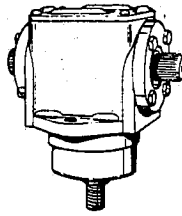
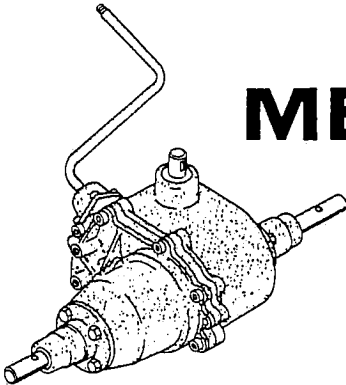


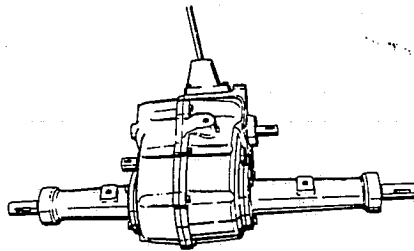
PEERLESS



MECHANIC'S



MANUAL



GENERAL
INFORMATION

1

TRANSMISSIONS

2

600
TRANSAXLES

3

1200, 1400,
1700, 2000
THREE - SPEED
TRANSAXLES

4

FOUR - SPEED
TRANSAXLES

5

1300
REDUCTION GEAR
AND
DIFFERENTIAL UNIT

6

2400 AND 2500
REDUCTION GEAR
AND
DIFFERENTIAL UNIT

7

DIFFERENTIALS

8

DRIVES

9

SHIFTING
ASSEMBLY

10

BEARING AND
BUSHING SERVICE

11



**TECUMSEH
PRODUCTS
COMPANY**

ENGINE DIVISIONS - GRAFTON, WISCONSIN 53024



**WHERE IMAGINATION AND INNOVATION
HELP SHAPE AN INDUSTRY**

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that this is crucial for the company's financial health and for providing reliable information to stakeholders.

2. The second part of the document outlines the specific procedures for recording transactions. It details the steps from initial entry to final review, ensuring that all necessary information is captured and verified.

3. The third part of the document addresses the role of the accounting department in this process. It highlights the need for clear communication and collaboration between different departments to ensure the accuracy of the data.

4. The fourth part of the document discusses the use of technology in accounting. It explores how modern software solutions can streamline the recording process and reduce the risk of errors.

5. The fifth part of the document provides a summary of the key points discussed. It reiterates the importance of accuracy and the need for a robust system of controls to support the recording process.

6. The sixth part of the document provides a detailed overview of the company's financial performance over the past year. It includes a comprehensive analysis of revenue, expenses, and profit margins, along with a comparison to industry benchmarks.

7. The seventh part of the document discusses the company's strategic goals for the upcoming year. It outlines the key areas of focus and the actions that will be taken to achieve these goals, including investments in research and development and marketing.

8. The eighth part of the document provides a detailed overview of the company's human resources. It includes information on the current workforce, turnover rates, and the company's approach to recruitment and employee development.

9. The ninth part of the document discusses the company's environmental and social responsibilities. It outlines the company's commitment to sustainability and the steps it is taking to reduce its carbon footprint and improve its social impact.

10. The tenth part of the document provides a final summary of the company's performance and outlook. It expresses confidence in the company's ability to continue to grow and succeed in the coming year, and thanks the employees and stakeholders for their support.

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CONFIDENTIAL



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

1

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.

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 capscrews. 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

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.

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.

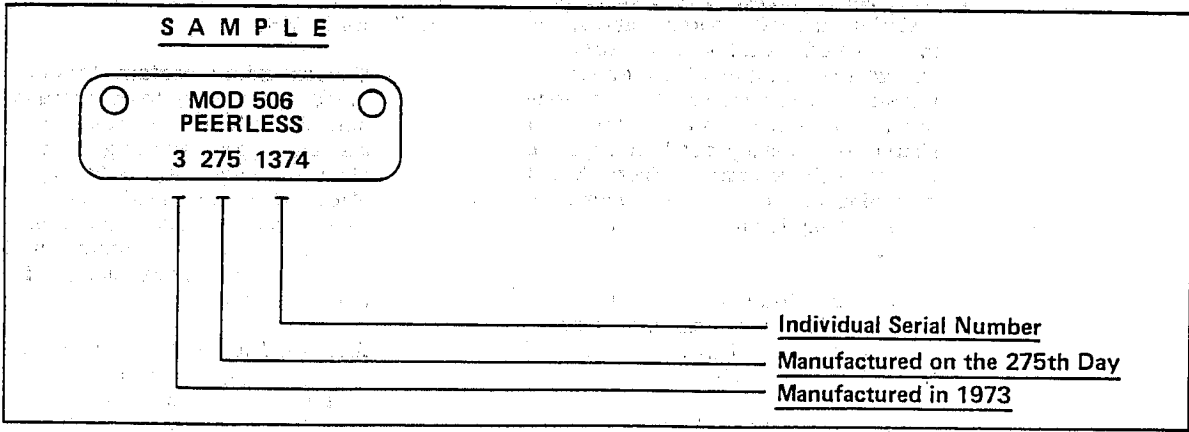
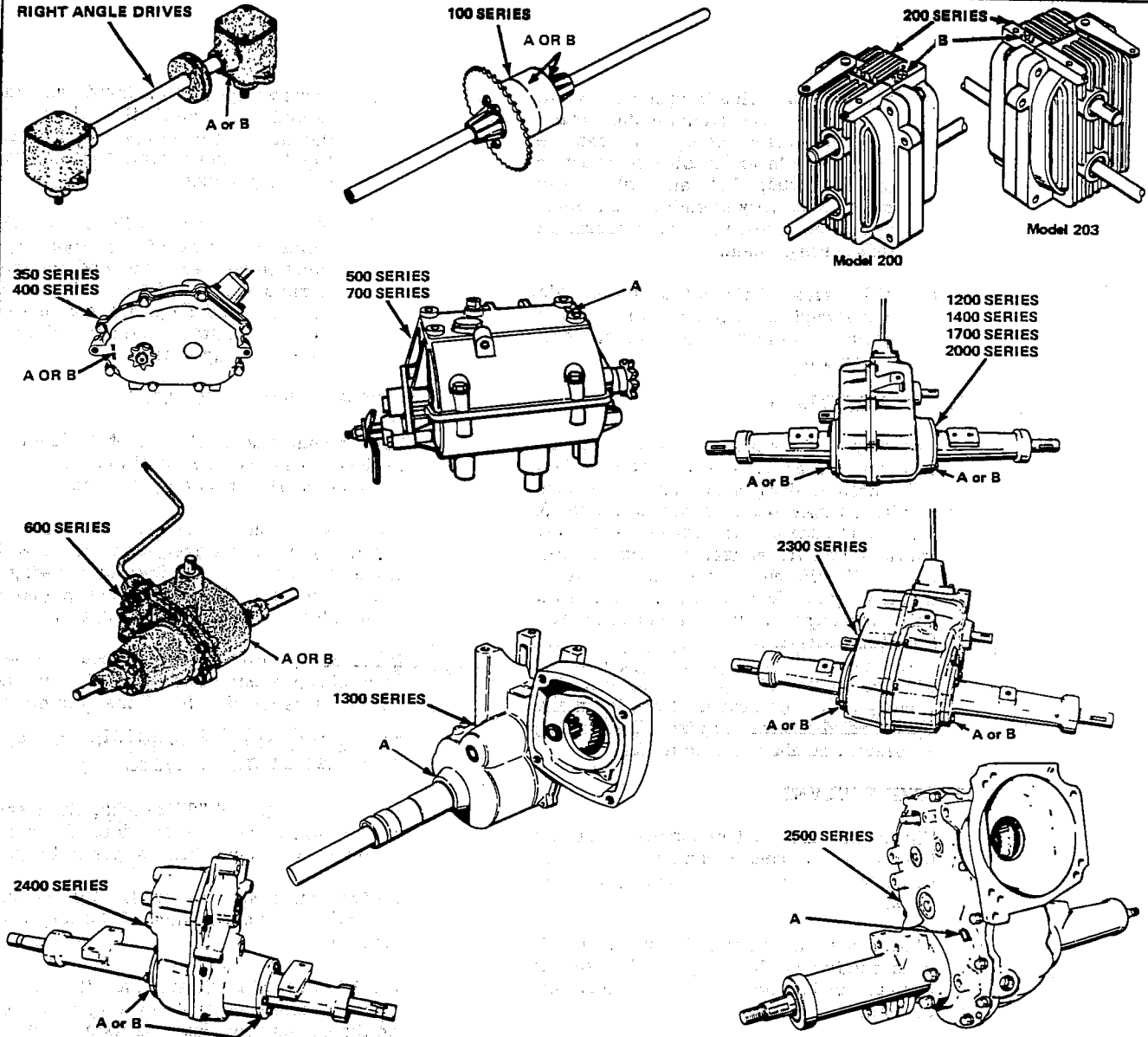
On the 100 series differential, the number is stamped either on cast housing diameter or on the housing end near the axle bushing.

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.

1



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.

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° , 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 transaxle 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 axes 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-

1

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			
	MODEL NO.	QUANTITY	
TRANSAXLES	600 Series	1-1/2 Pints Oil	
	1200 Series	2 Pints Oil	
		1200 1201 1201-3 1202-4 1203 1202-A 1202-4 1204 1204-A 1204-4 1209 1216 1250 1250-1 1250-2	
		1211 1212 1214 1215	2-3/4 Pints Oil
		1203 1205 1206 1207 1208 1210 1213 1217 1218	3 Pints Oil
	1300 Series	1305 1309 1313	2 Pints Oil
		1300 1301 1302 1303 1304 1305 1307 1308 1310 1311 1312	2-3/4 Pints Oil
	1400 Series		2 Pints Oil
	1700 Series		2 Pints Oil
	2000 Series		2 Pints Oil
	2300 Series	All Models Except*	4 Pints Oil
		*2300 *2300-A *2306-A *2311 *2314 *2315 *2321 *2322 2323 2325 2326 2329 *2330 2331 2332 *2333 *2334	3 Pints Oil
	2400 Series		2 Pints Oil
	12500 Series		
	TRANS-MISSIONS	350 Series	12 Oz Grease
400 Series		400	3/4 Pint Oil
		401	12 Oz Grease
		401A	3/4 Pint Oil
500 Series		12 Oz Grease	
700 Series	12 Oz Grease		
RIGHT ANGLE AND T DRIVES	All Models Except*	4 Oz Grease	
	*1408-P91 *1409-P91 *1410-P91 *3002 *3003 *3028 *3029 *3035	3 Oz Grease	
DIFFERENTIALS	All Models	1 Oz Grease	
TWO AND THREE SPEED AXLES	200 Series	2 Oz Grease	

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

*See Mechanic's Manual for quantity and type of lubricant

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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

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

- Cross tightening sequence to half the torque then finally to full torque value.
- Undertightening — Oil leakage, loosening of attaching parts, possible shifting of the internal part causing complete failure.
- Since all bolts are readily accessible there is no reason that a torque wrench cannot be used for all bolt and screw tightening. To use guess or chance, any of the previous can result:

TORQUE VALUE			
PART	MODELS AFFECTED	IN-LBS	FT-LBS
Bolt 5/16-18 (Housing)	100 Series		19-22
Nut 5/16-18 (Housing)	100 Series		10-13
Bolt 1/4-20 (Case to Cover)	200 Series	90-110	
Bolt 1/4-20 (Case to Cover)	350 Series	90-110	
Bolt 1/4-20 (Shift Lever Housing)	350 Series	84-108	
Bolt 1/4-20 (Case to Cover)	400 Series	90-110	
Bolt 1/4-20 (Shift Lever Housing)	400 Series	84-108	
Bolt 1/4-20 (Case to Cover)	500 Series	90-110	
Bolt 1/4-20 (Brake-Disc)	500 Series	90-110	
Bolt 5/16-24 (Shifter Rod)	500 Series		13-15
Bolt 1/4-20 (Case to Cover)	600 Series	84-108	
Bolt 5/16-18 (Axle Support Housing)	600 Series	156-180	
Bolt 1/4-20 (Shift Lever Housing)	600 Series	84-108	
Bolt 1/4-20 (Brake-Disc)	600 Series		7-9
Bolt 1/4-20 (Case to Cover)	1200 Series		8-10
Bolt 1/4-20 (Shift Lever Housing)	1200 Series	84-108	
Bolt 1/4-20 (Differential)	1200 Series		7-10
Bolt 1/4-20 (Case to Cover)	1300 Series	90-110	
Bolt 1/4-20 (Differential)	1300 Series		7-10
Bolt 1/4-20 (Case to Cover)	1400 Series		8-10
Bolt 1/4-20 (Shift Lever Housing)	1400 Series	84-108	
Bolt 1/4-20 (Differential)	1400 Series		7-10
Bolt 1/4-20 (Case to Cover)	1700 & 2000 Series		8-10
Bolt 1/4-20 (Shift Lever Housing)	1700 & 2000 Series		7-10
Bolt 5/16-18 (Axle Support Housing)	1700 & 2000 Series		13
Bolt 1/4-20 (Differential)	1700 & 2000 Series		7-10
Bolt 1/4-20 (Case to Cover)	2300 Series		8-10
Bolt 1/4-20 (Shift Lever Housing)	2300 Series		8-10
Bolt 5/16-18 (Axle Support Housing)	2300 Series		15-18
Bolt 1/4-20 (Differential)	2300 Series		7-10
Bolt 3/8-16 (Axle Support Housing)	2300 Series		20-26
Bolt 1/4-20 (Case to Cover)	2400 Series		8-10
Bolt 1/4-20 (Axle Support Housing)	2400 Series		8-10
Bolt 1/4-20 (Differential)	2400 Series		7-10
Bolt 5/16-18 (Case to Cover)	2500 Series		15-18
Bolt 3/8-16 (Differential)	2500 Series		35-40
Bolt 1/2-13 (Axle Support Housing)	2500 Series		60-65
Screws No. 10-24 (Cover)	R.A.D.	20-24	
Bolts 1/4-20 (Retainer Cap)	R.A.D.	90-110	

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 if 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 and that they are correctly positioned. Also, determine if bend on shaft is in correct position.

1

CAUSE	REMEDY
UNIT CANNOT BE SHIFTED (OR DIFFICULT TO SHIFT) (Continued)	
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.
UNIT IS NOISY	
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.
UNIT JUMPS OUT OF GEAR	
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.
AXLES CANNOT BE TURNED (SAME DIRECTION) WITH UNIT IN NEUTRAL GEAR	
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 brak shaft 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.

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SECTION 2 TRANSMISSIONS

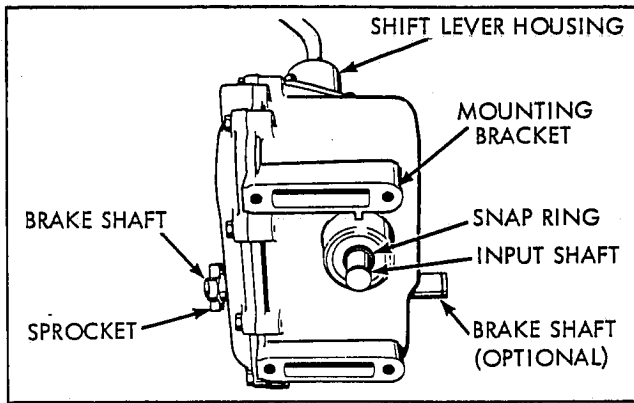


Figure 2-1 Transmission Bottom View

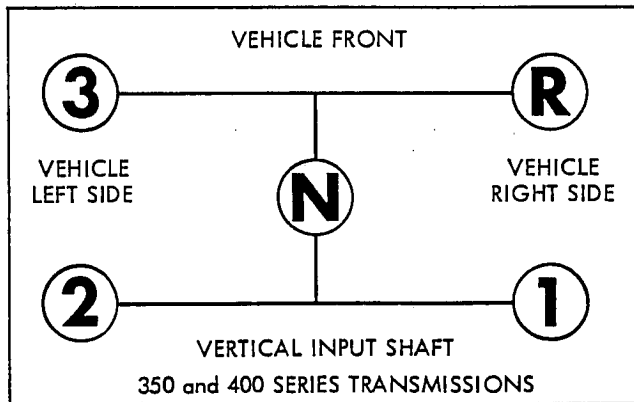


Figure 2-2 Shift Pattern

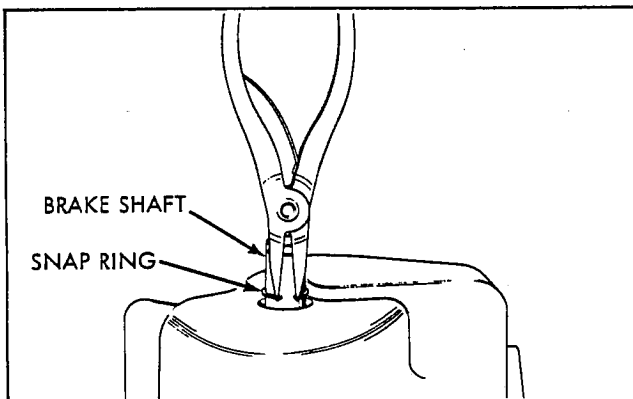


Figure 2-3 Removing Brake Shaft Snap Ring.

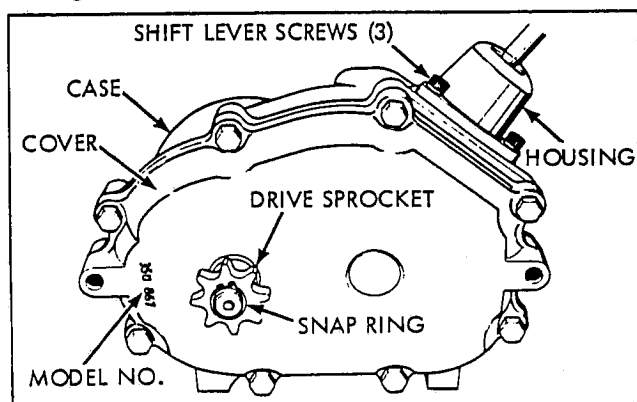


Figure 2-4 Transmission Side View

CAUTION

DECLUTCHING IS REQUIRED WHEN SHIFTING TO AVOID GEAR CLASHING AND DAMAGE.

A. GENERAL

The Model 350 and 400 series transmission are basically the same. The major difference is that the 350 series has bronze bushings and the 400 series has needle bearings. The transmission may have a brake shaft if the application requires a transmission brake. The model number is stamped on the cover. Figure 2-4.

B. TRANSMISSION DISASSEMBLY

1. Clean the outside surface of the transmission. Position shift fork in neutral position (Figure 2-2). Remove screws (3) holding shift lever and shift lever housing. Remove shift lever housing. For repair of shift lever assembly, see SECTION 10.

2. If a brake shaft is on the unit, remove snap ring from shaft. Clean shaft of dirt or burrs.

3. Remove snap ring holding sprocket to the output shaft and remove sprocket. Clean shaft of dirt and burrs.

4. Remove two dowel pins by tapping out with metal punch. Remove cover screws (8).

NOTE: Wipe grease from parts as they are removed.

2

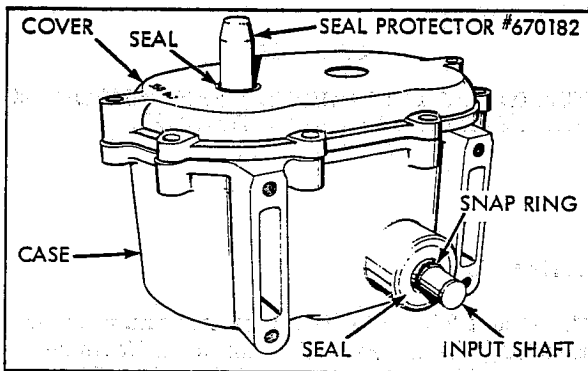


Figure 2-5 Seal Sleeve #670182

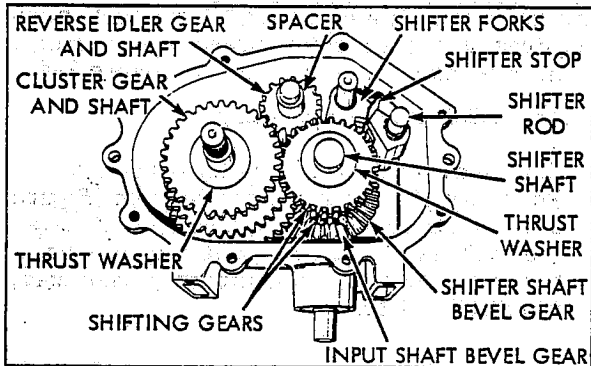


Figure 2-6

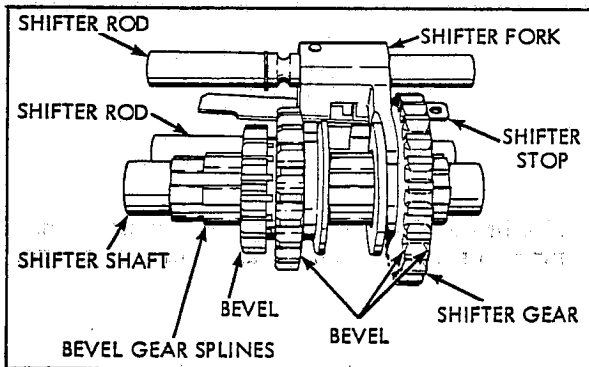


Figure 2-7 Shifter Mechanism

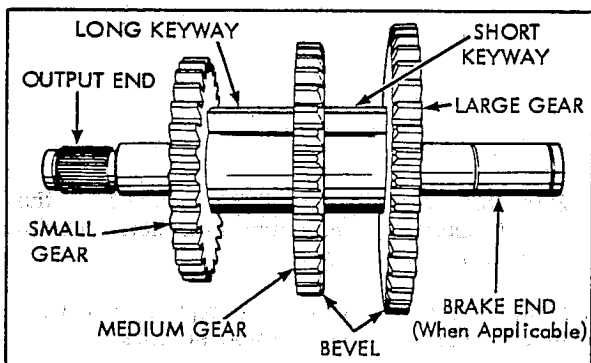


Figure 2-8 Cluster Gear and Shaft

5. Prior to lifting off the cover, install seal protector 670182 to protect seal for output shaft on units having it. Remove cover and discard gasket.

6. Remove reverse idler gear, shaft, and spacer. Install gear with bevel out toward spacer.

7. Remove shift fork, gears and shaft assemblies. Grasp shifter forks, gears and shaft and raise up while tapping shifter shaft bevel gear with handle of hammer to separate from shaft splines. If no service is required, put unit aside for easy reassembly. To repair unit, refer to SECTION 10.

8. Remove cluster gears and shaft. To separate gears, remove outer gears first, then slide off middle gear and key. For replacement, note that the larger gear belongs on the short keyway opposite the output end of the shaft. Note the bevel edge position of the gears.

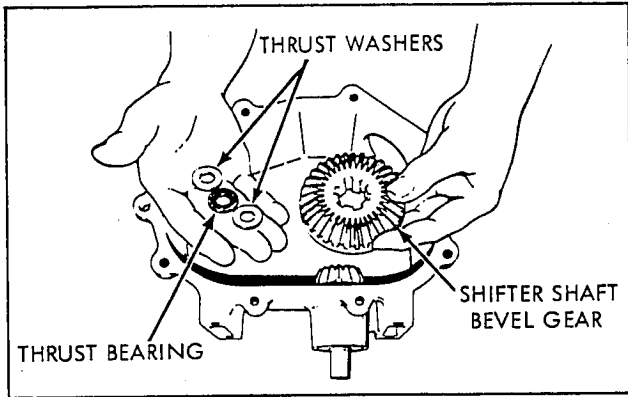


Figure 2-9

9. Remove the shifter shaft bevel gear, and the thrust bearing and washers.

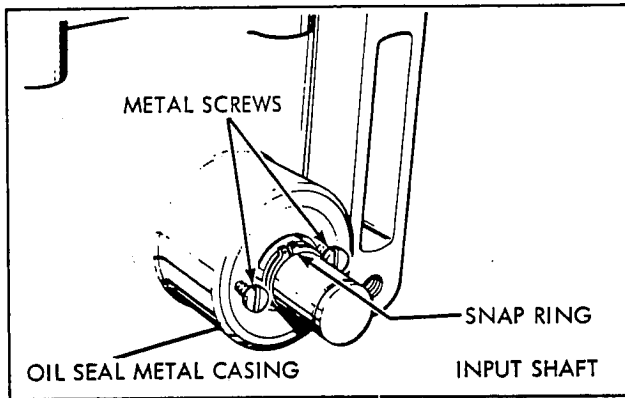


Figure 2-10 Removing Input Shaft Oil Seal (400 Series Only)

10. To remove the input shaft oil seal in the 400 series, use metal screws to puncture the seal casing and lift out seal. Seal must be replaced. Clean the input shaft of scratches and sharp edges. Remove the snap rings and thrust washer and press or tap the input shaft into the case. A thrust washer (Model 350) or a thrust washer and a thrust bearing (Model 400) should be on the shaft.

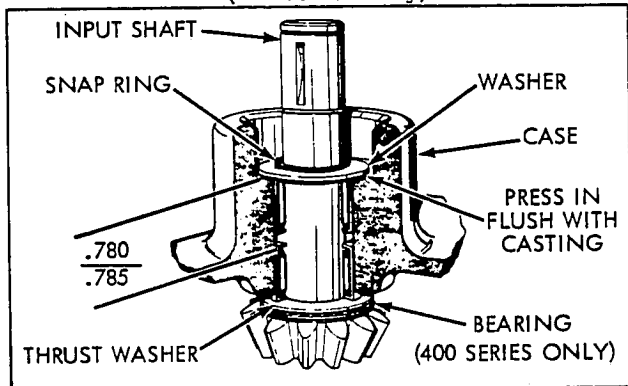


Figure 2-11

C. INSPECTION AND REPAIR

Examine all parts. Check gears for worn or chipped teeth and splines. Check shaft for wear or scratches and condition of snap ring grooves, splines and keyways. Examine case and cover for cracks and stripped thread condition. To replace bearing or bushing, refer to SECTION 11. To replace input shaft bearings, drive out bearings using bearing driver 670207. Inside bearing protrudes above the casting. See Figure 2-11 for installation dimensions.

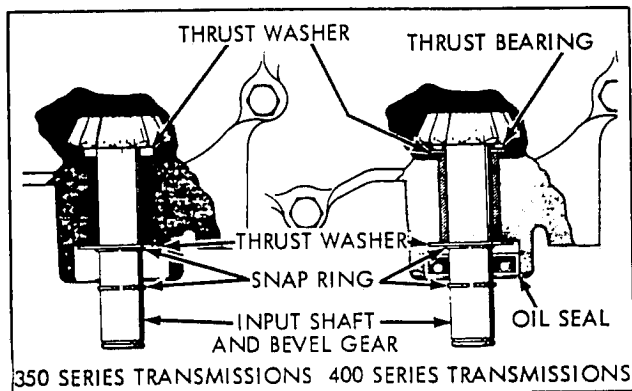


Figure 2-12 Input Shaft (Cutaway View)

D. ASSEMBLY

1. Install and secure the input shaft. Refer to Figure 2-12 for arrangement of parts depending upon series being repaired.

2

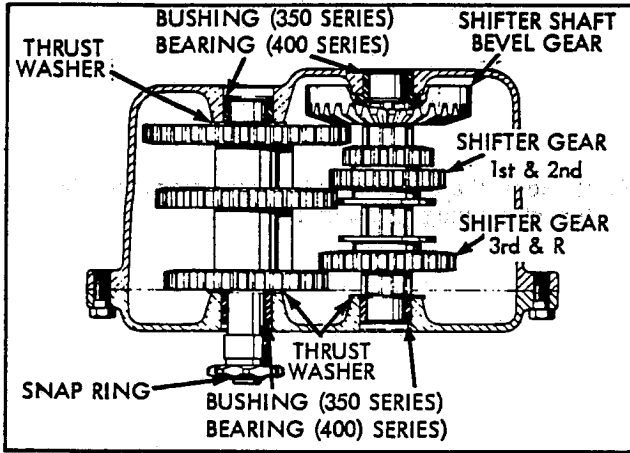


Figure 2-13 Transmission Sectional View (350 Shown)

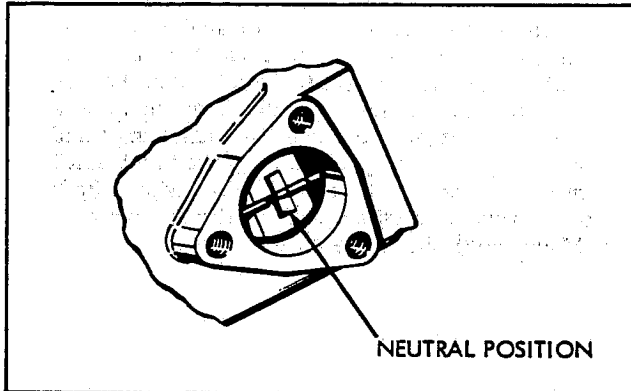


Figure 2-14

2. Install cluster gears and shaft with a thrust washer between the large gear and case. The small and middle gear bevel faces down, the large gear bevel faces up.
3. Install the shifter bevel gear. For 400 series, be sure thrust washers and bearings are between gear and case. Align the gear with the center of the hole.
4. Install the shift mechanism (Figure 2-7). Try to align the gear and shaft splines before inserting the shaft. To do so, visualize the shifter mechanism in position and note the position of one spline. Position a spline on the gear so that its relationship is the same. Carefully guide the shifter shaft through the gear, disturbing the gear and thrust washers as little as possible. The shifter mechanism must be held firmly to keep parts from changing position so that they appear as in Figure 2-13. Install shifter stop.
5. Install reverse idler shaft, gear and spacer. Install gear with bevel out toward spacer.
6. Install washers on the cluster gear and shifter shafts. Coat 12 oz. of E. P. Lithium grease around gearing if unit uses grease. (See chart SECTION 1, Paragraph E.)
7. Install gasket to case.
8. Install cover to case and secure by cross-tightening eight cap screws to 90-110 in. lbs. If cover does not close, use needle-nosed pliers to reposition shifter components until cover seats. Do not force cover on.
9. Install oil seals on 400 series. Use oil seal sleeve #670143 and oil seal driver #670203 on the brakeshaft oil seals. Use oil seal sleeve #670102 and oil seal driver #670209 on the input shaft oil seal.
10. Install new gasket, shift lever and housing with three socket head cap screws.
11. Install sprocket and snap ring on output shaft.
12. Turn input shaft to check for binding. Check for correct shifting pattern.

E. TESTING UNITS

1. With the unit in neutral, turn the output sprocket. The input shaft should not turn. With unit in any gear, input shaft turns.

SECTION 2-1 TRANSMISSIONS (200 SERIES)

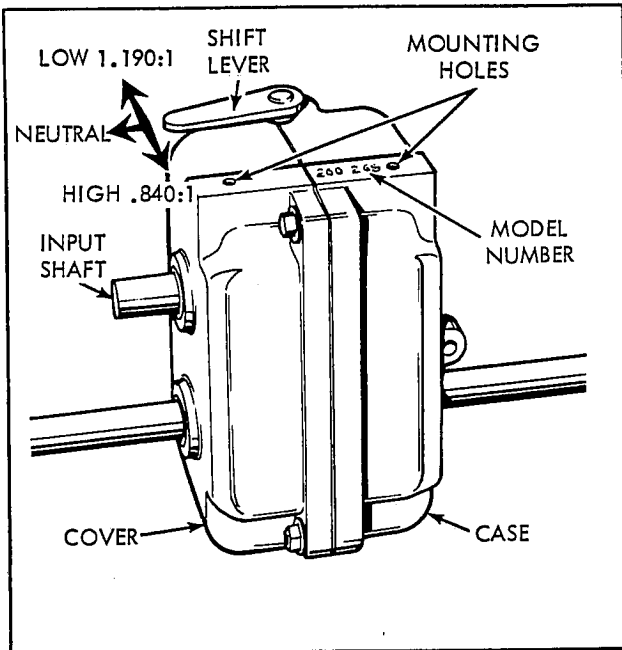


Figure 2-15. Model 200 Transmission

A. OPERATION

NOTE: Numbers in parentheses refer to Figure 2-17.

1. The input shaft (7) idles through the two gears (5) and (6) held in position by the bushing (2) flanges, a shouldered key (12), and thrust washers (13). The input shaft (7) however, turns the shifter lug (9) splined to the shaft by the shouldered key (12).
2. With the lug (9) centered on the key (12), the unit is in neutral, since neither of the 21 tooth nor 25 tooth gears is rotating.
3. If the shifter lever (4) is moved to LOW position, rotating its rod and fork to the left, the fork engaged in the lug (9) moves left along the shaft (7) so that its lugs engage lugs in the 21 tooth gear (5). There is a reduction in speed through the 25 tooth (6) gear to the axle (8).
4. By rotating the shifter rod and fork (4) (HIGH) so that the lug (9) goes right along the shaft (7) to engage the 25 tooth gear (6), there is a speed increase through the driven 21 tooth gear (5) to the axle (8).

B. REMOVAL

1. When removing the transmission from the equipment loosen the mounting bolts to relieve pressure on the belt or link chain.
2. Clean the outside of the unit. Grind off any high spots on the axle. Clean off any rust, corrosion, or paint which will bind parts during disassembly.
3. Remove any attached parts as pulleys or sprockets.
4. Note the unit identification number on the case.

C. DISASSEMBLY

1. Remove the capscrews retaining the housing halves together. Lift the case from the cover while pressing on the axle and input shafts to keep those parts remaining with the cover.
2. Clean excess grease from the cover and from around the transmission internal parts.
3. Lift out the axle and gears. Note that the axle extension from the gears is of different length.
4. Remove the input shaft, drive lug and gears, and shifter shaft as a unit; then separate parts.

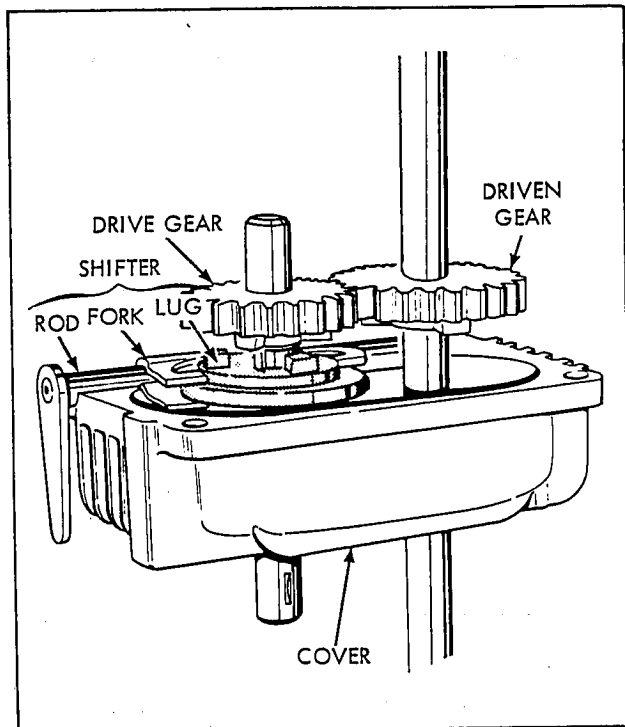


Figure 2-16. Case Removed

2

5. Degrease all parts.
6. Check keys and keyways for wear, galling, or breaks.
7. To remove and install bushings, use tool 670210. Use sizing ball and driver 670212.

D. INSPECTION AND REPAIR

1. Replace axle ends with worn grooves.
2. Replace gears with worn teeth or lugs.
3. Replace snap rings, thrust washers and gaskets.
4. Replace case and cover if cracked, or with stripped thread. Replace worn bushings.

E. ASSEMBLY

1. Position snap rings and keys on axle. Install 25 tooth gear to the short side of the axle and one 21 tooth gear to the longer side.

2. Smear E. P. Lithium grease around the bushings in the case and cover.
3. Press the shouldered key into the large keyway on input shaft, then slide the shifter lug onto the shaft over the key.
4. Position a thrust washer on each side of the key.
5. Install the remaining 21 tooth gear on the woodruff keyway side of the shaft and the 25 tooth gear on the smooth side of the shaft.
6. Hold the input shaft so that the other parts stay in their correct position.
7. Fit the shifter forks over the flange of the shifter lug.
8. Install the assembly into the unit cover so that the exposed woodruff key slot goes through the upper bushing and the shifter rod lays in its recesses at the top and bottom of the cover.

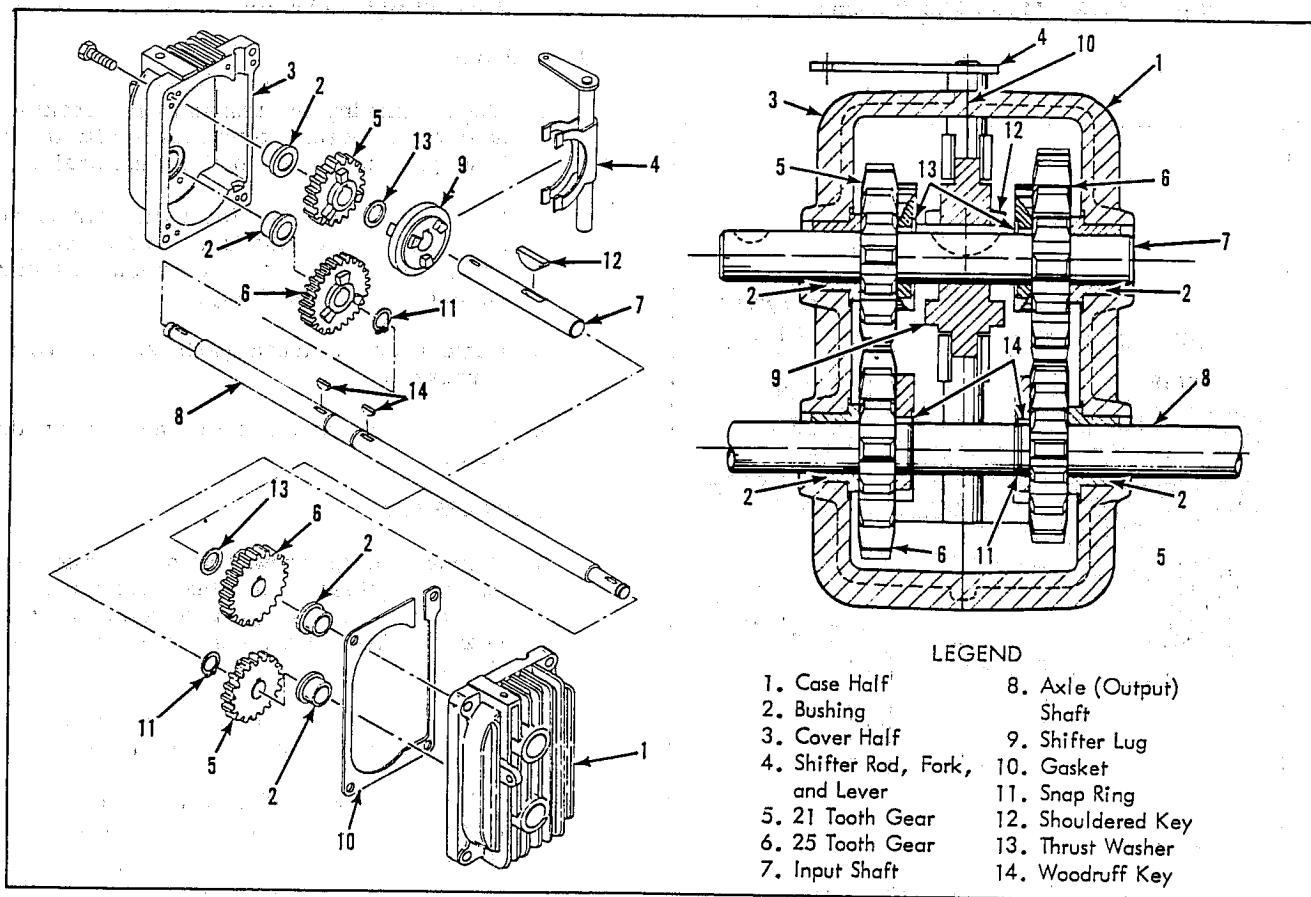


Figure 2-17. Sectional View of Model 200

9. Insert the short axle extension through the lower bushing on the cover.
10. Smear 2 oz. of Molybdenum Disulphide E.P. Lithium grease in the cover around the gears and shafts.
11. Position the new gasket on the cover and install the case onto the axle and input shaft until it contacts the gasket.
12. Install four self-tapping 1/4-20 x 3/4 cap screws to secure the case and cover and torque to 90-110 lbs. in.

F. INSTALLATION

1. Install the woodruff key and sprocket or pulley on the input shaft.

2. Loosely position the unit in place on the equipment with the mounting bolts.
3. Install the chain or belt and align the parts, then tighten mounting screws.
4. Perform all other re-assembly steps called out in the equipment mechanics instructions.

G. TESTING

1. Turn input and output shafts to insure that they are free from binding.
2. Shift the shifter lever to LOW, then turn input shaft; output should turn slowly.
3. Shift the shifter lever to HIGH, then turn input shaft; output should turn faster.
4. Check for seal around gasket surfaces.

2

SECTION 2 - 2 TRANSMISSIONS (500 SERIES)

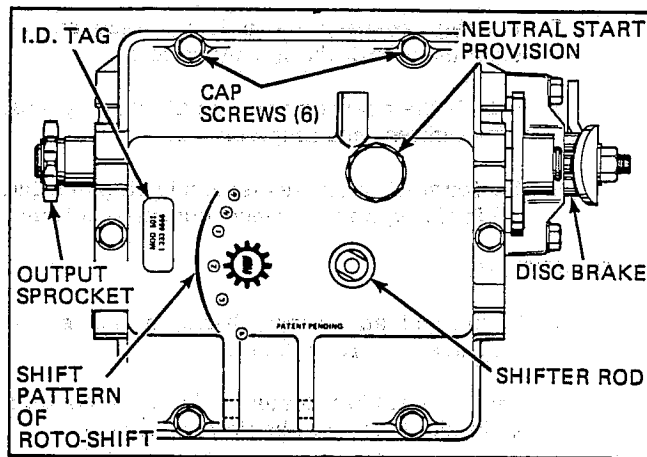


Figure 2-18

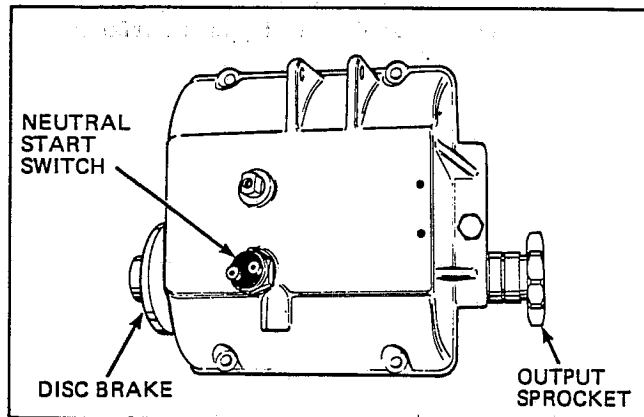


Figure 2-19

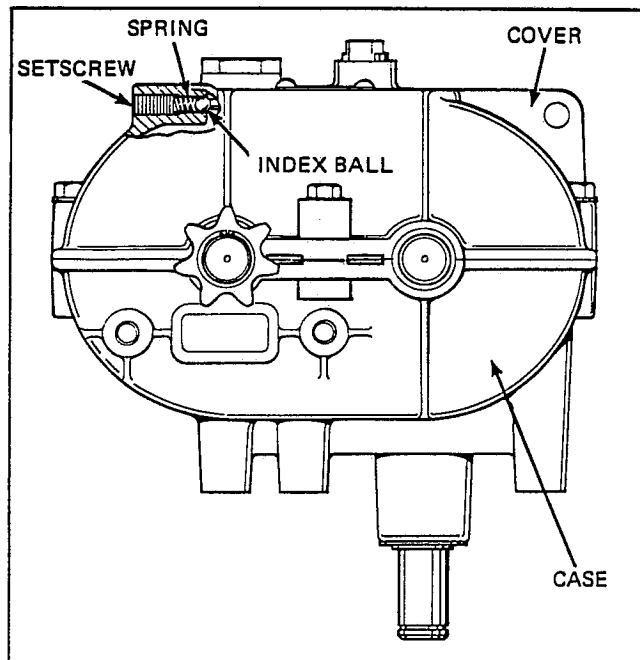


Figure 2-20

CAUTION

TO AVOID PREMATURE TRANSMISSION FAILURE DECLUTCHING IS REQUIRED WHEN SHIFTING FROM NEUTRAL TO FIRST OR REVERSE, FROM ANY FORWARD TO REVERSE GEAR, FROM REVERSE TO ANY FORWARD GEAR OR WHEN OPERATING EQUIPMENT ON A HILL OR UNDER HEAVY LOAD.

A. GENERAL

The model 500 series transmission is the first of the "Roto-Shift" variety to be produced by the Peerless Gear Division of Tecumseh Products Company. Capable of delivering 3, 4 or 5 speeds, depending on equipment manufacturer's specifications, the "500" will adapt itself to any conventional riding mower, lawn tractor or rear engine riding mower. Figure 2-18 is a 4 speed forward, 1 reverse with neutral start provision. Options available on the 500 include right or left hand output and disc brake. See Figures 2-18 and 2-19.

Note: Due to the many variations of equipment, braking systems, adjustments and repair to these components & linkages are not to be considered warranty.

B. DISASSEMBLY

1. Clean outside surface of transmission. Position shift lever in neutral position as indicated by shift pattern. Remove shift lever. If installed, remove neutral start switch. See Figures 2-18 and 2-19.
2. Remove setscrew, spring and index ball from transmission cover. See Figure 2-20.
3. Remove six cap screws that maintain cover to case. Remove cover. See Figure 2-18.

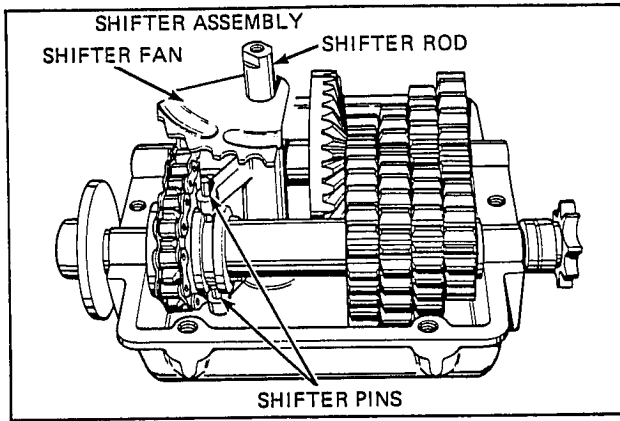


Figure 2-21

4. Remove shifter assembly (includes shaft, pins and fan) from transmission case by lifting shaft out of case. See Figure 2-21.

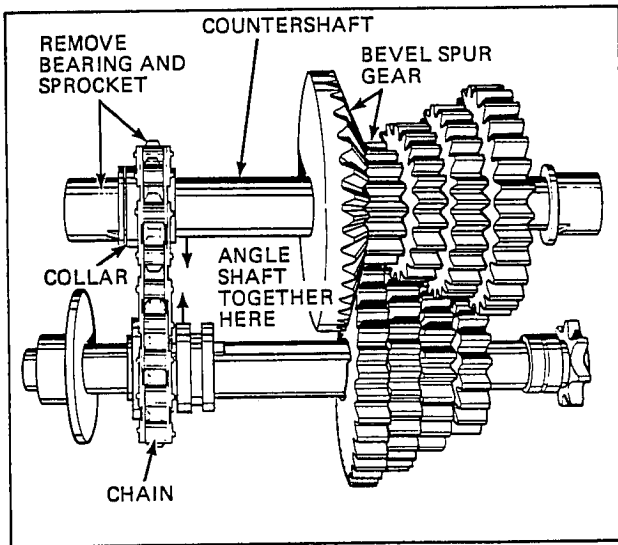


Figure 2-22

5. Remove gear and shaft assemblies from case half of the transmission by lifting the two shafts out of the bearing supports taking care not to disturb drive chain relationship with sprockets. See Figures 2-21 and 2-22.
6. Angle sprocket ends of shafts towards each other, removing the bearing and sprocket from the countershaft. Figure 2-22. Note the collar on the sprocket faces away from the bevel gear. Remove chain. See Figure 2-23.

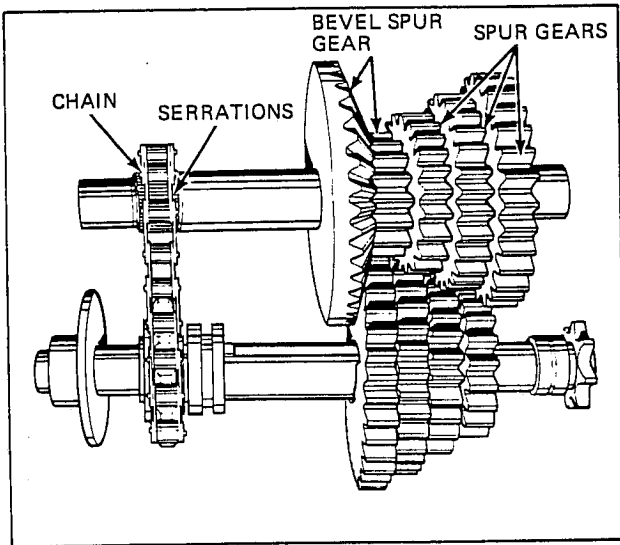


Figure 2-23

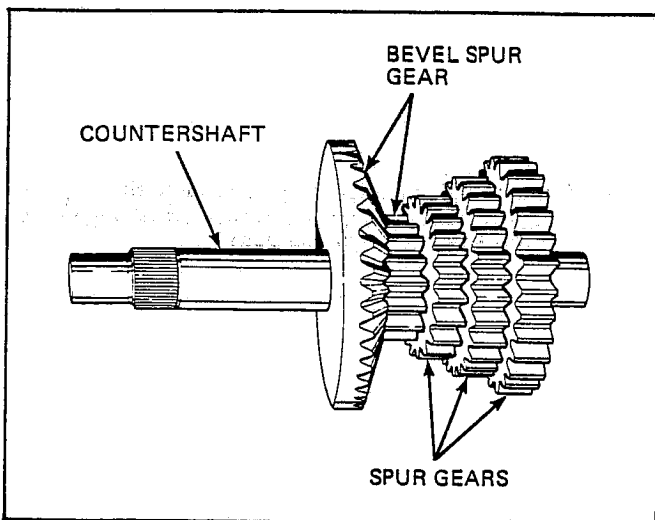


Figure 2-24

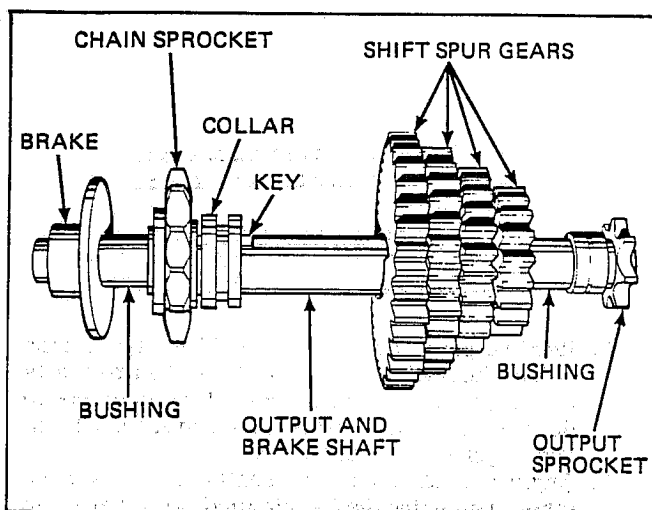


Figure 2-25

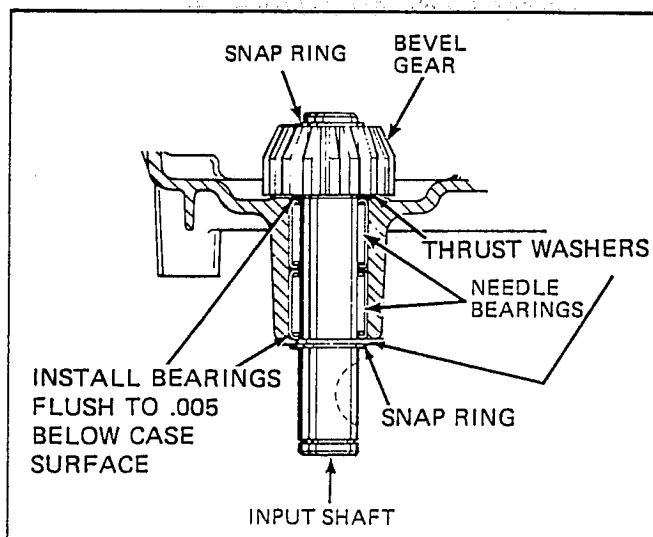


Figure 2-26

7. Remove bevel spur gear combination and spur gears from countershaft; these gears spline to countershaft. See Figure 2-24.
8. Remove output sprocket from output shaft and remove shift spur gears, keys and collar and chain sprocket. See Figure 2-25.
9. Remove snap ring from input shaft, remove bevel gear and pull shaft through case. See Figure 2-26.
10. Input shaft needle bearings should be installed flush to .005 below bearing bore surfaces from inside and outside case. See Figure 2-26.

C. INSPECTION AND REPAIR

Examine all parts after removing grease with cleaning solvent. Check gears and sprockets for worn or chipped teeth or splines. Check for shaft and bearing wear or damage. Check bearings, shifter keys and keyway, shifter shaft, pins and fan. Replace damaged parts.

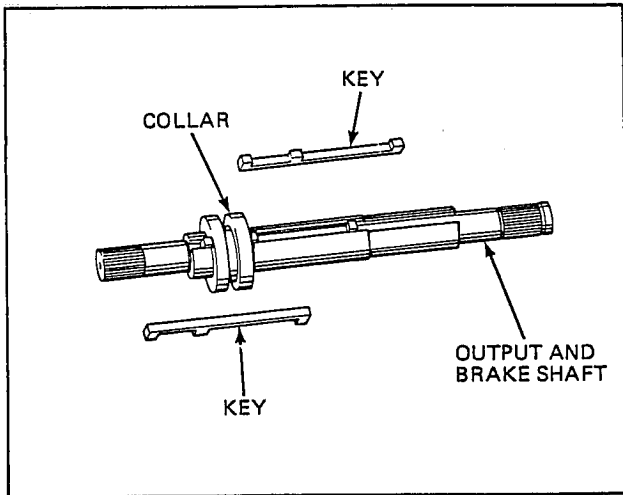


Figure 2-27

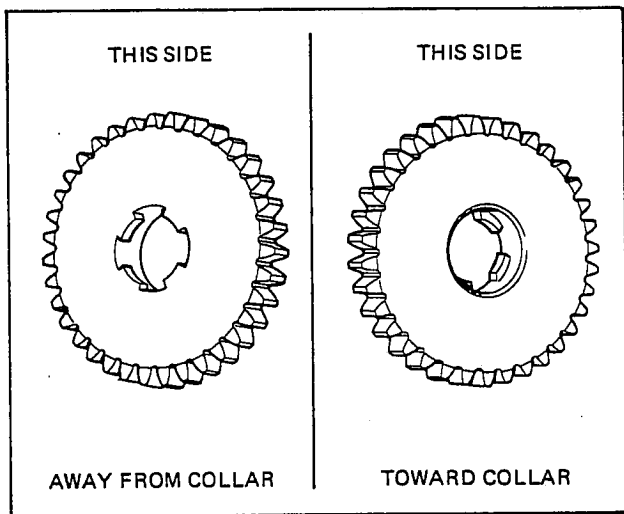


Figure 2-28

D. RE-ASSEMBLY

1. Install and secure the input shaft and bevel gear in the case. See paragraph 9 under "Removal Instructions".
2. Install collar and shifter keys to output and brake shaft and follow with largest to smallest shift spur gears. See Figures 2-27 and 2-28. Install chain sprocket, bearing, thrust washer and output sprocket. See Figure 2-29 and 2-33.

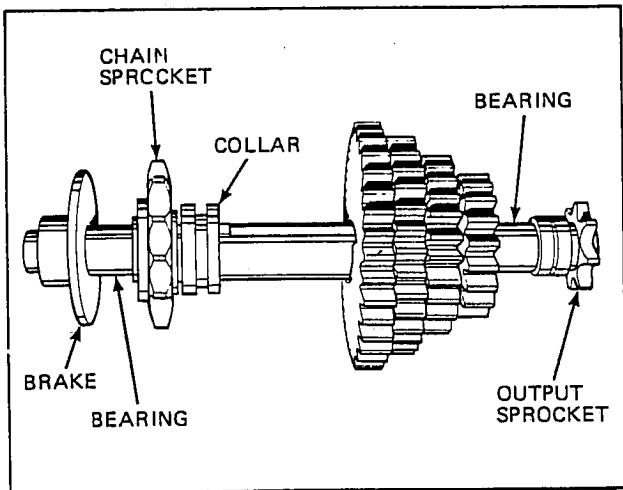


Figure 2-29

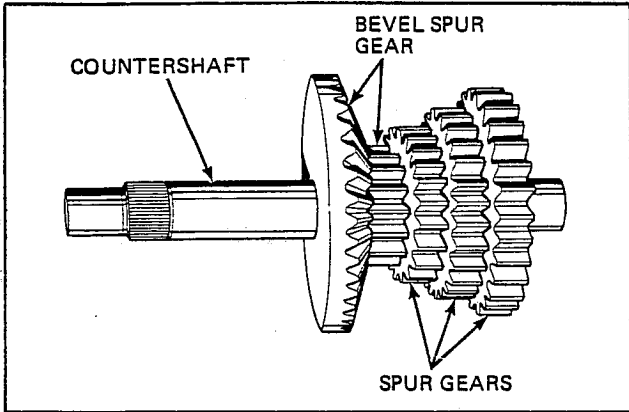


Figure 2-30

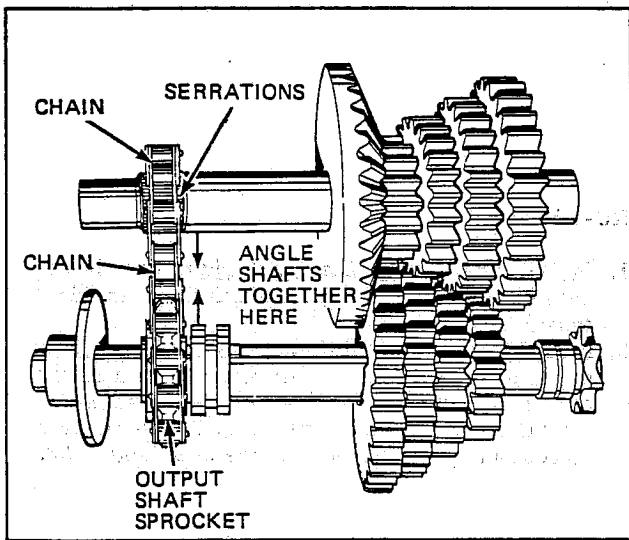


Figure 2-31

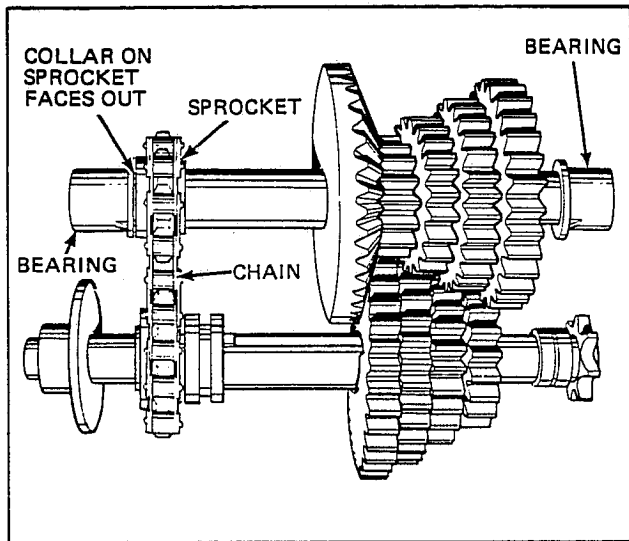


Figure 2-32

3. Install bevel spur gear and smallest to largest mating spur gears to splined end of countershaft. See Figure 2-30. Install chain over two shafts registering chain on output shaft sprocket and in-line with serration on countershaft. See Figure 2-31. Slip sprocket onto serrations and install chain, thrust washers and remaining bearings to shafts. See Figure 2-32 and 2-33.

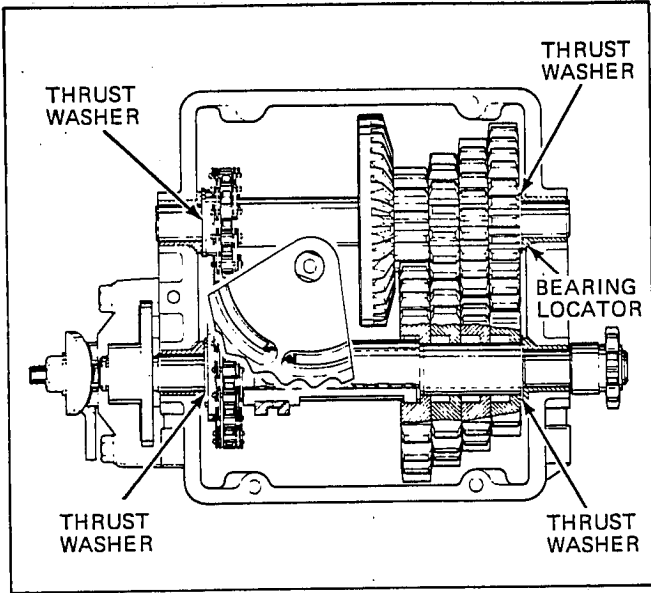


Figure 2-33

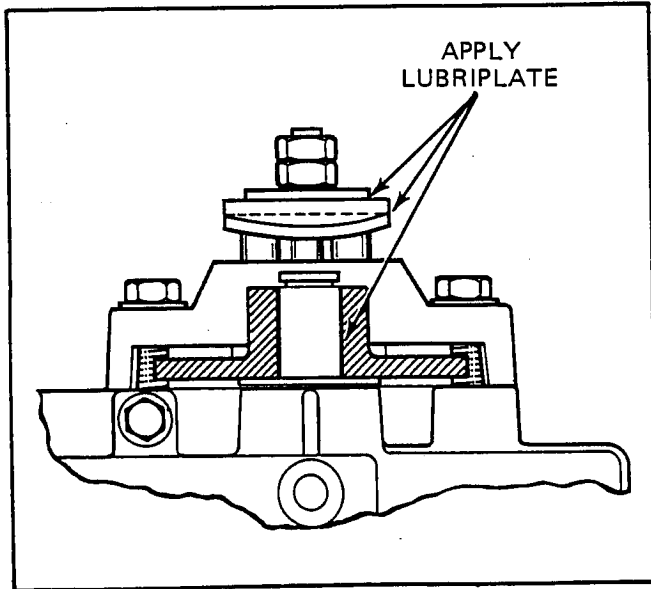


Figure 2-33A

4. Install shaft assemblies into case utilizing piloting locators on bearings to properly align notches in case. See Figure 2-33. CAUTION: Be sure bearing locators are seated in transmission case.
5. Install shifter assembly (shaft, pins and fan), 12 oz. E.P. Lithium grease around gearing, and reinstall cover on case. Torque cap screws 90-100 in. lbs.
6. Install index ball, spring and setscrew in that order into cover and tighten the screw two full turns from flush. Install shift lever.
7. Check for binding by turning input shaft. Install transmission on equipment. Install and adjust brake linkage to disengage when clutch is engaged.
8. Apply a light film of lubriplate to the inside of lever portion which contacts pins (Figure 2-33A); also to outside of lever which contacts flat washer, and between shaft O.D. and bore of brake disc. Brake pads and brake disc must be free of grease and oil.

Brake and linkages may vary.

NOTE: If adjusted incorrectly, the brake will do one of two things:

- a. It will not brake (stop) the vehicle when the brake is applied, or
- b. If adjusted too tightly, a drag or continued braking effect will be evident until the brake wears out.

A. OPERATION

NOTE: Number in parentheses refer to Figure 2-34.

1. The input shaft (11) idles through the three gears (5), (6) and (7) held in position by the retaining ring (18). Next to the retaining ring find the shift collar (15) which slides over the input shaft. The keyways on the input shaft accept the keys (12) held in location by the inside diameter of the shift collar.
2. Neutral is experienced when the shift rod lever (4) is rotated full clockwise, (See Paragraph I). First, second, or third gear is obtained by rotating the shift rod lever (4) counterclockwise causing engagement of the keys (12) in the internal splines of the shift spur gears (5), (6) and (7). The axle spur gears (8), (9) and (10) are locked to the axle by means of a woodruff key (17) and are in constant mesh with the shift gears.

3. When the shift rod lever (4) is moved counterclockwise causing the collar to move the keys (12), the keys will engage the internal splines of the shift spur gears (5), (6) or (7) the input force is then transferred to a meshed spur gear on the axle, thus giving torque to the axle.

B. REMOVAL

1. When removing the transmission from the equipment, loosen the mounting bolts to relieve pressure on the belt or link chain.
2. Clean the outside of the unit. Smooth off any high spots on the axle. Clean off any rust, corrosion, or paint which will bind parts during disassembly.
3. Remove any attached parts as pulleys or sprockets.

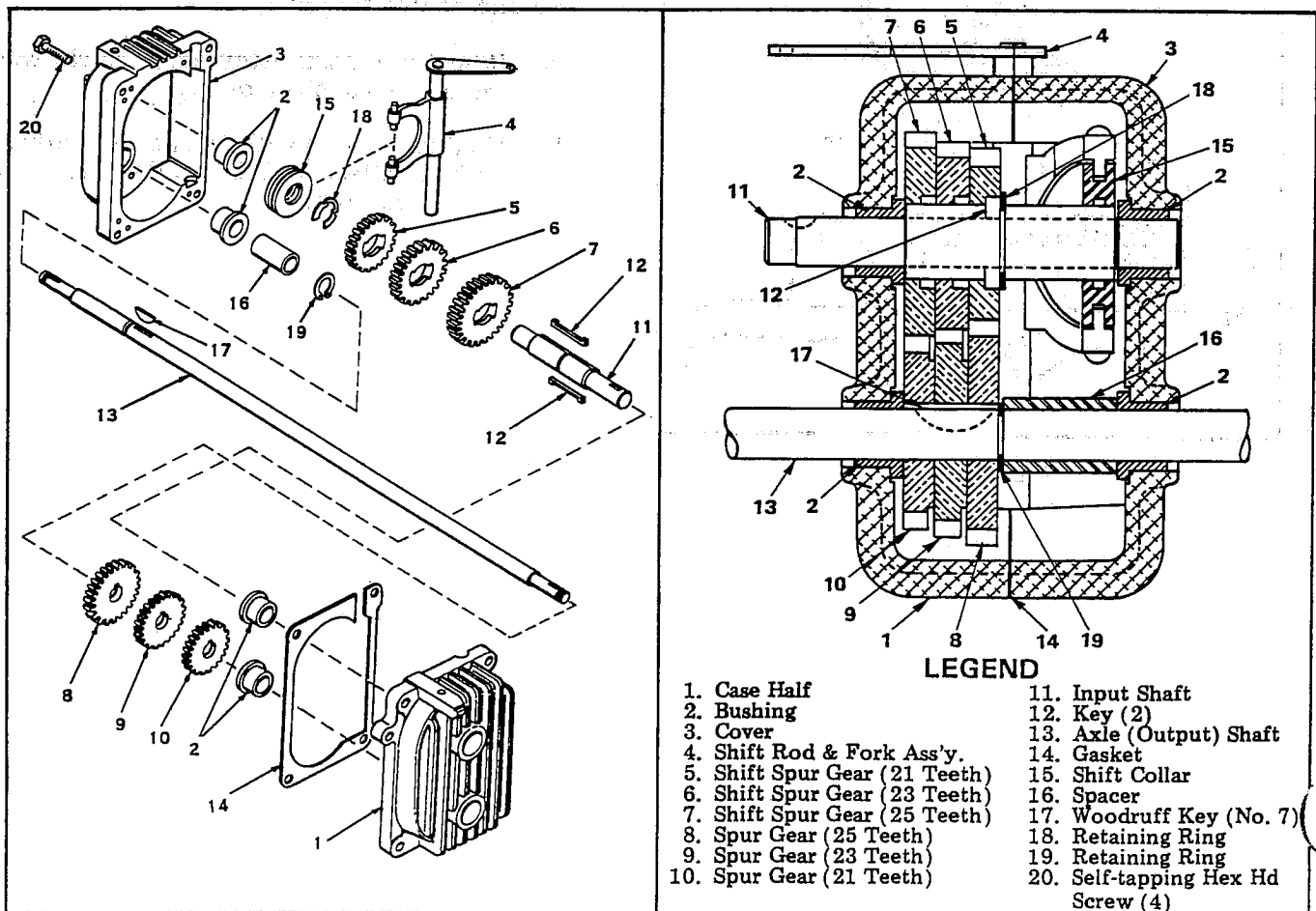


FIGURE 2-34. EXPLODED AND CROSS SECTIONAL VIEW

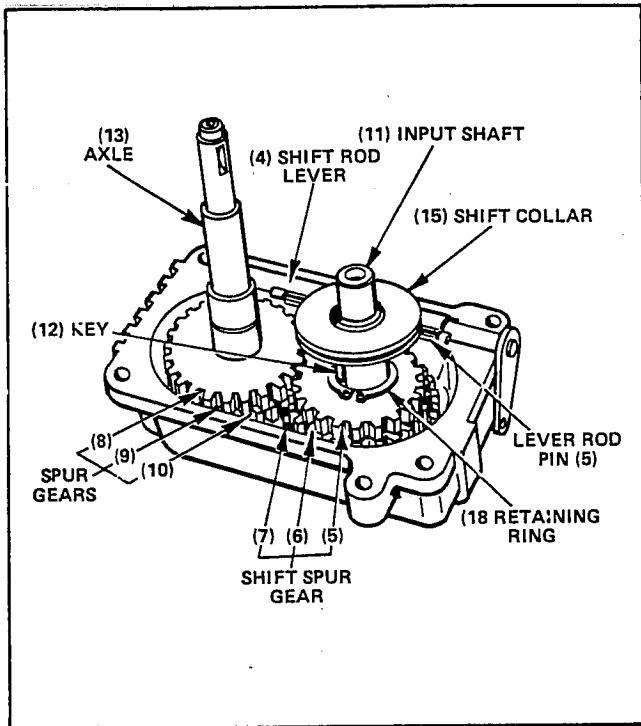


FIGURE 2-35. COVER REMOVED

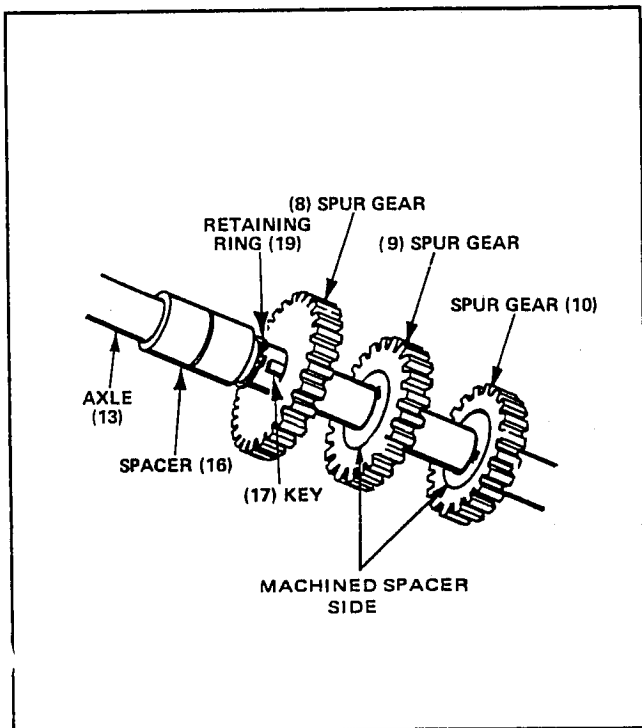


FIGURE 2-36. AXLE ASSEMBLY

C. DISASSEMBLY

1. Rotate shift rod lever fully clockwise (neutral).
2. Remove cap screws securing the cover to the case while pressing on the axle and input shafts to keep parts in the case.
3. Remove the gasket and clean any grass, dirt, or grease from around the external surfaces of the transmission.
4. Remove shift rod lever from its location in the case by lifting the lever up and away from the case by clearing the pins on the rod (Fig. 2-35) from the shift collar.
5. Remove the axle from case, with gears. Remove gears, (Fig. 2-36) items 8, 9 and 10 keyed to axle. Remove spacer (16).
6. Pull the input shaft out of the case. Remove the shift spur gears. (If the keys are not engaged, the input shaft will come out without the gears). Remove the retaining ring (Fig. 2-37, item 18) from the input shaft. Remove shift collar (15) and key (12) from input shaft.
7. Degrease all the disassembled parts.
8. Check keys, keyways, gears and associated parts for wear and damage. Replace as necessary.
9. To remove and install bushings, use tool part No. 670210. Use sizing ball and driver part No. 670212.

D. INSPECTION AND REPAIR

1. Replace axle ends with worn grooves.
2. Replace gears with worn teeth or lugs.
3. Replace retaining ring, keys, keyways and gaskets.
4. Replace case and cover if cracked, or with stripped thread. Replace worn bushings.

2

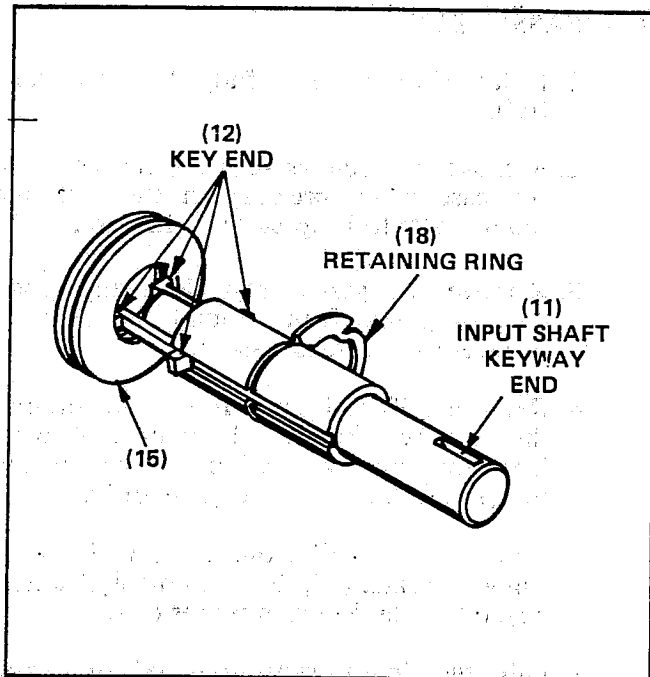


FIGURE 2-37. INPUT SHAFT

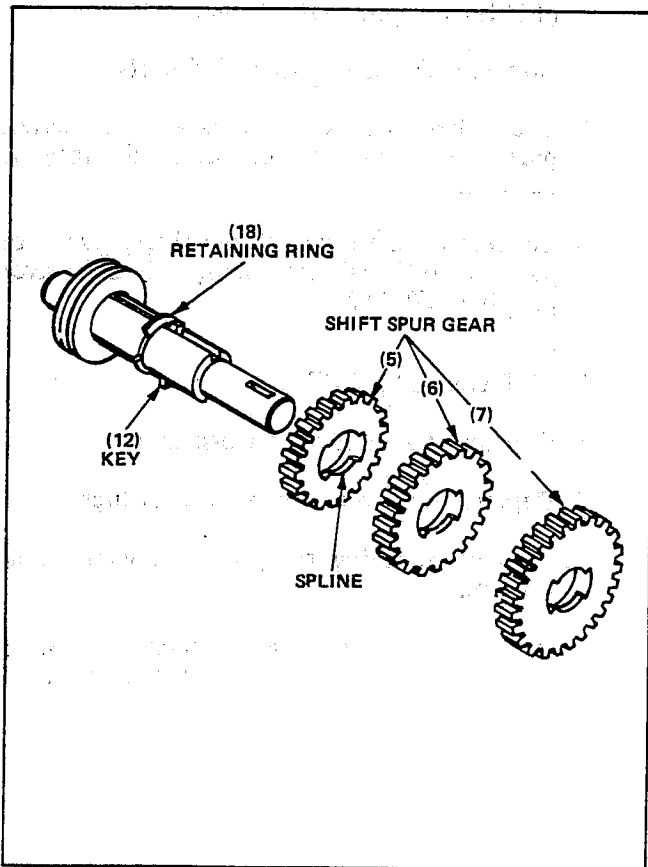


FIGURE 2-38. SHIFT SPUR GEAR ASSEMBLY

E. ASSEMBLY

1. Using the input shaft, Fig. 2-37, install key (12) end into the grooved inside diameter of the shift collar (15). Pilot collar and keys into keyways on input shaft with collar locating opposite keyway end. Install retaining ring (18) on input shaft in groove provided. Be certain the retaining ring keeps at least one key (Fig. 2-38) from moving past ring toward collar.
2. Install gears, Fig. 2-38, with smallest shift spur gear toward collar. Be certain the internal spline on each gear faces away from retaining ring side. Install input shaft with gear (5) into the case half.
3. Install retaining ring, Fig. 2-36, (19) on axle. Install spacer on axle shaft.
4. Apply 2 ounces of extreme pressure (E.P.) lithium grease in case around gears.
5. Install largest to smallest spur gears on the key on the axle. Be certain the machined spacer side of gears (Fig. 2-36, items 9 & 10) face the cover half. Install axle with gears into case half. All six gears must be in mesh.
6. Install shift rod and fork assembly-making sure pins on fork locate in groove on collar.
7. Install new gasket on the case and install cover on case until both halves lock gasket in place.
8. Install self-tapping screws to secure the cover.
9. The case; torque to 90-110 inch pounds.

F. INSTALLATION

1. Install the woodruff key and sprocket or pulley on the input shaft.
2. Loosely position the unit in place on the equipment with the mounting bolts.
3. Install the chain or belt and align the parts, then tighten mounting screws.
4. Perform all other re-assembly steps called out in the equipment mechanics instructions.

SECTION 2-3 TRANSMISSIONS (200 SERIES) 3 SPEED

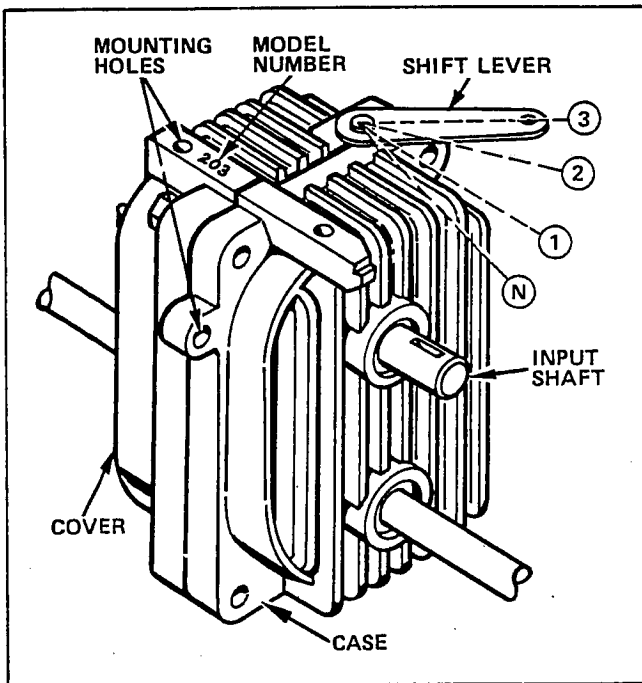


FIGURE 2-39. MODEL 203 TRANSMISSION

G. TESTING

1. Turn input and output shafts to insure that they are free from binding.
2. Shift the shifter lever to first gear position (Fig. 2-34), then turn input shaft; output should turn slowly.
3. Shift the shifter lever to second gear position, then turn input shaft; output should turn faster.
4. (Same as 3 except for third gear position.)
5. Check for seal around gasket surfaces.

H. IDENTIFICATION

The model number identification is found stamped on the edge as shown in Figure 2-39.

I. SHIFTING PATTERN

The shifting pattern of the Model 203 Transmission is shown in Figure 2-39.

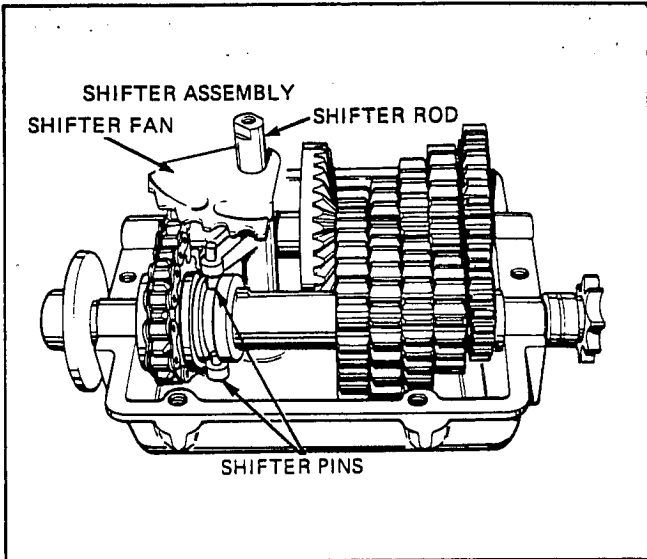


Figure 2-43

4. Remove shifter assembly (includes shaft, pins and fan) from transmission case by lifting shaft out of case. See Figure 2-43.

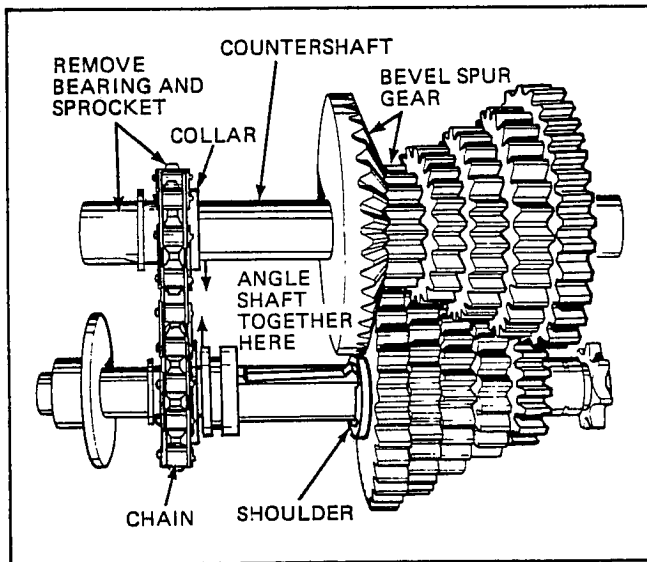


Figure 2-44

5. Remove gear and shaft assemblies from case half of the transmission by lifting the two shafts out of the bearing supports taking care not to disturb drive chain relationship with sprockets. See Figures 2-43 and 2-44.

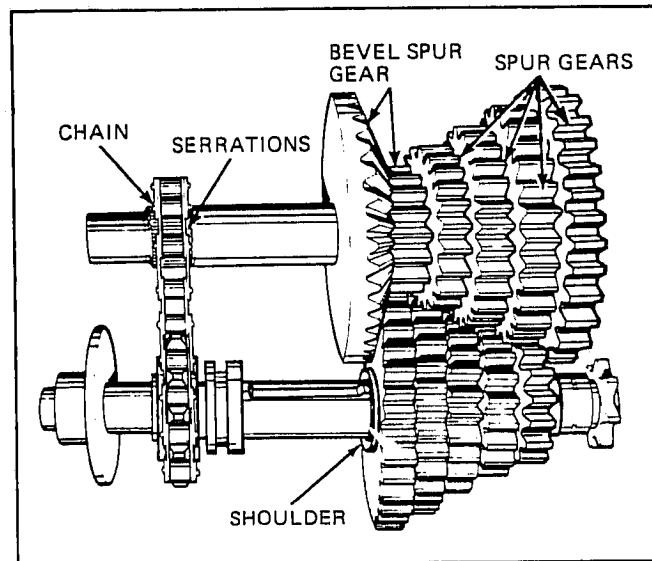


Figure 2-45

6. Angle chain and sprocket ends of shaft toward each other, removing the bearing and sprocket from the countershaft. See Figure 2-44. Note the collar on the sprocket faces the bevel gear. Remove chain. See Figure 2-45.

2

2

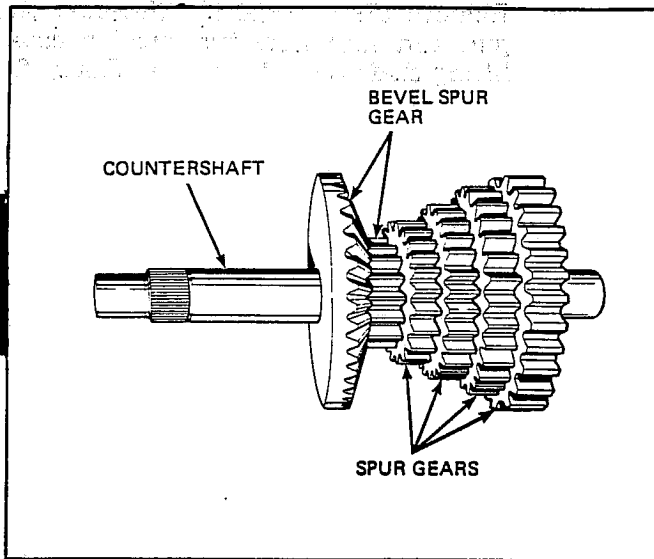


Figure 2-46

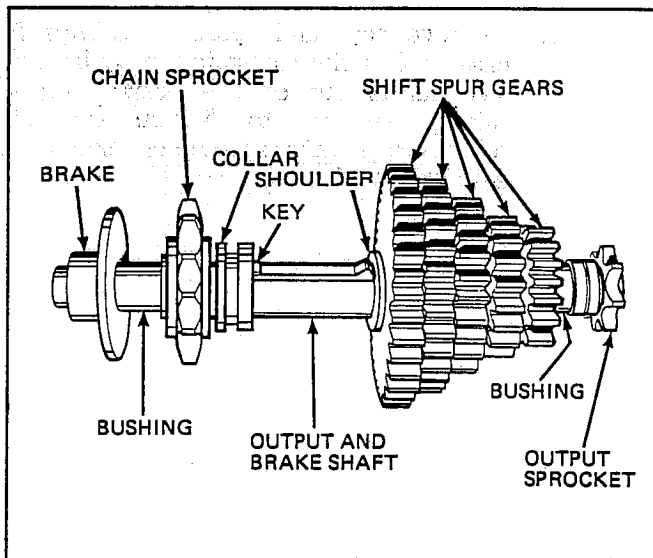


Figure 2-47

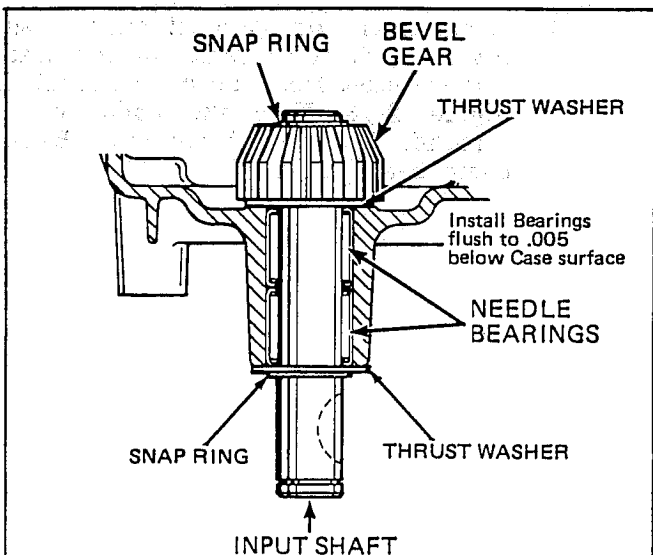


Figure 2-48

7. Remove bevel spur gear combination and spur gears from the countershaft these gears are splined to the countershaft. See Figure 2-46.

8. Remove the output sprocket and brake disc from the output shaft. Remove the bushings, shift spur gears, chain sprocket, collar and keys. See Figure 2-47.

9. Remove snap ring from input shaft, remove bevel gear and pull shaft through case. See Figure 2-48.

10. Input shaft needle bearings should be installed flush to .005 below bearing bore surfaces from inside and outside case. See Figure 2-48.

C. INSPECTION AND REPAIR

Examine all parts after removing grease with cleaning solvent. Replace damaged parts.

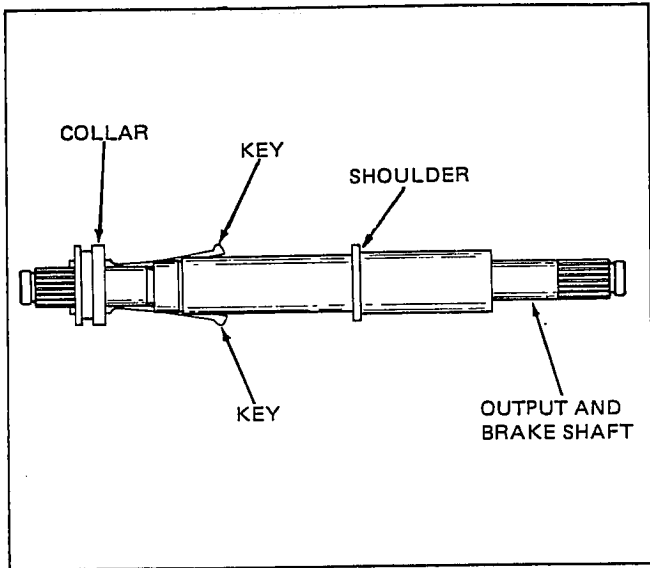


Figure 2-49

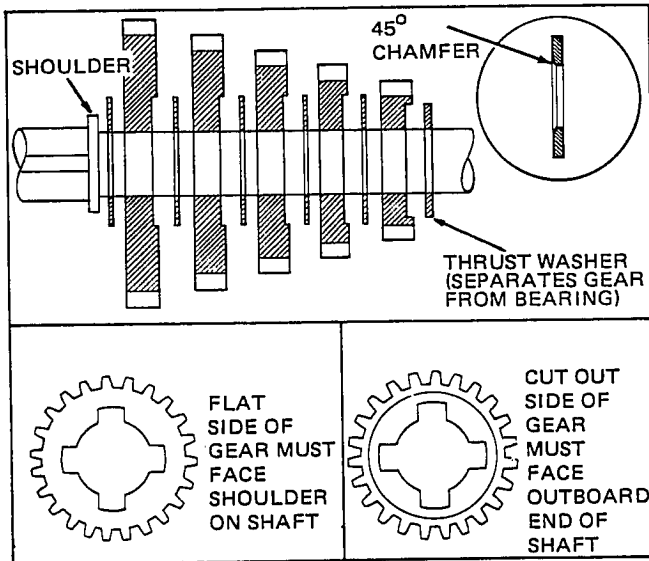


Figure 2-50

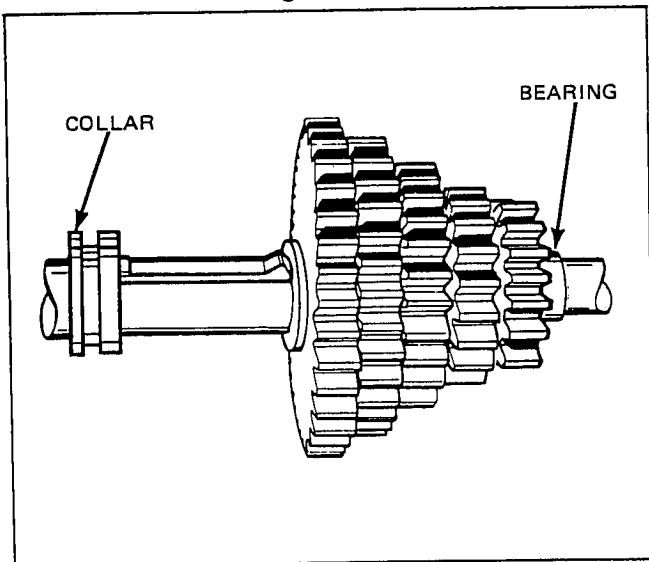


Figure 2-51

D. RE-ASSEMBLY

1. Install and secure the input shaft and bevel gear in the case. See paragraph 9 under "Disassembly Instructions" and reverse the order.
2. Install collar and keys on output shaft as shown in Figure 2-49. Thick side of collar MUST face shoulder on Shaft as shown in Figure 2-49.

2

3. Install thrust washers and shifting gears on output shaft as shown in the upper view in Figure 2-50. The 45° chamfer in the inside diameter of the thrust washers MUST face the shoulder on the output shaft. See inset in Figure 2-50. The flat side of the shifting gears ALWAYS face the shoulder on the output shaft.

NOTE: The thrust washer on the shift gear end of the output shaft does not have a chamfer on the inside diameter and must be positioned as shown in Figure 2-50. It is thicker than the other thrust washers separating the gearworks from the bearings.

When correctly assembled the output shaft should appear as shown in Figure 2-51.

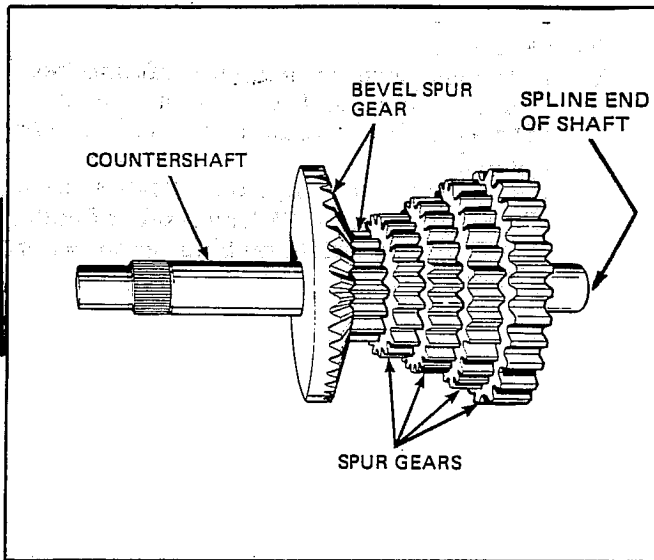


Figure 2-52

4. Install bevel spur gear and smallest to largest spur gears to the splined end of the countershaft. See Figure 2-52.

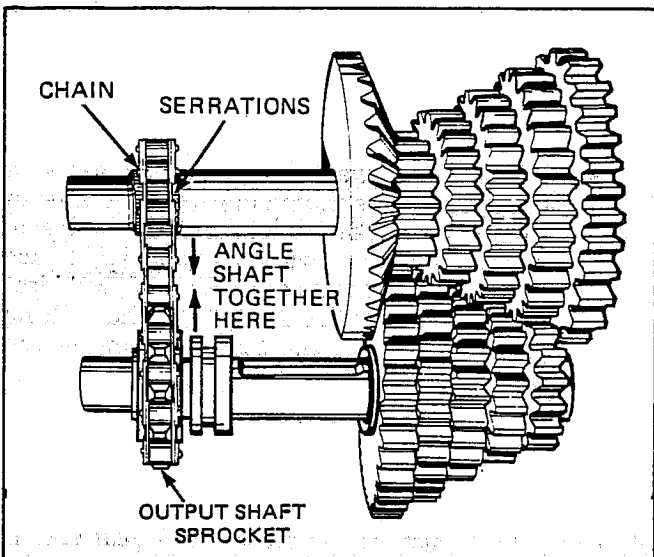


Figure 2-53

5. Install chain over two shafts registering chain on output shaft sprocket and in-line with serration on countershaft. See Figure 2-53. Be sure collar on sprocket faces shifting keys and collar.

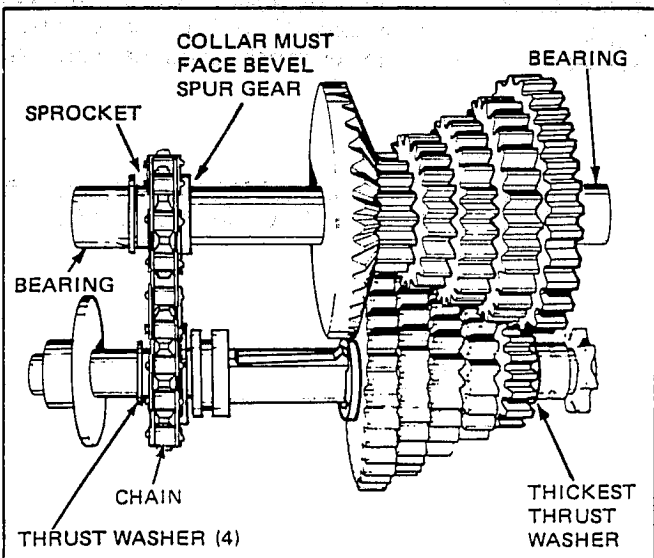


Figure 2-54

6. With collar on countershaft sprocket facing the bevel spur gear install sprocket onto serration and install chain. Install all (4) thrust washers to shafts. The thickest thrust washer MUST be positioned on the shifting gear end of the output shaft. See Figure 2-54. Install bronze bearings and disc and sprocket. See Figure 2-54.

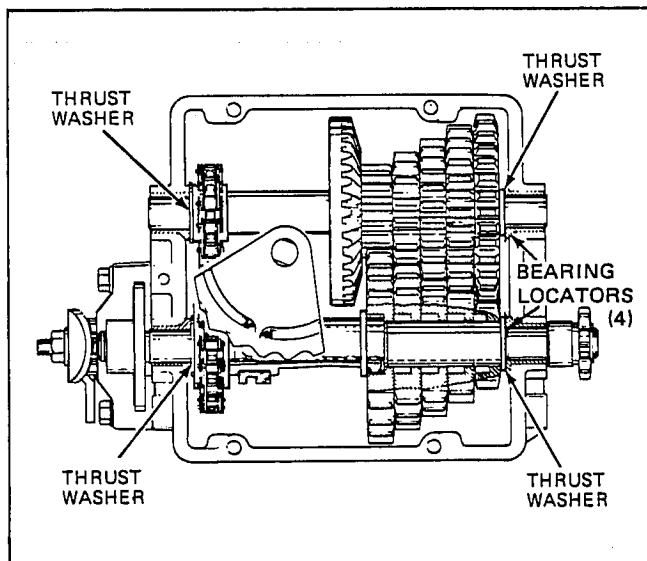


Figure 2-55

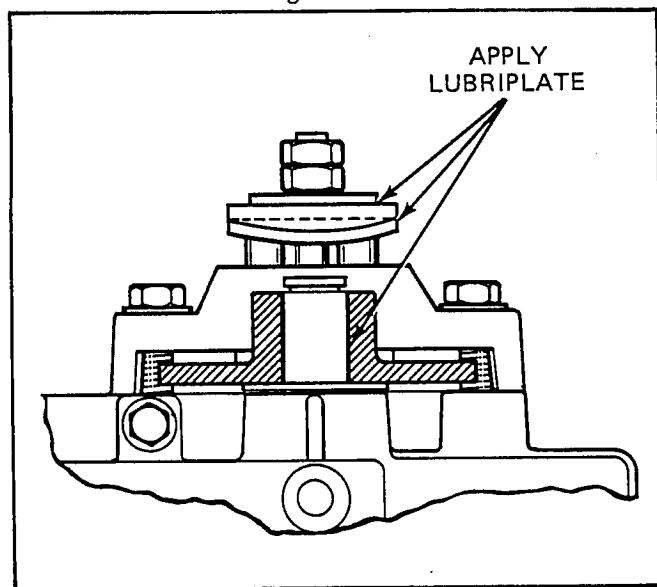


Figure 2-56

7. Install shaft assemblies into case utilizing piloting locators on bearings to properly align notches in case. See Figure 2-55. **CAUTION:** Be sure bearing locators are seated in transmission case.
8. Install shifter assembly (shaft, pins and fan), 12 oz. E.P. Lithium grease around gearing, and reinstall cover on case. Torque cap screws 90-100 in lbs.
9. Install index ball, spring and setscrew in that order into cover and slowly tighten the screw 2 turns below flush.
10. Check for binding by turning input shaft. Install transmission on equipment. Install brake and linkage and adjust to disengage when clutch is engaged. Consult equipment owners manual.
11. Apply a light film of lubriplate to the inside of lever portion which contacts pins (Figure 2-56); also to outside of lever which contacts flat washer, and between shaft O.D. and bore of brake disc. Brake pads and brake disc must be free of grease and oil.

Brake and linkages may vary.

Note: If adjusted incorrectly, the brake will do one of two things:

- a. It will not brake (stop) the vehicle when the brake is applied, or
- b. If adjusted too tightly, a drag or continued braking effect will be evident until the brake wears out.

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SECTION 3 TRANSAXLES (600 SERIES)

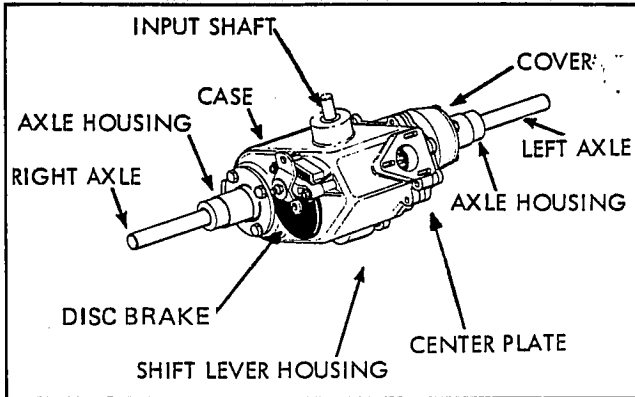


Figure 3-1

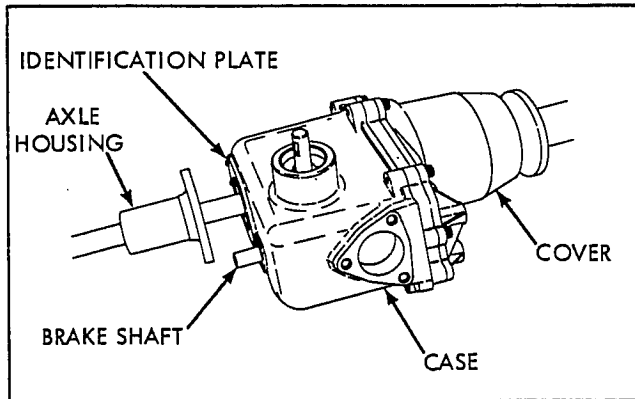


Figure 3-2

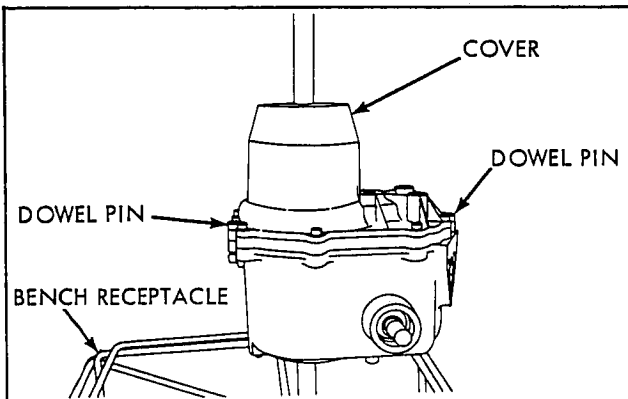


Figure 3-3

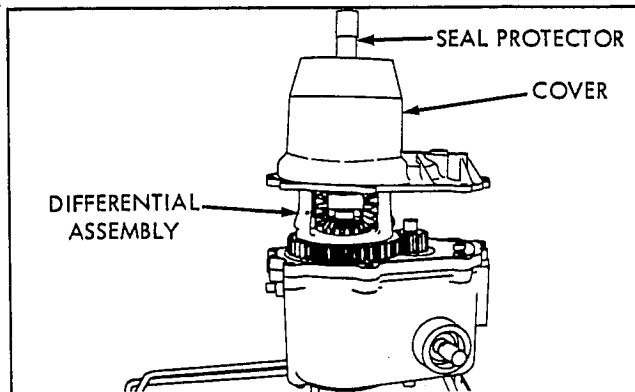


Figure 3-4

CAUTION

DECLUTCHING IS REQUIRED WHEN SHIFTING TO AVOID GEAR CLASHING AND DAMAGE.

A. GENERAL

The 600 series transaxle has an aluminum case and cover. The input shaft is on the top of the case. Some 600 series transaxles are equipped with optional disc brakes. See Figure 3-1. Due to the many variations of equipment braking systems, adjustments and repair to these components and linkage are not to be considered warranty.

B. TRANSAXLE DISASSEMBLY

1. Clean the outside surface of the transaxle, away from the area where disassembly will take place. (Position shift lever in neutral position to help disassembly. See Figure 3-16.) Remove screws (3) holding shift lever opening (for service of shift lever assembly, refer to SECTION 10.) Remove all keys from keyways, remove all burrs and dirt from shafts. On hardened shafts, use a stone to remove burrs. All seals should be replaced whenever a shaft is pulled through a seal. Always use a new gasket whenever the gasket surfaces have been separated.
2. After removing axle housings, place the unit in a receptacle, bench or clamp the transaxle in a soft jaw vise. Position the transaxle so that the socket head capscrews are facing up.
3. Remove the socket head capscrews holding the case and cover together. Drive out the dowel pins used for alignment of the case and cover.
4. Lift off the cover assembly. Use a seal protector on axle shaft and lift off transaxle cover assembly. Because this seal is a single lip type, it may be reused, if care is taken to see that it isn't scratched or cut. Discard gasket.

3

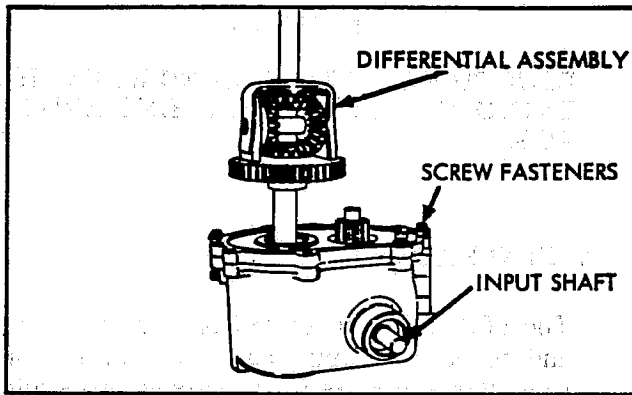


Figure 3-5

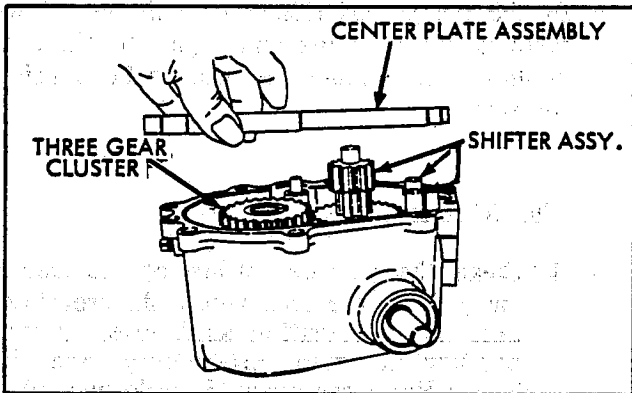


Figure 3-6

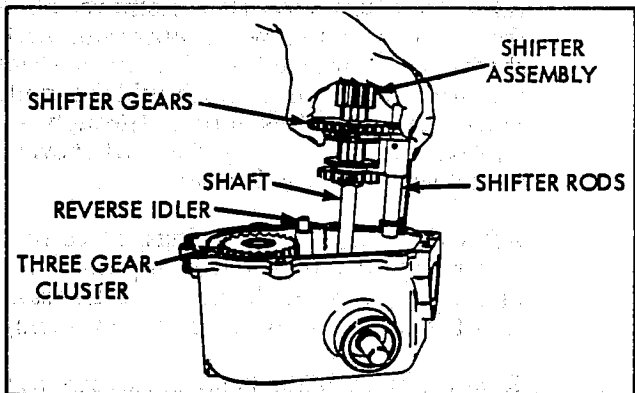


Figure 3-7

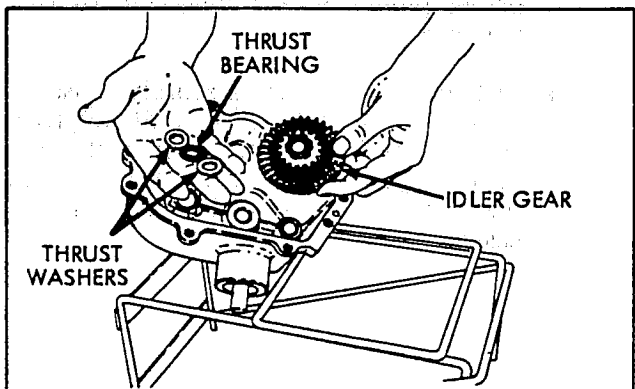


Figure 3-8

5. To remove differential assembly, it may be necessary to replace two or three screws to hold center plate assembly down. Pull assembly straight up. If tight, tap on lower axle with soft mallet. **CAUTION: DO NOT USE STEEL HAMMER.** Refer to Section 8 C for differential assembly service. Remove gear on top of shifter shaft.

6. Remove temporary holding screws, if used, and lift off center plate assembly. Discard gasket.

7. Remove complete shifter assembly by grasping shifter gears, shaft and both shifter rods as a unit.

NOTE: Examine assembly carefully; if no service is required, retain assembly as a unit for easy reassembly. If service is necessary, refer to SECTION 10. Also, refer to illustrations 3-11 and 3-12 and paragraph (13) on the next page.

8. Remove reverse idler shaft and spacer, cluster gear assembly and thrust washer. For removal and replacement of gears on cluster, see paragraph (12) on the next page.

9. Lift idler gear assembly out of case.

NOTE: For sequence of thrust washers and bearings, see Figure 3-8.

NOTE: Caution required as needles from shifter and brake shaft bearing may fall out. Refer to bearing chart, page 3-5, for number of needles.

3

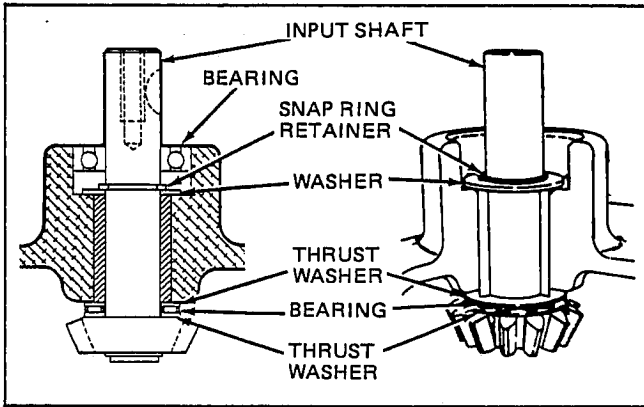


Figure 3-9

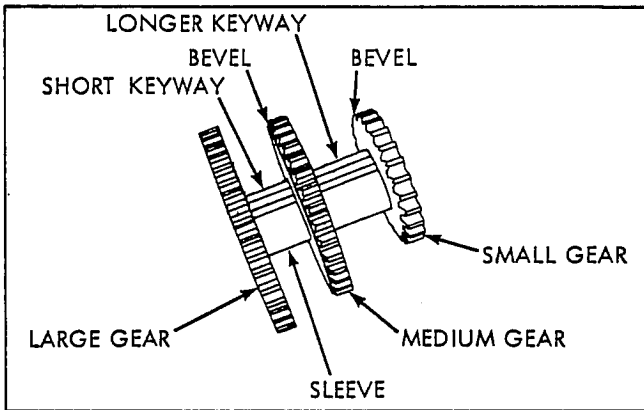


Figure 3-10

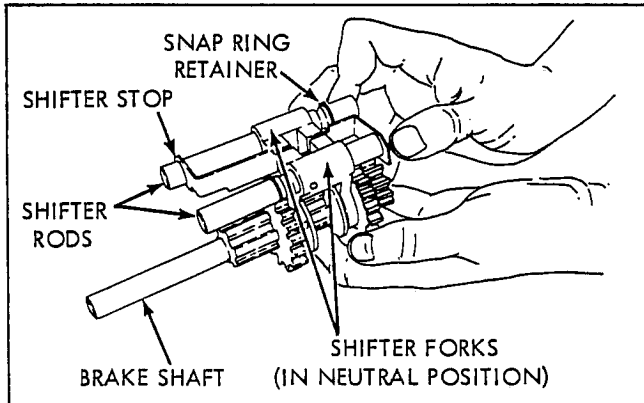


Figure 3-11

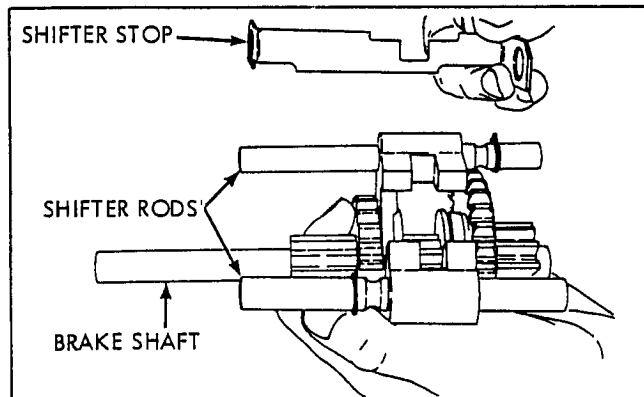


Figure 3-12

10. Remove input shaft oil seal to allow access to snap ring. Remove snap ring and input shaft will slide out. A removed seal must be replaced by a new seal.

11. One model (612) has a sealed ball bearing instead of an oil seal. To remove this unit, remove snap ring inside the case and drive out. On model 612-A, remove the oil seal in the normal manner.

12. Cluster Gear Sub-Assembly

- (a) The cluster gear can be disassembled. All gears are replaceable if damaged or worn. Preferably use a press to drive the gears squarely.
- (b) The small and middle gear bevel faces down, there is no beveled edge on large gear. Shorter section between middle and large gear.
- (c) Key edge ends must align with shaft ends.

13. Shifting Assembly

The shifting assembly is usually removed from and installed into the transaxle as a unit. The assembly is removed and replaced by grasping the shifter rods firmly. This will cause the binding necessary to hold the assembly together. Before removal or installation of the shifting assembly, notches in the shifter forks should be aligned with notches in the shifter stop. This indicates that shifting assembly is in a neutral position. The shifter stop must be so positioned that the notch aligns with notches in shifter forks. For service of the shifting assembly, refer to Section 10.

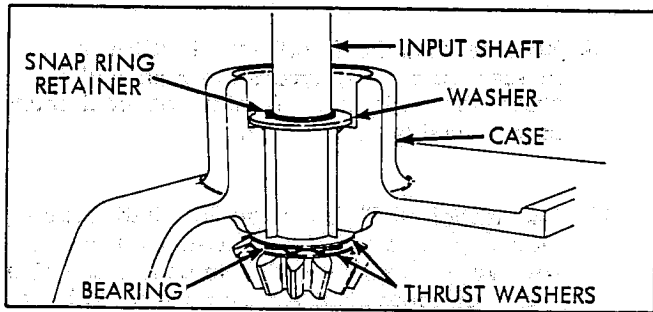


Figure 3-13

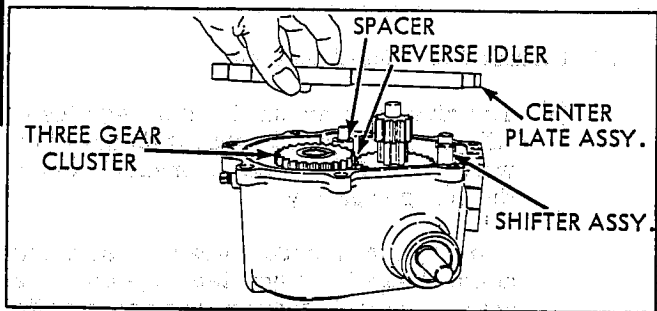


Figure 3-14

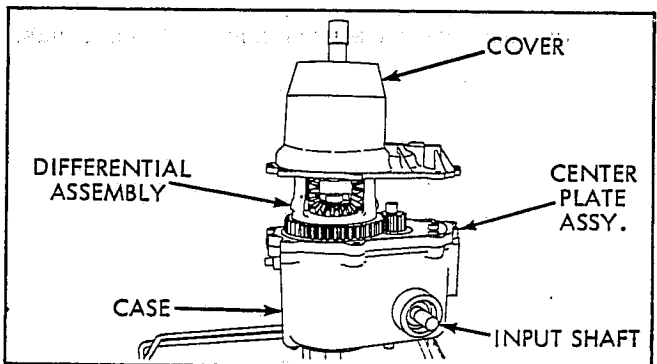


Figure 3-15

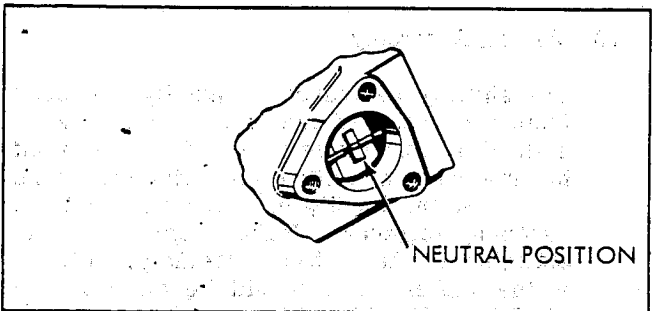


Figure 3-16

14. Transaxle Assembly

- (a) Install thrust washers and bearing on input shaft. Note sequence, Figure 3-13.
- (b) Install input shaft into case assembly. Lock on with snap ring retainer. Install oil seal, see SECTION 11.
- (c) Set case assembly open side up. Insert the idler shaft gear assembly, thrust washers and bearing. Note sequence of washers and bearings (Figure 3-8). Note: Place reverse idler shaft into bearing to aid in holding washers, thrust bearing, idler shaft and gear assembly prior to installing shifter assembly.
- (d) Insert the washer and then the three gear cluster assembly.
- (e) Insert shifter assembly. Check that rods are seated properly. Note: Reverse idler shaft will be pushed out at this time.
- (f) Install reverse idler. Make sure beveled edge is up. Spacer on top of gear.
- (g) Place new gasket on case and install center plate.
- (h) Place new gasket on center plate and install differential assembly, longer axle in down position. Be sure gear on shifter shaft is on shaft.
- (i) Install gear case dowel pins. Leave dowel pins slightly exposed on top to locate cover assembly.
- (j) Install transaxle cover assembly, and secure with eight (8) cap screws.
- (k) Install bearings and/or bushings, if necessary, using bearing driver and bushing tool. See bearing chart below. For seal installation see SECTION 12.
- (l) Install axle housing assembly. Fill with 1-1/2 pints S. A. E. EP90 oil.
- (m) Inspection Note: For a neutral position, shift notches in forks and notch in shifter stop must be aligned and centrally located.

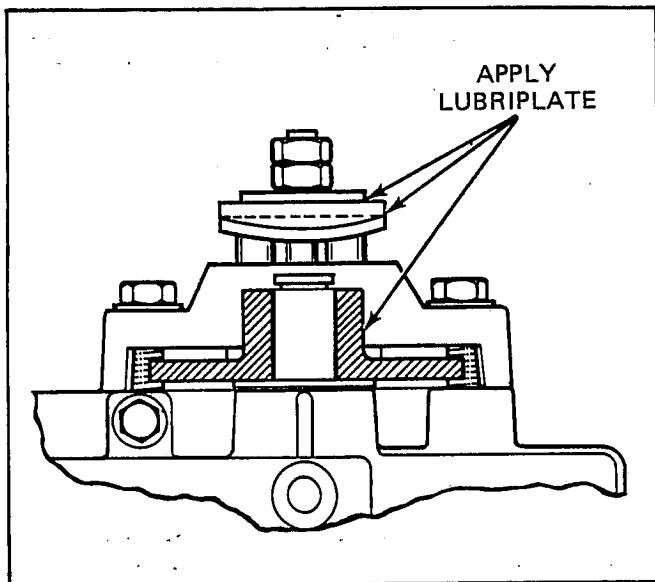


Figure 3-17

15. Brake Lever Assembly

The brake lever type is determined by the original equipment manufacturer's selection of this option.

When assembling, apply a light film of lubriplate to the inside lever portion which contacts the pins; (Figure 2-34) also to outside of lever which contacts flat washer, and between shaft O.D. and bore of brake disc. Brake pads and brake disc must be free of grease and oil (see Figure 3-17).

3

600 SERIES BEARING TOOLS

PART LOCATION	TOOL REMOVE & REPLACE	TOOL BEARING SIZER
Brake Shaft	670210	(27 needles)
Axle	670204	670214
* Input Shaft	*670207	670208
Center Plate	670205	
Brake Shaft	670213	(30 needles)
Differential	670204	670214
Cluster Gear	670204	670214
Idler Gear	670210	670212
Axle Housing	670204	670214
Reverse Idler		

* Bearing must be flush with top of case. Secure with Loctite.

(3-1) TRANSAXLES (800 SERIES)

3

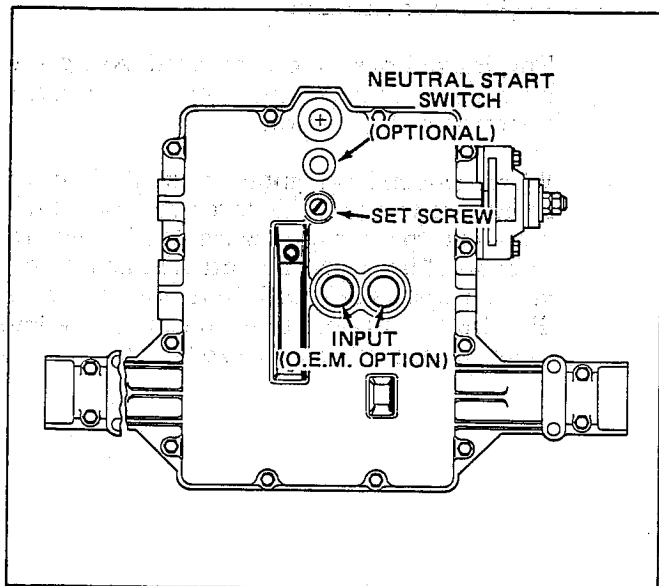


Figure 3-18

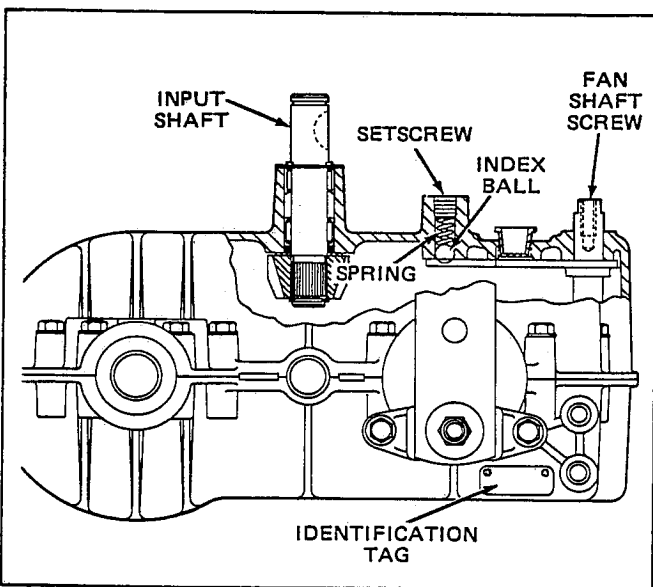


Figure 3-19

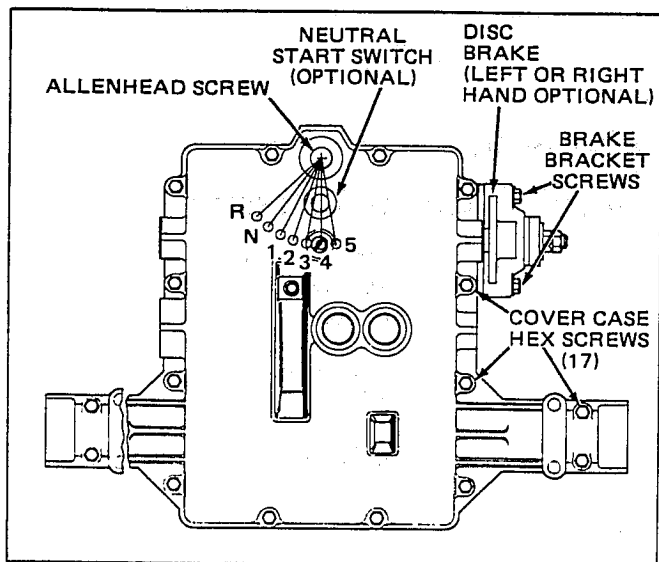


Figure 3-20

CAUTION: TO AVOID PREMATURE TRANSMISSION FAILURE DECLUTCHING IS REQUIRED WHEN SHIFTING.

NOTE: Due to the many variations of equipment braking systems, adjustments and repair to these components and linkages are not to be considered warranty. The brake may be either a left-hand or right-hand per the O.E.M. option.

A. GENERAL

The 800 series transaxle is basically a combination of the 700 series transmission with a 600 series transaxle differential. Figure 3-18. The position of the input shaft varies with a particular model. Because of the option of input shaft and gear positioning on either side of the bevel gear, the axle output will vary. The model described in this section is a five speed forward, single reverse. The input shaft for the model described in this section is located to the left of the bevel gear.

B. IDENTIFICATION

The unit contains an aluminum tag showing the model number. See Figure 3-19. Setscrew Adjustment is covered in paragraph F - Step 10.

C. PRE-DISASSEMBLY

1. Clean outside surface of transaxle.
2. Position shift lever in neutral position as indicated by the shift pattern. Remove Allenhead screw, washer(s), and shift lever.
3. If installed, (O.E.M. Option) remove neutral start switch. See Figure 3-20.
4. Remove setscrew, spring and index ball. See Figure 3-19.

D. DISASSEMBLY

1. Remove 17 Hex screws that hold cover to case. Figure 3-20.
2. Push shift lever rod in while pulling cover off of case. Shifting assembly may temporarily remain in case. Remove cover.

NOTE: Remove grease from the unit as parts are removed.

3. Remove two brake bracket screws (Figure 3-20) and remove brake assembly.

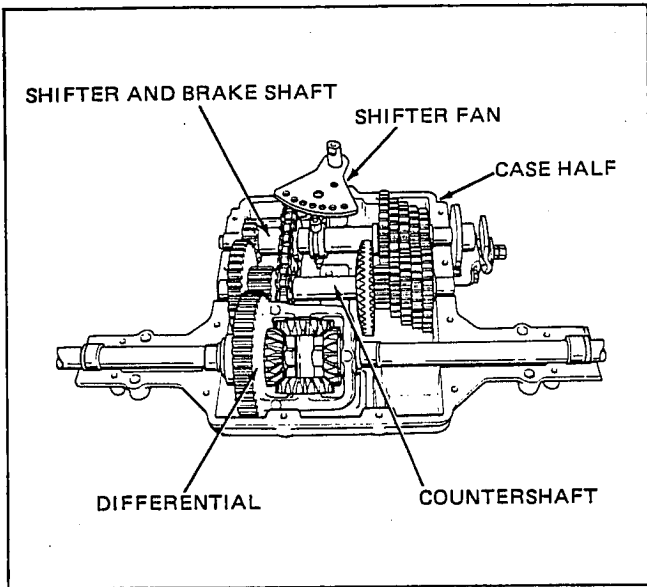


Figure 3-21

NOTE: Prior to removal of Gear shaft assemblies from the case, the shifter fan may be removed. It will be difficult to keep parts from falling off the assemblies. Note position of parts before removal.

4. Remove gear and shaft assemblies from case half of the transmission by lifting the two shafts out of the bearing supports taking care not to disturb drive chain relationship with sprockets. (See Figure 3-21)

NOTE: Before disassembly, observe how "V" notches on the flanged bushings fit into recess "V" of case. Figure 3-22.

3

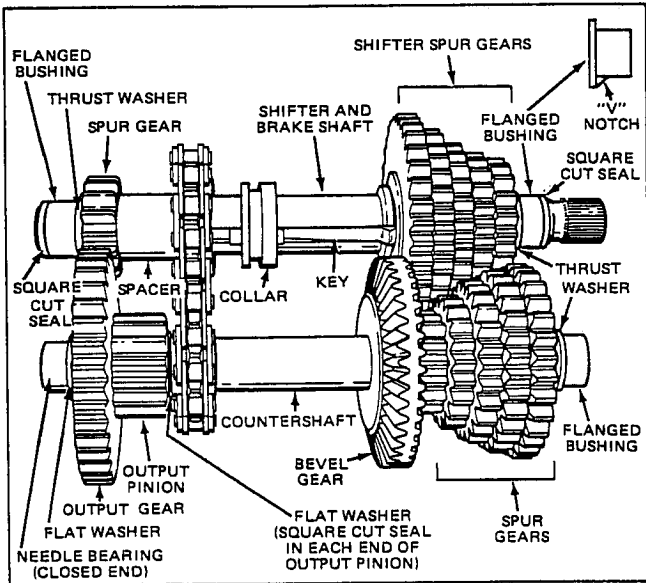


Figure 3-22

NOTE: The square cut seal acts as a lubrication seal.

5. Remove the needle bearing (closed end) flat washers (2), output gear and output pinion, and 3 square cut seals from the countershaft. Figure 3-22 (2 seals in output pinion, - 1 in needle bearing cap). Seals in countershaft are larger than those on brake shaft ends. Always replace with new seals whenever removed. See Figure 3-33.

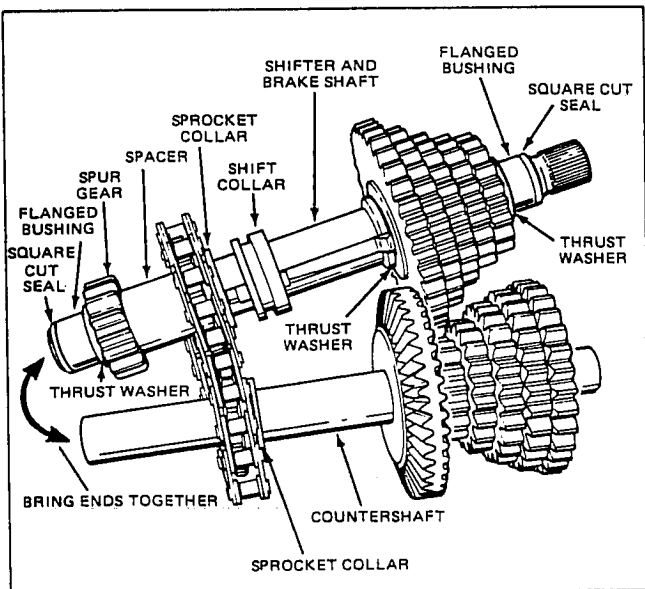


Figure 3-23

6. Angle the shifter and brakeshaft and countershaft chain sprocket ends toward each other. See Figure 3-23. Note the collar on the sprockets face the bevel gear. Remove chain.

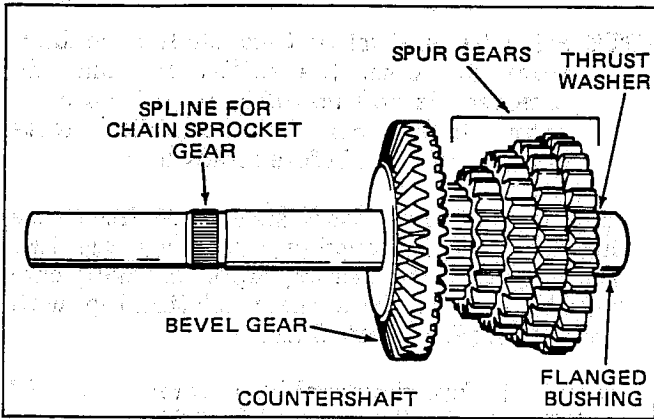


Figure 3-24

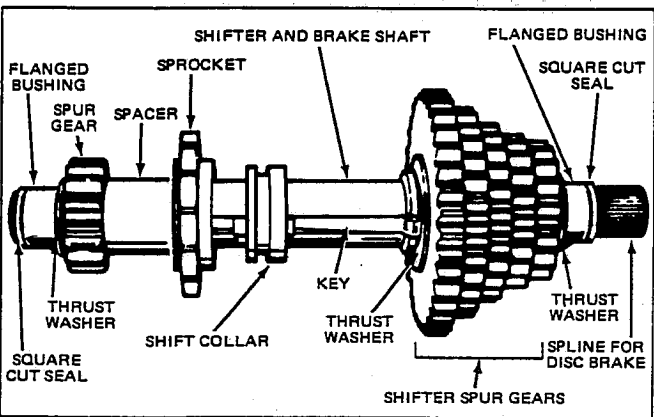


Figure 3-25

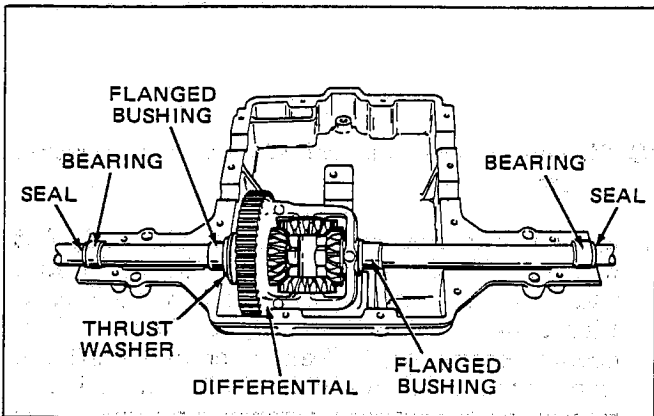


Figure 3-26

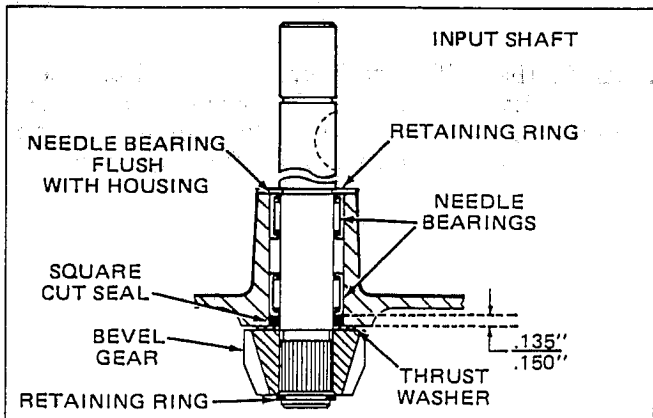


Figure 3-27

7. Remove the sprocket, bevel gear, spur gears, thrust washer, and flanged bushing. The spur gears are splined to the countershaft. See Figure 3-24.

8. Remove the square cut seals (2) and flanged bushings (2), thrust washers (2) on shaft ends, spur gear, spacer, sprocket shift collar with keys, thrust washers and shifter spur gears. See Figure 3-25.

9. Remove differential from case. Remove seals (2), needle bearings (2), flanged bushings (2) and thrust washer. (See Figure 3-26)

Teardown and reassembly procedures for this unit may be found on pages 8-2 and 8-3.

10. Remove retaining ring on bevel gear end from input shaft, remove bevel gear and pull shaft through case. See Figure 3-27. The square cut ring must be replaced, if removed.

Tool Part No. 670251 is used for removal and installation of needle bearings for the input shaft. The needle bearing on inboard side is installed .135"/.150" below flush.

NOTE: Removed seals must be replaced with new seals.

F. REASSEMBLY

1. Apply grease between bearings and install and secure the input shaft and bevel gear in the cover. See Paragraph 10 under "Disassembly Instructions" and reverse the order.

3

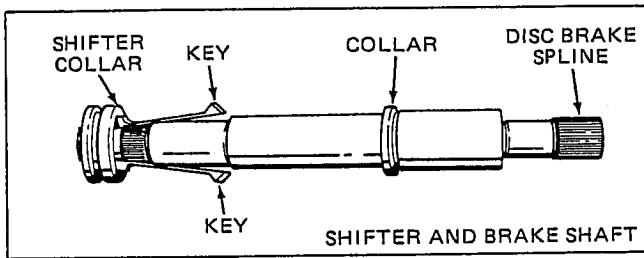


Figure 3-28

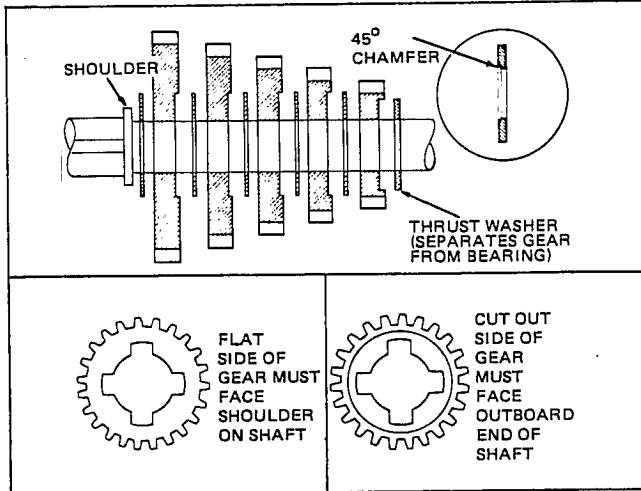


Figure 3-29

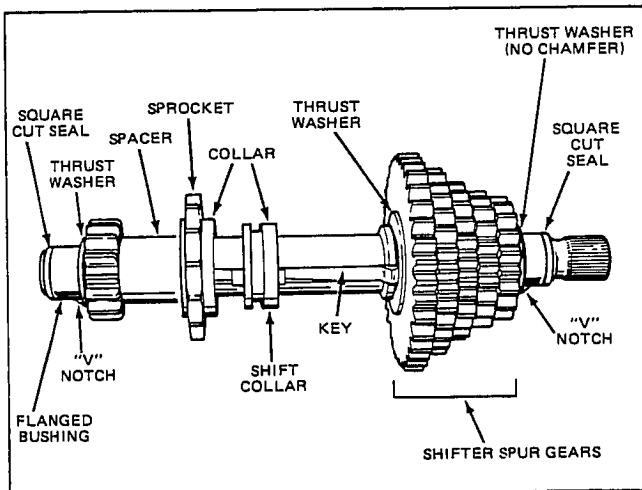


Figure 3-30

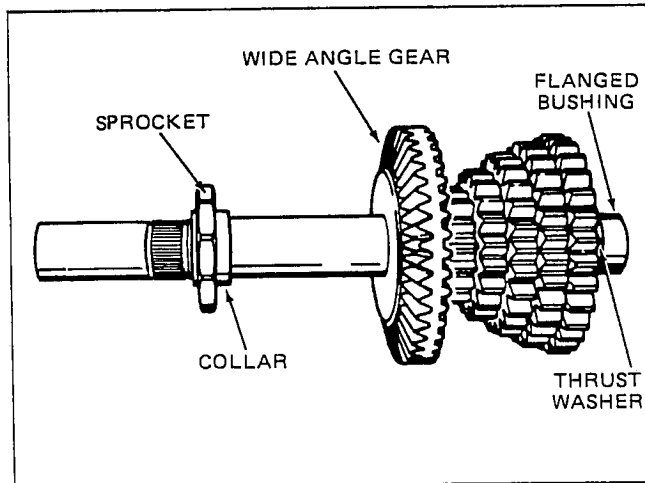


Figure 3-31

2. Grease both keyways and slide keys and collar on output and brakeshaft as shown in Figure 3-28. Thick side of collar MUST face shoulder on shaft as shown in Figure 3-28.

3. When ready to install thrust washers and shifting gears on output shaft as shown in the upper view in Figure 3-29. The 45° chamfer in the inside diameter of the thrust washers MUST face the shoulder on the output shaft. See inset in Figure 3-29. The flat side of the shifting gears ALWAYS face the shoulder on the output shaft.

3

NOTE: The thrust washer on the shift gear end of the output shaft does not have a chamfer on the inside diameter and must be positioned as shown in Figure 3-30. Install sprocket, spacer, spur gear, and thrust washer on output shaft as shown in Figure 3-30. Be sure collar on sprocket faces the shift collar. Install bearings on both ends of output shaft, install square cut rings on end of flanged bushings.

When correctly assembled, the shifter and brake-shaft should appear as shown in Figure 3-30.

(Be sure "V" notch of bushing fits recessed "V" notch in case.)

NOTE: Depending on model, the bevel gear may be installed one of two ways. For description purposes in this section the model used has the wide angle of the bevel gear facing the left. See Figure 3-31.

4. Install bevel gear and smallest to largest spur gears, thrust washer and bushing to the countershaft. Install the sprocket.

3

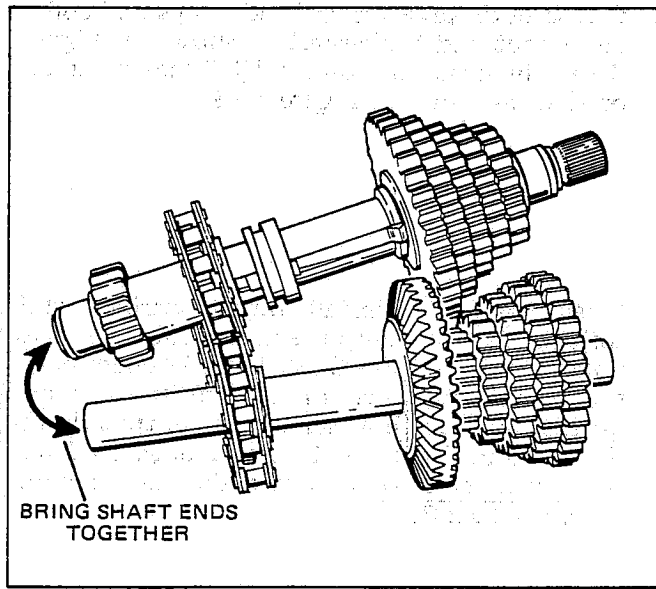


Figure 3-32

5. With the shifter and brakeshaft - and countershaft ends angled together as shown in Figure 3-32, install the chain on the sprockets. Figure 3-32.

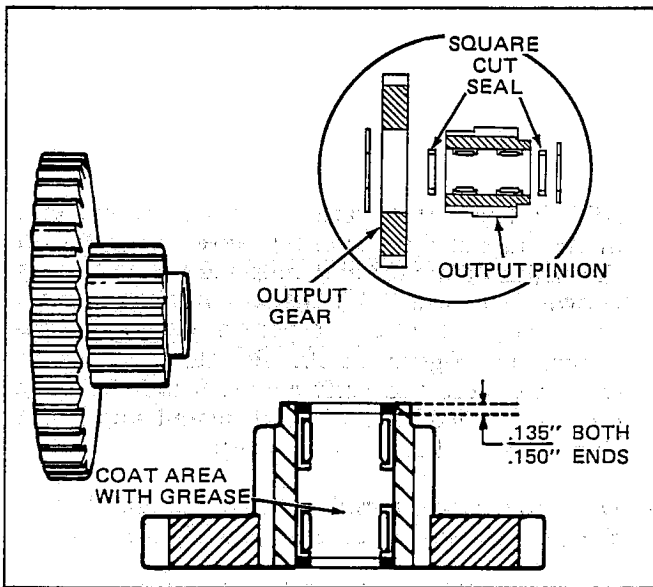


Figure 3-33

6. For correct positioning of the needle bearings use removal and installation tool Part No. 670252. Fill the area between the needle bearings with grease before installing on countershaft.

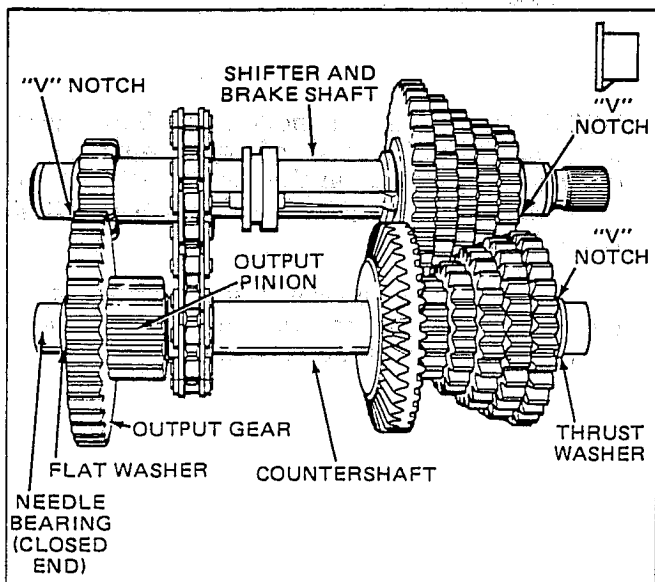


Figure 3-34

7. Install the output and pinion gears, the flat washer, square cut rings, needle bearing (closed end) and spacer on one end and thrust washer and flanged bushing on the other end. Note that the "V" notch on the bushing fits into recess "V" in case.

A square cut seal fits in each recessed end of output pinion. Also one square cut ring fits into recessed end of needle bearings. (closed end)

Install shafts with parts (Figure 3-34) into case.

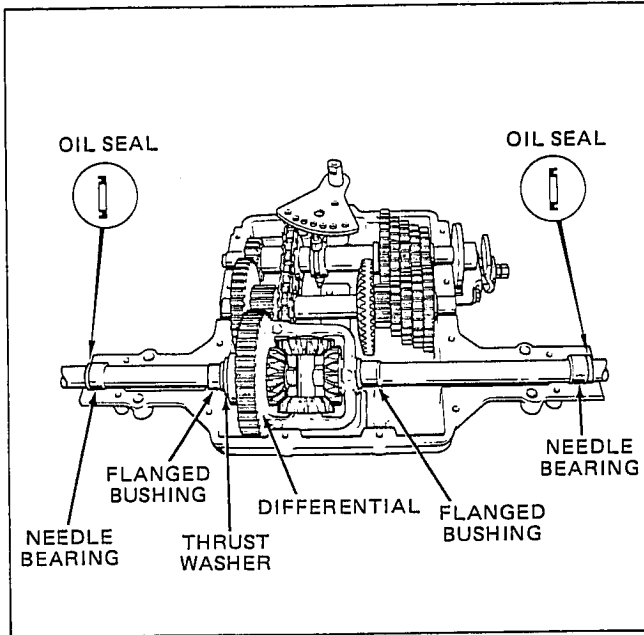


Figure 3-35

8. DIFFERENTIAL ASSEMBLY

Install the flanged bushings (2) flat washer, needle bearings (2) with oil seals (2) with seal grooves facing out. Figure 3-35.

For teardown and reassembly of the differential see pages 8-2 and 8-3.

Install differential in case. Figure 3-36.

9. Install shifter assembly, Figure 3-35, (shaft, pins and fans). Pack 24 oz. E.P. Lithium grease around bearings and gearing, and reinstall cover on case. Torque cap screws 90-100 inch pounds.

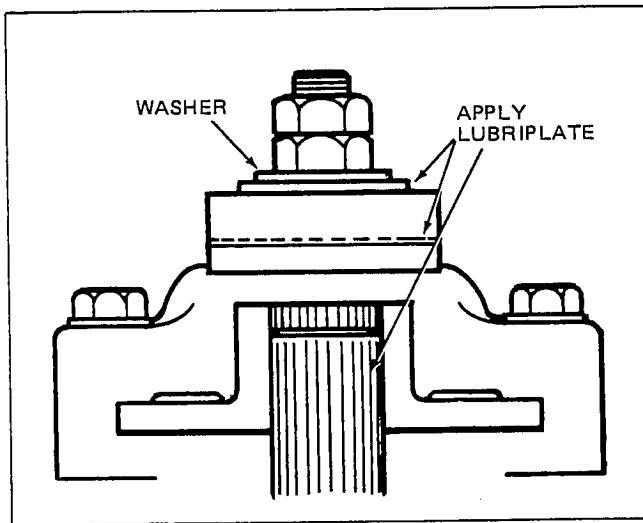


Figure 3-36

10. Install index ball, spring and setscrew in that order into cover and slowly tighten the screw 1 turn below flush.

If unit contained a neutral start switch - install.

11. Prior to installing the brake assembly apply a light film of lubriplate to the inside of lever portion which contacts pins (Figure 3-36) also to outside of lever which contacts flat washer and between shaft O.D. and bore of brake disc. Brake pads and brake disc must be free of grease and oil. Install brake and linkage and adjust to disengage when clutch is engaged. Consult equipment owner's manual.

Check for binding by turning input shaft. Install transmission on equipment.

Brake and linkages may vary.

Note: If adjusted incorrectly, the brake will do one of two things:

- a. It will not brake (stop) the vehicle when the brake is applied or
- b. If adjusted too tightly, a drag or continued braking effect will be evident until the brake wears out.

MEMORANDUM FOR THE DIRECTOR

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

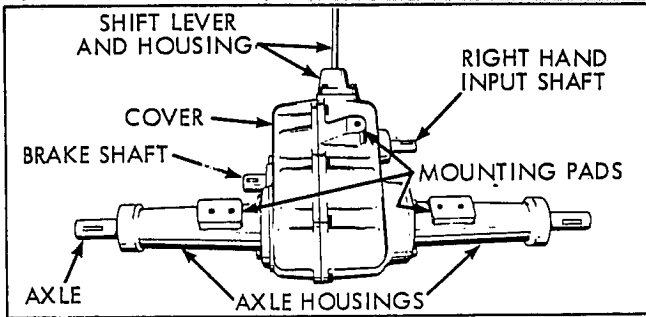


Figure 4-1 2000 Series Transaxle

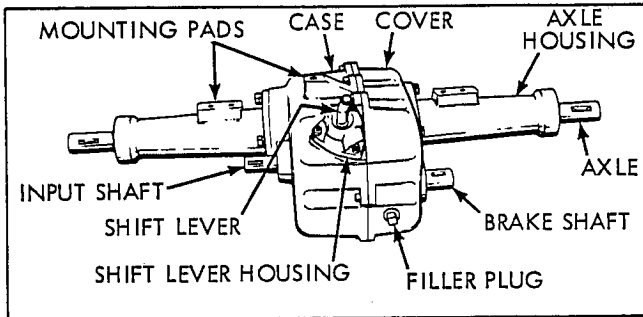


Figure 4-2 2000 Series Transaxle

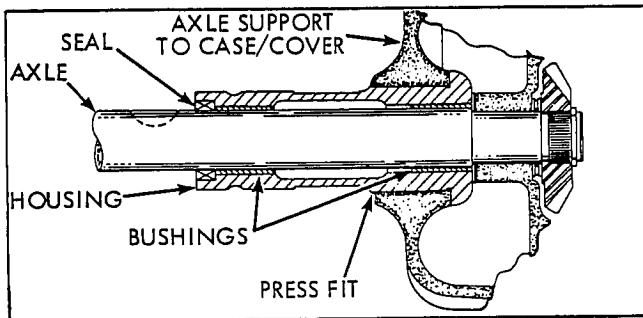


Figure 4-3 1200 and 1400 Series Axle Housing, Bushings and Seal

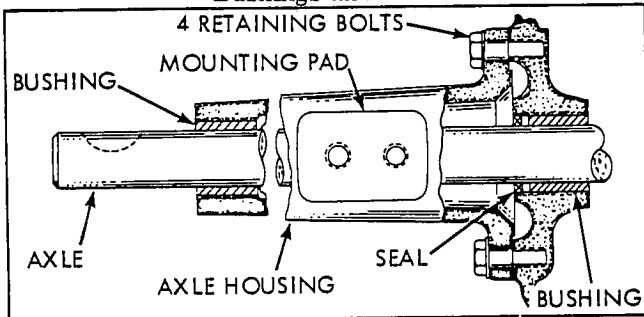


Figure 4-4 Typical 1700 Series Axle Housing, Bushings and Seal

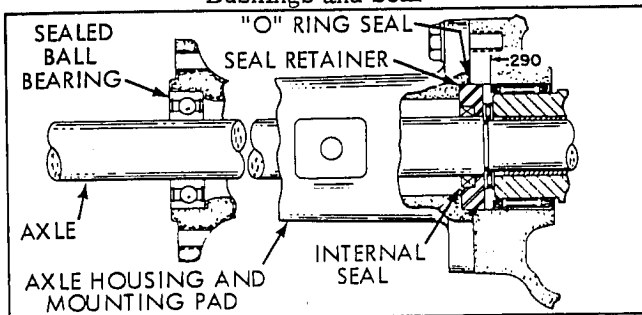


Figure 4-5 Typical 2000 Series Axle Housing, Bushing and Seal Assembly

CAUTION

DECLUTCHING IS REQUIRED WHEN SHIFTING TO AVOID GEAR CLASHING AND DAMAGE.

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.



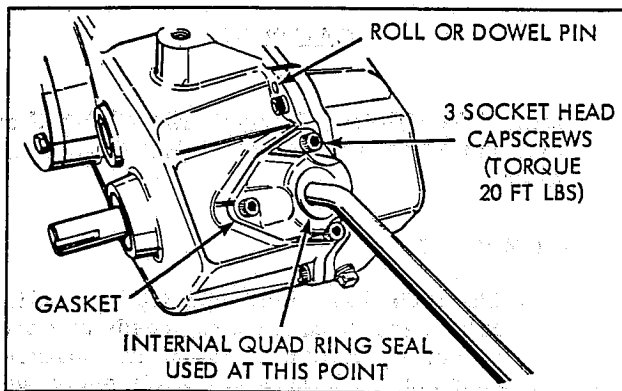


Figure 4-6 Shift Lever Housing

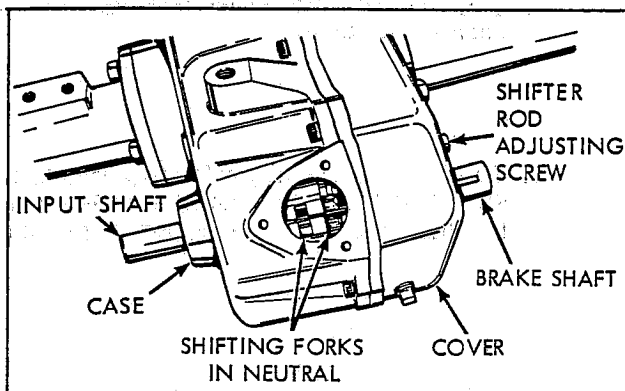


Figure 4-7 Transaxle Case

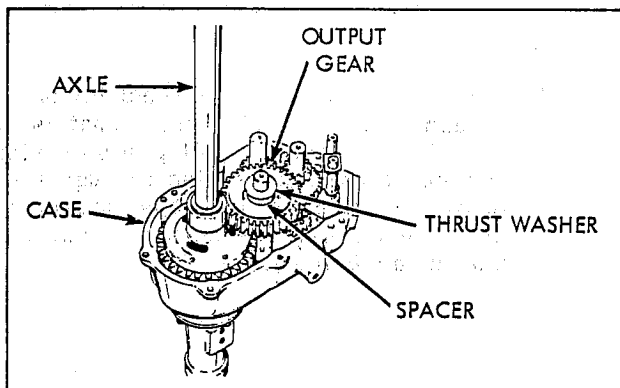


Figure 4-8 Output Gear and Shaft

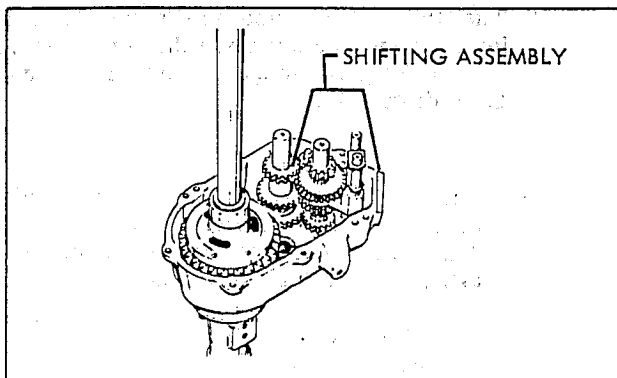


Figure 4-9 Shifter Assembly

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 capscrews.

7. NOTE: Some units have a threaded cover, so capscrew 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.

4

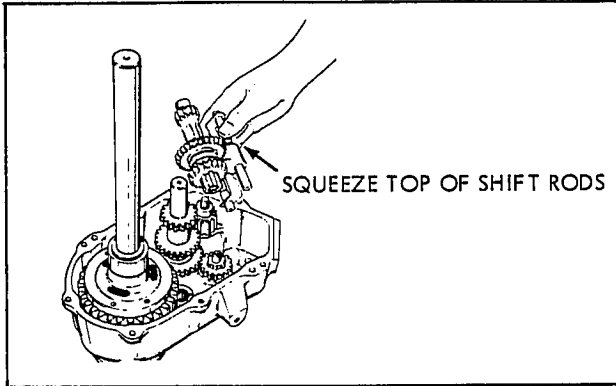


Figure 4-10 Removing Shifting Assembly

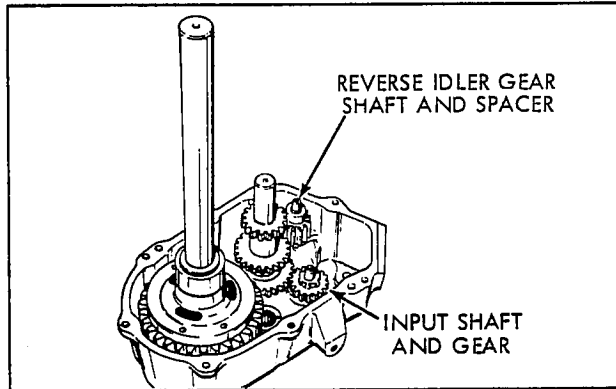


Figure 4-11 Reverse Idler Gear and Shaft

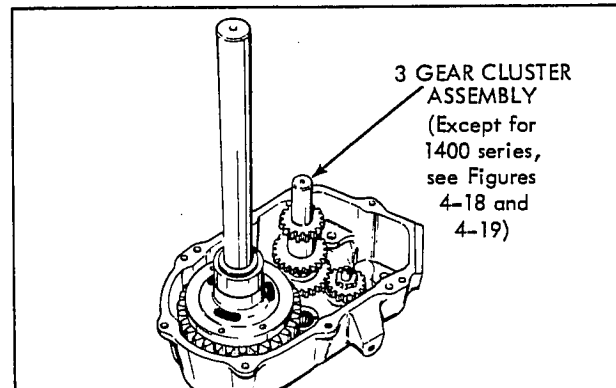


Figure 4-12 Three Gear Cluster

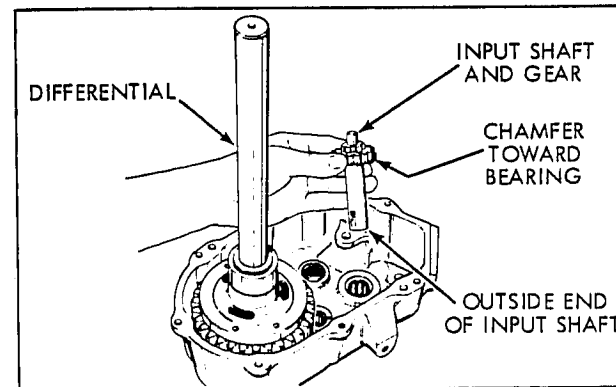


Figure 4-13 Input Shaft and Gear

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.

4

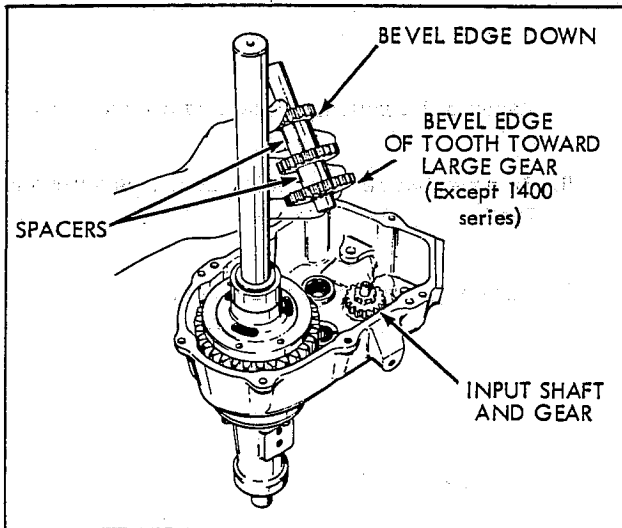


Figure 4-14 Install Three Gear Cluster

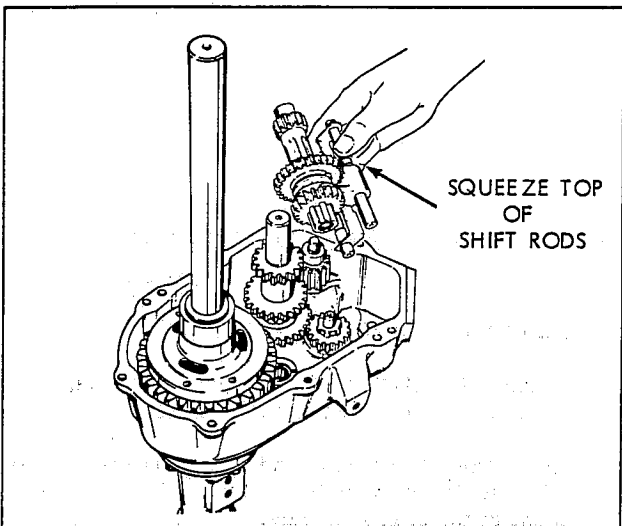


Figure 4-15 Install Shifter Assembly

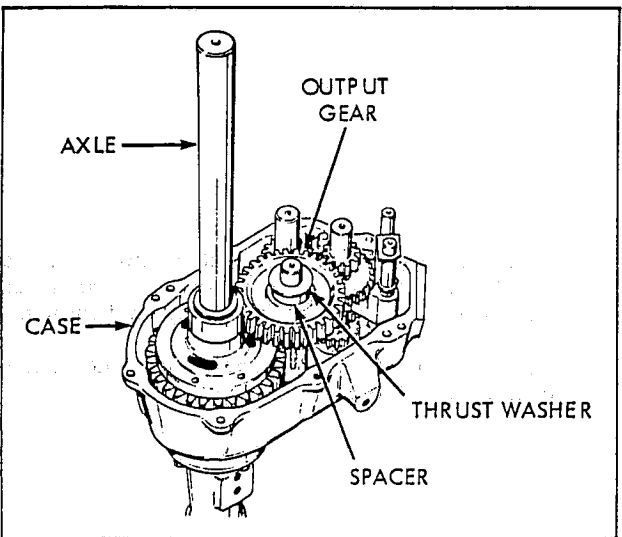


Figure 4-16 Output Gear and Shaft

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.

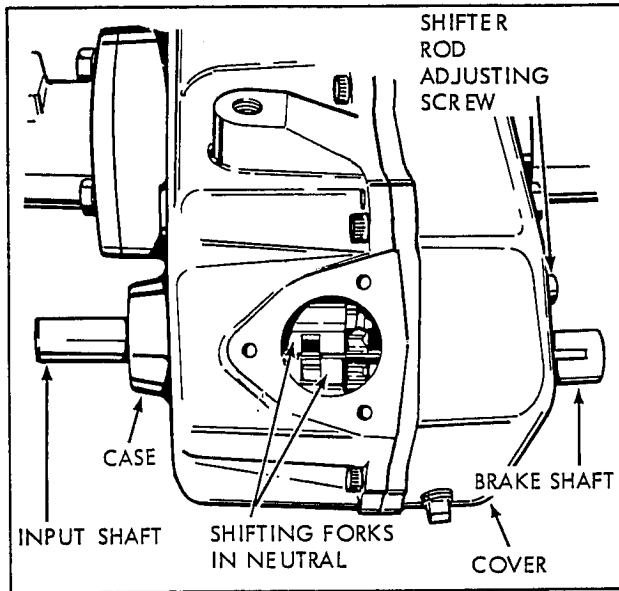


Figure 4-17 Transaxle Case

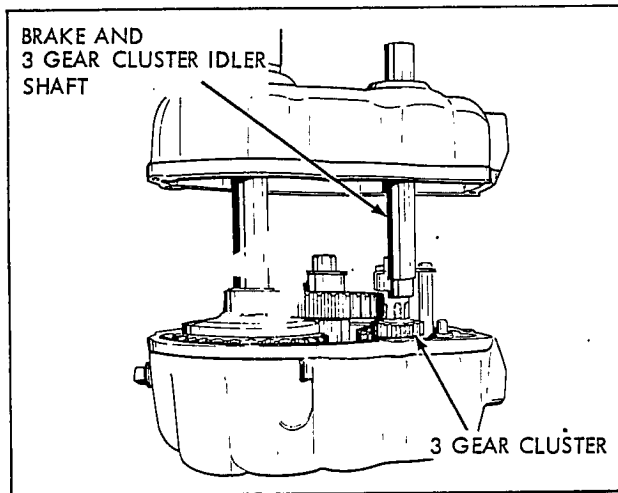


Figure 4-18 Removal 1400 Transmission

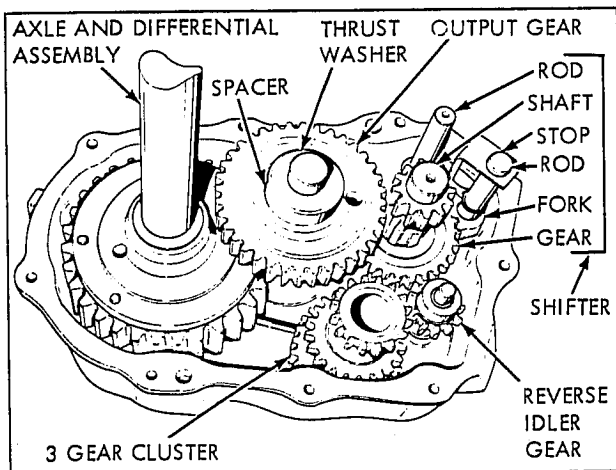


Figure 4-19 1400 3 Gear Cluster

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.

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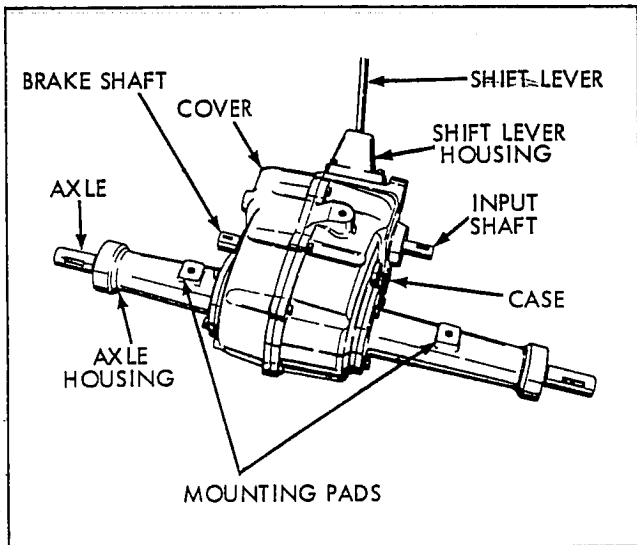


Figure 5-1 2300 Series Transaxle

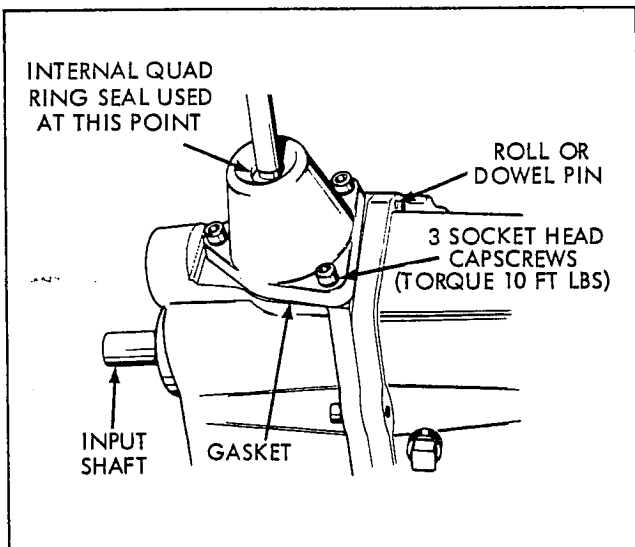


Figure 5-2 Shift Lever Housing

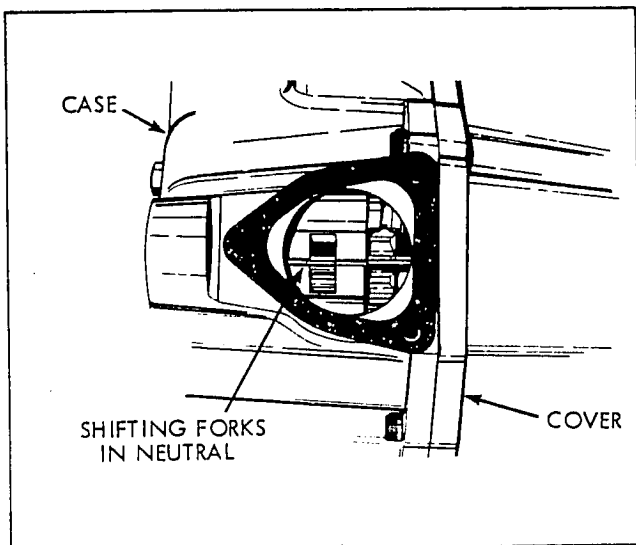


Figure 5-3 Position of Shifter Forks Prior to Disassembly

CAUTION

DECLUTCHING IS REQUIRED WHEN SHIFTING TO AVOID GEAR CLASHING AND DAMAGE.

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.

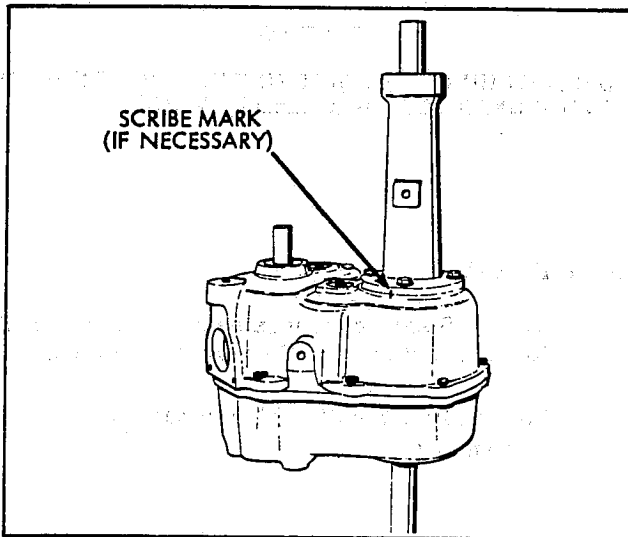


Figure 5-4 Remove Axle Housings

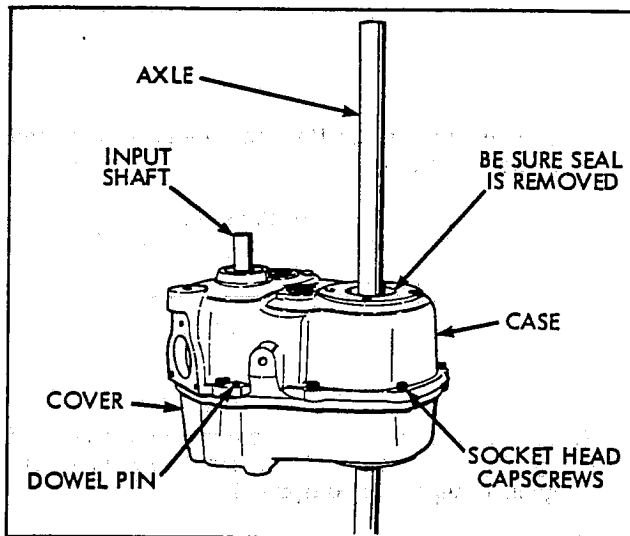


Figure 5-5

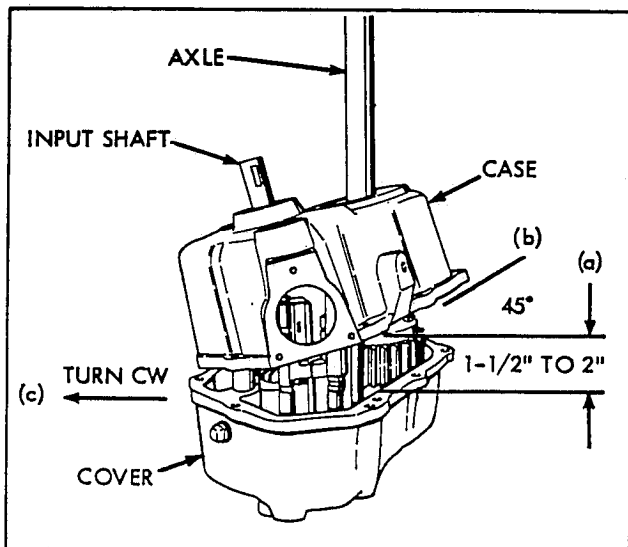


Figure 5-6

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.

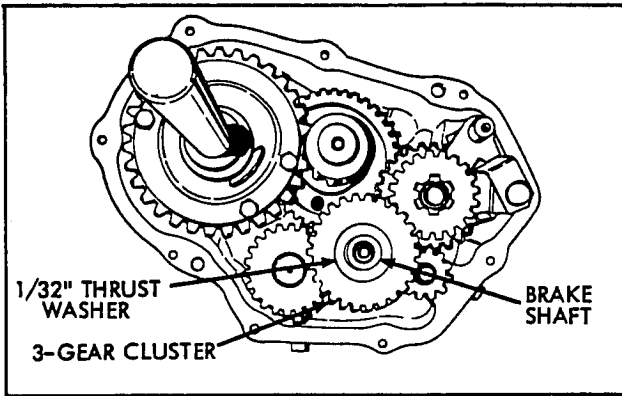


Figure 5-7 Remove Three Gear Cluster

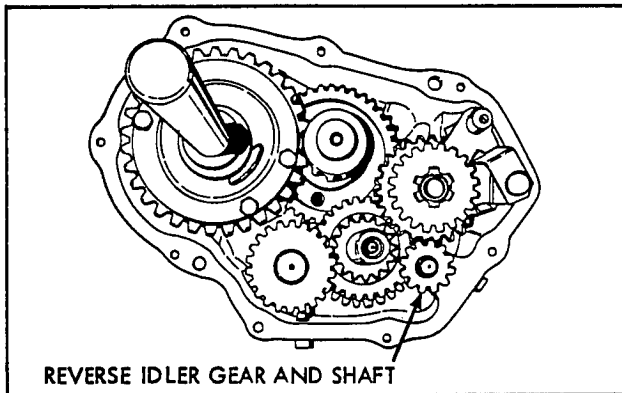


Figure 5-8 Reverse Idler Gear, Shaft and Spacer

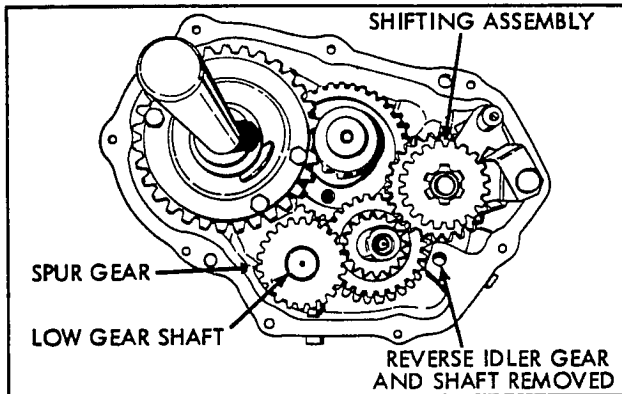


Figure 5-9 Remove Shifting Assembly

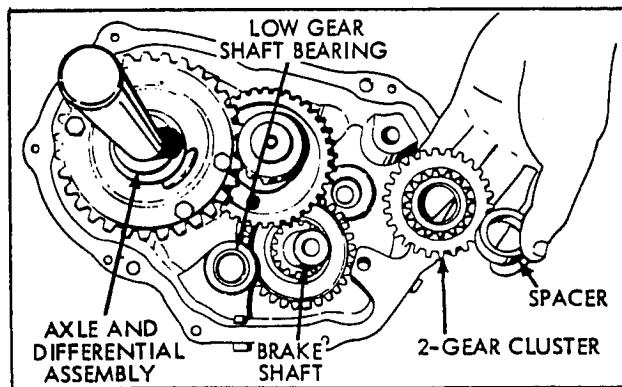


Figure 5-10 Brake Shaft

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.



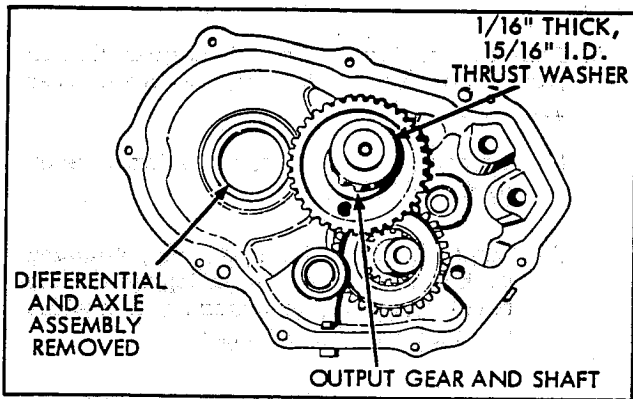


Figure 5-11 Output Gear and Shaft

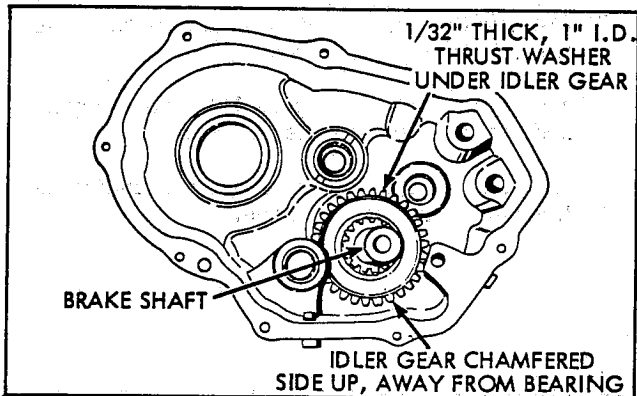


Figure 5-12 Idler Gear and Brake Shaft

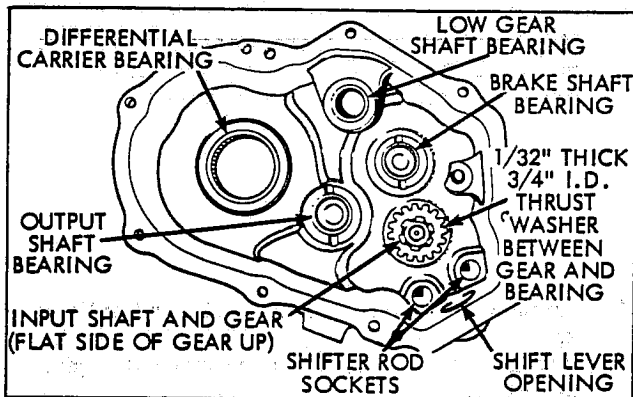


Figure 5-13 Case Assembly

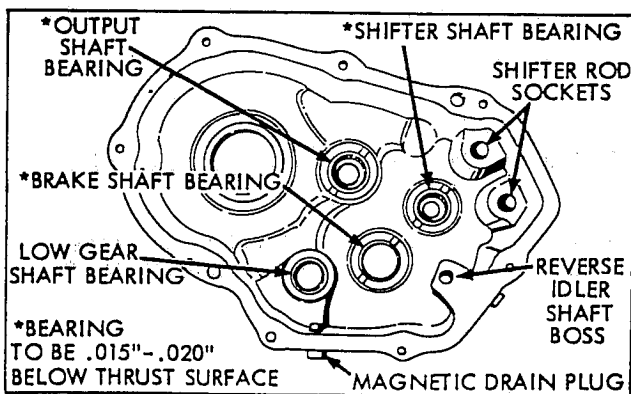


Figure 5-14 Cover Assembly

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.

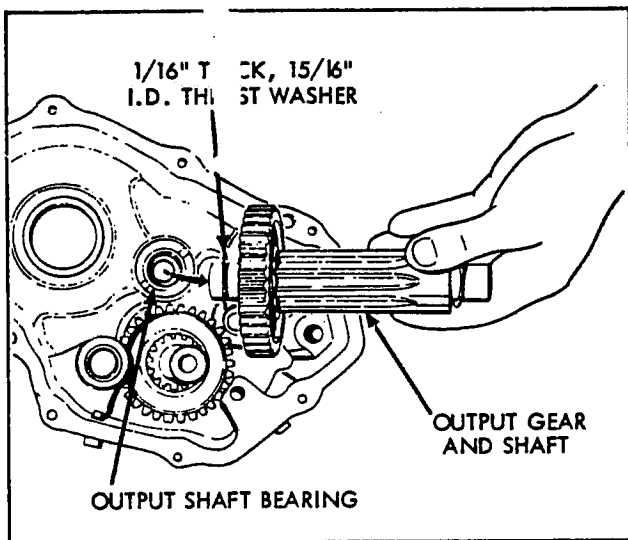


Figure 5-15 Output Shaft Bearing

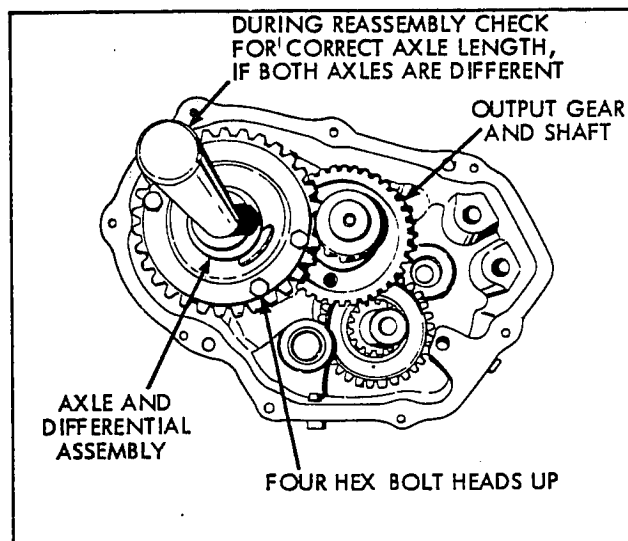


Figure 5-16 Install Differential

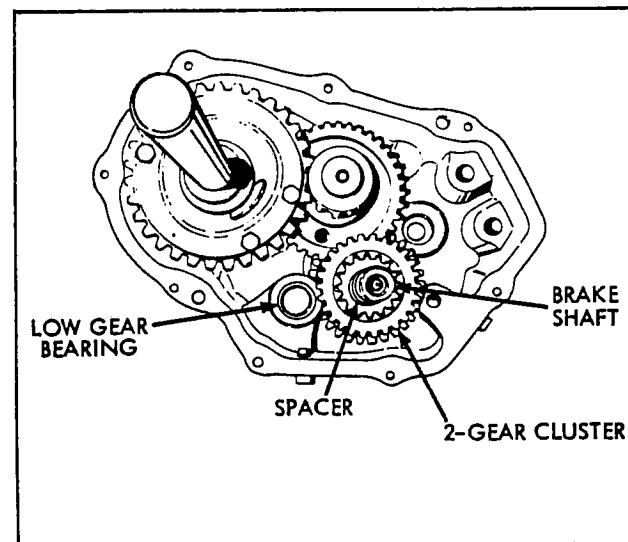


Figure 5-17 Two Gear Cluster

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.



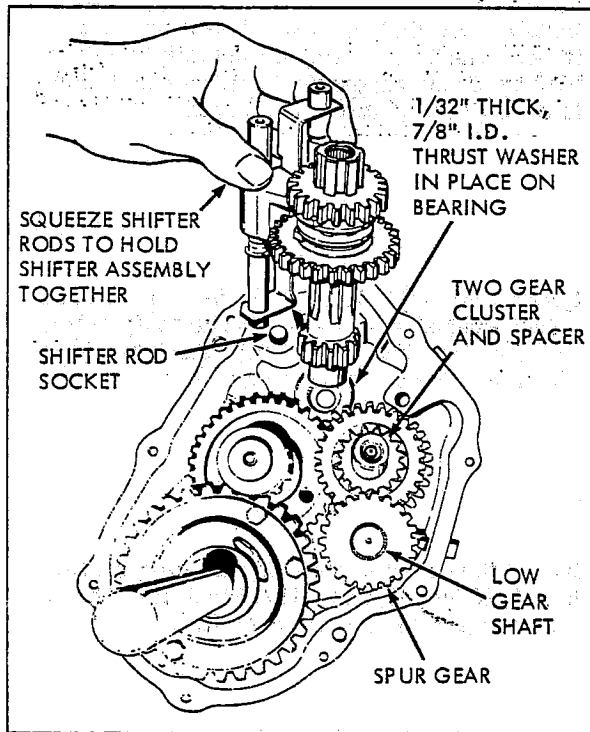


Figure 5-18 Spur Gear and Low Speed Shaft

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.

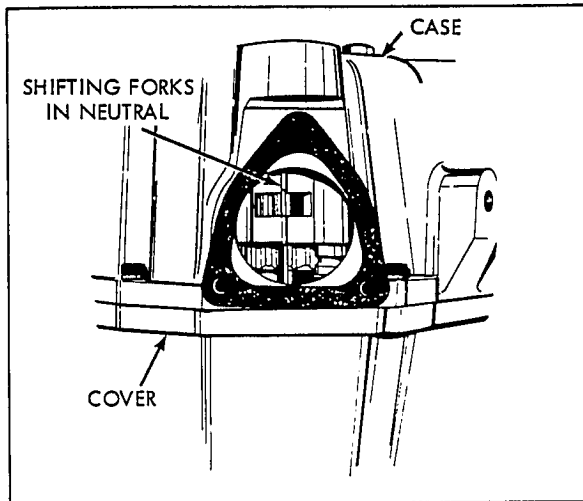


Figure 5-19 Install Case

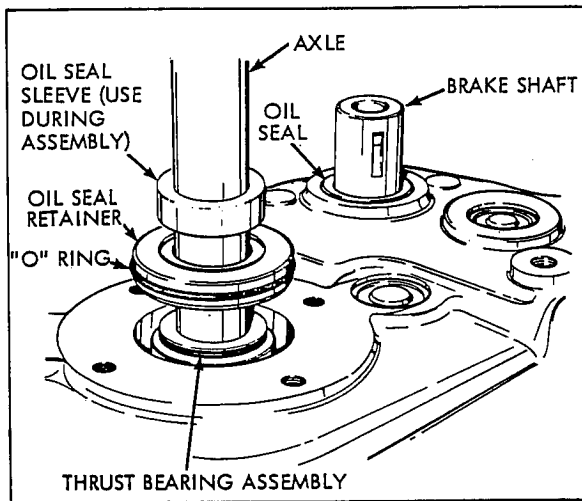


Figure 5-20 Install Seal Retainers

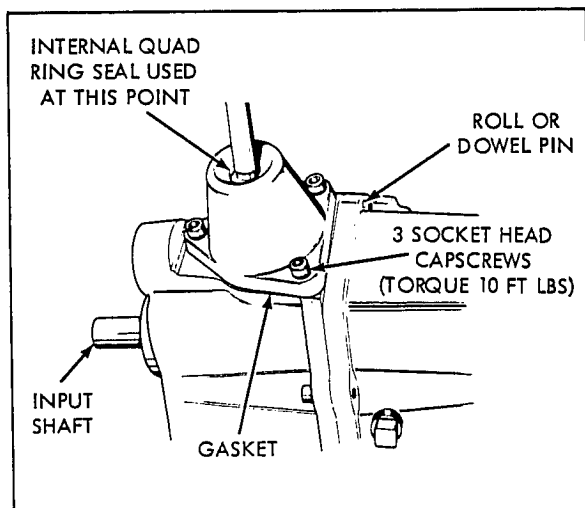


Figure 5-21 Shift Lever Housing Installed

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 capscrews. 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 capscrews 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.

1. The first part of the document discusses the general situation of the country and the role of the government.

2. The second part of the document discusses the economic situation and the measures taken to improve it.

3. The third part of the document discusses the social situation and the measures taken to improve it.

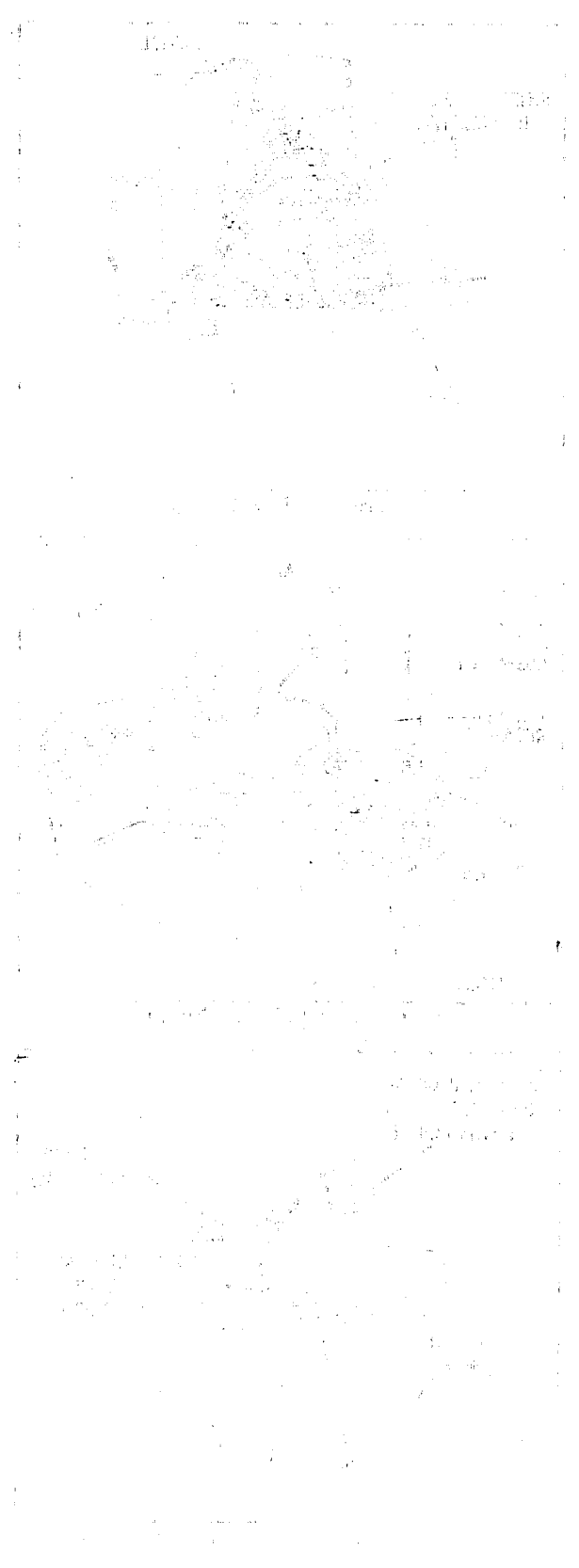
4. The fourth part of the document discusses the political situation and the measures taken to improve it.

5. The fifth part of the document discusses the international situation and the measures taken to improve it.

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7. The seventh part of the document discusses the cultural situation and the measures taken to improve it.

8. The eighth part of the document discusses the environmental situation and the measures taken to improve it.



SECTION 6 1300 SERIES REDUCTION GEAR AND DIFFERENTIAL UNIT

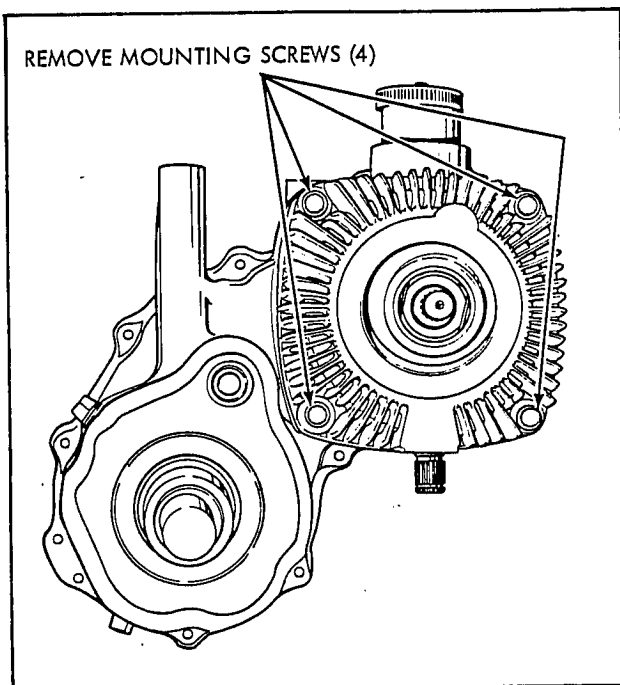


Figure 6-1 1300 Series Unit with Hydrostatic Unit Attached

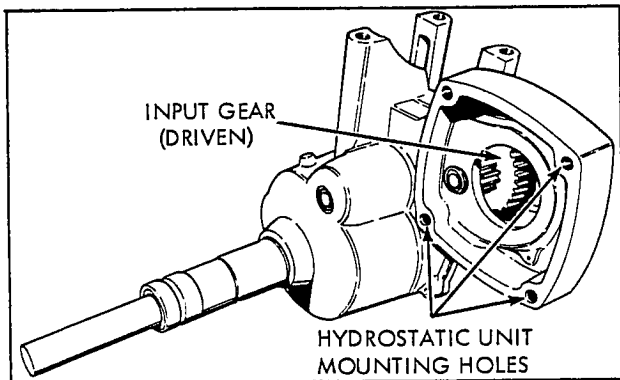


Figure 6-2 1300 Series Transaxle Right Front View

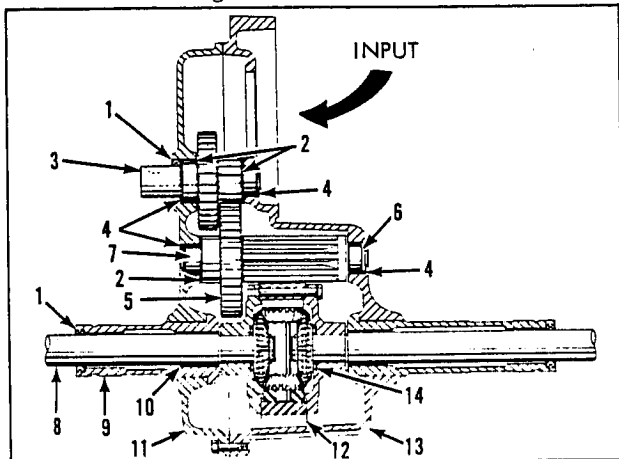


Figure 6-3 Transaxle - Sectional View

A. GENERAL

1. The 1300 series unit is driven by a hydrostatic motor connected to the unit case. The transmission function is accomplished by the hydrostatic controls. The Peerless unit, therefore, only reduces input shaft speed to the differential and axle assembly.
2. To separate the hydrostatic unit from the 1300, support both parts, then remove the four mounting screws, and separate parts. Drain oil from the 1300 unit. Any hydrostatic repair must be done through the equipment brand dealer.
3. Axle supports, pressed from the inside out, must be removed with the case and cover, similar to the method used in the 1200 series transaxle.

4. Legend for Figure 6-3

- | | |
|--------------------|------------------------|
| 1 - Oil Seal | 8 - Axle |
| 2 - Thrust Washer | 9 - Axle Support |
| 3 - Brakeshaft | 10 - Bushing |
| 4 - Needle Bearing | 11 - Cover |
| 5 - Output Gear | 12 - Differential Gear |
| 6 - Output Shaft | 13 - Case |
| 7 - Spacer | 14 - Thrust Bearing |

B. PRE-DISASSEMBLY

Clean the reduction unit exterior surfaces. Drain lubricant, then separate the reduction and hydrostatic units. Check axle shafts for cutting edges and high spots. Due to the hardness of the shafts, a stone may be necessary to take off metal. Check for any evidence of oil leakage at gasket or bearing surfaces.

C. DISASSEMBLY

1. Remove lockscrews and tap dowel pins out of cover. Lift off cover and discard gasket.
2. Lift out brake shaft, gear, and thrust washers on each side of gears.
3. Lift output shaft, gear, spacer, and thrust washer from case. At the same time, lift out the differential assembly.

NOTE: No thrust washer is located between the output shaft and case.

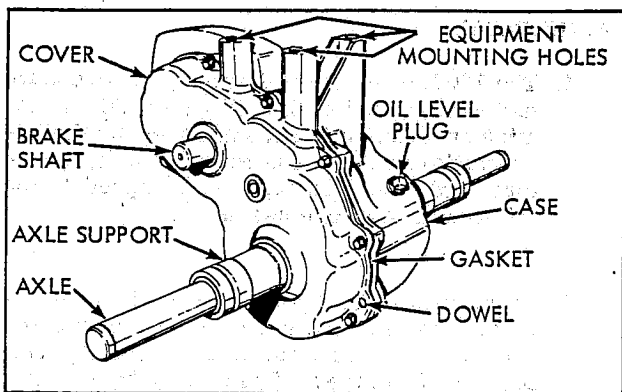


Figure 6-4 1300 Series Transaxle - Left Rear View

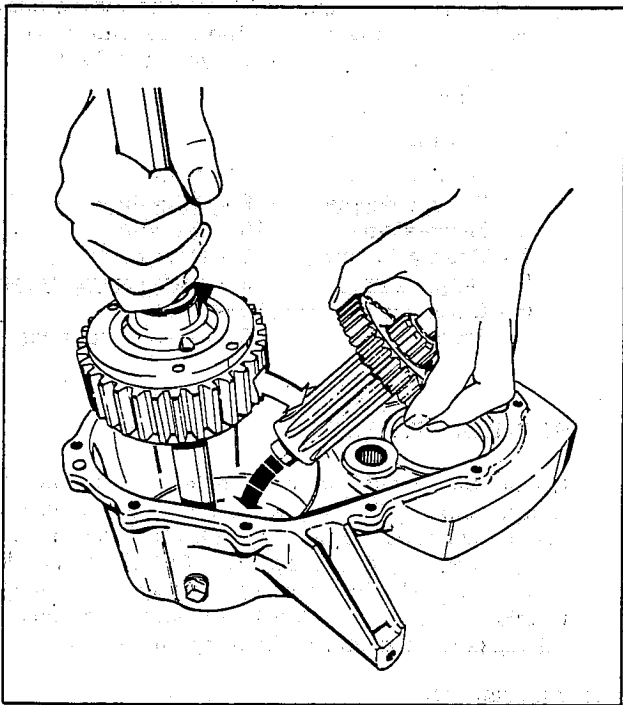


Figure 6-5 Installing Differential and Drive Pinion

4. To service differential, refer to SECTION 8.
5. To service bearings, refer to SECTION 11.
6. To separate axle supports from the case and cover, use an arbor or hydraulic press. A piece of bar stock should be used to protect the support from the press ram.

D. INSPECTION AND REPAIR

1. Inspect case and cover for cracks, stripped threads, marred sealing surfaces, and bearing condition. Cause of any oil leakage should be corrected. If parts can't be repaired, replace them.
2. Check shafts and gears for worn or chipped teeth. Check bearing surfaces for scratches which might affect oil seal performance. Check for wear.
3. Check needle bearing for presence, seal, and smoothness. Also, be sure bearings are not corroded or rusty. Replace bearings of doubtful condition.
4. Check differential for rigidity. Wobble indicates wear. Refer to SECTION 8 for service.

E. REASSEMBLY

1. When installing axle support, be sure case and cover alignment is true with the press. Press supports in until flanged surfaces contact case and cover.
2. Install differential and output shaft simultaneously. Position gear 3/4" I.D. spacer, and thrust washer on shaft.
3. Center one 3/4" I.D. thrust washer over case needle bearing then install brakeshaft gear, and other 1-1/8" I.D. thrust washer.
4. Position a new gasket on the mounting surface of the case, then install cover. Align cover and case by tapping dowel pins into cover and secure with lockscrews torqued to 10 lbs. ft.
5. Install new brakeshaft oil seal using sleeve number 670179 and driver number 670180.
6. Install new axle support oil seals using sleeve number 670179 and driver number 670180.
7. Add 2-3/4 (44 oz.) pts. oil (S.A.E. EP 90) before securing hydrostatic drive to the 1300 series unit. Clean mounting surfaces and use a new gasket between the units. Torque 4 mounting bolts to standard torque for bolt used.

SECTION 7 REDUCTION GEAR AND DIFFERENTIAL UNIT

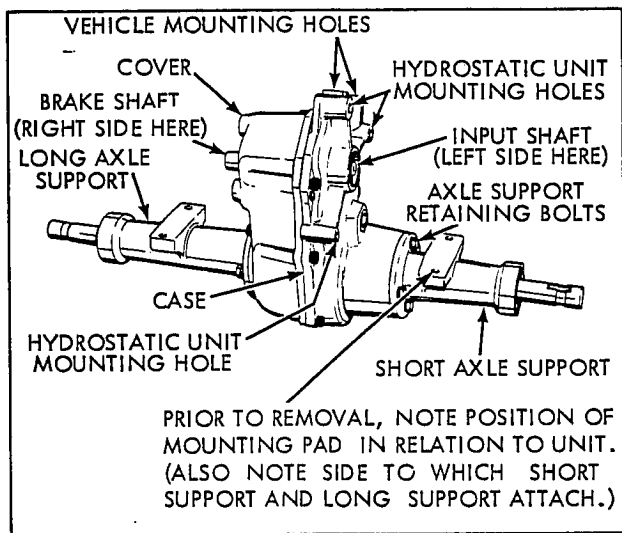


Figure 7-1 2400 Series Reduction Unit

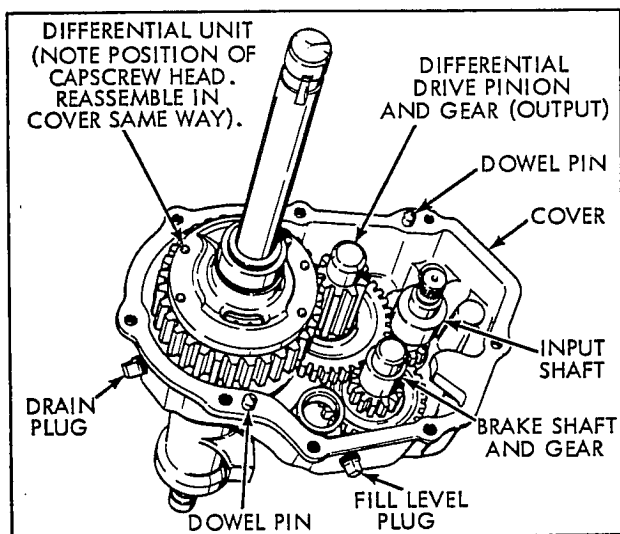


Figure 7-2 Unit Case Removed from Cover

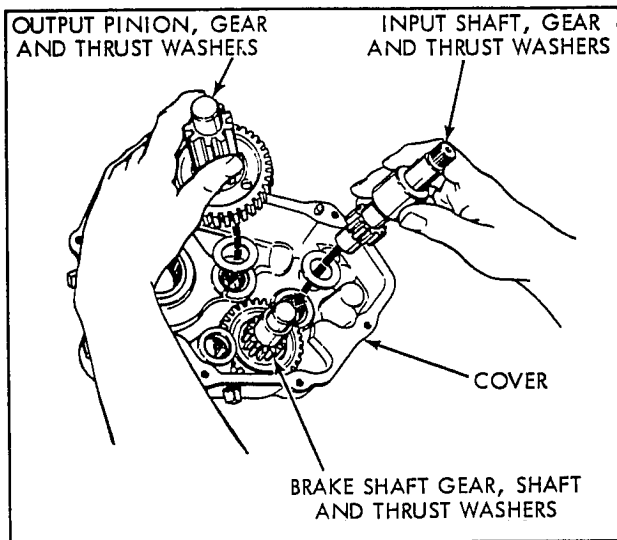


Figure 7-3 Removing Input and Output Gear, Shafts, and Parts

A. 2400 SERIES

Refer to SECTION 1 for service prior to removing the unit from a vehicle.

Refer to 4. below for hydrostatic removal.

1. DISASSEMBLY

- (a) Clean axles of burrs, rust and sharp edges.
- (b) Remove axle supports. Be sure to note in which position and to which side they attach.
- (c) Drain oil from unit.
- (d) Remove seal retainers and "O" rings.
- (e) Remove eight socket head cap screws securing case to cover. Drive dowel pins out of case into cover, then lift case off of the cover.
- (f) Before removing differential unit, note the position of the cap screwheads. Replace the unit in the same way to insure that axle lengths will be correct when installing axle supports.
- (g) Remove the input shaft and gear assembly. Note that thrust washers are on both ends of shaft.
- (h) Remove output pinion and gear splined to it. Note position of thrust washers on each end of pinion.
- (i) To remove the brake shaft, the shaft must be tapped from the gear splined to it. Use a soft hammer. Note that both ends of the shaft have thrust washers.

2. INSPECTION AND REPAIR

- (a) Clean all parts and examine for wear or damage.
- (b) Refer to SECTION 8 for differential service. Refer to SECTION 11 for bushing and bearing service. Replace any loose or worn bearings.
- (c) Remove and discard oil seals from input and brake shafts. Check axle seals and replace if any evidence of leaking exists. If protective seal sleeves were not used when removing seals and retainer assemblies, replace seals.

Replace seals after assembly. Use seal sleeves and correct drivers. See SECTION 1, Paragraph G for service.



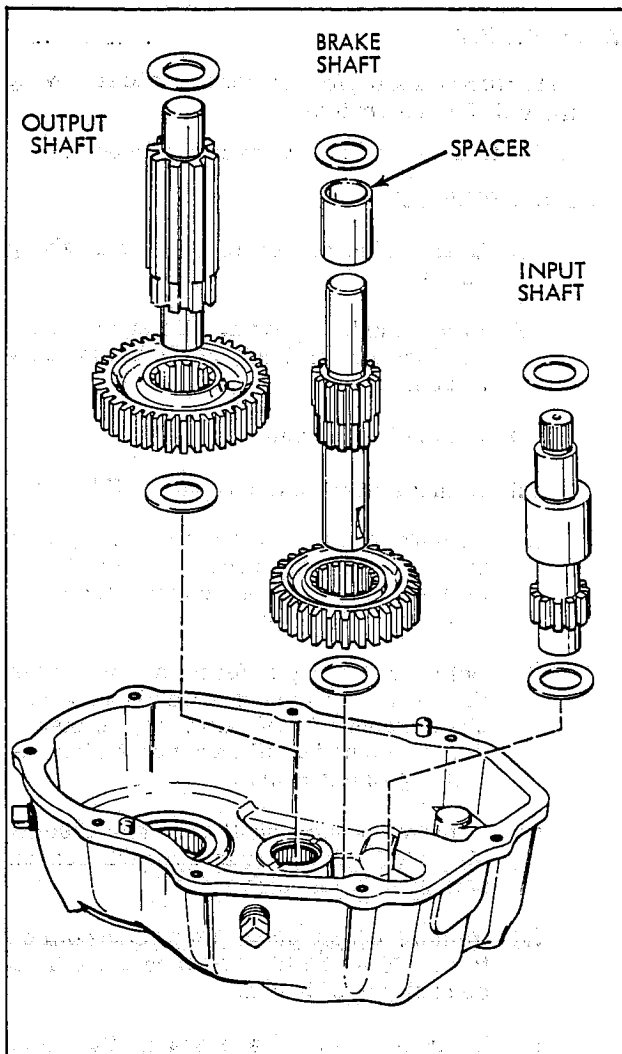


FIGURE 7-4 2400 SERIES EXPLODED VIEW

- (d) Clean the case and cover. Protect bearings from dirt. Lubricate bearings to prevent rusting.

3. ASSEMBLY

- (a) Install thrust washer in cover for input, output and brake shafts.
- (b) Install brake shaft into gear in cover.
- (c) Install input and output shaft (with gear) and position spacers on brake shaft. Install thrust washers on all shafts.
- (d) Install differential unit with cap screw, facing up.
- (e) Position new gasket on slightly raised dowels and install case. Turn down eight socket head cap screws lightly. Tap dowel pins in and tighten cap screws to 10 lb. ft.
- (f) Use seal sleeve and install seal and retainer assemblies. Position new "O" ring on seal retainer. Be sure the mounting pad is in correct position. Install each axle support and bolt down. Torque the cap screws to 13 lb. ft.
- (g) Using proper seal sleeve and driver, replace input and brake shaft seals. See SECTION 1, Paragraph G, for service.
- (h) Rotate shafts to check for binding or noise.
- (i) Add lubricant (2 pints S.A.E. EP90 oil) to level of fill plug with unit in normal mounted position.

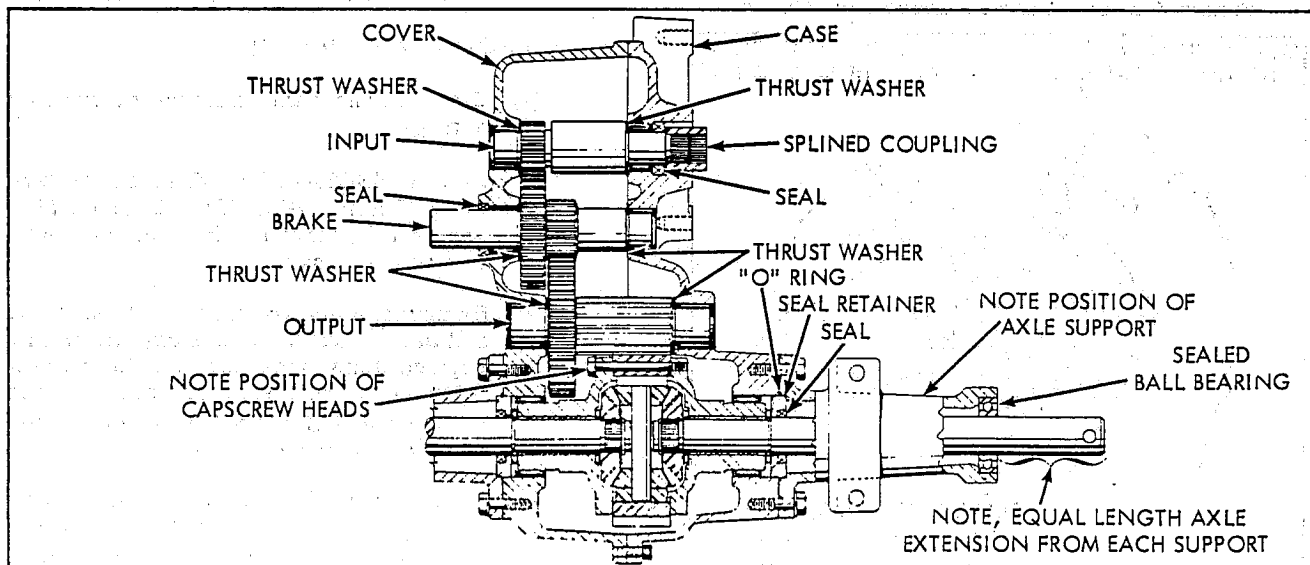


FIGURE 7-5 2400 SERIES CROSS SECTIONAL VIEW

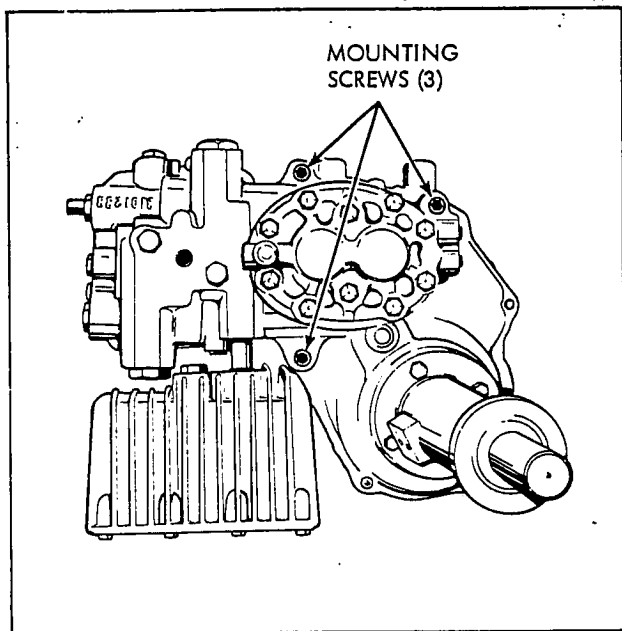


FIGURE 7-6

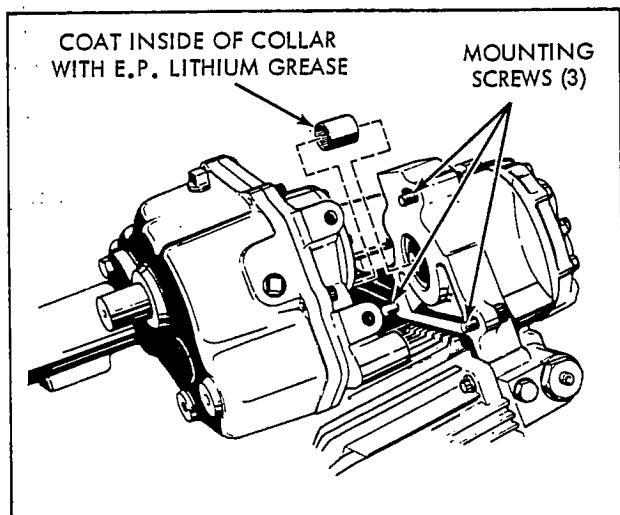


FIGURE 7-7

4. Separating and Combining Hydrostatic Unit and 2400.

The two parts should be removed from the vehicle together.

- (a) To separate the units, block the assembly to prevent falling, then remove the three hydrostatic mounting screws. Lift either unit from the other. If any binding occurs, remember that the drive shafts are held in common rotation by a splined coupling and the coupling may have a slight bind on the driveshafts.
- (b) Once separated, to make any further repair to the hydrostatic unit, it must be returned to the brand unit dealer who sold the vehicle for his service arrangement.
- (c) To combine the hydrostatic drive and the 2400 unit, coat the splined coupling with E.P. Lithium grease or install it on the 2400 input driveshaft.
- (d) Align the driveshaft of the hydrostatic unit to the coupling and press the units together. Secure the units in assembly with three socket head capscrews torqued to the standard for the bolt being used.

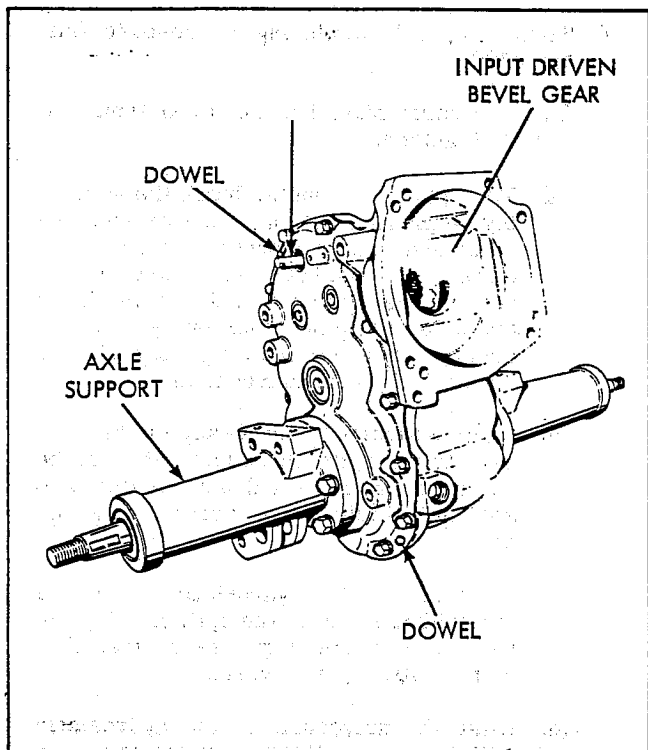


Figure 7-8 2500 Series Front View

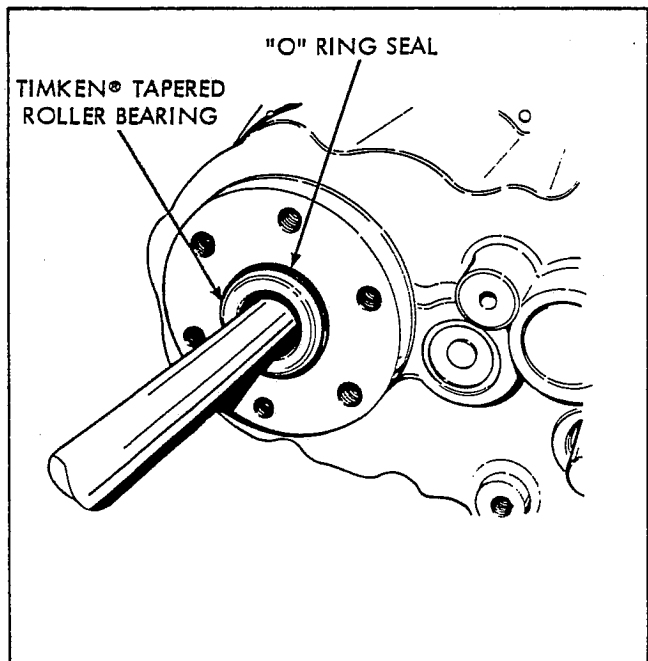


Figure 7-9

B. 2500 SERIES REDUCTION GEAR AND DIFFERENTIAL UNIT

1. GENERAL

Most 2500 series two speed gear boxes are run by an Eaton Model 10 hydrostatic unit. Power for the hydrostat is supplied by (as presently approved) an engine up to an 18 H.P. rating. The unit has infinite forward and reverse speeds in both a high and a low range.

The 2500 series are shipped without lubrication from Peerless. Original equipment manufacturers fill each gear case with lubrication when installing the 2500 in the equipment. Filling, checking and the quantity and type of lubrication is discussed in paragraph 6.

2. PREPARATION FOR DISASSEMBLY

- (a) Perform the applicable services outlined in Section 1.
- (b) Although the unit should have been drained of lubrication, be aware that axle support removal will allow trapped oil to spill.
- (c) Loosen the axle supports and allow fluid to drain from that area.
- (d) Remove piping and hydrostatic unit as necessary to allow repair.

NOTE: An oil supply is blocked in the hydrostatic unit when not running - so upon reassembly, hydrostatic charging is not necessary.

- (e) Any attempt to tamper with the hydrostatic unit will be done so only upon the authorization of Eaton or the equipment manufacturer. Tecumseh does not authorize repair or adjustment of the unit.
- (f) Clean all exterior surfaces in preparation for disassembly.

3. DISASSEMBLY

- (a) Remove the axle supports. If supports are different or if there is a chance for confused reassembly, scribe alignment marks.
- (b) Remove and discard square "O" ring seal.
- (c) If the tapered roller bearings are loose, remove them.

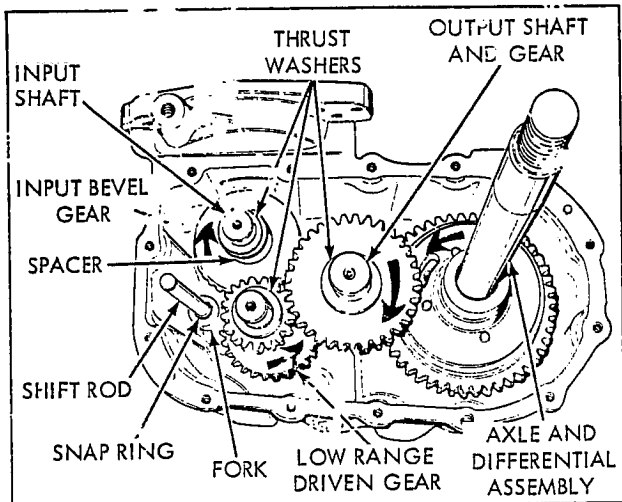


Figure 7-10 Counterclockwise Input Assembly

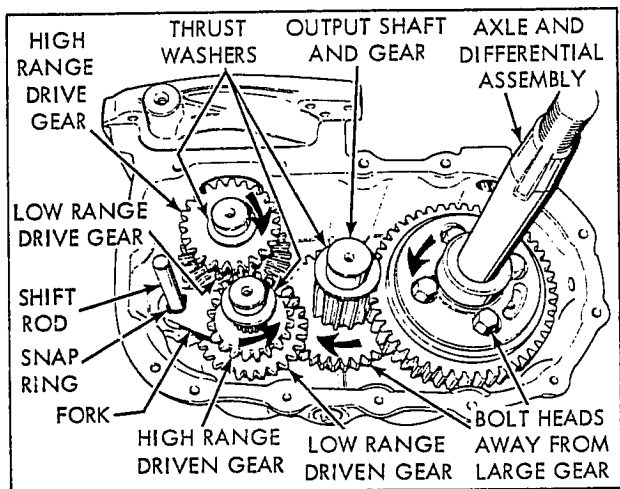


Figure 7-11 Clockwise Input Assembly

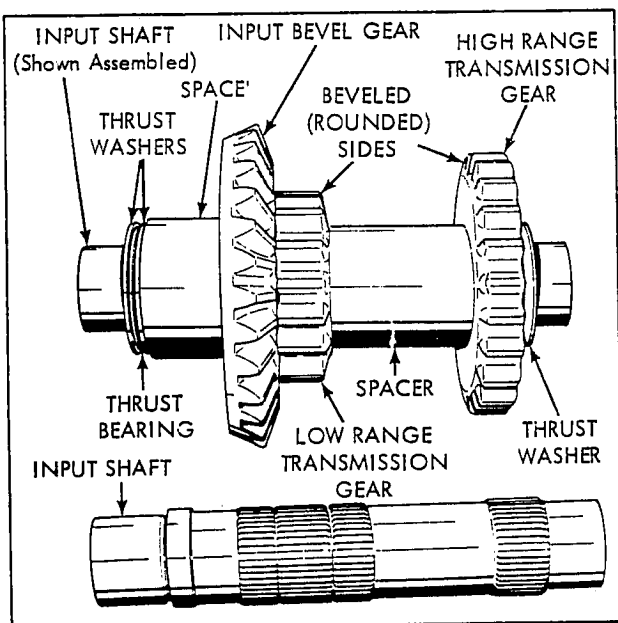


Figure 7-12 Input Shaft and Gear Assembly

(d) Position the unit on the 'cover up' side, then remove the dowels and screws. Lift off the cover and discard the gasket.

(e) Note whether the unit is as shown in Fig. 7-10 or Fig. 7-11. Disassembly and reassembly will have to follow one view or the other.

Because the hydrostatic can be driven either way and input rotation direction is a matter of application, the driven bevel gear must be changeable to accept either rotation. The gears and shafts also are "flopped" depending upon input rotation direction.

Disassemble as called out in Step (f) or (g) below.

(f) (Counterclockwise input for forward)

- (1) Remove the output shaft, thrust washer and gears.
- (2) Lift out the differential assembly.
- (3) Lift out the input bevel, gear and shaft as an assembly.
- (4) Work the shifter shaft and gears out of mesh with the shifter fork and rod and remove.
- (5) To remove the shifter rod and fork, the set screw, spring and ball (Fig. 7-18) should be removed at the outside of the case.

(g) (Clockwise input for forward)

- (1) Lift out the differential assembly.
- (2) Remove the output gear and shaft.
- (3) On the outside of the case (Fig. 7-18), remove the set screw, spring and ball.
- (4) Remove both the input and shifter gear and shaft assemblies, along with the shifter rod and fork.
- (5) Further disassembly of the components will be handled in Paragraph 4, Inspection and Repair.



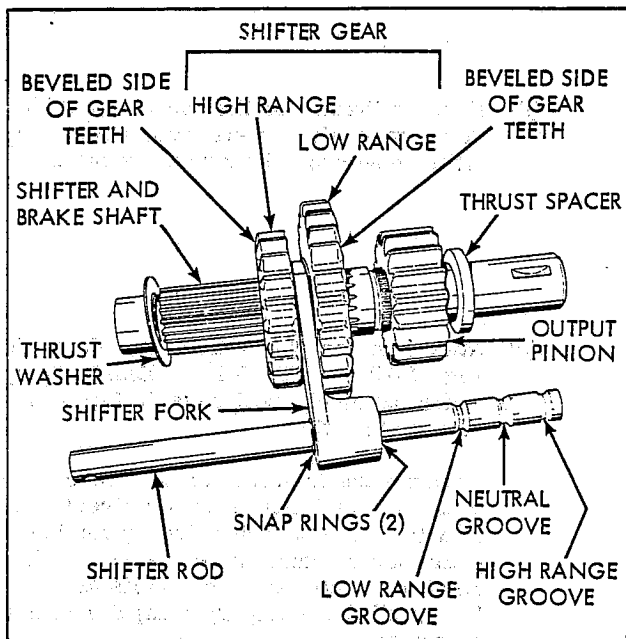


Figure 7-13 Shifter Assembly

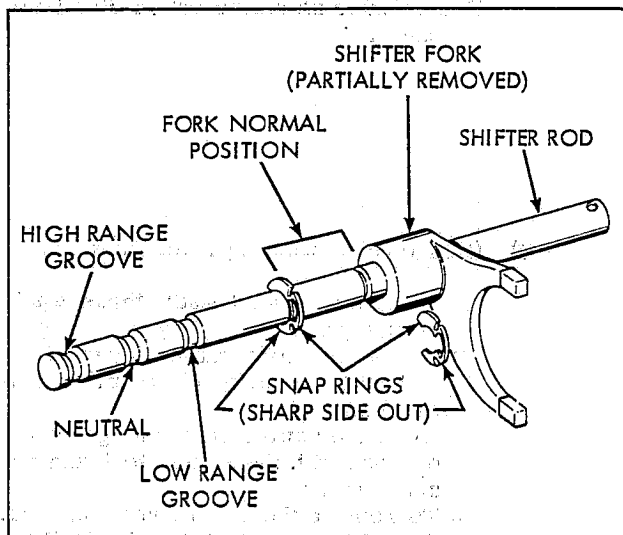


Figure 7-14 Shifter Rod and Fork

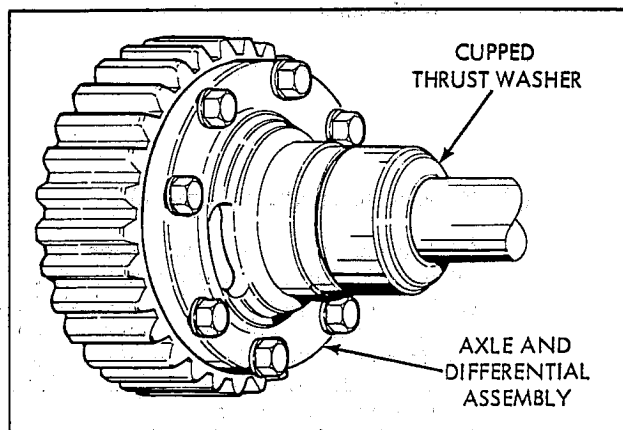


Figure 7-15 Differential Gear

4. INSPECTION AND REPAIR

(a) Axle Supports

- (1) Check ball bearings and bearing races for wear, rust and ease of rotation. Clean interior of the support if necessary.
- (2) Replace oil seals in axle supports.
- (3) Check for cracks.

(b) Case and Cover

- (1) Check for leaks or cracks.
- (2) As necessary, replace needle bearings as described in Section 11.
- (3) Do not replace brake shaft seal until the unit is reassembled.

(c) Shafts and Gears

- (1) Check teeth for wear, pitting, or breakage.
- (2) Inspect bearing surfaces for smoothness.
- (3) Inspect gears for concentricity and out of round.
- (4) Splines should allow a smooth fit. Rotate meshing parts for a better fit if binding seems excessive.

(d) Shifter Mechanism

- (1) Check spring for tension and ball for wear.
- (2) Check shifter rod grooves for wear. Be sure snap ring sharp edge goes away from shifter fork.
- (3) Inspect shifter fork for straightness and wear.

(e) Differential

- (1) Check and smoothen axle hub ends.
- (2) Check security of parts.
- (3) Check snap rings for condition and presence.

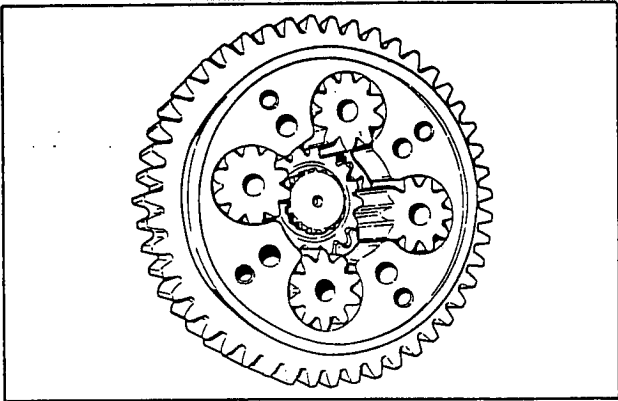


Figure 7-16 Differential Pinion Gears

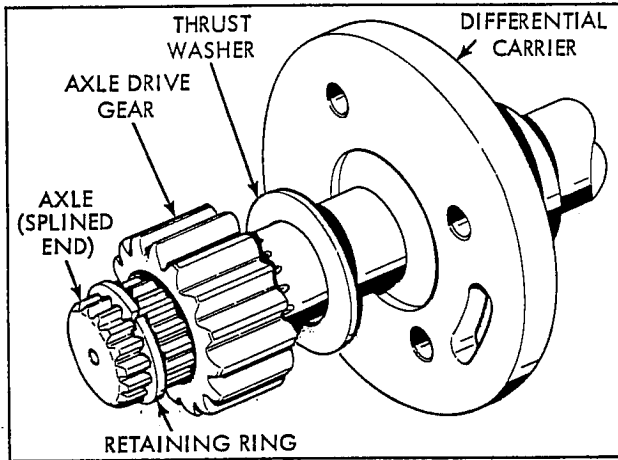


Figure 7-17 Axle and Drive Gear

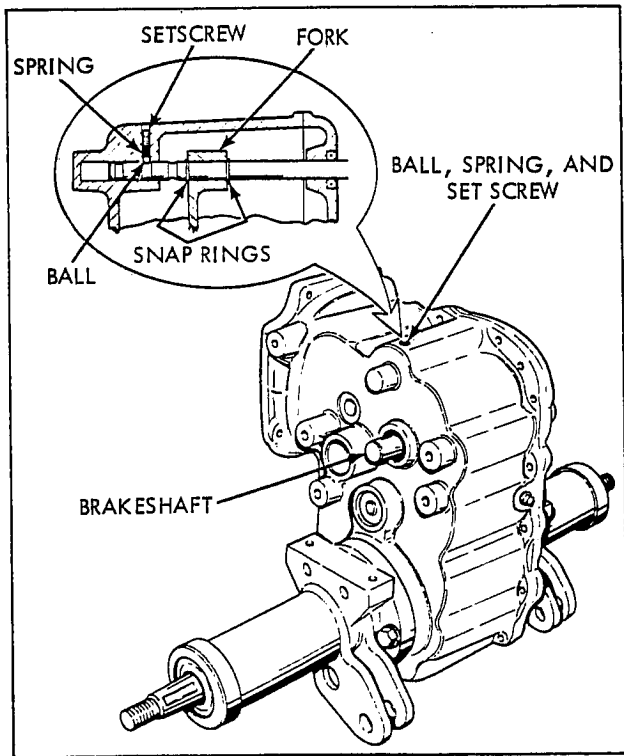


Figure 7-18 2500 Series Rear View

(f) Other

- (1) Check thrust washers for wear.
- (2) Check tapered roller bearings for wear and ease of rotation.
- (3) Replace shifter rod oil seal after assembly of all parts.
- (4) Check thrust bearing for wear and presence of rollers.

(g) Replace Any Parts Necessary

5. ASSEMBLY

Install parts reversing the disassembly procedure, watching out for the following.

- (a) After shifter rod is positioned, install ball, then spring and set screw. Turn set screw in slowly while raising and lowering rod - until ball stops rod movement.



- (b) Be sure thrust washers and spacers are between every shaft and case and cover.
- (c) Install new gasket. It may be helpful to dampen the gasket to get it to lie flat.
- (d) Be sure differential bolt heads go opposite output gear (large gear).
- (e) Use seal sleeve 670245 to protect axle support oil seals during installation.
- (f) Install axle supports correctly. Do not rotate the support to a new position when pressed tight against the square "O" ring seal or the seal may be cut.
- (c) Lubrication for all models is 7 to 8 pints of SAE Type A Automatic transmission fluid. When filling with fluid, allow fluid to settle behind the tapered bearings into the axle supports. This may necessitate filling, checking and adding. The lubrication fill and check hole is located in the case as shown in figure 7-18. If the shrouding on the vehicle does not allow access to the fill and check hole when the 2500 is installed in the chassis, lubrication should be filled prior to installation on vehicle. If filling takes place before installing 2500 in vehicle the unit must be oriented as shown in figure 7-18 or at a 90° angle to the axles. There should be no fluid leak.
- (d) Install drive assembly according to manufacturers instructions.
6. AFTER ASSEMBLY
- (a) To install brake shaft oil seal, use seal sleeve 670179 and drive 670180
- (b) To install shifter rod oil seal, use seal sleeve 670206 and driver 670211.

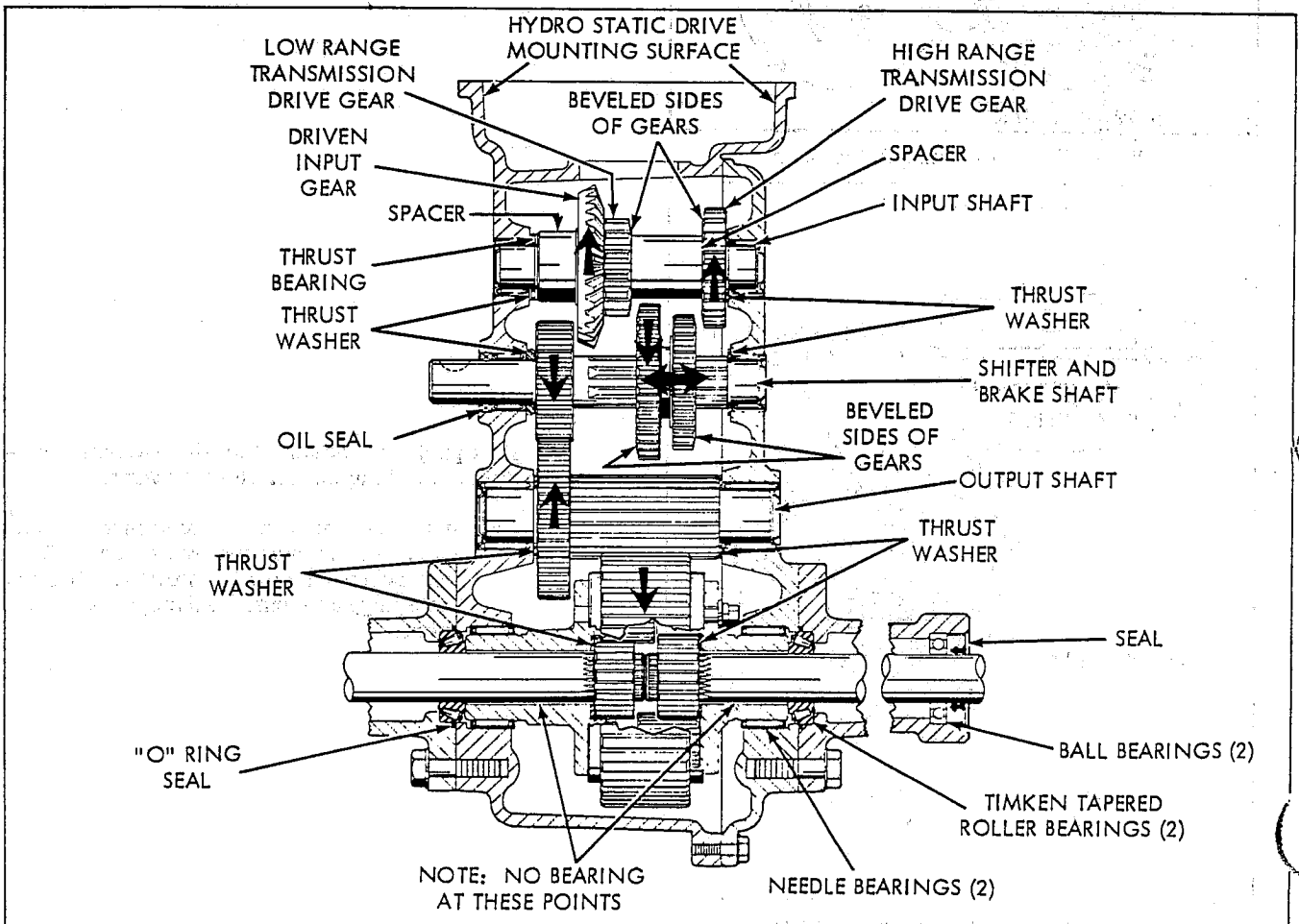
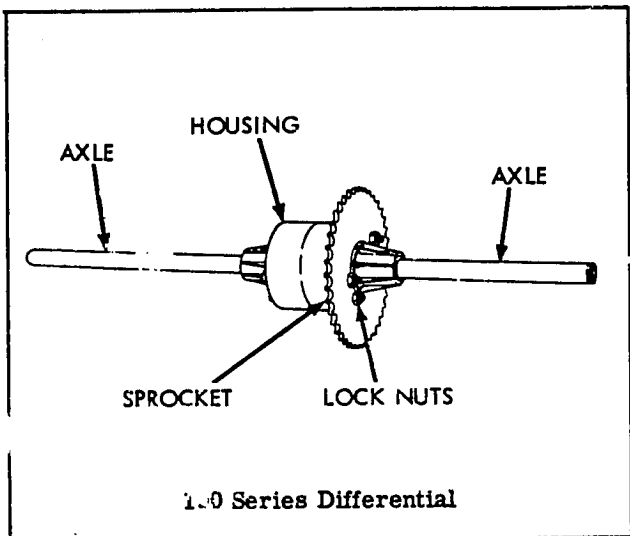


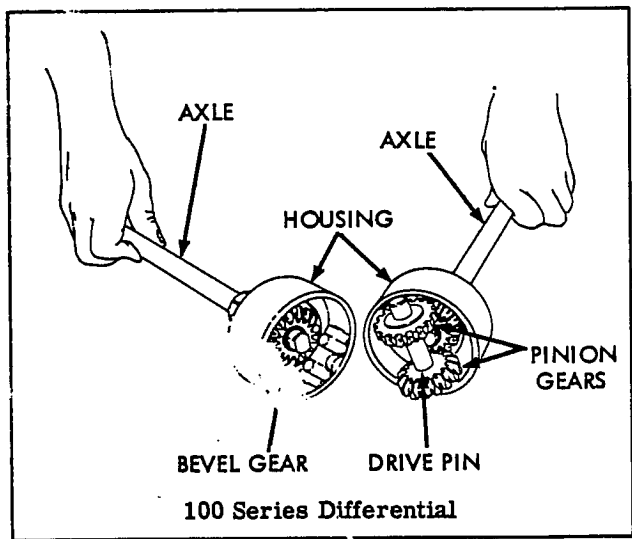
Figure 7-19 2500 Series Section View

SECTION 8 DIFFERENTIALS



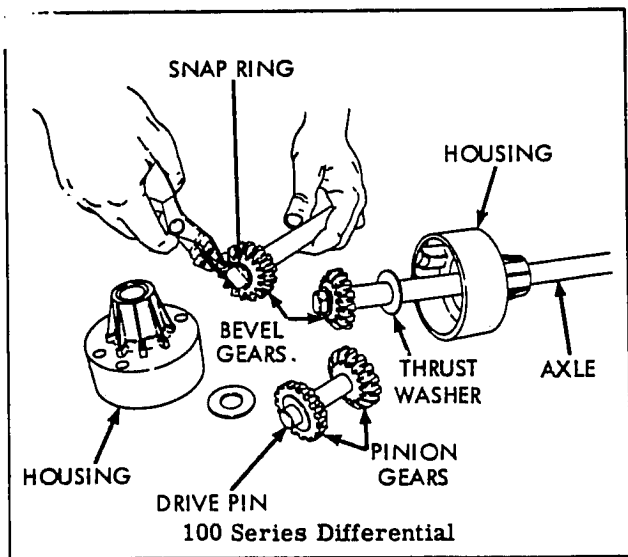
100 Series Differential

Figure 8-1



100 Series Differential

Figure 8-2



100 Series Differential

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.



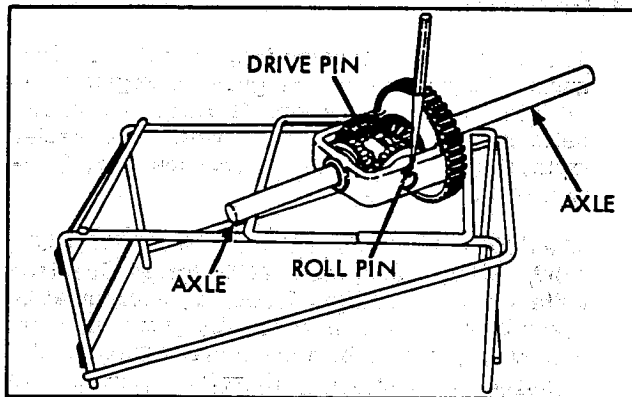


Figure 8-4

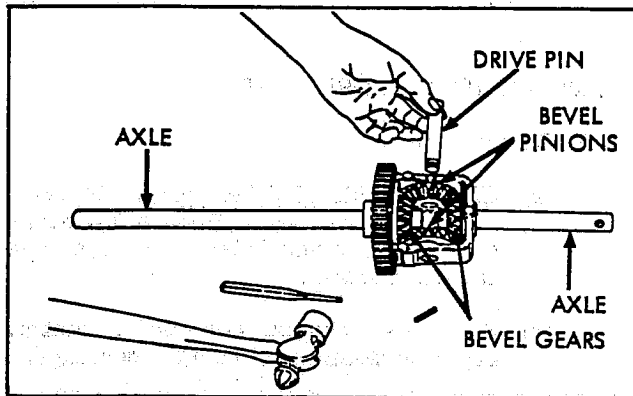


Figure 8-5

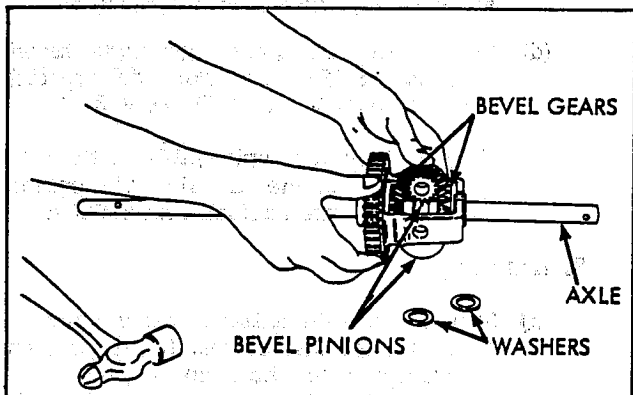


Figure 8-6

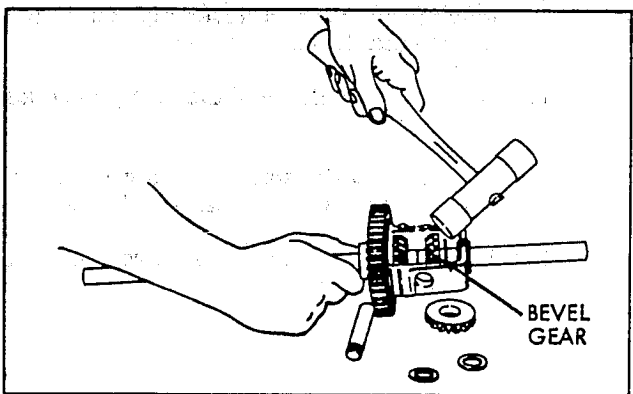


Figure 8-7

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.

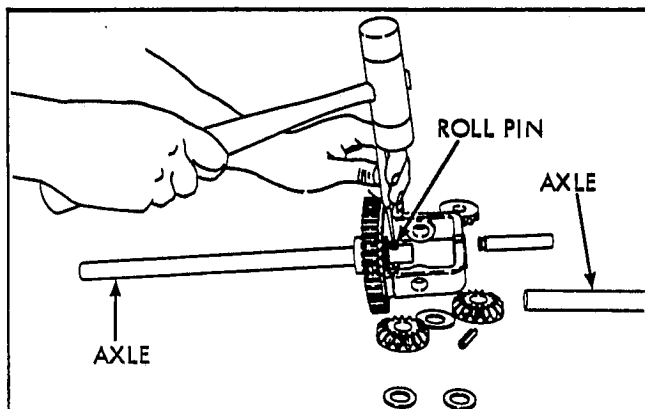


Figure 8-8

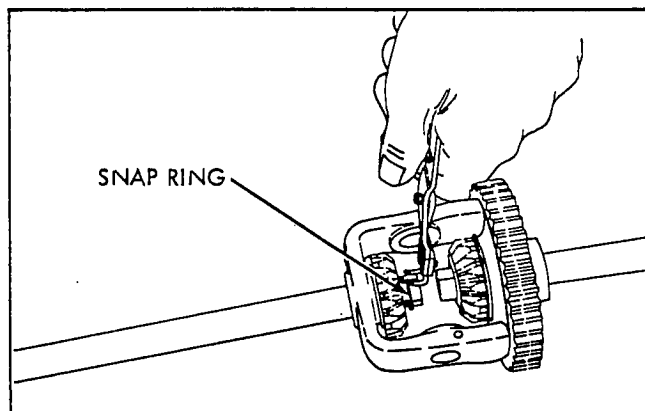


Figure 8-9

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.

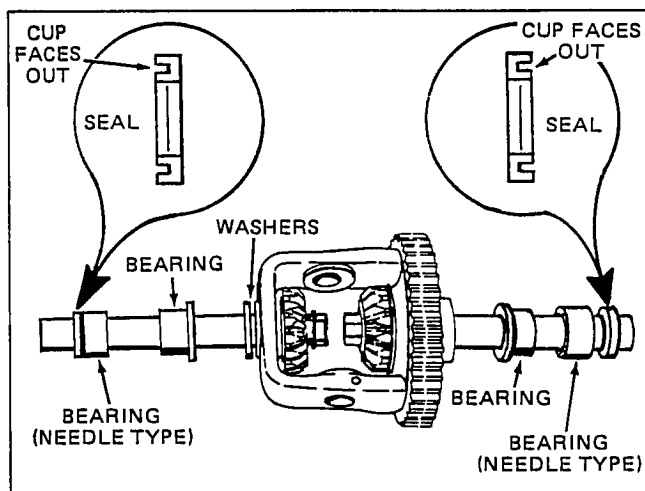


Figure 8-9A

C-1 MODEL 800

1. Disassembly

- (a) Same as disassembly for model 600; Steps 2, b, c, e, f, except for additional parts on the axle.
- (b) Remove and inspect seals, bearings and washers for wear - replace if required. (Figure 8-9A)
- (c) If differential was disassembled note positioning of differing length axles so correct reassembly may be performed.

2. Reassembly

- (a) Reassemble in reverse order of disassembly.
- (b) Install seal cup end out from the center of differential to prevent dirt entry.

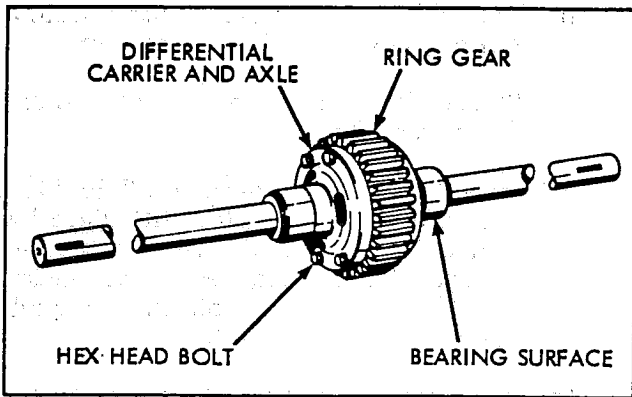


Figure 8-10 Typical Transaxle (3 Speed Series)

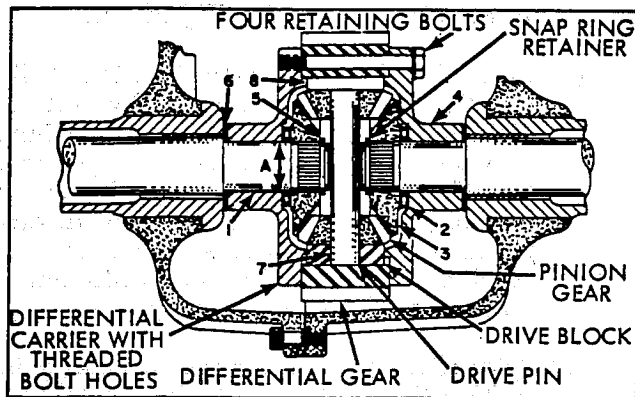


Figure 8-11 1200 Series Transaxle

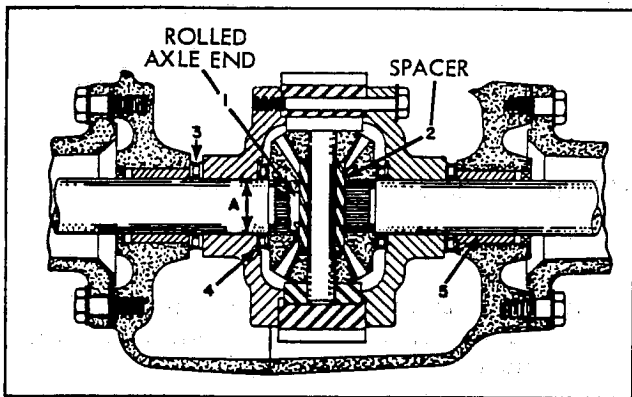


Figure 8-12 1700 Series Transaxle

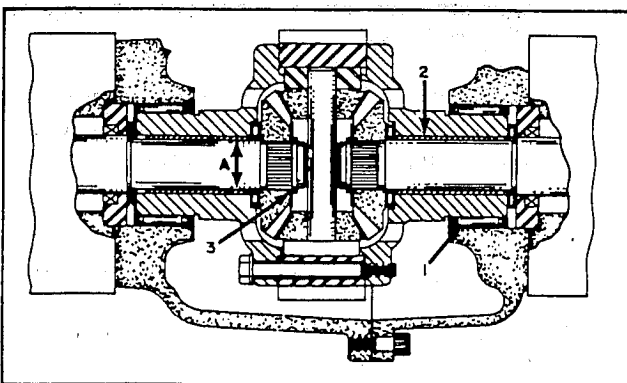


Figure 8-13 2000 and 2300 Series Transaxle

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.

8

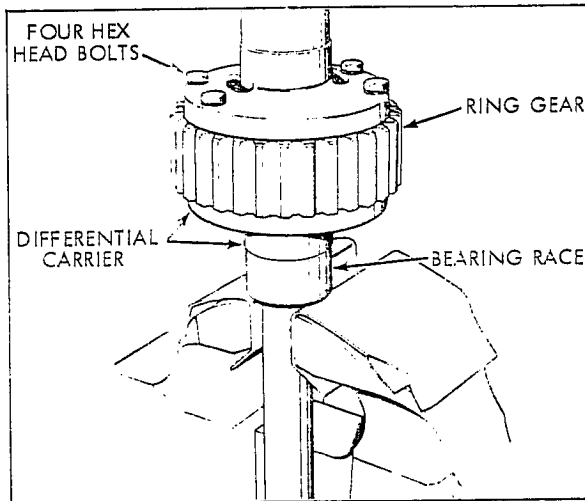


Figure 8-14 Differential Bolt Removal

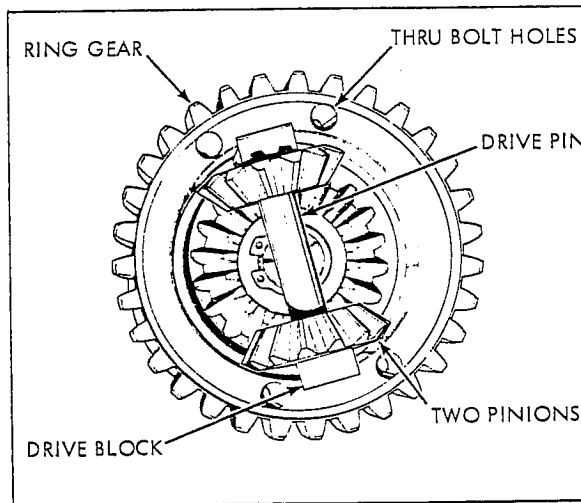


Figure 8-15 Differential Assembly (One Carrier Removed)

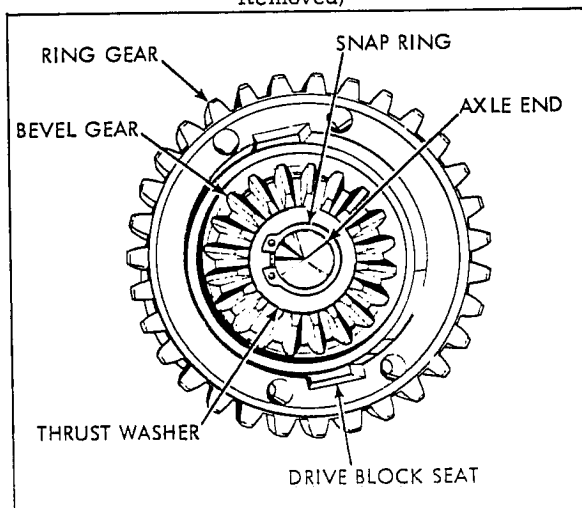


Figure 8-16 Drive Block, Pin and Pinion Gear Removed

6. Disassembly

- (a) Clean the differential assembly, then check and note the axle lengths and their relation to the heads of the four hex head bolts.
- (b) If the unit will not turn freely, note where the unit binds. Check and replace those parts.
- (c) 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.
 - (1) 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.
 - (2) 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.
 - (3) Remove the snap ring and the thrust washer, if used. Separate the bevel gear and differential carrier from the axle.

7. Inspection

- (a) See SECTION 11, for Bushing and Bearing Service.
- (b) 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.
- (c) Examine drive pinions, drive pins and drive blocks for wear and damage. Replace excessively worn pinion or the drive pin.

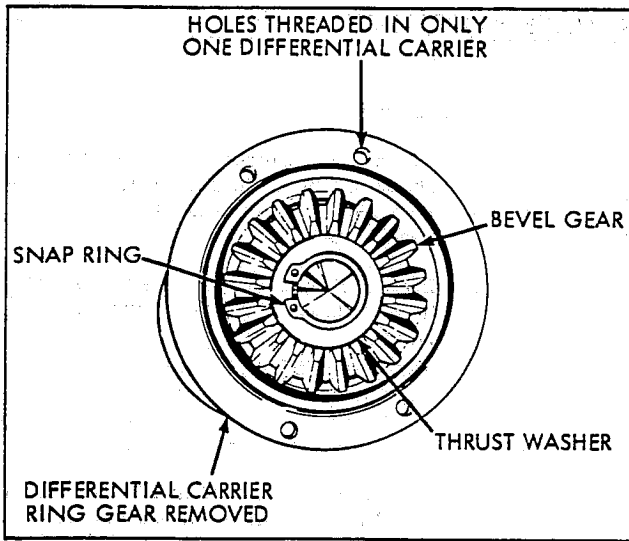


Figure 8-17 Ring Gear Removed

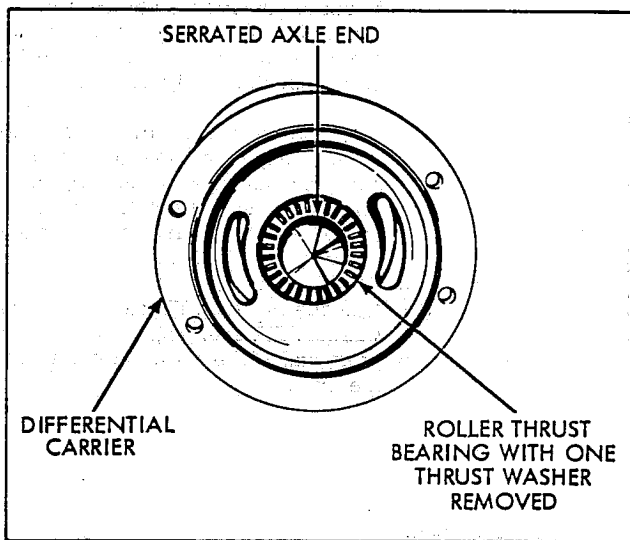


Figure 8-18 Snap Ring, Washer and Bevel Gear Removed

- (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. The main disadvantage of a "Locked Differential" which results in very difficult

2. Disassembly, Inspection, and Repair

Remove four through-bolts.

Separate axle assemblies from body

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

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

Separate the two body cores from the gear.

3. Assembly

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

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

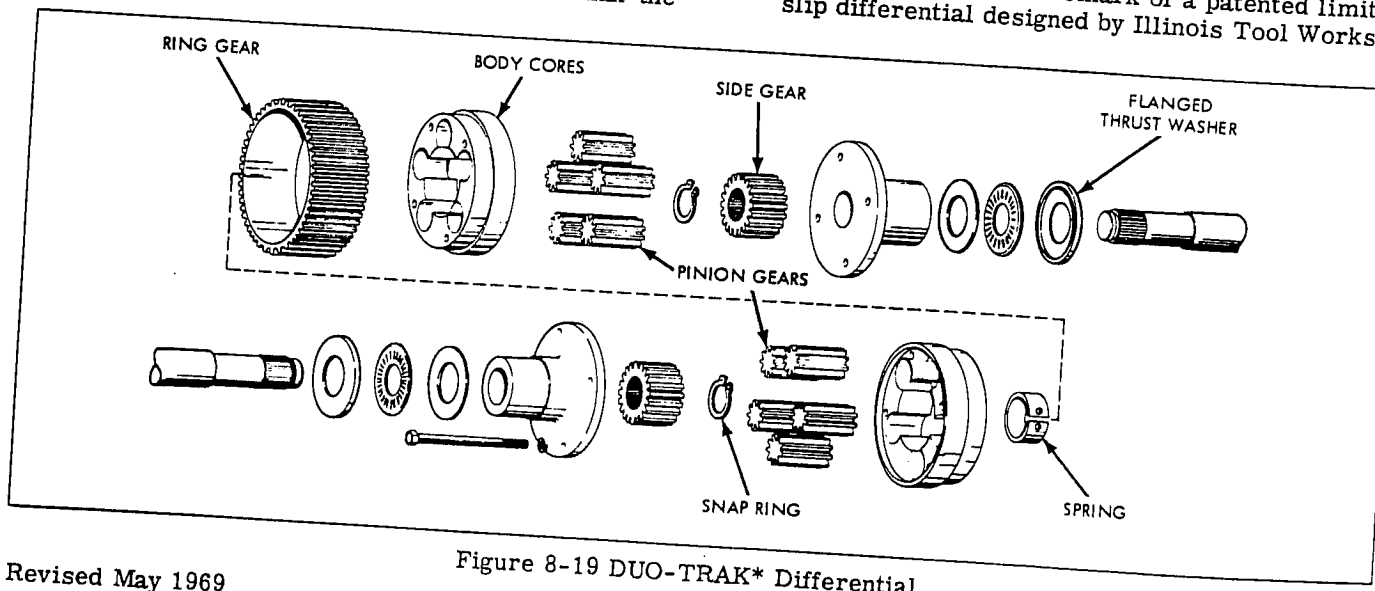
Install pinion gears on one side, then use differential carrier and axle to hold them from falling out when the unit is turned over. The side gear must mesh with the five pinions

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.



Revised May 1969

Figure 8-19 DUO-TRAK* Differential

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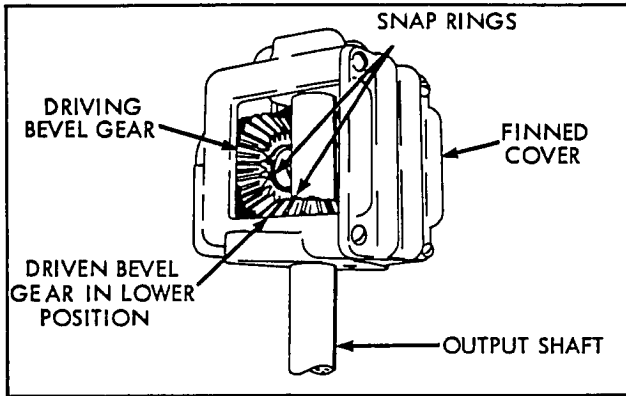


Figure 9-1 Output Shaft Removal

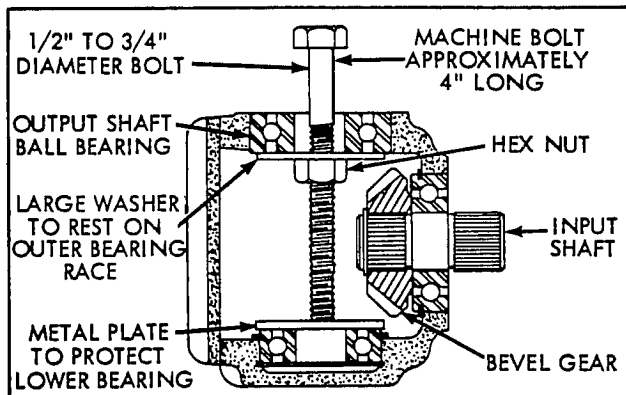


Figure 9-2 Bearing Removal

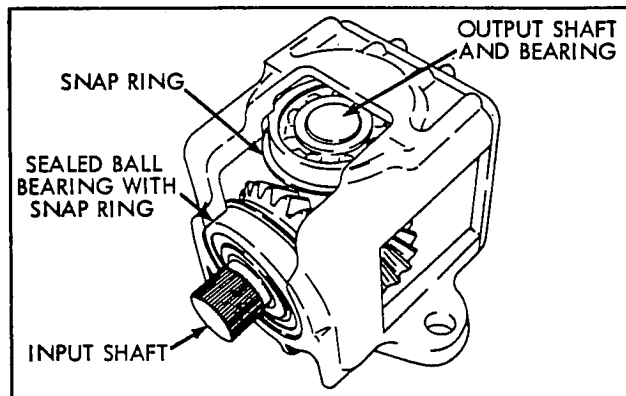


Figure 9-3 Input Shaft Removal

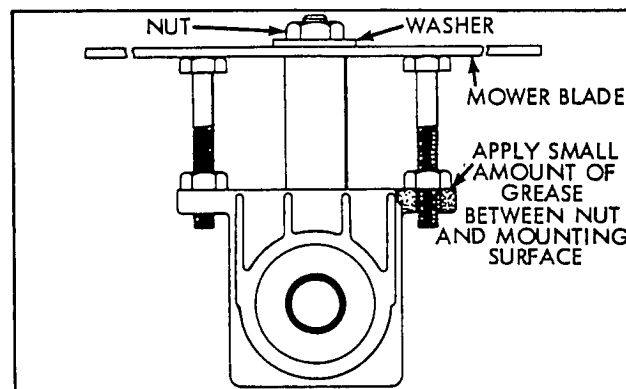


Figure 9-4 Driven Bevel Gear Removal

A. GENERAL

1. Prior to removing the assemblies, examine the following items that may have failed causing the right angle drives to appear inoperative.
2. Drive belts: Inspect for breaks, tension, oil or grease saturation, inoperative tightening devices.
3. Pulleys: Tighten retaining screws. Examine for sheared keys.
4. Mower blade clutches and break away devices: Some blades have slip type clutches that may slip during operation and appear to be damaged right angle drives. Shearing devices are also used to absorb a damaging impact load if encountered. Replace the clutch members or shearing devices prior to removal of the right angle drive if failure is noted.
5. Loose blade retaining nuts: Check torque and tighten if required.

B. FINNED COVER RIGHT ANGLE DRIVE

1. Leaking lubricant. These drives do not have oil seals, sealed ball bearings. If the unit is to be serviced because of lubricant leakage, it will be necessary to replace the ball bearings.

DISASSEMBLY

2. Remove the cover and gasket and remove the lubricant.
3. Different output shafts achieve a different rotation by mounting a gear at the top or bottom of the shaft. (Figure 9-5).
 - (a) If the driven bevel gear is on the bottom (Figure 9-1) remove the snap ring on the output shaft and pull out the output shaft.
 - (b) Remove the output shaft bearing by using a large machine bolt, washer and nut as illustrated in Figure 9-2.
 - (c) The input shaft bearing, input shaft and bevel gear may now be driven out of the housing. Use tool 27569 (Figure 9-3). Press bearing into housing to remove.



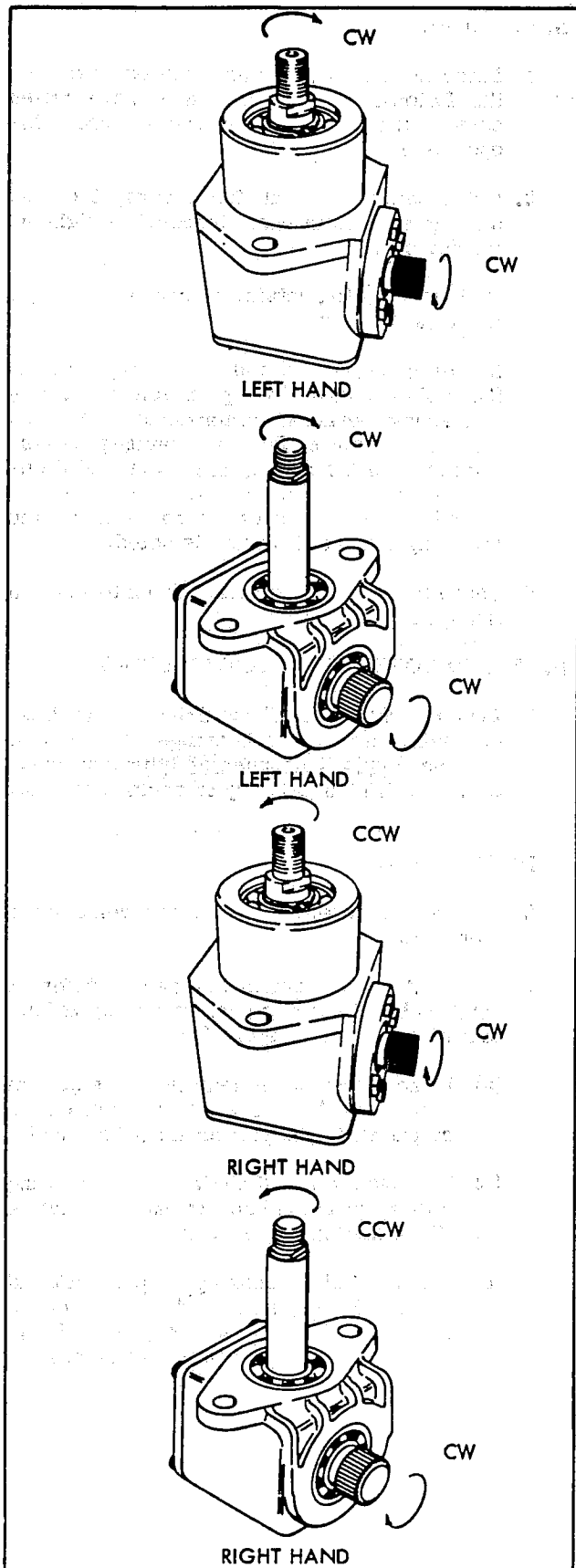


Figure 9-5 Right Angle Drive Movements

- (d) The top ball bearing in the blind end of the housing (Figure 9-3) is removed by either heating the housing on a hot plate or tapping the housing on the outside with a mallet.
- (e) Right angle units with the driven bevel gear at the top will have to be disassembled as illustrated in Figure 9-4. The output shaft is larger in diameter inside than outside. When the output shaft is pulled out the bearing will also be removed.

INSPECTION

Clean all parts in clean solvent. Examine for wear or damage and replace as needed. Use care when handling ball bearings, see SECTION 11 Bushing and Bearing Service.

REASSEMBLY

Assemble in reverse of the disassembly instructions. It is important that only ball bearings with snap rings (Figure 9-3) be used for the input shaft and top output shaft bearing. Use tool 27569 for driving in bearings. In the event bearing bore is tight in housing, heat housing on hot plate. Place a steel plate on the hot plate and rest housing on steel plate. Do not overheat. Work rapidly after removing housing from hot plate. Use care to prevent burns.

LUBRICATION

After assembly, fill unit with four ounces of Moly E.P. Lithium grease. This grease is obtainable at automotive service stations. It is the type of grease used for extended period automotive chassis lubrication.

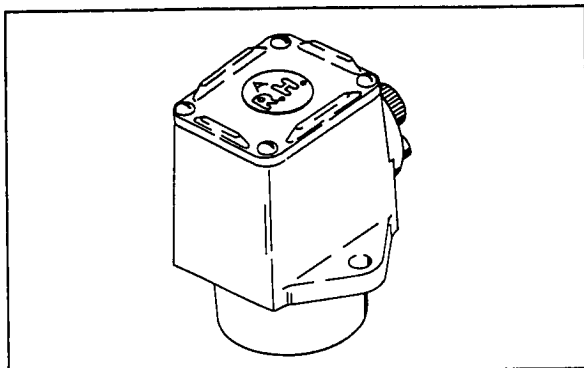


Figure 9-6 Top Cover

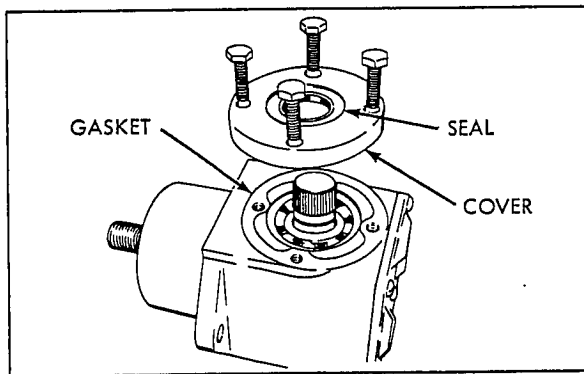


Figure 9-7 Input Shaft Seal Replacement

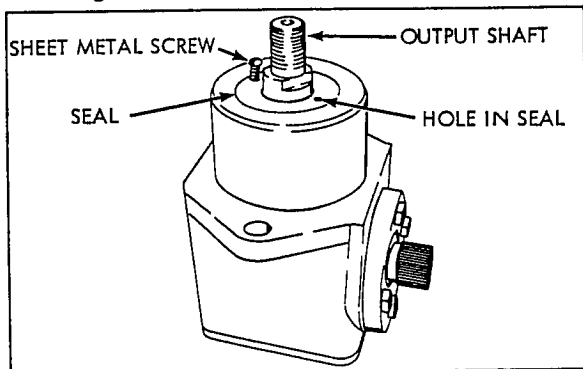


Figure 9-8 Output Shaft Seal Replacement

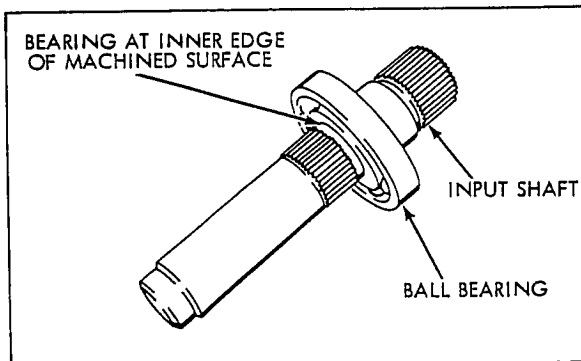


Figure 9-9 Input Shaft Removal

C. SMOOTH COVER RIGHT ANGLE DRIVES

SERVICE

Leaking lubricant: Correct lubricant leakage by replacing the seals at the input (Figure 9-7) and output (Figure 9-7) shaft as described below.

1. Input shaft seal replacement: (Figure 9-7). Remove four screws and the cover. Replace the seal by driving in squarely so that it is .040" to .050" below flush. Use tool 670185 to protect the seal when replacing the cover and seal assembly over the input shaft. Place the seal sleeve on the shaft and coat with oil. Slide the sealed retainer over the sleeve. Tighten the seal retainer screws and remove the sleeve.
2. Output shaft seal replacement: (Figure 9-8). Remove the seal by punching two small holes in the seal with an awl as close to the outer edge of the seal as possible and opposite each other. Use care when making holes in seal so that the ball bearing underneath is not damaged. Do not use a drill. Insert sheet metal screws into the holes and pull on the screws to remove the seal. Long screws may be turned in until they contact the outer race of the ball bearing and turned to lift out the seal. Place seal sleeve 670185 on the shaft, lubricate generously with oil and slide on the seal. Drive the seal into the housing until it is flush with the bottom of the housing. Use driver 28679.

DISASSEMBLY

1. Remove the cover, gasket and lubricant.
2. If the unit is built with the bevel gear on the input shaft toward the cover, (Figure 9-9) remove the snap ring on the input shaft from the groove.
3. Remove four screws and the cover and seal assembly.

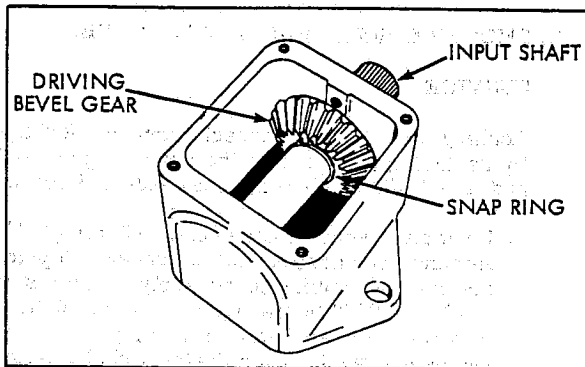


Figure 9-10 Bevel Gear and Input Shaft

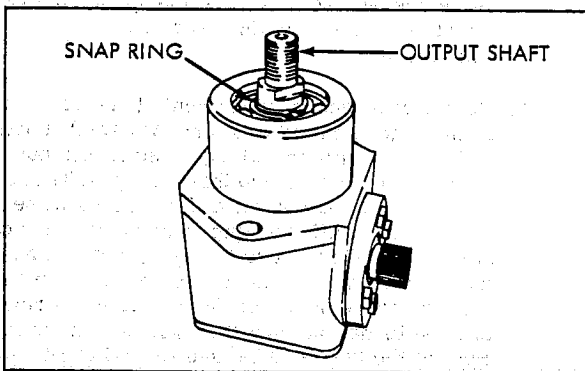


Figure 9-11 Remove Snap Ring

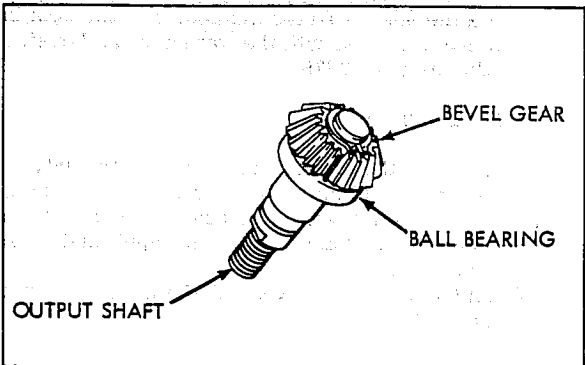


Figure 9-12 Output Shaft Removal

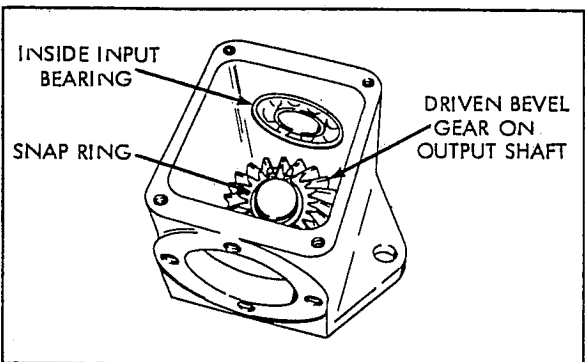


Figure 9-13 Bearing Removal

4. Remove the seal at the output shaft. See paragraph C of SERVICE above and Figure 9-8.
5. Remove the snap ring on the output shaft and tap it with a mallet on the outside end to drive it and the inner ball bearing (Figure 9-12) out of the housing. Remove the output end ball bearing by driving out from the inside.
6. Remove the input shaft from the ball bearing (Figure 9-12) with an arbor press. Always support the inner race when removing and replacing the input shaft into the ball bearing. Use tool 670185 to support the inner ball bearing race.
7. The ball bearing that supports the inner end of the input shaft (Figure 9-13) is removed by holding the housing in the hand and tapping the housing sharply on the outside with a soft mallet behind the bearing. It may at times be necessary to heat the housing to remove this bearing.

INSPECTION

Clean all parts in clean solvent. Examine for wear or damage and replace as needed. Use care when handling ball bearings, see SECTION 11 Bushing and Bearing Service.

REASSEMBLY

Assemble the unit in reverse of the disassembly. When building up the units it is important to install the correct input shaft (Figure 9-12) and identify it with the correct cover (Figure 9-6) if there is any identification on the cover, either R. H. or L. H. See Figure 9-5 to determine rotation. Use tools 28679, 670158, and 27569 to support bearings being pressed on shafts or into housing.

LUBRICATION

After assembly, fill unit with four ounces of Moly E. P. Lithium grease. This grease is obtainable at automotive service stations. It is the type of grease used for extended period automotive chassis lubrication.

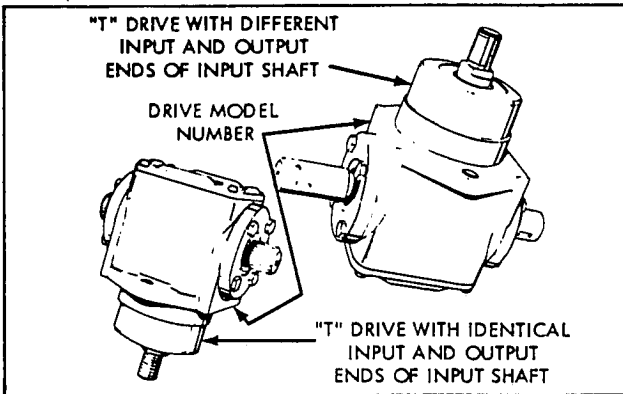


Figure 9-14 "T" Drive Shaft configurations vary

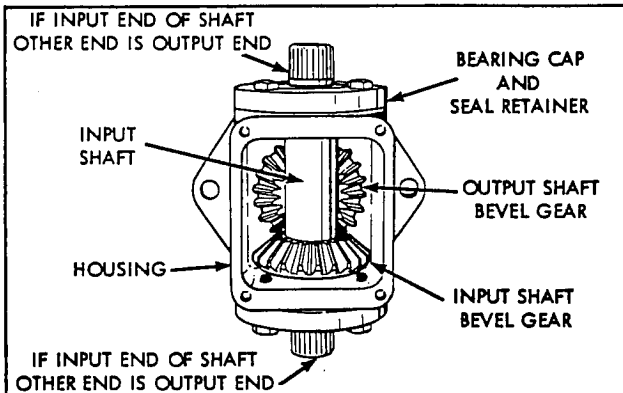


Figure 9-15 Remove Cover and Clean out Grease

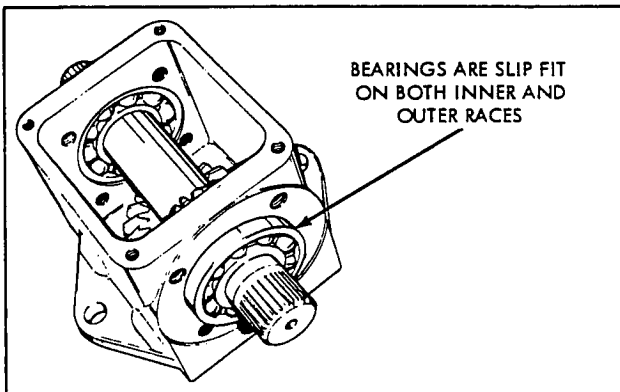


Figure 9-16 Remove Bearing Cap and Bearings

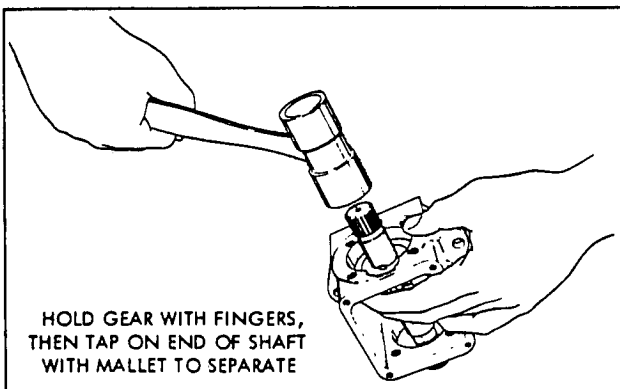


Figure 9-17 Separating Input Shaft from Input Bevel Gear

D. "T" DRIVE SERVICE

1. Before removing "T" Drive from equipment , be sure to scribe marks at one mounting hole to insure correct reassembly.
2. To disassemble "T" Drive self - tapping screws and housing cover and clean grease from internal area. Note and mark near the casting gasket surface on the side where the beveled input gear is located. To switch the "T" 180° will result in output shaft opposite rotation.
3. Remove capscrews and both retainer cap and seal assemblies. Separate and discard oil seals and gaskets.
4. Press input shaft ball bearings out of the housing with fingers. If they stick, tap lightly using a drift punch around the outer race.
5. Using a soft mallet, separate the input shaft and gear. A slight press fit holds a keyed surface on the shaft in a groove of the gear.

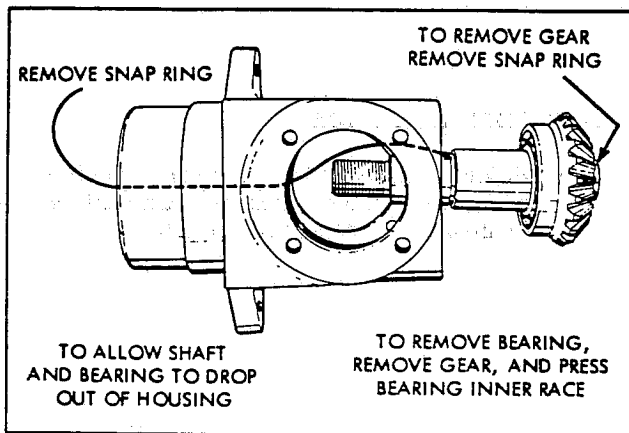


Figure 9-18 Output Shaft and Bevel Gear

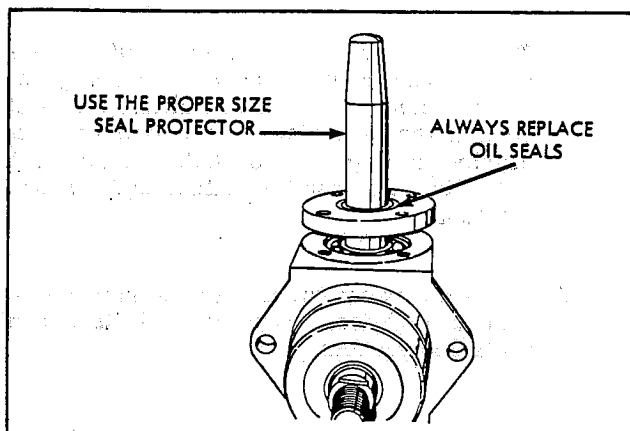


Figure 9-19 Replacing Seal Retainers on the Input Shaft

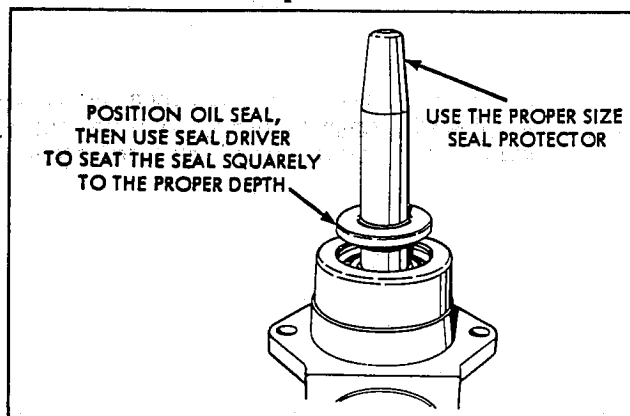


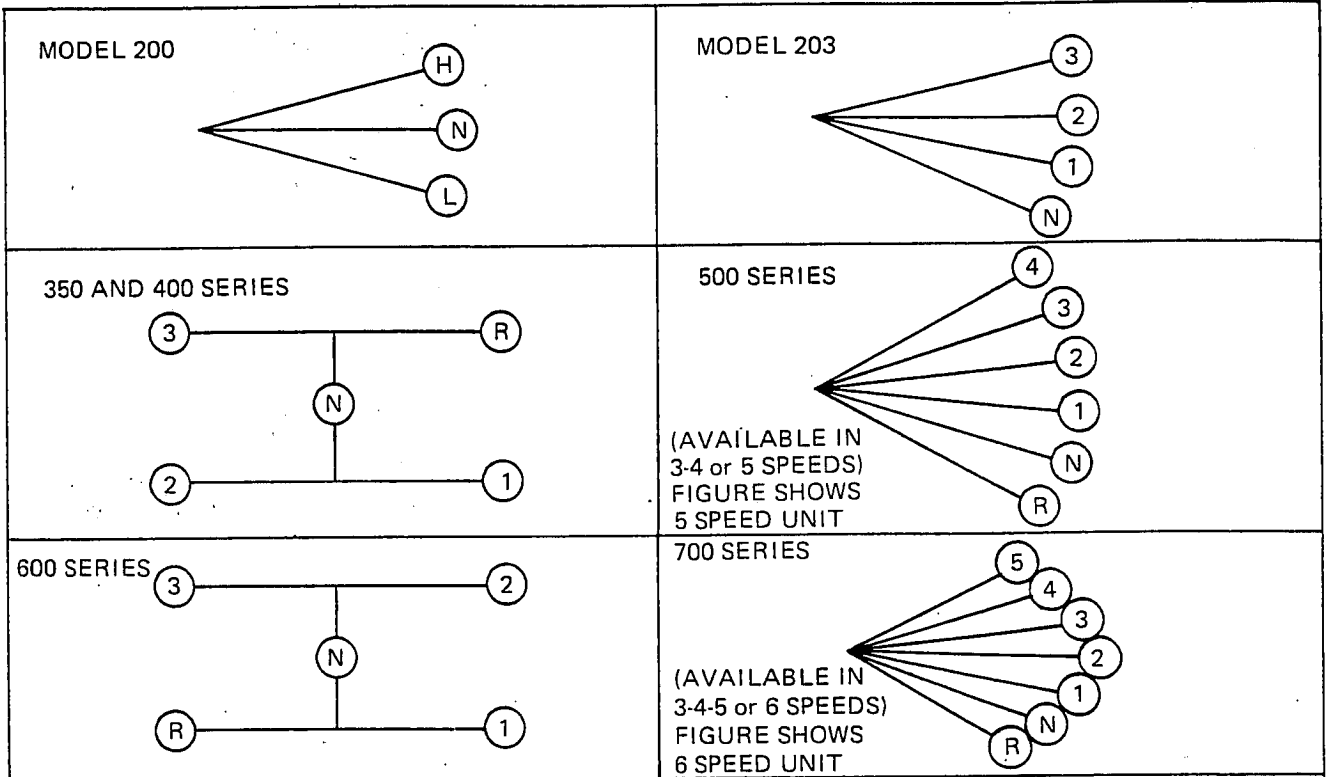
Figure 9-20 Replacing Seal Retainer on the Output Shaft

6. Remove and discard the output shaft oil seal. Do not scratch shaft. Remove and discard snap ring. Tap the shaft into the housing, using a soft mallet.
7. If necessary, remove the snap ring to separate the gear and bearing from the shaft. Hold the gear and bearing in one hand and tap the end of the shaft vigorously with a soft mallet.
8. Cleaning. Inspection. Repair.
 - (a) Clean all parts of grease, rust, or foreign matter.
 - (b) Dry all parts. Compressed air may be used on all parts EXCEPT BEARINGS.
 - (c) Check bearings for smooth rotation. Lubricate.
 - (d) Remove all burrs and scratches from shafts.
 - (e) Check housing for cracks or pulled metal.
 - (f) Replace all snap rings removed.
 - (g) Replace all oil seals.
9. If separated, install inner ball bearing and bevel gear on output shaft. Be careful of alignment. Use of a press is preferable to tapping parts together with a mallet.
10. Press shaft, bearing, and gear assembly into housing until outer bearing race bottoms in retaining cavity.
11. Install outer bearing and new snap ring.
12. Install new oil seal using seal sleeve No. 670185 and driver 28679 until seal is flush with housing.
13. Position input bevel gear in mesh with output shaft bevel gear. Tap the input shaft into place with a soft hammer. Use one hand to hold the gear and shaft to dampen tapping blows. Be sure gear is on the marked side of the housing.
14. Align shaft and insert ball bearing on each bearing surface by hand.
15. Install new seals in retainer caps, using driver 28679.
16. Using seal sleeve 670185 over the shaft serrated ends, install new gaskets and bearing cap. Tighten retaining capscrews to 8-11 ft.lbs.
17. Fill housing with 4 oz. of E.P. Lithium grease.
18. Install gasket and cover and secure with self-tapping screws. Torque to 20-24 in. lbs.
19. Align scribe marks and install "T" Drive on equipment.

SECTION 10 SHIFTING ASSEMBLY

A. SHIFT PATTERNS

VERTICAL INPUT
FRONT OF EQUIPMENT



HORIZONTAL INPUT
FRONT OF EQUIPMENT

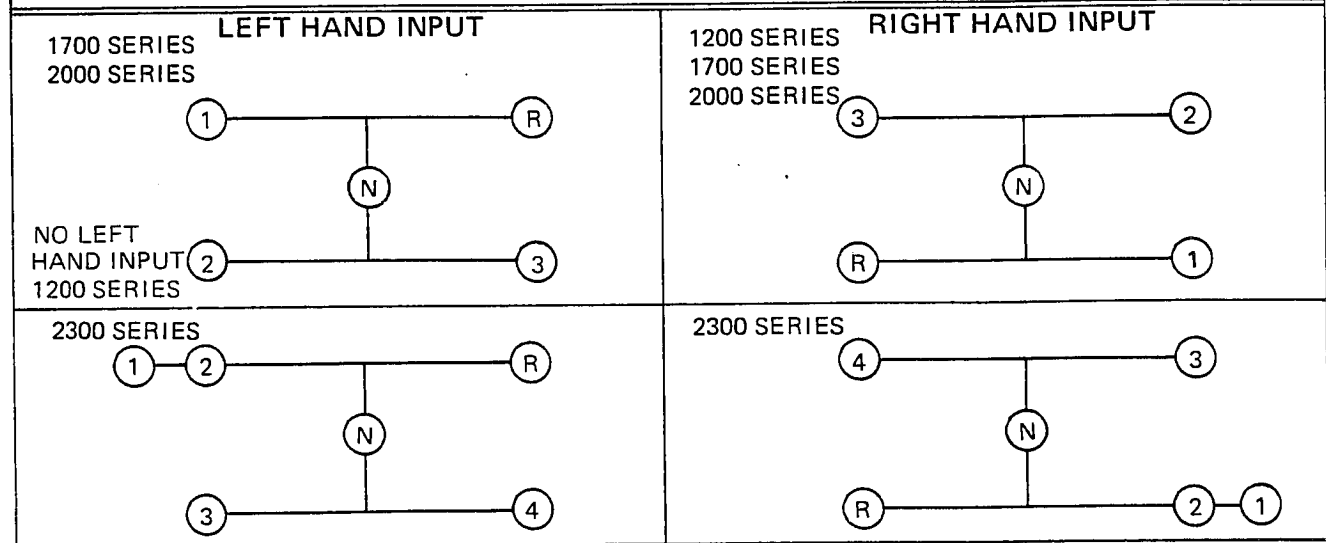


Figure 10-1 Shift Patterns

B. SHIFT LEVER ASSEMBLY

1. General

(a) 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.

(b) Move the shift lever to Neutral, if possible, before removing it from the transaxle. Clean around the lever housing to prevent dirt from falling into the transaxle. Cover this opening, if possible.



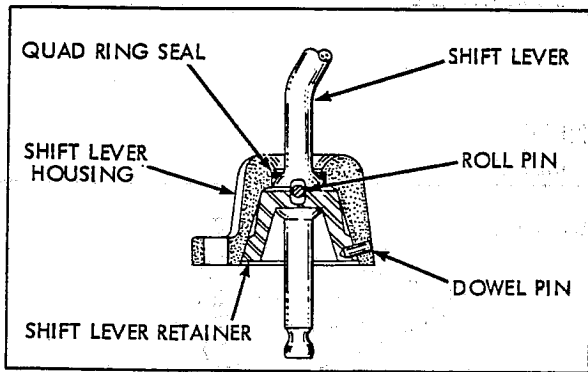


Figure 10-2 Dowel Pin Type Shift Lever

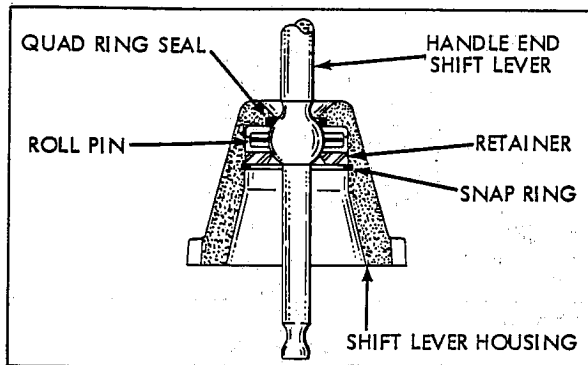


Figure 10-3 Snap Ring Type Shift Lever

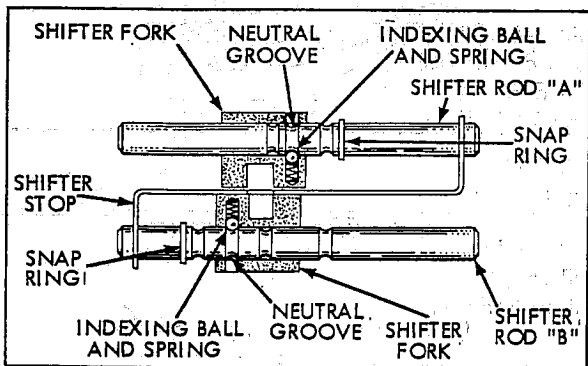


Figure 10-4 Three Stop Three-Speed Transaxle Shifter Rod and Fork Assembly

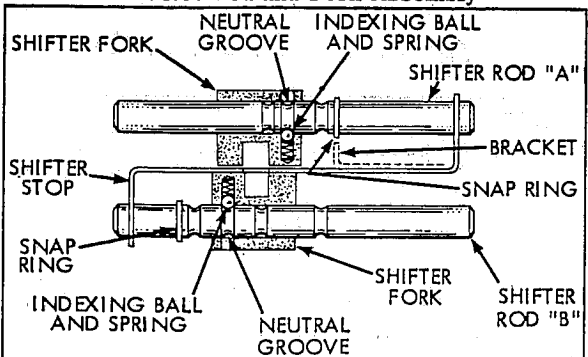


Figure 10-5 Four Stop, Three-Speed and Four-Speed Transaxle Shifter and Fork Assembly

2. Disassembly

- (a) 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.
- (b) **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).

- (c) 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.
- (d) 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.
- (e) Prior to reassembly, be sure that bends in the shift lever correspond to the mounting on the vehicle.

3. Reassembly

- (a) **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.
- (b) **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.
- (c) Always use new gaskets between the shift lever housing and the transaxle.

C. SHIFTING ASSEMBLY

1. General

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

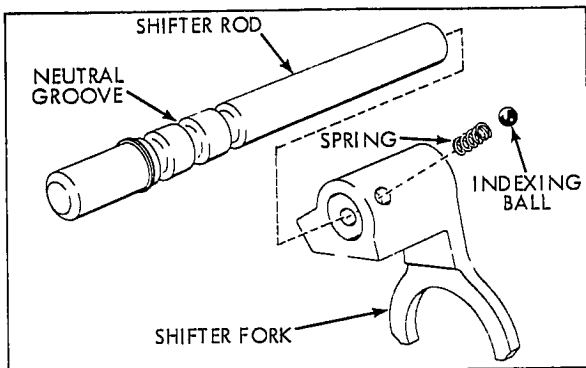


Figure 10-6 Assemble Shifter Forks to Shifter Rods

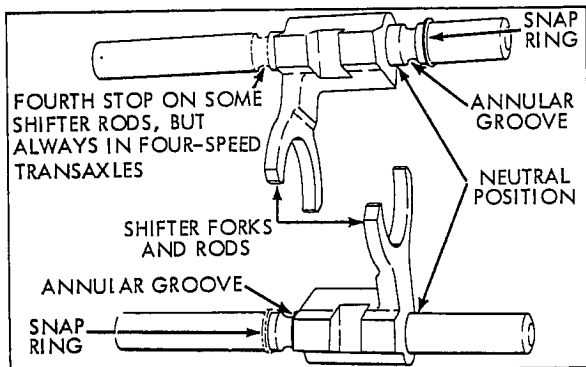


Figure 10-7 Shifter Forks and Rods Positioned in Neutral

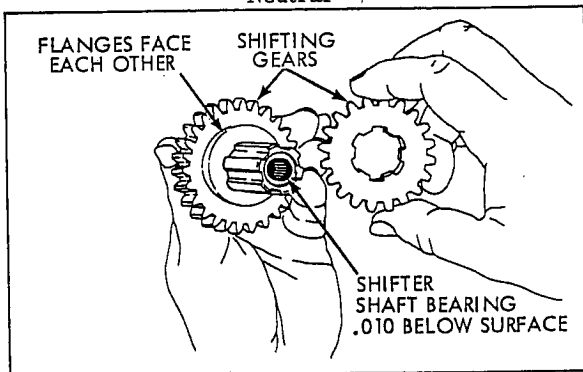


Figure 10-8 Two Flanged Gears onto Shifter Shaft

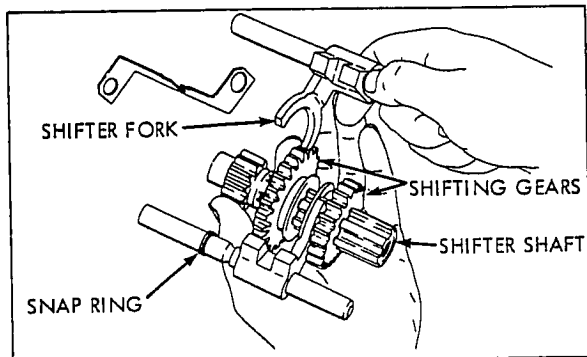


Figure 10-9 Assembling Shift Fork, Gears and Shaft Assemblies

(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

- (a) Replace the shifter stop if worn or damaged.
- (b) 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.
- (c) 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".
- (d) Replace other parts showing wear, looseness, cracks, etc.

4. Assembly

- (a) 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.
 - (1) Assemble the shifter forks to the shifter rods as illustrated in Figure 10-5. The shifter forks are interchangeable.
 - (2) 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.



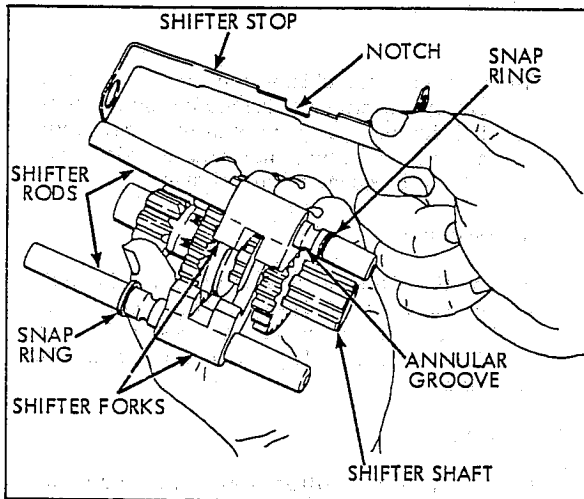


Figure 10-10 Positioning Shifter Stop

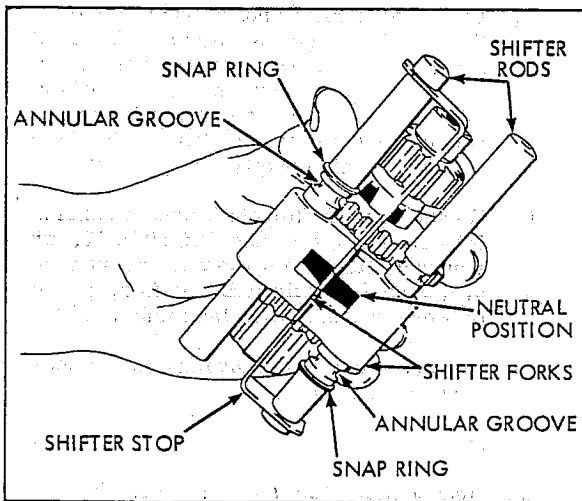


Figure 10-11 Final Assembly

- (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.

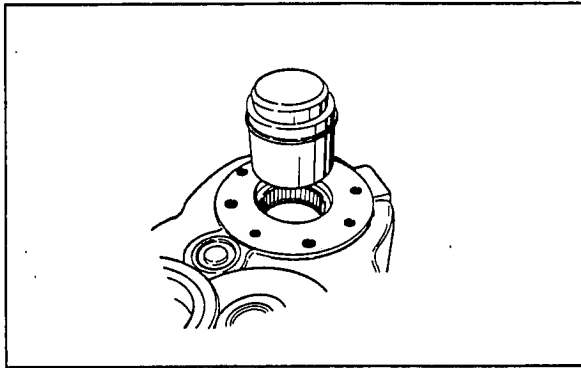


Figure 11-1 Bearing Remover End

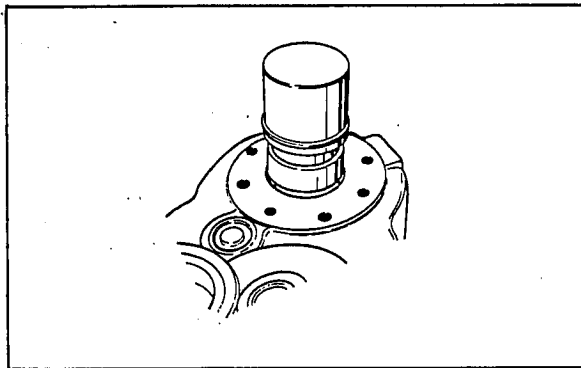


Figure 11-2 Bearing Installer End

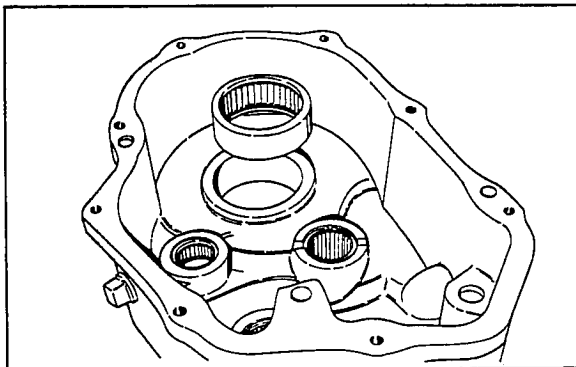


Figure 11-3 Bearing Surfaces

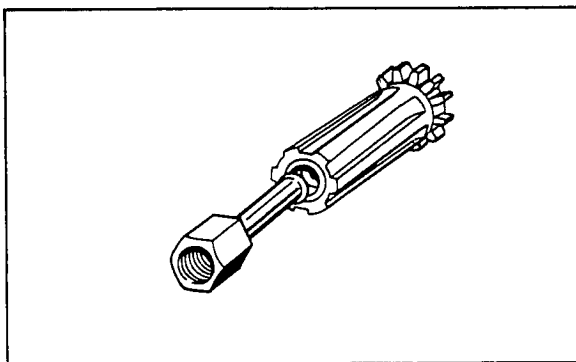


Figure 11-4 Blind Bearing and Puller

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 keep out 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.



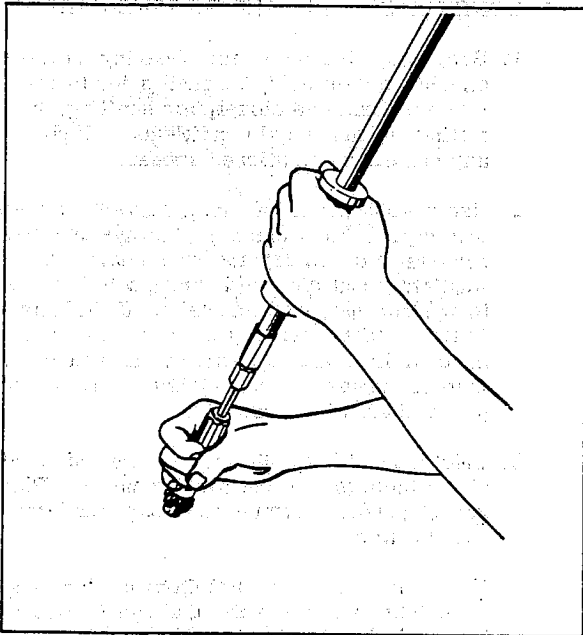


Figure 11-5 Removing Blind Bearing

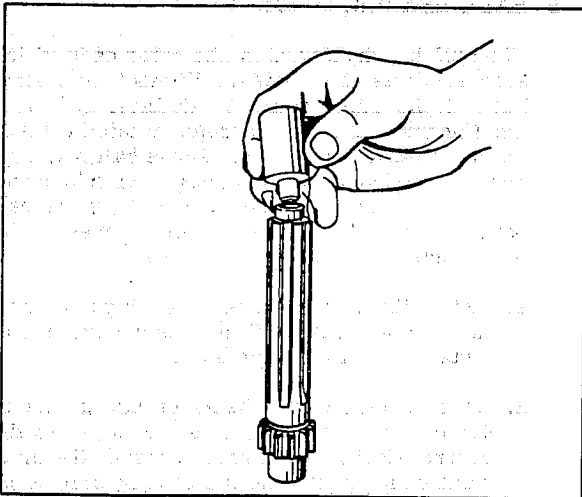


Figure 11-6 Installing Blind Bearing

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.