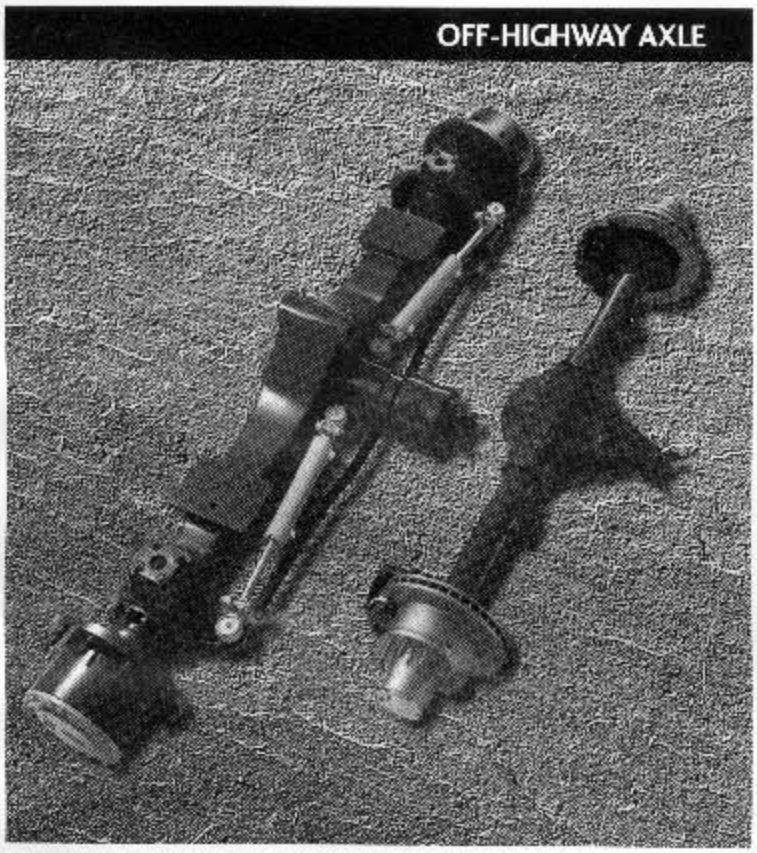
MODELS PS/PR-7036
MAINTENANCE MANUAL

SPICER®

DANA




*People Finding A Better Way*

SPICER

# MAINTENANCE MANUAL
## Models PS/PR-7036

## CONTENTS

# SECTION 1
# GENERAL INFORMATION

## IMPORTANT SAFETY NOTICE

Should an axle assembly require component parts replacement, it is recommended that "Original Equipment" replacement parts be used. They may be obtained through your local service dealer or other original equipment manufacturer parts supplier. **CAUTION: THE USE OF NON-ORIGINAL EQUIPMENT REPLACEMENT PARTS IS NOT RECOMMENDED AS THEIR USE MAY CAUSE UNIT FAILURE AND/OR AFFECT VEHICLE SAFETY.**

Proper service and repair is important to the safe, reliable operation of all motor vehicles or driving axles whether they be front or rear. The service procedures recommended and described in this service manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tool should be used when and as recommended.

**CAUTION: EXTREME CARE SHOULD BE EXERCISED WHEN WORKING ON COMPONENTS UTILIZING SNAP RINGS OR SPRING LOADED RETENTION DEVICES. FOR PERSONAL SAFETY, IT IS RECOMMENDED THAT INDUSTRIAL STRENGTH SAFETY GOGGLES OR GLASSES BE WORN WHENEVER REPAIR WORK IS BEING DONE ON ANY VEHICLE OR VEHICLE COMPONENTS.**

It is impossible to know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Accordingly, anyone who uses a service procedure or tool which is not recommended must first satisfy himself thoroughly that neither his safety or vehicle safety will be jeopardized by the service methods he selects.

### WARNING

**Some vehicle manufacturers may require the assembly of brake components on Dana axles that utilize materials containing asbestos fibers.**

**BREATHING ASBESTOS DUST MAY BE HAZARDOUS TO YOUR HEALTH AND MAY CAUSE SERIOUS RESPIRATORY OR OTHER BODILY HARM.**

**Follow O.S.H.A. standards for proper protective devices to be used when working with asbestos materials.**

**SILICONE RUBBER SEALANT (RTV) AND LUBRICATING GREASE AND OILS**

**Silicone rubber sealant is used as a gasket material on some Dana axles, as well as various lubricants and other materials. Before using any of these materials, one should become familiar with and follow all safety precautions as recommended by the product manufacturer/supplier. All personnel involved with these materials should follow good industrial hygiene practices (e.g. before eating, hand and face should be thoroughly washed. Eating, drinking and smoking should be prohibited in areas where there is potential for significant exposure to these materials).**

**When discarding any of the materials, observe all local, state, and federal laws and regulations for proper disposal procedures.**

# Safety Precautions

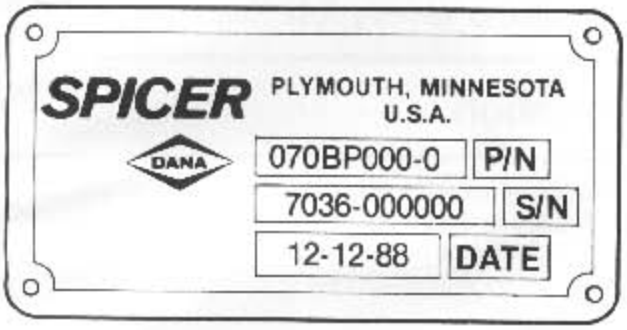
This symbol warns of possible personal injury.

A serious or fatal injury can occur . . .

- if you lack proper training
- if you fail to follow proper procedures
- if you do not use proper tools and safety equipment
- if you assemble components improperly
- if you use incompatible components
- if you use worn-out or damaged components
- if you use components in a non-approved application

SAFETY GLASSES SHOULD BE WORN AT ALL TIMES WHEN WORKING ON VEHICLES OR VEHICLE COMPONENTS.

# Axle Identification




The identification tag located on the rear of the axle housing contains the axle assembly number, the serial number and the build date. It is recommended when referring to components of the axle assembly that all the information recorded on this tag be obtained to aid in the correct identification.

# Gear Set Identification

**Manufacturer's date**—date gear set was made.

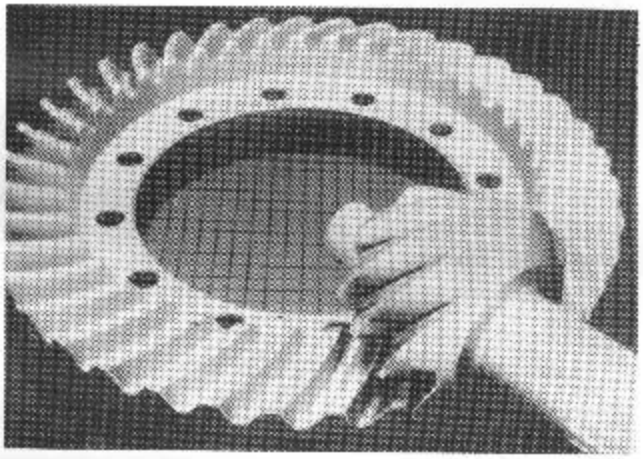
**Dana**—Dana name—and location of manufacturing.

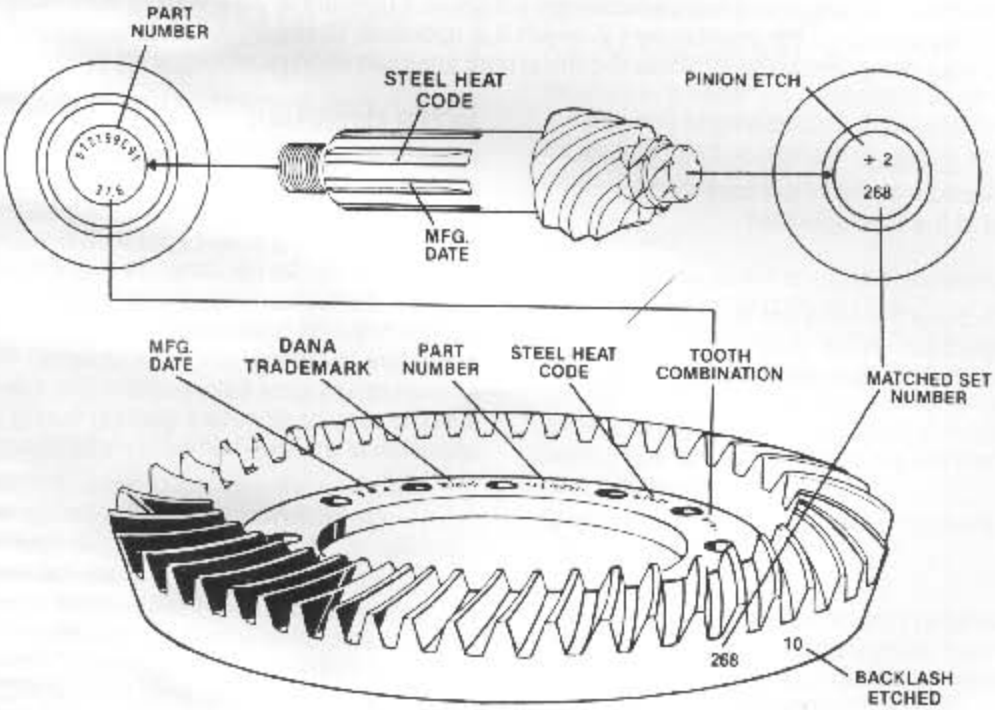
**572199C91**—part number of ring gear. (Typical)

**Tooth combination (i.e. 37-6)**—indicates the pinion has 6 teeth and the ring gear 37 teeth which results in a 6.17:1 ratio.

**Matched set number**—Spicer ring and pinions are manufactured as a matched set. Both pieces are marked with a corresponding number (i.e. 268) which indentifies them as a matched set.

A gear set that does not have the same matching numbers should not be run together. If either a ring gear or pinion require replacement **they must be replaced as a matched set.**





# Servicing Components Not Covered In This Manual

Service procedures for some components may not be covered in this manual because they are unique to the vehicle application. Refer to the vehicle manufacturer's service manual for servicing those components.

# Vehicle Storage Or Prolonged Inoperation

If the vehicle has not been operated on a regular daily basis, it is recommended that the vehicle be operated at least once every two weeks. The vehicle should be moved far enough to cause the drivetrain components to make several complete revolutions. This procedure will help assure that all internal components receive adequate amount of lubrication to help reduce component deterioration caused by an undesirable environment (e.g. high humidity).

# Submersion Or Deep Water Fording

If the vehicle is exposed to water deep enough to cover the hubs, it is recommended that the wheel ends be disassembled and inspected for water damage and/or contamination.

In the event the carrier housing should become submerged in water, particularly if over the breather, it is recommended that the hypoid gear lubricant be drained and internal parts be inspected for water damage and/or contamination.

Clean, examine, and replace damaged parts if necessary, prior to assembling and refilling with the specified lubricants.

**NOTE: If the hubs are exposed to deep water, it is possible on steering axles that the water could enter the carrier at the point the inner axle shaft enters the axle housing. This could also necessitate the draining of the hypoid lubricant as described above.**

**It is recommended that whenever bearings are removed, they be replaced with new ones, regardless of mileage.**

# Axle Lubricant Change Schedule

The following schedule is a suggested lubricant change schedule. Lubricant in your vehicle may require more frequent changes depending on the environment in which it is operated. Contact your local authorized service dealer or refer to your owner's manual for obtaining the proper lubricant change schedule for your vehicle.

**BREAK IN**

After 100 hours of operation, the lubricant should be drained and replaced with fresh lubricant to the correct level and of the type specified.

**SERVICE**

It is recommended that the lubricant be changed at 2000 hours of operation. When yearly usage is less than 4000 hours, the lubricant should be changed twice yearly.

**AFTER OVERHAUL**

When refilling the axle assembly or planetary hub assembly after it has been disassembled for service, the lubricant should be filled to the bottom of the fill hole located in the bowl of the axle housing or the planetary drive flange. After 24 hours of operation recheck the lubricant level and bring it up to the bottom of the fill hole again, if necessary. This procedure is recommended to replenish the small amount of lubricant that is retained in the differential support case or planetary gearing during initial operation of the axle immediately following an overhaul.

# General Precautions for Assembly and Disassembly

## IMPORTANT

READ THIS SECTION BEFORE STARTING THE DETAILED ASSEMBLY OR DISASSEMBLY PROCEDURES.

**USE ONLY GENUINE REPLACEMENT PARTS FOR SATISFACTORY SERVICE.**

**NOTE: The photos or pictures contained herein are for illustrative and instructional purposes only. The appearance of your axle assembly and/or components may vary from that shown. However, the service procedures described will apply.**

**If it becomes necessary to disassemble any parts inside the carrier, it is suggested that the entire axle be removed from the vehicle and held tight in a stand or rack.**

**All dimensions are in inches unless otherwise stated.**

**WARNING: When removing axle assembly, make sure vehicle is properly supported. Improperly supported vehicle can cause serious injury or death. Follow vehicle manufacturers recommendations for proper axle assembly removal procedures.**

Safety Glasses should be worn at all times when assembling or disassembling.

### CLEANLINESS

The axle assembly should be steam cleaned prior to disassembly. Seal all openings before steam cleaning to prevent entry of dirt and water which can damage serviceable parts.

Thoroughly clean all parts just prior to assembly.

### REBUILD FACILITIES

If the axle assembly is removed from the vehicle, it must be safely supported at three points on the housing. If the axle is to remain in the vehicle, use the OEM recommended support method.

A suitable holding fixture should be used rebuilding the carrier assembly. A lifting device should be used to relocate the carrier assembly and to install or remove the ring gear and support case assembly.

### END YOKES AND FLANGES

**CAUTION: Hammering on end yokes or flanges to remove or install them is not only destructive to the yoke or flange itself, but can also cause serious internal damage. Hammering on end yokes can close in the bearing bores or misalign yoke lugs and result in early failures of journal needle bearings or other driveline components. Serious damage can also be done internally to the ring and pinion set or pinion bearings by hammering on external parts. End yokes or flanges should be removed or installed using a recommended method such as that described herein.**

### BEARINGS

Use suitable pullers for bearing removal. Clean, inspect, and lubricate all bearings just prior to reassembly.

**NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.**

**NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.**

### OIL OR GREASE SEALS

Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.

### CLEANING

Parts with machined or ground surfaces such as gears, bearings, and shafts should be cleaned with emulsion cleaners or petroleum based cleaners.

Steam cleaning of internal components and the interior of the planetary hub and axle housing is not recommended. Water can cause corrosion of critical parts. Rust contamination in the lubricant can cause gear and bearing failure.

Clean all surfaces of old gasket material.

### DRYING

Use clean lintless towels to dry components after cleaning. DO NOT dry bearings by spinning with compressed air. This can damage mating surfaces due to lack of lubrication.

After drying, components should be lightly coated with oil or rust preventive to protect them from corrosion. If components are to be stored for a prolonged period they should be wrapped in wax paper.

**INSPECTION**

Prior to reassembly, inspect parts for signs of wear or damage.

Bearing surfaces should be inspected for pitting, wear, or overheating.

Inspect, all bearings, cups, and cones, and replace if worn, pitted or damaged. When replacing bearings, use a suitable puller or pressing fixture to remove them. Avoid using drifts and hammers which may mutilate or distort component parts.

Inspect planetary and carrier components for wear or damage. Replace if the following conditions are found.

- Worn, chipped, pitted or scored gears.
- Worn, pitted, or scored thrust washers.
- Worn or scored planet gear or differential pinion gear shafts.
- Axle shafts or worn splines, bends, cracks, or for torsional fractures or other indications of impending failure.

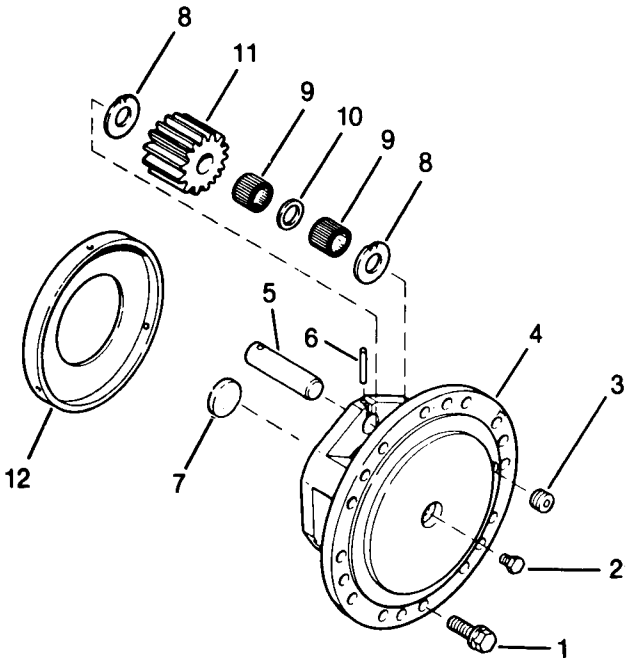
- **BOLTS:** Make sure all bolts are torqued to the recommended specifications.
- **LUBRICATION:** Coat bearings, seals, and splines with lubricant to provide initial lubrication and prevent damage during assembly.
- **BEARINGS:** Bearing drivers which apply equal forces to both races of the bearing are recommended. If another type of driver is used, it is important that the driving force not be transmitted through the rollers.

**USE A PRESS WHERE POSSIBLE WHEN ASSEMBLING COMPONENT PARTS WHICH REQUIRE AN INTERFERENCE FIT.**

Dana Corporation, Spicer Off-Highway Axle Division, reserves the right to make changes from time to time, without notice or obligations, in specifications, descriptions, and illustrations, and to discontinue models or revise designs.

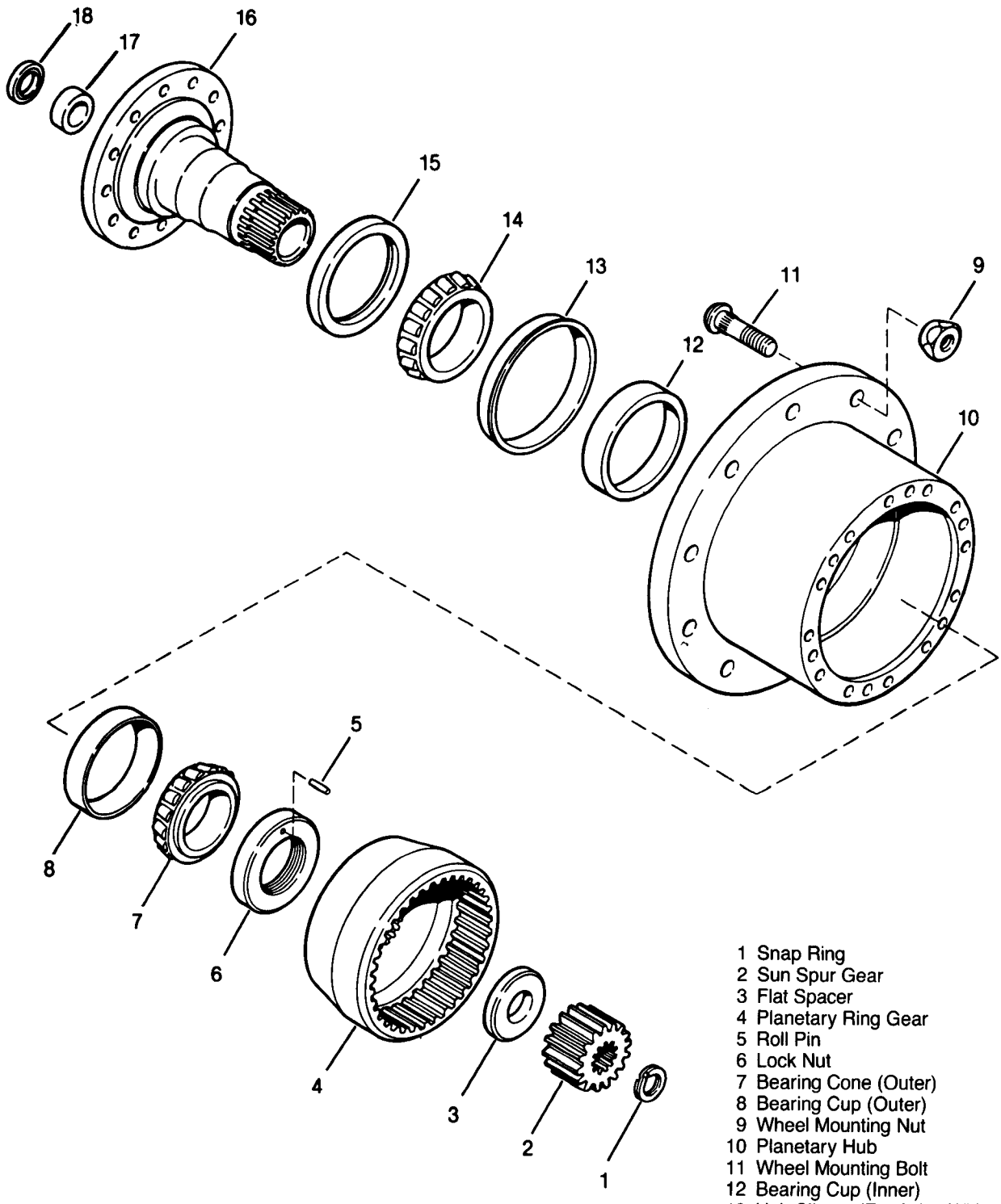
# SECTION 2
# Planetary Wheel End, Wheel End Brakes, Axle Shaft, Steering Knuckle Steering Cylinder, Tie Rod

## 3.650 Drive Flange



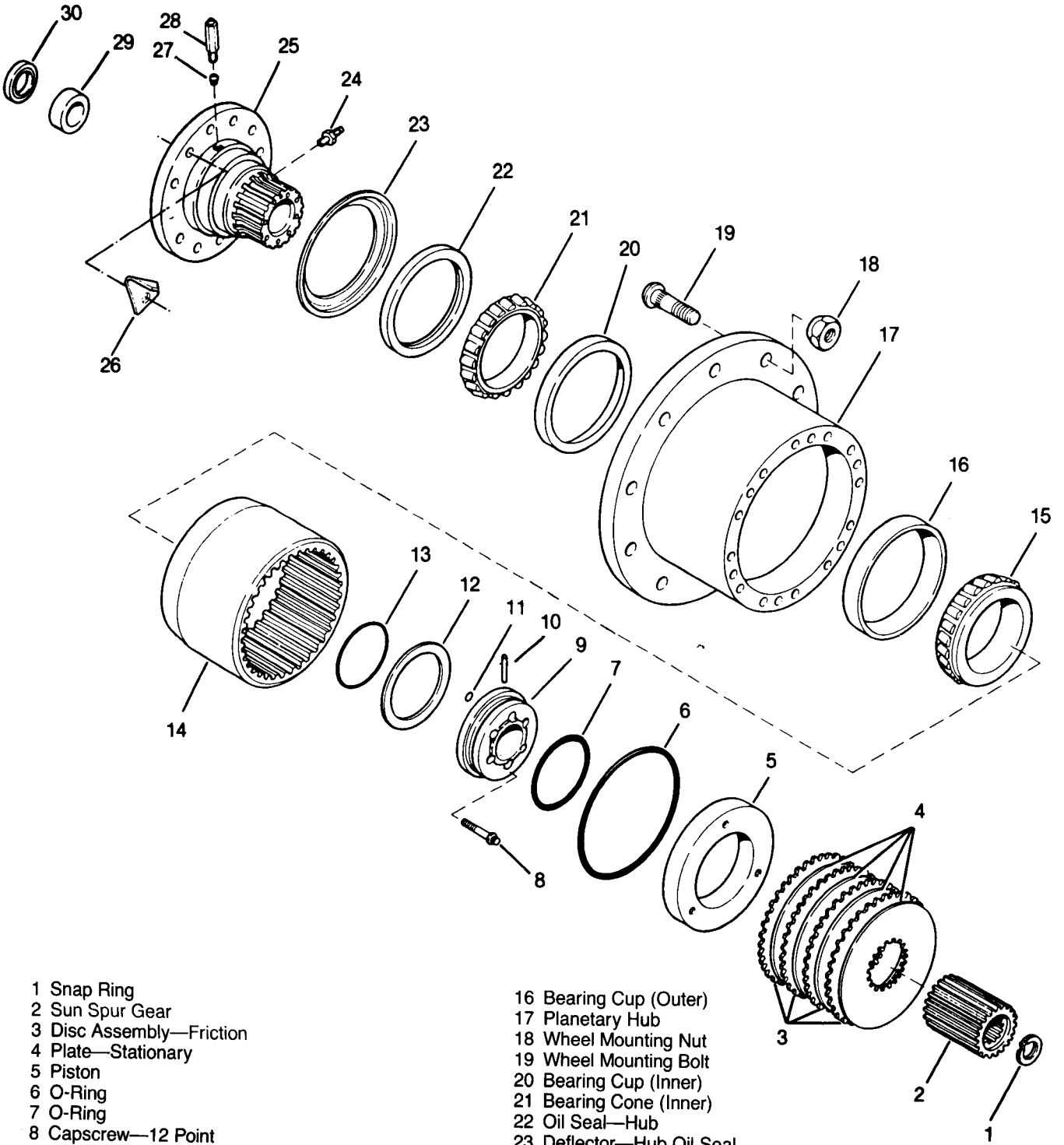

1 Capscrew—Self Locking Flange Mounting
2 Pipe Plug or Vent
3 Recessed Drive Pipe Plug (Magnetic)
4 Planetary Drive Flange
5 Planetary Gear Shaft
6 Roll Pin
7 Drive Flange Washer (Thrust Washer)
8 Flat Spacer (Thrust Washer)
9 Needle Roller Bearing
10 Spacer Ring—Bearing
11 Planetary Spur Gear
12 Plate—Lining Stop (Wheel End Wet Disc Brake Use Only)

# Wheel End 3.65 Reduction



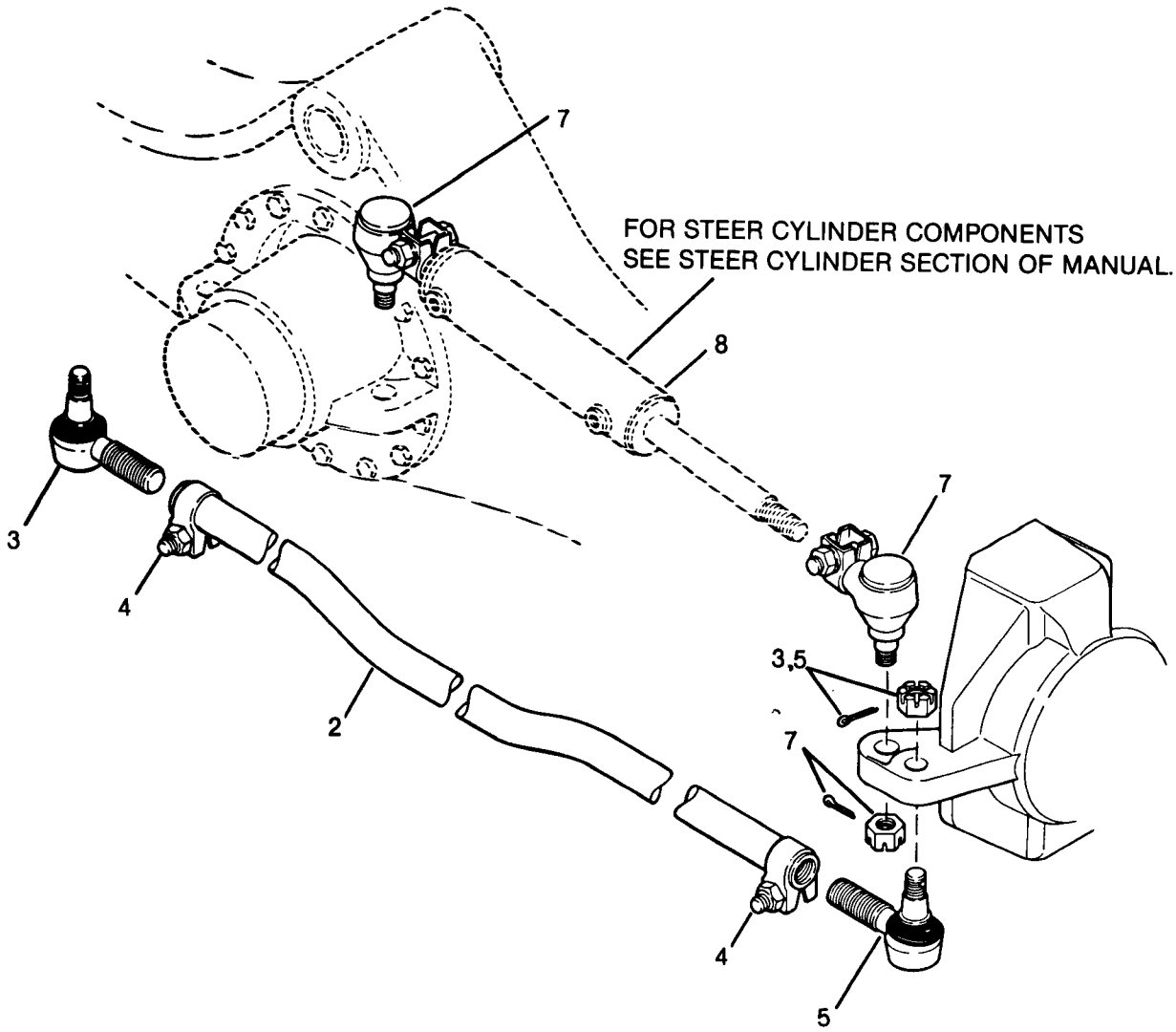

1 Snap Ring
2 Sun Spur Gear
3 Flat Spacer
4 Planetary Ring Gear
5 Roll Pin
6 Lock Nut
7 Bearing Cone (Outer)
8 Bearing Cup (Outer)
9 Wheel Mounting Nut
10 Planetary Hub
11 Wheel Mounting Bolt
12 Bearing Cup (Inner)
13 Hub Slinger (For Axles Without Wheel End Brakes Only)
14 Bearing Cone Inner
15 Oil Seal—Hub
16 Spindle
17 Bushing—Outer Shaft
18 Oil Seal—Outer Shaft

# Wet Disc Brake Wheel End 3.65 Reduction



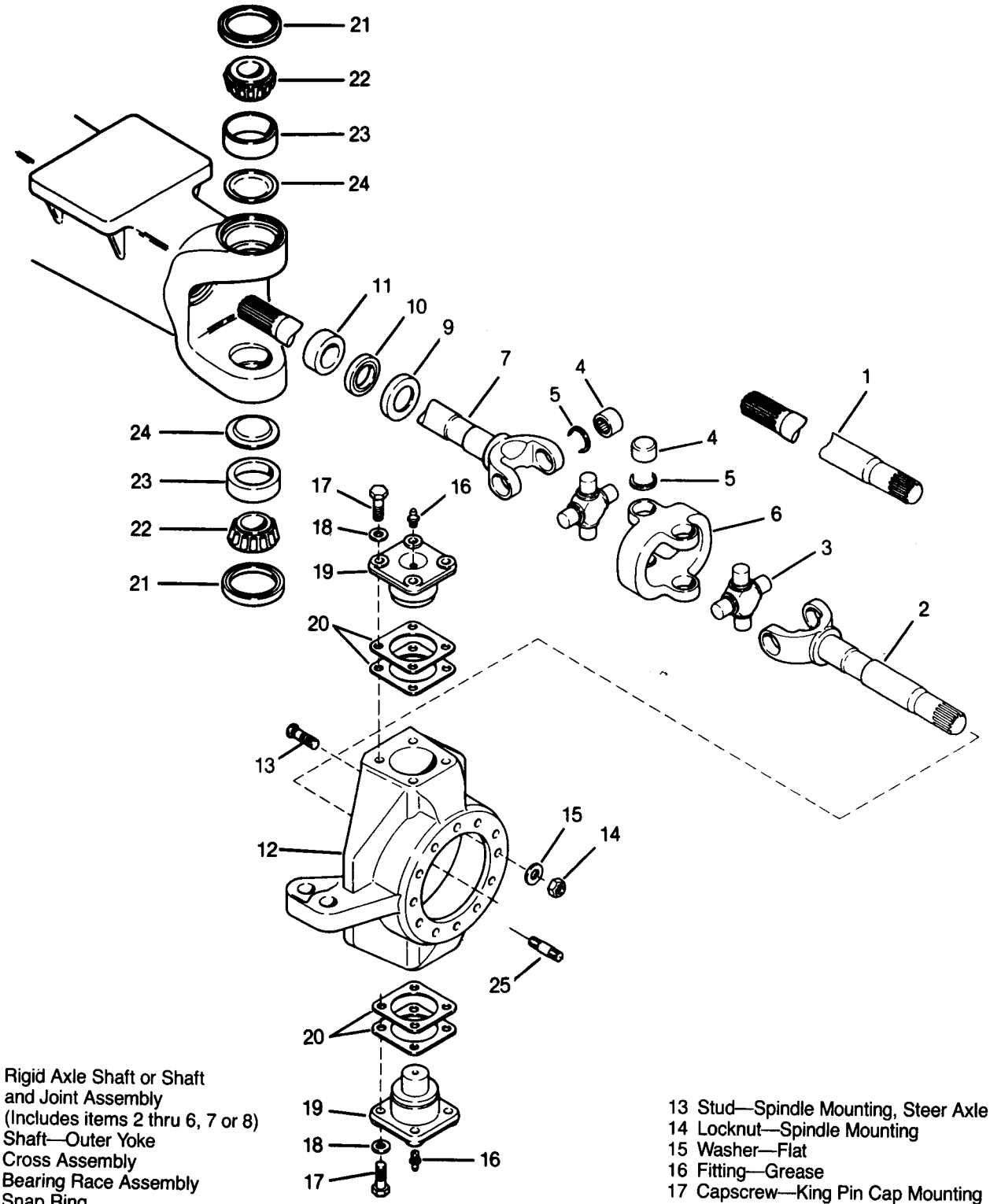

1 Snap Ring
2 Sun Spur Gear
3 Disc Assembly—Friction
4 Plate—Stationary
5 Piston
6 O-Ring
7 O-Ring
8 Capscrew—12 Point
9 Retainer—Bearing Adjusting
10 Tube—Brake Bleeding
11 O-Ring
12 Shim–Adjusting (.010, .011, .012, .013, .014, .015, .020, .030 Thick)
13 O-Ring
14 Planetary Ring Gear
15 Bearing Cone (Outer)
16 Bearing Cup (Outer)
17 Planetary Hub
18 Wheel Mounting Nut
19 Wheel Mounting Bolt
20 Bearing Cup (Inner)
21 Bearing Cone (Inner)
22 Oil Seal—Hub
23 Deflector—Hub Oil Seal
24 Fitting Brake Inlet
25 Spindle
26 Guard—Fitting/Bleeder
27 Seat—Insert
28 Bleeder
29 Bushing—Outer Shaft
30 Oil Seal—Outer Shaft

# Tie Rod & Steering Cylinder Mounting



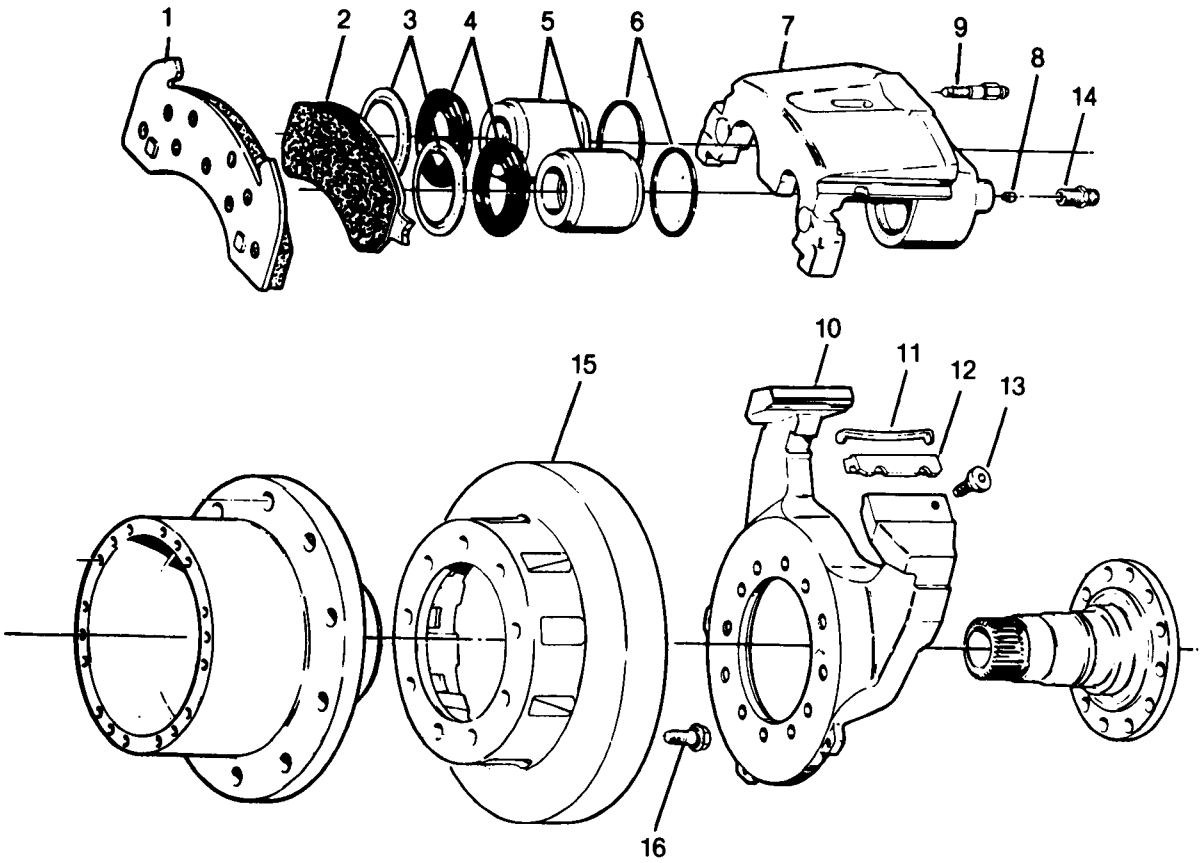

1 Tie Rod Assembly (Items 2 thru 5)
2 Tie Rod
3 Vertical Socket Assembly
4 Clamp Assembly—Tie Rod
5 Vertical Socket Assembly
6 Steer Cylinder/Vertical Socket Assembly (Items 7 and 8)
7 Vertical Socket Assembly
8 Steer Cylinder

# Axle Steering Joints




1 Rigid Axle Shaft or Shaft and Joint Assembly (Includes items 2 thru 6, 7 or 8)
2 Shaft—Outer Yoke
3 Cross Assembly
4 Bearing Race Assembly
5 Snap Ring
6 Center Yoke
7 Shaft—Inner Yoke (Short)
8 Shaft—Inner Yoke (Long)
9 Deflector—Inner Shaft Seals
10 Oil Seal—Inner Shaft
11 Bushing—Inner Shaft
12 Steering Knuckle
13 Stud—Spindle Mounting, Steer Axle
14 Locknut—Spindle Mounting
15 Washer—Flat
16 Fitting—Grease
17 Capscrew—King Pin Cap Mounting
18 Washer-Flat
19 Cap—King Pin
20 Shim—King Pin Bearing Adjusting
21 Seal—King Pin Bearing
22 Bearing Cone—King Pin
23 Bearing Cup—King Pin
24 Retainer—Grease
25 Stud-Spindle Mounting, Rigid Axle

# Wheel End Disc Brake

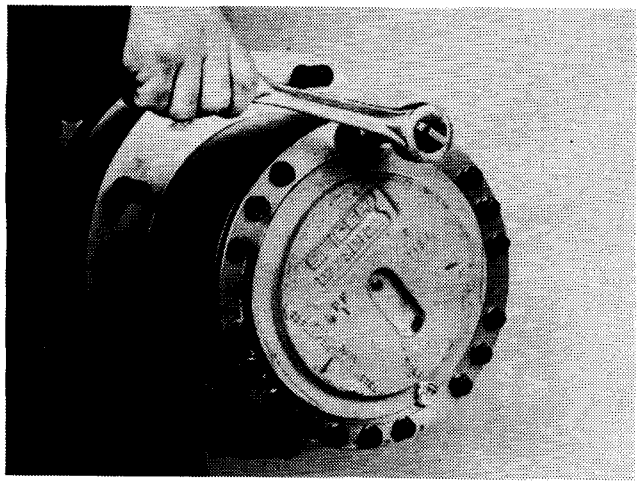



1 Brake Lining (Outer Pad)
2 Brake Lining (Inner Pad)
3 Dust Boot Shield
4 Dust Boot
5 Piston
6 Piston Seal
7 Caliper Housing
8 Bleeder Screw
9 Bleeder Screw
10 Caliper Bracket
11 Compression Spring (Caliper Support)
12 Caliper Support Key
13 Socket Head Screw (Caliper Support)
14 Hydraulic Fluid Fitting
15 Disc (Rotor)
16 Hex Bolt

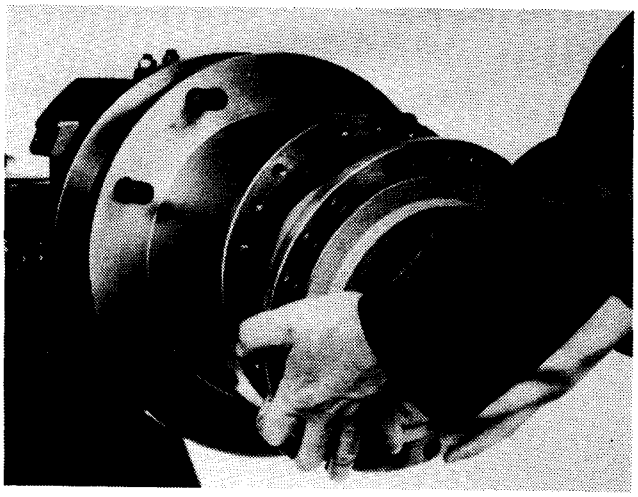
# Removal of Planetary Drive Flange Assembly

**NOTE: The following procedures are the same for both rigid and steer axles.**

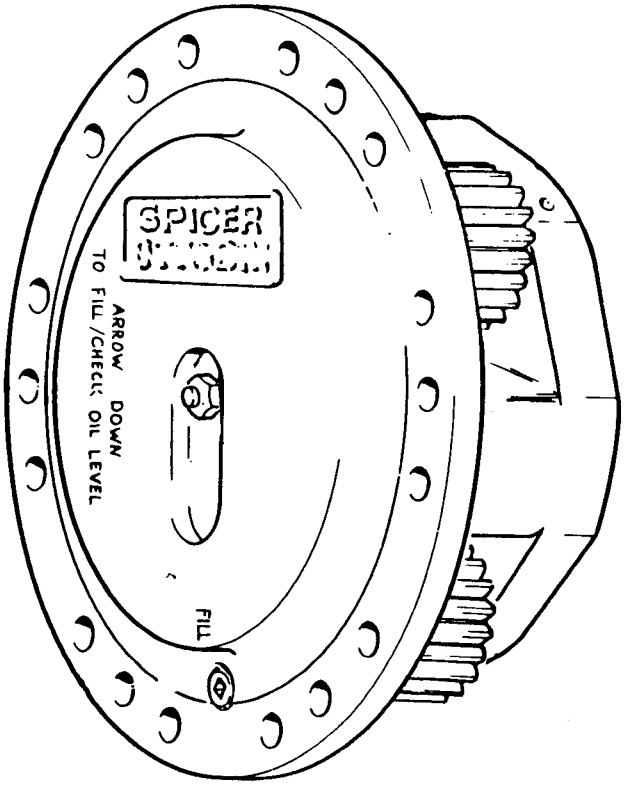
**1.** Rotate hub so drain plug is down. Remove plug and drain oil.



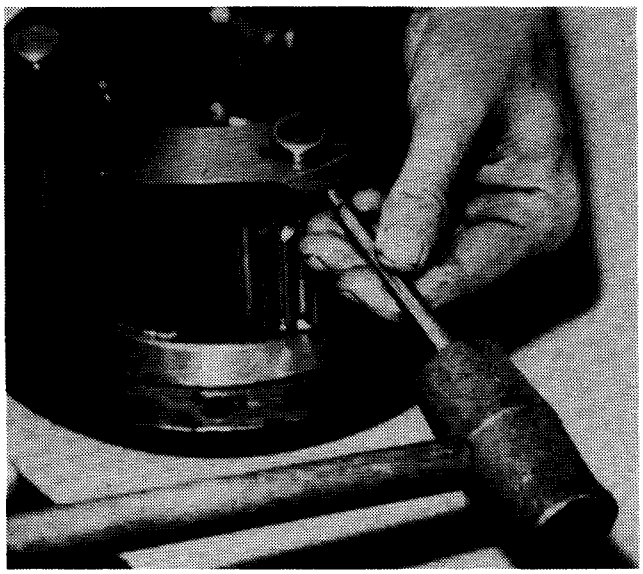
**2.** Remove capscrews from drive flange.



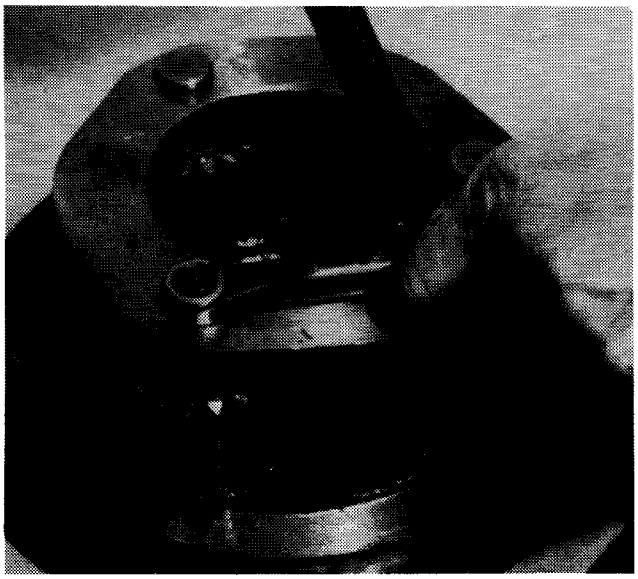
**3.** Tap drive flange with soft faced hammer to break loose from hub. Remove drive flange from hub.



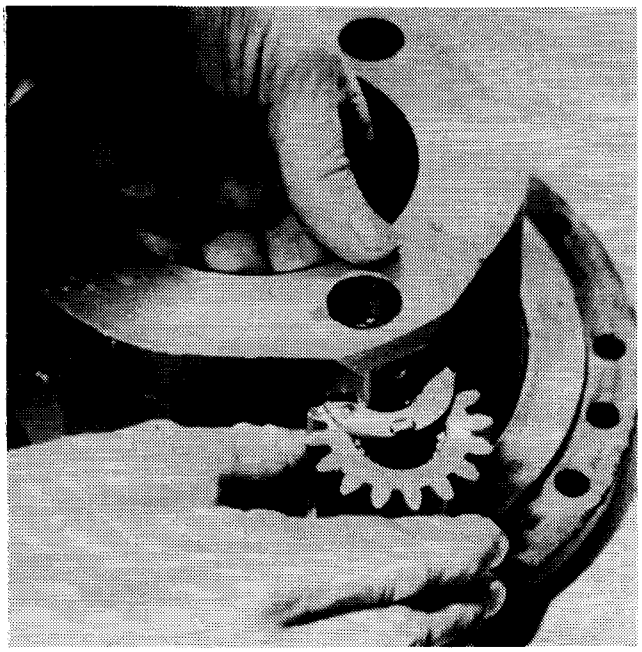
# Disassembly of 3.650 Drive Flange



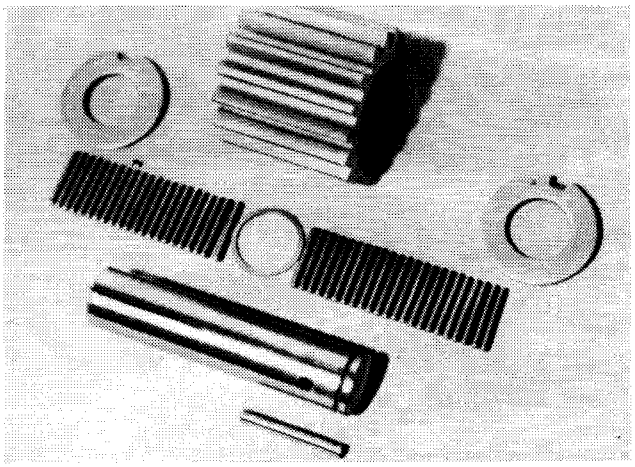
**1.** Using a hammer and punch, drive roll pins out of planet gear shafts. Remove lining stop plate for wheel end wet disc brake if used.



**2.** Insert pry bar into groove in planet gear shaft and remove gear shaft.



**3.** Remove planet gears and thrust washers.



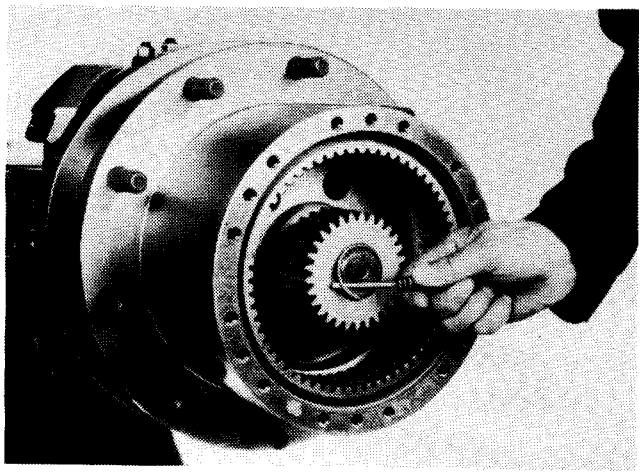
**4.** The planet gears are supported on the planet shafts by two rows of needle bearings divided by a spacer ring and a thrust washer on each end.

**5.** Inspect the thrust button located in the center of the drive flange. If worn, replace.

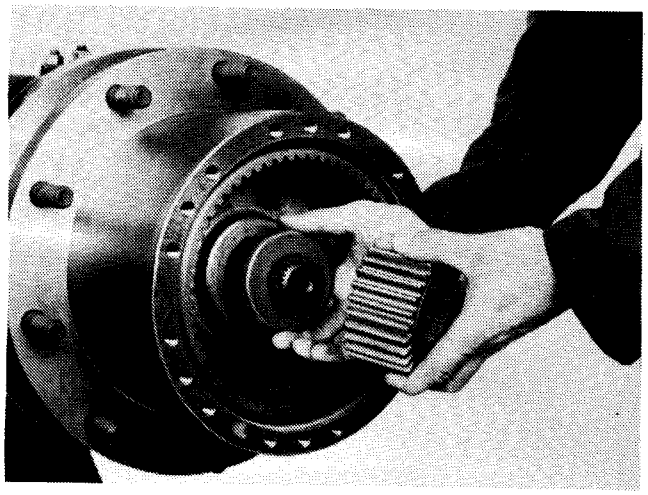
**WARNING: Keep the groove under the thrust button open. It is the access to the air vent if used.**

# Disassembly of Wheel End Hub

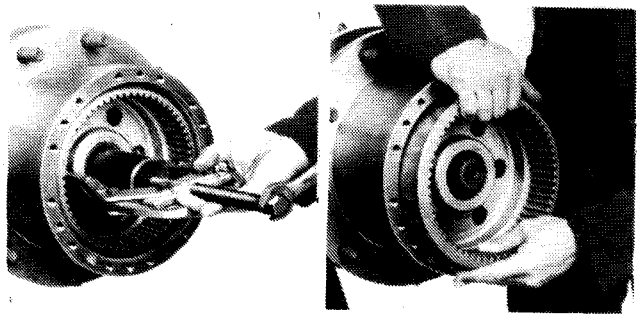
**NOTE: the following procedure is the same for both rigid and steer axles.**



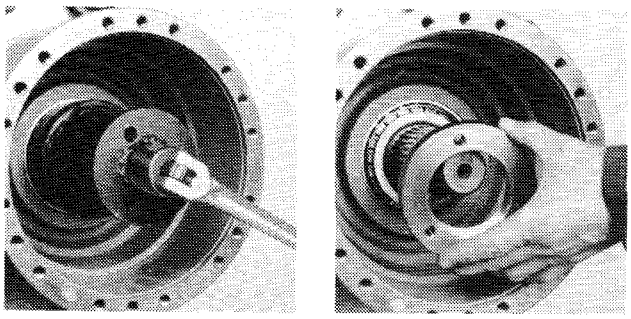
**1.** Insert small screwdriver under end and remove locking ring from end of axle shaft by rotating around shaft.



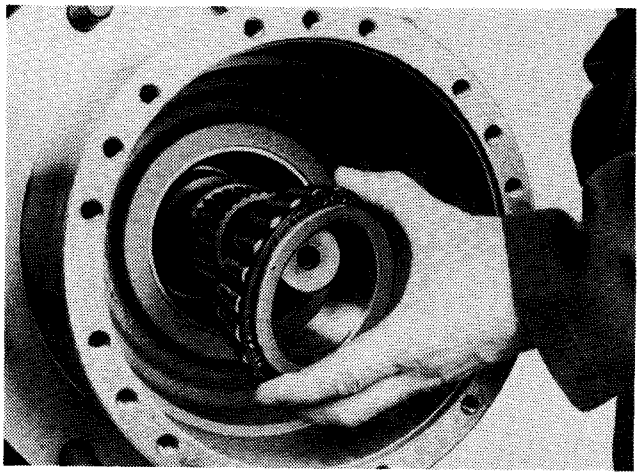
**2.** Remove sun gear and spacer from axle shaft.



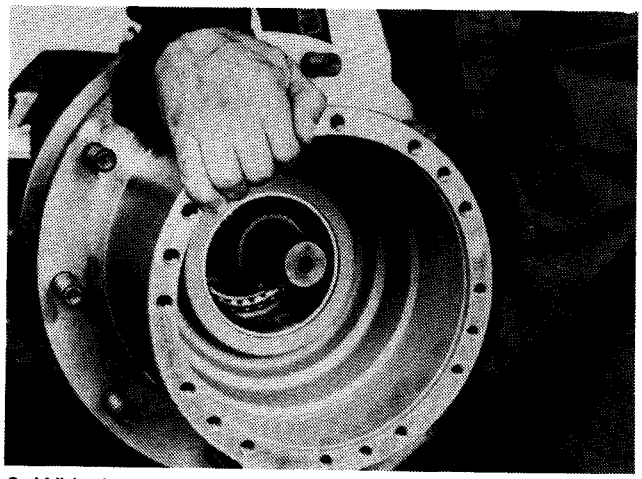
**3.** Remove ring gear. Use a suitable puller if necessary.
**NOTE: DO NOT pilot puller on axle shaft. This may damage the inboard axle seal.**



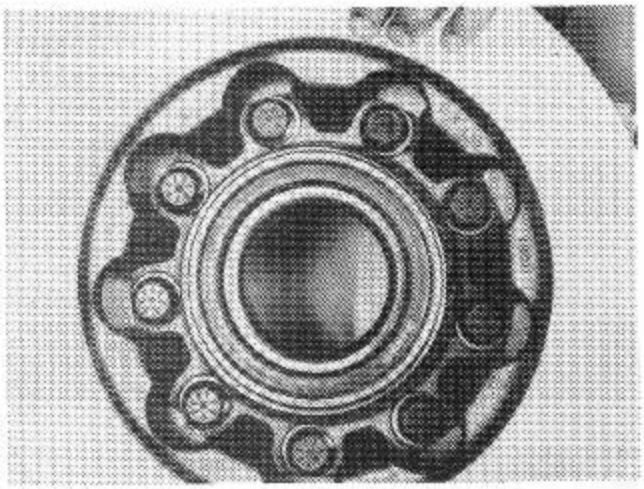
**4.** Remove the wheel bearing adjusting nut using a three pin spanner wrench. (Dana tool #451125)
**NOTE: If axle is equipped with wheel and disc brakes, remove the caliper assembly at this time as outlined in the disc brake section of this manual.**



**5.** Remove the outer wheel bearing while supporting the hub assembly.



**6.** With the hub supported, carefully remove it from the spindle.
**NOTE: A lifting device is recommended for assemblies having a rotor attached.**



7. If the axle is equipped with disc brakes the rotor can be removed at this time.

8. Rest hub on drive flange mounting face and remove the hub seal and inner wheel bearing.

9. Inspect wheel bearings and cups and replace if necessary. Remove cups with a suitable puller.

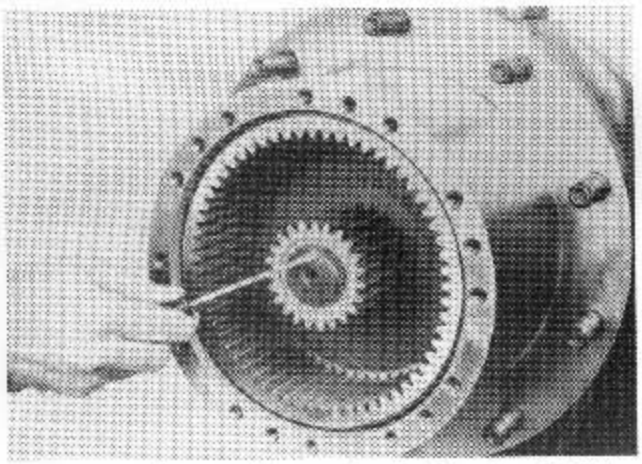
**NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.**

**NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.**

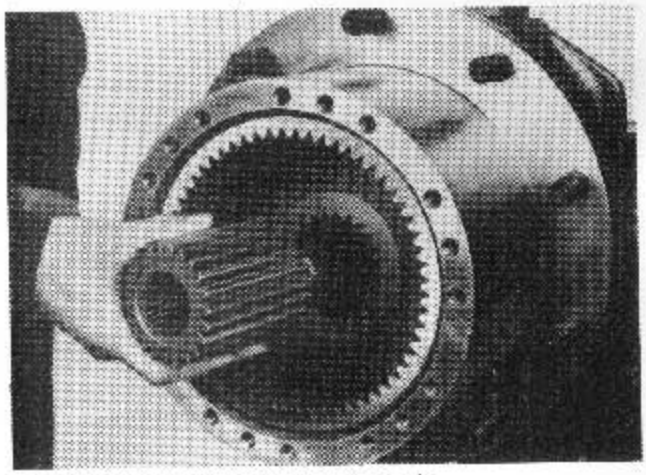
**NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.**

# Disassembly of Wet Disc Brake Wheel End

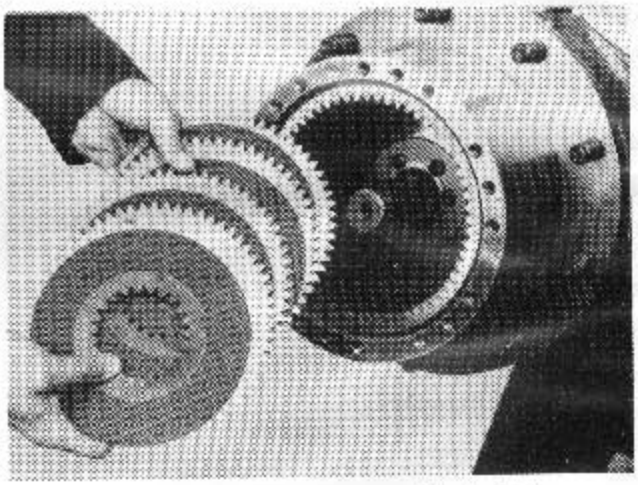
**NOTE: the following procedure is the same for both rigid and steer axles.**



1. Insert small screwdriver under locking ring on axle shaft and remove by rotating around shaft.



2. Remove sun gear from axle shaft.



3. Remove brake plates and discs. Check friction material thickness on discs. If groove depth is less than .005" they must be replaced.

Inspect stationary plates for warpage with a straight edge. If warpage is observed they must be replaced.

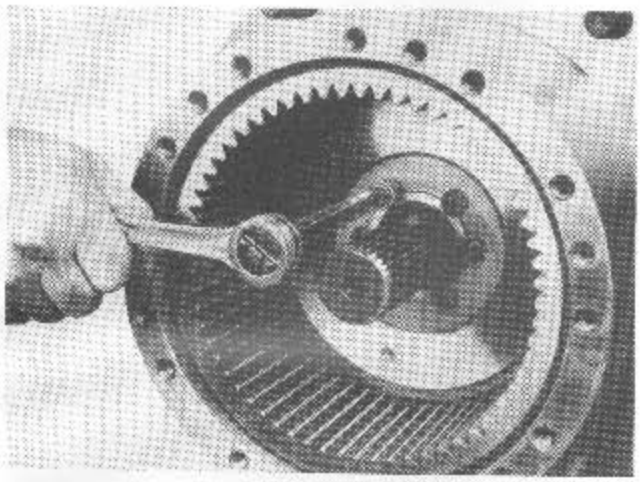
Inspect all plates and discs for heat damage. Replace if necessary.

**NOTE: If any of the above conditions exist it is necessary to replace all discs and plates together as a set. Piston O-rings should also be replaced at this time.**

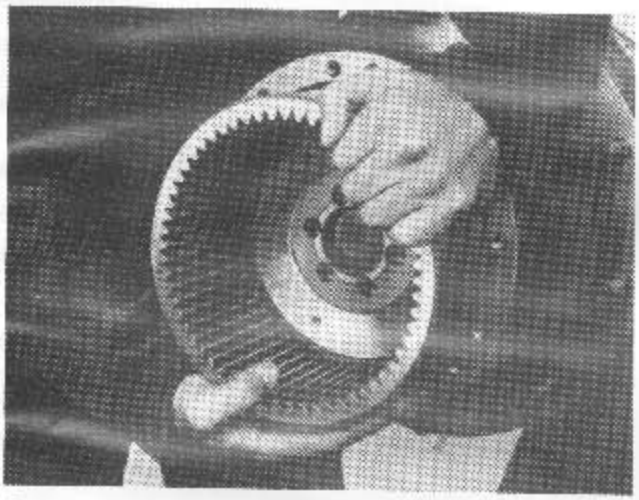
If brake discs and plates are within specifications and brake was operating properly it is not necessary to remove brake piston or replace piston O-rings.

**SPECIAL SERVICE NOTE: If the service procedure being performed does not require replacement of piston or wheel retainer O-rings the hub assembly may be removed using the following steps.**

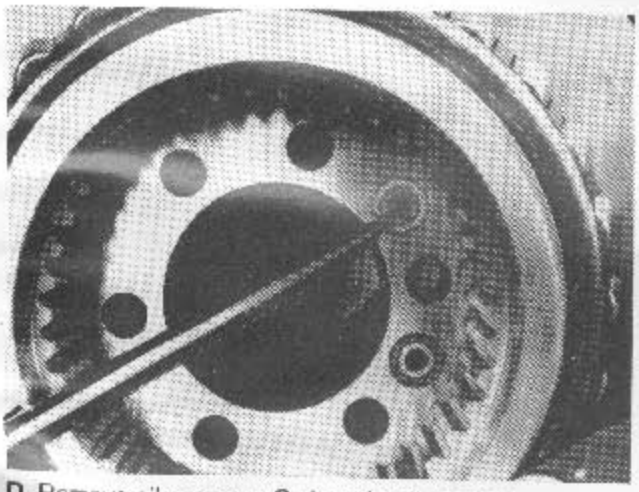
A. Safely support hub assembly with lifting device.



**B.** Remove wheel retainer cap-screws.

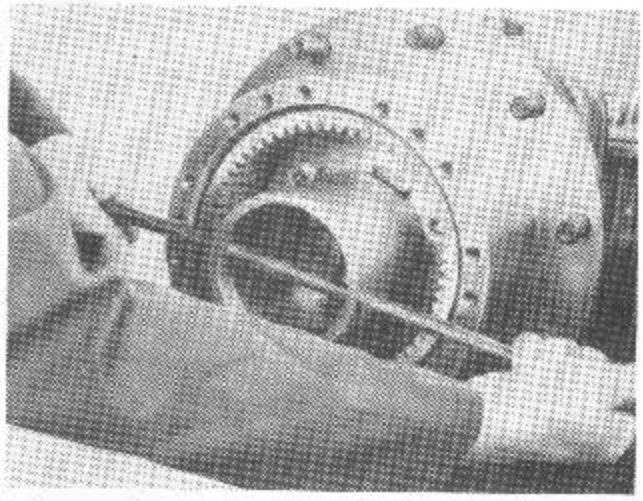


**C.** Remove planetary ring gear, brake piston and wheel retainer as one unit.



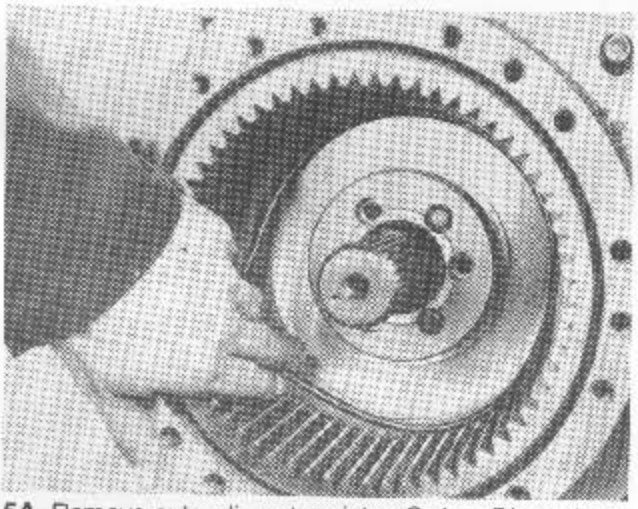
**D.** Remove oil passage O-rings from grooves on inboard face of wheel retainer. If damaged, replace. If ok, save for re-assembly.

**E.** Skip following steps #4 thru #9. Continue disassembly with step #10.

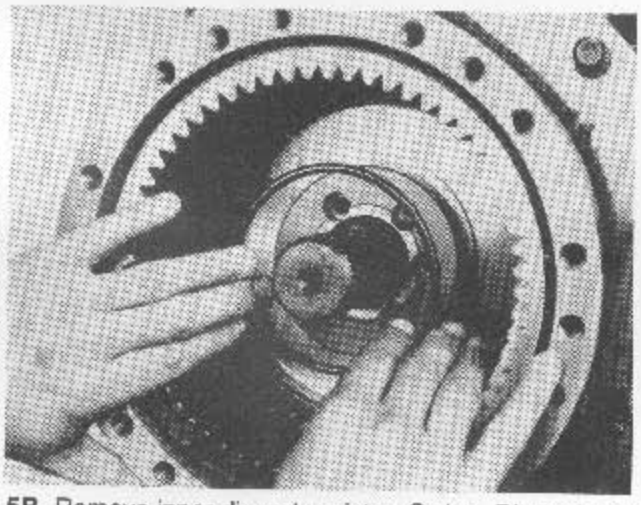


**4.** Remove brake piston from wheel end.

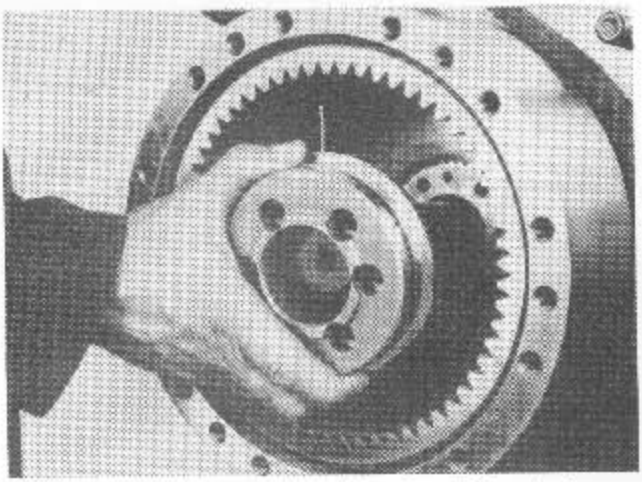
**NOTE: Use of a special piston remover/installer tool, (Dana tool #451164), is recommended to prevent damage to the piston.**



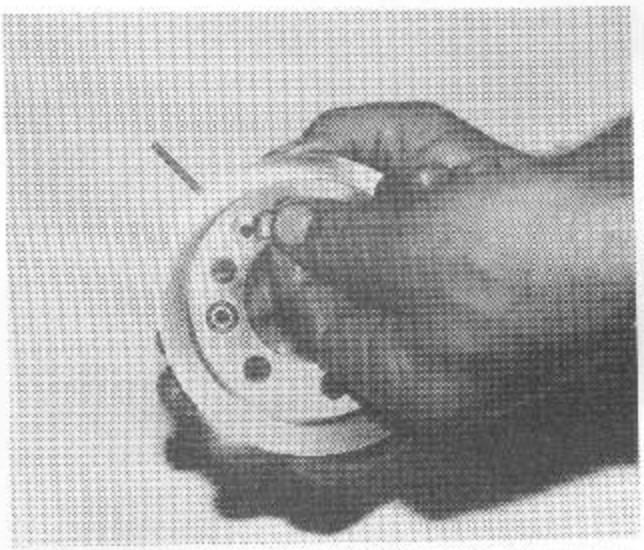
**5A.** Remove outer diameter piston O-ring. Discard and replace with new.



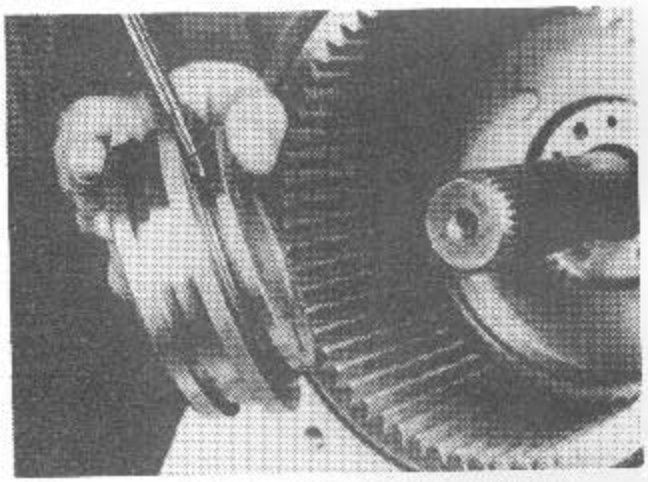
**5B.** Remove inner diameter piston O-ring. Discard and replace with new.



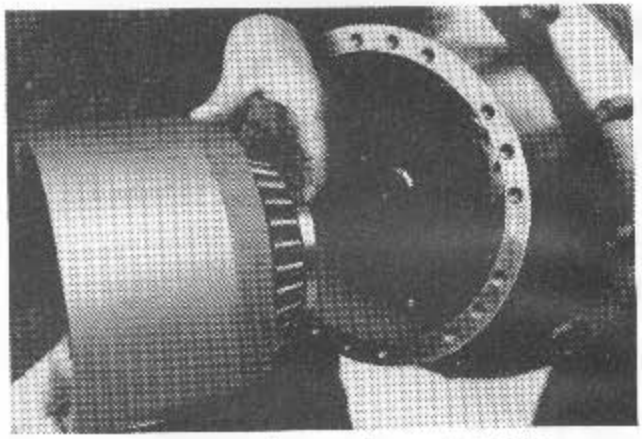
**6.** Safely support hub assembly with a lifting device. Remove wheel retainer capscrews. Remove wheel retainer and preload shims. Wire shims to retainer to facilitate re-assembly.



**7.** Remove oil passage O-rings from groove on inboard face of wheel retainer. If damaged, replace. If ok, save for re-assembly.

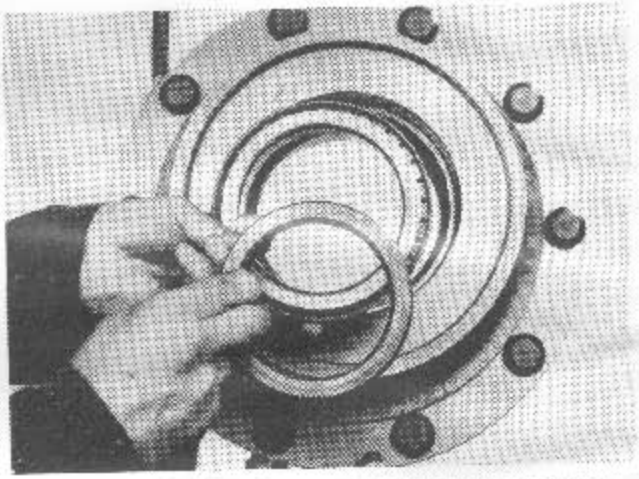


**8.** Remove and inspect outer diameter O-ring on inboard side of wheel retainer. Replace if necessary.



**9.** Remove planetary ring gear from wheel end. Inspect outboard wheel bearing. Replace if necessary.

**10.** With hub supported, carefully remove it from the spindle.



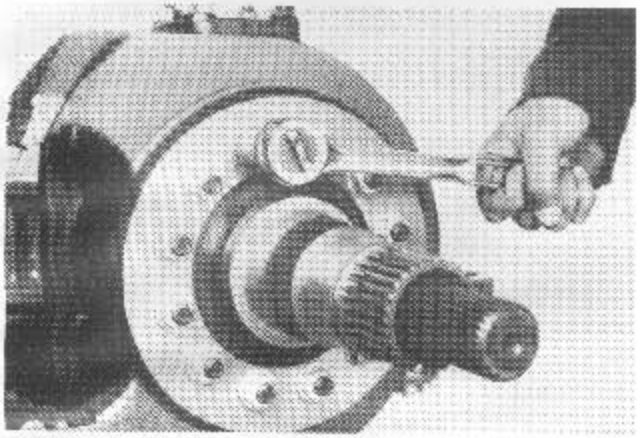
**11.** Inspect wheel bearings, cups and seal. Replace if necessary.

**NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.**

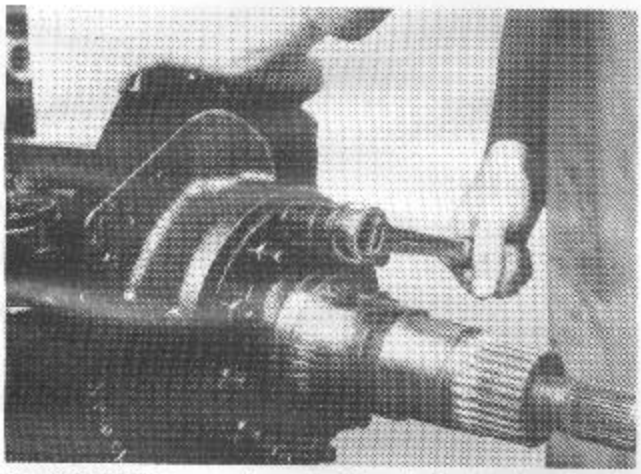
**NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.**

**NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.**

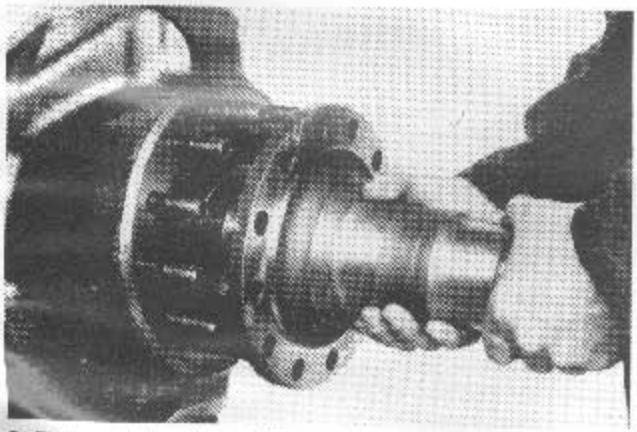
# Removal and Disassembly of Spindle and Axle Shaft



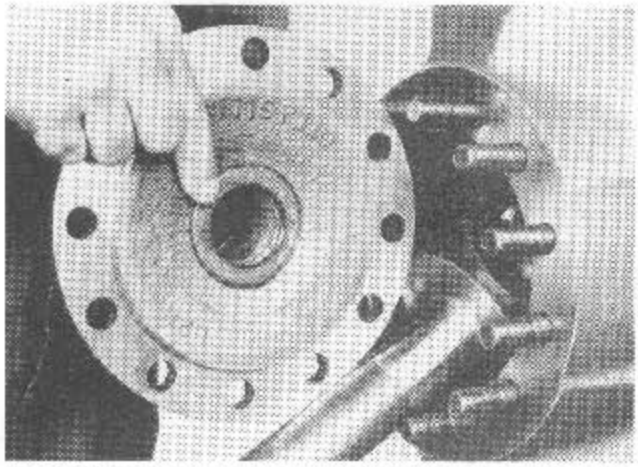
**1A.** Remove spindle mounting nuts and flat washers. On planetary equipped with disc brake, the caliper mounting bracket can be removed when the spindle mounting nuts are removed.



**1B.** On planetary equipped with wet disc brake wheel ends remove brake inlet fitting and bleeder screw. Remove spindle mounting nuts, washers, and (if used) the fitting/bleeder guards.



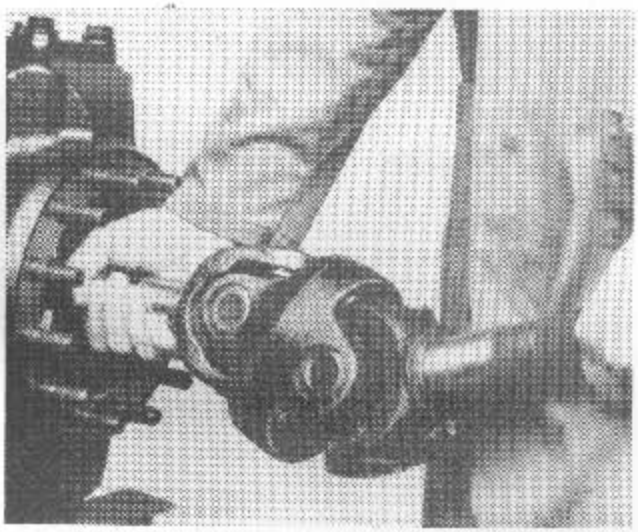
**2.** Tap spindle with soft faced hammer to loosen from steering knuckle or housing flange. Remove spindle.



**3.** The spindle in many applications, contains an outer shaft oil seal and bronze bushing in the spindle bore. These should be replaced if necessary.

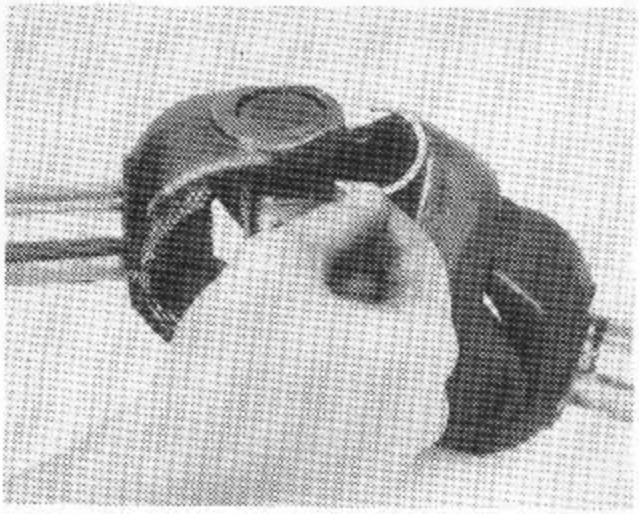
**NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.**

**NOTE: Inspect the spindle mounting studs in steer knuckle or axle housing (rigid axle) for damage and replace if necessary.**

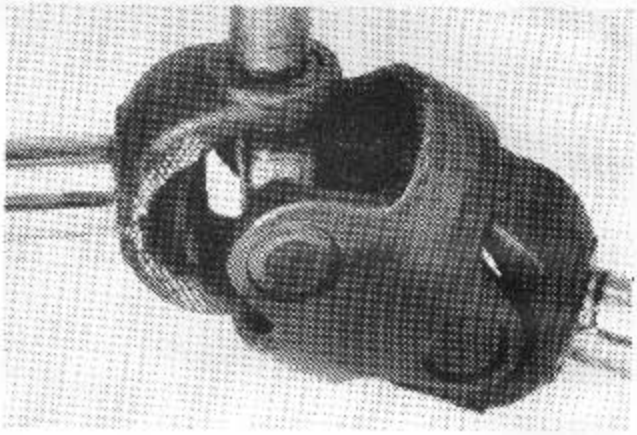


**4.** To remove axle shaft assembly on the steering axle, hold shaft level and pull straight out to avoid damaging inner shaft oil seal.

**NOTE: To remove axle shaft on rigid axles, pull shaft straight out.**



**5.** To separate inner and outer axle shafts, on steering axle, first remove all bearing cap retaining rings.

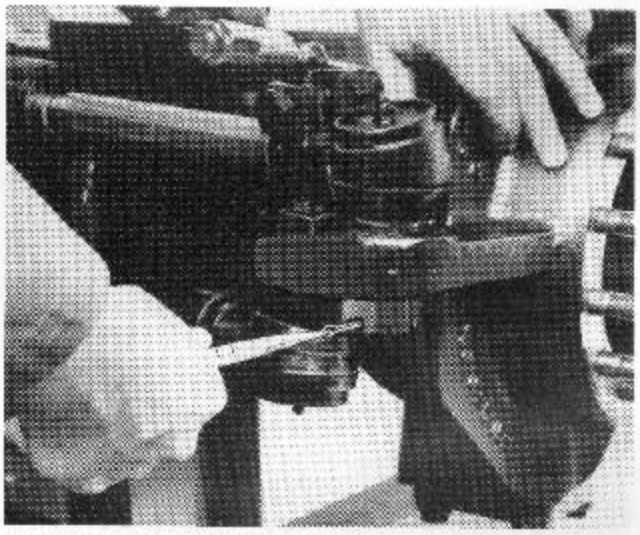


**6.** Next, press out u-joint bearing caps and remove cross.

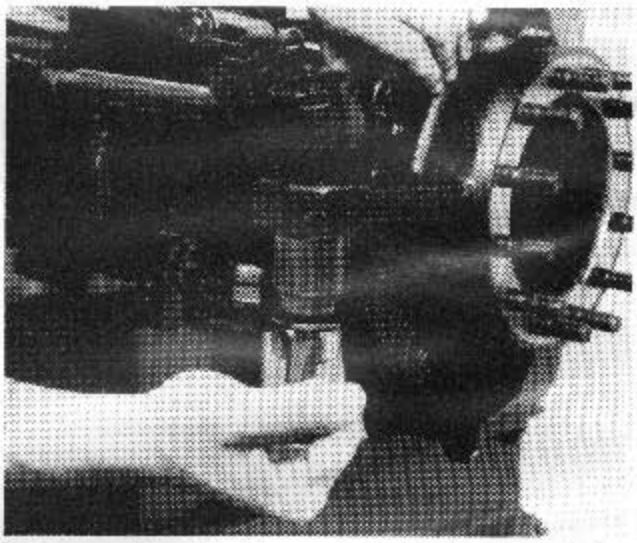
**7.** Inspect u-joint bearing caps and cross and replace if necessary.

# Removal of Steering Cylinder and Tie Rod Assemblies

**1.** Disconnect the hydraulic hoses to the steering cylinders. Plug the open fittings.



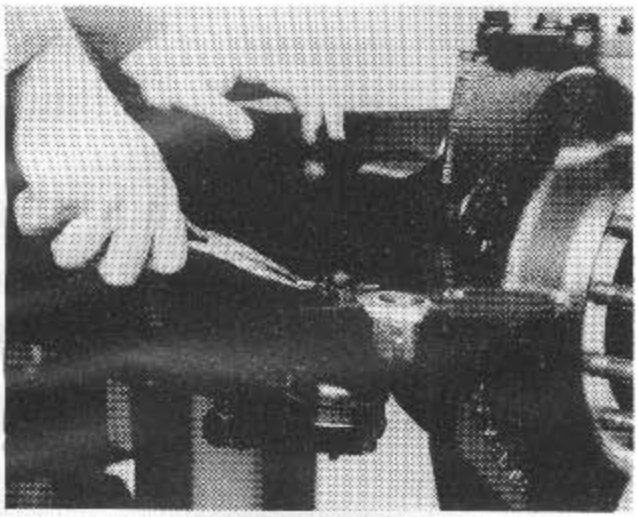
**2.** Remove the cotter pins from the steering cylinder socket assemblies.



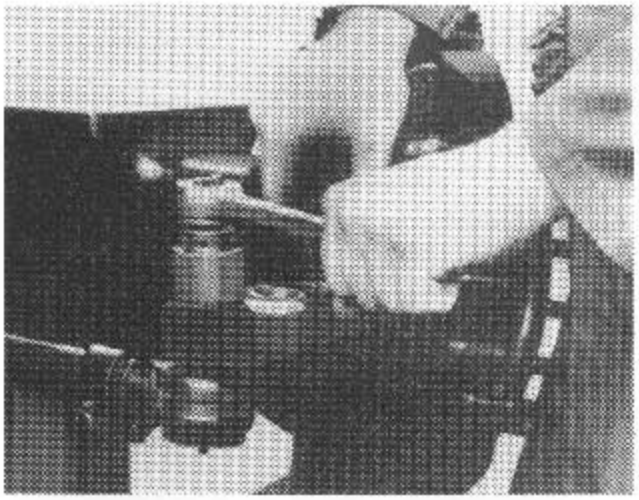
**3.** Remove the slotted hex nuts that fasten the cylinder socket assemblies to the anchor points on the carrier and steering knuckle. Tap the threaded end of socket assembly lightly with a soft faced hammer to unseat them. Carefully remove steering cylinder assemblies. Mark cylinder assemblies "rightside" "leftside" to aid reassembly.

**CAUTION: Protect chrome finish on rod at all times. Damage to surface of rod can cause premature seal failure.**

**NOTE: Refer to steering cylinder disassembly and assembly section of manual if further disassembly of cylinder assembly is required.**



**4.** Remove the cotter pins from the tie rod socket assemblies.



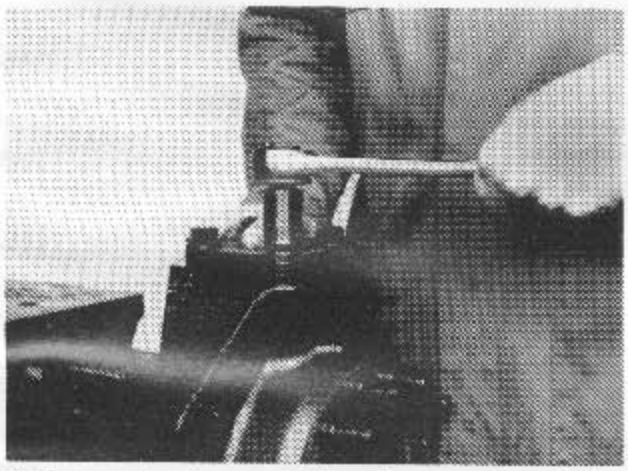
**5.** Remove the slotted hex nuts that fasten the tie rod socket assemblies to the steering knuckle anchor points. Tap the threaded end of the socket assembly lightly with a soft faced hammer to unseat them. Remove the tie rod assembly. Match marked tie rod end and steering knuckle to aid in reassembly.

**NOTE: Do not alter the tie rod adjustment unless further repair is required to tie rod components.**

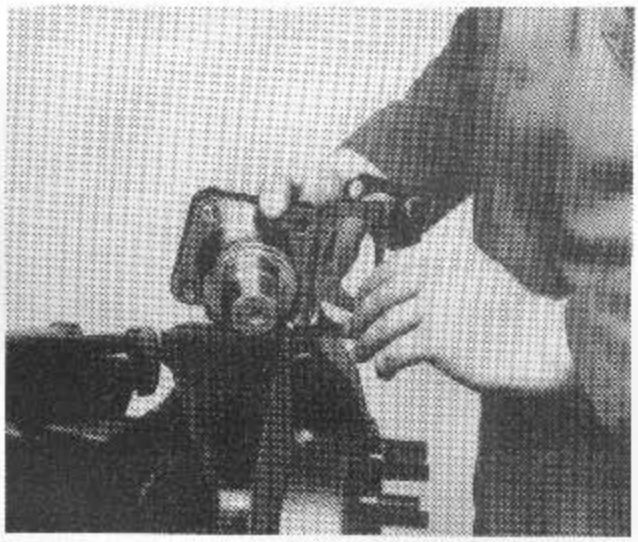
**If repair is required or tie rod adjustment is inadvertently changed it will require the resetting of this adjustment for proper "toe-in".**

# Disassembly of Steering Knuckles

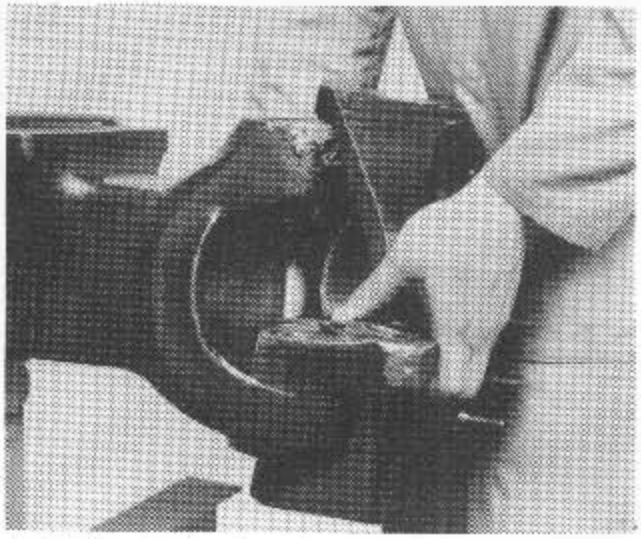
**1.** Remove the wheel end components, spindle, axle shaft, steer cylinder, and tie rod prior to disassembly of steer knuckle components.



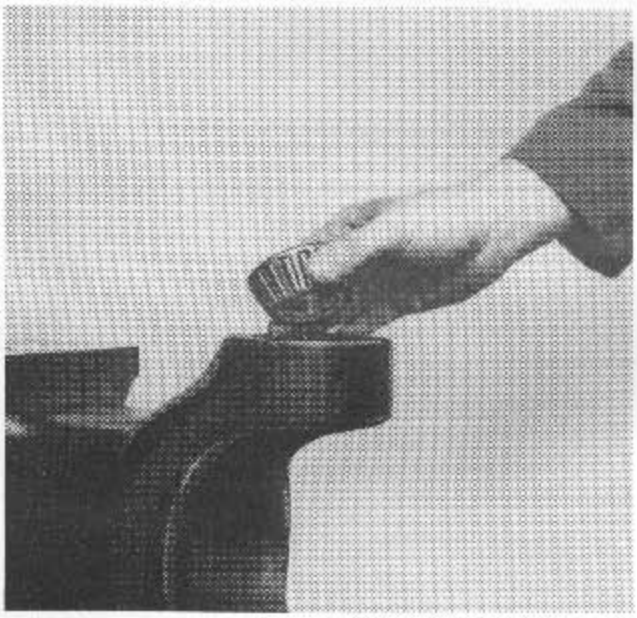
**2.** Remove bearing cap bolts and washers from both upper and lower bearing caps.



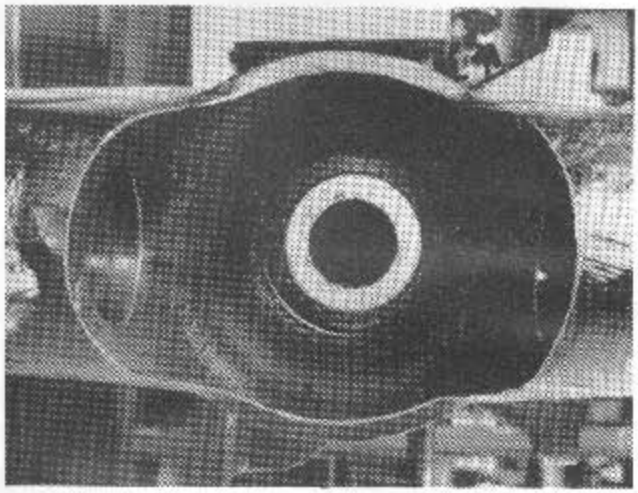
**3.** Remove both upper and lower bearing caps and shims. Wire shims together with their respective bearing caps to facilitate reassembly.



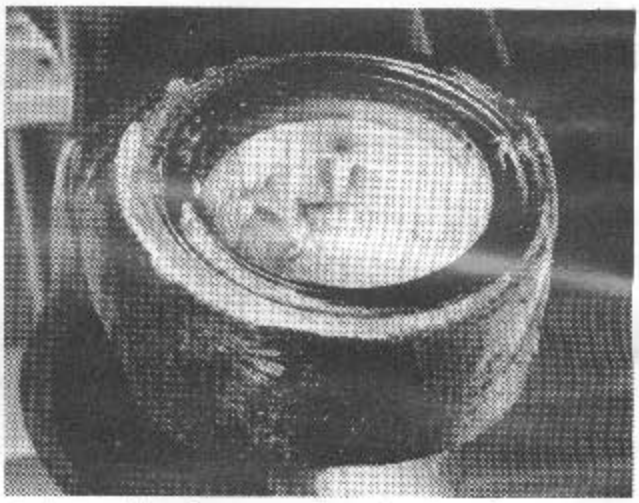
**4.** Tip the steering knuckle slightly and remove from housing yoke.



**5.** Inspect bearing cone and replace if necessary.



**6.** Inspect axle seal and bushing. If replacement is necessary, remove with suitable puller.



**7.** Inspect bearing cup and seal; replace if necessary.

**NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.**

**NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.**

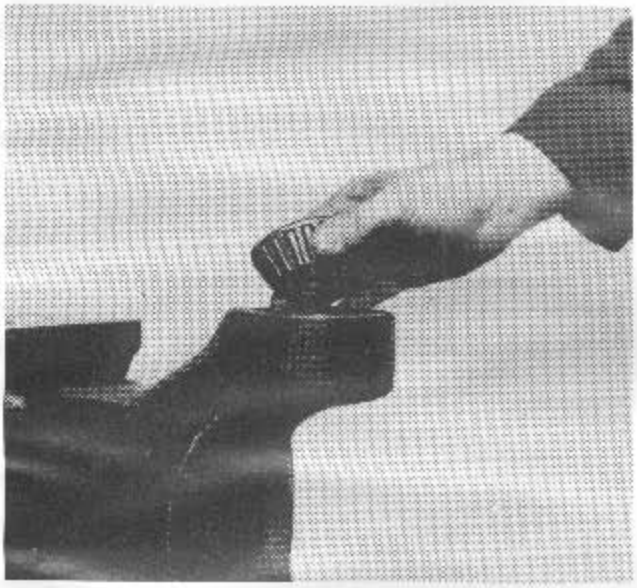
**NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.**

# Assembly of Steering Knuckles

**1.** Install inner axle shaft bushing and seal into housing yoke bore.

**2.** Apply #2 Permatex to grease retainers. Install grease retainers and king pin bearing cups into housing yoke.

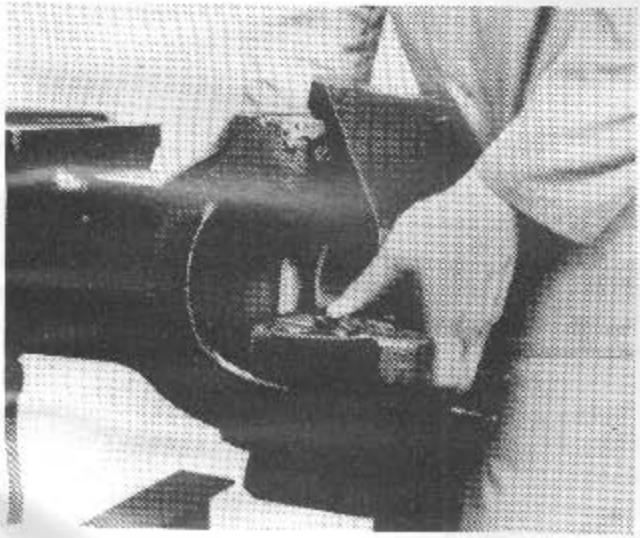
**NOTE: The grease retainer must be installed with its "dished" portion positioned toward the inside of the axle housing yoke. Installed opposite, the retainer would restrict the bearing cup from seating properly in the housing bore and clamp against the bearing cone cage restricting movement.**



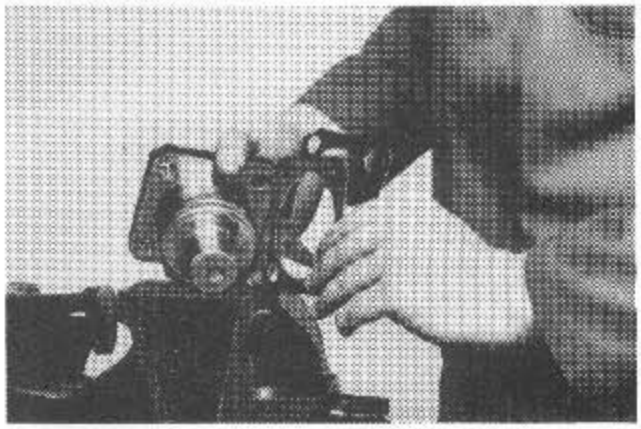
**3.** Install pregreased king pin bearing cones into bearing cups.

**4.** Install king pin seals.

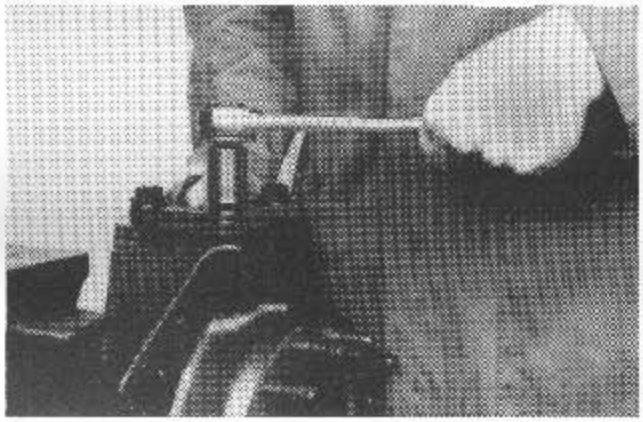
**NOTE: Inspect the spindle mounting studs in steer knuckle for damage and replace if necessary.**



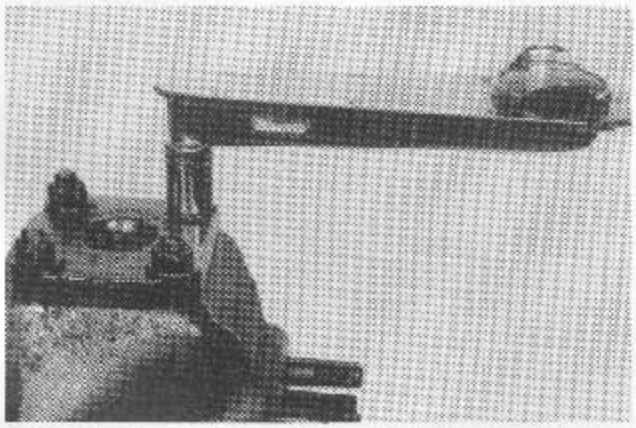
**5.** Place knuckle in position over housing yoke.



**6.** Place original shims in position on knuckle or king pin cap.



**7.** Install bearing caps, washers, and bolts. Torque to 80-90 ft. lbs.

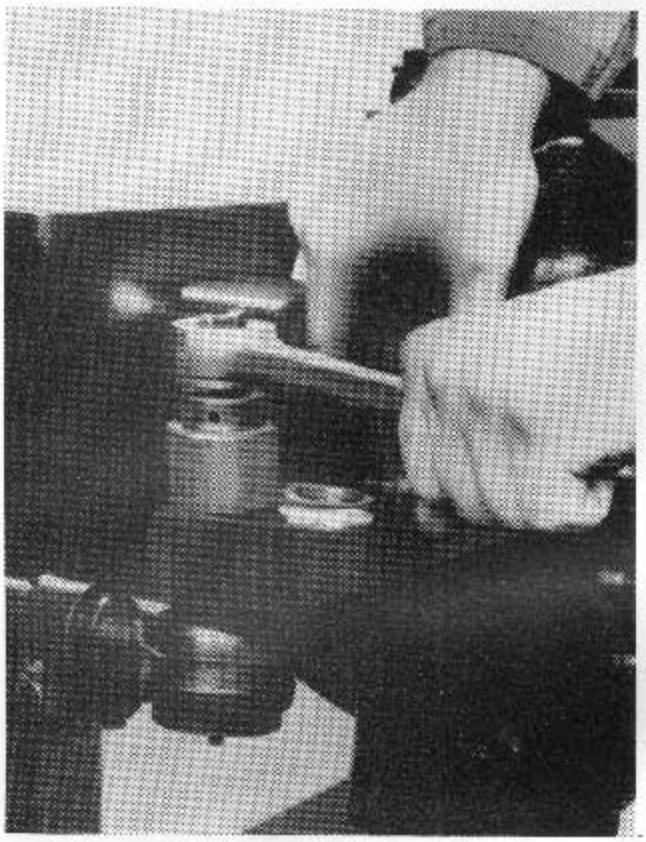


**8.** To check king pin bearing preload, turn knuckle all the way to the right. Place torque wrench on one of the king pin cap bolts. Rotate knuckle through complete turn angle. Torque reading should be 8-15 ft. lbs. Measurement is made less hub components, axle shaft, tie rod, and steering cylinder.

To increase preload, remove shims from top or bottom king pin bearing. To decrease preload, add shims to top or bottom king pin bearing. Keep top and bottom shim packs as equal as possible.

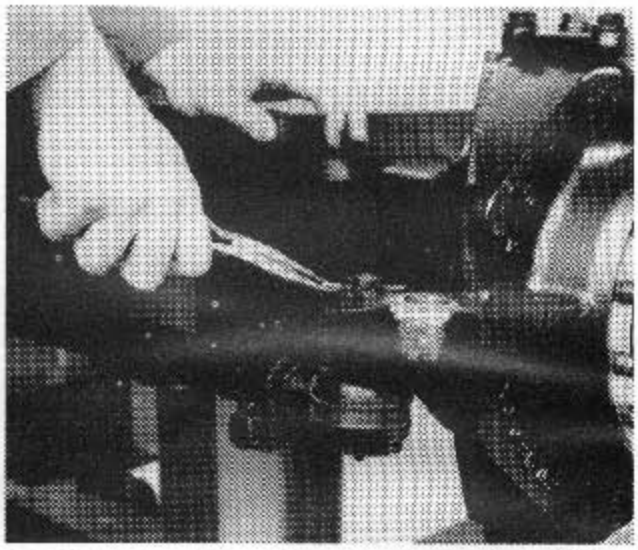
# Installation of Tie Rod and Steering Cylinder Assemblies

**NOTE: The carrier assembly and steering knuckles are to be installed prior to proceeding with the installation of these components.**



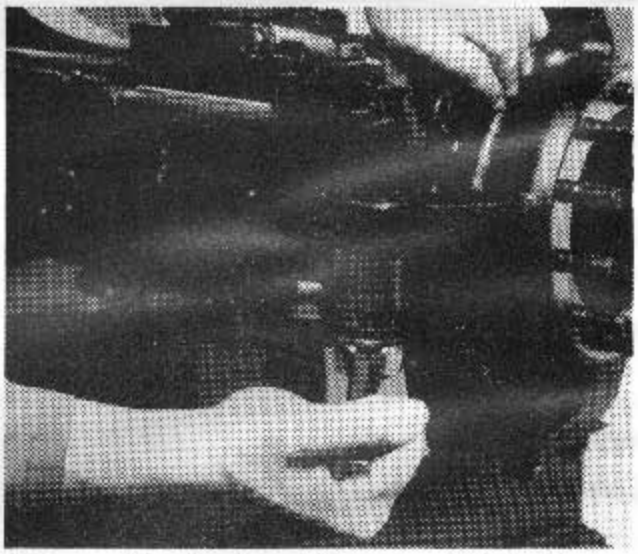
1. Connect the tie rod assembly to the steering knuckle anchor points. Torque the socket assembly slotted nuts to 140 ft. lbs. minimum. Check to make sure the position of the offset in the tie rod clears the carrier assembly in full turn posiition (both directions). The tie rod assembly should be switched around end for end if full turn clearance is not found and the slotted nuts retorqued.

**NOTE: If the tie rod adjustment (toe-in) has been changed it will be necessary to readjust it. Loosen tie rod clamp assembly bolt and nut. Position the steering knuckles in a straight ahead (0° turn angle) position. Position measuring bars on the spindle mounting face of the steering knuckles. Measure across them on the carrier side and cover side of the axle housing and compare readings. Remove tie rod, adjust the overall socket to socket length (in or out), reinstall the tie rod assembly and remeasure. Repeat this procedure until equal measurements are attained (zero toe-in) or the toe-in specified by the vehicle manufacturer is attained. Retorque slotted nuts to 140 ft. lbs. minimum. Torque the tie rod clamp assembly bolts and nuts to 60-70 ft. lbs.**



2. Install cotter pins and bend the pin over to lock it in place.

**NOTE: If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until the cotter pin can be installed.**



3. Connect the steering cylinder assemblies to the carrier and steer knuckle anchor points. Torque the socket assembly slotted nuts to 140 ft. lbs. minimum.

**NOTE: If repairs were made to or the retracted length of the steering cylinder assembly was inadvertently changed the retracted length of the assembly will require resetting as follows:**

**A. Remove slotted nuts from and remove rod end socket assemblies from steer knuckles. Push in or use air pressure retract the rod into the barrel assembly of both cylinders.**

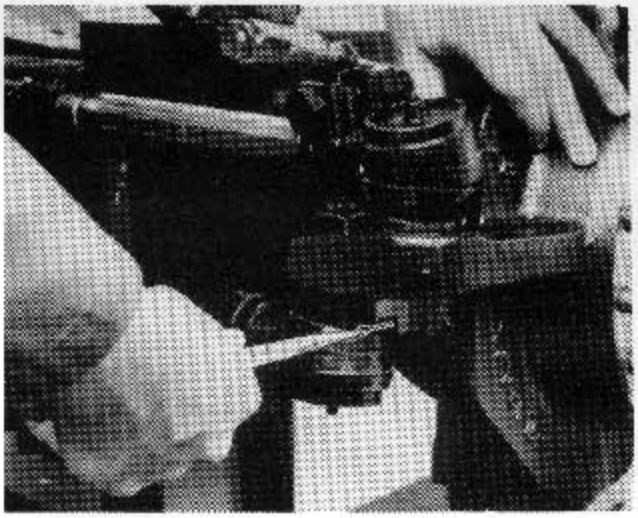
**B. Turn steering knuckle to full inside turn position on either the right or left hand side.**

**C. Adjust the socket assembly position in or out on the rod end and also barrell end, if required, such that its retracted length matches the length required for assembly to its steer knuckle.**

**CAUTION: Protect the rod from damage while adjusting socket position.**

**Reconnect the cylinder assembly as noted in step #3. Torque the cylinder socket clamp bolts and nuts to 60-70 ft. lbs.**

**D. Turn the other steer knuckle to its full inside turn position. Adjust its steer cylinder retracted length as noted in step C.**



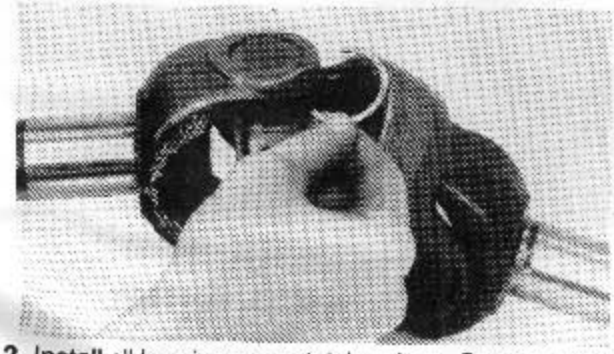
**4.** Install cotter pins and bend the pin over to lock it in place.

**NOTE: If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until the cotter pin can be installed.**

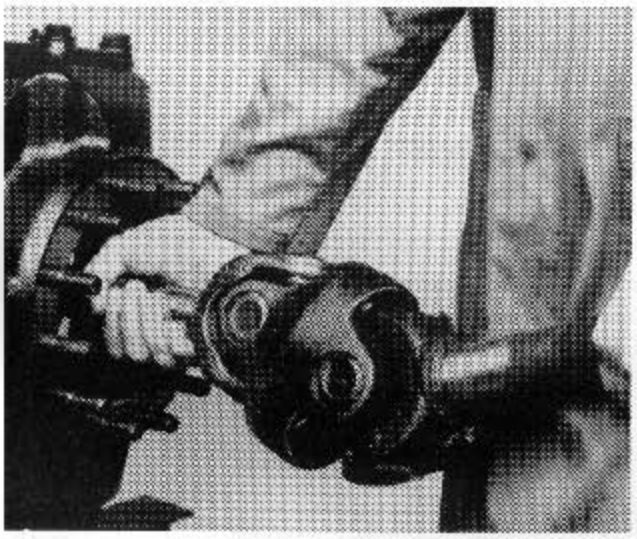
**5.** Connect the hydraulic hoses to the steering cylinders and "bleed" the system.

# Assembly and Installation of Axle Shaft and Spindle

**1.** To assemble inner and outer axle shafts, insert u-joint cross into yoke of outer shaft and press in bearing caps. Repeat with center yoke and inner shaft.

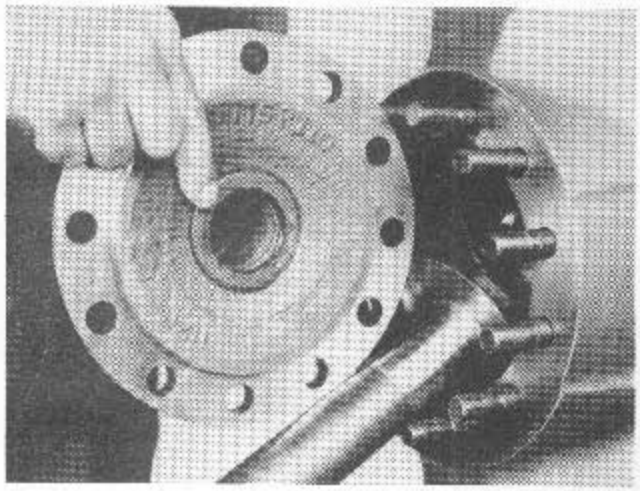


**2.** Install all bearing cap retaining rings. Grease u-joint.

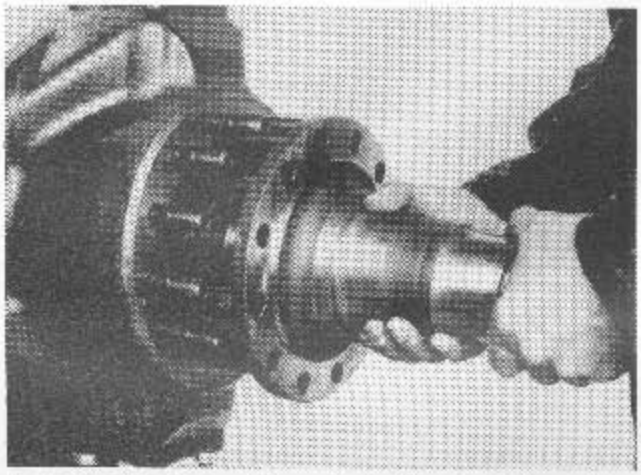


**3.** Support shaft assembly and slide into axle housing and engage in differential side gear. Care should be taken when installing shaft as not to damage axle shaft oil seal.

**NOTE: On rigid axles, install the axle shaft into the axle housing until it engages the differential side gear.**



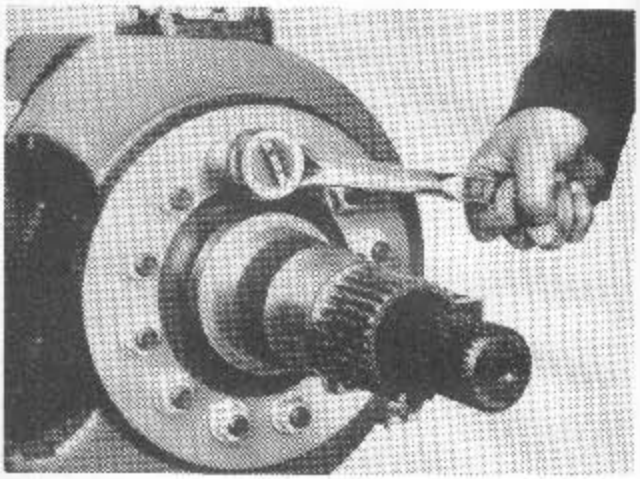
**4.** Install new bushing and seal in spindle if required.



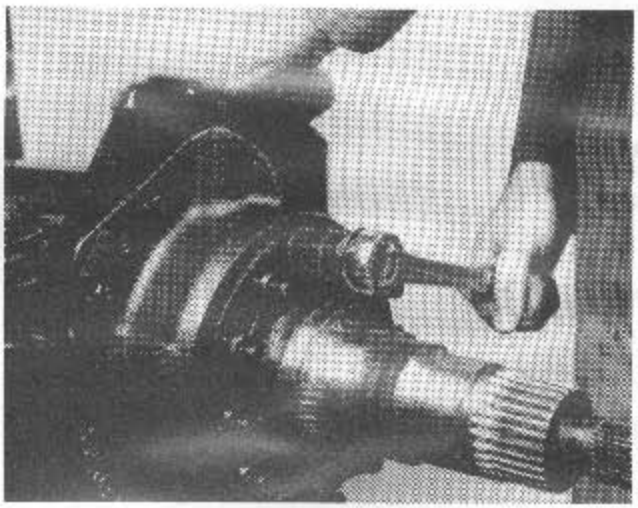
**5.** Install spindle over the axle shaft and onto knuckle or housing flange studs.

**NOTE: Care should be taken when sliding the spindle over the end of the axle shaft so as not to damage the outer shaft seal and bushing if so equipped.**

**NOTE: On planetary equipped with wet disc brake wheel ends the spindle is to be assembled to the mounting studs with the brake bleeder port positioned at the top (12 o'clock position) and the brake inlet port on the carrier side of the axle housing.**



**6A.** On planetary equipped with disc brake, install the caliper mounting braket on the mounting studs. The bracket is to be positioned such that when the brake caliper assembly is installed it will be on the cover side of the axle housing (3 or 9 o'clock position). Also, the support key and spring leg of the bracket is to be on the top side. Install the mounting washers and nuts and torque to 80-100 ft. lbs.



**6B.** On planetary equipped with wet disc brake wheel ends proceed as follows:

1) Install the fitting/bleeder guards, if used, on the mounting studs. Guards are not to be installed in the area between the bleeder and inlet ports but just outside of that area and such that they will not interfere with the installation of the bleeder screw and inlet fitting.

2) Install the mounting washers and nuts and torque to 80-100 ft. lbs.

3) Install the bleeder screw in the top port and tighten until it is seated properly.

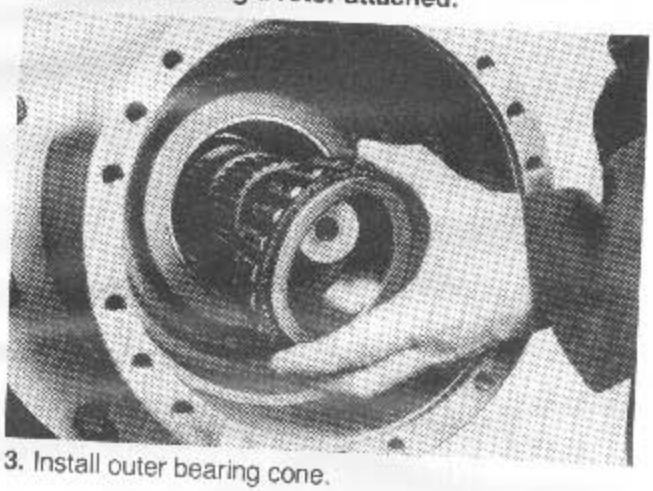
4) Install the brake inlet fitting in the other port and tighten until it is seated properly.

# Assembly of Wheel End Hub

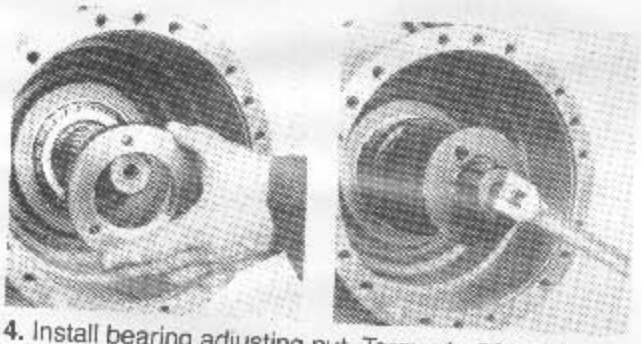
**1.** Install inner and outer bearing cups into hub. Install inboard bearing and hub seal.

**2.** Install hub onto spindle.

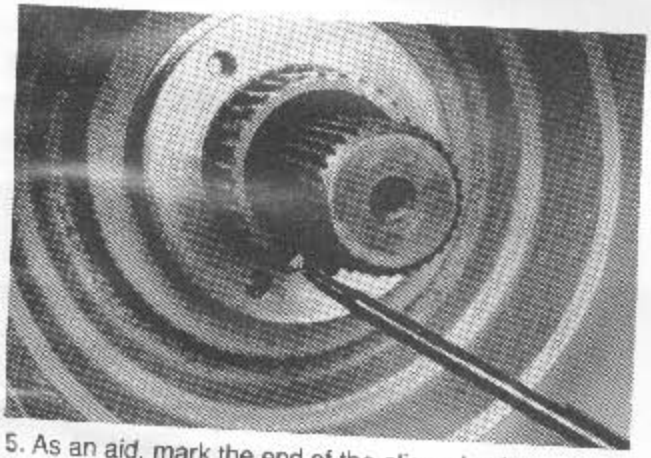
**NOTE: A lifting device is recommended for assemblies having a rotor attached.**



**3.** Install outer bearing cone.

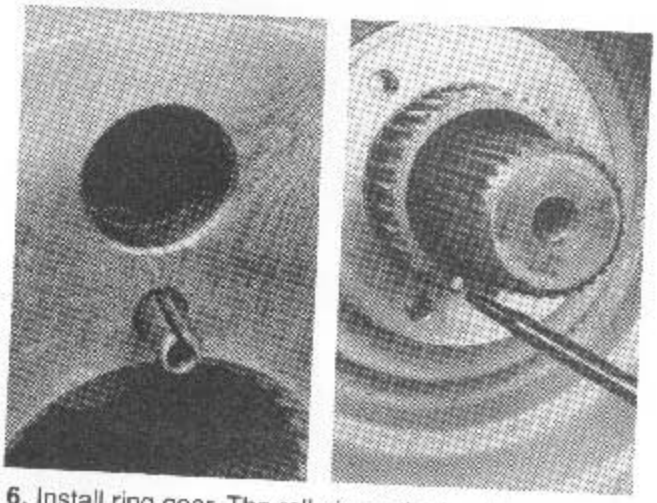


**4.** Install bearing adjusting nut. Torque to 200-250 ft.lbs. Back nut off 1/8 turn and align any hole in nut with a major spline on the spindle. Make sure hub rotates freely. (Use Dana Tool #451125)

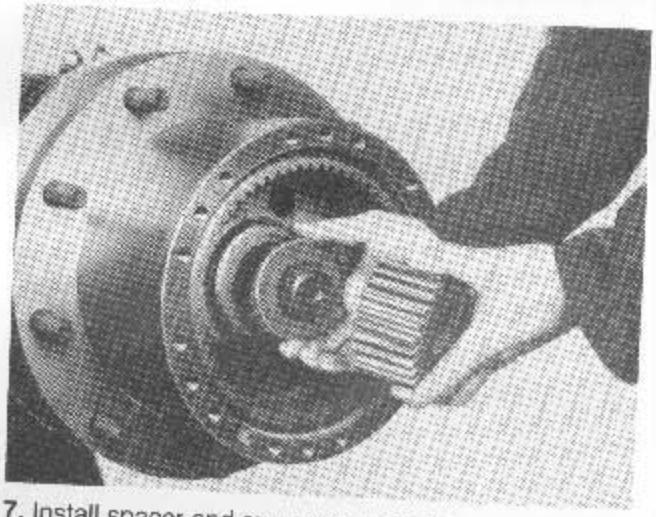


5. As an aid, mark the end of the aligned spline.

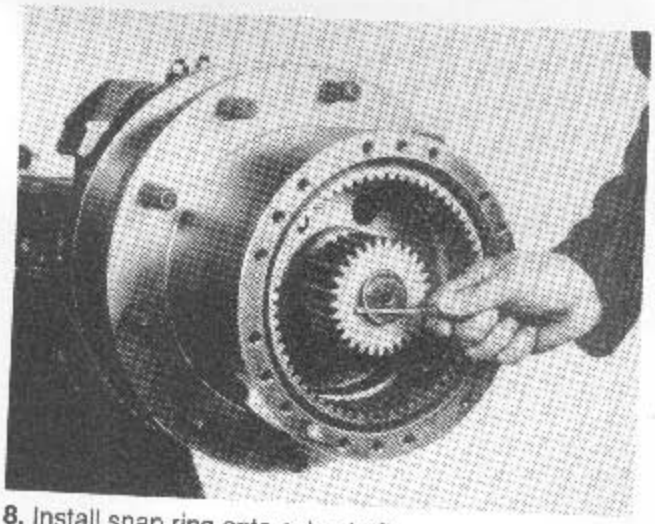
**NOTE: If axle is equipped with wheel end disc brakes, the brake caliper assembly can be installed at this time as outlined in the disc brake section of the manual.**



**6.** Install ring gear. The roll pin on the back face of the ring gear must be locked into the bearing adjusting nut hole. Use punch mark on front of ring gear as an alignment aid.

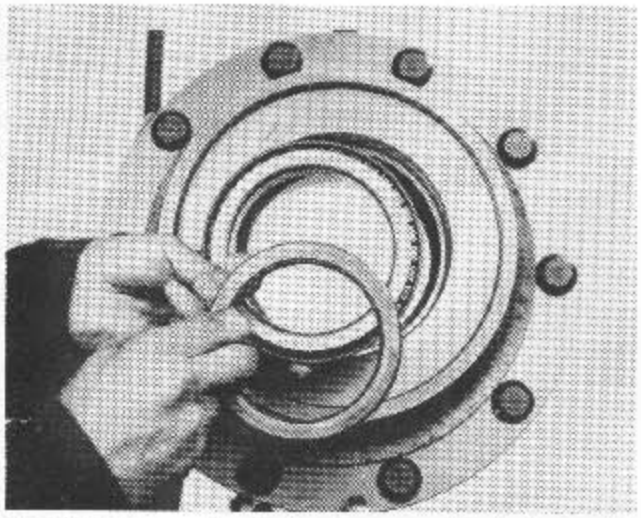


**7.** Install spacer and sun gear on shaft.



**8.** Install snap ring onto axle shaft.

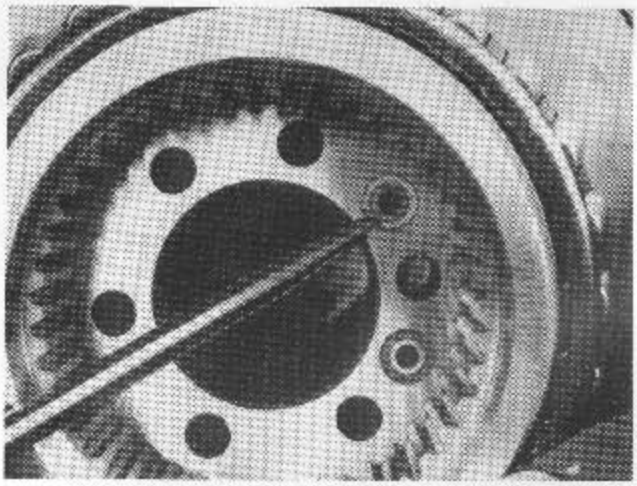
# Assembly of Wet Disc Brake Wheel End



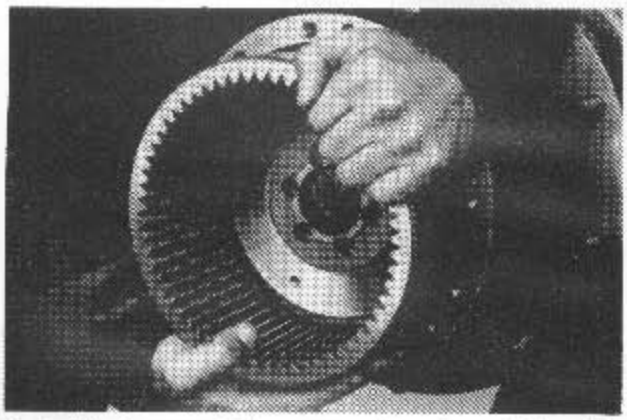
**1.** Install inner and outer bearing cups into hub. Install inboard bearing and seal and deflector.

**2.** Using a suitable lifting device, install hub assembly onto spindle.

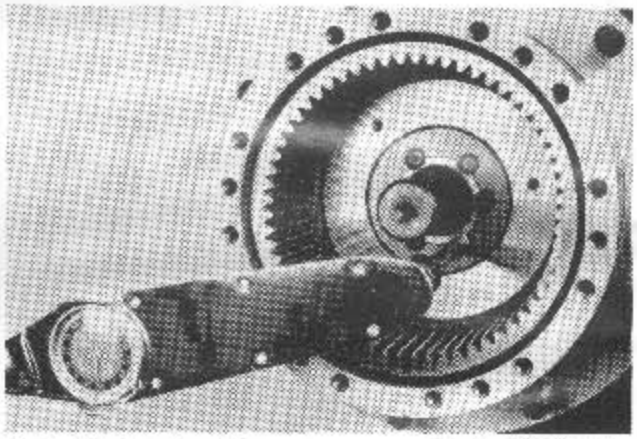
**SPECIAL SERVICE NOTE: If the planetary ring gear, brake piston, and wheel retainer were removed as a unit, (described in disassembly section), and it was not necessary to replace wheel bearings or cups, use the following lettered steps for reassembly. Otherwise proceed with steps #3.**



**A.** Insert both oil passage O-rings into grooves on inboard face of wheel retainer using a small amount of petroleum jelly to hold them in place and facilitate assembly.

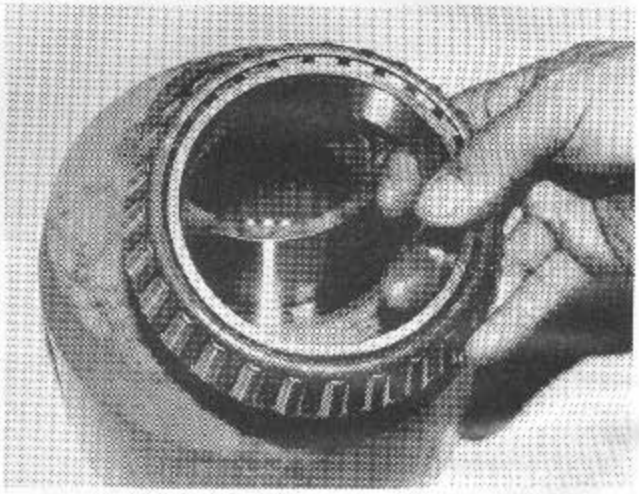


**B.** Install ring gear/piston assembly onto spindle spline making sure oil passage hole in ring gear is to bottom of axle at 6 o'clock position. Mounting holes in wheel retainer will align only one way.

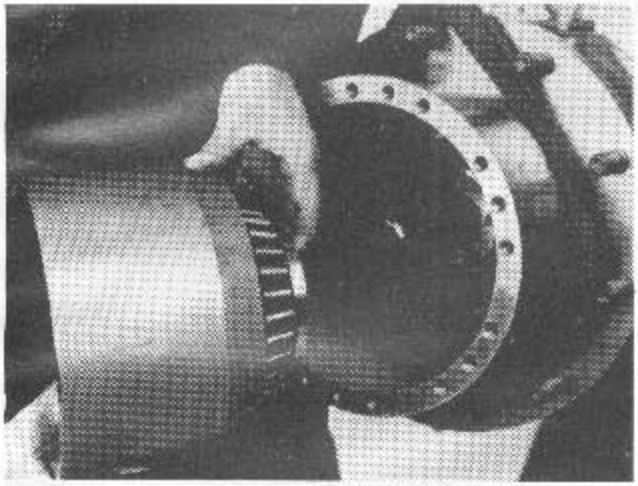


**C.** Install wheel retainer capscrews with Loctite® 271 compound applied to the threads and torque to 45 ft. lbs.

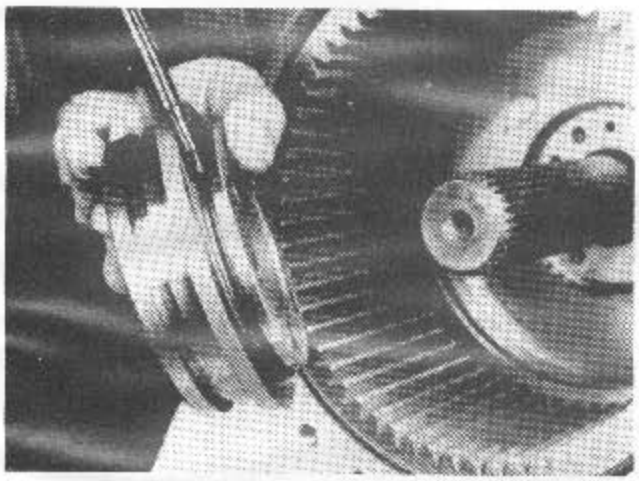
**D.** Skip following steps 3 thru 10 and continue assembly with step 11.



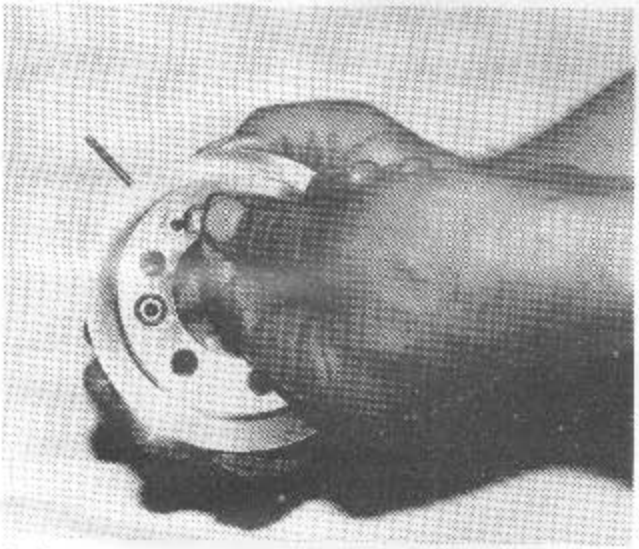
**3.** Install outboard wheel bearing onto planetary ring gear.



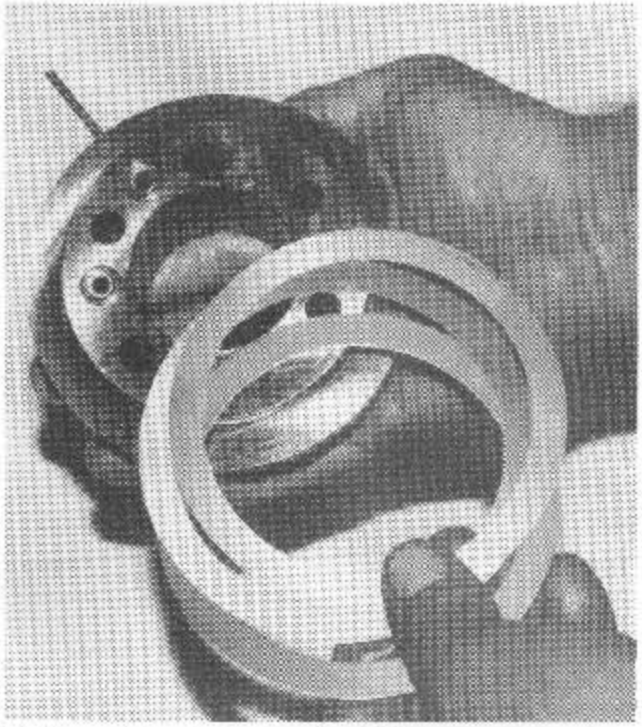
**4.** Install planetary ring gear onto spindle spline making sure oil passage hole in ring gear is to bottom of axle at 6 o'clock position.



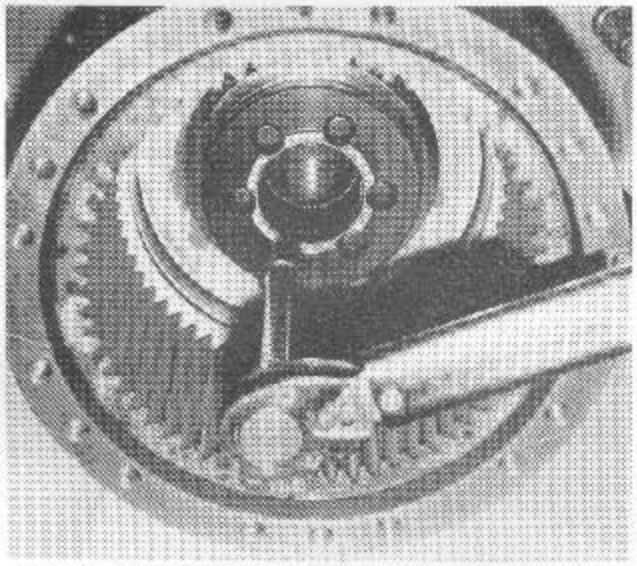
**5.** Lubricate and install outer diameter O-ring onto groove around inboard side of wheel retainer.



6. Insert both oil passage O-rings into grooves on inboard face of wheel retainer. Use a small amount of petroleum jelly to hold them in place and facilitate assembly.



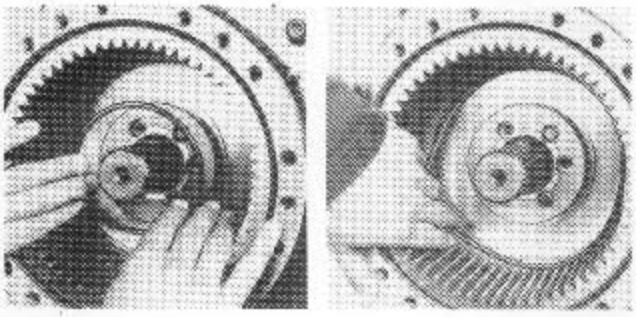
**7.** Place original wheel pre-load shims onto inboard side of wheel retainer and install into planetary ring gear. Make sure bleeder tube in retainer is to top of axle at 12 o'clock position.



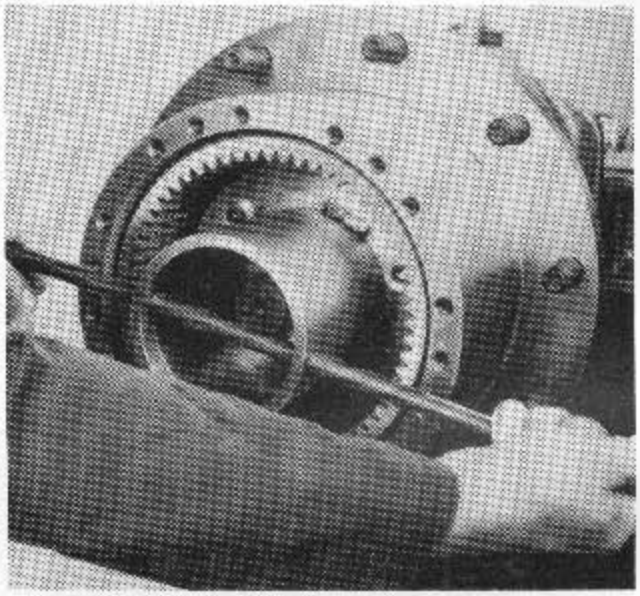
**8.** Install wheel retainer capscrews with Loctite® 271 compound applied to the threads. Gradually increase torque value on capscrews using a crossing pattern until 45 ft. lbs. is achieved on each capscrew.

**NOTE: At this point check wheel bearing preload. Torque to rotate wheel should be 50-80 in. lbs. when measured with a torque wrench from the center of the hub. If a spring scale is used, wrap a cord around the wheel pilot diameter. Readings taken with this method should be 10-15 lbs. Pull while the hub is rotating.**

To increase preload add shims. To decrease preload subtract shims.

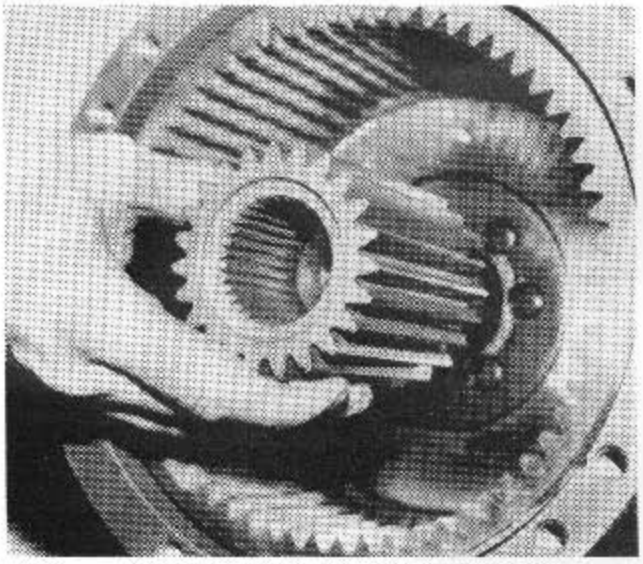


**9.** Lubricate and install outer and inner diameter piston O-rings.

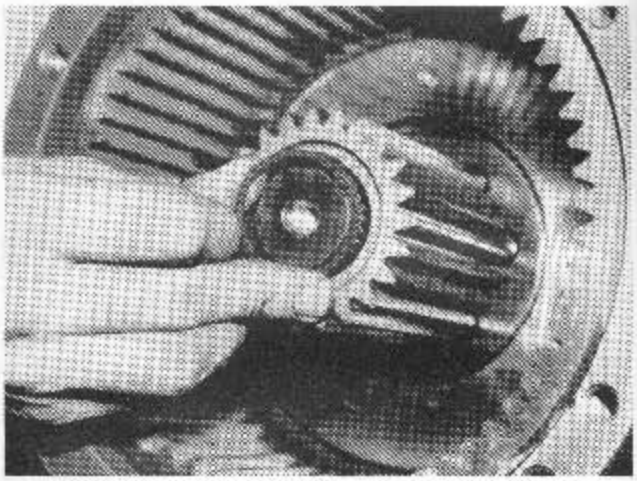


**10.** Install brake piston.

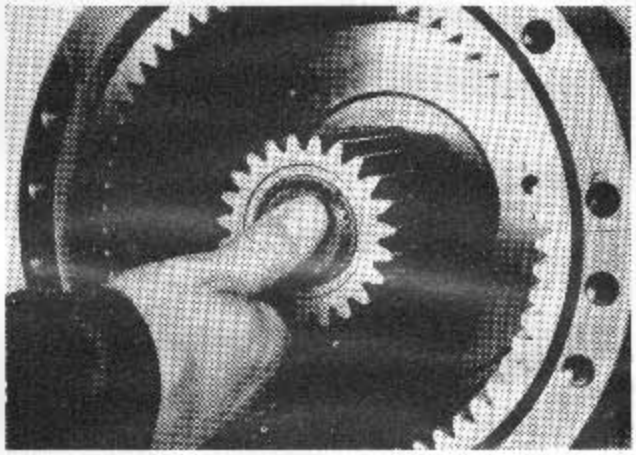
**NOTE: Use of a special piston remover/installer tool, (Dana tool #451164), is recommended to prevent damage to the piston.**



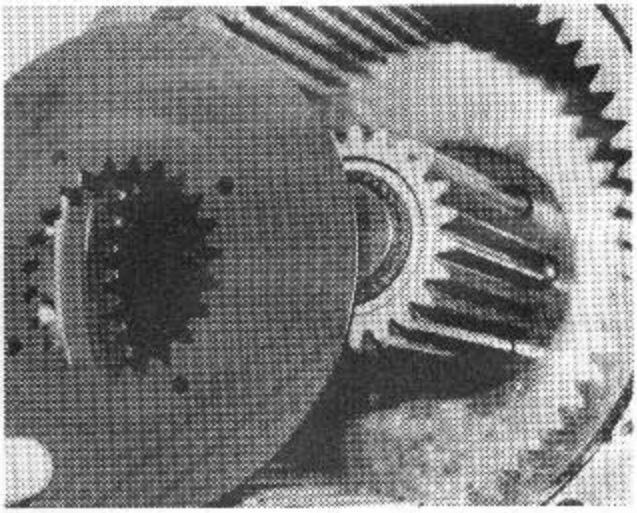
**11.** Install sun gear onto outer axle shaft.



**12.** Install snap ring into groove on outboard end of outer shaft.



**13.** Push inward on end of axle shaft to seat sun gear against wheel retainer. This will prevent rotating disc from dropping behind gear during installation.

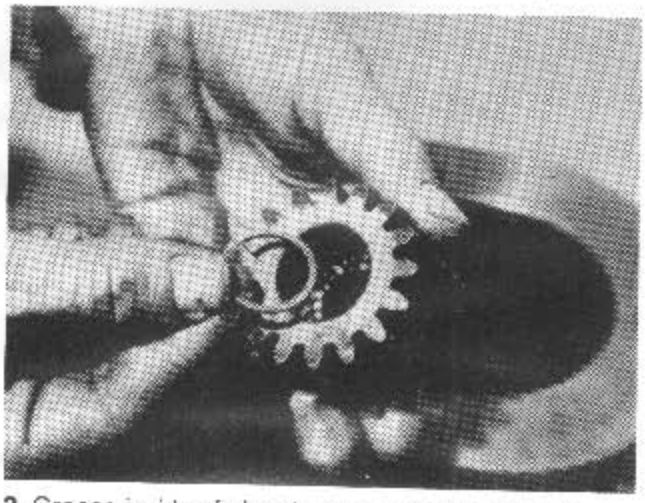


**14.** Install brake plates and discs into wheel end (4 each). Start with a steel stationary plate first, then a grooved friction disc (shown) second. Alternate until 4 of each are in place.

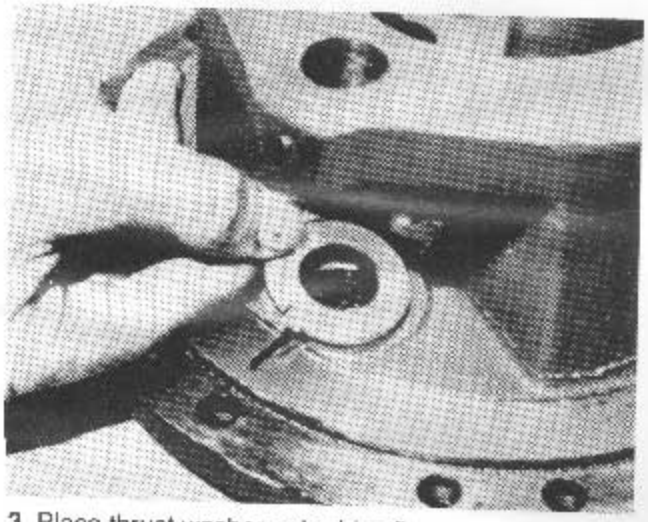
**NOTE: If new discs are installed, presoak in the correct lubricant as recommended by the vehicle manufacturer for a minimum of 15 minutes prior to assembly.**

# Assembly of 3.650 Drive Flange

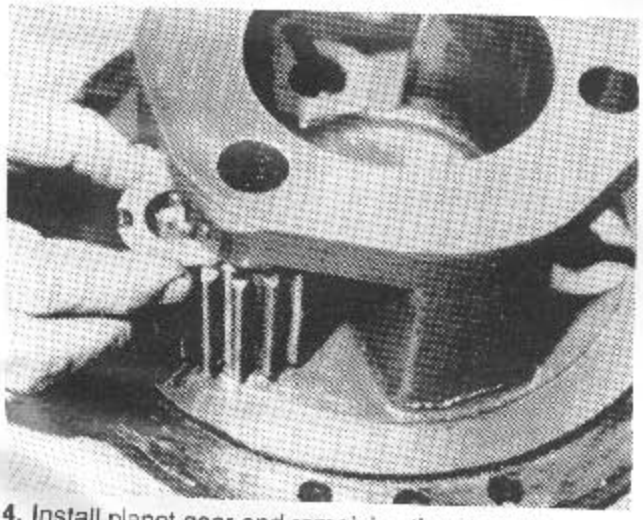
1. Install thrust button and vent into drive flange.



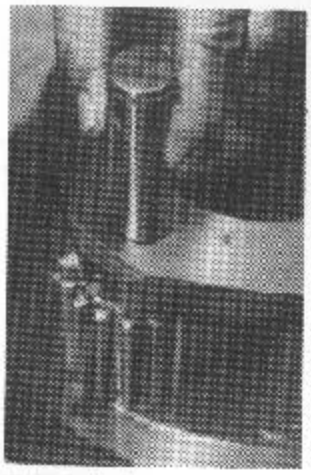
2. Grease inside of planet gear. Install two rows of needle bearings (25 per row) separated by spacer ring.



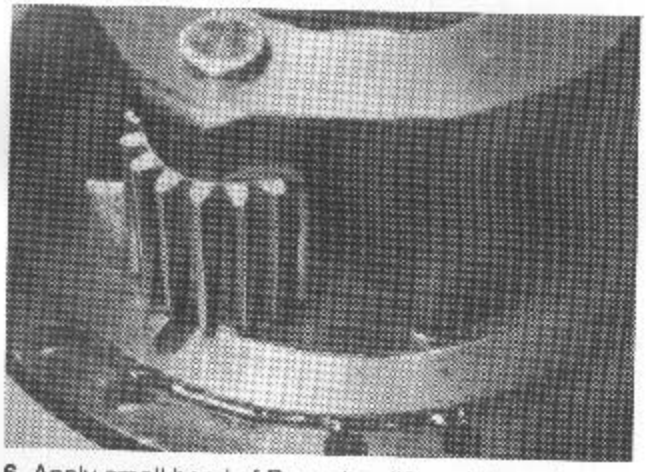
3. Place thrust washer onto drive flange.



4. Install planet gear and remaining thrust washer.

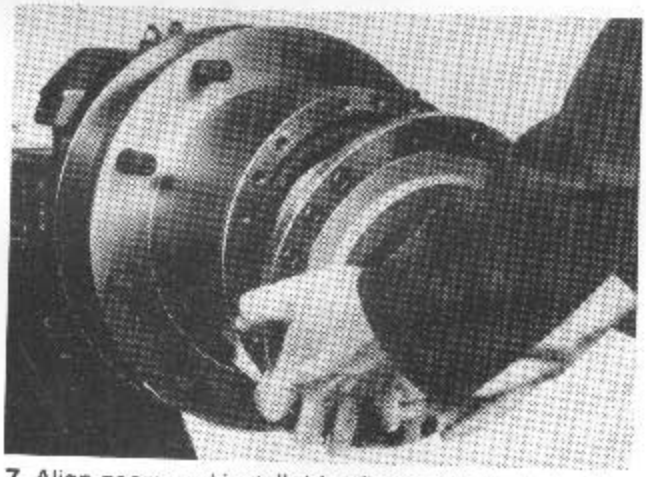


5. Install planet gear shaft into drive flange. If equipped with wet disc brakes install lining stop plate. Align holes and install roll pins.



6. Apply small bead of Permatex #2 gasket sealer around drive flange.

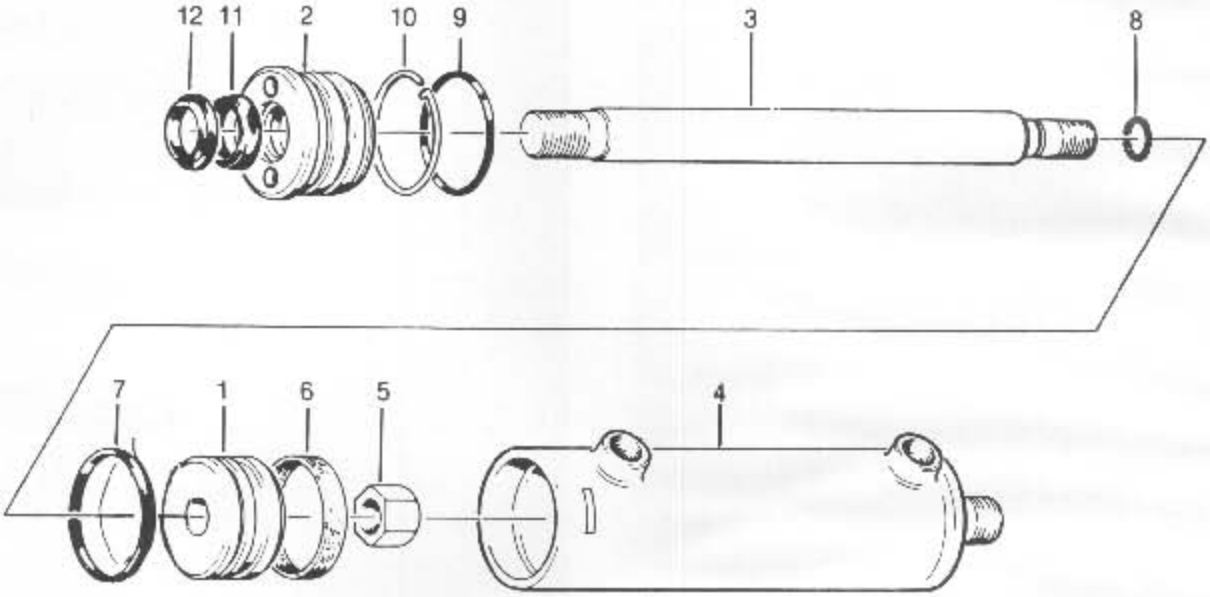
**NOTE: DO NOT use silicone sealer on drive flange. It can cause flange to loosen.**



7. Align gears and install drive flange into hub. Rotate hub to align bolt holes.

8. Install and torque bolts 90-100 ft. lbs.

# Steering Cylinder Disassembly and Assembly




1 Piston
2 Gland
3 Rod
4 Barrel Assembly
5 Locknut
6 Wear Strip
7 Piston Seal
8 Rod Static Seal
9 Gland Static Seal
10 Lockwire
11 Rod Seal U-Cup
12 Rod Wiper

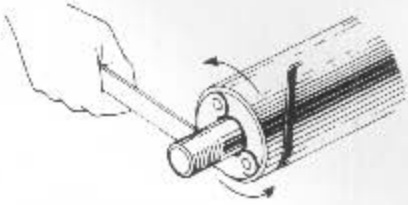
**NOTE: Prior to disassembly of steer cylinder assembly loosen the socket assembly clamp bolt and nut and remove the socket assemblies from the steering cylinder.**

**CAUTION: Protect chrome finish on rod at all times. Damage to surface of rod can cause premature seal failure.**

**DISASSEMBLY**

**1.** A sharp object, such as a screwdriver, must be used to get under the lockwire to start it out of the cylinder.

**NOTE: Direction of rotation for lockwire removal depends on prior installation. Check lockwire position for correct rotation.**



**2.** Locate spanner wrench in drilled holes in gland and rotate 360° in proper direction to remove lockwire.

**3.** Pull on the rod to remove the piston and gland.

**4.** Remove the nut from the end of the rod.

**5.** When the cylinder is disassembled, all seals should be replaced before reassembling.

**CLEANING AND INSPECTION**

**1.** Check rod and cylinder bore for nicks, burrs, scratches or rust. Slight defects may be removed with fine sand paper.

**2.** All parts removed from the cylinder that are to be reused should be thoroughly cleaned. Be sure to carefully clean all cavities and grooves prior to replacing parts.

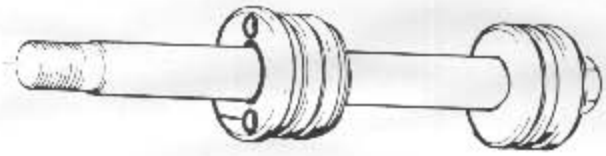
## ASSEMBLY

**1.** Install all seals. Do not over stretch seals to facilitate easier installation.

**2.** Make sure all seals are not twisted or distorted in grooves.

**3.** Install gland on rod with inner seal facing exposed section of rod.

**4.** Install piston on rod turn down.



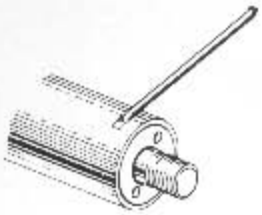
**5.** Install locknut and torque to 90-100 ft. lbs.

**NOTE: Two (2) jam nuts can be used on opposite end of shaft to hold while torquing.**

**6.** Lubricate all parts and inside of cylinder with hydraulic oil.

**7.** Push the piston into the cylinder bore with a steady, even pressure.

**8.** Push gland bore until shoulder of gland butts up to the barrel.

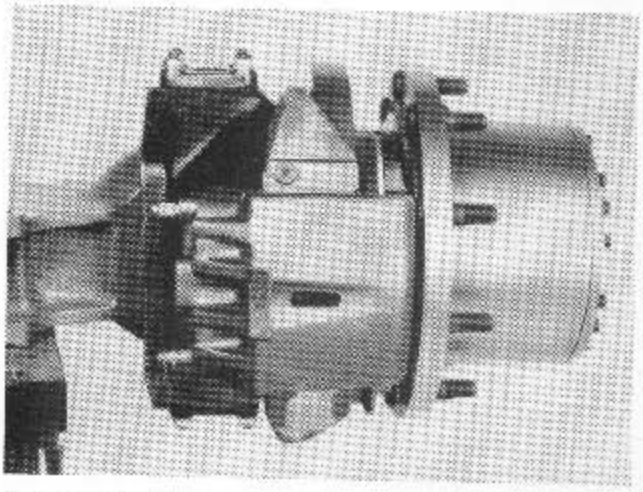


**9.** Locate drilled hole in gland through milled slot in the barrel and insert lockwire, then rotate the gland 360° to install lockwire.

**10.** Install the socket assemblies on the steering cylinder. Install the socket clamp bolt and nut (finger tight only).

**NOTE: The final socket to steer cylinder adjustments will be made when steering cylinder assemblies are installed on the axle assembly.**

# Disassembly and Assembly of Wheel End Disc Brake



**MAINTENANCE**
**GENERAL**

It is difficult to determine an exact maintenance interval (time and mileage), since vehicles will be used in a wide variety of applications and conditions.

A regular schedule for periodic inspection should be established based on past experience and type of operation.

Disc brakes do not require adjustment since the pad clearance is maintained by movement ofthe caliper and piston.

**BRAKE PADS**

To inspect brake pads for wear, raise vehicle onto floor stands and remove wheel. Visually inspect pad linings at each visible end and through opening in caliper assembly. Replace pads if the thinnest point is less than 3/16" (4.76 mm).

It is recommended that all brake pads be replaced at the same time to maintain balanced braking of the axle.

Moderate erosion or pitting is a normal characteristic or semi-metallic pad lining material which does not require replacement. Should erosion reduce the polished contact area to less than 20% of total surface area, replace pads.

**CALIPERS**

Visually inspect calipers for defects or brake fluid leakage. If necessary, follow repair procedures in the Pad and Caliper portion of this section.

**BRAKE FLUIDS**

The Bendix disc brake is designed to use either a standard brake fluid or petroleum base mineral oil.

**1.** If brake fluid is used the brake must have black colored seals and dust boots. Brake fluid must meet SAE 1703 or Super Heavy Duty DOT-3 brake fluid specifications.

**2.** If petroleum based mineral oil is used the brake must have green colored seals and dust boots. Petroleum based mineral oil must meet Mil Spec Mil-H-5606 requirements.

**SERVICE PRECAUTIONS**

**1.** When the vehicle is raised for inspection or servicing use floor stands for additional support.

**2.** Check fluid level in the fluid reservoir prior to servicing the brakes. If the reservoir is full when the caliper pistons are retracted it will overflow. Remove any potentially excess fluid from the reservoir with a siphon and discard.

**CAUTION: Avoid contaminating the caliper and other brake parts while servicing the brake. Handle parts carefully to prevent damage.**

**3.** The caliper assembly must be removed before removing the hub and disc assembly.

**4.** Replace worn or damaged caliper dust boots and piston seals.

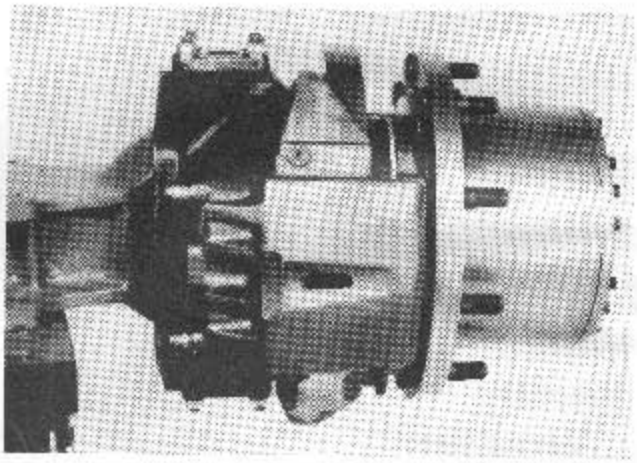
**5.** If the original brake pads are to be reused, mark them in some manner so they can be installed in the same location.

**6.** After any brake service, be sure to test brakes prior to returning vehicle to service. A firm pedal should be felt during brake application.

**CAUTION: DO NOT move vehicle until a firm brake pedal is obtained.**

## SERVICE PROCEDURES

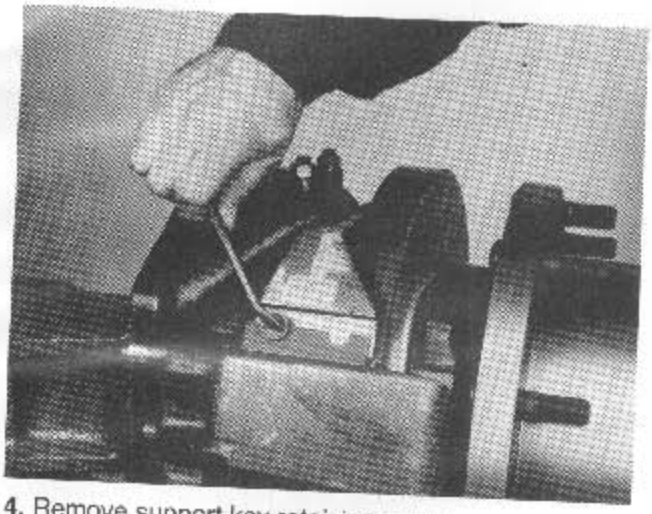
**CALIPER AND PADS REMOVAL**



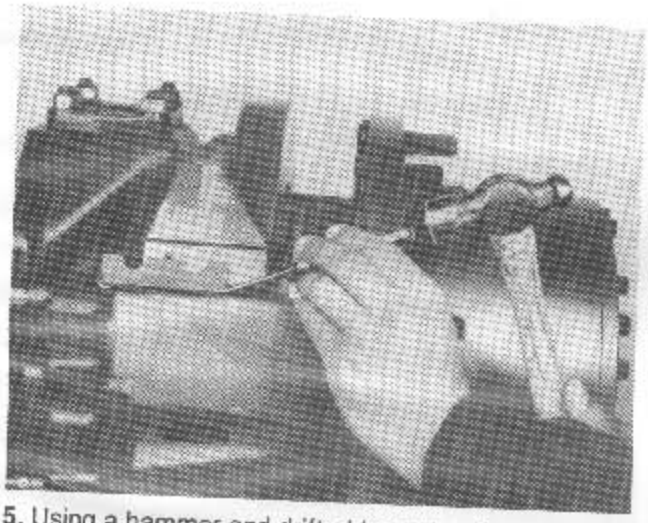
**1.** Position vehicle on floor stands and remove wheel.

**2.** Inspect master cylinder fluid level and remove fluid if necessary.

**3.** Pry the caliper outboard retracting the caliper pistons into the cylinder bore.

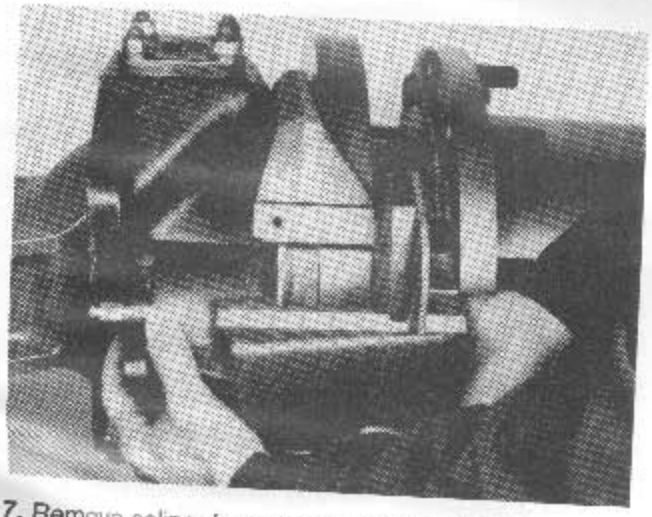


4. Remove support key retaining screw.

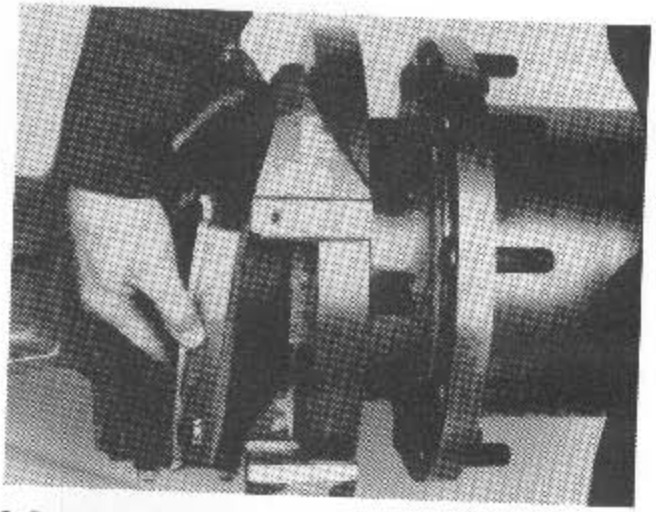


5. Using a hammer and drift, drive out caliper support key and spring.

6. Disconnect hydraulic hose if removing caliper to service other than brake pads.



7. Remove caliper from mounting bracket. Do not let caliper hang on brake hose.



8. Remove inboard pad from caliper mounting bracket. Inspect caliper for leakage. Rebuild if necessary.

**NOTE: If the caliper does not require rebuilding, retract the pistons into the caliper to obtain necessary clearance for reassembly over the rotor. Position a metal bar over both pistons, then use a "C" clamp to force both pistons into the caliper.**

## CALIPER DISASSEMBLY

1. Disconnect brake hose from caliper inlet. Cap the hose and inlet to prevent brake fluid leakage. Avoid getting grease or brake fluid on brake pads.
2. Clean exterior of caliper in denatured alcohol.
3. Remove pistons from caliper.

**NOTE: It may be necessary to use compressed air to aid in removal of pistons.**

**CAUTION: Use no more than 15 PSI air pressure to ease pistons from bore. Stay clear of area between piston and caliper housing to avoid personal injury. Avoid spray of brake fluid as pistons are dislodged from bores. Use shop towels to restrict piston travel and prevent damage to the pistons.**

**NOTE: If the piston becomes seized or cocked, release the air pressure and realign the piston, tapping with a soft faced hammer. Reapply air pressure to remove the piston.**

4. Remove boot from piston and seal from caliper bore. Discard boot and seal.

## CLEAN AND INSPECT CALIPER COMPONENTS

1. Remove any rust or corrosion from the external machined surfaces of the caliper housing. DO NOT use any abrasive material in the piston bores.
2. Remove any rust or corrosion from the machined surfaces on the caliper mounting bracket.
3. Clean the caliper housing and piston bores using denatured alcohol. Use dry compressed air to clean and dry all grooves and passages.

**NOTE: Make sure all alcohol is completely removed before reassembly.**

4. Inspect the piston bore, boot groove, seal groove, and piston for damage for excessive wear. Replace piston if it is pitted, scored or worn. Remove any corrosion that may be present in the piston bores and grooves with a fiber brush.

5. Inspect caliper support spring and key. Replace if necessary.

### CALIPER REASSEMBLY

1. Lubricate piston seal and piston bore with brake fluid (Refer to BRAKE FLUID SECTION), and install seal in groove in piston bore. Be sure seal is fully seated and not twisted.

2. Coat outside of piston and dust boot lips with brake fluid. Slide dust boot over the piston and position it at bottom (closed end) of piston.

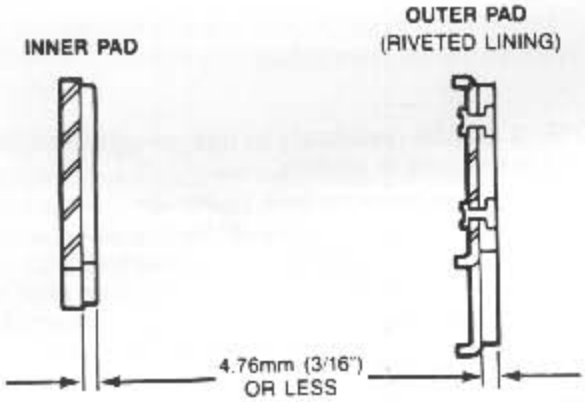
3. Position piston and boot over piston bore and install lip of boot into groove near top of bore. Be sure boot lip is fully seated.

4. Press straight in on piston until it bottoms in bore.

5. Assemble other parts on caliper and install as outlined in the Pad and Caliper Installation section.

### CLEANING AND INSPECTION OF ROTOR AND PARTS

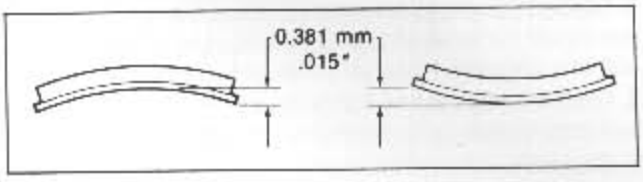
1. Measure lining thickness. If any point is less than 3/16" (4.76 mm), new pads should be installed on both wheels of that axle.




If lining material shows sign of excessive cracking, the pads must be replaced.

Replace brake pads as a set on an axle. Never replace pads one wheel at a time.

Replace brake pads contaminated with oil, grease, or any material not easily removed with a clean rag.




Examine the pads for flatness of the control surface. Any shoe found with a concave or convex bend more than 0.015" (0.381 mm), should be replaced.

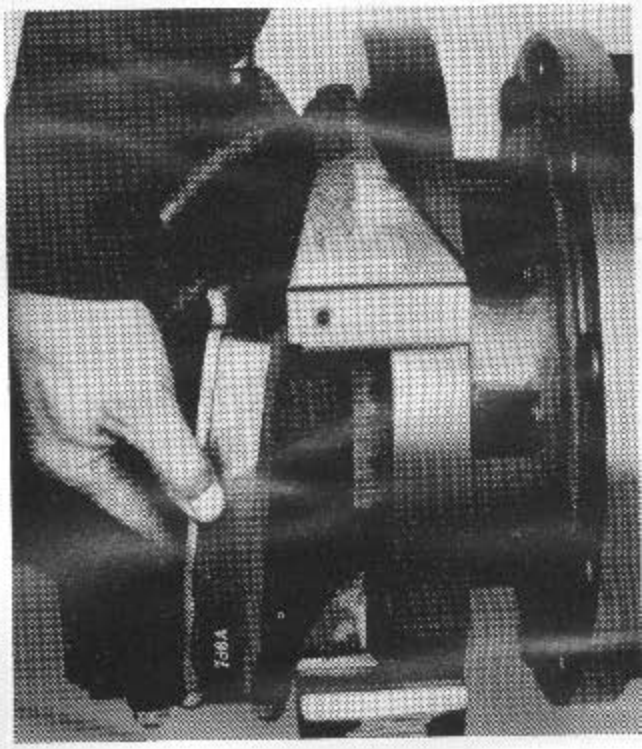
2. Inspect rotors. While rotors are mounted on wheel end, use dial indicator to check for warpage of braking surface. If surface varies more than .003 (.076 mm), it will be necessary to machine rotor to acceptable tolerance (Use standard automotive procedures). Rotors with cracks or burnt spots must be replaced.

**NOTE: The minimum allowable thickness of the rotor braking surfaces is 1.320 inch (This value is cast on the rotor). If the amount of cleanup machining to eliminate warpage decreases or will decrease the thickness to less than the minimum specified, the rotor must be replaced.**

**Before reassembling the reworked or new rotor on the hub make sure the rotor and the hub mounting surface and pilot diameter for it are cclean. Position the rotor on the hub, install the mounting bolts and torque them to 174-191 ft. lbs.**

**Recheck the braking surface runout to make sure it is acceptable.**

### PADS AND CALIPER INSTALLATION

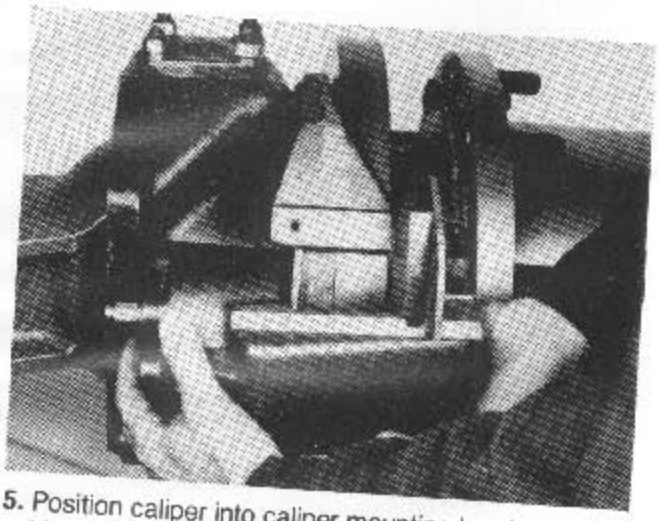


1. Position the inboard (smaller) pad into the caliper mounting bracket with lining towards rotor.

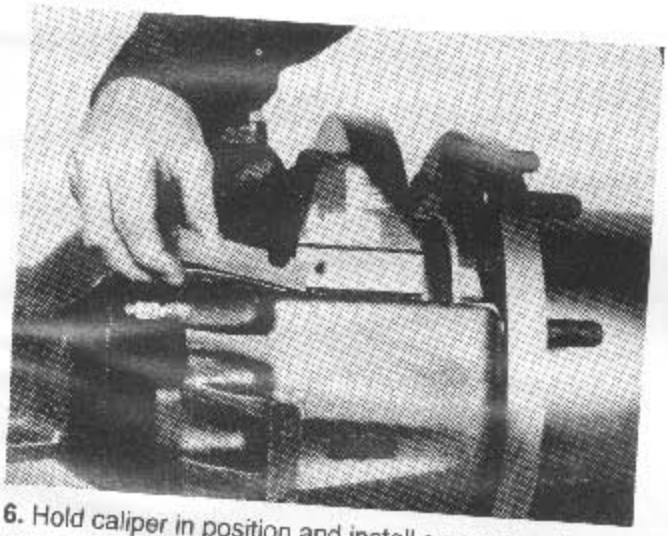
2. Be sure the caliper piston is fully bottomed in the piston bore.

3. Position outboard pad on caliper.

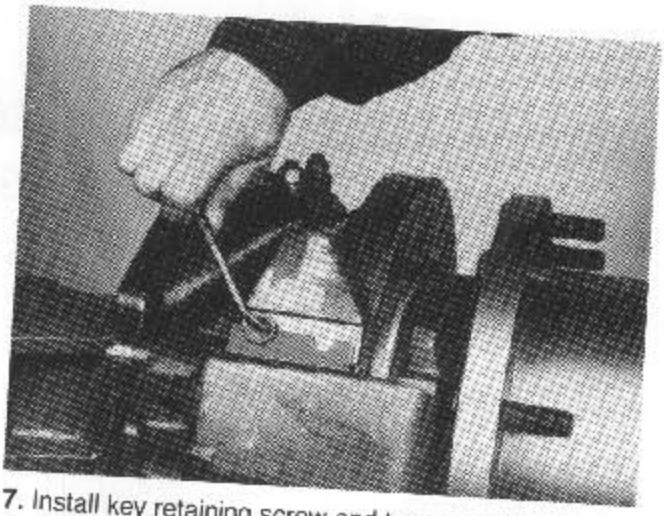
4. Apply a small amount of special lubricant (NLG-2 extreme temperature lithium grease), to the machined surfaces of the caliper vee-way grooves and caliper mounting bracket rails which are in contact during the sliding action of the caliper.



**5.** Position caliper into caliper mounting bracket. Avoid cutting piston dust boots.



**6.** Hold caliper in position and install support and support key between caliper and bracket. Use a soft faced hammer to drive the key and spring assembly into position.



**7.** Install key retaining screw and torque to 12-18 ft. lbs.

**8.** Install line fitting in bottom port and bleeder fitting in top port.

**9.** Connect brake line hose if removed.

**BLEEDING INSTRUCTION**

Refer to VEHICLE SERVICE MANUAL

**CAUTION: OBTAIN FIRM PEDAL BEFORE MOVING VEHICLE.**