

## REAR AXLE

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### 11-1. GENERAL

Full-floating front and rear axles are standard on the vehicles.

The axle model number is cast into the housing as illustrated in Fig. 11-1.

A metal tag under two of the differential housing cover screws is stamped to identify the number of teeth in the drive gear and pinion, Fig. 11-1.

To determine the axle ratio, divide the larger number (ring gear teeth) by the smaller number (pinion teeth). This section contains information for servicing the rear axles. Information for wheel bearing adjustment is given in Section 13.

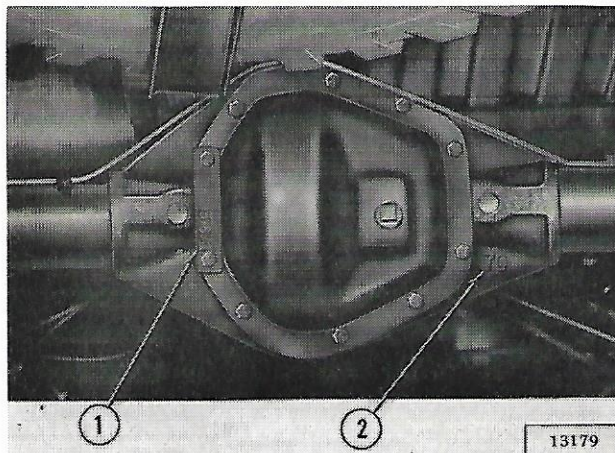


FIG. 11-1—AXLE MODEL AND RATIO IDENTIFICATION

1—Ratio

2—Axle Model

### 11-2. Rear Axle Shaft Removal and Installation

Refer to Fig. 11-2.

To remove the full-floating axle shaft, it is not necessary to jack up the rear wheels. Procedure is as follows:

a. Remove the axle flange nuts, lockwashers, lift hook bracket, and split washers holding the axle shaft flange.

b. Pull the axle shaft free from the housing.

c. A broken axle shaft can be removed from a full-floating axle by removing the opposite axle shaft and inserting a pipe which will drive the broken axle shaft out.

The installation of the rear axle shaft is the reverse of the removal.

### 11-3. Inspection and Servicing

Refer to Fig. 11-2.

Servicing of the differentials of both front and rear axles is covered in Par. 11-5 through 11-11. Before disassembling the differential, it is advisable to determine through inspection the cause of the failure. Inspection procedure is as follows:

a. Drain lubricant and remove housing cover and gasket.

b. Clean the differential parts thoroughly with solvent.

c. Carefully inspect all parts.

Should it be determined by inspection that the differential requires overhauling, the axle must first be removed from the vehicle.

**Note:** All service replacement axle assemblies are shipped from the factory without lubricant in the differential. Lubricant must be added to the differential before the axles are installed in vehicles. Use the grade and quantity of lubricant specified in the appropriate service manual. After the axle has been installed in the vehicle, check to be sure the lubricant level in the differential is up to the filler plug opening.

### 11-4. Rear Axle Removal

To remove the rear axle, proceed as follows:

a. Raise the rear of the vehicle with a hoist. Safely support the frame ahead of the rear springs.

b. Remove the wheels.

c. Disconnect the propeller shaft at the rear yoke.

d. Disconnect the shock absorbers at the axle mounting.



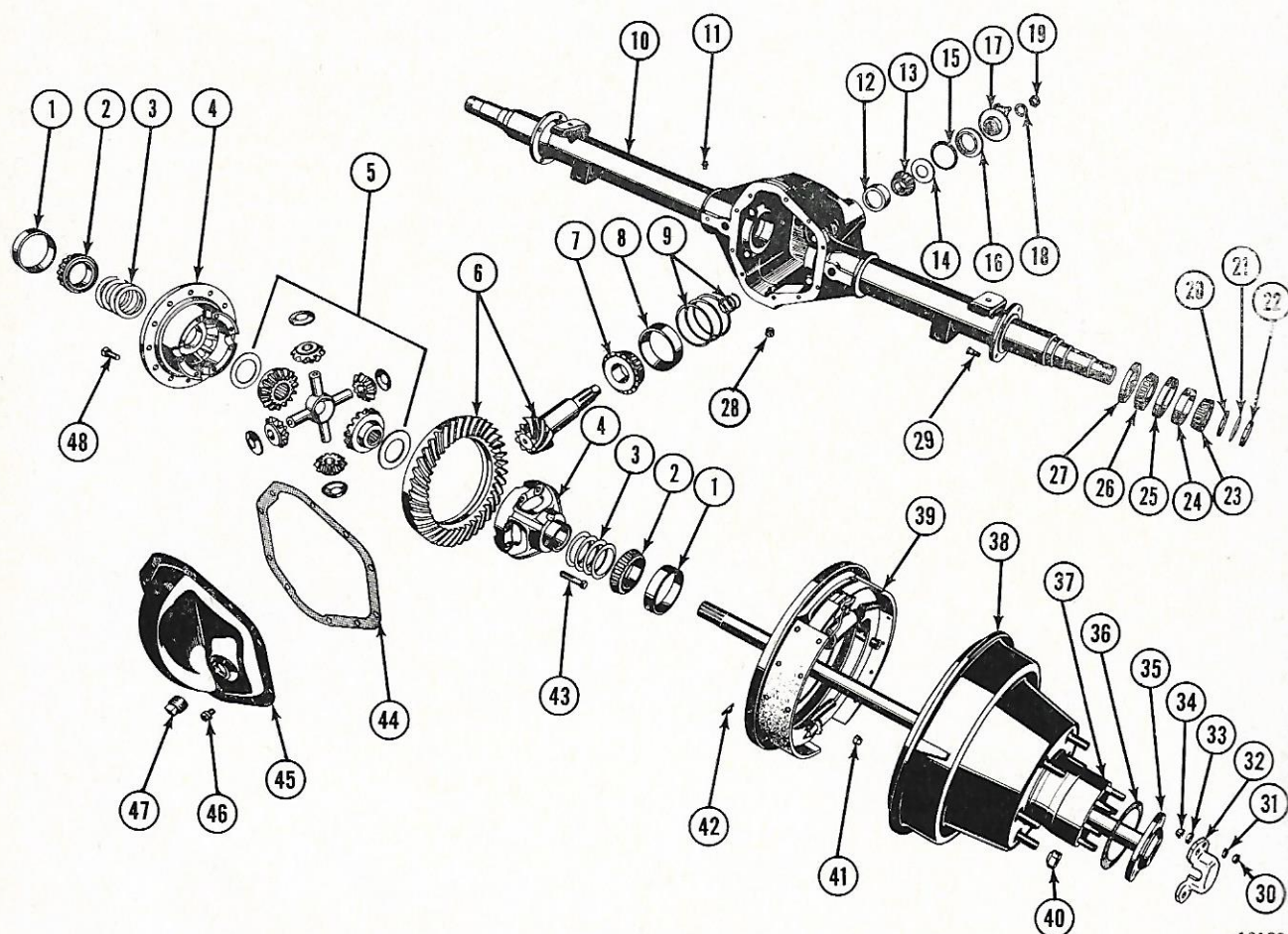


FIG. 11-2—FULL-FLOATING REAR AXLE

- |  |                                   |                          |
|--|-----------------------------------|--------------------------|
| 1—Differential Bearing Cup               | 17—Yoke                           | 33—Spacer                |
| 2—Differential Bearing Cone and Rollers  | 18—Washer                         | 34—Split Lock Washer     |
| 3—Shims                                  | 19—Nut                            | 35—Axle Shaft            |
| 4—Differential Case                      | 20—Nut and Pin                    | 36—Gasket                |
| 5—Differential Gear Set                  | 21—Lock Washer                    | 37—Hub                   |
| 6—Ring Gear and Pinion                   | 22—Nut                            | 38—Brake Drum            |
| 7—Pinion Inner Bearing Cone and Rollers  | 23—Outer Bearing Cone and Rollers | 39—Brake Assembly        |
| 8—Pinion Inner Bearing Cup               | 24—Outer Bearing Cup              | 40—Wheel Lug Nut         |
| 9—Pinion Shims                           | 25—Inner Bearing Cup              | 41—Nut                   |
| 10—Axle Housing                          | 26—Inner Bearing Cone and Rollers | 42—Dust Plug             |
| 11—Vent Plug                             | 27—Seal                           | 43—Cap Screw             |
| 12—Pinion Outer Bearing Cup              | 28—Drain Plug                     | 44—Cover Gasket          |
| 13—Pinion Outer Bearing Cone and Rollers | 29—Bolt                           | 45—Housing Cover         |
| 14—Oil Slinger                           | 30—Nut                            | 46—Screw and Lock Washer |
| 15—Yoke Gasket                           | 31—Lock Washer                    | 47—Filler Plug           |
| 16—Pinion Oil Seal                       | 32—Lifting Bracket                | 48—Cap Screw             |

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e. Disconnect the brake hydraulic hose at the bracket on the tubular cross member near the right frame side rail. Tape end of hose to keep out dirt. Disconnect breather hose.

f. Support the axle on a jack.

g. Remove the axle U-bolts.

h. Slide the axle from under the vehicle.

### 11-5. Axle Disassembly

Refer to Fig. 11-2.

Procedure for disassembling the differential on full-floating axle is as follows:

a. Remove the axle shafts. Refer to Par. 11-2 for rear axle removal.

b. Remove the housing cover and four cap screws

holding the two differential side bearing caps in position. Make sure there are matching letters or some type of identification marks on the caps and housing so that each cap can be reinstalled in the same position and location from which it is removed.

c. Use Spreader W-129 as shown in Fig. 11-3 to spread the housing. Install Hold-Down Clamps, to keep the spreader in position. Clamp on a dial indicator. From the side, measure the carrier spread. Do not spread the carrier more than .020".

d. Remove the dial indicator.

e. Carefully pry the differential case loose, using pry bars at the heads of the ring gear bolts and carrier casting.

f. Remove spreader immediately to prevent the



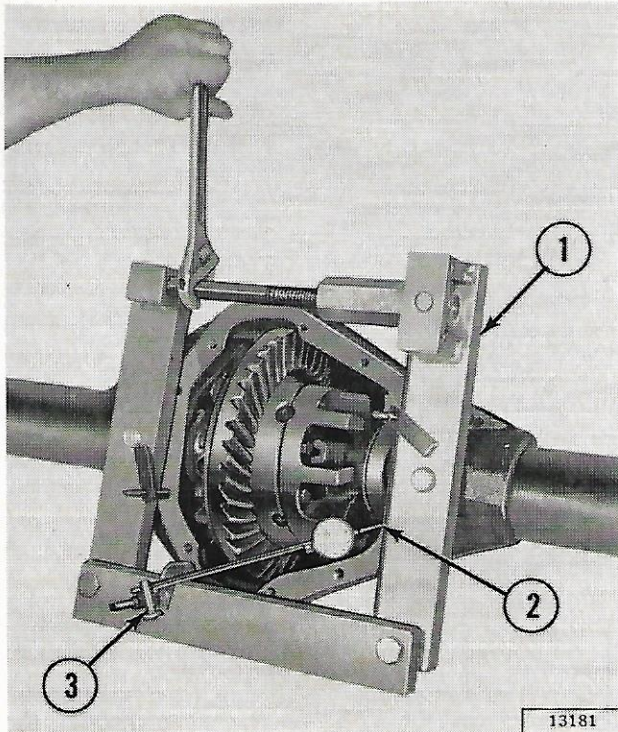


FIG. 11-3—DIFFERENTIAL CARRIER SPREADER

- 1—Spreader W-129
- 2—Dial Indicator and Pointer
- 3—Dial Indicator Clamp

possibility of the carrier taking a set.

**g.** Remove the screws holding the ring gear to the differential case.

**h.** Mark the case halves for reassembly in their same relationship.

**i.** Separate differential case halves by removing attaching cap screws.

**j.** Carefully so as not to lose the thrust washers, remove the differential gear set.

**k.** With Tool C-3281 to hold the shaft as shown in

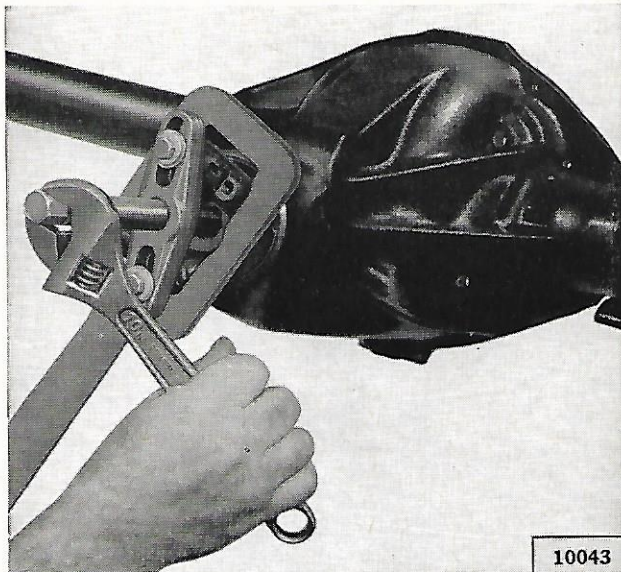


FIG. 11-5—END YOKE PULLER

Fig. 11-4, remove the nut. With Puller W-172 remove the yoke as shown in Fig. 11-5.

**l.** Remove pinion oil seal using Pinion Oil Seal Puller W-286, as shown in Fig. 11-6.

**m.** With a hammer and brass drift, drive on the end of the pinion shaft to force the pinion into the differential housing so that it may be removed.

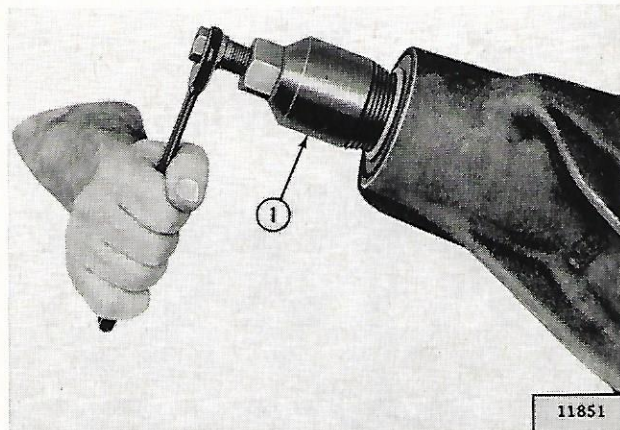


FIG. 11-6—PINION OIL SEAL PULLER

- 1—Tool W-286

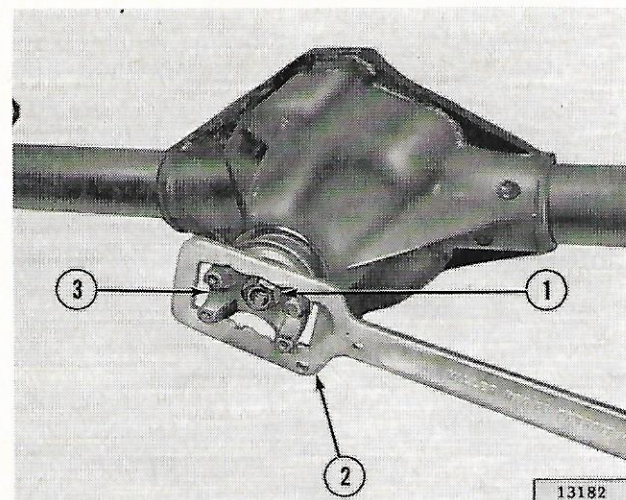


FIG. 11-4—END YOKE HOLDING WRENCH

- 1—Nut
- 2—Wrench C-3281
- 3—Yoke

## 11-6. Pinion and Case Bearings

Refer to Fig. 11-2.

**a.** To remove differential bearing cones and rollers on model 70 rear axle and model 60 front axle, use Tool DD-914P with Holding Ring DD-914-8 and Adapter DD-914-62, as shown in Fig. 11-7.

**b.** To remove the Model 70 rear axle pinion inner bearing cone and rollers, use Tool DD-914P with Holding Ring DD-914-8 and Adapter DD-914-95, as shown in Fig. 11-8. To remove the Model 60 front axle pinion bearing cone and rollers, use



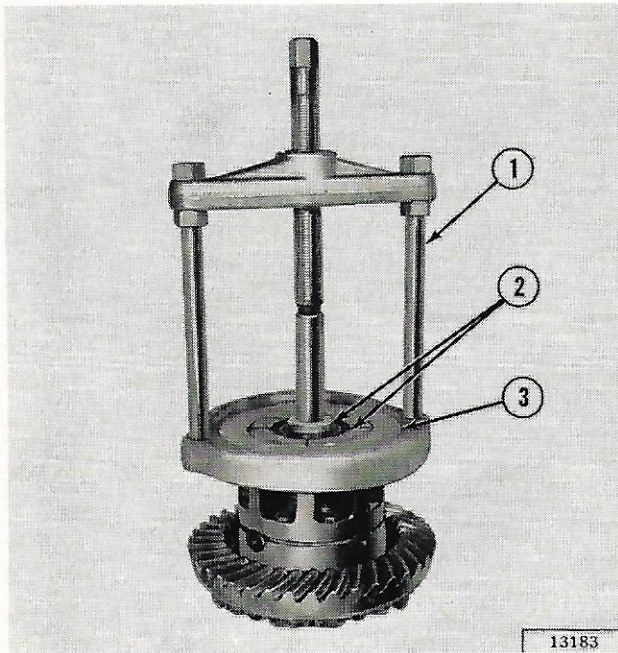


FIG. 11-7—DIFFERENTIAL BEARING CONE AND ROLLER REMOVAL

1—Press DD-914-P  
2—Adapter DD-914-62  
3—Holding Ring DD-914-8

Tool DD-914P with Holding Ring DD-914-9 and Adapter C-293-37. When using an Arbor Press, DD-914-7 Extension and DD-914-42 Button are used.

### 11-7. Pinion Bearing Cup Removal

Refer to Figs. 11-9 and 11-10.

To remove the pinion inner and outer bearing cups,

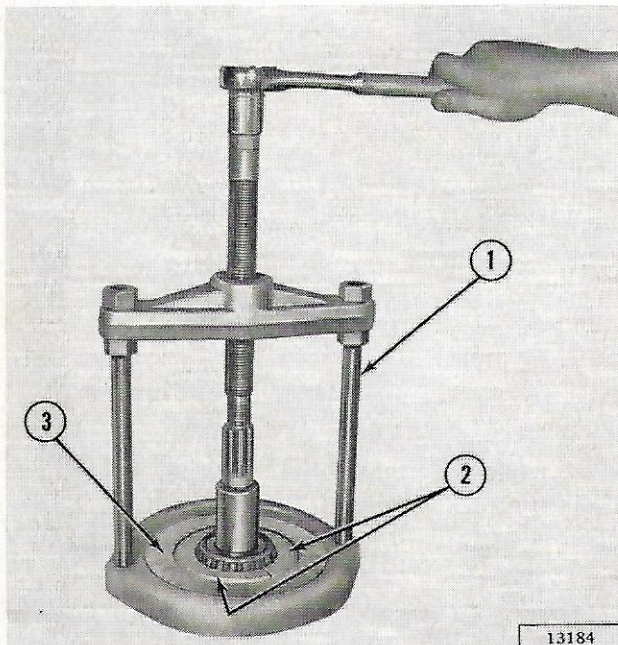


FIG. 11-8—PULLING INNER PINION BEARING

1—Press DD-914-P  
2—Adapter DD-914-95  
3—Holding Ring DD-914-8

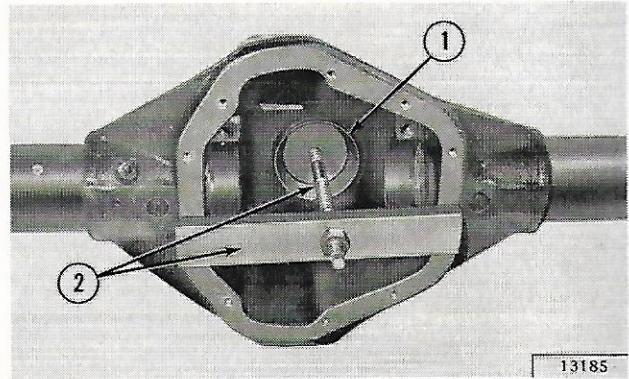


FIG. 11-9—PINION INNER BEARING CUP REMOVAL

1—Bearing Cup  
2—Tool W-100-60-70

use Tool W-100-60-70, with its adapter plates. Remove the inner bearing cup first

Procedure for removal is as follows:

a. Remove the hex nuts from each end of Tool W-100-60-70.

b. From the housing cover end, carefully insert the round adapter with two flat sides through the inner bearing cup and position it behind the bearing cup shoulder.

c. Insert the short-threaded end of the main puller screw through the hole in this adapter and secure the adapter with a hex nut.

d. Position the plate across the open face of the differential housing and secure with a hex nut.

e. Make sure the adapter plate sets flat against the pinion rear bearing adjusting shims. Turn down the nut to remove the bearing cup.

f. Remove Tool W-100-60-70 from housing cover end.

g. Attach Tool W-100-60-70 at yoke end of housing.

h. Insert adapter behind shoulder of outer bearing cup.

i. Make sure the adapter plate sets flat against the pinion outer bearing adjusting shims. Turn down the nut to remove the bearing cup.

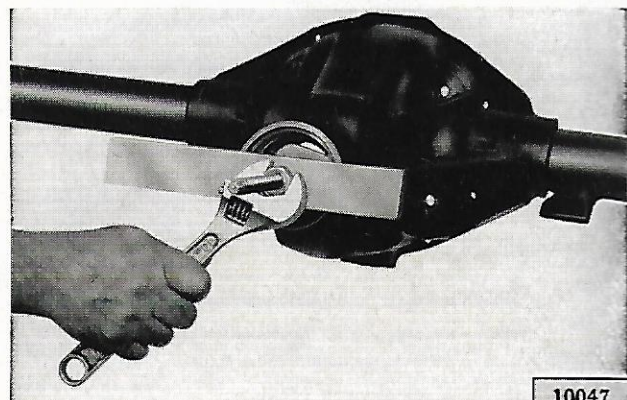


FIG. 11-10—PINION OUTER BEARING CUP REMOVAL



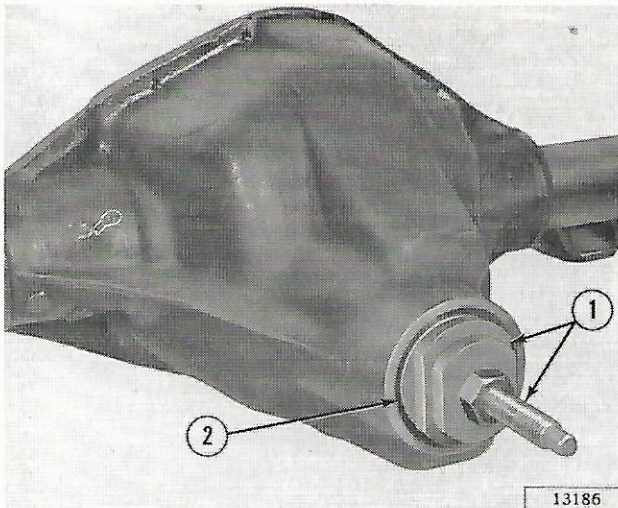


FIG. 11-11—INSTALLING OUTER BEARING CUP

1—Tool W-100-60-70  
2—Outer Bearing Cup

### 11-8. Pinion Installation and Adjustment

Adjustment of the pinion is accomplished by the use of shims placed between the inner bearing and the axle housing and between the pinion shoulder and the outer bearing. The shims behind the inner bearing adjust the position of pinion in relation to the ring gear. The shims behind the outer bearing adjust the pinion inner and the outer bearing preload. Install the pinion as follows:

- Install outer bearing cup using Tool W-100-60-70, as shown in Fig. 11-11.
- Install the inner bearing cup using Tool 100-60-70, to pull the cup into the housing. See Fig. 11-12.
- Use Tool C-3095 to press the inner bearing cone and roller onto the pinion shaft, as shown in Fig. 11-13.
- Place the pinion in the housing and install a .065" shim, the inner cone and roller, and the pinion nut.
- Select the proper pinion adjusting gauge to obtain the correct reading. The pinion adjusting fixture must first be set by the use of a master

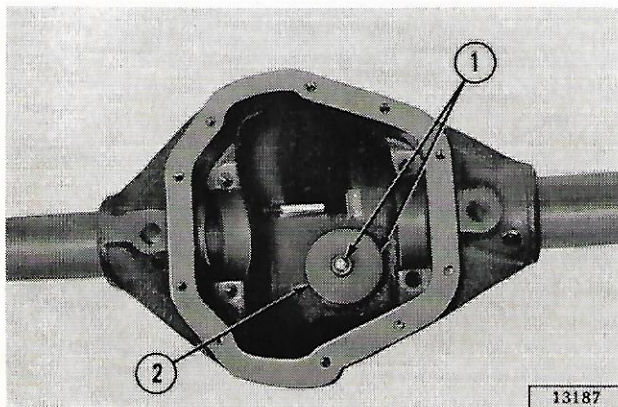


FIG. 11-12—INSTALLING INNER BEARING CUP

1—Tool W-100-60-70  
2—Inner Bearing Cup

gauge which is included in the W-99-B-60-70 kit. The gauge block supplied with the W-99-B-60-70 Master Gauge Set is stamped with the letter J. Use the J step for setting the Model 60 axle

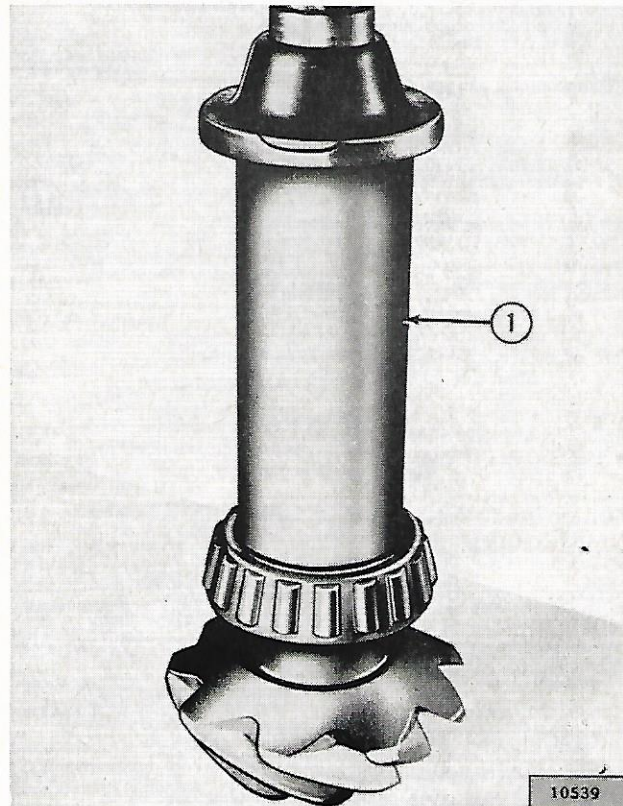


FIG. 11-13—PINION BEARING  
INSTALLING SLEEVE

1—Sleeve C-3095

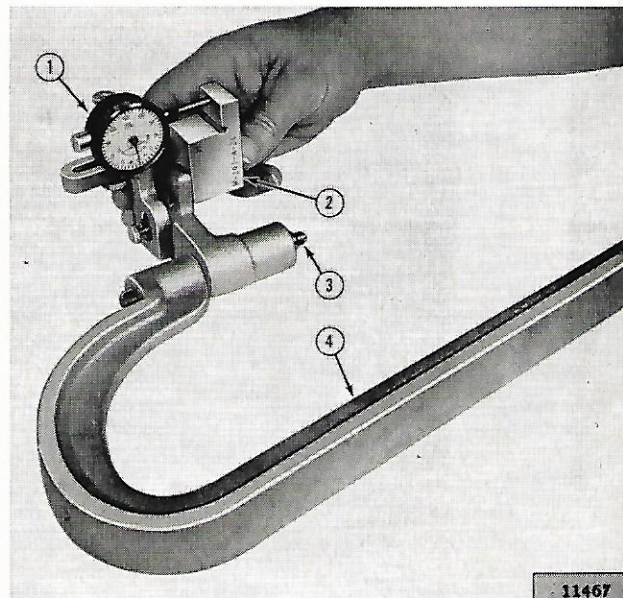


FIG. 11-14—SETTING PINION GEAR

1—Dial Indicator  
2—Gauge Block  
3—Stationary Pin  
4—C-Clamp



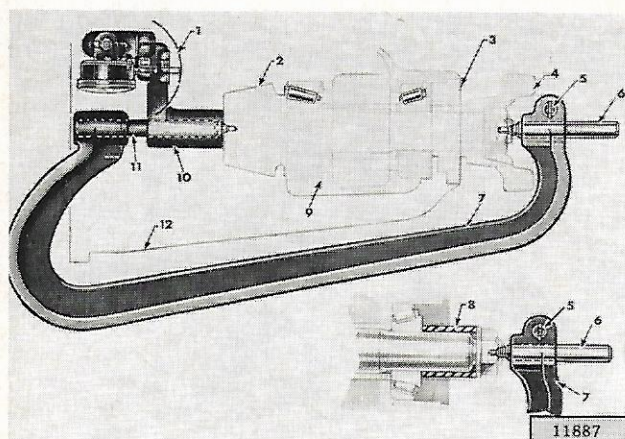


FIG. 11-15—PINION ADJUSTING FIXTURE

- |                        |                         |
|------------------------|-------------------------|
| 1—Dial Gauge Swing Arc | 7—C-Clamp               |
| 2—Pinion               | 8—Sleeve                |
| 3—Flange               | 9—Inner Bearing         |
| 4—Yoke                 | 10—Housing              |
| 5—Thumb Screw          | 11—Stationary Guide Pin |
| 6—Guide Pin            | 12—Pinion Housing       |

pinion and the opposite side when setting the Model 70 axle pinion. See Fig. 11-14.

**Note:** When setting Model 70 axle differentials, Spacer W-99-19 must be inserted on the stationary pin between the housing (No. 10, Fig. 11-15) and the pinion head.

After selecting the proper gauge, the adjusting fixture can be set as follows:

f. Place the gauge block against the machined surface of the dial indicator mount. See Fig. 11-14.

g. Set the dial indicator on zero by rotating the face.

h. Install the pinion adjusting fixture on the pinion with the stationary guide pin and the adjustable guide pin seated in the pinion shaft lathe centers, as shown in Fig. 11-15.

i. Seat the gauge mount firmly on the pinion head and swing the dial indicator through the differential bearing bore as shown in Fig. 11-16. The lowest reading indicates the center of the differential bearing bore. At this point the dial indicator should read the same as mark etched on the pinion head. If the reading does not agree, add or remove shims behind the bearing cup until the readings agree.

j. When the correct adjustment is reached, remove the pinion adjusting fixture and sleeve. Install outer bearing.

k. Install only the oil slinger, the yoke, the flat washer, and the pinion nut. Holding the yoke with Flange Holder C-3281, torque the nut 225 to 275 lb.-ft. for full-floating rear axle.

l. Using Inch-Pound Torque Wrench on the nut, check the rotating torque. The rotating torque should be 10 to 25 lb. inches.

**Note:** Disregard starting torque.

m. Add or remove shims between the pinion outer bearing and the pinion shaft to obtain correct torque reading.

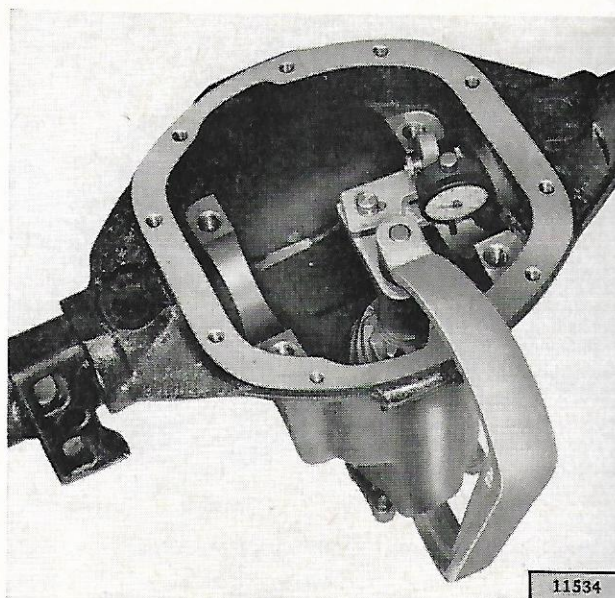


FIG. 11-16—CHECKING PINION ADJUSTMENT

### 11-9. Adjustment of Differential Side Gear

Clearance between the differential side gears and differential case should be .000" to .006". Procedure for checking clearance is as follows:

a. With the differential positioned as shown in Fig. 11-16, tap the differential lightly on a flat surface so the differential gears settle into proper position.

b. Measure the clearance between side gears and the case with leaf feeler gauge as illustrated.

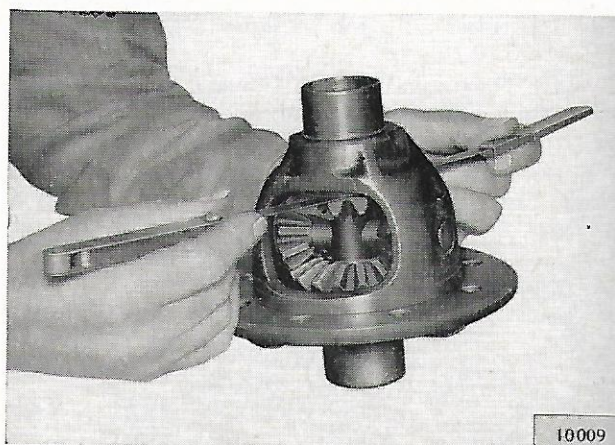


FIG. 11-17—CHECKING SIDE GEAR CLEARANCE

c. If the clearance exceeds .006", add shims between the side gears and the case. To bring the clearance within specified tolerance, shims in these thicknesses are available .004", .006", .008". If shims are required, at least one shim should be placed on each side and the shim packs kept as even as possible. After adding shims, repeat the clearance check.



### 11-10. Axle Assembly

Refer to Fig. 11-2.

- a. Assemble the differential gear set.
- b. Install the differential gear set in the differential case. Align the marks made on disassembly and fasten the case together with cap screws. Torque screws 35 to 55 lb-ft.
- c. Check side gear clearance as described in Par. 11-9.
- d. Align the marks made on disassembly. Install the ring gear on the differential case.
- e. Install cap screws. Torque screws 100-120 lb-ft.

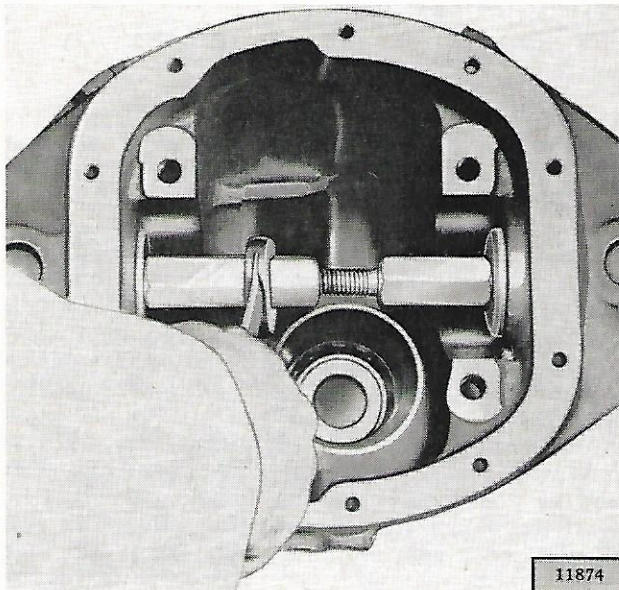


FIG. 11-18—INSTALLING INNER OIL SEALS  
(MODEL 60 FRONT AXLE)

### 11-11. Adjustment of Differential Bearing Preload and Ring Gear Backlash

Refer to Fig. 11-2.

The adjustment of the differential bearings is maintained by the use of shims placed between the differential case and the differential bearings. Procedure for adjusting bearing preload is as follows:

- a. Install the differential case and bearings in the axle housing without shims and with the bearing cups snug.
- b. Holding the ring gear in contact with the pinion and using a screwdriver blade to move the differential bearing cups toward the center, insert feeler gauge on each side between differential bearing cup and the axle housing.
- c. After the shim pack requirement for each bearing has been established, remove the differential assembly. Make up shim packs and keep them separated.
- d. Add an additional .015" thickness of shims to the pack on the tooth side of the ring gear.
- e. Place the differential bearing shim packs on the differential case under each bearing. Install bearings with Driver C-4025. See Fig. 11-19.

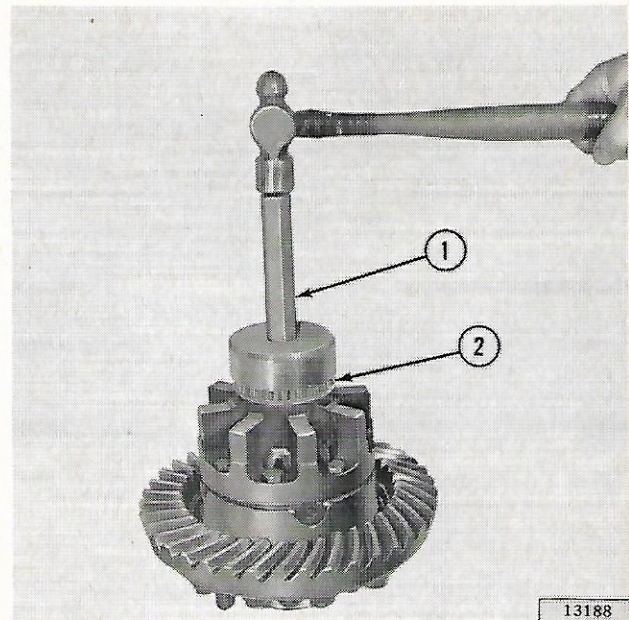


FIG. 11-19—DIFFERENTIAL BEARING DRIVER

1—Driver C-4025

2—Bearing

**Note:** When overhauling the Model 60 front full-floating axle differential, check the axle inner oil seals. Should new seals be required, install them, using DD-1243 Installer (Fig. 11-18).

- f. Attach the Carrier Spreader W-129, install a dial indicator, (Fig. 11-3) and spread the carrier a maximum of .020".
- g. Remove the indicator.
- h. Lubricate bearings and place the differential in the carrier.
- i. Tap the unit carefully into place with soft mallet, making sure the ring gear teeth mesh with the pinion teeth.

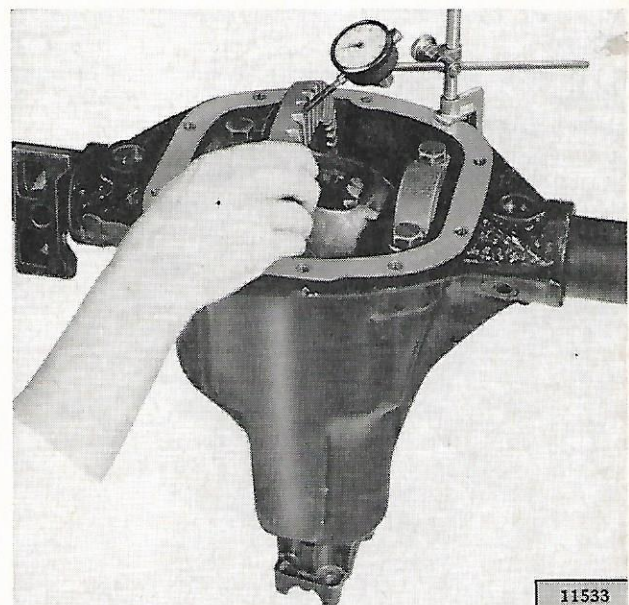


FIG. 11-20—CHECKING RING GEAR BACKLASH



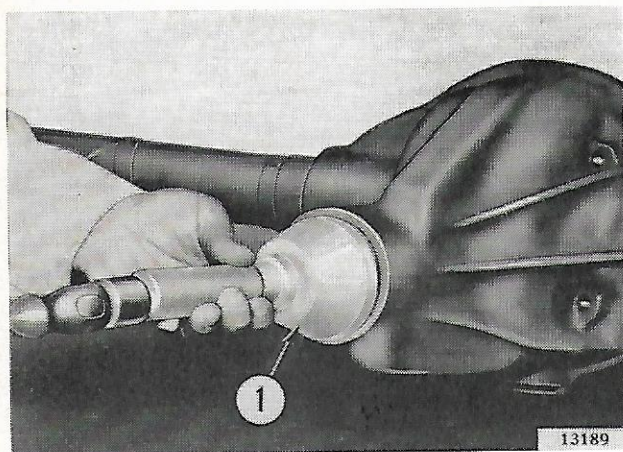


FIG. 11-21—PINION SHAFT OIL SEAL INSTALLER

1—Tool C-359

- j. Install bearing caps, matching their markings with those on the carrier.
- k. Apply sealing compound to the screw threads. Torque the screws 70 to 90 lb-ft.
- l. Install dial indicator to check ring gear backlash (Fig. 11-20). Check backlash at two points. Backlash must be held between .005" to .010". If backlash does not fall within specifications, shims should be interchanged between the two differential bearing shim packs until correct backlash is obtained.

**Note:** Changing the position of a .005" shim from one side to the other will change the amount of backlash approximately .003".

- m. Check ring gear for runout. A reading in excess of .006" indicates a sprung differential case, dirt between the case and the gear, or loose ring gear screws.
- n. After the differential has been assembled and adjusted, the pinion shaft oil seal should be installed.
- o. Remove the sleeve previously installed in place of the yoke. Install the oil seal with Tool C-359 shown in Fig. 11-21.
- p. Install the yoke with Yoke Installer, as shown in Fig. 11-22.

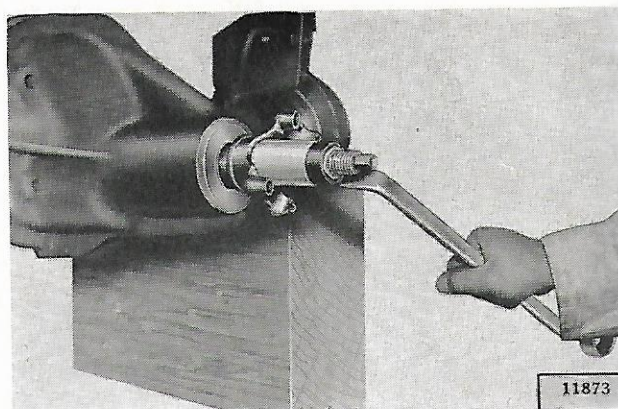


FIG. 11-22—YOKE INSTALLING TOOL

- q. Install pinion nut and cotter pin.
- r. Install axle shafts and housing cover.

### 11-12. Installing Rear Axle

**Note:** All service replacement axle assemblies are shipped from the factory without lubricant in the differential. Lubricant must be added to the differential before the axles are installed in vehicles. Use the grade and quantity of lubricant specified in Section B.

After adding differential lubricant, suspend the axle with the axle shafts horizontal and the yoke end of the pinion housing hanging down, then twirl the pinion shaft several times to assure that the lubricant gets into the pinion shaft bearings.

Procedure for installing the rear axle is as follows:

- a. Position the axle assembly under the vehicle.
- b. Install spring to axle pad, U-bolts, nuts, and properly torque.
- c. Connect the shock absorbers at the axle mounting pads.
- d. Connect the propeller shaft at the rear universal joint.
- e. Connect rear brake hose and bleed brakes.
- f. Install wheels and lower vehicle to floor.
- g. Fill the axle housing with the proper lubricant. For correct lubricant refer to Section B.



11-13. Trouble Shooting Differential

11-14. SERVICE DIAGNOSIS

SYMPTOMS	PROBABLE REMEDY
<b>Axle Noisy on Pull and Coast</b>	
Excessive Back Lash Bevel Gear and Pinion..	Adjust
End Play Pinion Shaft.....	Adjust
Worn Pinion Shaft Bearing.....	Replace
Pinion Set too Deep in Bevel Gear (too tight)..	Adjust
<b>Axle Noisy on Pull</b>	
Pinion and Bevel Gear Improperly Adjusted..	Adjust
Pinion Bearings Rough.....	Replace
Pinion Bearing Loose.....	Adjust
<b>Axle Noisy on Coast</b>	
Excessive Back Lash in Bevel Gear and Pinion.	Adjust
End Play in Pinion Shaft.....	Adjust
Improper Tooth Contact.....	Adjust
Rough Bearings.....	Replace
<b>Back Lash</b>	
Worn Differential Pinion Gear	
Thrust Washers.....	Adjust
Excessive Back Lash in Bevel Gear	
and Pinion.....	Adjust
Worn Universal Joints.....	Replace

11-15. REAR AXLE SPECIFICATIONS

Make.....	Dana
Model.....	70
Description.....	Full-Floating Hypoid Gears
Drive Pinion Offset.....	1.12"
Number of Differential Pinions.....	4
Gear Ratio.....	5.87:1
Ring Gear Outside Diameter.....	10.5
Pinion Adjustment.....	Shim
Pinion Bearing Adjustment.....	Shim