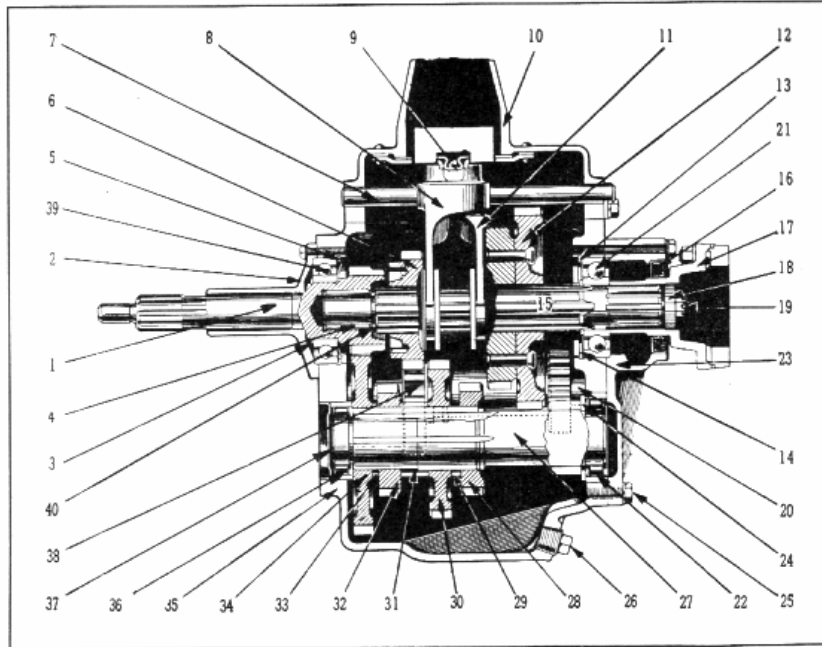


Fig. 1—Sectional View of Transmission

- | | |
|--|---|
| 1. Main Drive Gear. | 21. Mainshaft Rear Bearing. |
| 2. Front Bearing Retainer. | 22. Countershaft Rear Bearing. |
| 3. Main Drive Gear Bearing Lock—Small. | 23. Rear Bearing Retainer. |
| 4. Mainshaft Front Bearing. | 24. Countershaft Rear Bearing Thrust Washer. |
| 5. Main Drive Gear Bearing Lock—Large. | 25. Rear Bearing Retainer Bolt—Short. |
| 6. Mainshaft 3rd and 4th Speed Sliding Gear. | 26. Drain Plug. |
| 7. 3rd and 4th Speed Shift Rod. | 27. Countershaft. |
| 8. 3rd and 4th Speed Shift Fork. | 28. Countershaft 2nd Speed Gear. |
| 9. Shift Fork Interlock. | 29. Countershaft 2nd and 3rd Speed Gear Spacer. |
| 10. Transmission Cover. | 30. Countershaft 3rd Speed Gear. |
| 11. 1st and 2nd Speed Shift Fork. | 31. Countershaft 3rd and Reverse Gear Spacer. |
| 12. 1st and 2nd Speed Sliding Gear. | 32. Countershaft Reverse Gear. |
| 13. Mainshaft Rear Bearing Lock. | 33. Countershaft Reverse & Driven Gear Spacer. |
| 14. Mainshaft Rear Bearing Spacer. | 34. Countershaft Driven Gear. |
| 15. Mainshaft. | 35. Transmission Case. |
| 16. Mainshaft Rear Oil Seal. | 36. Countershaft Front Bearing. |
| 17. Mainshaft Flange. | 37. Countershaft Front Bearing Spacer. |
| 18. Mainshaft Flange Washer. | 38. Reverse Idler Gear. |
| 19. Mainshaft Flange Nut. | 39. Main Drive Gear Bearing. |
| 20. Reverse Idler Shaft. | 40. Mainshaft Front Bearing Spacer. |

The transmission is a selective sliding gear type with four speeds forward and one reverse.

The case is made of cast iron, accurately machined to give the proper alignment of the gears and their shafts. All of the gears are machined from drop forged steel gear blanks, and are heat-treated for strength and long life. The shafts are machined from high grade steel, and are heat-treated and ground to close limits.

The correct sequence of shifting and the proper shifting positions are shown in Fig. 2.

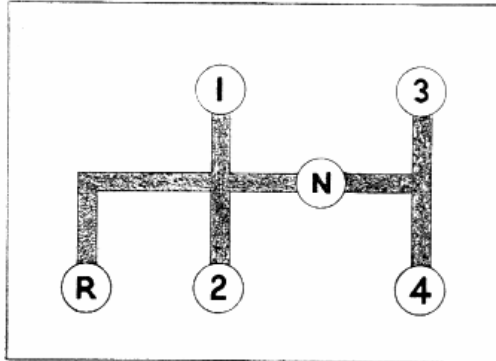


Fig. 2—Gear Shifting Diagram

The main drive gear (1, Fig. 1) or clutch gear, is supported by a heavy duty ball bearing, front transmission bearing. The forward end of the shaft is supported by a straight Hyatt roller bearing in a recess in the crankshaft and the rear end of the shaft is recessed for a Hyatt roller bearing which supports the front end of the transmission main shaft.

The forward end of the transmission main shaft (15) is supported by a straight roller bearing (4) in a recess in the rear end of the main drive gear (1). The rear end of this shaft is supported on a large annular ball bearing (21) in the rear of the transmission gear case.

The countershaft (27) is supported at each end by large roller bearings (22 and 36). The countershaft end play is controlled by a bronze thrust washer (24) at the rear end.

The reverse idler gear (38) is carried on a stationary shaft (20) and has pressed-in bronze bushings. The reverse idler gear is a sliding type engaging the integral gear on the countershaft and low speed gear on the main shaft when the gear shift lever is in the reverse position. With this type of construction, the reverse idler gears rotate only when in use.

Removal of Transmission

1. Remove the floor plates and disconnect the emergency brake pull rods.
2. Drain the oil from the transmission and remove the transfer case shift tower bracket from side of the transmission.

3. Remove the bolts holding the front universal joint and allow it to drop free from the rear of the transmission as described in the "Drive Shaft" section of this manual.
4. Remove the lower clutch housing.
5. Remove the two upper transmission support screws, and install two guide pins J1162.
6. Remove the two lower transmission support screws from the inside of the clutch housing.
7. Pull the transmission straight back until the splined shaft is clear of the clutch disc hub. This is very important because if the rear of the transmission is lowered while the shaft is still in the driven disc hub, the disc will be sprung or distorted so as to require replacement.

Replacement of Transmission

Reinstall the transmission in the reverse order in which it was removed, being particularly careful not to permit the transmission to get out of alignment after the splined shaft enters the clutch hub. The rear of the transmission must be supported until the upper clutch housing bolts are installed.

Check the adjustment of the hand brake after the transmission is installed.

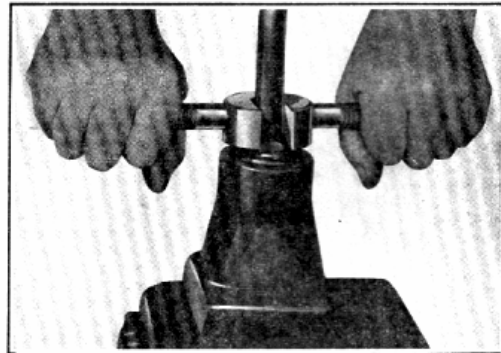


Fig. 3—Removing Gearshift Lever

DISASSEMBLY: (Refer to Fig. 1)

1. Mount the transmission in a holding fixture.
2. To remove the gearshift lever, slide the open side of tool No. K-353 gearshift lever remover, shown in Fig. 3 over the lever. Engage the lugs in the tool in the open slot of the retainer. Then press down on the tool and turn it to the left to disengage the lugs on the retainer. Lift the lever out of the cover.
3. Remove the transmission cover assembly and place the transmission in two gears at once to lock the mainshaft.
4. Remove the cotter pin and castle nut (19) which retain the universal flange (17) to the mainshaft. Loosen the oil seal retaining cap screws as the flange is being pulled from the shaft, in order to prevent damage to oil seal.

5. To remove the main drive gear (1), take out the screws holding the front bearing retainer (2) and pull out the gear.
6. To remove the main shaft (15) take out the screws holding the rear bearing retainer (23), slip the bearing (4) off the forward end of the shaft and drive the shaft toward the rear until the bearing (21) clears the case.
The mainshaft can now be withdrawn, towards the rear, and the sliding gears (6 and 12) lifted out through the top of the case.
7. To remove the reverse idler, drive out reverse gear idler shaft (20) front to rear and lift out the gear assembly (38).
8. To remove the countershaft (27) and gear assembly, drive the countergear assembly to the rear to remove the rear bearing (22). Remove the countergear assembly out through the top of the case and drive out the countershaft front bearing (36) and spacer (37) by tapping around the outer race of the bearing.
9. The main drive gear bearing (39) and the main shaft bearing (21) must be removed by supporting the inner race of each bearing on an arbor press, and pressing on the end of the shaft until it is free of the bearing. It will be necessary to remove the snap ring (3) using snapping pliers similar to J-1466, before pressing the main drive gear bearing from the shaft, Fig. 4.

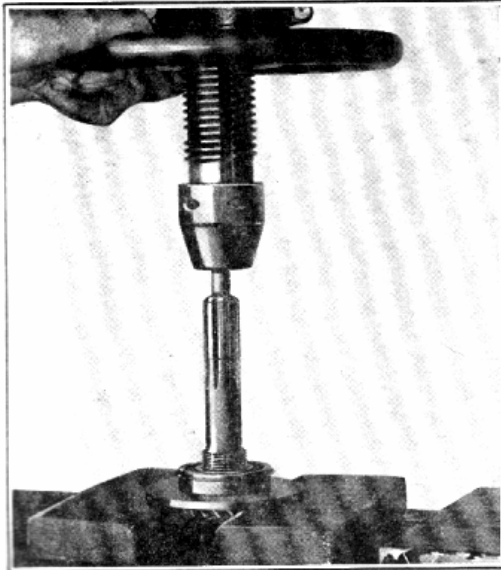


Fig. 4—Removing Clutch Gear Bearing

Cleaning and Inspection

1. Clean all parts carefully in gasoline or any other suitable cleaning fluid and blow them dry with compressed air

2. All bearings should be thoroughly cleaned. Allow the bearings to soak in gasoline or other cleaning fluid so as to loosen all the hard grease and foreign matter. Tap the bearing sharply on a block of wood several times to dislodge any solid particles. Slush them again in the cleaning fluid and blow them dry, directing the air through the bearing. Never use air on the bearings in a direction to spin the races.
3. After blowing them dry, apply engine oil and turn the bearings slowly by hand to test them for any worn spots or pitted balls or races. Then cover the bearings to protect them from dust and other foreign matter until they are ready for use.
4. Examine the teeth on all gears carefully for nicks and "gald" spots. Do not take chances with gears which are appreciably nicked or scored.
5. Inspect the faces of gear teeth. Cracked or chipped teeth or spots where the case hardening is worn through, render the gears unfit for further use. Any such gears should be replaced with new ones.
6. Inspect the splines on the mainshaft and on the main drive gear for evidence of twisting. Place the sliding gears on the mainshaft and check the clearance along the splines. If this clearance is not within .0035" and .0065", or if the shaft is badly scored or twisted, new parts should be installed.
7. Inspect the thrust washers. If they are damaged or worn so that they are beyond the limits shown in the "Specifications" at the end of this section they must be replaced.

Rear Bearing Oil Seal—(Refer to Fig. 1).

The oil seal (16) used at the rear end of the mainshaft (15) is a spring loaded leather type, which contacts the sleeve on the propellor shaft flange (17) (or yoke), thus any losses of lubricant at this point is reduced to a minimum. The spring in the seal holds the leather tightly against the flange at all times. The seal is held in place by a flange to which the seal is fastened; which is held by the same bolts that hold the mainshaft rear bearing retainer (23). The seal should be replaced whenever the transmission is removed for overhaul. Before installing a new oil seal, it should be thoroughly soaked in engine oil. (it is advisable to always keep a small stock of these seals in oil so that they will be ready for instant use). When pressing the new seal into the bearing retainer care should be used to line up the bolt holes in the seal with the bolt holes in the retainer.

Reverse Idler Shaft Disassembly

If the bushings in the idler gear show signs of wear, they should be removed from this gear with the special tool J-1662.

This same tool may be used to replace these bushings in the gear, see Fig. 5. After the new bushings have been installed they should be reamed to .876"-.877".

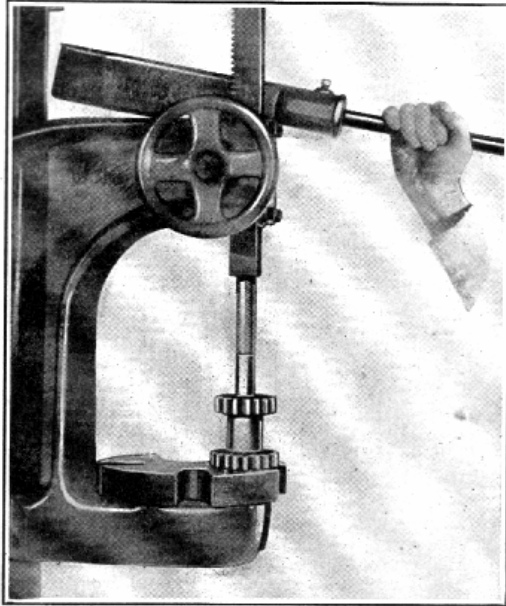


Fig. 5—Idler Gear Bushing Replacement Tool

leaving a minimum clearance of .002" between the bushings and shaft for proper lubrication, using reamer KMO-34-G.

Countershaft Disassembly

Should it be necessary to replace the gears on the countershaft, the old gears should be pressed off the shaft using an arbor press. The low speed gear is integral with the shaft and cannot be removed.

REASSEMBLY (Refer to Fig. 1).

All the Bearings, Thrust Washers and Bushings should be lubricated with gear oil before assembling, to prevent scoring when the transmission is first put into use. Also, gaskets used for this Transmission should be renewed and coated with some suitable sealing material when the transmission is re-assembled.

Countershaft Assembly

Press the countershaft gears on the countershaft (27) with an arbor press. Care should be taken in re-assembling to make sure that the four keys between the shaft and the gears are pricked punched in place. Any burrs set up by prick punching the keys should be filed off.

When re-assembling the gears to the countershaft, care must be used to place the gears and spacers in correct position. The correct sequence is as follows:—

1. The second speed gear (28) Fig. 1, with the chamfered side of the gear towards the low speed gear, or rear end of the countershaft.

2. The second and third gear spacer (29), Fig. 1, $\frac{1}{4}$ " wide.
3. The third speed gear (30) Fig. 1, the chamfered side of the gear faces the reverse gear, or towards the front of the countershaft.
4. The third and reverse gear spacer (31) Fig. 1, $\frac{7}{8}$ " wide.
5. The reverse gear (32) Fig. 1, with the chamfered side of the gear towards the third speed gear, or towards the rear of the countershaft.
6. Reverse gear to counter drive gear spacer (33), Fig. 1, is $\frac{5}{32}$ " wide.
7. Install counter drive gear.

The illustration, Fig. 6, shows the order in which the gears are pressed on the shaft.

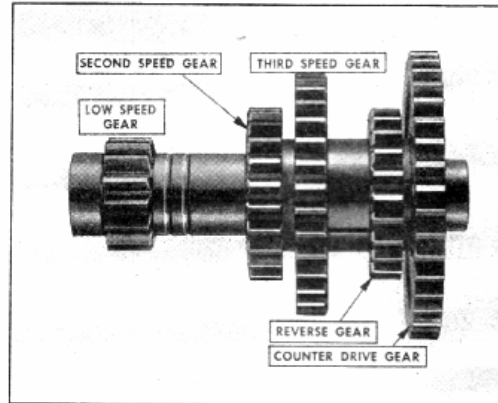


Fig. 6—Counter Shaft and Gear Assy.

When pressing the gears on the countershaft, the round keys should be used to keep the keyways lined up. After the gears are pressed into place, the round keys should be driven down $\frac{1}{32}$ " below flush with the gear. Any burrs set up should be filed down smooth.

Assemble the countershaft front bearing (36) and spacer (37) in place in the transmission case (35), making sure that the bearing is tight against the spacer, and that the spacer is flush with the front surface of the case. Place the countershaft and gear assembly in position and install the thrust washer (24) and rear bearing (22), as shown in Fig. 7.

Assemble the rear bearing retainer and gasket to the case, tightening the cap screws.

In checking the clearance between the low speed gear and the thrust washer, proceed as follows:—

Using a small pry bar, crowd the counter gear assembly against the rear bearing to make sure that the bearing is seating against the rear retainer; crowd the counter gear assembly against the front bearing, making sure not to force the welch plug out beyond the front face of the transmission case. Now check the clearance between the low speed

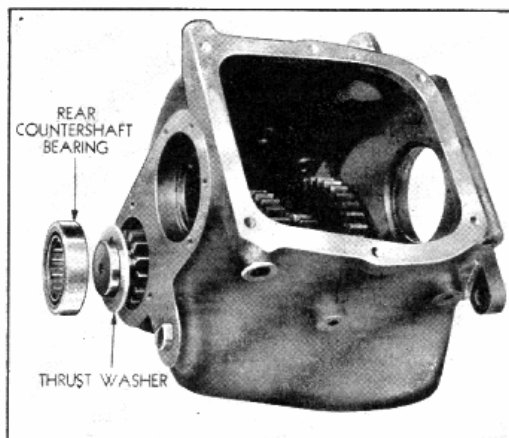


Fig. 7—Assembling Thrust Washer and Roller Bearing on Rear End of Counter Shaft.

gear and the rear end of the countershaft (27, Fig. 1), and the thrust washer (24, Fig. 1).

If the end play of the counter gear assembly is less than .012", remove the assembly from the transmission and pressing on the front main drive gear, force the complete train of gears further onto the countershaft, enough to give the required end play when the assembly is re-installed in the transmission case. When finally re-assembling the transmission, make sure that the counter gear bearings are forced outward, as covered in the preceding paragraph.

In cases where there is excessive end play in the counter gear assembly when overhauling a transmission, but the gears are not being removed from the shaft and the thrust washer is not scored, the end play can be reduced to within specifications (.012"-.017"), .015" is desirable) by adding shims as necessary between the welch plug and the counter gear front bearing.

Reverse Idler Shaft Assembly

Install the reverse idler gear (38) with the small gear toward the rear, and drive the idler gear shaft (20) into position from the rear to the front, being careful to have the flat machined surface on the end of the shaft in a vertical position, and toward the countershaft.

Main Drive Shaft Assembly

Assemble the main drive gear (1), bearing (39) and lock (5) to the transmission case.

Dip the roller bearing (4) for the front end of the mainshaft (15) in gear oil and assemble it in the inside of the main drive gear (1).

Insert the forward end of the mainshaft (15) (with the rear bearing in place) at the rear of the case, and assemble the sliding gears (6 and 12) onto

the shaft with the shifter fork collars toward each other, as shown in Fig. 1.

Push the mainshaft all the way in and install the rear bearing retainer (23), oil seal (16) and flange (17). The oil seal has a flange which fits against the rear face of the gear bearing retainer (23). Bolts holding the bearing retainer also hold the oil seal flange. The mainshaft flange (17) is held to the mainshaft (15) by a washer (18) and nut (19). Always be sure that the nut is drawn up tightly.

TRANSMISSION COVER ASSEMBLY

Disassembly

1. To disassemble the transmission cover, remove the two screws which attach the shifter shafts lock plate and remove the plate.
2. When removing the three shifter shafts from the cover, turn the shafts one-half turn to raise the shift lock balls out of the notches in the shafts, then push the shafts out of the cover and shifter forks, being careful not to lose the lock ball and springs which are located in the shifter forks.

Should it become necessary to replace the shifter interlock plate, cut the heads from the four rivets and remove the plate. A new plate may be installed by riveting it to the cover.

Reassembly

1. In reassembling the transmission cover, care must be used in installing the shifter shafts. They should be installed in the order shown in Fig. 8, namely reverse speed, low speed and high speed.

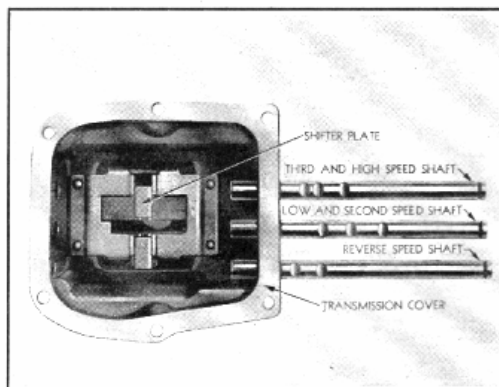


Fig. 8—Shifter Shaft Assembly

2. In assembling the shifter forks to the shafts, first place the shift lock spring and ball in the fork. With the special tool shown in Fig. 9 force the ball down on the spring in the fork, then turn the tool one-half turn to hold the ball in position. This tool holds the shift lock ball and prevents it from jumping out while the shaft is being installed.

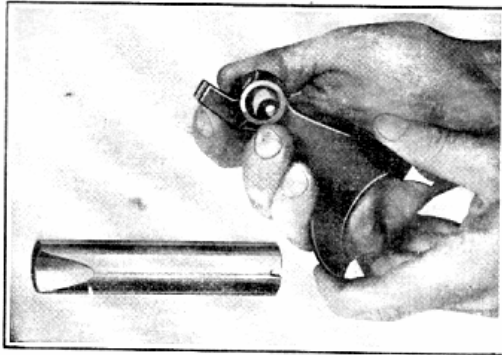


Fig. 9—Depressing Lock Ball

3. Install the shifter shaft lock plate. Install the cover and gasket to the transmission case being sure that the shifter forks enter the shifter

fork grooves in the gears. Install the gearshift lever using K-353 gearshift lever remover and replacer.

LUBRICATION

Gear oils generally available for transmission lubricants thicken considerably after use due to oxidation and chemical reactions resulting from normal service conditions. This thickening seriously impairs their lubricating qualities, and if neglected will finally result in semi-solids which will adhere to the sides of the case and afford no lubrication whatever.

It is essential, therefore, that in addition to checking the level of the lubricant, its condition should also be considered. If there is evidence of thickening, the transmission should be drained, flushed thoroughly and refilled with a fresh lubricant.

The type of lubricant recommended is given in the "Lubrication" section of this manual.

SERVICE DIAGNOSIS AND CORRECTIVE METHODS

Transmission Noise

Noises which seem to come from the transmission may actually originate in some other part of the chassis; therefore before any mechanical work is performed on the transmission, a thorough check should be made, by riding with the driver, if possible, to determine the actual source of the noise. If other possible causes have been investigated and eliminated, the following may apply:—

SYMPTOM AND PROBABLE CAUSE

1. Lubricant not of proper viscosity or insufficient lubricant.
2. Transmission out of alignment with clutch housing.
3. Transmission loose on clutch housing, clutch housing loose on engine.
4. Gears having excessive lash (wear).
5. Gears loose on shaft.
6. Worn bearings in case or on shafts.
7. Main drive gear clutch shaft worn or out of alignment.

NOTE—Noise may actually be in drive line—due to worn needle bearings, universal joints loose, out of alignment or out of balance.

REMEDY

1. Put proper lubricant in transmission and bring to level.
2. Align transmission to clutch housing.
3. Tighten bolts.
4. Replace worn gears.
5. Replace gears or shaft.
6. Replace worn bearings.
7. Replace main drive gear or align transmission to clutch housing.

Transmission Slipping out of High Gear

1. Weakened shift poppet springs.
2. Gears only partially engaged.
3. Misalignment of transmission with clutch housing.
4. Damaged mainshaft pilot bearing.

1. Change springs.
2. Replace shifter fork or worn gears.
3. Align transmission with clutch housing.
4. Replace mainshaft pilot bearing. (Check bore in clutch gear and pilot end of mainshaft for wear or damage).

SYMPTOM AND PROBABLE CAUSE	REMEDY
Slipping out of Low Gear—	
1. Shift lock spring weak or broken.	1. Replace shift lock spring.
2. Bent shifter fork.	2. Replace shifter fork.
3. Worn low speed gears.	3. Replace low speed sliding gear and low speed countershaft gear.
Noisy in Reverse—	
1. Worn reverse idler gear bushings.	1. Replace idler gear bushings.
Difficulty in Shifting into Low Gear—	
1. Worn reverse latch on lower end of gearshift lever.	1. Replace reverse latch.
2. Worn gearshift interlock guide plate.	2. Replace gearshift interlock guide plate.
Lubricant Leaks into Clutch Housing—	
1. Transmission case overfilled with lubricant.	1. Lower lubricant to proper level (See lubricant section).
2. Clutch gear bearing retainer loose.	2. Remove transmission, replace gasket and tighten clutch gear bearing retainer.

SPECIFICATIONS

Type.....	Selective Sliding Four Speed Spur	Reverse Idler Gear Bushing	
Speed.....	Four forward—One reverse	Length.....	1½"
Gear Ratio		Burnish.....	.8772"-.8782"
1st.....	7.058:1	Countershaft Gear Thrust Washer	
2nd.....	3.48:1	Thickness.....	.123"-.127"
3rd.....	1.71:1	Shift Fork Lock Ball Spring	
4th or direct.....	1.00:1	Free length.....	1-1/32"
Reverse.....	6.982:1		
Clearance between			
Mainshaft and Sliding Gears.....	.0035"-.0065"		
Reverse Shaft and Bushing.....	.0025"-.0045"		
Shift Fork and Gear.....	.009"-.019"		

SPECIAL TOOLS

K-353	Gearshift Lever Remover.	J-1147	Shift Shaft Lock Ball Depressor.
J-1662	Idler Gear Bushing Replacement Tool.	J-934	Transmission Holding Fixture.
KMO-34-G	Idler Gear Bushing Reamer.	*TR-278-R	Speedometer Gear and Transmission Bearing Puller.
J-1162	Transmission Support Studs.		
J-1466	Snap Ring Pliers.		

* Shown in front of a tool number denotes the tool is applicable to other sections.