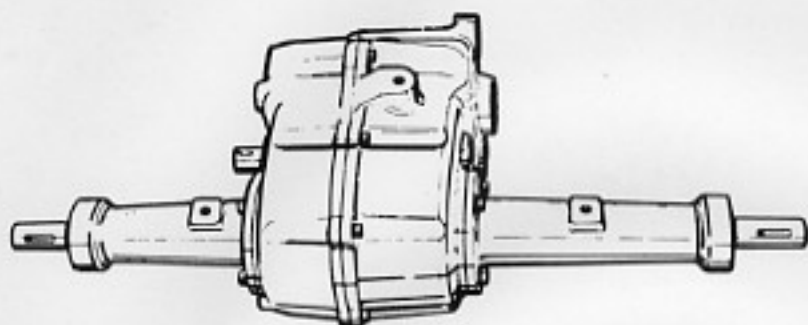


# PEERLESS MECHANIC'S HANDBOOK FOR



## ***Elec-Trak***<sup>®</sup>

# GARDEN TRACTOR



GENERAL  ELECTRIC

**GENERAL  
INFORMATION**

**1**

1200, 1400,  
1700, 2000  
THREE - SPEED  
TRANSA XLES

**4**

FOUR - SPEED  
TRANSA XLES

**5**

**DIFFERENTIALS**

**8**

**SHIFTING  
ASSEMBLY**

**10**

**BEARING AND  
BUSHING SERVICE**

**11**

Ⓣ TRADEMARK OF GENERAL ELECTRIC COMPANY

## SECTION 1 GENERAL INFORMATION

### A. HOW TO USE THIS MANUAL

1. **GENERAL.** The purpose of this handbook is to give up-to-date care, service, and repair instructions for Tecumseh's Peerless Division products.

By following this handbook, a better, faster, more profitable method of servicing Peerless products can be attained.

2. **USE.** Use this handbook with the pertinent Divisions of the Master Parts Manual.

The Parts List will show the exact parts for any Peerless unit.

This handbook points out procedures and methods for the proper repair or adjustment of parts according to factory recommendations.

3. **TABLE OF CONTENTS.** Use the Table of Contents whenever you are in doubt as to where to look for servicing information.

4. **BEFORE REPAIR.** Read the section pertaining to the unit being repaired (usually 4-6 pages or less). Complete understanding of what you will do will eliminate time consuming errors and rework.

5. **REPAIR.** Disassemble the unit in an orderly fashion. Lay disassembled parts out so that a clear pattern of reassembly is apparent. Use scribe marks on axle housing, shift lever housings, etc. Be aware of bevels on gears and how they are positioned. Give the unit definite area relationships, such as down, up, left, right, etc.

By working carefully with units until experience takes over, good working practices will become habit.

6. **REASSEMBLY.** Every part has a purpose. Try to explain the purpose to yourself as you put the parts together. The value of the orderly lay out of parts will be made clear at this time. Use the Master Parts Manual, if in doubt as to proper sequence of parts. It can save valuable time later on by not having to tear the unit down to find a "built-in" mistake.

#### Shift Lever Housing

1. Is there a mark on the housing?

2. How does the shift lever conform to the unit?  
Make scribe marks if in doubt as to how the unit will be re-assembled.

#### Case and Cover

1. Do I remove the case from the cover?  
On all units except the 2300 and 2400, remove the cover from the case.
2. How do I distinguish the case from the cover?  
The cover has the brake shaft extension, while the case has the inputshaft and shift tower as applicable. (Does not apply to 600 series, in which the case is apparent.)

#### Thrust Washers and Shafts

1. Do I know to which shaft and to which side each thrust washer will assemble?
2. Do I know which end of each shaft goes into the case or cover?

#### Gears

1. Are bevels identified and do I know which way they face?  
The purpose of the bevel on the tooth is to allow easier meshing of shifting gears. Therefore, the bevel must fall in the direction the gear meshes.

The outside gears on a three gear cluster are near the edges of the case and cover, therefore meshing must come from away from the case and cover.

### B. PEERLESS UNITS

#### 1. GENERAL

Peerless makes power transmission accessories for use in all types of lawn and garden equipment.

#### 2. TRANSAXLES

A combination of familiar parts of a drive train, the transmission and differential-axle, in one compact unit. Peerless transaxles are of various speeds forward units with one speed in reverse.

- (a) 600 Series. The 600 series units are considerable different from all other

Peerless transaxle series, both in design and appearance. The 600 series is a lightweight unit usually used in riding mower or similar application. The 600 series has a vertical input shaft at the top of the case. The case is aluminum, contributing to a considerable weight saving.

Variations in the series (which determines the specific model number such as 603, 603A, 609, etc.) includes:

- (1) Shift lever shape.
- (2) Axle lengths.
- (3) Axle machining for wheel hub attachment.
- (4) Axle housing variations.
- (5) Size of the brake shaft.

There may be other slight differences, however, these are present as a result of product improvement which are not options to an O.E.M. (Original Equipment Manufacturer).

NOTE: The transaxles described in paragraph (b), (c), (d), and (e), below are fairly similar in appearance, but do have specific recognizable characteristics. All these units have cast iron bodies for rugged application, although the 2300 series only can be used in ground engaging equipment applications.

- (b) 1200 Series. The distinguishing feature of the 1200 series transaxles is that the axle support housings are pressed from the inside of the case and cover, therefore, are not readily removable until the unit is completely disassembled. The casing is cast iron for rugged, long-time wear. The input shaft extends horizontally through the case while the larger brake shaft extends through the cover on the opposite side. The shift lever housing attaches to the case.

A basic difference within the 1200 series itself is that the input can be either right or left depending upon equipment application, therefore, the case can be either the left hand or right hand "half" of the casing, depending upon the application. This, along with the variations listed for the 600 series (a) above determines the model number within the 1200 series basic type.

- (c) 1700 Series. The 1700 design closely

follows the 1200 series except that the axle support housings bolt to the case and cover and are removed prior to disassembly of the case and cover.

- (d) 2000 Series. These units are similar to the 1700 series except that the axle support housing contains sealed ball bearings rather than bushings. Other differences are apparent internally which will be described in the tear-down procedure of these units.
- (e) 2300 Series. Generally similar to the 2000 series transaxle. The distinguishing features are a more massive casing, and a shift opening machined area that is larger. The obvious difference from the standpoint of application is that these units are four speed forward and will be found on equipment that can be used for ground engagement operations.

### 3. REDUCTION GEAR AND DIFFERENTIAL UNITS

#### GENERAL

These units do not have a transmission function characteristic of transaxles, but rather, are units to reduce input speed and torque to a suitable axle speed and torque. The hydrostatic units which match to these units perform the transmission function by the use of one control lever to the operator.

- (a) 1300 Series. This unit is the hydrostatic counterpart of the three-speed forward units (1200, 1700, and 2000). It has an aluminum casing and pressed through axle support housings, characteristic of the 1200 series.

The hydrostatic unit is of Eaton, Yale, Towne manufacture and is not serviced by Tecumseh Service Dealers.

- (b) 2400 Series. This series of hydrostatically driven reduction gear and differential unit can be used in ground engaging operations such as plowing. The hydrostatic unit is manufactured by Sundstrand Corp. in LaSalle, Ill.

### 4. TRANSMISSIONS

These units as manufactured by Peerless consist of the shifting mechanism to take a constant input shaft speed and reduce it to the desired output speed. The differential or axle unit is connected through a chain drive.

- (a) 350 Series. This 3-speed forward, 1-speed reverse transmission has a cast aluminum casing. It uses the same shift lever housing forward on the 600, 1200, 1700, and 2000 series transaxles. Bronze sintered bushings are porous, allowing for a lubricant flow through them.
- (b) 400 Series. This unit is like the 350 unit except the caged needle bearings replace bushings at the input and output shafts.

drive except that the input shaft is extended out through the other side of the case to transmit power in the same line to additional right angle drives or other equipment.

- (c) Shafts, Couplings, Pulleys, etc. These items are part of the total transmission unit and are used to connect angle drives, and other attachments. The serrated couplings match serrations on shafts of the angle drives or on connecting shafts.

## 5. DIFFERENTIALS

The only self contained differential/axle unit built by Peerless is the 100 series. It features hardened axle shafts of various length and machined for various methods of hub attachment. The case is cast aluminum and the differential gears are sintered metal. The differential pin is held securely in place by the four retaining cap screws. Oilite bushings reduce friction during differential operation.

The drive sprocket is part of the unit. Depending upon application, it can be in any of several diameters in size, thus having a different number of gear teeth.

## 6. ANGLE DRIVES

These units are used primarily to change the direction of power transmission at the point where the working equipment attaches.

They can be assembled for right or left hand rotation so that they can be used in various combinations for synchronous operation.

- (a) Right Angle Drive. These units consist of input shafts, output shafts, and the beveled gearing necessary to change the direction of power transmission at right angles. By positioning the drive bevel gear on the input shaft nearest the input end the opposite rotation will be attained from that of switching the beveled gear around to the side away from the input end of the shaft.

Casing and bearings are identical. A cover identifies each unit as being either a left hand (LH) or a right hand (RH) right angle drive.

- (b) "T" Drives. The "T" drive is essentially the same as the right angle

## C. IDENTIFICATION OF MODELS

Since acquisition by Tecumseh Products Co. in 1964, all Peerless assemblies have a model number identification tag, or stamping.

On units containing axles (transaxles, or reduction gear and differential units) the identification should be visible by viewing the case/cover unit from below and behind as it is mounted in the driven equipment.

If the area is dirt or oil covered, however, some cleaning may be necessary. Write down any numbers found in locations pointed out in

Figure 1-1, then compare with the Master Parts Manual Div. 8 index.

For right angle and "T" drives, the identification number is stamped into the housing under the input shaft boss opposite the cover.

On transmissions the identification number is stamped on the cover back of the output drive sprocket.

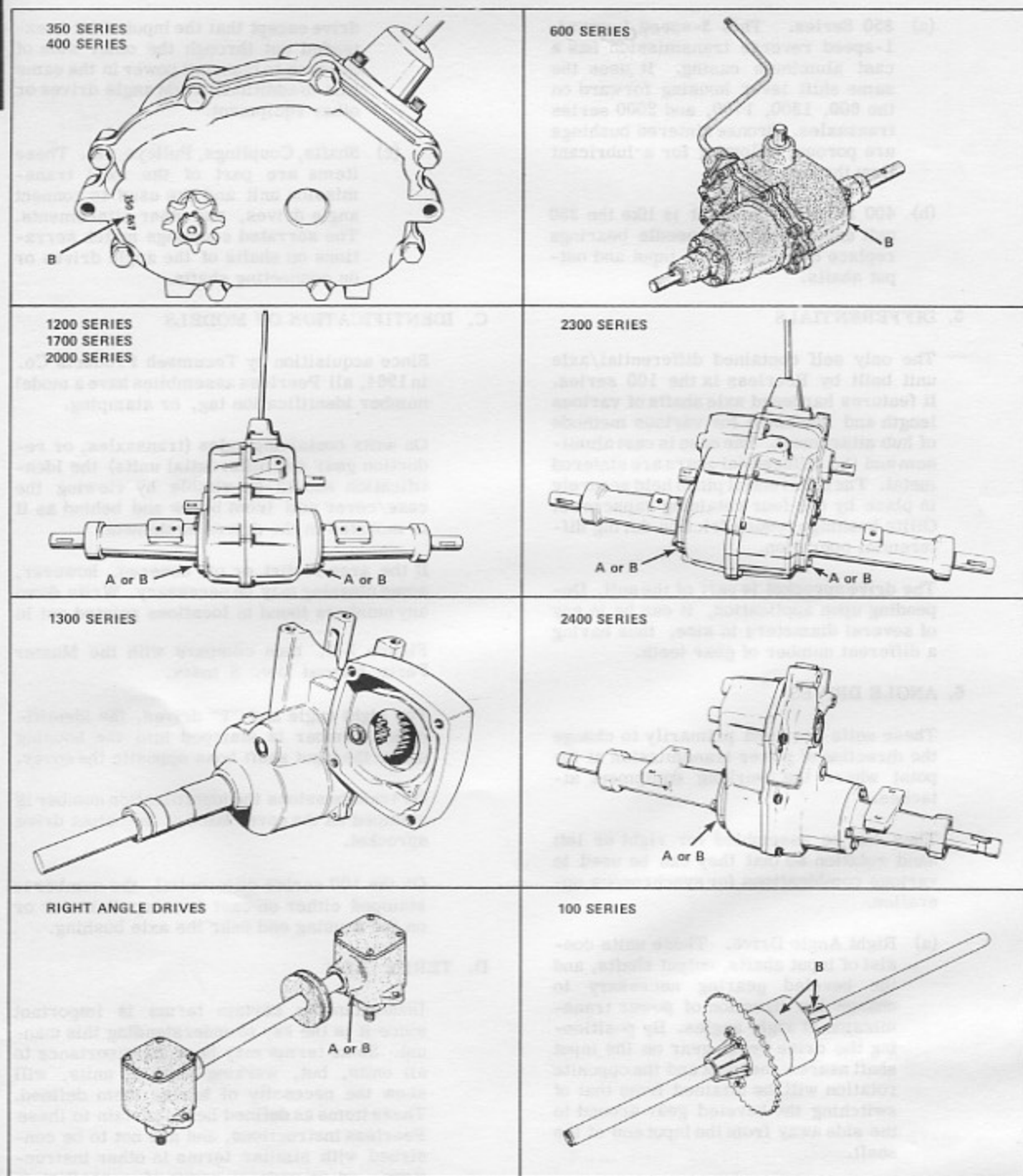
On the 100 series differential, the number is stamped either on cast housing diameter or on the housing end near the axle bushing.

## D. TERMS USED

Understanding certain terms is important since it is the key to understanding this manual. Some terms may be of no importance to all units, but, working with all units, will show the necessity of having them defined. These items as defined here, pertain to these Peerless instructions, and are not to be construed with similar terms in other instructions, or in general usage if a conflict in definition arises.

**AXLE** - The shaft which connects the wheel or hub to the differential unit and transmits force back to the wheels. Sometimes axle refers to the differential and axle combination as in the term TRANSAXLE.





Early models were not identified with a model number on the unit.

THE MODEL NUMBER WILL BE FOUND ON:

- A. Metal tag attached to unit as illustrated.
- B. Stamped on unit as illustrated.

Figure 1-1. Identification Number Locations

**AXLE HOUSING (or AXLE SUPPORT)** - An extension of the case and cover to support the outer ends of the axles. Because the housing is visible, it is often the best means of distinguishing the series in question.

**BEVEL** (on a gear - different from bevel gear) - Roundness of the meshing sides of gear teeth to allow easy shifting. Because this is about the only allowance made to make easier shifting, the unit should be stopped before the shift to keep these spur gears from getting chewed up.

**BEVEL GEAR** - A gear with teeth ground on a diagonal so that when it meshes with a second bevel gear, power is transmitted at an angle. If the angle is  $90^{\circ}$ , the gear is known as a **MITER GEAR**.

**BEVEL PINION** - The smaller of two meshed bevel gears in a gear train.

**BRAKE (or BRAKESHAFT)** - That shaft on a Peerless unit (Transaxles and Transmission) to which a braking system may be attached. The shaft is in the gear train with the differential to stop it when the operator "brakes". It is usually larger in diameter than the input shaft due to its function of taking shock loads experienced in braking.

**CASE** - That part of the unit "casing half" which contains the shift lever and input shaft openings. The other "half" is the **COVER** because the re-assembly must be done into one or the other depending upon the series.

**CHAMFER** - Diagonal milling at the corners of gear teeth to remove sharp edges. The usual reason for chamfer to eliminate the possibility of hardened gears chewing softer metal.

**COUPLING** - A sleeve to connect two serrated shafts in the same axial plane. Used in right angle drive systems or in connecting the hydrostatic drive to the input shaft on 2400 series transaxles.

**COVER** - That part of the unit "casing half" which contains the brake shaft opening (except the 600 series in which all openings are in the **CASE** as described in **CASE** - above). The case and the cover switch sides depending upon whether the trans-axle is right or left hand drive.

**DIFFERENTIAL GEAR BOLTS** - Through bolts holding the differential parts together.

The heads of these bolts must be opposite the output shaft gear (except in the 2400 series). This is an early check to see that the unit is being assembled correctly.

**DOWEL PIN** - Alignment pin used to align the case and cover and other parts in a transmission or transaxle. The dowel should be tapped in to hold the parts in alignment before tightening the retaining screws. Failure to install dowel pins first will usually lead to a unit that binds after assembly.

**DUO-TRAK\* DIFFERENTIAL**(\*Trademark - Illinois Tool Works) - A type of differential which increases torque to the tractive wheel to keep it turning, however, in situations where differentiation is necessary (as in turning) the unit acts much like a regular differential.

**EQUIPMENT** - The complete assembly built by a manufacturer, a part of which is the Peerless unit (riding mower, tractor, etc.). A check of the equipment manual is recommended prior to servicing the Peerless unit.

**HEAD ASSEMBLY-A COMPLETE UNIT CONTAINING ALL PARTS OF ONE** right angle or "T" drive assembly of a right angle drive system. The head assembly is permanently lubricated and sealed.

**IDENTIFICATION NUMBER** - See **MODEL NUMBER**.

**IDLER** - A gear used in a gear train to transfer motion or direction. The gear rotates independently of shaft upon which it is located.

**INPUT or INPUT SHAFT** - That part of a Peerless unit which is always connected to the drive. Its rotational speed is dependent on the driving mechanism. All parts of the input system are always in mesh with input shaft and turn whenever it turns.

**LIMITED SLIP DIFFERENTIAL** - See **DUO-TRAK\* DIFFERENTIAL**.

**MITER GEAR** - One of a pair of interchangeable bevel gears with axles at right angles. Since all bevel gears are miter gears in Peerless units, the terms can be the same.

**MODEL NUMBER** - The identifying number of a Peerless unit which will permit selec-

tion of the proper parts to repair that unit. See paragraph 1-C for locations of the model number.

**OIL SEAL, DOUBLE LIP** - An oil seal with two sealing surfaces to prevent entrance of foreign matter, and leakage of lubricant.

**OIL SEAL, QUAD RING** - A seal with two external and two internal sealing lips. Used in the shifter housing.

**OIL SEAL, SINGLE LIP** - An oil seal with one sealing surface to either prevent entrance of foreign matter or prevent leakage of lubricant.

**OUTPUT, or OUTPUT SHAFT** - On a transaxle, that shaft that contains the output pinion which is in direct mesh with and drives the differential. In a transmission, the exposed shaft which contains the sprocket for driving the axles. The output shaft is driven by the large OUTPUT GEAR.

**OUTPUT SHAFT GEAR** - The importance of defining this gear here is to point out that it must be opposite the differential bolts in Peerless units (except the 2400 series). The output gear assembles into transaxle cover.

**PEERLESS UNIT or UNITS - THE COMPLETE PEERLESS** assembly which is part of the EQUIPMENT. The Peerless unit is that assembly being described.

**REDUCTION GEAR AND DIFFERENTIAL UNIT** - A PEERLESS unit that reduces a high RPM input speed to a suitable axle speed without use of a transmission. Since there is a single gear train, there is a single input speed to output speed ratio, however, axle speeds are infinite, depending upon input speed.

**REVERSE IDLER** - A gear added to the gear train so that in mesh, it reverses the direction of all gears driven after it. Its number of teeth also affects the reverse gear ratio. The center gear of the three gear cluster always is in mesh with the REVERSE IDLER and the large shifter gear always shifts into it.

**RIGHT ANGLE DRIVE** - Interchangeable with HEAD ASSEMBLY. The major operating parts are a pair of miter gears. A system consists of other right angle or "T" drive head assemblies and connecting hardware.

**SEAL** - A mechanism which stops leakage.

It can be a rubber ring, as an "O" ring or "quad" ring, a sealing type ball bearing, or most commonly, a rubber-like sealing surface encased in a metal form.

**SEAL RETAINER** - Found on some models of transaxles and on right angle drives. The center of the retainer is bored to the size of the outer diameter of the seal. On transaxles the retainer acts to position the differential. In the casing on right angle drives, it acts as the end cap of the case and is secured with four capscrews.

**SPROCKET** - A geared wheel designed to turn a link chain drive. Various numbers of teeth (hence, sprocket diameter) are available to change output ratios.

**SPUR GEAR** - A gear having the shaft bore and teeth in a parallel plane. A rugged, economical gear.

**SHIFT LEVER** - The lever by which the operator manually changes the shifter gears to vary reduction speed ratios in the transmission. The configuration of the lever is variable and is often the reason for a unit being a particular model.

**SHIFTER FORK** - A mechanical arm which moves on rod to position the shifter gear at an exact spot axially along the shifter shaft.

**SHIFTER GEAR, LARGE** - This gear transmits 1st (low) and reverse (1st, 2nd and reverse in 4-speed units) gear ratio force to the output shaft. It is beveled on both sides.

**SHIFTER GEAR, SMALL** - This gear transmits 2nd and 3rd (3rd and 4th in a 4-speed unit) gear ratio force to the output shaft. It can have two different tooth diameters and be beveled on the outside of each, or it can have a beveled spline to engage 3rd (or 4th) gear through a splined shaft.

**SHIFTER HOUSING** - The housing which retains the shift lever and when installed on the transmission case, both the lever in a definite position relative to the shifter forks. The housing should be scribe marked upon removal to insure that it is re-installed so that the shift lever is in the proper configuration.

**SHIFTER ROD** - One of two similar smooth rods of equal length with grooves which match the fork position to meshed positions of the shifter gears and gears of the three gear cluster. Each rod has a snap



ring to act as a fork stop, but can also be used to determine how the fork is assembled to it.

**SHIFTER SHAFT** - A splined shaft which meshes with the internal splines of the shifter gears, to transmit force to the output shaft gear.

**SHIFTER STOP** - A stamped metal plate which separates the shifter forks. The stop has a notch cut in it which corresponds to the neutral position on the shifter forks and rod. The shifter lever must return the engaged fork back to neutral before it can cross to actuate the other fork.

**"T" DRIVE** - A right angle drive with an input shaft extending thru the case to transmit power axially in a second direction to the right angle output. On "T" drive with dissimilar input and out end of the input shaft, care must be taken to insure that the parts do not run in reverse when re-assembled.

**THREE GEAR CLUSTER** - A 3 gear assembly in mesh with the input shaft. The gears are of different sizes to change in gear ratios when meshing with the two shifter gears.

**THRUST RACE** - A thrust washer in which the outer edge is cupped to fit the outer diameter of a thrust bearing. This fit positions the thrust race concentric with the axle diameter. It further acts as a thrust washer.

**THRUST WASHER** - A flat polished surface separating metals of different hardness. It also acts as a spacer between shafts and the case and cover.

**TRANSMISSION** - A system of varying sized gears in a case, some of which can be slid along a shaft to vary gear ratio in the gear train. The net effect is to change speeds to the rear wheel according to the type of work being done.

**UNIT** - See PEERLESS UNIT.

# E. LUBRICATION CHART

Check the Peerless unit model number before filling with lubricant. There may be a difference in the quantity recommended. This is dictated by the design of the vehicle and the position of the Peerless unit in it.

PEERLESS LUBRICATION			
TRANSAXLES	MODEL NO.		QUANTITY
	600 Series		1-1/2 Pints Oil
	1200 Series	1200	2 Pints Oil
		1201	
		1201-3	
		1201-4	
		1202	
		1202-A	
		1202-4	
		1204	
		1204-A	
		1204-4	
		1209	
		1250	
		1250-1	
		1250-2	
	1211		2-3/4 Pints Oil
	1212		
	1300 Series	1203	3 Pints Oil
		1205	
1206			
1207			
1208			
1210			
1305		2 Pints Oil	
1309			
1300		2-3/4 Pints Oil	
1301			
1302			
1303			
1304			
1306			
1307			
1308			
1400 Series		2 Pints Oil	
1700 Series		2 Pints Oil	
2000 Series		2 Pints Oil	
2300 Series	All Models Except*	4 Pints Oil	
	*2300	3 Pints Oil	
	*2300A		
	*2306A		
	*2311		
	*2314		
	*2315		
	*2321		
	*2322		
	*2322A		
	*2323		
	*2324		
	*2325		
	2400 Series		2 Pints Oil
TRANSMISSIONS	350 Series	350	12 Oz. Grease
		350A	
		351	
		351A	
		352	
		353	
	400 Series	400	3/4 Pint Oil
401		12 Oz. Grease	
401A		3/4 Pint Oil	
500 Series		12 Oz. Grease	
RIGHT ANGLE AND T DRIVES	All Models Except*		4 Oz. Grease
		*1408-P91	3 Oz. Grease
		*1409-P91	
		*1410-P91	
		*3002	
		*3003	
*3028			
*3029			
*3035			
DIFFERENTIALS	All Models		1 Oz. Grease
TWO SPEED AXLE	200 Series		2 Oz. Grease
<div>NOTICE OIL OR GREASE INDICATES TYPE OF LUBRICATION BELOW: GREASE – E.P. LITHIUM GREASE</div>			

NOTICE  
OIL OR GREASE INDICATES  
TYPE OF LUBRICATION BELOW:  
GREASE - E.P. LITHIUM GREASE  
OIL - SAE E.P. 90 OIL



## F. GENERAL SERVICE PROCEDURES

## 1. Introduction

The following service procedures should be understood and practiced whenever service must be performed on a Peerless unit. Knowing time and will allow a constant check on repair status and thoroughness.

## 2. Before removal of unit from equipment, look for:

- (a) Loose drive belts.
- (b) Improperly adjusted or badly worn clutch.
- (c) Loose or lost set screws and/or sheared keys in drive and driven pulleys.
- (d) Oil saturated drive belts and clutches.
- (e) Bad operating habits, such as clutch riding.
- (f) Oil leaks. If found, refer to 1-B.
- (g) Any trouble, which might be pointed up by operating the unit and equipment, IF POSSIBLE.

## 3. Removal of the Peerless unit from the equipment:

- (a) Jack up equipment so that transaxle is accessible. Use wood blocks to prevent equipment movement. Do not use bricks, cement, or cinder blocks.
- (b) Visually inspect Peerless unit for oil leaks, cracked housing, binding or rubbing of parts, or other symptoms of malfunction.
- (c) Use a jack under the Peerless unit to support its weight when attachments are removed.
- (d) Remove wheels, drive belts, pulleys, chains and other associated equipment from Peerless unit. Be aware of positioning of parts. Scribe mark, if in doubt, as to ability to re-assemble parts quickly.
- (e) If shifter lever will interfere with unit in any way, remove it before unit is removed.
- (f) Remove attaching hardware holding Peerless unit to equipment at case, cover, axle supports, shifter, or by other means.
- (g) With Peerless unit free and supported, remove it from the area of the equipment to the work bench.

## 4. Preparing for dis-assembly:

- (a) Visually inspect for evidence of oil seepage, tampering, misalignment, freedom of rotating shafts, etc.
- (b) Clean unit thoroughly of dirt, oil, debris.
- (c) Remove shift housing and drain oil from unit. Observe oil to see if metal particles are present.
- (d) Check axle shafts carefully for smoothness. Use a stone or suitable hard abrasive to rub down high spots and eliminate

rust or paint.

- (e) Check model number at appropriate spot. It is advisable to have the exploded parts view handy.

- (f) Have seal sleeves, driver, tools, shop clothes and informational material at hand.

## G. OIL LEAKS, SEAL and GASKET SERVICE

Peerless units contain various styles and sizes of oil seals. The function of any oil seal can be:

- 1. To seal inward (single lip) to prevent lubricant leaks.
- 2. To seal outward (single lip) to prevent lubricant leaks.
- 3. To seal both inward and outward (double lip).

Some seals are spring loaded. That is, a spring creates a positive light compressing action to insure that the seal lip will make 100% contact around the shaft. All Peerless seals, seal on the inner diameter.

- 1. Other than leaking seals, gaskets and "O" rings, leakage can occur due to a cracked case or cover, flats on shafts, porosity (rarely, if ever), and worn bushings and shafts.
- 2. Single lip inward sealing can be salvaged by use of the proper seal protector when pulling the seal over a shaft. Outward sealing seal (both single and double lip) must be replaced since there is no assurance that the initial sealing surface can be protected.
- 3. If you can't protect the sealing lip, replace the entire seal. The cost of the seal is small in comparison to a return repair due to re-use for seals.
- 4. Check seals for cracks, scuffs, cuts, and distortion. Check seal areas for evidence of oil leak both at sealing surface and between metal-to-metal contact surface areas.
- 5. Some seals have a "Redicoat" sealant applied, while others may need a thin coat of this or a similar sealant.
- 6. The surface over which the seal lips must slide must be free of all cuts, scratches, high spots, or rust. The shafts should be smooth, shiny, and a thin film of light oil applied. Sleeves should be used to clear keyways, splines, or other sharp edges machined into shafts.

# H. TORQUE VALUES - TROUBLE SHOOTING

1. All torque values must be applied. The torque value for any fastener will be found in the assembly instruction where that fastener is used.

Differential Bolts 7 lbs. ft. (ref. 6-6)  
"T" Drive Bolt 8-11 lbs. ft.  
"T" Drive Cover Screw 20-24 lbs. in.

2. Overtightening - Can strip threads, compress the gasket excessively, possibly causing binding.

3. Cross tightening sequence to half the torque then finally to full torque value.

4. Undertightening - Oil leakage, loosening of attaching parts, possible shifting of the internal part causing complete failure.

5. Since all bolts are readily accessible, there is no reason that a torque wrench can not be used for all bolt and screw tightening. To use guess or chance, any of the previous can result:

## TORQUE VALUES

PART	MODELS AFFECTED	TORQUE READING	
		IN-LBS	FT-LBS
Self-Tapping Cap Screws (Case-to-Cover)	350, 400	90-110	
Socket Head Cap Screws (Case-to-Cover)	1200, 1300, 1700, 2000, 2300, 2400		10
Socket Head Cap Screws (Shift Lever Housing)	All Models With Shift		10
Hex Cap Screws (Axle Support Housing)	1700, 2000, 2300, 2400		13
Hex Cap Screws (Differential)	1200, 1300, 1700, 2000, 2300, 2400		7
Socket Head Cap Screws (Case-to-Cover)	600		7-9
Hex Cap Screws (Axle Support Housing)	600		13-15
Hex Cap Screws (Differential Throughbolts)	100		15
Hex Cap Screws (Seal Retainer)	Rt. Angle Drives	90-110	
Slotted Head Screw (Cover)	Rt. Angle Drives	20-24	
Hex Cap Screws (Differential, Duo-Trak*)	2300, 2400		7-10

\*Trademark of limited slip differential patented by Illinois Tool Works

CAUSE	REMEDY
UNIT CANNOT BE SHIFTED (OR DIFFICULT TO SHIFT)	
Gears improperly installed.	Review positioning of gearing.
Forks and Rod assembly incorrectly installed.	Remove assembly. Recheck and correctly position parts.
Axle Housing not installed or not tightened.	Seal retainers are not properly seated. Tighten axle housing bolts.
Same items covered under heading, "Axles Cannot Be Turned (Same Direction) While Unit In Neutral Gear".	Review remedy listed.
Shifting lever improperly positioned.	Determine finger of shifting lever is correct for the unit and correctly installed. Check to make sure shift lever housing has required gasket.
Shift lever housing misaligned to case.	Check to determine if alignment marks are on unit that they are correctly positioned. Also, determine if bend on shaft is in correct position.

(Continued on next page.)

1

CAUSE	REMEDY
<b>UNIT CANNOT BE SHIFTED (OR DIFFICULT TO SHIFT) (Continued)</b>	
Parts missing.	Install missing parts.
Equipment clutch not disengaging.	Adjust clutch according to equipment instructions.
Shifter stop assembled backwards.	Check to determine that notch in STOP aligns with shifter forks in NEUTRAL position.
Chamfer on shift gears on wrong side.	Check to determine that bevels on shifter gears are correct (fork flanges should be toward each other). On 3 gear cluster, small gear and medium gear chamfers go down toward big gear.
<b>UNIT IS NOISY</b>	
Gearing overly noisy - chatter, etc.	Check lubrication is at proper content.
Metallic pieces and/or other foreign objects in unit.	Check for and remove bits of broken metal, loose washers, etc.
Worn gears.	Remove and replace with new gears.
Worn bearings - mainly input shaft ball bearing.	Replace bearing.
<b>UNIT JUMPS OUT OF GEAR</b>	
Shifting lever improperly assembled in housing.	Disassemble shifting lever and determine if properly assembled.
Teeth of gears are worn beyond tolerances.	Check gears. Replace worn gears.
Spring in shifter fork weak or broken.	Replace spring.
Attaching screws for shift lever and housing assembly not properly torqued.	Torque screws to 10 lbs. ft.
Shift lever bent and hitting unit frame.	Replace shift lever.
Shift rod grooves worn.	Replace shift rods.
Shift rod of improper length or grooving installed.	Check rod length. Replace rod with correct part.
Constant mesh gears improperly installed on counter shaft.	Reposition gears.
<b>AXLES CANNOT BE TURNED (SAME DIRECTION) WITH UNIT IN NEUTRAL GEAR</b>	
Axle housing not installed (or not tightened).	Seal retainers are not properly seated. Tighten axle housing bolts.
Burrs on gearing.	Remove gear and hone with a stone.
Parts missing.	Install missing parts.
Broken shifter stop allowing unit to be shifted into two speeds at the same time.	Replace snap rings on shift rod out of groove.

(Continued on next page.)



CAUSE	REMEDY
AXLES CANNOT BE TURNED (SAME DIRECTION) WITH UNIT IN NEUTRAL GEAR (Continued)	
Thrust washers in wrong position.	Recheck thrust washer and reposition, if wrong.
Bearings not pressed in deep enough.	Use the proper bearing tool to seat the bearing.
Improper fit of case to cover.	Recheck positioning of thrust washers. A misplacement or omission of washer can cause binding.
Dowel pins not installed.	Install dowel pins.
Gears improperly installed.	Check unit for correct assembly of parts.
Input shaft not properly installed.	Input shaft spline must be fitted into gear and must be tapped completely into the case.
Differential installed improperly.	Re-check positioning of bolts in differential - must be opposite output shaft gear (except 2400).
Seal retainers improperly positioned.	Determine seals are correctly installed.
UNIT DOES NOT DRIVE	
Differential bevel gears broken.	Replace.
3 gear cluster counter shaft key sheared in Model 600, 350 and 400.	Replace.
Stripped teeth on gears.	Replace.
Keys sheared in drive pulleys.	Replace.
Broken input gear.	Replace.

## I. TESTING

The absence of binding and oil leakage are the best indications that the unit has been properly reassembled. Though other, more elaborate, tests can be done, this would be the prerogative of the servicing agency, since the following checks are considered adequate.

With the shift forks in neutral, rotate both axle ends in the same direction. They should turn smoothly although a little effort may be necessary. The brake shaft should rotate whenever the axles turn together, but in neutral, the input shaft should not turn.

By moving any shifter gear into mesh, a greater drag should be felt on the axles on both the input and brakshaft should turn.

To ease in turning of the various shafts, insert a tool (such as a punch or a socket head screw key) into the keyway, however, do not force if the shaft is binding.

### Reason for unit binding:

1. Reused or lack of gasket.
2. Oil seal retainers installed backward.
3. Mis-installed thrust washers.
4. Differential installed backward.
5. Mis-assembly of shifting parts.
6. Mis-placement of spacers.
7. Foreign matter blocking gear teeth mesh
8. Shifter stop installed backwards.
9. Input shaft not completely in case.
10. Mis-alignment of case and cover. Align with dowels before tightening cap screws.

SECTION 4 THREE-SPEED TRANSAXLES (1200,1400,1700, AND 2000 SERIES)

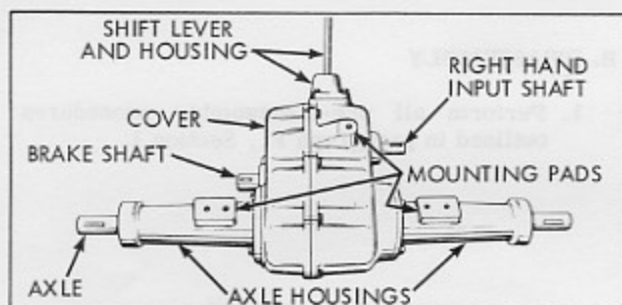


Figure 4-1 2000 Series Transaxle

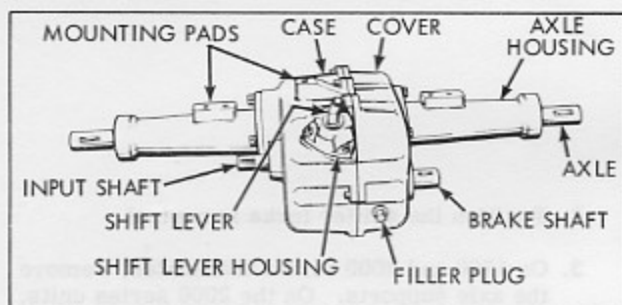


Figure 4-2 2000 Series Transaxle

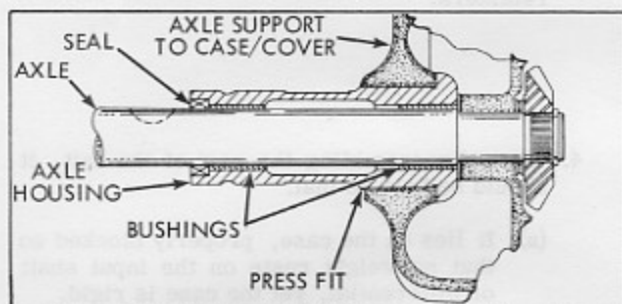


Figure 4-3 1200 and 1400 Series Axle Housing, Bushings and Seal

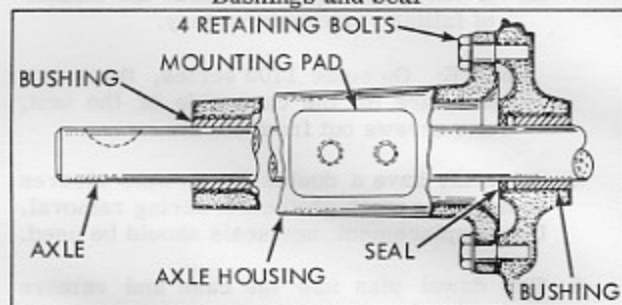


Figure 4-4 Typical 1700 Series Axle Housing, Bushings and Seal

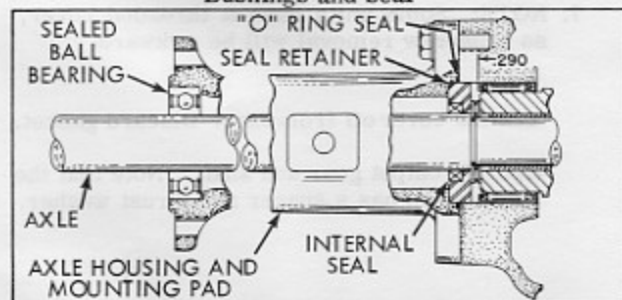


Figure 4-5 Typical 2000 Series Axle Housing, Bushing and Seal Assembly

A. GENERAL

1. The 1200, 1400, 1700, and 2000 series transaxles have three forward speeds and one reverse. All units are similar in construction, assembly, and repair. Differences will be pointed out where it is pertinent. See paragraph F for differences relating to the 1400 series transaxle.
2. To identify each unit, refer to paragraph C of SECTION 1, and to Figures 4-3, 4-4, and 4-5 for differences in axle support appearance.
3. None of the series is intended for use with ground engaging equipment. That is, they should not be used to pull plows or similar equipment which are pulled through the soil to overturn it. Also, judicious use is expected in any situation where a severe strain will be placed on the axles.
4. The three units use the same type shaft housing and are quite similar in appearance, except for axle support housings which are quite distinctive.
5. Note that oil seals are situated in different locations. The serviceman should be aware of this when re-assembling the various series so that he installs the seal at the proper time.
  - a. On the 1200 and 1400 series, replace the seals after complete reassembly.
  - b. On the 1700 series replace the seals after assembly, but before installing the axle supports.
  - c. On the 2000 series, the seals can be installed in the retainers at any time.

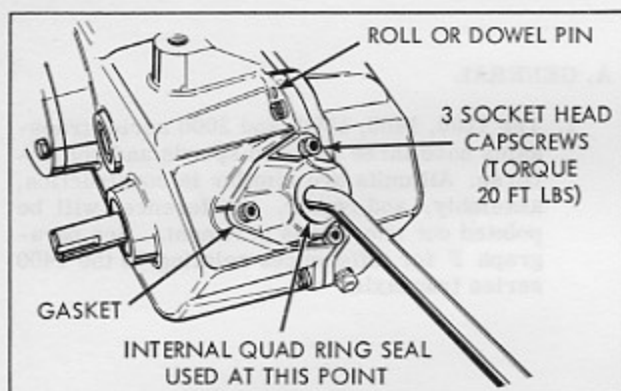


Figure 4-6 Shift Lever Housing

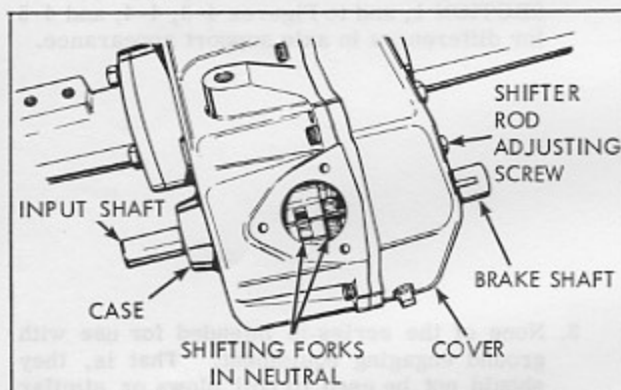


Figure 4-7 Transaxle Case

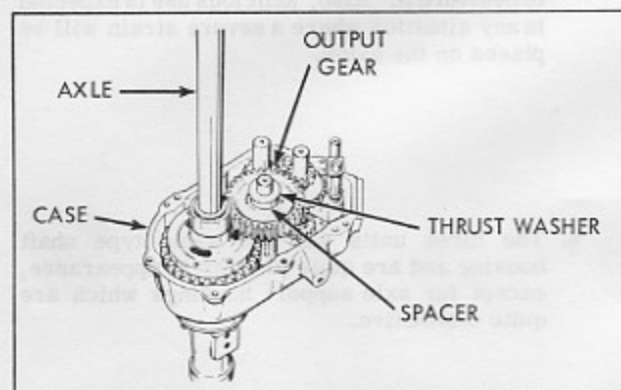


Figure 4-8 Output Gear and Shaft

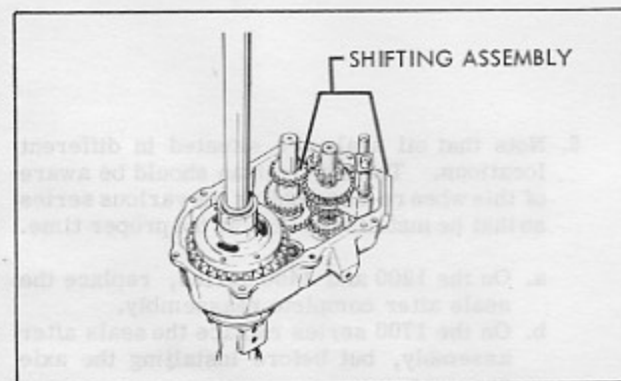


Figure 4-9 Shifter Assembly

## B. DISASSEMBLY

1. Perform all pre-disassembly procedures outlined in paragraph F., Section 1.

2. Position the shifter forks in neutral.

3. On 1700 and 2000 series transaxles, remove the axle supports. On the 2000 series units, use the axle as a ram to press out the seal retainers.

4. When disassembling the rest of the unit, it should be held so that:

- (a) It lies on the case, properly blocked so that no weight rests on the input shaft or differential, yet the case is rigid.
- (b) It can be worked on without the chance of falling, or causing injury.

NOTE: On some 1700 series, the screw heads are on the case side of the unit. Take screws out from below.

5. Oil seals have a double lip so seal sleeves do not offer much protection during removal. Upon replacement, new seals should be used.
6. Tap dowel pins into the case and remove socket head cap screws.
7. NOTE: Some units have a threaded cover, so cap screw removal will be awkward.

Lift the cover off from case. Discard gasket.

Remove output gear and shaft. Note that the 2000 series has a spacer and thrust washer.



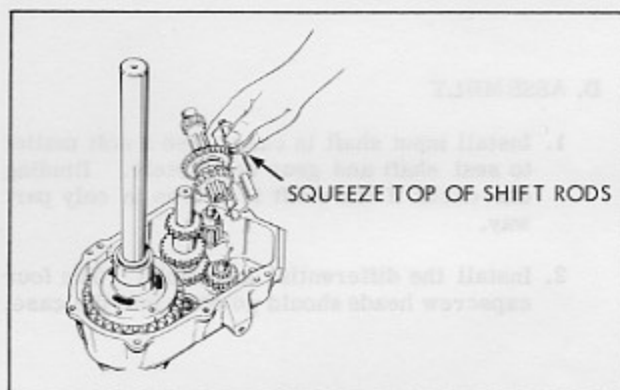


Figure 4-10 Removing Shifting Assembly

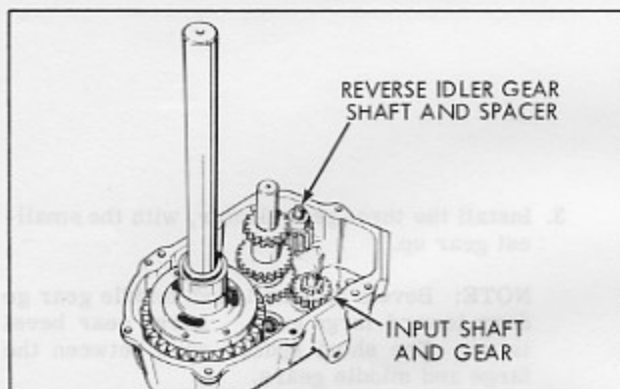


Figure 4-11 Reverse Idler Gear and Shaft

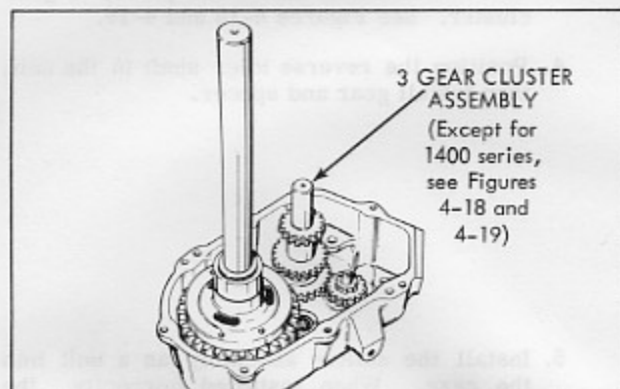


Figure 4-12 Three Gear Cluster

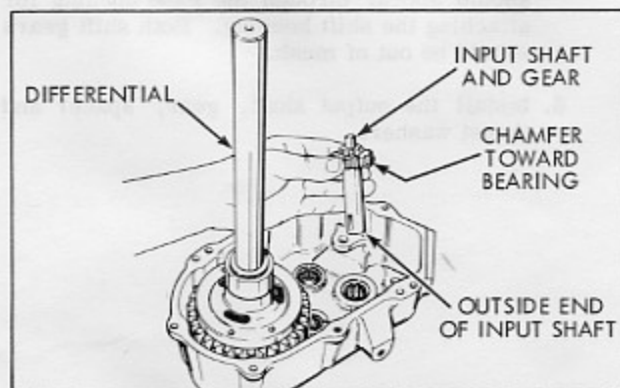


Figure 4-13 Input Shaft and Gear

8. Remove the shifting assembly as one unit.

9. Remove the reverse idler shaft, spacer and gear.

10. Lift out the three gear cluster.

11. Remove the differential.

12. Tap the input shaft out of the case.

#### C. INSPECTION AND REPAIR

Refer to SECTION 5, Paragraph B for discussion of gears, case, cover, and shafts.

Inspection of the case and cover on the 1200 or 1400 series may indicate the need for replacement of the axle housings.

Use an arbor press to drive out the housing, and a protective piece of bar stock between the housing and press when replacing the housing.

Press the housing in squarely until the flange seats against the case and cover.

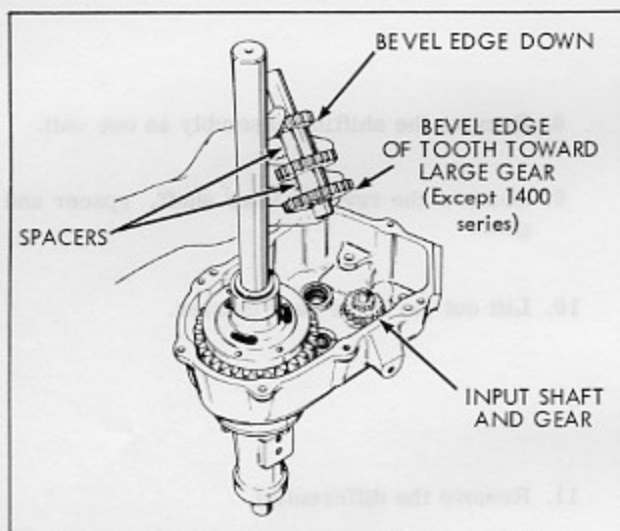


Figure 4-14 Install Three Gear Cluster

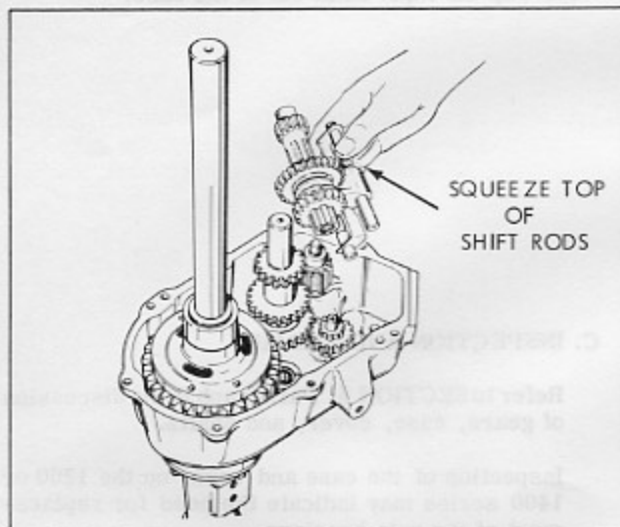


Figure 4-15 Install Shifter Assembly

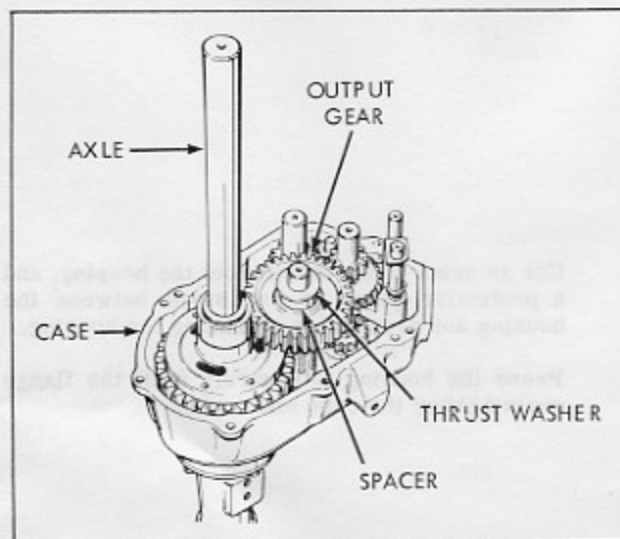


Figure 4-16 Output Gear and Shaft

## D. ASSEMBLY

1. Install input shaft in case. Use a soft mallet to seat shaft and gear completely. Binding can occur if the shaft is driven in only part way.
2. Install the differential assembly. The four capscrew heads should go down into the case.

3. Install the three gear cluster, with the smallest gear up.

NOTE: Bevels of small and middle gear go down toward large gear. Large gear bevel is up. The short spacer goes between the large and middle gears.

The 1400 series has a one piece, 3 gear cluster. See Figures 4-18 and 4-19.

4. Position the reverse idler shaft in the unit, then install gear and spacer.

5. Install the shifter assembly as a unit into the case. When installed correctly, the neutral square formed by the shifting forks should appear through the case opening for attaching the shift housing. Both shift gears should be out of mesh.

6. Install the output shaft, gear, spacer and thrust washer.

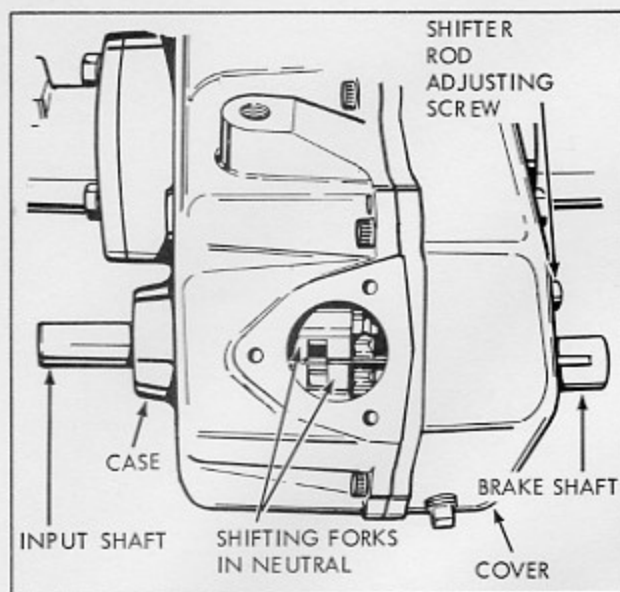


Figure 4-17 Transaxle Case

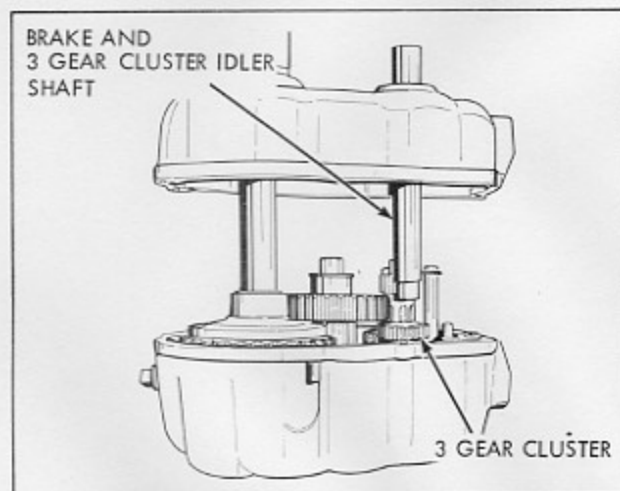


Figure 4-18 Removal 1400 Transmission

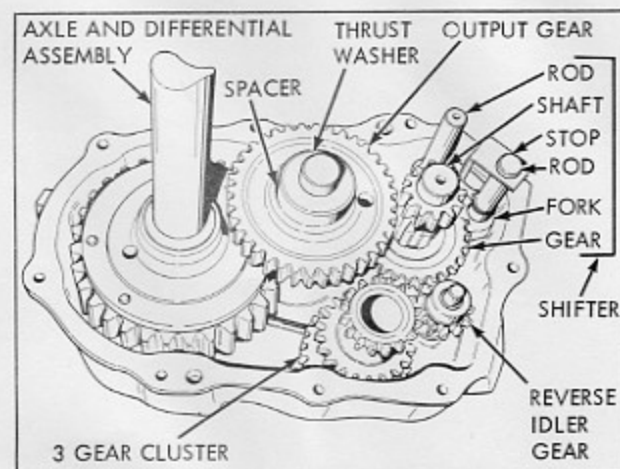


Figure 4-19 1400 3 Gear Cluster

7. Install brake shaft in the unit cover.
8. Position a new gasket on the cover mounting surface, then install cover.
9. Align cover with the dowel pin and secure with the socket head capscrew. Torque to 10 lbs. ft.
10. (a) On 1200 series units, install axle seals using sleeve and driver.  
(b) On 1700 series, install axle seals before installing axle supports using sleeve and driver.  
(c) On 2000 series, press seals into seal retainers, then use sleeve to protect seal when installing into the case and cover. Install "O" ring seal.
11. Install axle supports (1700 and 2000 series). Be sure that the mounting pad position is correct before tightening down capscrews to 13 lbs. ft.
12. Install a new gasket and shift lever housing. Torque screws to 10 lbs. ft. Be sure the shift lever is in the proper position to allow shifting.

#### E. LUBRICATION

Use S.A.E. 90 E.P. oil in the transaxle.

Fill units 1203, 1204, 1204-A, 1205 thru 1208 with 3 pints oil. All other units, fill with 2 pints oil.

#### F. 1400 SERIES TRANSAXLE

The following areas of repair and assembly are peculiar to the 1400 series transaxle.

1. The brakeshaft is also an idler shaft for the 3 gear cluster. When the cover is removed or installed with the shaft, the 3 gear cluster should be positioned in the case to its proper spot. Then the shaft is inserted through it into the needle bearing.
2. The one piece gear cluster is identical to that found in the 2300 series. Refer to page 11-2 of SECTION 11 for bushing replacement procedure. Use tool 670183 for the 7/8" I.D. bushing.



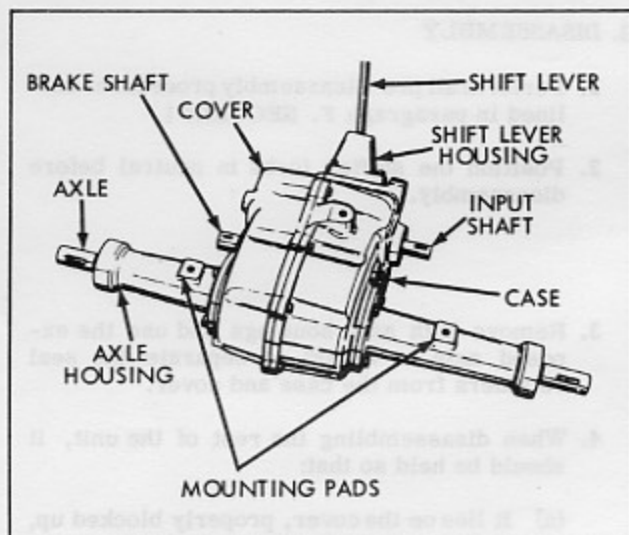


Figure 5-1 2300 Series Transaxle

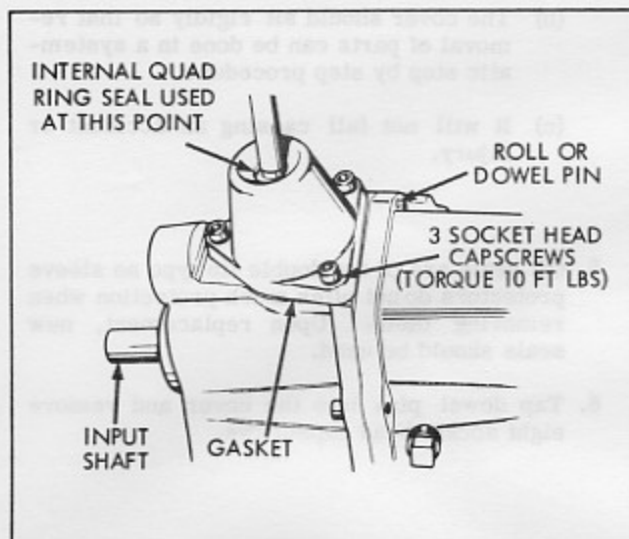


Figure 5-2 Shift Lever Housing

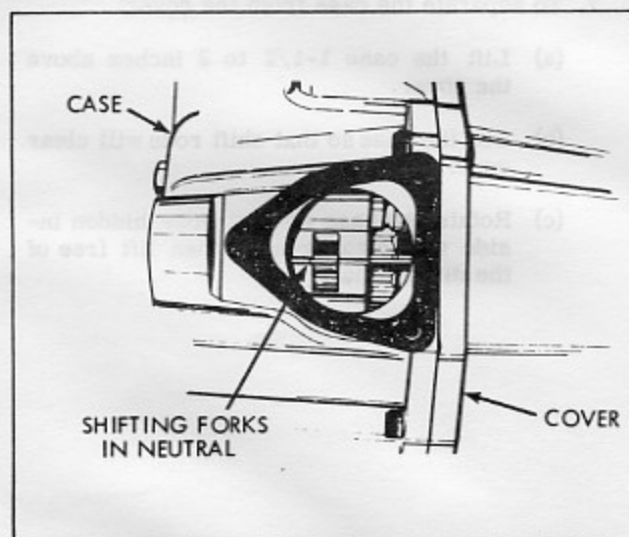


Figure 5-3 Position of Shifter Forks Prior to Disassembly

#### A. GENERAL

1. The 2300 series transaxles have a four speed forward and one speed reverse transmission.
2. To identify the unit, refer to paragraph C., SECTION 1.
3. Service for the shifter assembly is covered in SECTION 10.
4. This is the only transaxle currently produced by Peerless which is approved for use with ground engaging equipment.

5

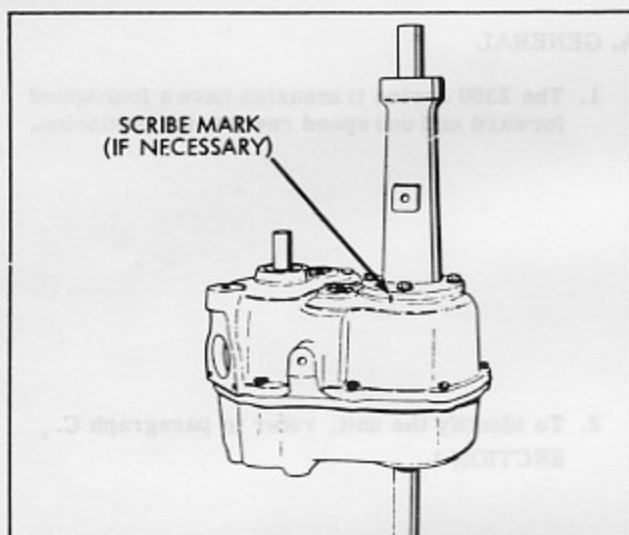


Figure 5-4 Remove Axle Housings

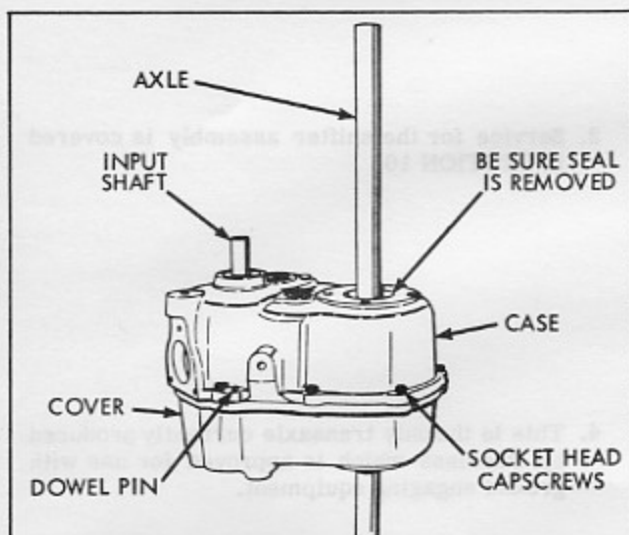


Figure 5-5

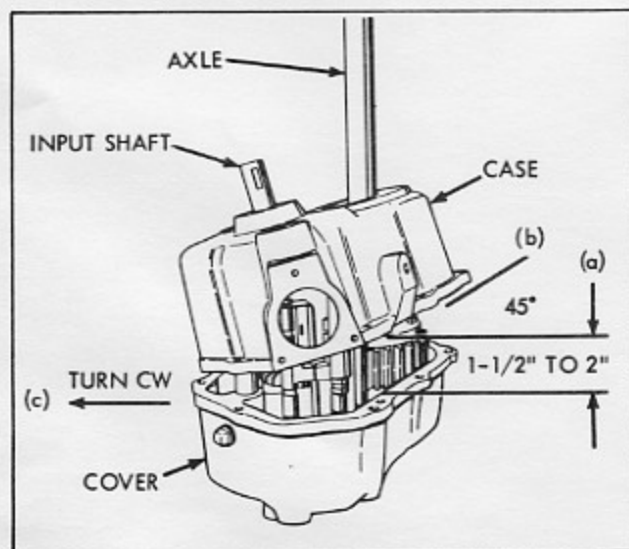


Figure 5-6

## B. DISASSEMBLY

1. Perform all pre-disassembly procedures outlined in paragraph F. SECTION 1.
2. Position the shifter forks in neutral before disassembly.
3. Remove both axle housings and use the exposed axle as a ram to separate the seal retainers from the case and cover.
4. When disassembling the rest of the unit, it should be held so that:
  - (a) It lies on the cover, properly blocked up, so that no weight rests on the brake shaft.
  - (b) The cover should sit rigidly so that removal of parts can be done in a systematic step by step procedure.
  - (c) It will not fall causing an accident or injury.
5. Oil seals are of the double lip type so sleeve protectors do not offer much protection when removing them. Upon replacement, new seals should be used.
6. Tap dowel pins into the cover and remove eight socket head capscrews.
7. To separate the case from the cover:
  - (a) Lift the case 1-1/2 to 2 inches above the cover.
  - (b) Tilt the case so that shift rods will clear edge.
  - (c) Rotate the case so that boss hidden inside will clear gears, then lift free of the differential.

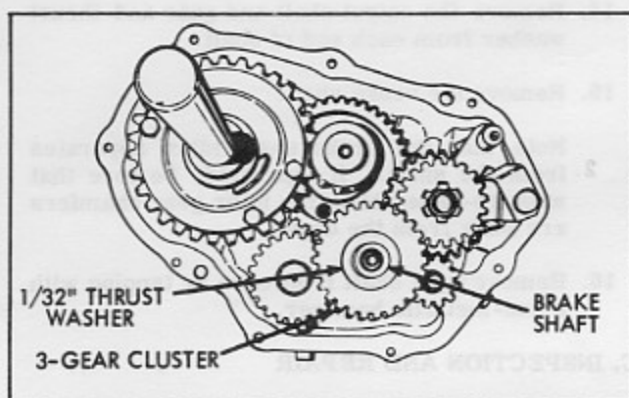


Figure 5-7 Remove Three Gear Cluster

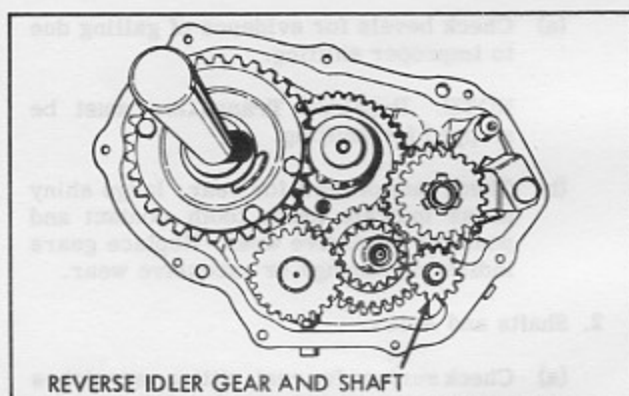


Figure 5-8 Reverse Idler Gear, Shaft and Spacer

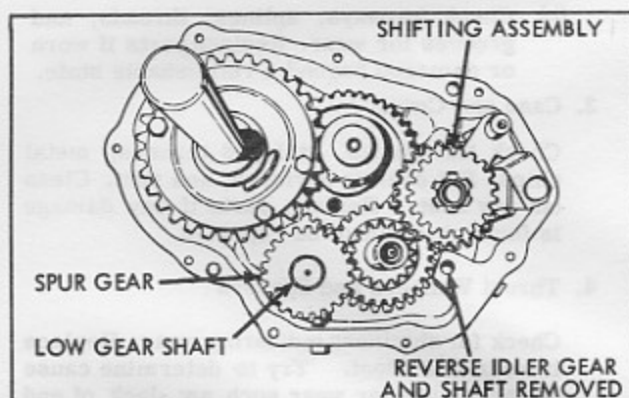


Figure 5-9 Remove Shifting Assembly

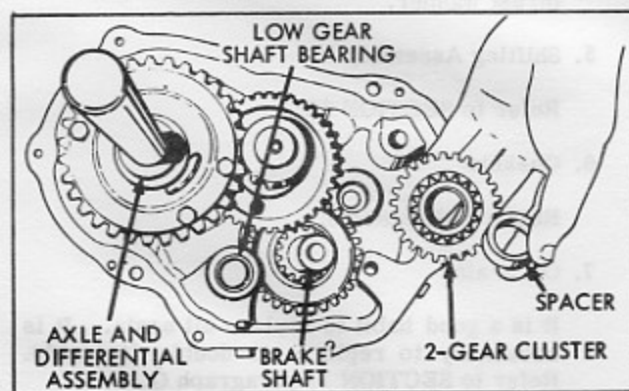


Figure 5-10 Brake Shaft

8. Remove thrust washer and three gear cluster from brake shaft, noting whether the cluster has a sloppy fit.

- (a) To service the cluster bushings, refer to SECTION 11.
- (b) Inspect gear teeth for wearing, chipping or breaks. Wear or chipping on the bevel area only, indicates shifting while the equipment is in motion.

9. Remove the reverse idler gear, spacer, and shaft from boss in cover.

Note that the spacer goes between the gear and that the gear bevels go down.

Excessive wear on teeth bevels indicates improper shifting technique.

10. Lift out the shifter assembly. Service of this unit is described in SECTION 10.

If it is evident that the shifter assembly needs no further teardown, place it aside, in a clean place, intact, for easy re-assembly.

11. Remove the low gear and shaft, and splined spur gear. Separate gear and shaft. Note that NO thrust washer is between the gear and case.

12. Remove the two gear cluster and spacer from the brake shaft.

13. Lift the differential unit out of the cover. Service information appears in SECTION 8.



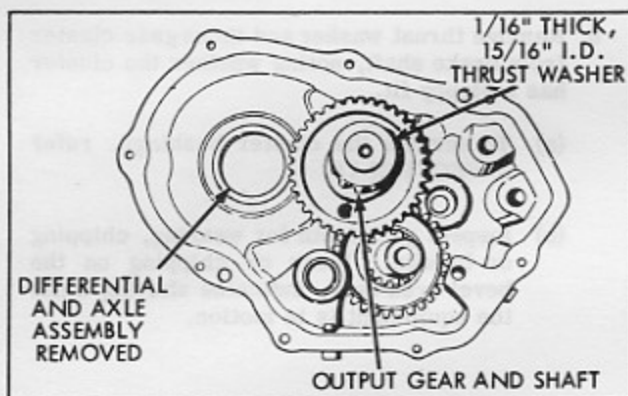


Figure 5-11 Output Gear and Shaft

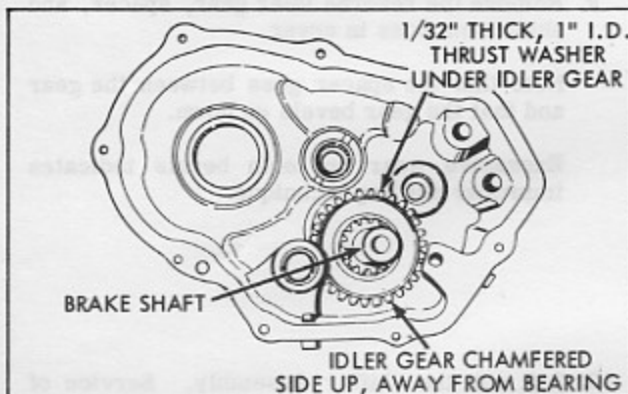


Figure 5-12 Idler Gear and Brake Shaft

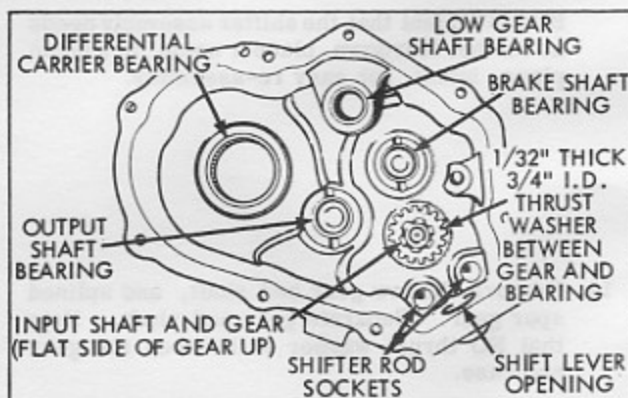


Figure 5-13 Case Assembly

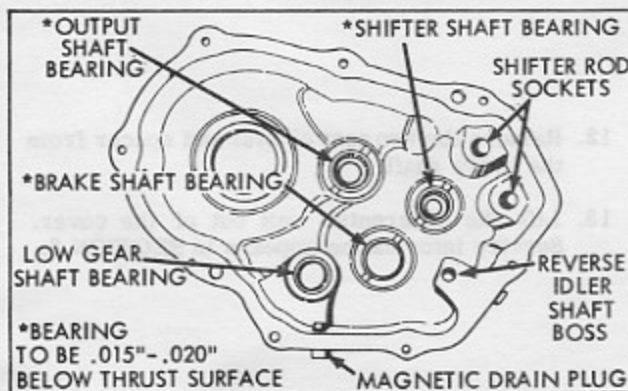


Figure 5-14 Cover Assembly

14. Remove the output shaft and gear and thrust washer from each end of shaft.

15. Remove the brake shaft:

Note that the brake shaft idler separates from the shaft. If separated, be sure that when re-assembled, the idler gear chamfers are away from the cover.

16. Remove input shaft from case by tapping with a non-metallic hammer.

### C. INSPECTION AND REPAIR

#### 1. Gears

(a) Check bevels for evidence of galling due to improper shifting.

NOTE: Peerless Transaxles must be stopped for shifting.

(b) Check face of teeth for wear, large shiny areas indicate much tooth contact and possible excessive wear. Replace gears indicating damage or excessive wear.

#### 2. Shafts and Axles

(a) Check surface for rust, pitting, scratches or wear.

(b) Check keyways, splines, threads, and grooves for wear. Replace parts if worn or damaged beyond a refinishable state.

#### 3. Case and Cover

Check for cracks, stripped threads, metal chips, flat sealing surfaces, and rust. Clean out any rust. Replace parts if any damage is found that cannot be repaired.

#### 4. Thrust Washers and Spacers

Check for shininess indicating wear. Replace if wear is evident. Try to determine cause of thrust washer wear such as: lack of end play due to re-use of gasket or use of wrong thrust washer.

#### 5. Shifting Assembly

Refer to SECTION 10.

#### 6. Gaskets

Replace all gaskets.

#### 7. Oil Seals

It is a good habit to replace all seals. It is necessary to replace all double lip seals. Refer to SECTION 1, paragraph G.

#### 8. Bearings and Bushings

Refer to SECTION 11.

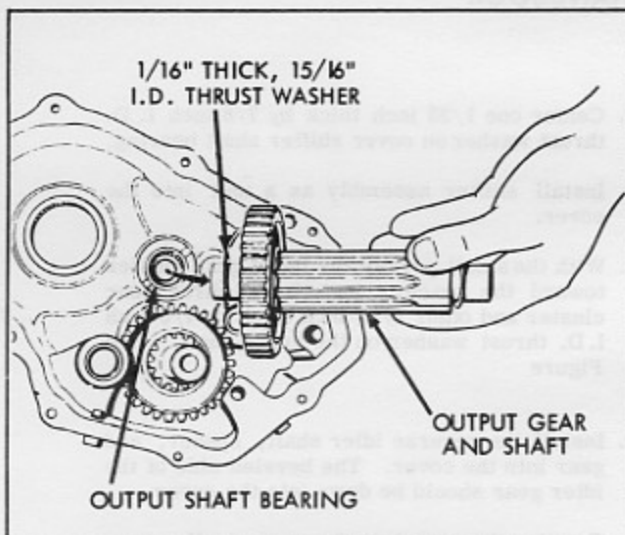


Figure 5-15 Output Shaft Bearing

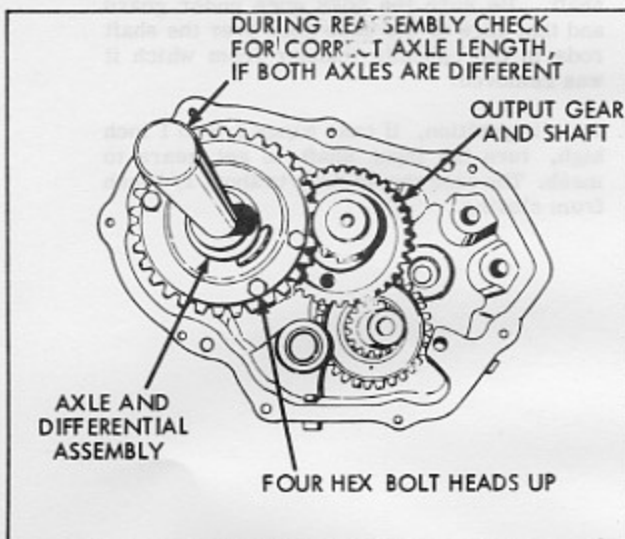


Figure 5-16 Install Differential

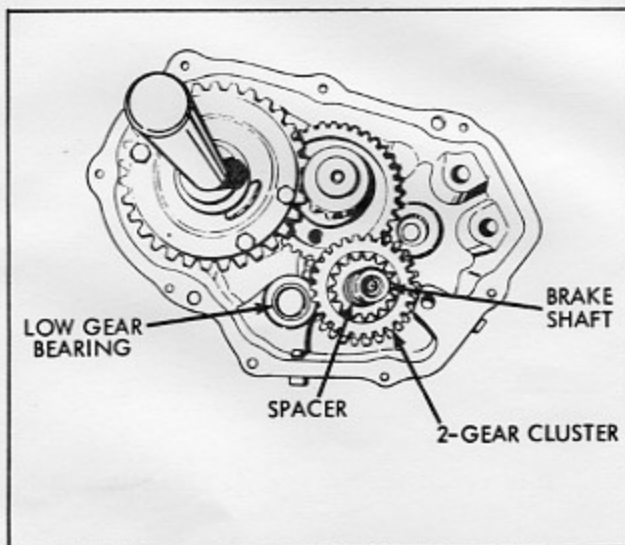


Figure 5-17 Two Gear Cluster

#### D. ASSEMBLY

1. Install input shaft in case. Use a soft mallet to seat shaft and gear completely. Often, binding in the assembled unit can be traced to a partially installed input shaft.
2. Center one 1/32 inch thick by 1 inch I.D. thrust washer on the cover brake shaft needle bearing, then install the brake shaft and gear (chamfer side away from cover).
3. Install the output shaft and gear after centering a 1/16 inch thick by 15/16 inch I.D. thrust washer on each end of the shaft.
4. Insert the differential assembly in the cover. Note that the four bolt heads should be out away from the output gear.
5. Install the two gear cluster and spacer on the brake shaft.
6. Install a 1/16 inch thick by 3/4 inch I.D. thrust washer, gear, and low gear idler shaft in cover. Do not put a thrust washer on the exposed end of this shaft. Be sure the small gear meshes with the larger gear of the two gear cluster.

5

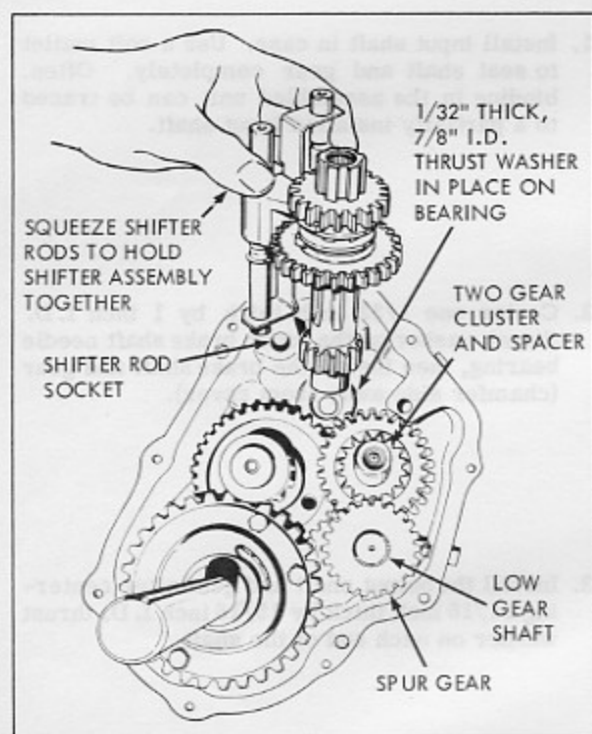


Figure 5-18 Spur Gear and Low Speed Shaft

7. Center one 1/32 inch thick by 7/8 inch I. D. thrust washer on cover shifter shaft bearing.
8. Install shifter assembly as a unit into the cover.
9. With the small gear of the three gear cluster toward the spacer, install the three gear cluster and other 1/32 inch thick by 7/8 inch I. D. thrust washer on the brake shaft. See Figure
10. Install the reverse idler shaft, spacer, and gear into the cover. The beveled side of the idler gear should be down into the cover.
11. Position the gasket on the cover sealing surface, then install case over the differential shaft. Be sure the boss goes under gears and that edge of the case goes over the shaft rods in the opposite manner from which it was removed.
12. Once in position, if case hangs 1/2 to 1 inch high, turn the input shaft to get gears to mesh. The case should drop to about 1/4 inch from closing.



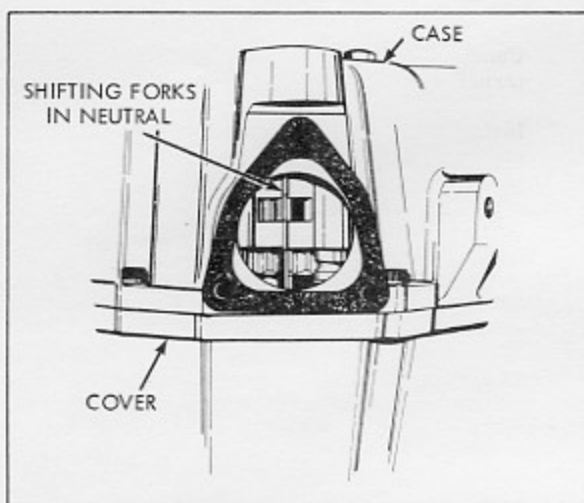


Figure 5-19 Install Case

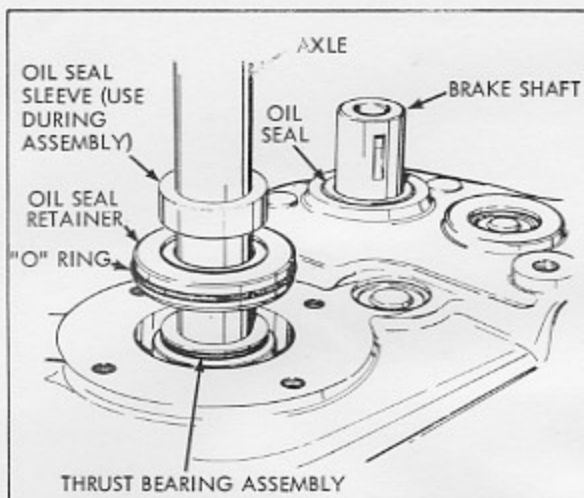


Figure 5-20 Install Seal Retainers

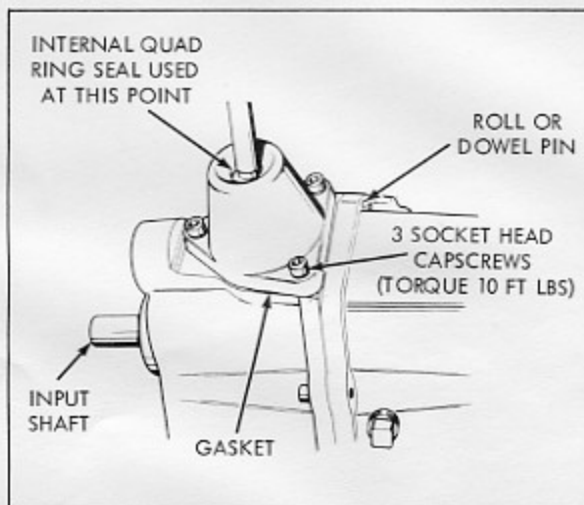


Figure 5-21 Shift Lever Housing Installed

13. Use a pair of needle nose pliers on the shifter stop on each shifter fork to agitate the shifter rod ends into their machined recesses in the case.

14. Align the case and cover with the two dowels, then install and tighten the eight socket head cap screws. Torque screws to 10 lbs. ft. Unit can now be placed flat on the work bench.

Position seal retainers and new seals in position.

Caution: Sleeves must be used to protect seals, especially axle ends or where wheels attach.

15. Install new "O" rings on seal retainers and position axle supports to case and cover. Be sure mounting pads face in same position as when removed. Install cap screws and torque to 13 lbs. ft.

16. Install shift lever housing and new gasket.

#### E. TESTING AND LUBRICATION

1. For testing, refer to SECTION 1, paragraph I.
2. For proper lubrication type and amount, refer to SECTION 1, paragraph E.

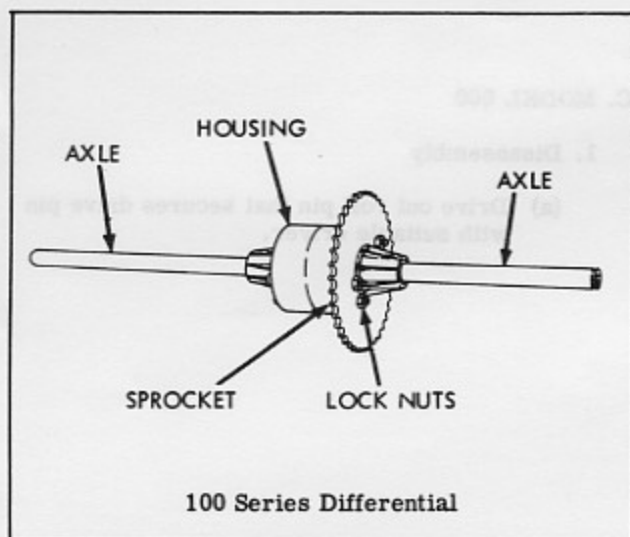


Figure 8-1

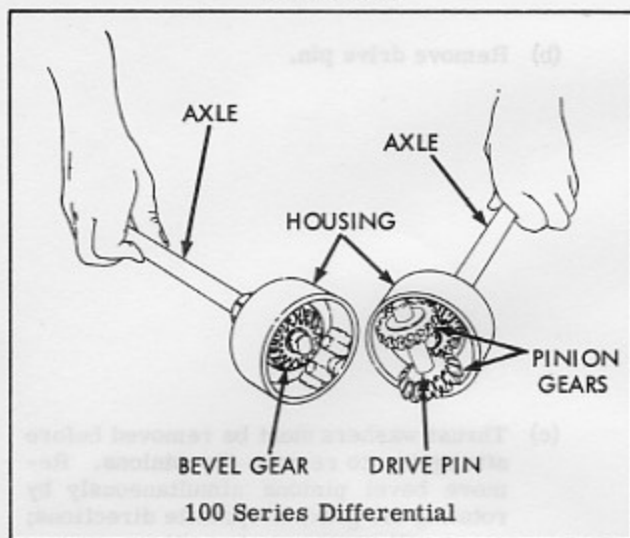


Figure 8-2

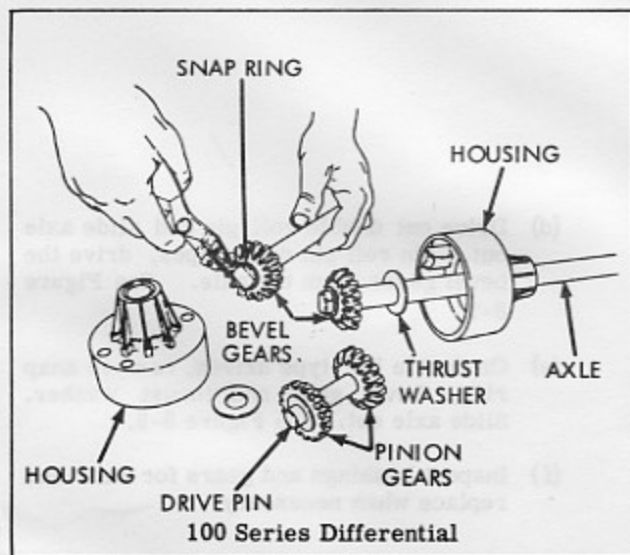


Figure 8-3

### A. GENERAL

The differential assemblies, of all Peerless units utilizing them, are grouped together in SECTION 8. Though there is little similarity between the 100, 600, and remaining series units, they are grouped here because their function is the same.

The differential assemblies for the 1200, 1300, 1700, 2000, 2300, and 2400 series Peerless units are very similar. However, each must be assembled in its own way. By grouping them together, you will become more aware of differences in each unit, therefore less apt to allow these differences to cause mistakes in assembly.

### B. MODEL 100 DIFFERENTIAL

#### 1. Disassembly

- (a) Clean outside of differential. Remove all keys, pins, etc. Remove all burrs from keyways and holes. Use stone on hardened shafts.
- (b) Remove 4 locknuts, bolts and sprocket. Separate differential carrier housings.
- (c) Remove drive pin, pinion gears and thrust washers as a unit. See Figure 8-2.
- (d) Remove snap ring, bevel gear and thrust washer. Slide axle from differential carrier housing. See Figure 8-2.

NOTE: Bushings are replaceable in the differential carrier housing. To replace bushing, use bushing tool 670204.

#### 2. Assembly

- (a) Slip axle in differential housing carrier. Place thrust washer and bevel gear on axle and secure with snap ring.
- (b) Place pinion gears and thrust washers on drive pin and insert assembly into either differential housing carrier.
- (c) Use 1 oz. S.A.E. EP90 Lithium grease as lubricant.
- (d) Assemble differential carrier housings and sprocket with 4 bolts and locknuts.

NOTE: No oil seals or gaskets are required in this unit.

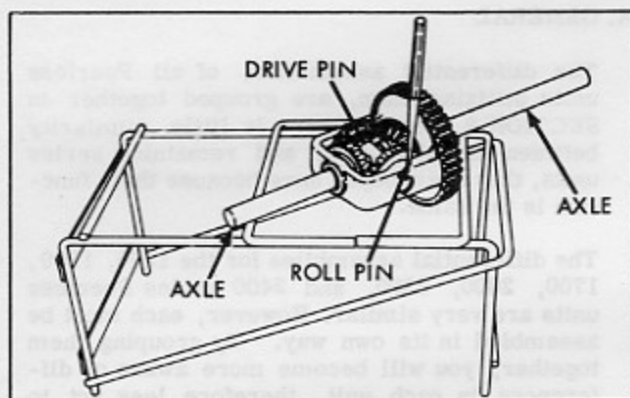


Figure 8-4

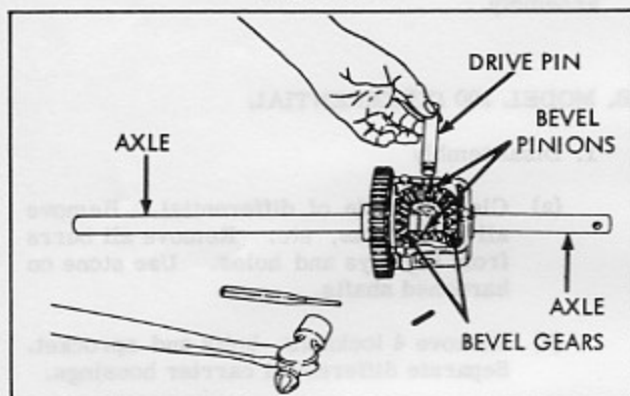


Figure 8-5

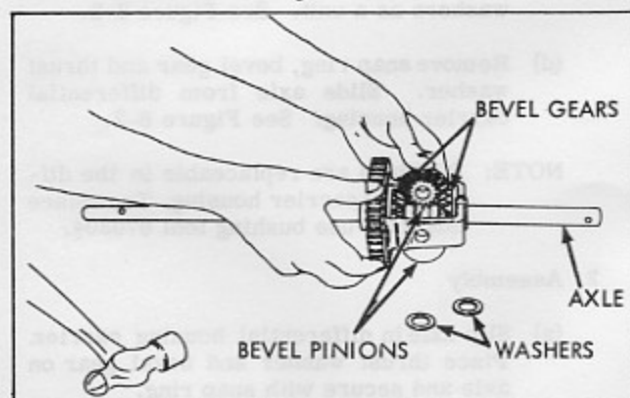


Figure 8-6

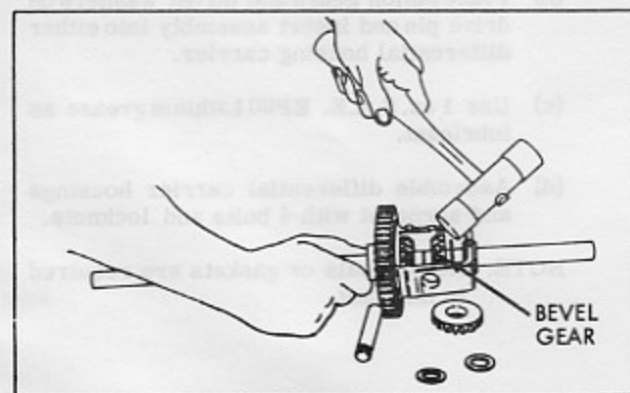


Figure 8-7

## C. MODEL 600

## 1. Disassembly

- (a) Drive out roll pin that secures drive pin with suitable driver.

- (b) Remove drive pin.

- (c) Thrust washers must be removed before attempting to remove the pinions. Remove bevel pinions simultaneously by rotating the gears in opposite directions; gears will move out of position.

- (d) Drive out double roll pin and slide axle out. On roll pin drive types, drive the bevel gears from the axle. See Figure 8-7.

- (e) On double "D" type drives, remove snap ring, bevel gear and thrust washer. Slide axle out. See Figure 8-9.

- (f) Inspect bushings and gears for wear and replace when necessary.



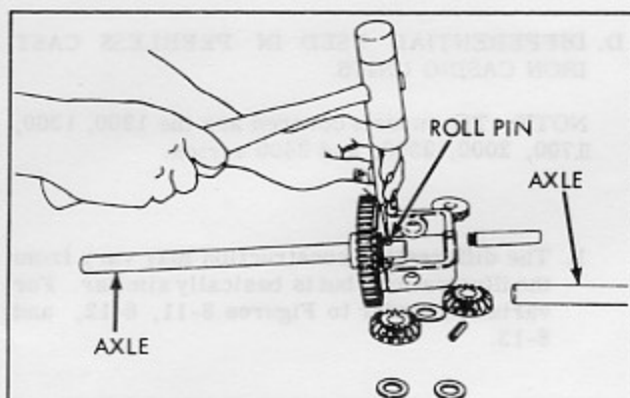


Figure 8-8

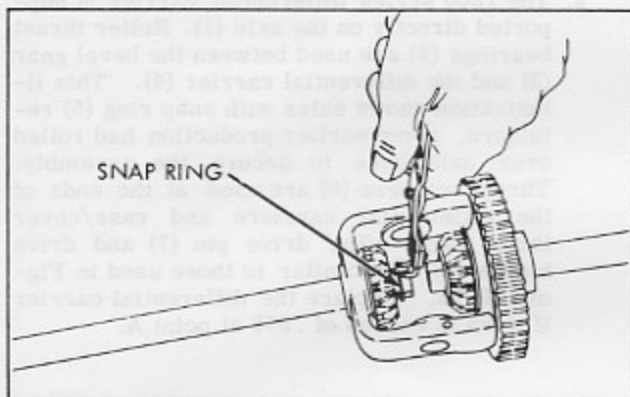


Figure 8-9

## 2. Reassembly of Differential Assembly

- (a) Place axles (left and right) into differential gear assembly. Install thrust washers.

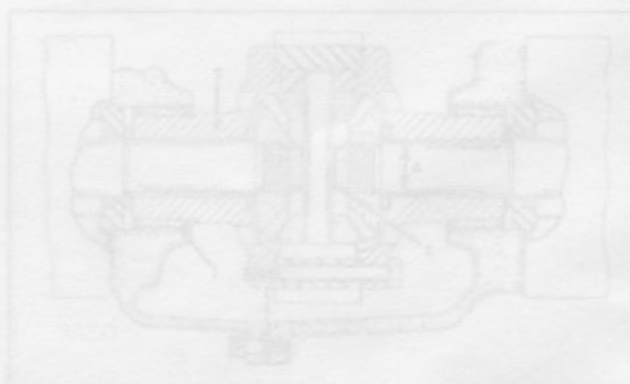
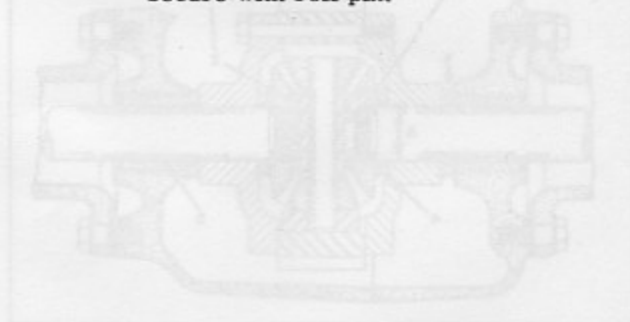
NOTE: The axles differ in length so select the proper axle.

- (b) On roll pin drive models, install double roll pins into holes in each shaft. Place bevel gears on shaft. Roll pins fit into the recess in back of the gears, bevel gears must be seated tightly on the roll pins or binding will occur. See Figure 8-8.

- (c) On double "D" type drives, place bevel gears on the shaft and install snap ring in groove on the shaft. See Figure 8-9.

- (d) Install bevel pinions **SIMULTANEOUSLY FROM OPPOSITE SIDES** by rotating pinions in opposite directions while sliding into position in gear assembly. See Figure 8-6. Check alignment by inserting fingers into drive pin holes. If not aligned, drive pin cannot be inserted. Remove and replace bevel pinions as only one tooth out of position will cause misalignment.

- (e) After aligning, insert thrust washers behind each pinion. Insert drive pin and secure with roll pin.



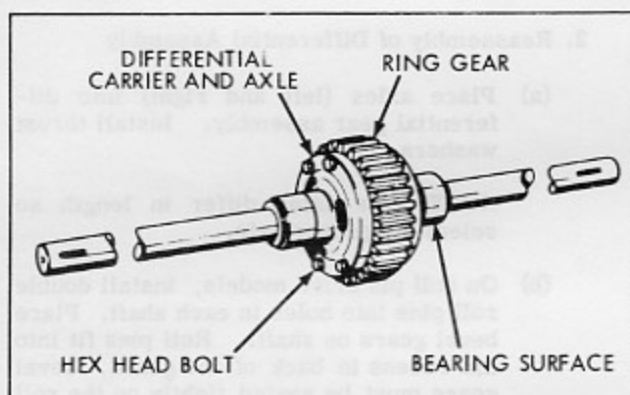


Figure 8-10 Typical Transaxle (3 Speed Series)

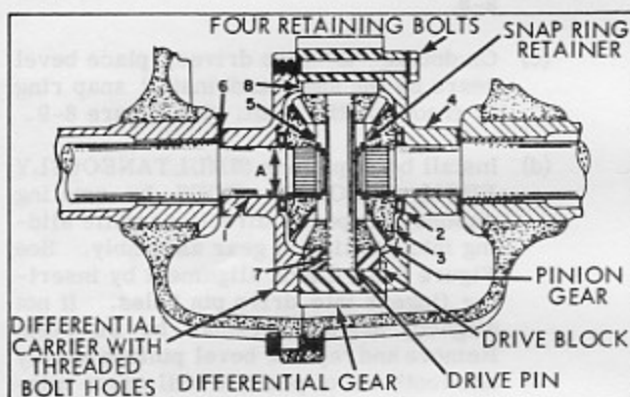


Figure 8-11 1200 Series Transaxle

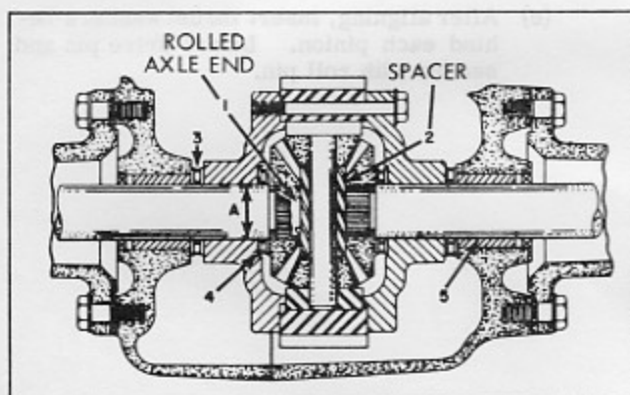


Figure 8-12 1700 Series Transaxle

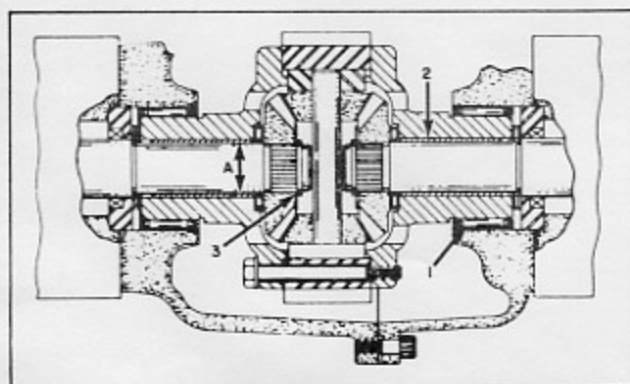


Figure 8-13 2000 and 2300 Series Transaxle

#### D. DIFFERENTIAL USED IN PEERLESS CAST IRON CASING UNITS

NOTE: The models covered are the 1200, 1300, 1700, 2000, 2300, and 2400 series.

1. The differential construction may vary from the illustrations but is basically similar. For variations refer to Figures 8-11, 8-12, and 8-13.

2. The 1200 series differential carrier is supported directly on the axle (1). Roller thrust bearings (2) are used between the bevel gear (3) and the differential carrier (4). This illustration shows axles with snap ring (5) retainers, some earlier production had rolled over axle ends to secure the assembly. Thrust washers (6) are used at the ends of the differential carriers and case/cover thrust face. The drive pin (7) and drive blocks (8) are similar to those used in Figure 8-12. Replace the differential carrier if worn in excess of .878 at point A.

3. The 1700 series differential has rolled on the ends (1) to retain the bevel gear to the axle. The 1700 differential is also made with snap ring retainer on the axle. In event it is necessary to replace parts, the new axles will be snap ring type and the spacer (2) will be eliminated.

Replace differential carriers worn in excess of 1.004 at point A.

4. Roller thrust bearings (3) and (4) are used between the carrier and case/cover and between the bevel gear and carrier.

The bushings (5) support the axles.

5. The 2000 series, three speed and the 2300 series, four speed differential. Examine the external bearing race on the differential carriers (1) for wear, pitting, replace if evident. The differential carriers in this assembly have replaceable bushings (2) replace if worn in excess of .878, point A. See SECTION 11, Bushing and Bearing Service. These differentials have been built with rolled axle ends and also snap rings (3) as illustrated.

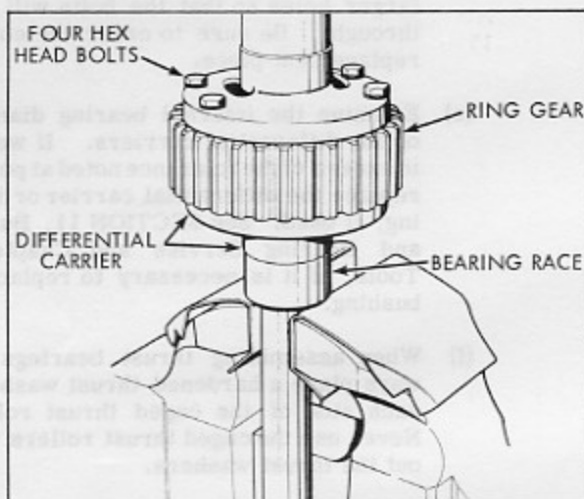


Figure 8-14 Differential Bolt Removal

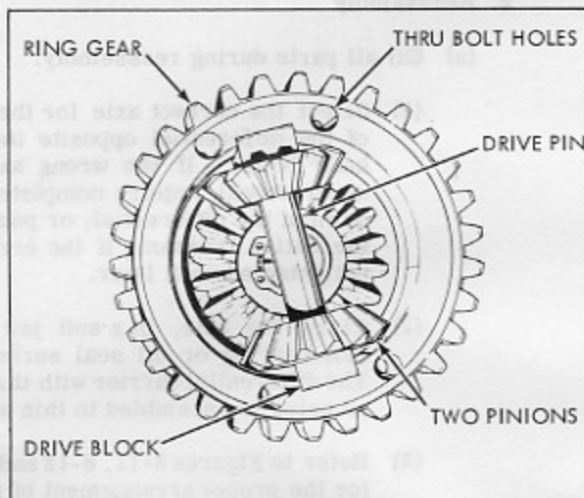


Figure 8-15 Differential Assembly (One Carrier Removed)

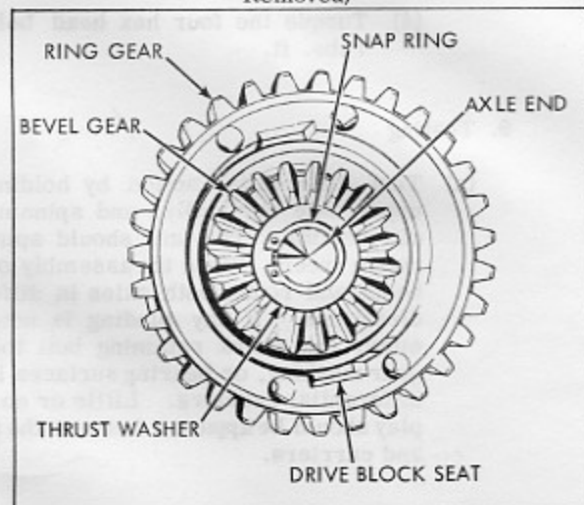


Figure 8-16 Drive Block, Pin and Pinion Gear Removed

## 6. Disassembly

- Clean the differential assembly, then check and note the axle lengths and their relation to the heads of the four hex head bolts.
  - If the unit will not turn freely, note where the unit binds. Check and replace those parts.
  - Place the differential in a large vise with soft jaws (hex head bolts up). Do not clamp the vise on the bearing race of a differential carrier.
- Remove the four hex head bolts and the upper axle and differential carrier. Remove the drive blocks, pinions, drive pin and thrust spacer if used, by lifting out of the ring gear. Tap the ring gear lightly with a mallet to loosen from the differential carrier. Figure 8-15.
  - If a snap ring is used, the axle assembly may be disassembled. If the axle end has been rolled, do not attempt to break the rolled retaining edge. The parts are to be replaced as an assembly.
  - Remove the snap ring and the thrust washer, if used. Separate the bevel gear and differential carrier from the axle.

## 7. Inspection

- See SECTION 11, for Bushing and Bearing Service.
- Examine gears for wear, cracked or chipped teeth. Check the internal splines of the gears and the axle if the gear is removeable. If excess play is noted, it may be necessary to replace the individual parts or both the gear and axle.
- Examine drive pinions, drive pins and drive blocks for wear and damage. Replace excessively worn pinion or the drive pin.



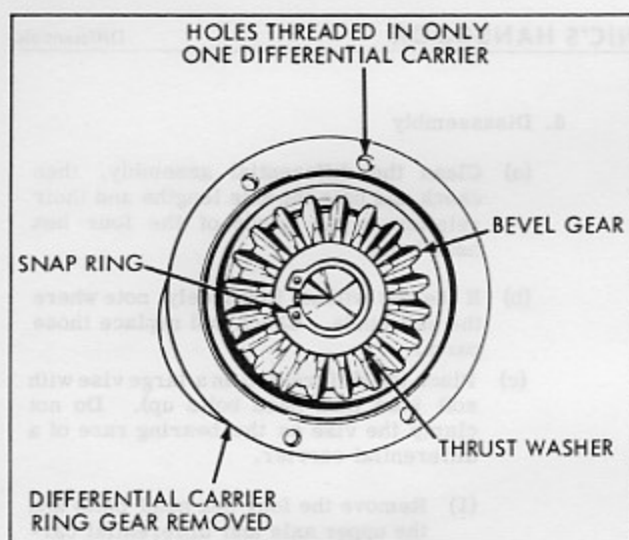


Figure 8-17 Ring Gear Removed

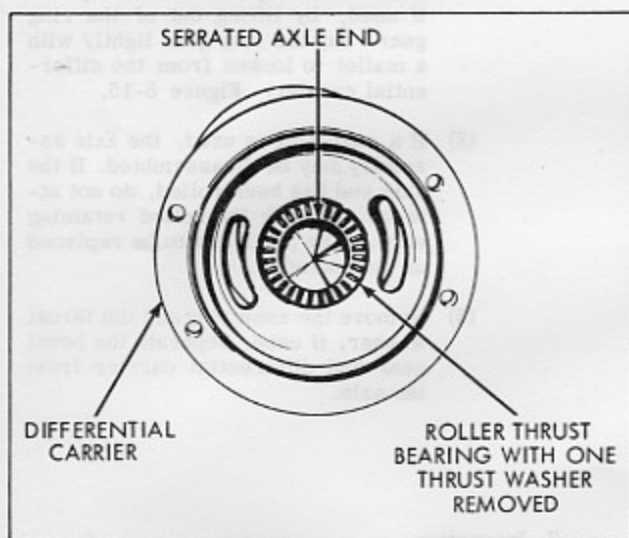


Figure 8-18 Snap Ring, Washer and Bevel Gear Removed

- (d) Examine the differential carriers. One has threaded holes and the other has larger holes so that the bolts will pass through. Be sure to order the correct replacement piece.
- (e) Examine the internal bearing diameter of the differential carriers. If wear is in excess of the tolerance noted at point A, replace the differential carrier or bushing, if used. See SECTION 11, Bushing and Bearing Service and Chapter 5, Tools, if it is necessary to replace the bushing.
- (f) When assembling thrust bearings, always place a hardened thrust washer on each side of the caged thrust rollers. Never use the caged thrust rollers without the thrust washers.

## 8. Reassembly

- (a) Oil all parts during reassembly.
  - (1) Select the correct axle for the side of the differential opposite the hex head bolts. If the wrong axle is used, it will require complete tear down of the differential, or possibly the entire transaxle if the error is not detected until later.
  - (2) Clamp the axle, in a soft jaw vise (not bearing or oil seal surfaces). The differential carrier with threaded holes is assembled to this axle.
  - (3) Refer to Figures 8-11, 8-12 and 8-13 for the proper arrangement of parts for the differential being serviced.
  - (4) Torque the four hex head bolts to 7 lbs. ft.

## 9. Testing

- (a) Test differential action by holding the upper axle vertically, and spinning the differential. The unit should spin and rotate freely. Place the assembly on the bench and rotate both axles in different directions. If any binding is noted in either test check retaining bolt torque, gear meshing, or bearing surfaces in the differential carriers. Little or no end-play should be apparent between the axles and carriers.

## E. DUO-TRAK\* DIFFERENTIAL

## 1. The Limited Slip Differential and How It Works

Peerless Gear and Machine Division of Tecumseh Products is offering a "Limited Slip Differential" for their series 2300 and 2400 model transaxles.

It seems that some people are expecting this differential to perform as a "locked differential" and the following information is given to clear up any confusion that may be present.

The standard bevel gear differential is a torque balancing device in which the low tractive and high tractive wheels deliver the same amount of torque. Therefore, when you experience low traction on one wheel the other wheel delivers exactly the same traction. The extreme example of this is when one wheel spins freely and the other wheel does not move, or in other words, you do not have any traction to move the vehicle.

The "Limited Slip Differential" is built in such a manner that an internal drag is developed in the differential gears so that the driving torque is more uniformly distributed between the two driving wheels. This gives superior traction (at least 50% more) in marginal situations such as snow plowing, turning on the side of a hill, hill climbing and operating on wet grass.

However, this feature cannot be demonstrated by jacking one wheel off the ground or placing one wheel in an extremely slippery position.

To sum it up, the "Limited Slip Differential" will allow the operator to use his unit in some situations where the unit with a standard differential cannot be used. At the same time there are certain extreme conditions in which the "Limited Slip Differential" cannot be expected to provide traction.

It should also be noted that the "Limited Slip Differential" retains the feature of allowing the outside wheel to rotate faster than the

inside wheel when making a turn. This is the main disadvantage of a "Locked Differential" which results in very difficult steering.

## 2. Disassembly, Inspection, and Repair

Remove four through-bolts.

Separate axle assemblies from body cores.

To disassemble axles, remove snap ring and retained parts. Be sure that flanged thrust washer goes toward hub end of axle upon reassembly.

Use a pair of large 90° tip snap ring pliers and remove the cylindrical spring putting tension on the ten pinion gears. Once the spring is removed, the gears can be removed.

Separate the two body cores from the ring gear.

## 3. Assembly

Install body cores to ring gear so that pockets in one core are out of alignment with pockets in the other core.

Re-assemble thrust washers, bearing, carrier and side gear to axle and secure with the snap ring.

Install pinion gears on one side, then use the differential carrier and axle to hold them from falling out when the unit is turned over. The side gear must mesh with the five pinions.

Install pinions in other side to mesh with previously installed pinions.

Insert the cylindrical spring with a pair of large 90° tip snap ring pliers so that it bottoms on the side gear. Most of the ten pinions should be in contact with the spring.

Install other axle and secure assembly with four through bolts. Torque to 7-10 lbs. ft.

\*DUO-TRAK is the trademark of a patented limited slip differential designed by Illinois Tool Works.

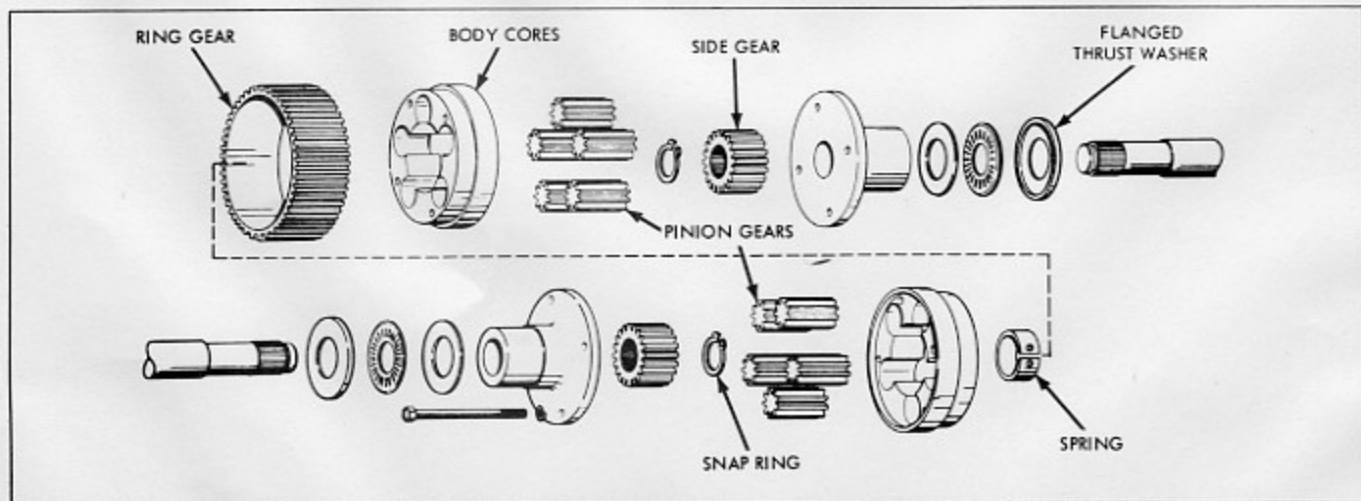


Figure 8-19 DUO-TRAK\* Differential

A. SHIFT PATTERNS

FRONT OF EQUIPMENT

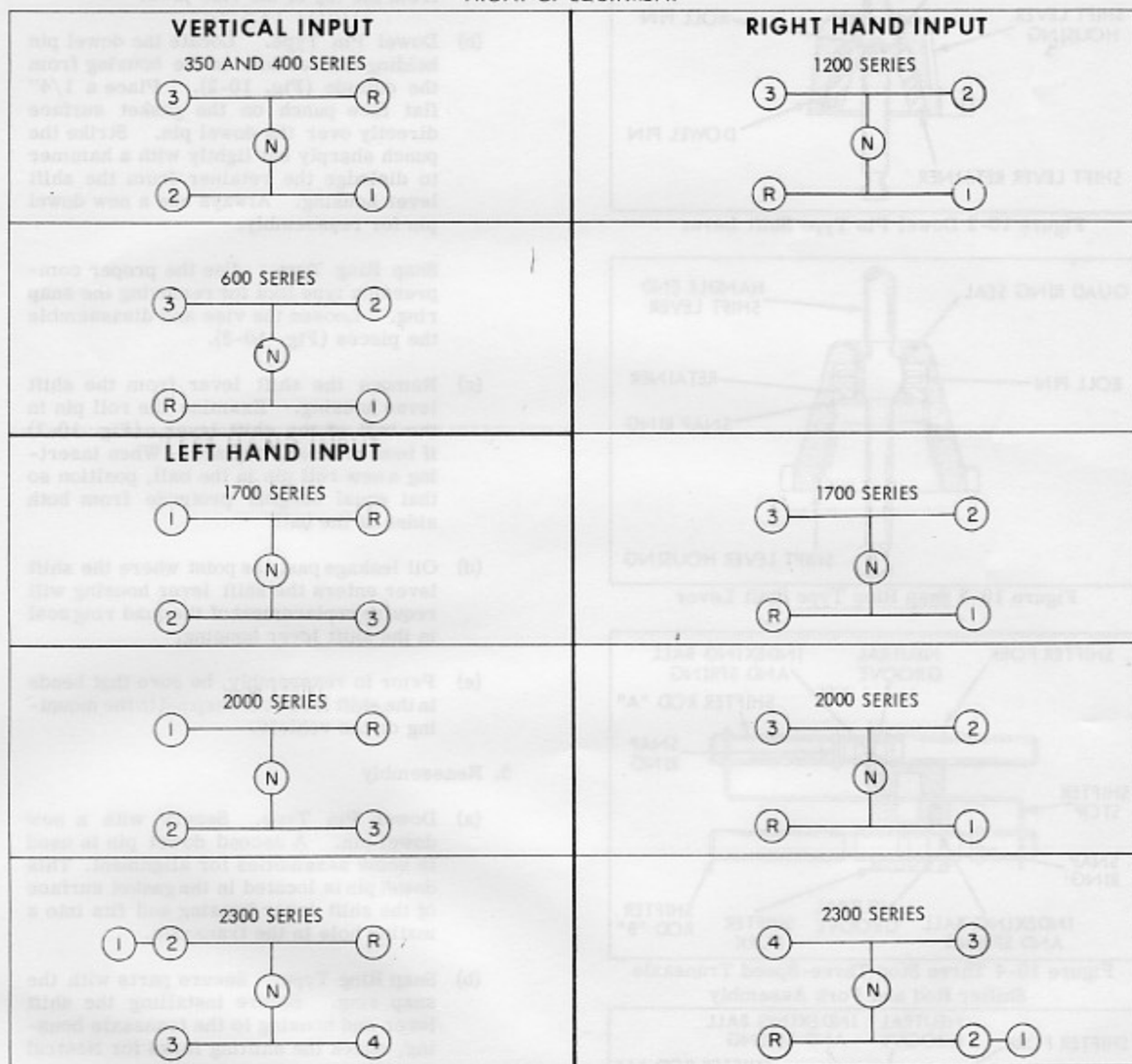


Figure 10-1 Shift Patterns

B. SHIFT LEVER ASSEMBLY

1. General

- Prior to removing a shift lever assembly from a transaxle, make note of the position of the shift lever so that it may be assembled correctly to the shift lever housing.
- Move the shift lever to Neutral, if possible, before removing it from the trans-axle. Clean around the lever housing to prevent dirt from falling into the trans-axle. Cover this opening, if possible.



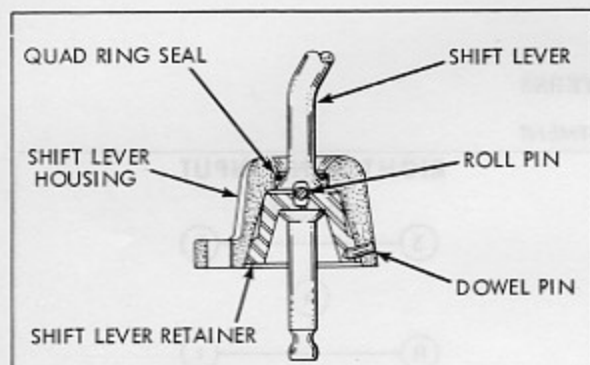


Figure 10-2 Dowel Pin Type Shift Lever

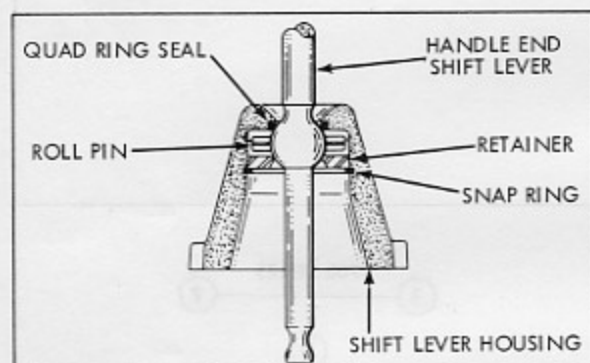


Figure 10-3 Snap Ring Type Shift Lever

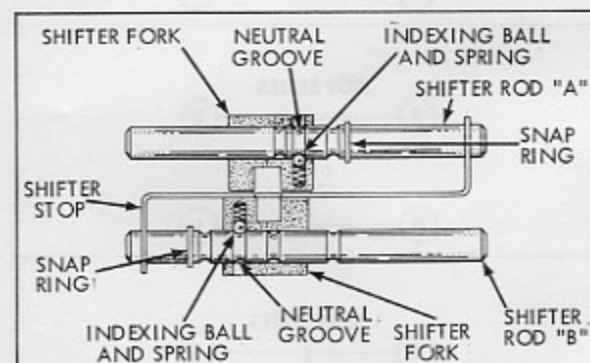


Figure 10-4 Three Stop Three-Speed Transaxle Shifter Rod and Fork Assembly

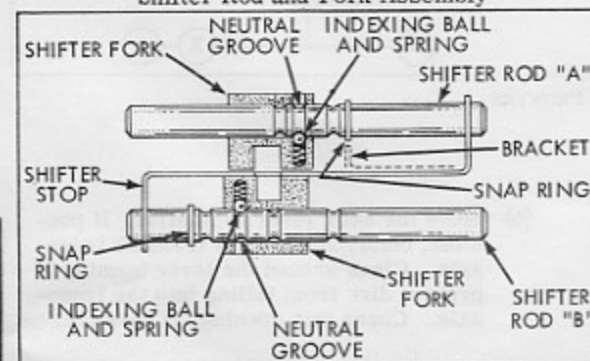


Figure 10-5 Four Stop, Three-Speed and Four-Speed Transaxle Shifter and Fork Assembly

## 2. Disassembly

- Place the shift lever in a vise so that the shift lever housing is at least one inch from the top of the vise jaws.
- Dowel Pin Type.** Locate the dowel pin holding the retainer in the housing from the outside (Fig. 10-2). Place a 1/4" flat face punch on the gasket surface directly over the dowel pin. Strike the punch sharply but lightly with a hammer to dislodge the retainer from the shift lever housing. Always use a new dowel pin for reassembly.

**Snap Ring Type.** Use the proper compressing type tool for removing the snap ring. Loosen the vise and disassemble the pieces (Fig. 10-3).

- Remove the shift lever from the shift lever housing. Examine the roll pin in the ball of the shift lever, (Fig. 10-2) if bent or worn, replace. When inserting a new roll pin in the ball, position so that equal lengths protrude from both sides of the ball.
- Oil leakage past the point where the shift lever enters the shift lever housing will require replacement of the quad ring seal in the shift lever housing.
- Prior to reassembly, be sure that bends in the shift lever correspond to the mounting on the vehicle.

## 3. Reassembly

- Dowel Pin Type.** Secure with a new dowel pin. A second dowel pin is used in some assemblies for alignment. This dowel pin is located in the gasket surface of the shift lever housing and fits into a mating hole in the transaxle.
- Snap Ring Type.** Secure parts with the snap ring. Before installing the shift lever and housing to the transaxle housing, check the shifting forks for Neutral position.
- Always use new gaskets between the shift lever housing and the transaxle.

## C. SHIFTING ASSEMBLY

### 1. General

- Differences in assemblies will be noted in the following servicing procedure. Always use the parts list for each model to obtain the correct parts.

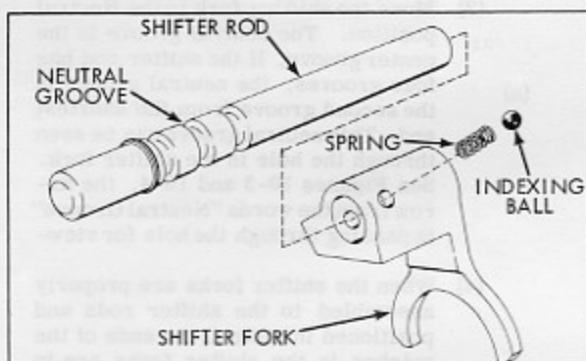


Figure 10-6 Assemble Shifter Forks to Shifter Rods

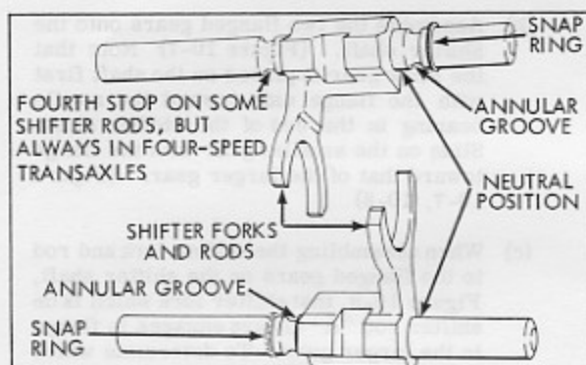


Figure 10-7 Shifter Forks and Rods Positioned In Neutral

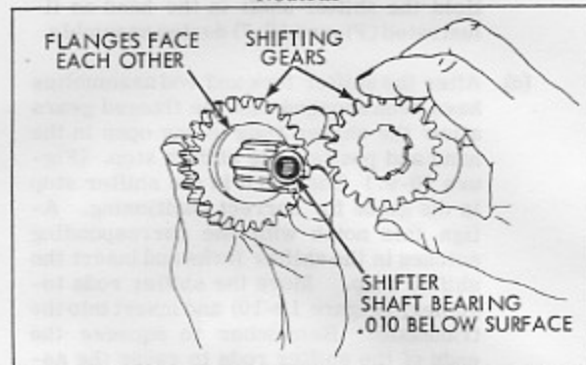


Figure 10-8 Two Flanged Gears onto Shifter Shaft

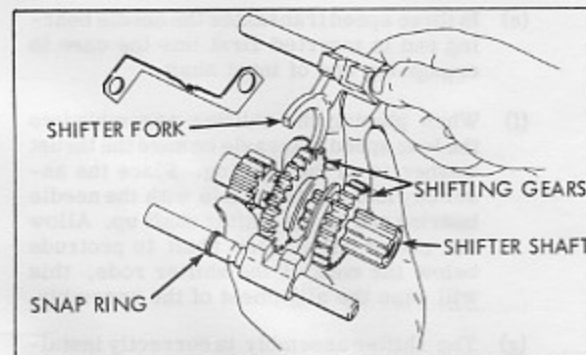


Figure 10-9 Assembling Shift Fork, Gears and Shaft Assemblies

- (b) Shifting assemblies are removed from and installed into transaxles by squeezing the top end of the shifter rods. This causes a binding that retains all parts during removal or installation.

## 2. Disassembly

Follow the illustrations in order. Figures 10-10, 10-9, 10-8, 10-7, 10-6, 10-5. Prior to disassembly compare the assembly with the illustrations. This will aid during the reassembly.

## 3. Inspection

- Replace the shifter stop if worn or damaged.
- Examine the teeth and internal splines of the two shifter gears. Replace damaged gears. The gears must slide freely on the shifter shaft. Excessive wear of the internal spline in the gears will create cocking and difficult shifting. Replace the gear if this condition is present.
- Replace the shifter shaft needle bearing if wear is evident. See SECTION 11, for removal. Replace if the bearing surface of this shaft should it be scuffed, pitted or worn to a diameter less than .750".
- Replace other parts showing wear, looseness, cracks, etc.

## 4. Assembly

- Reassemble the shifting assembly by following the illustrations beginning with Figure 10-5 through 10-10. Pay particular attention to either Figure 10-3 or 10-4 during the reassembly of the shifter forks and shifter rods. Lay the parts on the bench in the same manner as illustrated in Figure 10-3 or 10-4 on a clean paper or shop cloth. Pay particular attention to the annular grooves in the shifter rods and the snap ring.
- Assemble the shifter forks to the shifter rods as illustrated in Figure 10-5. The shifter forks are interchangeable.
- Refer to Figure 10-5. Slide the shifter fork onto the shifter rod until it comes to the hole with the indexing ball and spring. With a flat blade screw driver press the indexing ball into the hole and move the shifting fork completely onto the shifter rod.

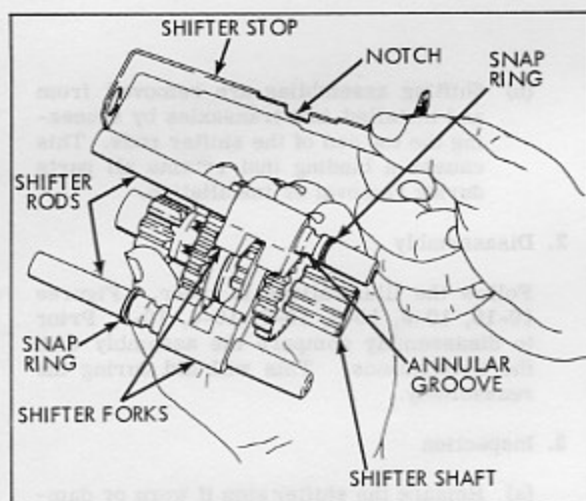


Figure 10-10 Positioning Shifter Stop

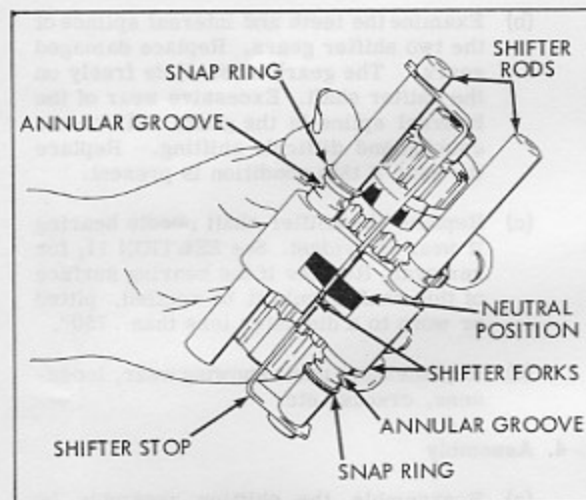


Figure 10-11 Final Assembly

(3) Move the shifting fork to the Neutral position. The neutral groove is the center groove. If the shifter rod has four grooves, the neutral groove is the second groove from the shortest end. This neutral groove can be seen through the hole in the shifter fork. See Figures 10-3 and 10-4, the arrow from the words "Neutral Groove" is passing through the hole for view-

(4) When the shifter forks are properly assembled to the shifter rods and positioned in neutral, the ends of the notches in the shifter forks are in alignment. (Figure 10-11)

(b) Assemble the two flanged gears onto the shifter shaft. (Figure 10-7) Note that the large gear is placed on the shaft first with the flange side toward the needle bearing in the end of the shifter shaft. Slide on the smaller gear with the flange toward that of the larger gear. (Figure 10-7, 10-8)

(c) When assembling the shifter fork and rod to the flanged gears on the shifter shaft, Figure 10-9, that shifter fork which is on shifter rod "A" always engages in flange in the larger gear. To determine which is shifter rod "A" compare the parts to illustrations. Figure 10-3 and 10-4. Hold the shifter shaft in the hand as illustrated (Figure 10-7) during assembly.

(d) After the shifter fork and rod assemblies have been engaged with the flanged gears allow the shifter rods to lay open in the hand and position the shifter stop. (Figure 10-9.) The notch in the shifter stop is the guide for correct positioning. Align this notch with the corresponding notches in the shifter forks and insert the shifter stop. Move the shifter rods together, (Figure 10-10) and insert into the transaxle. Remember to squeeze the ends of the shifter rods to cause the assembly to bind and stay together.

(e) In three speed transaxles the needle bearing end is inserted first into the case to engage the end of input shaft.

(f) When placing the shifting assembly into the four speed transaxle be sure the thrust washer is on the bearing. Place the assembly into the transaxle with the needle bearing end of the shifter shaft up. Allow the end of the shifter shaft to protrude below the ends of the shifter rods, this will ease the alignment of the assembly.

(g) The shifter assembly is correctly installed in the transaxle if the notches in the shifter forks are just about in the center of the opening in the case or cover of the transaxle.



PEERLESS MECHANIC'S HANDBOOK  
SECTION 11 BEARING AND BUSHING SERVICE

Bearing & Bushing Service

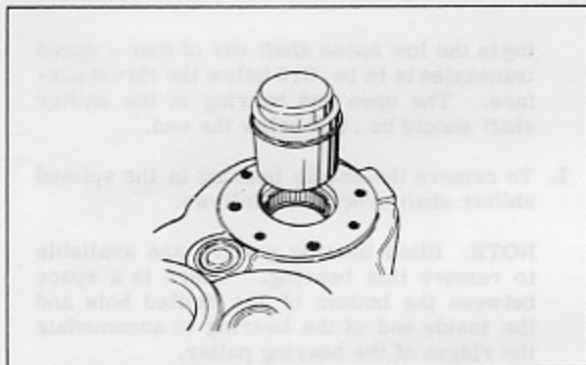


Figure 11-1 Bearing Remover End

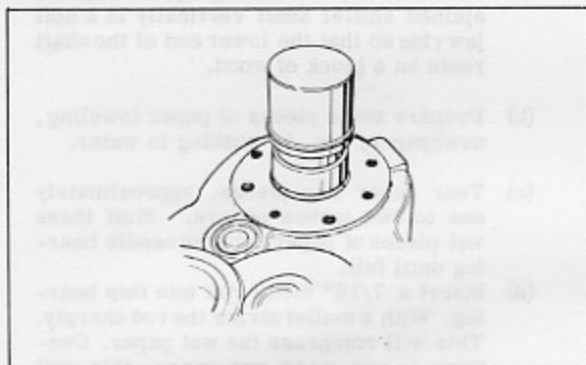


Figure 11-2 Bearing Installer End

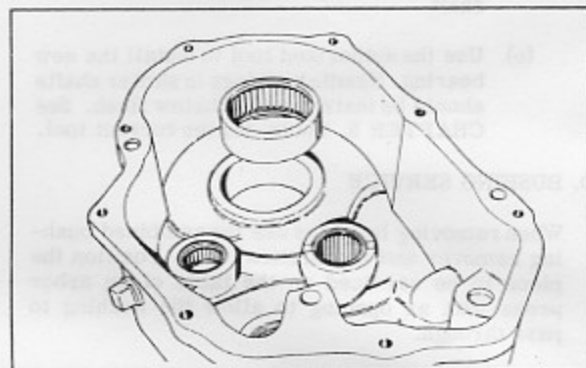


Figure 11-3 Bearing Surfaces

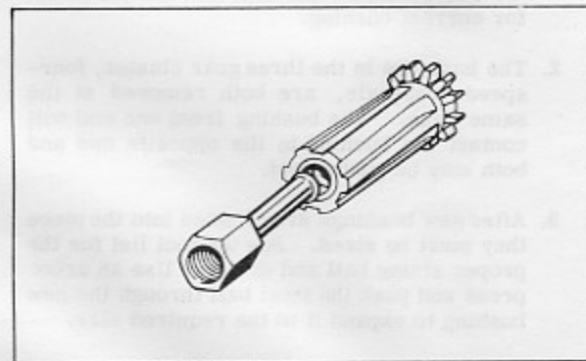


Figure 11-4 Blind Bearing and Puller

A. GENERAL BEARING AND BUSHING CARE

1. Bearings, bushings and bearing surfaces should be thoroughly cleaned prior to examination. Examine closely for scuffing, wear, pitting and abnormal conditions. Replace if any conditions mentioned appear.
2. Use a good grade of clean solvent to clean bearings. After cleaning, always use clean lint-free cloth to dry and wipe bearings. Immediately coat cleaned bearing with lubricant to prevent rusting or corrosion. If the bearing is to be stored, wrap in oil proof paper until needed. Ball bearings will be damaged if spun with compressed air. Moisture from compressed air will cause rust.
3. Take care of bearings in the case and cover. Cover them to keepout foreign matter. Place gasket surface down on clean paper and cover with clean cloth.

Never clean the lubricant from new bearings. This lubricant prevents damage before the transaxle lubricant enters the bearing.

B. BALL BEARING SERVICE

The ball bearings used in the outer ends of the axle supports are sealed. Without removing, but with the axle out, rotate the inner race with the fingers. If any roughness is noted replace the ball bearing assembly. These ball bearings are factory lubricated and additional lubricants cannot be added. When driving in these ball bearings, use the proper tool that drives on the outer race. See Chapter 5, Tools.

1. Install the needle and ball bearing combination for the input shaft into the cover prior to installation of the input shaft.
2. When installing ball bearings use a tool to drive on the race which is encountering the restricted fit. For example, install the input shaft ball bearing into the case by driving on the outer race. After the input shaft bearings are installed assemble the input shaft. Press the input shaft into the bearing combination while supporting the inner race of the ball bearing on a hollow tube.

C. NEEDLE BEARING SERVICE

It is advisable to use an arbor press to remove and install needle bearings.

1. Use a bearing tool to press out the bearing. Insert the proper tool in the bearing and with an arbor press, press out the bearing from the inside. See Three and Four - Speed Transaxle Service and Tool List for correct tool number.
2. When installing open end needle bearings, always apply pressure to the stamped side.

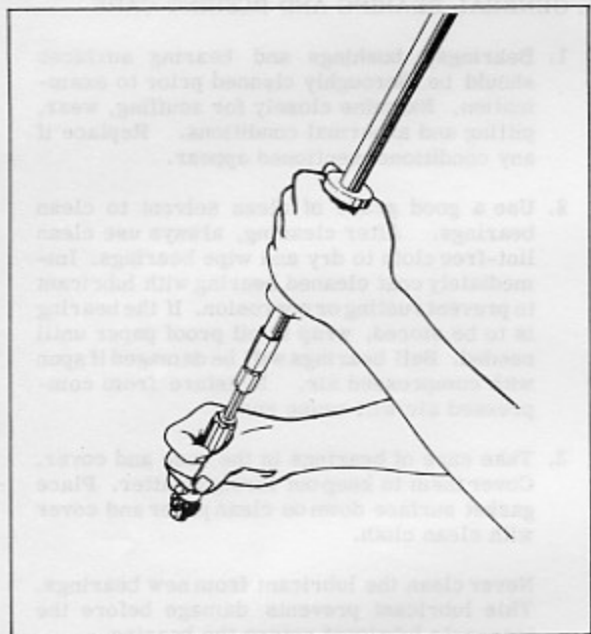


Figure 11-5 Removing Blind Bearing

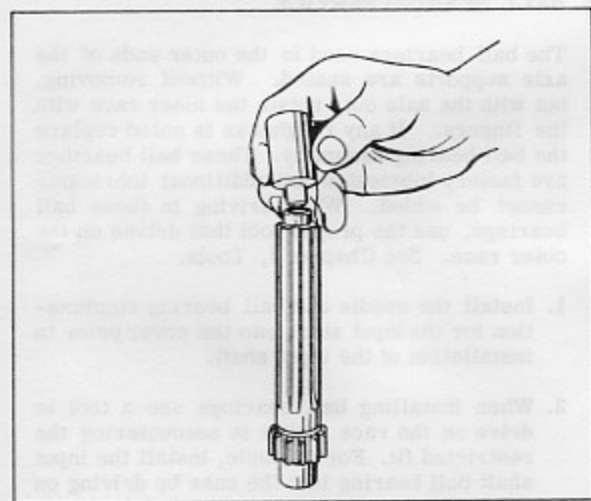


Figure 11-6 Installing Blind Bearing

3. Use only the recommended tools to insert bearings. The opposite end of the same tool used for removal is used for replacement.
4. The inside face of the bearing housing should be below the thrust face on the case or cover. This distance is controlled by the design of the inserting tool. By using the proper tool, bearing life will be extended. Bearings should be pressed into the case or cover .015 to .020 below the thrust surface. The open end bear-

ing in the low speed shaft ear of four - speed transaxles is to be .010 below the thrust surface. The open end bearing in the shifter shaft should be .010 below the end.

5. To remove the needle bearing in the splined shifter shaft proceed as follows:

**NOTE:** Blind bearing pullers are available to remove this bearing. There is a space between the bottom of the drilled hole and the inside end of the bearing to accommodate the ridges of the bearing puller.

- (a) With the needle bearing up, clamp the splined shifter shaft vertically in a soft jaw vise so that the lower end of the shaft rests on a block of wood.
- (b) Prepare some pieces of paper toweling, newspaper, etc. by soaking in water.
- (c) Tear paper into pieces, approximately one to two inches square. Stuff these wet pieces of paper into the needle bearing until full.
- (d) Insert a 7/16" metal rod into this bearing. With a mallet strike the rod sharply. This will compress the wet paper. Continue to add more wet paper, this will hydraulically lift the bearing out of the shaft.
- (e) Use the authorized tool to install the new bearing. Needle bearings in shifter shafts should be installed .010 below flush. See CHAPTER 5, Tools, for the correct tool.

#### D. BUSHING SERVICE

When removing bushings use the combined bushing remover and installation tool. Position the piece to be serviced on the table of an arbor press with an opening to allow the bushing to pass through.

1. Use the proper tool as illustrated. See CHAPTER 5, Tools, for correct tool and parts list for correct bushing.
2. The bushings in the three gear cluster, four-speed transaxle, are both removed at the same time. The bushing from one end will contact the bushing in the opposite end and both may be pushed out.
3. After new bushings are pressed into the piece they must be sized. See the tool list for the proper sizing ball and driver. Use an arbor press and push the steel ball through the new bushing to expand it to the required size.

