PART 5 — DRIVE AXLES — STEERING

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DESCRIPTION

The MF 33 Tractor Shovel may be either a front wheel steer, a rear wheel steer or an all wheel steer. The axle servicing procedures are basically the same.

The axle assemblies consist of a conventional pinion, ring gear and differential, jointed axle shafts, steering joints, brake assemblies and planetary reduction hubs.

The differential assembly is a bevel gear and pinion type. The steering joint is aligned by, and turns on, two tapered roller bearings positioned in the same axis as the axle joint. The steering joint serves the same purposes as a "King Pin" in a conventional front steering axle. The planetary is a three pinion reduction gear type located in the wheel hub.

REMOVAL AND INSTALLATION

The following procedures may be used to remove and install the complete drive axle as an assembly. Most of the service procedures can be performed without removing the axle from the Tractor. The basic procedures involve supporting the loader and main frame adequately to prevent possible injury.

FRONT DRIVE STEER AXLE

1. To remove the front drive steer axle proceed as follows:

(a) Raise the loader bucket high enough to clear the front wheels and secure it in this position.

(b) Disconnect steering cylinders at each end and lay cylinder and hose up on the loader frame.

(c) Turn wheels straight and disconnect steering drag link.

(d) Disconnect brake lines.

(e) Support loader frame on suitable stands or jacks.

(f) Disconnect drive coupling at axle companion flange.

(g) Remove bolts securing axle to the frame, and carefully roll axle out.

2. To reinstall the front drive steer axle, proceed as follows:

(a) With the loader supported on jacks, roll the axle into place. Secure to frame with retaining bolts.

(b) Reconnect steering drag link.

(c) Reconnect drive coupling to companion flange.

(d) Install steering cylinder in place.

(e) Reconnect brake lines and bleed brakes. Fig. 1 shows a view of the front drive steer axle installed.

REAR DRIVE STEER AXLE

1. To remove the rear drive steer axle, proceed as follows:

(a) Disconnect steering cylinders at each end and lay cylinders and hose up on the cradle and frame.

(b) Disconnect brake lines.

(c) Disconnect drive coupling at the axle companion flange.

(d) Support loader frame on suitable stand or jacks.

(e) Remove bolts securing axle to the cradle and carefully roll axle out.

2. To reinstall the rear drive steer axle, proceed as follows:

(a) With the loader supported on jacks, roll the axle into place. Secure to the cradle with retaining bolts.

(b) Reconnect the steering cylinders.

(c) Reconnect drive coupling to companion flange.

(d) Reconnect brake lines and bleed brakes. Fig. 2 shows a view of the rear drive steer axle installed.

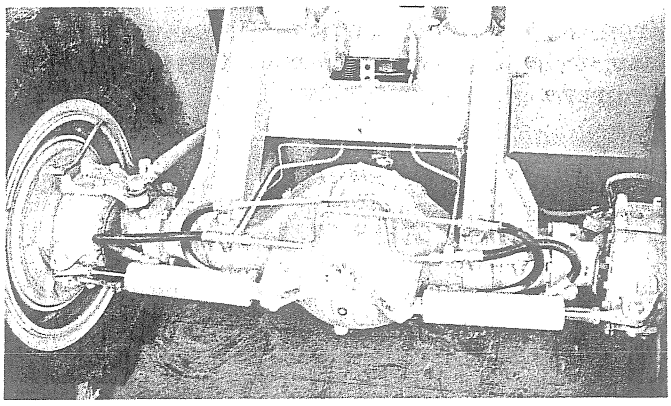


Fig. 1 - Front Drive Steer Axle

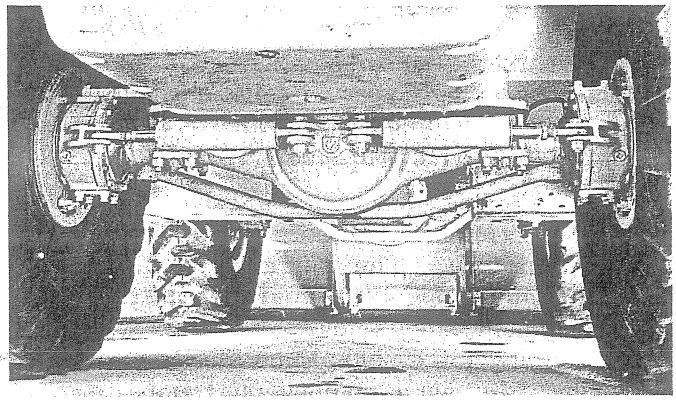


Fig. 2 - Rear Drive Steer Axle

SERVICING FRONT DRIVE STEER AXLE

The following instructions are with the drive axle removed from the unit. The procedures are to be used to completely disassemble the drive axle. However, it should be noted that certain components may be removed and serviced without completely disassembling the drive axle. (i.e.: brakes, flange coupling, oil seals, etc.). Fig. 3 shows an overall view of drive axle mounted on a stand.

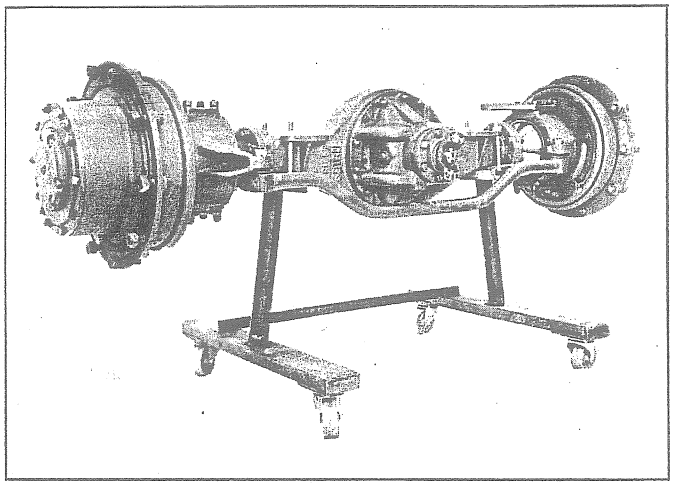


Fig. 3 - Front Drive Steer Axle Mounted on a Stand

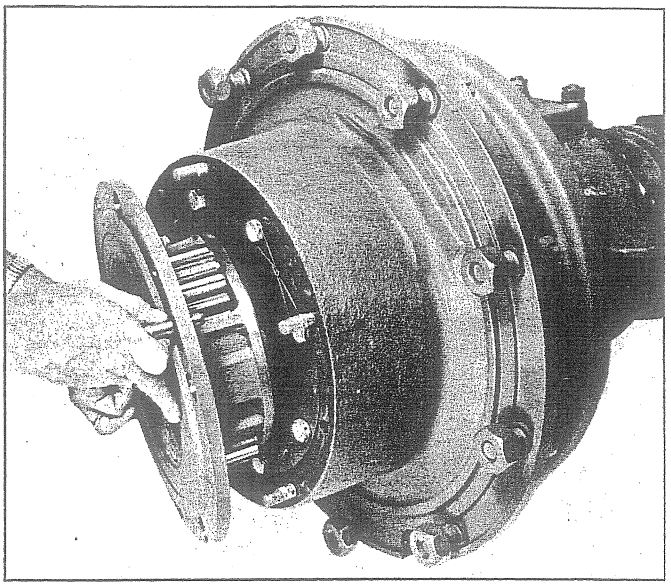


Fig. 5 - Removing Planetary

DISASSEMBLY

1. Drain the oil from the planetary housing and the differential housing.

2. Remove sun gear thrust cap, No. 1, Fig. 4.

3. Remove bolts and nuts securing planetary assembly to axle hub. Use two puller bolts and remove the planetary as shown in Fig. 5.

When the planetary is removed from the hub, the sun gear will be free to drop out of the planetary assembly. Use care not to drop the sun gear.

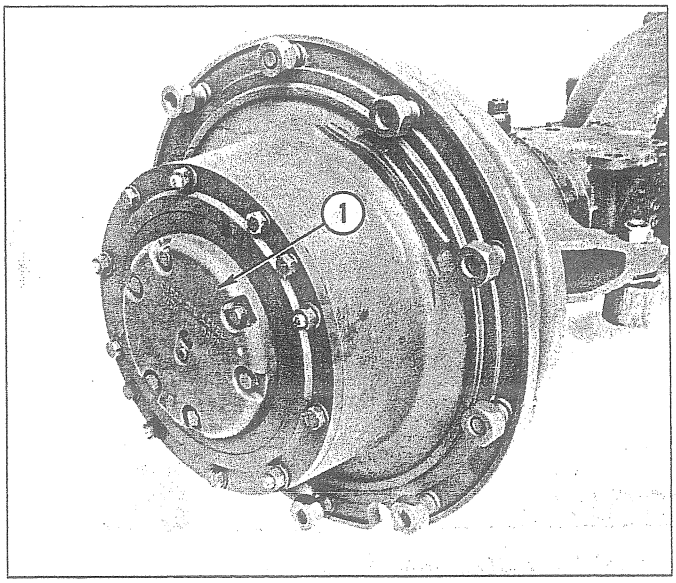


Fig. 4 - Sun Gear Thrust Cap in Place

1. Sun Gear Thrust Cap

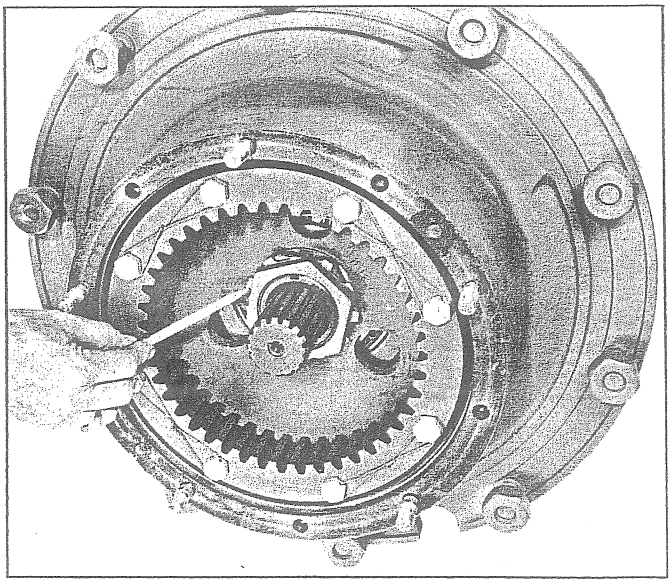


Fig. 6 - View Showing Spindle Nuts and Tang

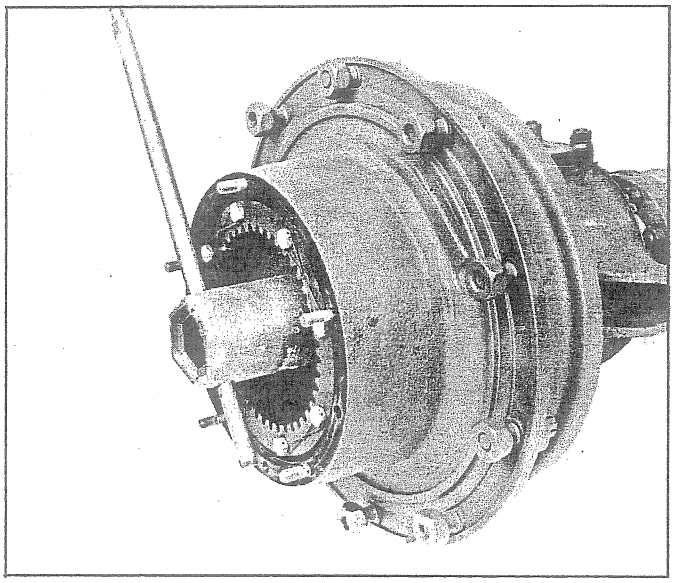


Fig. 7 - Tool Used to Remove Spindle Nuts

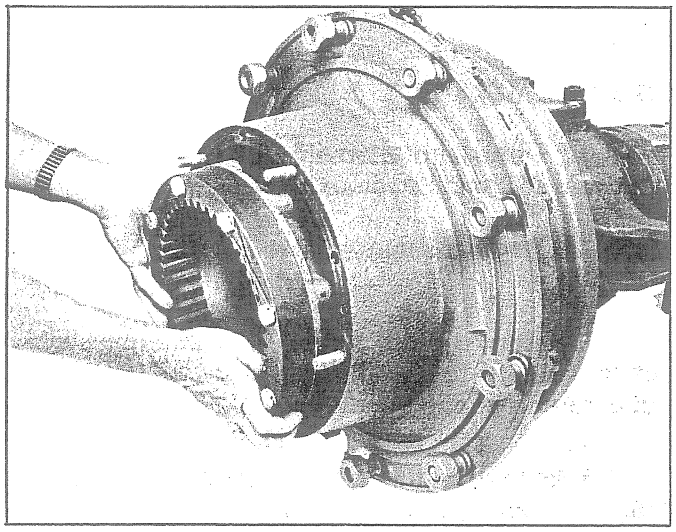


Fig. 8 - Removing Internal Ring Gear and Hub

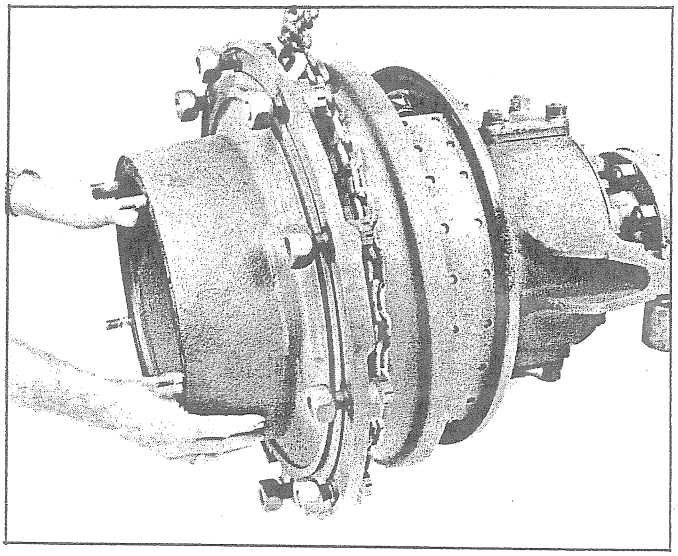


Fig. 9 - Removing Brake Drum and Hub

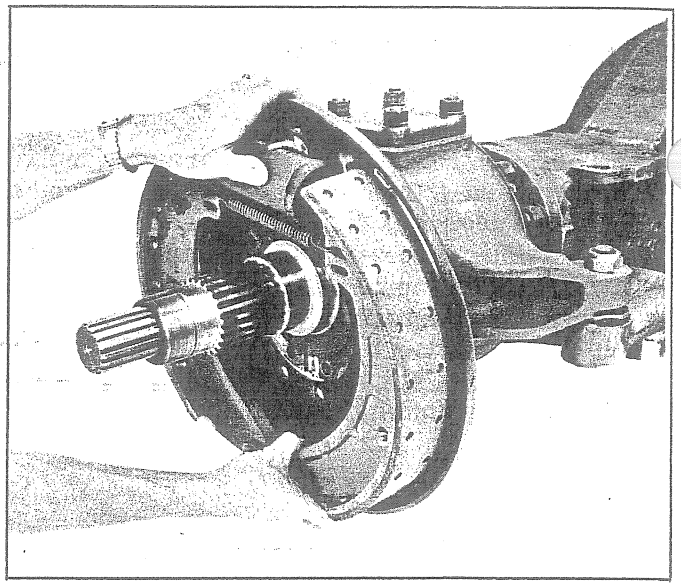


Fig. 10 - Removing Brake Backing Plate

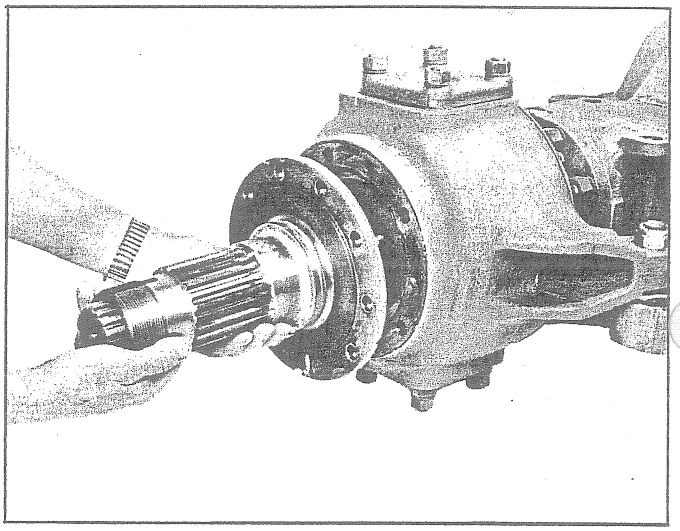


Fig. 11 - Removing Spindle Assembly

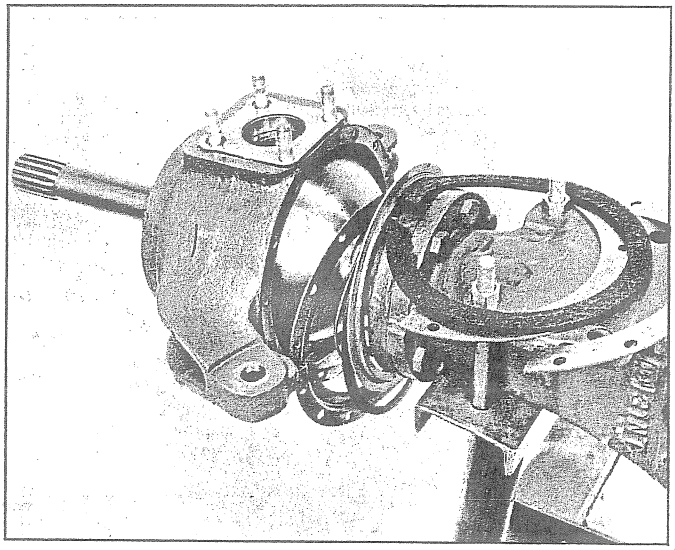


Fig. 12 - View Showing Seals and Bearing Trunnions Removed

4. Straighten the tangs on the lock which secures the spindle nut. See Fig. 6.

5. Use special tool as shown in Fig. 7, and remove the outer spindle nut.

6. Remove nut lock and use special tool to remove the inner spindle nut.

7. Support the weight of the brake drum and hub assembly as shown in Fig. 8.

8. Remove internal ring gear and hub assembly from the spindle as shown in Fig. 8.

9. Pull straight out on brake drum and hub assembly to remove it from axle. See Fig. 9.

10. Remove bolts securing brake backing plate, oil catcher ring and spindle to the housing.

11. Remove brake backing plate as shown in Fig. 10.

12. Pull straight out on spindle assembly to remove. See Fig. 11.

13. Remove tie rod and the hydraulic steering cylinders.

14. Remove seals and retainer rings from spindle support. See Fig. 12.

15. Remove upper and lower bearing trunnion from spindle support. See Fig. 12.

NOTE: When prying bearing trunnion from spindle support, use care not to damage the shims.

16. Remove lower trunnion bearing as shown in Fig. 13.

17. Carefully remove spindle support as shown in Fig. 14.

18. Carefully slide universal joint and axle shaft assembly out of the housing as shown in Fig. 15. The universal joint will separate if the axle shafts are not kept in alignment with each other.

19. Carefully pry universal joint thrust washer from end of axle housing as shown in Fig. 16.

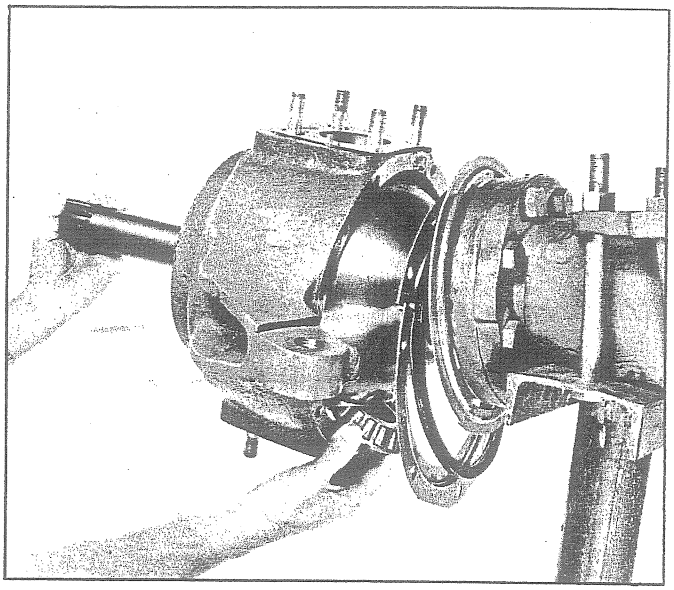


Fig. 13 - Removing Lower Trunnion Bearing

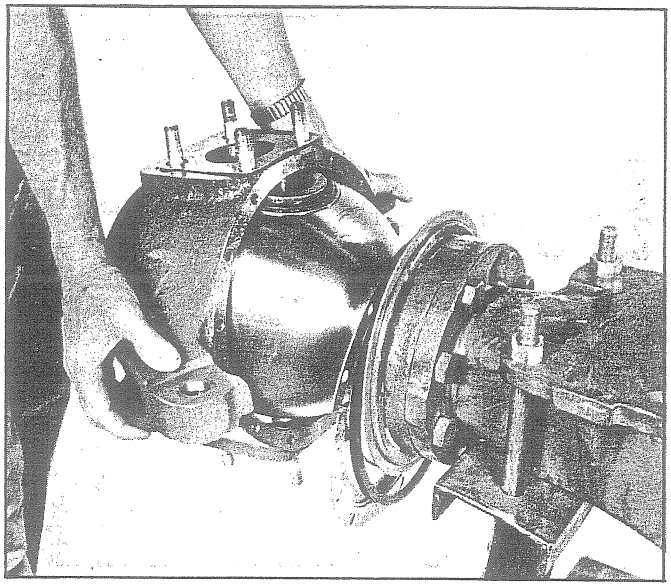


Fig. 14 - Removing Spindle Support

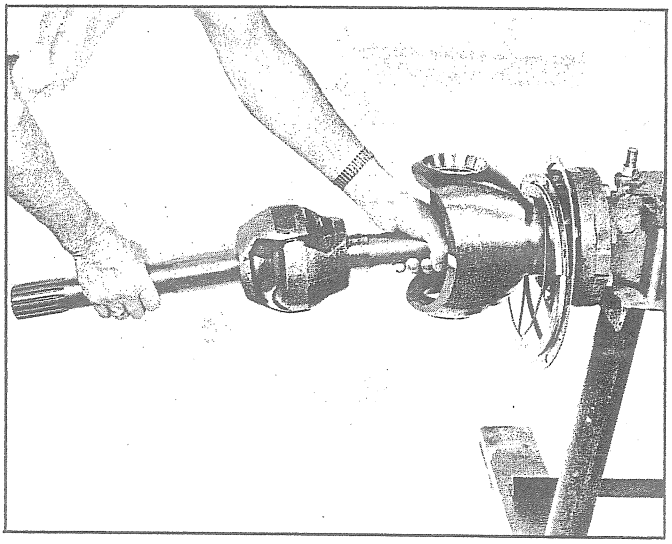


Fig. 15 - Removing Axle Shaft Assembly

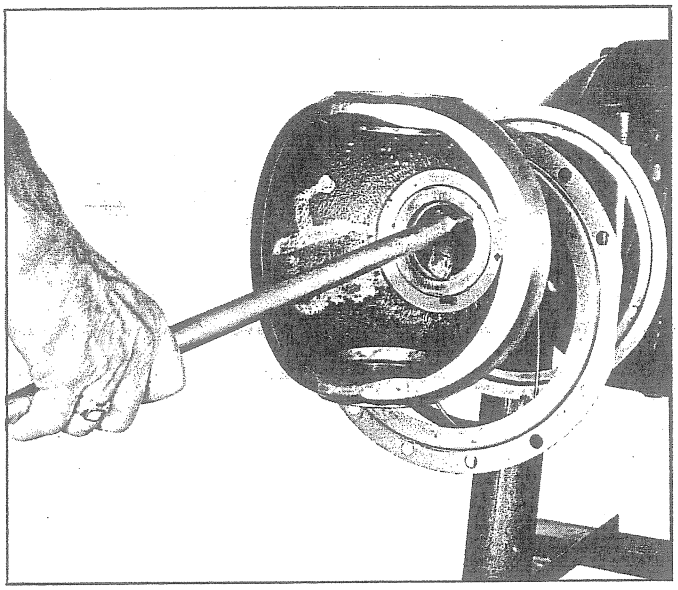


Fig. 16 - Removing Thrust Washer

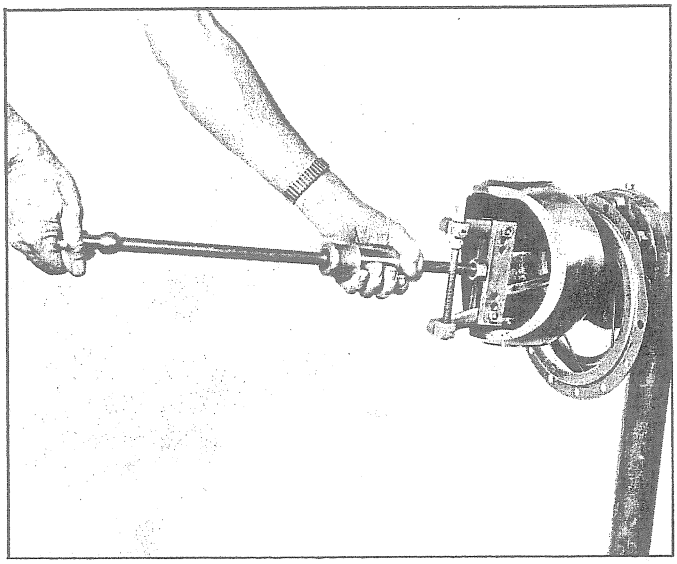


Fig. 17 - Removing Grease Seal

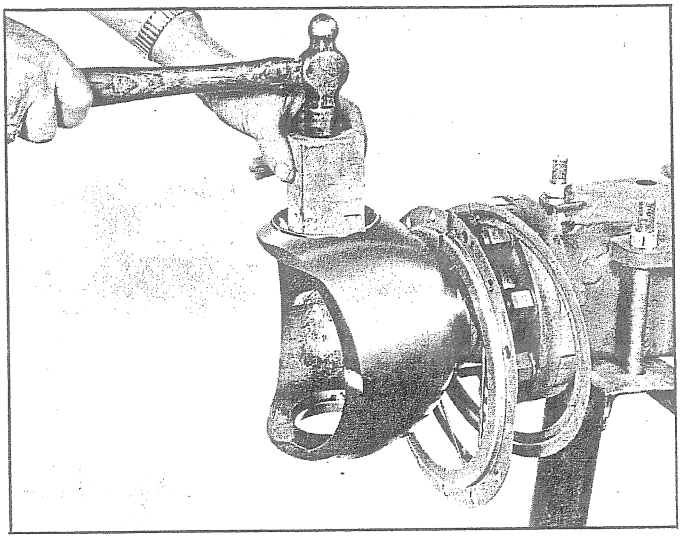


Fig. 18 - Removing Trunnion Bearing Oil Retainer

20. Remove seal from outer end of axle housing using a slide hammer arrangement as shown in Fig. 17.

21. If trunnion bearing requires replacement, drive upper trunnion oil retainer out of bearing bore as shown in Fig. 18. Remove bearing cups as shown in Fig. 19.

22. Remove outer end housing from axle housing.

23. Follow the preceeding steps to completely disassemble the opposite side of the axle. The opposite side of the axle will have a steering arm instead of a flanged trunnion.

SERVICE INFORMATION: To remove the differential assembly it will be necessary to remove <u>both</u> axles. This may be done by either completely disassembling the opposite side of the axle, or removing it as an entire unit. If it is desired to remove the axle unit as an assembly, refer to the heading "Servicing Differential Assembly".

24. To remove differential assembly from axle housing, it will be necessary to support it adequately to maintain proper alignment. This may be done in the following ways:

a. If the axle housing is rotated in a manner so that the differential is upward, a suitable hoist may be attached to companion flange, the retaining nuts removed, and the differential assembly lifted straight upward from the axle housing.

b. If the axle housing is in a normally mounted position (such as when mounted in the unit) attach a suitable pad to the differential assembly and to a rolling floor jack, remove retaining nuts and roll differential assembly straight out from axle housing, as shown in Fig. 20.

If the differential assembly requires servicing, refer to the heading "Servicing Differential Assembly".

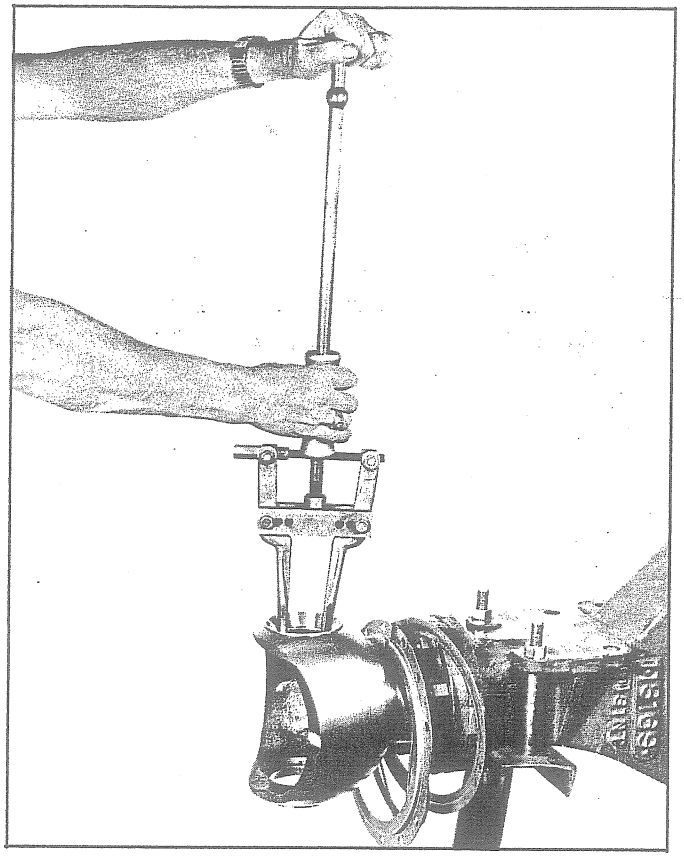


Fig. 19 - Removing Trunnion Bearing Cup

CLEANING AND INSPECTION

Use a suitable cleaning solvent, and clean all parts thoroughly. It is recommended that all parts be placed in the solvent and slushed up and down until they are completely clean. Dry all parts with compressed air on a lint-free cloth.

NOTE: Do not allow bearing to spin when drying with compressed air.

1. All seals, gaskets and retaining rings should be replaced with new parts.

2. Carefully inspect all bearings and their cups for wear, chipping or nicks. Do not replace a bearing cone or cup individually without replacing a mating cup or cone at the same time. After inspection, dip bearings in clean oil and wrap to protect them until they are installed.

3. Examine the gears and shafts for wear, pitting, chipping, nicks, cracks or scores. If gears show spots where case hardening is worn through, replace them. Small nicks may be removed with a suitable hone.

4. Inspect housings, covers, and differential case to be certain that they are thoroughly cleaned and that mating surfaces, bearing bores, etc. are free from nicks or burrs. There should be no evidence of cracks, or other conditions which would cause oil leaks.

REASSEMBLY

NOTE: The following procedures assume that the differential, planetary and ring gear, axle shafts and brake backing plate assemblies have been previously assembled as units.

1. Apply a light coating of Permatex No. 2 to face of all mating surfaces before reassembly.

2. Align differential assembly to axle housing as shown in Fig. 20. Secure differential assembly to axle housing with retaining nuts. Tighten to 50-55 ft.-lbs. torque.

3. Install outer end housing to axle assembly.

NOTE: The outer end seals and retainers may be placed over the outer end housings before the housings are bolted to the axle housing.

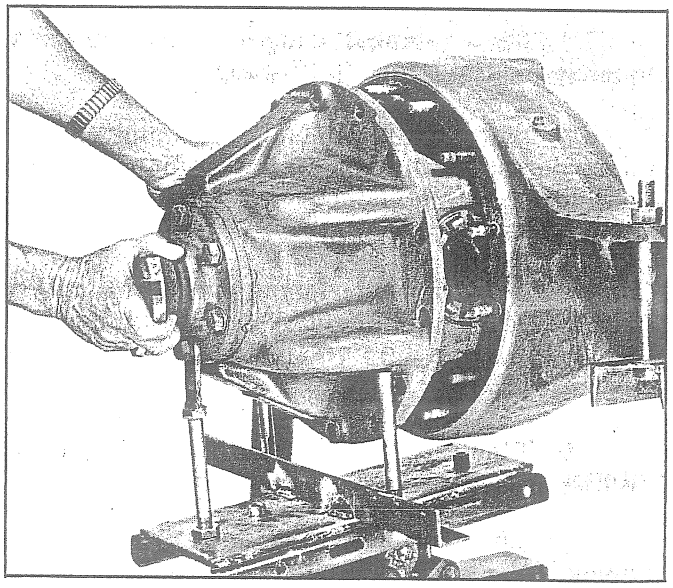


Fig. 20 - Removing Differential Assembly

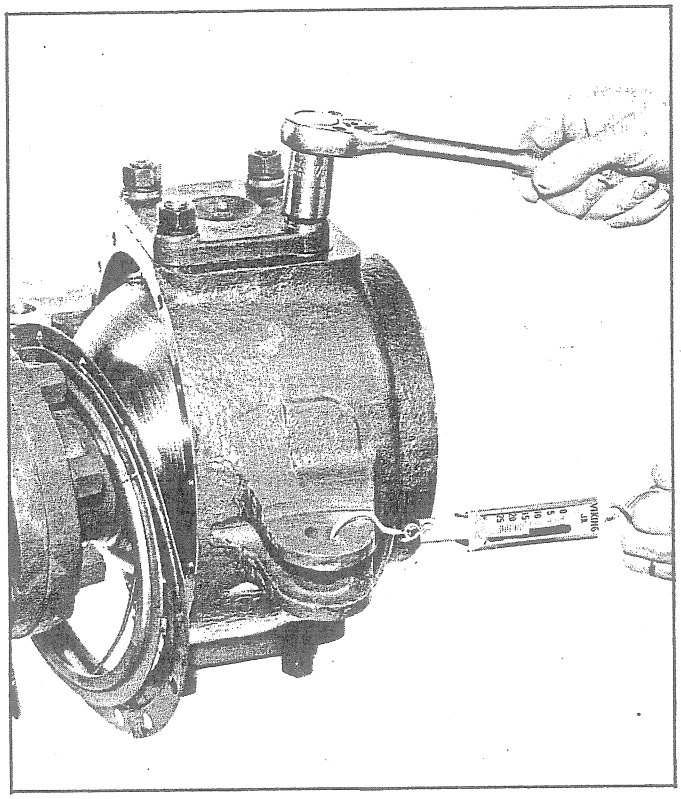


Fig. 21 - Checking Preload of Trunnion Bearings

4. Apply a light coating of Permatex No. 2 to surface of oil retainer and place retainer in upper trunnion bearing bore.

5. Install upper and lower trunnion bearing cups into the outer end housing.

6. Place upper trunnion bearing into its cup.

7. Slide a spindle support over outer end housing and top trunnion bearing.

8. Tilt the bottom of the spindle support outward and install lower trunnion bearing. Then allow spindle support to return to its normal position.

9. Install lower bearing trunnion and one .020 in. shim in place. Secure lower trunnion with retaining nuts tightened to 80-90 ft.-lbs. torque.

10. Install the upper trunnion in place without shims.

11. Connect spring scale to the spindle support as shown in Fig. 21. Then tighten nuts on the upper trunnion evenly while checking preload with spring scale. Tighten nuts until spring scale reads between 12-18 lbs.

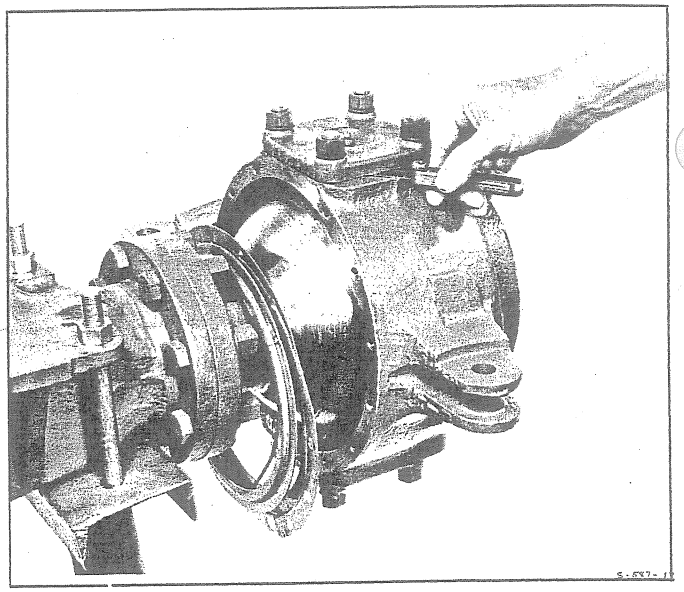


Fig. 22 - Determining Thickness of Shim for Preload

12. Use a feeler gauge as shown in Fig. 22, to determine the thickness of shims required to obtain the proper preload.

13. Remove the upper and lower trunnion. Tilt the bottom of the spindle support outward and remove a lower trunnion bearing. Slide spindle support from outer end housing and upper trunnion bearing.

14. Apply a light coating of Permatex No. 2 to the outside of the oil seal which is to be installed in the outer end housing. Install new oil seal with lips of seal inward (toward differential assembly).

15. Install thrust washer against oil seal and stake in three places.

16. Slide axle shaft and "U"-joint assembly into housing as shown in Fig. 23. Pack "U"-

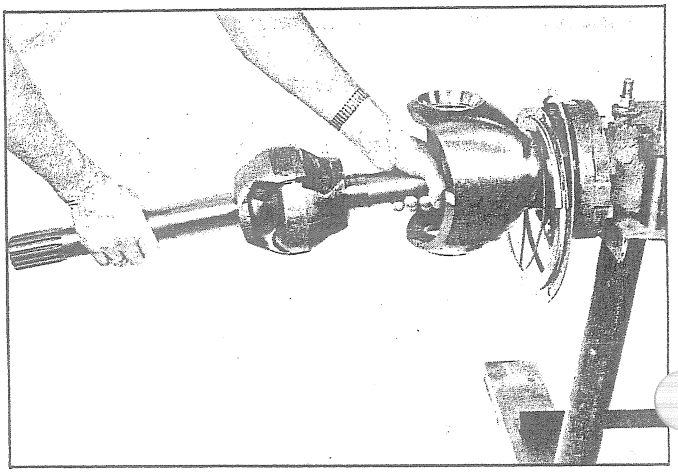


Fig. 23 - Installing Axle Shaft Assembly

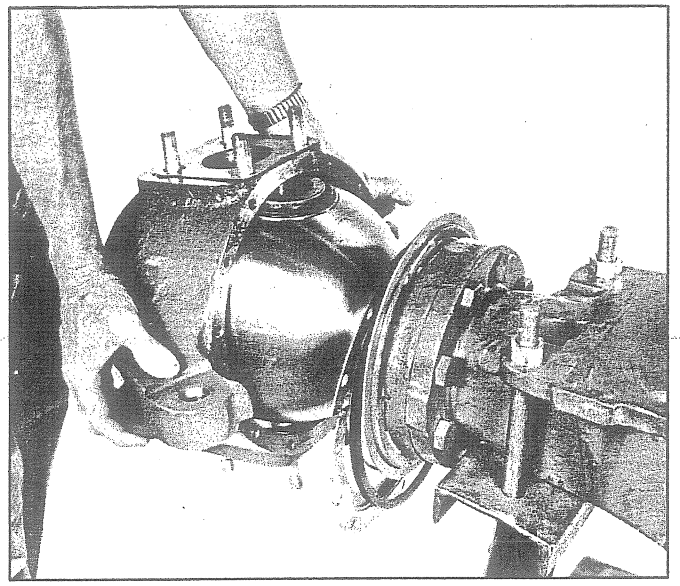


Fig. 24 - Installing Spindle Support

joint and outer end housing with a good grade of lithium soap grease (No. 1 consistency). Apply this same grease to both trunnion bearings.

17. With upper trunnion bearing in place, slide spindle support over axle shaft and outer end housing, as shown in Fig. 24.

18. Install lower trunnion bearing in place as shown in Fig. 25.

19. Install lower trunnion with its same .020 in. shim in place. Secure with retaining nuts tightened to 80-90 ft.-lbs. torque.

20. Place the pre-determined number of shims (for correct bearing preload) over the

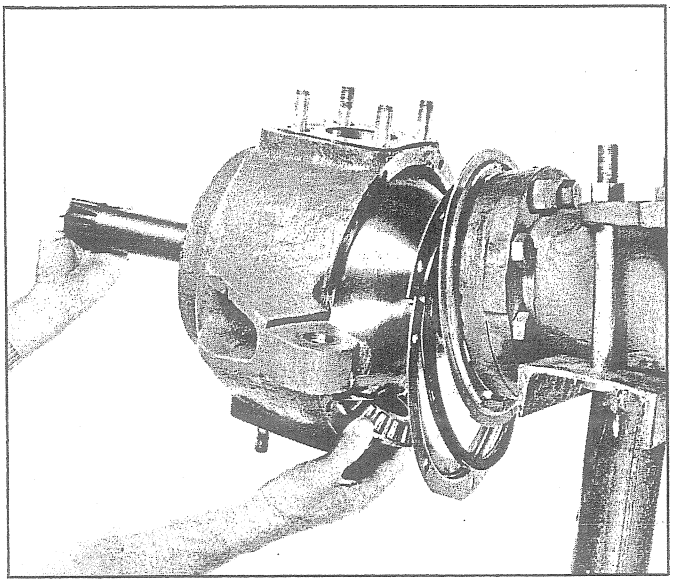


Fig. 25 - Installing Lower Trunnion Bearing

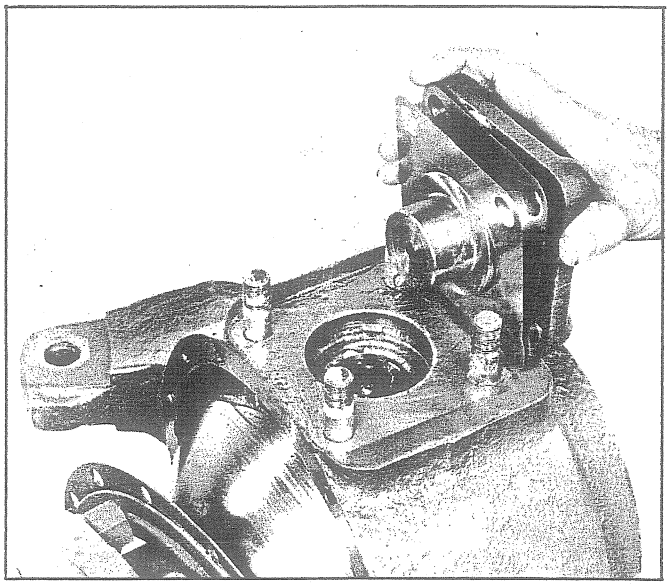


Fig. 26 - Installing Upper Trunnion

upper trunnion as shown in Fig. 26. Install the upper trunnion in place and secure with its retaining nuts tightened to 80-90 ft.-lbs. torque.

21. Slide spindle assembly over axle shaft and position it to the spindle support as shown in Fig. 27. The milled groove in the threaded portion of the spindle must be positioned toward the top of the axle.

22. Position the brake backing plate assembly to the spindle as shown in Fig. 28.

23. While maintaining position of brake backing plate assembly, position the oil catcher against the brake plate. Secure oil catcher, brake backing plate and spindle to the spindle

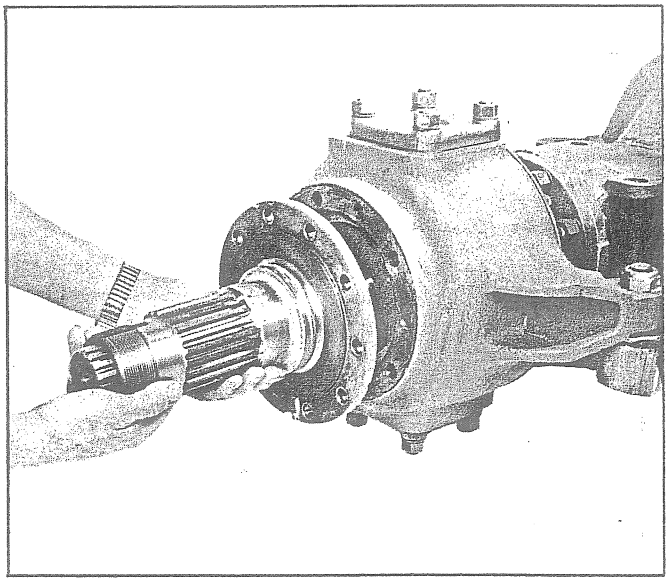


Fig. 27 - Installing Spindle Assembly

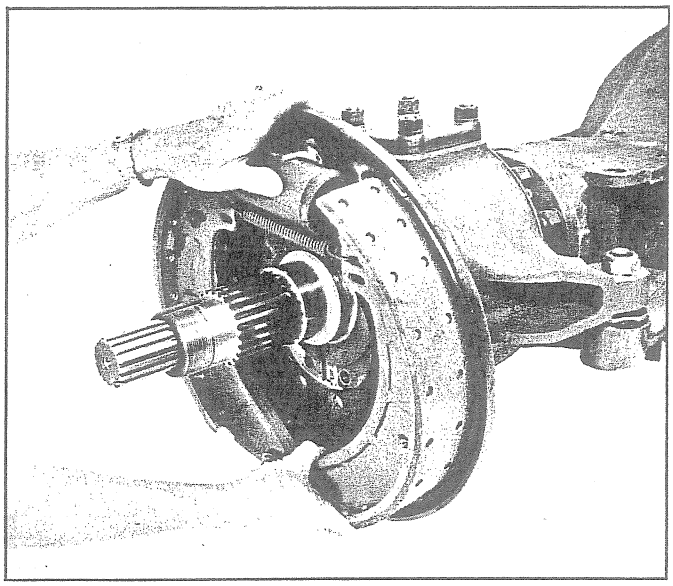


Fig. 28 - Installing Brake Backing Plate

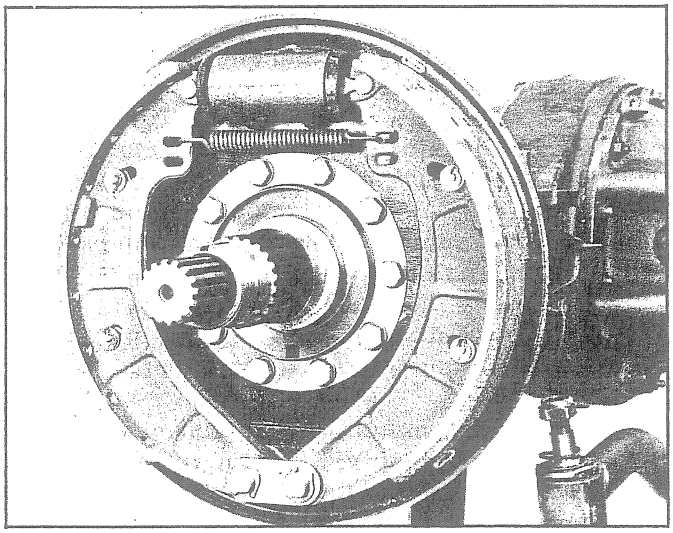


Fig. 29 - Brake Backing Plate Attached to Axle

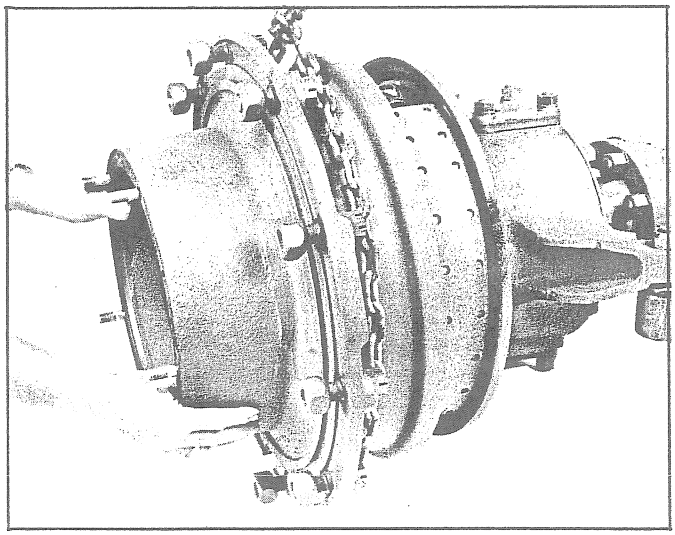


Fig. 30 - Installing Brake Drum and Hub

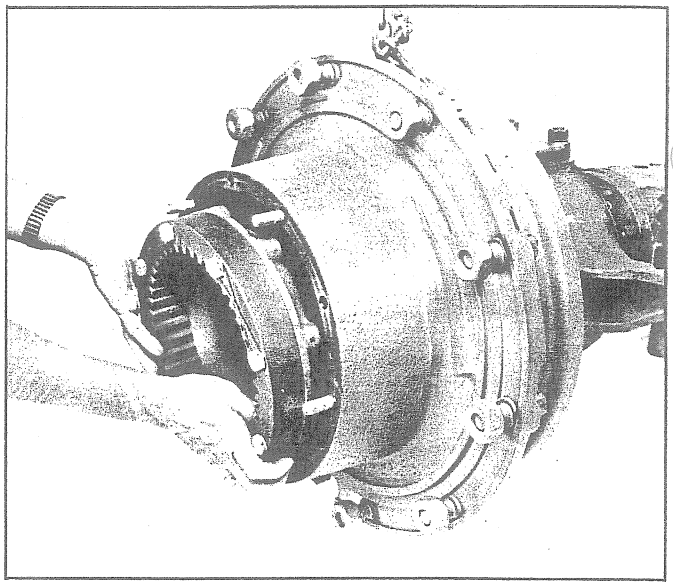


Fig. 31 - Installing Internal Ring Gear and Hub

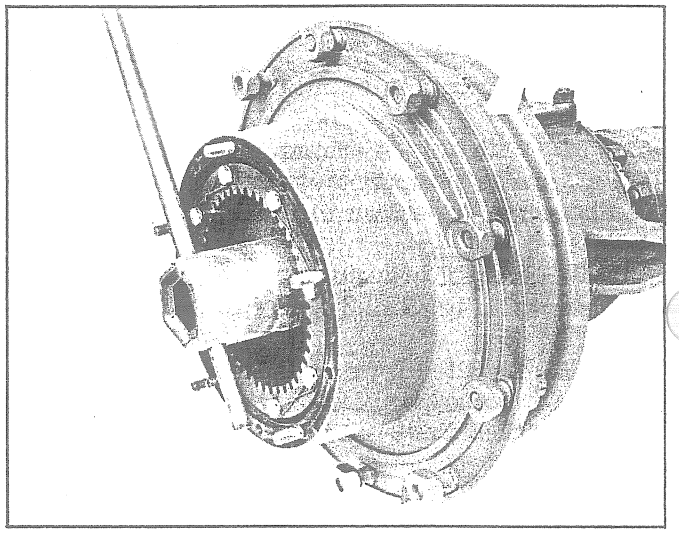


Fig. 32 - Tool Used to Tighten Spindle Nuts

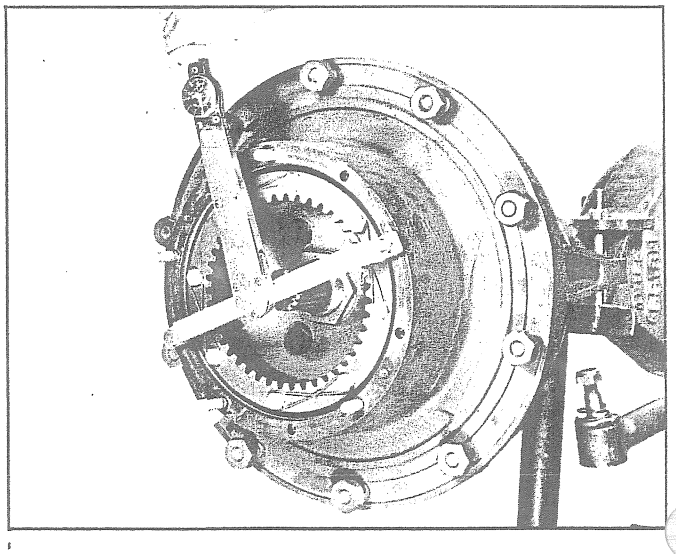


Fig. 33 - Checking Rolling Torque on Hub Bearings

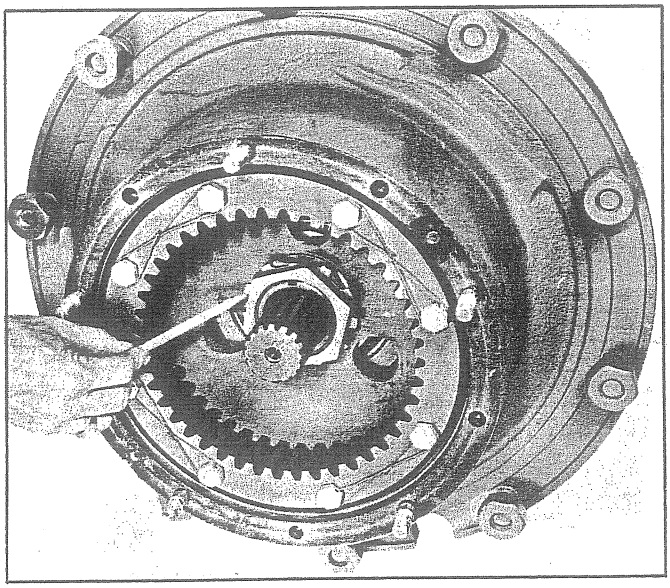


Fig. 34 - View Showing Spindle Nuts and Tang

support with bolts and flatwashers. Tighten to 80-90 ft.-lbs. torque. See Fig. 29.

24. Support drum and hub assembly, with a suitable hoist, as shown in Fig. 30. Work hub and drum until inner bearing is over spindle shaft and drum is over brake linings.

25. With drum and hub still supported, slide planetary ring gear and hub over spindle as shown in Fig. 31.

26. Thread inner nut to spindle and tighten inner nut using special tool (see Fig. 32.) while rotating wheel hub in both directions until there is a slight drag.

27. Attach special tool to hub and check rolling torque as shown in Fig. 33. The rolling

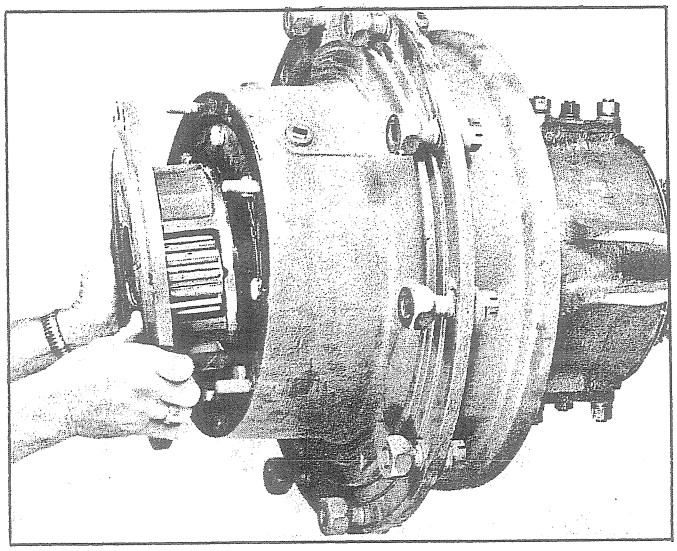


Fig. 35 - Installing Planetary Assembly

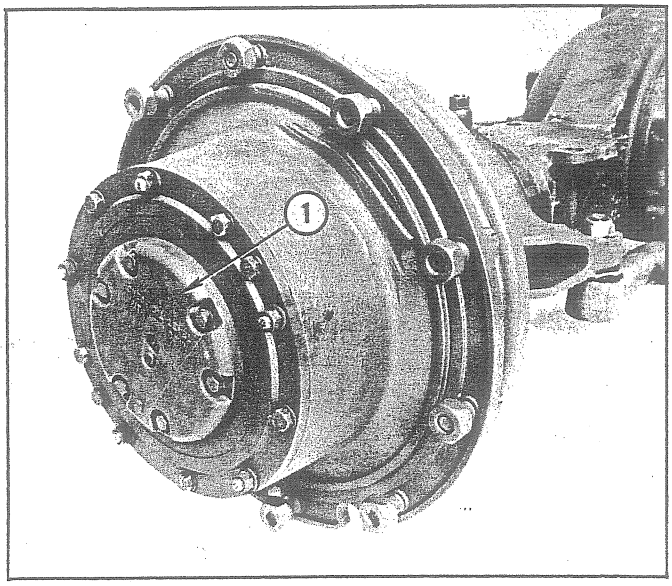


Fig. 36 - Sun Gear Thrust Cap in Place

1. Sun Gear Thrust Cap

torque should be between 16-20 ft.-lbs. on new bearings and between 6-12 ft.-lbs. on used bearings.

NOTE: Make certain the brakes are not creating a drag when attempting to obtain rolling torque.

28. Install the spindle nut lock and outer spindle nut. Tighten outer spindle nut securely. Bend the tang on the spindle nut lock so that both nuts will be locked in position. See Fig. 34.

29. Install planetary assembly as shown in Fig. 35. Install nuts and bolts to secure the planetary assembly to the hub. Tighten the nuts and bolts to 80-90 ft.-lbs. torque.

30. Position sun gear into planetary assembly.

31. Place thrust plate into position and then secure with retainer bolts. See Fig. 36. Tighten retaining bolts to 35-40 ft.-lbs torque.

32. Install new outer end seals and retainers as follows:

a. Position seal retainer against spindle support.

b. Insert felt seal into retainer.

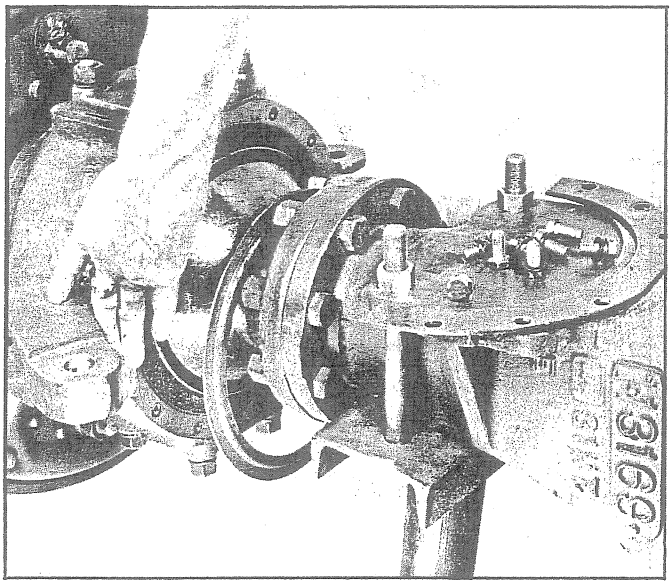


Fig. 37 - Positioning Seal and Spring Prior to Installation

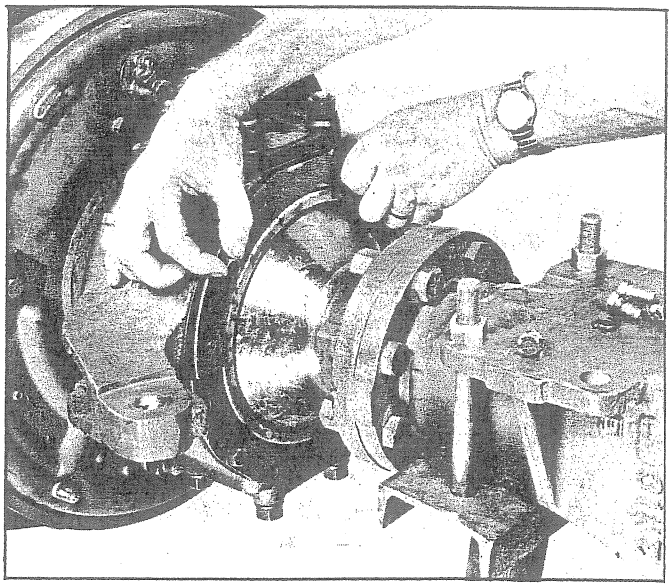


Fig. 38 - Securing Seals into Place

c. Insert spring into groove around dust seal and carefully position seal as shown in Fig. 37.

d. Hold seal in position shown and place outer retainer against seal.

e. Secure seals and retainers in place with split ring halfs as shown in Fig. 38. Tighten bolts to 23-25 ft.-lbs. torque.

33. Reinstall tie rod and steering cylinders.

SERVICING PLANETARY AND RING GEAR

1. To disassemble the planetary assembly, proceed as follows:

a. With sun gear removed, place planetary assembly in a suitable press as shown in Fig. 39.

b. Press shaft from pinion while catching shaft retaining ball which will be released by shaft movement.

c. Carefully remove pinions, thrust washers, rollers and spacers. When pinions are removed, the rollers will drop. Use care not to lose them.

2. Inspect the general condition of the planetary assembly parts for evidence of damage or wear.

3. Reassemble the planetary assembly as follows:

a. Coat the inside of the pinion with grease to retain the needle rollers. Each pinion will contain a double row of needle rollers with a spacer between the rows. Install one row of 29 rollers into the pinion. Place spacer on top, then install another row of 29 rollers into the pinion.

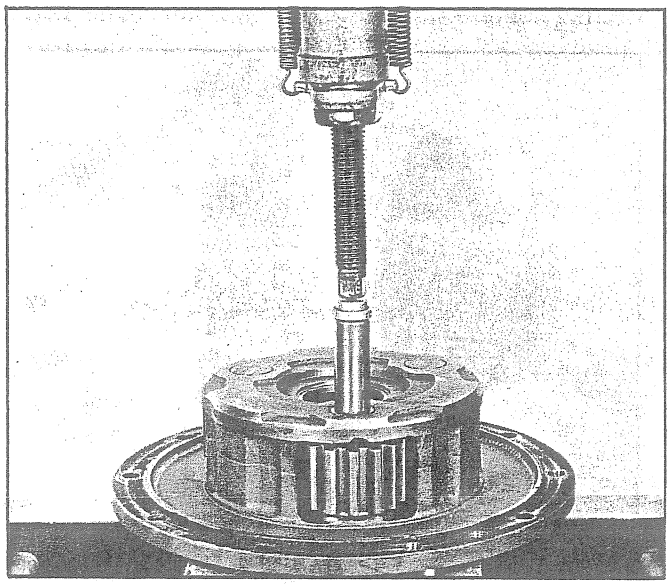


Fig. 39 - Pressing Shaft from Pinion

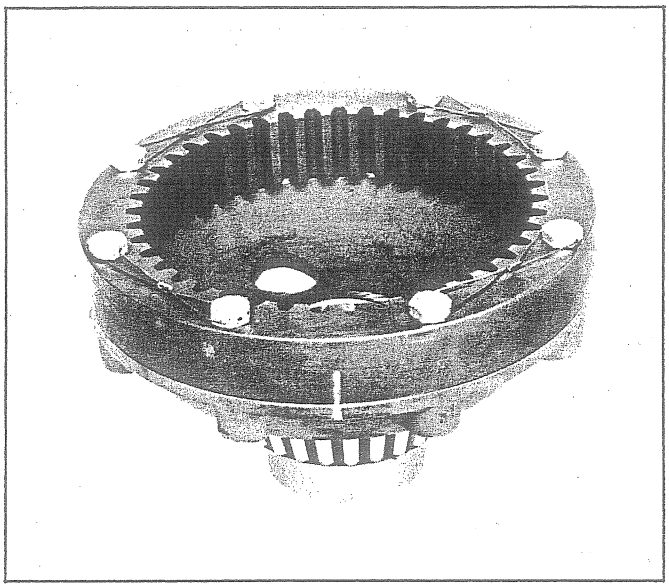


Fig. 40 - "Match Marked" Ring Gear to Hub

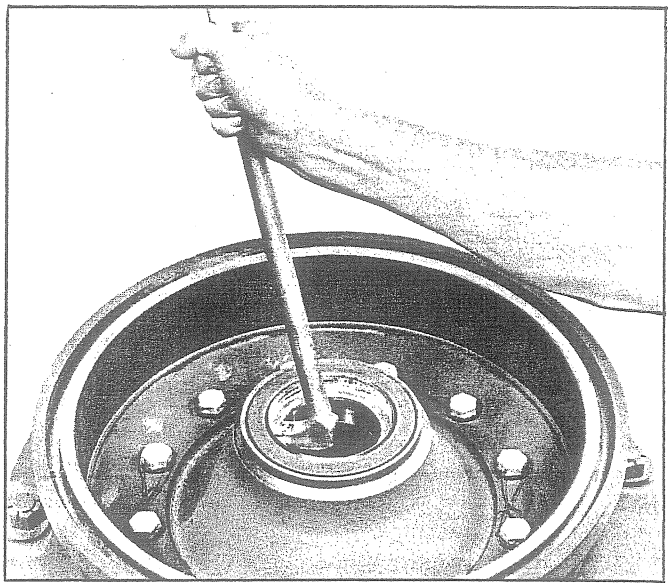


Fig. 42 - Removing Oil Seal

b. Position the pinion and one thrust washer on each side into the planetary. Make sure that the tangs on thrust washers engage the groove in the housing.

c. Position the pinion shaft so that the ball recess will align with the groove in the housing. Press pinion shaft into housing while at the same time inserting ball into recess in shaft and in housing. Press end of pinion shaft flush with the face of the housing.

d. Stake pinion shaft ball groove in two places to retain shaft.

4. "Match marked" ring gear to hub as shown in Fig. 40. This will assure proper reassembly.

5. Unbolt ring gear from hub. Remove gear.

6. If bearing requires replacement, remove old bearing from hub using a suitable puller and press new bearing onto hub. See Fig. 41.

7. Reassemble ring gear back to hub, aligning "matched marks" and tightening retaining bolts to 80-90 ft.-lbs. torque. Lock wire bolts in pairs. See Fig. 40.

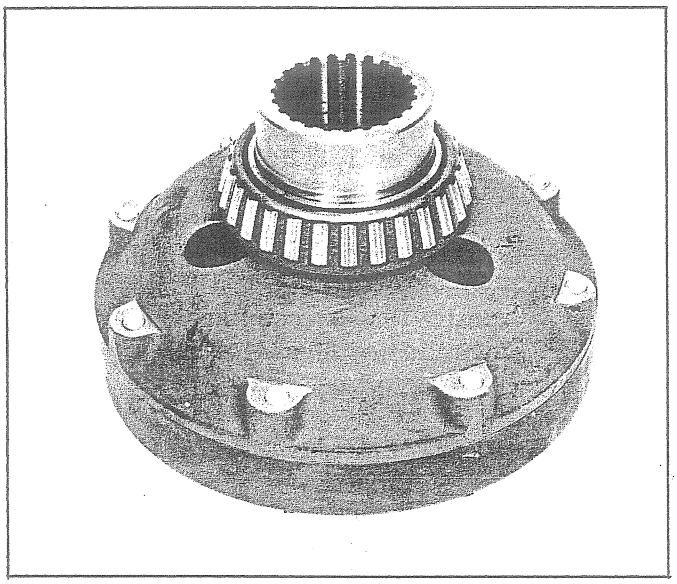


Fig. 41 - Bearing Correctly Installed on Hub

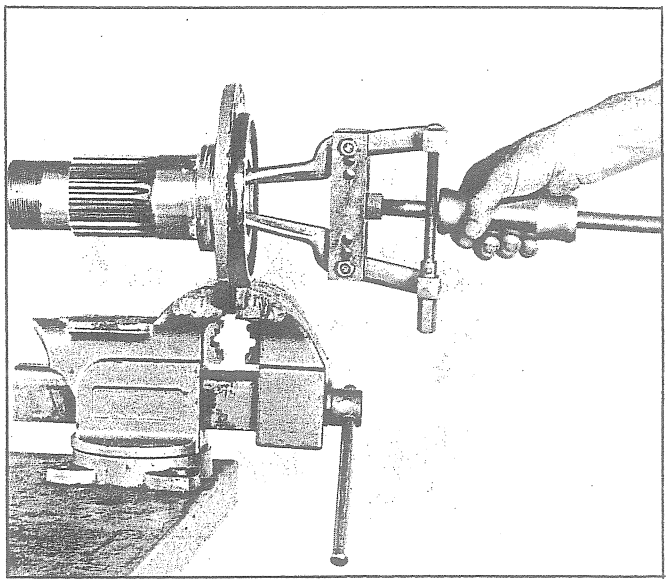


Fig. 43 - Removing Oil Seal and/or Bushing

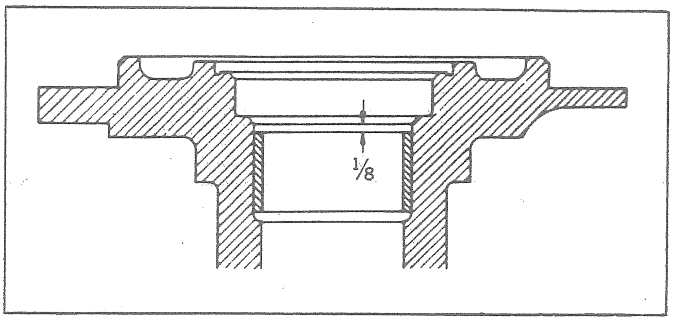


Fig. 44 - Correct Bushing Location

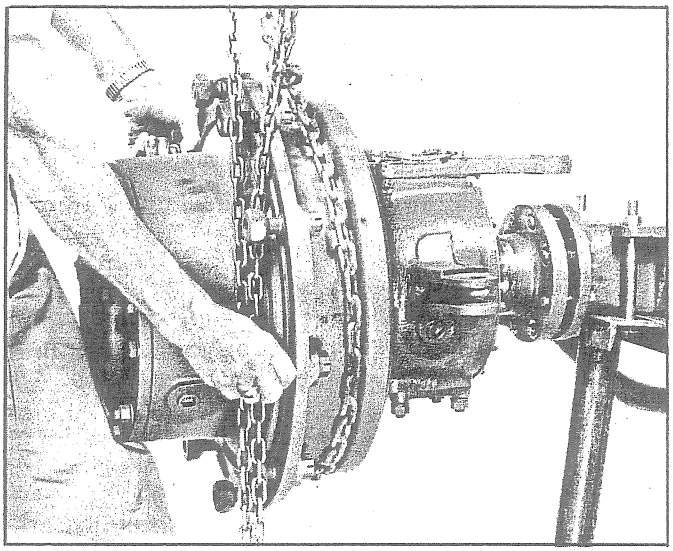


Fig. 45 - Removing Hub and Axle as a Unit

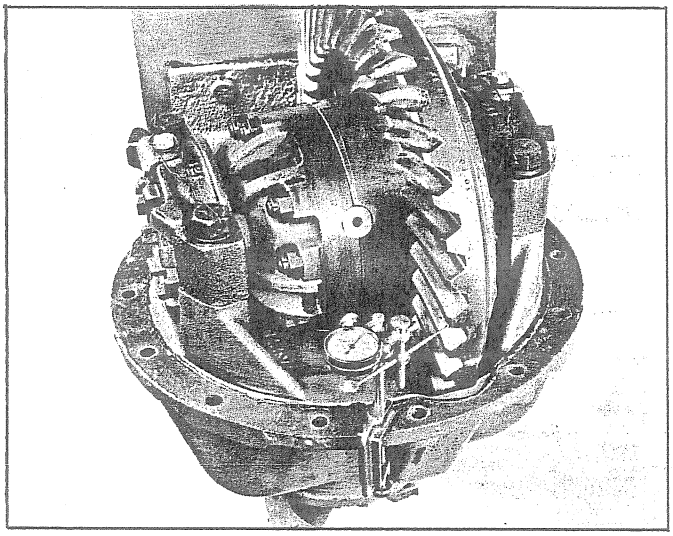


Fig. 46 - Checking Ring Gear and Pinion Backlash

SERVICING THE HUB ASSEMBLY

1. Pry oil seal from hub as shown in Fig. 42.

2. Inspect bearing. If bearing requires replacement, the bearing cone and cup must be replaced as a unit.

3. If it is necessary to separate the brake drum from the hub assembly, "match mark" hub and drum to insure proper assembly. Remove the retaining bolts and separate the drum from the hub.

4. Reinstall drum to hub aligning "match marks". Secure with retaining bolts and tighten to 160-175 ft.-lbs. torque. Lock wire bolts in pairs. See Fig. 42.

5. Coat outside diameter of new oil seal with Permatex No. 2. Press new seal into hub with spring-loaded lip of the seal toward the bearing.

SERVICING THE SPINDLE ASSEMBLY

1. Disassemble the spindle assembly as follows:

   a. Place the spindle in a vise and remove the oil seal with a sliding hammer puller arrangement as shown in Fig. 43.

   b. Remove bushing using a suitable puller as shown in Fig. 43.

2. Inspect splines and machined surfaces for evidence of wear or damage.

3. Reassemble the spindle assembly as follows:

   a. Press new bushing into the spindle to a depth of 1/8 in. below chamfer of spindle. See Fig. 44.

   b. Apply a light coating of Permatex No. 2 to the outer diameter of oil seal. Press new seal into place with lip of seal toward inside of spindle.

SERVICING DIFFERENTIAL ASSEMBLY

Before the differential assembly can be removed, it will be necessary to remove both axles. This may be done by either disassembling

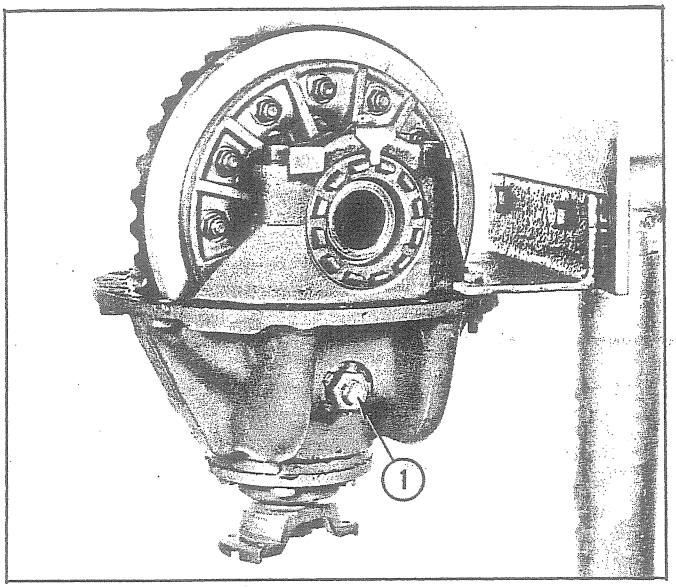


Fig. 47 - Side View of Differential Assembly

1. Differential Thrust Screw

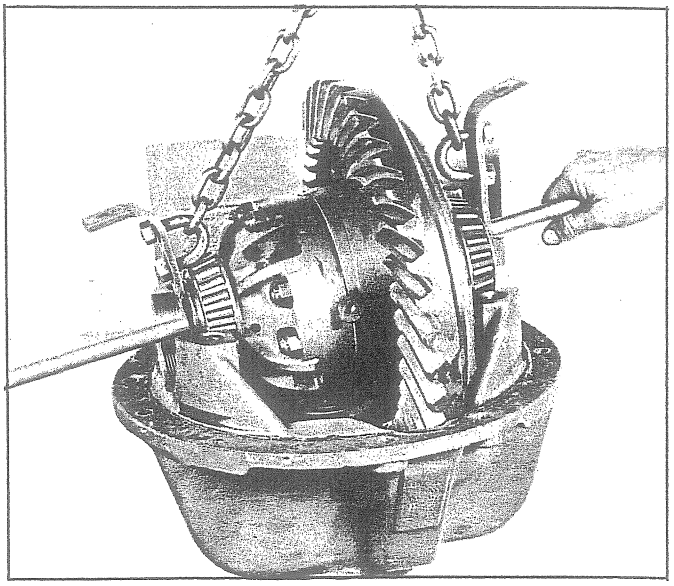


Fig. 49 - Lifting Differential from Housing

the complete axle assembly as outlined previously or removing the complete axle unit as shown in Fig. 45.

Disassembly

After the differential assembly has been removed, mount it to a suitable stand and proceed as follows:

1. Check and record ring gear backlash with a dial indicator if the same gears are to be reinstalled. See Fig. 46.

2. Loosen lock nut and back out the differential thrust screw, No. 1, Fig. 47, enough turns to clear ring gear.

3. Punch mark bearing caps and carrier assembly to insure correct match when reassembled.

4. Remove retaining bolts and lift caps off the carrier as shown in Fig. 48.

5. Attach suitable lifting devise to the differential and lift out of the housing as shown in Fig. 49.

6. Remove nut, washer and companion flange as shown in Fig. 50. It may be necessary to use a puller to remove the companion flange.

7. Remove bolts securing the seal retainer

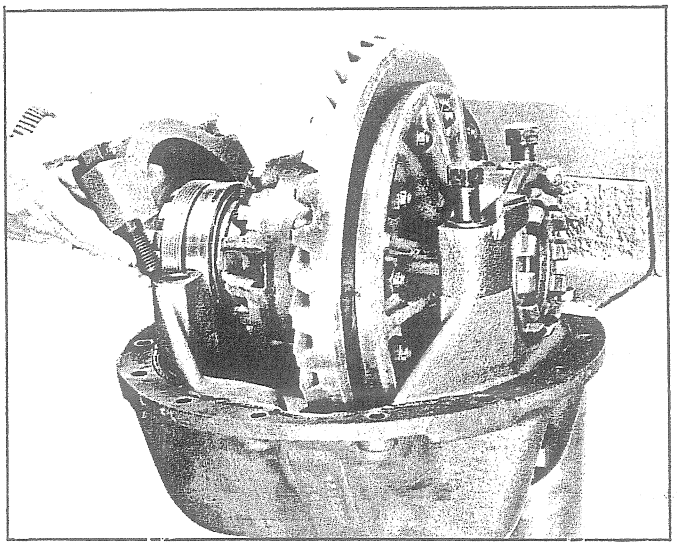


Fig. 48 - Removing Bearing Cap

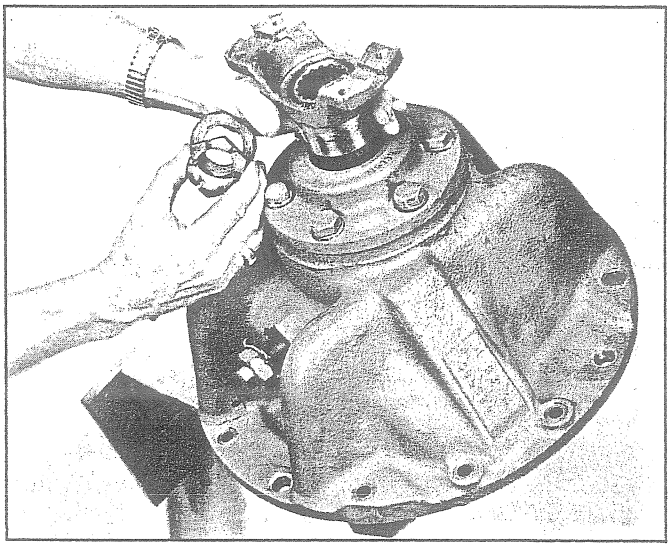


Fig. 50 - Removing Companion Flange

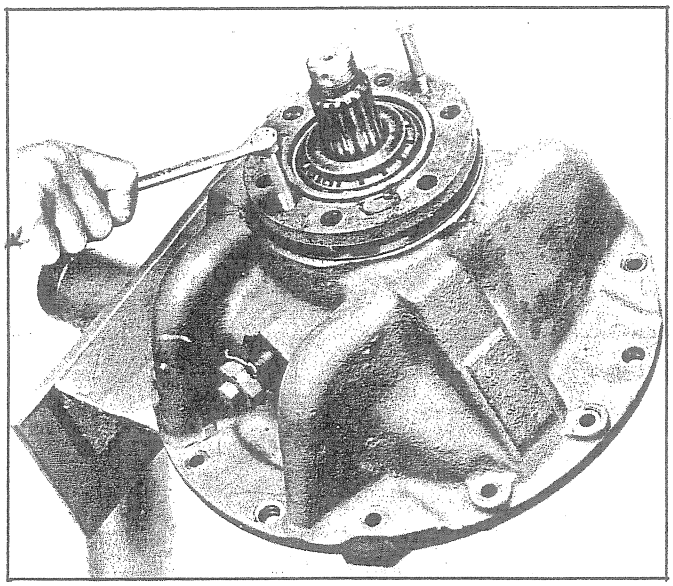


Fig. 51 - Removing Pinion Bearing Cage

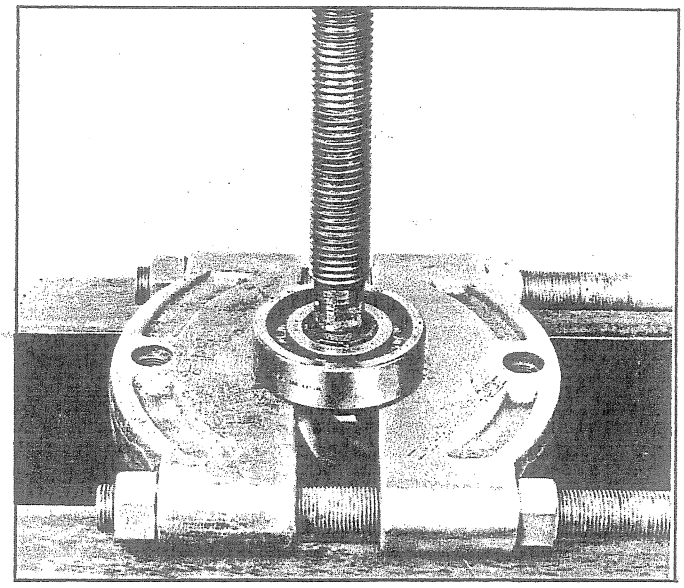


Fig. 53 - Pressing Inner Bearing from Pinion Shaft

to the carrier. Tap the retainer with a soft hammer to loosen and remove the retainer.

8. Use two puller bolts threaded in holes provided and remove bearing cage as shown in Fig. 51.

NOTE: When the bearing cage is removed, the pinion shaft and bearings may come out with it. If not, it can be easily removed from the carrier.

9. Press center bearing from pinion shaft as shown in Fig. 52.

10. Press inner bearing from pinion shaft as shown in Fig. 53.

11. Use a suitable bearing splitter and puller arrangement and remove differential bearings as shown in Fig. 54.

12. Punch mark the two differential case halves to insure correct reassembly. If the ring gear is to be removed, mark gear and case also.

13. Remove bolts and nuts securing the differential halves together.

14. Tap case half with a soft hammer and remove.

15. Remove side gears, spider, pinion and thrust washers. See Fig. 55.

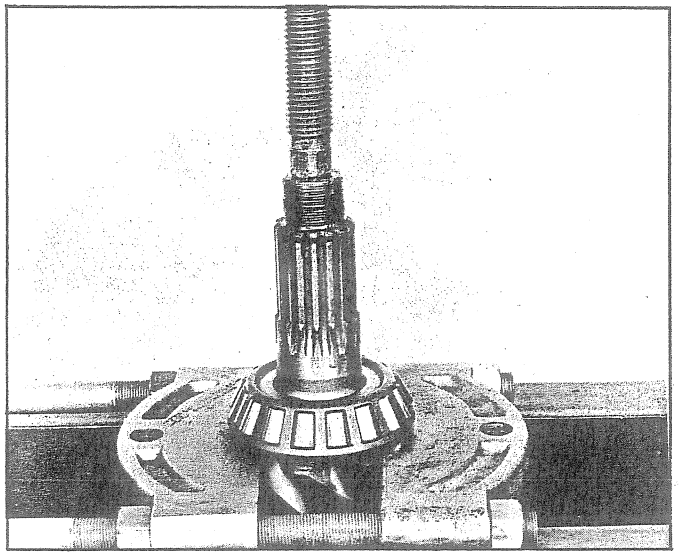


Fig. 52 - Pressing Center Bearing from Pinion Shaft

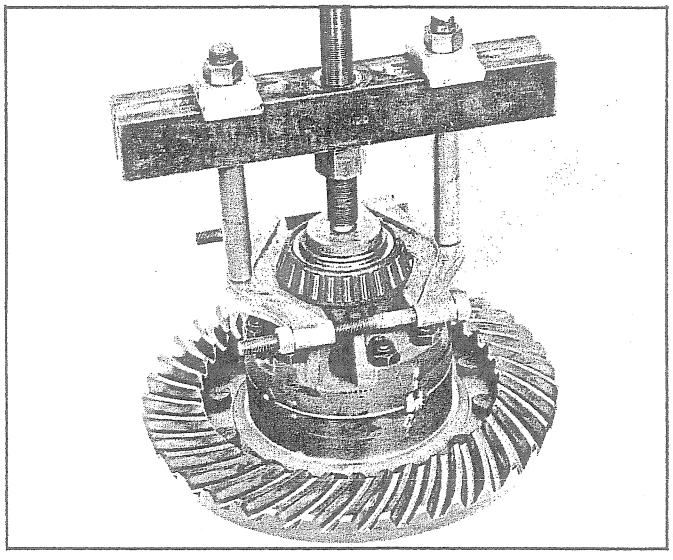


Fig. 54 - Removing Differential Carrier Bearing

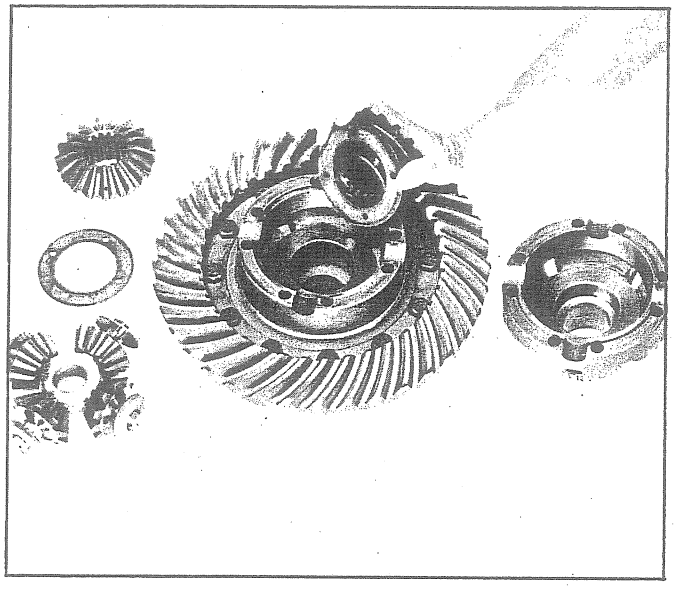


Fig. 55 - Differential (Disassembled)

Inspection

Inspect all gears, bearings and thrust washers for evidence of pitting, chipping, cracks or scores. If either is evident, they must be replaced. Small nicks may be removed with a suitable hone.

Reassembly

1. Press inner pinion bearing on pinion shaft. Use a square end staking tool and stake bearing to shaft in four places equally spaced.

2. Press center bearing onto shaft as shown in Fig. 56.

3. Position center bearing cup and bearing cage on pinion shaft.

4. A pinion bearing spacer and shim kit is provided for service repair. This kit consists of a spacer and a quantity of shims. Position one .010 in. shim and bearing spacer on shaft as shown in Fig. 57.

5. Press outer bearing onto shaft as shown in Fig. 58.

6. Install companion flange and tighten retaining nut to 400 ft.-lbs. torque.

7. Place bearing cage in a vise. Use an inch lb. torque wrench and check bearing preload. See Fig. 59. The rolling torque of the pinion shaft should be 13 to 23 inch-lbs. If the bearing preload is not within these specifications, disassemble parts and add shims to de-

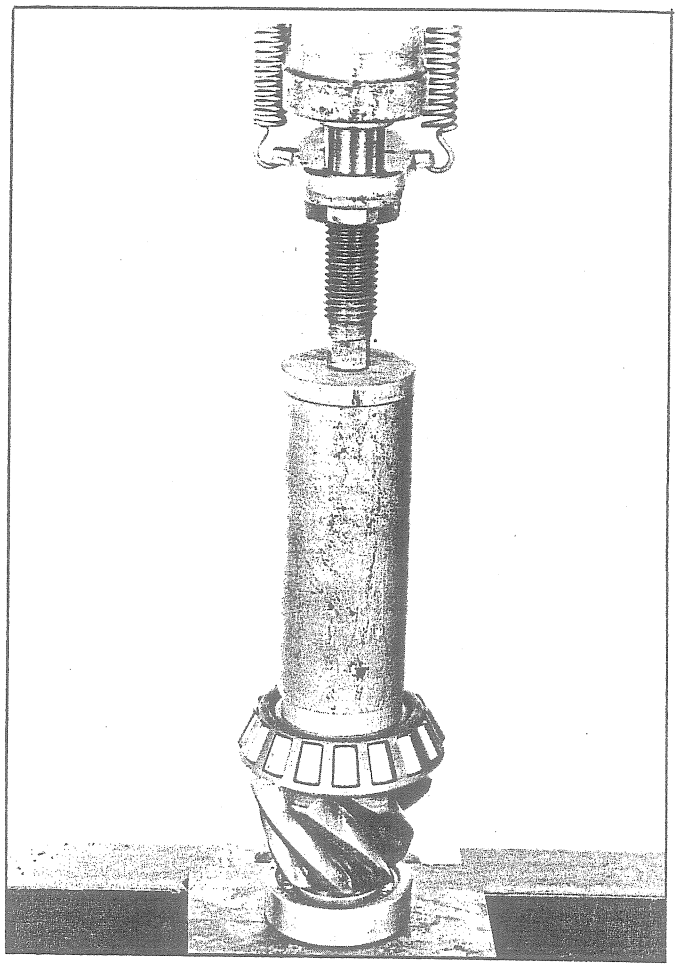


Fig. 56 - Pressing Center Bearing on Pinion Shaft

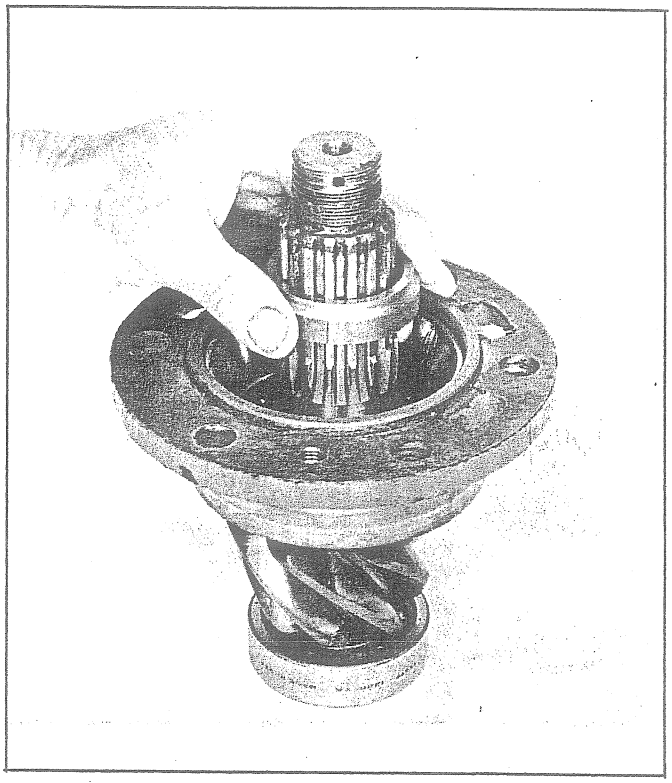


Fig. 57 - Installing Bearing Spacer

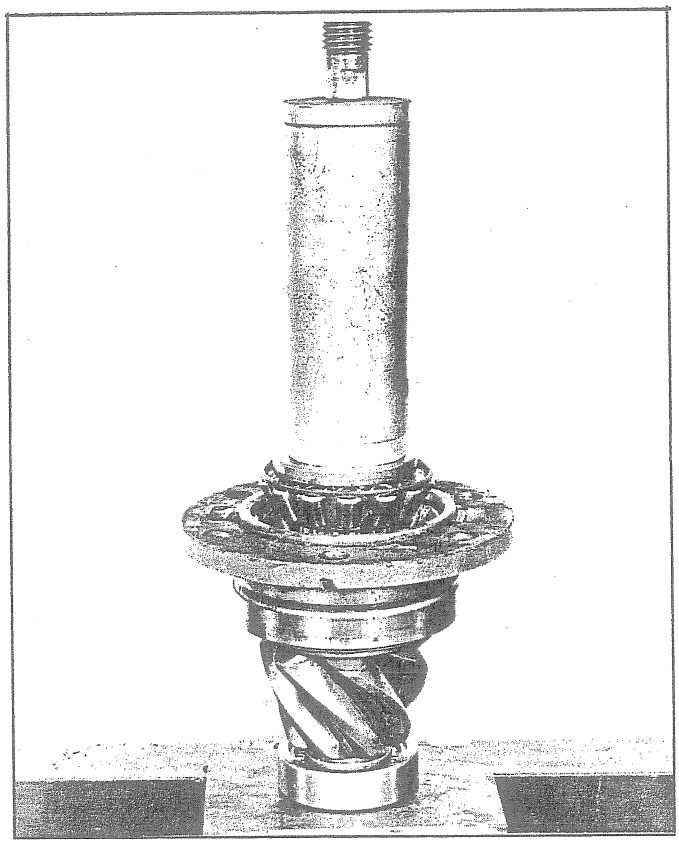


Fig. 58 - Pressing Outer Bearing on Pinion Shaft

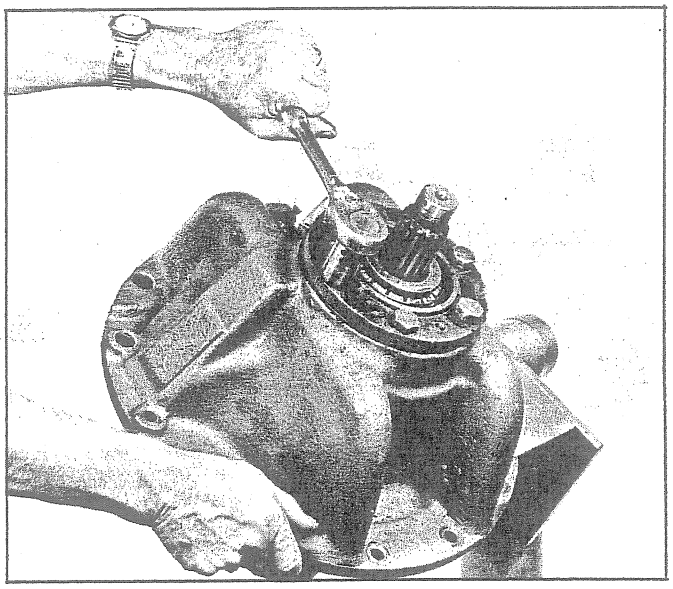
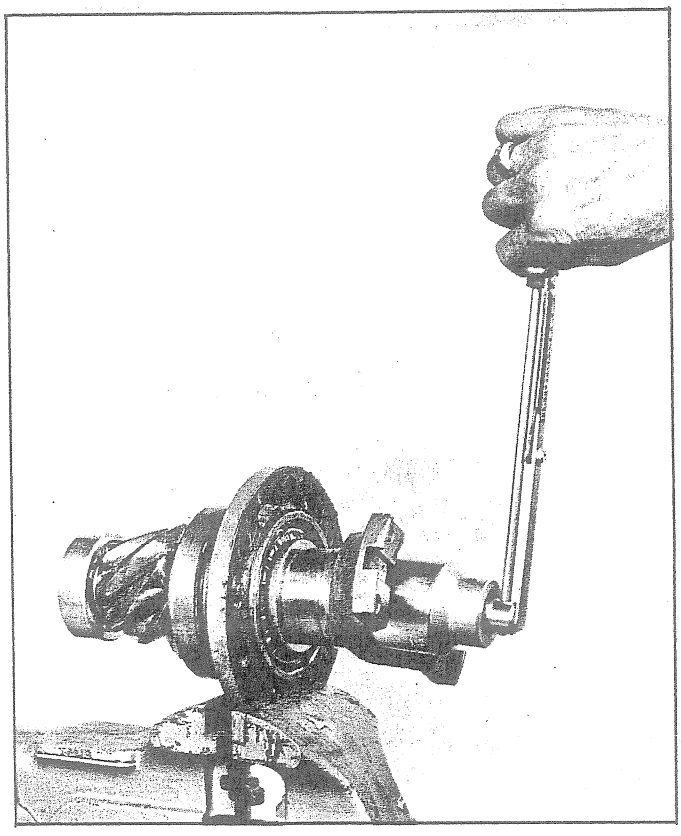


Fig. 60 - Positioning Pinion Shaft Assembly into Housing

crease preload or remove shims to increase preload. Remove companion flange.

8. Position pinion and cage assembly into housing. Use five identical retainer bolts and pull pinion shaft assembly into place as shown in Fig. 60. Make sure oil passages are aligned.

9. Coat outside diameter of oil seal with Permatex No. 2 and press into seal retainer with lip of seal inward. Place oil seal retainer over pinion shaft and secure with retaining bolts. See Fig. 61. Tighten the five 9/16 in. bolts to 80-90 ft.-lbs. torque and the one 1/2 in. bolt to 55-60 ft.-lbs. torque.



59 - Checking Rolling Torque of Pinion Bearings

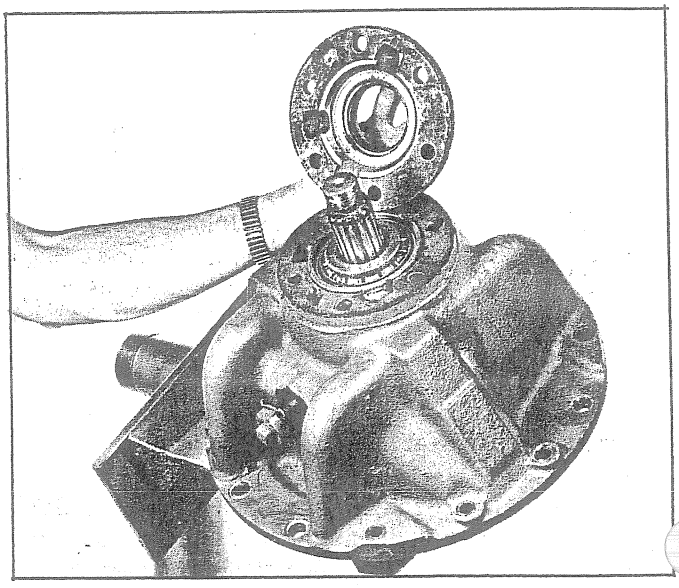


Fig. 61 - Installing Oil Seal and Retainer

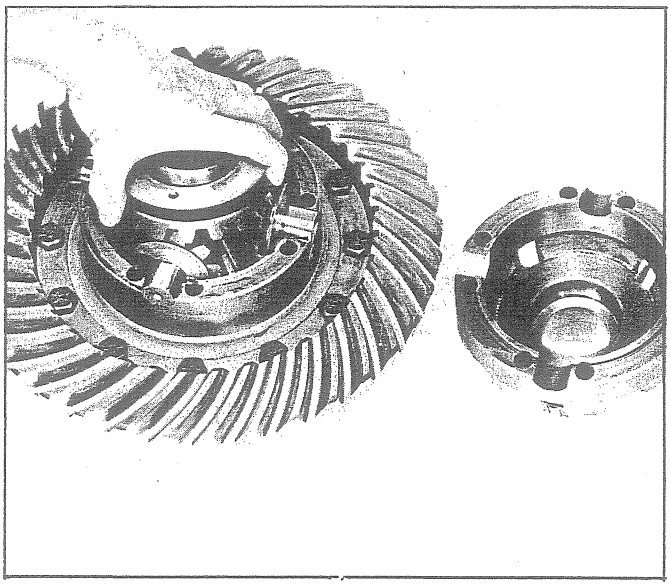


Fig. 62 - Reassembling the Differential

10. Install companion flange with flat washer and nut. Tighten companion flange nut to 400 ft.-lbs. torque.

11. If ring gear was removed from carrier, reinstall and tighten retaining bolts to 90-100 ft.-lbs. torque.

NOTE: If same gear is reinstalled, align match marks previously made.

12. Assemble side gears, spider, pinions and thrust washers in place as shown in Fig. 62.

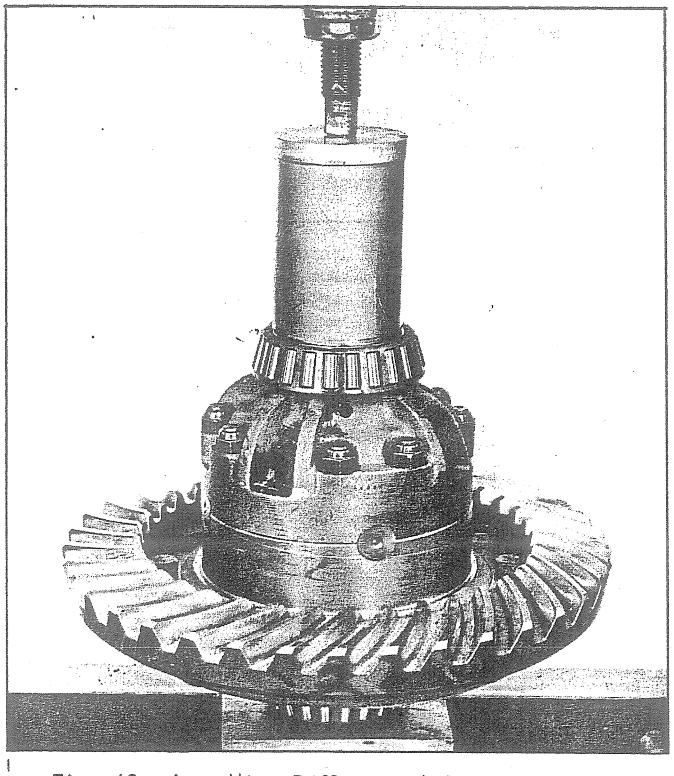


Fig. 63 - Installing Differential Carrier Bearing

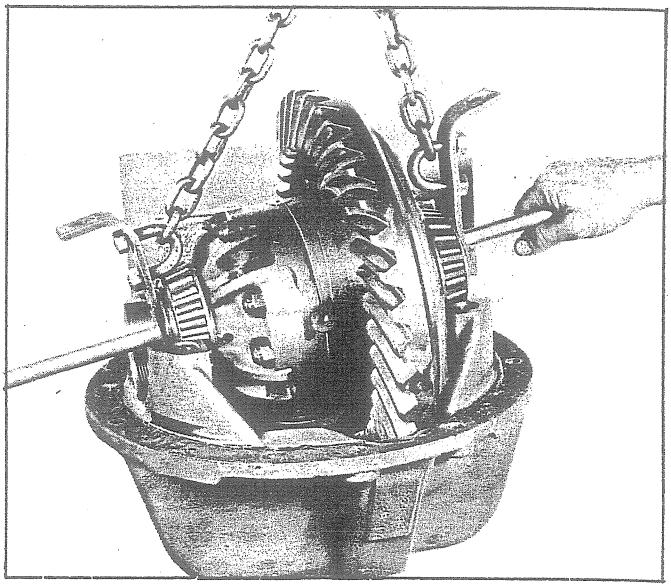


Fig. 64 - Installing Differential into Housing

13. Position halves together while aligning match marks previously made. Secure both retaining bolts and tighten to 90-100 ft.-lbs. torque.

14. Press bearing on each side of the differential as shown in Fig. 63.

15. Position the differential into the housing as shown in Fig. 64.

16. Position the two adjusting nuts into their threads in carrier.

17. Position bearing caps over bearings and nuts while aligning punch marks in caps with marks on carrier (made during disassembly). See Fig. 65.

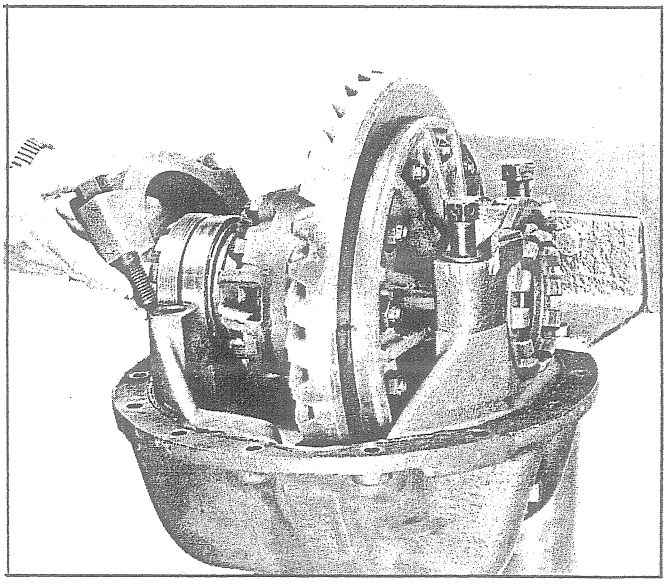


Fig. 65 - Installing Bearing Cap

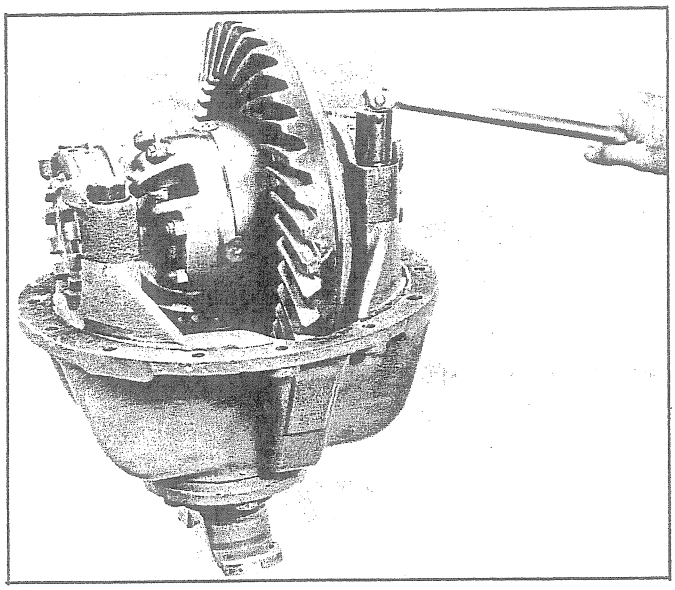


Fig. 66 - Tightening Bolts Prior to Adjusting Bearing Preload

18. Tighten bearing cap retaining bolts sufficiently to retain adjusting nuts as shown in Fig. 66.

19. Tighten bearing adjusting nuts, as shown in Fig. 67, to adjust bearing preload to zero end play. (All bearing rollers should rotate as ring gear is rotated, but it should not be possible to move the rollers sideways in their cage.)

20. Use a dial indicator as shown in Fig. 68 to check the backlash between ring gear and pinion. Backlash should be .009-.013 in. if new gear set is used; or the backlash noted at disassembly if the gears are not being replaced. Adjust backlash as follows:

a. Loosen one of the adjusting nuts, noting the amount of turn.

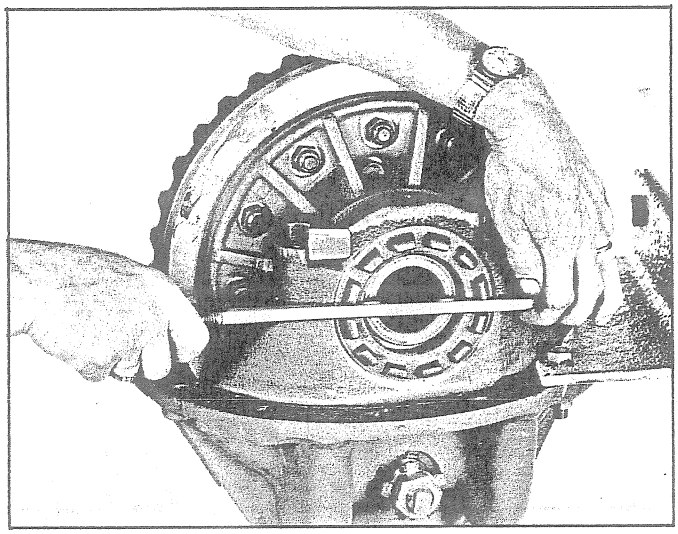


Fig. 67 - Adjusting Bearing Preload and/or Backlash

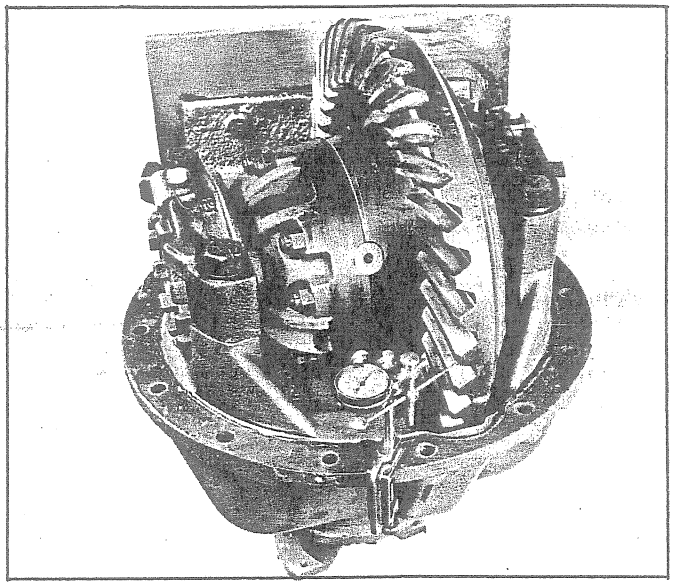


Fig. 68 - Checking Ring Gear and Pinion Backlash

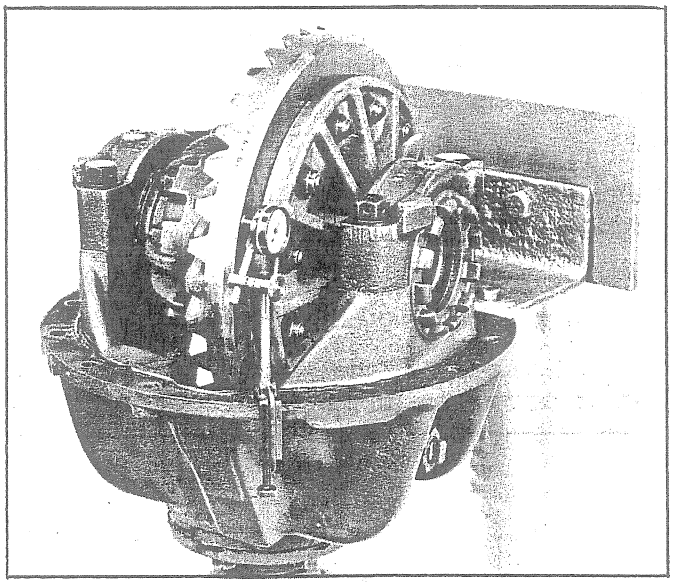


Fig. 69 - Checking Ring Gear Runout

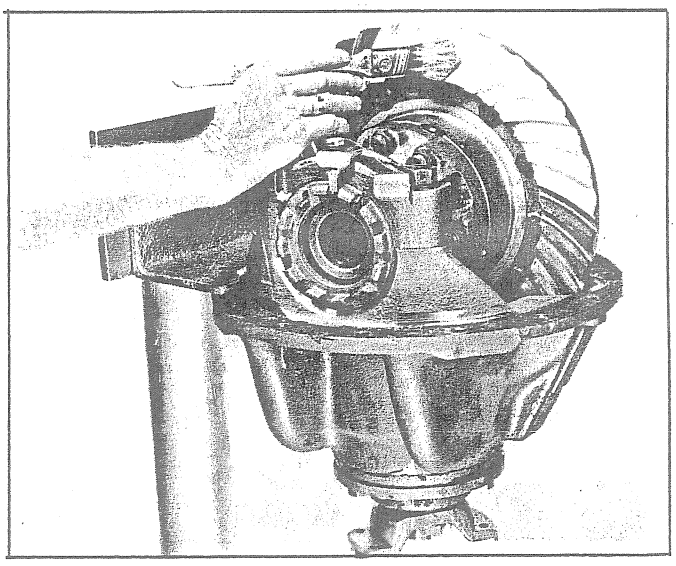
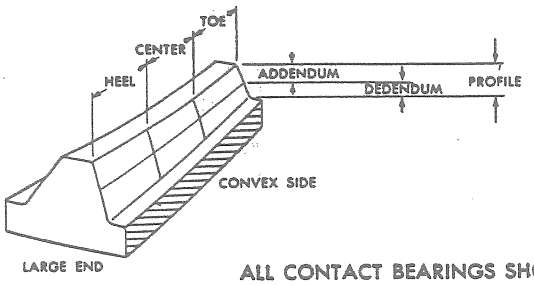
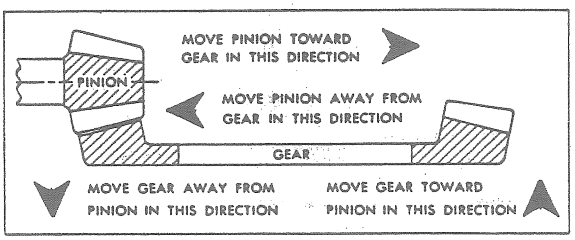


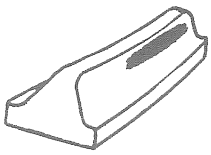
Fig. 70 - Preparation for Checking Tooth Contact

SPIRAL BEVEL AND HYPOID TOOTH BEARING CONTACT CHART

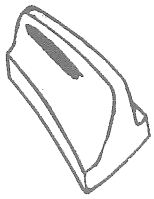


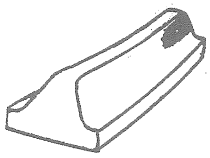


ALL CONTACT BEARINGS SHOWN BELOW ARE ON RIGHT HAND SPIRAL RING GEAR — THE DRIVE IS ON THE CONVEX SIDE OF THE TOOTH.

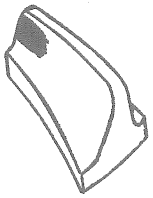


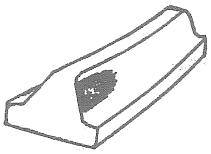
TYPICAL PREFERRED BEARING ON BOTH SIDES OF TOOTH WHILE UNDER A LIGHT LOAD



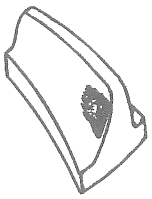


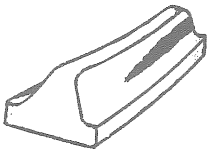
TOE BEARING ON BOTH SIDES OF TOOTH — GEAR SET NOISY. TO MOVE BEARING TOWARD HEEL INCREASE BACKLASH WITHIN LIMITS BY MOVING GEAR AWAY FROM PINION.



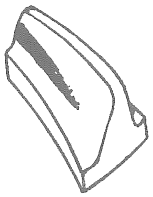


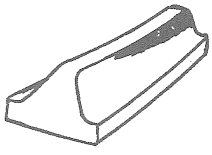
HEEL BEARING ON BOTH SIDES OF TOOTH — GEARSET NOISY AND COULD RESULT IN EARLY GEAR FAILURE. TO MOVE BEARING TOWARD TOE DECREASE BACKLASH WITHIN LIMITS BY MOVING GEAR TOWARD PINION.



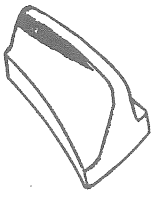


LOW BEARING ON GEAR AND HIGH BEARING ON PINION. CORRECT BY PULLING PINION AWAY FROM GEAR (INCREASE MOUNTING DISTANCE).





HIGH BEARING ON GEAR AND LOW BEARING ON PINION. CORRECT BY MOVING PINION IN TOWARD GEAR (DECREASE MOUNTING DISTANCE.



BACKLASH

BACKLASH SHOULD BE MEASURED WITH A DIAL INDICATOR RIGIDLY MOUNTED WITH THE STEM PERPENDICULAR TO THE TOOTH SURFACE AT THE EXTREME HEEL. THE AMOUNT SHOULD VARY FROM .007 TO .014 DEPENDING UPON THE PITCH OF THE GEAR — FINE PITCHES BEING NEAR THE LOW SIDE AND COARSER PITCHES NEAR THE HIGH SIDE.

Tooth Contact Chart

Fig. 71 - Tooth Contact Chart

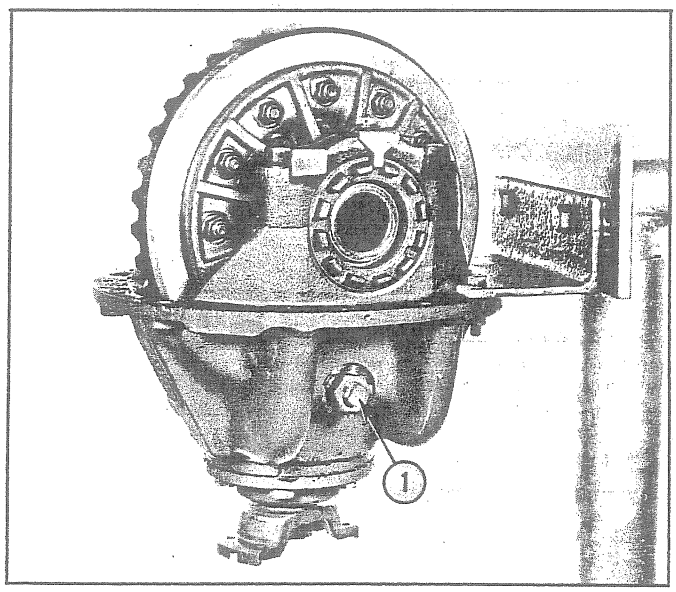


Fig. 72 - Side View of Differential Assembly

1. Differential Thrust Screw

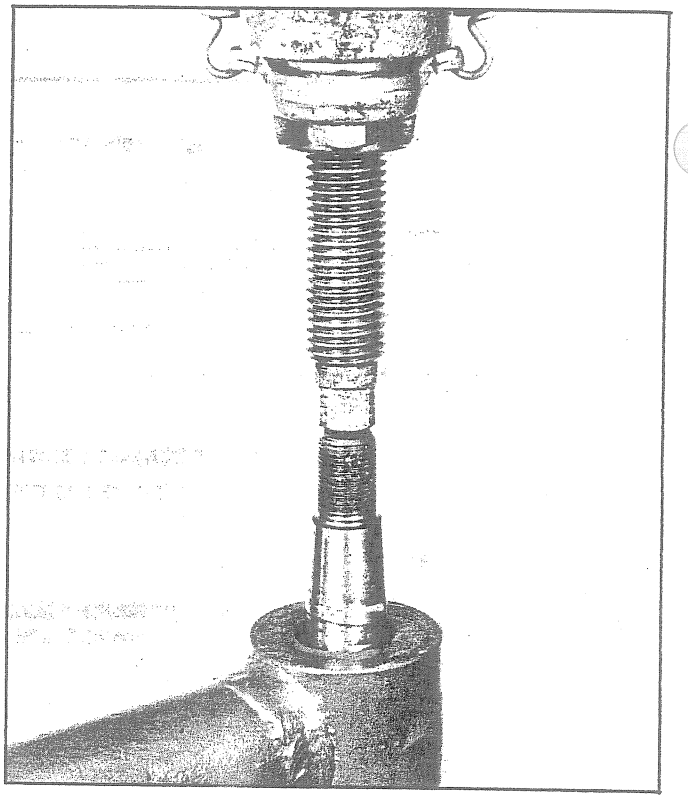


Fig. 74 - Pressing Ball Stud from Housing

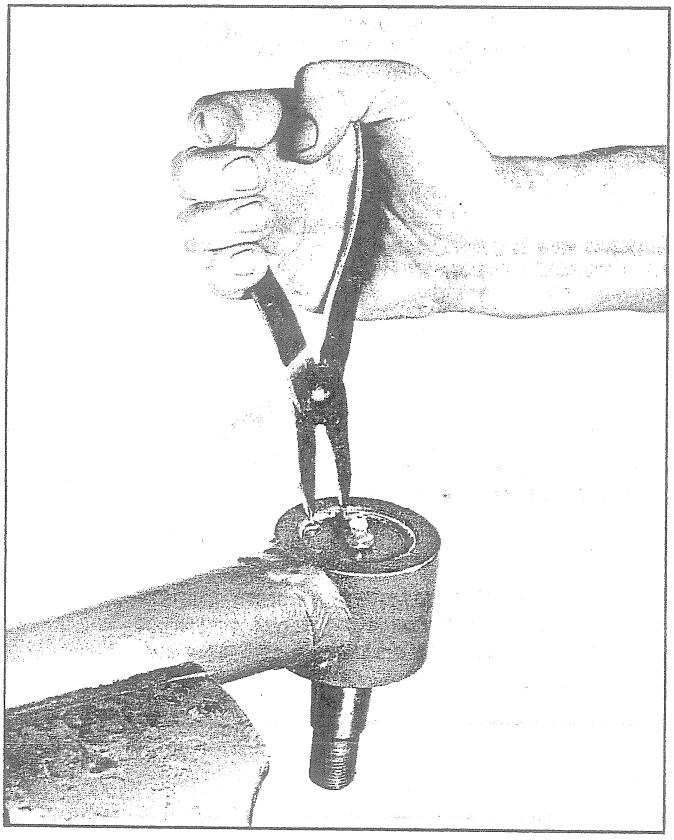


Fig. 73 - Removing Retaining Ring

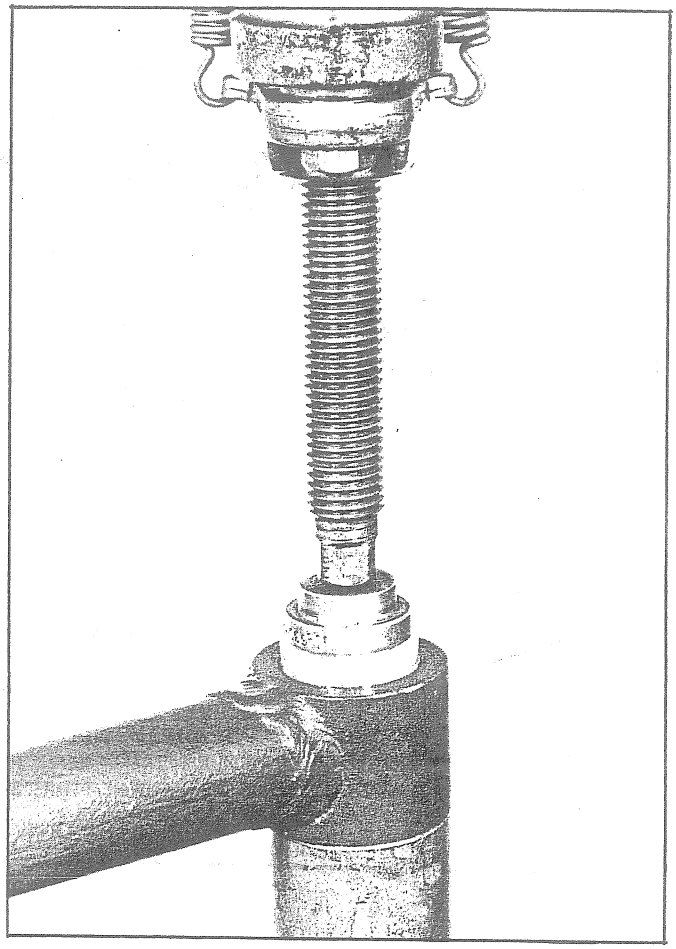


Fig. 75 - Installing New Ball Stud and Bushing intc Housing

b. Tighten the opposite adjusting nut the same amount.

c. Move the ring gear toward the pinion to decrease backlash or away from pinion to increase backlash.

21. After the backlash is set correctly, tighten bearing cap bolt to 200-220 ft.-lbs. torque.

22. Use a dial indicator, as shown in Fig. 69, to check back face of ring gear runout. Runout must not exceed .005 in. If runout is excessive, remove assembly and check for burrs or dirt under mounting surface of ring gear. Reassemble and recheck.

23. Install adjusting nut locks and wire lock bolts and bearing cap bolts together.

24. Paint ring gear teeth as shown in Fig. 70, then rotate gear one complete turn to check tooth contact of pinion to ring gear. Refer to tooth pattern chart shown in Fig. 71.

25. Adjust thrust screw, No. 1, Fig. 72 as follows:

a. Turn screw in until it contacts the ring gear, then back off 1/4 turn.

b. Tighten lock nut and secure with lock tab washer. This will be a clearance of .010 in. between thrust screw and ring gear.

SERVICING TIE ROD

1. Remove retaining ring as shown in Fig. 73, then remove ball stud retaining plate.

2. Press ball stud from tie rod housing as shown in Fig. 74.

3. Press new ball stud and bushing into tie rod housing as shown in Fig. 75.

NOTE: Press only on the bushing when installing the ball stud. Do not press on center of ball stud.

4. Place ball stud retaining plate into recess on tie rod housing and secure with retaining ring.

SERVICING REAR DRIVE STEER AXLE

The following instructions are with the drive axle removed from the unit. The procedures are to be used to completely disassemble the drive axle. However, it should be noted that certain components (sub-assemblies, etc.) may be removed and serviced without completely disassembling the drive axle (i.e.: brakes, flange coupling, oil seals, etc.). Fig. 76 shows an overall view of the drive axle mounted on a stand.

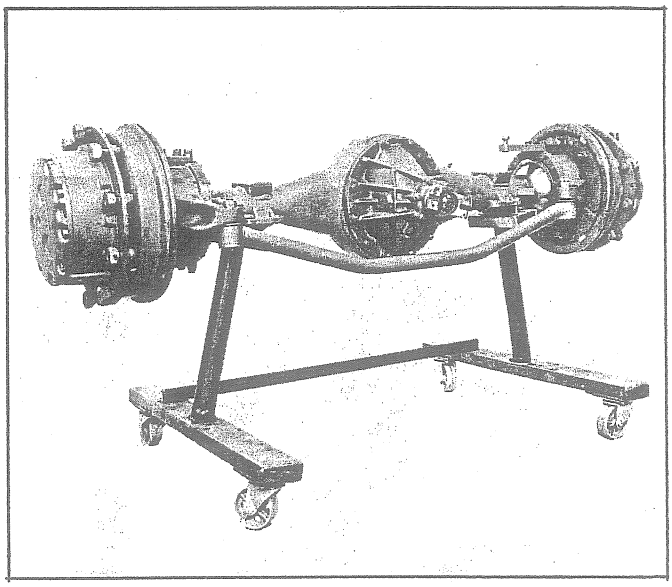


Fig. 76 - Rear Drive Steer Axle Mounted on a Stand

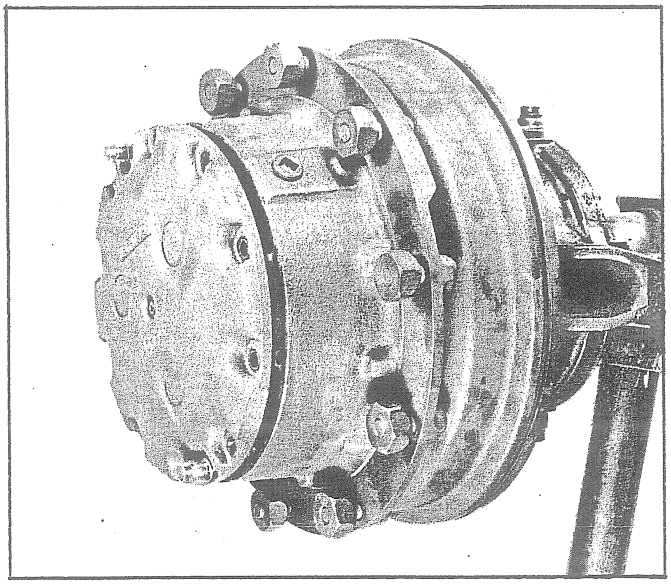


Fig. 77 - Separating Planetary from Hub

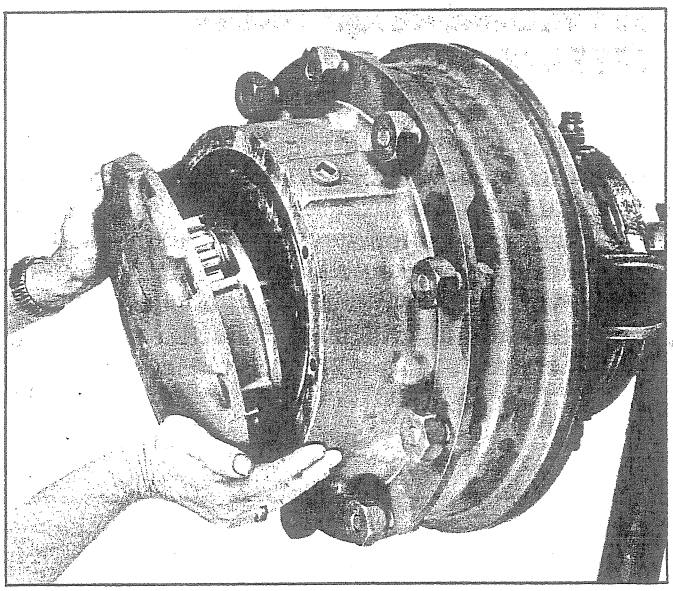


Fig. 78 - Removing Planetary Assembly

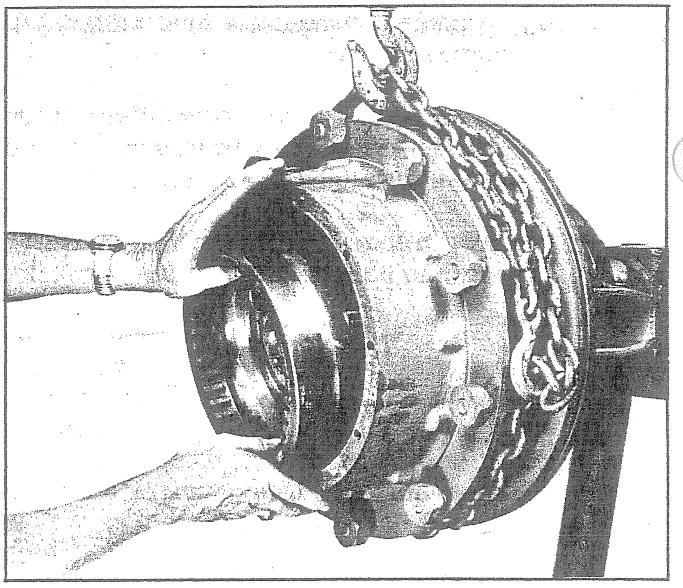


Fig. 81 - Removing Internal Ring Gear

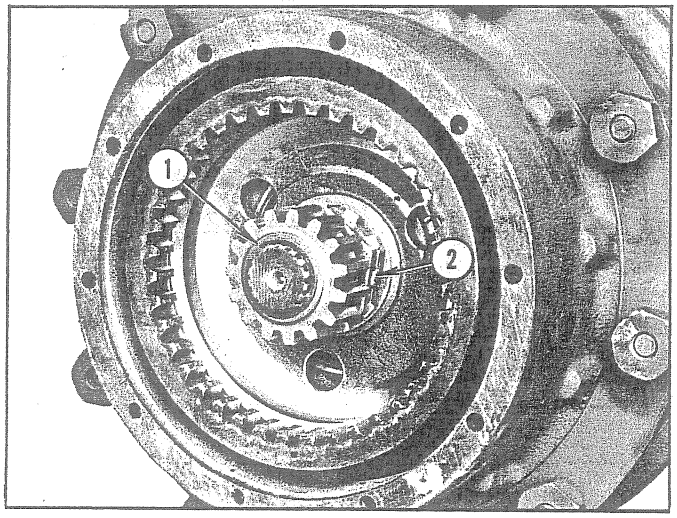


Fig. 79 - View Showing Sun Gear and Lock on Spindle Nuts

1. Retainer Ring
2. Spindle Nut Lock

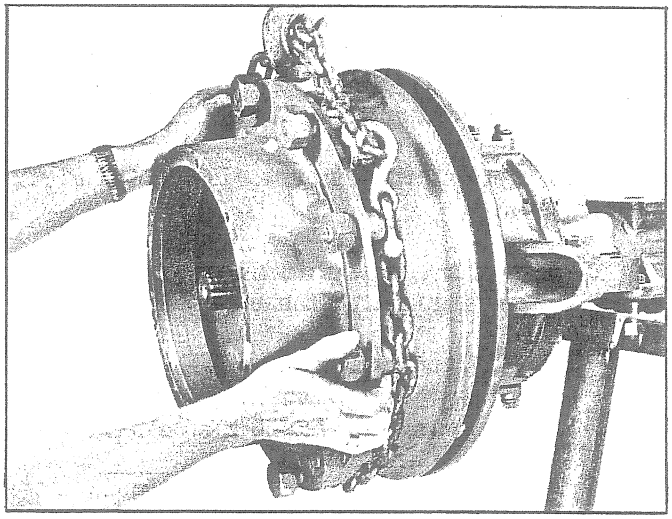


Fig. 82 - Removing Brake Drum and Hub Assembly

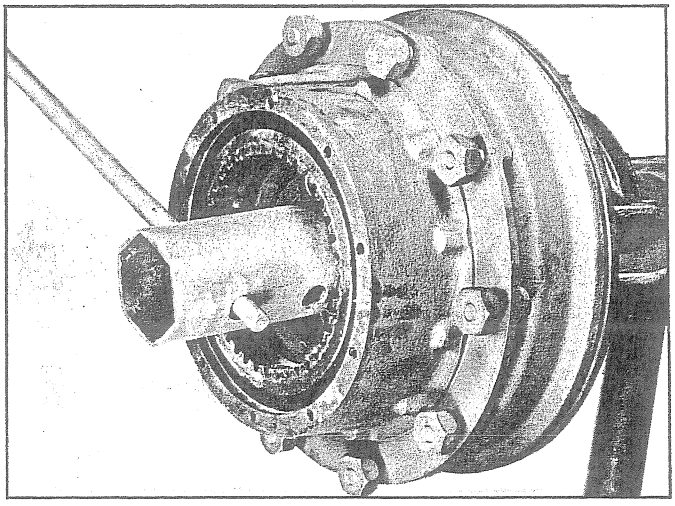


Fig. 80 - Tool used to Remove Spindle Nuts

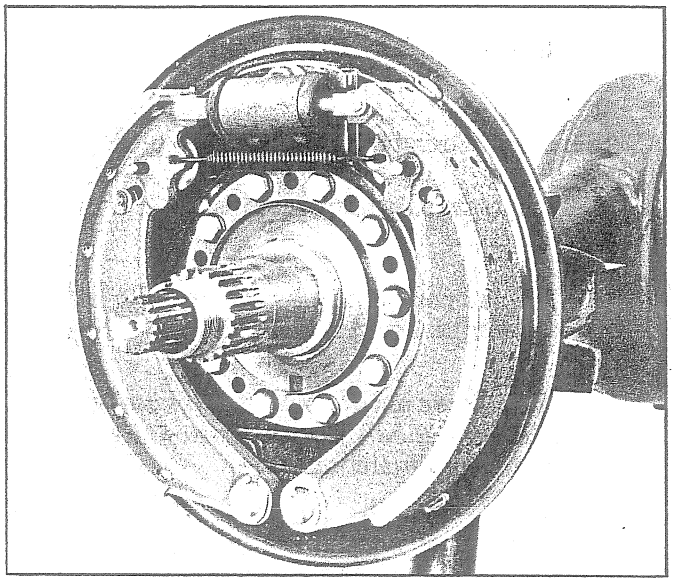


Fig. 83 - Brake Backing Plate Attached to Axle

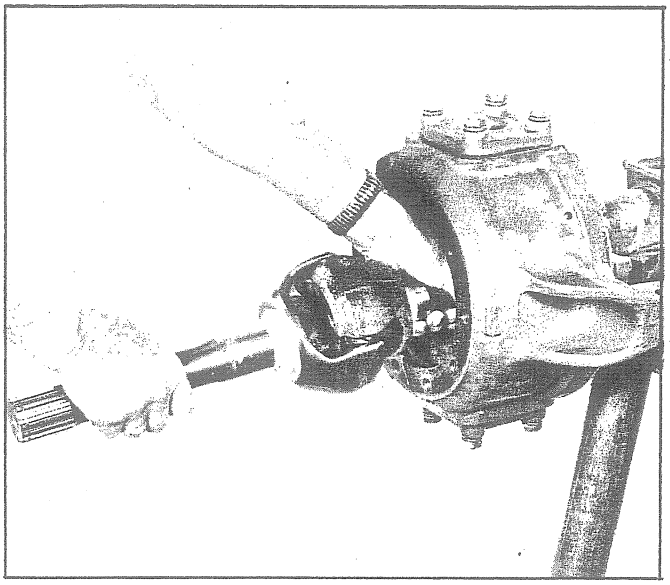


Fig. 84 - Removing Axle Shaft

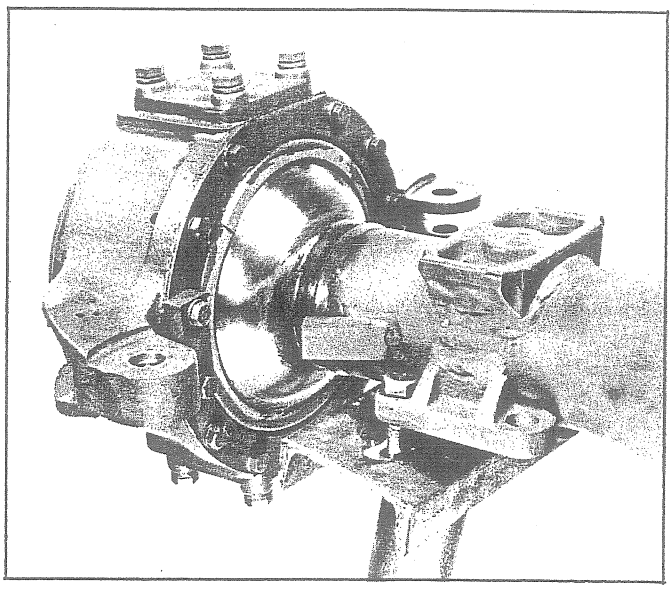


Fig. 85 - Spindle Support and Seals in Place

DISASSEMBLY

1. Drain the oil from the planetary housings and the differential housing.

2. Remove the bolts and washers securing the planetary assembly to the axle hub. Screw two of the bolts into the puller holes and separate the planetary assembly from the hub as shown in Fig. 77.

3. Remove planetary assembly as shown in Fig. 78. Refer to heading "Servicing Planetary Assembly" for service procedures.

4. Remove retainer ring, No. 1, Fig. 79, which secures sun gear to axle shaft -- then remove sun gear.

5. Straighten the tangs on the lock, No. 2, Fig. 79, that secures the spindle nut.

6. Use special tool, as shown in Fig. 80, and remove the outer spindle nut.

7. Remove the nut lock, then use special tool, as shown in Fig. 80, to remove the inner spindle nut.

8. Support the weight of the brake drum and hub assembly -- then remove internal planetary ring gear with its bearing, as shown in Fig. 81. If desired, removed bearing from ring gear.

9. Pull straight out on brake drum and hub assembly, as shown in Fig. 82, to remove it from the axle. Refer to "Servicing Hub and Brake Drum Assembly" for service procedures.

10. Remove bolts and washers securing brake backing plate, oil catcher ring and spindle to the spindle support. See Fig. 83.

11. Remove oil catcher ring and brake backing plate.

12. Pull straight out on spindle assembly to remove it from its support. Refer to "Servicing Spindle Assembly" for service procedures.

13. Carefully slide universal joint and axle shaft assembly out of the housing as shown in Fig. 84. The universal joint will separate if the axle shafts are not kept in alignment with each other.

14. Remove the tie rod and the hydraulic steering cylinders. Refer to "Servicing Tie Rod" for replacement procedures pertaining to ball stud and bushing.

15. Remove seals, retainer rings and steering "stop" block from inner side of spindle support. See Fig. 85.

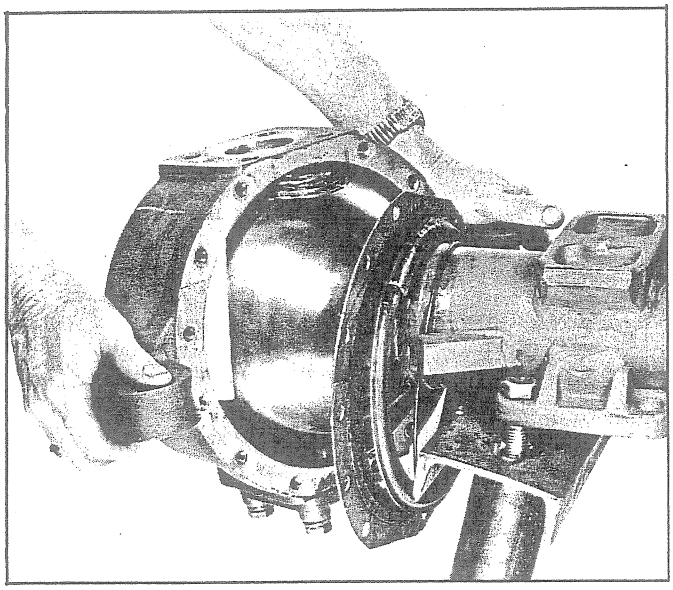


Fig. 86 - Removing Spindle Support

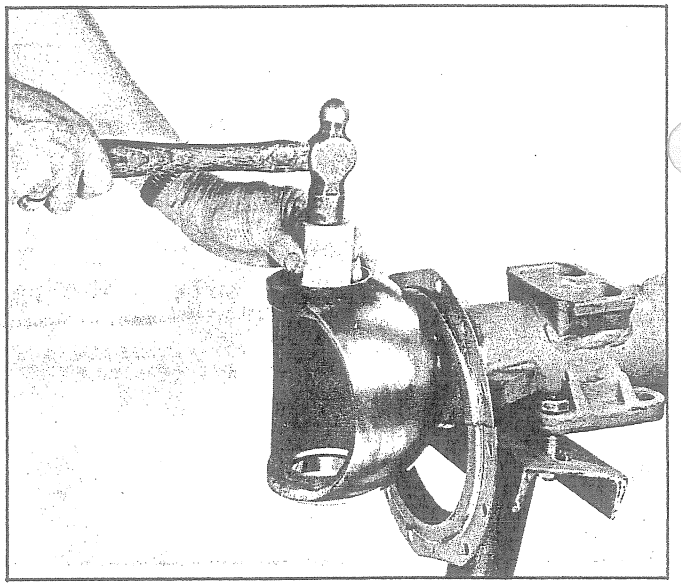


Fig. 88 - Removing the Oil Retainer

16. Remove upper bearing trunnion from spindle support. See Fig. 85. Then remove upper bearing.

NOTE: When prying bearing trunnion from spindle support, use care not to damage shims.

17. Carefully remove the spindle support as shown in Fig. 86. Then, if desired, remove lower trunnion and bearing from spindle support.

18. Carefully pry the universal joint thrust washer from end of axle housing -- then remove seal and its washer from outer end of axle housing using a slide hammer arrangement as shown in Fig. 87.

19. If trunnion bearing cups require replacement, drive the upper trunnion oil retainer out of bearing bore as shown in Fig. 88. Remove the bearing cups as shown in Fig. 89.

20. Follow the preceeding steps to completely disassemble the opposite side of the axle. The opposite side of the axle will have a steering arm trunnion instead of a flanged trunnion.

SERVICE INFORMATION: To remove the differential assembly, it will be necessary to remove both axle shafts.

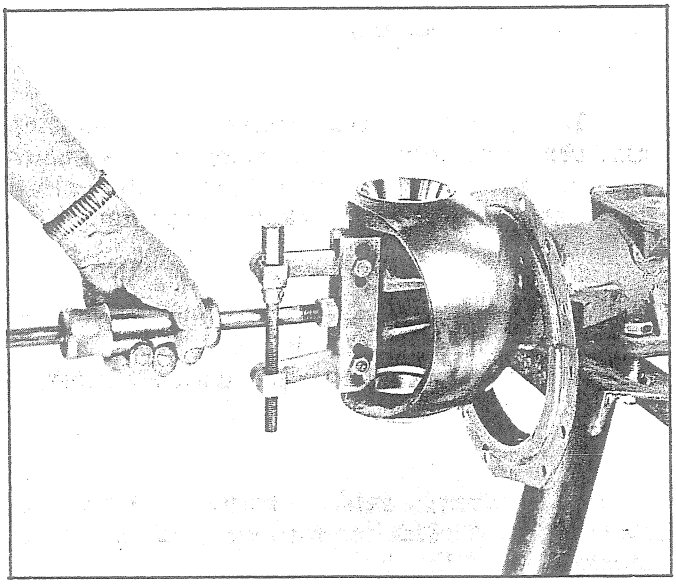


Fig. 87 - Removing Grease Seal

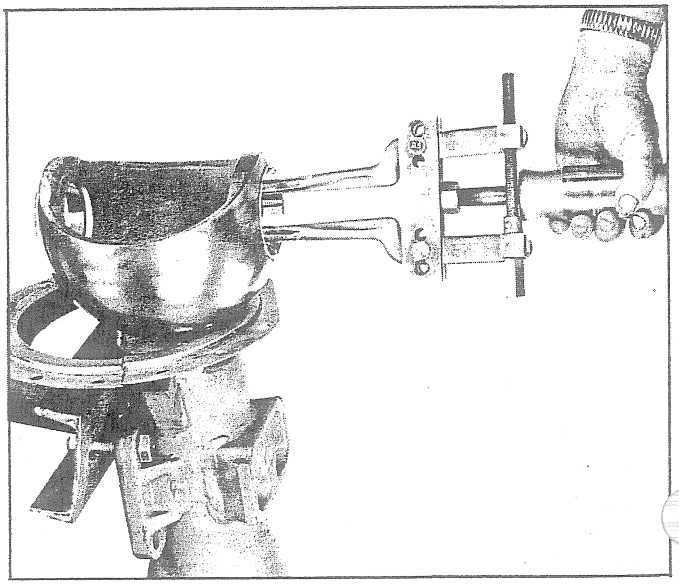


Fig. 89 - Removing Bearing Cup

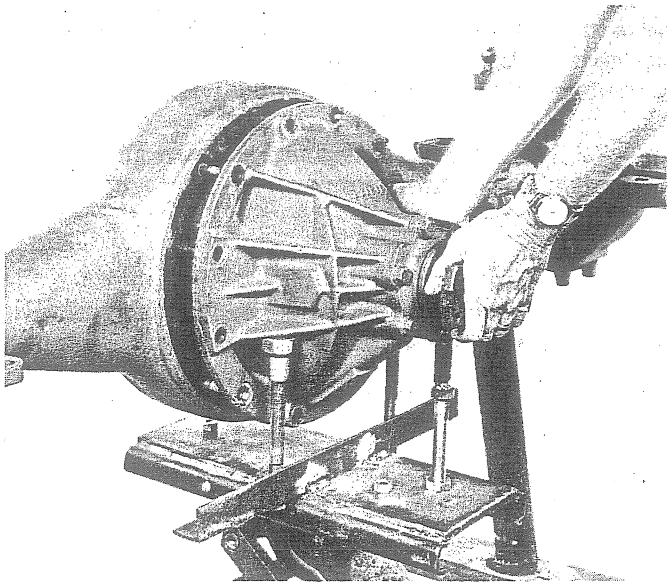


Fig. 90 - Removing or Installing Differential Assembly

21. To remove differential assembly from axle housing, it will be necessary to support it adequately to maintain proper alignment. This may be done in the following ways:

a. If the axle housing is rotated in a manner so that the differential is upward, a suitable hoist may be attached to the companion flange, the retaining nuts removed and the differential assembly lifted straight upward from the axle housing.

b. If the axle housing is mounted on a stand with the differential in a normal position (such as when mounted on the unit), attach a suitable pad to the differential assembly and to a rolling floor jack, remove retaining nuts and roll differential assembly straight out from the axle, as shown in Fig. 90.

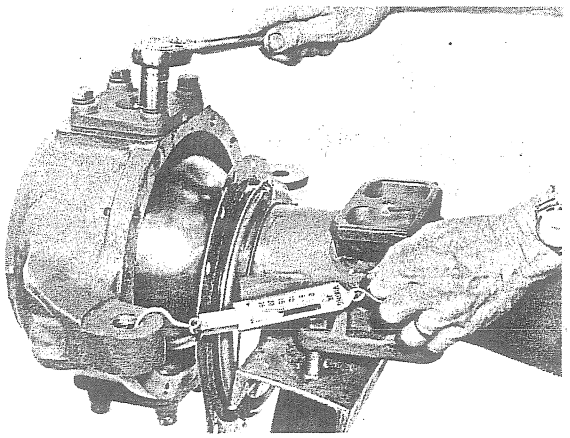


Fig. 91 - Checking Trunnion Bearing Preload

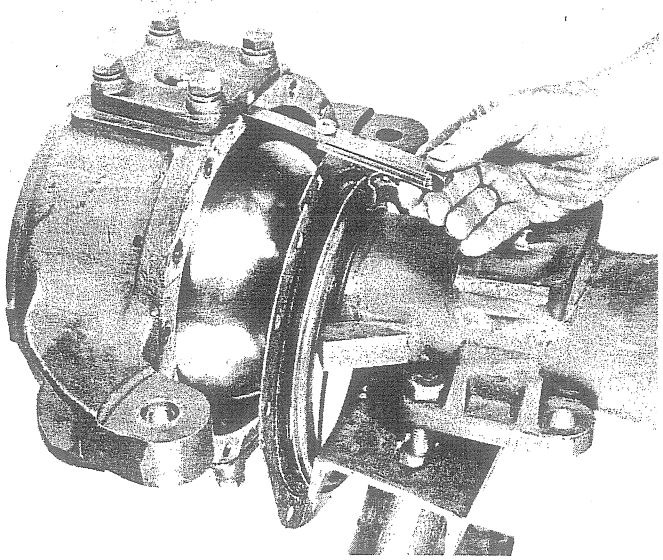


Fig. 92 - Determining Thickness of Shim Required

If the differential assembly requires servicing, refer to the heading "Servicing Differential Assembly".

CLEANING AND INSPECTION

Use a suitable cleaning solvent to clean all parts thoroughly. It is recommended that all parts be placed in the solvent and slushed up and down until they are completely clean. Dry all parts with either compressed air or a lint-free cloth.

NOTE: Do not allow any of the bearings to spin when blowing dry with compressed air. Do not use solvents (or cleaning fluid on brakes shoes).

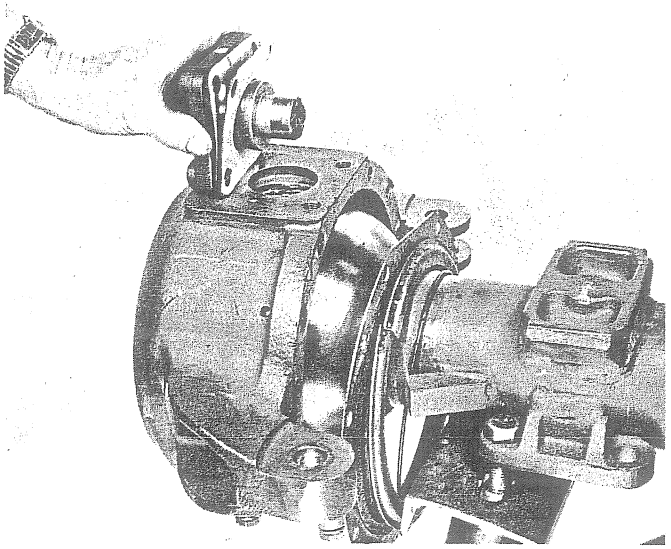


Fig. 93 - Installing Trunnion and Shims

1. All seals, gaskets, retaining rings, etc., should be replaced with new parts.

2. Carefully inspect all bearings and their cups for wear, chipping, or nicks. When replacing a bearing cone, or cup, always replace the mating part (i.e.: cone or cup) at the same time. After inspection, dip bearing in clean oil and wrap sufficiently to protect them until they are installed.

3. Examine the gears and shafts for wear, pitting, chipping, nicks, cracks, or scoring. If gears show spots where case hardening is worn through, replace them. Small nicks may be removed with a suitable hone.

4. Inspect housings, covers and differential case to be certain that they are thoroughly clean. Make certain that the housings' mating surfaces and bearing bores are free from nicks or burrs. There should be no evidence of cracks, or other conditions which would cause oil leaks.

REASSEMBLY

The following procedures assume that the differential, planetary, hub and brake drum, brake backing plate, axle shafts, spindle and tie rod sub-assemblies (to the axle) have been previously assembled as units.

Apply a light coating of Permatex No. 2 to the face of the housings' mating surfaces before reinstallation into the axle housing.

1. Align differential assembly to axle housing as shown in Fig. 90. Secure the differential assembly to the axle housing with retaining nuts tightened to 50-55 ft.-lbs. torque..

2. Place new seals and retainer rings, for inner side of spindle support, over outer end of axle housing.

3. Apply a light coating of Permatex No. 2 to seating surface of oil retainer (to be installed at upper trunnion bearing cup bore) and install oil retainer. Wipe off any excess Permatex.

4. Install upper and lower trunnion bearing cups into their bores in the outer end of axle housing. Use care not to score bearing cup.

5. Apply a light coating of Permatex No. 2 to the universal joint oil seal and lubricate the lip of this seal with Lubriplate. Install oil seal washer and oil seal with the lips of seal inward (toward differential).

6. Install thrust washer against universal joint oil seal and stake in two places (180° apart).

7. Pack the trunnion bearings with a good grade of long fiber, lithium base wheel bearing grease.

8. Place upper trunnion bearing into its cup.

9. Carefully slide spindle support over the outer end of axle housing and upper trunnion bearing. Tilt bottom of spindle support outward and place lower trunnion bearing into its

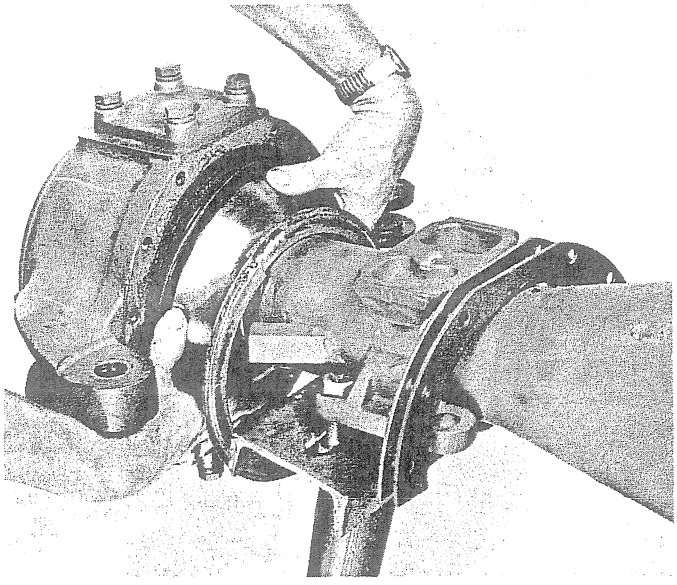


Fig. 94 - Positioning Seals

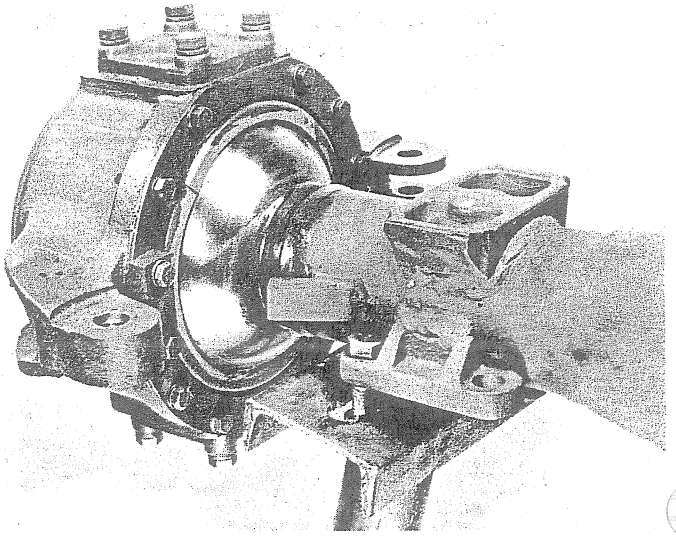


Fig. 95 - Spindle Seals and Stop Block in Place

cup. Allow spindle support to return to its normal position after lower trunnion bearing has been installed.

10. Install one .020-inch shim and lower bearing trunnion in place. Tighten the lower trunnion retaining bolts to 80-90 ft.-lbs. torque.

11. Install upper bearing trunnion without shims then attach a spring scale to spindle support, as shown in Fig. 91, and tighten the upper trunnion bolts evenly while checking the amount of force on the spring scale required to pivot spindle support. (This is trunnion bearing preload.) Tighten bolts evenly until spring scale reads between 12-18 lbs.

12. Use a feeler gauge, as shown in Fig. 92, to determine the thickness of shims required (between upper trunnion and spindle support) to obtain this correct trunnion bearing preload.

13. Remove upper trunnion and add the number of shims required for correct preload (as determined in step No. 12). Reinstall upper trunnion and shims. See Fig. 93. Tighten trunnion retaining bolts to 80-90 ft.-lbs. torque. Recheck preload with spring scale to make certain that it is between 12-18 lbs.

14. Install new seals, retainer rings and steering "stop" block to inner side of spindle support as follows:

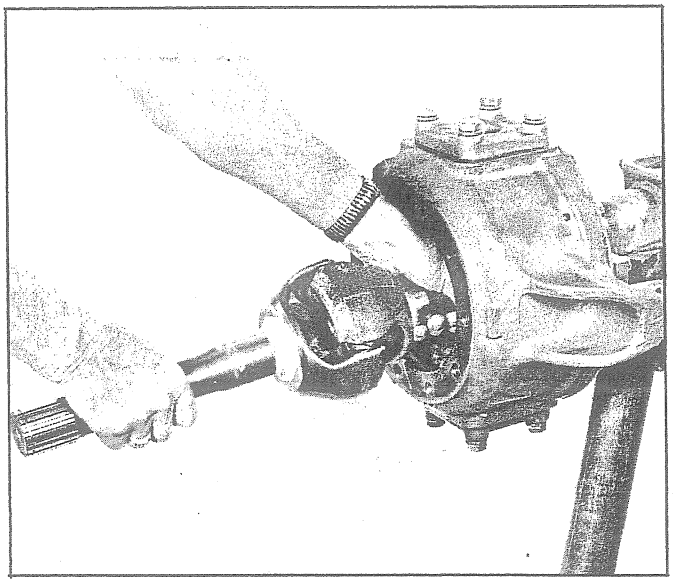


Fig. 96 - Installing Axle Shaft

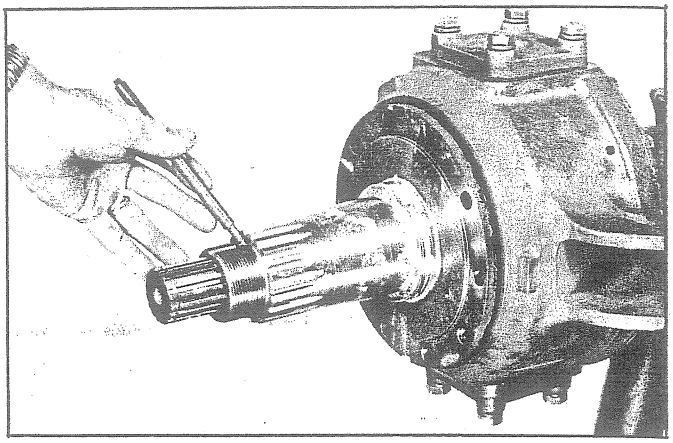


Fig. 97 - Spindle Assembly Properly Positioned

a. Install new gasket to inner side of spindle support. Apply a light coating of gasket cement to both sides of gasket.

b. Position seal retainer ring against gasket.

c. Insert felt seal into retainer.

d. Insert spring into groove around dust seal and carefully position dust seal as shown in Fig. 94. Hold seal in position shown and place outer retainer ring against seal.

e. Secure seals and retainers in place with split ring halfs, while installing steering "stop" block in its correct position using the two longest bolts. See Fig. 95. Tighten bolts 20-25 ft.-lbs. torque.

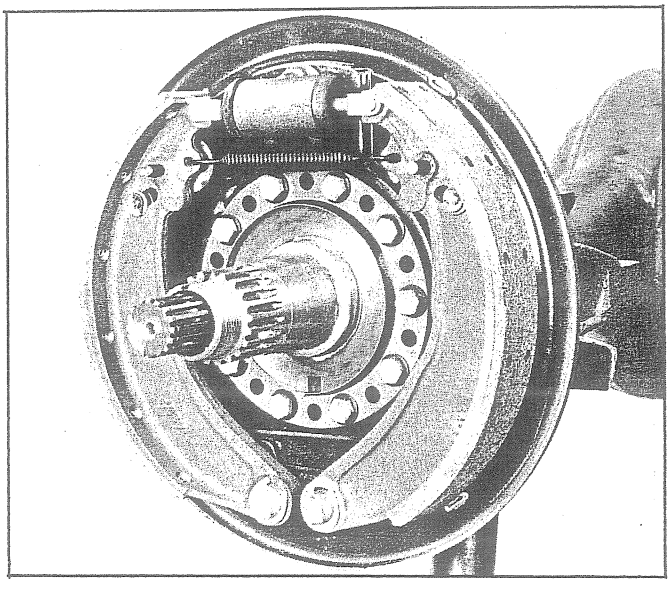


Fig. 98 - Brake Backing Plate Attached to Axle

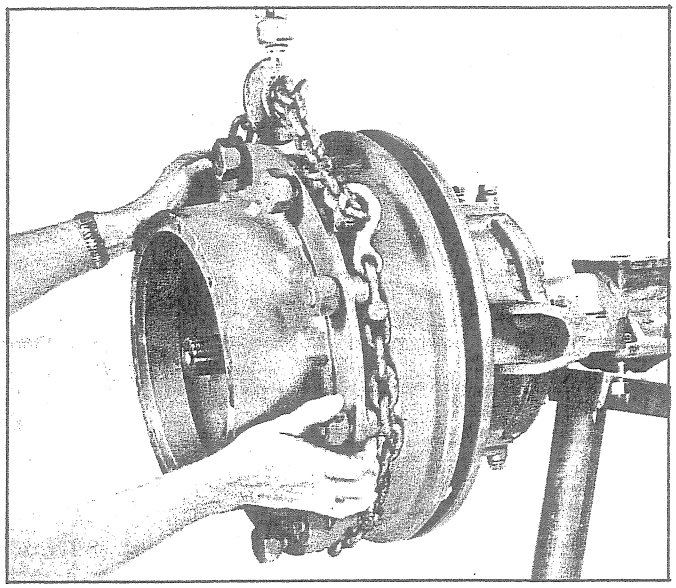


Fig. 99 - Installing Brake Drum and Hub Assembly

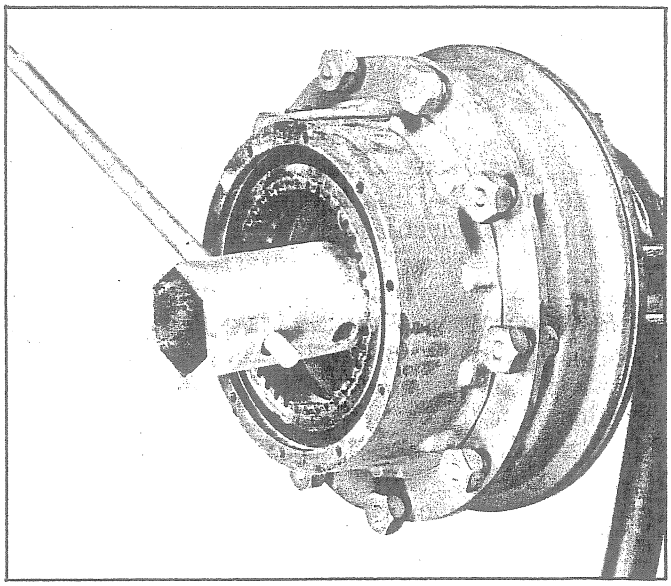


Fig. 101 - Tool Used to Install Spindle Nuts

15. Carefully slide axle shaft and "U-joint assembly into housing as shown in Fig. 96. Do not damage oil seal in axle housing. Pack "U"-joint and outer end of axle housing with a good grade of lithium soap grease, No. 1 consistency.

16. Carefully slide spindle assembly over axle shaft and position it to the spindle support as shown in Fig. 97. The milled groove in the threaded portion of the spindle must be positioned toward the top of the axle.

17. Position the brake backing plate assembly and the oil catcher ring to the spindle. Secure oil catcher ring, brake backing plate and spindle to the spindle support with bolts and flatwashers tightened to 80-90 ft.-lbs. torque. See Fig. 98. (Space between the brake shoe anchors is to be aligned with the milled groove in the flange at the bottom of the spindle.)

18. Support hub and brake drum assembly with a suitable hoist, then work hub and drum into position as shown in Fig. 99, until the inner bearing is over the spindle and drum is over the brake linings.

NOTE: Use care when aligning hub and drum over spindle so that the inner hub bearing does not "cock" on spindle. If drum binds on brake linings, adjust cams so that brake spring tension is at a minimum.

19. With hub and drum assembly still supported by hoist, slide planetary ring gear (with bearing installed) over spindle as shown in Fig. 100.

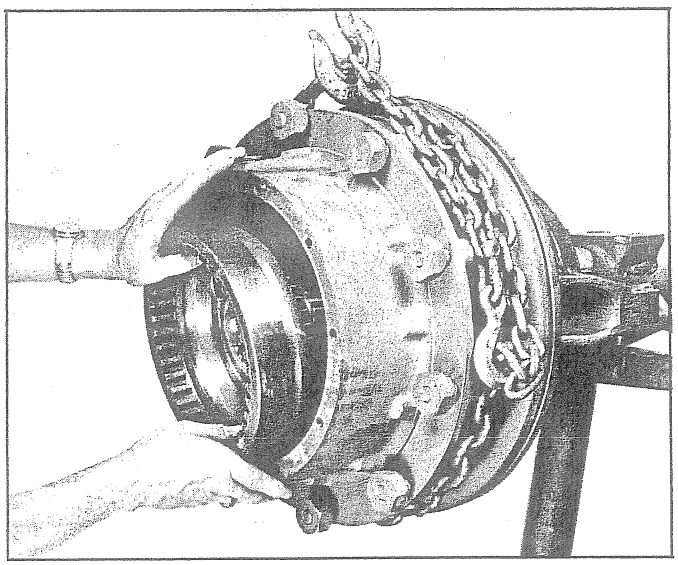


Fig. 100 - Installing Internal Ring Gear

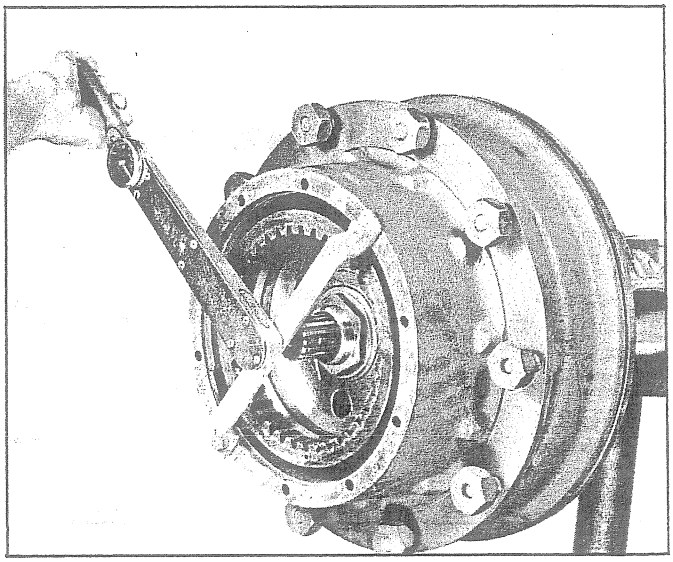


Fig. 102 - Checking Preload of Hub Bearings

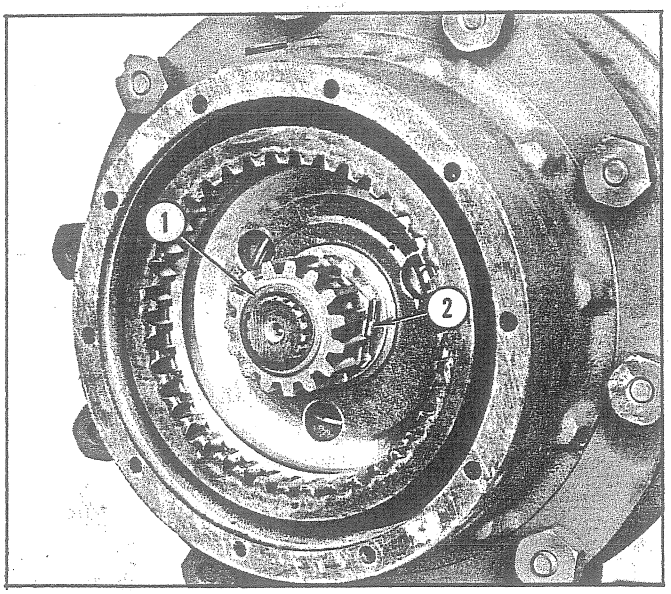


Fig. 103 - View Showing Sun Gear and Lock on Spindle Nuts

1. Retainer Ring 2. Spindle Nut Lock

20. Install flatwasher and inner spindle nut. Tighten inner spindle nut with special tool shown in Fig. 101, while rotating wheel hub, until there is a slight drag.

21. Attach special tool to hub and check rolling torque (rolling resistance) with a torque wrench as shown in Fig. 102. (The rolling torque is the force necessary to keep the hub in motion, not the torque wrench reading at start or end of check.) The rolling torque on new bearings should be between 10-15 ft.-lbs. and between 5-10 ft.-lbs. on used bearings. Tighten, or loosen, inner spindle nut as necessary.

NOTE: Make certain the brakes are not "dragging" when checking rolling torque of hub.

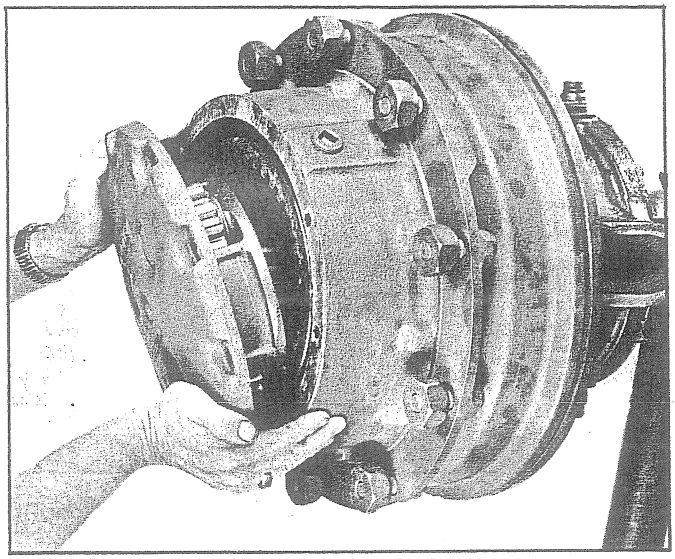


Fig. 104 - Installing Planetary Assembly

22. Install spindle nut lock and outer spindle nut. Tighten outer nut securely to hold inner nut in place -- then bend tangs on the nut lock, No. 2, Fig. 103, so that both spindle nuts will be locked in position.

23. Slide sun gear over splines on axle shaft and secure gear with retaining ring, No. 1, Fig. 103.

24. Position planetary assembly to axle as shown in Fig. 104. Install planetary assembly and secure with bolts and lockwashers tightened evenly to 50-55 ft.-lbs. torque. Install the plugs in the "puller" holes in planetary assembly.

25. Follow the preceeding steps to reassembly the opposite side of the axle. The opposite side of the axle will have a steering arm trunnion instead of a flanged trunnion.

26. Reinstall the tie rod and hydraulic steering cylinders. Use a new self-locking nut on tie rod and tighten to 165-ft.-lbs. torque.

SERVICING DIFFERENTIAL ASSEMBLY

It will be necessary to remove both axle shafts before the differential assembly can be removed for servicing. Refer to "Servicing the Drive Axle" under the heading "Disassembly" for procedures pertaining to removal of the differential assembly. (Perform steps #1 through #14 on both sides of the axle -- then perform step #21.)

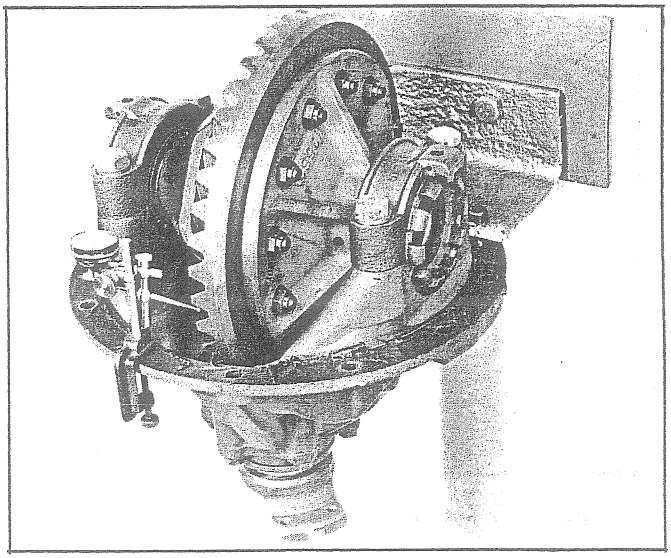


Fig. 105 - Checking Ring Gear and Pinion Backlash

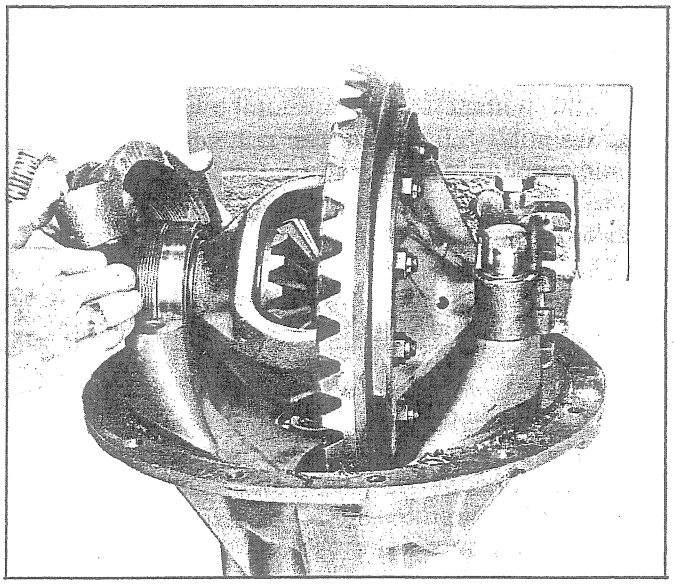


Fig. 106 - Removing Bearing Cap

Disassembly

After the differential assembly has been removed, mount it to a suitable stand.

1. If the same gears are to be reinstalled in the differential assembly, check and record ring gear backlash, using a dial indicator. See Fig. 105.

2. Punch mark bearing caps and carrier assembly to ensure they are correctly re-matched when reassembled.

3. Remove cotter pins and lock pins from bearing caps.

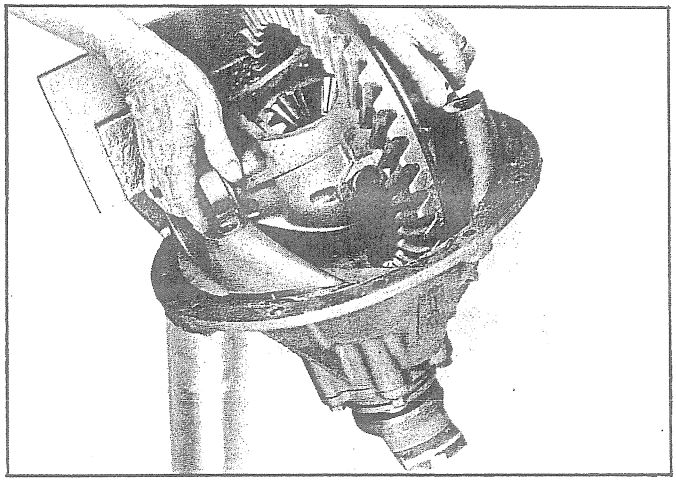


Fig. 107 - Removing Differential from Housing

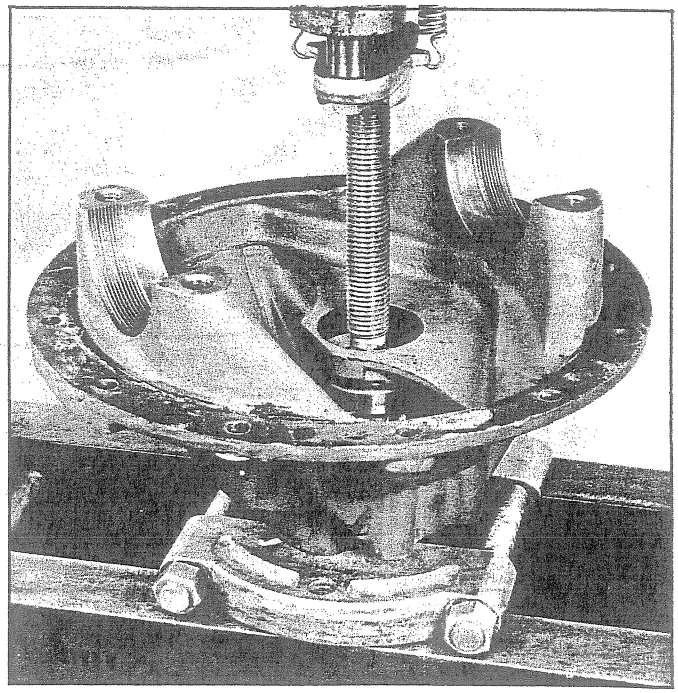


Fig. 108 - Pressing Pinion Assembly from Differential Carrier

4. Cut lockwire -- then remove bolts and bearing caps. See Fig. 106.

5. Remove the two adjusting nuts -- then lift ring gear and case assembly from the differential as shown in Fig. 107. Remove bearing cups.

6. Remove cotter pin and companion flange nut (nut is tightened to 300 ft.-lbs. torque) --

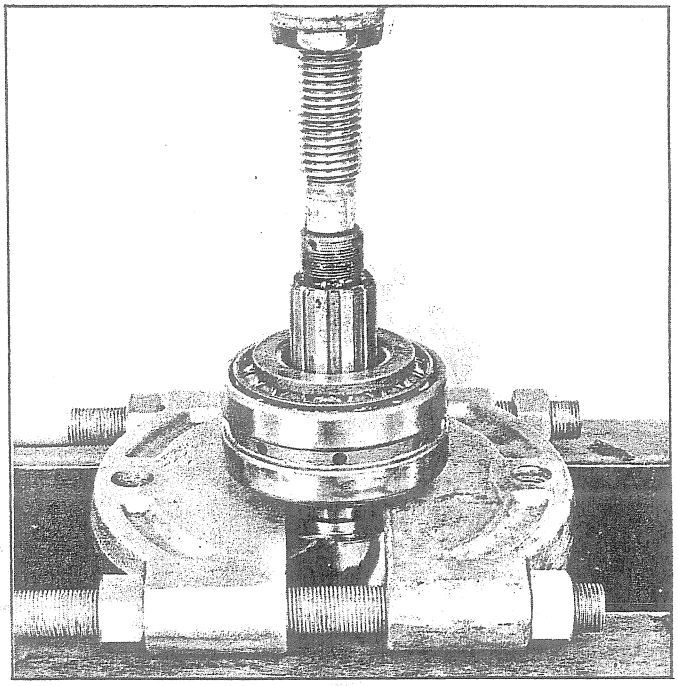


Fig. 109 - Pressing Pinion Shaft from Outer Bearing

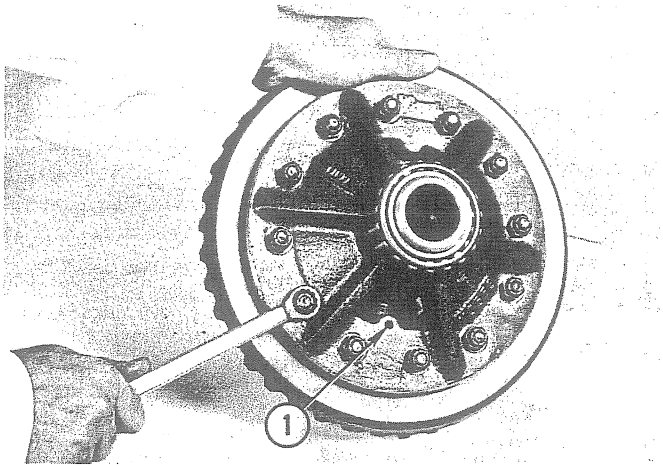


Fig. 110 - Removing Ring Gear Retaining Bolts
1. Lock Pin Access Hole

then remove companion flange from pinion shaft.

7. Remove bolts and lockwashers which secure the pinion bearing seal retainer to the differential housing. Tap retainer with a soft hammer -- then remove retainer. Press out oil seal.

8. Press pinion assembly from differential carrier as shown in Fig. 108.

9. Press pinion shaft from outer pinion bearings as shown in Fig. 109. Separate outer bearing cone, spacer and inner bearing cone from "dual" bearing cup.

10. Press inner pinion bearing from pinion shaft (using a similar arrangement to that used to remove outer bearings).

11. Match mark ring gear to case assembly to ensure correct reassembly (balance) -- then remove bolts and self-locking nuts securing gear to case. Separate ring gear from case.

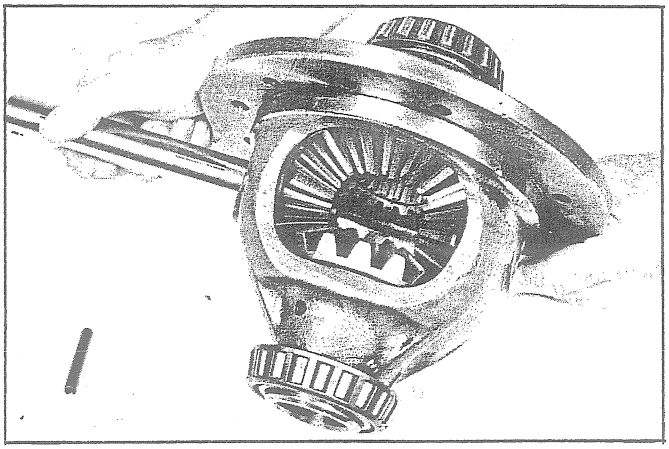


Fig. 111 - Removing Pinion Shaft

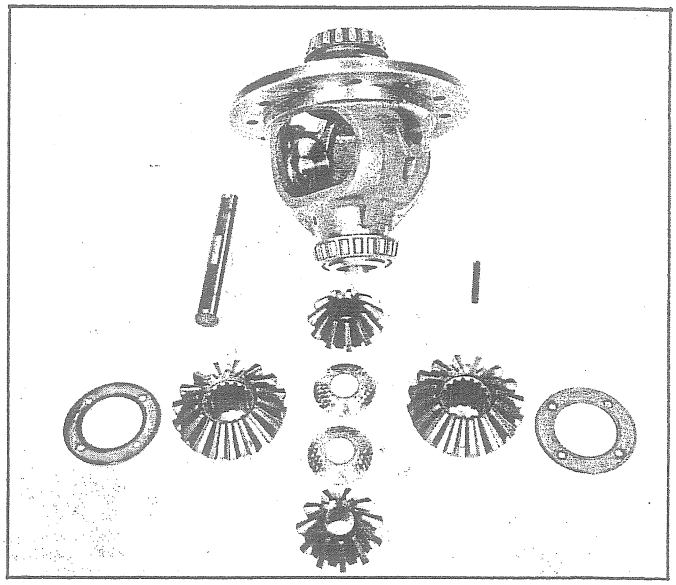


Fig. 112 - Differential (Disassembled)

12. Drive out pinion shaft lock pin using a suitable punch inserted in access hole, No. 1, Fig. 110, in case.

13. Remove Pinion shaft as shown in Fig. 111.

14. Rotate differential side gears until the pinions are positioned so they may be removed. Remove pinions and thrust washers.

15. Remove side gears and their thrust washers from case. See Fig. 112. If differential carrier bearings require replacement, remove them from the case using a suitable puller.

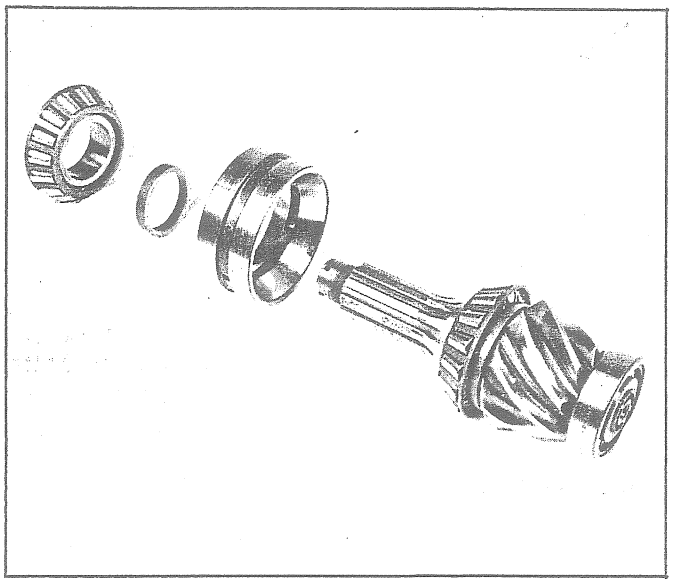


Fig. 113 - Pinion Shaft and Bearings

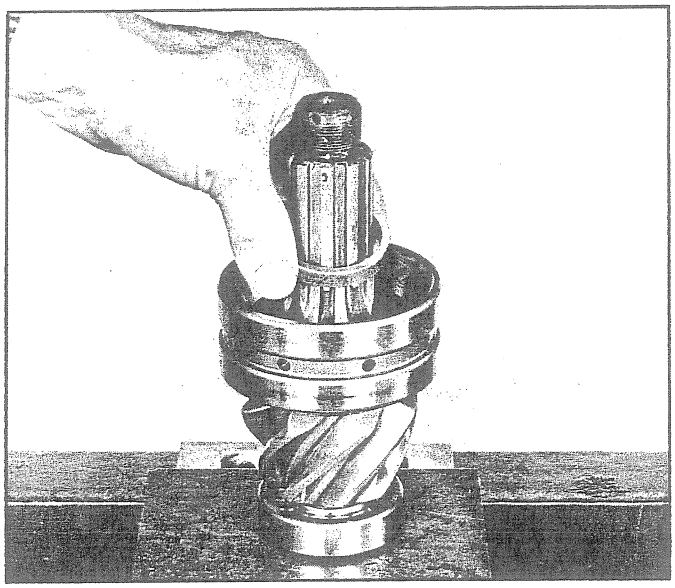


Fig. 114 - Installing Bearing Spacer

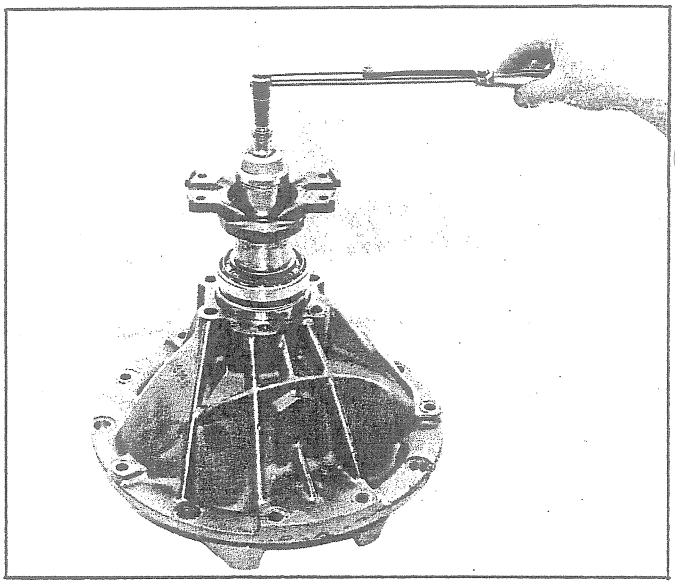


Fig. 115 - Checking Preload of Pinion Shaft Bearings

Cleaning and Inspection

Use a suitable cleaning solvent to clean all parts of the differential assembly thoroughly. Dry all parts with either compressed air, or a lint-free cloth.

NOTE: Do not allow bearings to spin when blowing dry with compressed air.

1. Pinion bearing oil seal and its retainers gasket should be replaced with new parts.

2. Inspect all bearings and their cups for wear, chipping or nicks. When replacing a bearing cone, or cup, always replace the mating part (i. e.: cone or cup) at the same time. Bearings should be dipped in clean oil and wrapped sufficiently to protect them until they are installed.

3. Examine all gears, thrust washers and shaft for evidence of wear, pitting, chipping, nicks, cracks or scoring. Small nicks may be removed with a suitable hone.

4. Check ring gear mounting surface of differential case to make certain it is free from burrs. Carefully remove any burrs with a file.

Reassembly

1. If removed, install differential carrier bearings. Press bearings fully onto their seats, at both ends of case.

2. Position side gears and their thrust washers in differential case.

3. Position pinion gears and their thrust washers so they are opposite each other and engage the side gears at the same time. Rotate side gears until both pinions are aligned with the pinion shaft holes in case.

4. Insert pinion shaft through holes in case and pinions as shown in Fig. 111. Make certain that the lock pin hole in shaft is at the same side of, and aligned with the lock pin hole in case.

5. Install pinion shaft lock pin and stake the case to retain lock pin.

6. Position ring gear to mounting surface of case assembly, while realigning match marks made prior to separation (during disassembly).

Secure ring gear to case with bolts and new lock nuts. Tighten the new lock nuts to 80-85 ft.-lbs. torque.

7. Press inner pinion bearing onto end of pinion shaft and stake bearing to shaft in four places. Use a suitable square end staking tool and space stake marks equally apart (90°) from each other.

8. Assemble outer pinion bearings onto pinion shaft as follows:

a. Press inner bearing cone onto pinion shaft. See Fig. 113.

b. Position "dual" bearing cup over inner housing cone. The letter "P" is stamped on one end of cup -- this letter "P" must be toward pinion.

c. Position bearing spacer and one .010 inch shim over pinion shaft and against inner bearing cone. See Fig. 114. (A pinion bearing and shim kit is provided for service repair. This kit, consisting of a spacer and a quantity of shims is used to obtain the correct bearing preload).

d. Press outer bearing cone onto pinion shaft. Lubricate bearings with gear lube and rotate several times to ensure a normal bearing contact.

9. Temporarily install companion flange, onto pinion shaft tightening nut to 300 ft.-lbs. torque.

10. Install pinion shaft assembly into differential carrier, as shown in Fig. 115, and use an inch-lb. torque wrench (as shown) to check bearing preload (rolling torque). Torque wrench should read between 13-23 in.-lbs. while continually rotating pinion (this is bearing preload). If bearing preload is not correct disassembly pinion and add shims to decrease preload, or remove shims to increase preload.

11. Remove companion flange from pinion shaft -- then press pinion shaft assembly into differential carrier as shown in Fig. 116. Pressure should be applied only to "dual" bearing cup. Make sure that cup is seated firmly against the shoulder in carrier housing.

12. Apply a light coating of Permatex No. 2, to outside diameter of new oil seal -- then press seal into pinion bearing seal retainer (lips of seal to be towards flange section and lubricated with lubriplate).

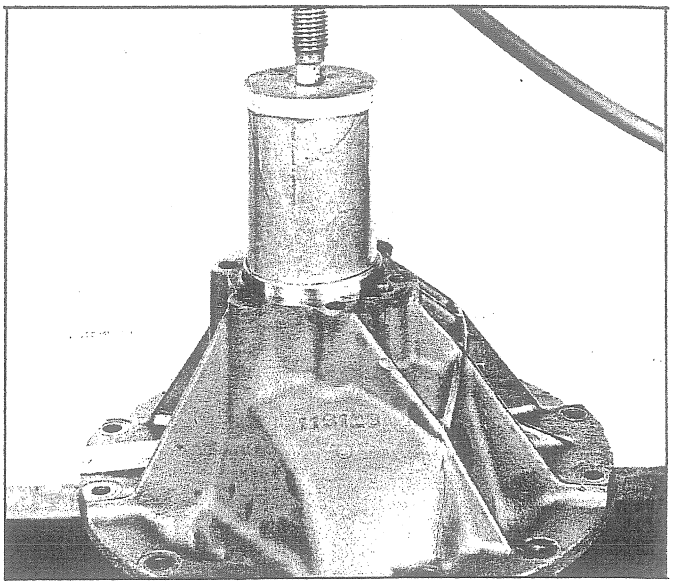


Fig. 116 - Pressing Pinion Shaft Assembly into Differential Carrier

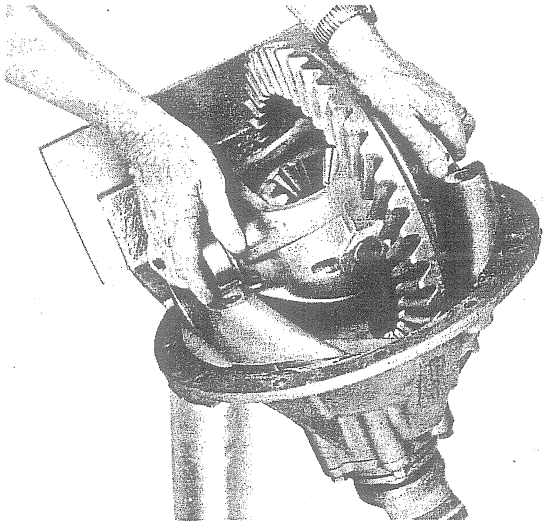


Fig. 117 - Positioning Differential into Carrier

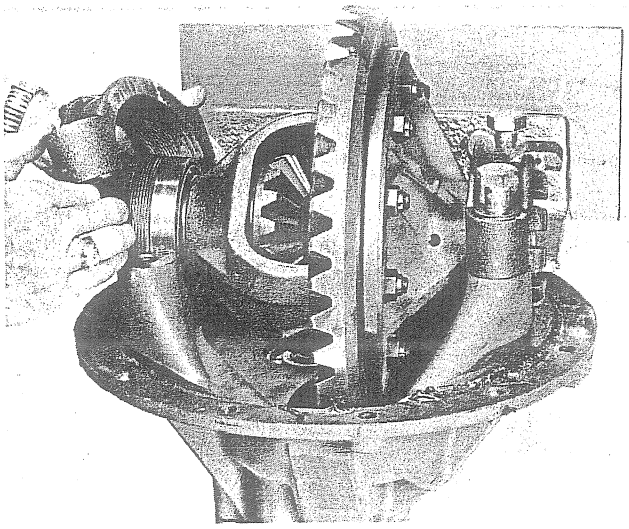


Fig. 118 - Installing Bearing Caps

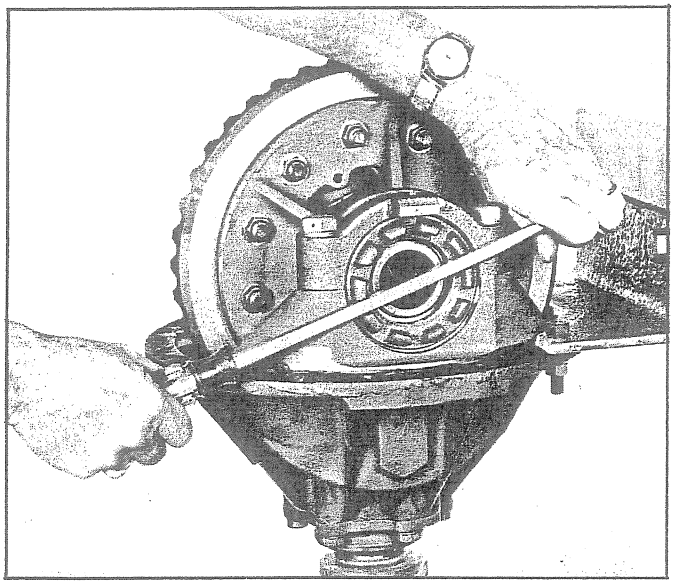


Fig. 119 - Adjusting Bearing Preload and/or Backlash

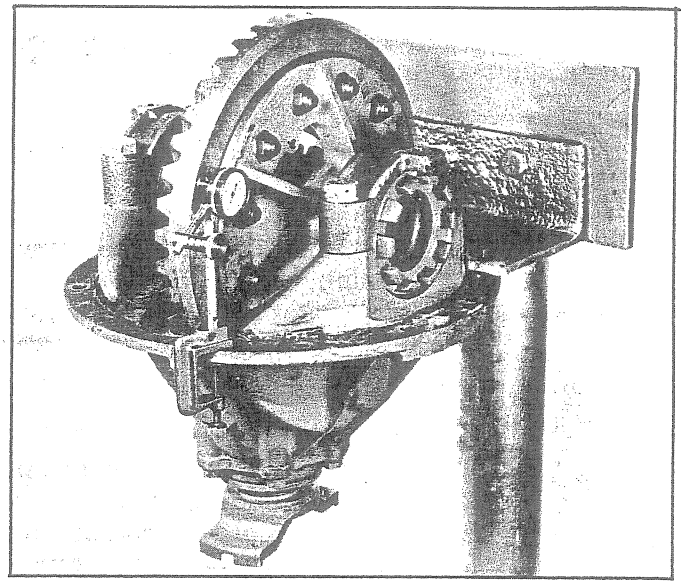


Fig. 121 - Checking Ring Gear Runout

13. Position gasket on carrier housing (cutout for drainback hole is to be aligned with hole in carrier) and position pinion bearing seal retainer over gasket (aligning drainback in retainer with hole in housing). Tighten bolts to 35-40 ft.-lbs. torque.

14. Install companion flange onto pinion shaft and secure with nut tightened to 300 ft.-lbs. torque. Install cotter pin to secure nut.

15. Check that bearing cones are properly seated in differential, position the cups over the cones -- then position ring gear and case assembly into the differential carrier as shown in Fig. 117.

16. Position the two adjusting nuts into their threads in carrier -- making certain that nuts are not cross-threaded.

17. Position bearing cups over bearings and nuts while aligning punch marks on caps with marks on carrier made during disassembly. See Fig. 118. Make certain that adjusting nuts are not cross-threaded. Tighten bearing cap bolts sufficiently to retain bearings and adjusting nuts.

18. Tighten bearing adjusting nuts, as shown in Fig. 119, to adjust bearing to zero end play. (All bearing rollers should rotate as ring gear is rotated, but it should not be possible to move the rollers sideways in their cage.)

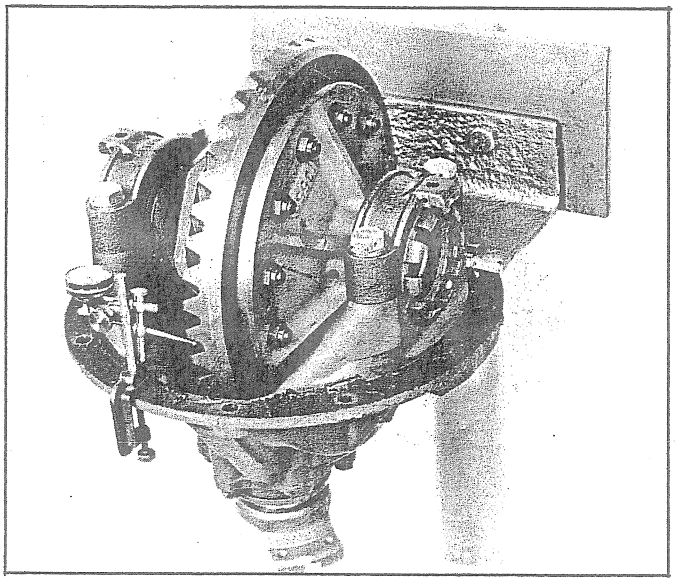


Fig. 120 - Checking Ring Gear and Pinion Backlash

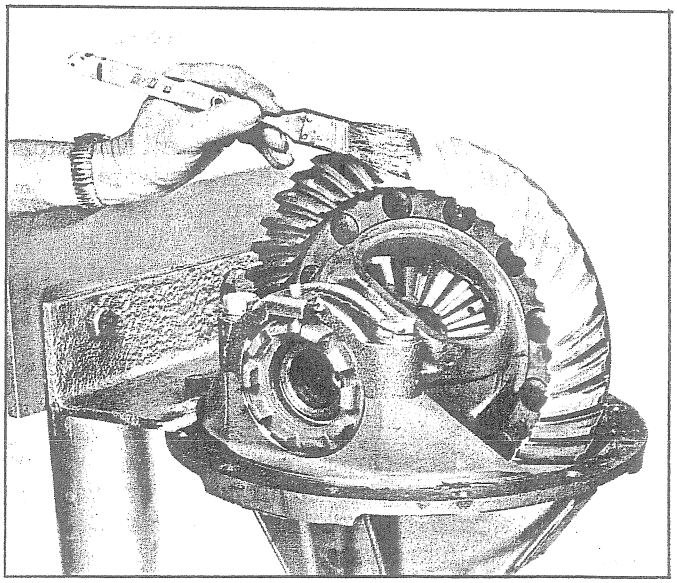
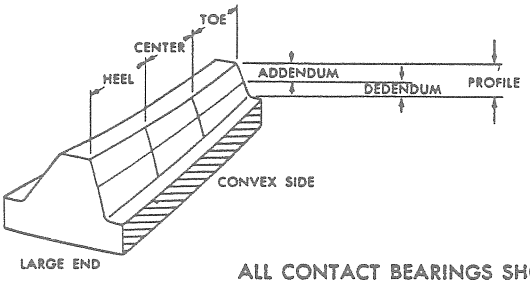
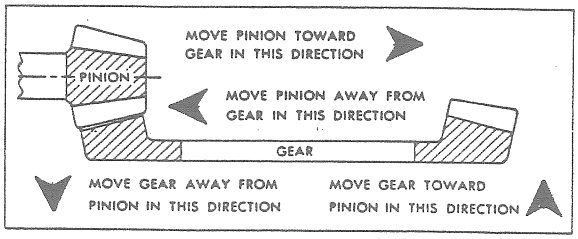


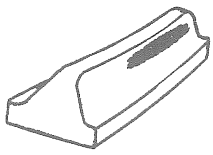
Fig. 122 - Preparation for Checking Tooth Contact

SPIRAL BEVEL AND HYPOID TOOTH BEARING CONTACT CHART

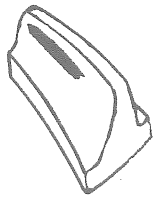


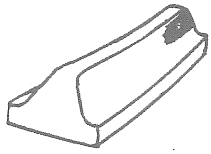


ALL CONTACT BEARINGS SHOWN BELOW ARE ON RIGHT HAND SPIRAL RING GEAR — THE DRIVE IS ON THE CONVEX SIDE OF THE TOOTH.

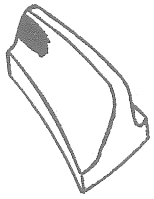


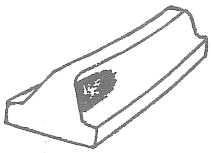
TYPICAL PREFERRED BEARING ON BOTH SIDES OF TOOTH WHILE UNDER A LIGHT LOAD



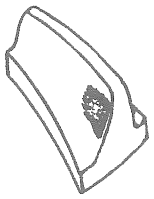


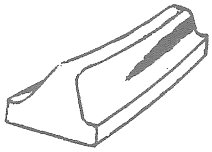
TOE BEARING ON BOTH SIDES OF TOOTH — GEAR SET NOISY. TO MOVE BEARING TOWARD HEEL INCREASE BACKLASH WITHIN LIMITS BY MOVING GEAR AWAY FROM PINION.



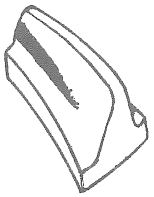


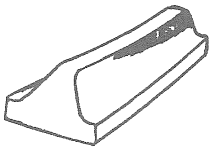
HEEL BEARING ON BOTH SIDES OF TOOTH — GEARSET NOISY AND COULD RESULT IN EARLY GEAR FAILURE. TO MOVE BEARING TOWARD TOE DECREASE BACKLASH WITHIN LIMITS BY MOVING GEAR TOWARD PINION.



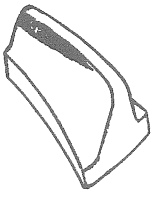


LOW BEARING ON GEAR AND HIGH BEARING ON PINION. CORRECT BY PULLING PINION AWAY FROM GEAR (INCREASE MOUNTING DISTANCE).





HIGH BEARING ON GEAR AND LOW BEARING ON PINION. CORRECT BY MOVING PINION IN TOWARD GEAR (DECREASE MOUNTING DISTANCE.



BACKLASH

BACKLASH SHOULD BE MEASURED WITH A DIAL INDICATOR RIGIDLY MOUNTED WITH THE STEM PERPENDICULAR TO THE TOOTH SURFACE AT THE EXTREME HEEL. THE AMOUNT SHOULD VARY FROM .007 TO .014 DEPENDING UPON THE PITCH OF THE GEAR — FINE PITCHES BEING NEAR THE LOW SIDE AND COARSER PITCHES NEAR THE HIGH SIDE.

Tooth Contact Chart

Fig. 123 - Tooth Contact Chart

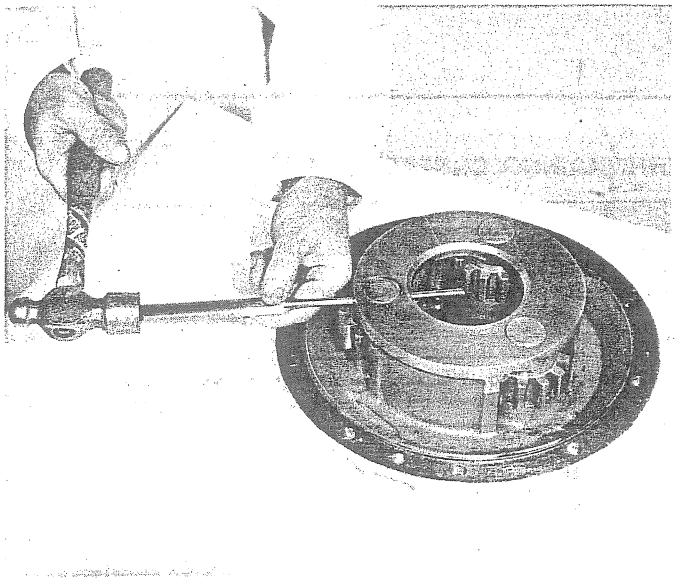


Fig. 124 - Removing Pin

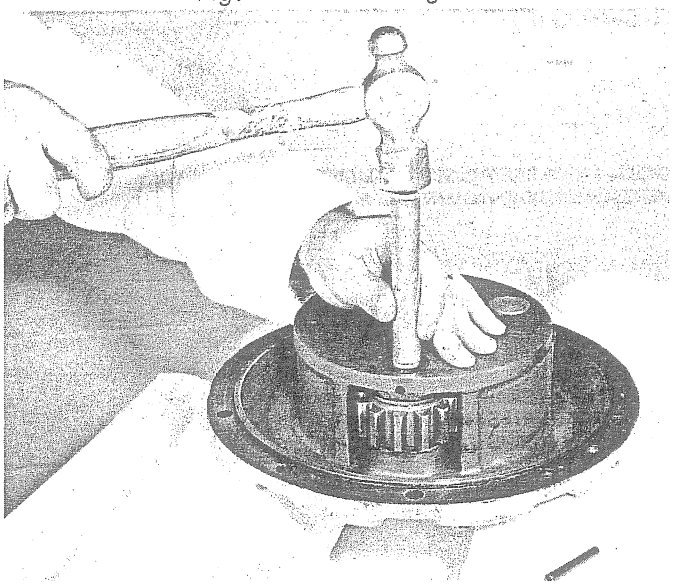


Fig. 125 - Removing Pinion Shaft

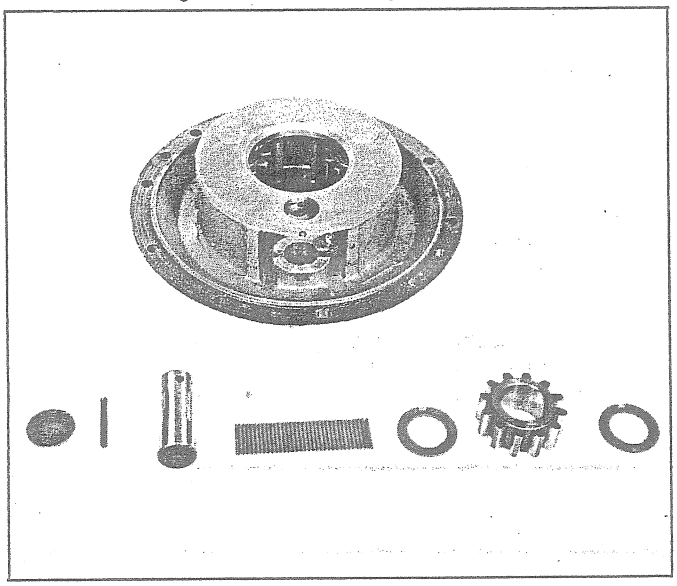


Fig. 126 - Planetary Pinion and Related Parts

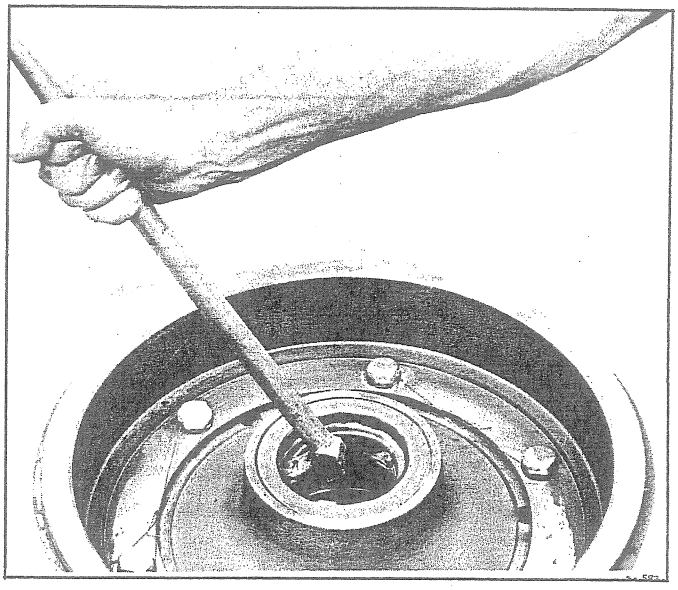


Fig. 127 - Removing Oil Seal

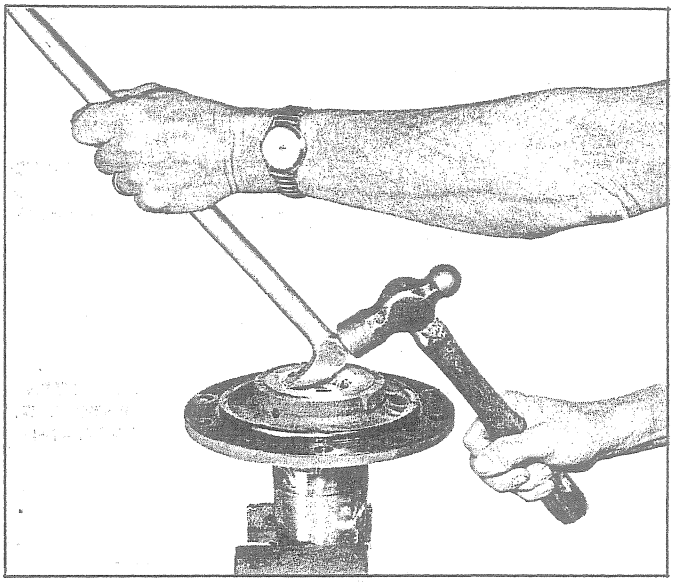


Fig. 128 - Removing Thrust Washer

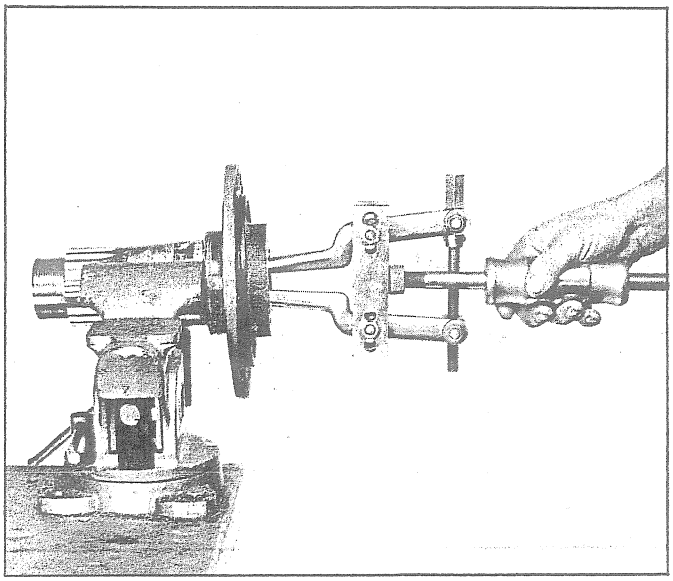


Fig. 129 - Removing Spindle Bushing

19. Use a dial indicator as shown in Fig. 120 to check backlash between ring gear and pinion. Backlash is to be .008-.013 in., if new gear set is used, or the backlash noted at disassembly, if the gear set is not being replaced. Adjust as follows:

a. Loosen one of the adjusting nuts, noting the amount of turns.

b. Tighten the opposite adjusting nut this same amount of turns.

c. Move the ring gear "in" (toward pinion) to decrease backlash, or "out" to increase backlash.

20. Tighten bearing cap bolts to 115-125 ft.-lbs. torque.

21. Use a dial indicator, as shown in Fig. 121, to check the back face of ring gear runout. Runout must not exceed .007 in. total indicator reading.

22. Install adjusting nut lock pins and secure with cotter pins. Lockwire bearing cap bolts to prevent them from loosening.

23. Paint ring gear teeth, as shown in Fig. 122, then rotate ring gear one complete revolution to check tooth pattern of pinion to ring gear. Refer to tooth pattern chart shown in Fig. 123.

SERVICING PLANETARY ASSEMBLY

1. To disassembly planetary, proceed as follows:

a. Remove roll pin, as shown in Fig. 124.

b. Block planetary to allow pinion shaft to be removed, then remove pinion shaft as shown in Fig. 125. As pinion shaft is removed, the expansion plug (toward outside of housing) will also be removed.

c. Remove thrust washers, pinion and pinion needle rollers. Take care not to lose rollers. See Fig. 126.

2. Inspect the general condition of the planetary assembly parts and the sun gear (on axle shaft) for evidence of damage or wear.

3. Reassemble planetary as follows:

a. Place planetary with axle side "up" on work bench.

b. Coat inside of pinion with grease to retain the rollers. Then position 34 needle rollers into pinion.

c. Position pinion (with rollers) and lower thrust washer into the planetary. The tang in thrust washer must engage groove in planetary.

d. Slide top of thrust washer into position-then insert pinion shaft so that hole in shaft aligns with hole in housing.

e. Install lock pin through housing and hole in pinion shaft.

f. Turn housing over and install expansion plug(s).

SERVICING HUB AND BRAKE DRUM ASSEMBLY

1. Pry oil seal from hub as shown in Fig. 127.

2. Inspect bearing. If bearing requires replacement, the bearing cone and cup both must be replaced.

3. If it is necessary to separate the brake drum from the hub, "match mark" hub and drum to ensure correct reassembly. Remove retaining bolts and separate the drum from the hub.

4. Reinstall drum to hub, aligning "match marks." Secure with bolts tightened to 160-180 ft.-lbs. torque. Lockwire bolts in pairs. See Fig. 127.

5. Coat outside diameter of new oil seal with Permatex No. 2. Press new seal into hub with spring-loaded lip of seal inward (toward bearing).

SERVICING SPINDLE ASSEMBLY

1. Remove bronze thrust washer as shown in Fig. 128.

2. Pry oil seal from spindle.

3. Use a puller and slide hammer arrangement as shown in Fig. 129 to remove spindle bushings, if damaged or worn.

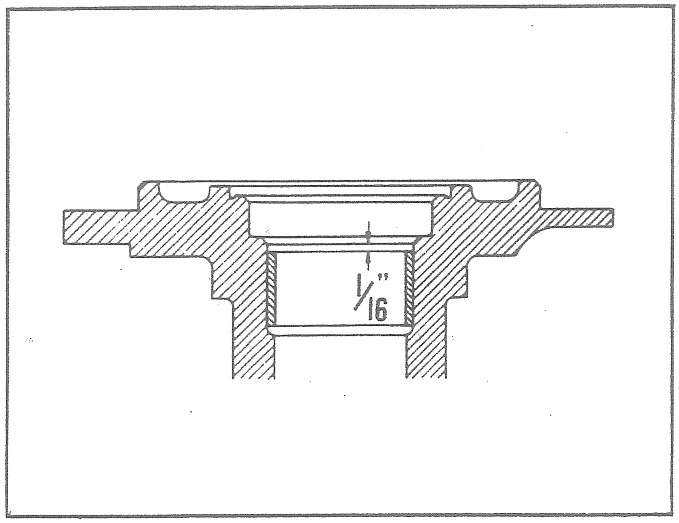


Fig. 130 - Correct Bushing Location

4. Press new bushing (if removed) into spindle with the bushing positioned 1/16 in. lower than chamfer of spindle seal seat. See Fig. 130.

5. Coat outside diameter of new oil seal with Permatex No. 2. Press seal into spindle. Lip of seal must be toward spindle bushing.

6. Install bronze thrust washer into spindle and stake in four places.

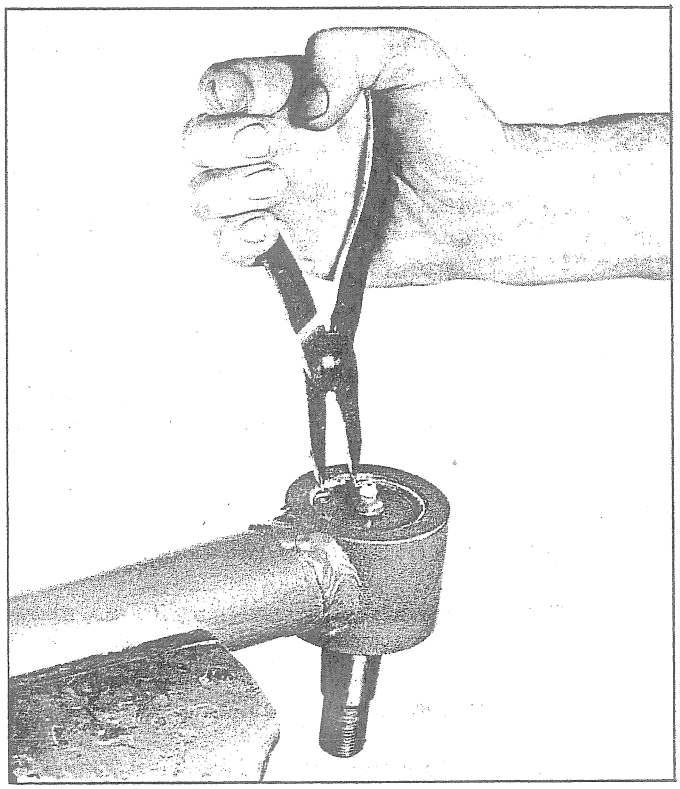


Fig. 131 - Removing Retaining Ring

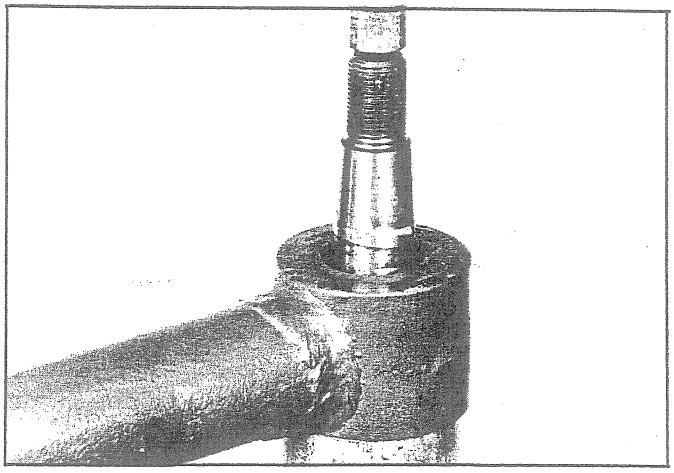


Fig. 132 - Pressing Ball Stud from Housing

SERVICING TIE ROD

1. Remove retaining ring as shown in Fig. 131. Then remove ball stud retaining plate.

2. Press ball stud from tie rod housing as shown in Fig. 132.

3. Press new ball stud and bushing into tie rod housing as shown in Fig. 133.

NOTE: Press only on bushing when reinstalling ball stud. Do not press on center of ball stud.

4. Place ball stud retaining plate into recess on tie rod housing.

5. Install retaining ring to secure plate.

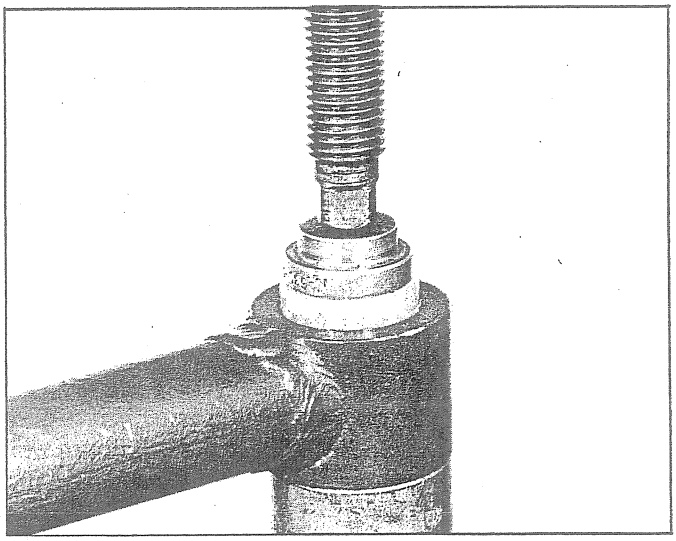


Fig. 133 - Installing New Ball Stud and Bushing into Housing

PART 6 — DRIVE AXLE — RIGID

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DESCRIPTION

The MF 33 Tractor Shovel may have a rigid drive axle either at the front or the rear of the unit.

The axle assembly consists of a conventional pinion, ring gear and differential, axle shafts, brake assemblies and planetary reduction hubs.

The differential assembly is a bevel gear and pinion type. The planetary is a three pinion reduction gear type located in the wheel hub.

REMOVAL AND INSTALLATION

To remove and install the drive axle as an assembly, refer to the appropriate sub-head under the heading "Removal and Installation" in Part 5. (i.e.: Front or Rear Drive Steer Axle). The procedures will be the same except disconnecting the drag link.

SERVICING THE RIGID DRIVE AXLE

The following instructions are with the drive axle removed from the unit. The procedures are to be used to completely disassemble the drive axle. However, it should be noted that certain components (sub-assemblies, etc.) may be removed and serviced without completely disassembling the drive axle (i.e.: brakes, flange couplings, oil seals, etc.). Fig. 1 shows a view of the drive axle mounted on a stand.

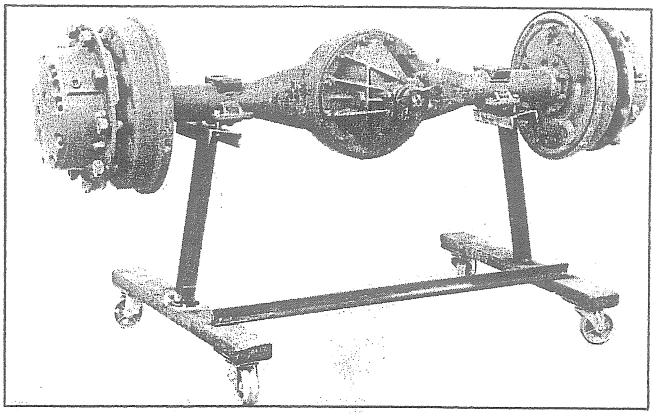

Fig. 1 - Rigid Drive Axle Mounted on Stand

DISASSEMBLY

1. Drain the oil from the planetary housings and the differential housing.

2. Remove the bolts and washers securing the planetary assembly to the axle hub. Screw two of the bolts into the puller holes and separate the planetary assembly from the hub as shown in Fig. 2.

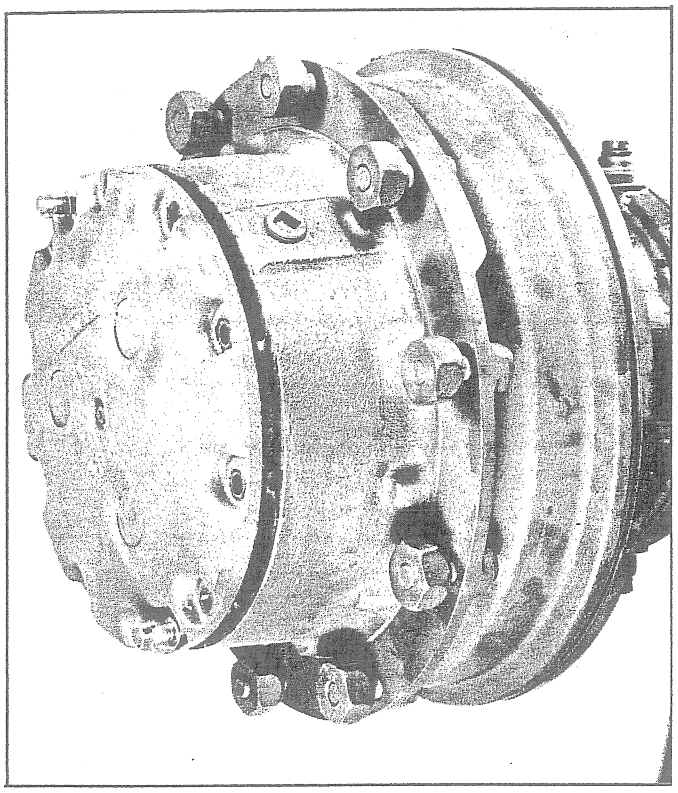

Fig. 2 - Separating Planetary from Hub

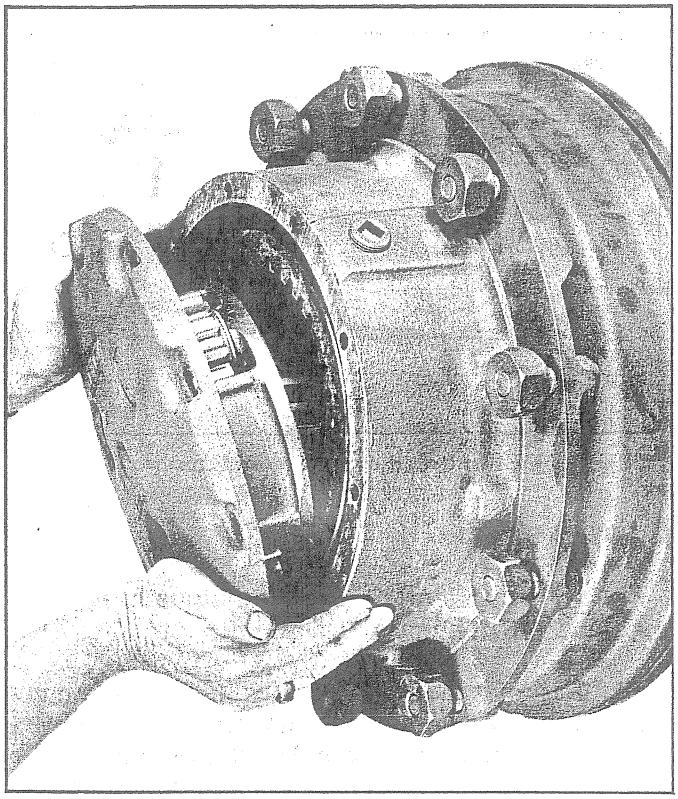

Fig. 3 - Removing or Installing the Planetary

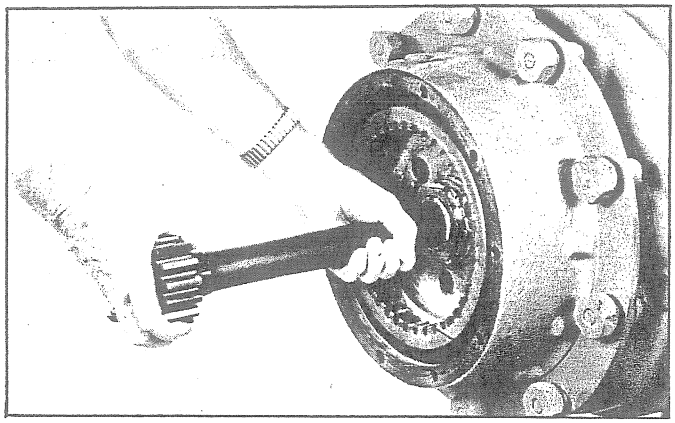

Fig. 4 - Removing or Installing Sun Gear and Axle

3. Remove planetary assembly as shown in Fig. 3. For service procedures, refer to "Servicing Planetary Assembly" under the heading "Servicing Rear Drive Steer Axle", in Part 5.

4. Remove sun gear and axle as an assembly as shown in Fig. 4.

5. Straighten the tangs on the lock that secures the spindle nuts. See Fig. 5.

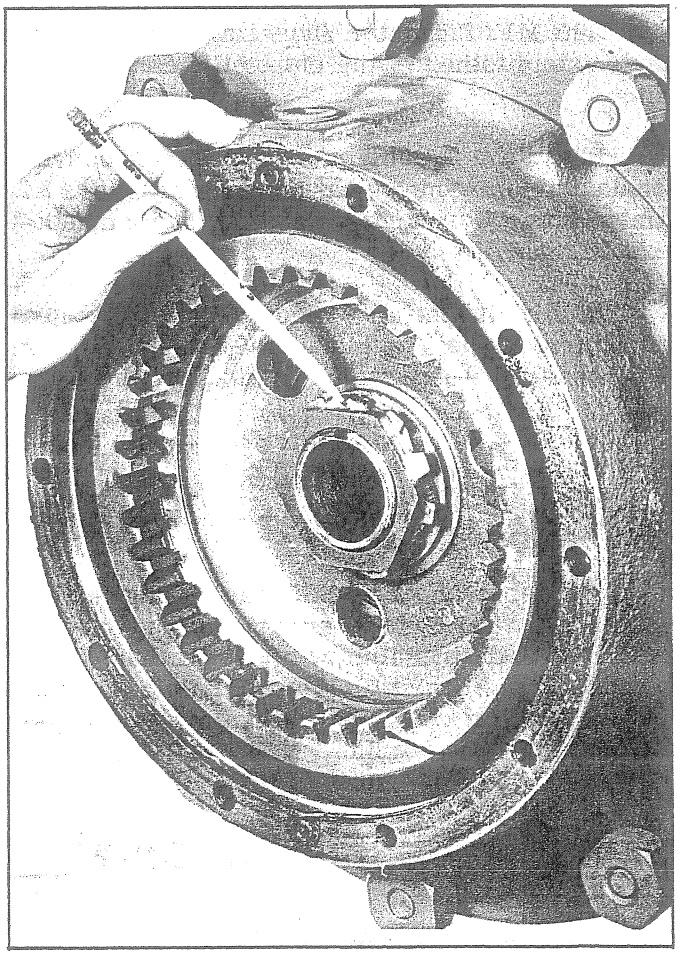

Fig. 5 - View Showing Nuts Locked with Tang

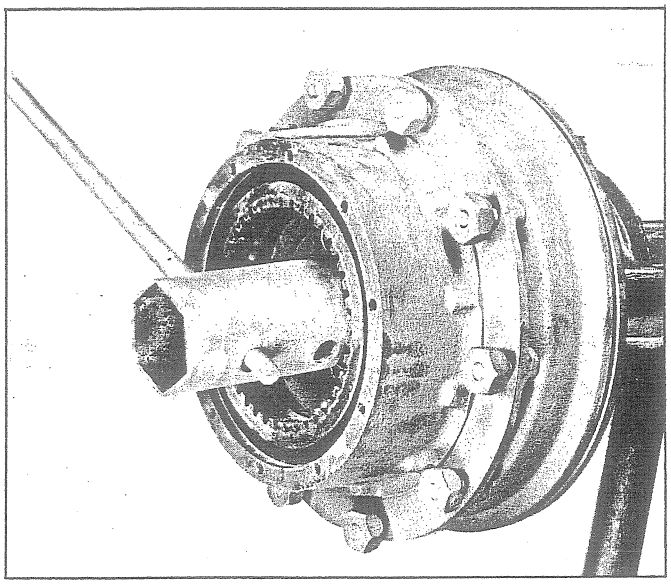

Fig. 6 - Removing or Installing Spindle Nuts

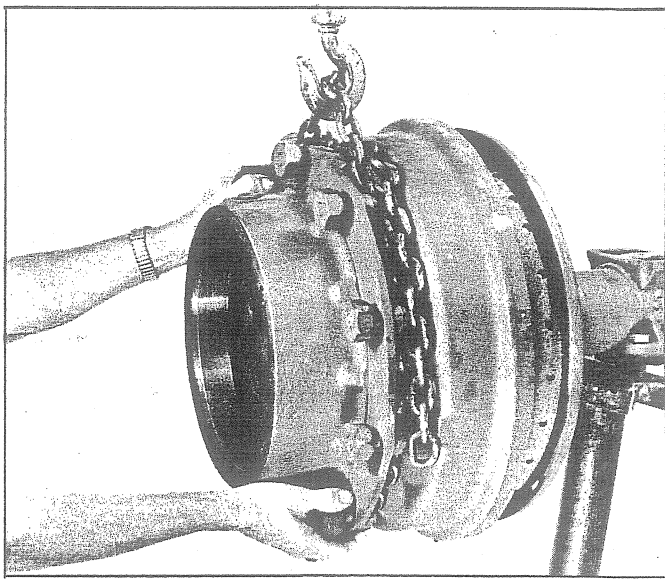

Fig. 8 - Removing or Installing Brake Drum and Hub

6. Use special tool, as shown in Fig. 6 and remove the nuts from the spindle.

7. Support the weight of the brake drum and hub assembly -- then remove internal planetary ring gear as shown in Fig. 7.

8. With the drum and hub still supported, pull brake drum and hub assembly from spindle as shown in Fig. 8.

9. Remove the bolts and nuts securing the brake assembly to the axle housing and remove the brake and backing plate as an assembly, see Fig. 9.

10. Follow the preceeding steps to disassemble the opposite side of the axle.

SERVICE INFORMATION: To remove the differential assembly, it will be necessary to remove both axle shafts.

11. To remove the differential assembly from the axle housing, it will be necessary to support it adequately to maintain proper alignment. This may be done in the following ways:

a. If the axle housing is rotated in a manner so that the differential is upward, a suitable hoist may be attached to the companion flange, the

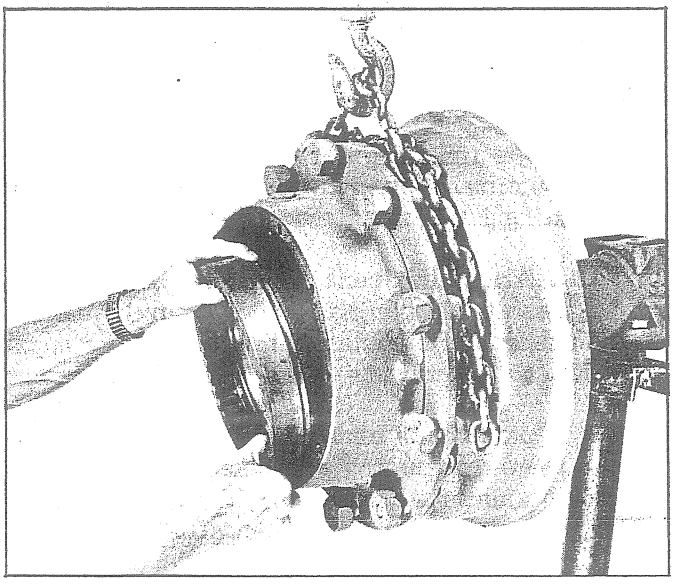

Fig. 7 - Removing or Installing Internal Planetary Ring Gear

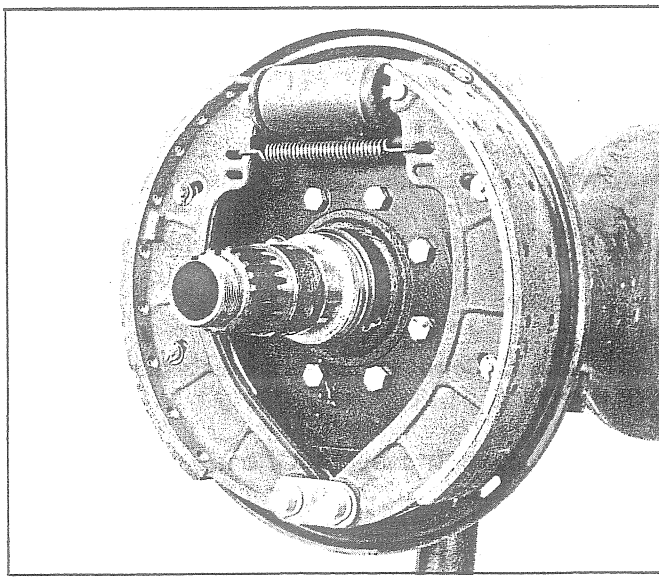

Fig. 9 - Brake and Backing Plate Attached to Axle

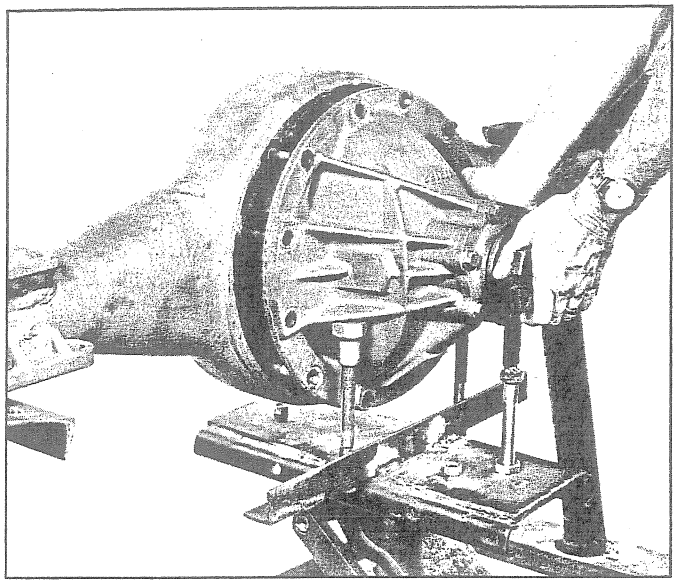

Fig. 10 - Removing or Installing Differential Assembly

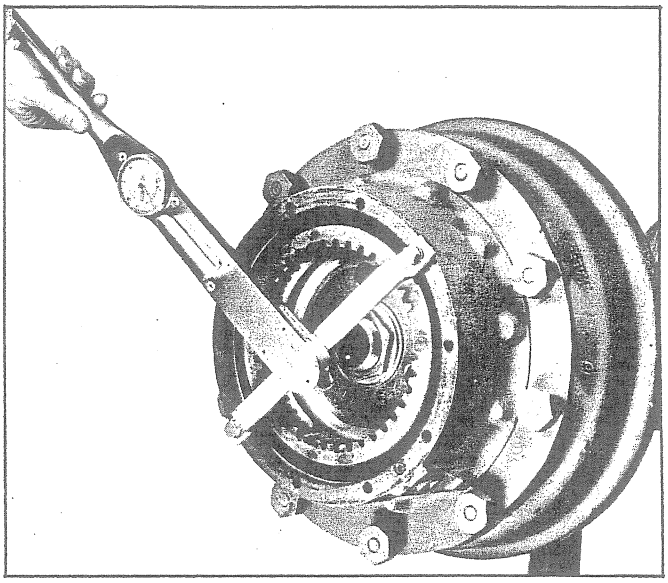

Fig. 11 - Checking Rolling Torque on Hub Bearings

retaining nuts removed and the assembly lifted straight upward from the housing.

b. If the axle housing is on a stand with the differential in a normal position (such as when mounted on the unit), attach a suitable pad to the differential assembly and to a floor jack, remove retaining nuts and roll differential from the axle housing as shown in Fig. 10.

If the differential assembly requires servicing, refer to "Servicing Differential Assembly" under the heading "Rear Drive Steer Axle" in Part 5.

CLEANING AND INSPECTION

Clean all parts in a suitable solvent and dry with compressed air or a lint free cloth.

NOTE: Do not allow any of the bearings to spin when blowing dry with compressed air.

1. All seals, gaskets, retaining rings, etc., should be replaced.

2. Carefully inspect all bearings and their cups for wear, chipping or nicks. When replacing a bearing cone, or cup, always replace the mating part at the same time. After inspection, dip in clean oil and wrap to protect them until they are installed.

3. Examine the gears and shafts for wear, pitting, chipping, nicks, cracks or scoring. If gears show spots where case hardening is worn through, replace them. Small nicks may be removed with a suitable hone.

4. Inspect housings, covers and differential case to be certain that they are thoroughly clean. Make certain that the housings' mating surfaces and bearing bores are free from nicks or burrs. There should be no evidence of cracks, or other conditions which would cause oil leaks.

REASSEMBLY

The following procedures assume that the differential, planetary, hub and brake drum, and brake backing plate assemblies have been previously assembled as units.

Apply a light coating of Permatex No. 2 to the face of the housings' mating surfaces before reinstalling into the axle housing.

1. Align differential assembly to the axle housing as shown in Fig. 10. Secure the differential assembly to the axle housing with retaining nuts. Tighten nuts to 50-55 ft.-lbs. torque.

2. Position the brake backing plate assembly to the axle housing and secure with retaining bolts and nuts as shown in Fig. 9. Tighten retaining bolts to 85-95 ft.-lbs. torque.

3. Support hub and brake drum assembly with a suitable hoist -- then work into position over axle as shown in Fig. 8.

4. With the hub and drum still supported by the hoist, slide planetary ring gear over axle housing as shown in Fig. 7.

5. Install flatwasher and inner nut. Tighten inner nut as shown in Fig. 6 while rotating the hub until there is a slight drag.

6. Attach special tool to hub and check rolling torque as shown in Fig. 11. The rolling torque on new bearings should be 10-15 ft.-lbs. and 5-10 ft.-lbs. on used bearings. Tighten or loosen inner nut to obtain the proper rolling torque.

7. Install lock tang washer and outer nut. Tighten outer nut securely then bend tangs on lock to secure both nuts. See Fig. 5.

8. Install axle shaft and sun gear as shown in Fig. 4.

9. Position planetary assembly on axle so that planetary gears engage ring gear and sun gear as shown in Fig. 3. Secure with retaining bolts and tighten to 50-55 ft.-lbs. torque.