



SERVICE MANUAL

Section 5 _____ DRIVELINE AXLES

INDEX

| ITEM NO. | NOMENCLATURE | PAGE NO. |
|----------|---|----------|
| 5-1. | General | 5-1 |
| 5-2. | System Design Specifications | 5-1 |
| 5-3. | Trouble Analysis Tables | 5-2 |
| 5-4. | Driveline | 5-4 |
| 5-5. | Axles | 5-6 |
| 5-6. | Park Brake Assembly | 5-9 |
| 5-7. | Wheels and Tires | 5-12 |
| 5-8. | Attachments: | 5-13 |
| | a. SPICER HEAVY DUTY AXLE SERVICE INFORMATION | |
| | b. GOODYEAR - MOTORWHEEL MOUNTING AND DEMOUNTING INFORMATION | |



5-1. GENERAL

This section contains functional descriptions and overhaul instructions for the subassemblies of the driveline and axles. Overhaul instructions include removal, disassembly and installation.

Complete preventive maintenance procedures are provided in Section 2 of this manual. Whenever feasible, the component manufacturer's service instructions are provided as a supplement to EIMCO information.

5-2. SYSTEM DESIGN SPECIFICATIONS

| ITEM | DESIGN DATA |
|------------|--|
| PARK BRAKE | Mechanically Actuated 9 Inch (230 mm) Double Anchor Drum Type |
| DRIVELINE | 2-1/4 Inch (57 mm) O.D. Shaft 25-1/4 Inch (641 mm) Compressed, Maximum 28-1/4 Inch (718 mm) Extended, Maximum |
| AXLES | Refer to the Spicer Heavy Duty Axle Service Information included in this section |



5-3. TROUBLE ANALYSIS TABLES (Sheet 1 of 2)

| TROUBLE | PROBABLE CAUSE | CORRECTIVE ACTION |
|-----------------------|--|--|
| PARK BRAKE | | |
| Squeals or Groans | Glazed lining. | Remove glaze from lining using file or emery paper. |
| | Misalignment of parts. | Correct misalignment by tightening any loose brake or drum mounting bolts. |
| | Dirt in drum. | Remove drum and clean out lining dust and dirt. |
| Wire Brush Noise | Worn out lining. | Check for lining worn down to rivets; reline shoes if necessary. |
| | Bent or misaligned shoe. | Check for misaligned shoe rubbing against the drum; replace with new shoes if necessary. |
| Clicks | Excessive clearance. | Adjust lining to drum clearance. |
| | Eccentric or wobbling drum. | Inspect drum runout. Also check for worn or loose bearing on main shaft. |
| | Excessive linkage friction. | Check linkage pivot points for rust, binding, or lack of lubrication. |
| Grabbing | Brake lubricant or transmission oil on lining. | Replace brake linings. Clean oil and excessive brake lubricant from brake and drum. Replace faulty oil seal at main shaft. |
| Low Effectiveness | Excessive clearance preventing complete brake application. | Adjust brake lining to drum clearance and also take up slack in brake linkage. |
| | Grease soaked linings. | Repair source of oil leak and install new linings. |
| | Excessive linkage friction. | Check for linkage binding and misalignment. |
| | Worn out linings. | Reline brake shoes. Check drum for scoring and replace if necessary. |
| Excessive Lining Wear | Brake drag. | Brake lever and camshaft adjustment too tight. Also inspect for broken or missing shoe return springs. |
| | Rough drum surface or abrasive dirt in drum. | Smooth drum with emery paper or replace drum if drum is badly scored. |
| DRIVELINE | | |
| Noise | Lack of lubricant. | Check grease seals. Install proper grade of lubricant. |
| | Driveline out of balance. | Check for damage to driveline shaft and alignment. Clean dirt from driveline. |



5-3. TROUBLE ANALYSIS TABLES (Sheet 2 of 2)

| TROUBLE | PROBABLE CAUSE | CORRECTIVE ACTION |
|-------------------------|--|---|
| DRIVELINE (CONT'D) | | |
| Noise (cont'd) | Backlash due to worn journal cross or bearing. | Replace worn parts. |
| Vibration | Driveline out of balance. | Replace driveline. |
| | Driveline sprung from contact with obstruction. | Replace driveline. |
| | Loose flange bolt or transfer case or differential flange. | Check splines; if worn, replace driveline and tighten bolt. |
| | Universal joints will not deflect. | Lubricate or replace universal joints. |
| AXLES | | |
| Noise | Insufficient or incorrect lubricant. | Check level, fill with proper type and grade of lubricant. |
| | Wheel bearings scored or rough. | Replace bearings. |
| | Gear teeth in planetary chipped. | Replace gear. |
| Loss of Lubricant | Lubricant level too high. | Drain and fill with correct amount of lubricant. |
| | Lubricant foams excessively. | Drain and fill with correct type and grade of lubricant. |
| | Worn or broken oil seal. | Replace oil seal. |
| | Restricted vent. | Clean vent. |
| | Loose nuts or bolts. | Tighten nuts or bolts. |
| Gain of Lubricant | Restricted differential housing vent. | Clean vent. |
| Planetaries Running Hot | Insufficient or incorrect lubricant. | Check level, fill with proper type and grade of lubricant. |
| | Pinion bearings seized. | Replace bearings. |



5-4. DRIVELINE

A. Physical Description

The driveline is comprised of four major components: two universal joints, which allow the driveline to pivot in any direction and accommodate any misalignment of the rear differential and transfer case, a hollow propeller shaft which connects the transfer case to the rear differential for transmitting power to the rear axle, and a slip joint that enables the shaft to telescope, thus easing installation and compensating for possible changes in distance between the transmission and transfer case.

B. System Operation

The purpose of the driveline is to transmit the power developed by the hydrostatic transmission to the rear differential. There the power is used to turn the rear wheels that provide the locomotive force for the machine.

C. Driveline Removal (See Figure 5-1)

CAUTION

EXTRA CARE SHOULD BE TAKEN WHEN HANDLING THE DRIVELINE. MISHANDLING MAY RESULT IN PREMATURE FAILURE OF THE COMPONENT.

- (1) Position the machine in a straight line.
- (2) Verify that the hydrostatic transmission is in neutral.

CAUTION

INDEX MARK THE DRIVELINE TO ENSURE PROPER REASSEMBLY.

- (3) Remove the two cap screws that secure the driveline shield and remove the shield.
- (4) Remove the four cap screws that attach the driveline assembly to the companion flange of the transmission. When doing this procedure, partially support the driveline.

- (5) Remove the four cap screws that attach the driveline assembly to the transfer case.

- (6) Compress the driveline at the slip joint and remove the driveline assembly from the machine.

D. Driveline Inspection

- (1) Clean all parts in a suitable solvent and wipe dry.
- (2) Inspect the shaft for nicks, burrs and excessive wear. Replace if wear is excessive. Burrs may be removed with a fine or medium stone.
- (3) Inspect all machined flange surfaces for roughness and pitting. Resurface or replace flanges as conditions warrant.
- (4) Check the universal joints for lubrication and freedom of movement. Replace if necessary.

E. Driveline Installation (See Figure 5-1)

CAUTION

MISALIGNMENT BETWEEN THE REAR DIFFERENTIAL AND TRANSFER CASE WILL CAUSE VIBRATION AND EXCESSIVE WEAR DURING OPERATION.

- (1) Position the driveline for installation and line up the index marks previously made.
- (2) Install four cap screws attaching the driveline assembly to the transfer case. Torque the cap screws to 75 - 80 foot-pounds (102 - 108 Nm).
- (3) Install four cap screws attaching the driveline assembly to the companion flange at the rear differential. Torque the cap screws to 75 - 80 foot-pounds (102 - 108 Nm).
- (4) After the driveline is repaired or replaced, a dial indicator should be set up to accurately check driveline runout. This should be checked at a machined section near each universal joint and should not exceed 0.020 inch (0.51 mm).
- (5) Reinstall the driveline shield.

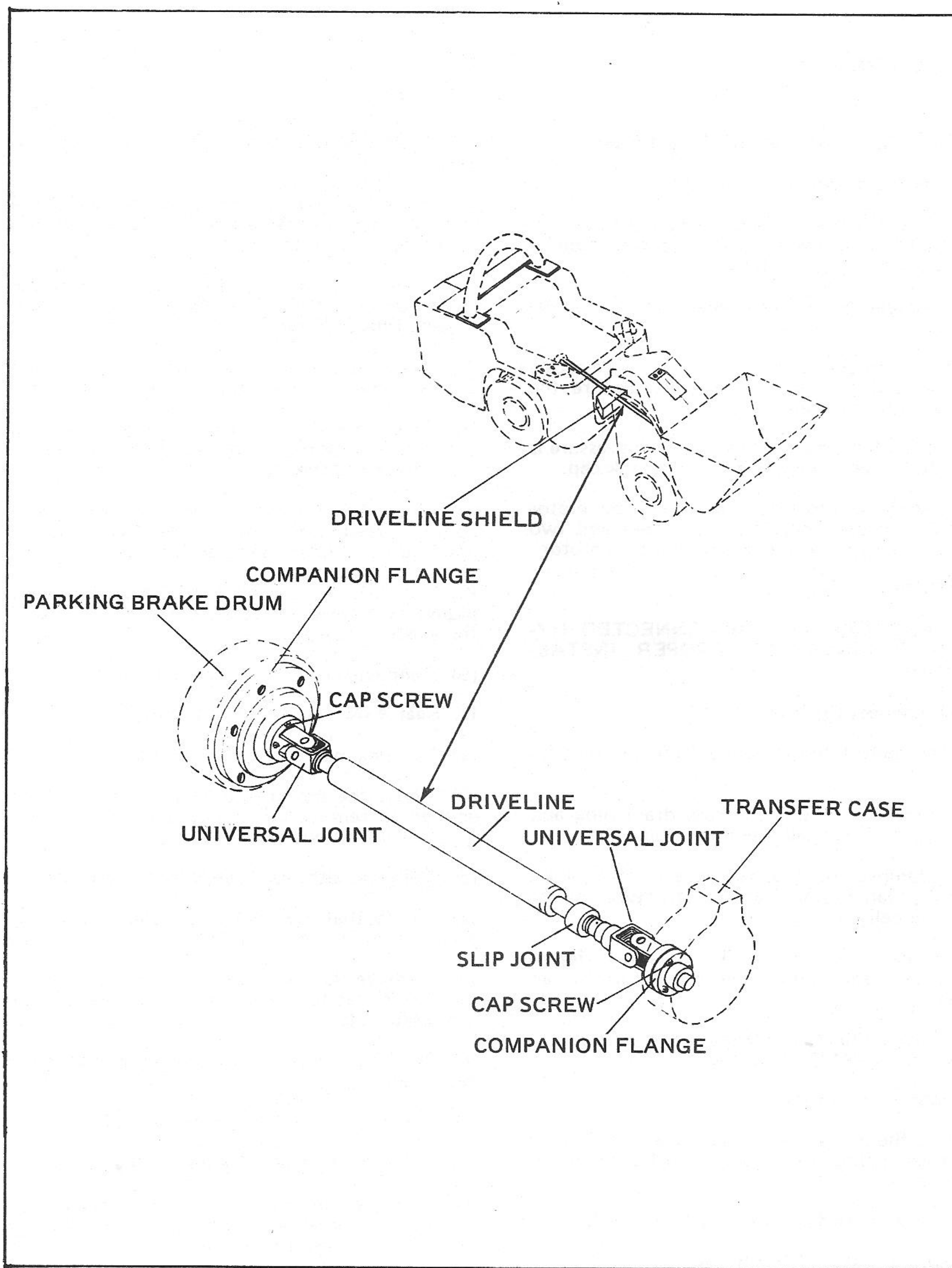


FIGURE 5 - 1. DRIVELINE INSTALLATION



5-5. AXLES

A. Front Axle Removal (See Figure 5-2)

- (1) Park the machine in a straight line.
- (2) Raise the bucket end of the machine high enough to remove the wheels. Securely support the machine in this position.
- (3) Remove both front wheels from the machine.
- (4) Raise the bucket high enough for free access to the front axle mounting bolts. Secure the bucket in this position.
- (5) Verify that the hydraulic system pressure is depleted by removing the hydraulic tank cap.
- (6) Disconnect the motor case drain line, motor control pressure line, two pilot lines and two high pressure lines from the transmission motor.

CAUTION

TAG AND CAP ALL DISCONNECTED HYDRAULIC LINES FOR PROPER INSTALLATION.

- (7) Disconnect the brake fluid line.
- (8) Disconnect the driveline from the transfer case.
- (9) Remove the transfer case drain plug and drain the oil. Reinstall the drain plug.
- (10) Remove the four cap screws that secure the belly pan to the machine structure and remove the belly pan.
- (11) Place a floor jack under the axle differential housing and remove the four mounting cap screws.
- (12) Lower the axle with the floor jack and remove from under the machine.

B. Front Axle Service

Refer to the Spicer Heavy Duty Axle Service Information included in this section for all service information.

C. Front Axle Installation (See Figure 5-2)

- (1) Support the axle with the floor jack under the differential housing.

- (2) Push the axle into position under the machine.

- (3) Raise the axle with the floor jack until the axle mounting pads are in contact with the mounting pads on the machine.

- (4) Secure the axle to the machine with the four mounting bolts. Tighten the bolts to 420 foot-pounds (570 Nm).

- (5) Position the belly pan for installation and attach to the machine with the four cap screws.

- (6) Mount the wheels, raise the floor jack until the frame supports can be removed, then lower the machine to the floor.

- (7) Reconnect the motor case drain line, motor control pressure line, two pilot lines and two high pressure lines to the transmission motor.

- (8) Connect the brake fluid lines. Bleed the brakes to remove air (refer to Section 6). Refill the master cylinder.

- (9) Connect the driveline to the transfer case.

D. Rear Axle Removal (See Figure 5-3)

- (1) Park the machine in a straight line.
- (2) Raise the motor end of the machine high enough to remove the rear wheels. Support the machine in this position.
- (3) Remove both rear wheels from the machine.
- (4) Verify that the hydraulic system pressure is depleted by removing the hydraulic tank cap.
- (5) Remove the two cotter pins that secure the operator's seat to the machine structure and remove the seat.
- (6) Partially support the rear axle with an overhead crane.
- (7) Disconnect, tag and cap the brake fluid lines.
- (8) Disconnect the driveline at the rear axle.
- (9) Remove the four belly pan cap screws and the four rear axle mounting cap screws. Remove the belly pan from the machine.
- (10) Lower the rear axle with the overhead crane and remove the axle from the machine.

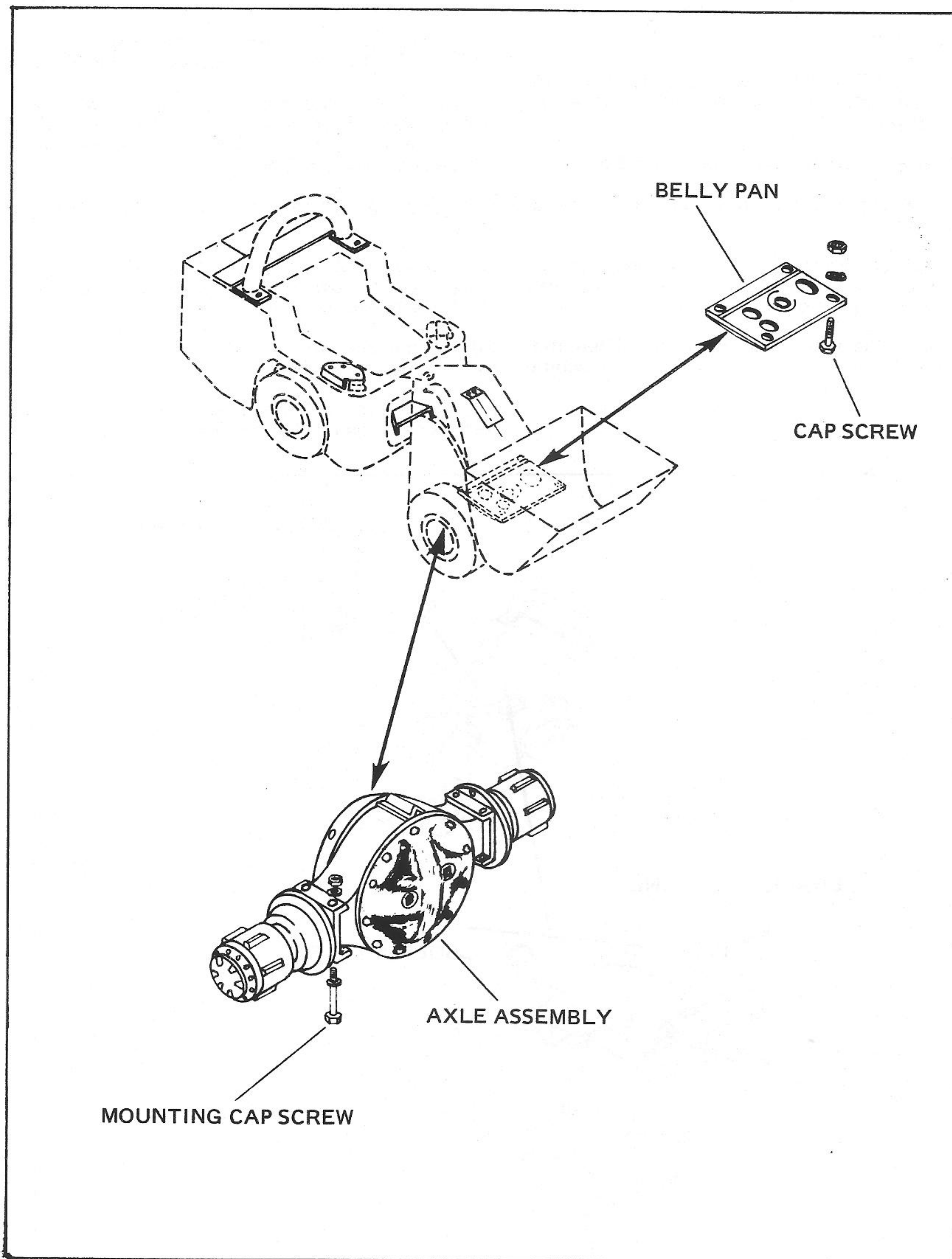


FIGURE 5 - 2. FRONT AXLE INSTALLATION



E. Rear Axle Service

Refer to the Spicer Heavy Duty Axle Service Information included in this section for all service information.

F. Rear Axle Installation (See Figure 5-3)

- (1) Push the axle into position under the machine for installation.
- (2) With an overhead crane, raise the axle until the axle mounting pads are in contact with the mounting pads on the machine.
- (3) Slide the belly pan under the differential housing. Mate the belly pan to the machine and align the mounting bolts.
- (4) Install the four axle mounting cap screws. Do not tighten the cap screws at this time.
- (5) Install the four belly pan cap screws and tighten the cap screws. Tighten the four axle mounting cap screws previously installed to 420 foot-pounds (570 Nm).
- (6) Connect the driveline to the rear differential.
- (7) Connect the brake fluid lines. Bleed the brakes to remove air (refer to Section 6). Refill the master cylinder.
- (8) Mount the wheels and lower the machine to the floor.
- (9) Position the operator's seat to the operator's requirements and install the seat.

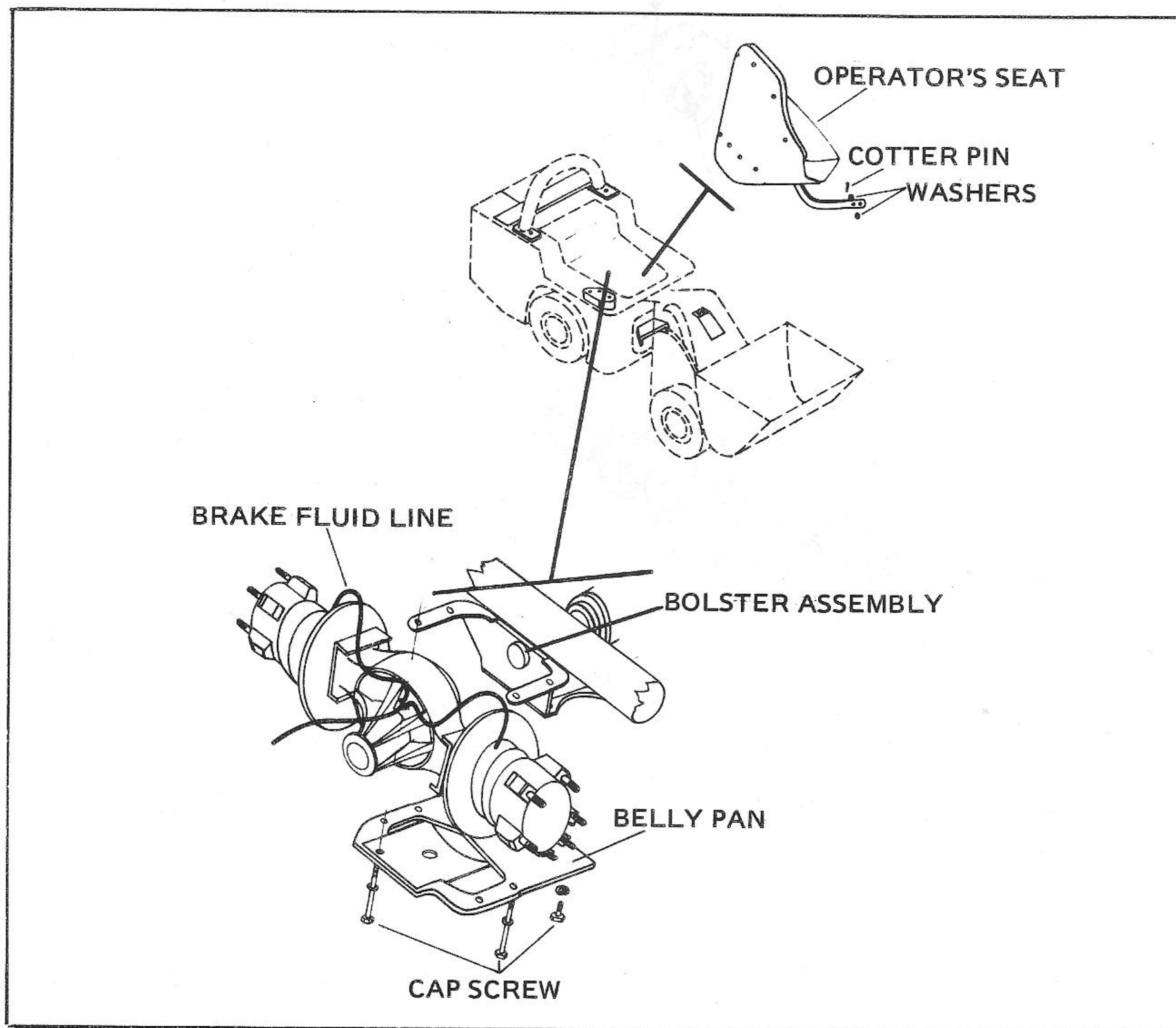


FIGURE 5-3. REAR AXLE INSTALLATION



5-6. PARK BRAKE ASSEMBLY

A. Physical Description

(1) The park brake is a mechanical drum brake designed for parking use only. The brake consists of two shoe assemblies, two shoe return springs, a single shoe-to-shoe spring and a support plate assembly.

(2) An operation diagram of the park brake is shown in Figure 5-4. For simplicity, the return springs and the shoe-to-shoe spring have been omitted. The park brake is a non-servo type brake and the shoes operate independently of each other. One shoe is energizing (leading shoe) and the other shoe is non-energizing (trailing shoe). Whether a shoe becomes "leading" or "trailing" depends upon the direction of the drum rotation.

B. System Operation (See Figure 5-4)

(1) With the drum rotation counterclockwise as indicated by the arrow, force is applied to the lever and the cam rotates counterclockwise around the upper anchor pin. Forces A and B are applied to the brake shoes and the upper ends of the shoe move out toward the drum.

(2) When the linings contact the drum braking surface, the friction force between the leading shoe and the drum forms a counterclockwise movement around the lower anchor pin. Since this movement is in the same direction as the drum movement (due to applying force A), the shoe to drum friction force aids the applying force in holding the shoe against the drum. The leading shoe therefore becomes an "energized" shoe. On the other hand, in the case of the trailing shoe, the friction force opposes the applying force B and the trailing shoe therefore becomes non-energized. During braking, the leading shoe does the greater portion of the work. If the drum rotation in Figure 5-4 is reversed (e.g., clockwise), the right-hand shoe becomes the trailing shoe.

C. Park Brake Removal and Disassembly (See Figure 5-5)

(1) Remove the 3/8 inch (9.5 mm) UNC cap screws that attach the drum to the companion flange.

(2) Remove the cotter key, nut and washer from the drive shaft end. Next, remove the companion flange from the drive shaft.

(3) Remove the lock wire from the cartridge cap screws. Remove the cap screws and cartridge.

(4) Remove the lined shoe and lever assemblies.

(5) Remove the lock nuts and wedges from the stud holes of the carrier.

(6) Next, remove the carrier, shim and spacer from the drive shaft.

(7) To disassemble the brake, remove the two shoe return springs and the shoe-to-shoe spring (see Figure 5-6). A spring removing tool should be used to remove the return springs. After the return springs have been removed, spread the free ends of the shoes apart to remove the shoes from the lower anchor pin. Remove the shoe-to-shoe spring.

(8) Clean grease and dust from the brake parts. Use care to prevent grease and oil from getting on the linings.

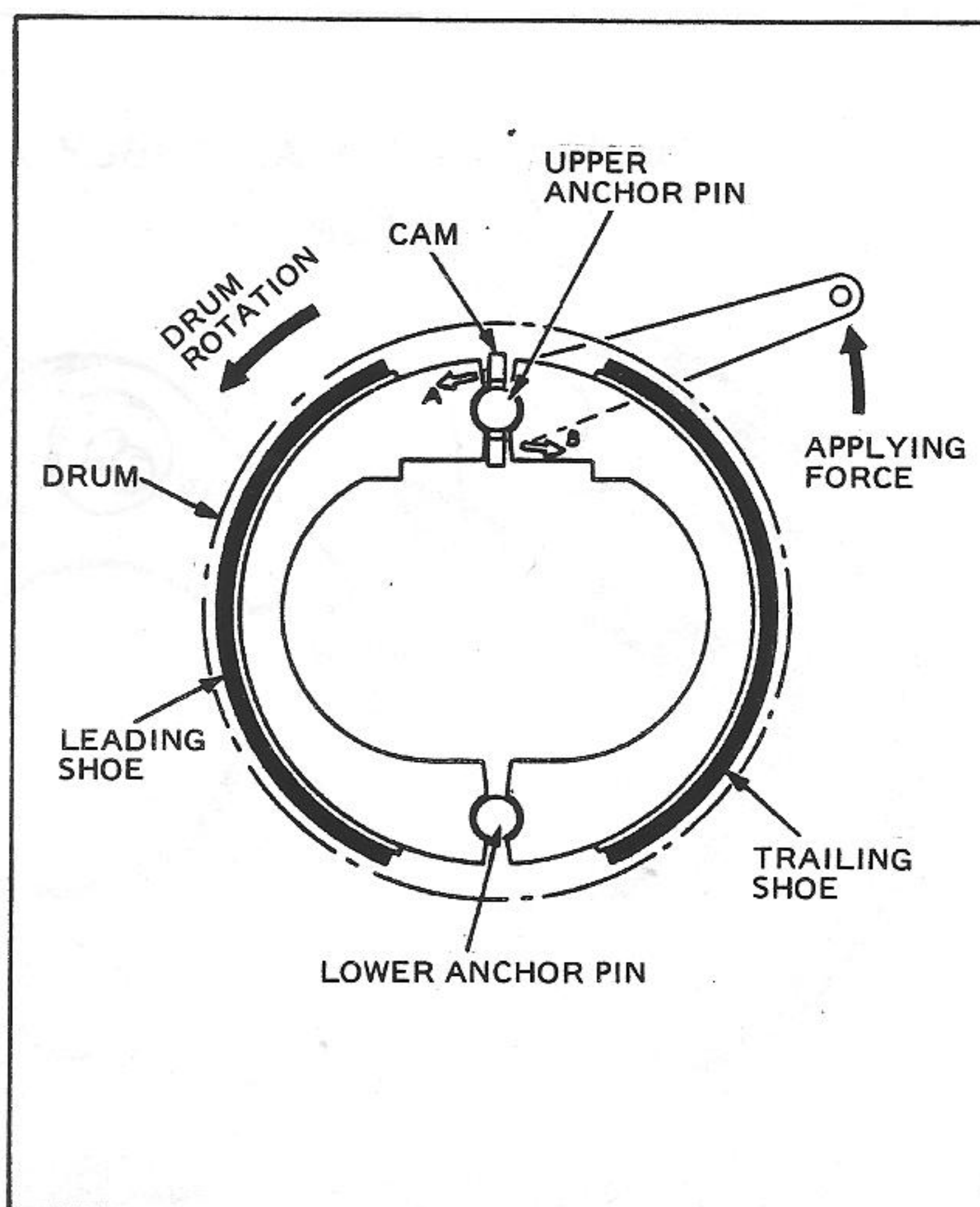


FIGURE 5 - 4. PARK BRAKE, PRINCIPLE OF OPERATION

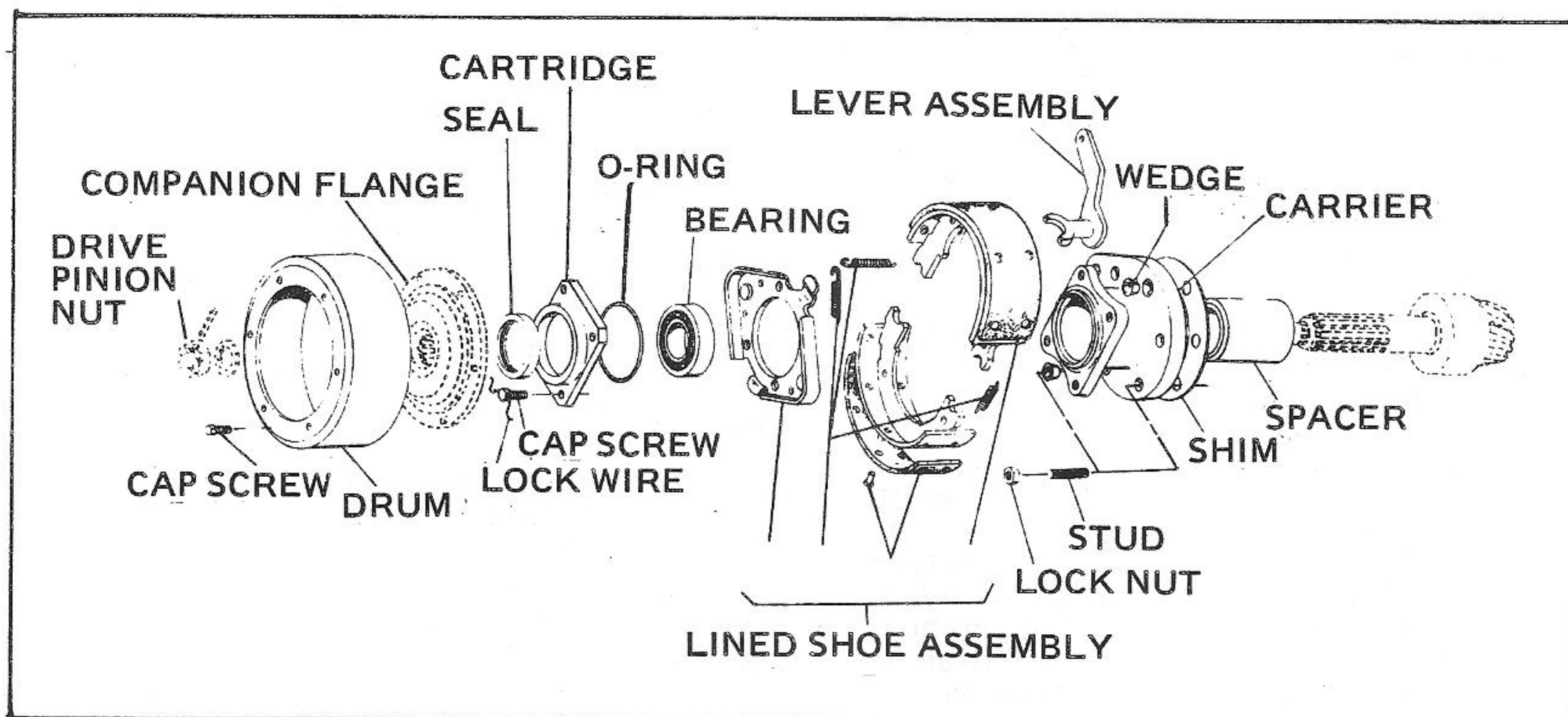


FIGURE 5 - 5. PARK BRAKE ASSEMBLY, EXPLODED VIEW

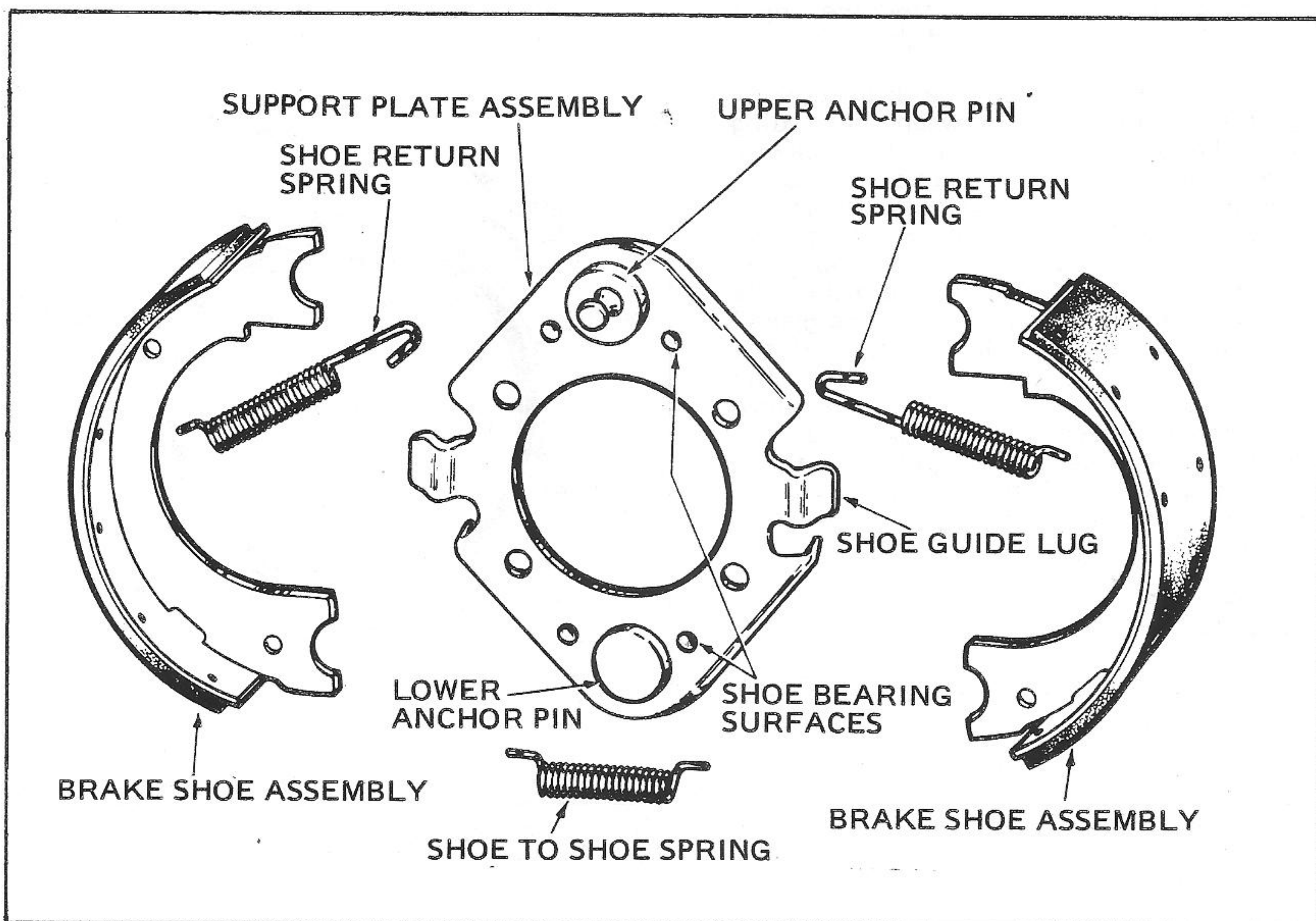


FIGURE 5 - 6. PARK BRAKE, LINED SHOE ASSEMBLY

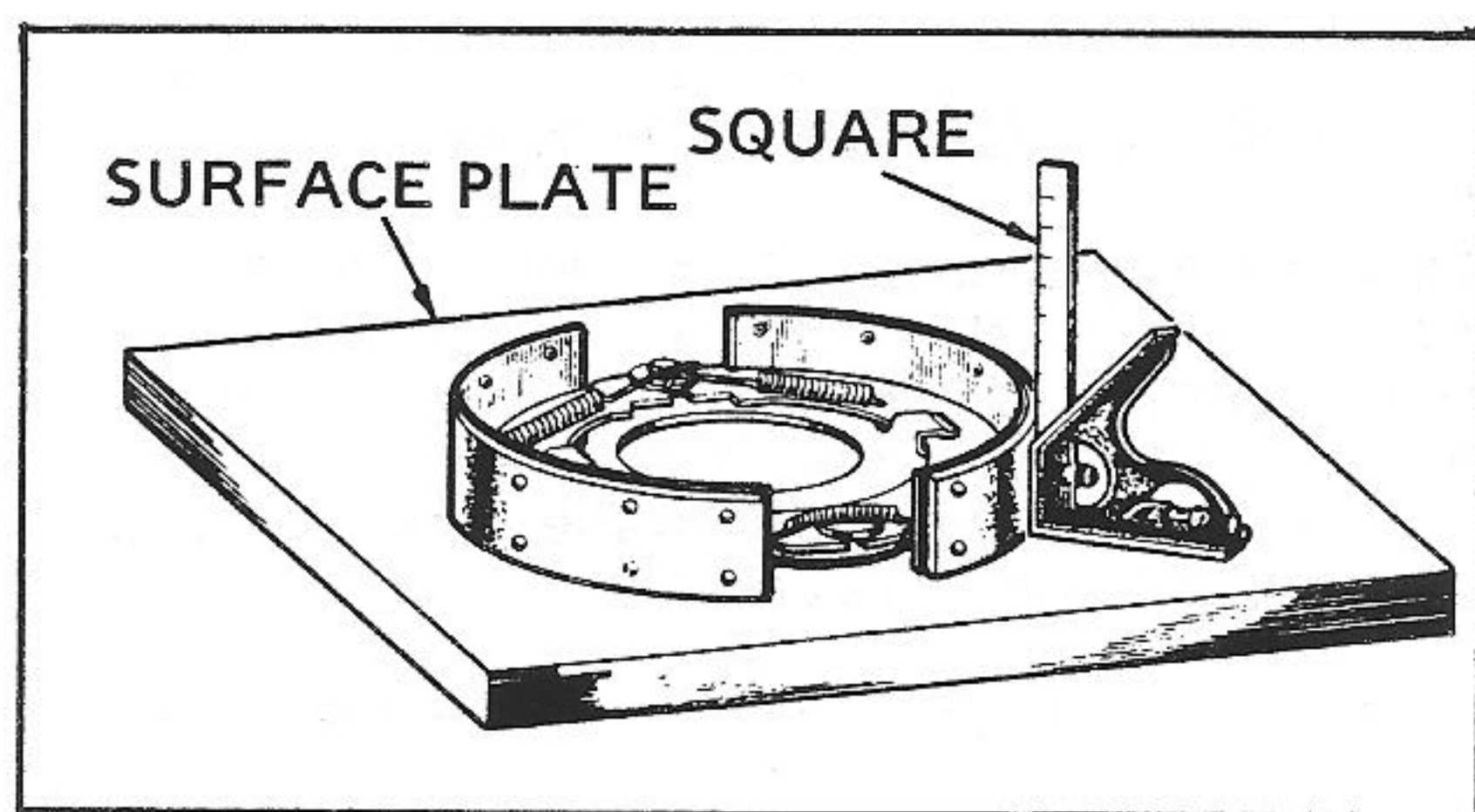


FIGURE 5 - 7. PARK BRAKE, SHOE SQUARENESS CHECK

D. Inspection

- (1) Inspect the springs for deformed hooks, fatigue cracks and loss of spring tension.
- (2) Check the support plate for distortion and loose anchor pins.
- (3) Inspect the shoes for bent webs and rims, and for worn linings. Linings worn down to the rivet heads must be replaced. Reline the shoes or replace with factory lined shoes.
- (4) Inspect the brake actuating cam for broken or cracked lugs, or for broken welds between the lever and shaft.

E. Lubrication

- (1) Coat the areas in setp 2 (below) with Lubriplate grease (or equivalent).

CAUTION

USE ONLY A LIGHT COATING OF GREASE AT THE POINTS SPECIFIED. EXCESS GREASE CAN MELT FROM BRAKE HEAD AND DRIP ON DRUM AND LINING SURFACES. THIS WILL CAUSE FAULTY BRAKE ACTION.

- (2) Lubricate the brake at the camshaft lugs and ball, support plate shoe-guide lugs and shoe bearing surfaces, support plate anchor pins and contact surfaces at both ends of the shoe web.

F. Park Brake Reassembly and Installation (See Figure 5-6)

- (1) Install the ends of the shoe-to-shoe spring into lower holes of the brake shoes.
- (2) Spread open the upper (applying) ends of the shoes and assemble the lower ends of the shoes over shoulder of the lower anchor pin. Move the upper ends of the shoes to the upper anchor pin, inserting the shoe webs between the guide lugs and bearing surfaces of the support plate.

- (3) With the upper ends of the shoes against the upper anchor pin, install the two shoe-to-shoe springs. Install the short hooks of the springs into the upper holes of the brake shoes and then hook the opposite ends of the springs over the anchor pin nib. A spring installing tool should be used.

- (4) The brake shoes must be square within 0.004 inch (0.1016 mm) per inch (25 mm) of lining width. Shoes that are badly out-of-square will drag (rub against the drum) causing heat damage to the lining. Check shoe squareness by placing the brake assembly on a flat surface, as in Figure 5-7, and check the shoes with a square as shown. To correct an out-of-square shoe, remove the shoes and bend the shoe guide lug slightly in a vise in the direction necessary to correct misalignment. Reassemble and recheck squareness.

- (5) Installation of the park brake assembly is basically the reverse of the removal procedures.

G. Park Brake Control Handle Removal (See Figure 5-8)

- (1) Set the park brake control handle in the OFF position. Remove the cotter key and pin attaching the brake control to the lever assembly.
- (2) Remove the 3/8 inch (9.5 mm) UNC cap screws that anchor the brake control handle to the support bracket.

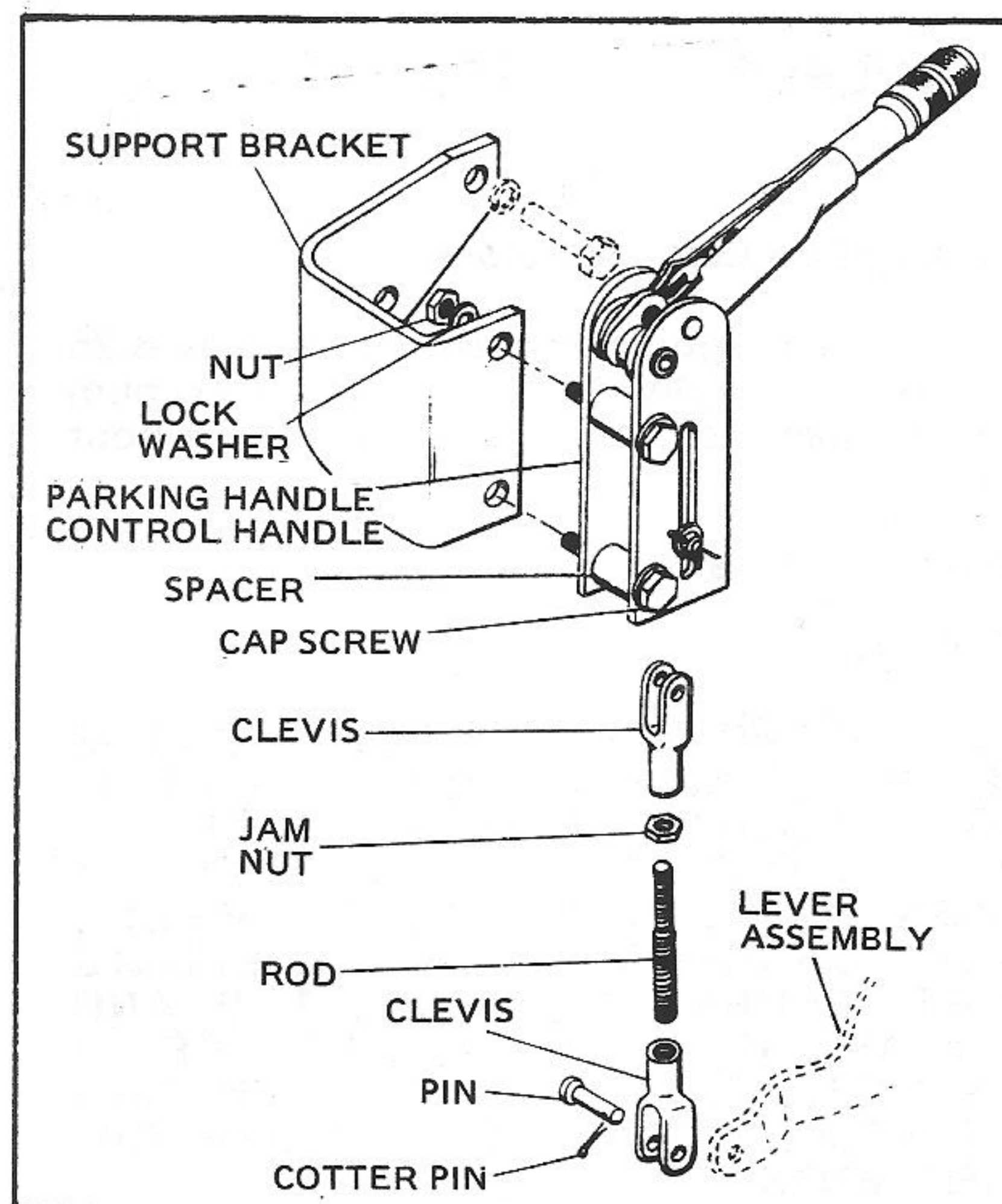


FIGURE 5 - 8. PARK BRAKE CONTROL HANDLE



H. Park Brake Control Handle Installation (See Figure 5-8)

- (1) Upon securing the park brake control handle to its support bracket, pull on the lever assembly of the park brake assembly until the brake lining almost makes contact with the drum.
- (2) Turn the adjustable clevis (of the hand park brake linkage) in or out as required to line up the holes in the lever assembly clevis.
- (3) Lubricate the adjustable clevis with Lubriplate grease (or equivalent) and install the clevis pin and cotter pin. Spread the ends of the cotter pin to prevent loss.
- (4) Pull the brake control to apply the brake. The drum should not be free to rotate.
- (5) Rotate the adjusting control (top portion of the brake control handle) to obtain the desired over-center travel of the brake control handle in the brake applied position.
- (6) After adjustment has been made, tighten the two jam nuts on the adjusting rod.

I. Park Brake Check and Adjustments

With the park brake on and the motor running, try to drive the machine forward or reverse. The park brake must prevent the machine from moving in either direction. If not, adjust the brake as specified in the Park Brake Control Handle Installation procedures above.

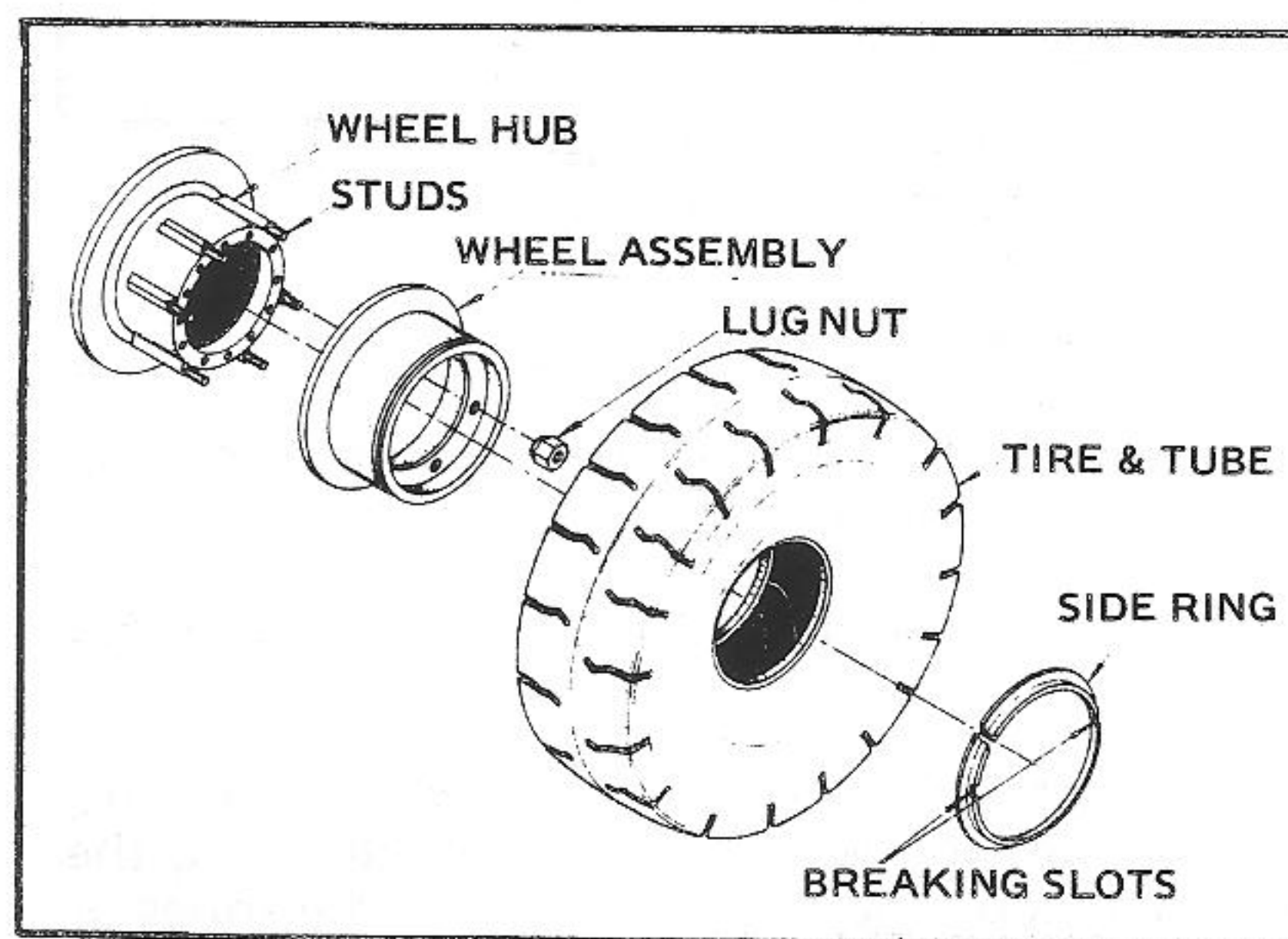


FIGURE 5-9. WHEEL AND TIRE INSTALLATION

5-7. WHEELS AND TIRES

A. Description (See Figure 5-9)

The machine is equipped with off-highway 8.25 x 15, 14-ply, all nylon tube type tires. Maximum allowable speed for the tires is 5 miles per hour (8 KMPH).

B. Wheel Removal

WARNING

BEFORE PERFORMING A SERVICE ON THE TIRE OR RIM, ALWAYS INSPECT THE SIDE RING AND WHEEL ASSEMBLY ON THE INSIDE AND OUTSIDE OF THE WHEEL. A LOOSENED SIDE RING OR BENT RIM EDGE IS VERY DANGEROUS. ALWAYS DEFLATE A TIRE BEFORE ATTEMPTING TIRE AND RIM REMOVAL. EVEN A FLAT TIRE, IN SOME INSTANCES, CAN RETAIN ENOUGH AIR PRESSURE TO BLOW OFF LOOSE RIM COMPONENTS.

- (1) Apply the park brake.

- (2) Inspect all rim components. If the condition of the rim assembly is questionable, remove the valve core and completely deflate the tire.

- (3) Break the wheel lug nuts loose, but do not remove them from the studs at this time.

- (4) Raise the machine up only as high as necessary to remove the wheel from the machine, and place safety blocks under the axle.

WARNING

THE FRONT OR BACK END OF THE MACHINE MUST BE COMPLETELY RAISED AND SECURELY BLOCKED PRIOR TO REMOVING THE TIRE.

- (5) Remove the lug nuts from the wheel studs. Lift the wheel assembly free from the wheel hub.



NOTE

TWO JACK HOLES ARE PROVIDED IN THE WHEEL ASSEMBLY TO AID IN PULLING THE WHEEL ASSEMBLY FROM THE WHEEL HUB.

C. Wheel and Tire Service

Refer to the Goodyear-Motorwheel Mounting and Demounting Information included in this section for service information.

D. Wheel Installation (See Figure 5-9)

(1) Lift the tire and align the wheel holes with

the wheel hub studs. Slide the wheel onto the wheel hub.

(2) Start the lug nuts on the wheel hub.

(3) Gradually tighten the lug nuts diagonally opposite each other, until all lug nuts are snug. Torque to 150 ft.-lbs. (203 Nm).

CAUTION

RETIGHTEN THE LUG NUTS AFTER A FEW HOURS OF OPERATION.

(4) Lift the machine and remove the support blocks. Lower the machine to ground level.

5-8. SERVICE BRAKES

For complete service information regarding the brake heads, refer to the Spicer (NAPCO) Heavy Duty Axle Service Information included in this section.

5-9. INSPECTION REQUIREMENTS

The following table lists the visual inspection requirements for the individual parts of the axle, wheels, transfer case and bolster. Make sure that all parts listed are inspected before installing them into the system. Always install new oil seals and gaskets during assembly.

INSPECTION REQUIREMENTS

| ITEM | INSPECTION REQUIREMENTS | CORRECTIVE ACTION |
|----------------------|---|---|
| AXLE SHAFTS | Inspect for bent axle shafts. | Replace if bent. |
| | Inspect for broken or severely worn splines. | Replace the shaft if splines are broken or severely worn. |
| AXLE HOUSINGS | Inspect the bearing bore for deep scratches or scoring. | Minor defects can be removed by sanding with 400 grit sandpaper. If the defects are serious, machine the bearing bores, but do not exceed normal machining tolerances. |
| | Inspect the housing for cracks. | Replace if cracked. |
| PLANETARY WHEEL ENDS | Inspect all studs and nuts for severely worn or damaged threads. | Replace if damaged or severely worn. |
| | Inspect wheel hub bearing bores for deep scratches and scoring. | Minor defects can be removed by sanding with 400 grit sandpaper. If the defects are serious, machine the bearing bores, but do not exceed normal machining tolerances. |
| | Check the two roller bearings for damage and severe wear. | Replace if damaged or severely worn. |
| TRANSFER CASE | Inspect all gears for damage and wear. | Minor defects can be removed with 400 grit sandpaper. If damage is serious, replace the gear. |
| | Inspect for broken or severely worn splines. | Replace the part if the splines are broken or severely worn. |
| | Inspect all bearing seats and bores for deep scratches or scoring. | Minor defects can be removed with 400 grit sandpaper. If the defects are serious, machine the bearing seats or bores, but do not exceed the dimensions given in subsection 5-2. |
| | Inspect all bearings, cups and cones for damage or severe wear. | Replace if damaged or severely worn. |
| | Inspect all machined surfaces for nicks, marks and burrs. | Smooth out all machined surfaces with 400 grit sandpaper. |
| BOLSTER | Inspect both support pins, bearings and bores for scoring, pitting, cracks, excessive wear. | Smooth out all machined surfaces with 400 grit sandpaper. |
| | With the bolster on the machine inspect for in-out or side movement. | If evident, replace shaft, bearing or resize bore in bolster, as required. |
| | Inspect bumpers for cracks or wear. | Replace as required. |

5-10. ATTACHMENTS

- A. Spicer Heavy Duty Axle Service Information**
- B. Goodyear-Motorwheel Mounting and Demounting Information**