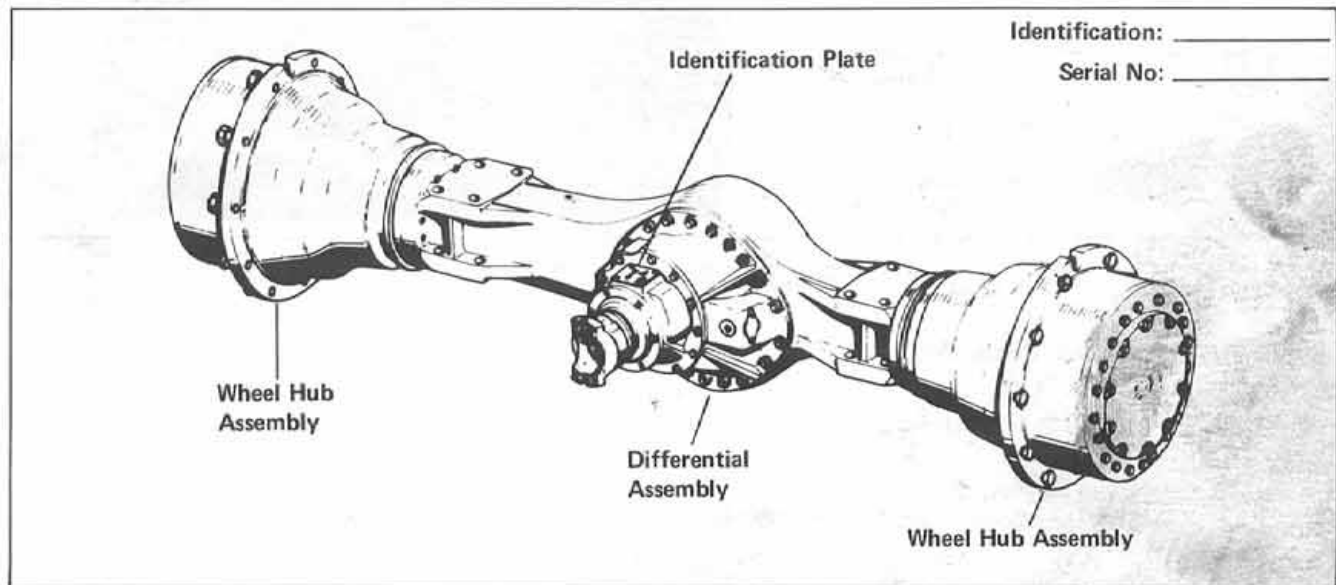


# STEIGER

## RABA AXLE

COUGAR II  
PANTHER II  
TURBO-TIGER II



### IMMEDIATE ACTION LETTER REFERENCE:

No/Date

1 \_\_\_\_\_ 4 \_\_\_\_\_ 7 \_\_\_\_\_

2 \_\_\_\_\_ 5 \_\_\_\_\_ 8 \_\_\_\_\_

3 \_\_\_\_\_ 6 \_\_\_\_\_ 9 \_\_\_\_\_

### SERVICE BULLETIN REFERENCE:

No/Date

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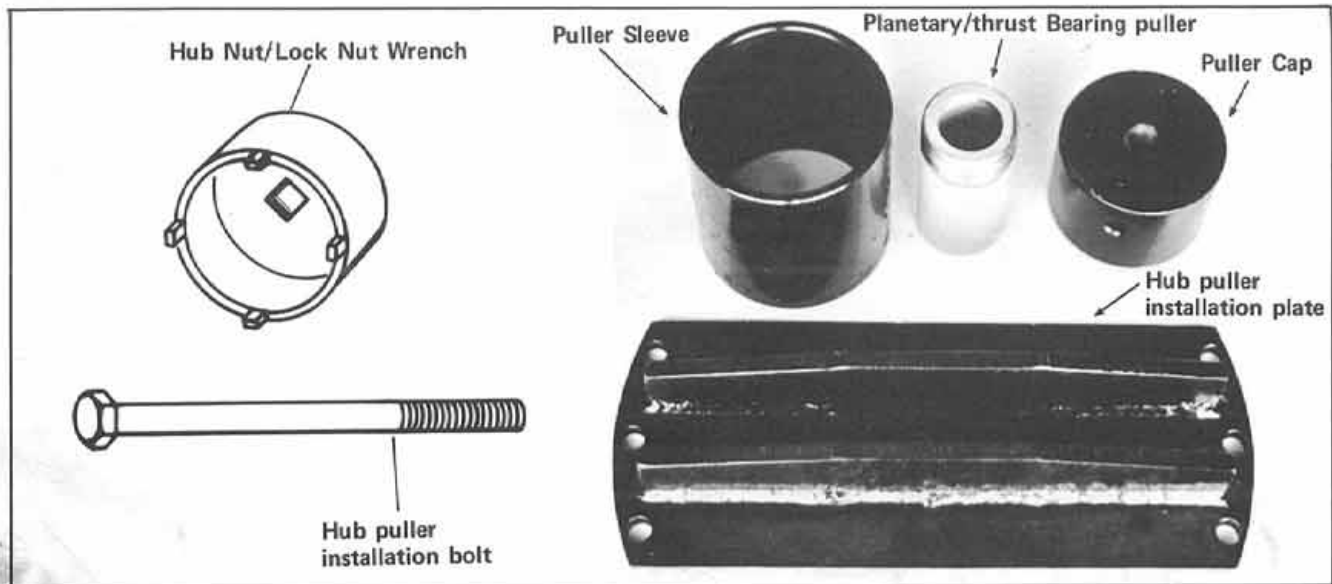
### SERVICE NEWS REFERENCE:

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3 \_\_\_\_\_ 6 \_\_\_\_\_ 9 \_\_\_\_\_

# RABA AXLE



## Special Service Tools

### TOOLS REQUIRED

- \_\_\_\_\_ 1-1/4 & 1-1/2 Std. Socket
- \_\_\_\_\_ Metric Socket  
(See Specification pp. CC-5 and CC-6)
- \_\_\_\_\_ Torque Wrenches  
(See Specifications pp. CC-5 and CC-6)
- \_\_\_\_\_ 30 Ton Power Twin Unit (Owatonna Tool Co.)
- \_\_\_\_\_ Outside Diameter Bearing Pullers
- \_\_\_\_\_ Inside Diameter Bearing Pullers
- \_\_\_\_\_ 6" Machinists Rule

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# FORWARD

The Steiger-Raba Axle went into service on some 1975 models, Cougar II, Panther II and Turbo Tiger II. This axle features a dual planetary wheel hub and a high speed differential ratio. This arrangement allows shock and stress to be more evenly distributed through out the axle, thus reducing wear and failure.

This service manual includes all information necessary to maintain and over-haul the axle.

Certain repairs can be done without removing the axle from the tractor or without jacking the tractor.

Repair of the planetary carriers, axle shafts and differential section, can be done without removing entire axle or jacking tractor. (Jacking required to remove differential from rear axle on Series II tractors).

Repair of hub seals, hub bearings, and planetary ring gears require either the entire axle be removed or the tractor jacked and supported.

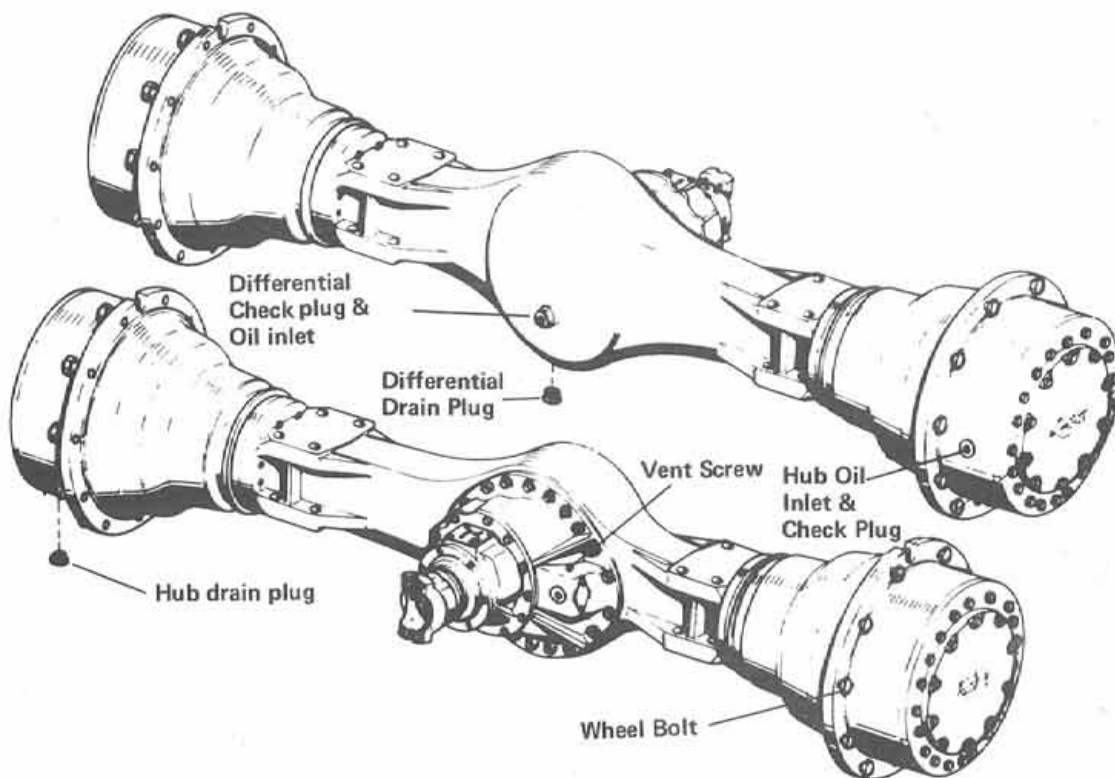
Be sure to read and follow the instructions provided in this manual before attempting to service the Steiger-Raba Axle.

On page CC-8 and CC-13 cutaway drawings provide an internal view of the axle components and their assembled position. All parts are listed and numbered. Reference to these drawings will be made throughout the manual.

Special tools are recommended in cases where certain operations cannot be done with standard shop tools or tools normally available in shops equipped to work on heavy tractors.

Throughout the manual the number of bolts have been listed to aid in identifying the part to be removed or assembled. (Example: Remove the 14 mm bolts (20). Twenty is the number of bolts.

# PERIODIC MAINTENANCE AND TROUBLE SHOOTING



## Checking Oil Level

The oil should be changed after 100 hours of operation. Oil should be changed after every 500 hours of operation thereafter.

The oil level should be checked after every 100 hours of operation

## Hubs

The oil level of the hubs should be checked as follow:

A. Turn hub position till the lower edge of the drain plug is located 1-1/2" below the horizontal center line of the axle. Oil should be level with the lower edge of the hole in this position.

B. Each hub should contain approximately 7-1/2 quarts of oil.

C. Check each drain plug for metal particles and contamination. Clean the plug by washing in clean fuel oil and blowing clean debris with compressed air.

**CAUTION:**  Always direct compressed air away from body and towards a safe area.


## Differential Section

The oil should be changed after 100 hours of operation. Oil should be changed after every 500 hours of operation thereafter.

A. The oil level in the differential section should be level with the lower edge of the check plug hole.

B. The differential section should contain approximately 8-1/2 quarts of oil.

C. Check the plug for contamination and metal particles. Clean the plug by washing in clean fuel oil and blow clean with compressed air.

**CAUTION:**  Always direct compressed air away from body and towards a safe area.

## Air Vent Screw.

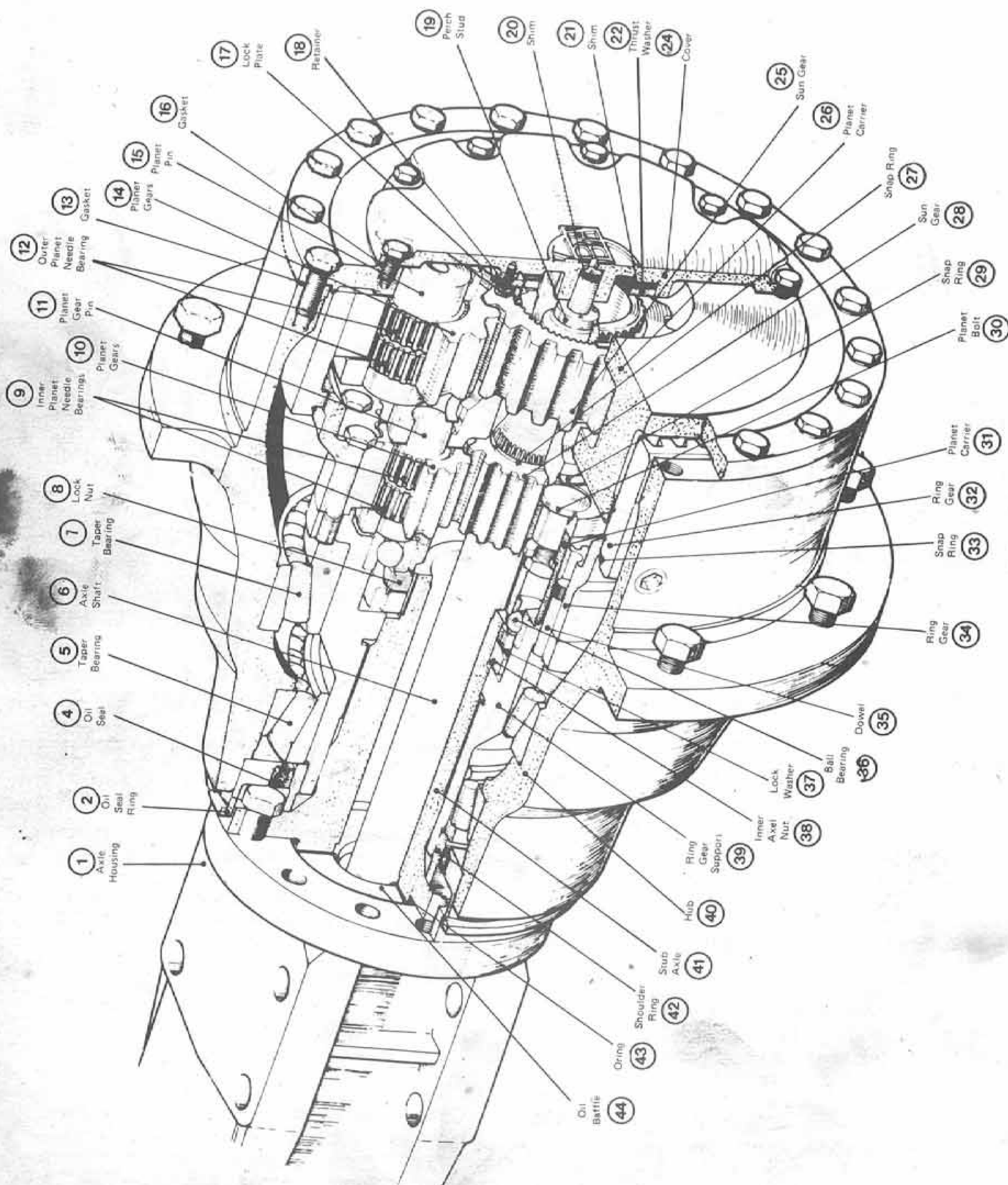
Remove the air vent screw and thoroughly clean in clean fuel and blow clean with compressed air.

## Torque

Check all wheel bolts, dual bolts, and plugs for tightness. Check specification for tightness values. If any part of axle is disassembled, reassemble using new gaskets and tighten all bolts with a torque wrench to the values listed in specifications.

# STEIGER/RABA AXLE

## Hub Cutaway Illustration





# STEIGER-RABA AXLE SPECIFICATIONS

<b>LUBRICATION:</b>	<b>Metric</b>	<b>U.S. Standard</b>
Wheel Hub(s)	7 liter	approx. 7-1/2 quarts
Differential Section	8 liter	approx. 8-1/2 quarts
Lubrication Oil		EP-90 MIL-L-2105-B
Grease Pack Thrust washer and perch stud in hub cover.		MPGM 3-5 molydenum disulfide mil-m-7866

## FITTING SPECIFICATIONS-DIFFERENTIAL SECTION:

Ring Gear Run Out (See figure 23 pp CC-17)		0-.003 Total Indicator Runout
Differential Assembly Bearing Preload		.001-.002"
Differential/Pinion Backlash	.2mm-.5mm	.008-.020
Bevel Pinion Gear Bearing Preload (Rotating torque) (See figure 26 pp CC-18)	1-2 mkp	86-172 in.lb.

## FITTING SPECIFICATIONS-HUB SECTION:

Hub Taper Bearing Preload		0-.002"
Inner Planetary/Cover Thrust Bearing Clearance (See figure 35 pp CC-21)	.05-1.0 mm	1/64-1/32 in. .019-.039 in.
Axle Shaft/Cover Perch Stud Clearance (See figure 35 pp CC-21)	.05-1.0 mm	1/64-1/32 in. .019-.039 in.

## TORQUE SPECIFICATIONS:

To convert mkg to ft.lbs. multiply x 7.235

Thread size	No.	Assembly	Wrench size	Meter Kilograms mkp	Foot Pound ft. lbs.
41 mm	(1)	Pinion Shaft Nut	54 mm	55-60	398-434
12 mm	(12)	Differential Housing Bolts	19 mm	8-10	58- 73
18 mm	(12)	Ring Gear to differ- ential housing flange	27 mm	30-35	217-253
24 mm	(2)	Differential Bearing Cap bolts	37 mm	55-60	398-434
12 mm	(18)	Differential Drive housing to Axle Housing	19 mm	7.8	56

# SPECIFICATIONS Cont.

## TORQUE SPECIFICATIONS (cont.)

Thread size	No.	Assembly	Wrench size	Meter Kilograms mkp	Foot Pound ft. lbs.
14 mm	(12)	Pinion Housing to Differential Case bolts	22 mm	12-14	87-101
8 mm	(6)	Pinion Shaft seal plate bolts	14mm	2-3	14- 22
105 mm	(1)	Hub to Axle Nut (Outer Locknut)	5" spanner	35-41	250-300
14 mm	(24)	Ring Gear Support to Inner Ring Gear	22 mm	18	130
Special Shoulder bolt	(3)	Inner Planet Carrier Nuts	10 mm hex	20-25	145-180
14 mm	(20)	Outer Planet-Carrier to Hub	22 mm	20	145
10 mm	(10)	Hub Cover to Planet Carrier	17 mm	3.6	26
7/8" std	(10)	Wheel bolts	1-1/4"-1-5/16" std	45	325
1"	(8)	Axle to frame mount bolts	1-1/2 std	62	450
20 mm	(16)	Stud Axle to Axle Housing	30 mm	34	245

## RATIOS:

Ring Gear/Pinion	$27/13 = 2.077$
Inner Planetary	$64/26 + 1 = 3.46$
Outer Planetary	$64/26 + 1 = 3.46$
Total Ratio	24.885



# STEIGER/RABA AXLE

## Disassembly of the Raba Wheel Hub

**Special Tools Required:** Metric wrenches  
(See specifications pp CC-5 & CC-6)

Special puller tools: hoist 1-1/2 ton capacity, torque wrenches, 3/4" hex wrench, dial indicator with magnetic swivel arm, machinist's rule (metric or standard), special axle tools, bearing pullers, approximate 10 ton press.

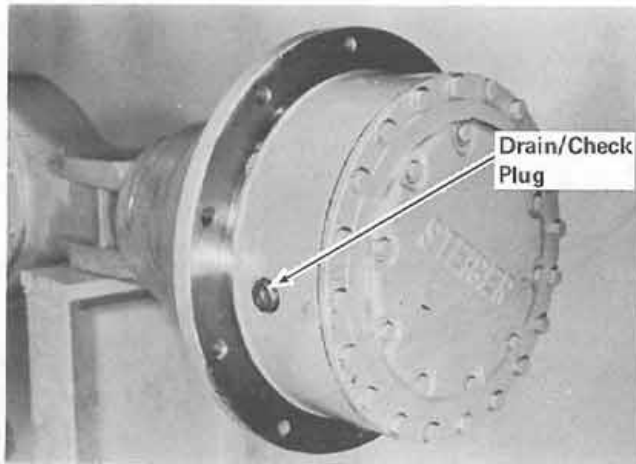


Figure 1

NOTE: Steps 1 through 5 may be done without jacking and supporting the tractor.

**Step 1** Drain all oil from the entire axle before disassembly. Oil flows to all compartments within the axle. To prevent further damage from contamination, fresh oil should be placed in the axle when reassembled. Axle contains 5.8 gallons of oil. Use at least a 6 gallon container when draining to prevent spillage. Turn drain plugs on hubs to lowest point to get complete drainage.

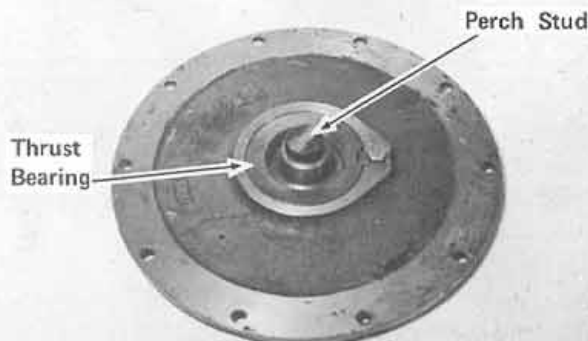


Figure 2

**Step 2** Remove cap screws and pry cover from hub.

NOTE: Check for the perch stud and thrust bearing in center of cover. There is a shim pack under the stud and under the bearing. Keep the shim pack intact for reassembly.

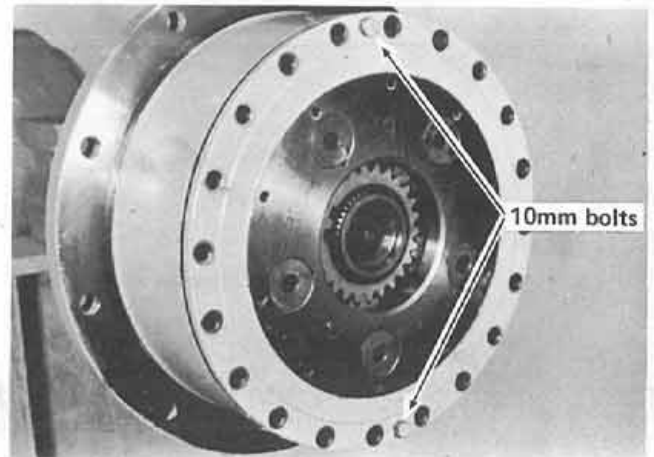


Figure 3

NOTE: Check step 67 in reassembly section pp CC-21 for correct procedure to set end play clearance.

**Step 3** Remove the cap screws (20). Pull outer planet carrier by turning two 10 mm bolts into the threaded holes on opposite sides of the planet carrier flange.

# STEIGER RABA AXLE

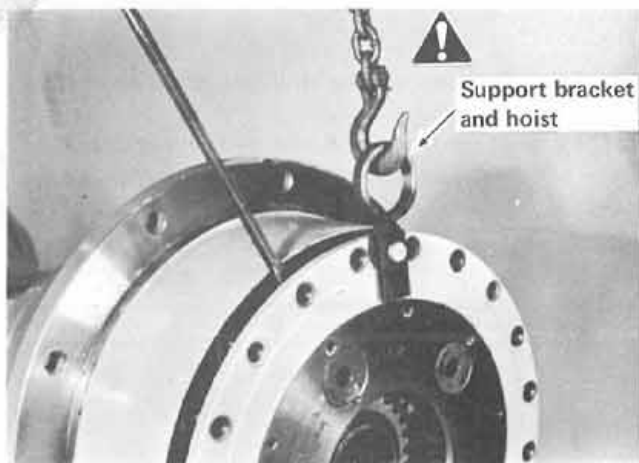


Figure 4

## CAUTION:



Use a hoist to support and lower carrier assembly.

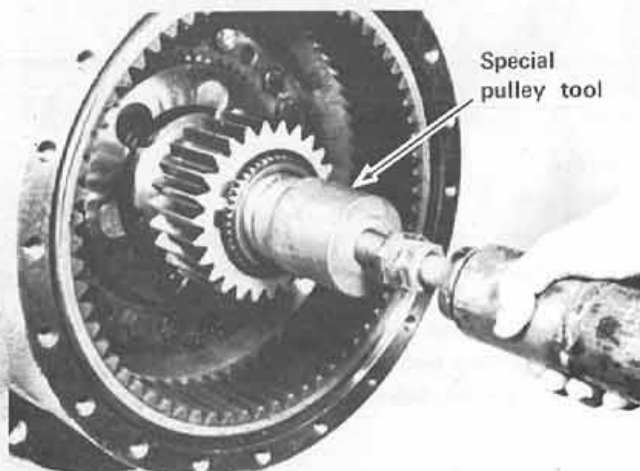


Figure 5

**Step 4** Remove the inner planet carrier with the threaded socket puller and puller bolt. A slide hammer may be used to pull assembly. (See figure 5).

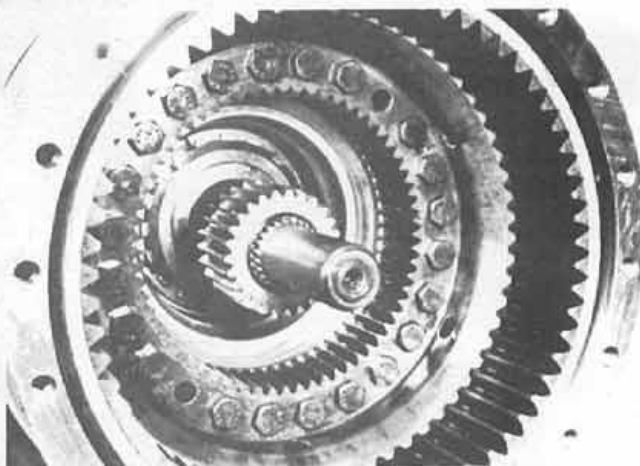


Figure 6

**Step 5** Remove axle shaft and sun gear. The axle will slide out of the center section freely. There is no fastener on the axle in the center section. (See figure 6).

**Step 6** Sun gears may be removed from the axle shaft and the inner planet carrier by removing snap rings and sliding sun gear from spline.

## Outer Planetary Disassembly

**Step 7** Disassemble the Outer Planet Carrier.

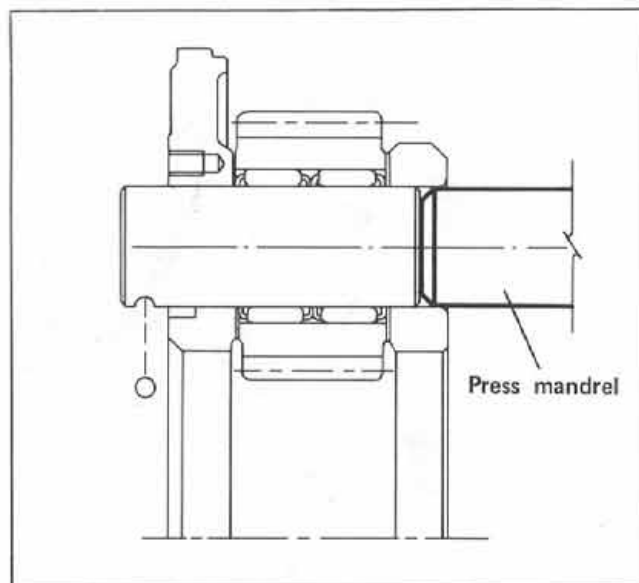


Figure 7, Illustration 1

*Note: Mark each planet gear, pin and planet pin bore to assure the same location for reassembly.*

A. Press out planetary gear pin toward outer flange. (see figure 7) Be sure to catch ball lock as pin emerges.

B. Replace pin and bearing as a matched set.

# STEIGER RABA AXLE

## Inner Planetary Disassembly

### Step 8 Disassemble the Inner Planet Carrier.

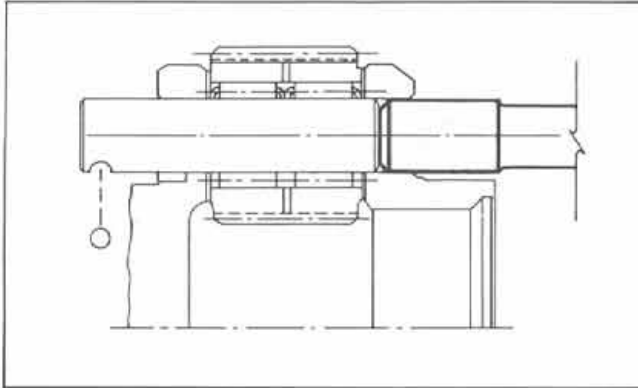


Figure 8, Illustration 2

A. Remove the ball bearing with a O.D. bearing puller. (See number 36 Page CC-8).

NOTE: Bearing may remain in hub housing. Pull with I.D. bearing puller. [See No. 36 page CC-8]

B. Remove the snap ring and press out planetary gear pins toward sun gear side. Be sure to catch the lock ball(s) as pin(s) emerge.


C. The inner planet carrier may be disassembled by removing the 3 hex head bolts. Be sure to match mark the carrier halves for alignment upon reassembly.

NOTE: Further disassembly steps 9 through 29 require the tractor to be jacked and supported by safety stands.

NOTE: Clean and thoroughly inspect the hub assembly before removing from axle. Inspect gear and bearing surfaces for damage, wear and excessive play. Check for contamination, metal particles or other foreign matter that may be in the hub housing.

**IMPORTANT:** Entire axle should be drained and flushed if breakage has occurred. Pieces of metal may have flowed to other areas of the axle in the oil.

**Step 9** Remove wheel and tires to continue axle disassembly. The axle should be supported on a suitable stand capable of supporting the weight of the axle.

**CAUTION:**  Place hoist in place directly over hub. Support hub by bolting chain to wheel mount flange. The hub weighs approximately 300 lbs. Hoist and chain must support this weight as hub is pulled free. Be sure the opposite end of the axle is supported so tipping does not occur when hub is removed.

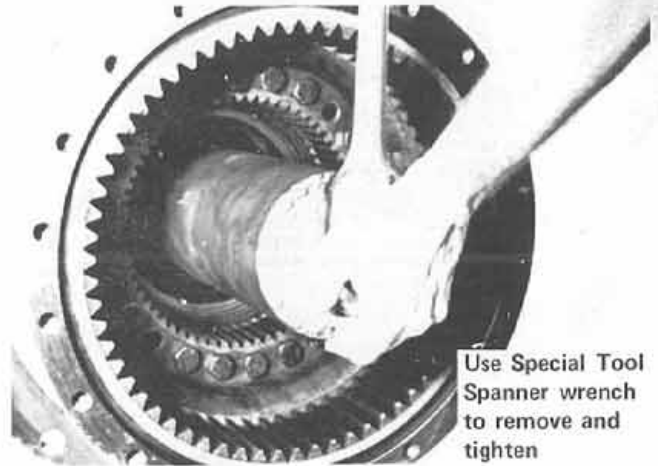


Figure 9

**Step 10** Remove axle lockwasher and nut with spanner type wrench. (see figure 9) Install the puller cap over axle threads. (see figure 10) Place a 30 ton power-twin hydraulic unit between puller cap, plate and remove hub assembly. (See figure 11 page CC-12). Bolt the puller plate across hub and fasten with 10mm bolts. (See figure 12 page CC-12).

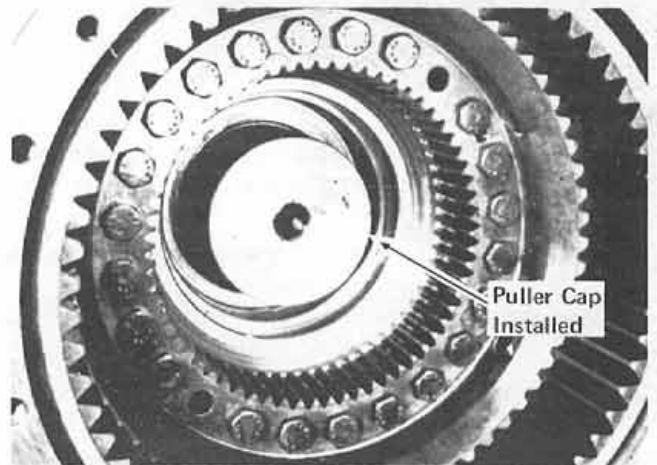


Figure 10

# STEIGER/RABA AXLE

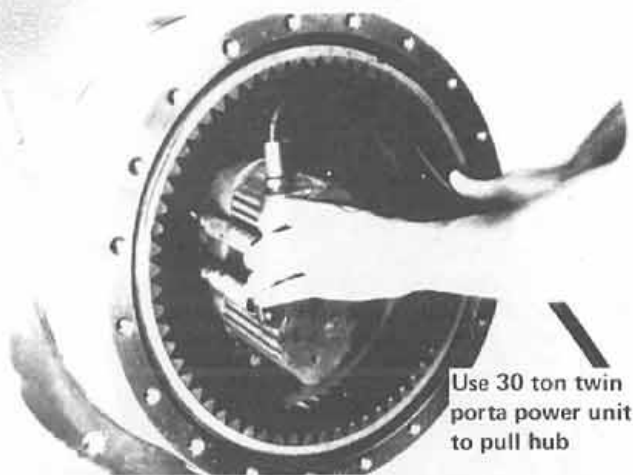


Figure 11

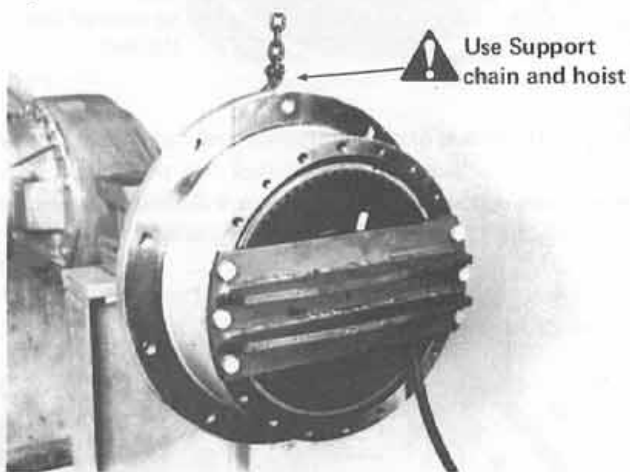


Figure 12

**Step 11** Remove the double ring gear by removing 24 mm bolts secured to the ring gear support. (See figure 10 page CC 11).

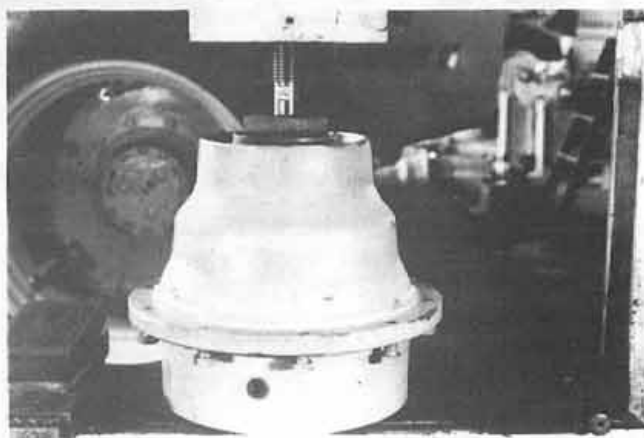


Figure 13

**Step 12** Remove the ring gear support seal shouldering ring and rear taper roller bearing by pressing out the carrier on a 10 ton press. Place the outer end of the hub down on the press table and press out stationary ring gear. Place a wooden block under the hub carrier to prevent damage to the carrier or bearings when it presses free from the hub. (See figure 14)



Figure 14

**Step 13** Bearings may be removed from the hub carrier by pulling them with a bearing puller. The inner bearing may be pushed off by threading 3 bolts thru the flange holes. Place bolts equal distance apart on flange.

**Step 14** Bearing cups should be removed from the hub using an inside diameter expanding bearing puller.

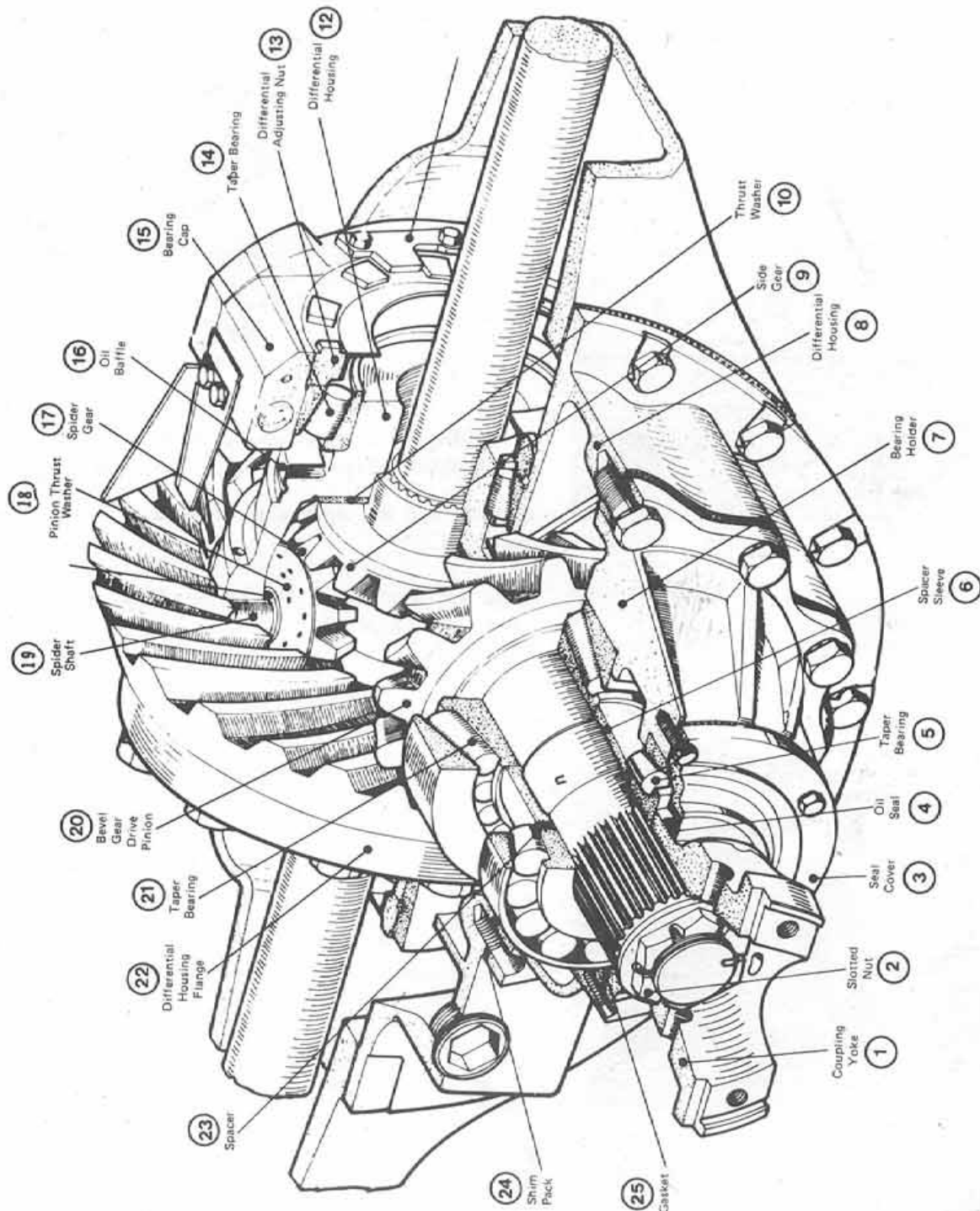


Figure 15

**Step 15** Remove axle stub from axle housing by removing 20mm bolts. Remove 5-1/4" diameter O ring and oil baffle seated behind spindle. (See No. 43 and 44 pp CC-8)

# STEIGER/RABA AXLE

## Differential Cutaway Illustration





# STEIGER/RABA AXLE

## Disassembly Of Differential Section

**Step 16** Drain all oil from axle as outlined at beginning of Hub disassembly pp. CC-7.

**IMPORTANT:** If breakage of metal particles are found in differential area drain all oil from entire axle. Flush with fuel oil and remove all contamination. Fill with fresh oil.

Follow steps 1 through 5 to disassemble hubs and pull left and right axle shafts from differential section.



Figure 16

**Step 17** Remove bolts from differential housing holder and axle housing. Place chain lift in place in threaded holes on opposite sides of the differential housing.

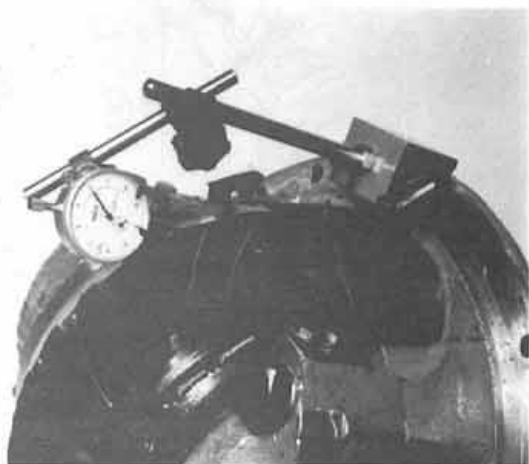


Figure 17

**NOTE:** Check the backlash of the ring gear and pinion before disassembly of the differential assembly. Backlash should be reset the same if the original gears are replaced. [See figure 17]

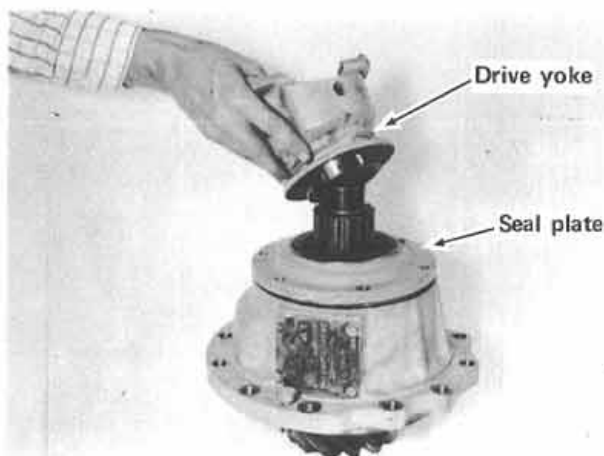


Figure 18

**Step 18** Remove the cotter pin from the pinion shaft nut. Remove the castle nut from the pinion shaft.

**Step 19** Pull the drive yoke from pinion shaft. (see figure 18)

**Step 20** Remove the seal plate from the pinion shaft. (see figure 18)

# STEIGER/RABA AXLE

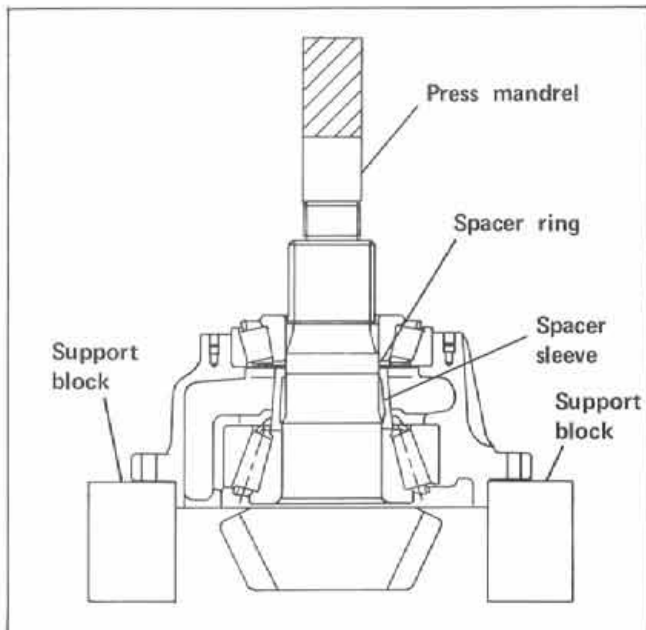


Figure 19

**Step 21** Press out the pinion shaft from the bearing holder.

**NOTE:** Keep the spacer ring and spacer sleeve in one assembly for reassembly. Use the same spacer ring and spacer sleeve for trial reassembly. After trial test of preload on the pinion bearings change the spacer sleeves as necessary to set correct preload. [See steps 38 to 41, differential reassembly.]

**Step 22** Press out the bearing cups from the bearing holder. This is necessary only when new bearings are being installed.

**NOTE:** If pinion bevel gear is damaged or worn, it must be replaced with a new ring and pinion gear. Both gears must have the same "wear in" pattern.

## Disassembly Of Ring Gear/ Differential Housing

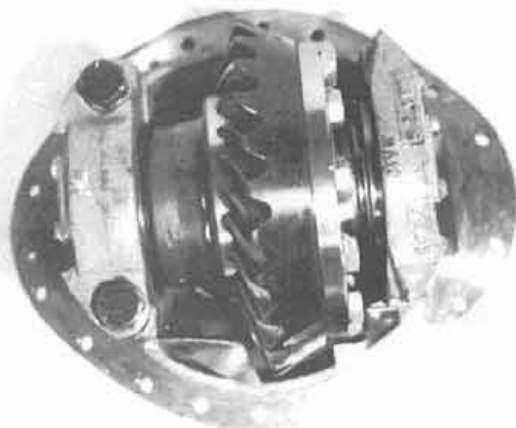


Figure 20

**NOTE:** Mark the adjusting nuts at each side of the differential for position. This is necessary to position the differential upon reassembly, if the same gear set is being reused. [See figure 21].

**Step 23** Remove the lock plate from each adjuster nut and mark the nut and housing with a center punch or chisel for position. (see figure 20)

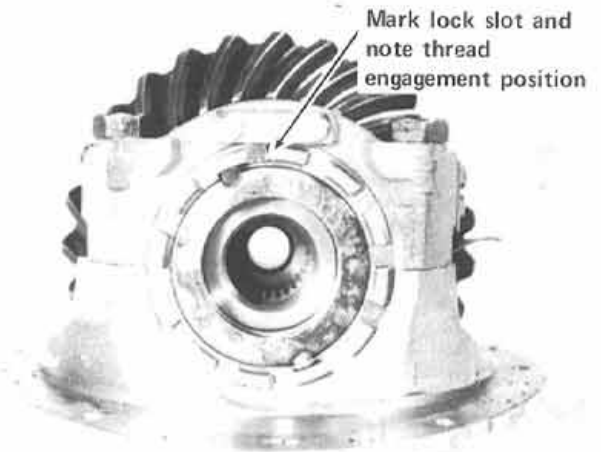


Figure 21

**Step 24** Remove the carrier cap and bearing cup.

**Step 25** Lift the differential housing from the carrier housing.

**NOTE:** Before disassembly of the differential housing, mark the halves with a center punch or chisel for identical realignment upon reassembly. Mark end of spider shaft to case also. [Case halves are numbered, numbers may be used as reference.]



# STEIGER/RABA AXLE

**Step 26** Remove the 12mm bolts from the ring gear side of differential housing and separate the differential housing.

**Step 27** Remove side gear and spacer. Remove the spider gear assembly. Keep all thrust washers and spider gears on the same shaft ends as they originally are when disassembled.

**NOTE:** *The side gears have a thrust washer on the axle side. Be sure to replace the same washer or a washer of correct thickness to remove play from cluster gear assembly. These washers are available in thickness of 4.6 mm to 5.3 mm in 1 mm steps. Follow step 30 of reassembly procedure.*

## Assembly

After each part has been inspected for damage or wear and all parts have been thoroughly cleaned reassemble all component parts using the following procedure.

**Step 30** Reassemble the spider gears in the differential case.

**NOTE:** *The side gear thrust washers will determine the side play within the differential. Part D of this step explains thrust washer tolerance.*

A. Place thrustwasher and side gear into differential case. (side gear tolerance)

B. Assemble spider, pinion gears and pinion thrust spacers and place in differential case.

C. Place thrustwasher and side gear in place on the spider-pinion gear assembly and place the other half of the differential case in place.

D. Secure the case together with four bolts placed at 90 degree intervals. If the side gear (s) turn without play, clearance is correct. If gear does not turn or if there is play in the gear, the thrust spacers must be changed behind the side gears. They range in size from 4.6 mm to 5.3 mm in steps of 0.1 mm.

E. When the side gears turn without play, spacers are correct. Assemble the differential and tighten to 72 ft. lbs. with a torque wrench.

**Step 31** Assemble the oil baffle to the differential housing. Secure it with a center punch by placing a punch mark in four places 90 degrees apart. This will keep the baffle from turning.

**Step 32** Bolt the ring gear to the differential and tighten the bolts to 220-250 ft. lbs. with a torque wrench.

**Step 28** Remove 18 mm bolts from ring gear and housing flange to remove ring gear.

**NOTE:** *Ring gear and drive pinion must be replaced in a set to obtain correct wear pattern.*

**Step 29** Bearings may be pulled from differential housing with a bearing puller of correct dimension.

**NOTE:** *If a new ring gear is installed the bevel pinion gear must also be replaced. Ring and pinion gears are replaced in matched sets to obtain correct run-in wear pattern. See Step 45 for bevel pinion gear installation and correct backlash.*

**Step 33** If bearings are replaced, press a new bearing cup into the bearing seat on full cast side of the differential drive housing.

**Step 34** Press bearings on the differential housing bearing seat.

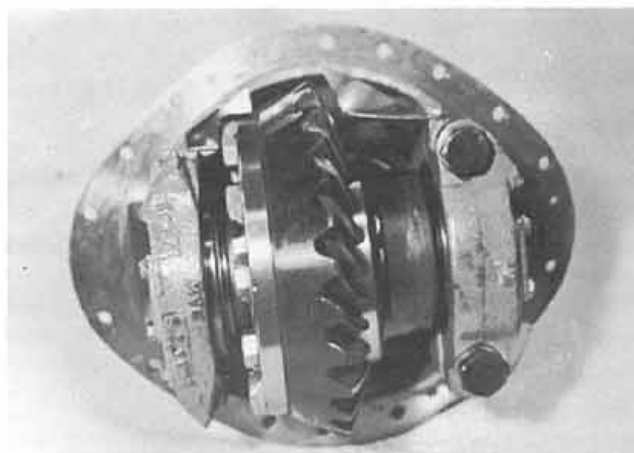


Figure 22

**Step 35** Seat the ring gear differential assembly into the differential drive housing and prepare to set side play and bearing prelaod. Place the bearing cup, and bearing cap in place and fasten finger tight with both bolts. Turn the side adjustment nut into the bearing till finger tight. Reset both side adjustment nuts as close to their original position as possible. Adjust the side play out of the differential assembly.

# STEIGER/RABA AXLE

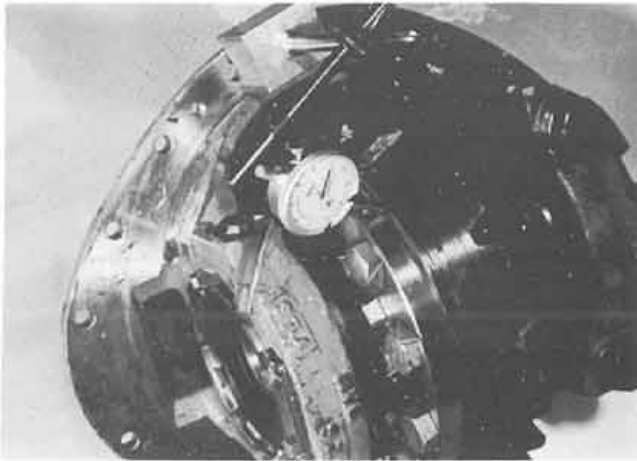


Figure 23

**Step 36** Use dial indicator check back face of ring gear. Rotate at least one full turn. Runout must not exceed .003 total indicator reading. If runout is excessive, remove assembly and check for burrs or dirt under mounting surface of ring gear. Reassemble and recheck.

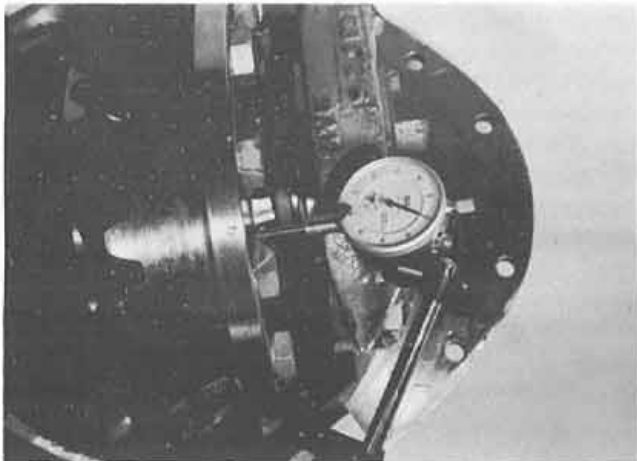


Figure 24

**Step 37** With the dial indicator in place on the side of the ring gear, adjust the nuts until the differential assembly has approximately .010-.015 side play. Then adjust to a point where there is 0 side play.

*NOTE: Further lateral adjustment of the differential will require that one adjusting nut be loosened the same amount that the opposite nut is to be tightened. This will maintain 0 side play in the bearing[s].*

The bearing on the pinion shaft must be set at the correct preload. The preload is correct when the bearings turn when exerting a torque of 86-172 in.lbs. Step 39 and 40 will explain how this is done.

## Assembly Of The Pinion Gear Shaft

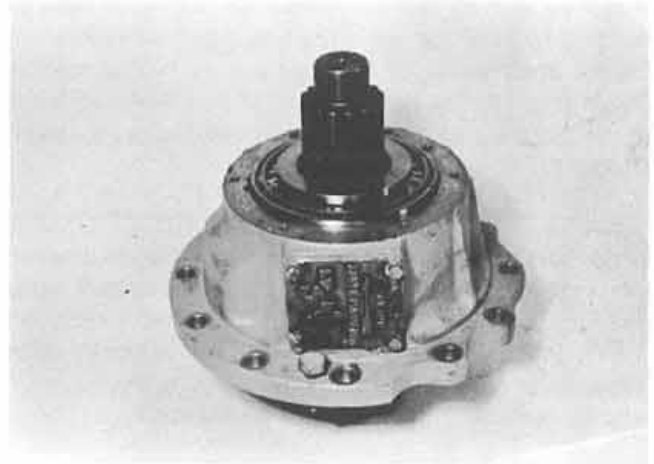


Figure 25

**Step 38** Press the bearing cups into the bearing case.

# STEIGER/RABA AXLE

**NOTE:** It will be easier and save time if a fitting shaft is used to set preload rather than the pinion shaft. Machine a shaft that will allow the bearing to slide on and off without the use of a press. Machine a discarded pinion shaft down till bearings can be slid on and off with ease. When correct preload has been adjusted, place bearings on the shaft to be used and apply correct torque.

**Step 39** Place rear bearing on pinion shaft (or fitting shaft) and place the original spacer and shim washers on shaft. Place shaft in bearing case, install outer bearing and nut. Tighten the nut and check the tightness or looseness of the bearing. Change shim washers till the approximate preload is achieved (shaft should turn by hand but with resistance.)

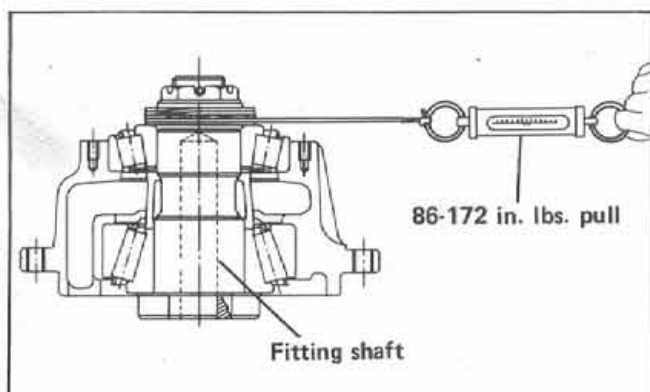


Figure 26

**Step 40** To check correct preload, fasten a 36" string or flexible wire to the pinion shaft nut and wind it around the washer behind the nut. Connect a spring scale and rotate the shaft. Correct preload will require a pull of 5-9 lbs.

**Step 41** When correct bearing preload is set, tighten the lock nut to 400-435 ft. lbs. with a torque wrench, after completing Step 42 and 43.

**Step 42** Place a new seal in the pinion shaft seal plate and install.

**Step 43** Press yoke on pinion shaft.

**Step 44** Place pinion bearing holder into differ-housing holder and tighten the hexagon cap screws to 87-101 ft. lbs. with a torque wrench.

## Reassembly Of Differential Section



Figure 27

**Step 45** Use a dial indicator to check backlash between ring gear and pinion shaft gear. Backlash is adjusted by moving ring gear toward or away from pinion shaft gear. Move ring gear by loosening one adjusting nut and tightening opposite lock nut. When loosening one lock nut and tightening opposite, move each lock nut same distance so that bearing adjustment made in previous paragraph is not disturbed. Adjust position until gear backlash is between .007" and .020" if new gear set is used, or adjust to backlash noted at disassembly for old gears.

**Step 46** Check ring and pinion gear for proper tooth contact. Paint ring gear with a mixture of red lead and linseed oil. When ring and pinion gears are rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts. As a rule, painting about 10 or 12 teeth is sufficient for checking purposes.

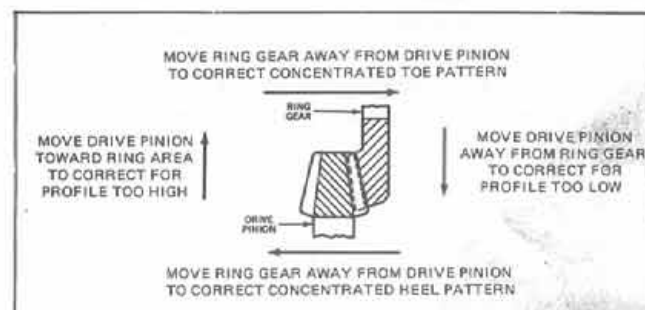


Figure 28

Adjust to obtain correct tooth contact on drive side of teeth.

# STEIGER/RABA AXLE

**NOTE:** Sharper impressions may be obtained by applying a small amount of resistance to the ring gear with a flat steel bar and using a wrench to rotate the pinion. Gears should be rotated, under slight load, until ring gear has turned at least one revolution in both directions.

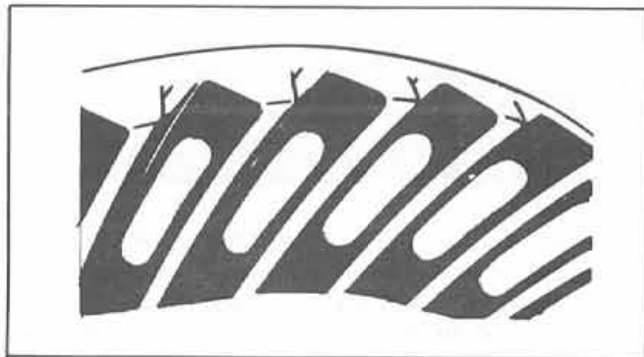


Figure 29

**Step 47** Check tooth contact pattern on drive side (convex side) of ring gear teeth. Coast side will automatically correct when drive side pattern is correct. If proper tooth contact pattern is not obtained, readjust backlash or add or subtract from shim pack between pinion bearing, case flange and differential housing. Addition of or subtraction of shims should be made in small increments until proper contact is established.

**Step 48** Tighten bearing cap bolts to specified torque. With dial indicator, recheck ring gear and pinion backlash. Recheck differential bearings for end play.

## Reassembly Of Hub

All disassembled parts should be completely cleaned and inspected. Replace damaged or worn parts with new parts in complete assemblies.

**Step 49** Assemble the hub ring gear support-bearing assembly by pressing the support to the largest taper bearing. (No. 7 p. CC-8 see figure 14)

**Step 50** Place the bearing and ring gear support into the hub. Support the ring gear in a press so all pressure is placed on the center flange of the ring gear support. See illustration. Press the rear taper bearing to the ring gear support.

**Step 51** Press the oil seal shoulder ring on the ring gear support.

**Step 52** Press the oil seal into the oil seal ring. Use a mandrel or press ring of same diameter as the oil seal.

**NOTE:** If a mandrel for pressing the oil seal into the seal ring is not available, use the seal shoulder ring No. 42 p. CC-8 placed in the center of the oil seal to prevent distortion.

**Step 53** Press the assembled oil seal ring into the hub.

**IMPORTANT:** Do not distort or damage the oil seal upon assembly. Damage during assembly will cause leakage when placed in service.

**Step 54** Turn the hub over after removing from press and reinstall the stationary ring gears. The outer ring gear is locked to the inner gear with an I.D. snap ring. (See No. 33 p. CC-8). Bolt the ring gear assembly to the ring gear support within the hub. Tighten the 13 mm bolts to 130 ft. lbs. with a torque wrench. (See fig. 10 p. CC-11).

**Step 55** Mount the stud axle by placing the O ring on the inside flange and the oil baffle in the axle housing, then secure the stub axle to the flange of the axle housing with 20 mm bolts. (See fig. 15 & 43 & 44)

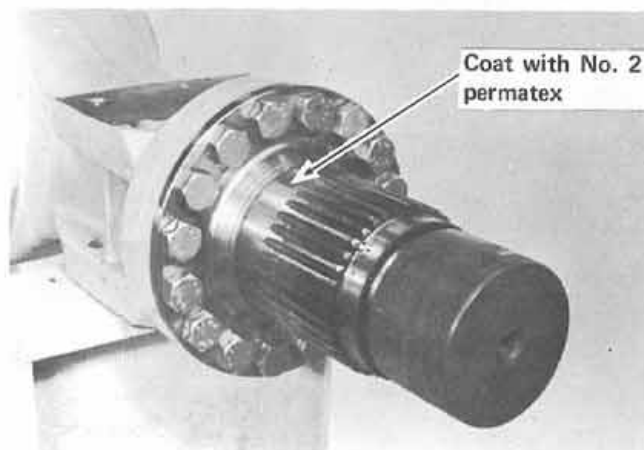


Figure 30



# STEIGER/RABA AXLE

**Step 56** Mount the special puller cap on the stub axle thread. This will protect the lip of the oil seal from being damaged on the axle threads when mounting the hub. (See figure 30 pp CC-19).

**NOTE:** Seal stub axle with No. 2 Permatex before mounting hub assembly.

**Step 57** Lift the hub to a in line position with the axle stub and push the hub on the axle stub until the spline aligns and engages.

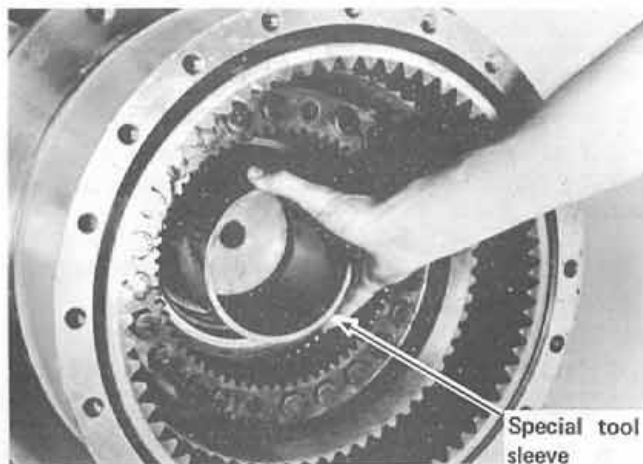


Figure 31

**Step 58** Place the special push collar over the puller cap. Place a 30 ton power-twin unit against the push collar and install the 1" puller bolt through the port-a-power unit. Engage the bolt threads till the port-a-power unit is snug against the collar.

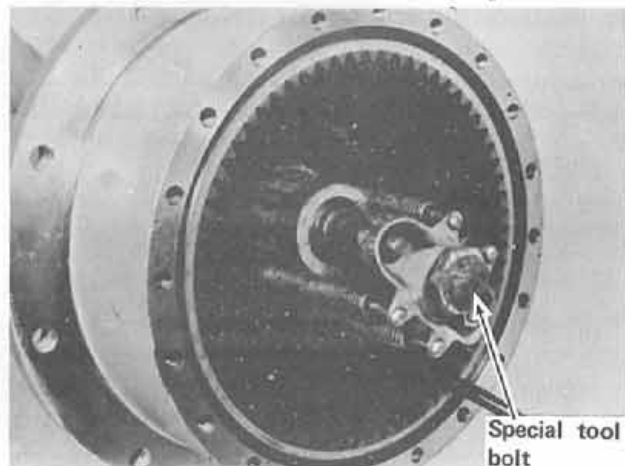


Figure 32

Owatonna Tool Co Model Y30A

**Step 59** Pull the hub onto the splined axle stub until it is completely engaged on the splined axle stub.

**Step 60** Remove the puller, bolt and puller cap from the axle stub.

**Step 61** Install the axle nut and tighten till there is no end play in the bearings. This may require that end play be measured until no measurement of end play exists as the nut is being tightened.

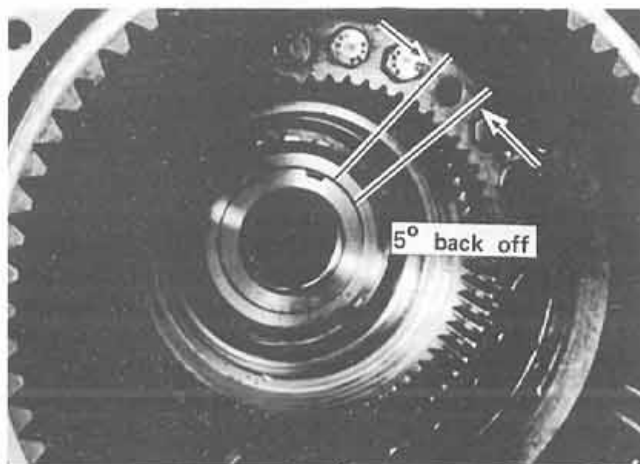


Figure 33

**Step 62** When nut is tightened till no end play exists, loosen the nut 5 degrees to 10 degrees and lock it with the lock washer. Place the outer lock nut in place and tighten to 250-300 ft. lbs. with a torque wrench. Lock the nut with the lockwasher previously installed.

**Step 63** Bump the outer side of the hub to loosen the preload of the bearings. The hub should turn but with resistance from the oil seal and tight bearing. No end play should exist.



Figure 34

**Step 64** Place the axle shaft with attached sun gear into the housing engaging the axle spline into the differential side gear spline.

**Step 65** Reassemble the inner planetary unit, press or drive the planetary bearing into the ring gear support till firmly seated.

A. Place new bearings in the planet gears. With spacer washers on each side, press pin into carrier bearing and gear. Be sure to align the lock ball grooves when installing pin.

**IMPORTANT:** Realign pins and gears to their original holes in the carrier.

B. Replace all 3 pin bearing and gear assemblies and place snap ring on carrier.

C. Press the ball bearing on the planetary carrier.

D. Hang planet carrier on axle sun gear and slide into place. Drive bearing into seat with soft lead hammer or wooden block.

# STEIGER/RABA AXLE

**Step 66** Place new gasket in place on the hub, seal all surfaces with a non-hardening sealer. Place the outer planetary over the sun gear on the inner planet carrier and mesh with outer stationary sun gear. Tighten all 10 mm bolts to 145 ft. lbs. with a torque wrench.

The clearance must be adjusted between the inner planetary sun gear shaft and thrust washer in the cover and the axle shaft and the perch stud in the cover before replacing the cover.

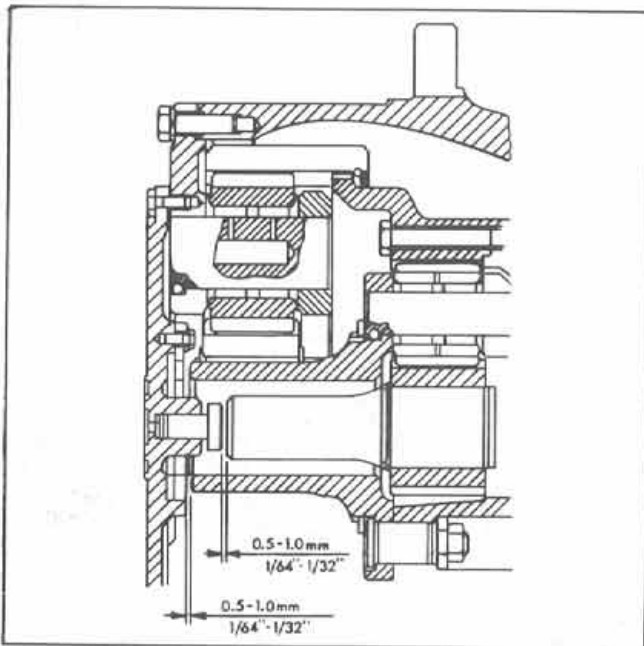


Figure 35

**Step 67** To check the clearance between the planetary axle and the thrust washer in the cover measure the distances in fig. 36 and use the following formula to determine the clearance. Measure the distances with a straight edge and machinists rule. Place the straight edge and rule as illustrated. Place new gasket on cover when taking cover measurements.

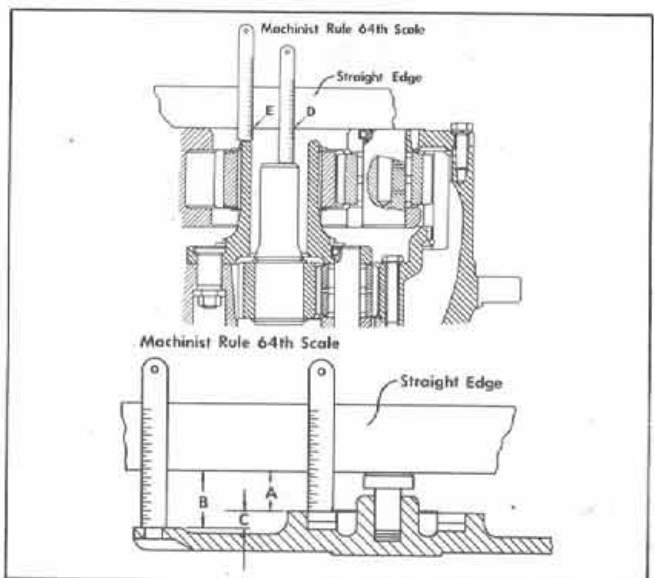


figure 36

**Measure B**

**Measure A subtract from B -**

**Difference equals C**

**Measure E**

**Subtract C**

**Difference equals clearance**

Clearance should be 1/64" to 1/32". Add or subtract shims under the washer till correct clearance is established. The washer is removed by pulling with the same tool that threads into the inner planetary shaft. (See fig. 37)

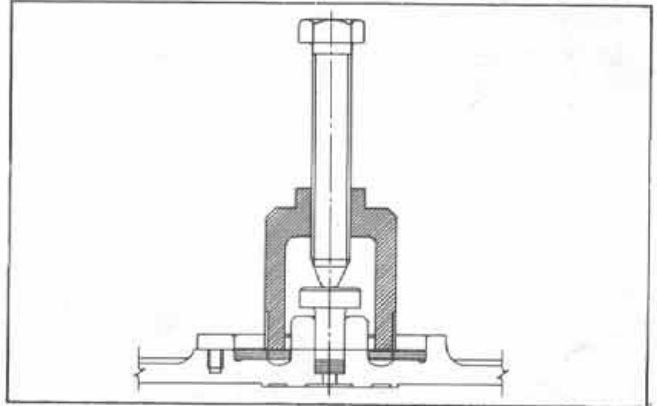


Figure 37

**Step 68** To check clearance between axle shaft and perch stud, measure distances in fig. -- as illustrated. Be sure axle shaft is pushed all the way into the differential against the spider thrust surface.

**Measure B**

**Measure D subtract from B -**

**Difference equals clearance**

Clearance should be 1-64" to 1-32". Add or subtract shims under perch stud till correct clearance is established. The perch stud is removed by driving a straight punch through the center hole on the outside of the cover.

**NOTE:** If a no spin has been installed in the differential, it will be necessary to place cover on one side of the axle and check axle shaft clearance from one side only. This is because a floating spacer slug replaces the stationary spider, that is normally in the differential. All play must be removed by pushing the axles against the perch bolt on the opposite side of the axle. Then, complete measurement as outlined in Step 67 & 68. The clearance specification will now be doubled, 1/32" minimum to 1/16" maximum.

**Step 69** Seal all surfaces with a non-hardening gasket sealer and place gasket and cover in place. Tighten all cover bolts to 26 ft. lbs. with a torque wrench.

**Step 70** Reassemble axle to tractor to operating positions. Attach drive shaft. Reattach all other components (ie hitch, draw bar, etc.)

**Step 71** Fill each hub end with 7-1/2 qts. of oil. Fill the differential section with 8-1/2 qts. of oil.

# INSTALLATION OF THE **NoSPIN**


Installation of the No Spin differential is accomplished by the following procedure.

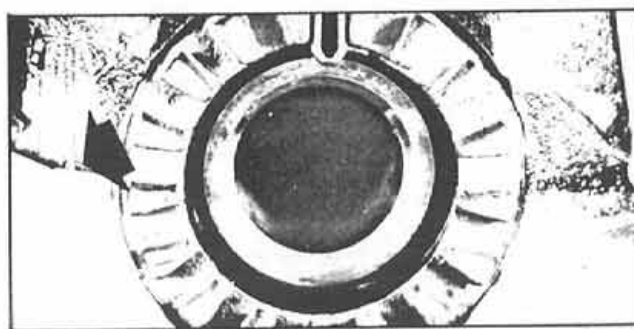
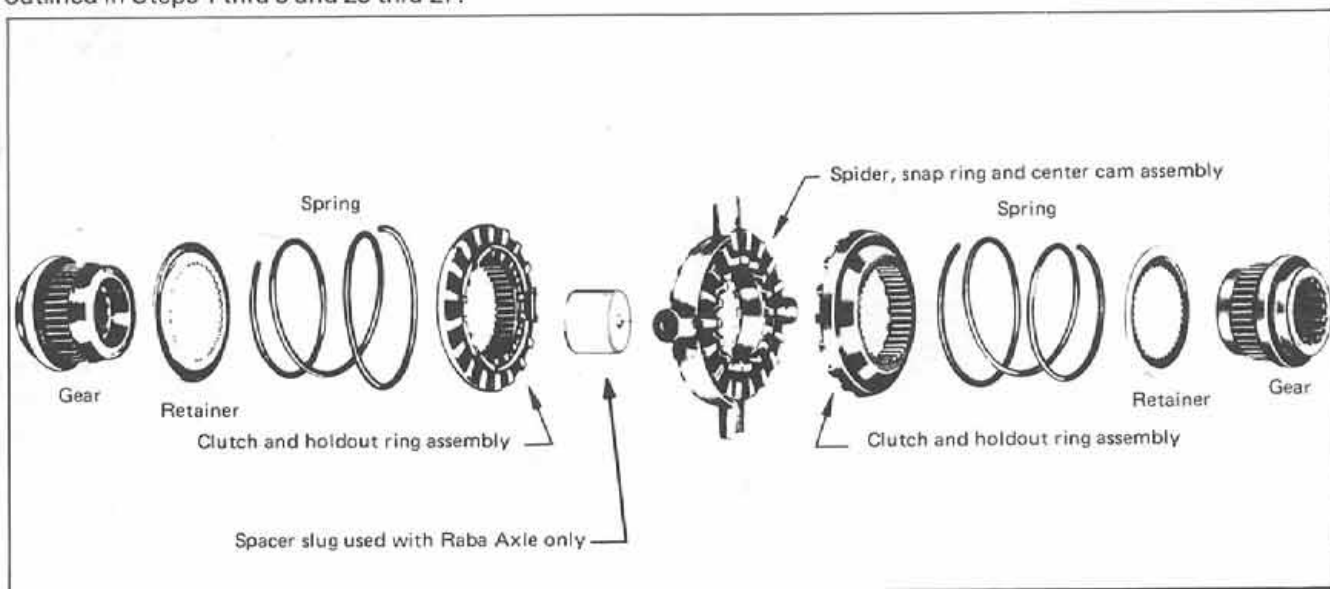
**Step 72** Place steering locks on both steering cylinders.

**Step 73** Remove the axle from the tractor as follows:

- A. Disconnect the drive shaft from the differential yoke.
- B. Remove the axle to frame bolts.
- C. Jack and block the tractor to a height that will allow the axle to clear the frame when rolled out on the tires. Tires will not have to be removed.

**Step 74** Disassemble the axle differential section as outlined in Steps 1 thru 5 and 23 thru 27.

**WARNING:**  Do not allow anyone under tractor when jacking or hoisting tractor from axle. When the tractor frame is raised from the axle the differential section will roll down. Be sure to clear the area under the differential section. Be sure the tractor is securely blocked when axle is removed.

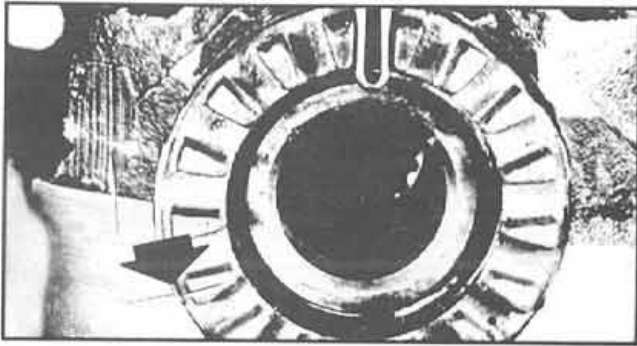


**Step 75** (Remove carrier assembly from vehicle. Follow procedure recommended by vehicle or axle manufacturer.) Before dismantling assembly, be sure that each bearing cap is marked as to its position on carrier bearing saddles (right or left side). If caps are not identified, mark them with a prick punch or chisel to assure proper reassembly. If caps are reversed (as they can be in some assemblies), this might affect bearing alignment.

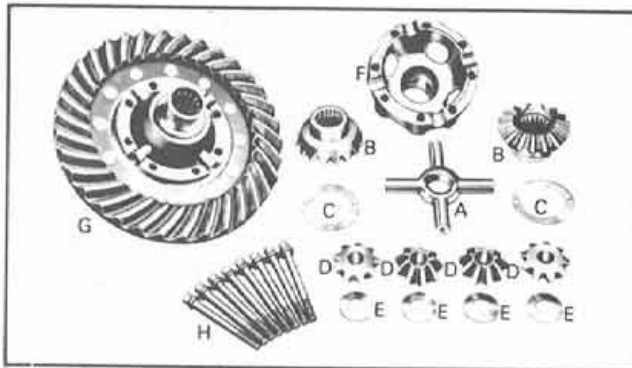
**NOTE:** Follow steps 16, 17, 23, 24, 25, 26 & 27.



## INSTALLATION Cont.



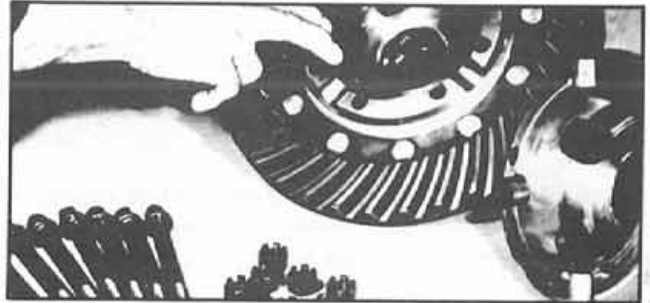
**Step 76** NoSPIN does not affect bearing adjustment. Time can usually be saved by marking the original position of the differential bearing adjusting nuts, locks, rings or caps with a prick punch or cold chisel. Then, when reassembling, adjusting nuts are turned until the locks can be placed in the same position (marks aligned as shown). If axle is *new*, very probably the factory adjustment was correct, and it may be assumed that the bearings are properly adjusted. If the axle is *used*, a new adjustment may have to be made. In either event, the final adjustment should be verified according to the manufacturer's recommendations.



**Step 77** Open differential gear support case (F). Then lift out and discard the old differential assembly (Part A through E should be discarded; Parts F, G and H should be retained). NoSPIN replaces spider (A), side gears (B), pinion gears (D), and *all of the thrust washers* (C and E) of the original differential. *Do not* remove ring gear (G) from case (F) unless worn or damaged. *Do not* remove cone assemblies from differential gear support case (F) or cover (F) if the bearings, (not shown) are to be re-used.



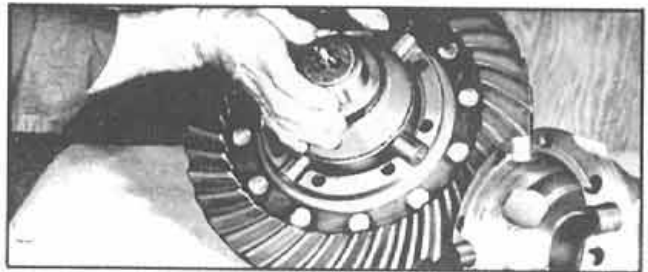
**Step 78** Thoroughly clean all of the parts that may be reused (the ring gear with half of the case and bearing cone, the loose case half (cover) and bearing cone, and the bolts and nuts); rinse them in clean solvent and dry. Set these parts on a clean bench top for inspection.



**Step 79** Carefully examine the differential case. If trunnion holes are worn or scored or if the thrust surfaces on inside ends of the differential case are worn or scored, the case should be replaced. Examine threads of all bolts and nuts or cap screws. Replace those which show indications of being stripped or damaged. At this time it is a good practice to carefully examine bearings and ring gear for wear or damage. *Be sure all thrust washers have been removed from the differential case.*

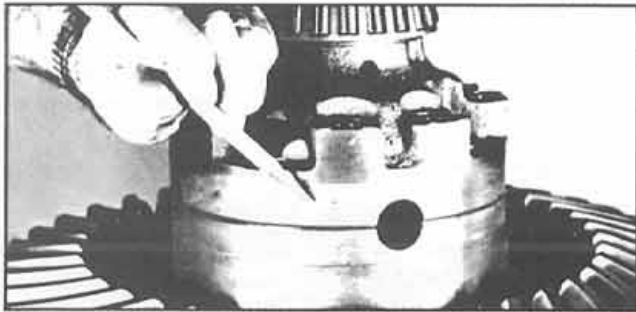


**Step 80** Clean the axle shafts and examine the spined ends. Remove any roughness or burrs with a file or stone. (See "Important note" after step 12.)

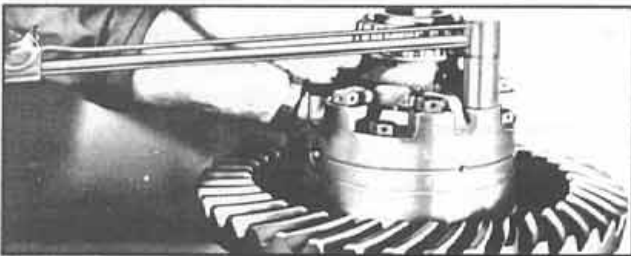


**Step 81** Place the NoSPIN assembly in the differential case. (For good performance a snug fit of the differential case around the trunnions of the spider is absolutely necessary.) *Do not* remove the retainer bolt, nut and washers.

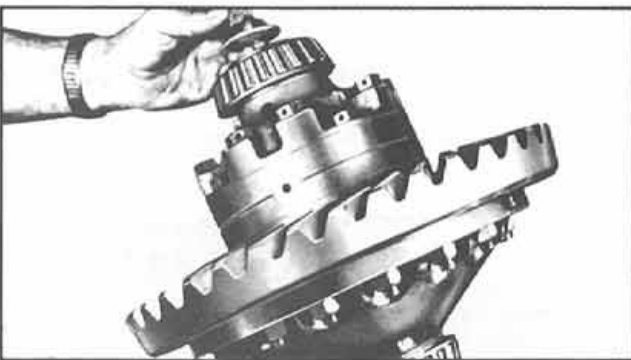
## INSTALLATION Cont.



**Step 82** Position the differential case halves around the NoSPIN. If the case halves are marked for proper alignment, *be sure* they are properly aligned!

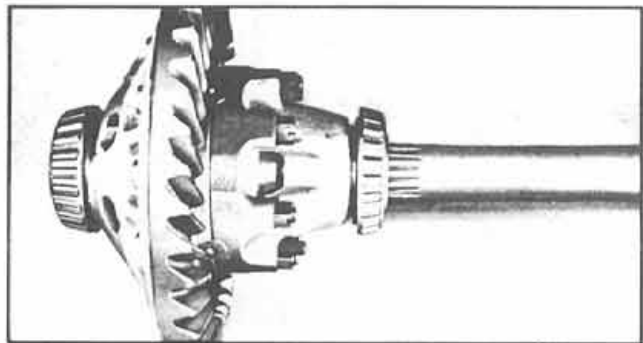


**Step 83** Install the bolts and nuts or cap screws, whichever are used. Tighten them snugly but do not *over-torque* and strip the threads. If cap screws are used, do the final tightening with a torque wrench. Re-check the fit between the spider trunnions and the case. As mentioned before, a loose fit between the spider and the case can stand in the way of the successful performance of the NoSPIN.



**Step 84** Remove the NoSPIN retaining bolt, nut and washers. Discard, or retain for future use if desired.

**IMPORTANT:** Check for the spacer slug in the center of the NoSPIN. This slug provides the end thrust bearing surface for both axles. If it is not in the NoSPIN, axles will slide out of the hub planetarys and ruin the gears. Be sure to check end place as outlined on page CC-21 step 68.



**Step 85** Before assembling into the axle carrier and housing, check splined end of axle shafts for a free sliding fit into side gear (as shown). See "Important note" below. Follow manufacturer's instructions for finishing installation — Reassemble NoSPIN-equipped ring gear and carrier assembly in axle housing. Adjust differential bearings if required, check for proper fit of thrust blocks, etc. Refill axle housing with lubricant recommended by axle or vehicle manufacturer. (See "Lubrication" on page CC-5).

**IMPORTANT:** Upon final assembly, the shafts should slide freely into the side gear splines. Do not attempt to force a shaft to fit by driving it into place or drawing it into place when tightening the studs or nuts at the flange end. This may compress the springs in the NoSPIN and cause it to malfunction.

**Step 86** Reassemble the Raba differential by following steps 31, 35, 36, 37, 44, 45, 46, 47, 48, 64, 65, 66, (67, 68 Note:) 69, 70 & 71 in the service manual.

**NOTE:** No adjustment can be made to the NoSPIN. All normal differential adjustments are required upon reassembly of the ring gear and pinion drive shaft.

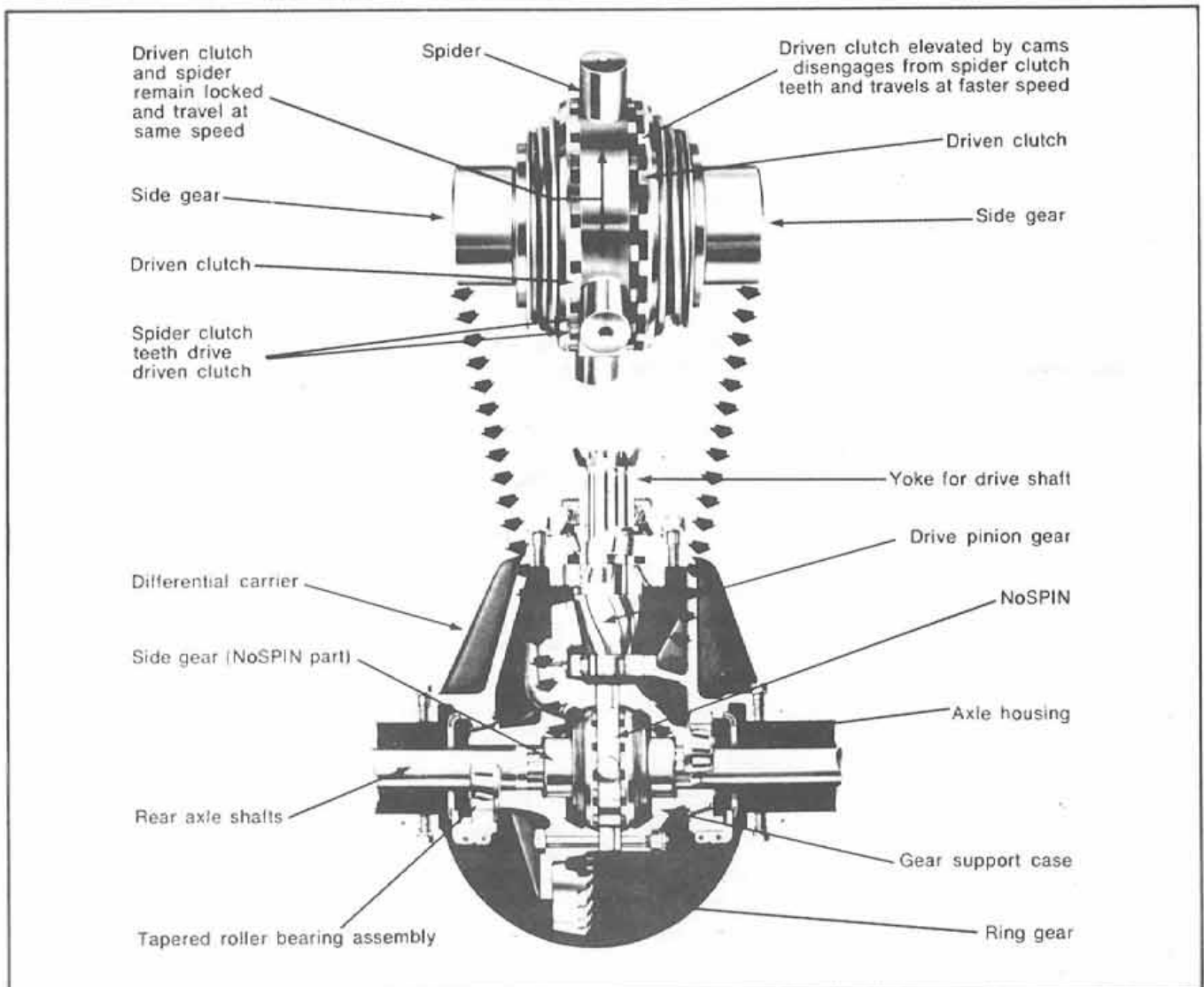
**Step 87** Replace the original steering cylinders with replacement cylinders required for NoSPIN steering. The replacement cylinders are included with the NoSPIN Kit from Steiger Tractor.

# PRIME FUNCTIONS OF THE *NoSPIN*

The NoSPIN differential has two prime functions. One is to compensate for differences in driving wheel travel which occurs when turning or traveling over uneven ground. The other is to prevent wheel-spin when one wheel loses traction, a condition which would stall a vehicle not equipped with a NoSPIN differential. This is because the NoSPIN prevents the driving torque from forcing one wheel to rotate faster than its opposite wheel.

When a vehicle is being driven in a straight-forward direction, the NoSPIN's clutch teeth and cams are fully engaged and give both rear wheels driving torque. The clutch teeth and cams are so positioned that neither wheel can turn more slowly than ring-gear speed. If one wheel should lose traction momentarily by rolling onto ice or snow, or over a soft shoulder of the road, the opposite wheel, which still has traction, continues to pull the vehicle until traction is regained by both wheels.

In normal operation when the right rear wheel passes over an obstruction, or if the vehicle makes a left turn, the right wheel must travel faster and farther than the left wheel. When this happens the NoSPIN automatically allows for this difference in wheel travel. The spider continues to drive the left wheel as the left clutch teeth remain completely engaged. But as the right wheel forces ahead, the right driven clutch member instantly rises on the incline of the center cam ring and over as many teeth as may be necessary for wheel speed compensation during the turn or passing over the obstruction. When the vehicle is again back on the straightaway or on smooth highway, the disengaged clutch is automatically returned to its full clutch tooth engagement.



# GENERAL INFORMATION ABOUT THE NoSPIN

The NoSPIN differential provides positive drive to both wheels of the axle in which it is installed and allows differential action when required. The performance of a vehicle equipped with the NoSPIN may be somewhat different from that of one with a standard differential. For example:

1. When turning a corner the outside wheel must rotate faster than the inside wheel, otherwise serious tire scuffing would occur. When driving around a turn, the NoSPIN clutch driving the outside wheel is automatically disengaged permitting this wheel to rotate freely until the turn is completed at which time it is re-engaged.

While the turn is being made there will be a series of clicking sounds resulting from the alternate disengagement and engagement of the differential clutch teeth on the outside clutch. These clicking sounds, which are quite audible in small trucks and pickups, are not so pronounced in larger trucks, and are normal in the standard-type NoSPIN.

With a silent-type NoSPIN, only a faint clicking or indexing noise may be heard, or possible no noise at all.

2. When driving straight ahead a continuous click may be heard if the tires are not equal in rolling radii due to unequal wear or unequal inflation. This, of course, can be corrected by matching up the tires and checking pressure periodically. If clicking continues, adjust tire pressures so that the distances from the ground to the rim are equal.

3. If you get a constant pull to the right or left in straight forward driving, check the tire pressures and rolling radii of the rear tires. They should be the same. (Also, if the load is on one side of the truck, you may get a pull to the right or left.)

4. In very short wheelbase trucks and tractors having a small turning circle, concern is periodically expressed about vehicle understeer or push characteristics when making a turn under power.

By letting off on the throttle for an instant, the torque to the rear wheels will be reduced and permit the truck or tractor to go into the turn.

NOTE: Short wheelbase highway tractor applications should be reviewed by the Detroit Automotive Engineering Department before NoSPIN is used. NoSPIN Application Guidelines Supplement No. 72-1008 discussing "Understeer Characteristics" will be furnished upon request.

5. An increase in the amount of backlash is also normal in both types of No SPIN differentials. This is due to inherent clearance designed into the NoSPIN to allow the clutch teeth to disengage or re-engage automatically during turns whether coasting or driving

and whether traveling forward or rearward. The noise is usually more noticeable when NoSPIN is used with standard transmissions than when used with automatic transmissions.

The inherent clearance in the NoSPIN is fixed and does not increase appreciably with use. The total backlash in the entire drive system including the transmission, joints, various splines and gears will develop a noticeable increase as mileage increases, due to normal wear of these parts.

6. When alternately accelerating or decelerating during a turn an occasional snapping noise may be heard as the torque is being alternated from "driving" torque on the inside wheel to "braking" torque on the outside wheel.

7. When making a turn in loose gravel or in other conditions of poor traction with the outside driven clutch momentarily disengaged, the inside wheel may receive so much torque that the tires will break traction momentarily until power is being transmitted to both wheels. Whenever traction conditions are so poor that there is not enough traction under one wheel to drive the vehicle, the inside tire may continue to slip or scuff until the turn is completed because the inside wheel must turn at the same speed as the outside wheel before the outside wheel begins to drive.

8. When operating NoSPIN-equipped vehicles (usually slower-moving off-road vehicles) in extremely cold weather, during the initial warm-up operation after a clutch overruns normally, it may re-engage erratically (sluggishly). This condition can usually be minimized by using the lightest acceptable lubricant that the axle manufacturer will approve and it can be overcome, if necessary, by controlling the axle and lubricant temperature or allowing time for axle warm-up before subjecting the vehicle to its normal operation. Detroit Automotive Tech Data report No. 72-1009 discussing "Axles Equipped with NoSPINs Operating in Sub-zero Environment" will be furnished upon request.

