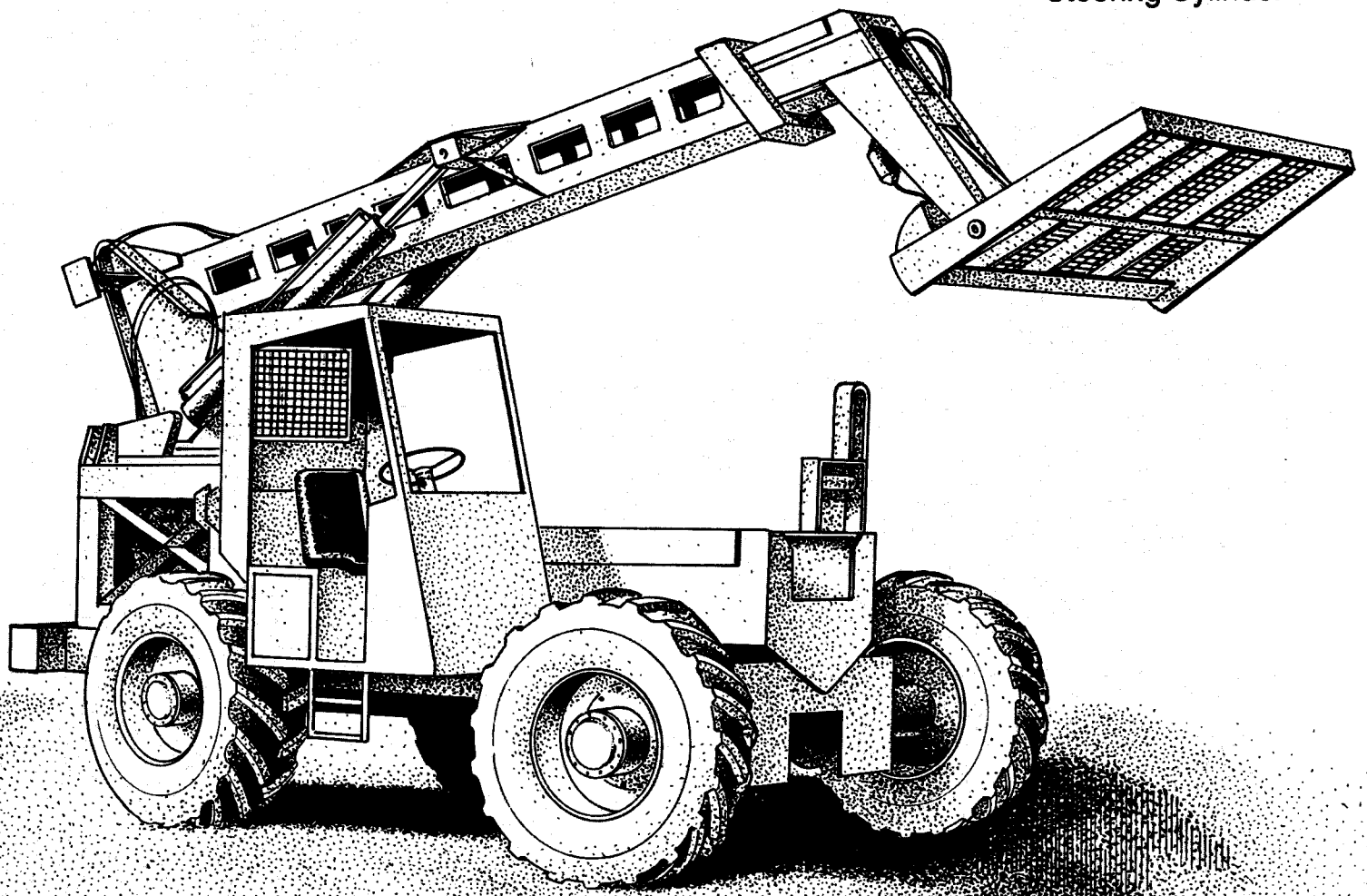
OFF-HIGHWAY AXLES

GLOBAL SYSTEMS TECHNOLOGY

MAINTENANCE MANUAL

Models PS/PR-1350
Planetary Wheel End,
Wheel End Brakes, and
Steering Cylinder



Tomorrow's Quality Standards Today...

SPICER®

MAINTENANCE MANUAL

Models PS/PR-1350

Planetary Wheel End, Wheel End Brakes and Steering Cylinders

CONTENTS

	Page
General Precautions for Disassembly	2
Removal of Planetary Drive Flange Assembly	3
3.103/3.650 Reduction Drive Flange	4
Disassembly of 3.103/3.650 Reduction Drive Flange	5
4.21 Reduction Drive Flange	6
Disassembly of 4.21 Reduction Drive Flange	7
Disassembly of Wheel End Hub	8-9
Steering Knuckle	10
Disassembly of Steering Knuckle	11-12
Steering Cylinder Disassembly and Assembly	13-14
General Precautions for Assembly	15
Assembly of Steering Knuckle	16-17
Assembly of Wheel End Hub	18
Assembly of 3.103/3.650 Reduction Drive Flange	19
Assembly of 4.21 Reduction Drive Flange	20
Disc Brake	21
Disassembly and Assembly of Wheel End Disc Brake	22-26
Drum Brake	28
Disassembly and Assembly of Wheel End Drum Brake	29-32
Torque Specifications	33
Wet Disc Brake Wheel End 3.65 Reduction	34
Disassembly of Wet Disc Brake Wheel End	36
Assembly of Wet Disc Brake Wheel End	40

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles or driving axles. 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. Special tools should be used when recommended and in the method described.

It is impossible to know, evaluate, and advise the service trade of all conceivable ways in which service might be performed or of the hazardous consequences of each.

Accordingly, anyone who uses a service procedure or tool which is not recommended must first satisfy himself that neither his safety nor the vehicle safety will be jeopardized by the service methods he selects.

Should an axle assembly require replacement of component parts, it is recommended that "Original Equipment" replacement parts be used. They may be obtained through your service dealer or other original equipment manufacturer parts supplier. The use of non-original equipment replacement parts is not recommended as their use may cause unit failure and affect vehicle safety.

General Precautions for Disassembly

READ THIS SECTION BEFORE STARTING THE DETAILED DISASSEMBLY PROCEDURE. FOLLOW EACH PROCEDURE CLOSELY USING BOTH THE TEXT AND ILLUSTRATIONS.

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 stand is desirable but not necessary to rebuild this unit.

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.

BEARINGS

Bearings should only be removed with appropriate pullers. Protect bearings from contamination.

CAUTION: HAMMERING ON FLANGES DURING REMOVAL OR INSTALLATION CAN CAUSE DAMAGE TO THE FLANGE ITSELF AS WELL AS SERIOUS INTERNAL DAMAGE.

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

CLEANING AND INSPECTION

CLEANING

1. Parts should be cleaned with emulsion or petroleum based cleaners.

2. Make sure interior of planetary hub is clean prior to assembly.

3. Clean, inspect, and lubricate all bearings just prior to reassembly.

4. Clean all sealing 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 gears for pitting, wear, or scoring.

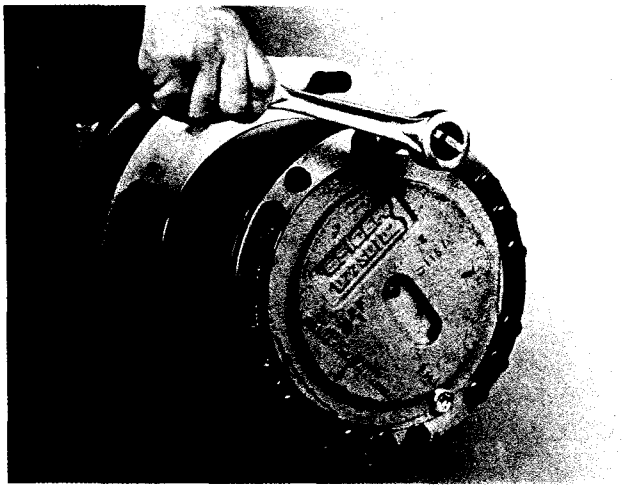
Inspect axle shafts for worn splines, bends, or cracks.

Replace all worn or damaged parts.

Removal of Planetary Drive Flange Assmbly

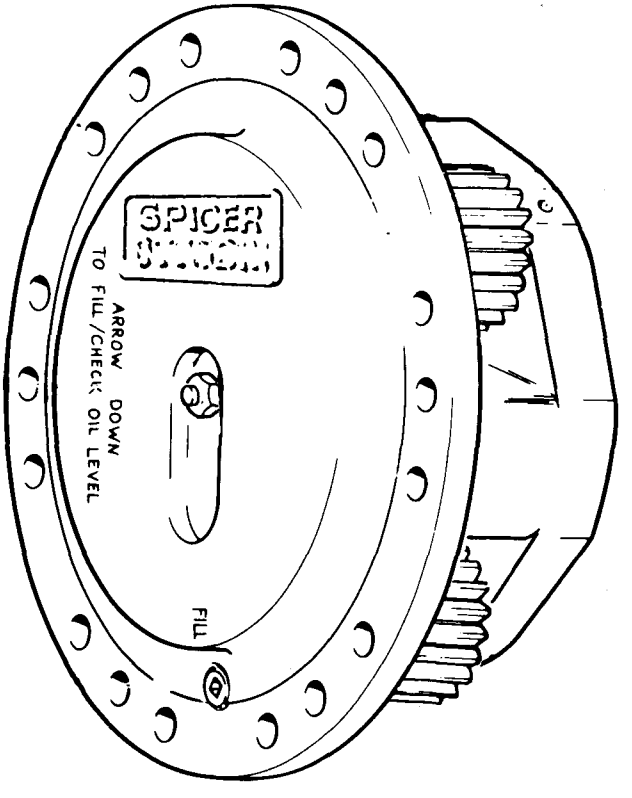
NOTE: The following procedures are the same for both rigid and steer axles.

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

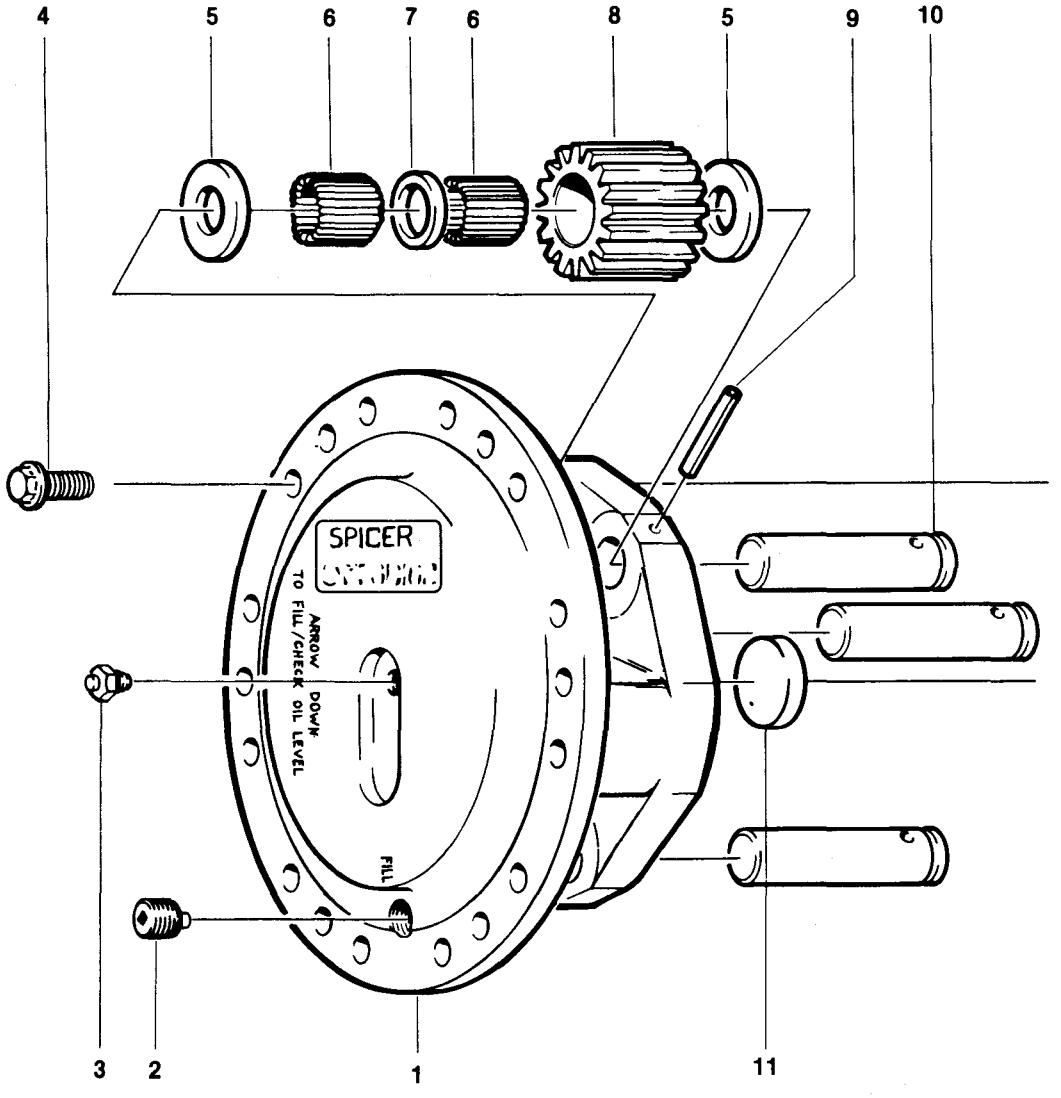


2. Remove capscrews from drive flange.

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

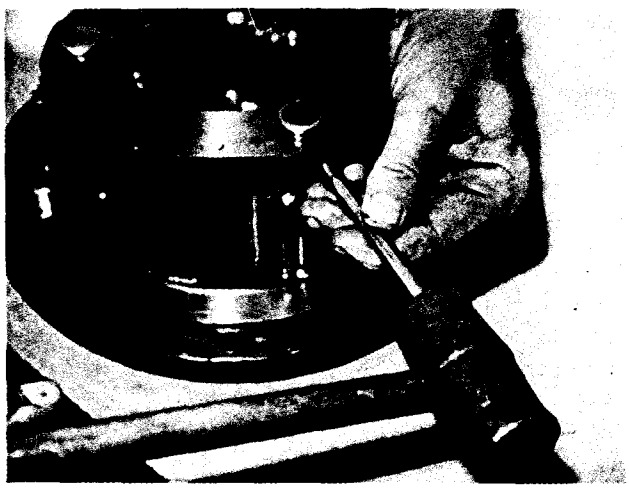


3.103/3.650 Drive Flange

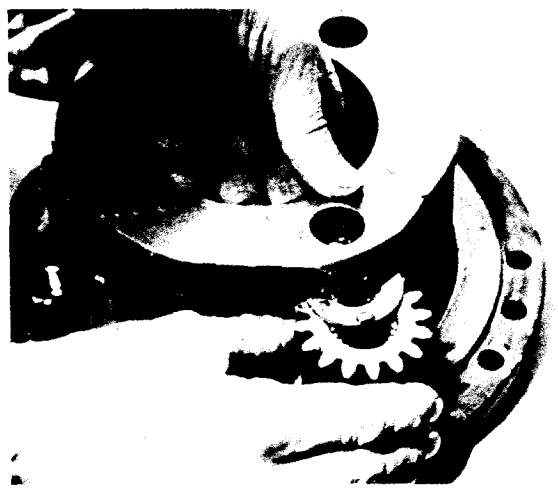


1 Planetary Drive Flange
2 Recessed Drive Pipe Plug
3 Vent
4 Self Locking Hex Screw
5 Flat Spacer (Thrust Washer)
6 Needle Roller Bearing
7 Planetary Gear Washer
8 Planetary Spur Gear
9 Roll Pin
10 Planetary Gear Shaft
11 Drive Flange Washer (Thrust Button)

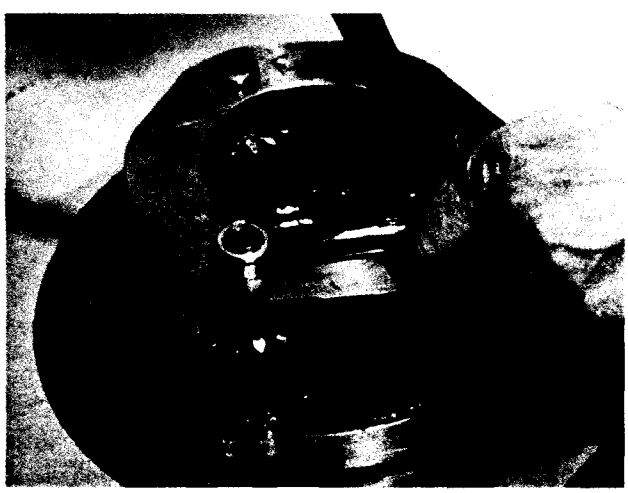
Disassembly of 3.103/3.650 Drive Flange



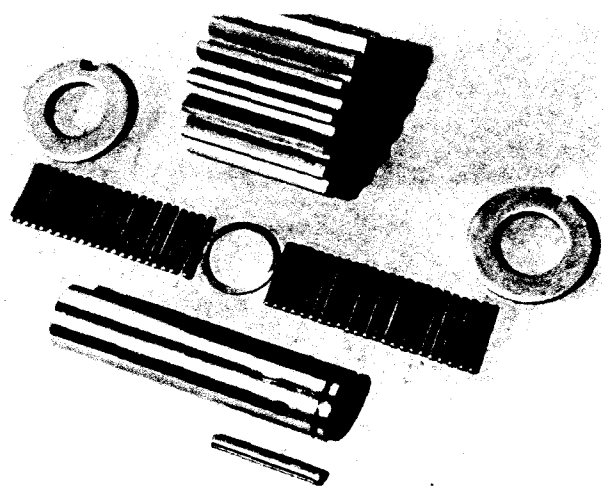
1. Using a hammer and punch, drive roll pins out of planet gear shafts.



3. Remove planet gears and thrust washers.



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

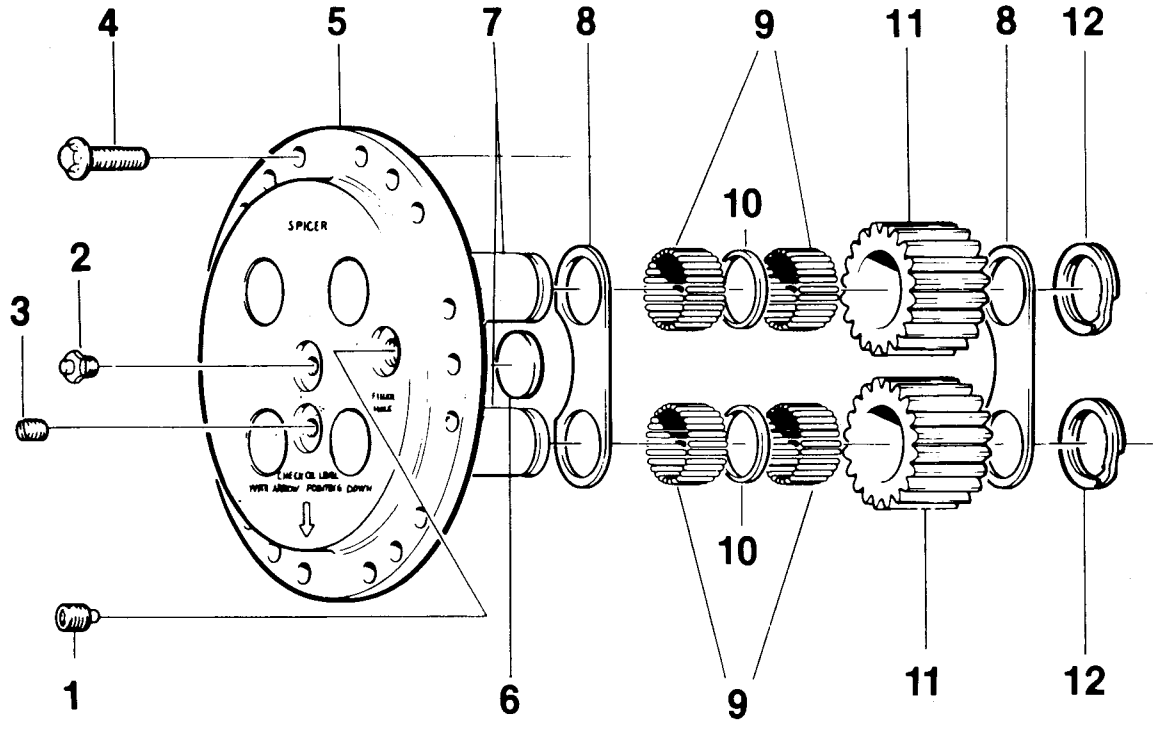


4. The planet gears are supported on the planet shafts by two rows of needle bearings divided by a center ring and a thrust washer on each end.

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

NOTE: Keep the groove under the thrust button open. It is the access to the air vent.

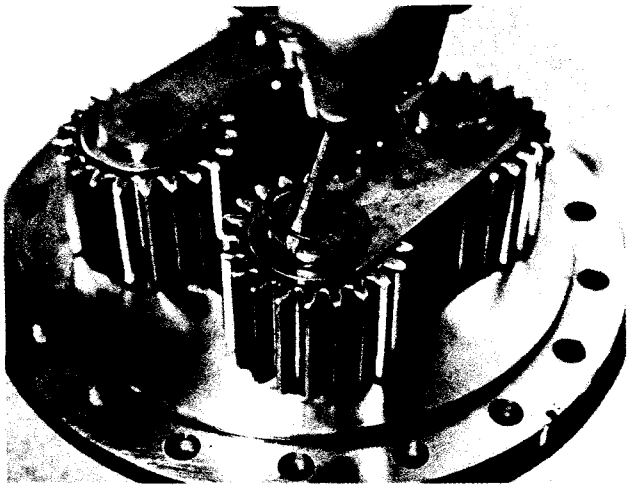
4.21 Reduction Drive Flange



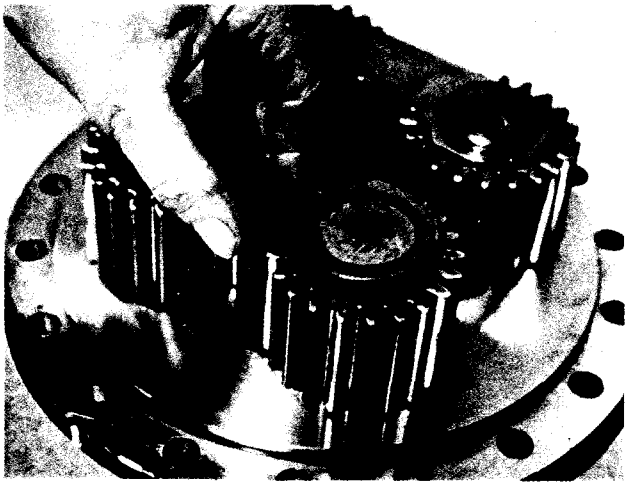
1 Recessed Drive Pipe Plug
2 Vent
3 Slotted Pipe Plug
4 Self Locking Hex Screw
5 Planetary Drive Flange*
6 Drive Flange Washer (Thrust Button)
7 Planetary Gear Shaft*
8 Flat Spacer (Thrust Plates)
9 Needle Roller Bearing
10 Flat Spacer
11 Planetary Spur Gear
12 Snap Ring

* Planetary Drive Flange and Planetary Gear Shafts are replaced as an assembly

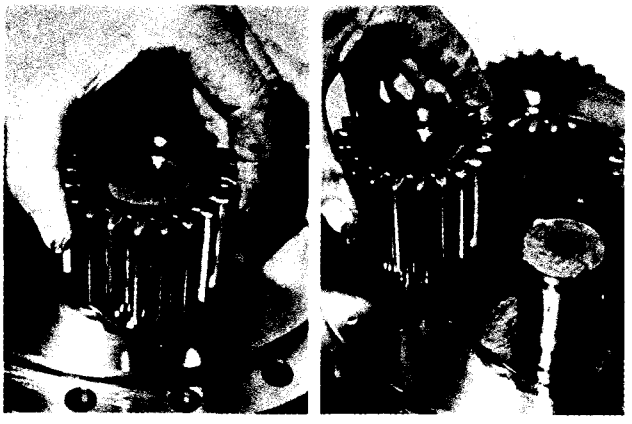
Disassembly of 4.21 Reduction Drive Flange



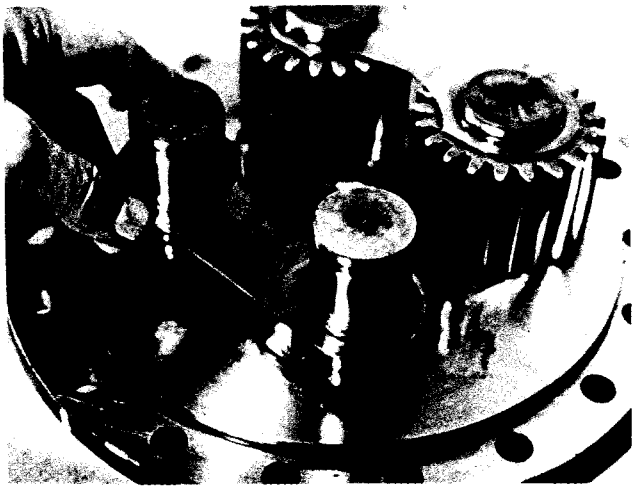
1. Use a small screwdriver, insert tip under spiral retaining ring and remove by rotating screwdriver around planet gear shaft. Repeat on 3 remaining gears.



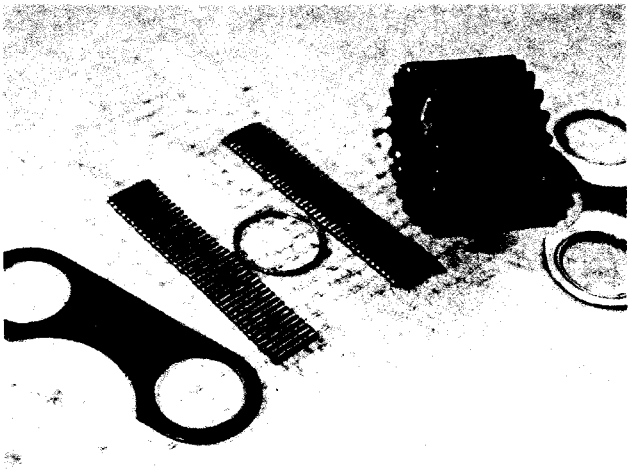
2. Remove thrust plates.



3. Remove planet gears.



4. Remove thrust plates.

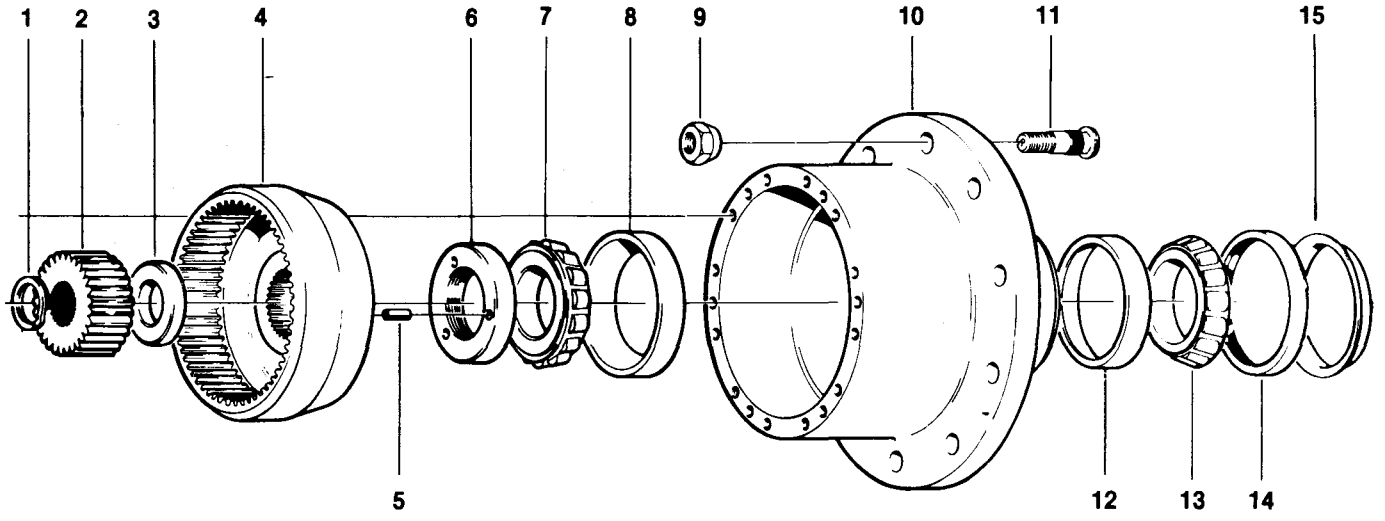


5. The Planet gears are supported on the planet shafts by two rows of needle bearings divided by a center ring, and a thrust plate on each end.

6. Inspect the thrust button located on the center of the drive flange. If worn, replace.

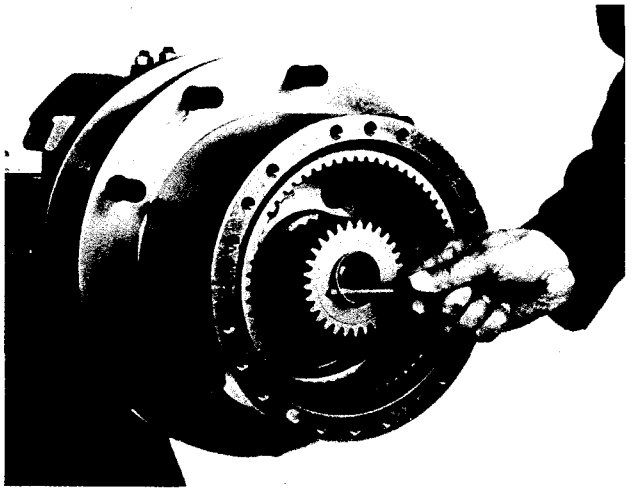
NOTE: Keep the groove under the thrust button open. It is the access to the air vent.

Disassembly of Wheel End Hub

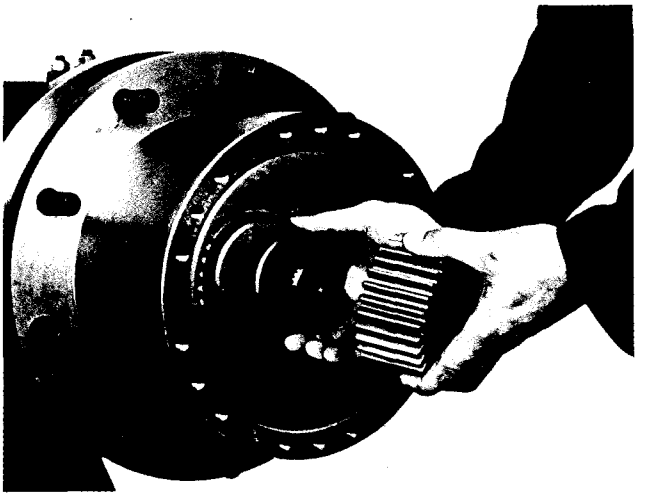


1 Snap Ring
2 Sun Spur Gear
3 Flat Spacer
4 Planetary Ring Gear
5 Roll Pin
6 Lock Nut
7 Bearing Cone (Outer)
8 Bearing Cup (Outer)
9 Wheel Mounting Nut
10 Planetary Hub
11 Wheel Mounting Bolt
12 Bearing Cup (Inner)
13 Bearing Cone (Inner)
14 Oil Seal
15 Hub Slinger (For Axles without Wheel End Brakes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

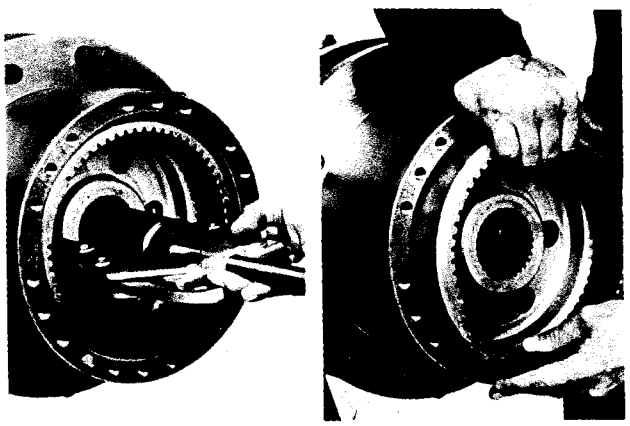
NOTE: the following procedure is the same for both rigid and steer axles.



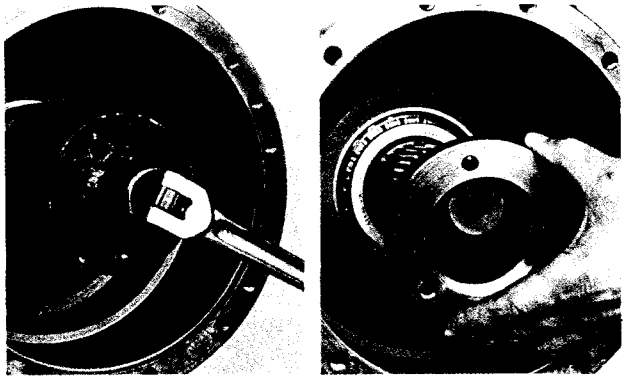
1. Insert small screwdriver under end and remove locking ring from end of axle shaft by rotating around shaft.



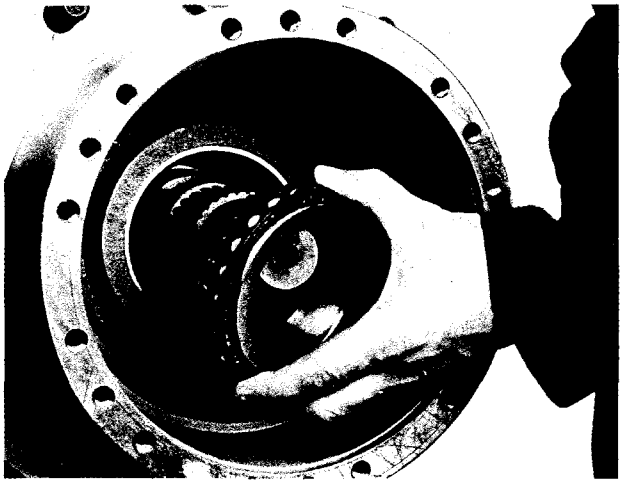
2. Remove sun gear and spacer from axle shaft.



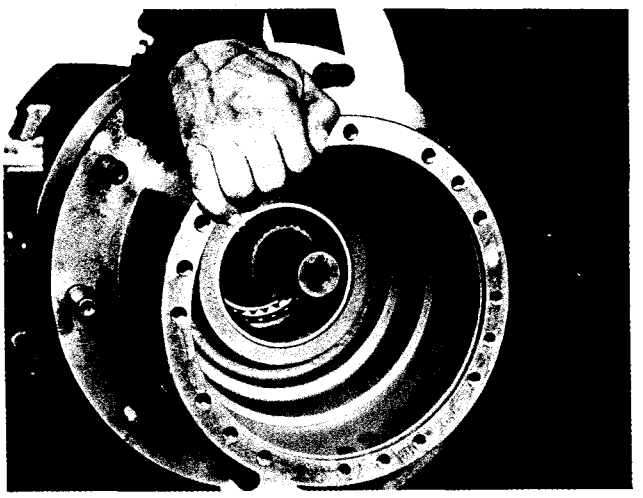
3. Remove ring gear. Use a suitable puller if necessary.
NOTE: DO NOT pilot puller on axle shaft. This may damage the inboard axle seal.



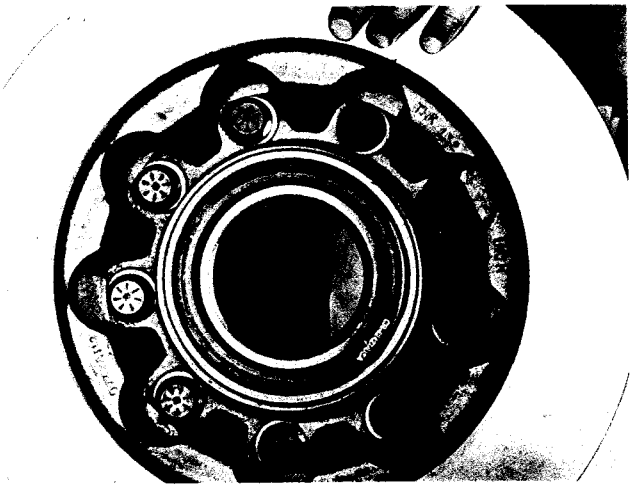
4. Remove the wheel bearing adjusting nut using a three pin spanner wrench. (Dana tool #451125)
NOTE: If axle is equipped with wheel end disc brakes, remove the caliper assembly at this time as outlined in the disc brake section of this manual.



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

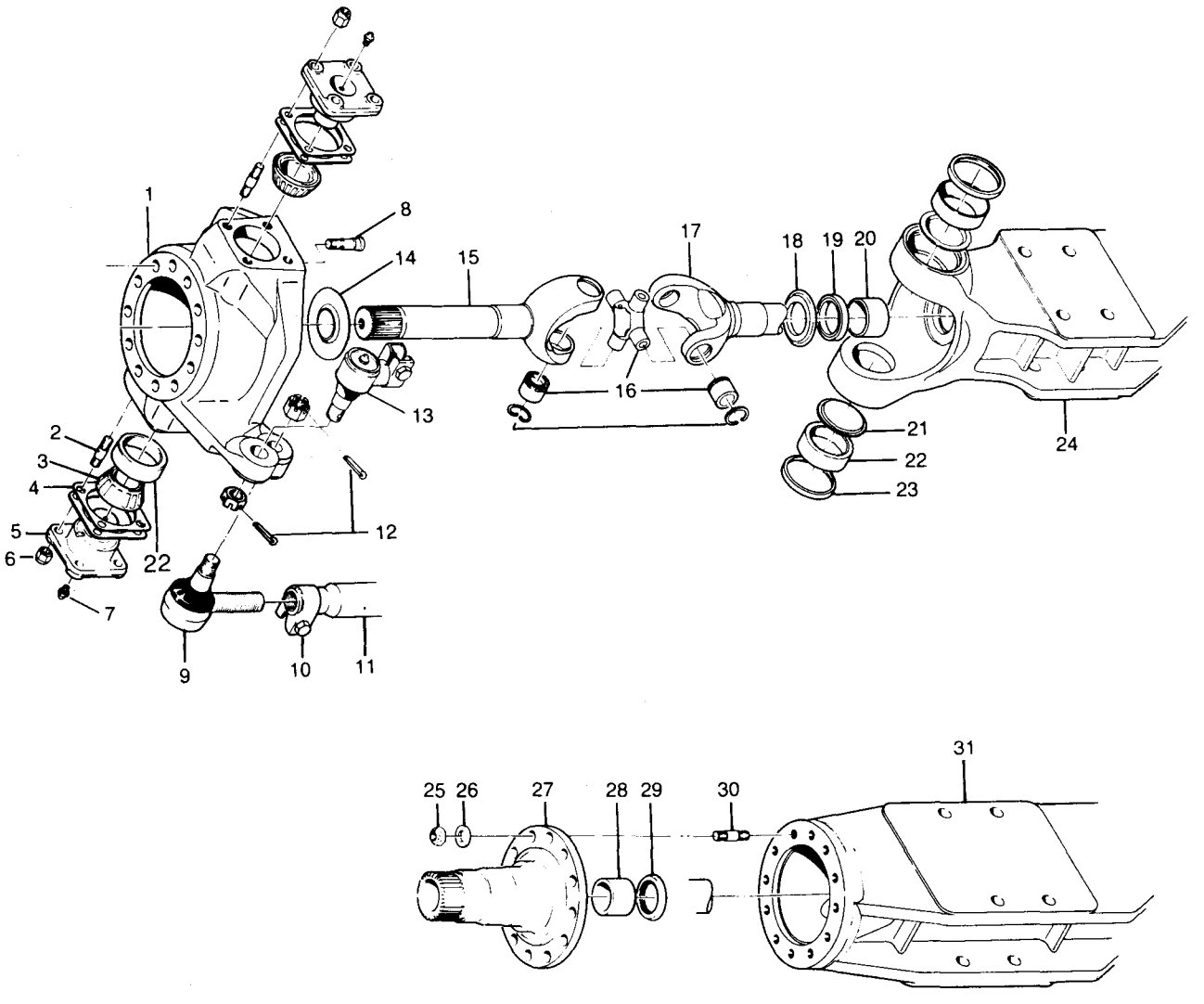


6. With the hub supported, carefully remove it from the spindle.
NOTE: A lifting device is recommended for assemblies having a rotor or brake drum attached.
7. If the axle is equipped with disc or drum brakes the rotor or drum can be removed at this time.
8. Rest hub on drive flange mounting face and remove the hub seal and inner wheel bearing.



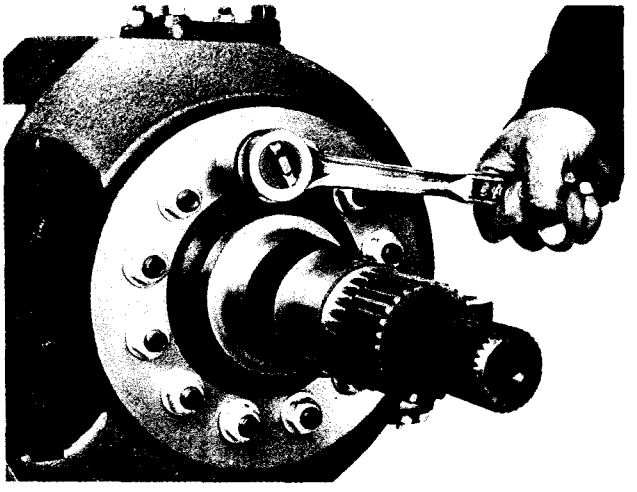
9. Inspect wheel bearings and cups and replace if necessary. Remove cups with a suitable puller.

Steering Knuckle



1 Steering Knuckle
2 Stud — King Pin Mounting
3 Bearing Cone — King Pin
4 Shim — King Pin
5 Bearing Cap — King Pin
6 Nut — Lock
7 Grease Zerk
8 Stud — Spindle Mounting (Steering)
9 Socket Assembly — Tie Rod
10 Clamp Assembly — Tie Rod
11 Tie Rod
12 Cotter Pin
13 Socket Assembly — Steering Cylinder
14 Slinger — Dust
15 Axle Shaft — Outer
16 Cross — U-Joint
17 Axle Shaft — Inner
18 Slinger — Dust
19 Oil Seal
20 Bushing — Shaft
21 Retainer — Grease
22 Bearing Cup — King Pin
23 Seal — King Pin
24 Housing — Steering Axle
25 Nut — Lock
26 Washer — Flat
27 Spindle — Wheel
28 Bushing — Spindle
29 Oil Seal
30 Stud — Spindle Mounting (Rigid)
31 Housing — Rigid Axle

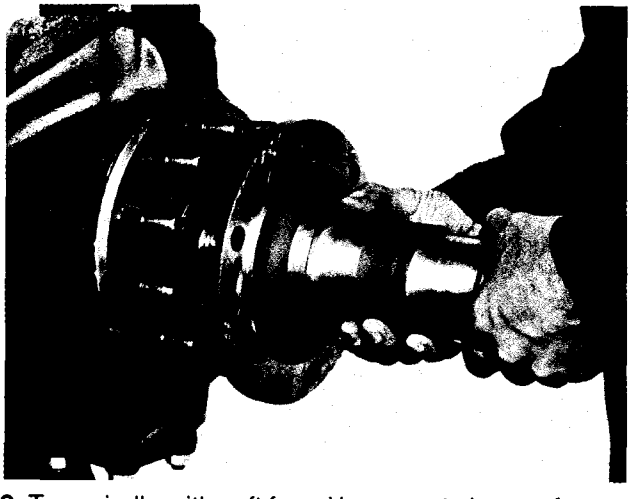
Disassembly of Steering Knuckle



1. Remove spindle mounting nuts and flat washers.

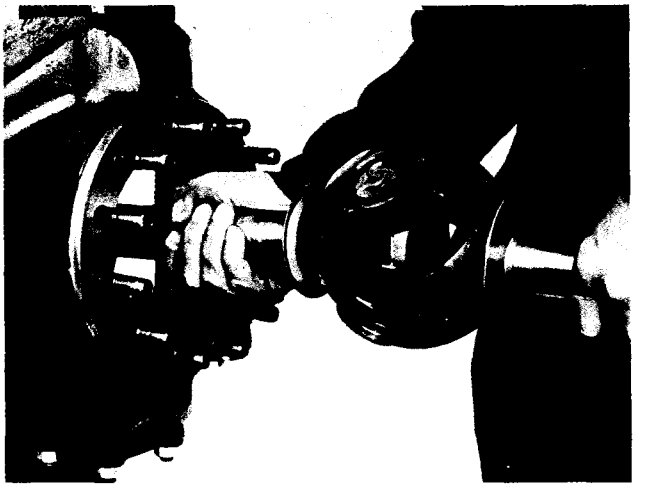
1A. On planetary equipped with disc brake, the caliper mounting bracket can be removed when the spindle mounting nuts are removed.

1B. On planetary equipped with drum brake the complete brake assembly can be removed after removing the spindle mounting nuts.



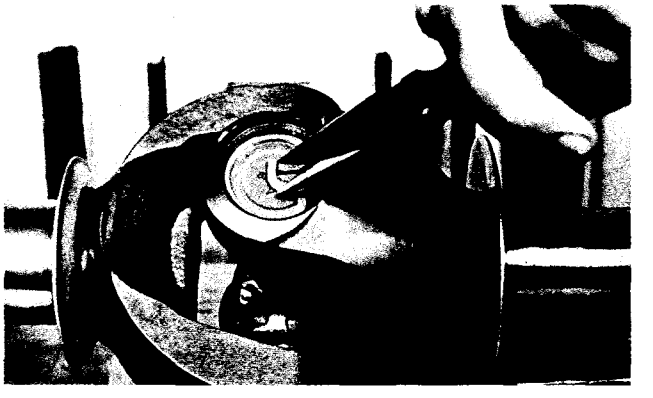
2. Tap spindle with soft faced hammer to loosen from steering knuckle or housing flange. Remove spindle.

3. On the steering axle the spindle contains an outer shaft oil seal and bronze bushing in the spindle bore. These should be replaced if necessary.

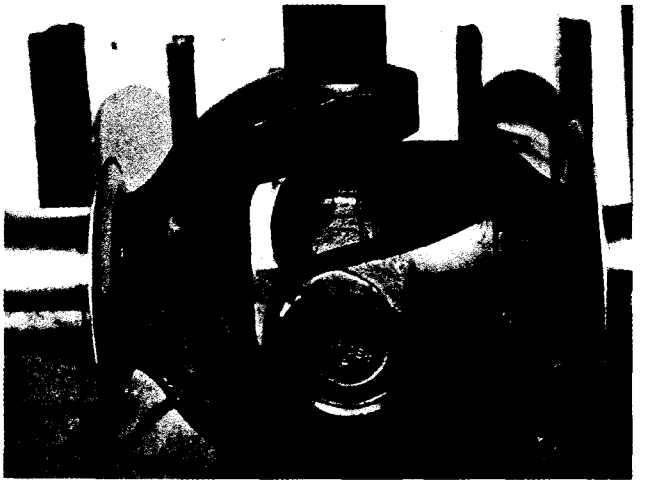


4. To remove axle shaft assembly on the steering axle, hold shaft level and pull straight out to avoid damaging inner shaft oil seal.

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



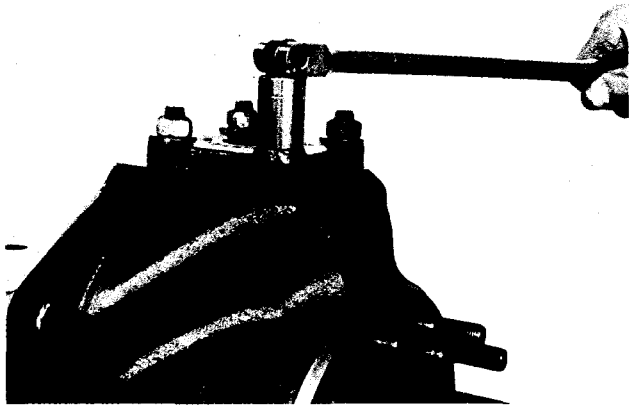
5. To separate inner and outer axle shafts, on steering axle, first remove all bearing cap retaining rings.



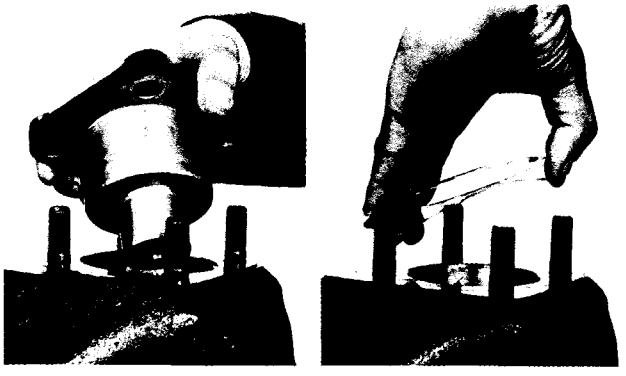
6. Next, press out u-joint bearing caps and remove cross.

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

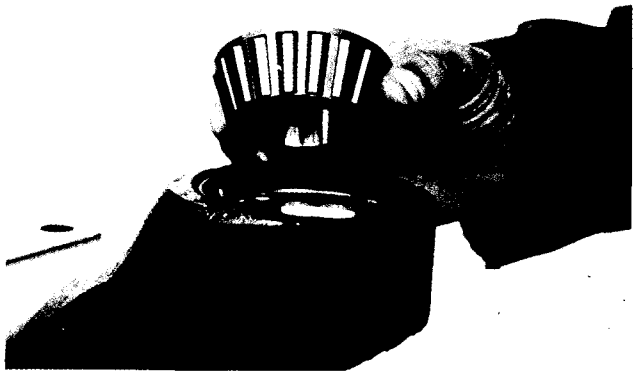
8. Remove tie rod from knuckle, also steering cylinder, if so equipped.



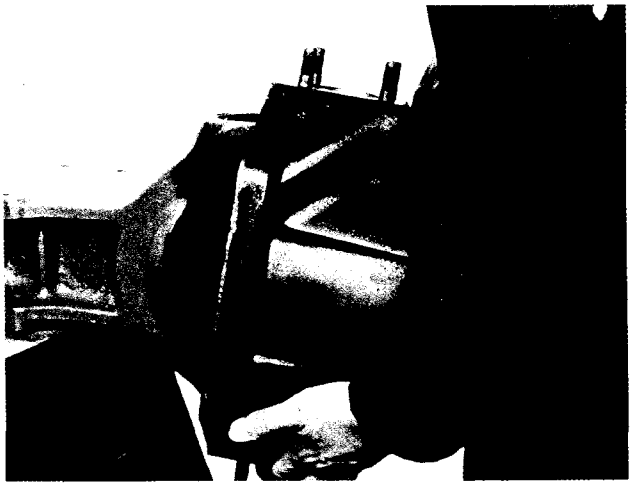
9. Remove bearing cap stud nuts from both upper and lower bearing caps.



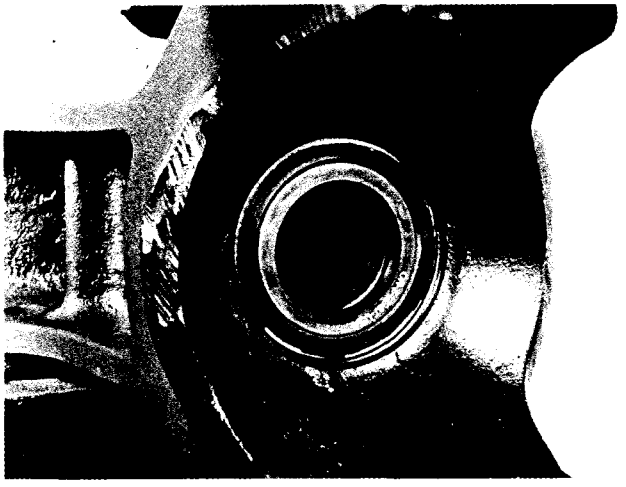
10. Remove both upper and lower bearing caps and shims. Wire shims together with their respective bearing caps to facilitate reassembly.



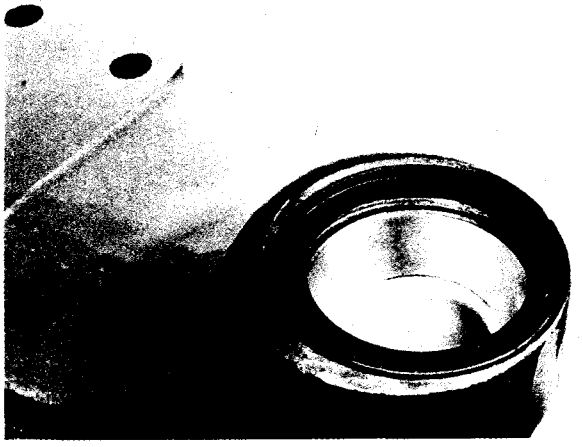
11. Inspect bearing cone and replace if necessary.



12. Tip the steering knuckle slightly and remove from housing yoke.

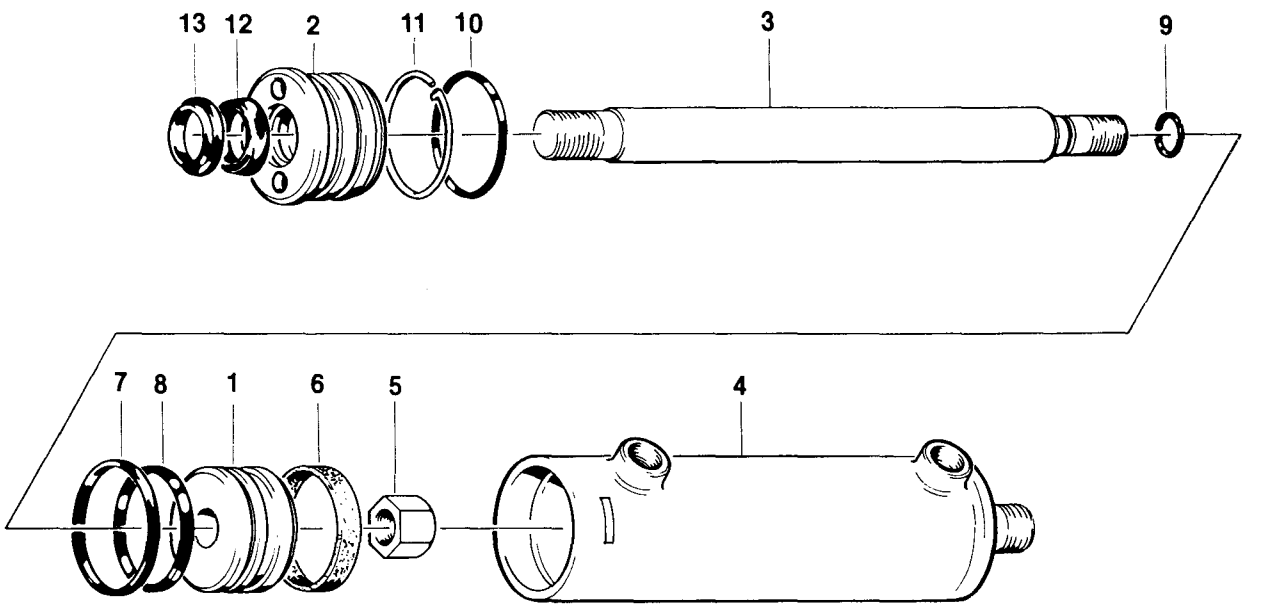


13. Inspect axle seal and bushing. If replacement is necessary, remove with suitable puller.



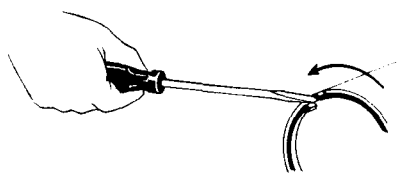
14. Inspect bearing cup and seal; replace if necessary.

Steering Cylinder Disassembly and Assembly



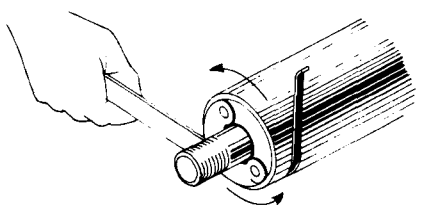
1 Piston
2 Gland
3 Rod (See Axle B/M)
4 Barrel Assembly
5 Locknut
6 Wear Strip
7 Slipper Seal
8 "O" Ring
9 Rod Static Seal
10 Gland Static Seal
11 Lockwire
12 Rod Seal U-Cup
13 Rod Wiper

DISASSEMBLY



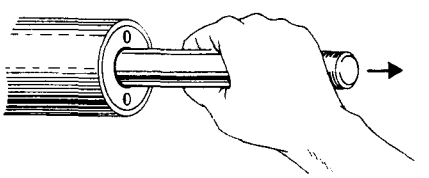
1. A sharp object, such as a screwdriver, must be used to get under the lockwire to start it out of the cylinder.

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.

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



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

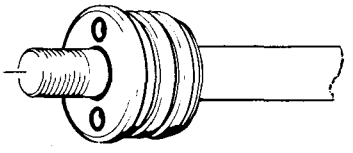
1. Check rod and cylinder bore for nicks, burrs, scratches or rust. Slight defects may be removed with fine sand paper.

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.

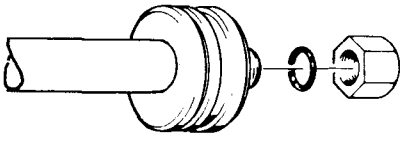
ASSEMBLY

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

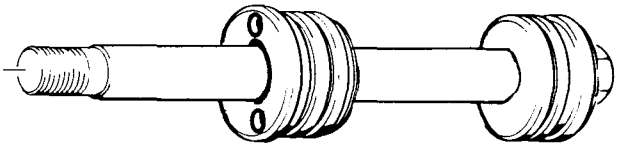
2. Make sure all seals are not twisted or distorted in grooves.



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



4. Install piston on rod turn down.



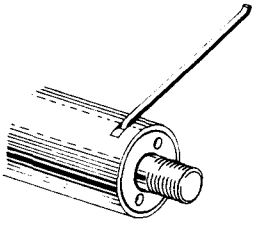
5. Install locknut and torque to 90-100 ft. lbs.

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 into 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.

General Precautions for Assembly

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 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 cause damage to 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 prolonged periods they should be wrapped in wax paper.

INSPECTION

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

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 components for wear or damage. Replace if the following conditions are found.

- Pitted or scored gears.
- Worn, pitted, or scored thrust washers.
- Worn or scored planet gear shafts.

NOTE: Planet gear shafts and drive flange must be replaced as a unit on the 4.21 reduction wheel end.

- Worn, scored or chipped planet gears.

Inspect axle shafts for torsional fractures or other indications of impending failure.

IMPORTANT: READ THIS SECTION BEFORE REASSEMBLY

USE ONLY GENUINE REPLACEMENT PARTS FOR SATISFACTORY SERVICE.

USE A PRESS WHERE POSSIBLE WHEN ASSEMBLING COMPONENT PARTS.

- **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.

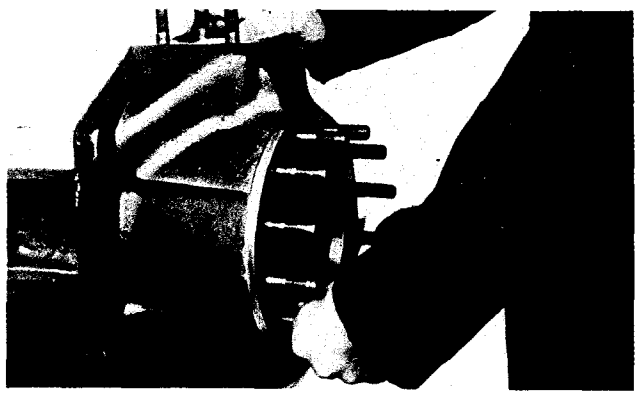
Assembly of Steering Knuckles

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

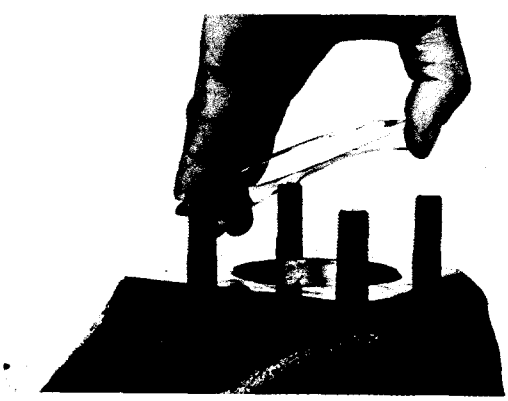
2. Apply #2 Permatex to grease retainers. Install grease retainers and king pin bearing cups into housing yoke.

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

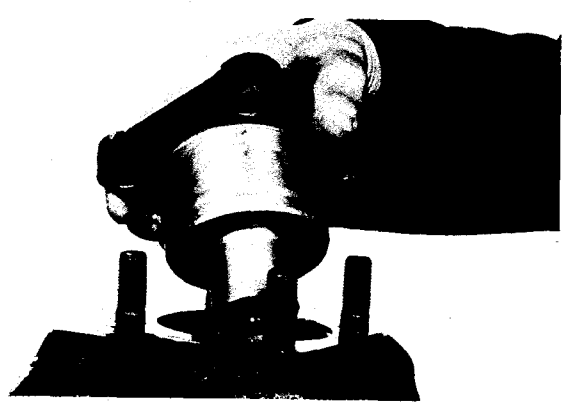
4. Install king pin seals.



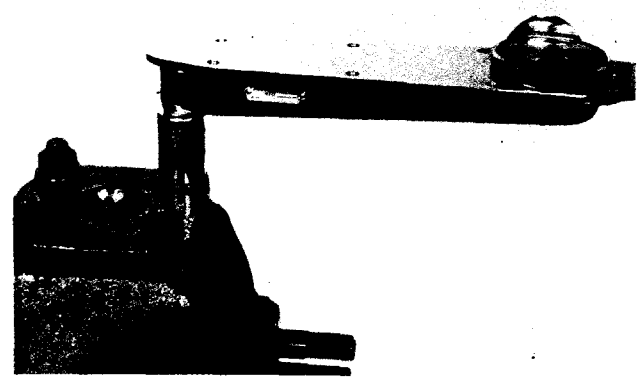
5. Place knuckle in position over housing yoke.



6. Place original shims onto king pin studs.



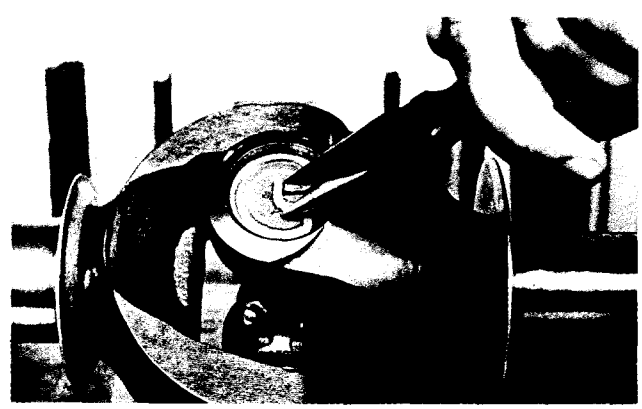
7. Install bearing caps and locknuts. Torque to 95 to 105 ft.-lbs.



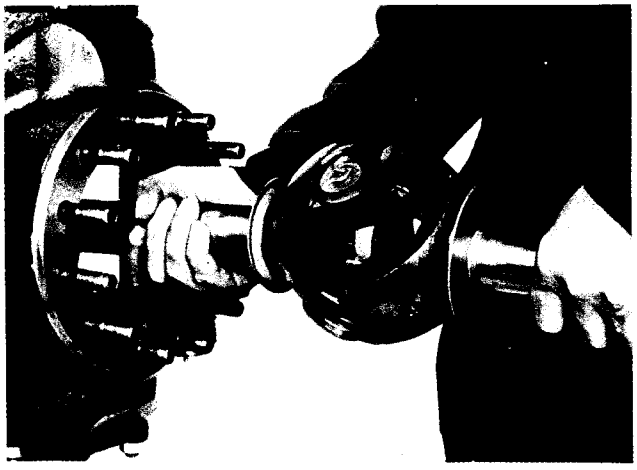
8. To check king pin bearing preload, turn knuckle all the way to the right. Place torque wrench onto nut of bearing cap. Rotate knuckle through complete turn angle. Torque reading should be 20-25 ft.-lbs. Measurement is made less hub components, axle shaft, tie rod, and steering cylinder.

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.

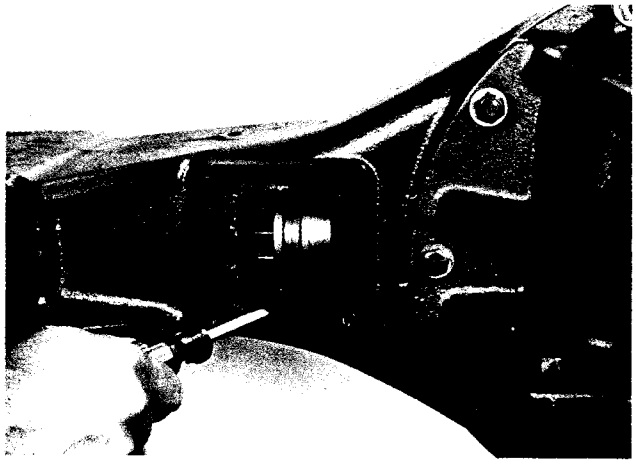
9. To assemble inner and outer axle shafts, insert u-joint cross into yoke of outer shaft and press in bearing caps. Repeat with inner shaft.



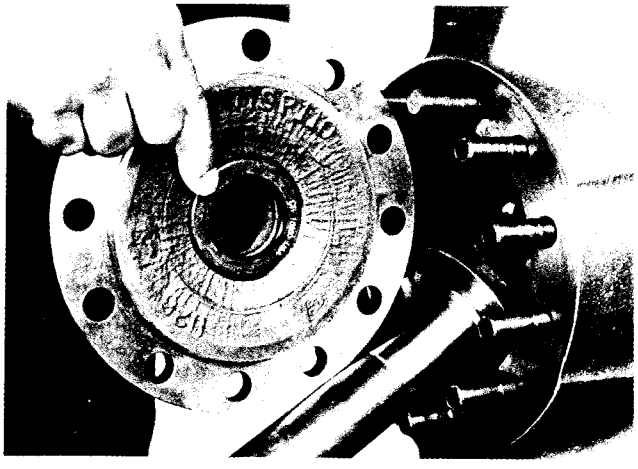
10. Install all bearing cap retaining rings. Grease u-joint.



11. 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.

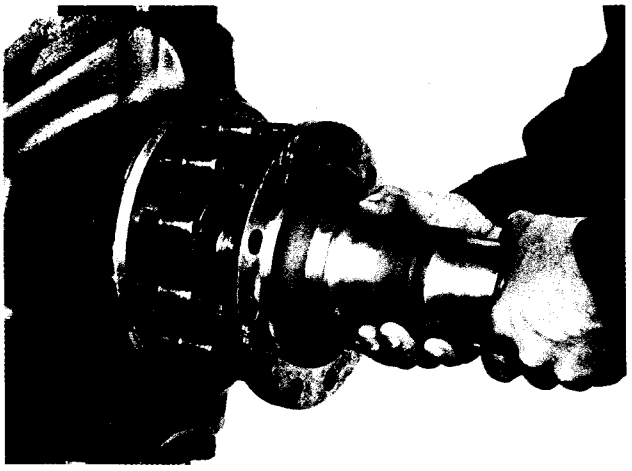


11B. If the axle assembly is equipped with a differential lock, the axle shaft spline must be engaged into the slide collar during installation. This is accomplished by supporting the slide collar through the differential lock opening while the shaft is being installed.

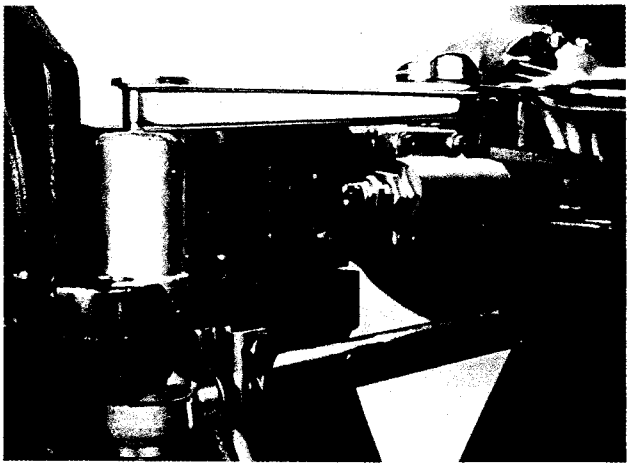


12. On steering axles, install bushing and outer seal into spindle bore.

NOTE: If the axle is equipped with wet disc brake wheel ends refer to the Wet Disc Brake Wheel End Section for remainder of instructions.



13. Install spindle onto knuckle studs or housing flange. Next, install caliper mounting bracket or drum type brake assembly on the studs. Assemble flat washers and lock nuts onto studs and torque to 80-100 ft.-lbs.



14. Connect tie rod ends and steering cylinder (where applicable). Torque socket assembly stud nuts to 140 ft.-lbs. minimum.

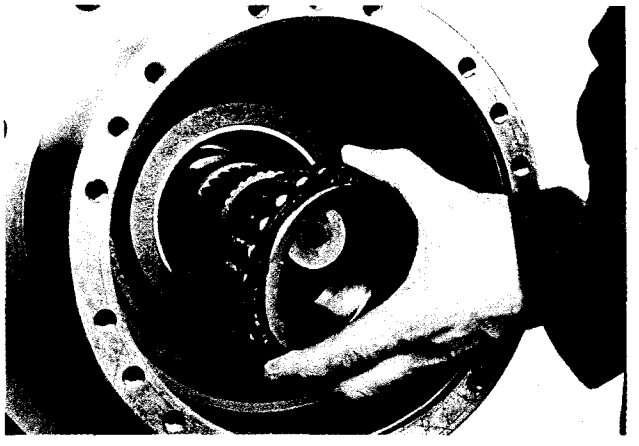
NOTE: If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until the cotter pin can be installed.

Assembly of Wheel End Hub

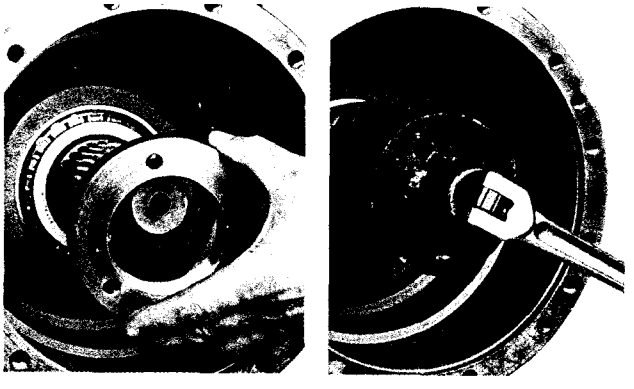
1. Install inner and outer bearing cups into hub. Install inboard bearing and hub seal.

2. Install hub onto spindle.

NOTE: A Lifting device is recommended for assemblies having a rotor or brake drum attached.

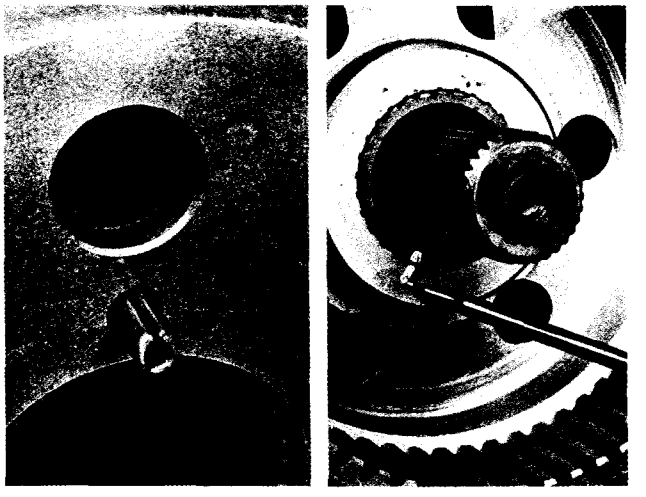


3. Install outer bearing cone.

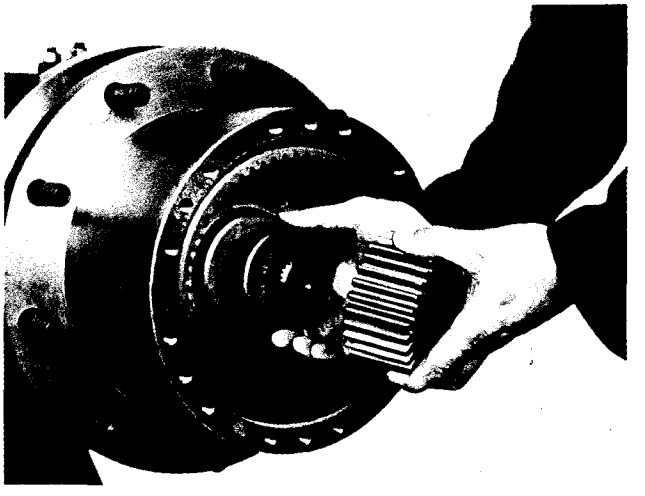


4. Install bearing adjusting nut. Torque to 200-250 ft.-lbs. Back nut off 1/8 turn and align any hole in nut with a major spline on the spindle. Make sure hub rotates freely. (Use Dana Tool #451125)

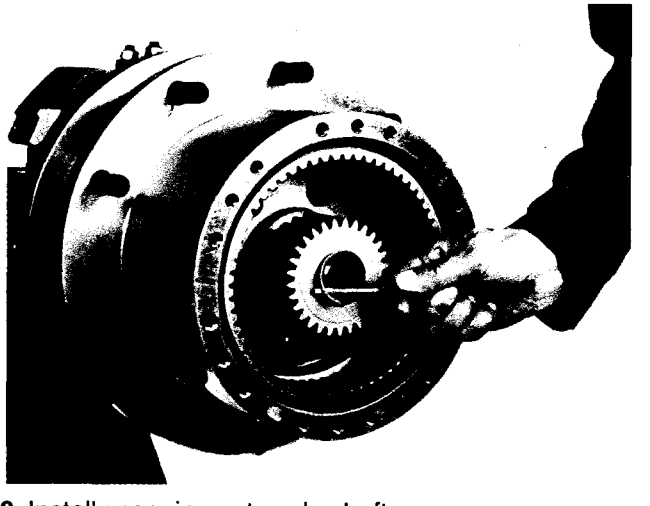
5. As an aid, mark the end of the aligned spline.



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.



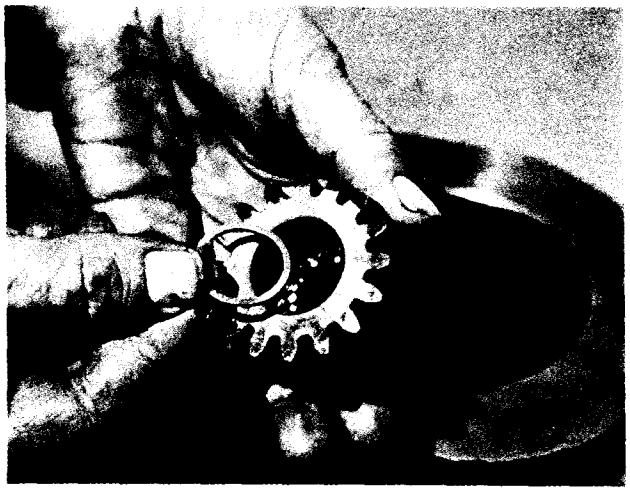
7. Install spacer and sun gear on shaft.



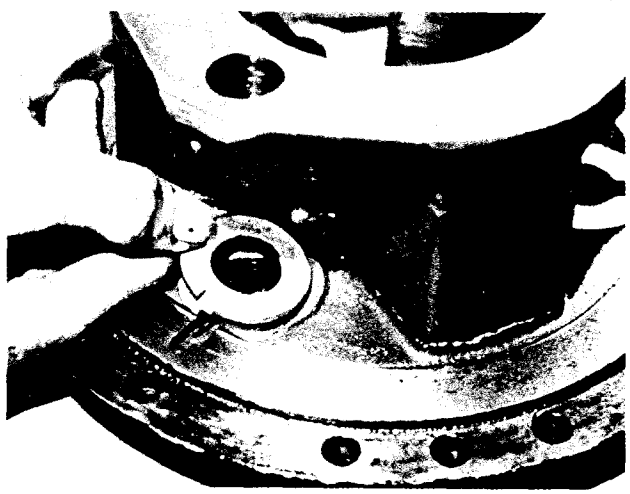
8. Install snap ring onto axle shaft.

Assembly of 3.103/3.650 Drive Flange

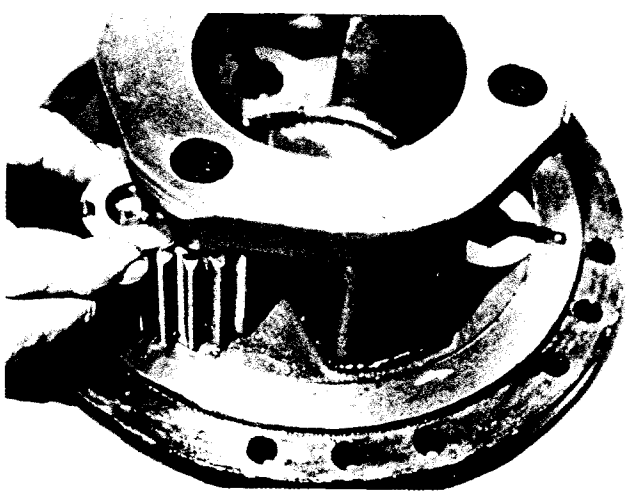
1. Install thrust button and vent into drive flange.



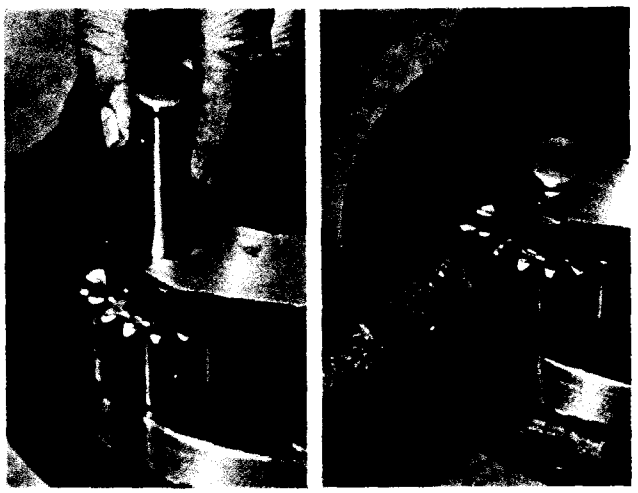
2. Grease inside of planet gear. Install two rows of needle bearings (25 per row) separated by spacer ring.



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.

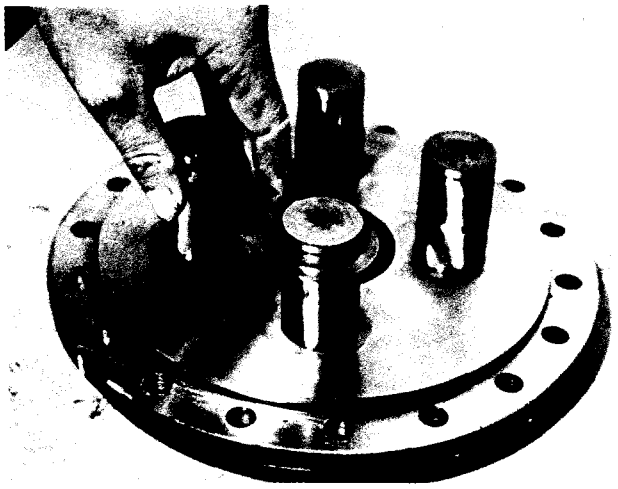
NOTE: DO NOT use silicone sealer on drive flange. It can cause flange to loosen.

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

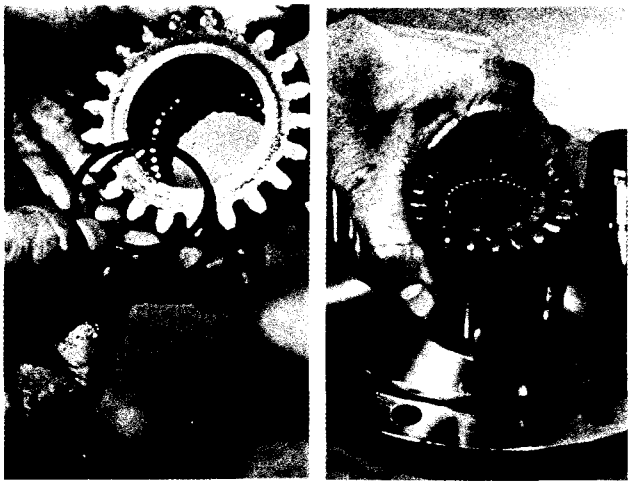
8. Install and torque bolts 90-100 ft.-lbs.

Assembly of 4.21 Reduction Drive Flange

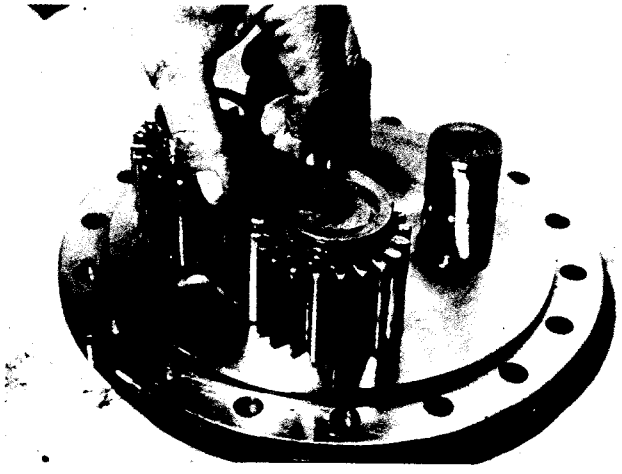
1. Install thrust button and vent into drive flange.



2. Place inner thrust plates onto pins.



3. Grease inside of planet gear. Install two rows of needle bearings (39 per row) separated by a spacer ring. Place planet gears onto planet shafts.



4. Install outer thrust plates onto pins, aligned with inner thrust plates.

5. Install snap rings into grooves of planet gear shafts by rotating around the pin until the snap ring locks into place.

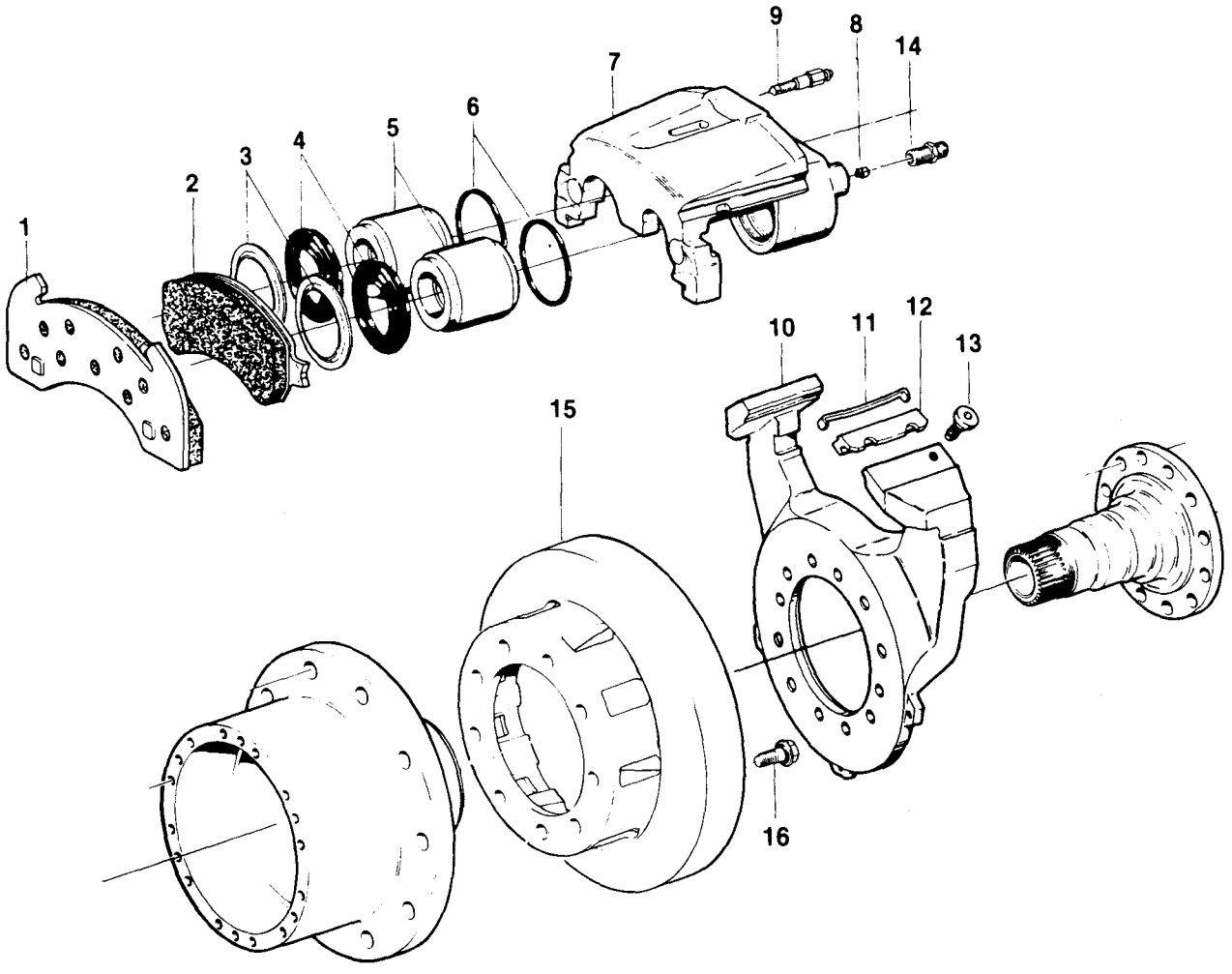
6. Apply a small bead of Permatex #2 gasket sealer around the drive flange as shown in step 6, pg. 19.

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.

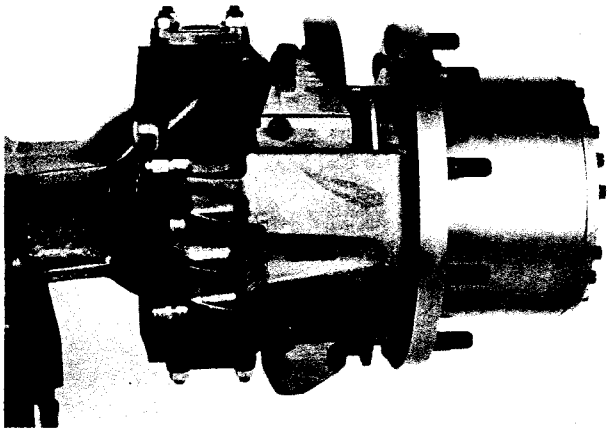
8. Install and torque bolts 90-100 ft.-lbs.

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 Hydrualic Fluid Fitting
15 Disc (Rotor)
16 Hex Bolt

Disassembly and Assembly of Wheel End Disc Brake



MAINTENANCE

GENERAL

It is difficult to determine an exact maintenance interval (time or 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 of the 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.

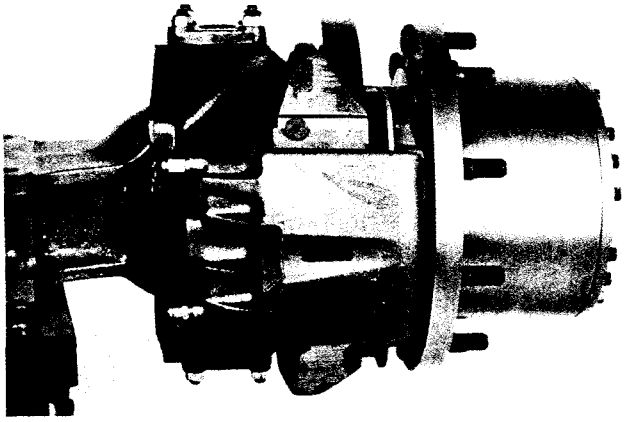
5. If the original brake pads are to be reused, mark them in some manner so they can be installed in the same location.

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

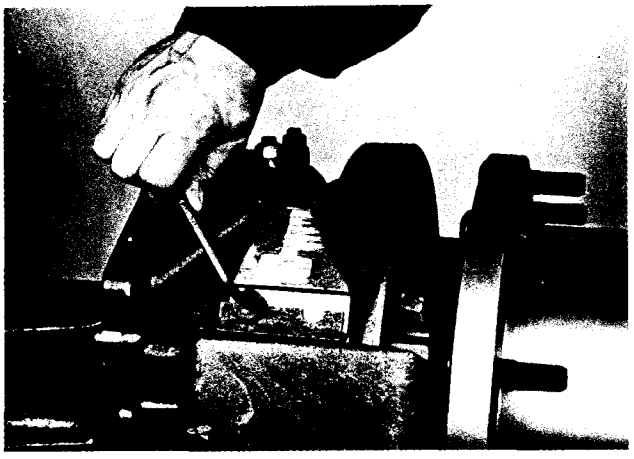
CALIPER AND PADS REMOVAL



1. Position vehicle on floor stands and remove wheel.

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

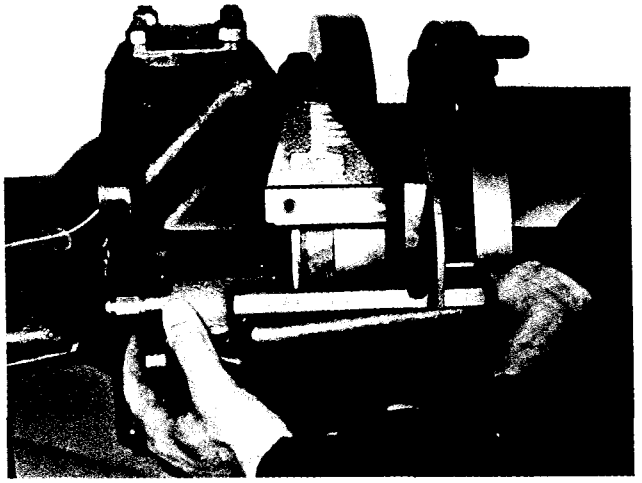
3. Pry the caliper outboard retracting the caliper pistons into the cylinder bore.



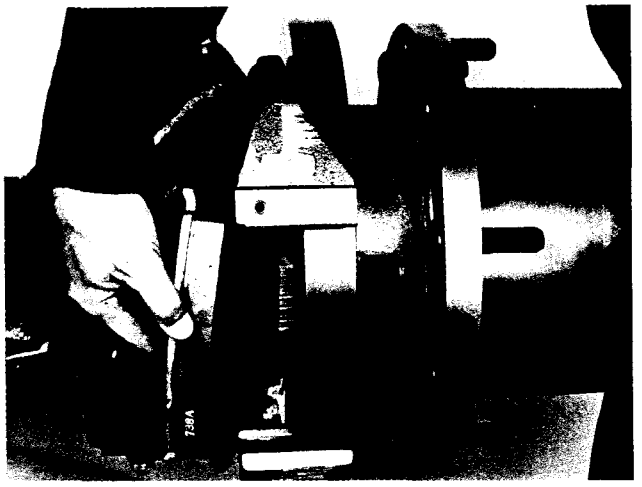
4. Remove support key retaining screw.

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.

NOTE: The piston boot and seal cannot be reused.

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.

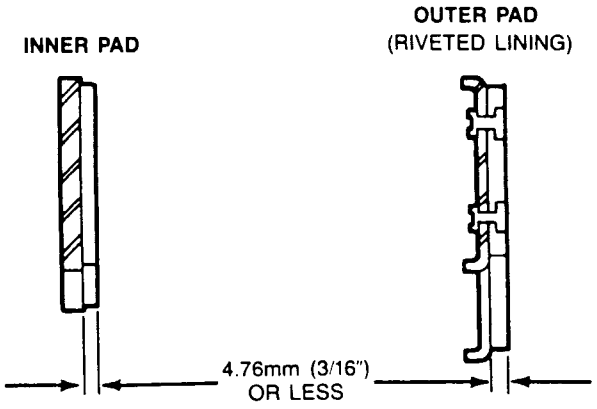
3. Position piston and boot over piston bore and install lip of boot into groove near top of bore. Be sure boot lip is fully seated.

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.

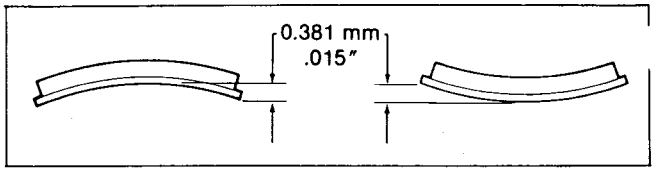


If lining material shows signs of excessive cracking, the pads must be replaced.

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

Replace chipped or flaking brake pads.

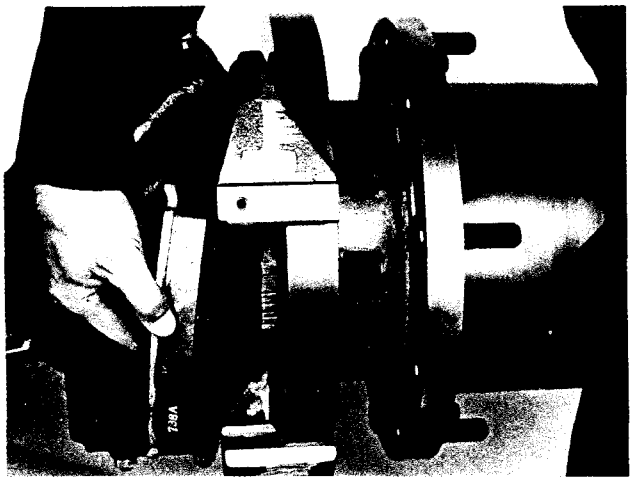
Replace brake pads contaminated with oil, grease, or any material not easily removed with a clean rag.



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.

PADS AND CALIPER INSTALLATION

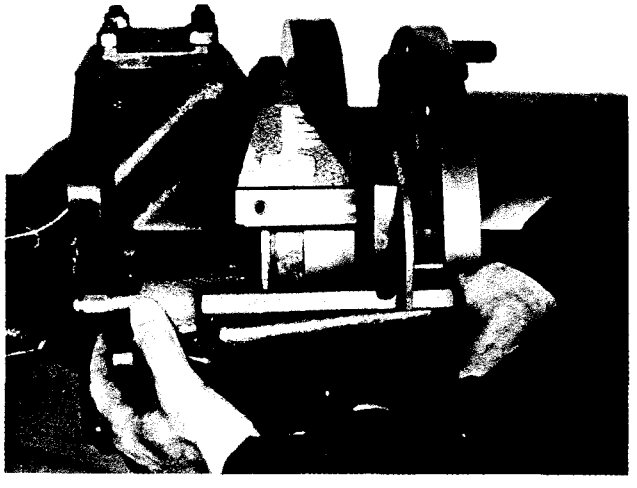


1. Position the inboard (smaller) pad into the caliper mounting bracket with lining towards rotor.

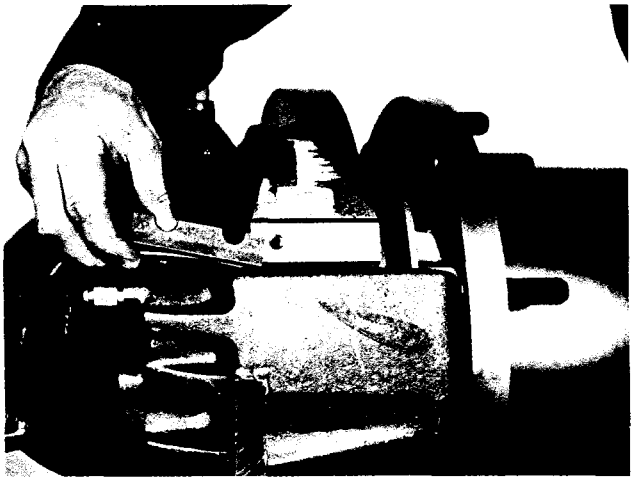
2. Be sure the caliper piston is fully bottomed in the piston bore.

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.

CAUTION!
Asbestos Brake Linings
Contain Asbestos Fibers

Breathing asbestos dust may be hazardous to your health and may cause serious respiratory or other bodily harm.

AVOID CREATING DUST

DO NOT remove brake drum without proper protective equipment.

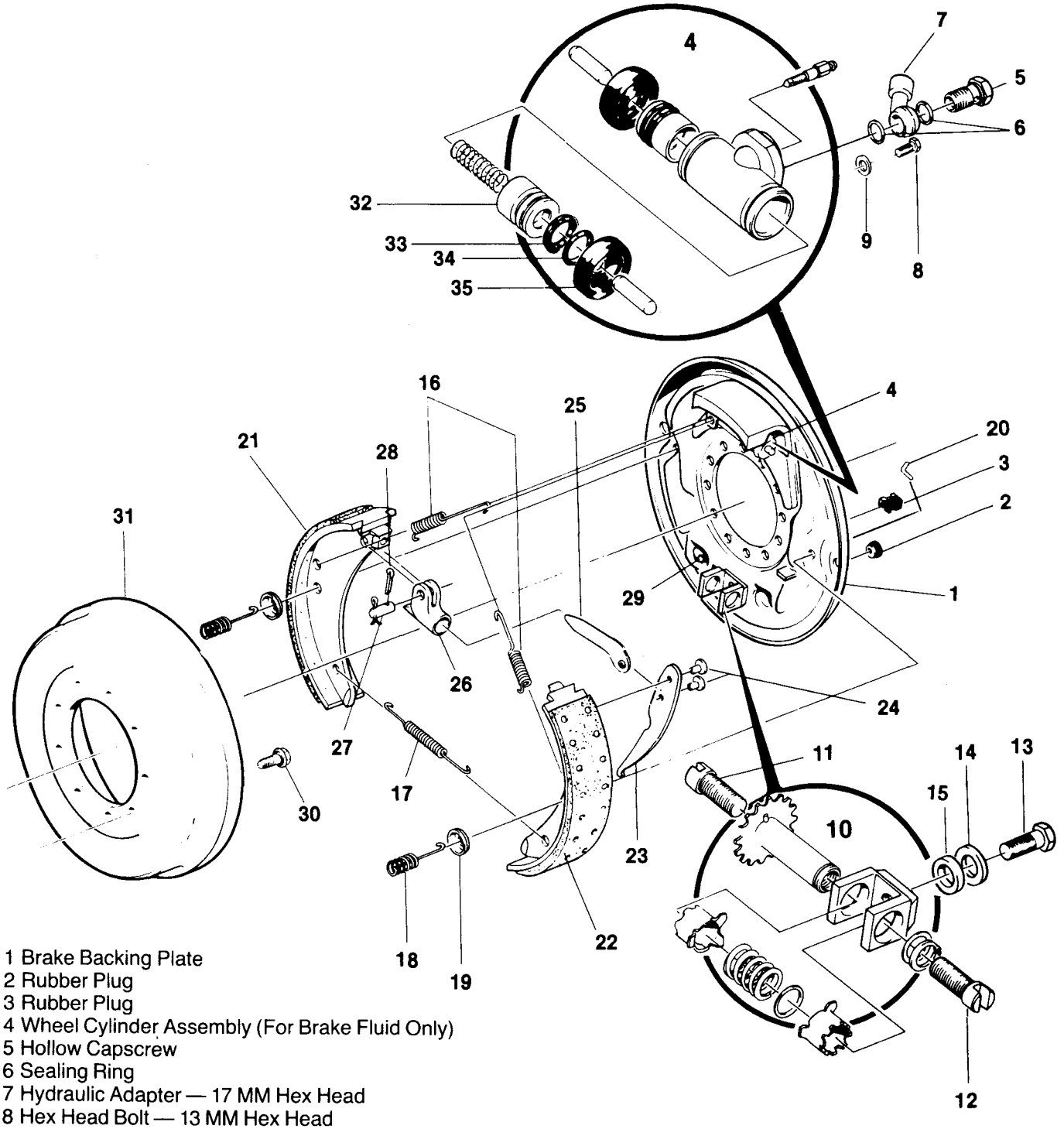
DO NOT work on brake linings without proper protective equipment.

DO NOT replace brake linings without proper protective equipment.

DO NOT attempt to sand, grind, chisel, file, hammer or alter brake linings in any manner without proper equipment.

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

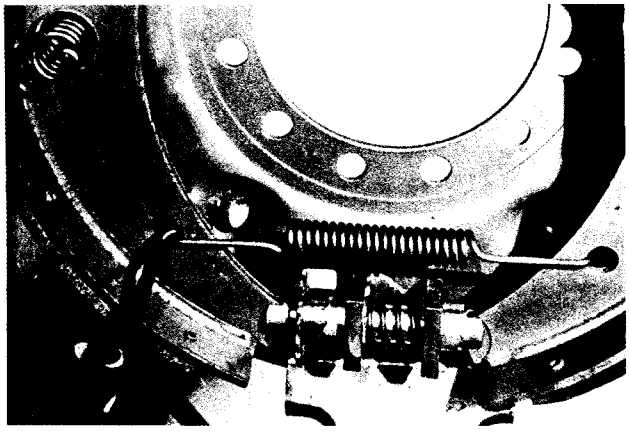
Drum Brake



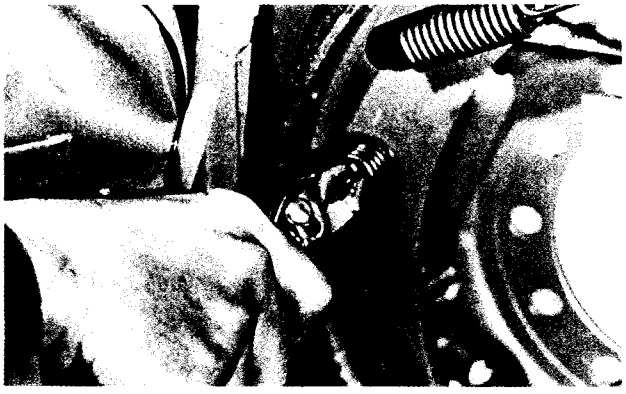
1 Brake Backing Plate
2 Rubber Plug
3 Rubber Plug
4 Wheel Cylinder Assembly (For Brake Fluid Only)
5 Hollow Capscrew
6 Sealing Ring
7 Hydraulic Adapter — 17 MM Hex Head
8 Hex Head Bolt — 13 MM Hex Head
9 Lockwasher
10 Manual Adjuster Assembly
11 Adjusting Screw — L.H. Thread
12 Adjusting Screw — R.H. Thread
13 Hex Head Bolt — 22 MM Hex Head
14 Lockwasher
15 Flat Washer
16 Tensions Springs
17 Tension Spring
18 Compression Spring
19 Spring Plate
20 Spring Retainer
21 Brake Shoe and Lining (Prim.)
22 Brake Shoe and Lining (Sec.)
23 Cable Lever
24 Rivets
25 Cross Strut
26 Cross Strut Holder
27 Pin
28 Cotter Pin
29 Parking Cable Adaptor
30 Hex Bolt
31 Brake drum
32 Piston
33 Piston Seal (Inner)
34 Piston Seal (Outer)
35 Dust Boot

Disassembly and Assembly of Wheel End Drum Brake

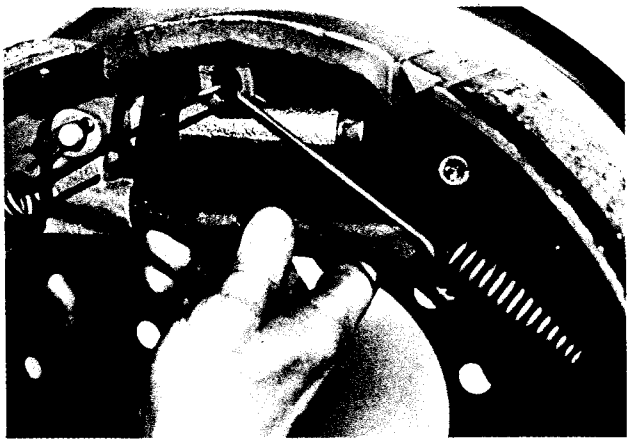
NOTE: All special tools required to service the wheel end drum brakes, are standard automotive brake service tools. Use DOT-3 brake fluid to service hydraulic system. If brake assembly is removed from axle housing, mount onto suitable holding fixture.



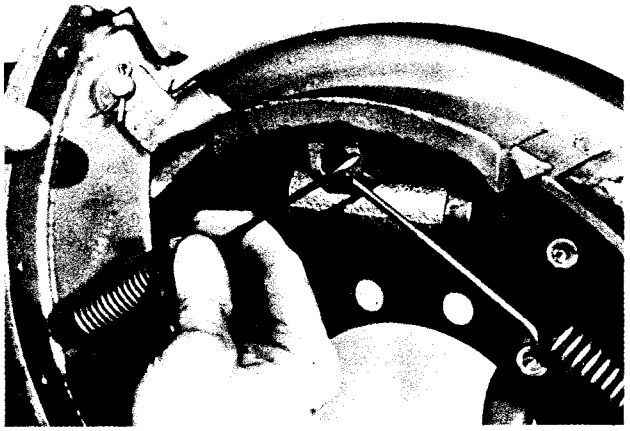
1. Remove the lower shoe retaining spring by using suitable brake spring tool.



2. Remove the shoe hold-down spring, of the primary brake shoe, by pushing the spring coils toward the backing plate, and remove hold-down spring retaining pin from backing plate.

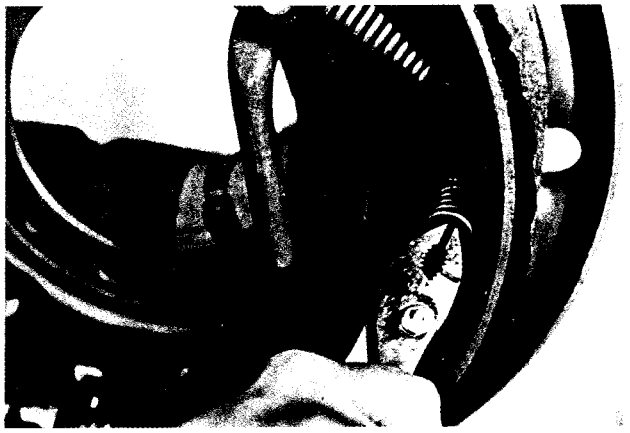


3. Remove primary brake shoe by pulling away from center and dropping emergency hand brake anchor rod.

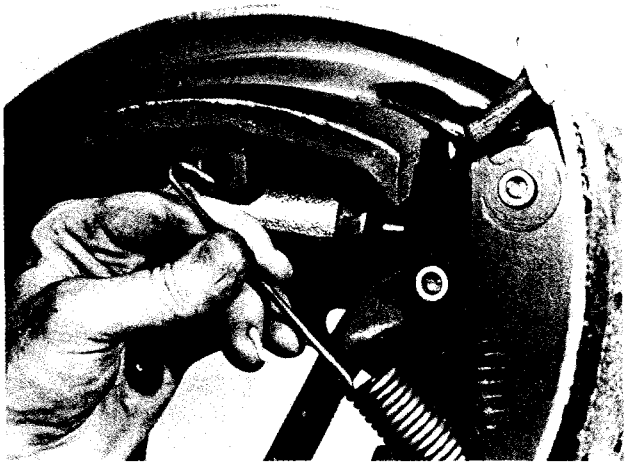


4. Now lift primary shoe up. Remove upper shoe retaining spring, and remove primary shoe.

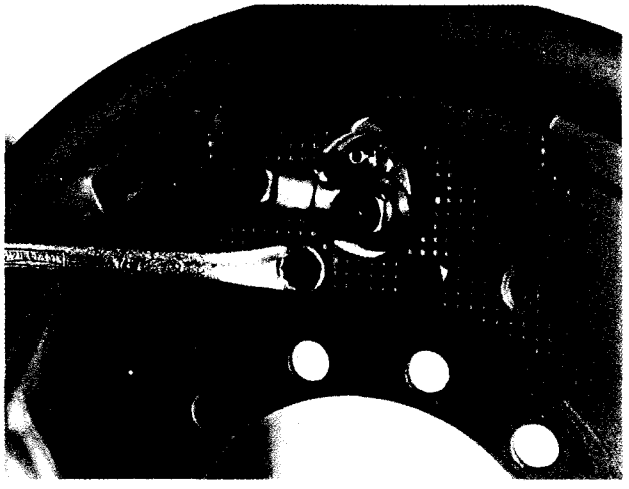
5. Remove hand brake cable from secondary shoe, if still attached.



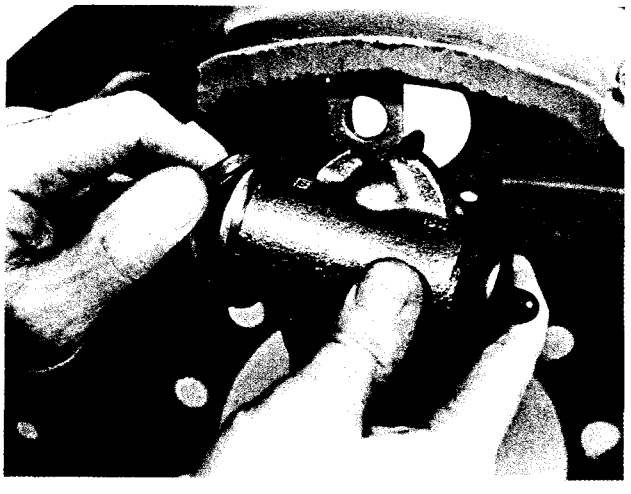
6. Remove secondary brake shoe hold-down spring following procedure outlined in step #2.



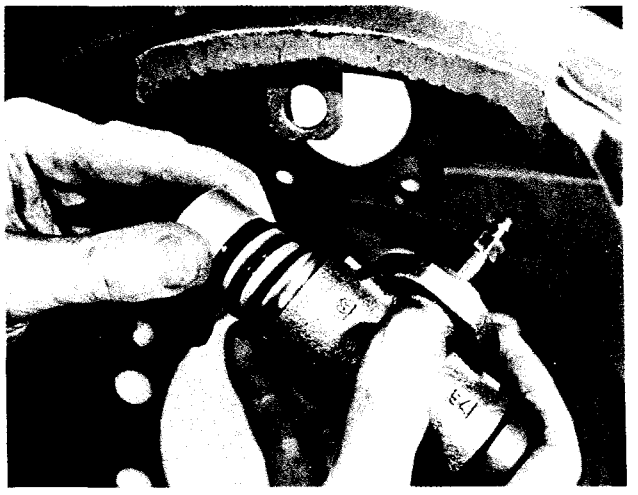
7. Lift secondary shoe up, remove upper shoe retaining spring, and remove secondary shoe.



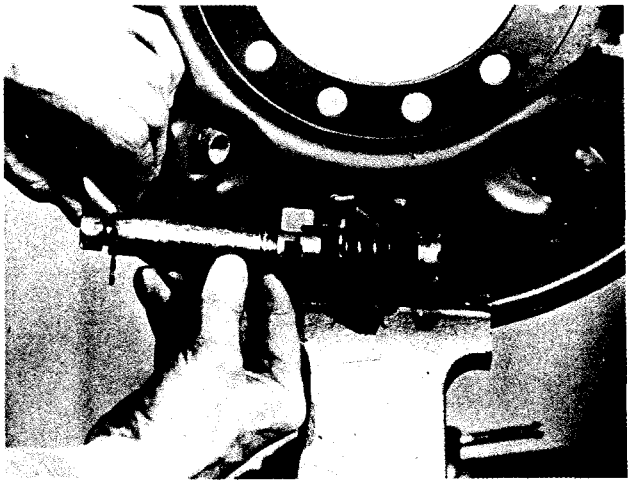
8. To service hydraulic wheel cylinders, remove attaching bolts from backing plate and remove wheel cylinder assembly.



9. Remove dust covers and push rods from wheel cylinder.



10. Remove pistons from wheel cylinder, inspect for grooves. Also at this time, inspect inner bore of cylinder for grooves or pits from rust. If the cylinder is pitted or grooved, it must be replaced.



11. Remove manual adjuster from mounting bracket and inspect for excessive wear.

Wheel End Drum Brake Assembly

DRUM SPECIFICATIONS

Nominal Internal Diameter	15.738″
Maximum Usable Diameter	15.870″
Maximum Allowable Remachining Diameter	15.830″
Allowable Radial Variance	.005″

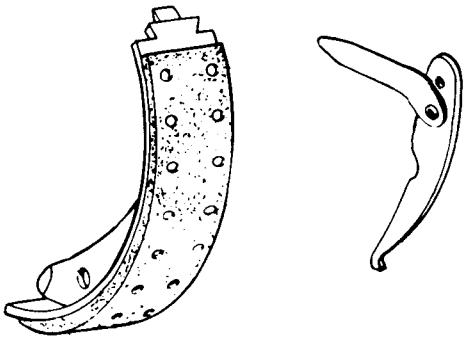
Replace or machine drum if not within these specs.

1. Clean all parts using suitable brake cleaning solution.

CAUTION: Do not use petroleum based solvents to clean brake parts or damage to lining and rubber parts will occur.

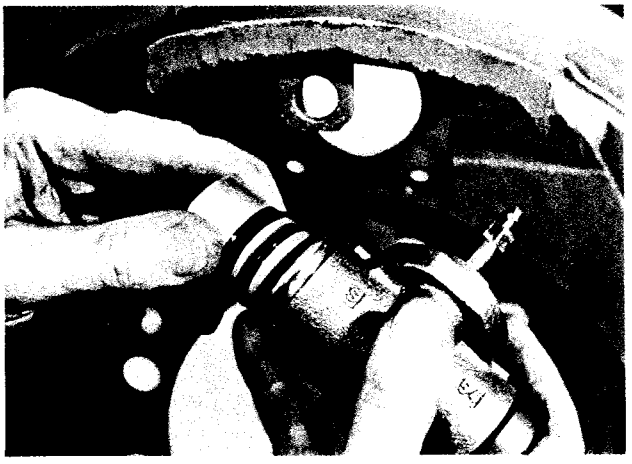
After cleaning, inspect all parts again for damage or excessive wear. Replace all worn components with Genuine Spicer Service Parts. (Refer to service parts catalog covering this application.)

2. If brake shoes are worn to 0.150 inches thickness replace all shoes at both wheel ends. It is recommended that brake drums be resurfaced when brake shoes are replaced.



When replacing brake shoes only, it will be necessary to remove parking brake lever and strut, and reassemble onto new secondary shoe.

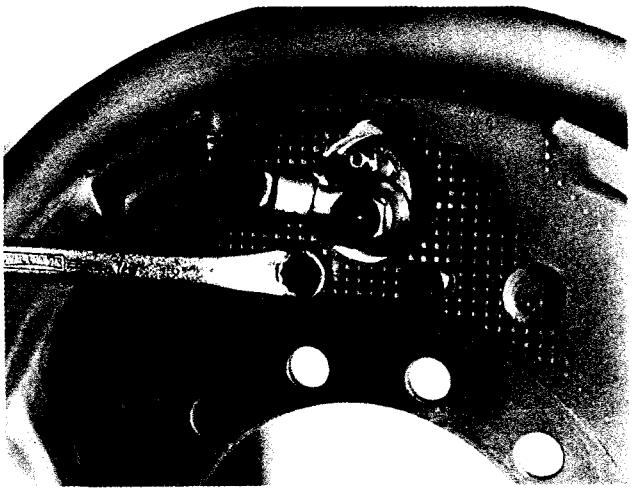
3. If wheel cylinder is not pitted or scored and rebuilding is possible, hone wheel cylinder inner bore to remove imperfections.



4. Replace both inner and outer piston seals and lubricate with brake fluid or suitable brake assembly lube. Replace both pistons and inner cylinder spring.

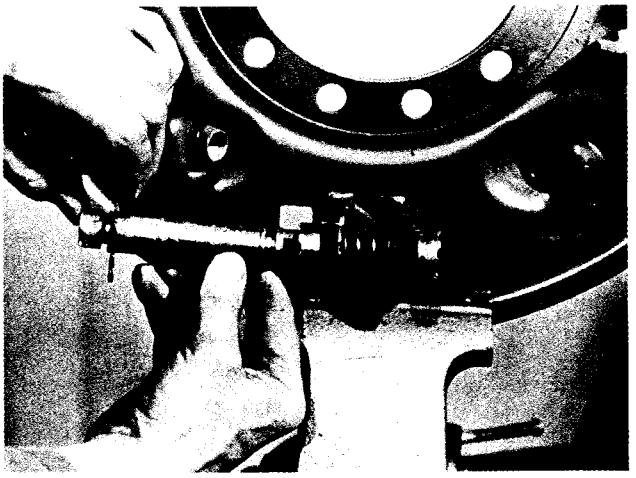
CAUTION: Sealing surface of cup type piston seals must face toward center of cylinder.

5. Replace dust boots and push rods.

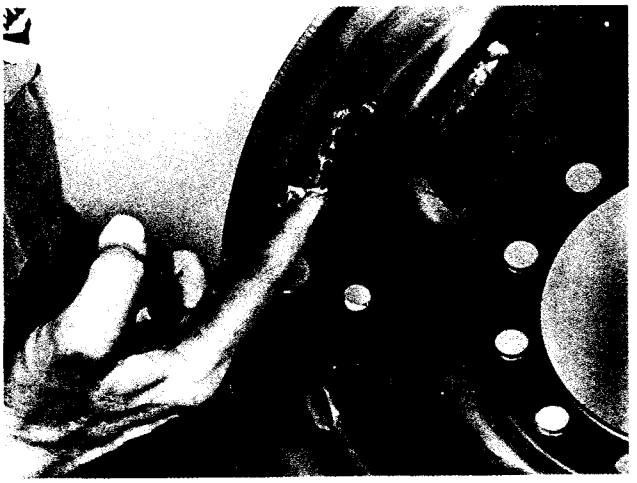


6. Attach wheel cylinder to backing plate. Torque capscrew to 10-12 ft. lbs.

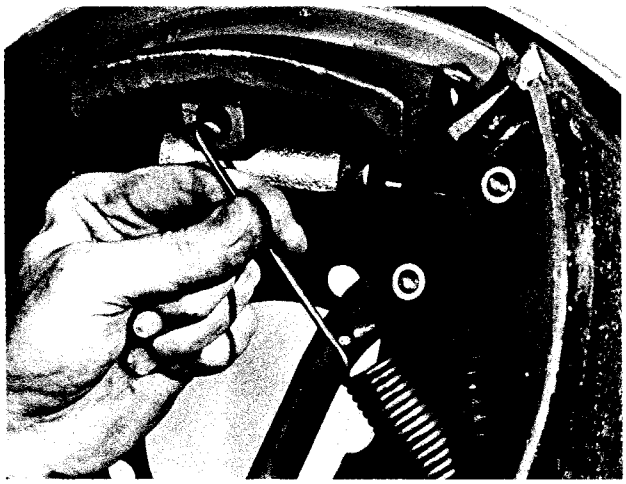
Install hydraulic adapter into wheel cylinder with copper sealing rings on each side and torque adapter capscrew to 22-26 ft. lbs.



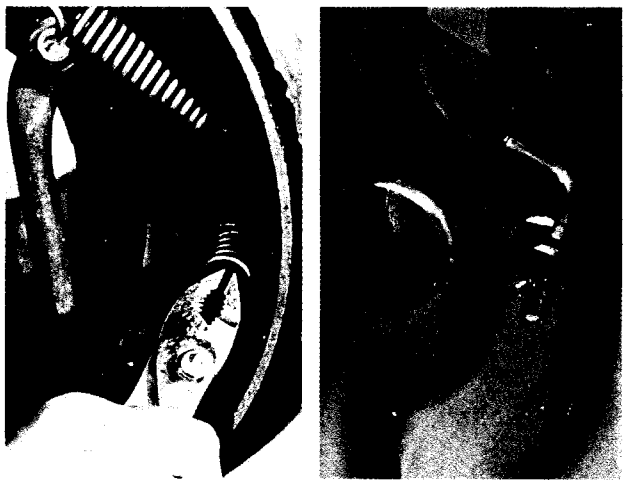
7. Coat adjuster screw with suitable multipurpose lubricant and install into adjuster nut. Thread into shortest position. Install unit into adjuster housing.



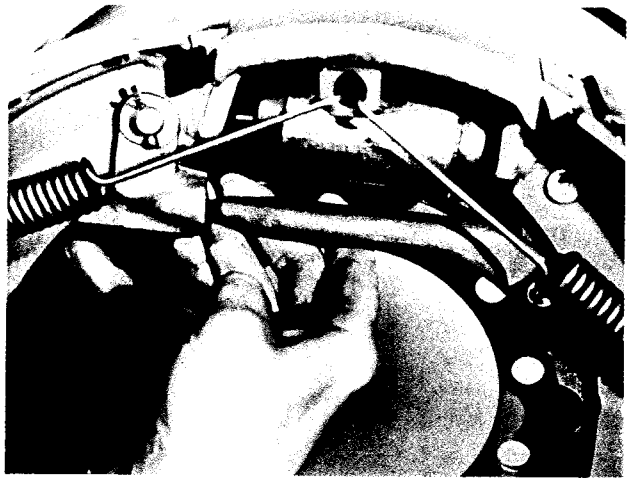
8. Coat all points of contact between the brake shoes and other brake parts with suitable multipurpose lubricant.



9. Replace secondary shoe by placing upper retaining spring into anchor, and moving shoe down into position.

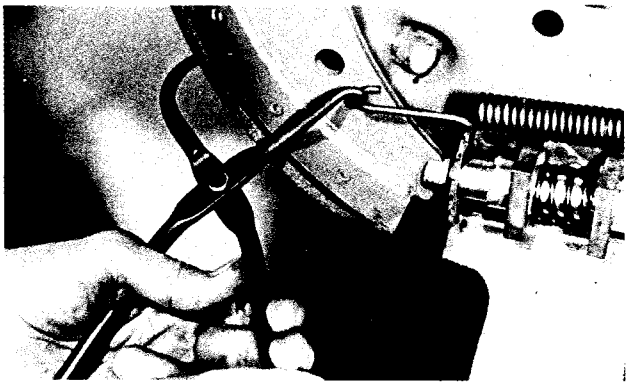


10. Replace secondary shoe hold-down spring by pushing it toward backing plate and through hole provided. Replace hold down spring retainer pin.

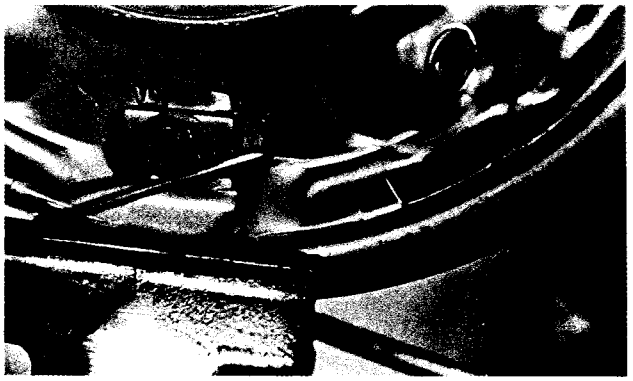


11. Replace primary shoe by placing upper retaining spring into anchor. Move shoe down into position so hand brake anchor rod can be replaced into socket.

12. Replace primary shoe hold-down spring.



13. Replace lower retaining spring, and hand brake cable.



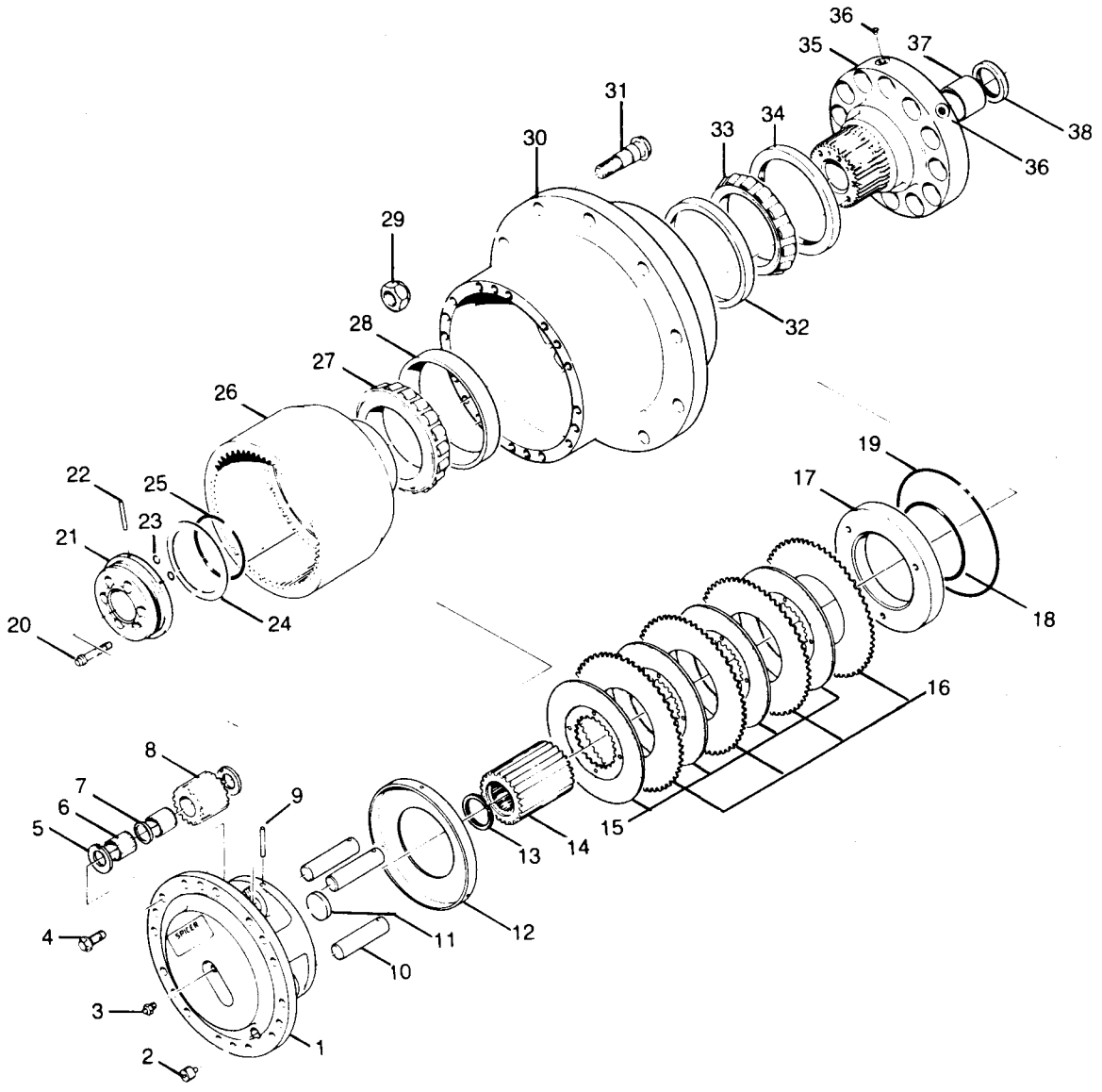
14. Replace brake drum onto wheel end, loosen adjuster housing mounting bolt (22 mm hex head shown behind adjusting tool). Adjust brake shoes out until they contact the brake drum. Tap backing plate lightly with soft hammer to center adjuster housing. Retighten housing mounting bolt and torque to 55-62 ft. lbs. Back adjuster off until brake drum can be turned freely. This completes service of wheel and drum brakes.

BLEEDING INSTRUCTIONS

For proper bleeding procedures refer to VEHICLE SERVICE MANUAL.

CAUTION: DO NOT move vehicle until a firm pedal is felt at brake application.

Wet Disc Brake Wheel End 3.65 Reduction



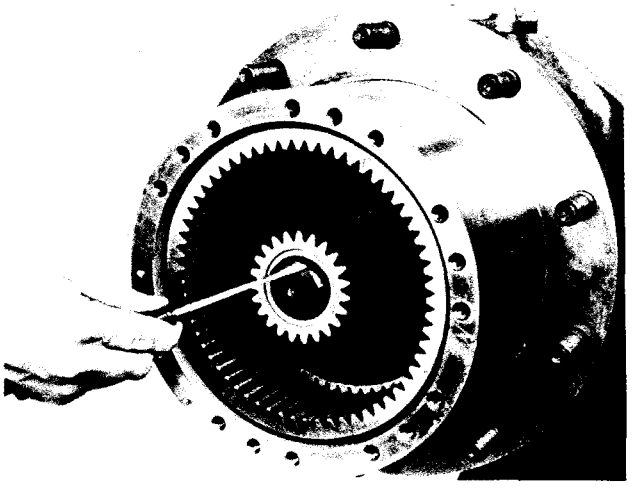
Ref. No.	Part No.	Part Description	Quantity Required
	R30SD104-1X	Gear Assembly-Planetary (Ref. Nos. 1 thru 12)	
1	R30SD103	Flange-Drive Planetary	1
2	H501041	Plug-Pipe Recessed Drive (Magnetic)	1
3	H431715	Vent	1
4	070HM139-1	Screw-Hex Self Locking	18
5	H45178	Washer-Keyed	6
6	H504658	Bearing-Needle Roller	150
7	H45192	Washer-Planet Gear	3

Ref. No.	Part No.	Part Description	Quantity Required
8	R30GS101	Gear-Spur Planet	3
9	R30HM103	Pin-Roll	3
10	R30SS105	Shaft-Planet Gear	3
11	077HS113	Washer-Drive Flange	1
12	R30WA109	Plate-Lining Stop	1
13	070HR116	Ring-Snap (Rigid Axle)	1
	H500632	Ring-Snap (Steering Axle)	1
14	R30GS105	Gear-Spur (Rigid Axle)	1
	R30GS103	Gear-Spur (Steering Axle)	1
15	**	Disc-Assembly-Friction	4
16	**	Plate-Lining Stop	4
17	R30WJ102	Piston	1
18	R30HH104	O-Ring	1
19	R30HH103	O-Ring	1
20	R30HM102	Screw-12 Point Cap	6
21	R30HR105	Retainer-Bearing Adjusting Ring	1
22	R30HN101	Tubing-Brake	1
23	R30HH105	O-Ring	2
24	R30HS113-1	Shim-Adjusting (.002)	As Req.
	R30HS113-2	Shim-Adjusting (.005)	As Req.
	R30HS113-3	Shim-Adjusting (.010)	As Req.
	R30HS113-4	Shim-Adjusting (.020)	As Req.
	R30HS113-5	Shim-Adjusting (.030)	As Req.
25	R30HH106	O-Ring	1
26	R30GT101	Gear-Planetary Ring	1
27	H505987	Bearing-Cone (Outer)	
28	131HA103	Bearing-Cup (Outer)	1
29	077HN114	Nut-Wheel Mtg. (5/8-18 R.H. Th'd)	12
	070HN137-1	Nut-Wheel Mtg. (3/4-16 R.H. Th'd)	8 or 10
30		Hub-Planetary (See Axle B/M)	
31		Bolt-Wheel Mtg. (See Axle B/M)	
32	070HA104	Bearing-Cup (Inner)	1
33	070HB104	Bearing-Cone (Inner)	1
34	R30HH102	Seal-Oil	1
35	R30SP109	Spindle-Wheel (Rigid Axle)	1
	R30SP106	Spindle-Wheel (Steering Axle)	1
36	R30WJ103	Seat-Insert	2
37	R30HS109	Bushing-Spindle (Rigid Axle)	1
	H10170	Bushing-Spindle (Steering Axle)	1
38	097HH101	Seal-Oil (Rigid Axle)	1
	H504384	Seal-Oil (Steering Axle)	1
Not Shown:			
	070WJ102	Bleeder	1
	070HN152	Fitting	1
Service Kits:			
	R30KC100X	Discs and Plates (Includes Items 15 & 16)	
	R30KS100X	O-Rings (Includes Items 18, 19, 23 & 25)	

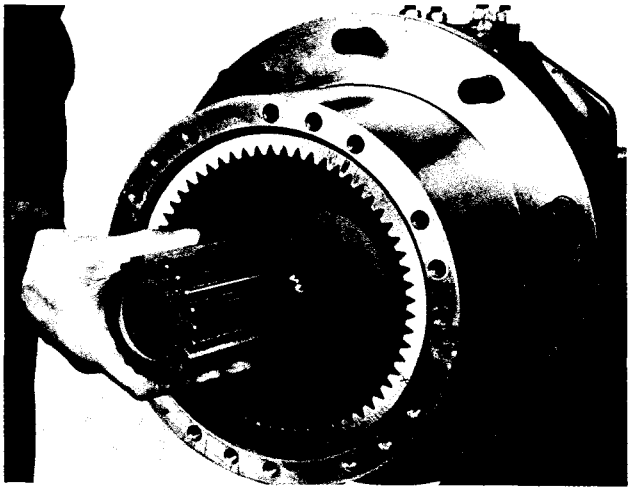
**Not Serviced Individually. See Service Kits.

Disassembly of Wet Disc Brake Wheel End

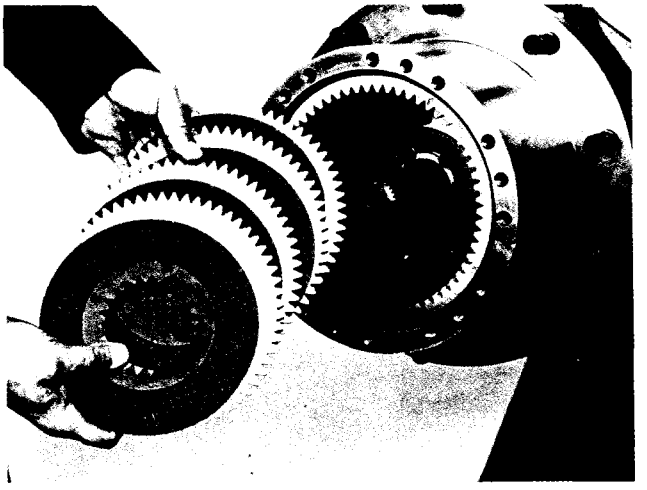
NOTE: Follow directions on pages 2 through 5 before beginning disassembly of wet disc brakes.



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.

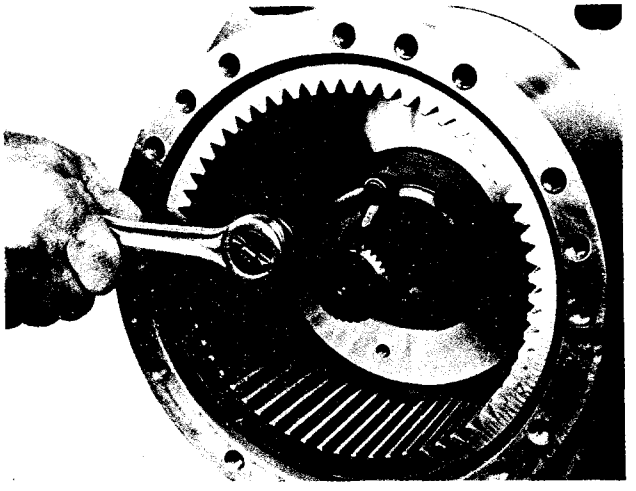
Inspect all plates and discs for heat damage. Replace if necessary.

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.

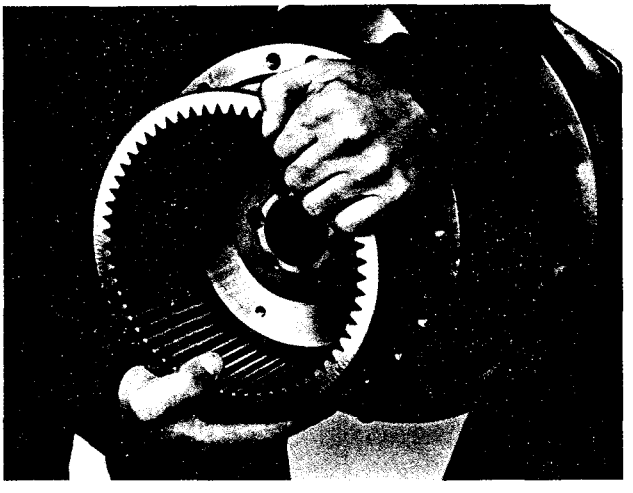
If brake discs and plates are within specifications and brake was operating properly it is not necessary to remove brake piston or replace piston O-rings.

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.

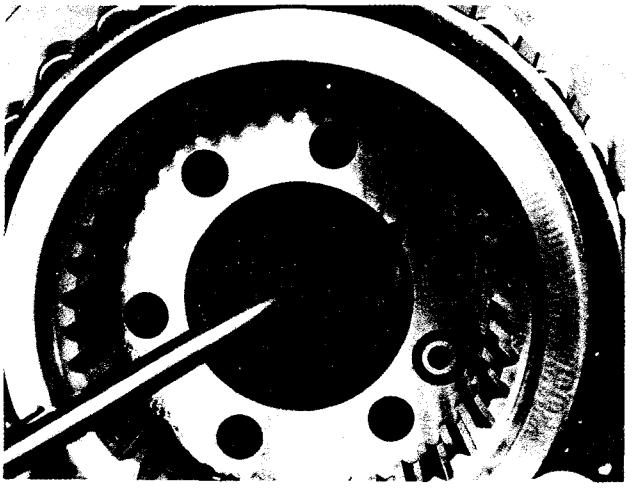
A. Safely support hub assembly with lifting device.



B. Remove wheel retainer cap-screws.

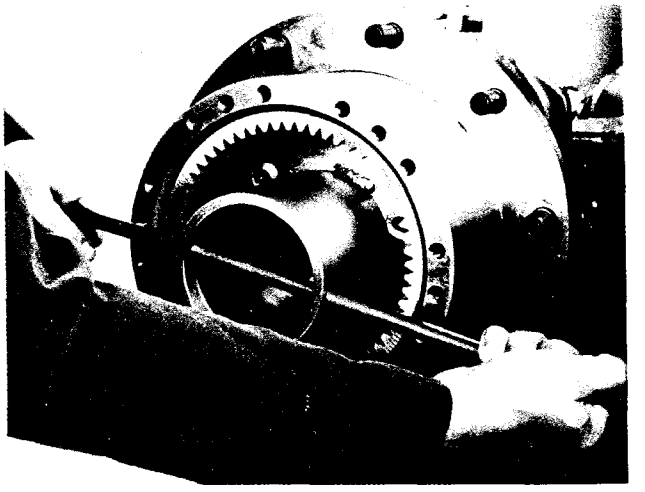


C. Remove planetary ring gear, brake piston and wheel retainer as one unit.



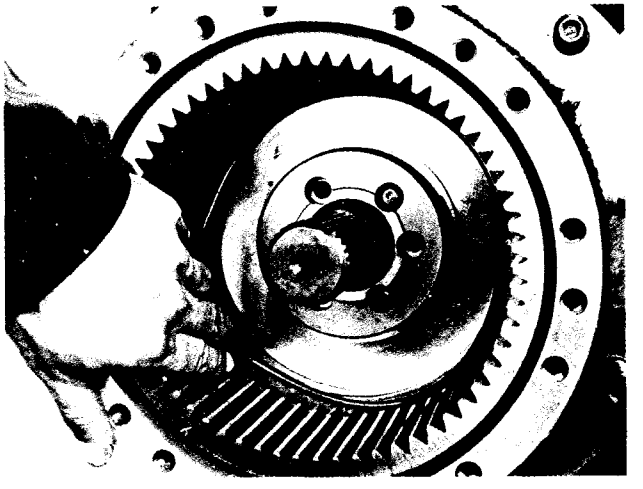
D. Remove oil passage O-rings from grooves on inboard face of wheel retainer. If damaged, replace. If ok, save for re-assembly.

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



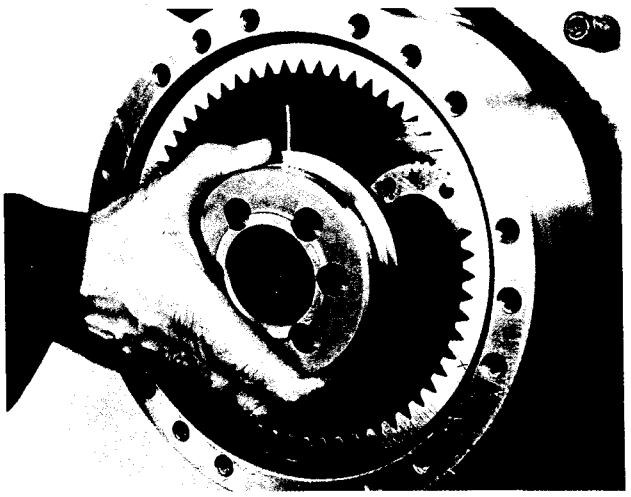
4. Remove brake piston from wheel end.

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

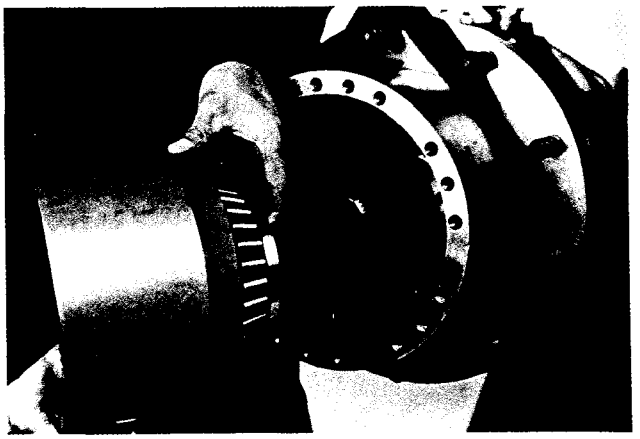


5A. Remove outer diameter piston O-ring. Discard and replace with new.

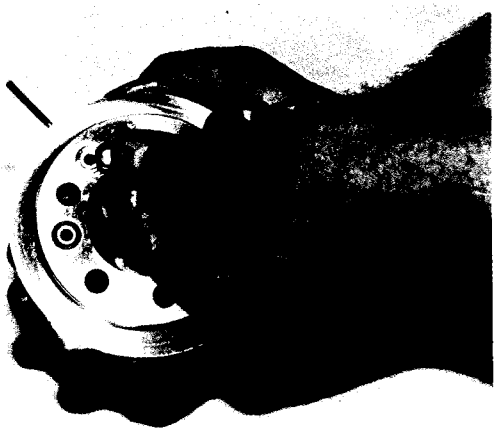
5B. Remove inner diameter piston O-ring. Discard and replace with new.



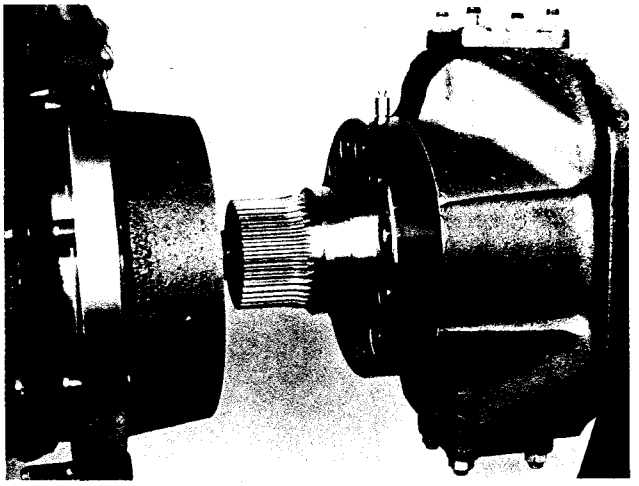
6. Safely support hub assembly with a lifting device. Remove wheel retainer capscrews. Remove wheel retainer and preload shims. Wire shims to retainer to facilitate re-assembly.



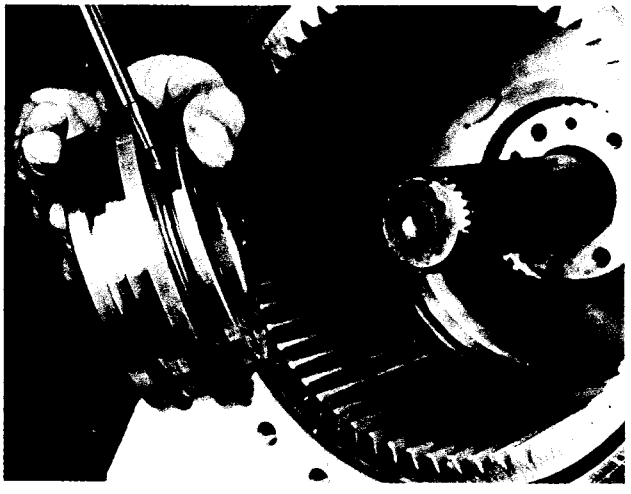
9. Remove planetary ring gear from wheel end. Inspect outboard wheel bearing. Replace if necessary.



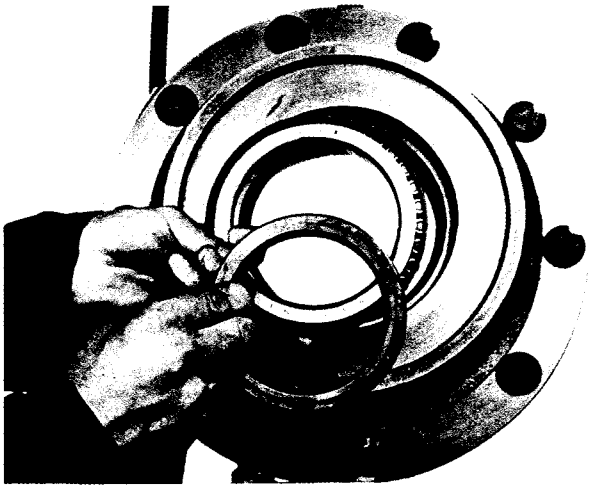
7. Remove oil passage O-rings from grooves on inboard face of wheel retainer. If damaged, replace. If ok, save for re-assembly.



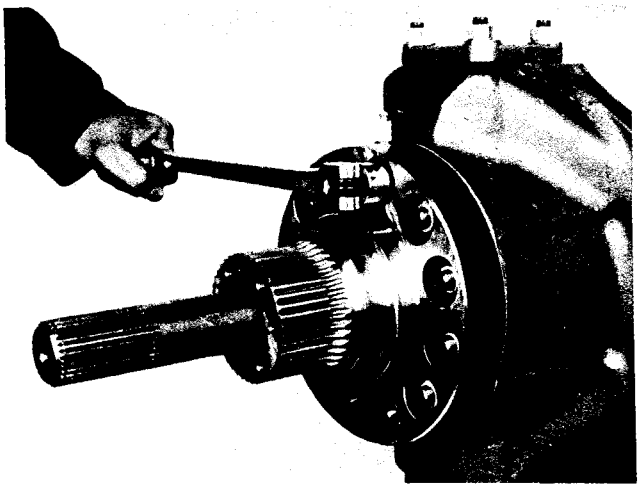
10. Remove hub assembly from spindle.



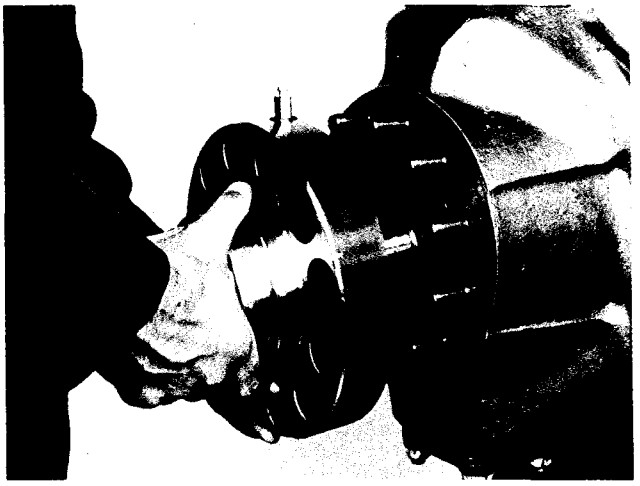
8. Remove and inspect outer diameter O-ring on inboard side of wheel retainer. Replace if necessary.



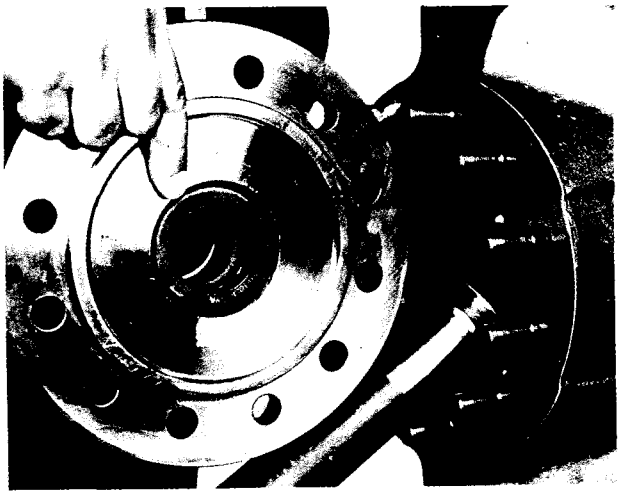
11. Inspect wheel bearings, cups and seal. Replace if necessary.



12. Remove spindle mounting nuts and washers.



13. Remove spindle from steering knuckle.

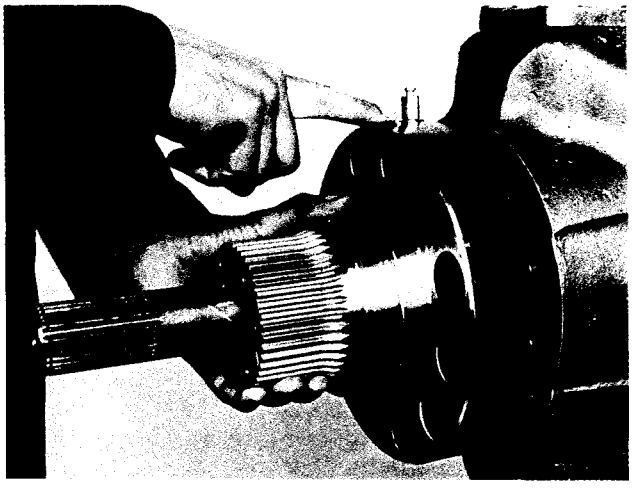


14. Inspect seal and bushing in backside of spindle. If worn or damaged, remove with suitable puller and replace.

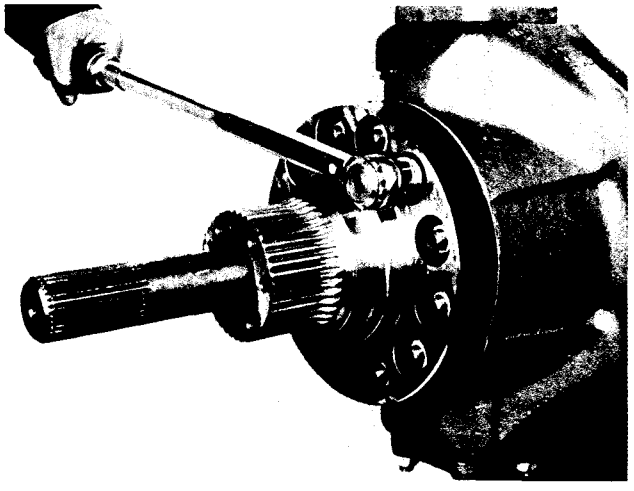
NOTE: For further disassembly of axle, refer to Page 10.

Assembly of Wet Disc Brake Wheel End

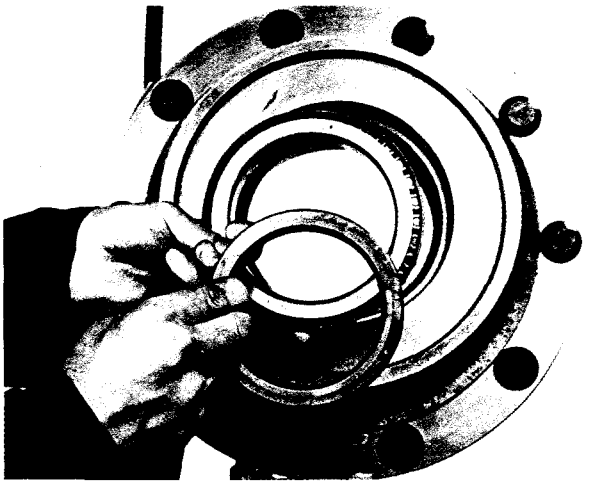
1. Install new bushing and seal in spindle if required.



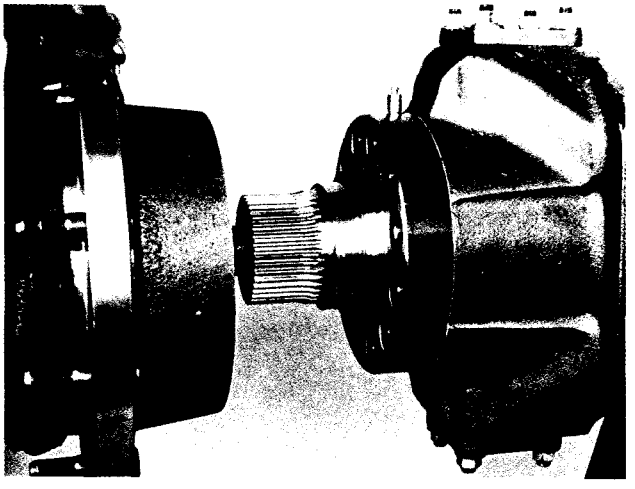
2. Install spindle over outer axle shaft and onto mounting studs on steering knuckle. Bleeder fitting is to be located at top of axle at 12 o'clock position.



3. Install spindle mounting washers and locknuts. Torque to 80-100 ft. lbs.

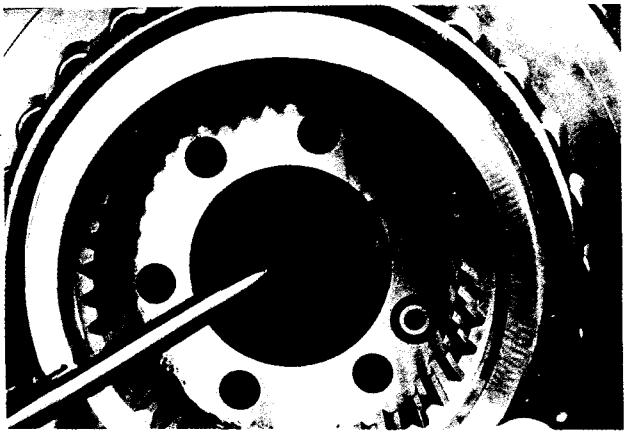


4. Install inner and outer bearing cups into hub. Install inboard bearing and seal.

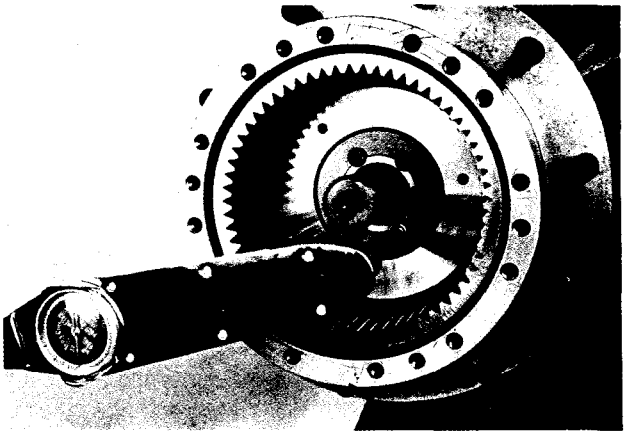


5. Using a suitable lifting device, install hub assembly onto spindle.

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 step #6.

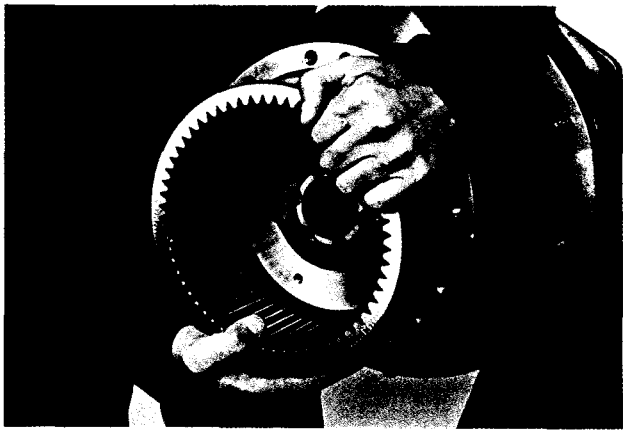


A. Insert both oil passage O-rings into grooves on inboard face of wheel retainer using a small amount of petroleum jelly to hold them in place and facilitate assembly.

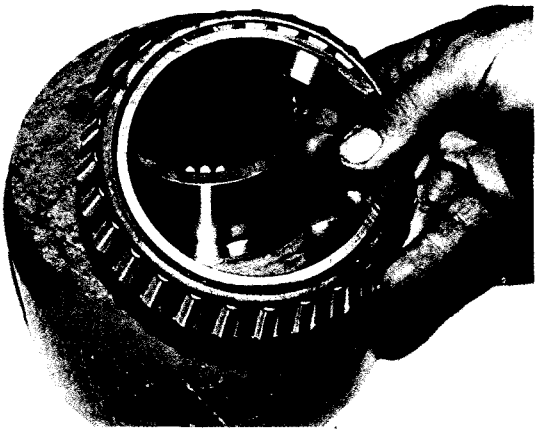


C. Install wheel retainer capscrews and torque to 45 ft. lbs.

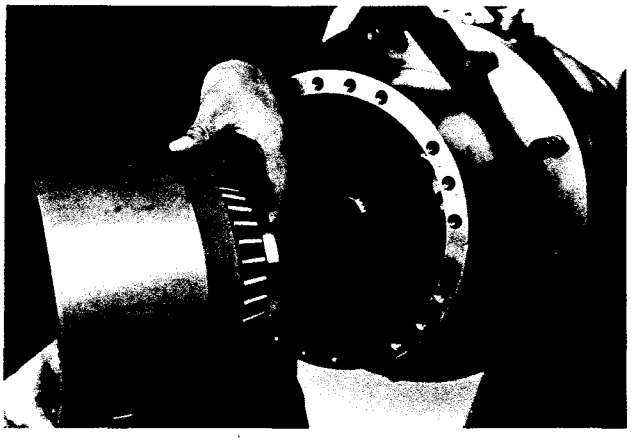
D. Skip following steps 6 thru 13 and continue assembly with step 14.



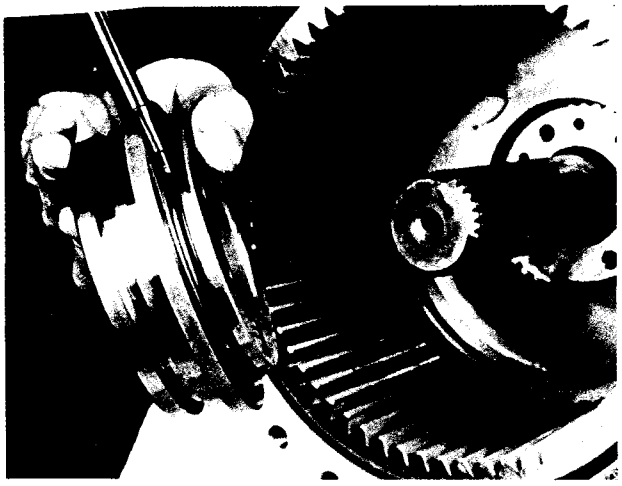
B. Install ring gear/piston assembly onto spindle spline making sure oil passage hole in ring gear is to bottom of axle at 6 o'clock position. Mounting holes in wheel retainer will align only one way.



6. Install outboard wheel bearing onto planetary ring gear.

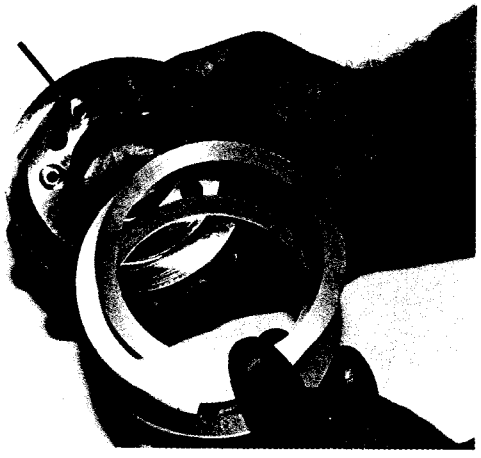


7. Install planetary ring gear onto spindle spline making sure oil passage hole in ring gear is to bottom of axle at 6 o'clock position.

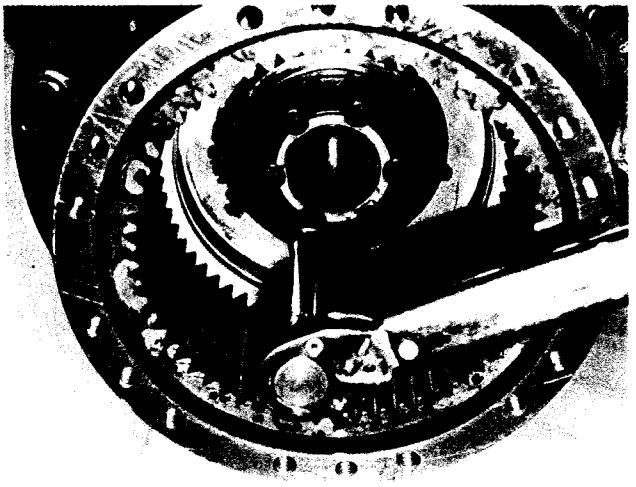


8. Lubricate and install outer diameter O-ring onto groove around inboard side of wheel retainer.

9. 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.



10. 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.

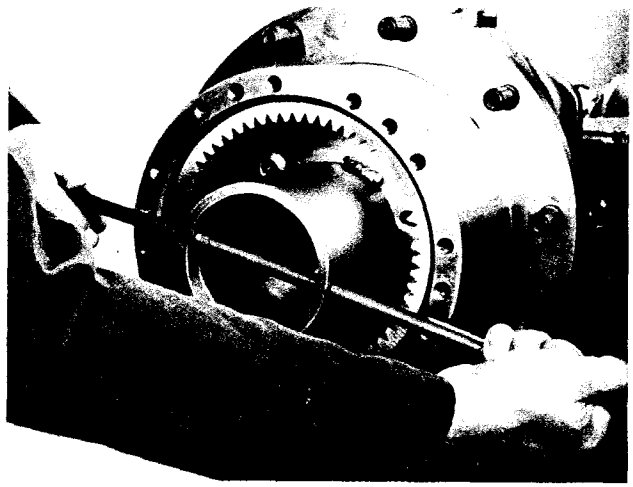


11. Install wheel retainer capscrews. Gradually increase torque value on capscrews using a crossing pattern until 45 ft. lbs. is achieved on each capscrew.

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.

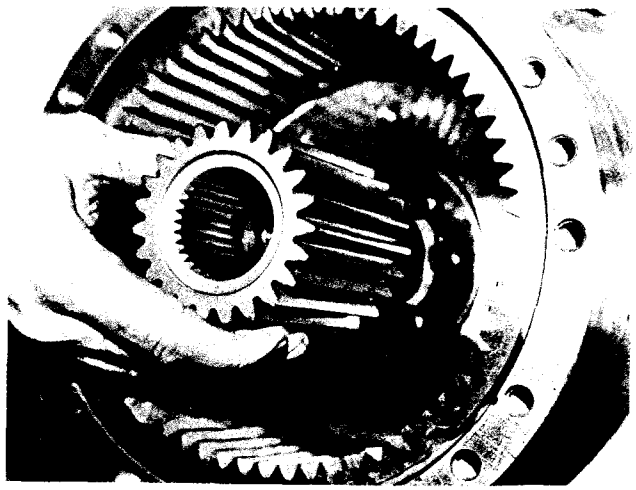
To increase preload add shims. To decrease preload subtract shims.

12. Lubricate and install outer and inner diameter piston O-rings.

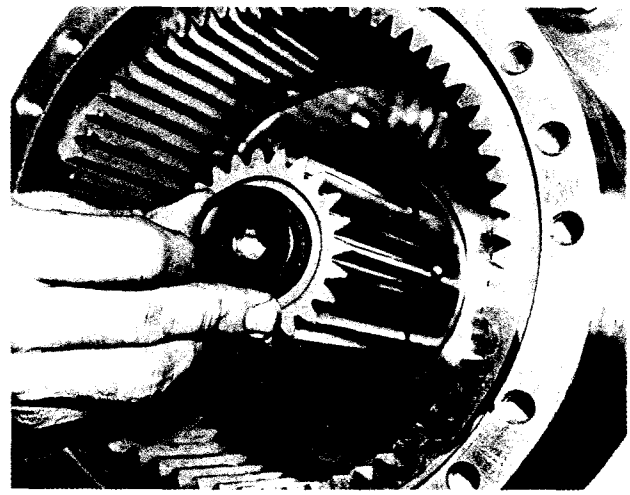


13. Install brake piston.

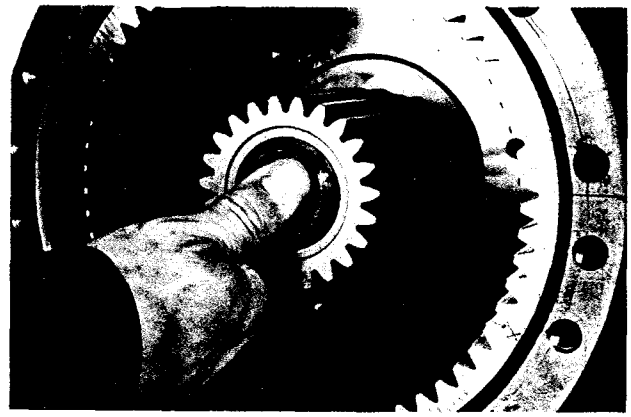
NOTE: Use of a special piston remover/installer tool, (Dana tool #451164), is recommended to prevent damage to the piston.



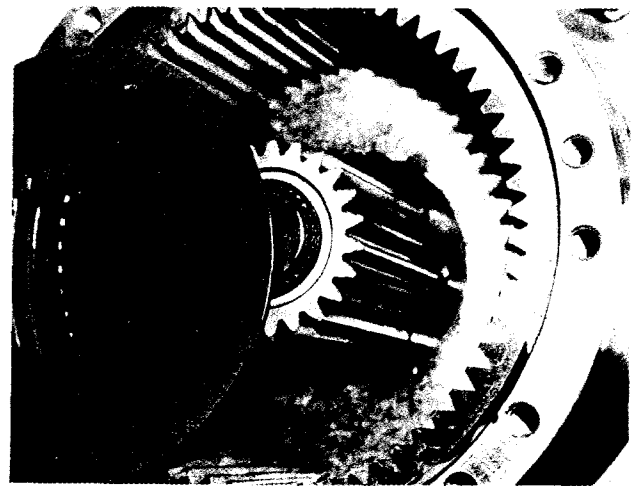
14. Install sun gear onto outer axle shaft.



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



16. 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.



17. 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 multipurpose tractor hydraulic fluid J20A for a minimum of 15 minutes prior to assembly.

18. Continue with planetary drive flange assembly procedures on page 19.

Torque Specifications

Position	Thread	Wrench Torque (Ft.-Lbs.)
Brake Drum and Rotor Mounting Capscrews	5/8-11	174-191
Tie Rod and Steer Cylinder Socket Assembly Clamp Nuts	5/8-11	60-70
Tie Rod and Steer Clyinder Socket Assembly Stud Nuts	5/8-18	140 Min. (Note: A)
Tie Rod Jam Nuts	1-1/8-12	250-300
Spindle Mounting Nuts	9/16-18	80-100
Drive Flange Capscrews	7/16-14	90-100
King Pin Cap Studs	1/2-13	40-60 (Note: B)
King Pin Cap Nuts	1/2-20	94-103

A) If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until cotter pin can be installed.

B) For non-interference fit (Class 2) threaded studs installed with Loctite #271 or equivalent.